PRACTICAL WIRELESS

JANUARY 1974

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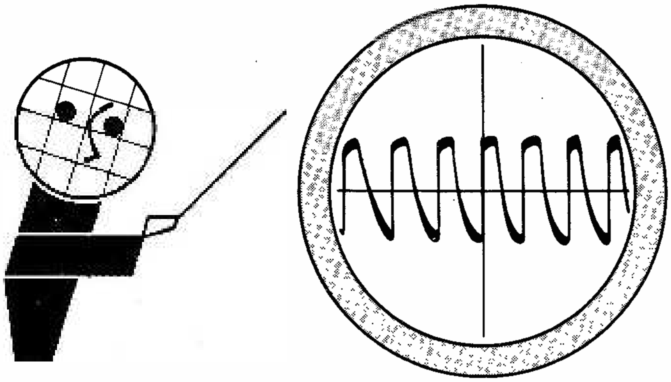

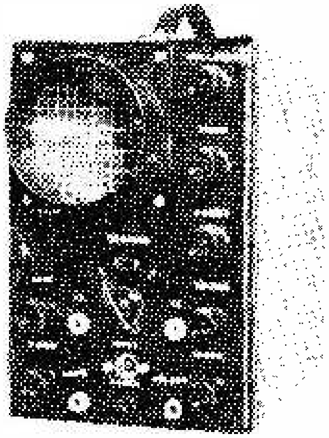

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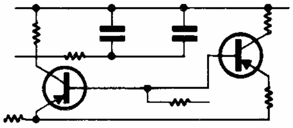

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PRACTICAL WIRELESS

VOL. 49 NO. 9
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JANUARY 1974

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

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● NEWS & COMMENT

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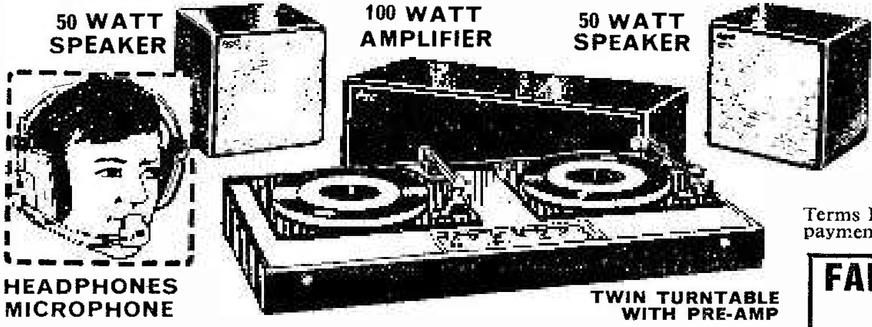
RSC GROUP/DISCO UNITS



PACKAGE OFFER

Units listed below
- (a) 100w POWER AMPLIFIER
- (b) PAIR OF HI-FI HEADPHONES
- (c) MATCHING DYNAMIC 'MIKE' (attached to h'phone)
- (d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18″ × 18″ × 8″
- (e) RSC TDI DISCO CONSOLE

(a) (b) (c) (d) & (e) Carr. £3·00 **£149·95**

Terms Deposit £30 and 18 monthly payments of £8·33 (Total £179·94).

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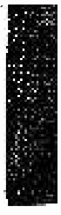
Incorporating twin Garrard SP25 or BSR MP60 type turntables and Sonotone or Acos Cartridges with diamond stylii. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control switch. Black Vynide covered Cabinet with lid. see illustration on left
Or Dep. £9·95 and 12 mthly pymts £5·85 (Total £80·15) **£69·95** Carr. £1·50

RSC DISCO-MASTER

DISCOTHEQUE CONSOLE with integrated power supply. 100w OUTPUT TWIN JACK OUTPUT SOCKETS Inc. twin Garrard SP25 Mk111 or BSR Macdonald MP60 type turntables, Pick-ups with high compliance cartridges and diamond styli. Separate volume controls for each turntable. FULL MONITORING FACILITIES plus Treble and Bass controls. Separate input for mic. with vol. control switch. Rexine covered cabinet size approx. 32¾″ x 16¾″ x 7¾″ with lid
Terms: Deposit £20 and 12 monthly payments £7·60 (Total £111·20). Carr. £2·50. **ONLY £99·75**



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All types 15 Ohms covered in Rexine and Vynair
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TYPE C4100 100 WATTS inc. four 12″ 50 watt speakers for conservative rating. Extra heavy construction. Size approx. 58×16×10″ Acoustically filled and pressurised. Terms: Dep. £15·50 & 12 mthly. pyts. £5·46 (Total £81·02). Carr. £1·50 **£71·50**

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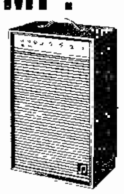
Incorporating Tremolo and 13″ × 8″ or 10″ Speaker. Output 8 watts R.M.S. Continuous. 3 Jack Inputs for Microphone and Instrument. Mains Neon Controls: Volume, Tone, Tremolo Speed Tremolo Intensity.
Terms: Deposit £2·75 and 9 monthly payments £2·17 (Total £22·28). **£19·95** Carr. free



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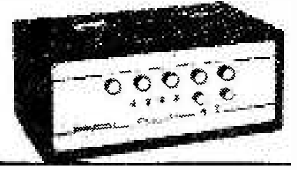
FAL PHASE 50 Mk.III AMPLIFIER 50 WATT.

Solid state. 4 Separately controlled inputs Plus master vol. control. Ind. Bass and Treble Controls. Protective circuit to guard against damage from accidental shorts. Output for Speaker/s 3 to 30 ohms. Size 17″ × 7″ × 7½″. 200-250v. A.C. mains. Output 50 watts music rating.
Or deposit £6·93 & 9 monthly payments £4·22. Total £44·91. **£39·93** Carr. 85p.



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Combined 50W Amplifier and 12in. Loudspeaker.

For Lead Guitar, Mic., Gram, Radio, Tape (Not for use with Bass instruments). Inc. 3 inputs and 2 vol. controls plus Treble, Bass and Presence. Output Jack for additional 15 ohm Speaker. Attractively finished in black with silver-finished fascia and trimmings. Compact size. Fitted carrying handle.
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All power ratings are R.M.S. continuous. 2 YEARS' GUARANTEE
High flux ceramic magnets. ALL CARRIAGE FREE.

'POP' 100	'POP' 60	'POP' 50
18″ 100 Watt	15″ 60 Watt	12″ 50 Watt
14,000 gauss	14,000 gauss	13,000 gauss
8/15Ω	8/15Ω	15Ω
£25·95	£14·75	£11·99
Dep: £5·95 and 9 mthly payments £2·56 (Total £28·99)	Dep. £3·75 and 9 monthly payments. £1·50 (Total £17·25)	Dep £2·99 and 9 monthly payments £1·28 (Total £14·51)
FOR BASS GUITAR, ELECT. ORGAN, ETC.		PAIR SUITABLE ALL PURPOSES

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Dual Cone 15 Ω (for uses other than Bass Guitar or Electronic Organ). Carr. free **£7·95** or Dep. £1·25 and 9 mthly payments 89p (Total £9·26).

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Pair BSR MP60 T/tables GP91 PU Cartridges.
FAL Disco Pre-amp. Totel Rec. Ret. Price £50·11 Carr. £1

GROUP/DISCO EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 MK.III AMPLIFIER PR. FANE POP 25/2 25W L/SPEAKERS Terms: Deposit £7·50 and 12 monthly payments of £4·29 (Total £58·98)	£39·93 £15·90 £55·83	PACKAGE PRICE £51·50 carr. £1·10
F.A.L. PHASE 50 MK.III AMPLIFIER PR. FANE POP 50 L/SPEAKERS Terms: Deposit £9·50 and 12 monthly payments of £4·88 (Total £68·06)	£39·93 £23·98 £63·91	PACKAGE PRICE £59·50 carr. £1·10
F.A.L. PHASE 50 MK.III AMPLIFIER PAIR L12/20 25W L/S in cabinets Terms: Deposit £10 and 12 monthly payments of £5·17 (Total £72·04)	£39·93 £26·30 £66·23	PACKAGE PRICE £63 carr. £1 35
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HIGH QUALITY LOUDSPEAKER UNITS

ALL TWO TONE REXINE AND VYNAIR FINISH
L125 50 WATT Fitted pair of 12″ 50 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Carr. £1·50 **£37·95**
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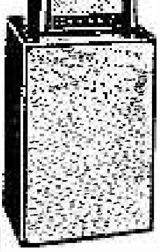
L12/20 12″ 20-25 WATT 13,000 lines 15 ohms Dep £2·15 & 9 mthly pymts £1·50 (Total £15·65) **£13·15** Carr. 55p.

L12/10 10-15 Watt veneer finish cabinet 12″ unit 8-15 ohm. Size approx. 14″ × 14″ × 9″. Carr. 50p. Dep. £1·25 & 9 mthly pymts £1·06 (Total £10·79) **£8·25**

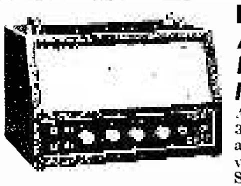
CREDIT TERMS AVAILABLE ON PURCHASES OVER £10 (Kits Excepted) INTEREST CHARGES REFUNDED ON CREDIT SALES Settled in 3 months

RSC BASS-REGENT 50 WATT AMPLIFIER



A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape. Peak Output rating. Loudspeaker unit either horizontal or vertical mounting.
- ★ Two extra heavy duty 12in. 50w Loudspeakers.
- ★ Four Jack inputs and two Volume Controls for instant use of up to four pick-ups or "mikes". Bass and Treble controls. Send S.A.E. for leaflet.

Credit Terms: Deposit £15·50 & 12 monthly payments of £5·56. (Total £82·12.) Carr. £2·50 **£72·50**



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. 75p

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NEW LARGER PREMISES AT **HULL, DARLINGTON, NEWCASTLE & DERBY** See Addresses

All items subject to availability. Prices correct at 25.10.73 E. & O.E.

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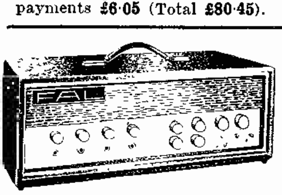
FAL PHASE 100/2 AMPLIFIER

100 WATTS MUSIC RATING. Solid State. Sep. Bass and Treble Controls. 4 separate controlled inputs plus master control. Output for speakers 3–30 ohms. Includes protective circuit against damage from short circuits.
Terms: Deposit £7·85 & 12 monthly payments £6·05 (Total £80·45). **£69·85**



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**
Terms: Dep. £8·50 & 12 mthly. pymts. £4·97 (Total £68·14)

FAL 'SUPER 100' 100 WATTS MUSIC RATING **£79-95**
Terms: Dep. £11·95 & 12 mthly. pymts. £6·63 (Total £91·51). Prices above include protective dust cover.

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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. 8–15Ω **£10·98** post free

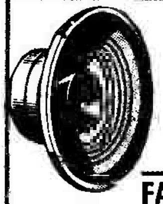
Price per pair £19·99 Or Dep. £1·98 & 9 mthly pymnts. £1·28 (Tot. £13·50)

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.

PLEASE STATE IMPEDANCE REQUIRED List £4·99 **£3·99**

MODEL 803T 8" 15w. with parasitic Tweeter. Response 25 Hz to 15 KHz. Gauss 13,000 Imp 3 or 8–15Ω. **£5·50** List £6·99

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.

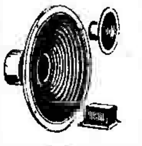
JE8 Size 16" × 11" × 9". Pressurised. Gives pleasing results with any 8in. Hi-Fi speaker. **£5·50**

SE10 For outstanding results with 10in. Hi-Fi spkr. Size 25¼ × 16 × 9in. Ported **£6·75**

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

SE12 For excellent performance with 12in. Hi-Fi speaker and tweeter Size 25¼ × 16 × 9in. **£7·95**

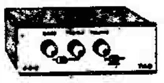
AUDIOTRINE HI-FI SPEAKER SYSTEMS



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, 9¼ × 2¾ × 5¼in. 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**

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250v., 60mA, 6·3v. 2a	£1·10
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300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·45
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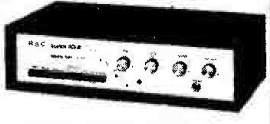

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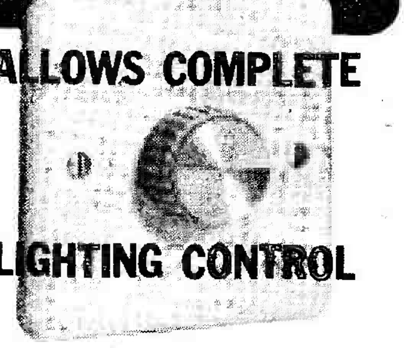
A DEXTER DIMMASWITCH



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30 Volts. All tapped at 0-12-15-20-30V.

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50 Volts. All tapped at 0-19-25-33-40-50V

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60 Volts. All tapped at 0-24-30-40-48-60V.

500mA	MT124AT	£2·33	2A	MT127AT	£4·36
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Power output	Winding tapped at	Ref. No.	Price
20VA	0-115-210-240	XMT113CT	£1·26
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400V. Output at 50HZ.
C-D Ignition System by R. M. Marston. Esq.. Wireless World.
Reference 1T3AT £3·00

EQUIPMENT RANGE

Sec. Output (r.m.s.)		Ref. No.	Price
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9-0-9	100mA	MT13CS*†	£1·36
12-0-12	50mA	MT239CS*†	£1·41
20-0-20	30mA	MT241CS*†	£1·41
0-20 × 2	300mA × 2	MT214CT*†	£1·87
0-8-9 × 2	500mA × 2	MT207CT*†	£2·22
0-15-20 × 2	500mA × 2	MT205AT*†	£2·95
0-15-27 × 2	500mA × 2	MT203AT*	£3·38
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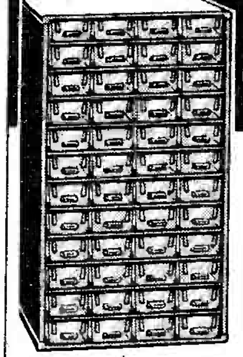

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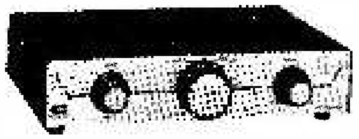
★  ★

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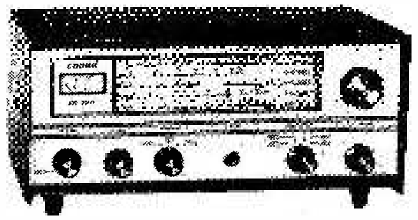
★  ★

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Mr. W. R. Jones, Woy, N.S.W., Australia.
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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.
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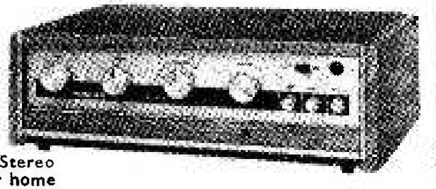

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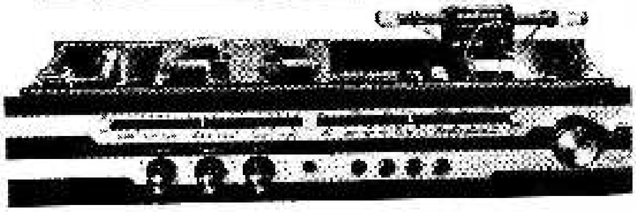

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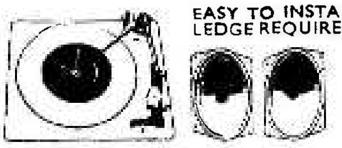

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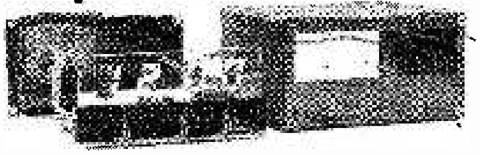

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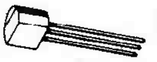

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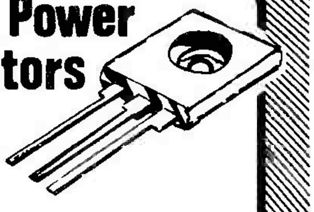

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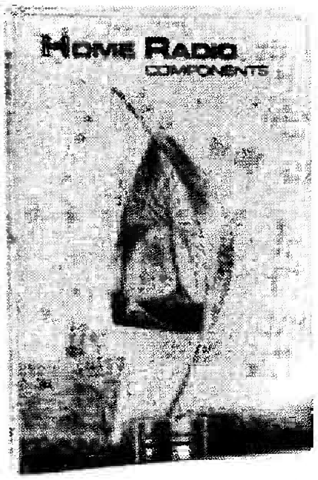

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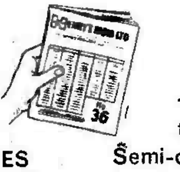

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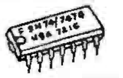

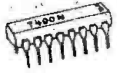

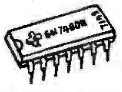

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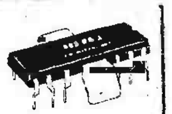
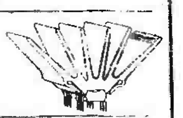
2N1671	1·00
2N2147	75p
2N2160	69p
2N2926	10p
2N3053	20p
2N3054	45p
2N3055	45p
2N3440	60p
2N3442	1·10
2N3525	80p
2N3614	59p
2N3702	11p
2N3714	1·60
2N3771	1·75
2N3773	2·25
2N3790	2·25
2N3819	35p
2N3866	75p
2N3903	15p
2N4002	14p
2N4126	15p
2N4871	85p
2N5457	36p
28001	3·00
28026	8·90
28303	70p
40250	45p
40361	45p
40362	40p
40408	50p
40486	75p
40636	1·00
40430	85p

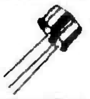
TBA800 5 WATT I.C.
Suitable alternative to SL403D. 5/30 volt operated. 8/16 ohm 5 watt output.
With circuits and data £1·50



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



ZN414 IC
Integrated circuit radio as featured by many magazines (PW Jan. 73 Reprint Ref. No. 19 for **10p**) **£1·20**

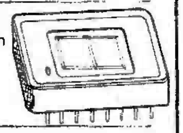


Toshiba Power and Preamplifier modules
TH9013P 20 watt
Power amplifier 22-0-22 or single 45 volts operated **£4·57**

TG9014P Stereo on two channel preamplifier. **£1·50**
(circuit book No. 42 price **10p**)

Ultrasonic Transducers
Operate at 40Khz up to 100 yds.
Ideal remote switching and signalling.
Complete with data transmitter and receiver new I.C. circuits.
Per pair **£5·90**
TA960 IC with socket **£1·80**

3015F 7 SEG.
I.C. size complete with data price **£2** each or 4 for **£7**
(digital clock circuits ref. No. 31, **15p**)



TRANSISTORS SPECIAL OFFER

2N3055

25	......47p ea
100	......42p
500	......39p
1000	......34p

AF117

25	......15p ea
100	......13p
500	......12p
1000	......10p

BY127

25	......12p ea
100	......10p
500	...... 9p
1000	...... 8p

OC35

25	......46p ea
100	......42p
500	......38p
1000	......34p

ZENER DIODES
400 m/w BZY88/BZX83. From 3·3 volt – 33 volts 10p each

1·3 watts 5% Miniature Tubulars IN4700 series. From 3·3 volt – 33 volt 18p each.

10 watts. Stnd Mounting. ZS series 6·8 volts – 100 volts 5% 40p each.

SILICON RECTIFIERS
1 amp series
IN4001 to IN4007
From 6p ea
1·5 amp
PL4001 to PL4007
From 8p ea
3 amp
PL7001/IN5400
From 14p ea
Send for full list 36

LINEAR I.C.

702C (T05)	75p
709C (T05)	39p
709C (D.I.L.)	39p
723C (T099)	90p
723C (D.I.L.)	90p
728C (D.I.L.)	45p
728C (T099)	45p
741C (T05)	50p
741C (D.I.L.)	50p
747C (T099)	£1·0p
748C (D.I.L.)	61p

MORE OF EVERYTHING AT
HENRY'S
See pages 819-820, and Back Cover of this magazine.
BEST VALUE

Semi-Conductor QUANTITY DISCOUNTS

10% 12–, 15% 25+, 20% 100+

Any one type except where quantity discounts shown.

Min. order £1·00 please.

TRIACS – **Stnd. mounting with accessories**

3 AMP RANGE

Type	P.I.V.	1–11 Price ea.
SC35A	100v	80p
SC35B	200v	85p
SC35D	400v	90p
SC35E	500v	£1·20

3 Amp

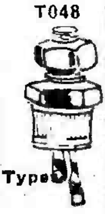
6 AMP RANGE

SC40A	100v	90p
SC40B	200v	95p
SC40D	400v	£1·20
SC40E	500v	£1·50

10 AMP RANGE

SC45A	100v	£1·05
SC45B	200v	£1·15
SC45D	400v	£1·45
SC45E	500v	£1·85

T048



15 AMP RANGE

SC50A	100v	£1·45
SC50B	200v	£1·65
SC50D	400v	£1·95
SC50E	500v	£2·25

TRIACS – Additional Types

40430 TRIAC (T066)	85p
40669 TRIAC (Plastic)	90p
40486 TRIAC (T05)	75p

NEW RANGES
BRIDGE RECTIFIERS
FEATURES SMALL SIZE AND LOW COST Sizes. are approx.

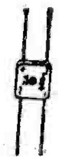
250M/A QUARTER AMP

B025/05	50 PIV	16p
B025/10	100 PIV	18p

¼ x ¼ x ¼" dia.

½ AMP 1-11 Pricing

Type	P.I.V.	Price ea.
B05/05	50v	20p
B05/10	100v	22p
B05/20	200v	23p
B05/40	400v	25p
B05/60	600v	27p



½H x ½L x 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 3/16" dia.

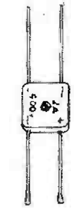
1 AMP P.I.V.

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 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 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 3/16" dia.

SILICON CONTROLLED RECTIFIERS

Type	P.I.V	1–11
ONE AMP (T05)		
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
CRS 7/200	200v	67p
CRS 7/400	400v	85p
CRS 7/600	600v	95p

All types offered subject to availabilty. Prices correct at time of press E. & O. E. 10% VAT to be added to all orders. UK post, etc, 15p. per order.

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EDGWARE ROAD, W2

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354-356 High Fidelity and Tape Equipment 01-402 5854/4736
309 PA-Disco-Lighting High Power Sound 01-723 6963
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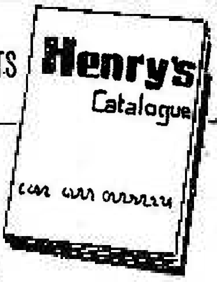
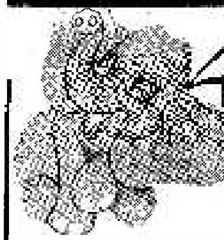
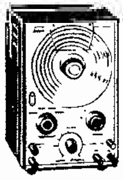
IRONS : TOOLS · VALVES · POT CORES MOST TYPES OF COMPONENTS
You need a catalogue! 55p post paid complete with Discount Vouchers





UK's LARGEST RANGE OF KITS & GADGETS



TEST EQUIPMENT

MULTIMETERS

(carr. etc. 30p)

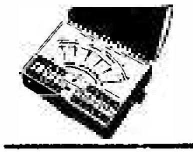
200H (M210)	20K/Volt Slimline with case	4·95
TLH33D	2K/Volt Robust with case	4·95
U437	10K/Volt Steel case. AC up to 40 KHz	4·95
U4324	20K/Volt with AC current ranges	8·00
AF105	50K/Volt with Leather case	9·50
U4313	20K/Volt AC current. Steel case	10·50
U4341	Plus Built in transistor tester	10·50
Model 500	30K/Volt	9·95

OTHER EQUIPMENT

SE250B	Pocket Signal Injector	1·90 carr. 15p
SE500	Pocket Signal Tracer	1·50 carr. 15p
TE15	Grid Dip meter 440kHz–280mHz	13·45 carr. 30p
TE40	AC Millivoltmeter 1·2mHz	18·75 carr. 35p
TE65	28 Range valve voltmeter	19·25 carr. 40p
TE20D	120kHz–500mHz RF Generator	16·95 carr. 40p
TE22D	20Hz–200kHz Audio Generator	18·75 carr. 40p
SE350A	Deluxe Signal Tracer	9·95 carr. 20p
SE400	Volts/ohms/R-C sub./ RF field/RF gen.	11·25 carr. 20p

New Revolutionary Supertester 680R

680R Multi-tester
£18·50



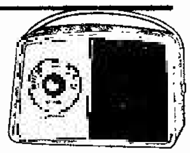
Accessories

Transistor tester	11·00
Electronic voltmeter	18·00
Ampclamp	11·95
Temperature probe	11·95
Guass meter	11·95
Signal Injector	5·95
Phase Sequence	5·95
EHT Probe	5·95
Shunts 25/50/100A	4·50 each

A SELECTION OF INTERESTING ITEMS

C3025	Compact transistor tester	5·50 p & p 15p
E1300	Mono mag. cart. preamp.	1·95 p & p 15p
E1310	Stereo mag. cart. preamp.	4·95 p & p 25p
Easiphone telephone amplifier		6·15 p & p 25p
D1203	Teleamp. with PU coil	3·60 p & p 20p
LL1	Door Intercomm. and chime	11·95 p & p 25p
Chattalite (lights as you talk)		13·90 p & p 20p
1 Kw Dimmer/controller		3·00 p & p 10p
9" Twin spring unit	For	2·75 p & p 15p
16" Twin spring unit	Reverbs	6·50 p & p 25p
Car Tachometer Electronic		7·50 p & p 15p
VHF 105 Aircraft Band Corrector		3·95 p & p 15p
B2005 4 Ch. mic. mixer		2·95 p & p 15p
B2004 2 ch. Stereo mixer		4 75 p & p 15p

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.

EXCLUSIVE: SPECIAL OFFERS

MW/LW CAR RADIO
+ or − Earth with speaker and fixings. **£6·50** carr./packg. 30p.

8 TRACK CAR STEREO
(− Earth) with speakers in Pods & fixings. **£12·50** carr/packg. 40p.

HANIMAX HC1000
Battery cassette recorder. **£10·50** carr/packg. 25p.

HANIMAX HC2000
Battery/Mains cassette recorder. **£13·50** carr/packg. 30p

AKAI GXC40
Stereo cassette recorder. **£59·95** carr/packg. 50p.
Pair Akai ADM microphones. **£6·95** carr/packg. 20p.

5 WAVEBAND PORTABLE TWIN SPEAKER RADIO. FM/MW/SW/AIRCRAFT—PUBLIC SERVICES. **£10·45** carr/packg. 30p.

PORTABLE CASSETTE TAPE PLAYER—
for car or carry around. **£7·25** carr/packg. 20p.

HANIMAX POCKET CALCULATOR WITH % KEY. **£33·50**

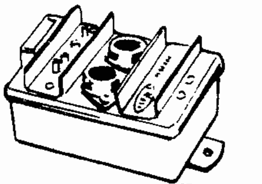
SPECIAL PURCHASES

AVOMETER MOVEMENTS
AVO 8 or 9 50mA MOVEMENTS. Ex Brand New AVO's **£3·50** Post 20p.

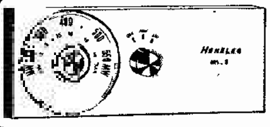
UHF TV TUNERS · CHANNELS 21 TO 64
Brand new transistorised geared tuners for 625 Line Receiver IF output. **£2·50**, Post 20p.

EASY TO BUILD KITS BY AMTRON— EVERYTHING SUPPLIED

Model No.		
310	Radio control receiver	2·98
300	4-channel R/C transmitter	5·95
345	Superhet R/C receiver	5·95
455	AM signal generator	12·33
65	Simple transistor tester	1·40
115	8 watt Amplifier	3·90
120	12 watt amplifier	4·70
125	Stereo control unit	5·70
130	Mono control unit	3·60
605	Power supply for 115	4·55
610	Power supply for 120	4·55
615	Power supply for 2 x 120	5·73
230	AM/FM aerial amplifier	2·93
240	Auto packing light	5·90
275	Mic. preamplifier	6·08
570	LF generator 10Hz–1mHz	15·80
575	Sq. wave generator 20Hz–20Khz	14·60
590	SWR meter	12·85
620	Ni-CAD Charger 1·2–12v	8·00
630	STAB Power supply 6-12v 0·25-0-1A	8·15
690	DC motor speed Gov.	2·87
700	Electronic Chaffinch	7·00
705	Windscreen wiper timer	6·80
760	Acoustic switch	10·75
780	Metal Detector (electronics only)	9·65
790	Capacitive Burglar alarm	6·85
835	Guitar preamp.	4·25
840	Delay car alarm	6·15
875	CAP. Discharge ignition for car engine (–Ve Earth)	13·15
·80	Scope Calibrator	2·25
255	Level indicator	6·15
525	120–160mHz VHF timer	11·30
715	Photo cell switch	7·70
795	Electronic continuity tester	4·30
860	Photo timer	13·25
871	Slide projector auto feed control	7·15
235	Acoustic Alarm for driver	7·60
465	Quartz XTAL checker	8·75
220	Signal Injector	2·30
390	VOX	15·50
432	Testakit	19·30
670	Buffer Battery Charger	6·55
885	Capacitive Contact Alarm	6·25
850	Electronic Keyer	18·75
820	Electronic Digital Clock	58·50



ALL KITS OFFERED SUBJECT TO STOCK AVAILABILITY



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 3⅞". All parts **£4·85**, carr. 15p.

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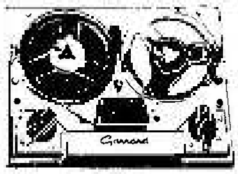
Telephone Communicator		7·20
X20	20 (Elec.) Projects	4·95
X40	40 (radio) Projects	9·45

(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 unless stated.



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).

SINCLAIR, MINIATURE AMPLIFIERS & TUNER/DECODER

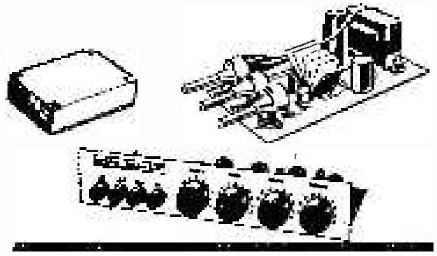
AMPLIFIERS (carr., etc. 20p)

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 (carr. 20p)
PROJECT 60
Z30 3·57 Z50 4·37
Stereo 60 Preamp. 7·97
PZ5 £3·97, PZ6 £6·37
PZ8 (for Z50) £4·77 (TRANS £2·95)
AFU £4·45

New SINCLAIR PROJECT 80

Stereo Preamp.	9·50
Audio Filter Unit	5·50
Z40 15 Watt Amp.	4·30
Z60 25 Watt Amp.	5·50
PZ5 Mod. for 1 on 2 Z40	3·98
PZ6 Mod. (S Tab) 1 on 2 Z40	6·25
PZ8 Mod. (S Tab) 1 on 2 Z60	6·30
TRANSFORMER FOR PZ8	2·95
Project 605 Kit	19·95



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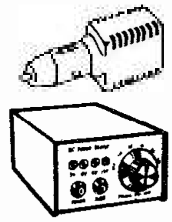
(All cased unless stated chassis)

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

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**.



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(carr./packing 50p)

AKAI	AA5200	61·70
	AA5500	78·50
	AA5800	117·50
AMSTRAD	1C2000 Mk. II	29·50
	4000 Mk II	23·95
EAGLE	TSA149	25·10
	TSA151	34·85
	AA2	30·80
	AA4	42·45
	AA6	55·95
HOWLAND WEST	DA1000	22·45
HENELEC TEXAN	Kit	28·50
HENELEC TEXAN	Built	35·00
NIKKO	TRM300	25·95
	TRM400	32·50
PIONEER	SA500A	34·25
ROTEL	RA 211	32·65
	RA311	41·15
	RA611	60·80
	RA810	75·75
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SINCLAIR	2000	22·95
	3000	28·95
TANDBERG	TA300	66·10
TELETON	SAQ206B	22·50
	SAQ307	22·50
	GA202	28·50

STEREO RADIO TUNERS

(carr./packing 50p)

AKAI	AT550	60·50
	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	RT222	32·65
	RT322	43·75
	RT622	65·40
SINCLAIR	2000	26·95
	3000	26·95
TELETON	GT202	30·50

DECODERS / SYNTHESIZERS (carr. etc. 30p)

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

MATCHED SPEAKER SYSTEMS

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

RANK DOMUS		
150		26·95 pr.
175		33·75 pr.
250		53·75 pr.
MARSDEN HALL		
110	10 watt	22·50 pr.
150	15 watt	27·50 pr.
200	20 watt	34·50 pr.
DYNACO		
A10	20-60 watts	43·00 pr.
A25	20-60 watts	69·00 pr.
A35	20-60 watts	79·00 pr.
WHARFEDALE		
Denton 2	18 watt	27·20 pr.
Linton 2	20 watt	32·65 pr.
Melton II	25 watts	51·80 pr.
Triton	25 watt	40·80 pr.
LEAK		
150	18 watt	32·65 pr.
250	18 watt	44·30 pr.
CELESTION		
120	20 watt	37·80 pr.
COUNTY	25 watt	33·60 pr.
15	30 watt	50·40 pr.
44	44 watt	81·20 pr.

UK's largest stockists for KEF Acoustic Research, Mordaunt Short & Cambridge Audio speakers. In stock and on demonstration. Phone for keenest price.

BATTERY CASSETTE RECORDERS (carr. etc. 30p)

Amerex	100	11·00
Wien	ET1008	11·00
Philips	EL3302	14·40
	N2203	16·60
	N2211	19·95
Sanyo	M1101	14·65
	M1102	12·95

STEREO MAGNETIC CARTRIDGES (carr. etc. 15p)

SHURE		M44G	4·20
M3Dm	3·20	M75/6/11B	6·75
M44.7	3·95	M75 EDII	8·50
M44E	4·25	M75 EJII	7·95
M55E	4·95	M75GII	7·25
GOLDRING			
G850	2·85	G800SE	10·00
G800	3·95	G820	6·70
G800H	3·95	G820E	10·00
G800E	5·95	G820SE	13·35
ADC			
Q36	10·70	Q30	5·90
Q32	8·70		
GRADO			
FTR	5·25	FTE	8·25
F3E	11·25	F2	18·75
EMPIRE		999TEX	14·95
		999REX	3·70
		999QUX	4·80
		999XEX	8·50
RONETTE		SM500/7	4·60
		SM500/5	4·60
		SM500/E	6·95

STEREO COMPACTS

Complete with Speakers (c./p. £1·25)

Fidelity	UA3	39·90
Sanyo	G2601KL	125·50
Sanyo	G2615N	71·50
Sanyo	GXT4520KL	103·50
Sanyo	GXT4730KL	97·50
Philips	GF908	102·75
Philips	RH802	159·95
Philips	RF836	57·20
Philips	GF826	41·75
Philips	RH811/RH421	84·95
Philips	RF839	55·95
Philips	GF829	39·95
Philips	GF815	47·75
Philips	GF808	65·75
Philips	RH814/RH411	96·75
Philips	GF603	19·95

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

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

PORTABLE TV BATTERY/MAINS (c./p. £1·00)

Elizabeth T9	9″	43·50
Crown 9TV	9″	48·50
Elizabethan T12	12″	43·95
Teleton TW12	12″	46·95
Sanyo 10T150	9/10″	52·50

CASSETTE PLAYER

FOR CAR – HOME AND AROUND

Made to sell at £12.50 OUR PRICE **£7.25** VAT +P&P 26p

Actually the price far belies the quality of the superb player. It is of beautiful quality both in sound and looks. Features wind, rewind, volume and tone controls. Speaker is very good indeed. Comes complete with earphone, batteries. Full guarantee. Optional adaptor to run off car or mains.

CAR CIGAR LIGHTER PLUG-IN ADAPTOR £1.95
MAINS ADAPTOR £1.95

DOLBY / NRU (carr./packing 30p)

Teleton	SNR100D	29·50
Philips	N6720	15·00

Teac AN60/AN80/AN180 stocked

RECORD DECK PACKAGES

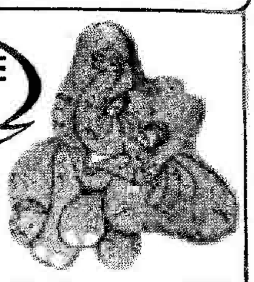
(carr./packing 75p)*Less cart.—rest with

(HL)	SP25 III/800 or H	15·95
(M)	SP25 III/M756S	19·45
(HL)	AP76/G800	25·55
(M)	AP76/M756S	29·10
(HL)	GL75 P/C	33·50
(HL)	GL75 P/C G800	36·65
(HL)	GL75 P/C G800E	39·15
(HL)	MP60 (TRD1) G800	15·80
	HT70 (TPDI) G800	19·50
RANK DOMUS	BD200	43·60
	BA400	53·95
	*Pioneer PL12D	31·75
	*Thorens TD165	43·80
	Thorens TD160C	50·80

BATTERY / MAINS CASSETTE carr. etc. 35p)

Wien	RT452	13·65
Amerex	AC101	12·00
Elizabethan	LZ315	12·25
Amerex	AC104	16·00
Philips	N2204	20·75
	N2205	29·50
PYE	9115	27·75
	9118	21·20
Hitachi	TRQ291	27·50
Sanyo	M2000G	23·25
	MR4010G	28·95
	M4000G	49·90
BASF	CC9201	37·25
Hitachi	TRQ2335	49·50

BEST VALUE IN U.K.



BATTERY / MAINS RADIO CASSETTE RECORDERS

(carr. etc. 30p)

Amerex	ACR200	22·00
	ACR201	30·00
Elizabethan	LZ416	27·25
	LZ516	29·10
BASF	CC9301	50·75
Philips	RR322	28·75
	RR413	33·90
	RR712	48·30
Sanyo	M4141FG	43·20
	M2400W	36·90
	M2400FG	36·90
	M4400FG	68·50
Grundig	C250	47·95
Hitachi	TRK1240E	29·50
	TRS1161	35·00
	KCT1210L	33·50

STEREO RECORDER DECKS (carr./packing 50p)

Cassette		
Philips	N2506	44·50
	N2510	£87·10
Pye	9145	44·50
Tandberg	TCD300	112·00
Akai	CS30D	50·65
	CS33D Dolby	62·50
	GXC36D	65·15
	GXC40D	57·40
	GXC38D Dolby	81·45
	GXC46D Dolby	89·15
	GXC45D	74·30
TEAC	A250/A350—A450	Stocked
Reel to Reel		
Akai	4000DS	62·50
Tandberg	3321X/3341X	107·70

Large range Akai/Tandberg/Revox/Teac stocked.

STEREO PHONES

(carr./packing 20p)

AKAI	
ASE11	4·75
ASE20	7·30
ASE22	8·25
DULCI	
SH650D	2·25
SH850GX	3·95
SH1300VS	5·25
AKG	
K60	9·25
ROTEL	
RH630	4·85
RH700	6·75
SENHEISSER	
HD414	11·25
WHARFEDALE	
DD1	8·95
ISODYN	15·00
KOSS	
K6	9·95
K6/LC	11·25
K711	7·95
KRD711	7·95
HV1	17·50
K0727B	12·45
K0747	15·95
PR04AA	21·95
PR05LC	23·95
HOWLAND WEST	
CIS200	2·75
CIS250	5·25
CIS1000	7·50
CIS2000	15·25

TTC	
G3000	6·60
G2222	5·95
LOW COST	
MD802	1·95
MD806	3·75
PIONEER	
SE20A	5·90
SE30A	9·45
SE50	16·35
SEL20	7·90
SEL25	11·15
SEL40	12·99
ACCESSORIES	
H1012/JB3 Junction Box	1·40
JB3DE Din Junction Box	1·60
JB11D De Luxe Junction Box	1·95
0250 Phone Switch	4·75
CONTROL BOXES	
G1301 (two phones)	2·62
G1305 Controller	2·15
FF17 2-pairs (Sliders)	6·25
Koss T4A	4·20
T5A	4·95
T10A	8·50
HW Mk.III Controller	6·90

8 Track

Akai	CR81D	53·60
	CR80DSS	93·65

STEREO RECORDERS

(carr./packing 70p)

Akai	1721L	67·20
Cassette		
Akai	GXC40 Dolby	59·95
	GXC46 Dolby	89·95
Philips	N2400/RH411	63·75
	N2401/RH411	74·50
	N2401S/RH411	79·95
	N2405/RH401	49·50
8 Track		
Akai	CR81	66·20

STEREO TUNER AMPLIFIERS (carr./packing 75p)

Akai	AA8030	92·50
Goodmans	Module 80	59·20
Goodmans	Module 90	75·75
Goodmans	One/Ten	88·50
Pioneer	SX525	90·75
	SX626	124·75
Rotel	RX150A	41·95
	RX200A	53·95
	RX400A	64·95
	RX600A	90·00
	RX800	114·50
	RX154A	78·30
Tandberg	TR200MPX	85·15
	TR1000MPX	143·75
	TR1010MPX	149·95
Teleton	TSF55	57·20

8 TRACK PLAYER DECKS

(carr./packing 35p)

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

IN CAR ENTERTAINMENT

CAR RADIOS (carr/packing 35p)
MW/LW Complete with speakers

SHIRA Touring	7·00
SHIRAMATIC	9·00
PHILIPS RN270	13·65
PHILIPS RP305	17·40
PYE 2644	26·75
PYE 2062	18·25
COURIER MC101	10·95
COURIER PC51	14·75
SHARP ATR 933	12·45
SHARP AR 947	18·60

STEREO CASSETTE (carr/packg 35p)
Complete with Speakers

SHIRA NA300	18·50
SHIRA CP401	23·75
PHILIPS N2607	26·40
R/MOBILE 302CS	32·00
PYE 2252	24·75
PYE 2253	28·40
HANIMAX HC6010	38·95
SELMAR (Plus MW/LW Radio)/	38·95

STEREO 8 TRACK (carr/packg 35p)
Complete with speakers

SHIRA ST805	15·00
WALTHAM TRE 1500	21·00

8 TRACK WITH MW/LW RADIO (carr/packg 35p)
Complete with speakers

SHIRA ST1000	25·70
SHIRA ST2000	31·50

MW/STEREO FM (carr/packg 35p)
Complete with Speakers

SHARP AR953 CAR RADIO	36·50
LEAR JET 277 (Plus 8 Track)	42·65

10% VAT to be added to all orders.

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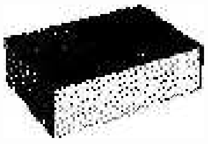
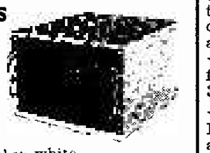


Model 120

PROJECTS DESERVE A Centurion PROFESSIONAL QUALITY INSTRUMENT CASE—4 MODELS



Model 320

Model 120 all aluminium two part construction. Top and sides, blue hammer finish, front, rear and base: white. Others: mild steel three part construction.
Top, base, sides and detachable rear panel, blue hammer. Detachable aluminium front panel finished in white.

Dimensions in inches.

Model	W	H	D	Price
120	8	2½	6	£1·85
220	8	6	3½	£2·65
221	8	6	6	£2·80
320	12	8	12	£5·00

Chassis for model 320 **£1·75** extra

Please send s.a.e. for free illustrated leaflet.

ORGAN BUILDERS

MES announce the very latest development in organ circuitry.

THE DMO2

13 Master Frequencies on ONE tiny circuit board.

LOOK AT THESE AMAZING ADVANTAGES

★ 13 frequencies from C8 to C9. ★ Each frequency digitally derived from a SINGLE h.f. master oscillator. ★ Initial tuning for the WHOLE ORGAN: ONE SIMPLE ADJUSTMENT. ★ Relative tuning NEVER DRIFTS! ★ External control allows instant tune-up to other musicians. ★ Outputs will directly drive most types of dividers including the SAJ110. ★ And each output can also be used as a direct tone source. ★ Variable DEPTH AND RATE tremulant optional extra. ★ Gold-plated plug-in edge connexion. ★ Complete fibre glass board (including tremulant if required) ONLY 3·7in. × 4·5in. ★ Very low power consumption.

★ EXTREMELY ECONOMICAL PRICE. ★ Ready built, tested and fully guaranteed.
DMO2T (with tremulant) ONLY **£14·25.**
DMO2 (without tremulant) **£12·25.**

★ S.a.e. please for full technical details.

Trade enquiries welcome.

SAJ110 7-stage frequency divider in one 14 pin DIL package. Sine or square wave input allows operation from almost any type of master oscillator including the DMO2 (when 97 notes are available). Square wave outputs may be modified to saw-tooth by the addition of a few components. SAJ110: **£2·63** each OR special price for pack of 12: **£25·00.** S.a.e. please for data sheet.

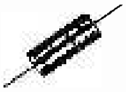
TRANSISTORS, DIODES & IC's.

AC127	25p	BF194	15p	OA90	7p
AC128	20p	BFY51	13p	OA91	6p
AC176	17p	MPF102	36p	1N914	4p
AD149	47p	OC44	20p	1N4148	4p
AD161/2	69p	OC71	20p	1N4001	6p
BC107	10p	TIS43	28p	1N4002	6½p
BC108	10p	2N1711	24p	1N4003	7p
BC109	10p	2N2219	25p	1N4004	7½p
BC147	10p	2N2646	45p	1N4005	8p
BC148	10p	2N2905	33p	1N4006	8½p
BC149	12p	2N2907	25p	1N4007	9p
BC168	13p	2N2926O	10p	WO05	30p
BC169C	12p	2N2926Y	10p	WO4	33p
BC182L	10p	2N2926G	10p	741C 8-pin D.I.L.	36p
BC204	14p	2N3053	18p		
BC209C	14p	2N3055	49p	741C 14-pin D.I.L.	45p
BD131	45p	2N3819	24p		
BD132	54p	AA119	7p	D.I.L. Sockets	
BD131/2	£1·20	BY127	16p	8-pin	20p
BD135	36p	BY164	49p	14-pin	15p

See our catalogue for our full range of transistors. 74 series I.C.'s bridges etc.

CAPACITORS

Sub-miniature
Axial lead electrolytic



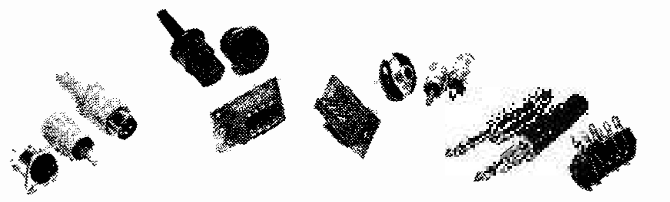
Mfd	V	Price	Mfd	V	Price	Mfd	V	Price
1	63	6p	68	6·3	6p			
1·5	63	6p	68	16	6p			
2·2	63	6p	68	63	10p			
3·3	63	6p	100	4	6p			
4·7	63	6p	100	10	6p	470	6·3	6p
6·8	40	6p	100	25	6p	470	10	10p
6·8	63	6p	100	40	6p	470	25	12p
10	25	6p	100	63	12p	470	40	18p
10	63	6p	150	6·3	6p	680	6·3	10p
15	16	6p	150	16	6p	680	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

OMNIUM GATHERUM

PP3, 6 etc. battery clip dual min.	9p
PP1, 9 etc. battery clip separate per pair	6p.
Pair crocodile clips 1 red, 1 black insulated sleeve.	7p
Solder Multicore 22swg 10 metres	20p
Silicone grease in special dispenser 20ml.	43p
Red neon 240V panel mounting	25p
Lacing Cord Strong rayon cored PVC 25m.	43p
Panel fuse holders 20mm **20p**; 1¼"	30p
Transformers LT700 min. output transformer Pri. 1·2k Ω Sec. 5 Ω 200mW	35p
Sub-min. Mains Transformer 6-0-6V 100mA	95p
12-0-12V 50mA Size: Both approx. 30 × 27 × 25mm.	95p
Min. Mains Transformer (Size: 46 × 31 × 38mm) 0-12V 250mA, 0-12V 250mA	£1·35
Mains transformer MT3AT Pri. 200-220-240V, Sec. 12-15-20-24-30V 2A	£2·48
Mains Transformer MT206AT Pri. 200-220-240V, Sec. 0-15-20V 1A, 0-15-20V 1A	£3·10

Also in stock: Wide range of brass and nylon nuts, bolts and washers + solder tags, shakeproof washers etc.

PLUGS AND SOCKETS



DIN PLUGS
2 pin (1 flat) **8p**
3 pin **9p**
4 pin, 5 pin A (180°), 5 pin B (240°), 6 pin **10p**

DIN Sockets
2 pin **6p**
3 pin, 4 pin, 5 pin A (180°), 5 pin B (240°), 6 pin **7p**

MAINS
P360 3 pin 1·5A chassis plug with line socket. Per pair **24p**
SA 2190 3 pin 5A chassis plug **17p**
SA 1862 Line socket for above **19p**

McMURDO
RP8 8 way chassis plug **36p**

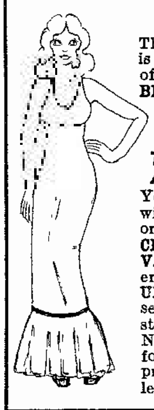
RS8 8 way chassis socket **52p**

PHONO
Plug plastic **5p**
Plug screened **9p**
Chassis socket **4p**

JACK
Std. ¼" mono plug
Plastic **13p**
Screened **17p**

Std. ¼" stereo plug
Plastic **16p**
Screened **25p**
Open mono socket ¼" **10p**; Moulded mono socket ¼" with 2 break contacts **13p**; Moulded stereo socket ¼" with 3 break contacts **18p**; 3·5mm. plug plastic **8p**; screened **11p**; open socket **8p.**

WE KNOW YOU NEED IT!



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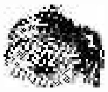
POTENTIOMETERS

Rotary miniature carbon track ¼" spindle

Single gang Lin or Log
5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M, 2M (and 1k Lin) **12p**



Dual gang (Stereo) without switch Log or Lin 5k to 2M as above **38p.**

Single gang with DP switch 250V 2A Log or Lin 5k to 2M as above **23p**

PRESETS
Sub-miniature 0·1W Vert or Horiz 100, 250, 500, 1k, 2·5k, 5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M **6p**

Wirewound 10% 1W ¼" spindle 10, 50, 100R **34p**; 250, 500, 1k, 5k **33p**; 10k, **37p**; 25k **40p**; 50k **44p.**

RESISTORS

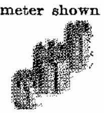
Carbon Film ¼W	5%	1 Ω to 1M; 10% 1·2M to 10M	E12	1p
Carbon Film ½W	5%	1 Ω to 10Ω; 10% 1·2M to 10M	E12	1p
Carbon Film ½W	5%	11 Ω to 910k	E12 & E24	1p
Carbon Film 1W	5%	10 Ω to 10M	E12	3p
Metal Oxide ¼W	2%	10 Ω to 1M	E12 & E24	4p
Wirewound 2½W	10%	0·22ohms to 0·47ohms	E12	10p
Wirewound 2½W	5%	1ohm to 270ohms	E12	10p

E12 values 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and decades
E24 values 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and decades

KNOBS

All ¼" shaft. Grub screw fixing

Diameter shown in brackets



K30/1 (13mm) **24p**
K30/3 (17mm) **22p**
K30/2 (13mm) **26p**

BK12 32mm long, black pointer with white stripe **6p**

K30/6 (32mm) **41p**

F18 (26mm) with numbered skirt **21p**

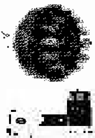
MK50 (34mm) **27p**

F12 (33mm) **21p**

CK4 (36mm) **14½p**

SWITCHES

Rotary with adjustable stop 1 pole 2 to 12 way; 2 pole 2 to 6 way; 3 pole 2 to 4 way; 4 pole 2 or 3 way, each **24p.**
Mains rotary DPDT 250V 2A **20p.**



Push to make non-locking **12p**

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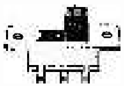

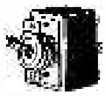

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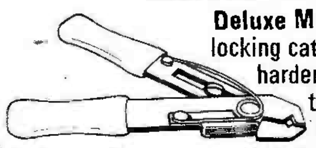

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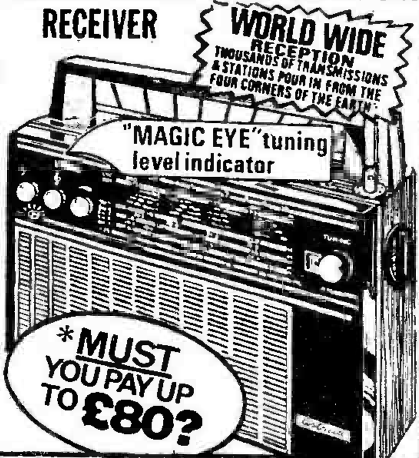

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EY84	.70
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EZ40	.55
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EZ81	.25
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PC97	.45
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PCC84	.40
PCC85	.44
PCC88	.60
PCC89	.50
PCC189	.53
PCF80	·28
PCF82	·33
PCF84	.59
PCF86	.44
PCF200	.67
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PCF802	.50
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PL81	.44
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PL82	.37
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PY82	.25
PY83	·33
PY88	.33
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UBC81	.45
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UBL21	.77
UC92	.45
UCC84	.75
UCC85	.38
UCF80	.65
UCH21	.66
UCH42	.65
UCH81	.38
UCL82	.38
UCL83	.60
UF41	.70
UF42	.70
UF80	.35
UF85	.44
UF86	1.00
UF89	.38
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2S323	·55
AA119	·17
AA120	·17
AA129	·17
AAZ13	·20
AC107	·17
AC113	·28
AC126	·14
AC127	·19
AC128	·22
AC132	·22
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	·25
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
GD9	·22
GET113	·22
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
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OC81D	·12
OC82	·12
OC82D	·12
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OC84	·26
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Business hours Mon.-Fri. 9–5.30 p.m. Closed 1–2 p.m. and Sats. We do not handle seconds or rejects, which are often described as "New and Tested" but have a limited and unreliable life. No enquiries answered unless S.A.E. is enclosed for reply. No overseas orders accepted.

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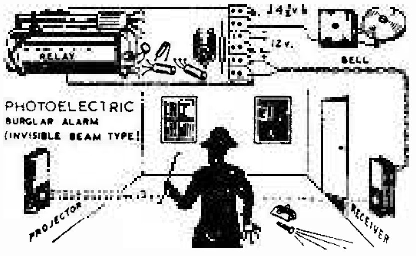

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Also Essential Data Circuits and Plans for Building 10 advanced Designs

INVISIBLE BEAM OPTICAL KIT

Everything needed (except plywood) for building: 1 Invisible-Beam Projector and 1 Photocell Receiver (as illustrated). Suitable for all Photoelectric Burglar Alarms. Counters, Door Openers, etc.

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Tunable, General-Purpose. Interference-Rejecting Differential Amplifier for experimental investigation of signals produced by the brain, heart and muscles. When used with an oscilloscope, or aural indicator, it enables you to monitor your brainwaves, learn to relax, meditate, etc.

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Aural Brainwave Indicator for use with a Biofeedback Amplifier. Converts subsonic brain frequencies into audible signals for easy recognition.

CONTENTS: Resistors, Pots, Capacitors, Transistors, Diodes, Leads, Chassis, Case, Earphone, Battery, Plans and instructions. Price **£3·25,** postage and pack. 15p (U.K.) Commonwealth: Surface 25p. Air Mail 75p.

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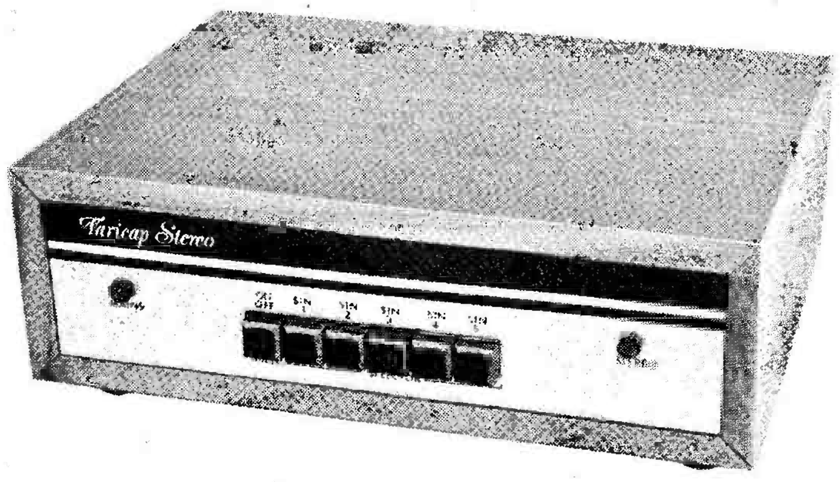
Send S.A.E. for full details, a brief description of all Kits and Projects.

YOU AIN'T HEARD NOTHIN' YET ! !

. . until you tune in to stereo perfection with 'Varicap'



'p.e.' f.m. varicap stereo tuner. Size approx. 8¾" x 2¾" x 6½"

This elegant and practical stereo tuner features push button 'spot-on' tuning with up to five simple pre-set stations (no difficult tuning dial and drive cord). It's easy 'no problem' construction requires only a few simple setting adjustments with a D.C. Voltmeter. It incorporates NEW pre-set modules for R.F. and I.F. circuits, this eliminates the need for the usually difficult circuit alignment.

All this, coupled with the latest Motorola high efficiency, Integrated Circuit 'phase lock loop' stereo decoder and automatic stereo lamp indicator, ensures perfect stereo reception.

The 'Varicap' is, in our opinion, THE most easily constructed stereo tuner available which will achieve professional results.

The kit comprises Fibre glass P.C. board, elegant slimline teak veneer cabinet, brushed aluminium front panel, push buttons, instructions, in fact everything you need.

We also supply any of these kit components as separate items.

Total kit price ONLY £28.50 (inclusive of VAT and postage).

IDEAL FOR USE WITH THE 'TEXAN', 'GEMINI' OR ANY OTHER GOOD QUALITY STEREO AMPLIFIER.

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After many requests, Electro Spares are supplying lists of components for ALL projects featured in 'Practical Wireless' from July 1973 issue onwards. We regret that we cannot supply lists for projects published before this date.

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We believe this method of 'one source' buying can save you time and postage - **AND THAT MEANS MONEY ! !**

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The 'Gemini' is a quality hi-fi stereo amplifier for the home constructor, featuring a genuine 30 watt R.M.S. per channel output into 8 ohms. Total harmonic distortion of 0.02% and a frequency response (-3dB) 20Hz - 100kHz, at all power levels.

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We know no better unit for the home constructor - hundreds have been supplied throughout the world.

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'THE COMPONENT CENTRE OF THE NORTH'.

Exciting...the Stereo 21!

Can you really get sound quality like this FOR LESS THAN £19? YES, YOU CAN! WITH THE NEW

STEREO 21

Until now, richly satisfying sound has always cost a richly satisfying price. *But not any more!* For an almost unbelievable **£18·45,** you can have Stereo 21—audio for the connoisseur! Whatever your taste in music, you can hear it on STEREO 21 the way its composers heard it in their dreams! Beethoven or Mahler . . . Ellington or Jellyroll Morton . . . Das Nibelung or Jesus Christ Superstar . . . Carols from King's College Chapel or the return of a Beatle . . . everything from a prettily fluting baroque organ to the newest pop group at full throttle—STEREO 21 does them all justice!

And have you ever seen a handsomer audio installation? Compact enough to go in a university student's bedroom-study, elegant enough for the suavest penthouse pad in Town, STEREO 21 offers you all the pride of possession as well as a thrilling musical experience!

Top-quality amplifier, BSR turntable, matching speakers. Deck and speaker cabinets you simply wrap round and glue to build. Screw in the amplifier and connect up (all push fit no soldering whatsoever), so simple literally anyone can do it. Except for glue and panel pins all parts supplied including full instructions—all for £18·45 (plus the cost of post and packing if you buy by mail), and—to round it all off—a money refund if not satisfied if your pleasure in STEREO 21 is not complete!

Just think—in only a few days you could be giving your ears the treat of a lifetime—AND introducing your envious friends to STEREO 21 !

Power Output 2·7 Watts per channel and headphone socket with automatic cut out provision for auxiliary inputs—radio, tape, etc. and output for taping discs. Overall Dimension: Speakers approx. 15½″ × 8″ × 4″. Complete deck and cover enclosed position approx. 15½″ × 12″ × 6″.

Personal shoppers and mail order price

£18·45 INCLUDING VAT plus £1·60 p + p.

Diamond stylii, if required, £1·37 extra

Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance, if required £3·85.

EMI SPEAKERS AT UNBELIEVABLE PRICES

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

15″ 14A/780. Bass unit on a rigid diecast chassis. Superior cone material handles up to 50 watts RMS, and is treated to give a smooth frequency response. Resonance 30 Hz. Fluse 360,000 Maxwells. Impedance at 1 kHz is 8 ohms. 3″ voice coil.

Recommended retail price £40·80.

OUR PRICE £18·70 + £1·50 p & p

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RTVC VISCOUNT III

a boost in the output,

VISCOUNT III now gives you an imposing 20 watts per channel—and the price quoted is actually INCLUSIVE OF VAT!

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The unique VISCOUNT III amplifier, plus the Garrard SP25 Mk III deck, plus the magnificent Duo Type III matched speakers (or Duo Type II for a small room) give you an audio installation that will prove unbeatable for listening pleasure! And the teak finish will harmonise and enhance virtually any style of interior decor! On the brushed aluminium front panel of the amplifier you'll find all the facilities you need—volume, bass, treble and balance controls, plus switches for mono/stereo, on/off function and bass and treble filters. Plus headphone socket on the back.

The heart-stopping timbre of Tom Jones at his most virile . . . the last lingering harmonics of a solo performance by Heifetz or Menuhin. . . , the pathos and the panache of Liza Minelli . . the majestic sonorities of the brass band and the elfin subtleties of the virtuoso clavichordist—hear every nuance with a fidelity that you have never experienced before!

Come and hear VISCOUNT III! If it's inconvenient to travel, buy by post in the confidence that you won't be disappointed (and with a 24-carat Money-Back Guarantee to give you extra reassurance). Don't settle for second-best!

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 × 8¼in 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.

STILL ONLY £49 COMPLETE

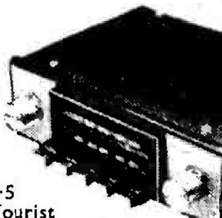
PRICES : SYSTEM 1

Viscount III R102 amplifier	£24·20 + £1 p & p
2 Duo Type II speakers	£14·00 + £2·20 p & p
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
Garrard SP25 Mk III with MAG cartridge plinth & cover	£18·00 + £1·75 p & p
total	£74·20
Available complete for	**£65·00** + £4 p & p

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 $4\frac{5}{16}$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.

RELIANT Mk IV

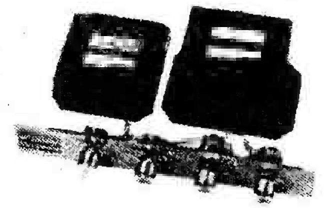
MONO AMPLIFIER

*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.

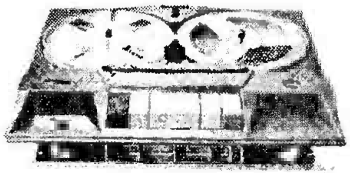
INPUTS 1. Crystal Mic or Guitar 9mV. 2. Moving coil Mic. or Guitar 8mV. Inputs 3, 4 & 5 are suitable for a wide range of medium output equipment (Gram, Tuner, Monitor, Organ, etc.) All 250mV sensitivity. Output 20 watts into 8 Ω (suitable for 15 Ω.) Size approx. 12½ x 6 x 3½ ins. **£13·50** p. & p. 60p

UNISOUND MODULES

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.



PE TAPE LINK CONSTRUCTORS

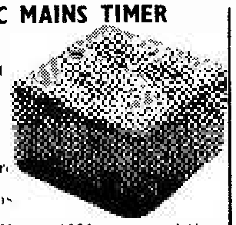
Suitable 3 speed tape deck, less heads. Caters up to 5¾ins. spools. 240V AC mains. Unused but store soiled hence no warranty. £1 p. & p. **£4.00**

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. **£10·60** + 90p. p. & p.

SEE OPPOSITE PAGE FOR ADDRESS DETAILS

ELECTRONIC MAINS TIMER

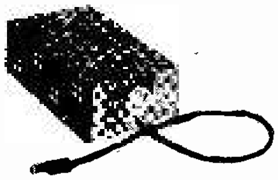


A reliable unit ideal for timing Bathroom/Toilet Ventilators Stairway/ Cloakroom Lighting etc. Gives up to 30 mins delay before switching off. Delay: 1–30 mins adjustable. Max Load: 400VA or 1000 watts resistive. Ivory Case: 3⅜" × 3⅜" × 2". Fitting instructions included. Trade Price: **£5·80**. Post 20p.

DIMMER SWITCH

Type C1. 300 Watt Light Dimmer for 200/250 Volt A/C operation. Ivory Case: 3⅜" × 3⅜" × 1⅜". Fitting Instructions included. Price: **£2·80**. Post 20p. 10 for **£2·15** each. Post 30p. **£5·00** per pair. Post 25p.

POWER UNIT Type P1076



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

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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**	*

LOW VOLTAGE

Prim:- 200–240V. Sec:- 12 & 24V.

Amps		Type	Price	P & P
12V	24V	No.	£	£
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

30 Volts

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

50 Volts

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

60 Volts

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

Prim 240V with screen

Volts		Milliamps		Type	Price	P & P
Sec. 1	Sec. 2	Sec. 1	Sec. 2	No.	£	£
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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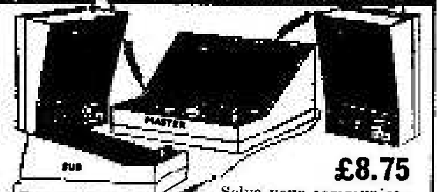

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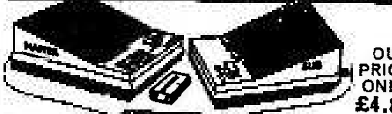

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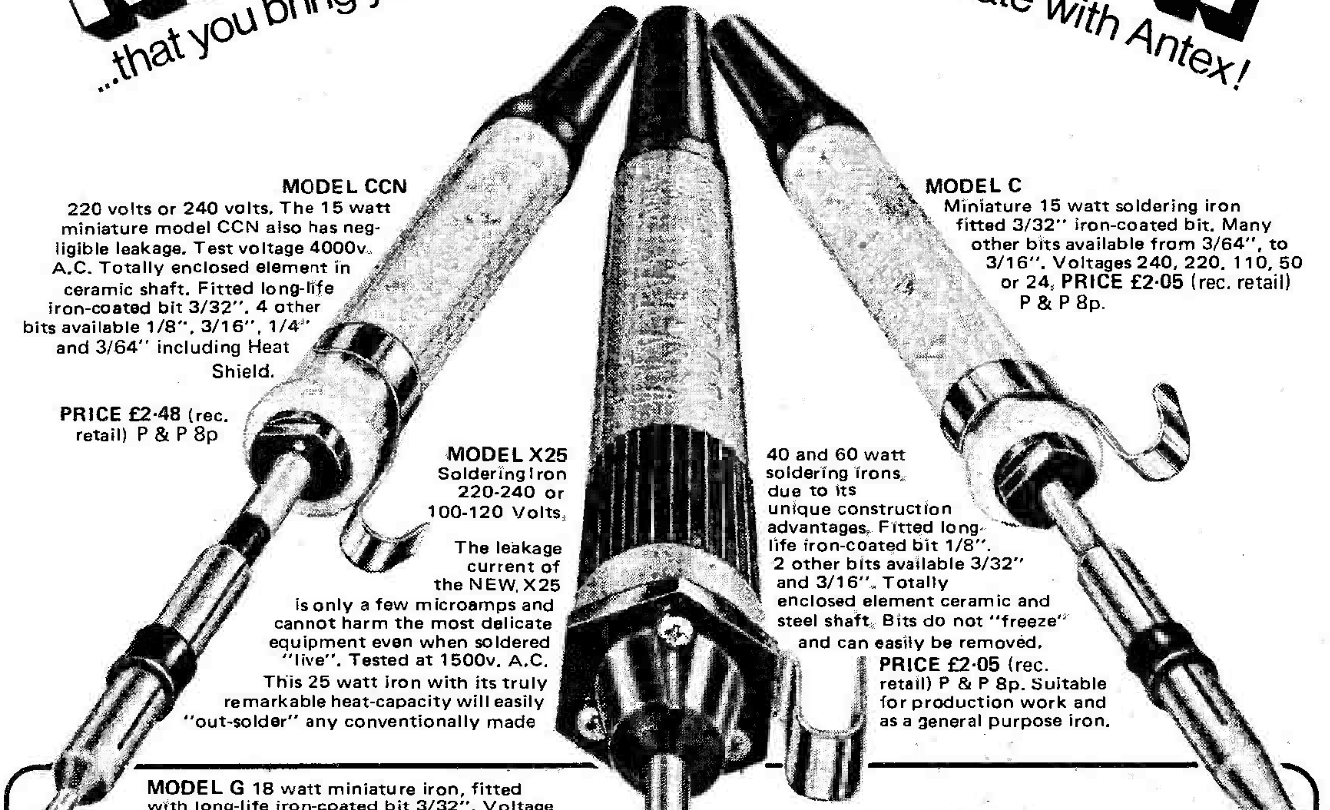

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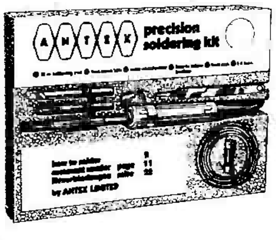

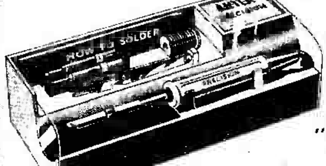

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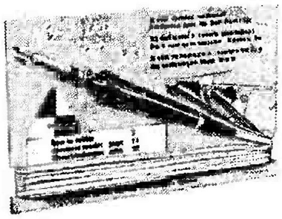

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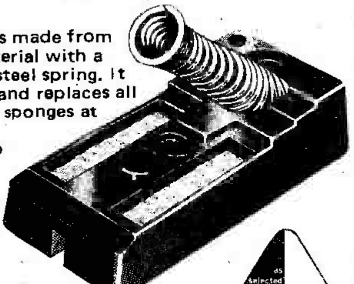

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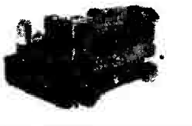

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FETS: 2N3819 **19p,** 2N3823E **20p,** 4416E **25p,** BC182/3/4 **10p,** BC212/3/4 **11p,** BCY70 **13p,** BD131/2 **35p** ea., BFY51/2/3 **15p,** TIS43 **25p,** 2N2926 Oy **7p,** 2N3053 **15p,** 2N3702/3/4/5/6/7/8/9/10/11 all **9p** ea.,2N3904/6 **14p. HEATSINKS** 5f/TO5, 18f/TO18 **5p.** TO3: 4YL **29p.** TV3 **14p**
CAPACITORS: 25V 10, 50, 100 uf **5p,** DISCS **4p,** PRESETS **5p,** CARBON-PTS **11p.** Switch + **11p.** Dual **55p.** ULTRASONIC TRANSDUCERS **£2** ea.
FLUORESCENT LIGHTS. 8W 13" 12 VOLT **£2·59.**

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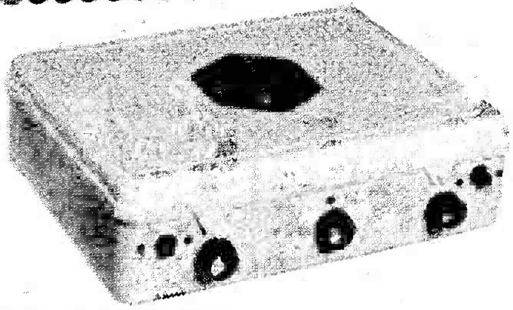

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- ★ 4 Transistor Push Pull Amplifier.
- ★ 5 Transistor Push Pull Amplifier.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ 5 Transistor Short Wave Radio.
- ★ Electronic Metronome.
- ★ Electronic Noise Generator
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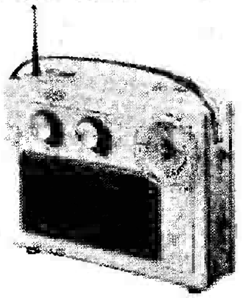
(+ 10% VAT 72p)

Components Include: 24 Resistors • 21 Capacitors • 10 Transistors • 3½" Loudspeaker • Mica Baseboard • 3 12-way connectors • 2 Volume controls • 2 Slider Switches • 1 Tuning Condenser • 3 Knobs • Ready Wound MW/LW/SW Coils • Ferrite Rod • 6½ yards of wire • 1 Yard of sleeving etc. • Parts Price List and Plans 50p. (Free with parts).]

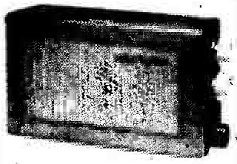


NEW ROAMER NINE

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 9½" × 7" × 2½" approx. Parts Price List and Plans 30p (Free with parts).

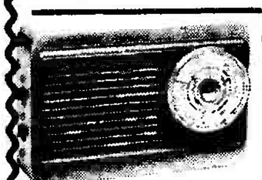
Total Building Costs **£6·95** P P & Ins. 44p (Overseas P & P £1·85)
(+ 10% VAT 69p)



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).

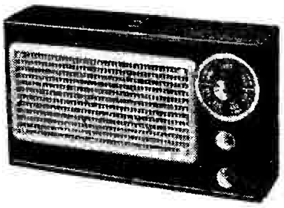
Total Building Costs **£2·28** P P & Ins. 26p
(+10% VAT 22p)
(Overseas P & P £1·25)



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. 26p
(+10% VAT 25p)
(Overseas P & P £1·25)



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" × 5¼" × 2½" approx. Parts Price List and Plans 15p. Free with parts.

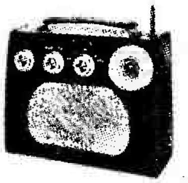
Total Building costs **£2·73** P P & Ins. 30p (+ 10% VAT 27p) (Overseas P & P £1·25)

E.V.6. Case and looks as above. 6 Transistors and 3 diodes. Powered by 9 volt battery. Ferrite rod aerial, 3" 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 (+ 10% VAT 36p) (Overseas P & P £1·25)

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. 3" Loudspeaker.
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 Overseas P & P £1·85 (+ 10% VAT 40p)

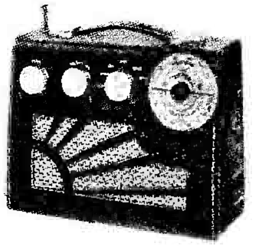


ROAMER EIGHT Mk I

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. Latest 4" 2 watt ferrite magnet loudspeaker. 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 (Overseas P & P £1·85) **£6·98** P P & Ins. 47p (+ 10% VAT 69p)



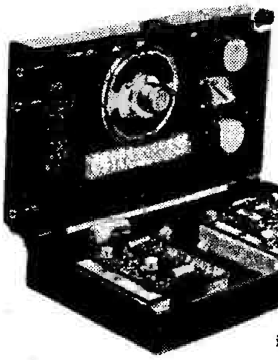
ROAMER TEN

WITH VHF INCLUDING AIRCRAFT

10 Transistors. 9 Tunable Wavebands. MW1, MW2, LW, SW1 SW2, SW3, Trawler Band, VHF and Local Stations also Aircraft Band. Latest 4" 2 watt ferrite magnet loudspeaker.

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. Ganged Tuning Condenser with VHF section. Separate coil for Aircraft Band. Volume on/off. Wave Change and tone Controls. 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 (Overseas P & P £1·85) **£8·50** P P & Ins. 52p
(+ 10% VAT 85p)



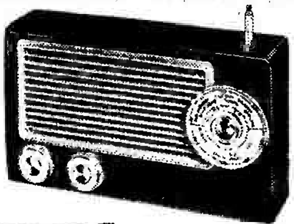
"EDU-KIT"

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 3" 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 £1·85)
(+ 10% VAT 55p)



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 × 5¼ × 2¾in. 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
(+ 10% VAT 44p)
(Overseas P & P £1·25)

ROAMER SIX

CASE AND LOOKS AS TRANS-EIGHT

6 Tunable Wavebands: MW, LW, SW1, SW2. 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 × 5¼ × 2¾in. approx. Plans and parts price list 25p (FREE with parts).

Total building costs **£3·98** P P & Ins. 31p (Overseas P & P £1·85)
(+ 10% VAT 39p)

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AC107	22	AD161 and		BC150	20	BD131	55	BF182	44	MAT121	22	2G308	39	2N2192	39	2N3391A	18	2N4062	13
AC113	20	AD162(MP)	75	BC151	22	BD132	66	BF183	44	MJE2955	95	2G309	39	2N2193	39	2N3392	16	2N4284	19
AC115	22	ADT140	55	BC152	19	BD133	72	BF184	28	MJE3055	62	2G339	22	2N2194	39	2N3393	16	2N4285	19
AC117K	32	AF114	27	BC153	31	BD135	44	BF185	33	MJE3440	55	2G339A	18	2N2217	24	2N3394	16	2N4286	19
AC122	13	AF115	27	BC154	33	BD136	44	BF187	30	MPF102	46	2G344	20	2N2218	22	2N3395	19	2N4287	19
AC125	19	AF116	27	BC157	20	BD137	50	BF188	44	MPF104	41	2G345	18	2N2219	22	2N3402	23	2N4288	19
AC126	19	AF117	27	BC158	13	BD138	55	BF194	13	MPF105	41	2G371	18	2N2220	24	2N3403	23	2N4289	19
AC127	20	AF118	39	BC159	13	BD139	61	BF195	13	OC19	39	2G371B	13	2N2221	22	2N3404	31	2N4290	19
AC128	20	AF124	33	BC160	50	BD140	66	BF196	16	OC20	70	2G373	19	2N2222	22	2N3405	46	2N4291	19
AC132	16	AF125	33	BC161	55	BD155	88	BF197	16	OC22	52	2G374	19	2N2368	19	2N3414	17	2N4292	19
AC134	16	AF126	31	BC167	13	BD175	66	BF200	50	OC23	54	2G377	33	2N2369	16	2N3415	17	2N4293	19
AC137	16	AF127	31	BC168	13	BD176	66	BF222	£1·05	OC24	62	2G378	18	2N2369A	16	2N3416	31	2N5172	13
AC141	20	AF139	33	BC169	13	BD177	72	BF257	50	OC25	42	2G381	18	2N2411	27	2N3417	31	2N5294	60
AC141K	32	AF178	55	BC170	13	BD178	72	BF258	66	OC26	32	2G382	18	2N2412	27	2N3525	83	2N5457	35
AC142	20	AF179	55	BC171	16	BD179	77	BF259	94	OC28	55	2G401	33	2N2646	52	2N3614	74	2N5458	35
AC142K	28	AF180	55	BC172	16	BD180	77	BF262	61	OC29	55	2G414	33	2N2711	23	2N3615	82	2N5459	44
AC151	17	AF181	55	BC173	16	BD185	72	BF263	61	OC35	46	2G417	28	2N2712	23	2N3616	82	2N6211	75
AC154	22	AF186	55	BC174	16	BD186	72	BF270	39	OC36	55	2N388	39	2N2714	23	2N3646	10	2S301	55
AC155	22	AF239	41	BC175	24	BD187	77	BF271	33	OC41	22	2N388A	61	2N2904	19	2N3702	13	2S302A	46
AC156	22	AL102	72	BC177	21	BD188	77	BF272	88	OC42	27	2N404	22	2N2904A	23	2N3703	13	2S302	46
AC157	27	AL103	72	BC178	21	BD189	83	BF273	39	OC44	17	2N404A	31	2N2905	23	2N3704	14	2S303	61
AC165	22	ASY26	28	BC179	21	BD190	83	BF274	39	OC45	14	2N524	46	2N2905A	23	2N3705	13	2S304	77
AC166	22	ASY27	33	BC180	27	BD195	94	BFW10	66	OC70	11	2N527	54	2N2906	17	2N3706	13	2S305	86
AC167	22	ASY28	28	BC181	27	BD196	94	BFX29	30	OC71	11	2N598	46	2N2906A	20	2N3707	14	2S306	86
AC168	27	ASY29	28	BC182	11	BD197	99	BFX84	24	OC72	16	2N599	50	2N2907	22	2N3708	09	2S307	86
AC169	16	ASY50	28	BC182L	11	BD198	99	BFX85	33	OC74	16	2N696	14	2N2907A	24	2N3709	10	2S321	62
AC176	22	ASY51	28	BC183	11	BD199	£1·05	BFX86	24	OC75	17	2N697	15	2N2923	16	2N3710	10	2S322	46
AC177	27	ASY52	28	BC183L	11	BD200	£1·05	BFX87	27	OC76	17	2N698	27	2N2924	16	2N3711	10	2S322A	46
AC178	31	ASY54	28	BC184	13	BD205	88	BFX88	24	OC77	28	2N699	39	2N2925	16	2N3819	31	2S323	62
AC179	31	ASY55	28	BC184L	13	BD206	88	BFY50	22	OC81	17	2N706	09	2N2926(G)	14	2N3820	55	2S324	77
AC180	22	ASY56	28	BC186	31	BD207	£1·05	BFY51	22	OC81D	17	2N706A	10	2N2926(Y)	12	2N3821	39	2S325	77
AC180K	32	ASY57	28	BC187	31	BD208	£1·05	BFY52	22	OC82	17	2N708	13	2N2926(O)	11	2N3823	31	2S326	77
AC181	22	ASY58	28	BC207	12	BDY20	£1·10	BFY53	19	OC82D	17	2N711	33	2N2926(R)	11	2N3903	31	2S327	77
AC181K	32	ASY73	28	BC208	12	BF115	27	BPX25	94	OC83	22	2N717	39	2N2926(B)	11	2N3904	33	2S701	46
AC187	24	ASZ21	44	BC209	13	BF117	50	BSX19	17	OC139	22	2N718	27	2N3010	77	2N3905	31	40361	44
AC187K	25	BC107	12	BC212L	12	BF118	77	BSX20	17	OC140	22	2N718A	55	2N3011	16	2N3906	30	40362	50
AC188	24	BC108	12	BC213L	12	BF119	77	BSY25	17	OC169	28	2N726	31	2N3053	19	2N4058	13		
AC188K	25	BC109	13	BC214L	16	BF121	50	BSY26	17	OC170	28	2N727	31	2N3054	51	2N4059	11		
ACY17	28	BC113	11	BC225	28	BF123	55	BSY27	17	OC171	28	2N743	22	2N3055	55	2N4060	13		
ACY18	22	BC114	17	BC226	39	BF125	50	BSY28	17	OC200	28	2N744	22	2N3391	16	2N4061	13		
ACY19	22	BC115	17	BC301	30	BF127	55	BSY29	17	OC201	31	2N914	16						
ACY20	22	BC116	17	BC302	27	BF152	61	BSY38	20	OC202	31	2N918	33						
ACY21	22	BC117	20	BC303	35	BF153	50	BSY39	20	OC203	28	2N929	23						
ACY22	18	BC118	11	BC304	40	BF154	50	BSY40	31	OC204	28	2N930	23						
ACY27	20	BC119	33	BC440	34	BF155	77	BSY41	31	OC205	39	2N1131	22						
ACY28	21	BC120	88	BC460	40	BF156	53	BSY95	14	OC309	44	2N1132	24						
ACY29	39	BC125	13	BCY30	27	BF157	61	BSY95A	14	OCP71	48	2N1302	16						
ACY30	31	BC126	20	BCY31	29	BF158	61	Bu105	£2·20	ORP12	48	2N1303	16						
ACY31	31	BC132	13	BCY32	33	BF159	66	C111E	55	P20	55	2N1304	19						
ACT34	23	BC134	20	BCY33	24	BF160	44	C400	33	P21	50	2N1305	19						
ACY35	23	BC135	13	BCY34	28	BF162	44	C407	28	P346A	22	2N1306	23						
ACY36	31	BC136	17	BCY70	16	BF163	44	C424	28	P397	46	2N1307	23						
ACY40	19	BC137	17	BCY71	22	BF164	44	C425	55	ST140	14	2N1308	26						
ACY41	20	BC139	44	BCY72	16	BF165	44	C426	39	ST141	19	2N1309	26						
ACY44	39	BC140	33	BCZ10	22	BF167	24	C428	22	TIS43	38	2N1613	22						
AD130	42	BC141	33	BCZ11	28	BF173	24	C441	33	UT46	30	2N1711	22						
AD140	53	BC142	33	BCZ12	28	BF176	39	C442	33	ZN414	£1·20	2N1889	35						
AD142	53	BC143	33	BD115	68	BF177	39	C444	39	2G301	21	2N1890	50						
AD143	42	BC145	50	BD116	88	BF178	33	C450	24	2G302	21	2N1893	41						
AD149	55	BC147	11	BD121	66	BF179	33	MAT100	21	2G303	21	2N2147	79						
AD161	39	BC148	11	BD123	72	BF180	33	MAT101	22	2G304	27	2N2148	63						
AD162	39	BC149	13	BD124	76	BF181	33	MAT120	21	2G306	44	2N2160	66						

DIODES AND RECTIFIERS

AA119	9	BY133	23	OA70	8
AA120	9	BY164	55	OA79	8
AA129	9	BYX38/30	46	OA81	8
AAY30	10	BYZ10	39	OA85	10
AAZ13	11	BYZ11	33	OA90	7
BA100	11	BYZ12	33	OA91	7
BA116	23	BYZ13	28	OA95	8
BA126	24	BYZ16	44	OA200	7
BA148	16	BYZ17	39	OA202	8
BA154	13	BYZ18	39	SD10	6
BA155	16	BYZ19	31	SD19	6
BA156	15	CG62		1N34	8
BY100	17	(OA91 Eq.)	6	1N34A	8
BY101	13	CG651		1N914	7
BY105	19	(OA70-OA79		1N916	7
BY114	13	Eq.)	7	1N414B	7
BY126	16	OA5	39	1S021	11
BY127	17	OA58L	23	1S951	7
BY128	17	OA10	39		
BY130	18	OA47	8		

LINEAR I.C's—FULL SPEC.

Type No.	Price 1	25	100+
72702	50p	48p	45p
72709	35p	33p	30p
72710	45p	43p	40p
72741	40p	38p	35p
72741C	45p	43p	40p
72741P	38p	36p	34p
72748P	38p	36p	34p
SL201C	59p	45p	40p
SL701C	50p	45p	40p
SL702C	50p	45p	40p
TAA263	80p	70p	60p
TAA293	£1·00	95p	90p
TAA350A	£1·85	£1·80	£1·70
μA703C	280	26p	24p
μA709C	35p	33p	30p
μA711	45p	43p	40p

NUMERICAL INDICATOR TUBES

CD66 .. .. £1·87

GR116 .. .. .. £1·70

3015F Minitron .. .. £1·50

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BP948	30p	28p	25p
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	£ p	£ p	£ p		£ p	£ p	£ p		£ p	£ p	£ p
7400	0·18	0·17	0·16	7448	1·10	1·07	1·05	74122	1·50	1·45	1·40
7401	0·18	0·17	0·16	7450	0·18	0·17	0·16	74123	3·00	2·90	2·80
7402	0·18	0·17	0·16	7451	0·18	0·17	0·16	74141	0·85	0·82	0·79
7403	0·18	0·17	0·16	7453	0·18	0·17	0·16	74145	1·65	1·55	1·45
7404	0·18	0·17	0·16	7454	0·18	0·17	0·16	74150	2·90	2·80	2·70
7405	0·18	0·17	0·16	7460	0·18	0·17	0·16	74151	1·10	1·05	1·00
7406	0·39	0·34	0·31	7470	0·32	0·29	0·27	74153	1·30	1·20	1·10
7407	0·39	0·34	0·31	7472	0·32	0·29	0·27	74154	1·98	1·90	1·75
7408	0·20	0·19	0·18	7473	0·41	0·39	0·35	74155	1·50	1·45	1·35
7409	0·20	0·19	0·18	7474	0·41	0·39	0·35	74156	1·50	1·45	1·35
7410	0·18	0·17	0·16	7475	0·50	0·48	0·46	74157	2·00	1·90	1·80
7411	0·28	0·27	0·26	7476	0·44	0·43	0·42	74160	2·10	2·00	1·90
7412	0·39	0·34	0·31	7480	0·74	0·71	0·64	74161	2·10	2·00	1·90
7413	0·32	0·31	0·30	7481	1·30	1·25	1·20	74162	4·40	4·15	3·85
7416	0·48	0·44	0·42	7482	0·96	0·95	0·94	74163	4·40	4·15	3·85
7417	0·48	0·44	0·42	7483	1·20	1·15	1·05	74164	2·20	2·10	2·00
7420	0·18	0·17	0·16	7484	1·10	1·05	1·00	74165	2·20	2·10	2·00
7422	0·55	0·53	0·50	7485	3·50	3·30	3·30	74166	3·20	3·10	3·00
7423	0·55	0·53	0·50	7486	0·35	0·34	0·33	74174	2·50	2·40	2·30
7425	0·55	0·53	0·50	7489	4·00	3·75	3·50	74175	1·75	1·65	1·55
7426	0·50	0·46	0·44	7490	0·74	0·71	0·64	74176	1·85	1·75	1·65
7427	0·50	0·46	0·44	7491	1·10	1·05	1·00	74177	1·85	1·75	1·65
7428	0·55	0·53	0·50	7492	0·74	0·71	0·64	74180	1·50	1·40	1·30
7430	0·18	0·17	0·16	7493	0·74	0·71	0·64	74181	5·00	4·50	4·00
7432	0·50	0·46	0·44	7494	0·85	0·82	0·75	74182	2·00	1·90	1·75
7433	0·75	0·73	0·70	7495	0·85	0·82	0·75	74184	3·20	3·10	3·00
7437	0·70	0·68	0·65	7496	0·96	0·93	0·86	74190	2·15	2·10	2·00
7438	0·70	0·68	0·65	74100	1·50	1·45	1·40	74191	2·15	2·10	2·00
7440	0·18	0·17	0·16	74104	1·07	1·04	1·00	74192	2·15	2·10	2·00
7441	0·74	0·71	0·64	74105	1·07	1·04	1·00	74193	2·15	2·10	2·00
7442	0·74	0·71	0·64	74107	0·44	0·42	0·40	74194	2·98	2·86	2·75
7443	1·20	1·15	1·10	74110	0·60	0·55	0·50	74195	2·00	1·95	1·90
7444	1·20	1·15	1·10	74111	1·38	1·27	1·21	74196	1·95	1·90	1·85
7445	1·98	1·95	1·90	74118	1·10	1·05	1·00	74197	1·95	1·90	1·85
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Code No's. mentioned above are given as a guide to the type of device in the pak. The devices themselves are normally unmarked.

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	TO5	TO66	TO66	TO64	TO48	TO48	TO48	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	—

INTEGRATED CIRCUIT PAKS

Manufacturers " Fall Outs" which include Functional and Part-Functional Units. These are classed as 'out-of-spec' from the maker's very rigid specifications, but are ideal for learning about I.C's and experimental work.

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UIC02	= 12 × 7402	0·55	UIC50	= 12 × 7450	0·55	UIC92	= 5 × 7492	0·55
UIC03	= 12 × 7403	0·55	UIC51	= 12 × 7451	0·55	UIC93	= 5 × 7493	0·55
UIC04	= 12 × 7404	0·55	UIC53	= 12 × 7453	0·55	UIC94	= 5 × 7494	0·55
UIC05	= 12 × 7405	0·55	UIC54	= 12 × 7454	0·55	UIC95	= 5 × 7495	0·55
UIC06	= 8 × 7406	0·55	UIC60	= 12 × 7460	0·55	UIC96	= 5 × 7496	0·55
UIC07	= 8 × 7407	0·55	UIC70	= 8 × 7470	0·55	UIC100	= 5 × 74100	0·55
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
UIC41	= 5 × 7441	0·55	UIC80	= 5 × 7480	0·55	UIC193	= 5 × 74193	0·55
UIC42	= 5 × 7442	0·55	UIC81	= 5 × 7481	0·55	UIC199	= 5 × 74199	0·55
UIC43	= 5 × 7443	0·55	UIC82	= 5 × 7482	0·55			
UIC44	= 5 × 7444	0·55	UIC83	= 5 × 7483	0·55	UICXI	= 25 Assorted 74's	1·65
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2N3055

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Size 16 mm × 16 mm.

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(Similar to 2N2060)

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B1P 19/20 TO3 NPN PLASTIC SILICON
Vebo = 100V. Vceo = 50V. I.C. = 10 amps. Ptot 50W. hfe = typ. 100 fT = 3MHz.

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CONDITIONED?

HAVE you ever been aware of being "conditioned"? We are subject to influences at sometime during our lives because we are human; because we are also British we seem often to fall for something just because the pundits say it is good. Only when the word gets around does it become an acceptance of standard.

When the "experts" told us about twenty years ago that the sound emitted from the radiogram was nowhere near authentic reproduction, a cult was developed in an effort to improve sound quality from records and radio. The term coined was high fidelity or "hi-fi". It took a long time to educate the listener in these terms, but eventually the term and its implications were accepted as part of our way of life.

CHANGING FACE

When the first Audio Festival was opened some 17 years ago, the organisers must have been thinking of future developments. Although strictly reserved for many years as the exhibition for better quality sound, it was inevitable that the other influential element, money, should be responsible for its changing face. From conditions and strict terms of reference for sound performance and unified presentation in hotel rooms, we have now seen the change to include anyone who is willing to pay the price for stand space, whether strictly in the accepted high fidelity bracket or just out to sell anything remotely connected with audio.

In the past, the Audio Fair must have been seen as the only alternative to the old Radio Show for showing domestic entertainment electronics, but there were many visitors who chose not to get involved in technical excellence. The cry today is the same, but the scene is changing.

The Audio Fair, once a paradise for studio technicians is now the all-comers show for the non-technical, where accepted sound reproduction standards for the Fair are lower; the electronics are in one package and a selection of tasteless reproduction cabinet work is offered. Throw in some thoughtlessly conceived visual display gimmicks that must cost the earth to construct and we seem to have turned full circle to where the Radio Show finally left off. Peripherals include a BBC disc-jockey show, colour video tape recorders, synthesised artificial sound, kits of components to build electronic gadgets, and a magazine called *Black Music*.

SATURATED MARKET

Where, oh where has all the top hi-fi gone? Some of the top hi-fi names were there, but in an overall impression of the show, they were a smaller proportion. However, it was interesting to note that the established high quality end of the market attracted the best crowds.

Being conditioned to the term hi-fi, therefore, commercial exploitation of it is now saturated, so it is sad that, in some cases, what is passed as hi-fi at very high prices needs careful scrutiny. The inflation disease has attacked much of the market, particularly where the equipment falls within a "mid-fi" bracket.

NOISES

On another subject, we have seen and heard much about pollution in most of its facets, but one such is a perpetual headache and nuisance that influences all of us. We become accustomed to patterning or break-up on television screens, clicks and plops on sound equipment, and whistles and burbles on radio. Even background noise is hardly noticeable when we are conditioned to a particular quality of sound reproduction.

Only when we hear high fidelity sound with negligable noise, do we notice the difference, but the trouble is that we seem to acquire "new" noises that perhaps one never realised existed: scratches on discs, drop-outs on tape, intermod on f.m., adjacent stations swamping a.m. They are not really new, but we have to learn to tolerate them or do something to eradicate them. Not all forms of interference can be completely eradicated, but we can do much to reduce the effects to a reasonable level.

INTERFERENCE

Some of the most mysterious forms of interference arise from airborne radiation from other equipment. The mains supply can also carry pulses from one end of the street to the other. The transistor is partly responsible for some of the trouble arising in domestic equipment. In some circumstances Amateur transmissions can break through on to high gain transistor equipment, the long loudspeaker leads acting as an aerial. The surprising fact is that the person responsible for effecting a cure is not the amateur transmitter licence holder, but the owner of the domestic equipment. The R.S.G.B. has a Committee to deal with this kind of interference problem, and in cases of unsettled dispute, the Ministry of Posts and Telecommunications will act as mediator, maybe enforcing a temporary period of rest from the transmitter.

An interesting and useful article on the subject, suggesting what can be done, is published in abridged form in this issue; a more detailed version which includes applications to television reception is being published in *Television* magazine (January issue).

M. A. COLWELL—*Editor*.

The February issue will include three star items; two pieces of valuable test equipment and a stop watch. Also a look at some simple experimental techniques with amplifier circuits, and the start of a special new series, helping you to understand and get the best from an oscilloscope. Also don't miss our advanced information revealing the identity of CRATA, and a preview of P.W. Datacards Nos. 7 and 8.

Further details on page 859

Leicester show

THE National Amateur Radio and Electronics Exhibition was held at the Granby Halls, Leicester on the 25th to the 27th October. The main theme was equipment especially for the radio amateur and indeed some of these items were quite sophisticated. Several stands concentrated on electrical components and they were doing a roaring trade.

Talk-in stations on various amateur bands were operating from the hall. GE3RAE was providing talk-in on 80m.

The British Amateur Radio Teleprinter Group (BARTG) were operating several teletype machines. Other groups were demonstrating amateur TV, slow scan and closed circuit TV.

For the 2 metre enthusiast, there was an extremely wide selection of gear, ranging from a six channel portable transceiver with re-chargeable batteries to a more sophisticated transceiver with a phase locked synthesised v.f.o. and digital read-out.

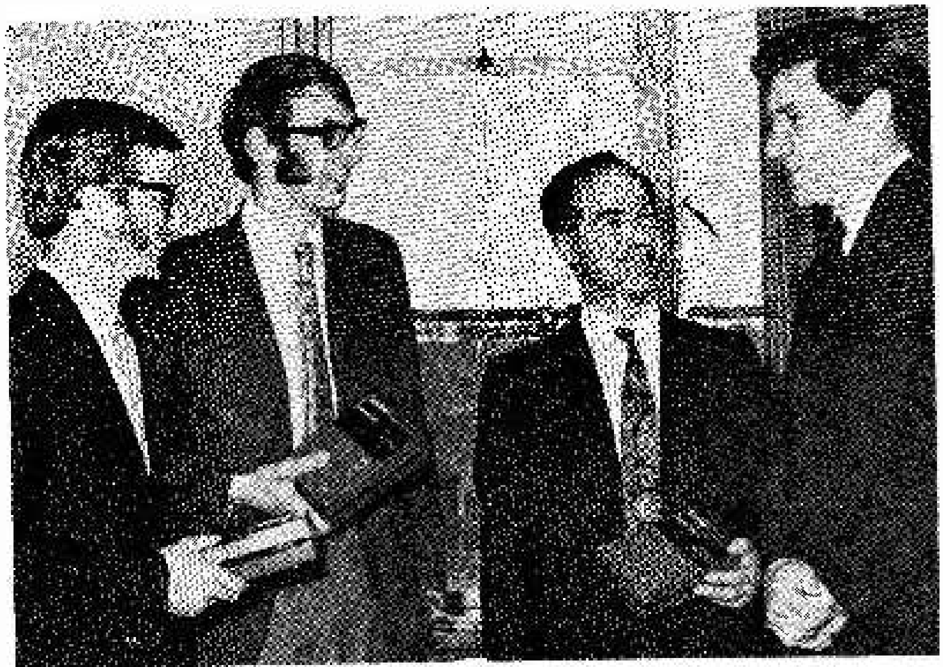
Equipment on show was by Heathkit (who were also showing their new 12in. portable TV) Drake, Yaesu (new FT101B transceiver), Trio, K. W. Electronics, Codar, J. Beam.

WIRELESS TELEGRAPHY ACT

Readers and advertisers are reminded of the requirements laid down by the Wireless Telegraphy Act. It is an offence in the U.K. to install or operate wireless telegraphy apparatus except under the provisions of the Act and, except in the case of broadcast sound-only receivers, a licence must be obtained from the Minister of Posts and Telecommunications.

Included within the provisions of the Act are any apparatus transmitting deliberate signals for any purpose such as "walkie - talkies", radio-controlled models or servos and some types of metal detectors. Apparatus radiating interference signals are subject to controls which also come under the administration of the same Ministry. If you require full information, please write to the *Ministry of Posts and Telecommunications, Waterloo Bridge House, Waterloo Road, London, SE1 8UA.*

P.W. multimeter competition



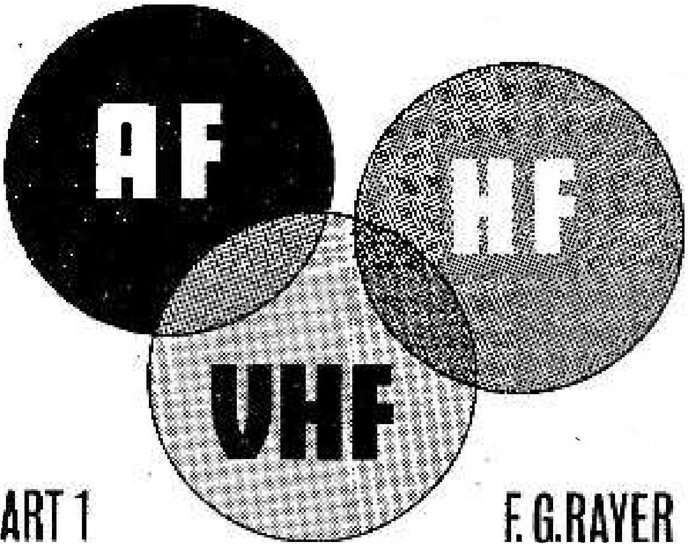
IN the June 1973 issue of P.W., readers were asked to put eight features of the Sinclair Radionics DMI multimeter in order of appeal to the average P.W. reader.

The four prizewinners were invited to a presentation at the Practical Wireless offices to receive their prizes. Our picture shows (from the left) Mr. J. R. Mann from Knaresborough, Yorkshire, Mr. R. Harris from Bristol and Mr. Bertram from Newcastle-upon-Tyne. The fourth winner was Mr. G. Rider from Southampton who received his prize by post. Each winner receives a Sinclair digital multimeter and a year of Practical Wireless free.

The Editor of Practical Wireless, Morris Colwell, is shown here sharing a joke with the winners after the presentation. The presentation was followed by a special luncheon also attended by Mr Roy Smith the Advertisement Manager, Mr. Lionel Howes, Assistant Editor of P.W. and Television, Mr. Roy Muggleton the Publisher and Mr. Kenneth Coad the Assistant Publisher.

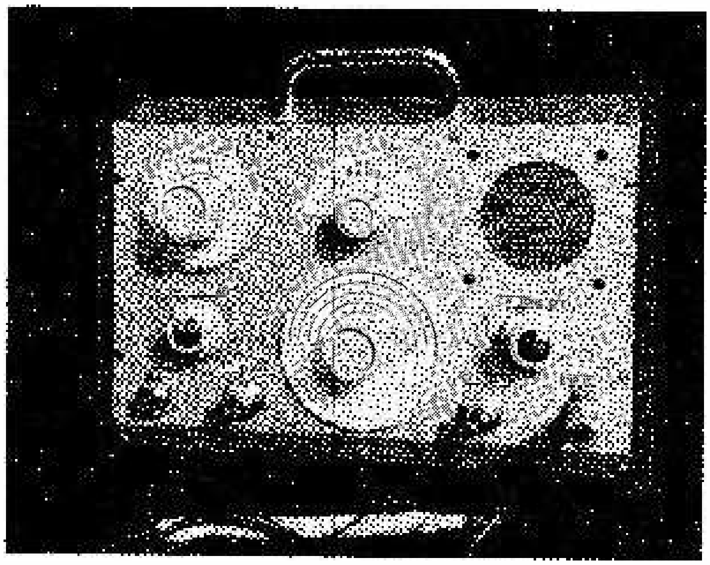
The BBC and quadraphonics

THE BBC is often asked about quadraphony. Demonstrations of quadraphony by four discrete channels have usually been impressive but unfortunately, the transmission of four separate signals by radio involves technical processes which either consume bandwidth that is not at present available or result in signal-to-noise ratio problems. A number of 'matrix' systems, which reduce the transmitted information to manageable proportions, show promise but there are several different proposals, each having its own advantages and disadvantages. There is, as yet, no international agreement on their relative merits. The BBC is actively investigating all the various proposals but at the moment is not ready to make a firm decision. In the United States, the National Quadraphonic System Committee (NQSC) has been set up and the BBC is in close touch with them. It is also actively co-operating with the European Broadcasting Union. Until there is a clear decision on a system to be adopted internationally and assurance that mono and stereo listening will not be affected, the BBC would not wish to imply recognition of any one system and thereby lead its listeners to the purchase of equipment which might later become useless.



PART 1

F. G. RAYER



TROUBLE-TRACER

THIS is a multi-purpose signal generator which covers VHF in addition to the usual long, medium and short wave bands, providing either a tone modulated or continuous wave output. The audio tone is also available for quick fault finding in audio circuits. For signal tracing, a high gain amplifier is included for audio circuit checks through all stages of audio equipment, together with a plug-in RF probe for tracing the course of a signal through RF and IF circuits.

CIRCUIT

Fig. 1 is a block diagram of the instrument which is constructed as five small units or modules, as follows:—

Tone Generator. This produces an audio tone, which is used to check audio circuits or switched to the HF or VHF oscillator to provide amplitude or frequency modulation of the RF outputs.

VHF Oscillator. This unit provides an RF output over the range 75MHz to 150MHz and has its own calibrated scale.

HF Oscillator. Five switched ranges allow complete coverage of the long, medium and short wave bands, for testing, alignment and similar purposes.

AF Amplifier. The three stage circuit operates a small internal speaker and a test probe allows the presence of an audio signal to be checked stage by stage through a receiver or audio amplifier.

RF Probe. The probe, on a co-axial lead, extends the range of circuit tracing so that the presence of a signal can be checked in RF and IF circuits.

Switching allows CW (unmodulated) or tone modulated RF outputs or AF output to be selected. A potentiometer is fitted as an output attenuator to reduce the output signal level as required. A control of this kind is satisfactory for audio frequencies and the lower frequencies in the RF range but due to stray circuit capacitance and RF leakage its efficiency in reducing output falls off as frequency is increased. However, in practice this simple type of attenuator is useful despite this drawback.

The tracer amplifier has its own switch and gain control, so it may be used by itself or simultaneously with the generator. It can also be used for other incidental purposes for which a small amplifier and speaker are required. The diode RF probe can be plugged into the audio amplifier input socket.

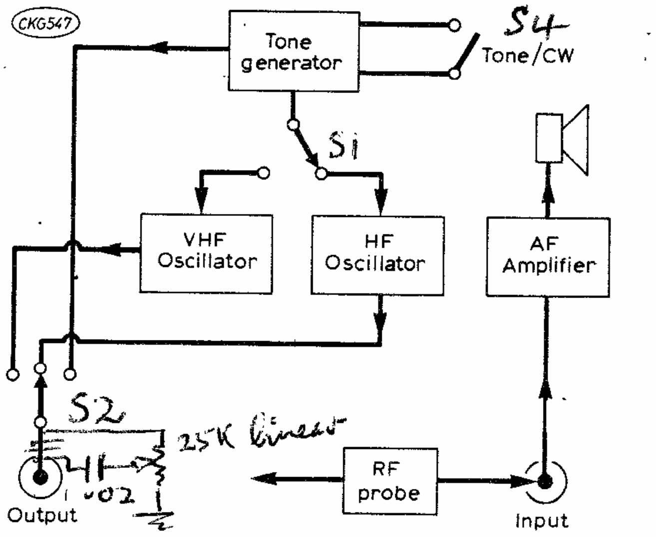


Fig. 1: Block diagram of the Trouble Tracer. Circuit diagrams of the units are given separately rather than as a complete circuit diagram.

Construction is simplified by having separate units. Each unit can be built, and operated by itself, for testing or other purposes. When the units are constructed they are fixed in the case, which allows the function switches, output and input sockets and other wiring between units to be completed.

VHF OSCILLATOR

This unit tunes approximately 75MHz to 150MHz so as to include the VHF FM frequencies from around 88MHz to 108MHz, as well as 144MHz and other frequencies. The VHF oscillator is amplitude modulated at base and collector which introduces frequency modulation when the switch is at

H.F. oscillator

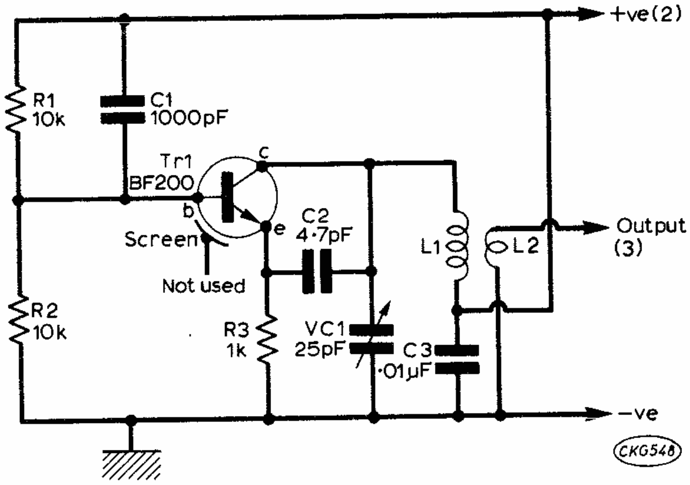


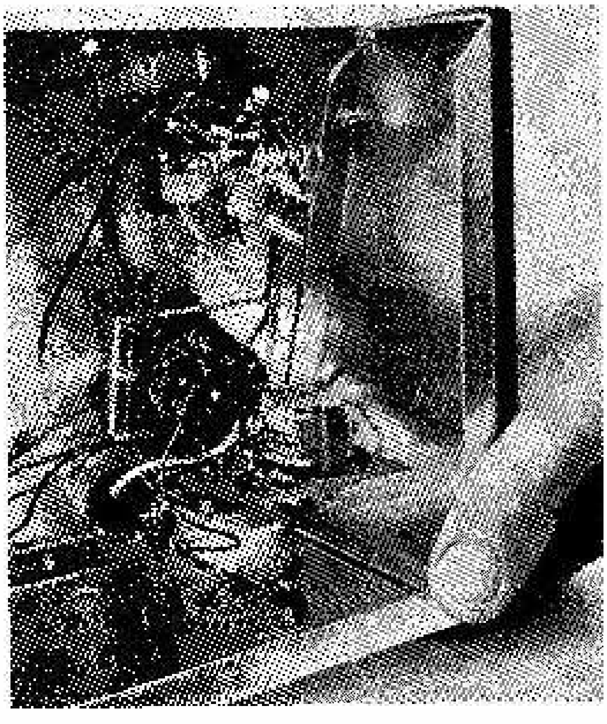
Fig. 2: Circuit of the VHF oscillator which tunes from about 75 to 150MHz.

"Tone." With this switch at "CW" modulation is removed.

Fig. 2 is the VHF unit circuit. Both L1 and L2 are self-supporting and VC1 is a separate panel control. For a narrower band, such as 88-108MHz or coverage around 144MHz, VC1 may be 5pF instead.

The unit is assembled on a tagboard about $1\frac{1}{2}$ x $1\frac{1}{4}$in, Fig. 3, cut to leave six tags. Plain perforated Veroboard may be used instead, but the pins must be cut off at the front of the board, to prevent shorts to the metal panel. The board is mounted by the bush and fixing nut of VC1. Washers are put between the board and metal panel, so that the tags are clear of the metal.

Connections in this unit are short and direct. L1 and L2 are wound with 20SWG tinned copper wire to $\frac{3}{8}$in outside diameter. For L1, wind $4\frac{3}{4}$ turns on a pencil or similar object, spacing the turns so that the coil is $\frac{7}{8}$in long. L1 lies over the tags, near VC1. One end of L1 is 1in long and goes down directly to tag 2 at Y. The other end is $\frac{1}{2}$in long and is soldered to X of VC1, from which a lead runs to tag 6. L1 is one turn, with ends shaped to reach tags 1 and 3, as shown. A space of about $\frac{1}{4}$in is left between the coils.



This photograph shows the VHF oscillator at the top with the tone generator below, mounted on the panel by the frequency selector switch.

A lead from tag 1 runs to the metal panel. Tag 2 is wired to switch S1 so that a positive voltage is supplied when the switch is in the VHF position. Tag 3 is connected to this switch so that output from L2 goes to the potentiometer and output socket. Other tags support resistors etc. as shown.

Operation of the VHF oscillator can be checked by listening for the signal on a VHF receiver, with the switch at "Tone." Battery current for this section should be around 3mA to 4mA.

If necessary, the frequency tuned can be lowered by compressing L1, or raised by stretching the coil to separate the turns.

This range may be calibrated by means of a sensitive wavemeter, or by means of a VHF receiver, over the frequencies for which calibration points are available.

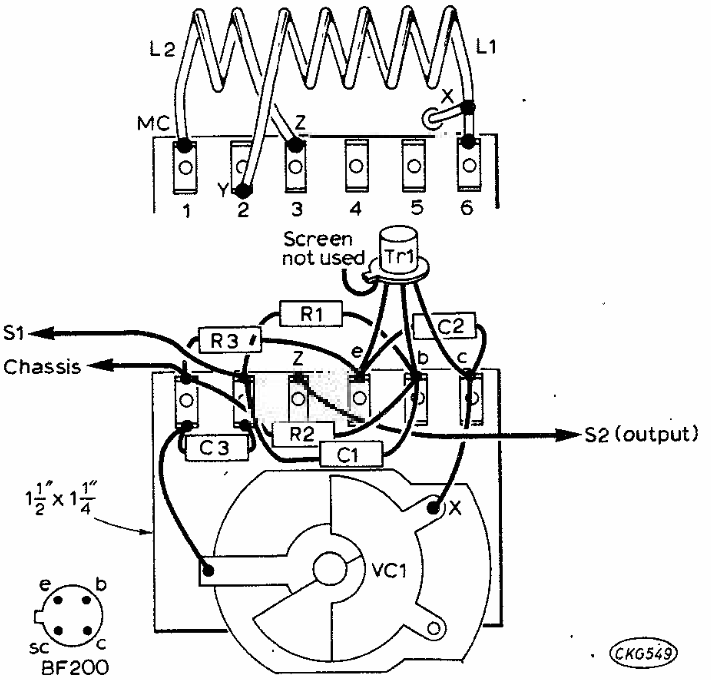


Fig. 3: Constructional details of the VHF oscillator which is mounted directly on to the panel by the nut holding the tuning capacitor.

The dial is a disc of perspex 2in in diameter, which is most easily cut out with an adjustable tank or washer cutter. The disc is secured to the control knob with two 6BA bolts though self-tapping screws could be used instead. Alternatively, the disc could be held with adhesive.

A black line on the disc travels over a card scale, held to the panel with adhesive. The main purpose of the disc is to avoid finger marks on the scale.

TONE GENERATOR

This unit is a single transistor audio oscillator using the circuit in Fig. 4. The phase of the collector winding 1-2 and the base winding 5-6 is arranged to sustain oscillation, the values used giving an audio tone of about 400Hz.

The third winding on the transformer, tags 3-4, provides a 9V supply for the HF or VHF oscillator, according to the setting of the switch. This modulates these oscillators. To remove modulation, switch contacts short the collector winding.

TONE GEN^{R} ≃ 4KC HZ

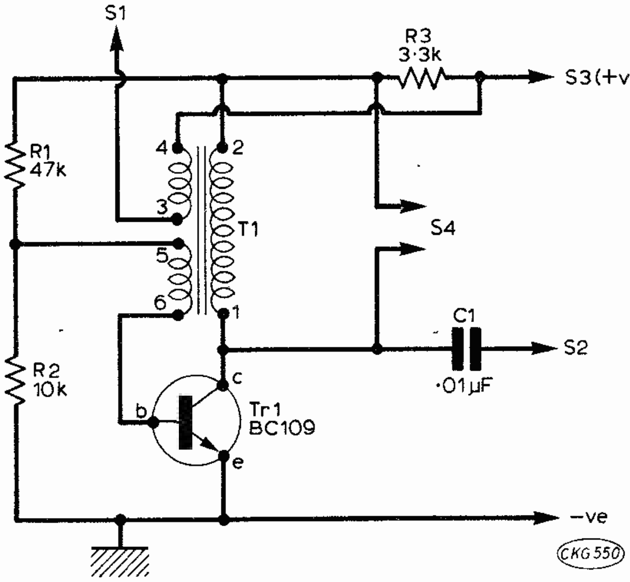


Fig. 4: The simple circuit of the tone generator shown in the previous photograph.

The tone generator is assembled on a small piece of Veroboard, as in Fig. 5. The two MC points are tags secured by 6BA bolts. Later, additional nuts on these bolts allow the board to be mounted on a bracket, which is secured by the switch brush and nut. The points MC are thus common to the metal panel.

Pin connections for T1 are when viewing this from below, as shown. If a different transformer is used, it may be necessary to experiment with connections to obtain oscillation, and some circuit values might have to be changed to obtain a suitable frequency.

Veropins or leads can be provided for external connections. The positive circuit is completed at both "Tone" and "CW" positions of the switch. The circuit from pin 3 of T1 is switched to the VHF or HF oscillator. Leads from 1 and 2 of T1 run to the switch so that T1 primary is shorted when the switch is in the "CW" position.

When the equipment is switched for audio output, the audio tone generator is switched directly to the output potentiometer, so that an audio tone is available at the output socket.

A bracket cut from scrap metal is drilled for the switch bush and the bolts MC. Extra nuts are run on these bolts to give a little clearance for other joints and leads. The tone generator board is locked to the bracket by further nuts.

Current drain by the tone generator itself is about 1mA to 2mA. It can be tested by noting that the

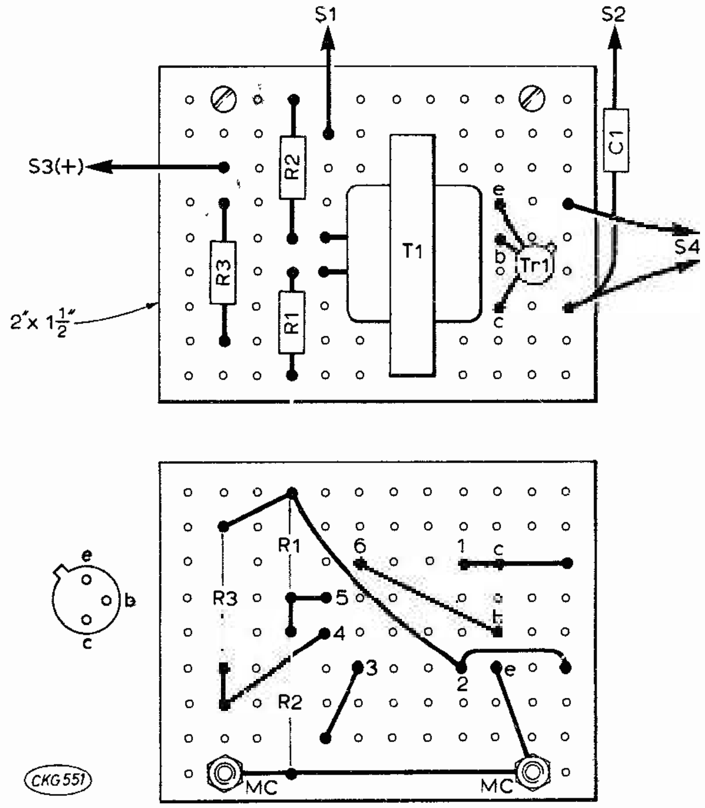


Fig. 5: Board layout of the tone generator components.

★ components list

VHF Oscillator (Fig. 2)

R1	10kΩ	C1	1000pF
R2	10kΩ	C2	4·7pF
R3	1kΩ	C3	0·01μF
Tr1	BF200	VC1	25pF (Jackson C804)

Tagboard 1½ x 1¼in. Knob for VC1.

Tone Generator (Fig. 4)

R1	47kΩ	C1	0·01μF
R2	10kΩ	Tr1	BC109
R3	3·3kΩ	T1*	T/T3 (RS Components)

* Intended for OC71 into 2 x OC71, 3·6 : 1 + 1

Plain Veroboard, 0·15in matrix, 2 x 1½in.

HF Oscillator (Fig. 6)

R1	12kΩ	C1	0·01μF
R2	10kΩ	C2	10pF
R3	2·2kΩ	C3	0·01μF
R4	2·7kΩ	C4	0·01μF
Tr1	BF167	VC1	365pF (Jackson 00)

S6, 2 pole 5 way wafer switch. Coils L1 to L5 (Denco 'Blue' miniature valve type coils, Ranges 1 to 5). Paxolin, 6 x 2in. Dial, preferably slow-motion, for VC1.

Audio Amplifier (Fig. 8)

R1	2·2MΩ	R4	220kΩ	R7	47Ω
R2	8·2kΩ	R5	2·7kΩ	R8	2·2Ω
R3	270kΩ	R6	680Ω	R9	2·2Ω

C1	0·02μF 500V	C4	100μF 10V
C2	0·047μF	C5	320μF 10V
C3	0·1μF		

VR1/S5 10kΩ log. potentiometer with switch

Tr1	BC109	Tr3	AC127
Tr2	BC149	Tr4	AC128

Plain Veroboard, 0·15in. matrix, 3 x 1½in.

RF Probe (Fig. 12)

R1	56kΩ	C1	22pF 500V
R2	22kΩ	C2	0·01μF

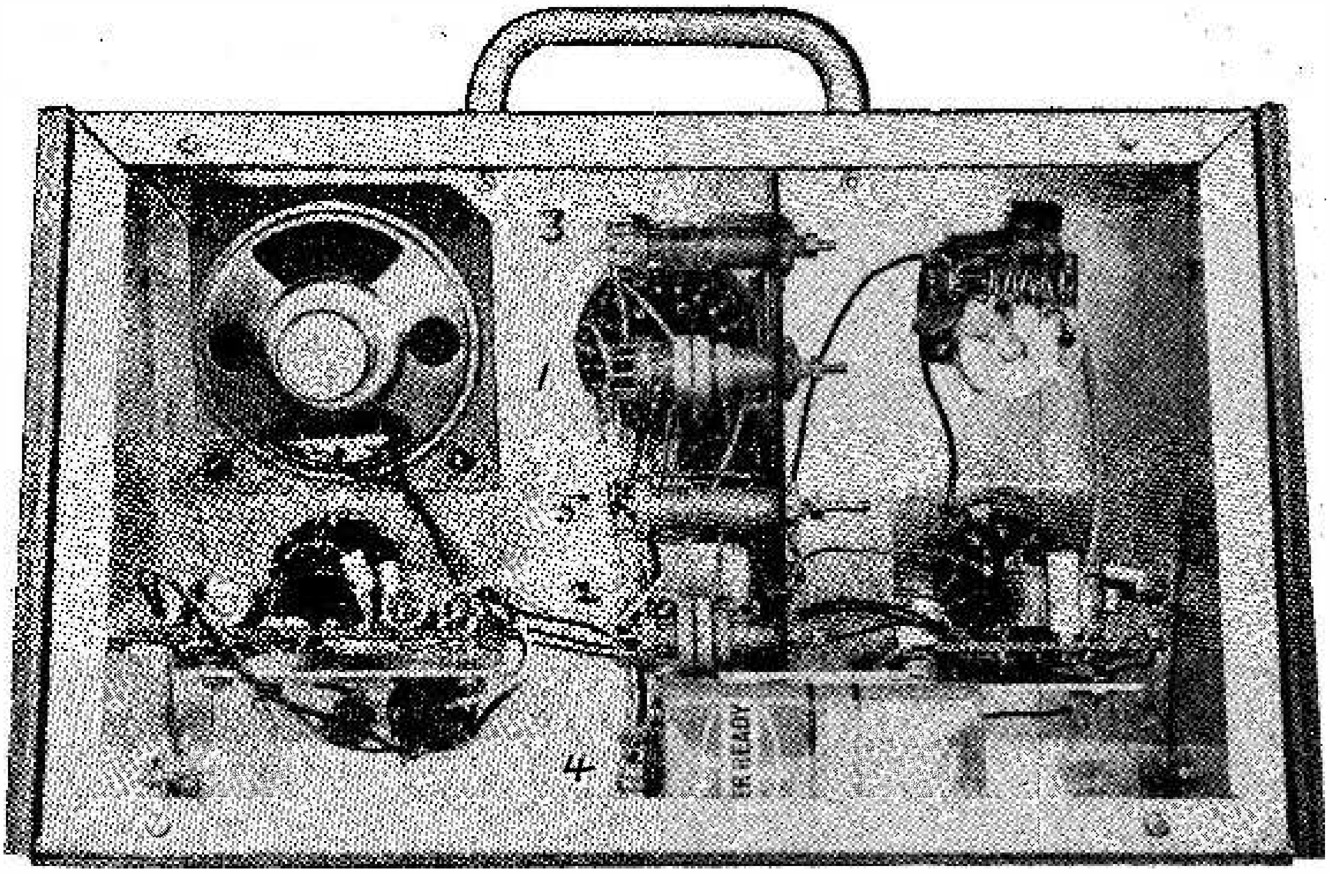
D1 OA70

Felt-pen casing, clip, screened cable and plug.

All resistors ¼W 5%

Miscellaneous

Universal Chassis members, 10 x 2in. (1), 10 x 4in. (1), 6 x 4in. (2). Panel 10 x 6in. (see text) (Home Radio). Speaker 2½in. 15Ω and upwards, or similar. Plywood and handle for cabinet. Co-axial sockets (2). VR2, 25kΩ linear potentiometer. S1/2 and S3/4, 2 pole 3 way wafer switches. Knobs. Cx (Fig. 11) 0·02μF 500V.



This look into the cabinet of the Trouble Tracer shows the positioning of the various modules. Bottom left is the audio amplifier board mounted on the tone selection switch. In the centre is the HF oscillator module and, to its right, the VHF oscillator. Bottom right is the tone generator in front of the band selector switch.

audio tone is present on a signal tuned in on a receiver, or by checking the audio output with headphones, or by taking the output to the signal tracer section input.

HF OSCILLATOR

The circuit for this unit is shown in Fig. 6. The transistor is used as a grounded base oscillator, the emitter being switched to tappings on the inductors, via C3. Section B of the switch is used for this purpose, while section A of the 5-way switch S6 is employed for the collector circuit.

Each of the inductors L1 to L5 is selected in the same way, only the inductor for the required band being in circuit. Each inductor has a large winding and a smaller coupling winding. Pins 6 and 8 are joined, as shown, to form the tapping.

Output is taken from the small capacitor C2. Switch S1 allows the oscillator to be switched on, and to be modulated by the tone generator when wanted.

The layout is shown in Fig. 7. The transistor, resistors and capacitors are first assembled and wired on a piece of Veroboard about 1 x $1^{1}{}_{8}$in. Provide pins or projecting leads for the external connections from this board. The board is fixed with a single 6BA bolt, with extra nuts.

A paxolin board 6 x 2in carries the coils, and this board is shaped approximately as shown to allow it to be placed in the case more easily. VC1 is secured to the board by a 4BA bolt with a few washers between capacitor and board, to clear the bottom frame tag marked MC in Fig. 7. A metal bracket is cut to hold the rotary switch which is fixed with two short 6BA bolts.

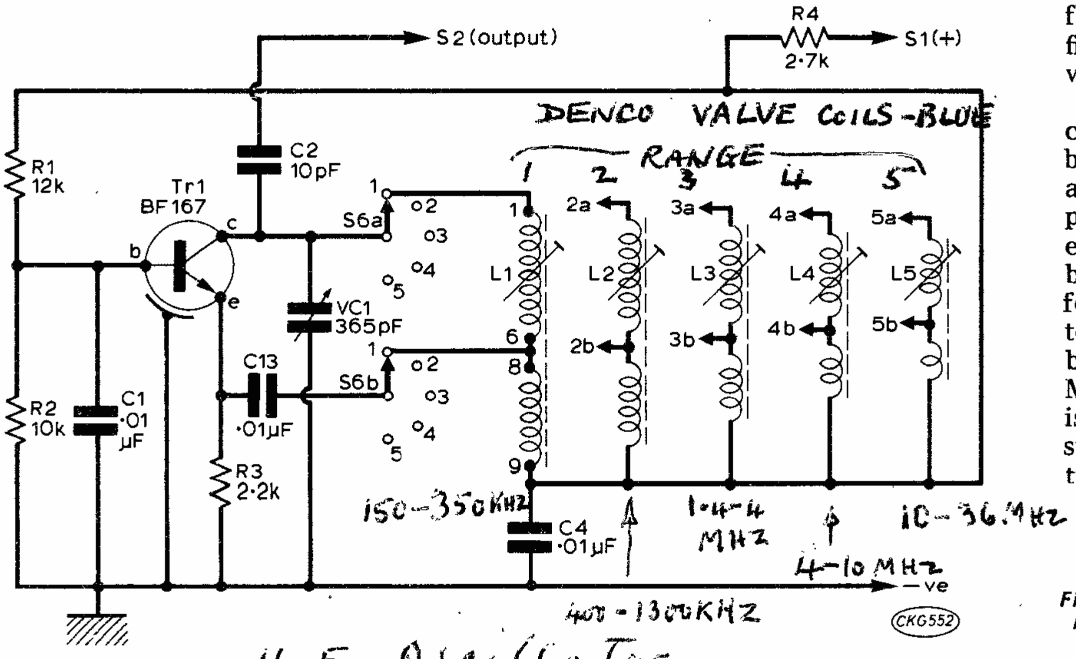


Fig. 6: Circuit details of the HF oscillator which has five switched bands.

H.F. Oscillator

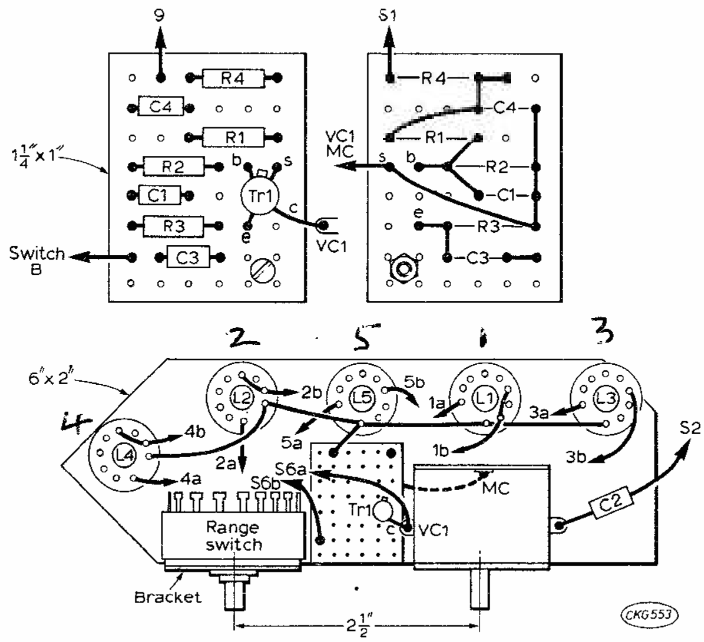
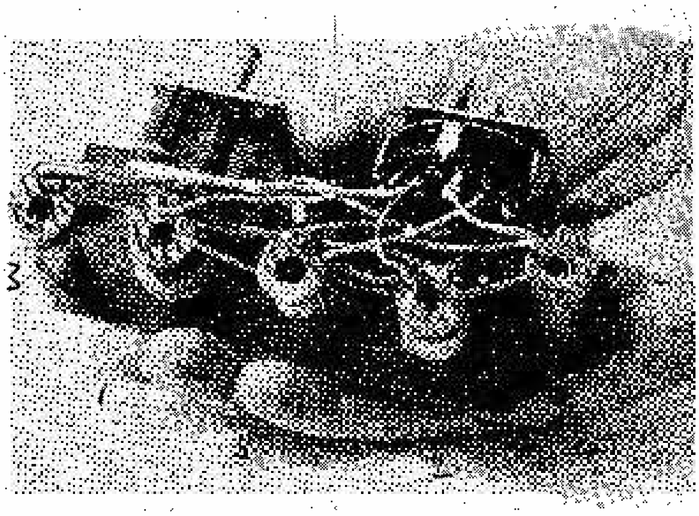


Fig. 7: Circuit board and layout of the HF oscillator. The board is held to the panel by the locknut on the range switch and a screw into the frame of the tuning capacitor.

When wiring is complete, the unit is held to the panel by the fixing nut of the switch and by a short 4BA bolt which passes through the panel into one of the tapped holes in the front of VC1. This bolt must not be so long as to short circuit the capacitor or bend the capacitor plates.

Switch connections to the inductors are straightforward if carried out systematically. If necessary, set the switch in the first position and check with a meter to make sure the correct outer tags are selected. Then connect L1 and check that the unit will oscillate when a battery is temporarily clipped to R4 and the negative line. A whistle or heterodyne should be heard with a receiver tuned to a LW transmission. L2 and the other inductors can then be wired to the switch one by one.



General view of the finished HF oscillator unit.

In order to ensure that the circuit will oscillate, the point 6-8 should be regarded as a virtual tap on a single winding, with no reverse of winding direction all the way from pin 1 to pin 9. If one range fails to oscillate it is worth checking that this is so. With pins wired as in Fig. 6 and Fig. 7 this was correct, but it was observed that connections to pins 1 and 5 on a further similar coil suitable for the L5 position were reversed during manufacture. Should an examination of any coil show that this is so, wiring to the pins 1 and 6, or 8 and 9, should be changed over.

The tuning dial for VC1 was arranged as for the VHF unit, but with a Perspex disc 3in in diameter.

AUDIO AMPLIFIER

This employs four transistors, Fig. 8, and has quite high gain. VR1 is the gain control and S5 is integral with this, so the amplifier can be used alone or in conjunction with the generator units.

Output is fed into a small speaker, handling about 250mW, which is adequate for this purpose. Though an 18Ω speaker is indicated, a 25-35Ω, or even higher impedance unit, will be found satisfactory.

The components are assembled on a 3 x $1^1{}_2$in board, as in Fig. 9. Two $^1{}_2$in 6BA bolts are secured at the points MC, each with a tag, and a 24SWG wire is soldered between these. When the amplifier is completed, these bolts allow the amplifier to be mounted on a bracket made from scrap metal, in a similar manner to the tone generator unit. Extra nuts give a little clearance to avoid shorts to the metal bracket, and further nuts are put on so that the negative line, MC in Fig. 9, is returned to the metal panel.

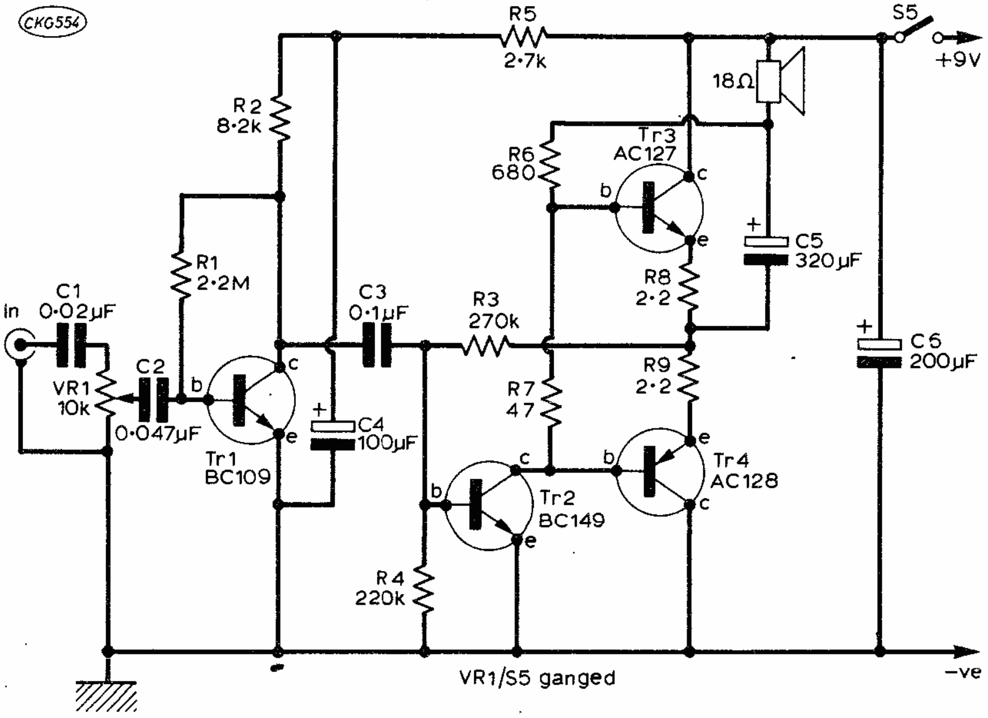
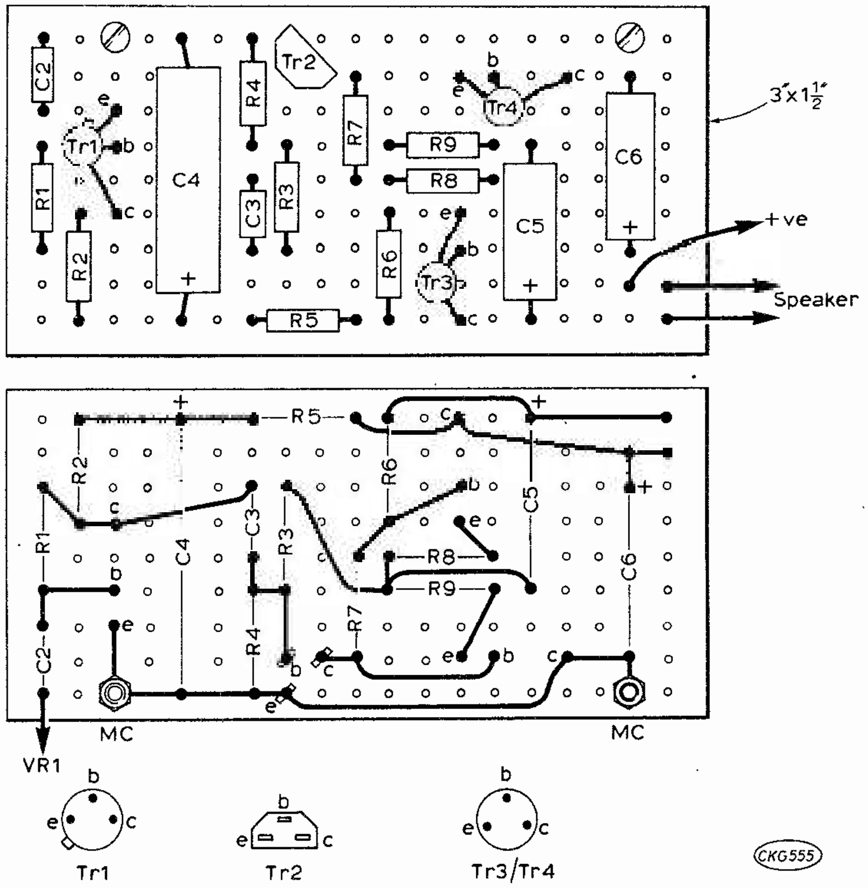


Fig. 8: The four transistor circuit of the audio amplifier.



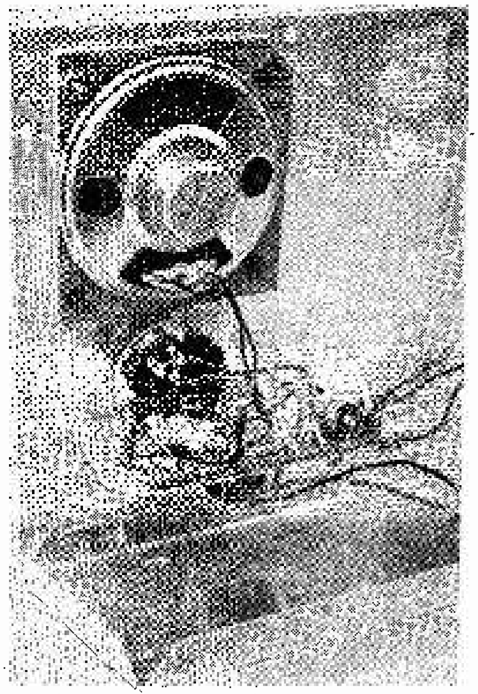


Fig. 9, left: Component layout and wiring information on the audio amplifier board. The board is mounted on a metal bracket as can be seen in the photograph above.

Wiring should be straightforward. Sleeving is put on leads which can touch each other or bare joints. Pins or leads are again provided for the external connections to VR1, battery positive (via switch S5) and the speaker.

The amplifier can be tested by applying the signal from a tuner or any other suitable input to VR1. Current drain is about 10mA, rising to peaks of 25mA or more with good volume.

The 3-way switch S3/S4 holds the bracket and amplifier, and the lead from C2 to VR1 runs round this, against the panel.

PANEL AND WIRING

Dimensions for drilling the front panel are shown in Fig. 10. This also shows the positions of the various controls and of the speaker aperture and input and output sockets.

All the units are supported on the panel which allows any checks to be made quite easily, with the units in position.

Wiring behind the panel is shown in Fig. 11. VR1 with its switch S5 and the audio amplifier are quite separate from other circuits, except that all units operate from the same battery.

The switch S3/S4 switches the generator units on, as required, resulting in either tone modulated or CW output, according to the switch position.

The remaining switch S1/S2 selects the appropriate units to give VHF, HF or AF output. VHF and HF outputs will be CW or modulated, according to the position of the other switch. When this switch is set for AF output S3/S4 must be at "Tone" or no AF signal is available. The HF bandswitch is in operation only when S1/S2 is at the HF position.

VR2 provides some control over the output level, especially at lower frequencies, as explained.

CABINET

The cabinet is metal and totally enclosed to help reduce stray radiation from the oscillators. As the sloping front is not essential and requires a little more work, it should be pointed out that similar parts can be used to make a case with a vertical front panel.

For the sloping front cabinet the bottom is a flanged universal chassis member 10 x 4in and the top a flanged member 10 x 2in. Each side is a 6 x 4in flanged member. To form a side, cut away the top flange for 2in and the adjacent front flange for $5^1{}_2$in. The $5^1{}_2$ x 2in flat triangular portion now projecting is gripped in a vice and the member is bent over to form a 90° flange. As this flange will be triangular, it is cut about $^3{}_8$in wide to match the other flanges. A matching side is made for the other end of the case. The bottom is then fixed on using the holes which are punched during manufacture. At the top, bolt holes are drilled to fix the 10 x 2in member.

Because of the slope, the panel is 10 x $6^3{}_8$in in size. The bottom $^1{}_2$in is bent to match the flanges of the sides. This can be done by gripping the panel between two pieces of wood clamped in a vice. The panel can then be fixed by 6BA bolts run through top, bottom and side flanges. The top will fit better if its front flange is gripped in the vice and turned outwards slightly, to match the slope of the panel. The back is 10 x 8in, secured with self-tapping screws into the flanges.

To avoid the work of shaping the sides for the sloping panel, the 6 x 4in members may be used as obtained. For the top, another 10 x 4in flanged member is required, the 10 x 2in member not being necessary. The parts are simply secured together by passing 4BA bolts through the holes already punched in them. The panel is then a 10 x 6in flat plate, secured with 6BA bolts or self-tapping screws.

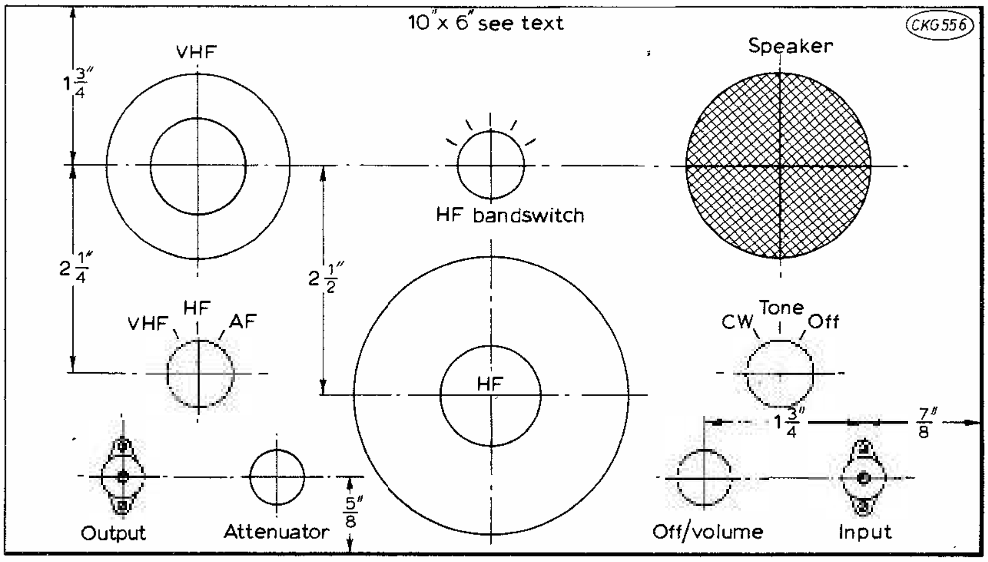


Fig. 10: Suggested layout of units and controls on the front panel. Position of VHF and HF units may depend on types of dial used.

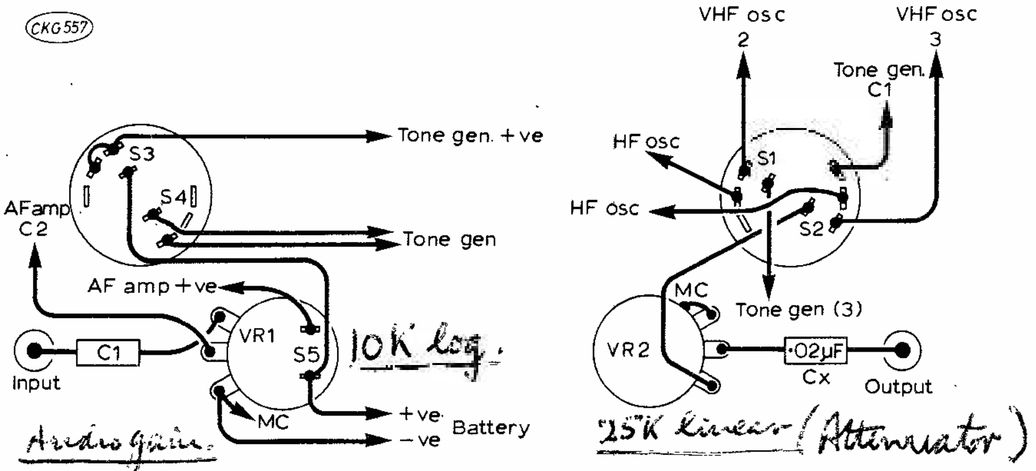


Fig. 11: Inter-unit wiring behind the panel. The wiring to the frequency selector switch from the individual oscillators should be as direct as possible.

To improve appearance, two side members can be cut from plywood, and secured by the same screws which hold the top, bottom and sides together. These wooden sides project about ¼in. The top and panel can be finished with silver paint or in any way required. A stippled finish can be obtained by waiting until the paint is half dry, then dabbing lightly all over the surface with the empty brush.

All the panel holes are drilled or punched to clear the bushes of the switches and potentiometers. A ½in or ⅝in hole is required for the HF tuning capacitor. Check that the central pins of the co-axial sockets are easily clear of the metal.

The speaker is a small unit fixed behind a 2in diameter hole, which is covered with perforated zinc. There is space to accommodate a slightly larger speaker, if so desired.

A metal bracket bolted to the bottom of the case holds a PP6 (9V) battery here.

RF PROBE

The circuit and construction of the probe is shown in Fig. 12. C1 is to isolate circuits tested, so it should be a 350 or 500V mica capacitor. An OA70 or similar point-contact diode will operate at up to 100MHz but most tests are likely to be in IF circuits or other relatively low frequency circuits.

A felt-tip pen casing was used about 5in long and ⅜in in diameter. The capacitors, diode and resistors will readily fit inside this, if arranged as shown. Solder a stiff wire (16 or 18SWG) to C1. Sleeving is put on leads which may touch other leads or joints. The inner conductor of a screened lead is soldered to the junction of D1 with C2 and R2. The outer conductor is soldered to R1, C2 and R2 and a 24SWG or similar wire is also soldered on here.

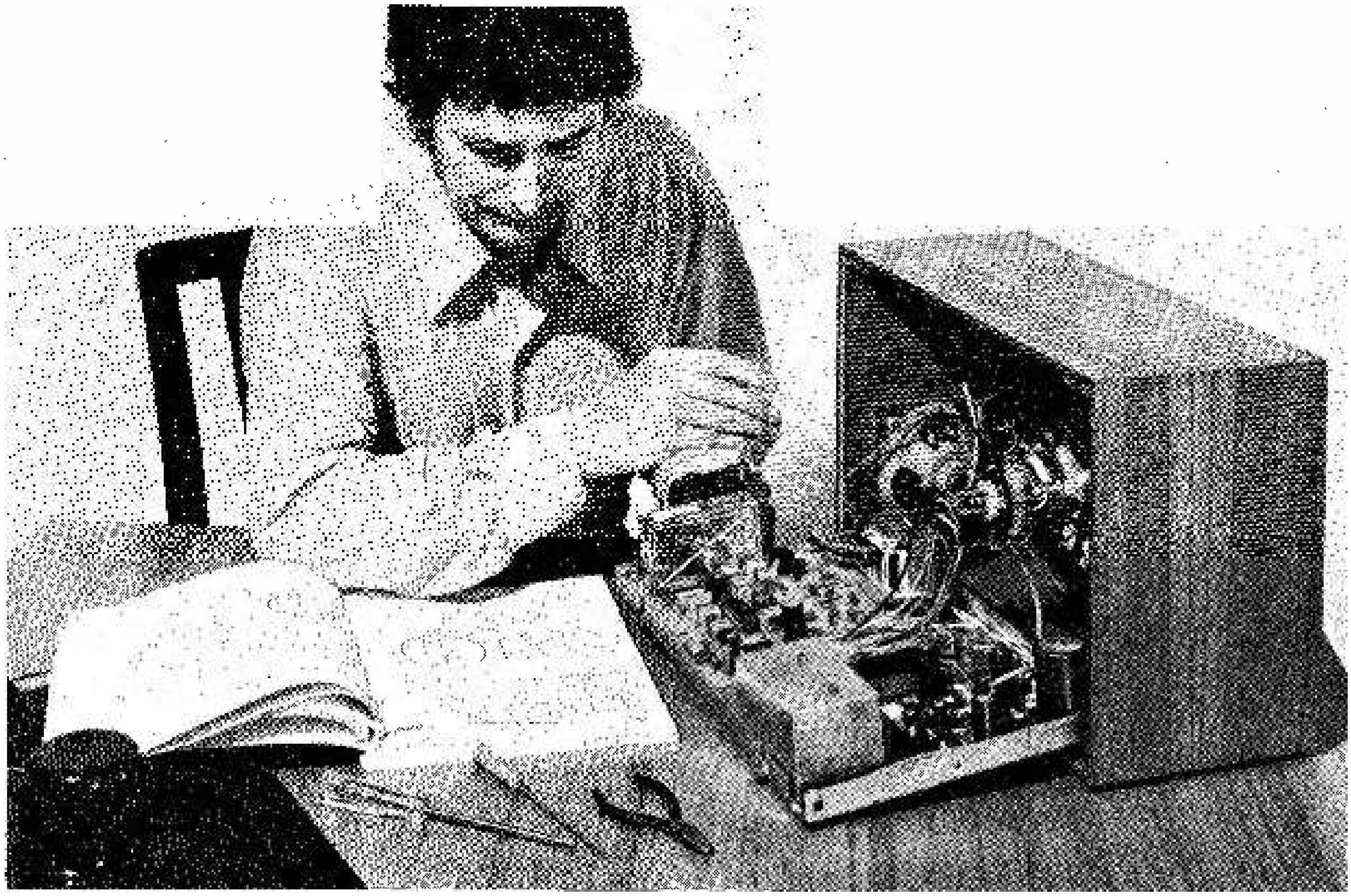
The assembly is then inserted in the pen casing. The tip piece was filed to fit, using a part of the ¼in insulated shaft cut from one potentiometer. It is cemented in, with the stiff wire passing through a small hole drilled in its centre. A little wire is then wound round the stiff wire near the end piece and soldered. This prevents pressure on the point pushing the wire back in. The wire is then cut to length and pointed.

The 24SWG wire from the co-axial or screened lead outer conductor is threaded through a small hole in the casing and bound a few times round it. It is then soldered, together with a short flexible lead equipped with a clip. The top of the casing is plugged with the original pen top.

USING THE PROBE

When the probe point is touched on any circuit where modulated RF is present, demodulation by D1 gives an audio frequency output which is amplified by the tracer amplifier.

One of the most useful applications is the quick testing of IF amplifiers. There is sufficient amplification for the signal to be normally traced onwards by this means from the mixer collector circuit (or frequency changer valve anode). After one or two stages of IF amplification, it may be necessary either to turn back the volume control of the tracer or



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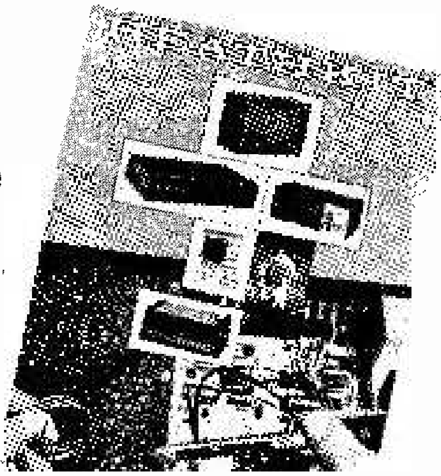

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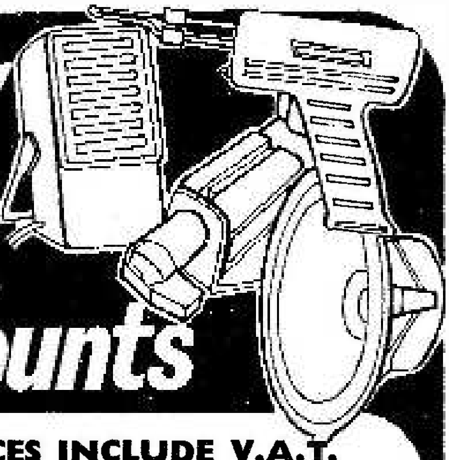

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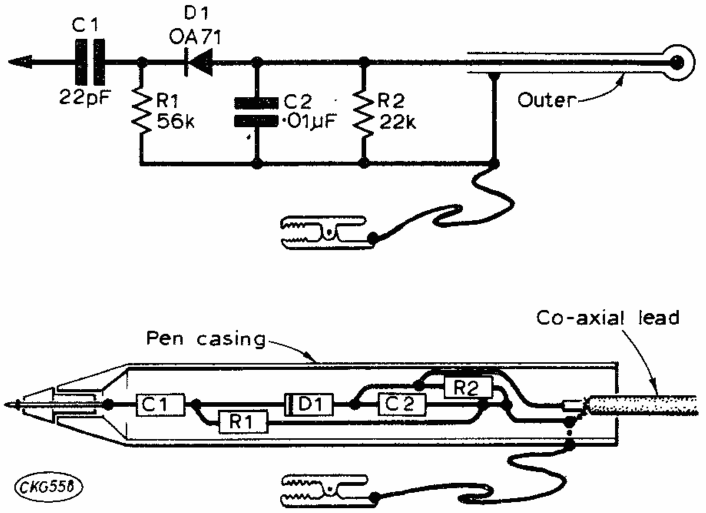

Fig. 12: Details of the construction of the RF probe used with the Trouble Tracer.

merely to put the point of the RF probe against the insulation of a lead in the appropriate part of the receiver circuit.

On no account should any connection or contact be made with a mains receiver which is of AC/DC type, or which derives HT directly from the mains, as the chassis may be alive, and dangerous.

For audio circuit tracing or testing, an insulated probe is required, with a few feet of screened lead. This can be plugged into either panel socket, as required. The probe can be made from the casing of a ball-point pen. The screened lead outer conductor is equipped with a flexible lead and clip so that this can be grounded to the earthed side of equipment under test, when necessary.

HF CALIBRATION

Though frequency calibration is not necessary for testing purposes to locate a fault, or for alignment of circuits for best results, it is convenient to provide some calibration of the five HF ranges. One method is to tune in the signal on a receiver, as explained for the VHF range.

Band coverage is approximately as follows:

Band 1 150—350kHz
Band 2 400—1300kHz
Band 3 1·4—4·0MHz
Band 4 4—10MHz
Band 5 10—36MHz

The positions of the adjustable coil cores have considerable influence on the actual band covered by each range.

For more accurate calibration it is necessary to have available some suitable means, such as a calibrated receiver or signal generator, or crystal harmonic marker.

Some calibration marks can be found by harmonics. For example, if a receiver is tuned to 600kHz the generator will be heard when also tuned to this frequency; in addition, the signal is heard at reduced strength when its second harmonic falls on 600kHz, so this gives a calibration point for 300kHz. Similarly, harmonics may be heard when the receiver is tuned to 2x, 3x, 4x and other multiples of any frequency generated, depending upon the receiver sensitivity.

IN NEXT MONTH'S PART 2 PLENTY OF PRACTICAL INFORMATION WILL BE GIVEN TO ENABLE READERS TO MAKE THE MOST OF THE 'TROUBLE TRACER'

PRODUCTION LINES

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P.C. KITS

GSPK Electronics Ltd. have launched three kits aimed at the prototype printed circuit enthusiasts.

The first is a P.C. board marking pen, sold in a pack of two for £1·20. The pens provide a quick and easy method of marking on a copper-clad laminate, the special ink acting as an etch resistant to most commercial etchings.

Kit 2 contains the pens, and six pieces of 6 x 4 in. copper laminate, some GSPK etching powder and a plastic dish. This sells at £4·50.

The third kit contains all the tools necessary to cut to size and drill the laminate plus the contents of kit 2. Named the "Professional" kit, this retails at £8.

Further gen from *GSPK Electronics Ltd., Hookstone Park, Harrogate, HG2 7BU, Yorkshire.*

AUDIO FAIR PRODUCTS

On page 869 we include details of some of the new products introduced at this year's Audio Fair.

THE 810

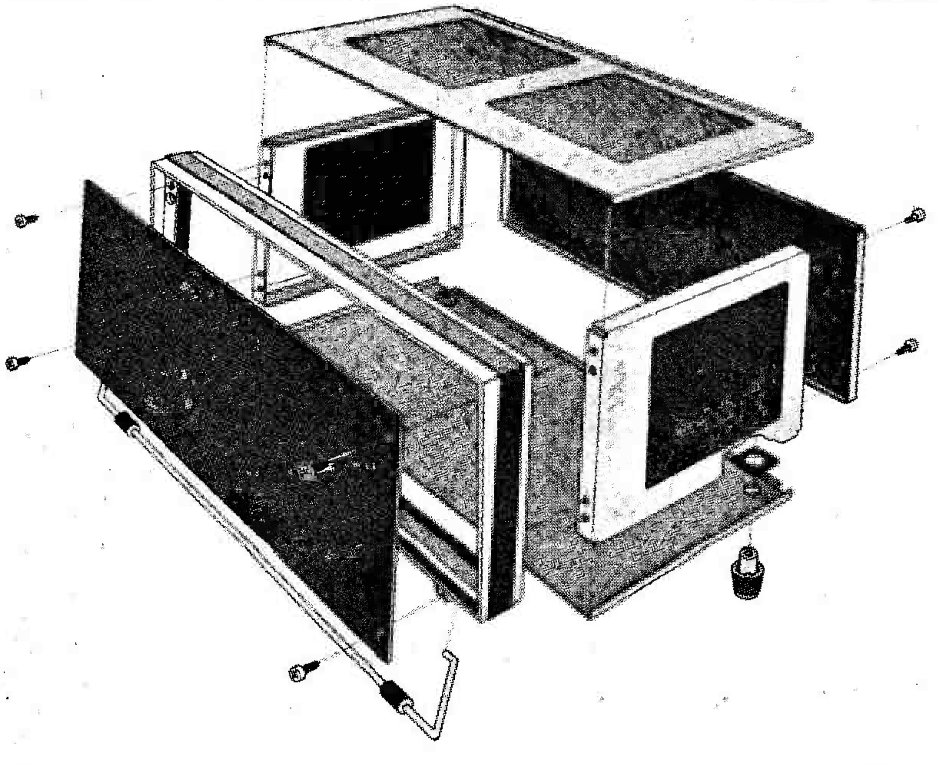
I recently had the opportunity to try out the latest BSR 810 transcription turntable. Although this unit was introduced some time ago, it is still the leader of the BSR range of decks. It employs a pre-programmed sequential cam system and a low mass transcription tone arm which floats in a concentric gimbal, helping to eliminate tracking error. The arm also has precise zero balance adjustment over the full range of stylus and cartridge masses.

The turntable weighs a massive 6¾ lbs. and is driven by a high torque synchronous dynamically balanced 4-pole motor. Other features include a variable pitch control, rotating stub spindle, dual-range anti-skid unit, stylus position gauge and a special "pause" control operated by a special friction clutch mechanism.

The unit tracks, with a high-compliance magnetic cartridge, down to 0·5 gm.

All in all, this is a very nice unit and if you would like further details of this and the other turntables in the BSR range, write to *BSR Limited, Monarch Works, Cradley Heath, Warley, Worcs.*

The latest 810 deck from BSR



AMTRON CABINETS

Amtron UK Ltd supply a range of metal cabinets suitable for housing equipment. They are made of aluminium and the side and top panels are of an open grid structure to assist ventilation.

The front panel escutcheon is made of high-impact plastic material which gives the unit a very professional finish. Plastic feet are supplied together with a fold-down tilt support bracket at the front. The kits come complete with all metal hardware necessary for assembly. The picture shows an "exploded" view of kit 00/3009-10, the internal dimensions of which are 224 x 138 x 120 millimetres.

For further information and prices cf the other cabinet kits available, contact *Amtron UK Limited, The Trading Post, 4 & 7 Castle Street, Hastings, Sussex, TN34 3DY.*

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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
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EBF83	0·40
EBF89	0·32
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EF98	0·75
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EF184	0·35
EL32	0·60
EL33	1·75
EL34	0·50
EL36	0·50
EL37	2·50
EL41	0·90
EL42	0·90
EL84	0·25
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EM85	1·00
EY51	0·40
EY86	0·40
EZ40	0·75
EZ41	0·75
EZ80	0·28
EZ81	0·29
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PCF805	0 60
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
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PL508	0·90
PL509	1·55
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PY81	0·30
PY82	0·35
PY83	0·38
PY88	0·40
PY500	0·47
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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
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VR150-30	0·40
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1R5	0·45
1S5	0·30
1T4	0·30
3S4	0·40
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6J6	0·30
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6J7G	0·40
6K6GT	0·75
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6K8M	0·60
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6X5G	0·40
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30C1	0·30
30C15	1·05
30C17	1·10
30C18	0·80
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BF167	0·25
BF173	0·25
BF179	0·30
BF180	0·30
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BF194	0·15
BF195	0·15
BF197	0·15
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BFS98	0·25
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BFX88	0·20
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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
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ZTX503	0·17
ZTX531	0·20
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IN4002	0·7
IN4003	0·8
IN4004	0·8
IN4005	0·10
1N4006	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
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2N1132	0·25
2N1302	0·18
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2N4062	0·12
3N141	0·81
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40361	0·40
40362	0·50
40430	1·00

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SN7402	0·20
SN7403	0·20
SN7404	0·20
SN7405	0·20
SN7406	0·30
SN7407	0·30
SN7408	0·20
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SN7410	0·20
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SN74123	2·70
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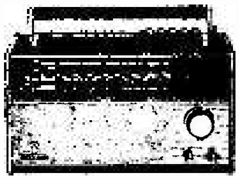

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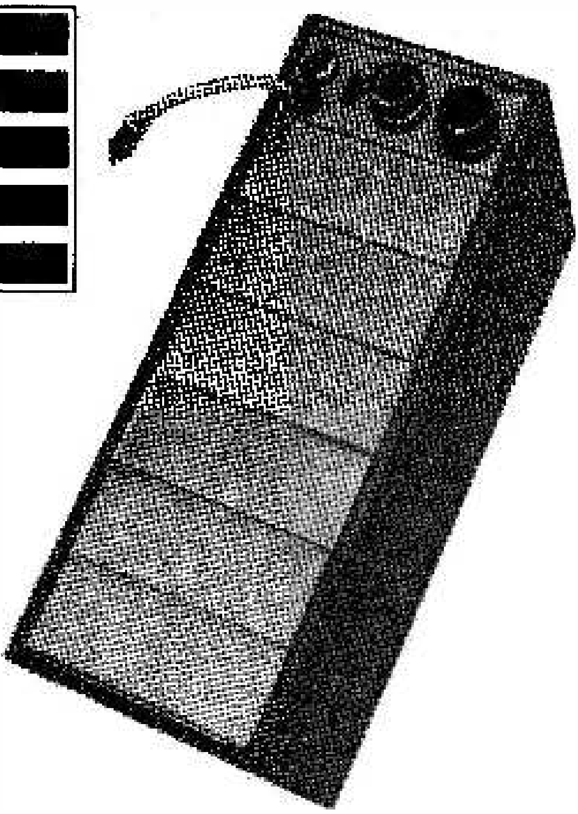
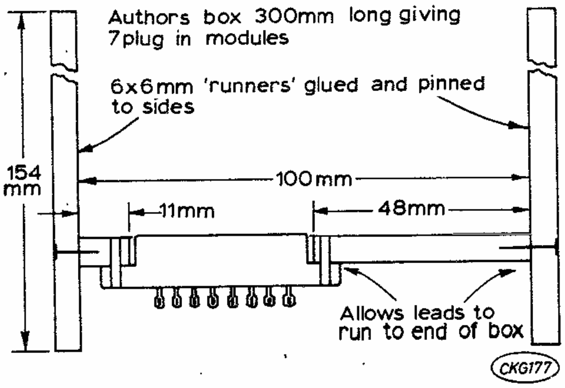


A plug-in module system allows the maximum use to be made of a given space as far as 'tucking away' circuitry is concerned. To be able to pull out a 'card', with the circuit components on it, for modification or maintenance, makes these tasks much easier. The cost of commercial designs (and their availability) must deter experimenters from using this desirable system. Described here is a method of building this system quite cheaply in terms of purchased items. A plywood box, hardwood runners, aluminium alloy sheet fabrications, RS Components small perforated sheet and edge connectors are the main items needed. A word or two first about the uses that the system can be put to. In the author's case such a unit stands beside a tape deck to provide versatile record and playback preamplifier facilities. However, it is suitable for a modular preamp or mixer etc. The dimensions quoted are to suit the author's particular requirements in that other factors dictated the maximum size possible.

DESIGN

Major requirements of the design were:— detachable screening of cards from each other, space on the panel for potentiometers, switches etc., ease of getting the leads away from the unit for external connections and the use of an external power supply. The latter was considered necessary because of the space it would take and because of possible hum induction problems.

Part of the detachable screen protrudes above the box by approximately 8mm and it is this which is used to pull out the cards. The perforated sheet as supplied measures 172mm by 133mm which, in the author's case, was cut to give two cards 123mm by 83mm.

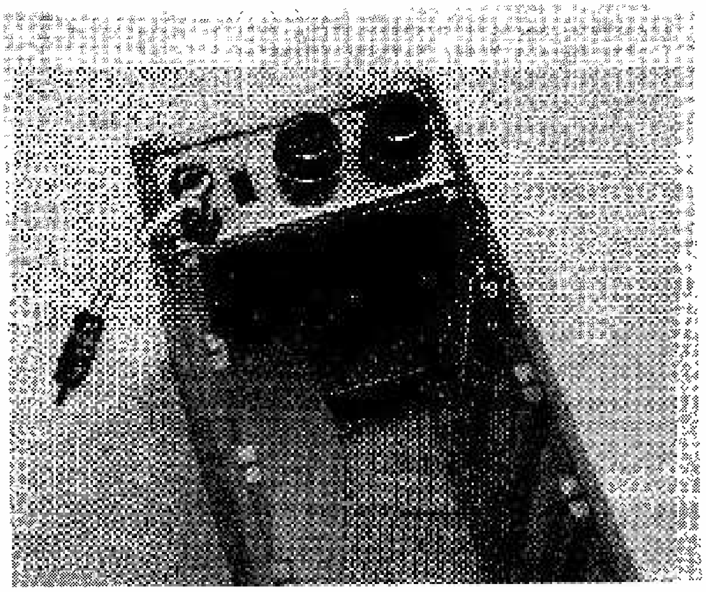


Cross section of the box detailing method of construction and mounting of edge connectors. The photograph shows the hardwood runners which are spaced to suit the gauge of metal used for the modules.

CONSTRUCTION

The photographs and drawings show the overall construction method. If the idea of painting with emulsion paint appeals then butt joints, pinned and glued, can be used. A filler glue such as Cascamite is suitable. The alloy sheet can be as thin as 20SWG; this is fine for the job due to its mechanical properties, easily cut, drilled and bent yet rigid enough to maintain shape. If aluminium is used it should be at least 18SWG.

The spacing between the runners is governed by the metal thickness. No fixing is provided in the top panels to hold the modules in place because the friction of metal against runner as the modules are pushed home holds everything firm. The inside of the detachable screens are Fablon covered to avoid contact with the wired side of the perforated sheet. It is necessary to bend the protruding part of the screens slightly inwards to allow the module alongside to slide in and out.



WIRING

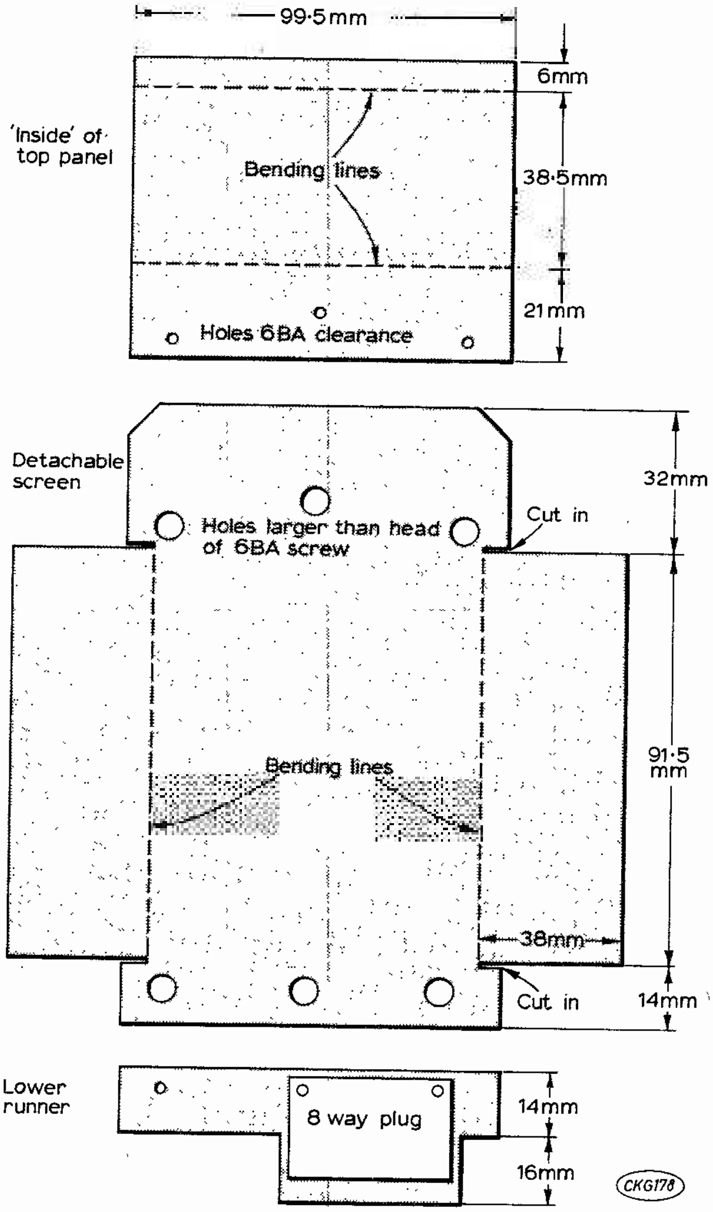
Inter-module wiring is run from connector to connector in the bottom recess of the box. The same ways should be reserved for earth and power supplies on each connector to prevent possible damage should a module be plugged into the wrong position. Sockets may be fitted at the end of the box for the external connections, but in the author's case the leads are run straight out through holes. Clips are fixed near the edge connectors to hold the cables in place. A removable cover for the base of the box can be added if required.

Countersunk 6BA screws, washers and nuts hold together the alloy top panel, perforated sheet, bottom runner and 8-way plug. As an aid to countersinking the screws in the thin alloy sheet, 2BA nuts are used over the screws immediately they are passed through the alloy sheet. These give the desired spacing between the perforated sheet and the alloy pieces. Earthing of the metal-work is achieved via one of the screws passing through the 8-way plug which is fitted with a solder tag. The plug point for earth is connected to it and from there a bare wire is suitably routed around the perforated sheet. Contact between the lower runner, the detachable screen and the top panel has been relied upon to extend the screening earth over these components. Earth loops due to contact between the top panels of adjacent modules could be a possible source of trouble. A strip of Fablon or pvc tape on the top panel flange should cure any problems here. ■

★ Materials List

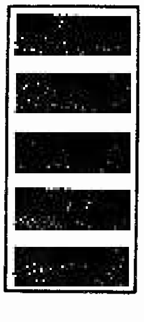
Edge connectors, 8-way
Edge plugs (cut down to give four 8-way plugs)
Perforated sheet, small
Turret tags, small (to fit the perforated sheet).

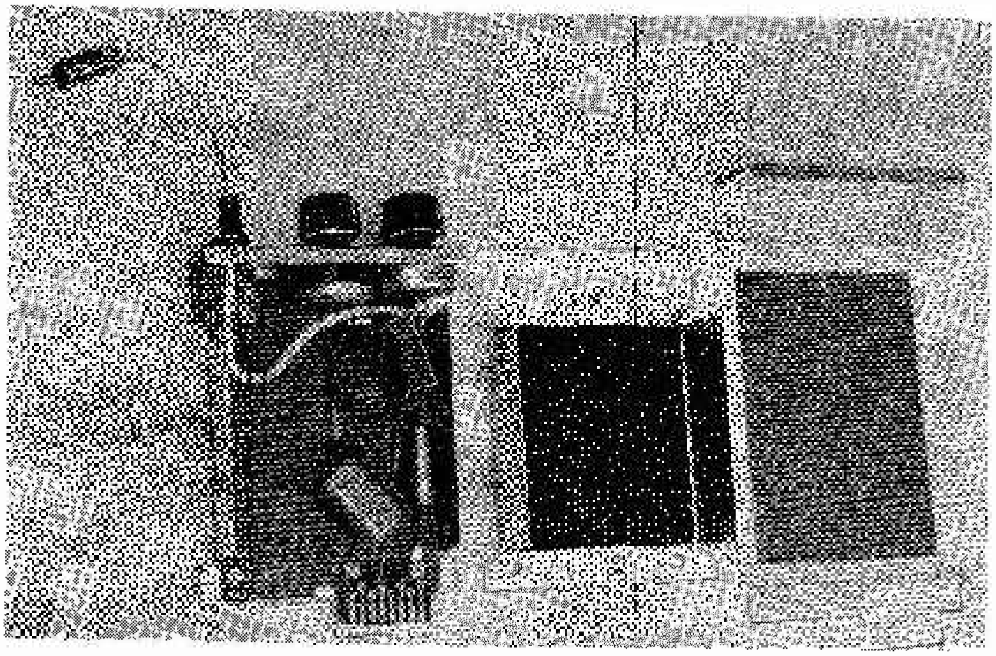
All these parts are by RS Components Ltd., available only via retailers handling that company's components.



Cutting, drilling and bending of the module metalwork.

Details of module construction showing, from left to right:—
- *(a) A typical module, assembled and wired.*
- *(b) The detachable screen with insulating plastic covering in position.*
- *(c) The top panel, perforated sheet and lower runner.*





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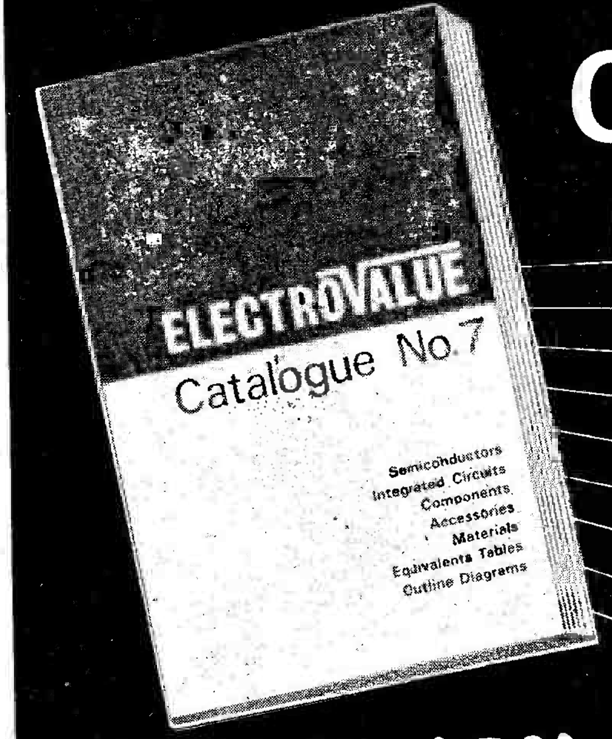

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PART 4—THE ASTABLE MULTIVIBRATOR

THE basic circuit that we shall describe this month is called the *astable* multivibrator. Sometimes it is called a free running multivibrator. Whereas last month's circuit required an input pulse to make the output voltage change in level for a fixed period of time the astable circuit causes the output to change to a new level for a fixed period—just as before—but after a dwell time with the output in its original state the circuit re-triggers itself. The operation continues indefinitely with the output level staying at a high voltage for a fixed period and then reverting to a low level for a fixed period; because this is a self sustaining process the circuit comes into the general category of oscillators and as such finds its way into many simple circuits. Its main attractions are that it needs no inductors and is very simple to build; at the same time it is reliable and can be designed to cover a vast range of frequencies. Its only limitation is the shape of its waveform which is rectangular.

Nevertheless there are many useful applications for such a signal as we shall see. First of all have a look at the basic working circuit shown in Fig. 21.

The diodes D1 and D2 serve no purpose other than providing reverse voltage protection for the base emitter junctions of Tr1 and Tr2. With the components suggested the circuit oscillates at a low frequency and the output waveform can easily be monitored on a 20,000Ω/V meter.

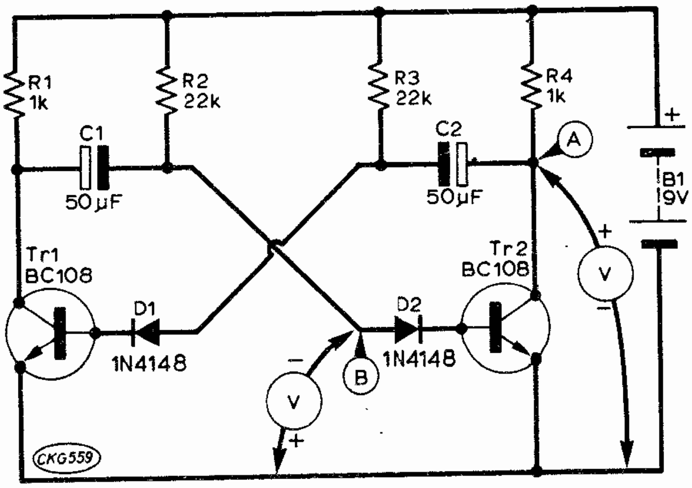


Fig. 21: Slow running astable multivibrator. Monitor the waveforms at points A and B with a 20,000Ω/V meter.

First of all check the frequency of the signal by counting the number of times the voltage at point A goes through a complete cycle in a minute and note that the extremes of output signal level approach the maximum +ve rail and zero voltage (negative) rail. The length of time the voltage is high should approximately equal the time in the low state—we say that the waveform has a unity mark space ratio.

Circuit operation

To understand the circuit's operation imagine that Tr1 is not conducting; the voltage at its collector will thus be +9V. Likewise assume that C1 has just discharged through the circuit of R1 and R2. This discharge will not be complete because when the potential at the base of Tr2 reaches 600mV (this corresponds to 1·2V at point B) Tr2 will be driven into conduction and the voltage at point A will fall to zero from an original +9V. The action of this drop in voltage at Tr2's collector causes a negative going voltage to appear on the negative plate of C2. This ensures that Tr1 is well and truly switched off. You can see that the negative plate of C2 actually goes negative by monitoring the voltage there; connect the *positive* lead of your meter to ground and the *negative* lead to the junction C2 and D1. The voltage is driven to approximately −8·5V. If, however you keep monitoring this voltage you will find that it starts to rise in a positive direction as C2 discharges through the circuit of R4 and R3. When +1·2V is reached Tr1 switches on and the voltage at its collector falls. In a similar manner this negative going change makes Tr2 switch off and the voltage at A rises to +9V. The junction of D2 and C1 will now be found to be at −8·5V and the level will return according to the time constant of C1 with R2 and R1 until eventually Tr2 switches on again—thus repeating the cycle.

You can say—in simple terms—that when Tr1 is switched on Tr2 is switched off and vice versa. The length of time Tr2 is on is set by C2 R4 and R3, but

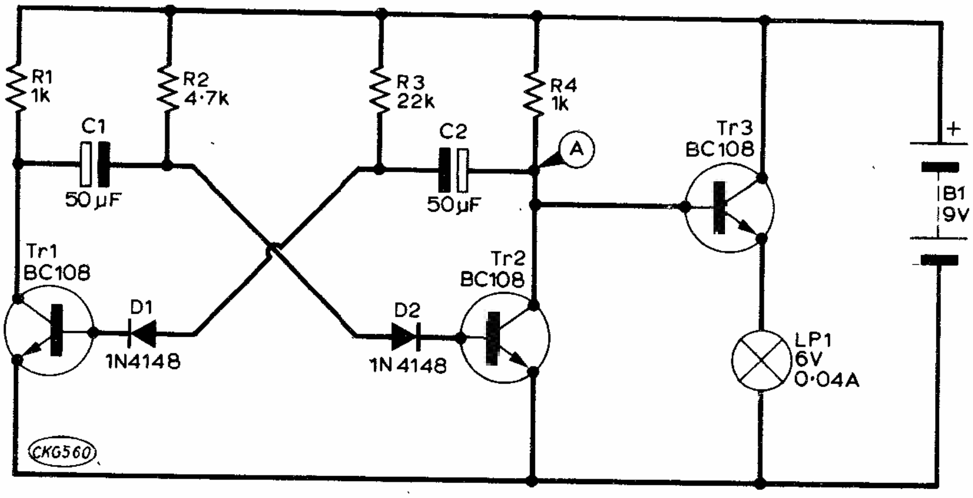
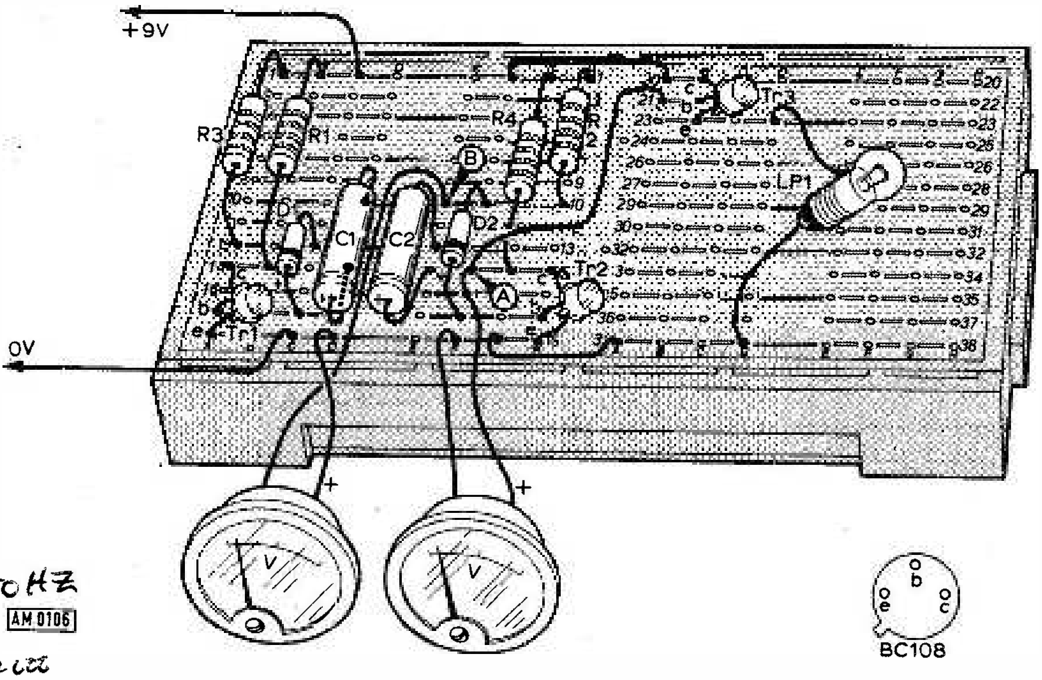


Fig. 22: R2 has been reduced in value so that the width of the positive level of the waveform at A is reduced. This produces a short repetitive flash from the lamp.

Fig. 23: Layout for Fig. 21 (left portion only). Layout for Fig. 22 (left and centre portion).



$$f = \frac{10^6}{1.4 \times \text{[illegible]} \times .05 \times 22000} = 650\,HZ$$

AM 0106

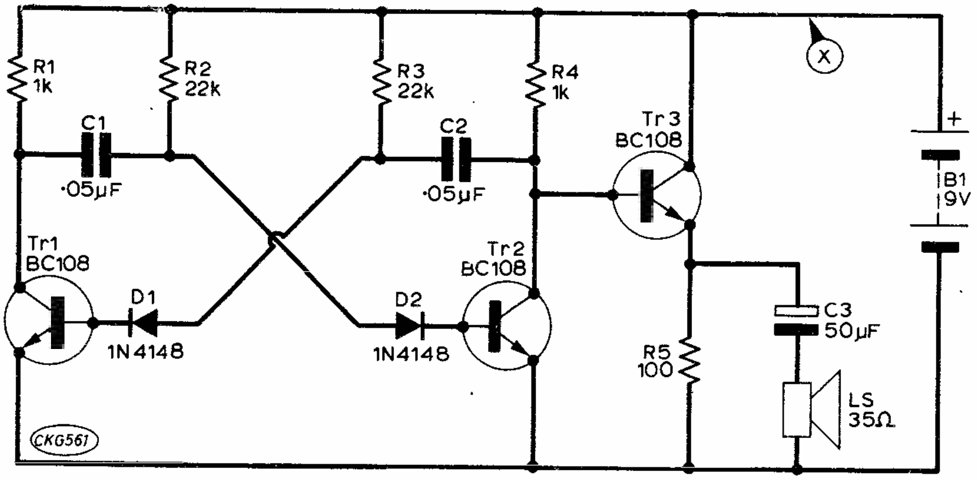


Fig. 24: Reducing the values of C1 and C2 brings the operating frequency into the audio range. If a key is inserted at point X the circuit makes a useful morse practice oscillator.

R3 is very large compared with R4 so the former has most effect. The time can be calculated from the formula

$T_{on} = 0·7 \times R3 \times C2$ (R in ohms, C in farads and T in seconds).

In a similar way one can say that the time Tr1 is switched on is controlled, effectively by R2 and C1. This is the length of time Tr2 will be off during that part of the cycle. We can thus write

$$T_{off} = 0·7 \times R2 \times C2$$

If we make the circuit symmetrical so that R2 equals R3 and C1 equals C2 the on time will equal the off time and the frequency of operation becomes

$$f = \frac{1}{1·4 \times C2 \times R3}$$

If you halve the value for R2 you will halve the off time of the waveform. This means that we get an asymmetric mark space ratio. Increasing the value for R2 will change the ratio the other way. One can vary the ratio over wide limits and the only

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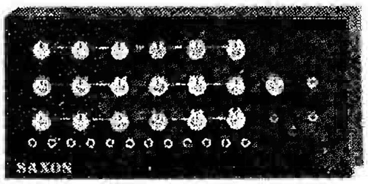

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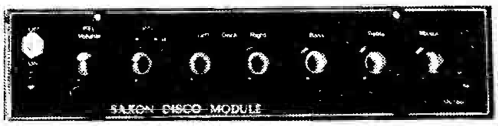

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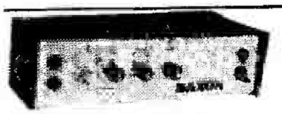

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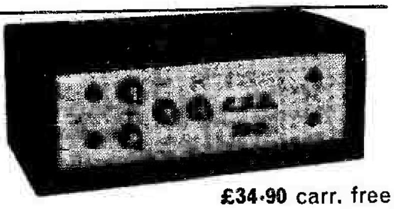

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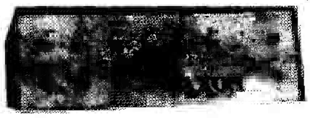

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½	CF	22-1M	1	0·8	0·65	0·62	0·55	0·5	0·45	5·5x16
¼	MF	10-2M7	1	0·9	0·8	0·7	0·65	0·65	0·6	3x7
½	MF	10-2M2	1	0·9	0·8	0·7	0·65	0·65	0·6	4·2x10·8
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33µF	16V	6p	1000µF	16V	20p
33µF	40V	6p	1000µF	25V	25p
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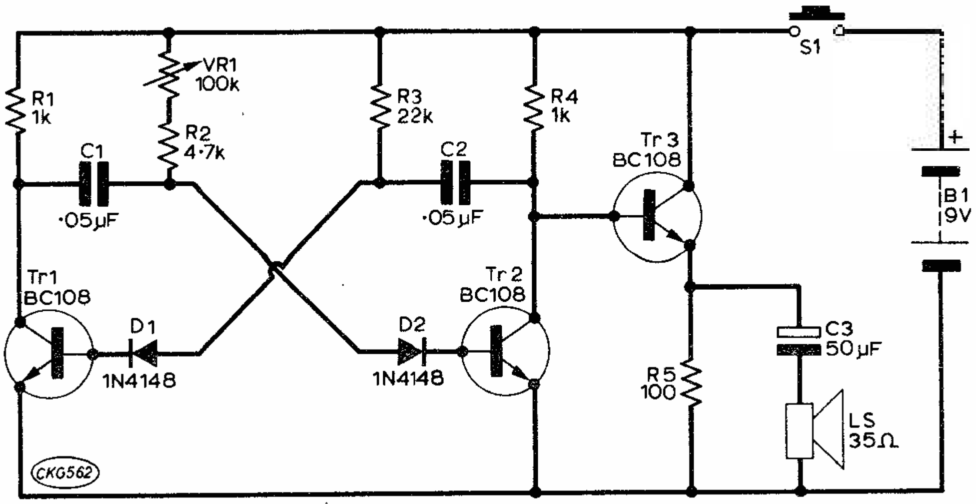
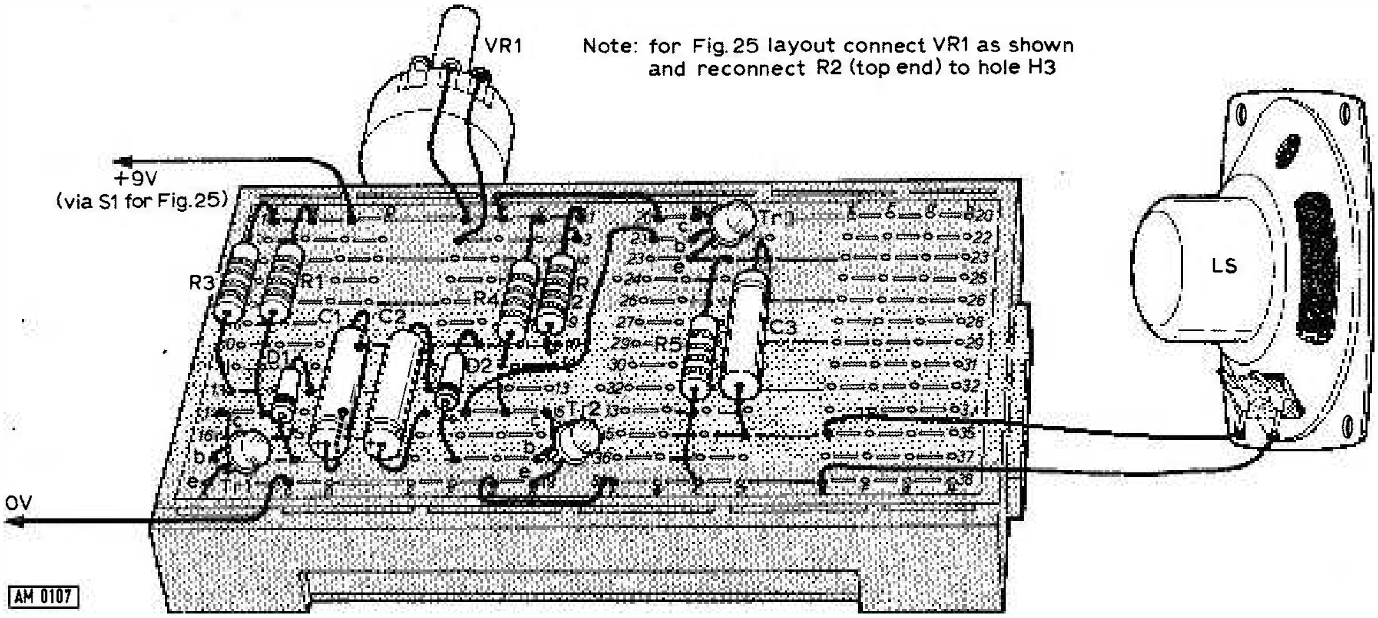


Fig. 25: Variable frequency astable multivibrator. In conjunction with S1 a melodic scale can be produced by adjusting VR1. For a wider frequency range substitute a ganged potentiometer and another 4·7kΩ resistor for R3.



Note: for Fig. 25 layout connect VR1 as shown and reconnect R2 (top end) to hole H3

Fig. 26: Layout for Fig. 24. For Fig. 25 layout see note (above).

factors that set the extreme values for R2 (or for that matter R3) are the maximum base current that is safe to pass into the transistor (thus do not reduce either of them below 1kΩ) and the minimum base current that will ensure the respective transistor will switch on completely so do not use values greater than about 200kΩ.

You can couple the output signal from point A into any of the lamp drivers we have already described—we show one possibility in Fig. 22. By adjustment of the timing resistors (R2 or R3 or both) you can make a simple repetitive lamp flasher.

Tone generator

To change the range of operating frequency there is the further possibility of different values for C1 and C2. Fig. 24 shows an identical circuit that operates within the audio range. One cannot use a meter or a lamp to monitor the output this time because they do not have a fast enough response; however we can use our emitter follower as a simple loudspeaker driver with the aid of an extra resistor and capacitor. The circuit now becomes a tone generator and could be used for morse code practice if a key was inserted into the supply rail.

One of the timing resistors could be changed for a variable potentiometer (it is preferable to keep a small value of fixed resistance in circuit to prevent damage to the base emitter junction of the transistor) as shown in Fig. 25. With a push button in the supply line one can make a rudimentary form of organ; the tone being selected by means of the potentiometer and the button pressed to produce the note—obviously some skill is required to produce anything melodic! A wider range of frequency with unity mark space ratio can be obtained if a ganged pair of potentiometers was used to replace both timing resistors.

Simple organ

For the more ambitious one could substitute a set of preset resistors for one of the timing resistors and have keys which connect each preset up to the positive rail. When a key is pressed a tone set by that particular resistor will be produced. Obviously

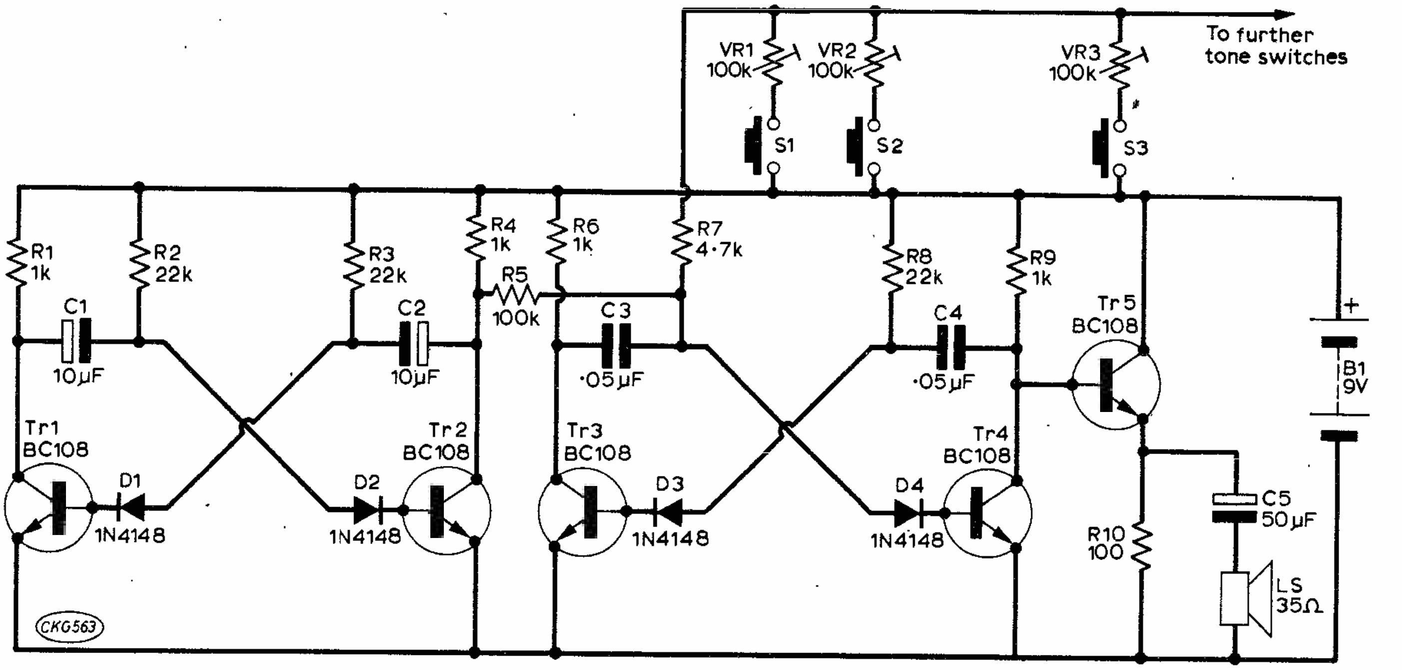


Fig. 27: Circuit for a simple monophonic organ. As long as R5 is in circuit the slow running multivibrator provides a degree of vibrato to the audio generator.

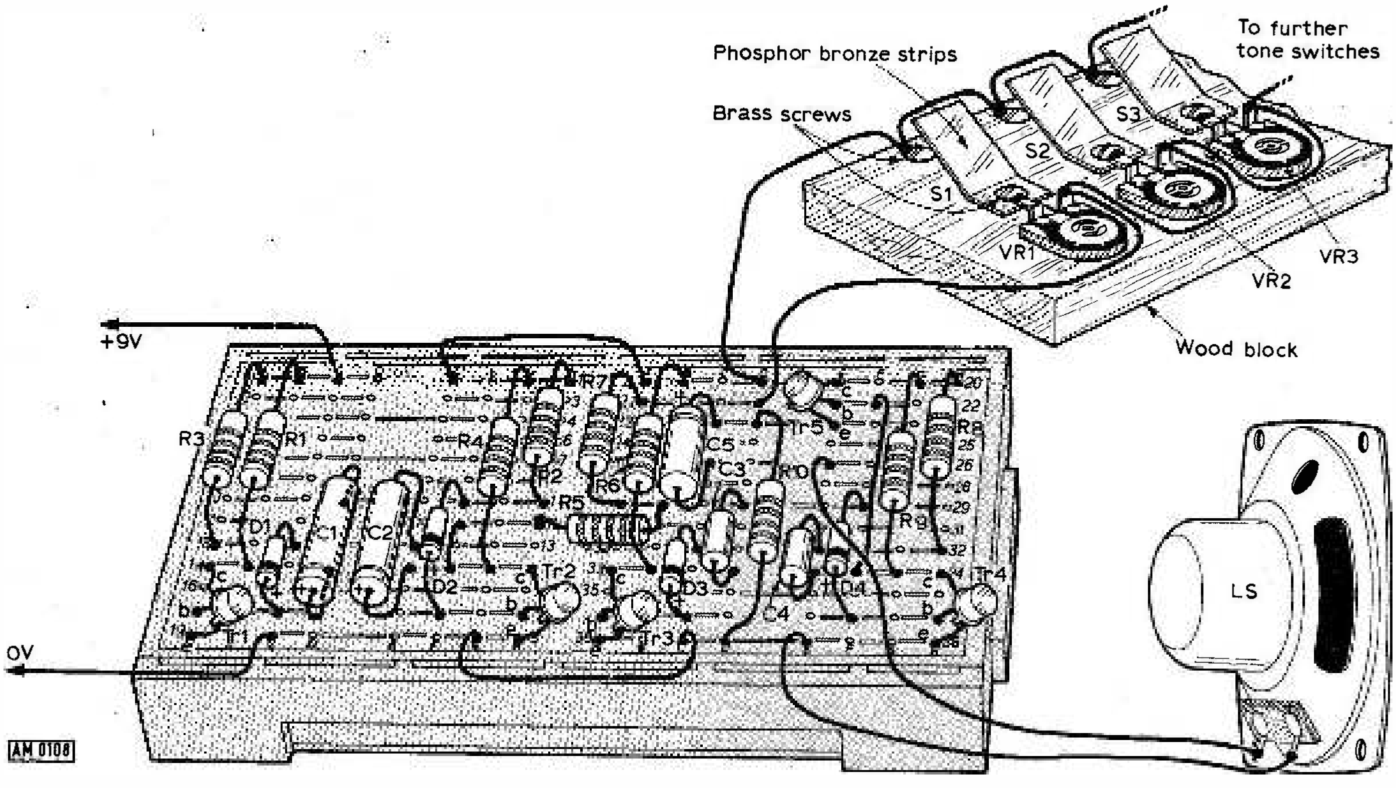


Fig. 28: Layout for Fig. 27.

only one note at a time could be generated but with careful selection and adjustment of these presets one can make a very effective little solo instrument.

To wind up this month you could experiment by adding vibrato (of sorts) to the tone generator. This is done with the help of the low speed astable similar to that described earlier. We use the signal at its output to modify the discharge rate of one of the capacitors in the tone generator circuit and if this is done at a rate of about 6Hz quite an effective vibrator (or warble-tone) can be produced. We show a working circuit for the latter two suggestions in Fig. 27. Of necessity we have not shown a complete range of notes nor have we given full details of a keyboard but the suggested sketch (Fig. 28) which uses phospher bronze door strip and brass screws could be used as the basis for experiment. There is no limit to the number of notes that can be set—all it requires is investment in the form of preset potentiometers. Remember, though, that you can only get a single note from the instrument at a time!

Next month we shall look at some amplifier circuits.

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FEBRUARY ISSUE ON SALE 4th JANUARY

★2 ZENER DIODE TESTER

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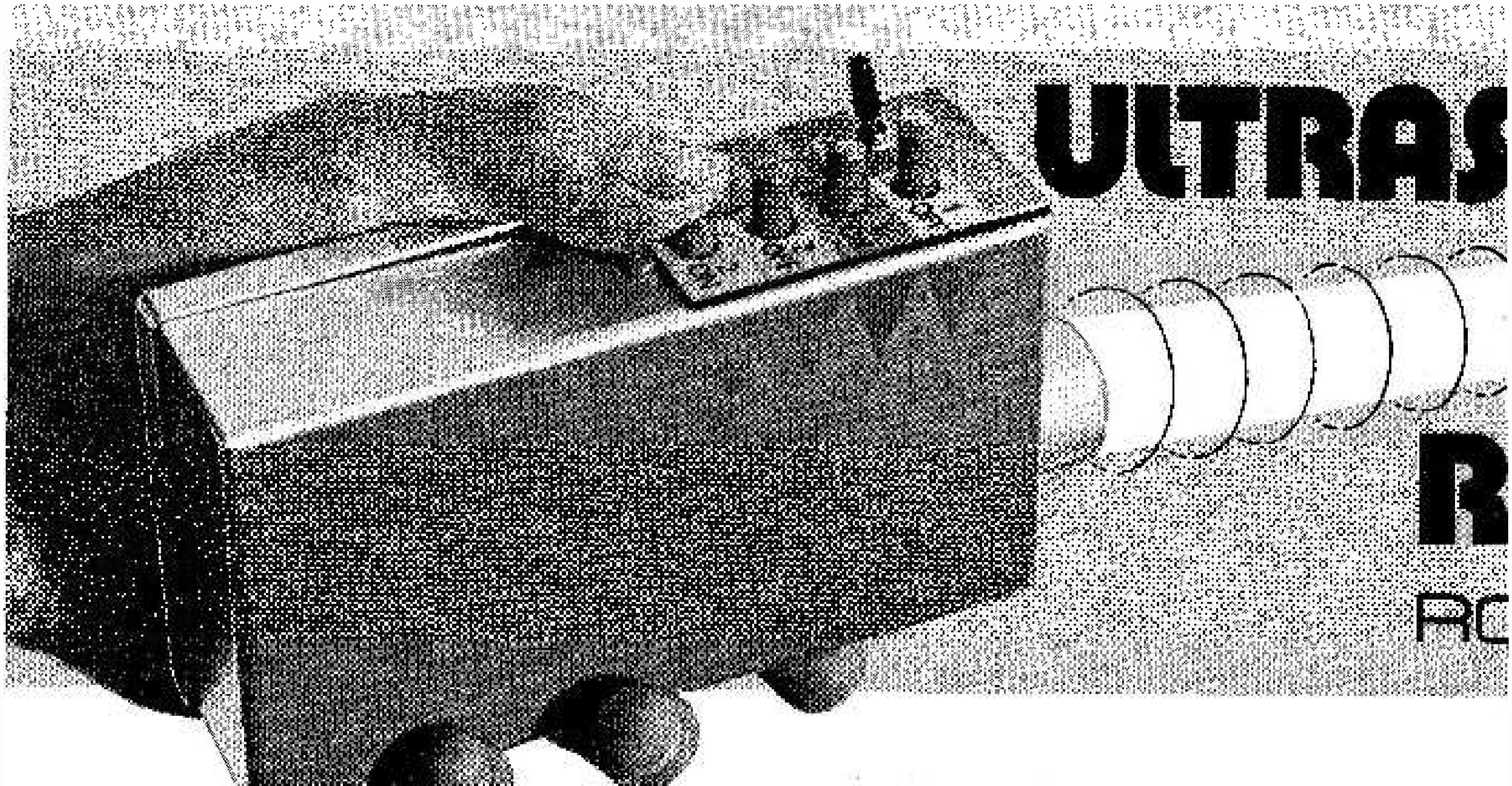


PART 1

REMOTE 'wireless' instigation of various functions is very largely associated with radio as a medium for transmitting the information. Here, the medium is ultrasonic sound eliminating the need for an MPT licence and providing some degree of system 'security'—that is, until everyone in your neighbourhood begins to appreciate the tremendous scope of remote command, and ultrasonic channels become just as full of those on VHF. Apart from the carrier medium, the rest of the system is very largely applicable to various forms of radio control. No doubt the model enthusiasts amongst the readers will quickly spot the potential.

The intelligence is transmitted by means of various tones which are frequency modulated upon the ultrasonic carrier; the heart of the system is the NE567 phase locked loop tone decoder modules. The 567 is an eight pin DIP IC containing about 110 components, and in order to programme the frequency and bandwidth, a further eight resistors and capacitors are necessary. Each decoder section is constructed along modular lines, so that they can be used as building blocks for larger and more sophisticated systems.

OPERATIONAL THEORY

The decoder firstly has to receive and demodulate the ultrasonic carrier. A SN76660N FM IF integrated circuit, Fig. 1(a), is used to amplify the transducer output to a level that will operate the first of the NE567 decoders, whose frequency is set at 40kHz (i.e. that of the transducer). This allows for the first, and the simplest, of the command functions. It means that the on/off control of some device can be controlled by means of the transmission of the 40kHz, unmodulated carrier. As long as the carrier is present, the output from the tone decoder is activated.

However, the system is extended greatly by the next sections which are the individual command tone

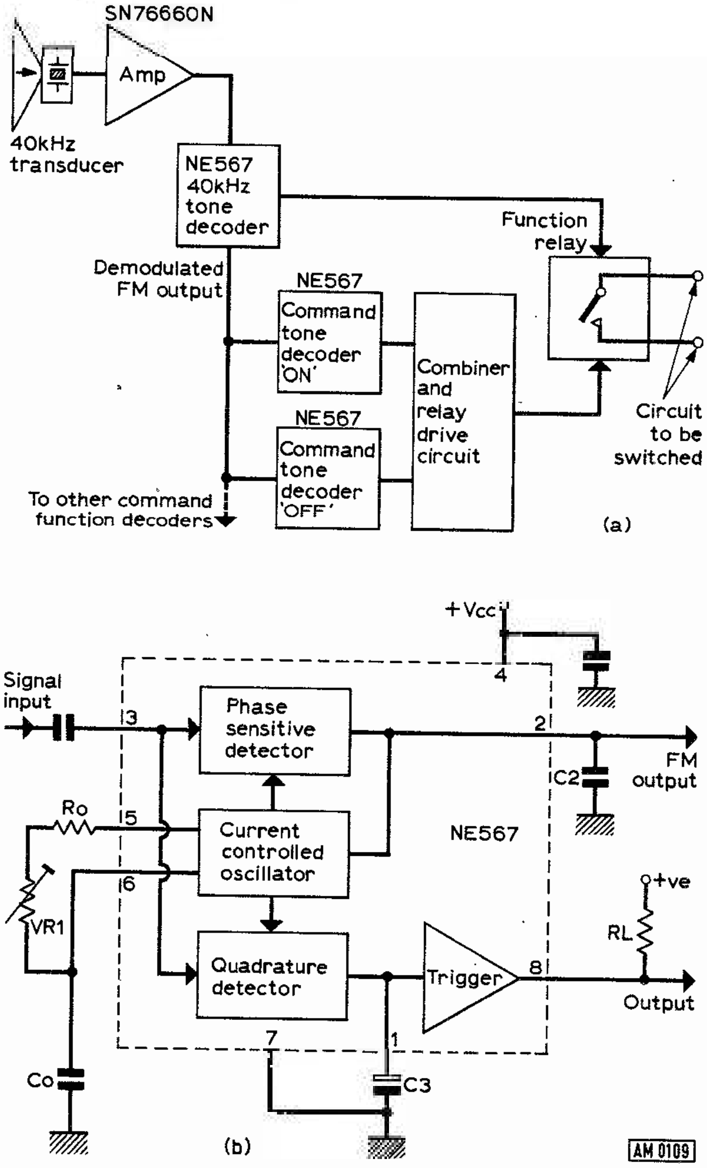
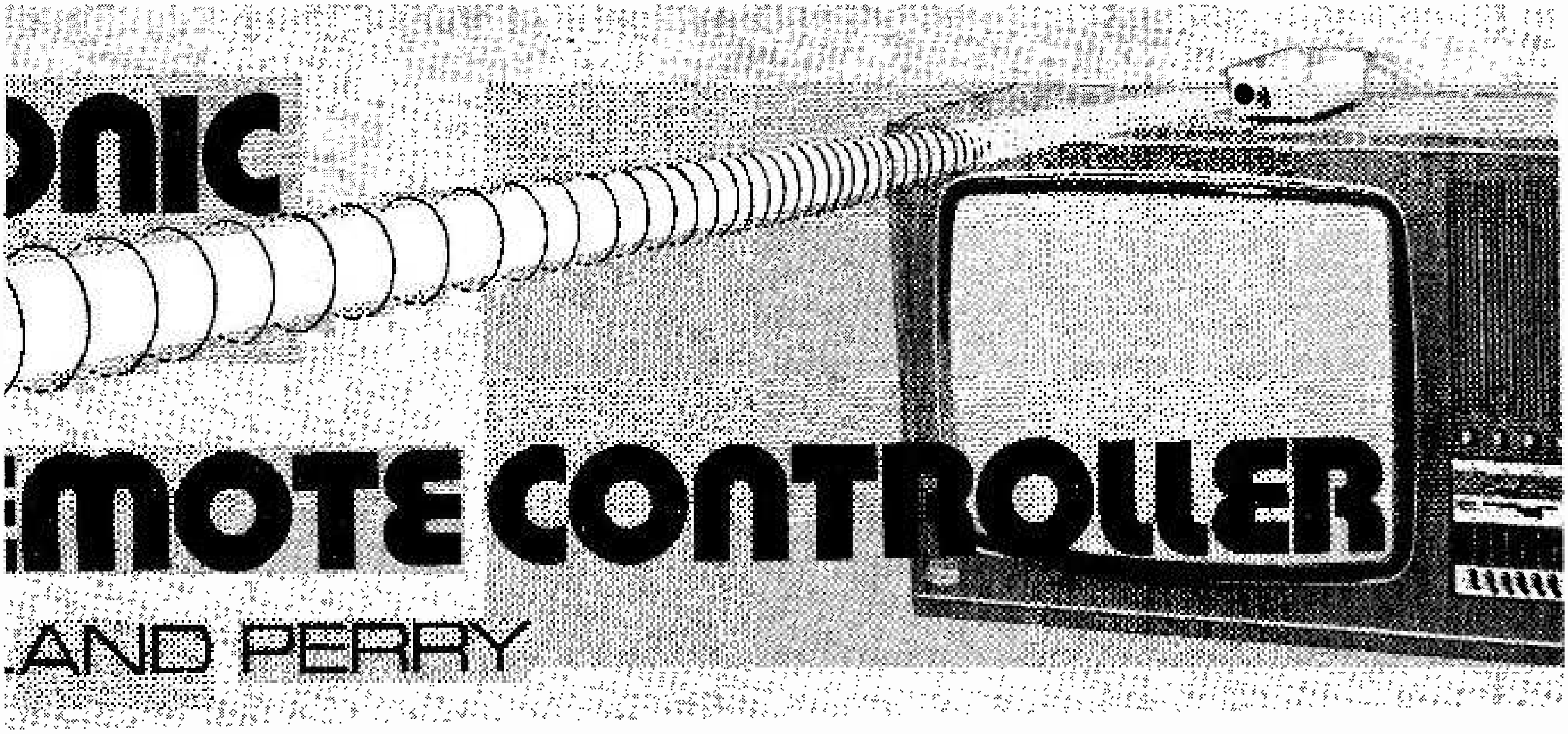


Fig. 1 (a) top, function diagram of the remote controlled receiver with a single function switched by a relay.
Fig. 1 (b) bottom, identifies the functions performed by a single NE567 command tone decoder.



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AND PERRY

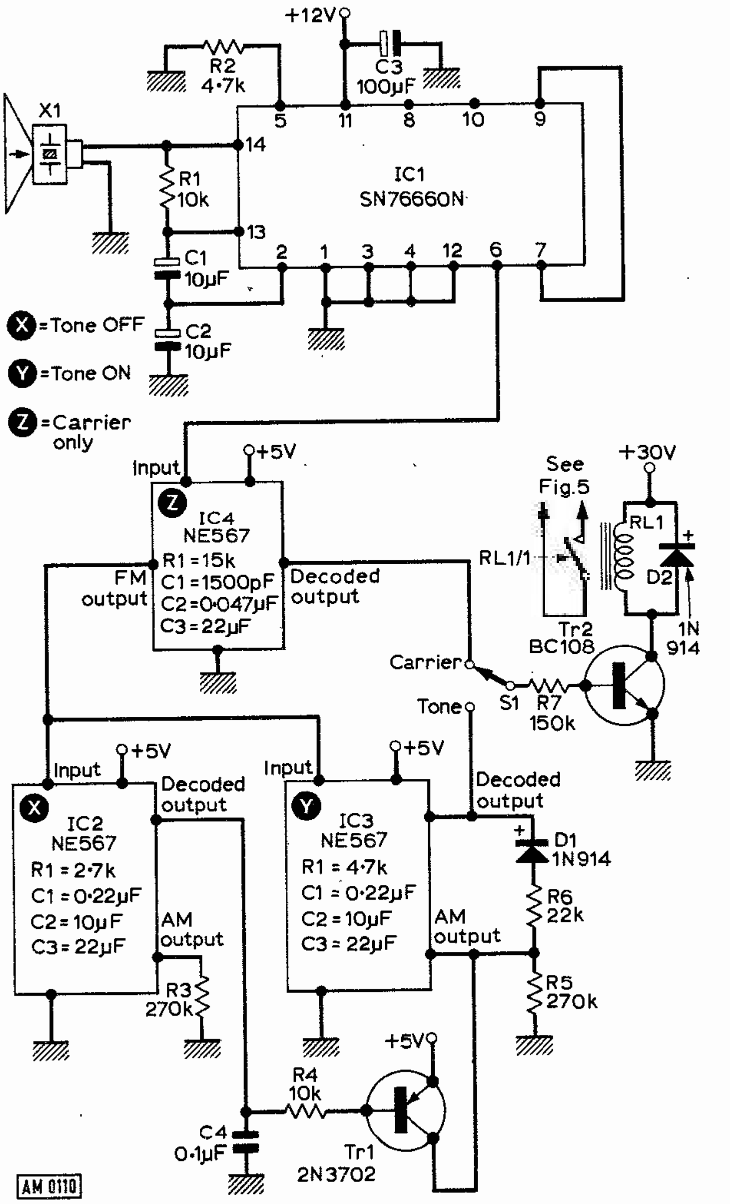


Fig. 2. Interconnection of the IC's comprising the complete receiver for one function. This can be operated only when the carrier is present or switched on with carrier plus tone Y or switched off with carrier plus tone X. The choice of operation is selected by switch S1.

decoders, Fig. 1(b). These are fed from the FM output of the 40kHz decoder, and operate from any number of assorted tones from 200Hz to 1kHz, with a 4% channel spacing. This means that a single ultrasonic carrier can be used to carry many different channels of command, and by combining two or three tones in sequence, the combinations are almost limitless. However, this article will confine itself to the simple single tone command signals, since multitone sequential systems require a good deal of test gear to set up properly.

THE RECEIVER

The receiver, Fig.2, employs the two modes of operation mentioned here, namely carrier, or tone-on-carrier. In the carrier-only mode, the decoder output from the carrier detector drives the relay switch, in this case a BC108. Do not forget to include the diode across the coil to prevent inductive surges from destroying the transistor.

In the tone-on-carrier mode, the FM output of the ultrasonic receiver drives two further decoders tuned to the desired tone frequency. The 'ON' tone decoder 'Y', is operated in latching mode. As soon as an input is detected pin 8 is grounded, and the AM output is held low by the external diode and 22kΩ resistor. In order to unlatch the 'ON' decoder, the 'OFF' decoder has to be activated by its appropriate tone, whereupon the 2N3702 transistor pulls the output of decoder Y up to 5V, and releases it. The relay switch now reverts to 'OFF'.

The 270kΩ resistors speed up the response time, and increase sensitivity, while the 0·1µF capacitor in the unlatch loop prevents the 'ON' decoder from latching, when the circuit is activated.

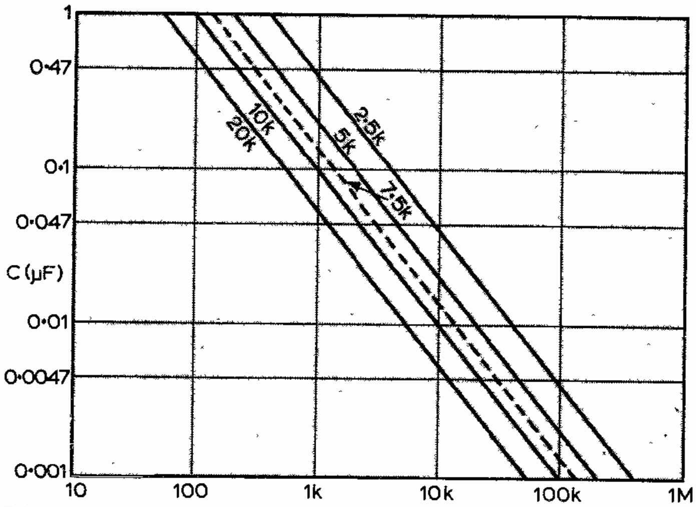
To most people, FM is now synonymous with VHF broadcasting, so when thinking about the receiver section, it was decided to try out one of the many FM IF IC's. Despite the fact that it is designed with 10·7MHz in mind, the SN76660N performed admirably at 40kHz, and was therefore adopted.

Only the limiting amplifier sections are employed, since the detection is carried out in one of the tone decoder modules detailed later. Whilst there is no objection to using the quadrature detector on the IC, it cannot provide the carrier presence facility available on the tone decoder.

Again, it will be seen that IC technology 'takes the strain', since the ultrasonic receiver itself needs only the IC, two resistors and three capacitors. The much amplified output is then fed into the tone decoder module.

TONE DECODER MODULE

The free running frequency of the PLL is determined by the values of C1 and R1+VR1, Fig. 3. A table of the more useful values is provided for quick reference, Table A.



AM 0117

μF	2·5kΩ	5kΩ	7·5kΩ	10kΩ	20kΩ
1·0	400Hz	200Hz	(133Hz)	100Hz	50 Hz
0·47	850Hz	425Hz	(280Hz)	212Hz	106 Hz
0·1	4kHz	2kHz	(1·33kHz)	1kHz	500 Hz
0·047	8·5kHz	4·25kHz	(2·8kHz)	2·12kHz	1·06kHz
0·01	40kHz	20kHz	(13·3kHz)	10kHz	5kHz
0·0047	85kHz	42·5kHz	(28kHz)	21·2kHz	10·6kHz
0·001	400kHz	200kHz	(133kHz)	100kHz	50kHz

Table A. *Values of C and R determining the tone decoder frequency. Values for other frequencies may be determined from the graph above. See Fig. 3.*

The PLL will lock on to an input whose frequency lies within the loop capture range. As we wish to vary the detection bandwidth the simplest way is to programme the capture range. The single capacitor C2 determines the bandwidth, and being part of the feedback low pass filter, it also provides a demodulated output for the FM tone. Again, a table of recommended values is provided for quick reference, Table B.

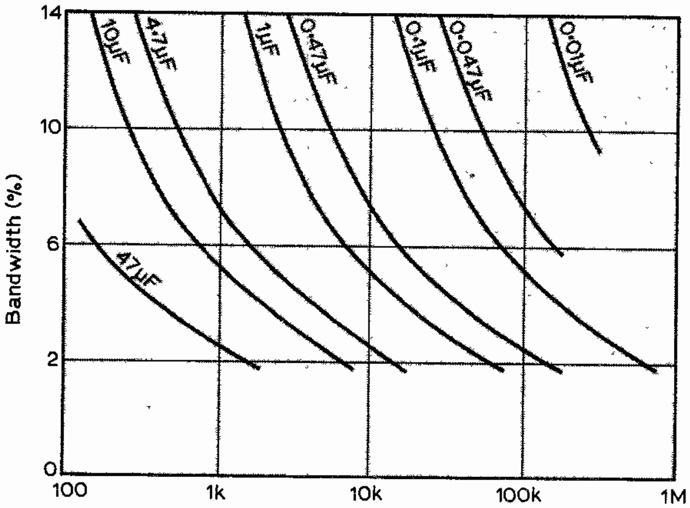
In order that the loop can detect AM, or merely the presence of a carrier, the input is mixed with the locked VCO frequency, but shifted through 90°, in a simple quadrature mixer. Pin 1 of the NE567 provides the AM signal, which, if it exceeds a certain value, then switches the output driver stage at pin 8. This then drives pin 8 low in the presence of signal within the capture range of the IC.

The capacitor C3, at the output of the AM detector, is determined from a consideration of the speed of the response of the loop, and its immunity to spurious triggering. Unfortunately, the one is at the expense of the other, so some form of compromise needs to be reached, and the recommended value is that C3 should be about twice the value of C2.

The input is capacitively coupled, since there exists an internal arrangement for the input stage bias voltage. The capacitor C5 is chosen to have a low impedance at the desired frequency.

The decoder gives optimum results with an input in excess of 200mV, but it will operate at lower levels, at the expense of the bandwidth. The degradation of the bandwidth is typically to 10% at 200mV, 7% at 100mV and 5% at 20mV.

Decoupling of the supply is necessary to smooth out the fast edges of the switch transients in the decoder and this is provided on the module. Although



AM 0118

μF	Bandwidth 2%	6%	10%	14%
0·01	—	—	260kHz	130kHz
0·047	—	150kHz	55kHz	28kHz
0·1	620kHz	73kHz	26kHz	13kHz
0·47	130kHz	15kHz	5·5kHz	2·8kHz
1·0	62kHz	7·3kHz	2·6kHz	1·3kHz
4·7	13kHz	1·5kHz	550 Hz	280 Hz
10·0	6·2kHz	730 Hz	260 Hz	130 Hz
47·0	1·3kHz	150 Hz	—	—

Table B. *Values of capacitor C2 setting the bandwidth or loop capture range. The graph enables intermediate values to be determined. See Fig. 3.*

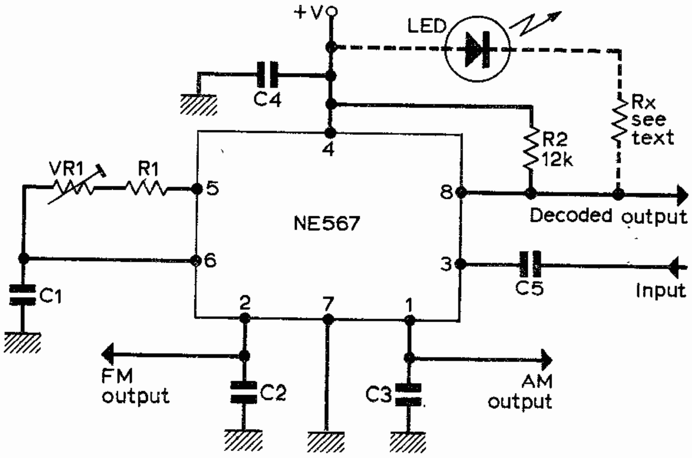


Fig. 3. Basic circuitry of a tone decoder module illustrating the components which fix the operating frequency. The LED is optional, see text.

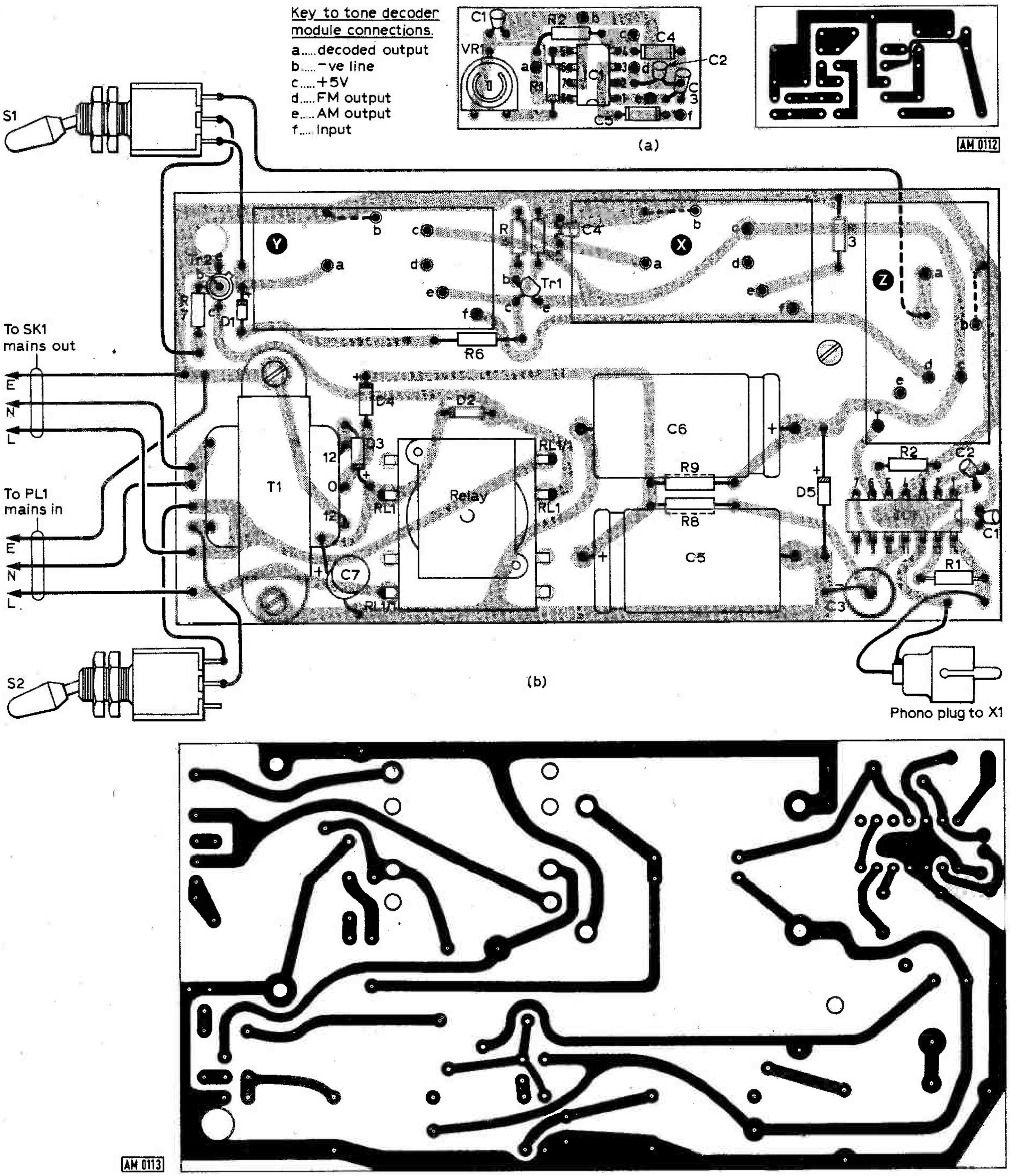


Fig. 4 (a) top, full size copper foil layout of a tone decoder pcb and component location. Three of these are required for one function. Certain component leads are extended below the board to mate with holes in the main receiver pcb, Fig. 4 (b), bottom. Note that the power supply circuitry of Fig. 5 is included on this pcb which is also full size.

it is desirable that the supply be regulated, the tone decoder frequency is not too closely voltage dependent.

The printed board layout of the module is shown in Fig. 4a, and the leadout connections, in the example shown, are by means of short pins soldered to the reverse side. The pins can simply be the cutoffs from resistor leads, since these provide quite adequate rigidity when mounted to the larger board of the system, Fig. 4b.

The PLL free running frequency must be set to the frequency to be decoded, in order to obtain a symmetrical bandwidth i.e. a 10% bandwidth represents 5% high and 5% low. If the tone is in

★ components list

RECEIVER AND POWER SUPPLY

R1	10kΩ	R4	10kΩ	R7	150kΩ
R2	4·7kΩ	R5	270kΩ	R8	10Ω
R3	270kΩ	R6	22kΩ	R9	120Ω
C	10μF 16V tantalum			C5	1000μF 18V
C	10μF 16V tantalum			C6	1000μF 18V
C3	100μF 25V electrolytic			C7	22μF 35V
C4	0·1μF 16V tantalum				
Tr1	2N3702			Tr2	BC108
D1/2	1N914	D3/4	1N4001	D5	5·V zener
		IC1	SN76660		

Miscellaneous

RL1, relay 30V, SP on/off minimum, see text.
S1, miniature SP changeover. S2, miniature on/off.
X1, transducer 40kHz (Ambit), plus phono plug connector.
T1, transformer 240V/12–0–12V. Aluminium box and lid, 5⅜ x 3 x 1½in approx. (Type AB7).
PCB, 5¼ x 2¾
Cable, 3 core, as required with mains plug and cable-end socket.

TONE DECODER MODULES

MODULE	X	Y	Z
R1	2·7kΩ	4·7kΩ	15kΩ
C1	0·22μF	0·22μF	1500pF
C2	10μF	10μF	0·04 μF
C3	22μF	22μF	22μF

C4	0·1μF	R2	12kΩ
C5	0·047μF	Rx	see text
VR1	2·5kΩ miniature preset	LED	see text
IC2/3/4	NE567	PCB's	1¼ x ¾in. (3)

TRANSMITTER

R1	6·8kΩ	R4	150kΩ	R7	33kΩ
R2	10kΩ	R5	18kΩ	R8	1·2kΩ
R3	390Ω	R6	1·2kΩ	R9	12kΩ

VR1 25kΩ VR2 10kΩ miniature pre-sets

C1	0·1μF polycarb.	C5	1000pF disc ceramic
C2	10μF tantalum	C6	47μF 25V electrolytic
C3	0·1μF polycarb.	C7	10μF tantalum
C4	0·22μF tantalum		

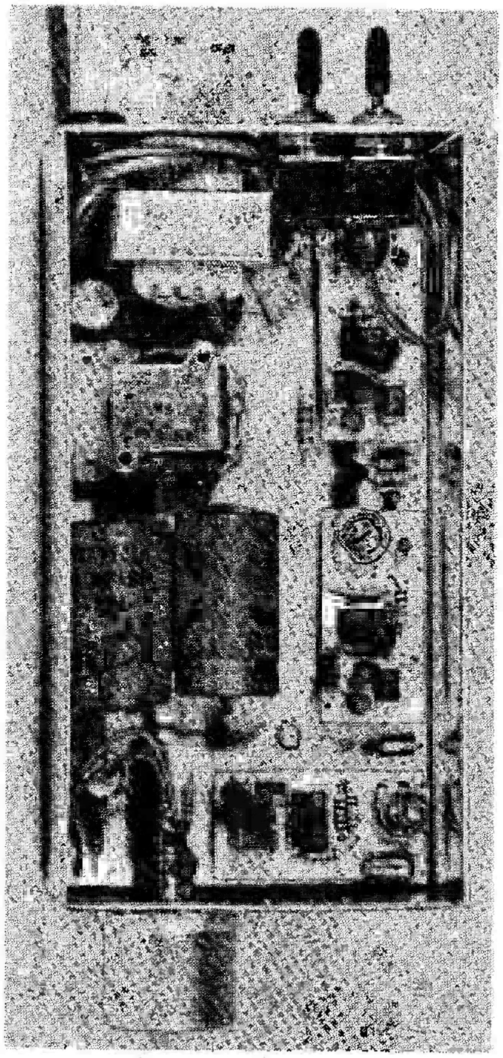
Miscellaneous

IC1/2, NE555. S1/4, 4-button switch assembly (Ambit) X2, transducer 40kHz plus phono plug connector (Ambit). Aluminium box type AB7, PCB, 3¼ x 2⅜in. S5, miniature on/off.

All resistors ¼ or ½W 5%.

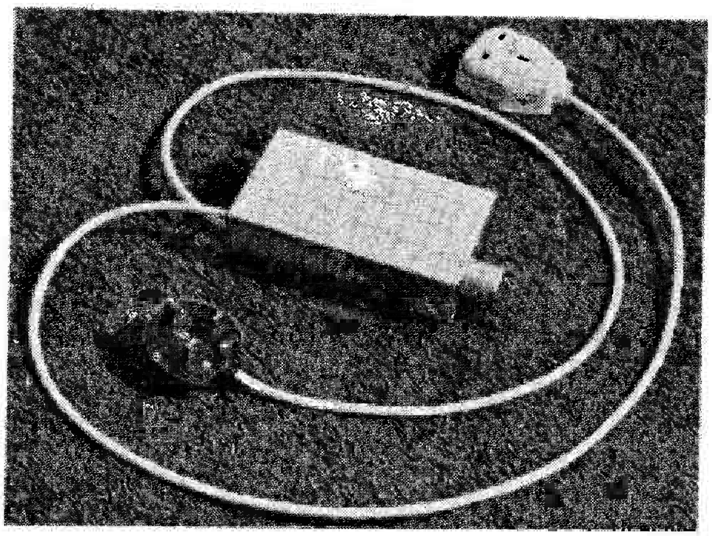
The following items can be obtained from Ambit International, 37 High Street, Brentwood, Essex. All prices include VAT and P/P:—NE555, 86p each. NE567, £2·75 each. SN76660 99p each. Transducers, £5·50 a pair. Transmitter PCB, 77p. Receiver PCB 82p. Tone Decoder PCB's 10p each.

the audible range, then a crystal earpiece can be connected to pin 5 of the IC, and the tuning accomplished by ear. The ideal equipment is a digital frequency meter, and an oscilloscope and it is assumed that owners of such instruments will be aware of how they should be used to set up the decoder. If neither of these is available, then the following procedure should be observed:—



View of completed receiver with power supply components down the left hand side and three decoder modules at the right and bottom. The input transducer is shown fixed to the lower side of the box.

Receiver with mains plug and fully insulated socket for plug from apparatus being controlled.



1. Inject the input tone and monitor the output with a meter.
2. Rotate the preset potentiometer until the output goes low. (Tone being detected.) Continue to rotate until the output goes high again.
3. Note these two positions and set the preset to the midpoint, which should then correspond to the centre frequency.

DECODER COMPONENTS

The most critical components in this design are those which determine the frequency, C1 and VR1 plus R1 should all be chosen for temperature and time stability. Wide tolerances in their absolute values are quite permissible, due to the latitude of adjustment available on the preset.

The bandwidth and decoupling capacitors are not critical, a 50% tolerance being acceptable. As a rule, it is best to standardize on a range of components when preparing for construction, so polycarbonate capacitors of 0·1μF and below, and tantalum bead capacitors for values above 0·1μF are chosen. Both these types of capacitor enjoy good stability combined with small physical size. In the PCB layout, the holes for the capacitors are given as either 0·1in. or 0·3in. spacing, so that either variety can be used.

RECEIVER PSU

A multipurpose PSU, Fig.5, is employed to supply:—

12V DC to the SN76660N (15mA)
5V (stab. DC) to the tone decoders (50mA approx.)
30V DC to the mains function relay (according to relay).

A 30V relay was employed for no better reason than one was available at the time. Any relay which can be fed with an available voltage, that can be switched by the BC108 or similar, will suffice. Remember that the contacts should be rated according to the power requirements of the system you wish to control.

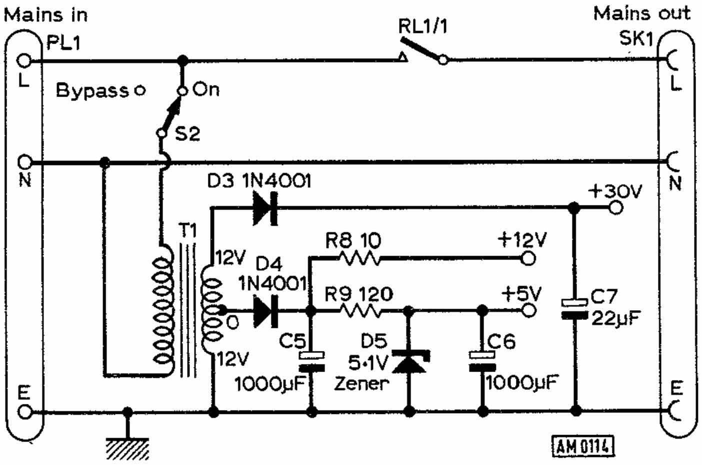
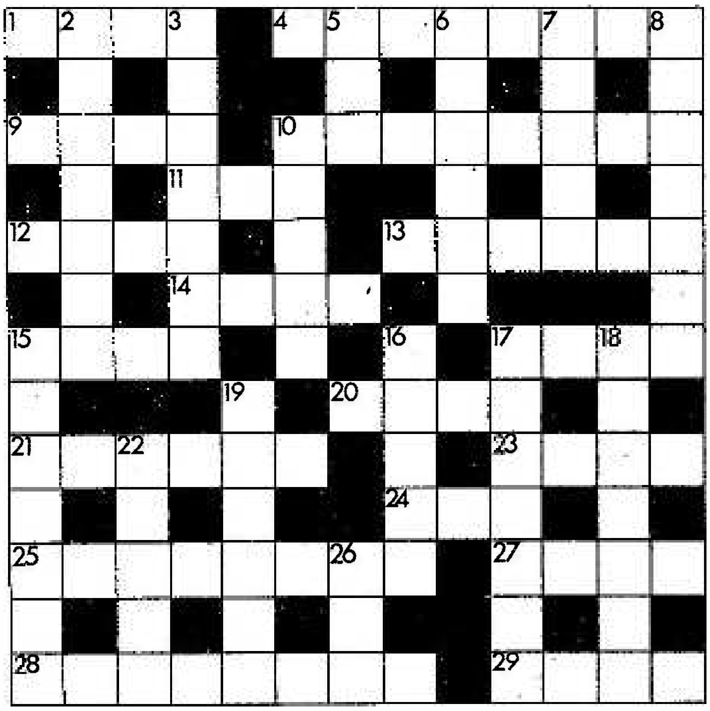


Fig. 5. Circuit of power supply which is accommodated on receiver pcb.

One advantage of feeding the relay from 30V is that it will be a low current drain on the transformer which will help to maintain voltage stability on the other parts of the receiver.

PART 2 next month will describe the construction of the transmitter, the procedure for adjusting the tone frequencies and the final alignment.

PW TECHNICROSS PUZZLE No.2



ACROSS

1 Should I scan about a record? (4)
4 Wet trees damaged h.f. loudspeakers (8)
9 Pinky recorded in tyro sync! (4)
10 Only agree about me making a coil? (8)
11 See 3 Down
12 A unit of the core of stem filaments? (4)
13 Make a crossing to wipe a tape? (6)
14 First man in farad amplifiers? (4)
15 Ringing tone on an old record? (4)
17 They turn on some signalling methods? (4)
20 Sound component that may need adjustment (4)
21 Not as selective around a curtain hanging (6)
23 Short course in maths (4)
24 Tune in this manner? (3)
25 What a charge for so small a part! (8)
27 True guarantee written into a thermionic? (4)
28 Alpine sound transmitter (8)
29 A backwater in bed dynamo production (4)

DOWN

2 Mighty atom active in radio! (7)
3 & 11 Across A sparkling receiver in the right spot (7, 3)
5 Go to court for half the speaker? (3)
6 The first group in the game (6)
7 Get away with oriental pole switches? (5)
8 Sorry state of Edna's rebuilt vessel (7)
10 High fidelity on a short instrument? (5)
15 Package deal in the power game (7)
16 Italian specialist from antenna centre (5)
17 Ted tore round with such a valve? (7)
18 Like a book on circuits? (7)
19 Learnt about the borrowing fee? (6)
22 M.p.h. or r.p.m.? (5)
26 No receiver has crude metal connections? (3)

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- ✳ Constant and algebraic logic combine to act as a limited memory, allowing complex calculations on a calculator costing less than £30.
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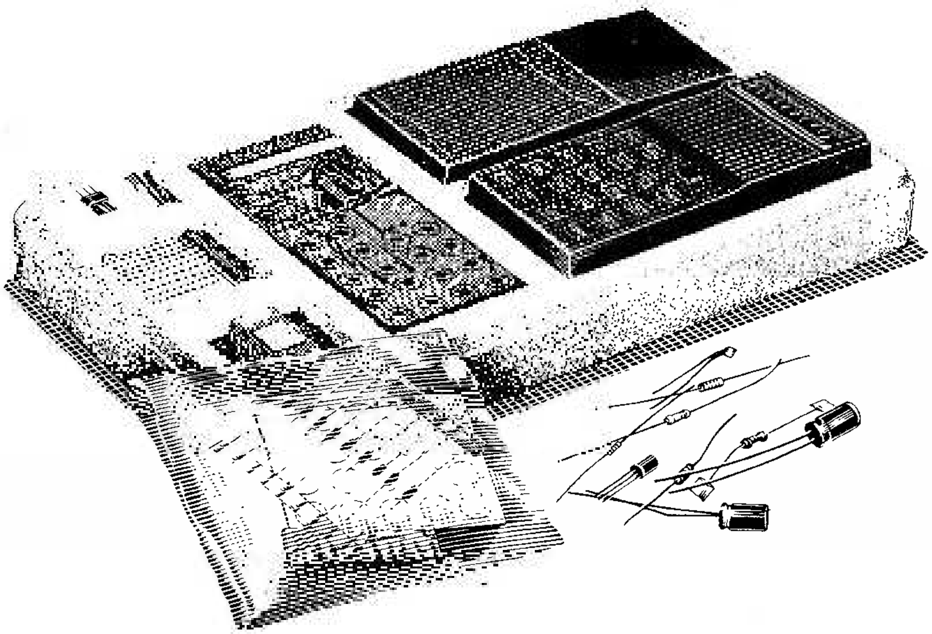
4. Thick-film resistor pack.
5. Case mouldings, with buttons, window and light-up display in position
6. Printed circuit board.
7. Keyboard panel.
8. Electronic components pack (diodes, resistors, capacitors, transistor).
9. Battery clips and on/off switch.
10. Soft wallet.



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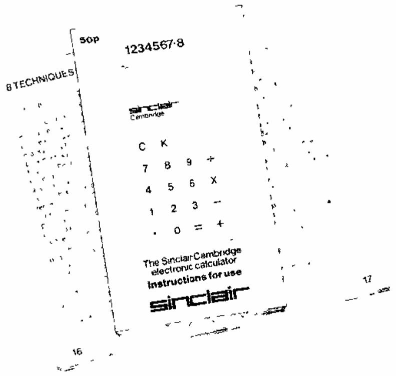

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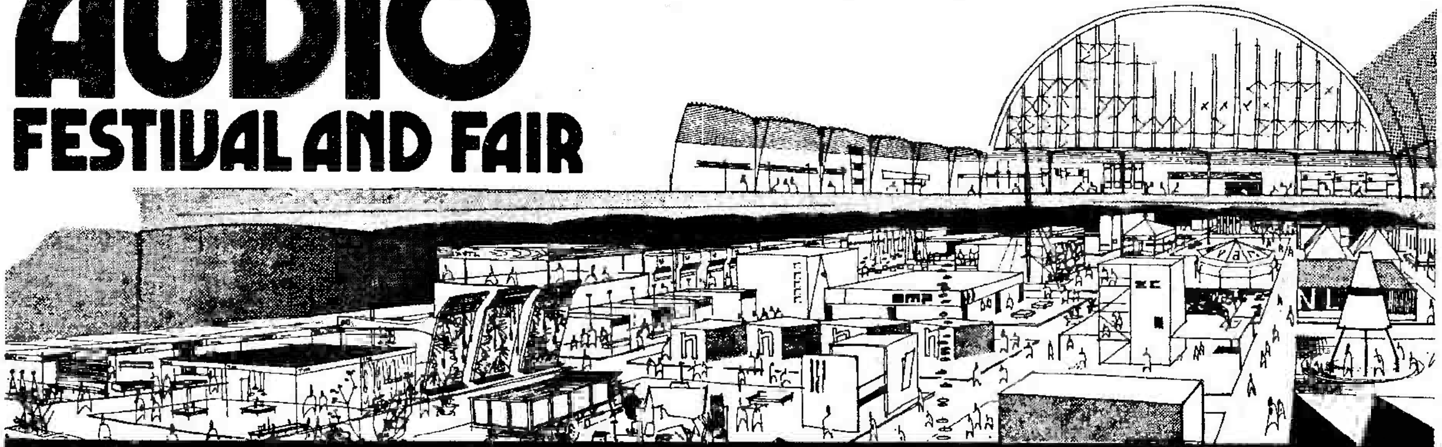
THE 1973 INTERNATIONAL AUDIO FESTIVAL AND FAIR

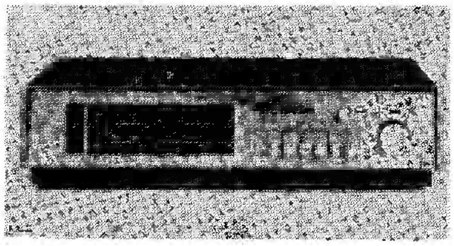


COLIN RICHES

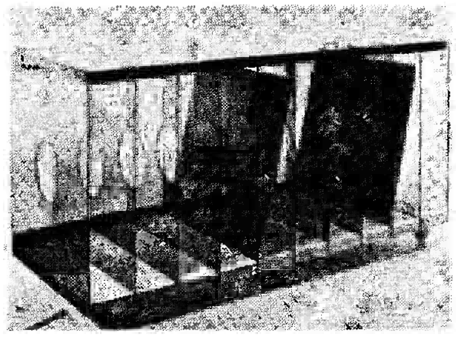
Whereas in previous years we have had stereo, quadraphonic, tape and cassette "revolutions" this year's Audio Fair gave me nothing that I could put a finger on any say "Ah yes, that was the "innovation" introduced at the '73 Audio Fair".

However, one thing that was noticeable was that many companies are offering "complete" systems which can be brought home from the shop, plugged in and used without any fuss or wiring problems. These systems are "one-up" from the unit audio equipment at present on the market, and cater for the person who requires something a little better than the usual run of "Mid-fi" equipment.

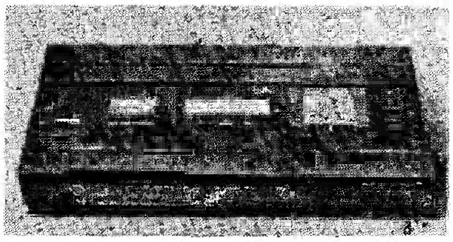
Below, I have made a selection of items of equipment exhibited at the Audio Fair which I feel will interest Practical Wireless readers.



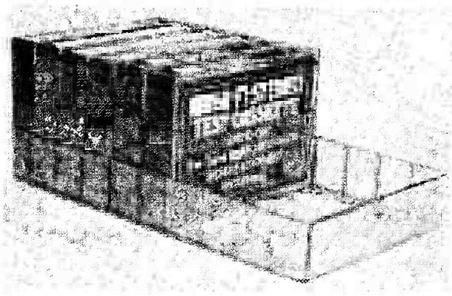
ALBA Ltd. were showing their medium price-range units with accent on the new UA800 a.m./f.m. tuner to match the popular UA700 amplifier. The UA800 pictured, is priced at about £38. *Alba Ltd., Bull Lane, Edmonton, London, N.9.*



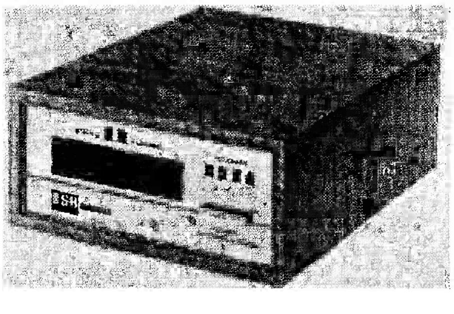
ARTIFACT DESIGNS Ltd. had their Encore record storage system as the main feature of their stand. Spacers screw together, to make bays for 20 LP's. You start with a 4-bay unit then add 2-bay extensions as your record collection grows. *Artifact Designs Ltd., 72 Boston Place, London N.W.1. 6EX.*



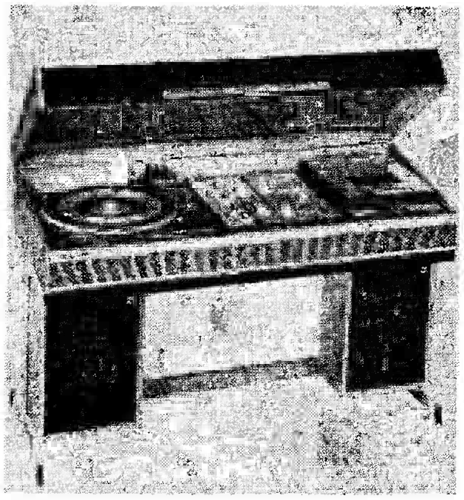
BANG AND OLUFSEN exhibited their complete range of audio equipment but the unit which caught my eye was the Beocord 2200 "Dolby-ised" cassette deck. It looks good, sounds good and by gum it is good! *Bang and Olufsen Ltd., Eastbrook Road, Gloucester, GL4 7DE.*



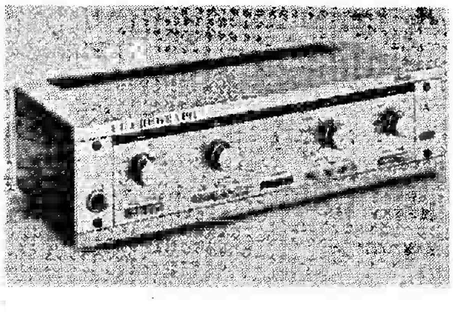
BIB Hi-Fi Ltd. exhibited a cassette storage system. Each tray holds ten cassettes in a horizontal position. *BIB Hi-Fi Accessories Ltd., P.O. Box 78, Hemel Hempstead, Herts, HP2 7EP.*



BSR introduced their TD8-QW 4-channel 8 track cartridge player. It will play ordinary stereo cartridges but if 4 channel playback is required, 4-channel or two stereo amplifiers must be used. The unit has a built in preamp with an output of 600mV (1kHz standard ref. level tape). Frequency response is 50Hz-10kHz. Power requirements are 105-130v a.c. at 60Hz or 210-250V a.c. 50Hz. Price is about £35. *BSR Ltd., Monarch Works, Cradley Heath, Worcs.*

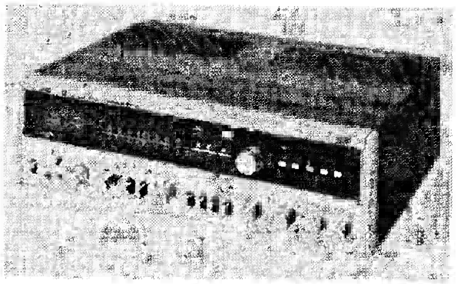


DECCA featured their compact 4 Music Centre. It has 10W per channel output and plays both records and cassettes. Decca also demonstrated their range of in-car entertainment units which included three cartridge players and one cassette player. *Decca Radio & Television, Neachells Lane, Willenhall, Staffs.*

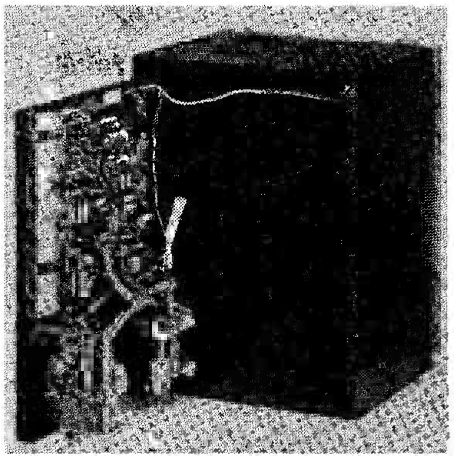


FERROGRAPH'S new 20 + 20W stereo amplifier matches their new v.h.f. tuner. It features steep-cut filters and switched pick-up matching. *Ferrograph Co. Ltd., Auriema House, Bath Road, Cippenham, Bucks, SL1 6BB.*

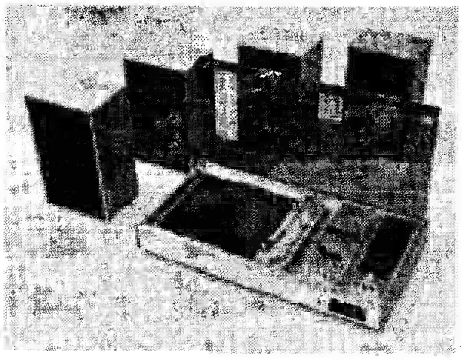
GRUNDIG showed their latest reel-to-reel machine, TK745, recommended price is £141·75 excluding mic but including VAT. *Grundig (Great Britain) Ltd., Newlands Park, London, SE26 5NQ.*



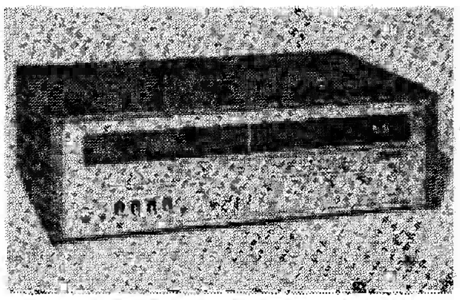
JVC demonstrated their 4-channel discrete tape on cassette and displayed their complete new range of both 4-channel and 2-channel tuner amplifiers. All the 4-channel tuner-amps have a built-in CD4 discrete modulator, SQ decoder, QS decoder and 2 to 4 channel synthesiser. Picture shows the 4VR 5446 a.m./f.m. tuner-amplifier. *JVC, Denham & Morley Ltd., 453 Caledonian Road, London N.7.*



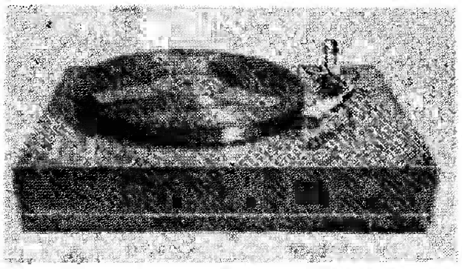
PHILIPS launched their motional feedback speakers—each having two output amplifiers, one feeding the woofer and the other, the mid-range and tweeter. This is said to allow for bigger output powers from existing amplifiers and better reproduction from smaller enclosures. *Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, WC2 8AS.*



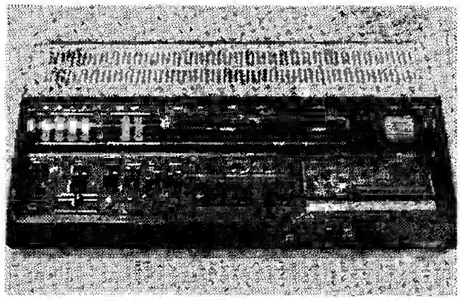
QUADRASONICS Q4-20 unit audio system is claimed to be the first European system that will play any of the quadraphonic discs, stereo and mono records, was a feature of their stand. Also featured were the "Quadraline" loudspeakers. *Quadrasonics Ltd., Spencer House, Brettenham Road, Edmonton, London N.18.*



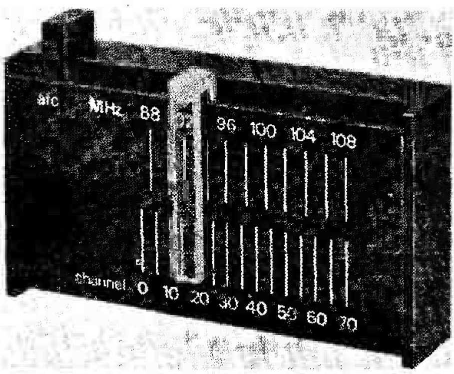
SANYO. Shown here is the DCX 3300 KA a.m./f.m. 4-channel tuner amp. Reproduces SQ discs and 4-channel reproduction of 8-track discrete tapes is a feature. Price is £176·75. *Sanyo Marubeni UK Ltd., Bushey Mill Lane, Watford, Herts.*



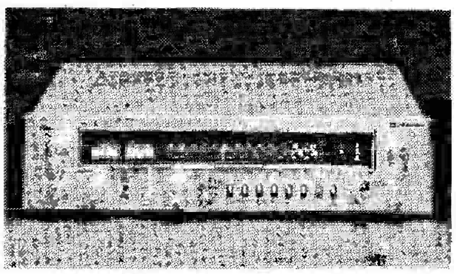
SCAN-DYNA'S new 1400 record deck was one of the features of the stand. It employs a specially designed motor and suspension and comes complete with an Ortofon AS 212 arm and F150 cartridge. *Scandinavian Dyna Production Co. A/S, Hulum 7600, Struer, Denmark.*



SIEMENS demonstrated their RS502 stereo tuner with 4-channel amplifier. This unit covers six wavebands and reproduces 4-channel and stereo records. *Siemens Ltd., Great West House, Great West Road, Brentford, Middlesex.*



SINCLAIR exhibited their Project 80 units and shown here is the f.m. tuner. Covers 87-108 MHz and distortion is claimed as 0·3% at 1kHz for 75kHz deviation. Price is £11·95 + VAT. *Sinclair Radionics, Ltd., London Road, St. Ives, Huntingdonshire, PE17 4HJ.*



TOSHIBA Amongst the display was the SA-504 4-channel tuner/amplifier which has a suggested selling price of £289 (inc. VAT). *Tokyo Shibaura Eleckic Co. Ltd., Consumer Products Export Division 2-1 Ginza J-Chome, Chuo-Ku, Tokyo, 104, Japan.*

WHARFEDALE. How better to finish this little review than with a pretty girl. Actually, she is cuddling a pair of the Design-Council award-winning electromagnetic phones in their presentation case. Price including VAT is £21·95 (the phones, not the girl). *Rank Radio International Ltd., P.O. Box 596, Power Road, Chiswick, London, W4 5PW.*

HOTLINES

ON RECENT DEVELOPMENTS

ENERGY CRISIS

THERE'S an energy crisis coming, claim the experts. They're probably right, too. The current world situation regarding oil has made many people aware of the importance of finding a "new" source of energy. Trouble is, it has to be cheap.

Two interesting ideas have thrust themselves forward recently. One is being vigorously pursued in the U.S. and the other is experimental and the work being carried out in the U.K.

First, if you take little balls of frozen hydrogen and suddenly shine a dirty great laser beam on them, these little balls collapse and melt almost instantaneously. When they do so, they release collosal energy. Problem at the present time is that this method of getting energy requires a laser beam considerably in excess of anything currently available. But then transistors began in a small way with very tiny currents, didn't they?

In the U.K. the work is focussed on solar cell research. For many years, the silicon photocell has been the key word in the utilisation of daylight—or better still, sunlight. Recently, an American Company displayed some large silicon solar cells in London. Similar cells are being used to "power" offshore navigation systems.

Trouble with silicon is that the efficiency of the cells is so very low, commonly around 10% although 12% and a shade higher has been quoted. The U.K. experiments employ Gallium Arsenide/Gallium Aluminium Arsenide to form heterostructure junction semiconductors. Because the GaA1As is transparent to sunlight, the surface layer can be made quite thick. Because it is thick, its electrical resistance is low and thus a higher power can be generated. An efficiency of 20% is claimed to be possible in theory. Although very little information is presently available, results so far seem promising.

ELECTRONIC HOUSEWIFE

I predict that the time will come (and soon, too) when housewives will carry electronic calculators on their wrists when they do their shopping. The price will drop to such a level that this will be easily possible. Schoolboys too will have these units.

Take a look at electronic calculators two years ago. Mostly expensive items. Now comes an announcement that a £20 unit is on the market—the Calate 44. This calculator has a keyboard where the only moving element is rubber. Around 30 hours of "normal" use is expected from a 9V alkaline battery. Although the IC chip employed performs calculations to eight digits, only four are shown on the display. The four most significant digits are shown, however, by depressing a button, the next (least significant) four digits are displayed.

It is interesting to note that the manufacturers achieve the long life of the battery by pulsing the chip/display instead of running these continuously. This is the technique which was employed by Clive Sinclair to achieve the same ends.

In the U.S. one source quotes that IC calculator chips will reach the next stage of their development: 200 mils square, accomodating up to 25,000 m.o.s. transistors and costing around five dollars.

RADARMOBILE

Electronics seems a natural ally to the motor car and yet the marriage of the two has been a slow process. It appears that legislation is the only thing which will cause any real progress here. However, this has not deterred many manufactuers from making numerous experiments and coming up with prototype equipment.

One manufacturer at the recent Motor Show talked of a radar system for locating obstacles in the path of the vehicle. The very first units were large and bulky, and required a considerable amount of modification to the car when they were fitted. Now, the system has been miniaturised and very little modification indeed is needed. The aerial array has been fabricated on a p.c.b. and the unit has interesting possibilities.

£2·50 CALCULATOR?

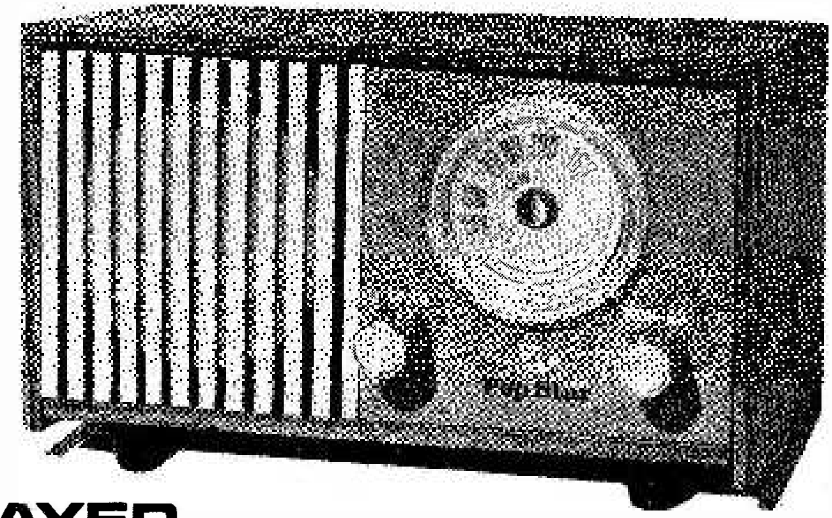
Talking of miniaturisation, my ears gave an excited flap when I heard about the projected progress in memories—electronic types, of course. I'm always fascinated by the number of "bits" of information which these chips manage to accomodate. At present we have a 4,096-bit chip which has evolved after only two years from the 1,024-bit chip. The prediction is that by 1976, we will see a 16,384-bit component to be followed some years later by a 65,536-bit chip.

It is scarcely possible for the mind to grasp what this means in circuit complexity and packaging in terms of miniaturisation, but the fact remains that more and more is being packed onto these tiny chips. One person I spoke to recently, believed that the £200 computer was not quite so far fetched as many supposed and neither was the £2·50p electronic calculator. It is known that one UK source is poised to announce a £10 calculator.

Perhaps the most impressive, yet factually true, way to think of it is in real terms of transistors and ICs. Today, one can purchase a chip containing 10,000–12,000 transistors for the price which once had to be paid for a single transistor. Truly, the advances made in electronics have surpassed the boldest imagination. Think what is possible in the next decade!

Ginsberg

I.C. AMPLIFIER* for the PW POP STAR



F.G.RAYER

SUGGESTED ALTERNATIVE I.C. AMPLIFIER TO REPLACE THE SL403D

THE "PW Pop Star" i.c. radio featured in our September issue was very popular: in fact it created supply problems regarding the SL403D amplifier. Readers who do not have one of these i.c.s will be pleased to learn that they can still make the Mark 2 version of this radio and obtain almost the same result. The answer is to use the TBA800 integrated circuit for the amplifier section, but do not carry out a direct replacement procedure.

The TBA800 is not a direct substitute for the SL403D. Circuit requirements, tags and encapsulation are different. Reference to the revised component list will show that changes are made to the items in the audio section.

Revised Circuit

Fig. 1 is the revised amplifier circuit. The early section of the receiver, including R4, C6 and the volume control VR1, remains unchanged. The new and modified part of the receiver is that from R5 onwards.

As the receiver operates from a 9V battery, none of the electrolytic capacitors need have a higher voltage working rating than this. However, capacitors of higher voltage rating are in some cases more easily obtained, and are of course suitable.

Resistors R7 and R8 in parallel, each of 2·2Ω, may be replaced by a single 1Ω resistor. Two 2·2Ω resistors are shown because these are readily available, while a number of stockists do not appear to carry the 1Ω value.

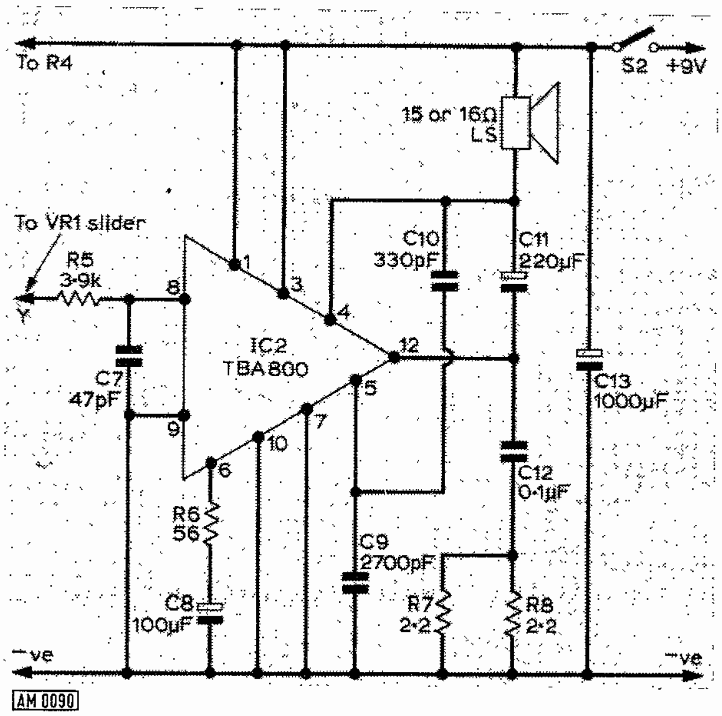


Fig. 1: Revised circuit of the "Pop Star" amplifier.

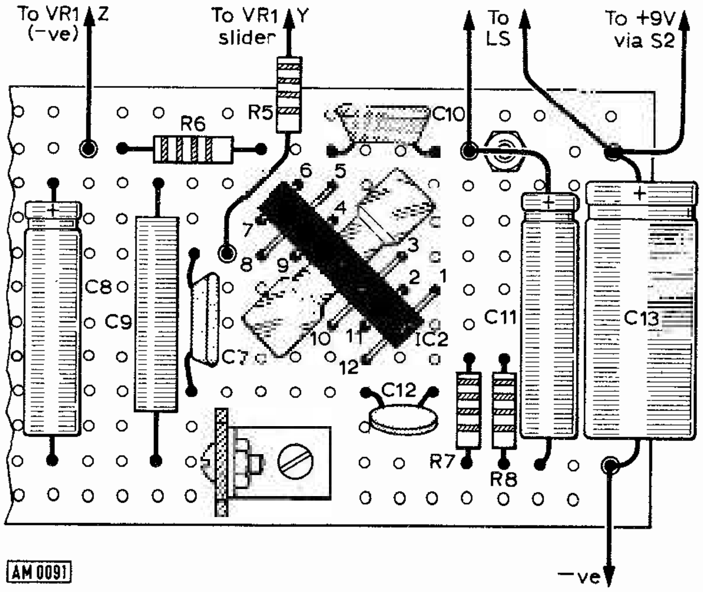


Fig. 2: Components viewed from the top side of the Veroboard. Note the indent on the i.c., adjacent to pins 1 and 12.

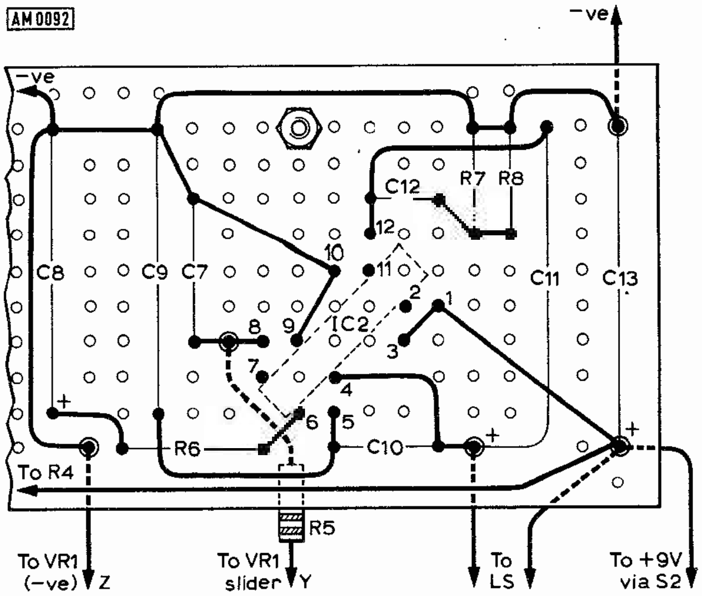


Fig. 3: Underside view of the Veroboard showing the additional wiring.

★ components list

Revised components shown in italics

Resistors

R1	100kΩ
R2	1kΩ
R3	470Ω
R4	2·7kΩ
R5	3·9kΩ
R6	56Ω
R7	2·2Ω
R8	2·2Ω

All resistors ¼W 5%

(*R7* and *R8* may be replaced by a single 1Ω resistor)

VR1 100kΩ log pot with switch

Capacitors

C1	12pF
C2	470pF
C3	0·01μF
C4	0·1μF
C5	0·047μF
C6	6·4μF 6·4V
C7	47pF
C8	100μF 6·4V
C9	2700pF
C10	330pF
C11	220μF 10V
C12	0·1μF
C13	1000μF 10V

Miscellaneous

VC1 Jackson 00, 208/176pF
TC1 400–1250pF compression type VC29SA
L1 Denco FR5, medium wave ferrite rod
Transparent medium wave 2½in dial
IC1 ZN414
IC2 TBA800
15 or 16Ω 3½in square speaker
Veroboard, Veropins
1-pole 2-way rotary switch
Two knobs
Case:
6mm. plywood: Top 8 x 4⅜in
Bottom 8 x 4⅜in
2 off 4⅜ x 4⅜in
Back 8 x 3⅞in
Hardboard 8 x 4in, ⅛in thick
Panel: Universal chassis flanged member 8 x 4in

The TBA800

Some pins are unused. The i.c. is positioned as in Fig. 2, and will fit the 0·15 matrix Veroboard. Pin 1 is indicated by the figure 1 near it, and an indentation also marks this end of the i.c. The integral heat sink tabs are bent up so far as is necessary to clear the pins and board.

Fig. 2 indicates the positions of all the components on the board, including the original IC1 stage, which is unchanged.

Underneath wiring is shown in Fig. 3. The components are easily accommodated on the original board. Wires are soldered directly to the projecting pins of IC2, underneath.

Volume control connections are unchanged, but R5 is soldered to the central tag Y, a lead from here running to C7 and tag 8 of IC2 when the board is fixed in position.

Battery drain is about 8mA, rising to some 20-30mA or so, with average good volume. The heat sink tabs alone are suitable for operation with up to 1W, and as the amplifier is operated from a 9V supply only, and at lower volume levels than this, no additional heat sink is fitted.

Tuning adjustments, and other details of construction, remain as originally described. ■

GOING QUADRAPHONIC

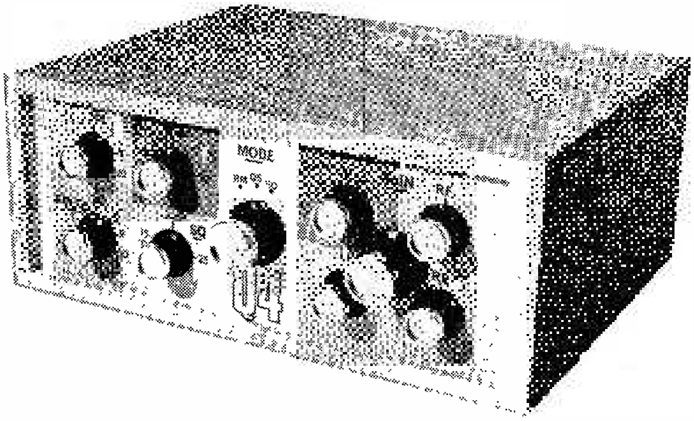
PW Q4 PROJECT

PART 4 D. BOLLEN

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

Power supply components are grouped on a piece of 0·1in. Veroboard 1·9in. wide by 2·1in. long. Note that the end of the diodes marked positive in Fig. 25 corresponds to the cathode, and to a black or coloured band on the component itself. Tr9 is fitted with a push-fit heat sink before being soldered into position.

The power supply can be tested by temporarily connecting it to T1, but take care not to short the output as this will almost certainly destroy Tr9.



Decoder wiring

Position and mount all circuit boards on the chassis tray, and fit SK1-SK10, T1, and a power supply screen made of scrap aluminium sheet or tinplate. Wiring can commence with the earth connections shown in

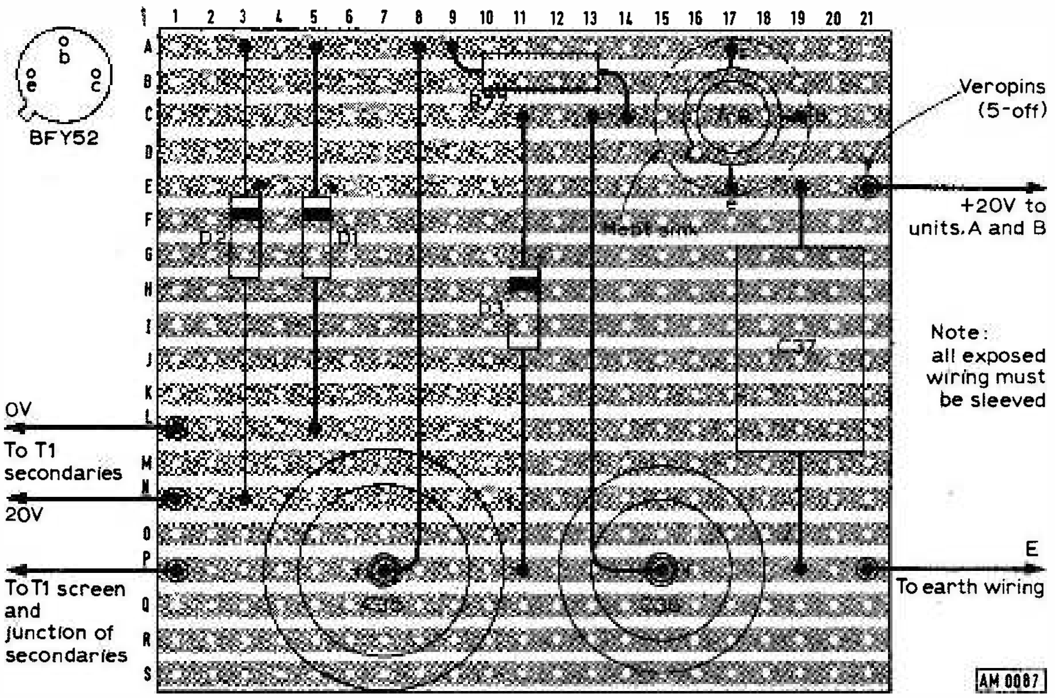


Fig. 25: Power supply circuit board.

Fig. 19. The layout of the earth wiring is arranged to avoid hum loops and should be adhered to.

Transformer T1 output terminals consist of two pairs of tags marked 0 and 20V. The two inner tags are linked together and connected to the tag marked SCN, which is in turn wired to the appropriate terminal on the power supply board. The outer 0 and 20V tags on T1 are then wired to the power supply board as in Fig. 19.

Low number SK11 tags are positioned under S1 and it is therefore advisable to wire these up first while they are still readily accessible. The following wiring procedure can be adopted. Connect S1 to the circuit boards and SK11, starting with the middle wafer S1E and S1F (Figs. 26, 27) and then S1G and S1H. Next link up SK11 tags 6 and 7 to unit B and SK11 tags 8 to 11 to VR1 and VR2 sliders, then wire the front switch wafer starting with S1I.

Connect the outputs of unit A to VR5-VR8 and VR9 and then wire up the rear switch wafer S1A-S1D. Take a red wire from the power supply output terminal to the +20V terminal pins on unit A and unit B, not forgetting to link together the supply rails of the two unit B channels, and then complete the wiring with a mains lead to T1.

Cabinet

Details of a cabinet for the decoder are given in Fig. 28. The front panel sits in a groove and is a permanent fixture in the front of the cabinet. The decoder chassis will slide in from the back of the cabinet and is retained in position by a couple of self-tapping screws. Self-adhesive vinyl or wood veneer will give a smart appearance to the finished cabinet.

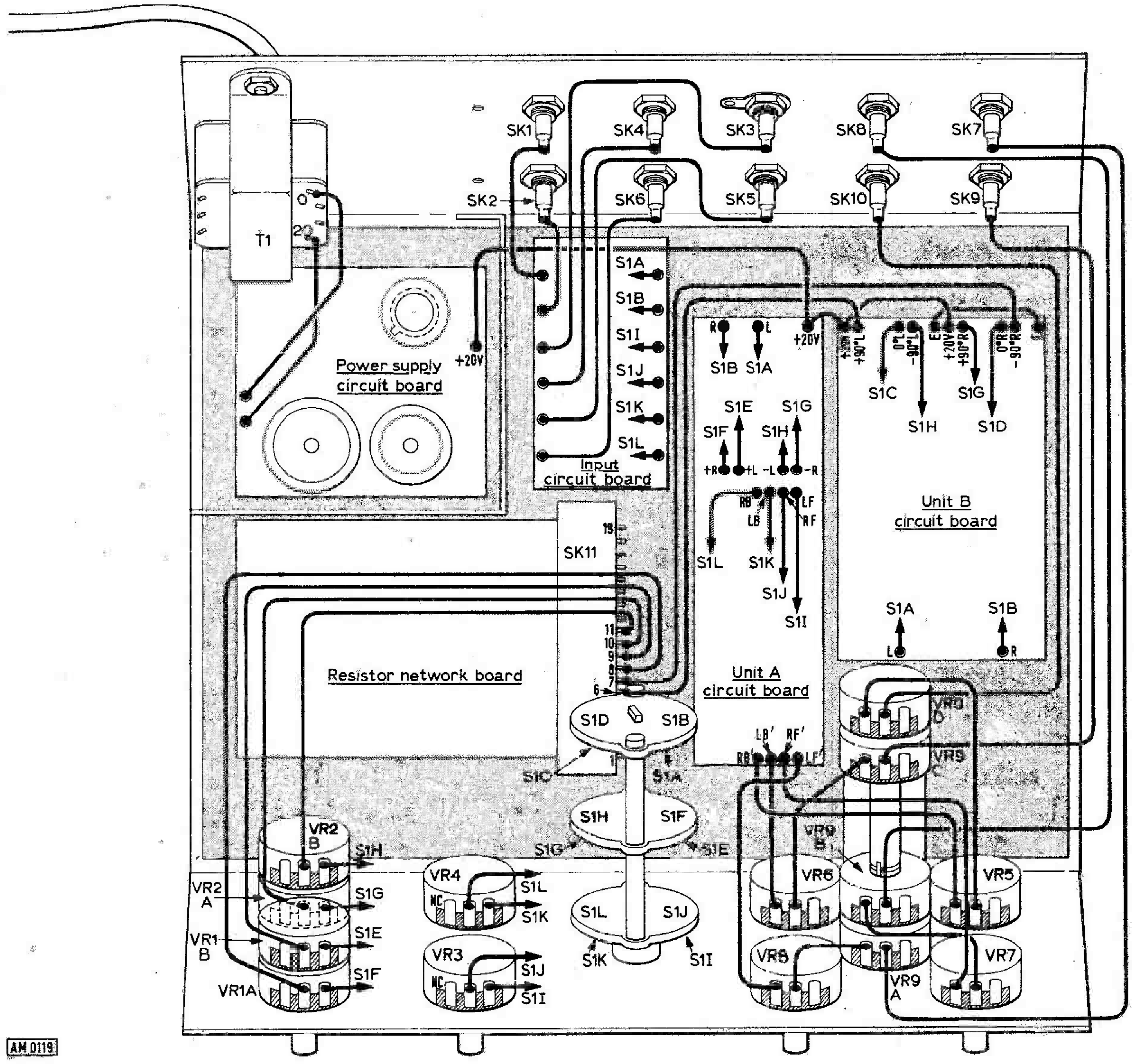


Fig. 26: Multi-system decoder wiring

Testing the decoder

Ideally, the decoder should be tested with an audio generator and a high impedance a.c. voltmeter or calibrated oscilloscope, but failing these certain tests can be carried out with music signals or a stereo test record.

If instruments are available, proceed as follows. Set VR9 to full gain and VR5-VR8 mid-way. Connect the a.c. voltmeter or oscilloscope to SK7 and inject a 1V 1kHz signal into SK3. Trim VR8 for a reading of 1V. Repeat for LB, RF, and RB inputs and outputs while trimming controls VR6, VR7, and VR5 respectively.

Set VR1 and VR2 to the mid position, and S1 to the RM mode. Inject a 1kHz 1V signal into the left input SK1, and, without altering the settings of VR5-VR9, look for a voltage of 0·92V at the LF and LB outputs SK7 and SK9. There may be minor voltage discrepancies of a few percent, due to circuit tolerances, but a large discrepancy will indicate a circuit fault.

Without altering the input signal (SK1), transfer the a.c. voltmeter or scope to the RF output SK8 and adjust VR1 for a reading of 0·38V. Repeat for the RB output and VR2. Still with the same input to SK1, switch S1 to the QS mode and check for the following output voltages; LF=0·92V, RF=0·38V, LB=0·92V, and RB=0·38V. Transfer the 1kHz input signal to the right input SK2 and this should give LF=0·38V, RF=0·92V, LB=0·38V and RB=0·92V in the RM and QS modes.

To test the SQ section of the decoder, set VR3 and VR4 to maximum resistance (fully clockwise) and inject the 1V 1kHz signal into the left input SK1. The following outputs should be obtained; LF=1V, RF=0V, LB=0·71V, and RB=0·71V. When the input signal is transferred to SK2, the LF and RF readings will be transposed, with LB and RB outputs remaining the same.

Music signal testing

Set up the decoder with outputs connected to four amplifiers with speakers (*see Figs. 2 and 5 and instructions for speaker phasing in the October issue of PW*), and with a stereo music signal applied via a pre-amplifier to the decoder left and right inputs. The decoder mains lead can be temporarily connected to any convenient supply source at this stage.

Place S1 in the RM position, VR5 and VR6 to minimum gain, VR9 to maximum gain, and VR1 fully clockwise. Balance VR7 and VR8 for normal front speaker stereo, and then unplug the input to SK2. The sounds issuing from the LF speaker should move to centre front when VR1 is rotated fully anti-clockwise. Repeat with the input to SK1 disconnected and an input signal on SK2. The sound image should then move from RF to centre front when VR1 is rotated. Repeat the above tests in the QS mode.

Set VR7 and VR8 to minimum gain and balance VR5 and VR6 for a stereo output from the rear speakers only in the RM mode. Disconnect the input to SK2 and rotate VR2 anti-clockwise to shift the sound image from LB to centre back. Repeat with a right input only on SK2 for a sound image moving from RB to centre.

Using a similar test procedure, controls VR3 and VR4 should shift the sound image from left or right to centre when S1 is set to SQ.

Installing and balancing

When installing the decoder, its main lead can be wired to the main equipment on-off switch. Do not earth the decoder chassis as this could set up a hum loop. Earthing is normally achieved via the outer braiding of the screened interconnecting leads.

The importance of correct balancing cannot be stressed too highly, and it is worth taking trouble over this until experience is gained in quadraphonic listening. Set controls VR1, VR2, and VR5-VR8 mid-way, and S1 to RM. Adjust VR9 for the desired level of sound output with a stereo signal on SK1 and SK2, and then remove the plugs from SK9 and SK10.

Using a mono recording, or a stereo recording

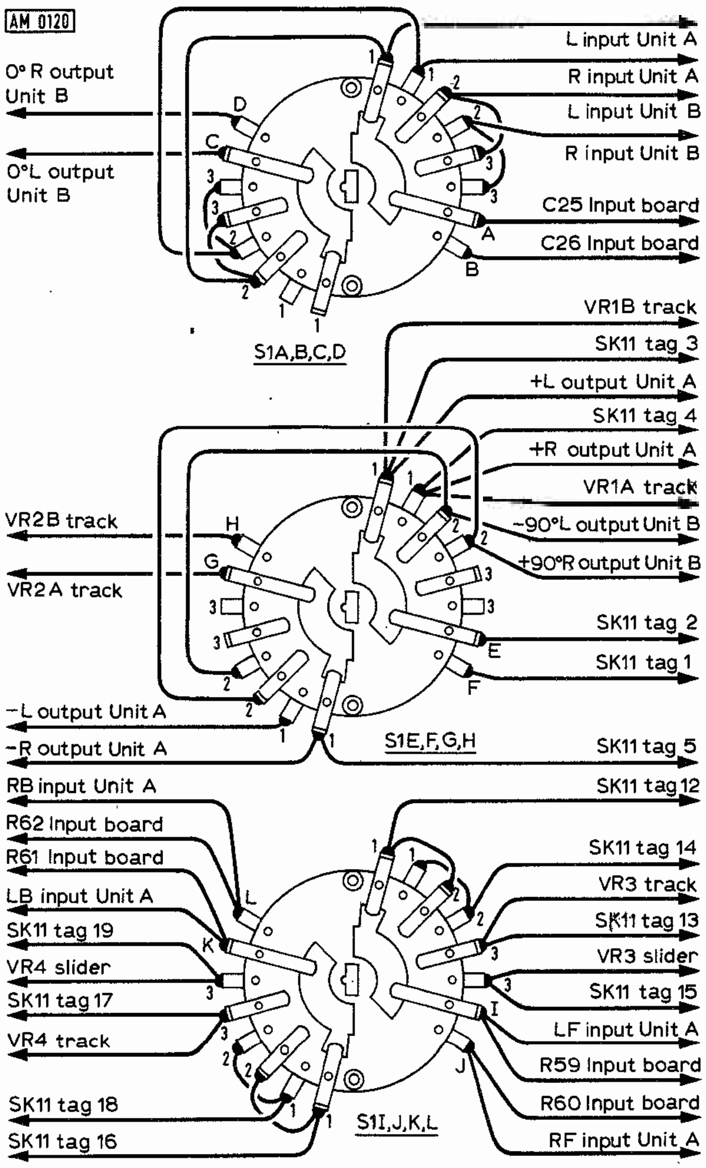


Fig. 27: Mode switch (S1) with wafers as seen from the front of chassis and in the RM position.

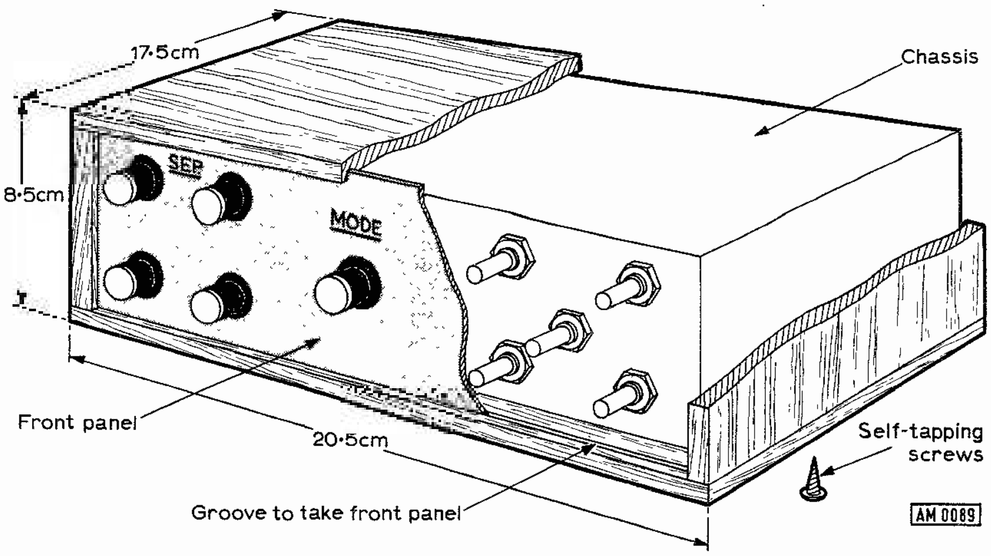


Fig. 28 : Q4 decoder cabinet details.

with a known centre front image, trim VR7 and R8 for correct location of the centre front image. If there is a balance control on the pre-amp. which feeds the decoder this should be in its normal position. Insert the SK9 LB plug and remove the SK8 RF plug and SK2 right input plug. Trim VR6 for a left sound image, mid-way between the LF and LB speakers, when the listener is seated equidistant from all four speakers and is facing centre front.

Insert SK8 RF plug and SK10 RB plugs, and remove SK7 LF and SK9 LB plugs. Adjust VR5 for a right hand sound image mid-way between RF and RB speakers with the listener positioned as before. Remove SK8 RF and insert SK9 LB plug, then check for a centre back image mid-way between the LB and RB speakers. Listening tests can now be conducted on a variety of stereo and quad recordings to establish mean balance settings. Thereafter, one or more of the balance controls can be trimmed to suit individual preferences and recordings.

Using the decoder

Where the listener wishes to be completely immersed in sound, as though sitting in the middle of a group of musicians, the following settings can be tried. With stereo discs, tapes, or radio, the mode switch is set to RM, VR1 is adjusted for a separation of 1-5dB, and VR2 for a separation of 1-3dB. Some stereo sources can sound slightly better in the QS mode, where blurring of back sound images is less pronounced than with RM.

For QS discs in the QS mode, front and back separation settings should be 3dB, but it is worth experimenting with these settings to obtain optimum results. Most SQ discs, in the SQ mode, will sound well with a front separation of 10-20dB and a back separation of 5-10dB, but again it is worth experimenting with these settings. It may be necessary to reduce back channel gain with SQ recordings for a well balanced effect.

A more realistic listening position, with the musicians at the front and mainly ambience from the back, can be achieved by reducing the settings of VR5 and VR6, and with stereo or QS sources, adjusting VR1 for high separation (20dB) and VR2 for low separation (1dB) in the RM and QS modes. With SQ discs in the SQ mode, VR3 can be set to 25dB and VR4 to 5dB.

Generally speaking, when the decoder separation controls are set to low values this will give an increase in front to back separation, and conversely. The effect of altering the separation settings from optimum is to alter the shape of the sound stage from a circle to an ellipse, with the major axis lying from left to right at high separations, and from front to back at low separations.

For conventional front speaker stereo, or mono, VR5 and VR6 are adjusted for minimum gain and the front separation controls set to maximum. With normal quad settings, a mono signal input will, however, give a centre front sound image without the need for adjustments. Centre of the room stereo or mono can be achieved by placing all separation controls at maximum with VR5 and VR6 at normal quad settings.

When applying four-channel signals to SK3-SK6, S1 should be placed in the RM or QS positions for maximum separation, and this will make VR1 and VR2 inoperative. Alternatively, where a measure of separation control is required with discrete signals, S1 can be set to SQ and VR3 and VR4 adjusted for front and back separation. SK3-SK6 can also be employed for mixing in other signals when the decoder is handling two-channel inputs.

In Fig. 8 (October issue) the 110kΩ resistors linking −R and RF and −R and RB should be connected to +R instead of −R. ■

Curing Radio Interference in Audio Equipment

BRIAN L. PHILLIPS

IN some localities, problems are experienced with interference caused to audio systems by nearby radio transmitters, which may be amateur, public service or military. Such interference can occur even though there is nothing wrong at the transmitting end.

What happens is that the locally powerful signal enters the audio system via one or more routes and causes interference or distortion, or at worst "mutes" the output completely. Such effects may occur in tape recorders, record players and hi-fi amplifiers, or in fact in any unit using transistors, integrated circuits or valves. In solid-state equipment, the interfering signal voltage injected into the amplifier can be greater than the standing DC bias on the transistors, or ICs, pushing them into non-linearity. The higher electrode voltages used in valved equipment mean that it suffers far less from this effect.

In tackling such a problem, the first step is to try to establish how the RF signal is entering the amplifier, which may be either by direct radiation or via the input, output or mains supply leads.

VALVED EQUIPMENT

Valved equipment doesn't often respond to direct pickup from radio transmitters unless the signal level is very high and, in general, a cure can be effected by the addition of resistive stoppers in each control grid lead, close to the valve holder. This forms an RF filter with the valve's input capacitance in parallel with the input.

Often, especially in unit audio equipment where long loudspeaker leads are used, the interfering signal is injected via these leads back into the amplifier and then around the negative feedback loop to an early amplifier stage. Usually low frequency RF, such as 3·5MHz amateur transmissions, finds its way in by such a method and a cure can often be effected by adding capacitors across each speaker socket at the amplifier. Values of the order 0·01 to 0·1μF are suitable and should not affect the audio response because of the low output impedances present.

Radio frequency pickup on the input leads (gramophone pickups, microphone lines etc.) is usually responsible if altering the volume control affects the level of interference, or if unplugging a lead stops the effect. Small value ceramic capacitors around 100 to 500pF placed across the input concerned may stop the trouble. Ferrite beads fitted at the input grid of the first stage may also help. Sometimes a good RF earth attached to the screening of the offending lead will prevent the signal reaching the amplifier.

TRANSISTORISED EQUIPMENT

Transistor amplifiers will respond far more readily to the effects mentioned earlier and the problem can be difficult to cure in some instances. Pickup via the speaker leads needs the same treatment as for valve amplifiers, but usually ferrite beads and capacitors at amplifier inputs are less effective due to the low input impedances present in transistor circuitry. Some success has been achieved by placing small capacitors between base and collector on each stage (about 50 to 500pF) to produce negative feedback at the unwanted frequencies thus preventing the transistor from either detecting or amplifying the interfering signal. The effect on audio response will vary and depends finally on the exact circuitry and values used. The usual effect is a slight loss of treble response, but this can probably be corrected by increasing the treble lift in the amplifier. At all events, the owner will probably accept slight loss of treble rather than have a local transmitter belting through his equipment!

In severe cases of interference, where all else seems to fail, inserting a low value resistor in the existing emitter lead close to the transistor can work wonders. Being unbypassed, negative feedback is produced lowering the stage gain slightly, possibly enough to prevent the RF producing rectification effects. Values around 47 to 100Ω have been used successfully. The slight loss of audio gain can always be overcome by increasing the volume control setting. A similar resistor in the transistor's base lead can also be effective, forming a low-pass filter with the input capacitance of the transistor.

Incidentally, an amplifier employing field effect transistors will not respond as much to RF fields because the characteristics of such devices are similar to those of the thermionic valve. In cases where such an amplifier is picking up RF signals, the techniques recommended for valved equipment should be applied.

INTEGRATED CIRCUITS

Audio equipment utilising ICs can be very unpredictable in its response to RF pickup. It has been found that one IC may be entirely unaffected whereas another of the same type may completely defy efforts to cure interference. In some IC stereo units, it is possible for one channel to be riddled with RF interference whilst the other channel is perfectly clear. Audio response and performance may be normally balanced despite the difference in RF response. Possibly manufacturer's characteristic spreads allow widely differing RF responses between ICs; it is not unusual for some audio ICs to give a hefty output up to 1 or 2 MHz!

Electrolytic decoupling capacitors can make the situation worse because of their increasing impedance with frequency. Very often the circuit operation at RF is so different from the normal operation at audio frequencies, even though the same physical

—continued on page 886

SHORT WAVE DX

by MALCOLM CONNAH

THE FEW paragraphs which I wrote a few months ago on the subject of ex-government receivers seems to have aroused a great deal of interest from readers.

About ninety per cent of your letters asked the same basic question: where can these receivers be obtained?

The main source of these receivers is, the second-hand market. The best place to look for them is at the various Amateur Radio Rallies which take place during the summer months. Also the For Sale columns of Amateur Radio magazines should be studied.

Construction Season

These dark, winter months are always the best time for turning one's thoughts, and *hands,* to the subject of constructional projects. Apart from the building of a new receiver, a lot of pleasure can be derived from building some of the simpler circuits which contribute to the efficient operation of a receiving station.

The construction of a preselector, or a Q-multiplier or the addition of crystal filter will greatly improve the performance of most average receivers. A crystal calibrator or other means of frequency determination will prove invaluable in identifing some of those rare DX catches.

Readers' Logs

John Spinks of Norwich has recently invested in a Trio 9R-59DS receiver, with this connected to 75 feet of aerial wire John heard:

6605 *R. Pyongyang, N. Korea* at 2055.
9009 *Jerusalem, Israel,* news at 2000.
9023 *R. Tehran, Iran,* news at 2000.
9570 *R. Australia* noted at 2100.
9605 *AIR, Delhi* noted at 1810.
9750 *R. Vilnius* with Mailbag at 2245.
11815 *NHK, Tokyo,* Japan noted at 2050.
11845 *R. Canada Int.,* SW Club at 2115.
15012 *Voice of Vietnam,* Hanoi, news at 1000.
15150 *R. Grenada, Windward Is.,* music at 2125.
15185 *WINB, Red Lion, USA* noted at 2100.
15415 *R. Kuwait* with news at 1730.
17755 *HCJB, Quito,* Ecuador, DX pgr. at 1930.
17890 *U.N. Radio, New York,* news at 1805.
21550 *RSA, South Africa,* news in French at 1200.

Steve Fletcher of Bromsgrove describes his equipment as follows: "Receiver is a very unaligned Heathkit SW717 and the antenna is 150 feet of copper wire, wound around the loft." However, this did not prevent Steve from hearing:

6035 *TWR, Monte Carlo* noted at 1415.
7250 *Vatican Radio* at 2054.
9520 *ORTF, France* noted at 1419.
9525 *All India Radio,* Delhi at 2005.
9590 *Swiss Broadcasting Company* at 1323.
9630 *Radio Sweden* noted at 1100.
9833 *Radio Budapest,* Hungary at 1730.
11765 *Radio Australia* at 0645.
11775 *R. Nacional de Espana* at 1030.
11940 *R. Bucharest,* Rumania noted at 0658.
15165 *Radio Denmark* at 1200.
15185 *Radio Finland* at 1820.
15245 *Radio Sofia,* Bulgaria at 2330.
17800 *Radio Norway* noted at 1810.
17825 *NHK, Tokyo, Japan* at 0805.
21945 *Radio Portugal* noted at 0730.
25790 *RSA, South Africa* noted at 1415.

Christopher Hodgson of Sunderland is still using the same equipment; Codar Multiband 6, PW A.T.U. and 50 foot end-fed; and although his return to school has curtailed listening hours the following stations found their way into his log:

6180 *BBC, Cyprus relay,* s/on at 1700.
7210 *Red Cross Broadcasting Service Geneva,* s/on at 1700.
7245 *Austrian Radio* in German at 0900.
9006 *R. Tehran, Iran,* s/on at 2000.
9620 *Radio Belgrade* noted at 1540.
9745 *Radio Baghdad,* Iraq at 1945.
9830 *Radio Kiev* noted at 1940.
11765 *Radio Australia* at 0955.
11880 *Voice of Turkey,* Ankara at 2215.
11900 *RSA, South Africa* at 2215.

Michael Johnson of Hockley in Essex used his Ferguson 6 valve domestic receiver and 25 metre long-wire to hear:

6070 *Radio Sofia* in English at 1930.
7215 *All India Radio,* Delhi at 1830.
9620 *Radio Belgrade* in English at 1430.
9665 *R. Damascus,* Syria in English at 2030.
11770 *R. Vilnius* in English at 2230.
11925 *R. Tashkent* in English at 1400.
15295 *ORTF, France* in English at 1100.

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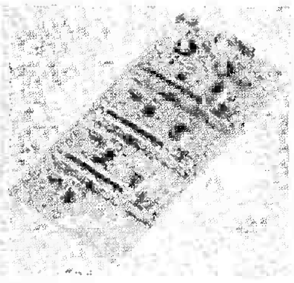

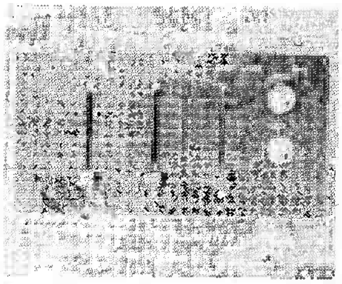

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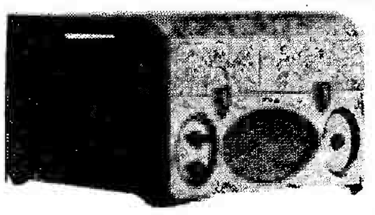

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ON THE AIR

MEDIUM WAVE BROADCASTS

by CHARLES MOLLOY

Mark Webster (Ipswich) reports good daytime reception of Radio Nottingham on 1520kHz and Radio Norway 1578kHz which broadcasts in English on Sunday afternoons from 1400hrs to 1430hrs GMT. During the evening Mark has logged RNE (Radio Nacional Espana, Spain) stations at Murcia 854kHz; Barcelona 737kHz; San Sebastian 773kHz; Madrid 584kHz; La Corunna 638kHz; Seville 683kHz together with BBC Local Radio stations at London 1457kHz; Sheffield 1034kHz; Medway 1034kHz.

Ross Galbraith (Lifford, Co Donegal) is using a domestic Mullard receiver and a Pye table model along with a 150ft longwire aerial. He reports BBC Radio Leeds at 1600hrs on 1106kHz; Radio Blackburn at 1230hrs on 854kHz; Radio Merseyside at 1500hrs on 1484kHz; Radio Carlisle at 1530hrs (testing on 755kHz); Radio Teesside at 1430hrs on 1546kHz; Radio Bristol at 1500hrs on 1546kHz; AFN Berlin at 2200hrs on 935kHz; Manx Radio at 1500hrs on 1594kHz and Radio Sweden at 2300hrs in English at 2300hrs on 1178kHz. Ross has been DXing for three years and has acquired 25 medium wave QSLs.

C.MacVicar (Felixstowe) has used his Sanyo 10 transistor portable with internal aerial to log BBC Radio London at 0835hrs on 1457kHz; Radio Medway at 1630hrs on 1034kHz; Radio Tirana, Albania at 2220hrs on 1394kHz; AFN low power relays at 2300hrs on 1502kHz and at 2000hrs on 611kHz; AFN Frankfurt 2130hrs on 872kHz; Trans World Radio, Monte Carlo 2156hrs on 1466kHz; Madrid (EAJ2) at midnight on 917kHz; RNE Seville 0445hrs on 638kHz; RNE Barcelona 0500hrs on 737kHz.

Chris Webster (Ringwood, Hants) does his MW DXing with a Hallicrafter Super Pro, a PCR receiver, a 260ft longwire and a medium wave loop antenna located in the loft and controlled by string rotation and motorised tuning. He reports hearing Radio Nottingham on 1520kHz at the same strength as Radio Stoke 1502kHz; New York City (WINS) at 0515hrs on 1010kHz as strong as Lopik (Holland) on 1007kHz; a weak unidentified Middle East station on 1010kHz at 0100hrs (both India and Pakistan use this frequency). Chris has built the Audio Frequency Processor (Practical Wireless July 1972) which gives very good results with the PCR receiver.

The BBC Radio 4 medium wave service in North East England is now being radiated on 908kHz (330m) from Scarborough and Stagshaw (near Hexham) while a new transmitter serving Teesside will be brought into service on 1052kHz (285m). The BBC states that a number of changes were made in September 1972 to prepare for the introduction of local commercial radio; to permit the BBC Local Radio stations to transmit on the medium waves; and to release an additional frequency for use by the BBC's External Services. It was a part of the plan drawn up at that time that the BBC should change the frequency used in the North East. The BBC go on to say that 980kHz is also used by three other transmitters in the South of England and to avoid mutual interference it is necessary that all five transmit the same programme. Local news and weather will in future be transmitted on Radio 4 v.h.f. but items of local interest, including new and weather forecasts are broadcast by BBC Radio Newcastle on 1457kHz (206m) and BBC Radio Teesside on 1546kHz (194m).

VHF/FM DXING

by SIMON DAVID

THE f.m. DXing season is not over yet, although probably the more difficult catches will hibernate until the spring. During the coming months I shall be looking into my aerial system (thanks to Gordon King's recent articles). I rather fancy one of those twin array 6-element jobs hoisted atop a rotating mast. Rotators vary in price somewhat starting at around £23 basic and for driving one array only these lower priced units are quite good. If you are a multiple DX enthusiast with amateur bands aerials as well you will probably need a more robust rotator costing more than about £30. I still think that the prices are high for the job they do and would be reluctant to recommend one to anyone unless the anticipated field of coverage is likely to justify their use.

From readers' reports some very good results can be had with a three or four element aerial, so again before getting carried away with those impressive whoppers, make sure that the extra outlay is likely to be worthwhile.

There is very little further development on the tuner front judging by what I saw at the Audio Fair, but then these exhibitions are more concerned with just local reception of BBC or IBA programmes. Talking of the latter reminds me that I read a very critical report in my local newspaper on the programme content of the new London IBA stations. Has any reader some comments on the technical side? I am trying at home to get a decent signal strength from them and they are sandwiched between the police and the BBC local radio stations. I was amused to hear about the expected re-allocation of that particular police frequency.

Last month I gave some details on BBC local radio stations and frequencies. From time to time I shall try to include more on European stations for a start here is the French listing.

V.H.F./F.M. TRANSMITTERS IN FRANCE

	MHz	MHz	MHz	kW
Carcassonne	88·2	90·9(S)	96·6	125
Le Mans	89·1	92·7	96·9(S)	100
Lille	88·8(S)	94·8	98·1	150
Limoges	89·4	93·0	97·5(S)	150
Nantes	90·6	94·2	99·0(S)	200
Niort	91·2	96·3	99·3	200
Reims	89·1(S)	96·9	98·7	150
Rennes	90·0(S)	93·6	98·4	100
Rouen	92·1(S)	93·9	96·6	100

These frequencies are subject to deviation by up to 150kHz. Frequencies used for stereo transmission are shown with (S).

ON THE AIR

SHORT WAVES

by DAVID GIBSON, G3JDG

THE festive season is with us once again, which is more than can be said for DX if the past month is any indication. Listening at the right times seems to be half the battle; like scanning topband at 0100 hours to hear the dulcet c.w. tweets of PY1RO and WB8APH.

Before you start stoking up with goodly portions of Christmas pud, how about some serious thought to Amateur Radio? Your receiver deserves a pressy; a good antenna? No room? How about the loft, a veritable haven for an invisible aerial/antenna?

All you need is some cheap single lighting flex and a packet of insulated staples (uninsulated ones will do if you're in a Scrooge-like mind). The wire can be simply stapled to the woodwork around the supporting beams in the roof, and the lead smuggled down to the receiver unobtrusively. Don't lay the wire on the floor, it could be a bit too close to mains wiring. Most average lofts can easily accommodate 100ft. of wire (twice round ending in a neat granny knot) and if you feed it into an a.t.u. before your faithful receiver "sees" it, you'll have an all-band aerial for only a few pence. Have a go; it'll keep you out of the kitchen and from under the XYL's feet.

What sort of a.t.u. Wind a coil with tinned copper wire spaced one turn between individual turns. All you need then is a tuning capacitor. You can wire the coil and capacitor up either in series or parallel and you can short out however many turns you like on the coil. Once you've found the optimum set up for each band, you can work out something a bit more permanent.

Another thought; how about a useful pressy for you? An Amateur Radio map of the world showing countries with their callsigns costs only a few pence —well, about 50p for a small one. You could also treat yourself to an up-to-date countries list, too. This is a must because of the amazing rapidity with which callsigns seem to change over night.

You should also join your nearest Amateur Radio Club. There, you can ask all sorts of questions and be virtually certain that someone in the club will have the answers. It's like having access to a complete Amateur Radio brains trust; free!

Lastly, before I rush off to order the canary (Ok, so *I'm* the one in a Scrooge-like mood), don't forget the numerous Christmas morning nets. Topband is a favourite with two metres running a close second.

Readers' Logs

Well bless my base-loaded bodkin, first log out of the postbag covers four bands. **Stephen Fletcher** (Bromsgrove, Birmingham) borrowed a KW2000 from the Bromsgrove and District Amateur Radio Club and poked the end of a 150ft. wire in the aerial socket. Results of this are as follows. On 3·5MHz; ZL3GS, ZL4BA, ZL4BX. Up to 7MHz (brave lad); PA25WTA, SM7CRW, 4U1ITU. Twenty parted with; CR7IC, CT1DW, EL2BA, ET3DS, IS0RUA, JA1AAT, KP4DHD, PY2DVX, PY6FH, PY7VJS, SV1DXO, VE1BAB, VE2BPE, VE3BHR?, VK2AM, VK2ATB, VK2BNG, VK3AD, VK3ANQ, VK3RV, VK3SX, VK3TE, VK7IL, VO1CV, VO1KF, VP2AZA, VP9GE, VU2MA, YV5CVE, ZC4SB, ZD7SD, 3V8DM, WA3SBW/6Y5, 9G1GG, 9H1CD, 9M2TR. Stephen mentions that the Club meets on every second Friday of the month.

Goodie bagger **John Turner** has heard some juicy morsels of DX on 7MHz. He runs a Pye Cambridge receiver model 1101 and has an 85ft. end fed antenna. The unit now has a b.f.o. fitted (*Practical Wireless* design using varicaps from the Take Twenty series). Best of forty included; CR7IC, EL2DL, FL8OM, JA2BAY, TR8DG, VU2AIK. A peep at 21MHz revealed signals from; A2CCY, A4XFF, A4XFJ, CE3IF, CN8HD, CN8PO, EL2DG, EL9C, EP2SP, EP2TW, ET3DS, FP8DH, HC1ME, HI8LI, HK4CJB, KA6BQ, KG4DS, KP4BCL, KP4ZM, KV4FC, KZ5JM, KZ5OH, MP4BJR, OA4AQ, A OD5CS, TI3BVF, UA0AR, UI8NE, VK5EL, VO1BT, VP1KR, VP2SV, VP8KF, VP9AD, VU2DK, VU2GVG, XT2AJ, YS3FH, ZD7FT, ZS1ZE, 3B6CF, 3D6AW, 3V8DM, 5H3AP, 5N2ESH, 5X5NK, 7X0WW, 9G1HG, 9H1AF, 9H1AQ, 9H4L, 9H5D, 9J2EP, 9J2WR, 9M2DQ, 9X5VA, 9Y4BO.

Michael Best (Cwmbran, S. Wales) uses an R209 Mk. II and describes his antenna thus, ". . . is coax thro' the window and over the roof in a West/East direction terminating in an 8ft. Vee". (Doesn't get many signals but it sure confuses the birds). The best of Best on 14MHz is; A4XFD, EA1MU, EP2WOU, VE1ADU, VE3EWJ, ZL4LL, ZM1AJZ, 9H1NJD. On 7MHz, squeaks were heard from; KZ5PW, OD6MV, VE4SI, VK3ZL, VK7AZ, ZL1BKX, ZL4BQ.

R. Donaldson (Trimdon Colliery) is a mine of information on happenings around 3·5MHz. The gear is a CR70A Mk. II, 19 set and "several aerials". The 3·5MHz log reads; MP4MA, WA2UNS, WA4ISZ, VE6MC, ZL4KE, 5B4LR, 7X0WW, 7X2MD. A perusal of 14MHz brought forth; HB9TZ, JA9JNF, JA9SP, K6OFN/MM, PY1BOU, VE3VOA, VE6UM, VE8YK, VK7NE, VO1FX, VQ9DAS, YV5CKR, ZD8RR, 4X4DK, 9Y4LK. Pickings from 21MHz are; MP4BJD, PJ1HV, ZK5AFZ, 4H4OK, 6W8WL, 9Q5WQ.

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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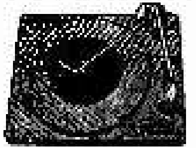


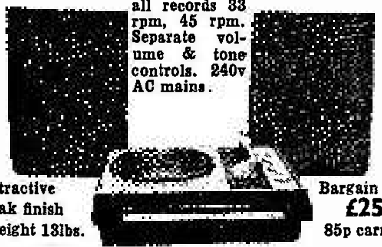
Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. AC 200/250v.
Size 13½ × 11¼in.
Above motor board 3¾in.
Below motor board 2½in.
With STEREO and MONO XTAL **£8·25** Post 25p.

PORTABLE PLAYER CABINET £4.50

Modern design. Black rexine covered.
Silver front grille. Chrome fittings. Post 25p.
Motor board cut for BSR deck.

COMPACT PORTABLE STEREO HI-FI

Two full size loudspeakers 13¾ × 10 × 3¾in. Player unit clips to loudspeakers making it extremely compact. Overall size only 13¾ × 10 × 8½in. 3 watts per channel. plays all records 33 rpm, 45 rpm. Separate volume & tone controls. 240v AC mains.



Attractive
Teak finish
Weight 13lbs.

Bargain Price
£25
85p carriage

SPECIAL OFFER

SMITH'S CLOCKWORK 15 AMP TIME SWITCH
Single pole two-way, Surface mounting with fixing screws. Will replace existing wall switch to give light for return home, garage, automatic anti-burgular lights, etc. Variable knob. Turn on or off at full or intermediate settings. Two types available 0 to 60 minutes Type A or 0 to 6 hours Type B. Makers last list price £4·50. Brand new and fully guaranteed. Fully insulated.
OUR PRICE £1·65 or £3 pair Post 25p
(PLEASE STATE TYPE A OR B WHEN ORDERING)

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:A2W Ferrite Aerial	85p	Driver Trans. LFDT4	65p
)sc. P50/1AC	40p	Printed Circuit, PCA1	65p
.F. P50/2CC 470 kc/s.	40p	J.B. Tuning Gang	65p
rd I.F. P50/3CC	40p	Weyrad Booklet	10p
pare Cores	3p	OPT1	65p

errite Rod 8 × ⅜in. 20p 6 × ⅜in. 20p 3 × ⅜in. 10p

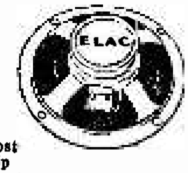
'OLUME CONTROLS

K. ohms to 2 Meg. LOG or
IN. L/S 15p. D.P. 25p.
TEREO L/S 55p. D.P. 75p.
dge 5K.S.P. Transistor 25p

80 Ohm Coax 4p. yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £1·40; 60 yd. £2.
FRINGE LOW LOSS Ideal 625 & colour **10p** yd.

3in & 10in ELAC HI-FI SPEAKER



)ual cone plasticised roll urround. Large ceramic nagnet. 50–16,000 c/s. ass resonance 55 c/s. ohm impedance.
in. 10 watt, 0in. 12 watt nusic power. **£3·75** Post 25p

E.M.I. 13½ × 8in. SPEAKER SALE!

Vith twin tweeters nd crossover. 10 watt. tate 3 or 8 or 15 ohm. As illustrated) **£4·50** Post 25p

Vith flared tweeter cone and ceramic nagnet. 10 watt. ass res. 45–60 c/s. lux 10,000 gauss. tate 3 or 8 or 15 ohm. Post 25p **£2·75**

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LANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides × 4in. 45p; 8 × 6in. 53p; 10 × 7in. 65p; 12 × 8in. 85p; 4 × 9in. 90p; 16 × 6in. 90p; 12 × 3in. 50p; 16 × 10in. £1. LUMINIUM BOXES 3 × 3 × 3in. 60p; 4 × 4 × 4in. 70; × 4 × 4in. 80p; 9 × 4 × 4in. £1; 12 × 4 × 4in. £1·30 LUMINIUM PANELS 18 s.w.g. 6 × 4in. 9p; 8 × 6in. 15p; 4 × 3in. 16p; 10 × 7in. 19p; 12 × 5in. 20p; 12 × 8in. 28p; 6 × 6in. 28p; 14 × 9in. 34p; 12 × 12in. 40p; 16 × 10in. 50p 'AXOLIN PANEL 10 × 8in. 15p.

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Suitable 7" × 4" speaker, £1.

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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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Details S.A.E. Size 3½ × 1½ × 1¾in.

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All post 25p each

Eagle MT12 12-0-12V 50mA 90p
250-0-250 80 mA. 6·3V 3·5A 6·3V 1A or 5V 2A ..... £2·50
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MINIATURE 200V 20mA, 6·3V 1A 2½ × 2½ × 2in. 75p
MIDGET 220V 45mA, 6·3V 2A 2¾ × 2½ × 2in 90p
HEATER TRANS. 6·3V 3A 60p

GENERAL PURPOSE LOW VOLTAGE. Trapped outputs at 2 amp, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30V £2·80
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1 amp, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £2·25
2 amp. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £3·80
5 amp. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £8·75
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AUTO TRANSFORMERS, 115V to 230V or 230V to 115V 150W £2·25; 500W £6·25; 750W £10; 1000W £15
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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	60p
32/500V	50p	8+8/450V	22p	350+50/325V	55p
25/25V	10p	8+16/450V	25p	100+50+50/350V	55p
50/50V	10p	16+16/450V	40p		

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500mF. 12V. 15p; 25V. 20p; 50V. 30p.
1000mF. 12V. 20p; 25V. 35p; 50V. 47p; 100V. 70p.
2000mF. 6V. 25p; 25V. 42p; 50V. 57p.
2500mF. 50V. 62p; 3000mF. 25V. 47p; 50V. 65p.
5000mF. 6V. 25p; 12V. 42p; 25V. 75p; 35V. 85p; 50V. 95p.

CERAMIC 1pF to 0·01mF, 4p. Silver Mica 2 to 5000pF, 4p. PAPER 350V–0·1 4p, 0·5 13p; 1mF 15p; 2mF 150V 15p. 500V-0·001 to 0·05 4p; 0·1 5p; 0·25 8p; 0·47 25p. SILVER MICA. Close tolerance 1% 2·2-500pF 8p; 560-2,200 pF 10p; 2,700-5,600pF 20p; 6,800pF-0·01, mfd 30p; each. TWIN GANG. "0-0" 208pF+176pF, 65p; 500pF standard 75p; 365+365 with 25+25pF Slow motion drive 50p. SHORT WAVE, SINGLE. 10pF 30p; 25pF 55p; 50pF 55p. NEON PANEL INDICATORS. 250V AC/DC Amber 20p. RESISTORS. ¼W, ½W, 1W, 20% 1p; 2W, 5p. 10 Ω to 10M. HIGH STABILITY. ½ w. 2% 10 ohms to 6 meg., 10p. Ditto 5% Preferred values 10 ohms to 10 meg., 4p. WIRE-WOUND RESISTORS. 5 watt, 10 watt, 15 watt 10 ohms to 100K 10p each; 0·5 ohm to 8·2 ohms 10p. TAPE OSCILLATOR COIL. Valve Type 35p.

NEW MODEL "BAKER LOUDSPEAKER" 12in. 50 watt GROUP 50/12 8 or 15 ohm high power full range. Quality—Professional. **£17·60**

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

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£12·50**
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Please state 3 or 8 or 15 ohms.

BAKER "BIG-SOUND" SPEAKERS Post free

'Group 25'		'Group 35'		'Group 50'	
12 inch 25 watt	£8·80	12 inch 35 watt	£9·90	15 inch 50 watt	£22
3 or 8 or 15 ohm		3 or 8 or 15 ohm		8 or 15 ohm	

TEAK VENEERED HI-FI SPEAKER CABINETS
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LOUDSPEAKER CABINET WADDING 18in. wide, 15p ft

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8 ohm, 10 watt. Large ceramic magnet. Special Cambric cone surround. Frequency response 30-12,000 c/s. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. **£4**
Suitable cabinet 12 × 8 × 6 £4·00.
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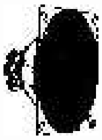
ELAC CONE TWEETER



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

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MAJOR 100 WATT ALL PURPOSE GROUP AMPLIFIER

All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 4 way mixing. Output 8/15 ohm. a.c. Mains. Separate treble and bass controls. **£49** Carr. £1·00
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BARGAIN AM TUNER. Medium Wave. Transistor Superhet. Ferrite aerial. 9 volt. **£4·95**

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COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p OUTLET BOXES, SURFACE OR FLUSH, 25p. BALANCED TWIN FEEDER 300 ohms 5p yard. JACK SOCKET Std. open-circuit 14p, closed-circuit 23p. Chrome Lead Socket 45p. Phono Plugs 5p. Phono Socket 5p. JACK PLUGS Std. Chrome 20p; 3·5mm Chrome 12p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 25p. DIN PLUGS 3-pin 18p; 5-pin 25p. VALVE HOLDERS. 5p; CERAMIC 8p; CANS 5p.

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1,400 r.p.m. Reversible 42 Watt. Post 25p spindle 1¼" × 7/32", size 3½" × 3". As illustrated. With Cooling Fan 240V A.C.

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Radar test unit with 3" CRT VCR138 green screen, med persistence okay for scope unit, meter 50 Ua 4" dia scale 0 to 5 linear, 19 misc valves inc min and octal. Klystron unit tunable S band, complete in case size 17 x 11 x 16" as internal P.U. not 50c/s, supplied with circ, except for power trans all P.U. components can be used at 50c/s. Available new cond with leads and Cal chart **£12·45** or good cond less leads and cal chart **£10·45.**

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Test osc covering range 20 to 88 Mc/s in 3 bands also as noise generator, 2 Mc/s xtal check, pulse mod, requires supplies of 250v DC at 60 Ma and 6·3v. Supplied with Cal chart and Ae, in case used good cond **£5·50.**

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ass with 12x 25/125pf trimmers 12x ·1% res **60p**

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TAKE 20

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No. 56
TRAFFICATOR AUDIO REPEATER

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IN Take 20 we try to bring you good "value-for-money" experimental projects. These days one can hardly get better value than the electronic capabilities of some of the integrated circuits that are available on the market. Because of this we have decided to incorporate IC's into some of our projects from time to time. This month we are using a very common IC, the SN7400, in an unusual role.

Circuit

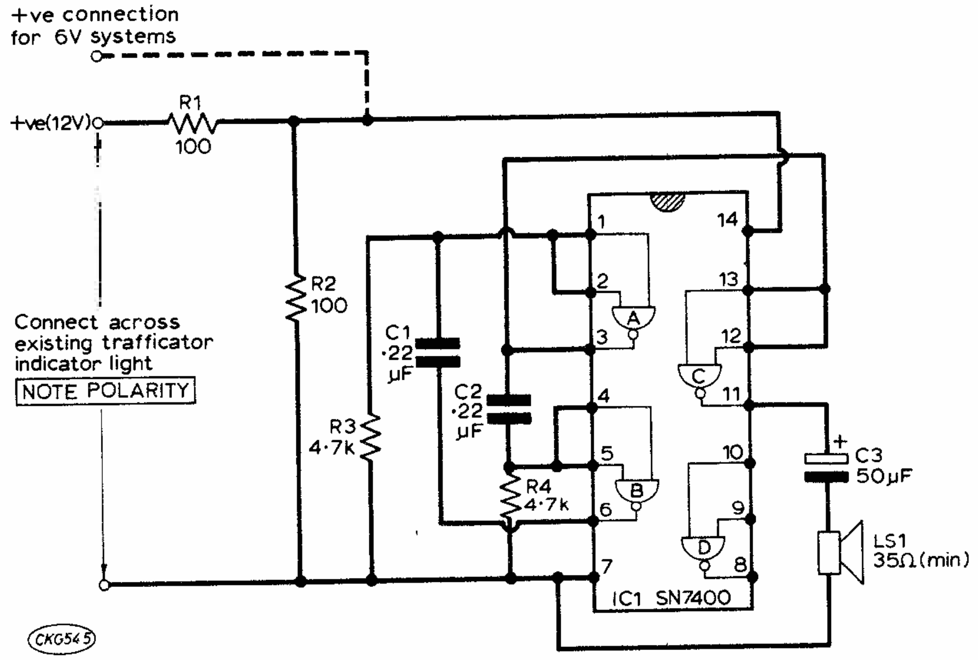
Two of the four "gates", A and B, are cross coupled by C1 and C2 to form a very simple astable multivibrator, the output of which is directly coupled to the third gate C that acts as a low power driver stage for a miniature loudspeaker. The fourth gate D is not used. No doubt we are breaking all sorts of rules in doing this but the fact remains that a 35Ω speaker can be driven reliably without over-running the output of the third gate. We recommend that you do not push your luck too far by reducing the loudspeaker impedance to less than 35Ω but you can use any speaker or earpiece having a higher impedance.

Application

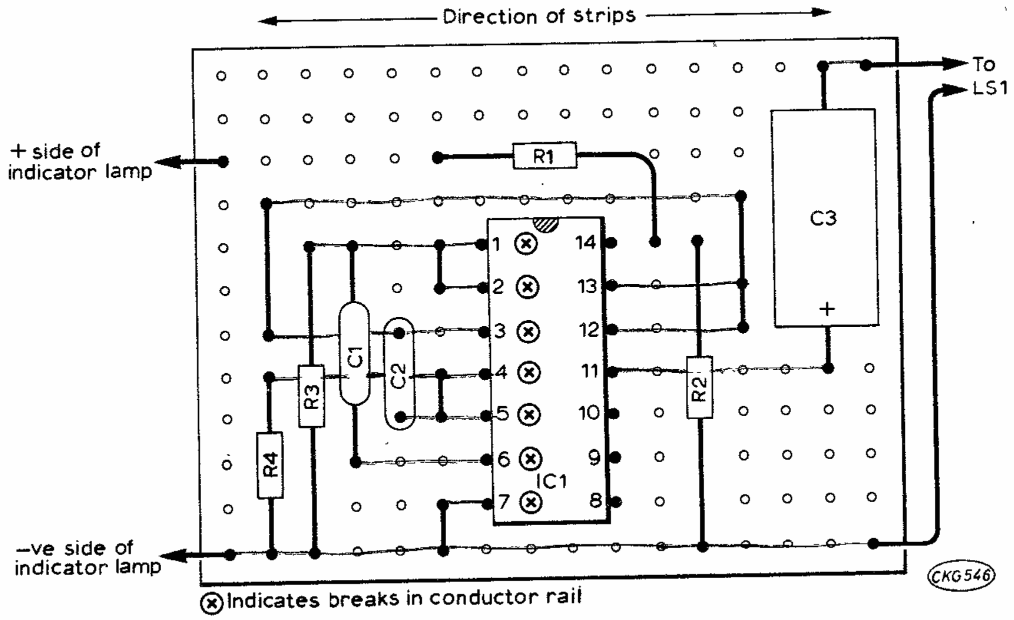
The output level is quite high which allows the circuit to be used for all sorts of applications, from a morse practice oscillator to an electronic door

★ components list

R1	100Ω ½W	C1	0·22μF
R2	100Ω ½W	C2	0·22μF
R3	4·7kΩ ¼W	C3	50μF 15V
R4	4·7kΩ ¼W	IC1	SN7400
LS1	Speaker, 35Ω minimum impedance.		



▲ *Fig. 1: Circuit of audio repeater for 6 or 12v operation. Observing correct polarity is essential.*



◀ *Fig. 2: Layout on veroboard of repeater shown in Fig. 1. Circuit must be isolated from chassis.*

alarm and on to our suggestion, which is a repeater for trafficators on cars where the warning light is not very obvious and the tick of the relay is not very loud.

The circuit needs a supply voltage of between 4·5 and 6V so for 12V systems it is necessary to incorporate the voltage droppers R1 and R2 which **MUST** be of $\frac{1}{2}$W or greater rating. For 6V systems these resistors can be omitted and the supply fed in according to the dotted rail of Fig. 1. As a trafficator repeater the best place to get the supply power is from across the existing indicator lamp. The bleep from the circuit will follow the same rythm as the flashing of the lamps. The circuit will work for positive or negative earth cars provided you connect the repeater across the lamp with the correct polarity and do not allow any of the circuitry to touch the car's chassis.

CURING RADIO INTERFERENCE

—continued from page 877

components are used. Shunting all decoupling electrolytics with 1000pF to 0·01μF ceramic capacitors can help to reduce the interference in difficult cases, plus trying the usual RF filtering of inputs and outputs. In extreme cases, changing the particular IC has cured the effect.

SCREENING

In practice, no real benefit has been found from screening equipment cabinets: aluminium foil has been tried but as bonding is difficult and short circuits a high probability, it is not likely to make much difference in the level of interference to audio equipment. Earthing the metalwork of the amplifier can make a considerable improvement, although mains socket earths are not usually very effective at RF and can sometimes even give rise to increased interference. What is required is a short, stout connection to a rising water main or an earth spike.

Finally, one way in which it is less common for RF interference to reach audio amplifiers is via the mains lead. Whilst clicks and motor noise will easily travel long distances on the cable in the street, attenuation of frequencies above about 2MHz is considerable. It has, though, been noticed on rare occasions that the last few feet of mains lead to an amplifier have acted as an aerial and injected RF into the equipment. Capacitors around 0·1μF, suitable for 250VAC working, connected between live and neutral and between neutral and earth will usually dampen the lead enough, fitting being done inside the amplifier away from prying fingers. ■

An expanded version of this article, covering radio interference to TV receivers, will be published in the January 1974 issue of our sister magazine TELEVISION to be published on 17th December.

The Editor and Staff of
Practical Wireless
wish all readers a Merry
Christmas and a Happy
New Year

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½W Iskra high stability carbon film—very low noise—capless construction.
⅓W Mullard CR25 carbon film—very small body size 7·5 x 2·5 mm.
½W 2% ELECTROSIL TR5.

Power watts	Tolerance	Range	Values available	Price 1–99	Price 100+
½	5%	4·7 Ω–2·2M Ω	E24	1p	0·8p
½	10%	3·3M Ω–10M Ω	E12	1p	0·8p
½	2%	10 Ω–1M Ω	E24	3·5p	3p
⅓	10%	1 Ω–3·9 Ω	E12	1p	0·8p
⅓	5%	4·7 Ω–1M Ω	E12	1p	0·8p
4	10%	1 Ω–10 Ω	E12	6p	5·5p

Quantity price applies for any selection. Ignore fractions on total order.

DEVELOPMENT PACK

0·5 watt 5% Iskra resistors 5 off each value 4·7 Ω to 1M Ω. E12 pack 325 resistors **£2·40.** E24 pack 650 resistors **£4·70.**

POTENTIOMETERS

Carbon track 5k Ω to 2M Ω, log or linear (log ¼W, lin ½W). Single, **12p.** Dual gang (stereo), **40p.** Single D.P. switch, **24p.**

SKELETON PRESET POTENTIOMETERS

Linear: 100, 250, 500 Ω and decades to 5M Ω. Horizontal or vertical P.C. mounting (0·1 matrix).
Sub-miniature 0·1W, **5p** each. Miniature 0·25W, **7p** each.

TRANSISTORS

AC107	15p	AF126	20p	BF115	25p	OC42	12p	2N3707	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	12p	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

ZENER DIODES

400mW 5% 3·3V to 30V, **12p.**

WIRE WOUND POTS. 3W, 10, 25, 50 Ω and decades to 100k Ω, **35p.**

DIODES

RECTIFIER

BY127	1250V	1A	12p
1N4001	50V	1A	7p
1N4002	100V	1A	8p
1N4004	400V	1A	8p
1N4006	800V	1A	10p
1N4007	1000V	1A	10p

SIGNAL

OA85	7p
OA90	5p
OA91	5p
OA202	7p
1N4148	5p
BA114	8p

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.

BRUSHED ALUMINIUM PANELS

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

THYRISTORS

2N5060	50V	0·8A	30p
2N5064	200V	0·8A	47p
106F	50V	4A	40p
106D	400V	4A	55p

ALUMINIUM BOXES

AB7	2¾" x 5¼" x 1½"	50p	AB14	7" x 5" x 2½"	84p
AB8	4" x 4" x 1½"	50p	AB15	8" x 6" x 3"	108p
AB9	4" x 2¾" x 1½"	50p	AB16	10" x 7" x 3"	122p
AB10	4" x 5¼" x 1½"	50p	AB17	10" x 4½" x 3"	108p
AB11	4" x 2½" x 2"	60p	AB18	12" x 5" x 3"	120p
AB12	3" x 2" x 1"	44p	AB19	12" x 8" x 3"	160p

HEATSINKS—REDPOINT

2W	24p	4W	45p	TO5	Clip	5p	TO1	Single	5p
3W	36p	6W	60p	TO18	Clip	5p	TO1	Double	8p

TRANSFORMERS All have 240V primary

MT30/2	0–12–15–20–24–30V	2A	£2·85
MT50/½	0–19–25–33–40–50V	½A	£1·90
MT50/1	0–19–25–33–40–50V	1A	£2·55
MT50/2	0–19–25–33–40–50V	2A	£3·50
MT60/½	0–24–30–40–48–60V	½A	£2·10
MT60/1	0–24–30–40–48–60V	1A	£2 80
MT60/2	0–24–30–40–48–60V	2A	£3 80

MULLARD POLYESTER CAPACITORS C296 SERIES

400V: 0·001μF, 0·0015μF, 0·0022μF, 0·0033μF, 0·0047μF, **2½p.** 0·0068μF, 0·01μF, 0·015μF, 0·022μF, 0·033μF, **3p.** 0·047μF, 0·068μF, 0·1μF, **4p.** 0·15μF, **6p.** 0·22μF, **7½p.** 0·33μF, **11p.** 0·47μF, **13p.**
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.**

MULLARD POLYESTER CAPACITORS C280 SERIES

250V P.C. mounting: 0·01μF, 0·015μF, 0·022μF, **3p.** 0·033μF, 0·047μF, 0·068μF, **3½p.** 0·1μF, **4p.** 0·15μF, 0·22μF, **5p.** 0·33μF, **6½p.** 0·47μF, **8½p.** 0·68μF, **11p.** 1·0μF, **13p.** 1·5μF, **20p.** 2·2μF, **24p.**

MYLAR FILM CAPACITORS 100V

0·001μF, 0·002μF, 0·005μF, 0·01μF, 0·02μF, **2½p.** 0·04μF, 0·05μF, 0·068μF, 0·1μF, **3½p.**

CERAMIC DISC CAPACITORS

100pF to 10,000pF, **2p** each.

ELECTROLYTIC CAPACITORS

(μF/v) 1/63, 1·5/63, 2·2/63, 3·3/63, 4·7/63, 6·8/40, 6·8/63, 10/25, 10/63, 15/16, 15/40, 15/63, 22/10, 22/25, 22/63, 33/6·3, 33/16, 33/40, 47/4, 47/10, 47/25, 47/40, 68/6·3, 68/16, 100/4, 100/10, 100/25, 150/6·3, 150/16, 220/4, 220/6·3, 220/16, 330/4, **6p.** 47/63, 100/40, 150/25, 220/25, 330/10, 470/6·3, **7p.** 68/63, 150/40, 220/40, 330/16, 1000/4, **10p.** 470/10, 680/6·3, **11p.** 100/63, 150/63, 220/63, 1000/10, **12p.** 470/25, 680/16, 1500/6·3, **13p.** 470/40, 680/25, 1000/16, 1500/10, 2200/6·3, **18p.** 330/63, 680/40, 1000/25, 1500/16, 2200/10, 3300/6·3, 4700/4, **21p.**

SOLID TANTALUM BEAD CAPACITORS

12p

0·1μF	35V	2·2μF	35V	22μF	16V
0·22μF	35V	4·7μF	35V	33μF	10V
0·47μF	35V	6·8μF	25V	47μF	6·3V
1·0μF	35V	10μF	25V	100μF	3V

VEROBOARD

	0.1	0.15
2½ x 3¾	22p	16p
2½ x 5	24p	24p
3¾ x 3¾	24p	24p
3¾ x 5	27p	27p
17 x 2½	75p	57½p
17 x 3¾	100p	78p
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
Pin insertion tool	52p	52p
Spot face cutter	42p	42p
Pkt. 50 pins	20p	20p

JACK PLUGS AND SOCKETS

Standard screened	18p	2·5mm insulated	8p
Standard insulated	12p	3·5mm insulated	8p
Stereo screened	35p	3·5mm screened	13p
Standard socket	15p	2·5mm socket	8p
Stereo socket	18p	3·5mm socket	8p

D.I.N. PLUGS AND SOCKETS

2 pin, 3 pin, 5 pin 180°, 5 pin 240°, 6 pin
Plug 12p. Socket 8p.
4 way screened cable, **15p**/metre.
6 way screened cable, **22p**/metre.

BATTERY ELIMINATOR

£1.50

9V mains power supply. Same size as PP9 battery.

LARGE (CAN) ELECTROLYTICS

1600μF	64V	74p	2500μF	64V	80p	4500μF	16V	50p
2500μF	40V	74p	2800μF	100V	£2·60	4500μF	25V	£1·68
2500μF	50V	58p	3200μF	16V	50p	5000μF	50V	£1·10

HIGH VOLTAGE TUBULAR CAPACITORS—1,000 VOLT

0·01μF	10p	0·047μF	13p	0·22μF	20p
0·022μF	12p	0·1μF	13p	0·47μF	22p

POLYSTYRENE CAPACITORS 160V 2½%

10pF to 1,000pF E12 Series Values, 4p each.

SMOKE AND COMBUSTIBLE GAS DETECTOR—GDI

The GDI is the world's first semiconductor that can convert a concentration of gas or smoke into an electrical signal. The sensor decreases its electrical resistance when it absorbs deoxidizing or combustible gases such as hydrogen, carbon monoxide, methane, propane, alcohol, North Sea gas, as well as carbon-dust containing air or smoke. This decrease is usually large enough to be utilized without amplification. Full details and circuits are supplied with each detector.
Detector GDI, **£2.** Kit of parts for detectors including GDI and P.C. board but excluding case. Mains operated detector **£5·20.** 12 or 24V battery operated audible alarm **£7·30.** As above for PP9 battery, **£6·40.**

PRINTED BOARD MARKER

97p

Draw the planned circuit onto a copper laminate board with the P.C. Pen, allow to dry, and immerse the board in the etchant. On removal the circuit remains in high relief.

METERS 1½" Scale-500uA, 1mA, 10mA, 100mA **£1·90**

BULGIN MAINS CONNECTORS

3 Pin	1½A	Chassis Plug	10p	3 Pin	1½A	Chassis Socket	18p
		Line Socket	13p			Line Plug	13p
3 Pin	3A	Chassis Plug	10p	3 Pin	3A	Chassis Socket	21p
		Line Socket	14p			Line Plug	23p
3 Pin	5A	Chassis Plug	16p	2 Pin	5A	Line Plug	20p
		Line Socket	15p				

THERMISTORS

VA1005	15p
VA1026	15p
VA1033	15p
VA1055S	15p
VA1066S	15p
VA1077	15p
R53	£1·35

WAVECHANGE SWITCH 23p

1p 12W, 3p 4W. 2p 2W, 2p 6W. 4p 3W

ROTARY MAINS SWITCH

D.P. 2A **32p**

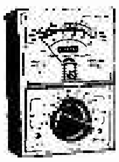
LINEAR IC's

709	14 pin DIL	40p
741	8 pin DIL	40p
741	14 pin DIL	38p
723	14 pin DIL	95p
747	14 pin DIL	85p
748	8 pin DIL	45p

DIL Sockets 14 pin and 16 pin **16p**

GWS 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.

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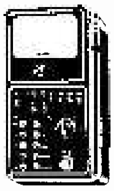

Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2·5/10/50/250/500/1000v D.C. 2·5/10/50/250/500/1000v. A.C. DC Current 100wA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3m Ω. Complete with batteries. test leads, instructions and sturdy steel carrying case. **£4·95**. P. & P. 25p

MODEL TE-200

20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000V. D.C. 0/10/50/250/1,000V. A.C. 0/50 μA/250 mA. 0/60K/6 meg Ω. −20 to +62db. **£4·95**. P. & P. 15p.

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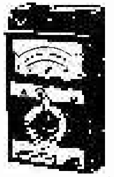
30,000 O.P.V. Mirror scale. overload protection 0/·6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30μA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm −20 to +63 db. **£7·50**. P. & P. 15p.

U4312 MULTIMETER

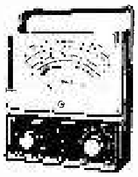


Extremely sturdy instrument for general electrical use. 667 o.p.v.
0/·3/1·5/7·5/30/60/150/300/600/900 VDC and 75mV.
0/·3/1·5/7·5/30/60/150/300 600/900 VAC.
0/300μA/1·5/6/15/60/150 600mA/1·5/6 AMP. D.C.
0/1·5/6/15/60/150/600mA/1·5/6 AMP. AC.
0/200 Ω/3K/30K Ω.
Accuracy DC 1%. AC 1·5%.
Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. **£9·75**. P. & P. 25p.

MODEL 500

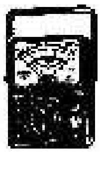
30,000 O.P.V. with overload protection, mirror scale. 0/·5/2·5/10/25/100/250/500/1,000v. D.C. 0/2·5/10/25/100/250/500/1.000V. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60/K/6 Meg./60 Meg Ω
£10·50. Post paid.
Leather Case **£1·75**

MODEL C-7080 EN



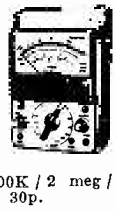
Giant 6″ mirror scale. 20,000 o.p.v. 0 / ·25 / 1 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. D.C. 0 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. A.C. 0 / 50μA / 1 / 10 / 100 / 500mA / 10 amp. D.C. 0 / 2K / 200K / 20 meg − 20 to + 50 dB.
£13·95. Post 35p.

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.

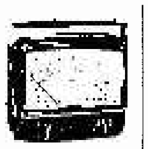
KAMODEN 72.200 MULTITESTER



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.

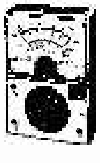
ALL PRICES ARE SUBJECT TO 10% VAT

TMK LAB TESTER.



100,000 O.P.V. 6½in. 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. × 3⅞in. **£19·95**. P. & P. 25p.

HIOKI MODEL 700X

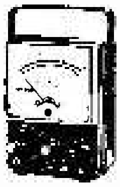


100,000 O.P.V. Overload protection. Mirror scale.
·3/·6/1·2/1·5/3/6/12/30/60/120/300/600/1200V DC
1·5/3/6/12/30/60/150/300/600 1200 V. A.C.
15/30μA/3/6/30/60/150/300mA 6/12 AMP. DC. 2K/200K/2 Meg/20 Meg ohm −20 to +63dB. **£14·95**. P. & P. 20p

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 HM.350 TRANSISTOR TESTER

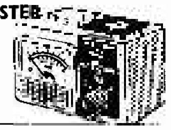


High quality instrument to test Reverse Leak current and DC current. Amplification factor of NPN, PNP, transistors, diodes, SCR's etc. 4″ × 4¾″ clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. **£12·50**. Post 30p.

MODEL 449A IN CIRCUIT TRANSISTOR TESTER

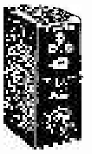
Checks true A.C. beta in / out. Checks Ico. Checks diodes in / out. Checks SCR, etc. Beta HI 10 − 500, LO 2 − 50. Icbo 0–5000μA. 220/240 V A.C. operation **£17·50**. Post 25p.

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.

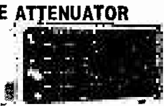
TE–40 HIGH SENSITIVITY A.C. VOLTMETER

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 instruotions. Operation 230V. A.C. **£17·50**. Carr. 25p.

TE-65 VALVE VOLTMETER

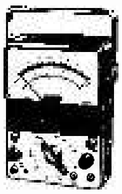
28 ranges. D.C. volts 1·5–1,500v. A.C. volts 1·5–1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions.
£17·50. P. & P. 30p. Additional probes available: R.F. **£2·12**; H.V. **£2·50**.

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.

KAMODEN HM. 720B F.E.T. V.O.M.

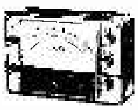


Input impedance 10 meg ohms.
Ranges:
0 / ·25 / 1 / 2·5 / 10 / 50/ 250 / 1000V. D.C.
0 / 2·5 / 10 / 50 / 250 1000V. A.C.
0 / 25μA / 2·5 / 25 / 250 mA D.C.
− 20 to + 62dB
0 / 5K / 50K / 500K / 5meg 500meg ohms.
£14·95. Post 30p

TMK MODEL 117 F.E.T. ELECTRONIC VOLTMETER

Battery operated, 11 meg input, 26 ranges. Large 4⅜″ mirror scale. Size 5⅞″ × 4⅜″ × 2⅜″. 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.

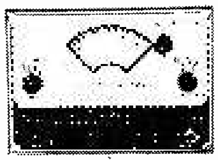
KAMODEN HMG-500 INSULATION RESISTANCE TESTER



Range 0–1000 Megohms. 500 Volt. Battery operated. Wide range clear meter 4¾″ × 4″. Complete with deluxe carrying case, batteries, instructions. **£19·95**. Post 30p

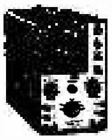
BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR

Sine 18 × 200,000 Hz; Square 18 × 20,000 Hz



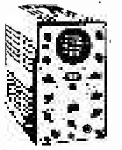
Output max. + 10 dB. (10 K ohms) Operation internal batteries Attractive 2-tone case 7¾″ × 5″ × 2″.
Price **£17·50**.
Carr. 17p.

TO-3 PORTABLE OSCILLOSCOPE



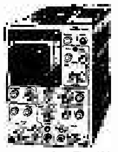
3in. tube, Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps–1·5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0·9v. p-p/CM. Bandwidth 1·5cps–800kHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps 300 kHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15¼lb. 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

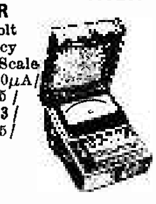


5 Mc/s Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 5in. × 4in. C.R.T. Calibrated triggered sweep from ·2 μ/sec. to 100 milli-sec. per cm. Free running time base 50 c/s-1 mc/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with all accessories and instruction manual
£87. Carr. Paid.

TE-16A TRANSISTORISED SIGNAL GENERATOR

5 ranges 400kHz-30mHz. An inexpensive instrument for the handyman. Operates on 9v battery Wide easy to read scale 800kHz modulation.
5⅞ × 5⅞ × 3⅝in.
Complete with instructions and leads. **£8·97**. Post 25p.

MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER

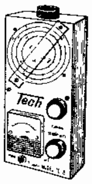


Sensitivity 330 ohms/Volt AC and DC. Accuracy 0·5% D.C. 1% AC. Scale length 165mm. 0/300/750μA/1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5AMP DC 0 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5 AMP AC 0 / 75 / 150 / 300 / 750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 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.

TMK MODEL TW-50K

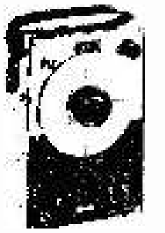
46 ranges, mirror scale, 50K/Vol. D.C. 5K/Volt A.C. D.C.: Volts ·125, ·25, 1·25, 2·5, 5, 10, 25, 50, 125, 250, 500, 1000V, A.C. Volts: 1·5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50μA, 2·5, 5, 25, 50, 250, 500mA, 5, 10amp. Resistance: 10K, 100K, 1 MEG, 10 MEG Ω. Decibels: −20 to +81·5db **£8·50**. P. & P. 17½p.

MODEL TE.15 GRID DIP METER



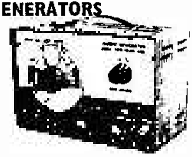
Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440Kc/s–280Mc/s in 6 coils. 500μA Meter. 9V battery operation. Size 180 × 80 × 40mm.
£15·00. Post 20p.

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.

TE22 SINE SQUARE WAVE AUDIO GENERATORS



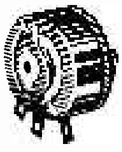
Sine: 20cps to 200 kc/s on 4 bands. Square: 20cps to 30 kc/s. Output impedance 5,000 ohms, 200/250V. A.C. operation. Supplied brand new and guaranteed with instruction manual and leads. **£17·50**. Carr. 37½p.

240° Wide Angle 1mA Meters

MW 1-6 60mm square	**£3·97**
MW 1-8 80mm square	**£4·97**

P. & P. 15p.

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. £1·15 P. & P. 10p.
50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. **£1·62**. P. & P. 10p.
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms. **£2·34**. P. & P. 15p.

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

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AF30	Mono Transistor Pre-Amplifier	£2·61
AF310	Mono Amplifier (use two for stereo)	£5·91
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AT30	Photo Cell Switching Unit	£5 70
AT50	400W Triac Light Dimmer/ Speed Control	£4·80
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AT56	2200W Triac Light Dimmer/ Speed Control	£6·90
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HF75	FM Transistor Receiver	£2·88
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HF325	Deluxe FM Tuner Unit	£24·12
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NT10	Power Supply 100mA, 9V Stab. 12V Unstab.	£6·15
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NT305	Transistor Convertor 12/15V AC/DC to 6V, 7·5V or 9V DC	£4·50
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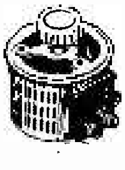
P. & P. 25p **OUR PRICE £3·30**

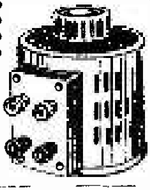
" YAMABISHI " VARIABLE VOLTAGE TRANSFORMERS

Excellent quality at low cost. All models—Input 230V. 50/60 c/s. Variable output 0–260V.



MODEL S-260
GENERAL PURPOSE BENCH MOUNTING

	£	P.&P.
1 Amp	8·75	30p
2·5 Amp	10·00	35p
5 Amp	14·70	37p
8 Amp	25·30	50p
10 Amp	28·10	75p
12 Amp	29·50	100p
20 Amp	72·50	125p
25 Amp	72·50	130p
40 Amp	103·10	150p



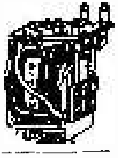
MODEL S-260B

Panel Mounting.

1 Amp	8·75	30p
2·5 Amp	10·00	35p

Carriage and Packing Extra

230 VOLT A.C. 50 CYCLES RELAYS



3 sets of changeover contacts at 5 amp rating, 40p each. P. & P. 12p (100 lots £30. Quantities available.

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 4⅛". Dial size 5" × 3". Overall size 7½" × 4⅝" × 1⅜" deep including knob and coupling. ¼" dia. shaft.

OUR PRICE £1·62 P. & P. 15p.

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.

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
50–0–50µA	£3·95
100µA	£3·95
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
5 amp. D.C.	£3·60
300V. A.C.	£3·70
VU Meter	£4·30

Type SD.830 82.5mm x 110mm Fronts

50µA	£3·40
50–0–50µA	£3·40
100µA	£3·35
100–0–100µA	£3·35
200µA	£3·30
500µA	£3·15
1mA	£3·10
5mA	£3·10
10mA	£3·10
50mA	£3·10
100mA	£3·10
500mA	£3·10
1 amp.	£3·10
5 amp.	£3·10
10 amp.	£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
50–0–50µA	£3·05
100µA	£3·00
100–0–100µA	£3·00
200µA	£3·00
500µA	£2·95
1mA	£2·90
5mA	£2·90
10mA	£2·90
50mA	£2·90
100mA	£2·90
500mA	£2·90
1 amp.	£2·90
5 amp.	£2·90
10 amp	£2·90
5V. D.C.	£2·90
20V. D.C.	£2·90
50V. D.C.	£2·90
300V. D.C.	£2·90
15V. A.C.	£3·00
300V. A.C.	£3·00
VU Meter	£3·15

Type MR.45P. 2in. square fronts

50µA	£2·70
50–0–50µA	£2·65
100µA	£2·60
100–0–100µA	£2·50
200µA	£2·50
500µA	£2·45
500–0–500µA	£2·40
1mA	£2·40
5mA	£2·40
10mA	£2·40
50mA	£2·40
100mA	£2·40
500mA	£2·40
1 amp.	£2·40
5 amp.	£2·40
10V. D.C.	£2·40
20V. D.C.	£2·40
50V. D.C.	£2·40
300V. D.C.	£2·40
15V. A.C.	£2·40
300V. A.C.	£2·40
8 Meter 1mA	£2·50
VU Meter	£2·70
1 amp. A.C. *	£2·40
5 amp. A.C. *	£2·40
10 amp. A.C. *	£2·40
20 amp. A.C. *	£2·40
30 amp. A.C. *	£2·40

"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
100µA	£6·40
50–0–50µA	£6·40
1mA	£5·95
1–0–1mA	£5·95
1A d.c.	£5·95
5A d.c.	£5·95
5V d.c.	£5·95
10V d.c.	£5·95
15V d.c.	£5·95
20V. d.c.	£5·95
50V. d.c.	£5·95
300V. d.c.	£5·95
Dual range	
500mA/5A d.c.	£7·00
1/15A d.c.	£7·00
5V/50V d.c.	£7·00
5/15V d.c.	£7·00

Type MR.85P. 4¼in. x 4¼in. fronts

50µA	£4·40
50–0–50µA	£4·25
100µA	£4·25
100–0–100µA	£4·05
200µA	£4·05
500µA	£3·90
500–0–500µA	£3·90
1mA	£3·90
1–0–1mA	£3·90
5mA	£3·90
10mA	£3·90
50mA	£3·90
100mA	£3·90
500mA	£3·90
1 amp.	£3·90
5 amp.	£3·90
15 amp.	£3·90
30 amp.	£3.95
10V D.C.	£3·90
20V. D.C.	£3·90
50V. D.C.	£3·90
150V. D.C.	£3·90
300V. D.C.	£3·90
15V. A.C.	£3·95
300V. A.C.	£3·95
8 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
50–0–50µA	£3·05
100µA	£3·00
100–0–100µA	£2·95
500µA	£2·65
1mA	£2·50
5mA	£2·50
10mA	£2·50
50mA	£2·50
100mA	£2·50
500mA	£2·50
1 amp	£2·50
5 amp	£2·50
10V. D.C.	£2·50
20V. D.C.	£2·50
50V. D.C.	£2·50
300V. D.C.	£2·50
15V. A.C.	£2·60
300V. A.C.	£2·60
8 Meter 1mA	£2·60
VU Meter	£3·60
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

Type MR.65P. 3¼in. x 3¼in. fronts

50µA	£3·70
50–0–50µA	£3·15
100µA	£3·15
100–0–100µA	£3·10
200µA	£3·05
500µA	£2·75
500–0–500µA	£2·60
1mA	£2·60
5mA	£2·60
10mA	£2·60
50mA	£2·60
100mA	£2·60
500mA	£2·60
1 amp.	£2·60
5 amp.	£2·60
10 amp.	£2·60
15 amp.	£2·60
20 amp.	£2·60
30 amp.	£2·80
50 amp.	£2·90
5V. D.C.	£2·60
10V. D.C.	£2·60
20V. D.C.	£2·60
50V. D.C.	£2·60
150V. D.C.	£2·60
300V. D.C.	£2·60
15V. A.C.	£2·80
50V. A.C.	£2·80
150V. A.C.	£2·80
300V. A.C.	£2·80
500V. A.C.	£2·80
8 Meter 1mA	£2·85
VU Meter	£3·70
50mA A.C. *	£2·60
100mA A.C. *	£2·60
200mA A.C. *	£2·60
500mA A.C. *	£2·60
1 amp. A.C. *	£2·60
5 amp. A.C. *	£2·60
10 amp. A.C. *	£2·60
20 amp. A.C. *	£2·60
30 amp. A.C. *	£2·60

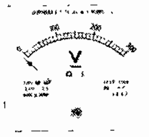
"SEW" EDGWISE METERS

Type PE.70. 3 17/32in. x 1 15/32in. x 2¼in. deep

50µA	£3·75
50–0–50µA	£3·60
100µA	£3·60
100–0–100µA	£3·50
200µA	£3·40
500µA	£3·20
1mA	£3·20
300V. A.C.	£3·25
VU Meter	£3·85

***MOVING IRON— ALL OTHERS MOVING COIL**
Please add postage

Type MR.38P. 1 21/32in. square fronts



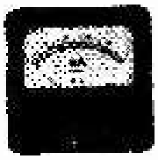
50µA	£2·55
50–0–50µA	£2·50
100µA	£2·45
100–0–100µA	£2·40
200µA	£2·25
500µA	£2·25
500–0–500µA	£2·25
1mA	£2·25
1–0–1mA	£2·25
2mA	£2·25
5mA	£2·25
10mA	£2·25
20mA	£2·25
50mA	£2·25
100mA	£2·25
150mA	£2·25
200mA	£2·25
300mA	£2·25
500mA	£2·25
750mA	£2·25
1 amp.	£2·25
2 amp.	£2·25
5 amp.	£2·25
10 amp.	£2·25
3V. D.C.	£2·25
10V. D.C.	£2·25
15V. D.C.	£2·25
20V. D.C.	£2·25
50V. D.C.	£2·25
100V. D.C.	£2·25
150V. D.C.	£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
8 Meter 1mA	£2·30
VU Meter	£2·65

Type SD.460 46mm x 59.5mm Fronts

50µA	£2·80
50–0–50µA	£2·80
100µA	£2·75
100–0–100µA	£2·75
200µA	£2·70
500µA	£2·55
1mA	£2'60
5mA	£2·60
10mA	£2·60
50mA	£2·60
100mA	£2·60
500mA	£2·60
1 amp.	£2·60
5 amp.	£2·60
10 amp.	£2·60
5V. D.C.	£2·60
10V. D.C.	£2·60
20V. D.C.	£2·60
50V. D.C.	£2·60
300V. D.C.	£2·60
15V. A.C.	£2·70
300V. A.C.	£2·70
VU Meter	£2·90

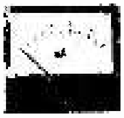
"SEW" BAKELITE PANEL METERS

Type MR.65. 3½in. square fronts



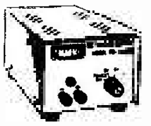
25µA	£4·60
50µA	£3·55
50–0–50µA	£3·05
100µA	£3·00
100–0–100µA	£3·00
500µA	£2·70
500–0–500µA	£2·60
1mA	£2·60
1–0–1mA	£2·80
5mA	£2·60
10mA	£2 60
50mA	£2·60
100mA	£2·60
500mA	£2·60
1 amp.	£2·60
2 amp.	£2·60
5 amp.	£2·60
15 amp.	£2·60
30 amp.	£2·60
50 amp.	£2·60
5V. D.C.	£2·60
10V. D.C.	£2·60
20V. D.C.	£2·60
50V. D.C.	£2·60
150V. D.C.	£2·60
300V. D.C.	£2·60
50mV. D.C.	£2·90
100mV. D.C.	£2·90
30V. A.C. *	£2·65
50V. A.C. *	£2·65
150V. A.C. *	£2·65
300V. A.C. *	£2·65
500V A.C.	£2·65
500mA A.C. *	£2·60
1 amp. A.C. *	£2·60
5 amp. A.C. *	£2·60
10 amp. A.C. *	£2·60
20 amp. A.C. *	£2·60
30 amp. A.C. *	£2·60
50 amp. A.C. *	£2·60
VU Meter	£3·65

Type S-80 80 mm. square fronts



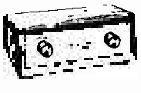
50µA	£3·50
50–0–50µA	£3·40
100µA	£3·40
100–0–100µA	£3·30
500µA	£3·05
1mA	£3·00
20V. D.C.	£3·00
50V. D.C.	£3·00
300V. D.C.	£3·00
1 amp. D.C.	£3·00
5 amp. D.C.	£3·00
300V. A.C.	£3·00
VU Meter	£3·70

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" × 6¼". £11·97. P. & P. 25p.

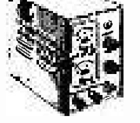
MP7 MIXER PREAMPLIFIER



5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9¼" × 5" × 3". Inputs Mics: 3×3mV 50K; 2×3mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K.

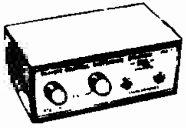
Our Price £8·97 P. & P. 20p

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 7½" × 5¼" × 3¼". £19·95. P. & P. 25p.

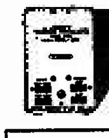
1021 STEREO LISTENING STATION



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" × 3 × 2¼".

Our Price £2·25 P. & P. 15p

MCA. 220 AUTOMATIC VOLTAGE STABILISER



Input 88 125 VAC or 176, 250VAC. Output 120VAC or 240VAC. 200VA rating. £11·97. Carr. 50p.

SEND SAE FOR NEW 8 PAGE SEMI CONDUCTORS & VALVES LIST

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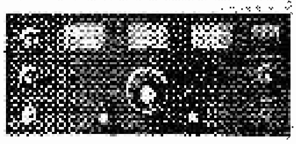
GWS G.W.SMITH & CO (RADIO) LTD

FANTASTIC VALUE TRIO QUALITY ENGINEERED COMMUNICATIONS UNITS

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 445 kc/s, audio output 1·5w. Variable RF and AF gain controls 115/250 v. A.C. with instruction manual.

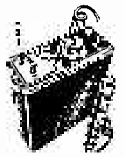
Our Price £42·50 Carr. Paid

TRIO JR599 RECEIVER

9 wavebands covering 1·8-29·7MH 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. Size 270 x 140 x 310mm.

Our Price £132·50 Carr. Paid

TRIO TR2 200 TRANSCEIVER



Fully transistorised portable VHF Transceiver. Will transmit and receive on 6 channels between 144-146 MHz. 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 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. Size 3 30 × 179 × 310mm.

Our Price £75·00 Carr. Paid

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

GWS
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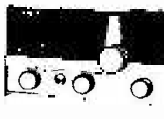
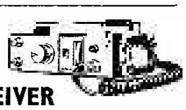
UNR 30 RECEIVER



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

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. Controls: Volume/on/off, squelch channel selector Internal 3" speaker. Complete with dynamic mike, PTT switch, three sets of crystals for 144·48MHz, 144·60 MHz, 145·00MHz, mounting bracket and instructions. Size approx. 150 × 70 × 220mm.

Our Price £75·00 P & P 50p

SWR METER—Model SWR-3

Handy SWR Meter for transmitter antenna alignment, with built-in field strength meter. Accuracy: 5%, Impedance: 52, Indicator: 100μA DC, full scale 5 section collapsible antenna. Size: 145 × 50 × 60 mm.

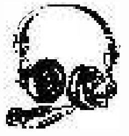
OUR PRICE £4·25 P. & P. 25p

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

LH02S STEREO HEADPHONES



Lightweight headphones with padded earpieces. 4-16 ohms. 20-20,000 Hz. Complete with 6 ft. cord and plug.

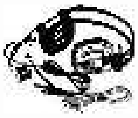
Our Price £1·97 P. & P. 30p

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



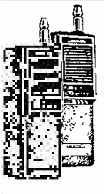
Moving Coil. Ideal for language teaching, communications. Headphone imp. 16 ohms. Microphone imp. 200 ohms.

Our Price £5·95 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



HAND-HELD 2-WAY WALKIE-TALKIES

P. & P. 50p.

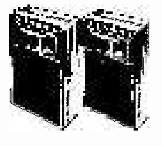
SKYFON—100MW. **£24·95** pair,
P302—2 CHANNEL 300MW. **£52·50** pair.
P1003—3 CHANNEL 1 Watt **£71·25** pair.
LICENCE REQUIRED FOR OPERATION IN U.K.

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 × 4¾in.

Our Price £7·50 P. & P. 15p

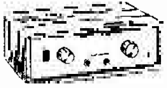
SPECIAL BARGAIN! PHONIC 10 TWO WAY SPEAKER SYSTEM



Matched pair of compact bookshelf speakers of unique design incorporating 2" high frequency tweeter and 6" woofer. 8 ohms impedance. 10 watts power handling. Size 348 × 228 × 110mm.

GWS SPECIAL PRICE £9·85 per pair. P. & P. 50p plus VAT.

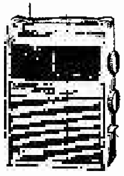
AUDIOTRONIC AHA101 STEREO HEADPHONE AMPLIFIER



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

Our Price £7·50 P. & P. 20p

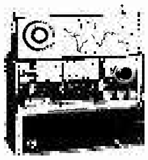
AUDIOTRONIC AR.1000 SPORTSMAN AM/FM PORTABLE RADIO



5 wavebands covering AM 535 1065KHz FM 88–108MHz. AIR 108–135MHz. PB 147–174MHz. WB 162. 5MHz. Large horizontal slide dia 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 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.

AUDIOTRONIC DIGITAL CLOCK RADIO ADC. I

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, and operating instructions.

OUR PRICE £12·50 P. & P. 50p.

NOW AVAILABLE!

ADC II DELUXE VERSION
OUR PRICE £14·95 P. & P. 50p.

AUDIOTRONIC DOLBY 'B' NOISE REDUCTION UNITS

Reduce tape hiss by 3dB at 600Hz, 6dB at 1200Hz and 10bB for all frequencies above 3000Hz.
Size 16⅜" × 8" × 3⅛". 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

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

A1018 FM TUNER

Specification as above chassis but complete in cabinet with on/off switch Size 7¼" × 3⅜" × 5".

Our Price £9·65 P & P 30p

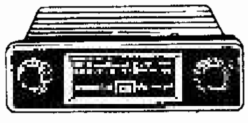
Stereo multiplex adaptor **£4·97.**

AUDIOTRONIC AM/FM Portable Radio AR3000

4 wavebands covering FM 87 - 108 MHz, MW 510 - 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

AUDIOTRONIC ACR3500 CAR RADIO



Manual tuning of Medium and Long waves. 12v pos. or neg, earth. Complete with speaker. mounting brackets and instructions.

Our Price £7·50 P & P 50p

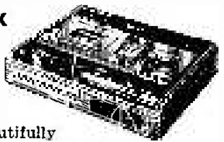
SAVE UP TO 33⅓% OR MORE! GWS

AUDIOTRONIC 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.

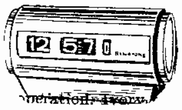
AUDIOTRONIC ACD.660 Stereo Cassette Deck



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 40-12KHz (40-16KHz) (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

BINATONE DS100 DIGITAL CLOCK



240v. mains operation. Ivory case with large clear numbers for hours, minutes and seconds. Approx. size 6¼″ × 3″ × 3½″.

OUR PRICE £4·50 P. & P. 30p.

SPECIAL PURCHASE! BSR 8 TRACK PLAYER CHASSIS

Famous BSR 8 track chassis as used in Model TD8S complete with silver and black escutcheon ready to fit into cabinet. Output 125mV. AC 240v. Overall size approx. 185 × 215 × 80mm.

OUR PRICE £8·95 P & P 50p.

NEW STORE IN TUNBRIDGE WELLS

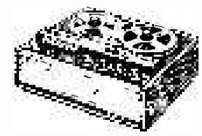
53/57 Camden Road,
Tunbridge Wells
Tel. 23242

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



8416 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

SINCLAIR PROJECT 80 PACKAGES

2 × Z40/Stereo 80/PZ5 ..	£25·00 P. & P. 37p
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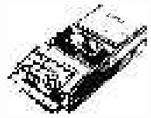

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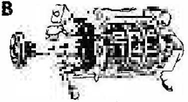

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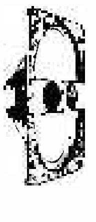

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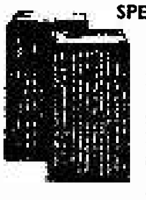

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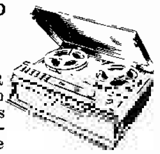

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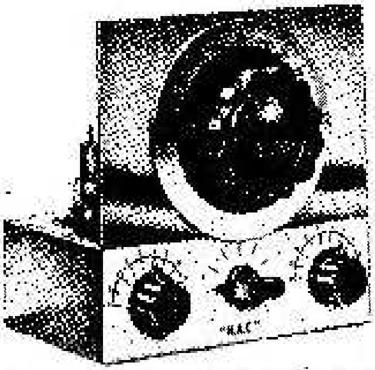

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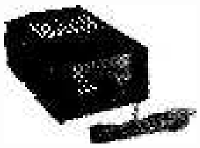

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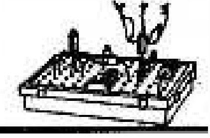

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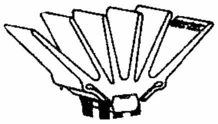

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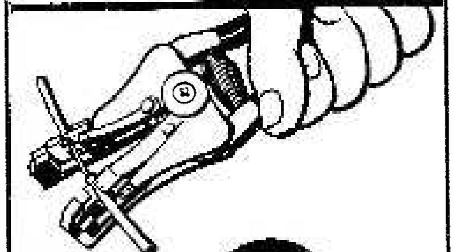

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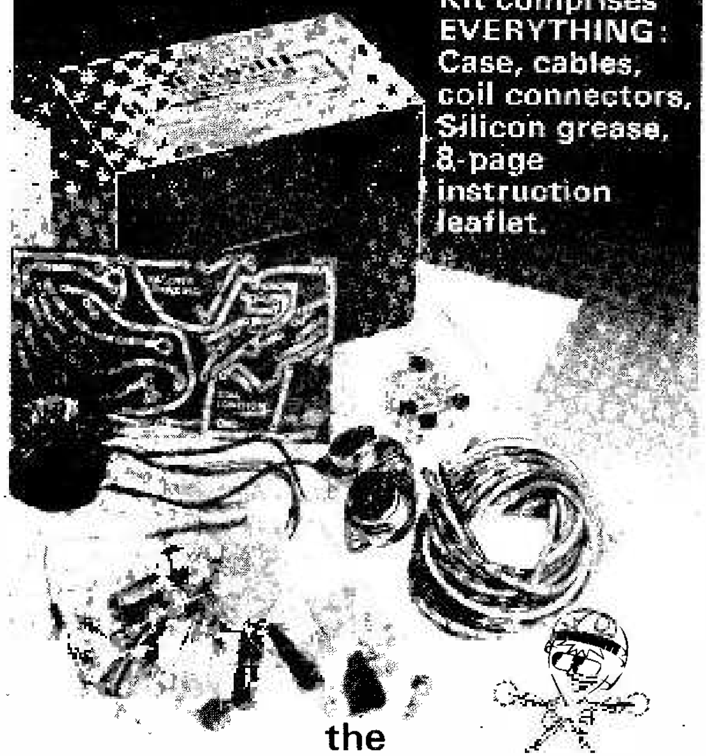

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149	60	3	12	9·9 x 7·7 x 8·6	3·45	36
150	100	5	8	9·9 x 8·9 x 8·6	3·79	52
151	200	8	0	12·1 x 9·3 x 10·2	6·45	52
152	250	13	12	12·1 x 11·8 x 10·2	8·41	67
153	350	15	0	14·0 x 10·8 x 11·8	11·22	82
154	500	19	8	14·0 x 13·4 x 11·8	16·25	–
155	750	29	0	17·2 x 14·0 x 14·0	22·10	
156	1000	38	0	17·2 x 16·6 x 14·0	29·87	–
158	2000	60	0	21·6 x 15·3 x 18·1	49·25	–

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64	75	2	4	7·4 x 6·7 x 6·1	0-115-210-240	2·40	30
4	150	3	4	8·9 x 7·7 x 7·7	0-115-200-220-240	2·89	36
66	300	6	4	9·9 x 9·6 x 8·6	,,	5·63	52
67	500	12	8	12·1 x 11·2 x 10·2	,, ,,	8·36	67
84	1000	19	8	14·0 x 13·4 x 14·3	,, ,,	15·19	82
93	1500	30	4	14·0 x 15·9 x 14·3	,, ,,	21·99	–
95	2000	32	0	17·2 x 16·6 x 14·0	,, ,,	39·17	*
73	3000	40	0	21·6 x 13·4 x 18·1	,, ,,	28·70	*

CASED AUTO TRANSFORMERS

115V 500W enclosed transformer, with mains lead and two 115V outlet sockets. **£9·49.** P & P 67p. 20 Watt version **£2·02** P & P 27p.

TRANSFORMERS

PRIMARY 240·250 VOLTS 12 AND OR 24 VOLT RANGE

Ref.	*Amps.*		*Weight*		*Size cm.*	*Secondary Windings*	*P & P*	
No.	*12V*	*24V*	*lb*	*oz*			*£*	*p*
111	0·5	0·25		8	4·8 x 2·9 x 3·5	0·12V at 0·25A x 2	1·22	22
213	1·0	0·5	1	4	6·1 x 5·8 x 4·8	0·12V at 0·5A x 2	1·44	22
71	2	1	1	12	7·0 x 6·4 x 6·1	0·12V at 1A x 2	1·90	22
18	4	2	2	12	8·3 x 7·7 x 7·0	0·12V at 2A x 2	2·68	30
70	6	3	3	8	8·9 x 8·0 x 7·7	0·12V at 3A x 2	3·20	42
108	8	4	5	8	9·9 x 8·9 x 8·6	0·12V at 4A x 2	3·60	52
72	10	5	6	4	9·9 x 9·6 x 8·6	0·12V at 5A x 2	4·25	52
116	12	6	6	12	9·9 x 10·2 x 8·6	0·12V at 5A x 2	5·10	52
17	16	0	8	12	12·1 x 9·9 x 10·2	0·12V at 8A x 2	6·56	52
115	20	10	11	8	14·0 x 9·6 x 11·8	0·12V at 10A x 2	8·36	67
187	30	15	15	8	14·0 x 12·1 x 11·8	0·12V at 15A x 2	15·40	82
226	60	30	32	0	17·2 x 15·3 x 14·0	0·12V at 30A x 2	28·44	*

30 VOLT RANGE

Ref.	*Amps.*	*Weight*		*Size cm.*	*Secondary Taps*	*P & P*	
No.		*lb*	*oz*			*£*	*p*
112	0·5	1	4	6·1 x 5·8 x 4·8	0-12-15-20-24-30V	1·42	22
79	1·0	2	4	7·0 x 6·7 x 6·1	,, ,,	1·92	36
3	2·0	3	4	8·9 x 7·7 x 7·7	,, ,,	2·90	36
20	3·0	4	8	9·9 x 8·3 x 8·6	,, ,,	3·58	42
21	4·0	6	4	9·9 x 9·6 x 8·6	,, ,,	4·25	52
51	5·0	6	12	12·1 x 8·6 x 10·2	,, ,,	5·30	52
117	6·0	8	0	12·1 x 9·3 x 10·2	,, ,,	6·31	52
88	8·0	12	0	12·1 x 11·8 x 10·2	,, ,,	8·18	67
89	19·0	13	12	14·0 x 10·2 x 11·8	,, ,,	10·33	67

50 VOLT RANGE

Ref.	*Amps.*	*Weight*		*Size cm.*	*Secondary Taps*	*P & P*	
No.		*lb*	*oz*			*£*	*p*
102	0·5	1	12	7·0 x 6·4 x 6·1	0-19-25-33-40-50V	1·90	30
103	1·0	2	12	8·3 x 7·4 x 7·0	,, ,,	2·80	36
104	2·0	5	8	9·9 x 8·9 x 8·6	,, ,,	3·87	42
105	3·0	6	12	9·9 x 10·2 x 8·6	,, ,,	5·26	52
106	4·0	10	0	12·1 x 10·5 x 10·2	,, ,,	6·99	52
107	6·0	12	0	14·0 x 10·2 x 11·8	,, ,,	10·35	67
118	8·0	18	0	14·0 x 12·7 x 11·8	,, ,,	13·51	97
119	10·0	25	0	17·2 x 12·7 x 14·0	,, ,,	16·93	*

60 VOLT RANGE

Ref.	*Amps.*	*Weight*		*Size cm.*	*Secondary Taps*	*P & P*	
No.		*lb*	*oz*			*£*	*p*
124	0·5	2	4	7·0 x 6·7 x 6·1	0-24-30-40-428-69C	1·93	36
126	1·0	3	4	8·9 x 7·7 x 7·7	,, ,,	2·70	36
127	2·0	6	4	9·9 x 9·6 x 8·6	,, ,,	4·25	42
125	3·0	8	12	12·1 x 9·9 x 10·2	,, ,,	6·46	52
123	4·0	13	12	12·1 x 11·8 x 10·2	,, ,,	8·36	67
40	5·0	12	00	14·0 x 10·2 x 11·8	,, ,,	9 85	87
120	6·0	15	8	14·0 x 12·1 x 11·8	,, ,,	12·14	82
121	8·0	25	00	14·0 x 14·7 x 11·8	,, ,,	13·65	*
122	10·0	25	0	17·2 x 12·7 x 14·0	,, ,,	20·09	*
189	12·0	29	00	17·2 x 14·0 x 14·0	,, ,,	22·49	*

MINIATURE TRANSFORMERS WITH SCREENS

Ref.	*MA.*	*Weight*		*Size cm*	**VOLTS**	*P & P* £	*p*
238	200		2	2·8x2·6x2·0	3-0-3	1·31	10
212	1A 1A	1	4	6·1x5·8x4·8	0-6 0-6	1·52	22
13	100		4	3·9x2·6x2·9	9-0-9	1·12	10
235	330,330		4	4·8x2·9x3·5	0-9, 0-9	1·52	10
207	500, 500	1	00	6·1x5·4x4·8	0-8-9, 0-8-9	2·03	22
208	1A, 1A	1	12	7·0x6·4x6·1	0-8-9,0-8-9	2·73	30
236	200, 200		4	4·8x2·9x3·5	0-15, 0-15	1·52	10
214	300, 300	1	4	6·1x5·8x4·8	0-20, 0-20	1·60	22
221	700 (D.C.)	1	8	7·0x6·1x6·1	20-12-0-12-20	1·41	30
206	1A, 1A	2	12	8·3x7·7x7·0	0-15-20, 0-15-20	3·08	36
203	500, 500	2	4	8·3x7·0x7·0	0-15-27, 0-15-27	2·82	38
204	1A, 1A	3	4	8·9x7·7x7·7	0-15-27, 0-15-27	2·86	38

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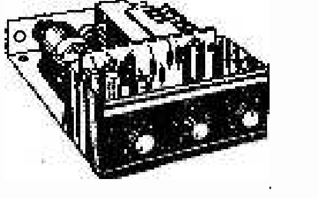

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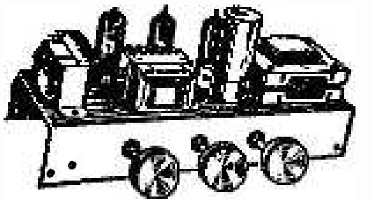

A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:—2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300m/v for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. **PRICE £9·90** P. & P. 50p.

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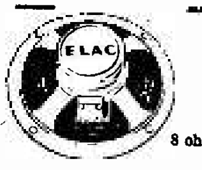

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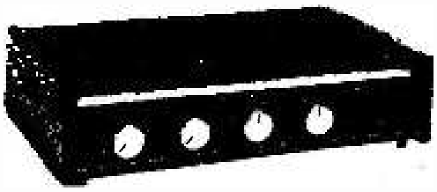

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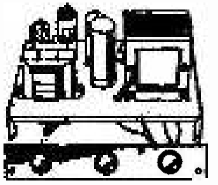

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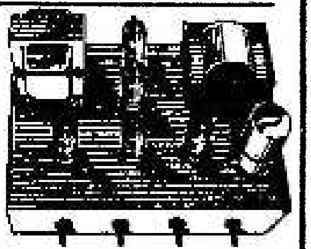

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EBF89	27p
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ECC82	25p
ECC83	25p
ECC84	27p
ECC85	36p
ECC86	80p
ECC88	39p
ECC189	48p
ECF80	31p
ECF82	31p
ECF83	67p
ECF801	56p
ECH81	25p
ECH63	40p
ECH84	40p
ECL80	40p
ECL82	31p
ECL83	63p
ECL86	36p
EF36	50p
EF37A	85p
EF40	62p
EF41	65p
EF80	25p
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PCF801	44p
PCF802	45p
PCF805	80p
PCF806	65p
PCF808	85p
PCH200	65p
PCL81	50p
PCL82	30p
PCL83	60p
PCL84	35p
PCL85	40p
PCL86	43p
PFL200	60p
PL36	50p
PL81	40p
PL82	35p
PL83	36p
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PX4	£2·50
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PY88	32p

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OA10	25p
OA70	10p
OA71	10p
OA73	7p
OA74	7p
OA79 (6D15	10p
OA81	8p
OA91	7p
OA200	7p
OA202	10p
OA210	25p
OA211	30p
OC22	50p
OC25	40p
OC26	25p
OC28	60p
OC29	60p
OC35	50p
OC36	56p
OC38	42p
OC44	17p
OC45	12p
OC70	12p
OC71	12p
OC72	20p
OC73	30p
OC75	25p
OC76	25p
OC81	20p
OC81D	20p
OC81DM	20p
OC82	25p
OC82DM	30p
OC83	25p
OC83B	15p
OC84	25p
OC122	50p
OC139	25p
OC140	40p
OC170	25p
OC171	30p
OC172	37p
OC200	40p
OC201	75p
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AF178	48p
AF186	40p
ASY26	25p
ASY28	25p
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All preferred voltage

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1W	0·37
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UBF89	34p
UCC85	35p
UCF80	60p
UCH42	60p
UCH81	35p
UCL82	35p
UCL83	55p
UF80	30p
UF89	35p
UL41	60p
UL84	35p
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6AC7	45p
6AH6	50p
6AK5	35p
6AK8	30p
6AL5	18p
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6AN8	60p
6AQ5	36p
6AQ5W	45p
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6AT6	30p
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6SJ7GT	28p
6SK7	45p
6SL7GT	35p
6SN7GT	35p
6SQ7	45p
6SQ7GT	32p
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6V6GT	35p
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30F5	80p
30FL1	70p
30FL12	95p
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30L17	80p
30P12	75p
30P19	70p
30PL1	70p
30PL13	90p
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35L6GT	50p
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35Z4GT	55p
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50EH5	55p
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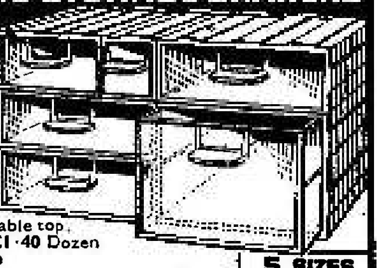
I-N-T-E-R-L-O-C-K-I-N-G PLASTIC STORAGE DRAWERS

NEAT! HANDY! TIDY!

DISCOUNT PRICES



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.

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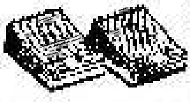
HILLS HEADPHONE JUNCTION BOX MODEL JB-3

Designed to connect headphone to amplifier previously not fitted with headphone socket, or alternatively for remote switching 3 position switch allows instant switching between speakers and headphones or both simultaneously.

Rec. Retail £1·75 **OUR PRICE £1·25** P. & P. 15p

"HOMER" INTERCOM



One of the leading makes. Ideal for home, office, factories, etc. This 2-station intercom includes volume control and on-off switch. Supplied with 66ft. cable and batteries.

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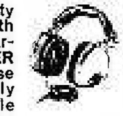
HILLS DYNAMIC HEADPHONE MODEL H-707 VS DE-LUXE



An extremely high quality headphone supplied with Padded Headphone and Earcups together with SLIDER volume controls for precise listening levels. Specially offered at an unbeatable price. 8 ohms 20–20,000Hz.

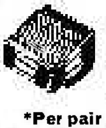
Retail Price £7·95 **OUR PRICE £5·75** P. & P. 25p

HILLS DYNAMIC HEADPHONE MODEL H-101 VSM

Offered at a remarkably low price, supplied with padded Headband and Earcups, adjustable volume controls with stereo and mono switch. 8 ohms imp. 30–18,000Hz.

Rec. Retail £5·25 **OUR PRICE £3·75** P. & P. 25p

CAR STEREO SPEAKERS MODEL CRB-200



These dual purpose Car Speakers can be used for either shelf mounting or converted to door mounting. 5in 5 watt Speakers ensure a brilliant audio performance.

Rec. Retail £5·25* **OUR PRICE £3·50** *Per pair P. & P. 25p

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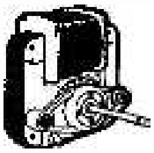


MAINS MOTOR

Precision made—as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at **72p.** Postage 20p for first one then 10p for each one ordered.

MUSIC ON TAPE

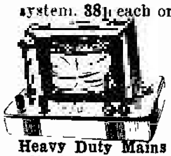
A further buy enables us to offer these at an even lower price—namely **65p** each or 5 for **£2·50.** Send for list of titles. We can't repeat when sold out.

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 **£3·42.**



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 **£6·33** plus 65p post.

BAKELITE INSTRUMENT CASE

Size approx. 6¼″ × 3¾″ × 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 **50p** 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

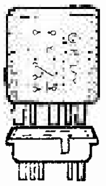
7/0076 Copper conductors. 500 metre drums available in the following colours:—Red/Brown – Yellow – Green/Grey – Blue/Green – Red/Orange – Green/White – Grey/White – Blue/Orange – Brown/Red – Brown/White – Red/Grey – Blue/Grey – Blue/Brown. Price **£2·20** per drum plus 10p post. State alternative colours.

Screened Cable 7/0076 core suitable for pick up or mike lead for later—connecting amplifiers. 10 metres. **33p.**

U.V. LIGHTING

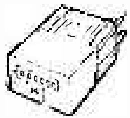
Useful for flaw detection in metals and for looking for water marks, etc., also for fitting over tropical fish tanks. African violets and other indoor plants which must have U.V. for healthy growth. The outfit comprises of a 8″ U.V. tube—choke—starter holder and tube ends. Price **£2·20** plus 20p post.

MINIATURE SEALED RELAY



American made. Our Ref. No. REL A1. Measures only ¾″ wide × ¼″ thick and ¾″ high and it's a double change over, we don't know the contact rating but estimate this at 3/5 amps. The coil resistance is 600 ohms and 9–12 volt will close it. Idea for models and miniaturised equipment. It's a plug in relay but we supply complete with base. Price **28p** including base.

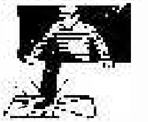
6 DIGIT COUNTER



Resettable, 440 ohm coil up to 25 impulses per second. Ex-equipment but guaranteed perfect. **£2·20** each.

Ditto but not resetable **£1·10**

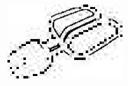
SWITCH TRIGGER MATS



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**

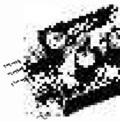
KETTLE ELEMENTS



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—1½″ (approx.) suitable for Swan and other similar models—1¾″ (approx.) suitable for G.E.C., Hotpoint, etc. All quick boil 2¼Kw elements at 240v. Price **£1·38** each.

WINDSCREEN WIPER CONTROL

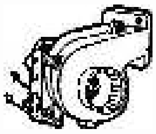
Vary speed of your wiper to suit conditions. All parts and instructions to make. **£2·48.**



MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied.
Model 1153 500mW power output **72p.**
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.

6 MAINS TRANSFORMERS

Our Ref: MTM1 27 volt at 8 amps. Upright mounting fully shrouded – flying leads—fully tapped primary. Price **£3·30.**

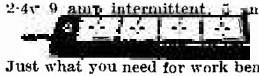
Our Ref: MTM2 12v at 1 amp. Upright mounting with fixing lugs, tag connection. 240v primary—12v 1 amp secondary. Price **83p.**

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 25p post and ins.

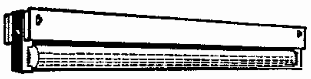
THYRISTOR LIGHT DIMMER

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

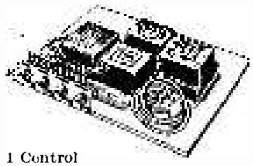
WALL THERMOSTATS. Made by the famous Smiths Instrument Co. called Colourstat. Wall mounting and in a handsome plastic case. (Cream and beige). Adjustable by slider (lockable) and may be set to control temperatures from around freezing through to 50°C. The slide panel is engraved and indicates (frost) (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



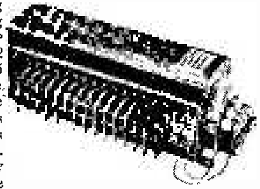
Fluorescent lighting units with polyester choke and finished white enamel. 40 ins. model. Ideal kitchen, bedroom, hallway, porch, lift, etc., with tube. Assembled ready to install. Price **£2·20** + 40p p. & p.

MULLARD UNILEX STEREO SYSTEM



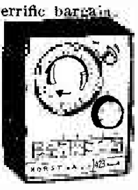
There is no doubt that it is a good system. we believe that for the money it is without comparison. We demonstrate gladly at our Tamworth Road depot. Prices of the individual items for this:—
1 Uniflex Amplifier Ref. E.P. 900 **£1·60.**
1 Unilex Pre-Amp Ref. EP.9001 **£1·98.**
1 Uniflex Power Unit Ref. EP.9002 **£2·53.** 1 Control panel kit with spun aluminium faced knobs **£3·30.** Or the complete outfit—**£11·30** post paid. Pair of 15 ohm speakers made by E.M.I. are also available if required, Price **£3·30** the pair. No extra postage if ordered with the above, otherwise add 25p.

HONEYWELL PROGRAMMER



This is a drum type timing device, the drum being calibrated in equal divisions for switch setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type. operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs. per min. Some of the many uses of this timer are Machinery control, Boiler firing. Dispensing and Vending machines. Display lighting animated and signs, Signalling, etc. Price from makers probably over £10 each. Special snip price **£6·33** plus 25p post and insurance. Don't miss this terrific bargain.

HORSTMANN 24-HOUR TIME SWITCH

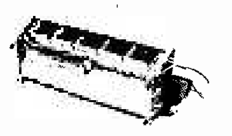


With 6 position programmer. When fitted to hot water systems this could programme as follows:—

Programme	Hot Water	Central Heating
0	Off	Off
1	Twice Daily	Off
2	All Day	Off
3	Twice Daily	Twice Daily
4	All Day	All Day
5	Continuously	Continuously

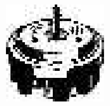
Suitable of course, to programme other than central heating and hot water, for instance, programme upstairs and downstairs electric heating or heating and cooling or taped music and radio. In fact there is no limit to the versatility of this Programmer. Mains operated. Size 3in. × 3in. × 2in. deep. Price **£3·85** as illustrated but less case.

TANGENTIAL HEATER UNIT

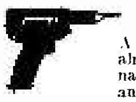


This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters. Comprises motor, impeller, 2kW, element allowing switching 1, 2W, and with thermal safety cut-out. Can be fitted into any metal case or cabinet. Only needs control switch, **£2·75.** Don't miss this. Control Switch **44p**, P. & P. 40p.

PRESSURE SWITCH



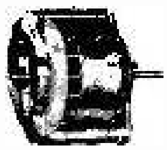
Containing a 15 amp. change over switch operated by a diaphragm which in turn is operated by air pressure through a small metal tube. The operating pressure is adjustable but is set to operate in approx. 10in. of water. These are quite low pressure devices and can in fact be operated simply by blowing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



SOLDER GUN

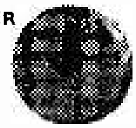
A must for every busy man, gives almost instant heat also illuminated job. 100 watt **£2 47** plus post and ins. 20p.

PAPST MOTORS



Est. 1/40th h.p. Made for 110–120 volt working but two of these work ideally together off our standard 240 volt mains. A really beautiful motor. extremely quiet running and reversible. **£1·65** each. Postage one 23p. two 33p. 230V model **£3·30.**

HOUR MINUTE TIMER



Made by Smiths. Complete with control knob and calibrated dial. Useful in kitchen. office. dark-room. etc. Bargain at **55p.**

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 at only **£1·10**

MULTI-SPEED MOTOR.

Six speeds are available 500, 850 and 1,100 r.p.m. and 8,000. 12.000 and 15,500 r.p.m. Shaft is ¼ in. diameter and approximately 1 in. long. 230/240v. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2 in. dia. × 5 in. long. Price **97p** plus 23p postage and insurance.

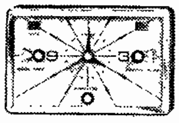
ULTRA-SONIC REMOTE CONTROLLER

As featured this issue! Our 1974 catalogue lists hundreds of bargains and probably many of the parts needed for this project. 66p brings the catalogue and the next 6 monthly supplements.

MAINS OPERATED CONTACTOR

220/240v. 50 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10 amps. Extremely well made by a German Electrical Company. Overall size 2¼ × 2 × 2in. **£2·20** each.

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.

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.

J. BULL (ELECTRICAL) LTD.

(Dept. P.W.) 7 Park Street, Croydon CRO IYD
Callers to: 102/3 Tamworth Road, CROYDON

WEYRAD

IMPORTANT ANNOUNCEMENT

IT IS WITH GREAT REGRET THAT WE HAVE TO STATE THAT OWING TO REVISED COMPANY POLICY WE SHALL NO LONGER BE PRODUCING COMPONENTS FOR AMATEUR CONSTRUCTORS OR SMALL QUANTITY USERS.

THIS CHANGE WILL COME INTO EFFECT IMMEDIATELY AND WE ARE UNABLE TO ACCEPT FURTHER ORDERS FROM THE TRADE OR INDIVIDUAL CUSTOMERS. EXISTING ORDERS WILL BE COMPLETED WITH A MINIMUM OF DELAY.

WE ARE SORRY TO HAVE TO TAKE THIS STEP WHICH HAS BEEN FORCED UPON US BY INCREASES IN THE COST OF LABOUR AND MATERIALS WHICH NOW MAKE ANY FORM OF SMALL SCALE PRODUCTION HOPELESSLY UNECONOMIC. IN CLOSING THIS PARTICULAR FACET OF OUR BUSINESS WE SHOULD LIKE TO THANK ALL OUR PAST AND PRESENT CUSTOMERS FOR THEIR VALUED SUPPORT OVER MANY YEARS.

WEYRAD (ELECTRONICS) LIMITED

G. F. MILWARD 369 Alum Rock Road, Birmingham B8 3DR. Tel. 021-327 2339

NEW! NEW! NEW! NEW!

An aerosol spray providing a convenient means of producing any number of copies of a printed circuit both simply and quickly.
Method: Spray copper laminate board with light sensitive spray. Cover with transparent film upon which circuit has been drawn. Expose to light. (No need to use ultra-violet.) Spray with developer, rinse and etch in normal manner.

Light sensitive aerosol spray	**£1·00**	plus
Developer and Etchant	**50p**	postage

NEWER THAN NEW! ! !

Fibre Glass Board pre-treated with light-sensitive lacquer enabling you to produce prototype printed circuits within five minutes.

75mm × 100mm	**33p**
150mm × 100mm	**66p**
150mm × 200mm	**£1·32**

SILICON N.P.N.

Type	*Volts*	*Frequency*	*Price*	*Type*	*Volts*	*Frequency*	*Price*
BC 108	30	150 MHz	**10p**	2N 697	60	40 MHz	**12p**
BC 109	30	150 MHz	**10p**	2N 709	15	900 MHz	**30p**
BF 179	225	125 MHz	**40p**	2N 718	60	60 MHz	**12p**
BF 180	30	625 MHz	**25p**	2N 753	25	250 MHz	**12p**
BFW 58	80	80 MHz	**15p**	2N 744	20	300 MHz	**12p**
BFX 43	30	500 MHz	**20p**	2N 1613	75	60 MHz	**17p**
BFX 86	40	50 MHz	**17p**	2N 2220	60	250 MHz	**15p**
BFY 53	30	50 MHz	**10p**	2N 3053	60	100 MHz	**17p**
BSX 19	40	500 MHz	**10p**	2N 3707	30		**12p**
BSX 67	30	200 MHz	**12p**	2N 5179	20	900 MHz	**40p**

SPECIAL OFFER
Uni-Junction Transistor Similar to 2N2646—25p

POSTAGE (MINIMUM) 20p PER ORDER

ALL GOODS 10% V.A.T.

MICROWAVE DEVICES

CL 8300	Gunn effect oscillator	9·4 GHz	**£40**
CL 8370	ditto	9·5 GHz	**£10**
CL 8380	ditto	10·5 GHz	**£10**
CL 8390	ditto	11·5 GHz	**£10**
CL 8430	ditto	9·35 GHz	**£40**
CL 8450	ditto	9·35 GHz	**£40**
CL 8470	ditto	9·35 GHz	**£40**
BXY 27	Varactor Diode. "S" Band. Cut-off	70 GHz	**£1**
BXY 28	Varactor Diode. Cut-off	100 GHz	**£1**
BXY 32	Frequency Multiplier. "X" Band	150 GHz	**£1**
BXY 35A/C	ditto	25 GHz	**£1**
BXY 36C/D	ditto	75 GHz	**£1**
BXY 37C/D	ditto	100 GHz	**£1**
BXY 38C/E	ditto	120GHz	**£1**
BXY 39C/D	ditto	150 GHz	**£1**
BXY 40D/E	ditto	180 GHz	**£1**
BXY 41C/D/E	ditto	200 GHz	**£1**
CV 7777 (AAY 51)	Microwave Mixer Diode	18 GHz	**£2**
CAY 10	Microwave Detector Diode	250 GHz	**£5**
AEY 13	Microwave Tunnel Diode	6 GHz	**£5**
AEY 16	ditto	10 GHz	**£10**
AEY 17	Microwave Detector	18 GHz	**£3**
AEY 31A	ditto	18 GHz	**£3**
BAW 95	Schottky Barrier Diode	12 GHz	**50p**

SILICON P.N.P.

Type	*Voltage*	*Frequency*	*Price*
BCY 71	45	200 MHz	**12p**
BFS 92	100	70 MHz	**20p**
BFS 95	40	70 MHz	**17p**
BFX 12	25	210 MHz	**10p**
2N 2906	60	200 MHz	**15p**
2N 3702	40	100 MHz	**11p**
2N 3703	50	100 MHz	**12p**
HIGH FREQUENCY, POWER			
BFR 64	40	1,200 MHz	**£1**
BLY 89A	35	650 MHz	**£5**
BLY 93A	60	500 MHz	**£5**
BLY 218	36	1,200 MHz	**£2**
2N 709	15	800 MHz	**15p**
2N 3926	36	250 MHz	**£1**

GERMANIUM P.N.P.

Type	*Voltage*	*Frequency*	*Price*
ACY 44	50	1 MHz	**10p**
ADY 26	80	75 watts	**£1**
AF 124	20	75 MHz	**20p**
AFY 19	32	350 MHz	**20p**
ASY 32	25	5 MHz	**10p**
ASZ 21	15	450 MHz	**20p**
GET 113	32		**10p**
GET 120	32	2 watts	**10p**
OC 123	50	1 MHz	**10p**
OCP 70	Light-sensitive		**20p**
2N 1307	30	10 MHz	**15p**
2N 1309	30	15 MHz	**15p**
2N 443	60	150 watts	**£1**

£1 100 ¼-½ WATT RESISTORS
100 CERAMIC CAPACITORS
100 DIODES
POSTAGE 20p — PACK No. 1

£1 100 RESISTORS
100 CERAMIC CAPACITORS
100 POLYSTYRENE CAPACITORS
POSTAGE 20p — PACK No. 2

£1 1 VERO-BOARD CUTTER
5 2½ in. x 1 in. x ·15 BOARDS
50 SQ. INS. "ODD PIECES" VERO
POSTAGE 20p — PACK No. 3

£1 100 RESISTORS
100 CERAMIC CAPACITORS
50 MULLARD POLYESTER CAPACITORS
POSTAGE 20p — PACK No. 4

£1 20 ASSORTED UNUSED MARKED, TESTED TRANSISTORS
BC108 ETC.
POSTAGE 20p — PACK No. 5

£1 1 TRANSISTORISED SIGNAL TRACER KIT
1 TRANSISTORISED SIGNAL INJECTOR KIT
POSTAGE 20p — PACK No. 6

£1 6 COMPUTER PANELS CONTAINING MASSES OF DIODES, TRANSISTORS, INDUCTORS, RESISTORS & CAPACITORS
POSTAGE 27p — PACK No. 7

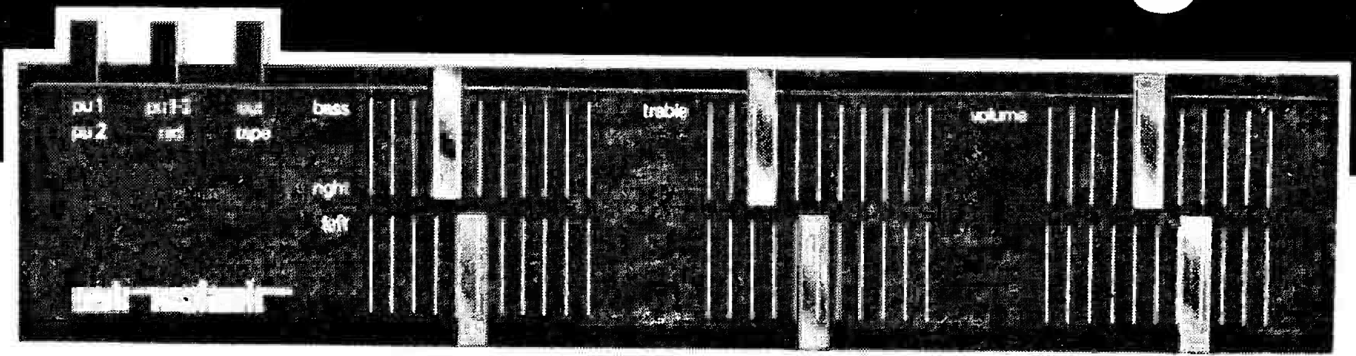
£1 100 RESISTORS
100 CAPACITORS
(ASSORTED TYPES)
POSTAGE 20p — PACK No. 8

www.americanradiohistory.com

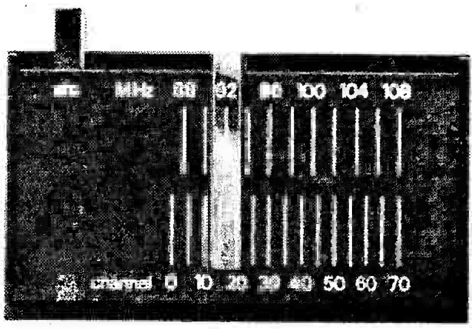
now...

Project 80

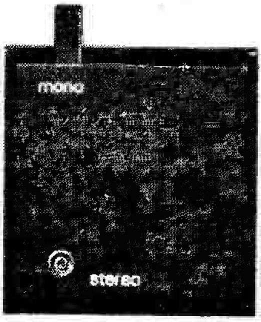
...exciting new thinking in modular hi-fi design



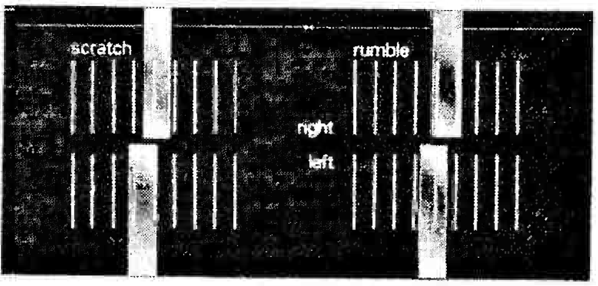
Stereo 80 pre-amplifier/control unit



Project 80 tuner

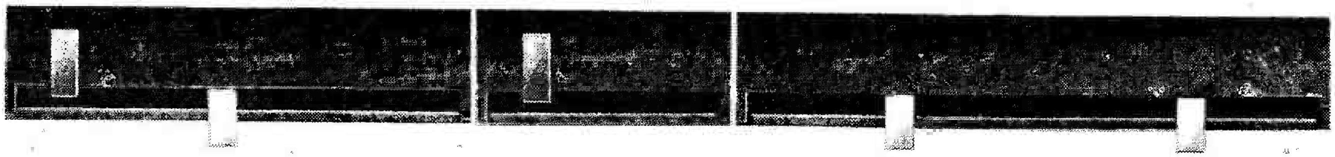


Stereo decoder



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

Project 80 new modules

Stereo 80 pre-amplifier and control unit

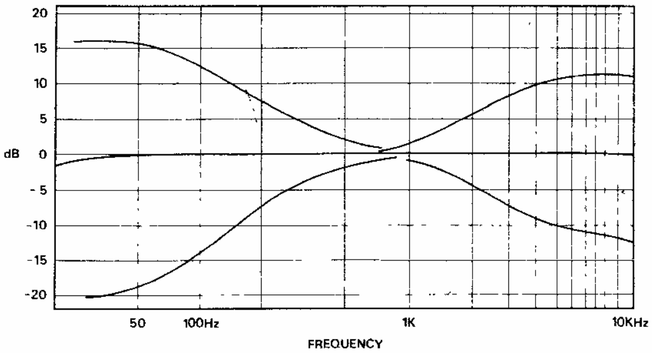
As with other Project 80 units, the Stereo 80 is mounted by means of two bolts fixed at the rear which pass through holes drilled in the wood or plastic on which modules are to be mounted. *All the electronics are contained within the ¾" deep front panel!* Connecting leads are taken away similarly out 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.

NEW

- For P.U., radio and tape
- Tape monitoring switch
- Two-hole fixing

R.R.P. £11.95 + £1 19 V.A.T

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

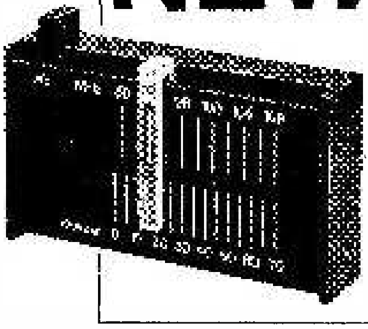


Project 80 FM tuner smaller, more efficient

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



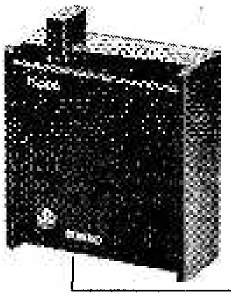
- AFC switch
- Twin dual varicap tuning
- 4-hole ceramic filter
- Slider tuning

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

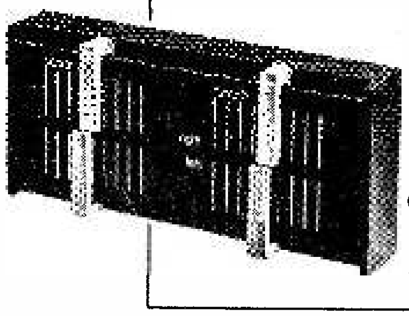
1962	Micro-miniature power amp small enough to stand on a 10p. piece. Slimline pocket receiver smaller than a 20 cigarette pack
1963	Micro-6 receiver, smaller than a matchbox
1964	Pocket F.M. receiver, PWM amp.
1965	Z.12 power amplifier module; PZ.3 power supply
1966	Stereo 25 pre-amp/control unit
1967	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



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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 × 3¾ × 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 – 4Ωmin; max. safe on open circuit

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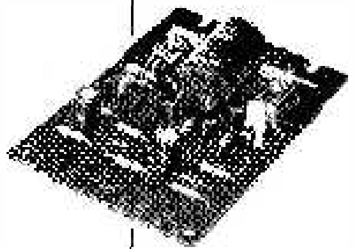

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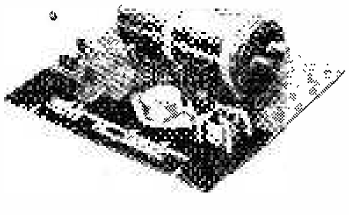

Recommended Project 80 applications

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.
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amplifier 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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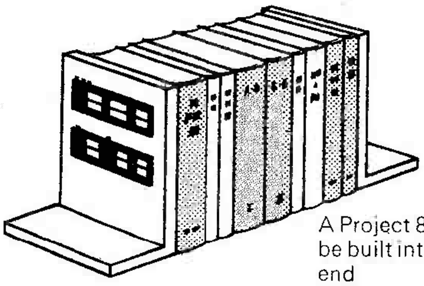
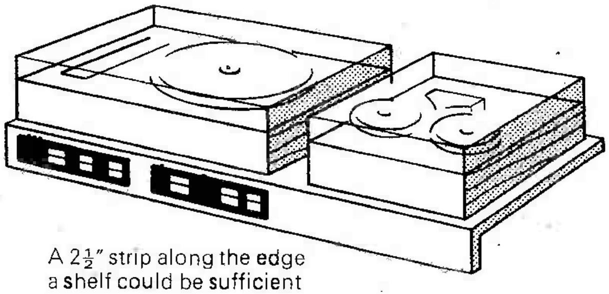
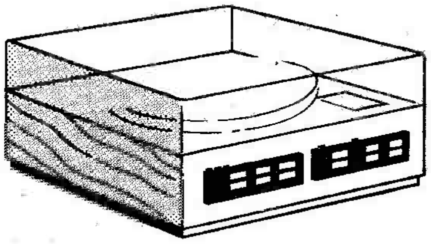


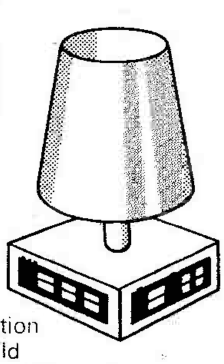
A Project 80 system could be built into a book-shelf end



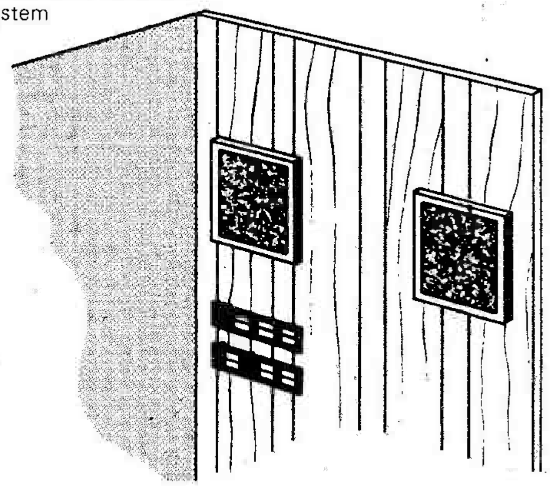
A 2½" strip along the edge a shelf could be sufficient to contain a complete system



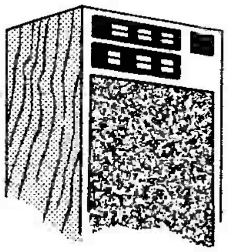
The modules mount very easily onto a playing plinth



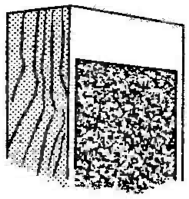
A novel application would be to build around the base of a lampshade



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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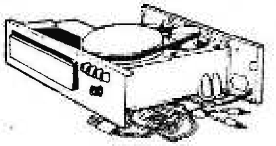

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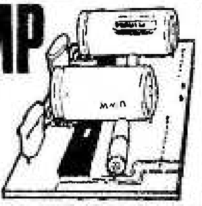

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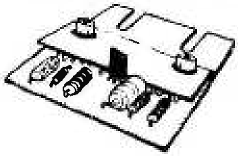

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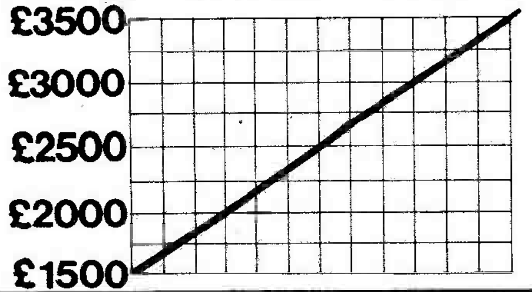

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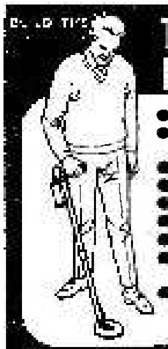

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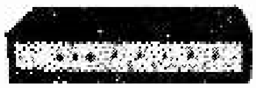

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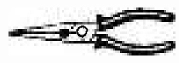

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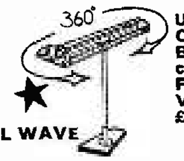

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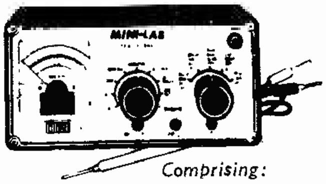

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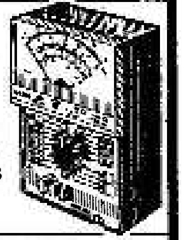

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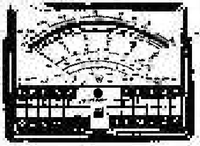

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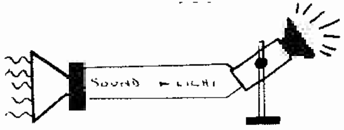

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When used with three single channel modules this unit filters the sound into bass, middle and top frequencies enabling three coloured light displays to be shown. Independent sensitivity controls on each channel. Ready built and tested. **Price £3·50** inc. VAT

OIL WHEEL PROJECTOR

Build your own using our

MULTI-COLOURED OIL WHEEL AND MOTOR KIT

Suitable for mounting on virtually all Slide Projectors.

Kit contains:

★ 6" dia. or 4" dia. OIL WHEEL (please state size required when ordering).
★ Suitable Miniature mains motor.
★ Full instructions.

For Professional Discotheque use or home enjoyment.
Price £7·15 inc. VAT

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1 500 Carbon resistors, ¼, ½, 1, 2 watt.
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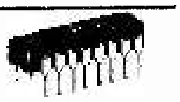
Telephone 37739

Reg. office **1 Dockyard Station Road, Old Harlow, Essex.**

All Prices FULLY INCLUSIVE of VAT

74 Series TTL

(National Semiconductors and I.T.T.)
LOW PRICES, HIGH QUALITY



* 100 plus less 10% on the 25+ column

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7400	20p	16p
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7402	20p	18p
7403	20p	18p
7404	21p	19p
7405	21p	19p
7406	54p	49p
7407	54p	48p
7408	29p	24p
7409	29p	24p
7410	20p	18p
7411	23p	21p
7412	40p	33p
7413	31p	29p
7416	49p	47p
7417	57p	53p
7420	20p	18p
7422	60p	58p
7423	60p	58p
7425	60p	53p
7426	35p	31p
7427	55p	51p
7428	85p	79p
7430	20p	18p
7432	42p	33p
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7437	77p	74p
7438	77p	74p
7440	20p	18p
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7443	£1·40	£1·32
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7446	£2·31	£2·18
7447	£1·48	£1·37
7448	£1·98	£1·81
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7453	20p	19p
7454	20p	18p
7460	20p	18p
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74145	£1·65	£1·48
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74154	£2·20	£1·87
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74156	£1·65	£1·21
74157	£1·54	£1·43
74160	£2·18	£2·05
74161	£2·18	£2·05
74162	£4·84	£4·54
74163	£4·84	£4·54
74164	£2·73	£2·63
74165	£2·73	£2·63
74166	£4·28	£3·94
74174	£2·78	£2·66
74175	£1·94	£1·81
74176	£1·99	£1·87
74177	£2·75	£2·64
74180	£2·75	£2·64
74181	£6·49	£6·05
74182	£2·16	£2·02
74184	£2·69	£2·42
74190	£3·08	£2·69
74191	£2·30	£2·24
74192	£2·53	£2·30
74193	£2·53	£2·30
74194	£3·27	£3·15
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723c	DIL	99p
723c	TO99	95p
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741c	14 PIN DIL	39p
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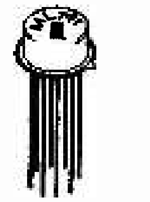
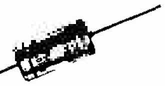
747c	DIL	46p
748c	DIL	39p
748c	TO99	41p



THE FERRANTI RADIO IC

ZN414 £1·32

Electrolytic Capacitors



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

10 VOLT

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

16 VOLT

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

25 VOLT

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

40 VOLT

6·8μF	6½p
15μF	6½p
33μF	6½p

40 VOLT

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

63 VOLT

1μF	6½p
2·2μF	6½p
4·7μF	6½p
6·8μF	6½p
10μF	6½p
22μF	6½p
68μF	10p
100μF	11p
150μF	13p
220μF	19p
330μF	22p
470μF	26p
1000μF	44p

VOLUME CONTROLS

Potentiometers

Carbon track 500Ω to 2·2MΩ. Log or Linear.
Single **13p.** Dual gang (stereo) **44p.** Single type with D.P. switch **13p** extra.

CARBON SKELETON PRESETS

Small high quality type (linear only). All valves 100-5 meg ohms.

—1 watt	**6p** each
—2·5 watt	**6½p** each

THYRISTORS

P.I.V.	50	100	200
1 Amp	28p	35p	41p
3 Amps	44p	50p	60p

P.I.V.	300	400
1 Amp	44p	53p
3 Amps	—	60p

SLIDE SWITCH

SPST **11p** each. D.P.D.T. **13p** each.

MINIATURE NEON LAMPS

240V or 110V 1·4 **5p.** 5 plus **4½p** each.

Mullard Polyester Capacitors

C280 SERIES

250V P.C. mounting: 0·01μF, 0·015, 0·022 **3½p.** 0·033, 0·047, 0·068 **4p.** 0·1 **4½p.** 0·15, 0·22 **5½p.** 0·33 **7p.** 0·47 **9½p.** 0·68 **12p.** 1μF **14p.** 1·5μF **22p.** 2·2μF **27p.**

C296 SERIES

400V: 0·001μF, 0·0015, 0·0022, 0·0033, 0·0047 **3p.** 0·0068, 0·01, 0·015, 0·022, 0·033 **3½p.** 0·047, 0·068, 0·1 **4½p.** 0·15 **6½p.** 0·22 **8½p.** 0·33 **12p.** 0·47 **14½p.**
160V: 0·01μF, 0·015, 0·022, 0·033, 0·047, 0·068 **3½p.** 0·1 **4p.** 0·15 **4p.** 0·1 **4½p.** 0·15, 0·22 **5½p.** 0·33 **7p.** 0·47 **9½p.** 0·68 **12p.** 1μF **14½p.** 1·5μF **22p.** 2·2μF **24p**

KITS

We have been appointed stockists of Amtron high quality Construction Kits.
(20p P.P. on all kits).

Other Kits include:

UK65 Transistor tester	£2·50
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UK120 Hi-Fi Amplifier 12w	£5·20
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UK235 Acoustic Alarm for Absent minded drivers	£8·39
UK300 Four channel radio control transmitter	£6·55
UK310 Radio control Receiver	£3·28
UK325 'GCX2' channel splitting unit 1000 and 2000 Hz	£7·86
UK330 'GCX2' channel splitting unit 1500 and 2500 Hz	£7·86
UK345 Superheterdyne radio control receiver	£6·55
UK515 mW Radio Receiver	£7·86
UK525 VHF Tuner 120 to 160 mHz	£12·44
UK705 Windscreen Wiper timer	£7·48
UK715 Photoelectric cell switch	£8·49
UK760 Acoustic switch	£11·85
UK875 Capactive Discharge Electronic Ignition for internal combustion engines	£14·51

Many other kits available. Send for the Amtron Catalogue.

★THESE KIT PRICES INCLUDE V.A.T.

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	0·1	0·15
2½ × 3¾	24p	19p
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3¾ × 5	31p	31p
17 × 2½	82p	63p
17 × 3¾	£1·10	87p
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Pin insertion tool	57p	57p
Spot face cutter	46p	46p
Pk 36 Pins	20p	20p

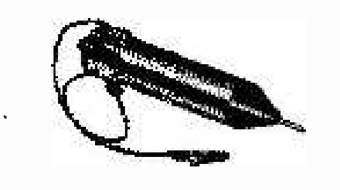
Silicon Rectifiers lamp miniature

Type	PIV	1–99
IN4001	50	6p
IN4002	100	6p
IN4003	200	6½p
IN4004	400	7p
IN4005	600	8p
IN4006	800	10p
IN4007	1000	12p

400mW ZENER DIODES

BZY88 Series 3·3 volt to 33 volt.

1–99	100 plus
7p	6p



SIGNAL INJECTOR

The UK 220 Signal Injector is a "must" for repairmen engaged in the repair and servicing of radio receivers and AF amplifiers. It permits a thorough check of the various stages to the antenna coupling circuit due to the signal it delivers, which has a frequency spectrum extending from the lowest acoustic frequencies to the highest short wave band frequencies. The unit is designed to perform quickly and efficiently all the operations involved in fault tracing, and many cases that would normally call for the set to be taken back to the repair-shop can be successfully carried out on the spot.

Specifications

Frequency:	500 Hz
Harmonics:	up to approx. 30 MHz
Output voltage:	1 V peak-to-peak
Maximum voltage applicable to the probe:	500 V DC
Power supply:	1·4 V DC
Transistors:	(2) BC208B

£2·57

ANNOUNCEMENT

Our new Retail Shop will be opening on 17th December at:—

4 Bush House,
Bush Fair Road,
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Open 9 to 5.30 Mon. to Sat.
We are looking forward to your visit.

MINITRON DIGITAL INDICATOR TYPE 3015F

Read 0·9 and decimals. ONLY **£1·65**

Resistors

¼ watt 5% carbon	1p
½ watt 5% carbon	1p
1 watt 10% carbon	2½p

range 10 ohms to 4·7 megohms.

½ watt m/o 2%	4p

range 10 ohms to 1 megohms.

Transistors/ Diodes

AC107	16p
AC126	14p
AC127	13p
AC128	13p
AC142K	22p
AC141K	20p
AC176	15p
AC187	18p
AC187K	20p
AC188	18p
AC188K	20p
ACY17	24p
ACY18	21p
ACY19	25p
ACY20	22p
ACY21	23p
ACY22	18p
ACY39	68p
AD140	40p
AD142	44p
AD143	39p
AD149	38p
AD150	60p
AD161	38p
AD162	38p
AF114	18p
AF115	18p
AF116	18p
AF117	18p
AF118	92p
AF124	27p
AF139	39p
AF239	41p
AL100	77p
AL102	66p
AL103	55p
BC107	11p
BC108	11p
BC109	11p
BC113	15½p
BC116	16p
BC125	16p
BC126	25p
BC132	16p
BC134	16p
BC135	16p
BC137	16p
BC138	36p
BC142	33p
BC143	33p
BC144	30p
BC145	26p
BC147	9p
BC148	9p
BC149	9p
BC153	16p
BC154	17p
BC157	13p
BC158	12p
BC159	14p
BC167	13p
BC168	11p
BC169	11p
BC177	15p
BC179	15p
BC182L	10p
BC183L	11p
BC184L	11p
BC186	33p
BC212L	11p
BC213L	11p
BC214L	11p
BC258	9p
BC259	9p
BC267	14p
BC268	15p
BC300	40p
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BF195	17p
BF244	27p
BF260	29p
BF329	18p
BF330	18p
BF390	37p
BFX84	28p
BFX85	35p
BFX86	22p
BFX87	28p
BFX88	26p
BFY50	21p
BFY51	17p
BFY52	17p
BFY64	39p
BFY90	72p
BSX20	19p
C407	22p
C426	33p
C428	31p
C450	17p
MP8111	35p
MP8112	42p
MP8113	35p
MP8121	33p
MP8122	44p
MP8123	50p
NKT211	28p
NKT212	28p
NKT214	25p
NKT217	55p
NKT261	23p
NKT271	20p
NKT274	20p
NKT275	25p
NKT403	71p
NKT405	83p
NKY603F	66p
NKT613G	33p
NKT674	26p
NKT677G	24p
NKT713	32p
NKT773	27p
OC19	55p
OC20	55p
OC23	49p
OC25	45p
OC28	50p
OC29	50p
OC35	50p
OC36	50p
OC44	14p
OC45	14p
OC70	23p
OC71	14p
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OC81	14p
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2N2926	10p
2N3053	26p
2N3054	55p
2N3055	52p
2N3702	11p
2N3703	11p
2N3704	11p
2N3705	11p
2N3706	11p
2N3707	11p
2N3708	11p
2N3709	11p
2N3710	11p
2N3711	9p
2N3794	17p
2N3819	28p
40361	50p
40362	50p
40636	50p

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1N914	6p
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1N4148	8p
1S44	10p
1N4007	22p
1S113	17p
BA100	16p
BA102	25p
BA115	8p
BA144	14p
BA145	22p
BA154	14p
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BAX16	14p
BAY18	19p
BAY31	9p
BY100	19p
BY126	16p
BY127	19p
BYX10	24p
OA5	19p
OA10	24p
OA47	9p
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OA85	11p
OA90	8p
OA91	8p
OA95	8p
OA200	11p

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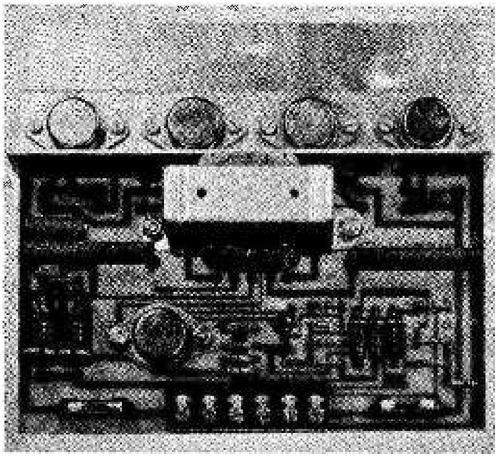
TUAC POWER MODULES



TP125 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 **£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 3in.

TL60 **£9·75**
- ★ 60 Watts RMS sine wave
- ★ RCA 115 Watt output transistors
- ★ Only six connections to make
- ★ Same size as TL100

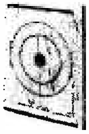
Power supplies vacuum impregnated Transformers with supply board incorporating stabilised pre-amp supply:

PS 125 ±50 volts for one TP125	£8·75
PS 100 ±45 volts for one TL100	£8·00
PS 60 ±40 volts for one TL60	£6·75
PSU 2 For supplying Disco Mixer	£3·50

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.

ALL PRICES INCLUDE V.A.T. AND POSTAGE AND PACKING
ACCESS & BARCLAY CARDS ACCEPTED, JUST SEND US YOUR NUMBER.
H.P. ARRANGED THROUGH PAYBONDS.

poly-planar
20-Watt Full Range Speaker



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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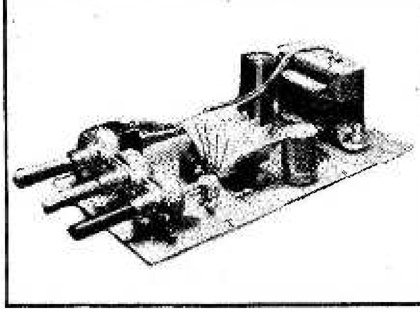
RAYMER MICROCHIP RE500



This advanced high-fidelity integrated amplifier is completely self-contained and only requires connecting to mains, speaker and input.

Ideally suited for:
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MONO CONVERSION TO STEREO
STEREO CONVERSION TO QUADRAPHONIC
(x 2 Microchip + Decoder)
T.V. AMPLIFIER
TAPE AMPLIFIER
P.A. INSTALATIONS
AUDIO ALARM ETC.

SPECIFICATIONS
OUTPUT 5 watt RMS (10w peak)
FREQUENCY RESPONSE 10hz to 50khz ±3db
TOTAL HARMONIC DISTORTION less than 1%
LOAD IMPEDANCE 4 to 16 ohms
INPUT IMPEDANCE 100k ohm Nominal
POWER GAIN 40db Typical
SIZE 140 x 60 x 45mm

With free instruction sheet.

PRICE £6. 93 (inc. VAT) plus 25p p. & p.

Guaranteed 12 months against failure in normal use.

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AC126	12p	BC148	12p	OC71	10p
AC127	12p	BC149	12p	OC72	10p
AC128	12p	BD131	49p	2N526	25p
AC187	12p	BD132	49p	2N2926R	9p
AD161	30p	BF194	15p	2N2926O	9p
AD162	30p	BF195	15p	2N2926Y	9p
AF114	12p	BFY50	22p	2N2926G	10p
AF115	12p	BFY51	22p	2N3014	10p
AF116	12p	OC26	40p	2N3053	20p
AF117	12p	OC28	40p	2N3055	55p
AF118	40p	OC35	40p	2N3704	12p
BC107	9p	OC42	10p	2N3705	9p
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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**.

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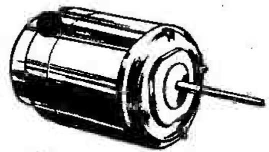

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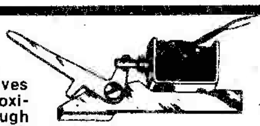

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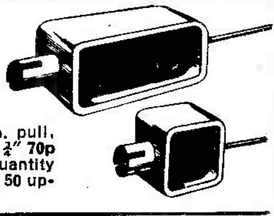

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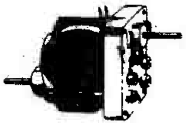

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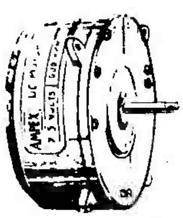

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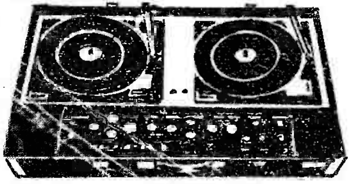

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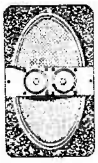

8 ohms full range (post 20p)				
FR4	4"	5 watt		£4·00
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B139/2	13" x 8"	30 watt LF		£10·25
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K2011	30 watt	8 ohms		£3·75
T27	KEF			£4·25
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