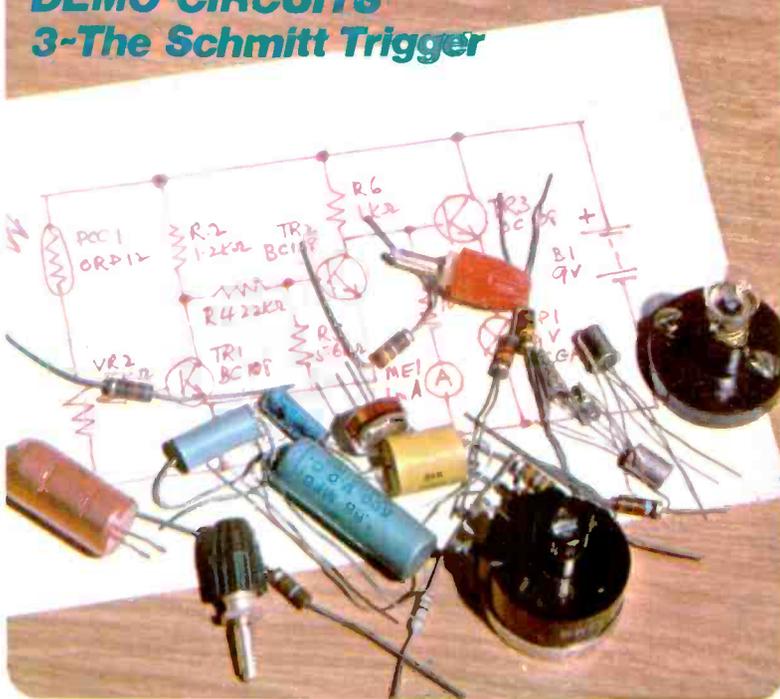


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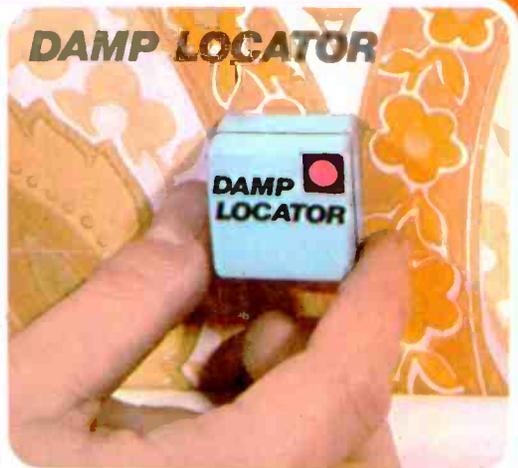
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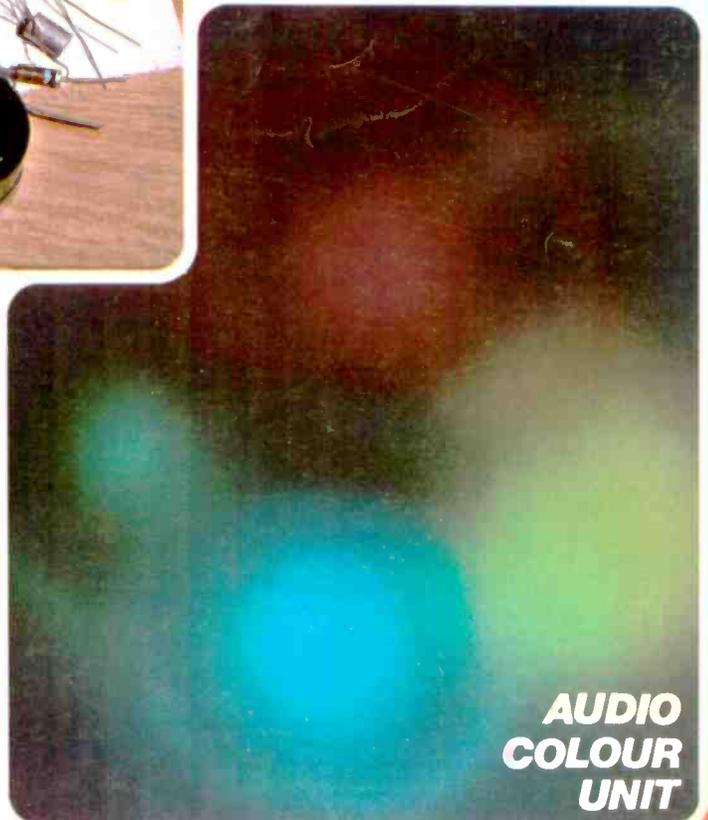
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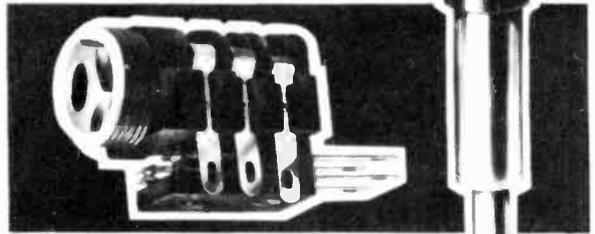
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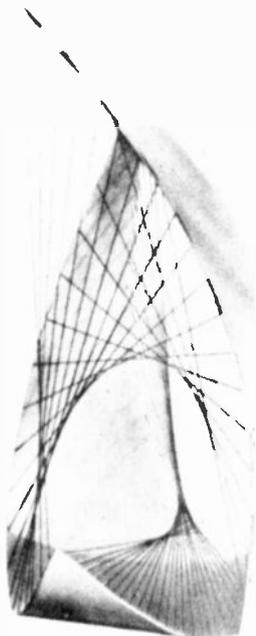
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15 amp. A.C.	£2-15
5 amp. A.C.	£2-15
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50µA	£2-80
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500µA	£2-50
1mA	£2-40
20V. D.C.	£2-40
50V. D.C.	£2-40
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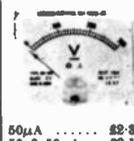
Type MR.85P. 4 1/2in. x 4 1/2in. fronts



50µA	£2-85
50-0-50µA	£2-40
100µA	£2-40
100-0-100µA	£2-30
200µA	£2-30
500µA	£2-20
500-0-500µA	£2-10
1mA	£2-10
1-0-1mA	£2-10
5mA	£2-10
10mA	£2-10

60mA	£2-10
100mA	£2-10
500mA	£2-10
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15 amp.	£2-10
30 amp.	£2-10
20V. D.C.	£2-10
50V. D.C.	£2-10
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VU Meter	£2-95
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30 amp. A.C.*	£2-10

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100µA	£2-10
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200µA	£1-95
500µA	£1-80
500-0-500µA	£1-75
1mA	£1-75
1-0-1mA	£1-75
2mA	£1-75
5mA	£1-75
10mA	£1-75
20mA	£1-75
50mA	£1-75
100mA	£1-75
150mA	£1-75

300mA	£1-75
500mA	£1-75
750mA	£1-75
1 amp.	£1-75
2 amp.	£1-75
5 amp.	£1-75
10 amp.	£1-75
3V. D.C.	£1-75
10V. D.C.	£1-75
15V. D.C.	£1-75
20V. D.C.	£1-75
50V. D.C.	£1-75
100V. D.C.	£1-75
150V. P.C.	£1-75
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150V. A.C.	£1-85
300V. A.C.	£1-85
500V. A.C.	£1-85
8 Meter 1mA	£1-85
VU Meter	£2-30

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50µA	£2-70
50-0-50µA	£2-70
100µA	£2-70
100-0-100µA	£2-70
200µA	£2-50
500µA	£2-50
1mA	£2-50
5mA	£2-50

10mA	£2-50
50mA	£2-50
100mA	£2-50
500mA	£2-50
1 amp.	£2-50
10 amp.	£2-50
5V. D.C.	£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.	£2-75
300V. A.C.	£2-75
VU Meter	£2-00

Type SD.640 63.5mm x 85mm Fronts

50µA	£2-60
50-0-50µA	£2-55
100µA	£2-55
100-0-100µA	£2-55
200µA	£2-55
500µA	£2-55
1mA	£2-35
5mA	£2-35
15mA	£2-35
50mA	£2-35
100mA	£2-35

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1 amp.	£2-35
5 amp.	£2-35
10 amp.	£2-35
5V. D.C.	£2-35
20V. D.C.	£2-35
50V. D.C.	£2-35
300V. D.C.	£2-35
15V. A.C.	£2-40
300V. A.C.	£2-40
VU Meter	£2-70

Type SD.460 46mm x 59.5mm Fronts

50µA	£2-40
50-0-50µA	£2-35
100µA	£2-35
100-0-100µA	£2-35
200µA	£2-35
500µA	£2-35
1mA	£2-15
5mA	£2-15
15mA	£2-15
50mA	£2-15
100mA	£2-15
500mA	£2-15

1 amp.	£2-15
10 amp.	£2-15
5V. D.C.	£2-15
10V. D.C.	£2-15
20V. D.C.	£2-15
50V. D.C.	£2-15
300V. D.C.	£2-15
15V. A.C.	£2-30
300V. A.C.	£2-30
VU Meter	£2-55

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Type MR.52P. 2 1/2in. square fronts

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100µA	£2-35
100-0-100µA	£2-25
200µA	£2-25
500µA	£2-25
1 amp.	£2-20
5 amp.	£2-20

10V. D.C.	£2-20
20V. D.C.	£2-20
50V. D.C.	£2-20
300V. D.C.	£2-20
15V. A.C.	£2-30
300V. A.C.	£2-30
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VU Meter	£2-50
1 amp. A.C.*	£2-20
5 amp. A.C.*	£2-20
10 amp. A.C.*	£2-20
20 amp. A.C.*	£2-20
30 amp. A.C.*	£2-20

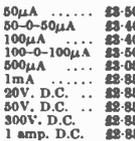
Type MR.65P. 3 1/2in. x 3 1/2in. fronts

50µA	£2-70
50-0-50µA	£2-65
100µA	£2-65
100-0-100µA	£2-50
200µA	£2-50
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
10 amp.	£2-40
15 amp.	£2-40
20 amp.	£2-40
30 amp.	£2-40
50 amp.	£2-40
5V. D.C.	£2-40

10V. D.C.	£2-40
20V. D.C.	£2-40
50V. D.C.	£2-40
150V. D.C.	£2-40
300V. D.C.	£2-40
15V. A.C.	£2-55
50V. A.C.	£2-55
150V. A.C.	£2-55
300V. A.C.	£2-55
500V. A.C.	£2-55
8 Meter 1mA	£2-60
VU Meter	£2-70
50mA A.C.*	£2-40
100mA A.C.*	£2-40
200mA A.C.*	£2-40
500mA A.C.*	£2-40
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

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50µA	£2-50
50-0-50µA	£2-40
100µA	£2-40
100-0-100µA	£2-50
500µA	£2-35
1mA	£2-35
20V. D.C.	£2-35
50V. D.C.	£2-35
300V. D.C.	£2-35
1 amp. D.C.	£2-35

5 amp. D.C. £2-55
300V. A.C. £2-55
VU Meter £2-70

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50V. d.c.	£4-85
300V. d.c.	£4-85
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50-0-50µA	£2-30
100µA	£2-30
100-0-100µA	£2-20
200µA	£2-20

500µA	£2-05
1mA	£2-70
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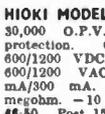
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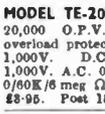
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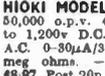
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20,000 O.P.V. 0/0-6/6/30/120/600/1,200/3,000/6,000V. D.C. 0/0.5/1/2/5/10/20/50. A.C. 0/0.5uA/6/60/600mA. 0/8K/800K/6Meg. 150 Meg. 0/2mFd. £5.97. Post 17p.



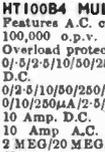
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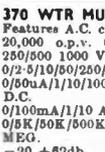
MODEL 500
30,000 O.P.V. with overload protection mirror scale 0/5/2.5/10/25/100/250/500/1,000V. D.C. 0/2.5/10/25/100/250/500/1,000V. A.C. 0/50uA/5/50/500mA. 12 amp. D.C. 0/50K/8 Meg. 50 Meg Ω.
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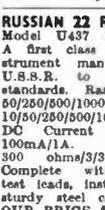
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£8.97. Post 20p.



HT100B4 MULTI-METER
Features A.C. current ranges, 100,000 o.p.v. Mirror Scale Overload protection. 0/5/2.5/10/50/250/500/1000 V D.C. 0/2.5/10/50/250/1000 V. A.C. 0/10/250uA/2.5/25/250 MA/10 Amp. D.C. 10 Amp. A.C. 0/20K/200K/2 MEG/20 MEG. -20 +62db.
£12.50. Post 25p.



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 A.C. 0/50uA/1/10/100mA/1/10 Amp. 0/100mA/1/10 Amp AC 0/5K/50K/500K/5 MEG/ 50 MEG. -20 +62db.
£15. Post 25p.



RUSSIAN 22 RANGE MULTIMETER
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 100uA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3m Ω. Complete with batteries, test leads, instructions and sturdy steel carrying case.
OUR PRICE £5.97. Post 25p.



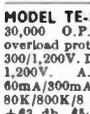
ROUND SCALE TYPE PENCIL TESTER
MODEL P.T.S. 68
Completely portable, simple to use pocket sized tester. Ranges 0/3/30/300 AC and DC at 2,000 o.p.v. Resistance 0-20K ohms. ONLY £1.97. Post 13p.



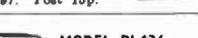
LT601 MULTIMETER
New style 20,000 o.p.v. pocket multi-meter. 5/25/50/250/500/2500 V. D.C. 10/50/100/500/1000V. A.C. 50uA/250mA. 6K/6 meg ohms. -20 to +22db.
£3.75. Post 20p.



MODEL TH-12
20,000 o.p.v. Overload protection. Slide switch selector 0/1/25/2.5/10/50/250/1000V. A.C. 0/50uA/25/250mA. D.C. 0/3K/30K/300K/3 meg -20 to +50db.
£4.97. Post 15p.



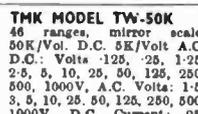
MODEL TE-300
30,000 O.P.V. Mirror scale, overload protection. 0/5/15/150/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30uA/60uA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm -20 to +63 db. £5.97. Post 15p.



MODEL PL436
20k Ω/Volt D.C. 8k Ω/Volt AC. Mirror scale. 6/12/30/120/600 V D.C. 0/10/100/1000 V A.C. 50/600uA/60/600 mA. 10/100K/1 Meg/10 Meg Ω. -20 to +46db.
£8.97. Post 12p.



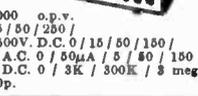
TMK MODEL TW-50K
46 ranges, mirror scale, 50K/Vol. D.C. 5K/Volt A.C. D.C. Volts: 125, 25, 1.25, 2.5, 5, 10, 25, 50, 125, 250, 500, 1000V. A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 500uA, 2.5, 5, 25, 50, 250, 500mA. 5, 10 amp. Resistance: 10K/100K/1 MEG. 10 MEG Ω. Decibels: -20 to +81-6db
£8.50. Post 17p.



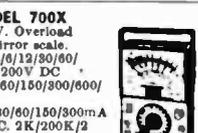
MODEL K228A
Taut band suspension. Overload protection. Polarity reversing switch. 30,000 o.p.v. 0/7.5/2.5/15/50/250/500/1000/2500V. D.C. 0/15/50/150/500/1000 A.C. 0/50uA/5/50/150/500mA/5A. D.C. 0/3K/300K/3 meg. £8.95. Post 20p.



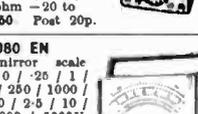
HIOKI MODEL 700X
100,000 O.P.V. Overload protection. Mirror scale. 3/7.5/2.5/15/30/120/60/120/300/600/1200V D.C. 1.5/8/15/30/60/150/300/600/1200 V. A.C. 15/30uA/3/6/30/60/150/300mA 6/12 AMP. DC. 2K/200K/2 Meg/20 Meg ohm -20 to +63db. £12.50 Post 20p.



MODEL C-7080 EN
Giant 6" mirror scale 20,000 o.p.v. 0/25/1/2.5/10/50/250/1000/5000V. D.C. 0/2.5/10/50/250/1000/5000V. A.C. 0/50uA/1/10/100/500mA/10 amp. D.C. 0/2K/1200K/20 meg -20 to +50 db.
£13.95. Post 35p.



U4312 MULTIMETER
Rugged, sturdy instrument for general electrical use. 607 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. 0/300uA/1.5/6/15/60/150/300mA/1.5/6 AMP. A.C. 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. £9.50. Post 25p.



Selected TEST EQUIPMENT

FTC-401 TRANSISTOR TESTER
Full capabilities for measuring A, B and 100. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads.
£7.50. Post 20p.



TE-16A TRANSISTORISED SIGNAL GENERATOR
5 ranges 400KHz-30MHz. An inexpensive instrument for the handyman. Operates on 8v battery. Wide easy to read scale, 800KHz modulation. 51 x 51 x 3 1/2". Complete with instructions and leads. £7.97. Post 25p.



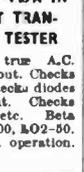
Model S-100TR MULTIMETER TRANSISTOR TESTER
100,000 o.p.v. mirror scale/overload protection. 0/12/-6/3/12/30/120/600 V. DC. 0/6/30/120/600 V. AC. 0/12/600uA/12/300mA/12 AMP DC. 0/10 K/1 MEG/100MEG -20 to +50db. 0.01-2 MPD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. £13.50. Post 25p.



TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE
A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1 Ω 11-1 meg Ω. 6 Ranges ±1% L1 L2 H 111 HENRYs 6 Ranges 2-2% C10pF ±110mFD 6 Ranges ±2%. TURNs RATIO 1:1/1000-1:1/100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100uA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 5 x 2in. £20. Post 25p.



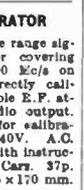
MODEL 49A IN CIRCUIT TRANSISTOR TESTER
Checks true A.C. beta in/out. Checks Ico. Checks diodes in / out. Checks SCR, etc. Beta HI 10-500, LO 2-50. Ico 0-5000uA. 220/240 V. A.C. operation.
£17.50. Post 25p.



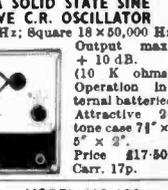
MODEL TE-15 GRID DIP METER
Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440Kc/s-280Mc/s in 6 colls. 500uA Meter. 9V battery operation. Size 180 x 80 x 40mm.
£18.50. Post 20p.



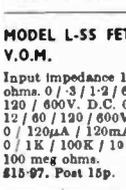
TE-20D RF SIGNAL GENERATOR
Accurate wide range signal generator covering 120 Kc/s 500 Mc/s on 6 bands. Directly calibrated Variable E.F. attenuator, audio output. Xial socket for calibration. 220/240V. A.C. Brand new with instructions £15. Carr. 37p. Size 140 x 215 x 170 mm.



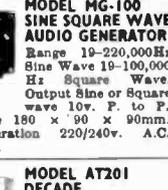
BELCD AF-5A SOLID STATE SINE SQUARE WAVE CR. OSCILLATOR
Sine 18 x 200,000 Hz; Square 18 x 50,000 Hz. Output max. +10 dB. (10 K ohms) Operation internal batteries Attractive 2-tone case 7 1/2 x 5 x 2". Price £17.50. Carr. 17p.



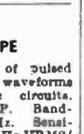
MODEL L-55 FET V.O.M.
Input impedance 10 meg ohms. 0/3/1.2/6/30/120/600V. D.C. 0/3/12/60/120/600V. A.C. 0/120uA/120mA D.C. 0/1K/100K/10 meg/100 meg ohms.
£18.97. Post 15p.



MODEL MG-100 SINE SQUARE WAVE AUDIO GENERATOR
Range 19-220,000Hz Sine Wave 19-100,000 Hz. Square Wave. Output Sine or Square wave 10v. P. to P. Size 180 x 90 x 90mm. Operation 220/240V. A.C.
£17.50. Post 37p.



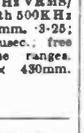
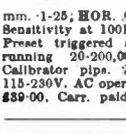
CI-5 PULSE OSCILSCOPE
For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/mm. 1-25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz. V RMS/mm. 3-25; Preset triggered sweep 1-3,000uSec. free running 20-300,000Hz in nine ranges. Calibrator pins. 220 x 360 x 430mm. 115-230V. AC operation. £39.00. Carr. paid.



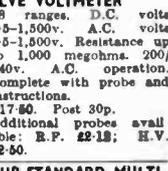
MODEL AT201 DECADE ATTENUATOR
Frequency range 0-200KHz. Attenuator 0-111db. 0.1db step. Impedance 600 ohms. Max. input power 30dbm. Size 150 x 90 x 65mm.
£18.50. Post 37p.



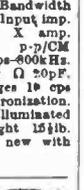
TO-3 PORTABLE OSCILSCOPE
3in. tube, Y amp. Sensitivity 0.1v p-p/CM. Bandwidth 1.5 cps-1.5 MHz. Input imp. 2 meg Ω 20pF X amp. sensitivity 0.8v p-p/CM. Bandwidth 1 cps-600KHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps 300 kHz. Synchronization. Internal/external. Illuminated scale 140 x 215 x 330 mm. Weight 15lb. 220/240V. A.C. Supplied brand new with handbook. £40.00. Carr. 50p.



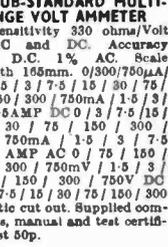
TE-65 VALVE VOLTMETER
28 ranges. D.C. volts 1.0-1,500V. A.C. volts 1.0-1,500V. Resistance up to 1,000 megohms. 200/240V. A.C. operation. Complete with probe and instructions.
£17.80. Post 30p. Additional probes available: B.F. £2.18; H.V. £2.50.



RUSSIAN CI-16 DOUBLE BEAM OSCILSCOPE
5 mc/s Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 8in. x 4in. C.R.T.C. Calibrated, triggered sweep from 2 uSec. to 100 mill-sec. per cm. Free running time base 50 o/s-1 mc/s. Built-in time base calibrator and amplitude recorder. Supplied complete with all accessories and instruction manual.
£27. Carr. Paid.



MODEL U4311 SUB-STANDARD RANGE VOLT AMMETER
Sensitivity 330 ohm/Volt AC and DC. Accuracy 5% D.C. 1% AC. Scale length 165mm. 0/300/700uA/1.5/3/7.5/15/30/75/150/300/750mA/1.5/3/7.5-AMP DC 0/3/7.5/15/30/75/150/300/750V AC 0/150V/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.



G. W. SMITH & CO (RADIO) LTD.
Also see opposite page and next two pages

UMR-30 RECEIVER

4 Bands covering 550kc/s - 30Mc/s. B.F.O. Built-in speaker 220/240v A.C. Brand new with instructions. \$15.75 Carr. 37p.



UR-1A SOLID STATE COMMUNICATION RECEIVER

4 Bands covering 550kc/s-30Mc/s. PET 8 Meter. Variable BFO for SSB. Built-in Speaker. Bandspread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12 1/2" x 4 1/2" x 7 1/2" Brand new with instructions. \$25. Carr. 37p.

SKYWOOD CX203 COMMUNICATION RECEIVER



Solid state. Coverage on 5 bands 200-420 KHz and .55 to 30 MHz. Illuminated aldo rule dial. Bandspread. Aerial tuning BVO, AVC, ANL, 'S' meter. AM/CW/SSB. Integrated speaker and phone socket. Operation 220/240v AC or 12v DC. Size 225 x 265 x 185 mm. Complete with instructions and circuit. \$28.50. Carr. 50p.

LAFAYETTE HA-400 SOLID STATE RECEIVER



General coverage 160-400kc/s. 550 Kc/s-30Mc/s. PET front end. 2 mech. filters, product detector, variable B.F.O. noise limiter. 8. Meter. Bandspread, RF Gain. 18" x 8 1/2" x 8 1/2". 18 lbs. 220/240v. A.C. or 12v. D.C. Brand new with instructions. \$50. Carr. 50p.



TRIO 9R59DS COMMUNICATION RECEIVER

4 band covering 550Kc/s. to 30 Mc/s continuous and 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW. ANL. Variable BFO. 5 meter. Sep. bandspread dial. IF frequency 455 Kc/s. audio output 1.5w. Variable RF and AF gain controls 116/250v. A.C. Size: 7" x 13" x 10" with instruction manual. \$49.50. Carr. Paid



EMI LOUSPEAKERS

Model 350. 13" x 8" with single tweeter/crossover. 30-20,000 Hz. 15 watt RMS. Available 8 or 15 ohms. \$7.95 each P. & P. 37p. Model 450. 15" x 8" with twin tweeter/crossover. 55-13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. \$8.65 each. Post 25p.

HONEYWELL DIGITAL VOLTMETER VT.100



Can be panel or bench mounted. Basic meter measures 1 volt D.C. but can be used to measure a wide range of AC and DC volt. current and ohms with optional plug in cards. Specification: Accuracy: ± 0.2, ± 1 digit. Resolution: 1meV. Number of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1.999). Input impedance: 1000 Meg ohm. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100v. D.C. Input: Fully floating (3 poles). Input power: 110-230v. A.C. 50/60 cycles. Overall size: 5 1/2" x 2 1/2" x 3 1/2". AVAILABLE BRAND NEW AND FULLY GUARANTEED. \$25.50. Carr. 50p.

SINCLAIR IC-12



List Price £2.99
OUR PRICE £1.80
P. & P. 10p

SINCLAIR EQUIPMENT

Project 60. Package offers.



2 x Z30 amplifier, stereo 60 pre-amp, P23 power supply. \$15.95 Carr. 37p. Or with P23 power supply \$18.00 Carr. 37p. 2 x Z30 amplifier, stereo 60 pre-amp, P23 power supply. \$20.55. Carr. 37p. Transformer for P23. \$2.97 extra. Add to any of the above \$4.45 for active filter unit and \$13.00 for pair of Q16 speakers. All other Sinclair products in stock. 2000 Amp \$31.95 Carr. 37p.; 3000 Amp \$28.50 Carr. 37p.; Neoteric Amp \$44.95. Carr. 37p. IC12 \$1.90 p. & p. 10p. NEW PROJECT 605 - \$80.97. Carr. 37p.

SPECIAL OFFER! GOODMANS AXIOM 301

Hi Fi 12" 20 watt twin cone full range speaker. 30-16,000 Hz. 16,500 gauss. 8 ohm impedance. Brand new and boxed. (List price \$21.72) OUR PRICE \$12.80 each. Carr. 50p.



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, 7 1/2" x 3" x 4 1/2". \$25.97. Post 15p.



SPECIAL OFFER! STEREO SPEAKERS

Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size 14 1/2" x 9" x 7 1/2". 8 ohms. 8 watt RMS. 16 watt peak. Complete with DIN lead. \$12.95 pr. Carr. 50p.



HA-10 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 5MU/100MU. Output 50MW. \$5.97. Post 15p.



SPECIAL PURCHASE! NEAT G30J STATIC BALANCE PICK-UP ARMS



Identical specification to NEAT G30 arm but with two-tone chrome and black finish. Complete with head shell, pick up rest and plug in phono leads. BRAND NEW - FULLY GUARANTEED ONLY £8.95. P. & P. 25p.

ARF-300 AF/RF SIGNAL GENERATOR



All transistorised, compact, fully portable. AF also 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. A.C. Complete with instructions and leads. \$29.95. Post 50p.

AKAI BARGAINS

SUPER MONEY SAVING OFFERS— BUY NOW WHILE STOCKS LAST! ALL BRAND NEW AND FULLY GUARANTEED



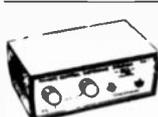
1721 Tape Rec.	\$75.95	GXC40 Cassette Rec.	\$28.95
X5000 Tape Rec.	\$89.95	GXC40D Cassette Deck	\$66.95
GX370 Tape Rec.	\$259.95	GXC40T Cassette/Receiver	\$128.95
4000D Tape Deck	\$61.50	GXC45D Cassette Deck	\$85.95
4000DB Tape Deck	\$73.95	GXC46D Cassette Deck	\$108.50
X201D Tape Deck	\$182.95	GXC60D Cassette Deck	\$111.25
X221D Tape Deck	\$189.50	GXC65D Cassette Deck	\$110.25
GX220D Tape Deck	\$143.50	CS8D Cassette Deck	\$59.50
GX280D Tape Deck	\$240.40	AA6200 Receiver	\$74.95
X1810D Tape/8 track Deck	\$189.95	AA6300 Receiver	\$83.50
GX1900D Tape/Cass. Deck	\$177.95	AA6600 Receiver	\$109.00
X2008D Tape/Cass/8 Rec.	\$223.30	AA8500 Receiver	\$175.00
CR81 8 track Rec.	\$92.95	ADM11 Microphones (Pair)	\$7.50
CR81D 8 track Rec.	\$65.95		
CR81T 8 track/Receiver	\$118.90		
CR808B 8 track system	\$146.00		
CS85 Cassette Rec.	\$79.00		
CS85D Cassette Deck	\$74.95		

Carriage 50p extra. (Recorders & Decks 75p)

DOLBY SYSTEM NOISE REDUCTION UNIT



Improves the performance of cassette and semi-professional recorders. Reduces tape hiss by 3dB at 600Hz, 6dB at 1900Hz and 10dB for all frequencies above 3000Hz. Controls for input levels and noise reduction on record and replay. 2 meters for Dolby level. Off tape monitoring. Frequency response: 20Hz to 15kHz ± 1dB 19kHz - 35dB. Size 13 1/2" x 9" x 3 1/2". AC 200/250v. OUR PRICE £32.50 Carr. 50p.



1021 STEREO LISTENING STATION

For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 3 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" x 4" x 2 1/2". \$23.85. P. & P. 15p.



MP7 MIXER PREAMPLIFIER

5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9 1/2" x 8" x 3". Inputs Mic: 3 x 2mV 50K - 2 x 2mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 280mV 100K. \$8.97. P. & P. 30p.



TE-1035 STEREO HEADPHONES

Low cost high performance stereo headphones. Foam rubber ear cups. Adjustable head-band. 8 ohm impedance 28-15,000 Hz. With lead and stereo jack plug. ONLY £1.97. P. & P. 12p.

NEW GARRARD MODULES



Popular range of Garrard decks with Shure cartridge fitted in deluxe plinth with hinged lid. SP25 III Module/M75-6 \$29.50 AP76 Module/M75-6 \$28.80 AP96 Module/M75-6 \$28.75 Zero 1008 Module/M93E \$53.00 Carr. 50p extra any item.

HOSIDEN DH-08S DE-LUXE STEREO HEADPHONES

Features unique mechanical 2 way units and fitted adjustable level controls. 8 ohm impedance 20-20,000cps. Complete with spring lead & stereo jack plug \$7.97. Post 12p.

GENUINE BARGAIN!



KOSS 3P JXC STEREO HEADPHONES
Response 10-16,000Hz. Impedance 4-8 ohms. Brand new. Bored & fully guaranteed (List \$9.50). OUR PRICE \$6.50. Post 25p.

HOSIDEN DH-02S STEREO HEADPHONES



Wonderful value and excellent performance combined. Adjustable head-band. 8 ohm impedance. 20-12,000 cps. Complete with lead and plug. ONLY \$3.97. Post 12p.

TAPE CASSETTES

Top quality Hi-Fi Low Noise in Library cases.



C80 3 for 75p. 10 for \$2.25
C90 3 for \$1.95 10 for \$2.00
C120 3 for \$1.35 10 for \$4.80
Tape Head Cleaner 80p each. P. & P. 10p extra.



SPECIAL OFFER! ROTEL RH700 STEREO HEADPHONES

20-20,000Hz. 8-16 ohm. (List \$9.95). OUR PRICE \$6.75. Post 25p.

SPECIAL PURCHASE! LEAK MINI-SANDWICH SPEAKERS



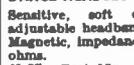
Brand new and fully guaranteed. 5 watts, 8 ohm. Teak finish. (Rec. list \$59.50 pr.) OUR PRICE \$29.50 pair. Carr. \$1.00.

TRANSISTORISED FM TUNER



6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6 x 4 x 2 1/2 in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 82-106MHz. Ready built ready for use. Fantastic value for money. \$6.97. P. & P. 12p. Stereo multiplex adaptors \$4.97.

TE 1018 DE-LUXE MONO HIGH IMPEDANCE DANCESET



Sensitive, soft earpads, adjustable headband. Magnetic impedance 2,000 ohms. £1.97. Post 15p.

G. W. SMITH & CO (RADIO) LTD.
Also see previous pages and opposite page

FANTASTIC OFFER!

NIKKO TRM 50 STEREO AMPLIFIER



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TELETON CRI0T/RG42 SYSTEM

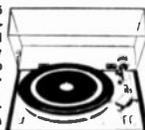


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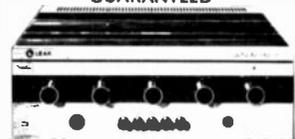
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Teleton SAQ206B 8+8 watt amplifier, BSR MP60, plinth & cover, Goldring G800 cartridge, pair of Apollo speakers and all leads.

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in plain aluminium with sloping front panel.

Type	H.	W.	D.	Price p. & p.
SF1	2in	5½in	2½in	45p 12p
SF2	2in	7½in	3in	60p 16p
SF3	2in	9½in	4in	75p 19p

Stove-enamelled silver-grey hammer finished, 25p extra.

CONSOLE CASES

in plain aluminium, ideal for mixers, instruments, etc.

Type	W.	A	B	C	D	Price p. & p.
GB20	8	3½	2	3	3	£1-42 30p
GB21	10	9	3½	2	3	£1-58 30p
GB22	12	9	3½	2	3	£1-72 30p

VEROBOARD

Size	0-1 matrix	0-15 matrix
2½in × 3½in	22p	16p
2½in × 5in	24p	25p
3½in × 3½in	24p	25p
3½in × 5in	27p	29p
17in × 2½in	75p	37p
17in × 3½in	41p	75p

Pins—either size, packet of 36, 18p

ELECTROLYTICS

1µF 450V	19p	1,000µF 25V	27p
2µF 450V	20p	1,000µF 50V	27p
4µF 450V	14p	2,000µF 25V	39p
8µF 450V	17p	2,000µF 50V	53p
16µF 450V	18p	2,500µF 25V	45p
25µF 25V	7p	2,500µF 50V	60p
25µF 50V	10p	3,000µF 25V	48p
32µF 450V	27p	5,000µF 25V	60p
50µF 50V	10p	5,000µF 50V	£1-10
100µF 25V	10p	8-8µF 450V	18p
100µF 50V	11p	8-16µF 450V	20p
250µF 25V	14p	16-16µF 450V	27p
250µF 50V	17p	16-32µF 450V	63p
500µF 25V	18p	32-32µF 450V	49p
500µF 50V	25p	50-50µF 350V	38p

MINIATURE ELECTROLYTICS

1µF 63V	6p	47µF 16V	7p
2.2µF 63V	6p	47µF 25V	6p
3.3µF 63V	6p	68µF 16V	6p
4.7µF 63V	6p	100µF 10V	6p
8µF 40V	7p	220µF 16V	7p
10µF 25V	6p	330µF 16V	11p
10µF 64V	7p	470µF 10V	11p
16µF 40V	7p	1,000µF 16V	19p
33µF 16V	6p	1,500µF 16V	23p

CASSETTE OWNERS!

For Philips and similar cassette recorders.
 PU12 Power unit for connection to 12V + or - E car electrical systems, giving 7½V, stabilised output. **£3-25**
 PU14 As above but switched for 4.5-10V output. **£5-10**
 PP75 Mains power supply, output 7½V d.c. **£1-95**
 All units are complete with cable and plug.

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Top quality British made, low noise, complete with transparent library cases—
 C60—40p; C90—55p; C120—70p

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suitable for transistor radios and similar light current equipment
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 PP9 Input 240V a.c. Output 9V d.c.
 Price £1-50 plus 12p p. & p.

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Post Free 15p

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Single, less switch, 15p
 Single, D.P. switch, 24p
 Tandem, less switch, 40p
 5kΩ, 10kΩ, 25kΩ, 50kΩ, 100kΩ, 250kΩ, 500kΩ, 1MΩ, 2MΩ

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Carbon
 All 5%, high-stability, E12 values. ½W, 1p; ¼W, 1½p; 1W, 4p; 2W, 6p
 Wire-wound
 5W, 10p; 10W, 12p

SWITCHES

Toggle switches, standard size.
 SW20—S.P.S.T. 18p; SW21—D.P.D.T. 23p.
 Push Button, miniature, SW1—13p.
 Wafer switches (rotary)—24p each.
 SW4—1 pole, 12 way, SW5—2 pole, 6 way.
 SW6—3 pole, 4 way, SW7—4 pole, 2 way.
 SW8—4 pole, 3 way.

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B.A.F. wadding, 18in wide, 1in thick. The ideal lining for speaker enclosures. 30p per yard. p. & p. one yard 12p; each extra yard 4p.

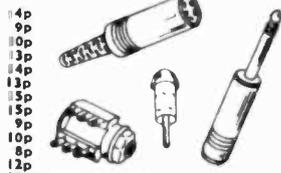
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 Co-axial
 D.I.N. 2 pin (speaker)
 D.I.N. 3 pin
 D.I.N. 4 pin
 D.I.N. 5 pin, 180°
 D.I.N. 5 pin, 240°
 D.I.N. 6 pin
 Jack, 2½mm unscreened
 Jack, 2½mm screened
 Jack, 3½mm unscreened
 Jack, 3½mm screened
 Jack, 4mm unscreened
 Jack, 4mm screened
 Jack, stereo, unscreened
 Jack, stereo, screened
 Phone, plastic top
 Phone, plated metal
 Wander, red or black
 Banana 4mm, red or black



SOCKETS

Car aerial
 Co-axial, surface
 Co-axial, flush
 D.I.N. 2 pin (speaker)
 D.I.N. 3 pin
 D.I.N. 5 pin, 180°
 D.I.N. 5 pin, 240°
 Jack, 2½mm
 Jack, 3½mm
 Jack, 4mm
 Jack, 4mm switched
 Jack, stereo, unscreened
 Jack, stereo, screened
 Phone, 2 on a strip
 Phone, 3 on a strip
 Phone, 4 on a strip
 Wander, single, red or black
 Wander, twin strip
 Banana 4mm red, or black

LINE SOCKETS

Car aerial
 Co-axial
 D.I.N. 2 pin (speaker)
 D.I.N. 3 pin
 D.I.N. 5 pin, 180°
 D.I.N. 5 pin, 240°
 Jack, 2½mm
 Jack, 3½mm
 Jack, 4mm
 Jack, stereo, screened
 Jack, stereo, unscreened
 Phone, plated metal

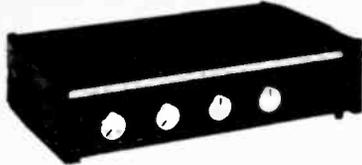
CAPACITORS

2.2pF	500V	S/M	7½p	0.0027µF	500V	S/M	15p
3.3pF	500V	S/M	7½p	0.0033µF	125V	P.S.	5p
5pF	500V	S/M	7½p	0.0033µF	500V	Poly.	6p
10pF	125V	P.S.	5p	0.0033µF	1,000V	MDC	6p
10pF	500V	S/M	7½p	0.0036µF	500V	S/M	15p
15pF	125V	P.S.	5p	0.0047µF	125V	P.S.	9p
15pF	500V	S/M	7½p	0.0047µF	+300V	Poly.	5p
15pF	500V	S/M	7½p	0.0047µF	500V	S/M	20p
18pF	500V	S/M	7½p	0.0047µF	1,000V	MDC	6p
22pF	125V	P.S.	5p	0.005µF	100V	Mylar	3p
22pF	500V	S/M	7½p	0.005µF	500V	Cer.	5p
25pF	500V	S/M	7½p	0.0068µF	125V	P.S.	10½p
27pF	500V	Cer.	4p	0.0068µF	500V	S/M	30p
33pF	125V	P.S.	5p	0.0068µF	500V	Poly.	6p
33pF	500V	S/M	7½p	0.0082µF	500V	S/M	10½p
39pF	500V	S/M	7½p	0.0082µF	500V	S/M	30p
47pF	125V	P.S.	5p	0.01µF	18V	Disc	4p
47pF	500V	Cer.	4p	0.01µF	125V	P.S.	10½p
50pF	500V	S/M	7½p	0.01µF	160V	Poly.	4p
56pF	500V	S/M	7½p	0.01µF	250V	M.F.	3p
68pF	500V	S/M	7½p	0.01µF	400V	M.F.	3p
68pF	500V	S/M	7½p	0.01µF	500V	Cer.	5p
75pF	500V	S/M	7½p	0.01µF	500V	S/M	30p
82pF	500V	S/M	7½p	0.01µF	600V	MDC	7p
100pF	125V	P.S.	5p	0.01µF	1,000V	MDC	9p
100pF	500V	S/M	7½p	0.015µF	160V	Poly.	3p
100pF	500V	S/M	7½p	0.015µF	400V	Poly.	3p
120pF	500V	S/M	7½p	0.022µF	100V	Mylar	4p
150pF	125V	P.S.	5p	0.022µF	18V	Disc	5p
150pF	500V	S/M	7½p	0.022µF	250V	M.F.	3p
150pF	500V	Cer.	5p	0.022µF	400V	Poly.	3p
180pF	500V	S/M	7½p	0.022µF	600V	MDC	7½p
200pF	500V	S/M	7½p	0.022µF	1,000V	MDC	10p
220pF	125V	P.S.	5p	0.033µF	250V	M.F.	4p
220pF	500V	Cer.	5p	0.033µF	400V	Poly.	4p
250pF	500V	S/M	7½p	0.047µF	12V	Disc	6p
270pF	500V	Cer.	5p	0.047µF	160V	Poly.	3p
300pF	500V	S/M	8p	0.047µF	250V	M.F.	3p
330pF	125V	P.S.	5p	0.047µF	400V	Poly.	4p
330pF	500V	S/M	8p	0.047µF	600V	MDC	8p
390pF	500V	S/M	8p	0.047µF	1,000V	MDC	10p
470pF	125V	P.S.	5p	0.1µF	30V	Disc	4p
470pF	750V	Disc	3p	0.1µF	250V	M.F.	4p
500pF	500V	S/M	8p	0.1µF	400V	Poly.	5p
560pF	500V	S/M	8p	0.1µF	600V	MDC	10p
680pF	125V	P.S.	6p	0.1µF	1,000V	MDC	14p
680pF	500V	S/M	8p	0.15µF	250V	M.F.	5p
820pF	500V	S/M	8p	0.22µF	160V	Poly.	6p
0.001µF	100V	Mylar	5p	0.22µF	250V	M.F.	5p
0.001µF	125V	P.S.	6p	0.22µF	400V	Foil	10p
0.001µF	400V	Poly.	3p	0.22µF	1,000V	MDC	15p
0.001µF	500V	S/M	10p	0.33µF	250V	M.F.	8p
0.001µF	500V	Cer.	5p	0.47µF	250V	M.F.	15p
0.001µF	1,000V	MDC	6p	0.47µF	400V	Foil	10p
0.0015µF	400V	Poly.	3p	0.47µF	1,000V	MDC	25p
0.0015µF	500V	S/M	10p	1.0µF	250V	M.F.	15p
0.0015µF	500V	Cer.	5p				
0.0018µF	500V	S/M	10p				
0.002µF	100V	Mylar	3p				
0.002µF	500V	Cer.	5p				
0.0022µF	125V	P.S.	6p				
0.0022µF	500V	S/M	10p				
0.0022µF	1,000V	MDC	6p				

Note:
 S/M = silver mica 1% tol.
 P.S. = polystyrene 2½% tol.
 MDC—a.c. rating = 300V.
 M.F. = Mullard min. foil.
 Cer. = ceramic.

MAIL ORDERS. Some items have a post and packing charge shown against them. Where a price is not shown the charge is 12p for any section. When both classes of goods are ordered the charge is 12p plus any p. & p. charges shown. (Overseas extra.) Telephone 01-692 4412

**HARVERSONIC SUPER SOUND
10 + 10 STEREO AMPLIFIER KIT**



A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 5 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled fibreglass printed circuit board, smart brushed anodised aluminium front panel with matching knob, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification: Power output: 14 watts r.m.s. per channel into 8 ohms. Frequency response: $\pm 3dB$ 12-30,000 Hz. Sensitivity: better than 80mV into 1M Ω . Full power bandwidth: $\pm 3dB$ 12-15,000 Hz. Bass boost approx. to $\pm 12dB$. Treble cut approx. to $-16dB$. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp. Overall Size: 12" w. x 8" d. x 2 1/4".

Fully detailed 7 page construction manual and parts list free with kit or send 18p plus large S.A.E. AMPLIFIER KIT £10.50 P. & P. 15p (Magnetic input components 30p extra) POWER PACK KIT £3.00 P. & P. 30p CABINET £3.00 P. & P. 30p

(Post Free if all units purchased at same time)
Full after sales service.
Also available ready built and tested £21.00. Post Free.
Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi-Fi Discotheque use, etc.

**SUPERSOUND 13 HI-FI MONO
AMPLIFIER**



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohm. Frequency response 12Hz-30KHz $\pm 3dB$. Fully integrated pre-amplifier stage with separate Volume, Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high x 6" wide x 7 1/4" deep. AC 200/250V. PRICE £10.50. P. & P. 25p.

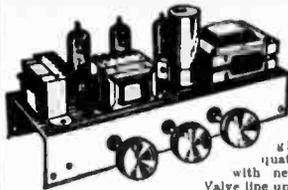
QUALITY RECORD PLAYER AMPLIFIER MK II
A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide x 3in. deep x 6in. high. Ready built and tested. PRICE £3.95. P. & P. 40p.
ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE £5.25. P. & P. 50p.

DELUXE QUALITY PORTABLE R/P CABINET MK II
Uncut motor board size 14 1/2 x 12in., clearance 2in. below. 6in. above. Will take above amplifier and any B.S.R. or GARRARD changer or Single Player (except AT60 and SP25). Size 18 x 15 x 8in. PRICE £4.75. P. & P. 50p.



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LIMITED NUMBER OF BRAND NEW ELAC 10" TWIN CORE LOUSPEAKERS
With large ceramic magnet and plasticised cone surround.
8 ohms impedance £2.75. P. & P. 25p.

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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 x ECC83 Triode Pentodes, 1 x E290 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 8 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. x 4" d. Overall height including valves 5". Ready built & tested to a high standard. PRICE £8.92 P. & P. 45p.

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Mains models. All brand new in maker's packing. LATEST B.S.R. C109/C129 4-SPEED AUTOCHANGER. With latest mono compatible cartridge £6.97. Carr. 50p. With stereo cartridge £7.97. Carr. 50p.

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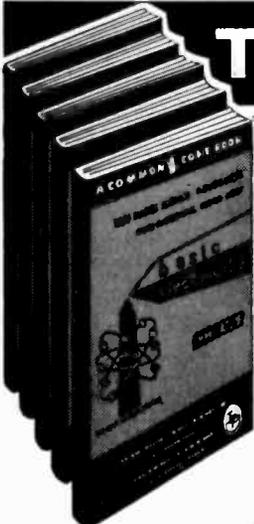
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Freq. response	15-40,000 Hz ± 1dB
Distortion	0.2% at 1 kHz
Loads	4 to 16 ohms
Quiescent current	15 mA
Noise	Better than -75 dB
Supply voltage	25-45 volts SA25/35 40-70 volts SA100
Size	4½" x 4" x 1" (SA100) 4" x 3" x 1" (SA25/SA35)

Circuits, connecting instruction and application data are supplied free with all modules.

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PU70	Unstabilized supply for one or two SA100	£7.75 carr. 40p
MT45	Transformer for above, heavy duty	£2.85 carr. 20p
Stab PS45	Stabilized module for 2 SA25's or two SA35's	£3.50 carr. free
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120 WATT HEAVY DUTY MODULE £13.90 + 20p carr. or with supply
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Featuring a rugged class A driver stage, this module will run from all our mixers, etc., and most other makes of mixer. It delivers 120 watts into an eight ohm load and employs 4 T03 can (115 watt) output transistors.

SPECIFICATION

Power output	120 watts into 8 ohms
Freq. response	20-20,000 HZ ± 2dB
Input sensitivity	200 mV into 10K
Construction	Fibreglass board
Size	8" x 4" x 4" (5" with supply)
Low distortion parallel push-pull output stage.	

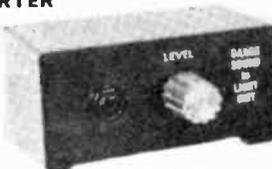


NEW 160 watt version & supply **£27.90**

SINGLE CHANNEL SOUND/LIGHT CONVERTER

This compact and reliable unit operates from amplifiers with outputs from 5-100 watts. Does not impose a heavy load on the amplifier, or, if connected in the wrong polarity, cause any damage, as with some units.

Operation is simplicity itself and the unit is fully fused. The unit is supplied to function from bass notes but may easily be converted to respond only to treble or mid-range notes by the addition of components costing less than 5p.



£8.90 carr. free



THREE CHANNEL SOUND TO LIGHT UNIT

Handling the total of 3000 watt (3kw) this unit is unique for its price in that not only bass, middle and treble but also master controls are provided. Two amplifier sockets eliminate the need for split leads etc. Supplied in tough white steel case with a blue hooded cover. Fully guaranteed.

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£15.80 carr. 30p

SAXON STEREO CONTROL UNIT

Two decks, and full headphone monitoring. The unit is mains operated and measures 17½" x 3" x 4" deep and is finished with a smart white on black fascia. The controls are: Left/Right deck slider, volume, bass, treble, Headphone Selector and volume, Microphone volume, bass, treble, mains on/off. THIS IS A MUST FOR THE HOME BUILT HIGH QUALITY DISCOTHEQUE AND IS COMPARABLE TO UNITS AT OVER TWICE THE PRICE. (N.B.—Stereo only has mic input.)

COMPLETE AMPLIFIERS

The CSE 100. £34.90 carr. free

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



The SAXON 100 £48.50 carr. free



With an RMS output of 120 watts speech and music, 100 watts continuous power, four individually controlled FET input stages and wide range bass and treble controls, this amplifier has established itself as a unit offering quality and reliability at low cost.

LOUDSPEAKERS British made bargains!!

12" 25 watt 8/15 ohms £5.95 carr. 30p. 15" 50W.8/15 ohm £14.50 carr. 50p.
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everyday electronics

PROJECTS...
THEORY.....

ADD COLOUR

To amplified sound, there is now that popular "added ingredient" colour. Perhaps, in a way too popular. Discotheques and dance halls have been quick to appreciate the emotive and sensuous atmosphere that sound and coloured lighting in combination can create. The strident sounds of pop generate an equally brilliant and flamboyant visual accompaniment. So not surprisingly it is the garish kind of colour display that usually comes to mind when this subject is mentioned.

But the technique is applicable to all kinds of music. And, after all, a link between sound and colour is not altogether unnatural. Most people have their own mental "colour" interpretation for various sounds they hear. It is well known that certain musical instruments evoke particular colour patterns in the mind. Furthermore a similarity of terminology employed helps to establish some affinity between the aural and visual fields. Tonal shades are the subtle variations that produce the "colourful" tune and the attractive picture. To combine harmoniously the senses of hearing and sight must only increase the general pleasure obtained.

IN THE MIND

Not that everyone would subscribe wholeheartedly to this idea. Some music lovers would avow that their fullest and deepest appreciation of music is obtained when listening in a darkened room or with eyes closed. Yet this is not entirely contradictory to the idea proposed above. The

darkened room or closed eyes are devices to eliminate distraction and to aid the creation of mental imagery in response to the aural stimuli alone.

Perhaps, for many other individuals, such mental imagery may be more readily stimulated with the aid of a colour accompaniment.

JUST DREAMING

But like music itself, this colour business is not all serious. It can of course be used to suit all moods and fancies. What about those occasions when all we want is quiet relaxation? Well, in today's centrally heated home the audio controlled colour display unit could be a very agreeable substitute for the flickering flames of the long departed coal fire. What better than to gaze at the kaleidoscopic display and let the imagination run?

ANOTHER VIEW

However, for those readers who decide to go in for colour television instead, we can still offer some help. Our unique design for a u.h.f. aerial will save the handiman some of the normal initial outlay. And add some distinction to his roof top, being markedly different from the all too common Yagi display—which is a familiar feature of the suburban skyline.



Our March issue will be published on Friday, February 16

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EASY TO CONSTRUCT SIMPLY EXPLAINED



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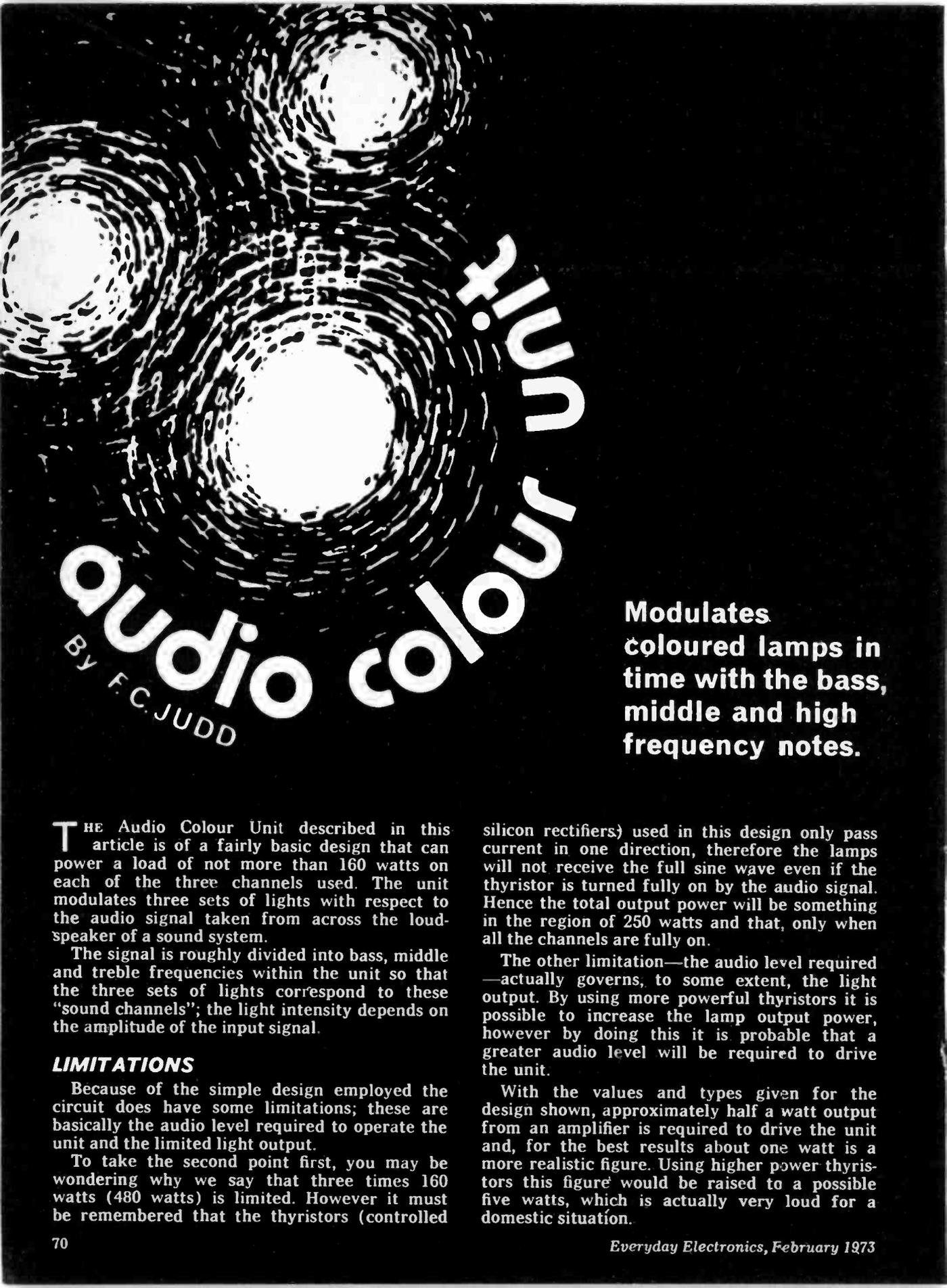
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Demo Deck Reprint

A reprint of the Demo Deck article, including one experiment from *Teach-in*, is now available price 15p, postage and packing 3p. To receive a reprint send a postal order or cheque for 18p, made payable to IPC Magazines Ltd., to: The Receiving Cashier (E.E. Demo Deck), IPC Magazines Ltd., Tower House, Southampton Street, London, W.C.2.



Audio Colour Unit

BY F.C. JUDD

**Modulates
coloured lamps in
time with the bass,
middle and high
frequency notes.**

THE Audio Colour Unit described in this article is of a fairly basic design that can power a load of not more than 160 watts on each of the three channels used. The unit modulates three sets of lights with respect to the audio signal taken from across the loud-speaker of a sound system.

The signal is roughly divided into bass, middle and treble frequencies within the unit so that the three sets of lights correspond to these "sound channels"; the light intensity depends on the amplitude of the input signal.

LIMITATIONS

Because of the simple design employed the circuit does have some limitations; these are basically the audio level required to operate the unit and the limited light output.

To take the second point first, you may be wondering why we say that three times 160 watts (480 watts) is limited. However it must be remembered that the thyristors (controlled

silicon rectifiers) used in this design only pass current in one direction, therefore the lamps will not receive the full sine wave even if the thyristor is turned fully on by the audio signal. Hence the total output power will be something in the region of 250 watts and that, only when all the channels are fully on.

The other limitation—the audio level required—actually governs, to some extent, the light output. By using more powerful thyristors it is possible to increase the lamp output power, however by doing this it is probable that a greater audio level will be required to drive the unit.

With the values and types given for the design shown, approximately half a watt output from an amplifier is required to drive the unit and, for the best results about one watt is a more realistic figure. Using higher power thyristors this figure would be raised to a possible five watts, which is actually very loud for a domestic situation.

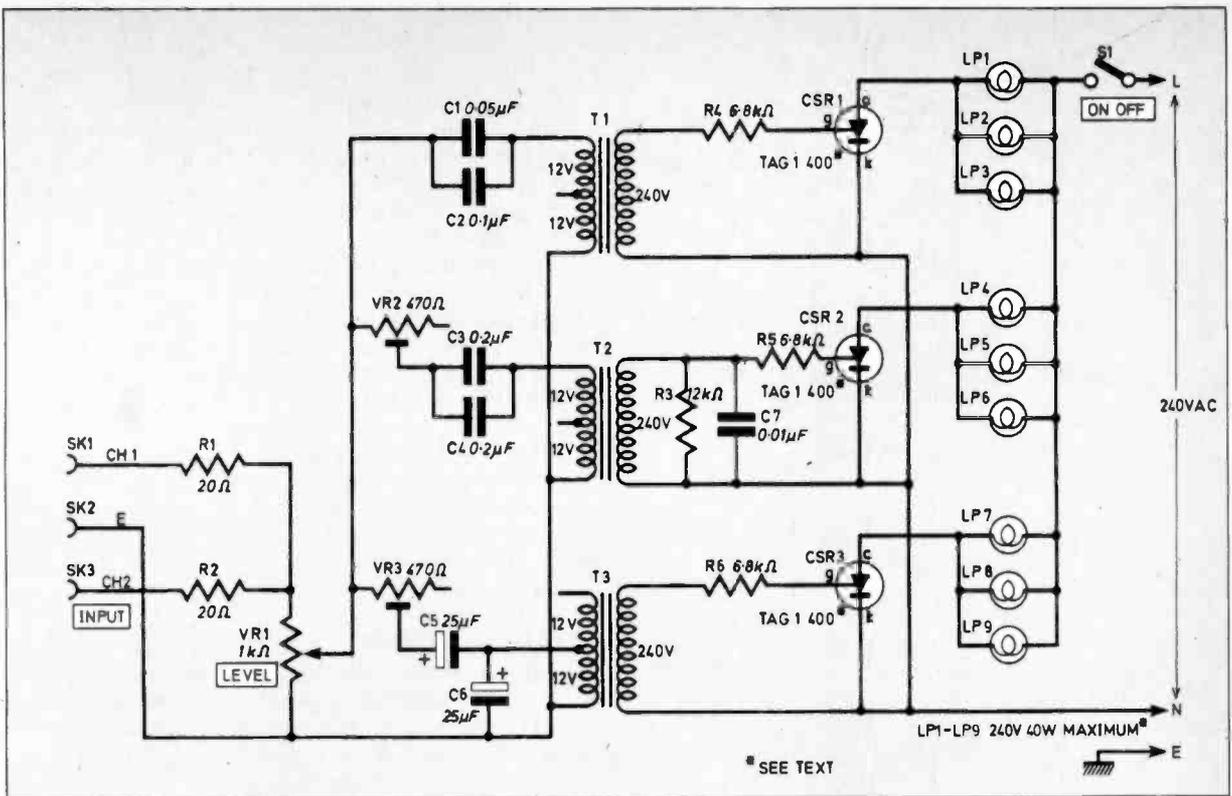


Fig. 1. Circuit diagram of the Audio Colour Unit using three 40W lamps on each channel as in the prototype unit.

Approximate cost of components
£ 6.50 plus cases and lamps

DESIGN

The unit as described is designed to be used in a reasonable size room and to provide some colour mixing rather than just individual flashing lights.

The unit can be used upright as a colour light column or placed horizontally on a bookshelf, or the basic light system itself could be incorporated in a wall panel or as concealed ceiling lighting. The display could be made square as an alternative to the oblong design shown. Two could be constructed for operation from a stereo amplifier, one each side with the loudspeakers or the single unit may be operated from a record player or hi fi system, mono or stereo.

The lamps used for illumination are standard 40 watt 240V colour lamps which are readily

available from electrical equipment dealers in red, blue, green and yellow. Pink lamps are also made but few dealers seem to stock them.

CONTROL CIRCUIT

The circuit diagram of the unit is shown in Fig. 1. The input from any mono or stereo amplifier is taken through a series resistor of 20 ohms (R1 or R2) to prevent amplifier loading. To operate a single display unit from a stereo amplifier the two channels are connected to CH1 and CH2 inputs which the common or earth lead being taken to E; for mono amplifiers use either input and E. Signals fed into the circuit are taken via the level control (VR1) which can be adjusted according to the loudness of the music and the required light output.

For power levels from about 0.5 to 1 watt the control is used at maximum. When the amplifier output is increased (louder reproduction) then VR1 can be turned anti-clockwise to control the lights.

The audio signals are separated according to frequency by the filter circuits built around the three transformers T1, T2 and T3. These transformers are mains to low voltage types and therefore have mains voltage insulation. This is necessary to safely isolate the lamps and the

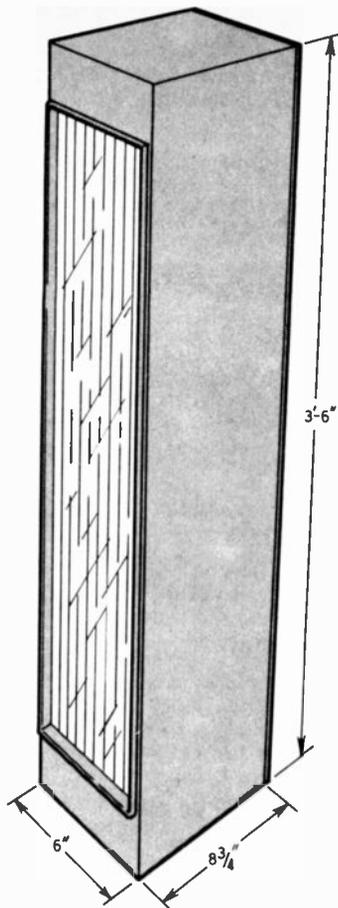
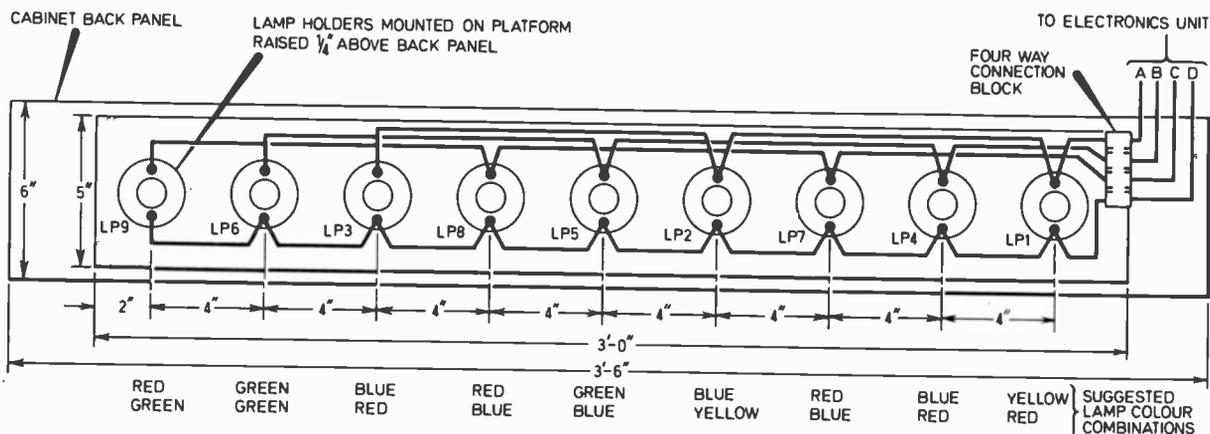


Fig. 2. Dimensions of the prototype lamp box. The size and shape of this box can be varied but adequate ventilation should be provided.

Fig. 3. Layout and wiring of the lamps and suggested colour combinations.



thyristors, which are live to mains voltage, from the signal input side which is at earth potential. **Do not use transformers other than mains types of similar specification.**

The three transformers are used in reverse, i.e., the low voltage 12+12V secondary winding becomes the primary and the 240V winding the secondary. Each low voltage winding is "tuned" to respond to bass, midrange and lower treble frequency bands by the capacitors around them.

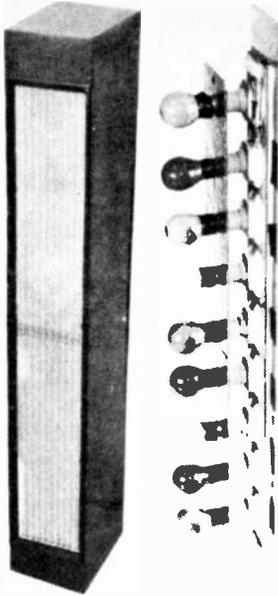
The thyristors (CSR1, CSR2 and CSR3) are triggered by the audio voltage from the transformers and in turn conduct and allow current to pass through each set of lamps. Note that a thyristor behaves like a half-wave rectifier so the voltage across each lamp will only be half of the 50Hz sine wave. The thyristors specified can be run at 1 amp anode current and can each operate four 240V lamps at 40 watts each with only a small clip-on type heatsink. Using three 40 watt bulbs as shown in Fig. 1 no heatsinks are required.

DISPLAY UNIT

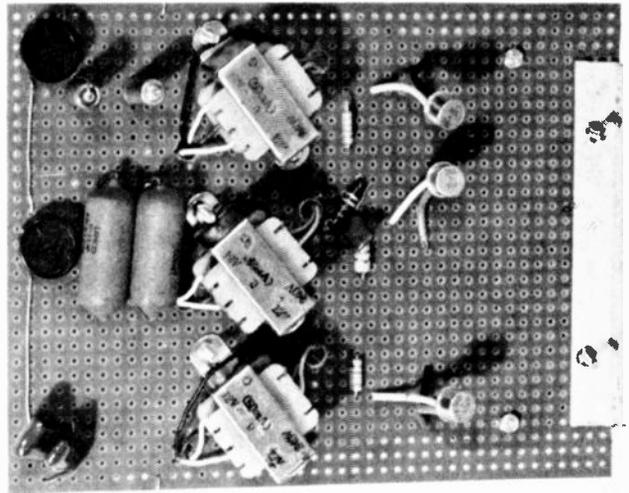
The unit shown in the photographs, the prototype lamp unit, was constructed in an oblong shape to form a column so that it could be stood upright on the floor. The case could be made square if required by rearranging the lamps in rows of three side by side.

Dimensions of the prototype are given in Fig. 2. The original was made from $\frac{1}{8}$ inch thick hardboard secured with $\frac{1}{2}$ inch by $\frac{1}{2}$ inch batten and pins. The glass screen can be fluted or "arctic ice" decorative glass, or better still frosted glass, which provides a greater degree of diffusion. The screen may be 36 inches long and about $5\frac{1}{2}$ to $5\frac{3}{4}$ inches wide, depending on the beading around it and the width of the box material.

One end of the box carries the connection block for the connection of the electronics unit to the lamps. The rear panel of the box also carries all the lamps on a slightly raised platform as in Fig. 3. The platform is simply a piece of hardboard raised on $\frac{1}{2}$ inch by $\frac{1}{2}$ inch battens.



Photograph showing the finished lamp box and the back panel with lamps and reflector in place.



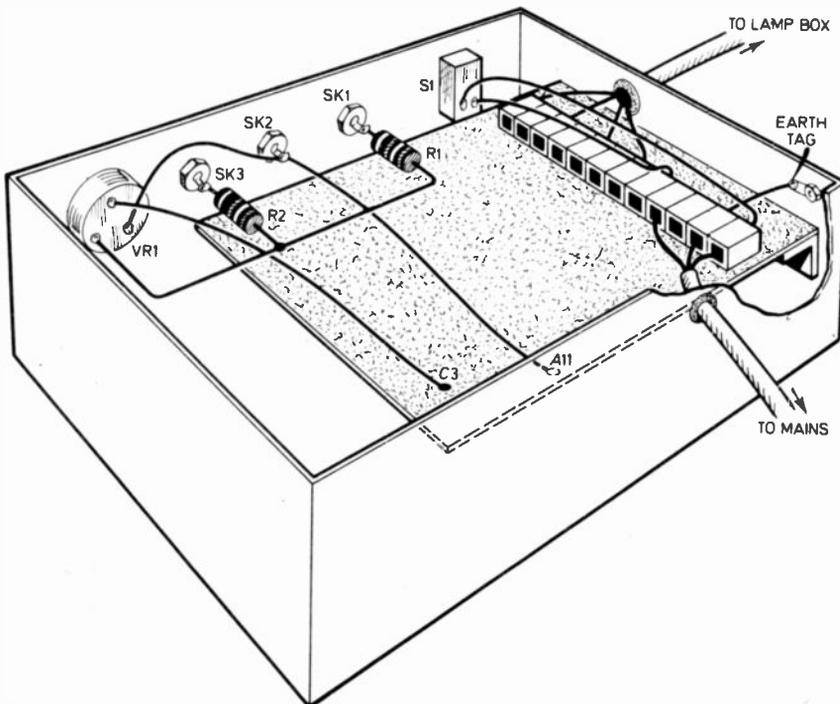
Photograph of the complete circuit board of the prototype.

Wires to the lamps run underneath and should be connected before mounting the lamp platform onto the rear panel.

The lamp reflector screen is made from hard-board and is retained in position by the lamps.

The reflecting surface is obtained by covering the upper side with aluminium foil, which can be glued on with Evostik (see photograph). The top and bottom of the interior of the box are also lined with aluminium foil to provide

Fig. 5. Layout and wiring of the "electronics" box. Make sure that components R1 and R2 cannot touch the component board and that the case is earthed if it is metal.



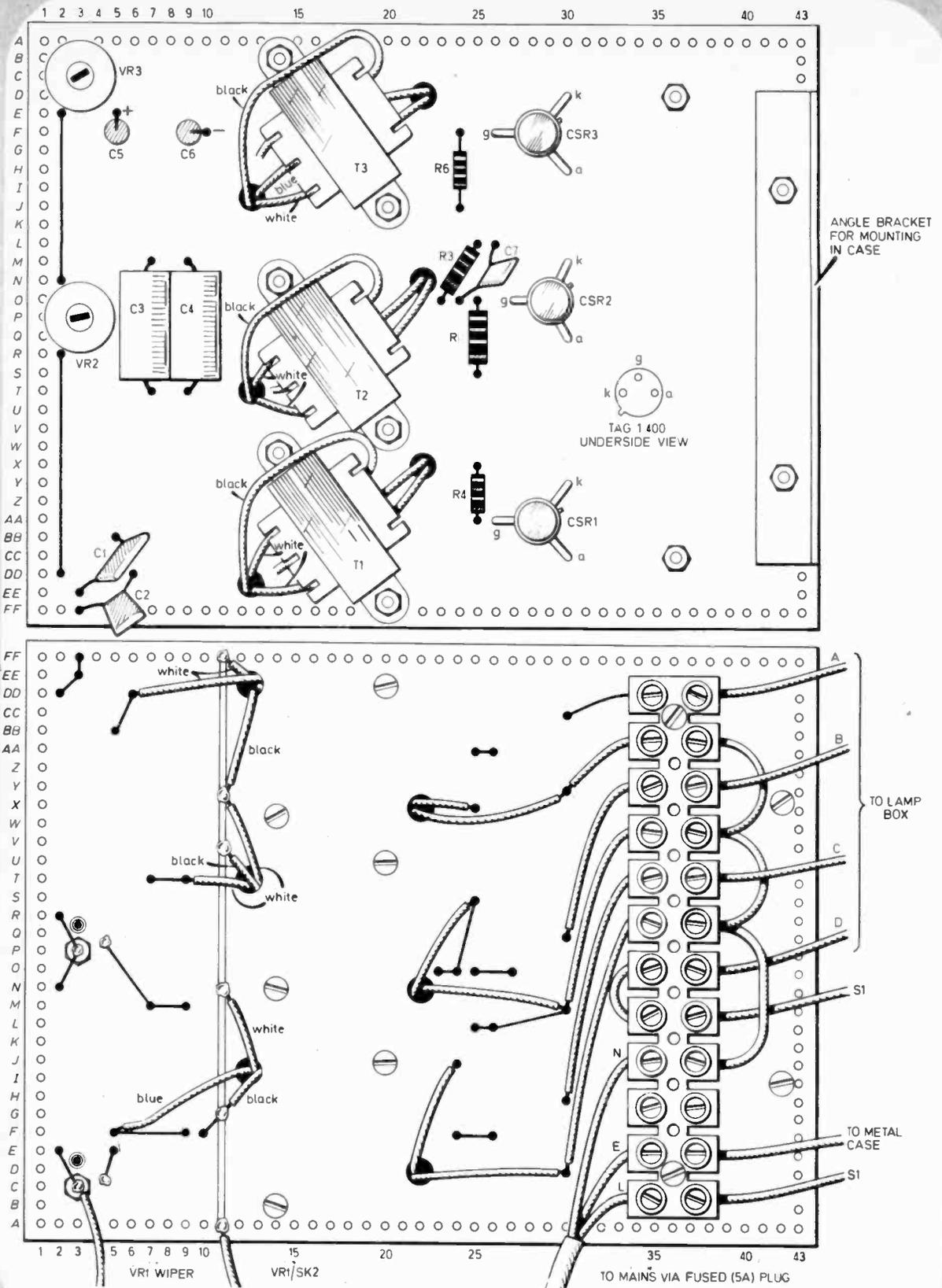


Fig. 4. Layout and wiring of the complete circuit board. The spare wires from the transformers can be cut off as shown.

reflection. It is important that adequate ventilation is provided by means of holes in the sides of the case.

CONTROL UNIT

All the "electronics" should be housed in a separate unit away from the lamps to prevent overheating. The circuit board layout and wiring is shown in Fig. 4. Note how the connections to the lamps are taken off via a mains connector block. These blocks are readily available from electrical equipment dealers and should be used for reasons of safety. The unit is connected to the lamps by means of a four-way cable. The wiring associated with the input terminals and VR1 is shown in Fig. 5.

Lamp wiring is shown in Fig. 3 and leads from this are taken off through another electrical connecting block to the four-way lead that is connected to the "electronics" unit. Wiring to the lamps should be completed before mounting the lamp platform onto the rear panel so that the wiring can be run underneath the platform. The wiring of the lamps in the groups as shown was found to be the most effective when used with either of the colour groupings shown below the lamp wiring diagram. Note that only one yellow lamp is used in either group as this colour produces a much stronger light than the others. It was found that more than one yellow lamp tended to swamp the light given by the other colours. Constructors can of course experiment with various lamp combinations.

SETTING UP

With VR1 at maximum and VR2 and VR3 both at maximum resistance (turned down) connect CH1 and E to the loudspeaker connections on the audio equipment by means of a two-way cable—it does not need to be screened lead—and set the volume control to average listening level. Note that at least half a watt of audio signal is required to trigger the thyristors so the unit will not operate from low output amplifiers such as the output stage of a transistor radio or very low output record player or tape recorder. Verify that your amplifier, record player or tape recorder is rated for at least two to three watts output.

Music with a fairly well defined bass and some contrasting mid range and lower treble is best for setting the response of the three light channels. There is no adjustment for the treble filter circuit so it is only necessary to set VR2 so that mid range notes operate lamps LP4, 5 and 6 and VR3 so that bass notes operate lamps LP7, 8 and 9.

First adjust the amplifier volume so that lamps LP1, 2 and 3 (upper treble) are just flashing. Now bring VR2 toward minimum resistance until the corresponding lamps begin to flash and then do the same with VR3. The approximate setting for VR2 and VR3 should

be about half resistance. A little experiment along these lines with different kinds of music will soon reveal the optimum setting of VR2 and VR3 to obtain defined operation of the lamp groups for the three frequency bands.

These preliminary adjustments are easier made before enclosing the lamp platform or the circuit board within their cases. Whilst these adjustments are being carried out **take care to avoid touching the thyristors**, the cases of which are also the anode connection and are therefore live to mains voltage. This warning applies of course to any other mains wiring.

There will probably be some interaction between channels whilst setting up, e.g., variation of VR3 may alter the response of the other two channels, particularly the treble channel, hence some careful adjustment may be required.

The finished lamp case can be painted or covered with one of the plastic adhesive materials available in woodgrain or pattern. □

Components

Resistors

R1	20 Ω	R4	6.8k Ω
R2	20 Ω	R5	6.8k Ω
R3	12k Ω	R6	6.8k Ω

All $\frac{1}{4}$ W $\pm 10\%$ carbon

SEE
**SHOP
TALK**

Capacitors

C1	0.05 μ F	C4	0.2 μ F
C2	0.1 μ F	C5	25 μ F elect. 25V
C3	0.2 μ F	C6	25 μ F elect. 25V
C7	0.01 μ F at least 300V rating		

Semiconductors

CSR1, 2, 3, any 1 amp 400 p.i.v. thyristor
(controlled silicon rectifier 3 off)

With respect to the above ratings see text.

Potentiometers

VR1 1k Ω carbon linear
VR2 470 Ω skeleton preset or miniature preset
VR3 470 Ω skeleton preset or miniature preset

Transformers

T1, 2, 3—12,0,12V secondary 240V primary
miniature mains transformers used in reverse
(Eagle MT12 or similar—three off)

Miscellaneous

SK1, 2, 3 Single screw or spring loaded
terminals (three off)

LP1 to LP9 240V 40W coloured lamps and
batten mounting holders (9 off)

S1 S.p.s.t. mains toggle switch

Plain perforated 0.15 inch matrix Veroboard
6 $\frac{1}{2}$ x 5 inches, one four way and one 12 way
terminal block, control knob, connecting
wire, case for control unit approx. 7 x 6 x 2
inches die-cast or similar metal or plastic
case.

Materials for display case—see text and
drawings, 4BA fixings and wood screws,
three core mains lead and plug.

BASIC

4 Electricity

Meters and Ohms Law

By Maureen Birch

LAST month we showed that the electric current flowing in a coil produced a magnetic effect. We can go on to show that the magnetic field strength produced is controlled by the amount of current.

EXPERIMENTS

Use your U shaped electromagnet and a piece of iron that just closes the gap between the pole pieces.

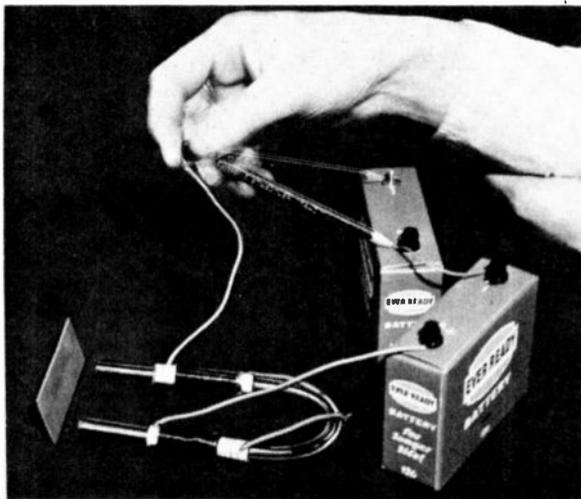


Fig. 4.1. Experiment to show the relationship between magnetic strength and current flowing in an electromagnet.

First of all check the degree of force you need to pull the iron off the magnet when no current is flowing through the coil—there should be virtually no force required as any magnetism left in the magnet is due to remanence. Now connect the magnet to a 9V supply and the force required will be very large; as an extra experiment connect a lead pencil or old electric fire element in series with the magnet and the battery—the force required to pull the iron off

the magnet will be reduced, Fig. 4.1. This is because we are limiting the current through the coil with the resistance of the pencil's graphite. The higher the current the higher the force and vice versa.

Increasing the electrical resistance of the circuit reduces the current—provided we do not change the battery voltage. Try different battery voltages (4.5V) with and without a resistance in circuit. You should find a relationship showing that the higher the voltage or the lower the resistance, the more force you need (i.e. we have most current flowing); a low voltage or high resistance will give a smaller current.

This very crude experiment is the beginnings of measuring the absolute magnitude of electric current and is the basic principle by which meters work.

MOVING COIL METER

The modern moving coil meter uses this principle but works the other way round from our experiment. It uses a very powerful permanent magnet with a light coil of wire suspended on a pivot between the poles see Fig. 4.2. Note that there is no iron core in the coil.

The coil is mechanically coupled to a pointer that moves over a calibrated scale. The movement of the coil is limited by a very fine hair-spring which is also used to carry the current to the coil; the other connection to the coil usually goes via the bearing and the pivot. Without the spring a very small current flowing through the coil would produce a field (even though there is no iron) and the coil would immediately line itself so that its North pole pointed straight to the permanent magnet's South pole.

This is a very sensitive way of showing that current is flowing through the coil but does not give any indication of magnitude. Without a spring our meter is called a **ballistic galvanometer**.

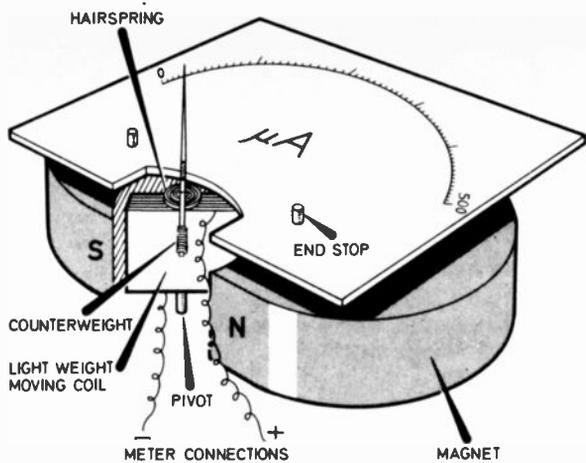


Fig. 4.2. The basics of a moving coil meter.

meter; reverse the direction of current flow and the coil will swing round the other way.

Now consider the action of the hair spring; it will always try to keep the coil in its original position (zero on the scale). If we pass a current, the magnetic forces will operate against the restraining action of the spring and instead of a full 90 degree rotation of the coil it will only move a few degrees—this being controlled by the strength of the field (proportional to the current) and the reverse torque of the spring.

Meter movements (as the magnet, coil, spring assemblies are called) are as delicate as any watch movement and thus they are able to register minute electric currents—millionths of an ampere as compared to the many amperes that flow in car electrical systems.

HOT WIRE TYPE

Another effect of an electric current, with which we are all familiar, is its "heating effect". Examples of this are an electric fire element and light bulb glowing. Certain types of meter—used mainly for alternating currents—take advantage of this effect; they are called hot wire meters. Fig. 4.3 shows in schematic detail the principle.

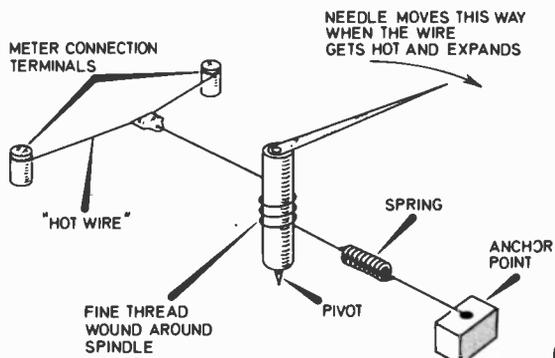


Fig. 4.3. Schematic diagram of a hot wire meter.

Everyday Electronics, February 1973

When a current flows through the wire, it becomes hot and expands (irrespective of the direction of flow); this causes the pointer to move over the scale indicating the current magnitude. Hot wire meters are not often used in amateur applications and the time they take to reach an end reading is a factor which limits their use.

THERMOCOUPLE METER

There is another type that uses the heating effect in a roundabout way. Called a thermocouple meter it has a moving coil movement to which is connected a very sensitive thermocouple (a device that generates a voltage when it gets hot). The thermocouple is in contact with a piece of resistance wire that gets warm when current flows through it.

Again the direction of current flow is not important and the device is used for measuring high frequency currents—as occur in radio transmitters. Again they are not often used by amateurs and they have a non-linear scale (i.e. the readings tend to be cramped at one end and stretched out at the other).

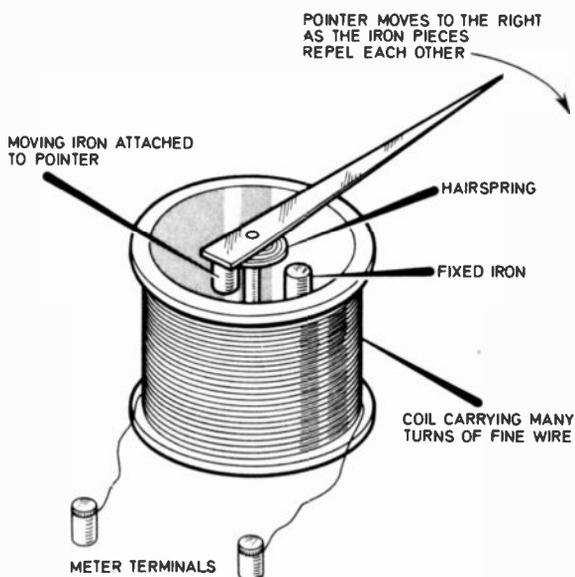


Fig. 4.4. The movement of a moving iron type meter.

MOVING IRON

In a fourth type of meter—called a moving iron meter—a magnetic field is produced by a current passing through a fixed coil. Two pieces of iron are placed within the coil, one fixed and the other on the end of a pivoted pointer, see Fig. 4.4.

The magnetic effect of the current causes both pieces of iron to become electromagnets having like poles at the same end; this produces a repulsion between the two pieces of iron and the one at the pointer moves away from the

fixed piece. As with the moving coil movement a hair spring limits the deflection and the scale reading is in proportion to the current flowing through the coil.

This type of movement is often used in very low priced meters but there are problems. The heavy iron on the pointer has an inertia which causes the meter to "overshoot" the correct deflection and the pointer tends to swing backwards and forwards for some considerable time—we say the meter is not damped.

The balance of the iron about the pivot is critical and the meter can only be used flat on its back; the scale is not truly linear and the coil requires quite a lot of current to produce a deflection—it is therefore not very sensitive. The direction of current flow, however, does not matter.

SHUNT RESISTANCE

Because of the respective problems associated with the other types the moving coil meter is most generally favoured for straightforward current measurement. Very sensitive movements can be used to measure heavy currents by using a low resistance shunted across the coil, see Fig. 4.5.

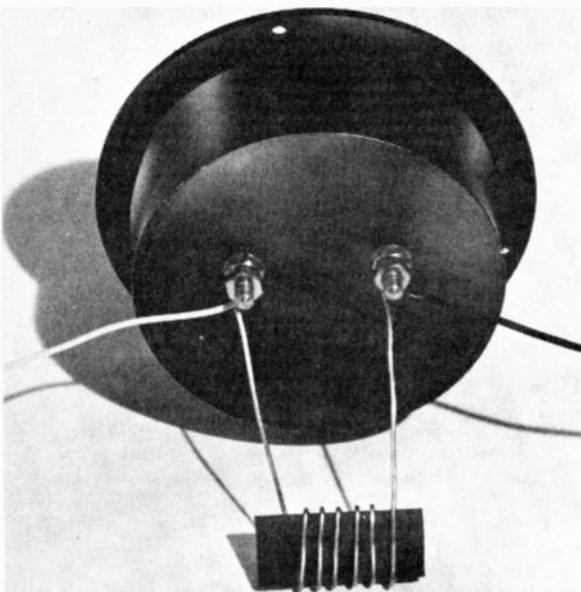


Fig. 4.5. Using a shunt resistor to enable a high sensitivity movement to measure high currents.

This resistance has to be less than the internal resistance of the coil so that most of the current flows through the external circuit; only a very small proportion flows through the coil. This way we can make a meter sensitive to millionths of an ampere measure several amperes. Obviously care has to be taken in using the

correct value of shunt resistor. Using switched shunt resistors we could make a multi-range ammeter.

VOLTMETER—SERIES RESISTANCE

The current flowing through the coil is controlled by the circuit resistance and the voltage causing the current as demonstrated in our simple experiment. If we make the circuit resistance a fixed value, the current will be in direct proportion to the voltage; thus we can turn our movement into a voltmeter by putting a fixed resistor in series with it.

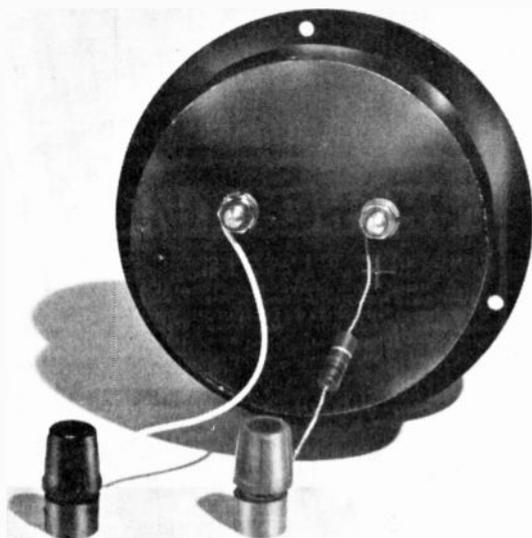


Fig. 4.6. A high sensitivity moving coil meter used to measure voltages.

For a given movement sensitivity we will need a certain value of resistance to give a full scale reading indicating a known voltage. The greater the sensitivity of the movement the greater we can make this resistance. For electronics work it is usual to make the movement as sensitive as possible thus keeping the meter series resistance high. Fig. 4.6 shows the basic circuit of a voltmeter.

MULTIMETER

It is possible, with careful switching, to combine both ammeter and voltmeter into one unit and this is called a multimeter, see Fig. 4.7.

A multimeter usually has other scales for measuring alternating current and voltage as well as resistance, but the full circuit for a complete multimeter is outside the scope of this simple series. It may be that you are considering the purchase of a multimeter for use in electronics, in which case you should buy the most sensitive you can afford.

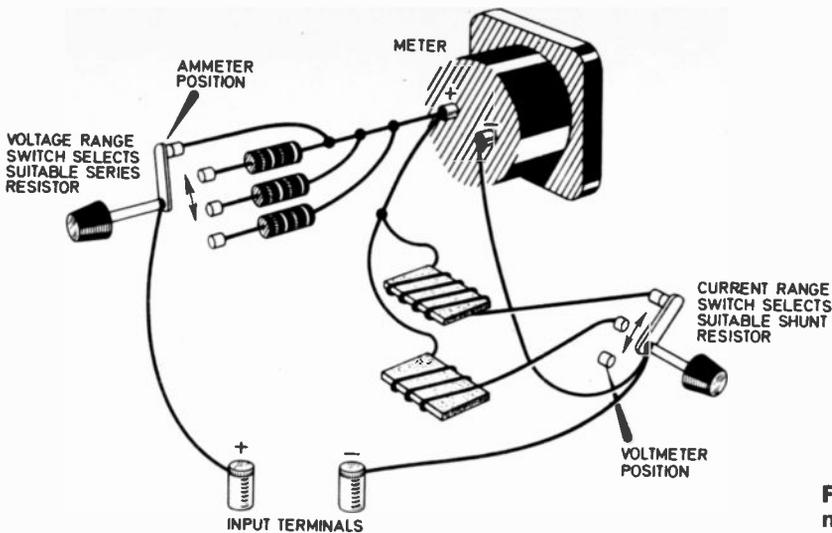


Fig. 4.7. Schematic diagram of a multirange volt/amp meter.

Sensitivity is quoted in terms of the voltmeter's series resistance (ohms per volt) and the higher the value the better—ideally 20,000 ohms per volt for all practical applications; lower sensitivities of 1,000 to 2,000 ohms per volt are a lot cheaper and although they can be used in many applications can give rise to apparent inaccuracies in some instances.

AMMETERS & VOLTMETERS IN CIRCUIT

When using ammeters and voltmeters in a circuit they must be connected correctly if they are to measure current and voltage differences. Visualise an ammeter as a body with arms outstretched; the positive terminal is always connected toward the positive battery terminal, and the circuit current should flow in through the positive arm and out through the negative arm into the rest of the circuit. In other words, to measure current, the ammeter *must* be connected in series with the circuit.

Note: the arms and legs are used only as an illustration and should not of course be taken literally.

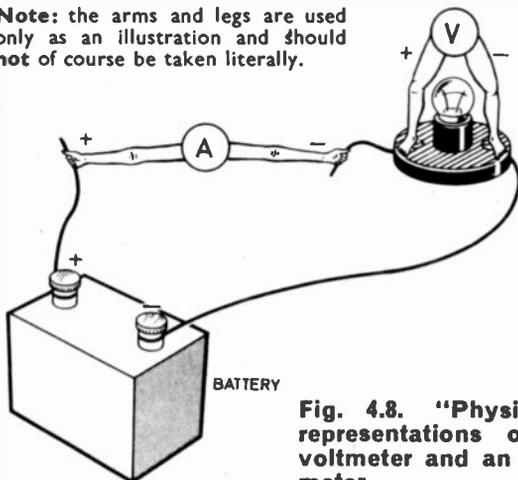


Fig. 4.8. "Physical" representations of a voltmeter and an ammeter.

Imagine a voltmeter as a body with two legs standing astride parts of a circuit across which we want to know the voltage difference. The positive terminal must connect to the point that has the more positive voltage, see Fig. 4.8.

OHM'S LAW

The amount of current measured by an ammeter is the quantity of electrons flowing per second, and this movement is caused by the voltage difference between the ends of the wire through which the current is flowing. This difference is usually called the **electromotive force** (e.m.f. for short).

Provided all the circuit conditions remain the same (e.g. there are no changes in temperature) doubling the e.m.f. will double the current. In fact we can say that the current is directly proportional to the e.m.f. and the constant of proportionality is the circuit resistance. We call this relationship **Ohm's Law** and if we use volts and amperes to measure the e.m.f. and current, then the resistance is in ohms.

WORKED EXAMPLE

Let's say the current through our electro-magnet was 2A when we used an e.m.f. of 9 volts; it would fall to 1A if we halved the e.m.f. to 4.5V. The ratio of voltage divided by current is the same in each case i.e. 4.5 and this would be the resistance of our magnet's coil in ohms. There are three ways of writing down this relationship,

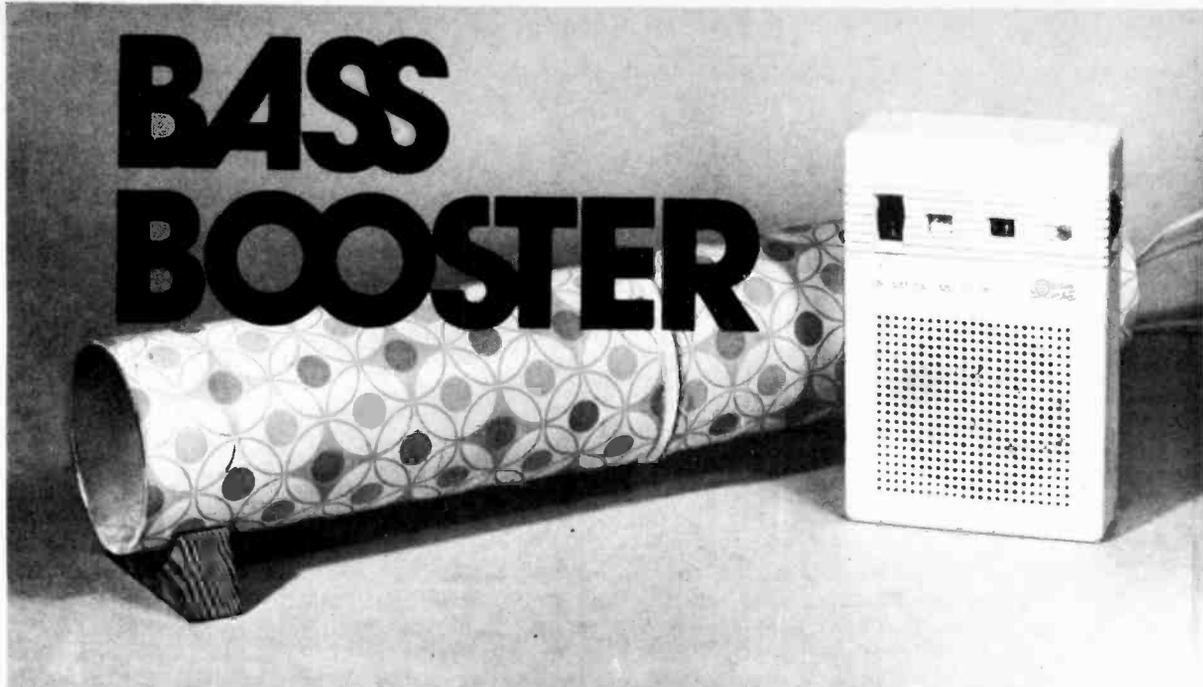
$$V = I \times R \qquad R = \frac{V}{I}$$

$$I = \frac{V}{R}$$

where V is the e.m.f. in volts, I is the current in amperes and R is resistance in ohms.

Next month: motors, generators and alternators.

BASS BOOSTER



An extension speaker unit to improve the sound output of small transistor portables.

By A. Sproxtan

ANYONE who uses a small portable transistor radio and is annoyed by the "quality" of the sound output may find this extension speaker project well worthwhile.

The construction of the unit can be completed in a very short time and the improvement in the sound is well worth the small outlay. Most of the small transistor radios suffer from a lack of bass. After hearing a demonstration of how, by placing a speaker in a tube, the bass response could be increased, it was decided to apply the idea to a small extension speaker for a transistor radio.

CONSTRUCTION

The resulting speaker consists of a 2¼ inch diameter 8 ohm speaker placed between two 6 inch pieces of 2½ inch diameter paxolin or

Components SEE **SHOP TALK**

Loudspeaker

LS1 8Ω, 2¼ inch diameter, moving coil type

Miscellaneous

JK1 2.5mm or 3.5mm mono jack plug
2½ inch paxolin or plastic tube 6 inches long (2 off). Thin 2 core wire, wooden or rubber feet, Contact fabric, plastic sticky tape and 4BA fixings.

plastic tubing, see Fig. 1. The tube rests on the metal surround of the speaker, which is a slightly larger diameter than the tube, and plastic sticky tape is stretched around the tube to hold the whole thing together.

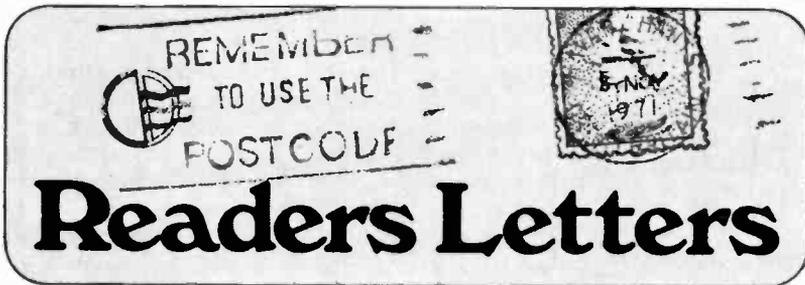
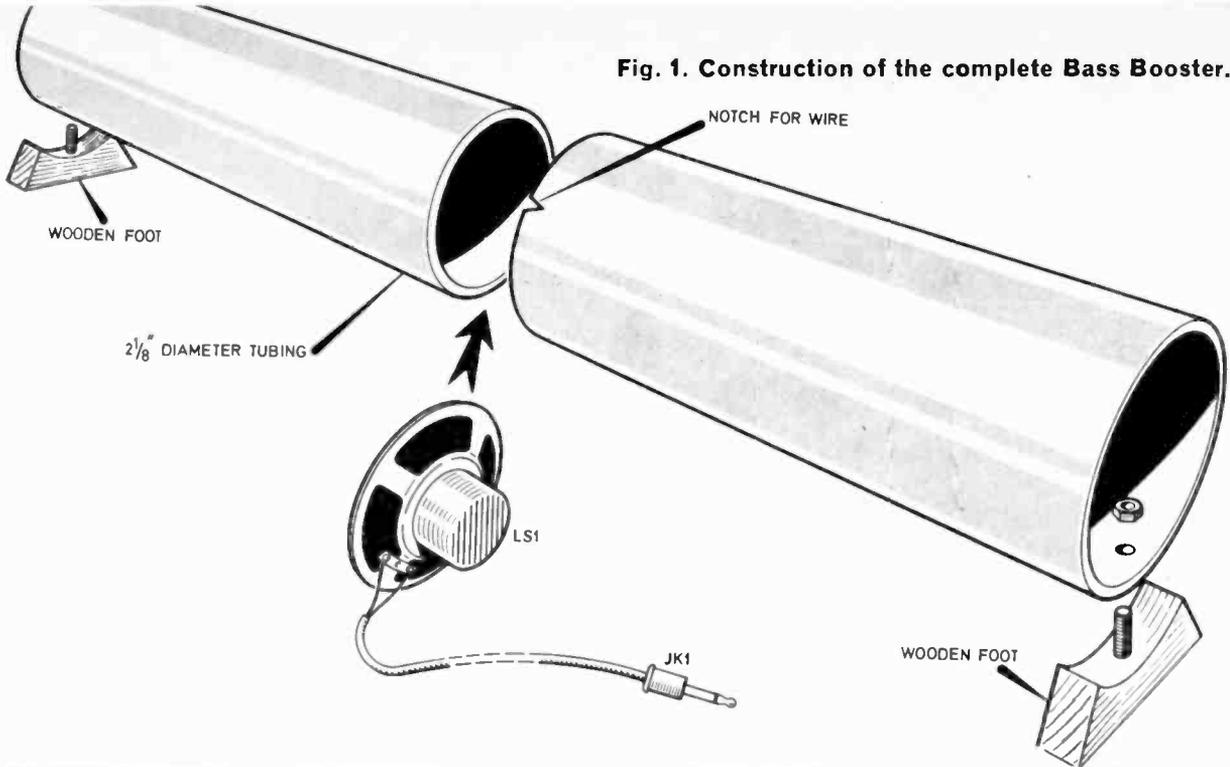
A small notch cut in the tube allows the wire to the speaker to be led out. The other end of this wire is connected to a 2.5mm or 3.5mm jack plug—whichever suits the portable being used. Plug the jack plug into the earphone socket of the radio and switch on; the difference in sound should be quite noticeable.

FINISH

To finish off the speaker, it can be covered in Contact fabric, and rubber or wooden feet can be added as shown in Fig. 1. If thin wire is used for the connection and the outside of the tube is carefully covered the resulting speaker should be pleasing in appearance. □



Fig. 1. Construction of the complete Bass Booster.



Colour Code

Being a beginner with limited funds, I was pleased when I received an old television set to strip down. Among the resistors I removed were a few with a fifth coloured band, pink in each case. I can find no reference to this band.

D. G. Wood
Yorkshire

The fifth band—termed salmon pink—signifies that the resistor is a high stability type. This means that its value will not vary very much with temperature.

Wireless Museum

We thought that some of your readers who are interested in old wireless sets with bright-emitter valves, or crystal sets with cat's whiskers, might like to know of the recently opened Vintage Wireless Museum in Lincolnshire. Amongst the dozens of wireless sets from the twenties

on display, many can be found in working order and may be tuned in by visitors.

The Museum is run by the Wireless Preservation Society, the sole objects of which are the preservation and restoration of vintage wireless equipment for purely cultural educational and historical purposes. Readers can ring the curator at 077 584 485 for an appointment to view—it's free of charge.

Wireless Preservation Society

Index

I would like to put just one question to you—are you intending to publish an index to Volume 1—preferably of a “pull out” type so it can be incorporated in case any readers deciding to have their copies permanently bound?

E. Heesom
Warrington

An index will be available, for a small fee, from us in due course—watch for an announcement in the magazine.

Radio Control

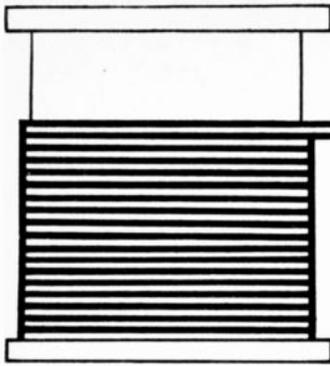
We feel that some of your readers might be interested to know of our society.

In common with many societies in these times, our membership has slowly diminished for several reasons, the main one being that the society was formed in 1947, and exists today to encourage and assist its members to build their own radio control equipment and ancillary gear. With the advent of commercial equipment of every type, the aim and purpose of the society has been bypassed. However our group, as a result of this situation, is nowadays composed of members who are keen constructors.

We meet on the second Thursday in each month at: The Rose and Crown, Old Park Lane, Piccadilly, London W1.

Our meetings start at 7.30 p.m. and usually consist of a few minutes of business matters followed by a lecture from well known experts in the radio control world, or one of our own members. Throughout the year we hold contests of radio controlled models at various venues.

R. Ing.
Radio Control Models Society
41 Hogback Wood Road
Beaconsfield, Bucks.



SIMPLE SOLDERING

ONE basic "technique" wrongly executed can spell disaster for any constructional project; virtually all electronic construction is based on that technique—soldering. No matter how you try to avoid it, at some stage in the practice of constructional electronics you are going to have to be able to make a good soldered joint and it is better that you start soldering as soon as you start learning because soldering must be mastered not just learnt.

Having said this we hope that we have not put you off the subject—soldering is really quite easy provided you follow a few basic rules. We intend to set out a procedure which we hope, with the aid of the photographs opposite, will enable you to grasp the basics of the technique—after that, practice makes perfect!

TOOLS

The first step is to obtain the correct tools—you cannot expect to make a good job of soldering if you are using the wrong tools.

The most important "tools" are the soldering iron and the solder; they may sound obvious and simple but the right types make all the difference. The iron should be a small type of about 15 to 25 watts with $\frac{1}{8}$ inch or $\frac{3}{16}$ inch bit.

Many such irons are advertised in our pages for around £2. The solder must only be the resin cored type sold for "electronic" or "radio" use and should be about 18 or 22 s.w.g. Many component retailers and radio and TV repair shops sell this type of solder in tubes or boxes—the more you buy the cheaper it will work out in the long run.

You will also need a pair of tapered nose pliers and a pair of side cutters, both about five inches long. A pair of wire strippers are also very helpful, as is a small flat file to clean up the soldering iron bit (unless it is a long life type) when it becomes pitted.

To demonstrate the method of soldering, we will use a piece of Veroboard and some lengths of wire and solder the wire to the board in the same way as components and flying leads would be fixed.

TINNING

The first basic rule is to make sure everything is clean; no grease, dirt or paint on the surfaces to be soldered. Having satisfied yourself of this point, the next step is to take a short length of 18 s.w.g. tinned copper wire (available from most component stockists) and to tin one end of it.

To do this, first tin the iron bit so that a small amount of molten solder is held on the bit surface to aid heat transfer to the work—always retain a small amount of solder on the iron bit. Touch the end of the wire on the iron (either the wire or the iron can be fixed for this, we suggest using an iron stand that allows access to the bit which is pointing upwards) and melt some solder onto the wire (a)—not onto the iron.

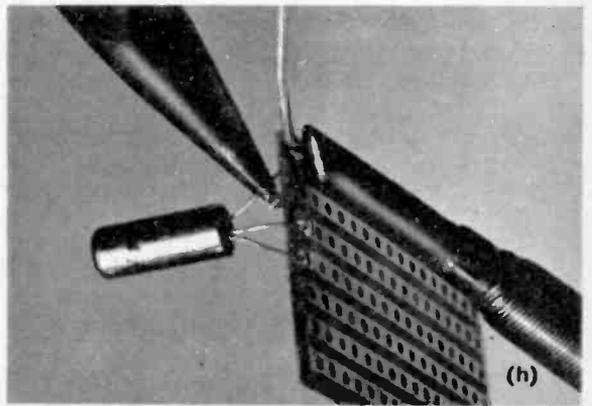
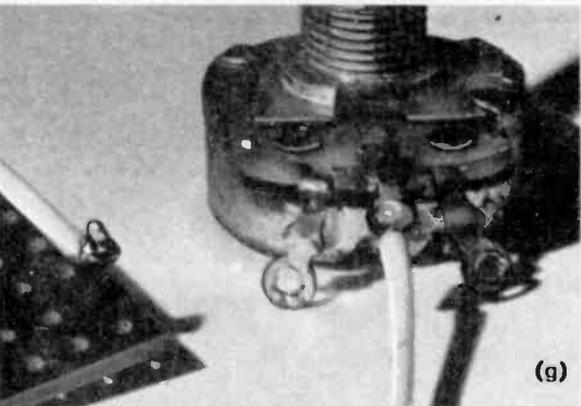
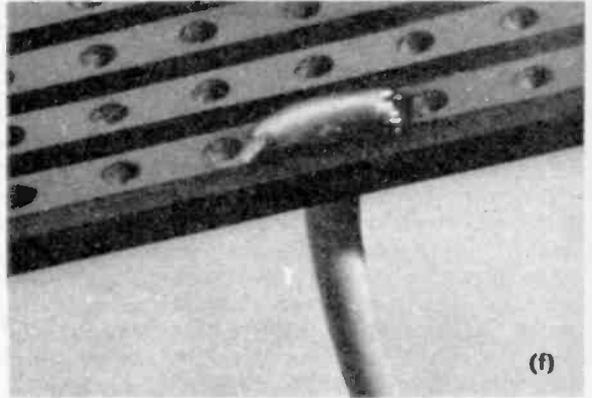
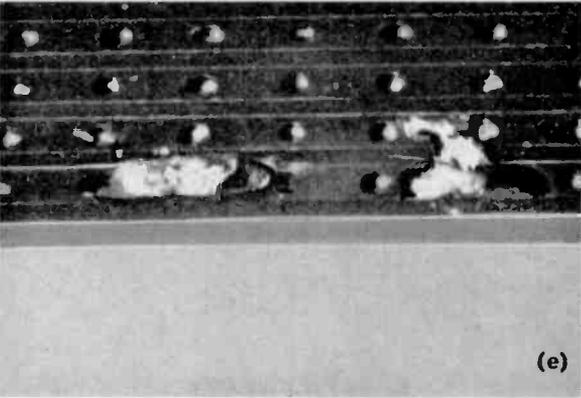
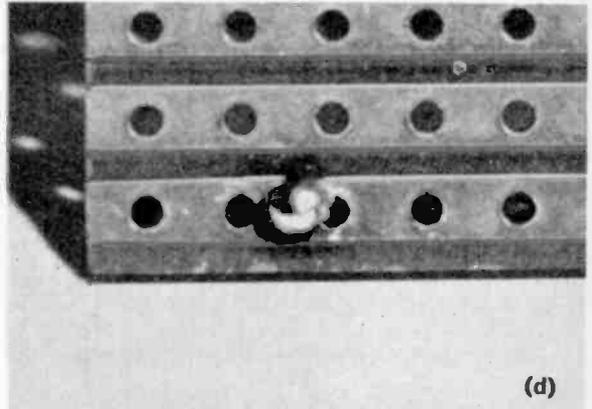
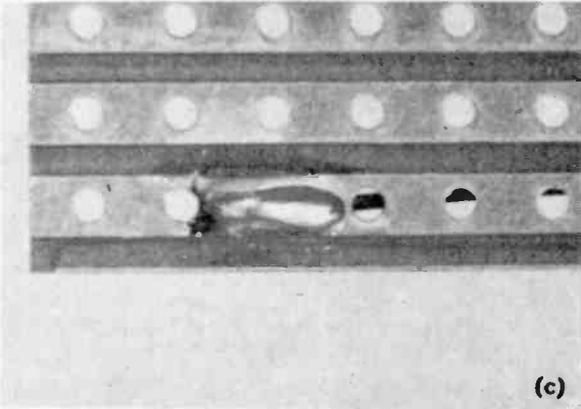
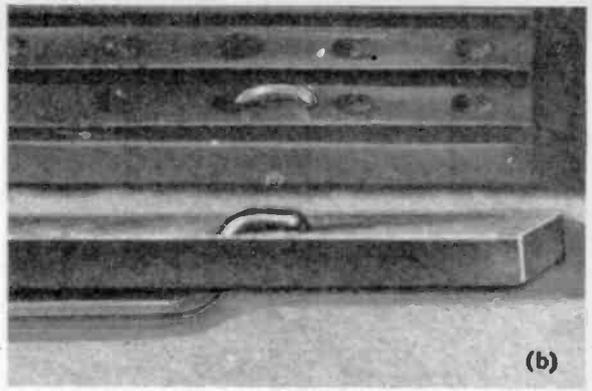
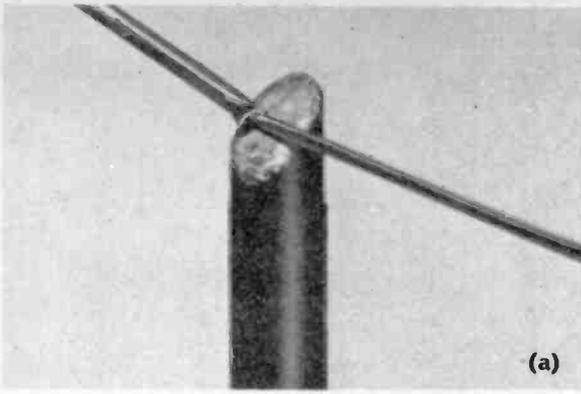
By this means the wire will be hot enough to solder correctly and will tin properly. Remove the wire from the iron, it should be thinly covered by a layer of shiny solder.

MAKING THE JOINT

Next bend the wire at right angles about $\frac{1}{4}$ inch from one end and insert it in the Veroboard, then bend the end down flat against the copper strip (b).

Place the iron bit on one side of the joint in contact with the wire and apply the solder to the other side. Apply enough solder for it to run around the wire and along the copper strip just away from the wire, as soon as the solder runs this far remove the iron, and leave the joint to cool.

The photographs opposite illustrate soldering technique and soldered joints. They are: (a) tinning a wire, (b) wire inserted in Veroboard, (c) a good joint on Veroboard, (d) a bad "blob" joint where the solder has not flowed around the copper strip, (e) two bad joints, a bridged solder joint and a dry joint, (f) a good joint using stranded plastic covered wire, (g) two good joints to a tag and a pin, (h) using a heat shunt to solder semiconductors.



BAD JOINTS

The solder around the joint should be clean and shiny and it should have flowed cleanly around the joint (c). If the solder has formed a blob on top of the copper (d) then you have not allowed the iron to heat the job to the correct temperature for proper soldering, this is one type of bad joint.

The second main fault when soldering is the "dry joint", this can be caused by transferring the solder to the job on the iron—the flux burns off and the job cannot solder properly—keeping the iron on the joint too long, with a similar effect, or moving the joint before it is cool.

The third bad joint is caused by trying to make a connection between two surfaces that are not in contact. Although this joint may be electrically good it will be mechanically very weak as the solder, which is soft—is forming a bridge, photograph (e) shows two bad joints.

VARIOUS JOINTS

Try making a few joints with tinned copper wire and then make some using stranded plastic covered connecting wire (type 7/0076). This is done by stripping the insulation from $\frac{1}{4}$ inch of one end—use wire strippers, a sharp knife or side cutters—twist the strands together and tin them.

Be careful not to use too much solder when tinning as the solder will tend to run back up the wire and make it stiff, also too much heat will melt the plastic covering. Now make the joint as before. With a little practice it should be possible to get a good joint without damaging the covering on the wire (f).

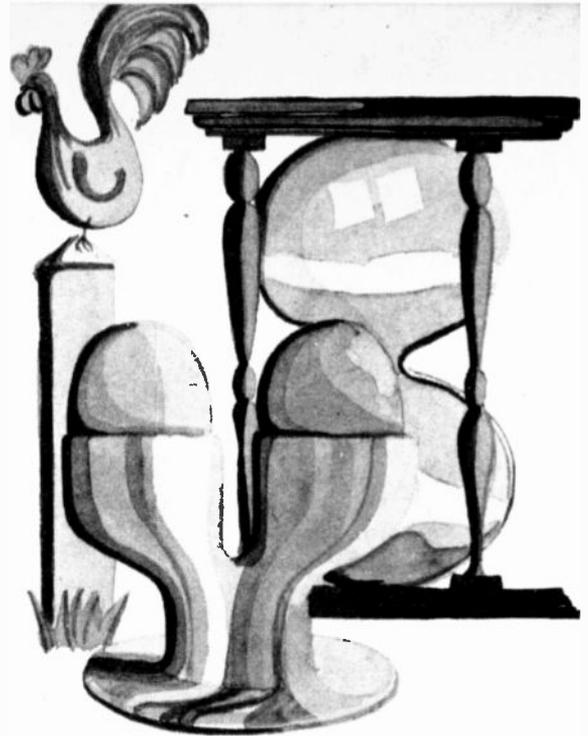
Having practised these joints until you are confident of a good connection every time, it will be worthwhile to try soldering to some other items. We suggest that you try stranded wire to solder tags and Veroboard connecting pins, make sure you have a good mechanical connection first—to do this wrap the wire round the pin or insert it through the hole in the tag and bend it over, after tinning it. You should finish with joints like those shown in (g).

HEAT SHUNT

When soldering transistors or other semi-conductors you should use a heat shunt to prevent overheating of the component. For this use the pliers to grip the lead being soldered between the joint and the component (h).

As we have said before, practice makes perfect and after a fairly short time you should be confident enough to start some construction.

Most of the designs we publish utilise Veroboard of one kind or another and we would suggest that you commence construction with a simple project using standard 0.15 inch matrix Veroboard. The 0.1 inch matrix used for some projects is rather more difficult to work with. □



NEXT MONTH

Electronic Egg Timer

Hard, soft or medium—the timer lets you know when the eggs are to your taste. The audible signal at the end of the timed period will summon you from the morning paper to a perfect breakfast.

ENLARGER EXPOSURE METER

Of special interest to the photographer who does his own enlarging, this article describes a meter to determine the exposure required for enlargements, without the need for test strips.

NEON NOVELTY

A simple idea for an interesting ornamental project.

All in the March issue.

On sale Friday, February 16.



Everyday Electronics, February 1973



 **Approximate
cost of
materials
£1.50 plus cable**

U.H.F. T.V. AERIAL

A simple aerial for u.h.f. TV reception on all bands.

By T. A. Lindsey

LOOKING around the rooftops one sees a variety of aerials used for television reception on u.h.f. In general the most common designs are "Yagi" aerials or designs based on the "Yagi", i.e. an array of elements placed in front of a fed dipole with a reflector behind.

There are good reasons for this, the main one being that a Yagi array has good forward gain. This means that it is able to concentrate a relatively large proportion of the received signal towards its feed point, the dipole.

DESIGN

The aerial described here however, consists of two diamond shaped elements fed in parallel and fixed in front of a reflecting mesh (Fig. 1.). It will be found to have comparatively good forward gain for its size and a good front-to-back ratio, due to the large reflector. The gain obtainable is approximately equal to twice that from a single half-wave element placed in front of a reflector.

U.H.F. T.V. AERIAL

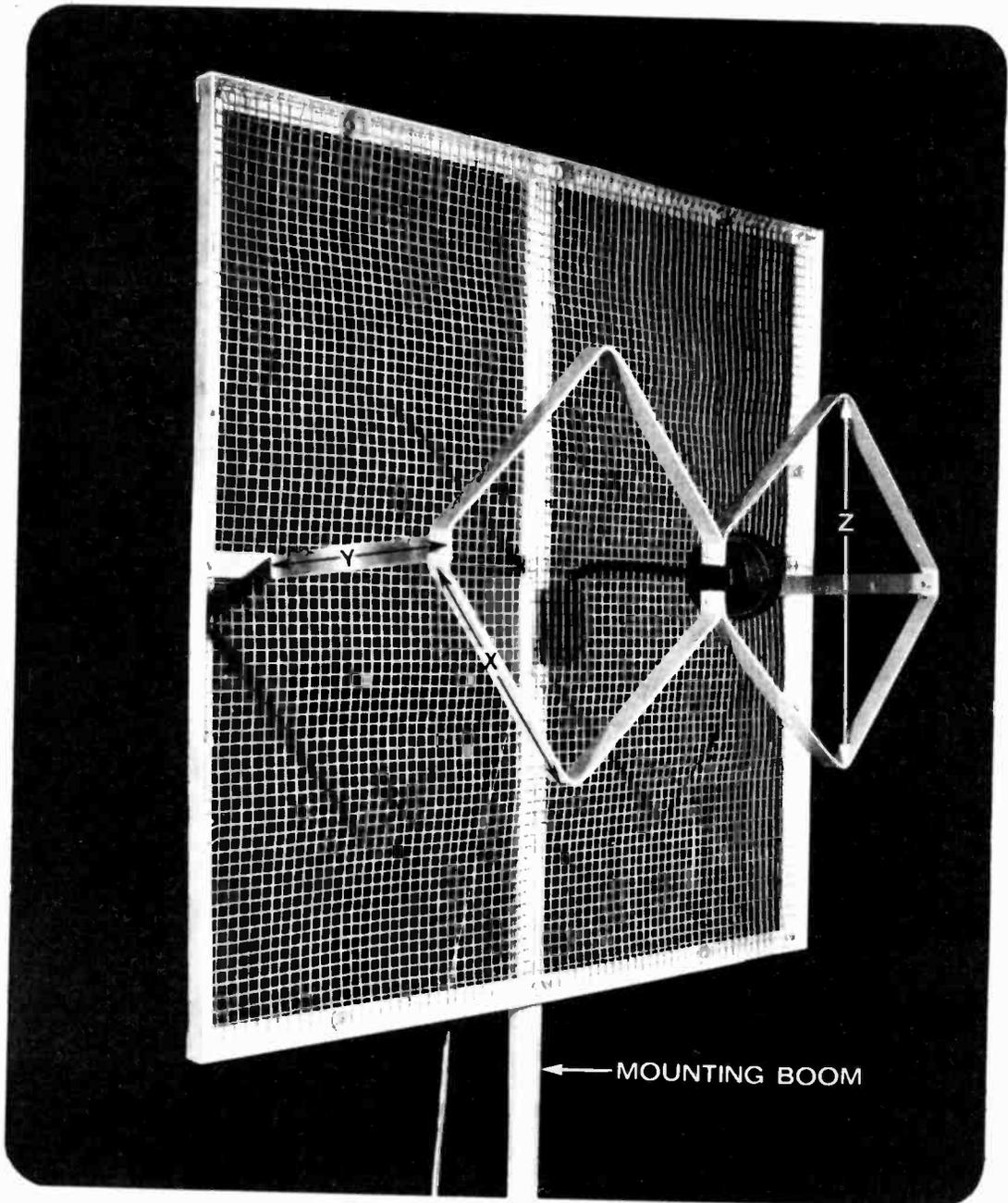


Fig. 1. Details of the complete aerial showing various dimensions.

Table 1: Aerial dimensions for various channels

Channel Group	Channels	Frequency	Dimensions X and Y	Dimension Z	Reflector size
A	21-34	470-582MHz	5in.	8in.	18 x 18in.
B	39-51	614-718MHz	4½in.	6½in.	18 x 18in.
C	50-66	702-838MHz	3½in.	5½in.	15 x 15in.

As the aerial is compact it will be found easy to mount in confined spaces such as lofts. It is also lightweight and in some cases can be fixed to an outside wall without appearing very conspicuous.

Although not intended for use in "fringe" areas, it can be used up to approximately 25 miles from the transmitter when mounted outside and up to 20 miles when used inside the house. These figures should only be taken as a guide as local conditions can cause widely varying signal strengths at u.h.f.

QUALITIES

Some of the important qualities that a u.h.f. aerial should possess are (a) good matching to the feeder cable, (b) sufficient bandwidth, (c) good directional characteristics.

A good match means that the aerial impedance should "look like" the input impedance to the down-lead. This ensures maximum power transfer of the received signal to the receiver. In this case the aerial elements, the "diamonds", are dimensioned to give good matching.

By bandwidth we refer to the frequency band

that the aerial can cover without the received signal dropping below a certain specified value. Except for very wideband aerial types, three differently dimensioned versions of the same u.h.f. aerial are usually required to cover the u.h.f. TV band. These bands are called A, B and C.

Table 1 gives details of the relative sizes of the elements and the spacing required for the three versions of this aerial covering the three bands.

The directional characteristics of an aerial are shown on a polar diagram, which is a graph of the signal received by the aerial as it is rotated through 360 degrees.

The diagram in Fig. 2 shows a typical plot for this aerial (plotted at 570MHz). The front-to-back ratio (i.e. ratio of signal received in the forward direction to that received from behind) is some 8 or 10 to one.

CONSTRUCTION

The reflecting mesh (Fig. 1) can be made in two ways, the one shown is constructed from Weldmesh 22 s.w.g. galvanised ¼ inch square mesh, framed with ½ inch aluminium angle.

Fig. 2. Polar diagram of the U.H.F. TV Aerial described.

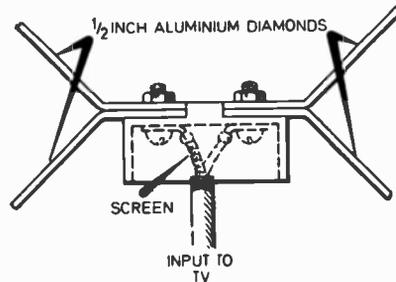
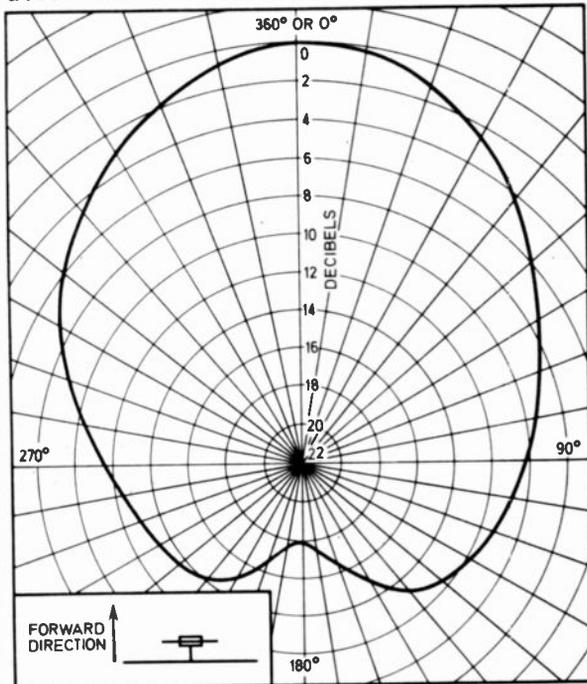


Fig. 3. Insulator box mounting.

The reflector can also be made from Expamet expanded aluminium, any type with the longest opening of mesh less than one inch is suitable. If Weldmesh is used it can be painted for extra protection. The frame is made first by screwing or pop-rievting four pieces of aluminium angle together to form a square (see Table 1 for dimensions). The mesh is then cut to size so that it fits exactly into this frame, and is fixed to the frame with pop rivets and washers or brass screws and nuts.

The diamond shaped elements are made from half inch wide aluminium strip (18 gauge) with dimensions according to Table 1. If these are made as two separate diamonds they can be

fixed together when the insulator box is mounted between them (Fig. 3). Two metal strip spacers support the elements and these are fixed to the apex of each diamond and bolted directly to the reflector frame. Finally a 1 inch diameter aluminium boom can be fitted to the back of the reflector, as shown, if it is desired to mount the aerial to an existing mast.

A suitable small insulator box can be obtained from Stromberg Components Ltd. The cable used should be 80 ohm low loss coaxial, terminated at the receiver end in a suitable coaxial plug.

SETTING UP

The direction of maximum signal strength can easily be found before mounting the aerial at any height. One method is to prop the aerial up against an outside wall facing roughly in the direction of the desired signal with a length of cable connected to aerial and TV set. The set is then tuned until a faint signal is heard and lines appear on the screen. After this the aerial is held in the hand outside and rotated to find the direction giving the best results. This is best done by two people, one with the aerial and the other watching the set. When taken higher the best direction will be similar to that obtained on the ground. But test to be sure.

Some u.h.f. channels are horizontally polarised and others vertically polarised. A Yagi aerial has its elements horizontal for the former and vertical for the latter.

With our diamond aerial it should be noted however, that for horizontal polarization the aerial must be mounted with the two diamonds vertically above one another and for vertical polarisation the two diamonds are horizontal.

This polarization can be checked by rotating the aerial through 90 degrees in the same plane to see which gives maximum signal. ▣

Materials

SEE SHOP TALK

Aluminium angle, $\frac{1}{2}$ x $\frac{1}{2}$ inch, four pieces to dimension of reflector side (see Table 1).

Galvanised $\frac{1}{2}$ inch square mesh or expanded aluminium grille material to dimension of reflector (see Table 1).

Aluminium strip $\frac{1}{2}$ inch wide, 18 s.w.g. length as required (see Table 1).

Aluminium mounting boom, 1 inch diameter tube, if required, length approx. 3 feet.

Small u.h.f. insulator box (Stromberg Components Ltd.).

Length of 80 ohm low loss coaxial cable and coaxial plug to suit TV set.

Pop rivets or 4 BA brass fixings.

Paint to protect Weldmesh if used.

Good Companions...

PE



Yes indeed, Practical Electronics and Everyday Electronics are very good companions.

Under a single editorship, these two magazines are planned to complement each other.

Together they cover the widest needs of amateurs—from the elementary to the advanced level—for up-to-date technical information and sound practical designs.

The February issue of P.E. is now on sale. It includes full details of a simple radio based on the latest i.c. device, and the first part of a series describing the P.E. Sound Synthesiser. A free Capacitor Identichart is also included in this issue.

The March issue of P.E. (on sale February 9) will feature a hi fi stereo tape link.

PRACTICAL
ELECTRONICS

DAMP LOCATOR

By P. E. Hopkins

A simple and inexpensive device for locating damp regions on walls, ceilings etc.

THE device to be described is an inexpensive simple, but effective, damp locator that will reveal damp in a variety of normally non electrically conducting materials such as stone, concrete, plaster, papers and textiles.

As well as making a fascinating toy for children, it may prove invaluable to the prospective house buyer, d.i.y. enthusiast and housewife.

The prototype, using some miniature components, was built and installed in a box measuring only 1in. x 1in. x 3/4in. The circuit layout is not critical, so the constructor has ample scope for improvisation and further miniaturisation.

Since the device is intended to indicate a low level of dampness that is normally hard to determine by hand or eye, the use of a meter was not merited, and indeed by using an l.e.d. (light emitting diode) a fair portion of space and cost are saved.

Dampness occurs when a material absorbs small quantities of water. With some materials it can be hard to determine merely by the sense of touch, whether the material in question is damp or just cold.

Most building materials are, as far as low voltages are concerned, insulators, and thus they will only conduct electricity when they become damp.

CIRCUIT DETAILS

The complete circuit diagram of the Damp Locator is shown in Fig. 1. The two transistors, TR1 and TR2, are arranged in a configuration known as a Darlington pair. This arrangement has the property of providing extremely high gain—approximately equal to the multiplied gains of TR1 and TR2—with very high input impedance. Thus a small current flowing between TR1 base/emitter causes a very much larger current to flow between TR2 collector and emitter.

When the Damp Locator is placed upon a



**Approximate
cost of
components
£1.15 plus case**

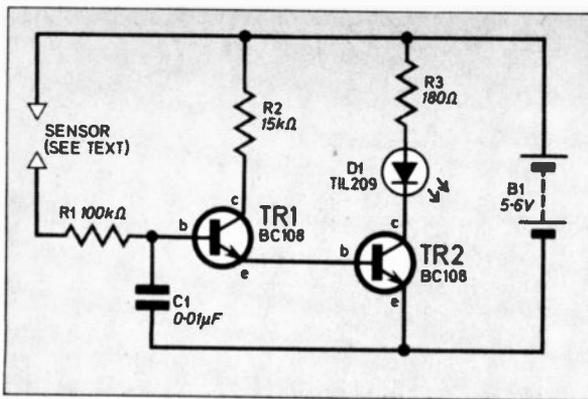


Fig. 1. The complete circuit diagram of the Damp Locator.

damp surface, a minute current is able to pass via that surface between the sensors. This small current provides the base bias for TR1 causing it to be in the conducting state and allows a larger current to pass through its collector and emitter to the base of TR2. This in turn allows TR2 to reach a state of conduction allowing a current to flow through the light emitting diode, damp is indicated by the resultant glow.

In the absence of a conducting media between the sensors, the circuit draws negligible current from the battery, thus an on/off switch was not used on the prototype, the battery being removed during long periods of non use. For long life and compactness a mercury battery is used.

CONSTRUCTION

The circuit components are laid out on a small piece of Veroboard, size 10 by 6 holes by 0.1in. matrix as can be seen in Fig. 2. Begin assembly by making the three cut-outs on the back of the Veroboard as shown in Fig. 2 and then solder in position the resistors, capacitor and flying leads—these should be about 1½in. long single cored insulated wire. Next solder the transistors in position using a heat shunt on the transistor legs. Not using a heat shunt could easily cause permanent damage.

Now solder two short pieces of tinned 22 s.w.g. copper wire in locations E9 and F10 to take D1 and then solder D1 in position (paying attention to polarity indicated by spot) so that its tip is parallel with the top edge of the Veroboard. A heat shunt *must* be used when soldering D1 in position.

TEST

Before installing the unit in a box, check the layout of the components and that there are no bridges between the Veroboard strips. If this is satisfactory carry out the following test. Hold the battery flying leads on the battery and touch the sensor lead (from B3) on the positive terminal of the battery. The diode should glow brightly. If this does not happen re-check and rectify.

FIXING IN A BOX

The prototype was fitted into a small transparent plastic box having a removable lid; any size box will do but it *must* be made from a non electrically conducting material.

Drill four small holes in the base of the box as indicated in Fig. 3 and photograph, then, using either two lengths of Q-strip or stout tinned copper wire pass through the two pairs of holes to form two parallel contacts on the underside of the box; these are the sensors of the device.

The ends of the sensors protruding through the holes should be bent down against the base of the inside of the box. Apply a dab of polystyrene glue to each hole to make watertight.

Next prepare the battery clips from two thin pieces of copper or brass plate as shown in Fig. 3. Note that only one clip is to be connected to the sensor; make this piece, solder to the sensor and glue in position as shown.

To the other terminal, B1 negative, solder a short length of spring—such as is used to hold the carbon brushes in place in an electric motor. Now solder this clip to the flying lead from D6 on the component board and glue this clip in position on the side of the box.

Next place the cardboard washer in place and then solder the flying lead to the sensor as shown. Solder the other flying lead to the positive battery clip and place the component board and battery in the box. It may be necessary to put a piece of cardboard in between the battery and component board for insulation purposes.

Apply a small blob of glue to each side of the component board to hold the board in place.

Next, place the transparent lid in position over the box and mark the position of the l.e.d. as seen through the lid. The complete box may then be painted leaving a clear space on the lid where the l.e.d. will shine through. Take care not to get paint on the sensors. □

Components . . .

Resistors

R1 100k Ω

R2 15k Ω

R3 180 Ω

¼ watt ±10% carbon

Capacitors

C1 0.01μF sub-miniature type

Semiconductors

TR1 BC108 or similar silicon npn

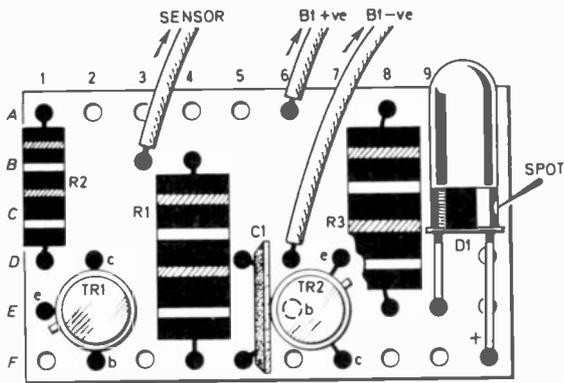
TR2 BC108 or similar silicon npn

D1 TIL209 or similar light emitting diode

Miscellaneous

B1 5.6 volt mercury type PX-23 battery
Veroboard 10 x 6 holes x 0.1in. matrix;
small transparent plastic box; Q-strip stick
down wiring or 22 s.w.g. tinned copper wire.
Connecting wire, paint

SEE
**SHOP
TALK**



DAMP LOCATOR

Fig. 2 (left). The layout of the components on the Veroboard. Note the polarity of the l.e.d. identifiable by the spot.

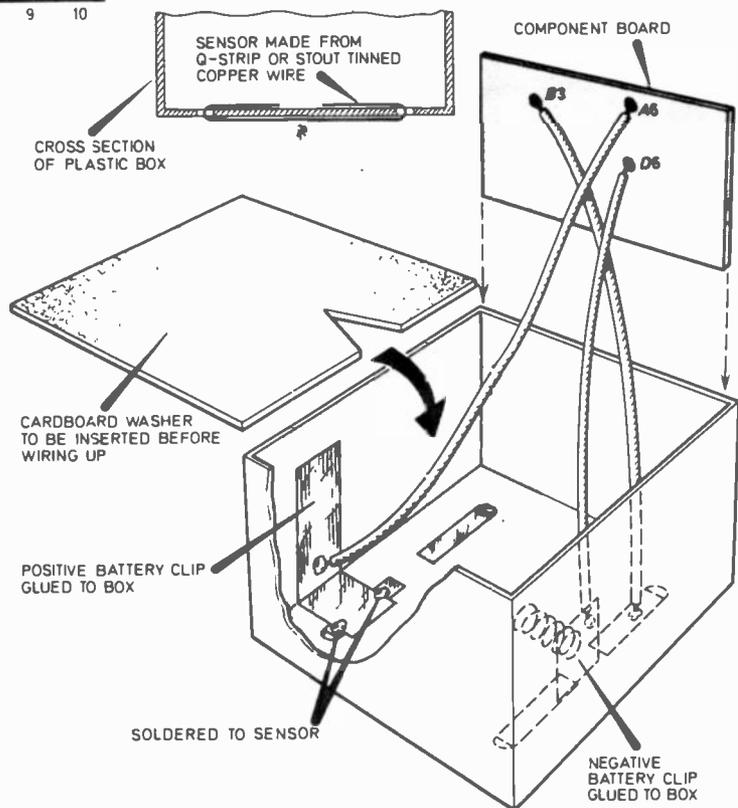
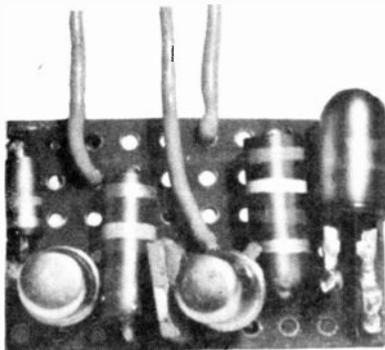
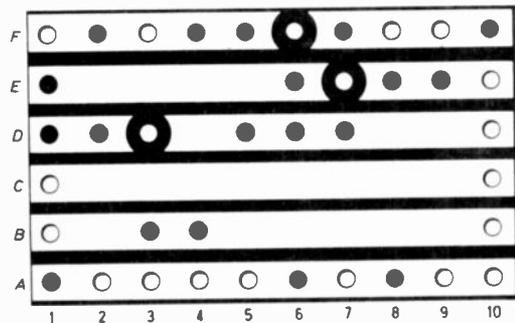
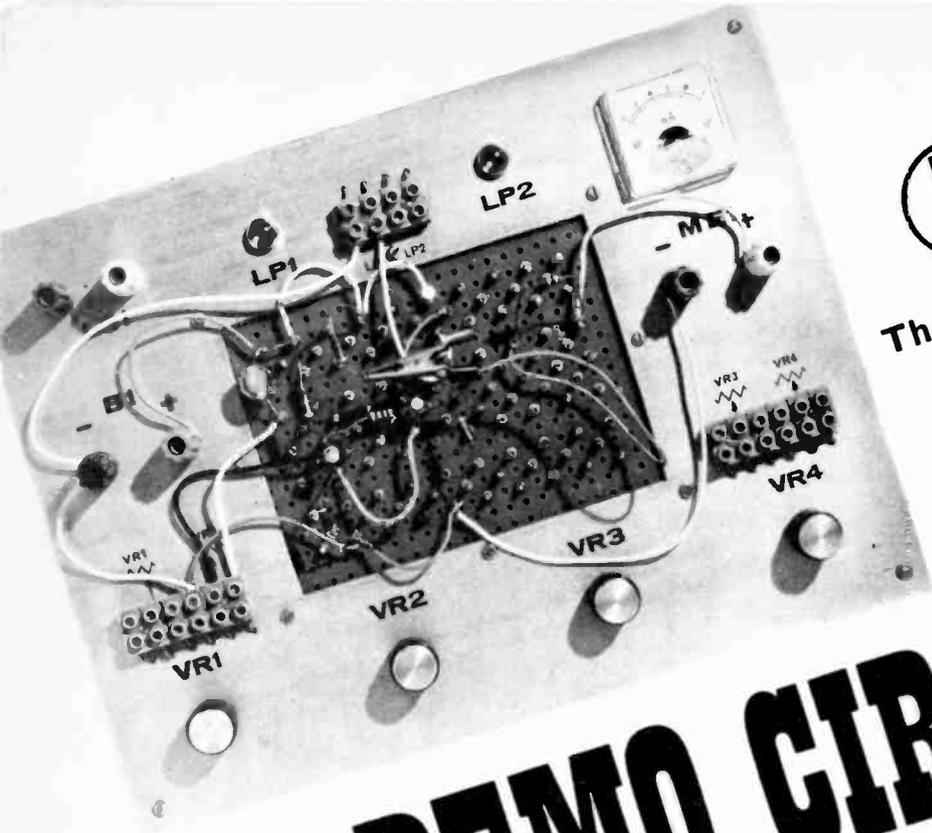


Fig. 3. Layout and wiring of the complete Damp Locator.



3

The Schmitt Trigger

DEMO CIRCUITS

By MIKE HUGHES

FREQUENTLY a voltage level is required to initiate a reaction; for example an automatic car light switch might rely on the falling output of a photo electric cell to turn on the car lights. The ambient light level might be falling very slowly but the car lights must come on positively (usually via a relay or a power transistor) and a circuit is required that will detect the lowest level of available light permitted and then cause the switching circuit to operate once and for all. The car lights must either be on or off; they cannot be "half on".

The output of the detector must, therefore be unambiguous and one of two pre-determined states. The Schmitt trigger is such a detector and also incorporates a form of electronic "backlash" (known as hysteresis) that prevents the output state changing back if there is a small amount of variation of its input conditions (e.g. the ambient light level might rise slightly due to a car passing etc., and we would not want the car lights to switch off again if this was to happen).

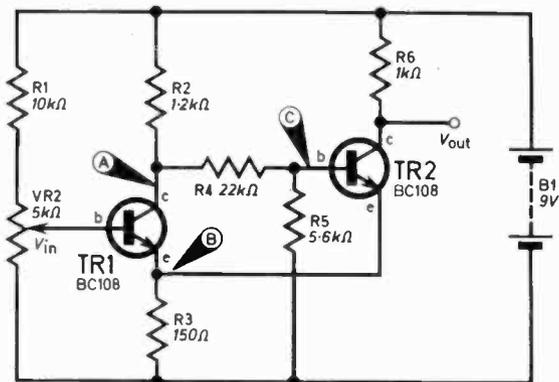
A more general description of the function of a Schmitt trigger is that it only has two output voltage levels "high and low" whatever type of input waveform is applied; therefore it can

be used to convert sine waves or sawtooth waveforms to square waveforms. This effect is sometimes used to create fuzz from electronic guitars.

CIRCUIT OPERATION

The basic experimental circuit, shown in Fig. 3.1, looks fairly simple but like most things

Fig. 3.1. Basic circuit of the Schmitt Trigger.



there is more to it than meets the eye. We suggest you wire up the circuit of Fig. 3.1 on the Demo Deck and measure voltage levels as we proceed with the description. The input to the trigger is at the base of TR1 and an input waveform of 0 to 3V is simulated by adjustment of the wiper of VR2.

With the wiper of VR2 at zero, TR1 will be non-conducting as there is no base current and, assuming that the base current flowing into TR2 is so small that it can be ignored, it is possible to calculate the potential at point A by the potential divide effect of R2, R4 and R5. Point A is at $\frac{9 \times 27.6}{28.8} V = 8.6V$. Similarly the potential at the base of TR2 will be about 1.75V. Base current will flow in TR2 but by emitter follower action the potential at point B will rise to 0.6V less than TR2's base (i.e. 1.15V).

The emitter current of TR2 can now be calculated because it must be the current flowing through R3 that gives rise to the 1.15V. The emitter current is therefore $\frac{1.15}{150} = 7.7mA$ and this will be approximately the same as the collector current. The voltage drop across R6 can now be calculated ($0.0077 \times 1,000$ volts), it is 7.7V; the output voltage relative to the common rail is therefore 1.3V.

If the input voltage rises slowly (actioned by slow adjustment of VR2), as soon as it reaches 1.75V the base of TR1 will be 0.6V more positive than the emitter and base current will start to pass. Several things now happen very quickly; the potential at A will start to fall from its original 8.6V and this reduces the level at C. The potential at B will start to rise as TR1

begins to draw emitter current; this in conjunction with the fall in voltage at C makes TR2 start to cut off. While this is happening TR1 begins to "steal" current through R3 which was formerly flowing through TR2 and the potential at A falls even more quickly.

There is a complicated positive feedback loop in operation and the two transistors interact with each other until TR1 is fully conducting and TR2 is fully turned off. The process occurs very quickly and the speed is limited only by stray capacitance within the circuitry; it is impossible to see a gentle change in voltage at the output however slowly VR2 is adjusted. Notice that triggering occurred when the input voltage reached 1.75V; increasing the input

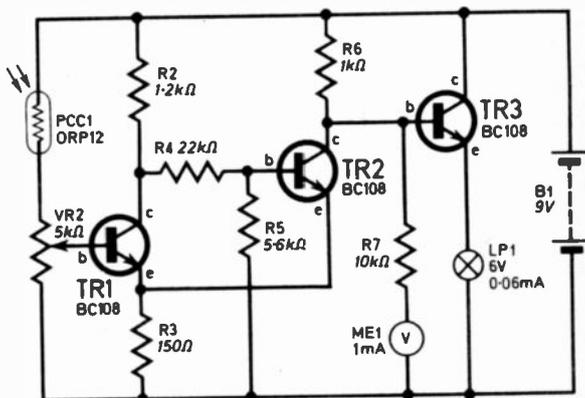
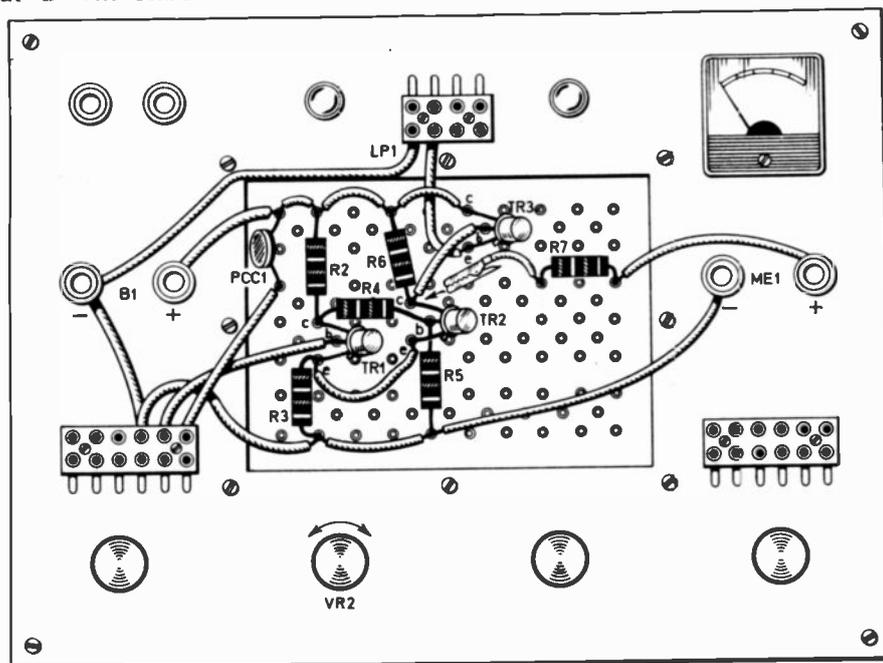


Fig. 3.2. Practical circuit for the light operated switch.

Fig. 3.3. The circuit of Fig. 3.2 wired up on the Demo Deck.



voltage above this level will make no further difference to the output voltage.

HYSTERESIS

On reducing the input voltage to about 1.6V—it would be reasonable to expect the output to revert to its original level of 1.3V; this does not happen even though the input has been reduced to below the “up-going” triggering level; this is due to the hysteresis or backlash mentioned earlier. The reason for this is that once TR1 is conducting the potential at A is very low and there is no reason why it should not stay low—provided we are passing sufficient base current into TR1.

By monitoring the potential at A and reducing the input voltage to about 1.2V an increase will be observed at A—due to the fact that there is no longer enough base current to keep TR1 saturated. When the input reaches about 1.1V the potential at A will have risen sufficiently for base current to flow in TR2 and it will start to conduct. The potential at B rises and forces TR1 out of conduction. Again positive feedback takes place and TR2 becomes fully conducting with the output falling to its original 1.3V.

Try cycling the circuit several times taking note of the hysteresis and the various voltage measurements (use a 20,000 ohm per volt meter). Operate VR2 as fast or as slow as possible and try to catch the output voltage “mid-way” between 1.3V and 9V; this will be impossible because of the regenerative trigger action of the circuit.

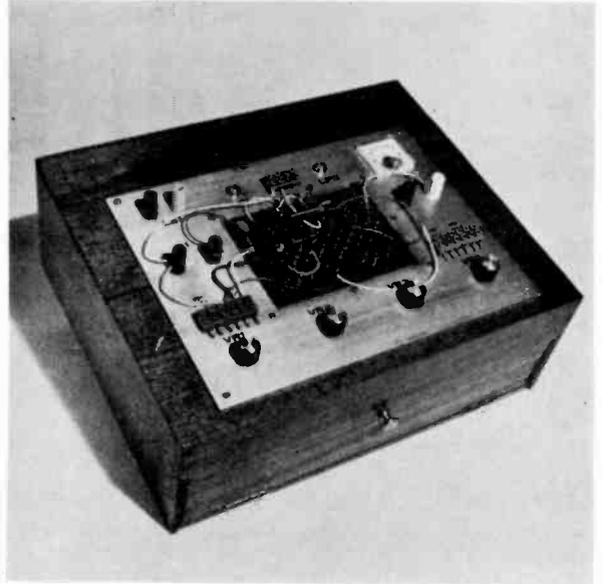
PRACTICAL CIRCUIT

An example using a Schmitt trigger in conjunction with a light dependent resistor (PCC1)

to control a low voltage bulb is shown in Fig. 3.2. The circuit of Fig. 3.2 is shown wired up on the Demo Deck in Fig. 3.3. In a moderately lit room with VR2 set to minimum, the meter will show that the output of the trigger is low and, of course, the bulb in the emitter follower output stage will be out. Slowly advance VR2 until the output just changes and the bulb lights. Try shadowing the photocell as slowly as possible, it will be found that there is an extremely positive and sharp reaction controlling the bulb.

Notice also that the hysteresis also helps to enhance the effect by introducing a margin between the levels for triggering on and off.

Next month: The Grounded Base Amplifier



PLEASE TAKE NOTE

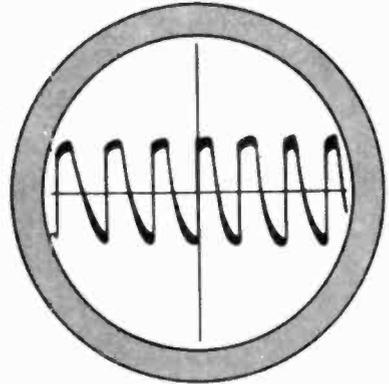
The transistors specified for the *Ice Warning Device*, last month should be AC126 not AC127. The AC127 is an *nnp* device not *pnp*. The unit will work with the AC127 provided the battery and capacitor polarities are reversed.

The AC127 was also wrongly listed as a *pnp* device in the *Constructors Companion* given free with the May 1972 issue (no longer available).

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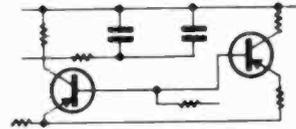
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WE continually get letters from readers asking about the supply of back numbers—mainly for the beginners' series *Teach-In* or for various parts of it. As we have said before, we are sorry but we are not able to supply any back issues or copies of individual articles.

It is the intention of this magazine to publish further series for beginners, both at a similar level to *Teach-In* and at rather higher and lower levels—*Basic Electricity* is an example of the latter. It is not our intention to go very much higher in level as other publications, in particular PRACTICAL ELECTRONICS—our associate magazine—cover the “higher level” techniques and theory.

Therefore we recommend that if you want a basic course in electronics, you follow *Basic Electricity*, our next beginners' series and the various theory and practice articles that we publish e.g. *Demo Circuits* and *Simple Soldering* in this issue. If you miss any issues we are unfortunately unable to supply them but you may be lucky enough to find a technical or reference library that keeps them, or even a school or college.

Audio Colour Unit

Before building the *Audio Colour Unit* we suggest that you take note of the limitations mentioned in the article and decide what type of display is required and just how you want to use the unit. Having decided this you can then decide how many lamps you require and what type of thyristors must be used.

Assuming that you are going to build the unit exactly as described the only component likely to cause difficulties is the transformer specified (Eagle type MT12, 3 off). It is better to use this transformer rather than a substitute as the inductance of the primary winding will affect the tuning of the audio filter. If you do use substitutes make sure all three are the same and small enough to fit on the component board. The Eagle type is available from most large suppliers but in case of difficulty we suggest writing to G. W. Smith.

As far as the remaining components go, Woolworths is probably the best place to buy the lamp holders and bulbs. Case materials should be readily available but remember to provide adequate ventilation for the lamps.

When the prototype was constructed, the author had difficulty in obtaining a piece of frosted glass and reeded glass with tracing paper glued onto the back provided an excellent substitute.

Damp Locator

One or two rather unusual items are used in the *Damp Locator*, the main one being the l.e.d. (light emitting diode). This device is employed because it is miniature, consumes very little power and is much more reliable than a bulb. Prices of l.e.d.'s vary by a considerable amount, and we have found that Arrow Electronics' price is one of the lowest.

Another unusual item is the Q strip stick down wiring employed for the sensor, this product was mentioned in *Shop Talk* some months ago, and we are now assured that it is generally available, again, if you have any problems one of the London suppliers should be able to help.

A point to remember when buying the resistors and capacitor for this project is the space into which they must fit—if you do not get the resistor wattages quoted they will quite simply not go in, so buy the smallest sizes—a ceramic disc capacitor should be suitable.

If the battery cannot be obtained locally Henry's Radio can supply.

U.H.F. TV Aerial

An unusual project for this magazine, the *U.H.F. TV Aerial* uses no electronic components in

the normal sense of the word and most of the parts should be available from an ironmonger or hardware shop. Various types of metal mesh can be used for the reflector, Expamet (expanded aluminium) being the most readily available from many metal suppliers, but you must use the type with holes smaller than one inch. Another useful material is Weldmesh, this is made for use in reinforcing concrete and is available through British Reinforced Engineering Co., Dichfield Road, Stafford, write to them for addresses of local suppliers.

The remaining aluminium sections should be readily available and we suggest the use of brass fixings to hold the aerial together if pop rivets are not used.

For the insulator any small u.h.f. insulator similar to that shown can be used, or the actual component can be obtained from Stromberg Components Ltd., Electra Works, Baddeley Green, Stoke on Trent, Staffs, who inform us that that will supply one off's to readers.

Bass Booster

The components for the *Bass Booster* should all be readily available; if you have difficulty with the tube try Home Radio Components Ltd.

New Products

Two tools of possible interest to readers have recently been introduced by Spiralux (Hollands and Blair Ltd). The most interesting is a combined wire stripper, cutter, cable looper and screwdriver which has an adjustable wire gauge control—not that the markings mean anything to us—and what we think is a crimping tool, but Hollands and Blair do not mention this fact. The tool should be available from most retailers for 40p (recommended retail price).

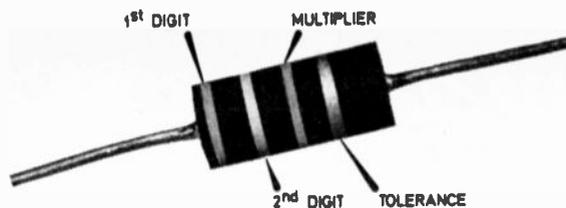
The second Spiralux tool, which should also be available from most retailers, is a “Swinghead Snap Rivetter”. This is an improved version of a previous design and can be used with two sizes of rivet by virtue of the “swinghead”. The new model 2710 would be suitable for case or chassis construction, or for such items as the *U.H.F. TV Aerial* in this issue, recommended retail price, £1.98 with some rivets and instructions.

DATA PAGE DATA PAGE

RESISTOR COLOUR CODE

There are normally four coloured bands on carbon resistors, the first three indicating the ohmic value and the fourth band giving the tolerance limit. The code should be read starting with the band nearest to the end of the resistor body (usually the other end has a metallic gold or silver, band).

The first band gives the value of the first digit, the second band gives the second digit whilst the third band gives the multiplying constant, or more simply, the number of zeros to place after the first two digits. The fourth band indicates the tolerance, see right.



Colour	Digit (1st 2 bands)	Multiplying Factor (3rd band)	Tolerance \pm per cent (4th band)
Black	0	1	—
Brown	1	10	1
Red	2	100	2
Orange	3	1000	3
Yellow	4	10,000	4
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Grey	8	100,000,000	—
White	9	1,000,000,000	—
Gold	—	0.1	5
Silver	—	0.01	10
No fourth band indicates a tolerance of ± 20 per cent			

ABBREVIATIONS

The following is a list of abbreviations used in the text of articles and in components lists. Only the direct meaning of the abbreviations is given, no attempt has been made to describe the meaning of the words in full.

a.c.	alternating current
a.f.	audio frequency
a.f.c.	automatic frequency control
a.g.c.	automatic gain control
a.m.	amplitude modulation
BA	British Association (nut and bolt sizes)
cm	centimetre
d.c.	direct current
d.p.d.t.	double-pole double-throw
elect.	electrolytic
e.h.t.	extra high tension
e.m.f.	electromotive force
f.e.t.	field effect transistor
f.s.d.	full scale deflection
f.m.	frequency modulation
ft.	feet
g.	gram
h.t.	high tension
i.c.	integrated circuit
in.	inch
l.e.d.	light emitting diode
l.d.r.	light dependent resistor
lin.	linear
log.	logarithmic
l.t.	low tension

m	metre (measurement of length)
mm	millimetre
m.w.	medium wave
npn	transistor structure (two types)
pnp	
oz	ounces (avoirdupois)
p.i.v.	peak inverse voltage
p.v.c.	polyvinyl chloride
r.f.	radio frequency
r.m.s.	root mean square
s.p.s.t.	single-pole single-throw (switch)
s.r.b.p.	synthetic resin bonded paper
s.w.g.	standard wire gauge
t.r.f.	tuned radio frequency
u.h.f.	ultra high frequency
u.j.t.	unijunction transistor
v.h.f.	very high frequency
%	per cent
X	reactance
Z	impedance
A	ampere (amp)
dB	decibel
F	farad
H	henry
Hz	hertz (cycles per second)
Ω	ohm
V	volt
W	watt
p	pico (\div 1,000,000,000,000)
μ	micro (\div 1,000,000)
m	milli (\div 1,000)
k	kilo (\times 1,000)
M	Mega (\times 1,000,000)

2N414 £1.25 POST FREE
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C24	13p	R54	£1.46	VA1033	13p
C213A	13p			VA1040	10p
E298 ED/A258	10p			VA1053	10p
E298 ZZ/06	10p			VA1055S	10p
GL16	£1			VA1034	10p

Potentiometers



5KΩ	50KΩ	500KΩ	
10KΩ	100KΩ	1MΩ	
25KΩ	250KΩ	2MΩ	

log of lin less switch (& 1KΩ lin) 12p
 log of lin with switch 24p
 dual less switch 40p
 dual with switch 10K, 100K & 1M log only 62p
 10K log 10K antilog less switch 40p

Capacitors

disc ceramic	low voltage		
0.1μF 18v	5p	0.1μF 30v	5p
0.22μF 18v	5p	0.22μF 50v	8p
0.47μF 12v	5p	0.47μF 3v	3p
ceramic plate	30V		
1000pf	10p	4700pf	10p
2200pf	10p	10,000pf	10p

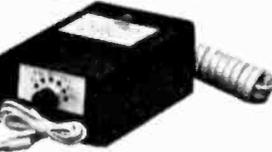
Slider Pots

Single	Dual	log	
10K	10 + 10K	or	
25K	25 + 25K	lin	
50K	50 + 50K		
100K	100 + 100K	Knobs	
30p	50p	10p	

Resistors

1/2 watt 5% Carbon Film - low noise
 Hi-Stabs
 All E24 values 1p each plus p. & p. 7p for up to 50 Resistors and a further 2p for each additional 50. Deduct 33 1/3% for 100 of one type or 25% for mixed orders over £1 in value.
 1W 10% Carbon Composition 3p each
 2W 10% Carbon Composition 6p each
 2 1/2W 5% Wire wound 9p each
 5W Wire wound 9p each
 10W Wire wound 10p each
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 7 1/2 volt for cassette recorders £2.00
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 3, 4 1/2, 6, 7 1/2, 9, 12 - 500mA (Illus.) £3.99
 Car Battery Converter fully stabilised to provide 6, 7 1/2 or 9 volts £4.99
 (p. & p. 18p on all types)

Ceramic - plate 63V (C333)

1.6pf	8.2pf	33pf	120pf
2.2pf	10pf	39pf	150pf
3.3pf	12pf	47pf	180pf
3.9pf	15pf	56pf	220pf
4.7pf	18pf	68pf	270pf
6.6pf	22pf	82pf	330pf
6.8pf	27pf	100pf	

all 6p. each

mylar film 100V

1000pf	2p	0.1μF	3p	0.68μF	4p
2000pf	2p	0.2μF	3p	1μF	4p
5000pf	2p	0.4μF	3p	2μF	5p
		0.5μF	3p		

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BA102	25p	OA79	9p	IN4001	6p
BA115	17p	OA90	7p	IN4002	7p
BA130	10p	OA91	7p	IN4003	8p
BA145	20p	OA200	10p	IN4004	8p
BA148	20p	BY100	15p	IN4005	10p
BA154	13p	BY126	15p	IN4006	12p
BA155	14p	BY127	15p	IN4007	15p

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 chassis fully transistorised
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Presets

Vertical or Horizontal	0.25 watt 7p				
100	1KΩ	10KΩ	100KΩ	1MΩ	
250	2.5KΩ	25KΩ	250KΩ	2.5MΩ	
500	5KΩ	50KΩ	500KΩ	5MΩ	

polystyrene 160V
 10pf to 10,000pf in multiples of 10, 15, 22, 33, 47 & 68. 3p each

metallised polyester 250V (C280)

0.1μF	3p	0.68μF	3 1/2p	47μF	8p
0.15μF	3p	1μF	4p	68μF	11p
0.22μF	3p	1.5μF	4p	1μF	13p
0.33μF	3p	2.2μF	5p	1.5μF	20p
0.47μF	3p	3.3μF	6 1/2p	2.2μF	24p

metallised polyester 400V (C281)

0.1μF	4p	0.47μF	6p	47μF	10p
0.15μF	4p	0.68μF	6p	33μF	14p
0.22μF	4p	1μF	7p	47μF	16p
0.33μF	5 1/2p	1.5μF	8p		

silvered mica 1% (>50pf) 500V

2.2pf-820pf	7p	4.7nF-5600pf	19p
1nF-2.2nF	8p	6800pf-0.1μF	29p
2.7nF-3.6nF	16p		

mixed dielectric 600V

0.1μF	7p	0.47μF	7p	2.2μF	16p
0.22μF	7p	0.68μF	8p	4.7μF	24p
0.33μF	7p	1μF	8p	1μF	33p

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AC107	75p	BC147	16p	BF196	15p	OC81	16p	2N1304	22p	2N9178	18p
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AC127	11p	BC149	16p	BF272	50p	OC170	22p	2N1993	30p	ZEMERS SERIES	ea.
AC128	11p	BC187	16p	BF190	24p	OC171	30p	2N2926	all 19p	LOST	£1.50
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AC188	25p	BC268	15p	BS95A	14p	2TX300	15p	2N3102	12p	MC1380	80p
AC188K	25p	BD115	67p	BU106/08	£1.78	2TX301	15p	2N3103	12p	MC1381	80p
ACV70	20p	BD131	70p	MJE340	67p	2TX302	20p	2N3104	16p	MC1382	£1.00
AD140	40p	BD132	70p	MPP192	40p	2TX303	20p	2N3105	16p	MC1385	£1.00
AD149	40p	HD131/2M P.		MPP103	37p	2TX304	25p	2N3106	10p	MFC4008	49p
AD181	80p		148p	MPP104	37p	2TX341	20p	2N3107	15p	MFC4009	49p
AD182	80p	BF180	21p	MPP105	40p	2TX350	15p	2N3108	12p	LM38C	£1.40
AF114	16p	BF167	20p	MPP110	45p	2TX501	16p	2N3109	12p	SL4030	£1.50
AF115	16p	BF173	20p	OC28	40p	2TX502	20p	2N3110	12p	TA0100	£1.50
AF116	16p	BF180	25p	OC35	40p	2TX503	17p	2N3111	12p	TR1175	£1.50
AF117	16p	BF181	30p	OC44	45p	2TX504	50p	2N3819	35p		
AF139	25p	BF184	25p	OC45	11p	2TX511	25p	2N3903	15p	KA79C	45p
BC107	16p	BF185	25p	OC71	11p	8N687	16p	2N3904	17p	KA710	45p
BC108	16p	BF194	15p	OC72	17p	2N706	12p	2N3905	21p	KA79C	£1.80
BC109	10p	BF195	15p	OCM	13p	2N708	12p	2N3906	12p	KA79C	30p

mixed dielectric 1000V

1000pf	6p	6800pf	9p	1μF	12p
2200pf	6p	0.1μF	9p	2.2μF	22p
3300pf	6p	0.22μF	9p	4.7μF	32p
4700pf	6p	0.47μF	12p		

Ceramic 8KV.d.c. 8KV.d.c. HI-K 750V.

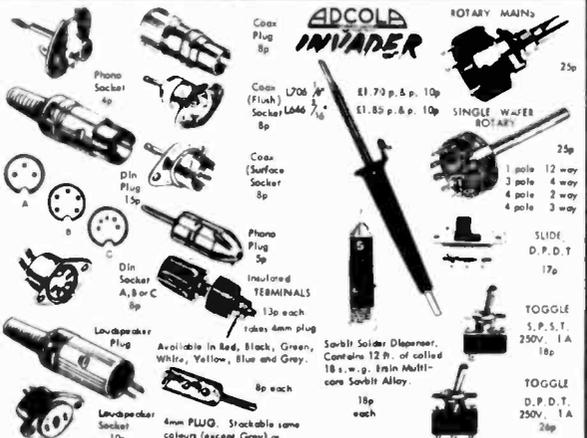
10pf	9p	200pf	9p	1000pf	5p
15pf	9p	220pf	9p	1500pf	5p
22pf	9p	250pf	9p	2000pf	5p
68pf	9p	270pf	9p	3000pf	5p
82pf	9p	300pf	9p	5000pf	5p
100pf	9p	750V DISC	10,000pf	5p	
120pf	9p	47μF	5p	feed-through	
140pf	9p	1000pf	5p		
150pf	9p	5000pf	5p		
180pf	9p	10,000pf	5p	1000pf	5p

Veroboard

Copperclad	Plain	
0.1"	0.15"	0.15"
6p	6p	10p
2 1/2" x 3 1/2"	20p	16p (9)
2 1/2" x 5"	24p	21p (7)
3 1/2" x 3 1/2"	24p	21p (8)
3 1/2" x 5"	27p	27p (10)
17" x 2 1/2"	67p	50p
17" x 3 1/2"	90p	70p
17" x 5"	-	75p

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 3 pole 4 way
 4 pole 2 way
 6 pole 3 way
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Mullard & Siemens Electrolytics

CAP μF	VOLTAGE	4	8.3	10	16	25	40	50
1.5								5p
2.2								5p
3.3								5p
4.7								5p
6.8								6p
10								6p
15								6p
22								6p
33								6p
47								6p
68								6p
100								6p
150								6p
220								6p
330								6p
470								6p
680								6p
1000								6p
1500								6p
2200								6p
3300								6p
4700								6p
6800								6p
10000								6p
15000								6p
22000								6p
33000								6p
47000								6p
68000								6p
100000								6p
150000								6p
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6800000000								6p
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Faraday Lecture

This year's Faraday lecture is concerned with Navigation—Land, Sea, Air and Space. The lecture tells the story of the development of navigation, from the days when the stars were man's only guide, to the sophisticated instruments of today.

The lecture, the 44th in the series, is being given at various centres (listed right) by Dr. Andrew Stratton, Director of Defence Operational Analysis Establishment, together with his deputy lecturer, Wing Commander (Ret'd) E. W. Anderson, navigational adviser of Smiths Industries Ltd.

The lectures are organised by the Institute of Electrical Engineers and tickets may be obtained, free of charge, from addresses given right—a stamped addressed, correspondence size envelope must be sent with all applications for tickets. Tickets are not available earlier than one month before each lecture; the morning and afternoon presentations are for students and "older" school children only.

FARADAY LECTURE 1972/73 TOUR DETAILS

Date	Place	Presentations	Address for Tickets
29 and 30. 1.73	Birmingham. Town Hall	evening (29), morning, afternoon and evening (30)	G. E. Bennett, IEE., Savoy Place, London, WC2R 0BL.
6. 2.73	Leicester. De Montford Hall	afternoon and evening	G. M. Bayley, c/o Brush Electrical Engineering Co. Ltd., Rotating Machine Design Dept., Loughborough, Leicestershire.
15. 2.73	London.	evening	IEE., L.C. Dept.,
16. 2.73	Central Hall, Westminster	evening (students)	Savoy Place, WC2.
22. 3.73	Exeter. Great Hall, Exeter University	afternoon and evening	J. J. Matthews, 18 Fairfield Avenue, Whipton, Exeter, Devon.
27. 3.73	Sheffield. City Hall	morning, afternoon and evening	R. Smalley, 80 Crimicar Lane, Fulwood, Sheffield.
29. 3.73	Liverpool. Philharmonic Hall	afternoon and evening	N. A. Pond, IEE., Savoy Place, London, WC2R 0BL.
5. 4.73	Edinburgh. Usher Hall	afternoon and evening	L. E. J. Green, c/o SSEB., 130 George Street, Edinburgh.
10. 4.73	Newcastle. City Hall	afternoon and evening	S. H. Walker, 63 Langdon Road, Hillhead Estate, Westerhope, Newcastle-upon-Tyne.

Ruminations By Sensor

A Bit of Straw

I recently became a country dweller in a sparsely populated area where mains water is not available. This would not have mattered at all if my removal here had not coincided with the worst drought for over thirty years!

One by one my neighbours' wells went dry, until eventually my own three wells dried up. When the water eventually began to flow into the wells again I was unable to pump it out of them—a most frustrating situation.

It seemed obvious that the pump needed to be primed, but priming made no difference to the water supply and only made me critical of the pump's designers. After checking all connections, looking for frozen pipes, lifting heavy well covers and peering

into the depths, I decided to dismantle the pump.

In one of the valves I found a small piece of straw. When the straw was removed and the pump again primed, water began to flow. Such a little bit of straw, but what a lot of inconvenience caused!

Mice and Men

All this trouble caused me to recall how often the unexpected and unplanned for "bit of straw" can cause the failure of the most sophisticated equipment. The commonest "bit of straw" in electronics, is undoubtedly, the dry joint; but there are countless others. I have seen military radar equipment put out of service by the unwanted attentions of various insects.

At the domestic level, I heard only the other day of a television receiver which seemed to be functioning correctly, but which produced no sound output. It was discovered that the whole of the loudspeaker cone had been eaten by mice!

The process of decay, in its many forms, takes its toll of any

electronic equipment that is not sufficiently protected from its environment. Experience over the years has helped to identify the causes of component failure and severe testing of all components intended for military use is the order of the day. The domestic user benefits enormously from this, since many of the components he utilises are manufactured to the same high standard of quality.

The advantages to be gained by the use of integrated circuits, lie not so much in their small physical size but more in the great reduction in the number of soldered joints, per equipment, made possible by their use, and consequently the reduction in numbers of potential "dry" joints.

The high degree of protection, against adverse environmental conditions, built into the integrated circuit itself, plus the additional protection afforded by the encapsulation does much to improve reliability.

An integrated circuit is not entirely immune to "bits of straw" but the failure rate is very much lower than a similar circuit employing discrete components.



Readers' Bright Ideas; any idea that is published will be awarded payment according to its merit. The ideas have not been proved by us.

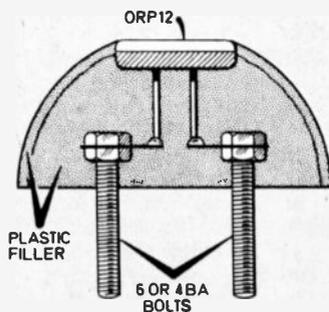
When using nuts and bolts for chassis assembly and finding that the bolt is too short to allow a necessary shake-proof washer to be fitted, this may be overcome by making the nut into a locking nut as follows.

Using a kerf or razor saw (junior hacksaw for larger nuts) cut a slot in the side of the nut about one-third of the way through. Pinch the nut across the slot to obtain the desired amount of locking pressure.

B. Besant,
Bristol.

I have devised a way of protecting the fragile leads from I.d.r.'s such as the ORP12 when used on the outside of a project. Cut a table tennis ball in half and coat the inside with a thin layer of plastic filler (such as Isopon). A suitable sized aperture is then drilled and filed to shape in the half ball. The I.d.r. leads are then soldered to tags for connection to either small bolts or a two-pin plug. The I.d.r. is then placed in position and the remainder of the half ball filled in with more filler.

D. J. Powditch,
Norfolk.



Here is another idea for a used Scripto felt tip pen. Rather than use the usual type of solder dispenser, I find the thin pen more compact, and more easy to use.

Removing the felt and nylon tip, I wound the solder round a No. 5 knitting needle (7ft. of solder) this solder spiral is placed inside the pen and the white cap replaced. The solder protrudes through the black pointed top, as it is used it can be pulled out at ease.

E. R. Wall,
Chalton, S.E.7

Before building a piece of electronic equipment I always lay the components out on the table in the order I want to use them. However, sometimes the bits and pieces get mixed up, or they roll off the table and are lost or broken. To stop this happening I now push the wires of the components into a polystyrene tile to hold them still. Also I can now move my half-built project from the kitchen table without disturbing the components.

David Piper,
Norwich.

Also suggested by G. P. Wild, Tooting.

For the beginner and the more experienced constructor this is an invaluable tool, it is very simple to construct. Start by selecting a crocodile clip and a narrow, thin piece of copper. Cut the copper into two equal pieces and slide one into each of the teeth of the clip. A slight tapering of the ends may be needed for a snug fit followed by a small drop of glue to hold the copper in place. This can now be used as a heat shunt when soldering semiconductors.

A. Smith,
Thornton Heath.

Also suggested by Revd. John H. Hart, Liverpool.

The quickest and cheapest way for a beginner to get a stock of components to "play" with is to buy circuit boards and strip them. It is messy, damaging and time consuming to unsolder components, and leads are so short that cutting them is out of the question.

I find that with a coarse Abrafile (or possibly a Surform?) the solder can be filed off the back and the components gently prised out with a small screw-driver. Anything other than an extremely coarse file quickly becomes clogged with the soft solder.

The leads on transistors are generally so short that they are better left on the board which can be easily sawn up and the solder blobs make for easy soldering of leads.

R. D. Pasnham,
Sheffield.

Please Note: this column is intended for constructional ideas and ideas relating to electronic construction. It is not our intention to publish circuits of any description.

All items submitted should be original and not previously published.

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Why not do the thing that really interests you? Without losing a day's pay, you could quietly turn yourself into something of an expert. Complete the coupon (or write if you prefer not to cut the page). No obligation and nobody will call on you ... but it could be the best thing you ever did.

Others have done it, so can you

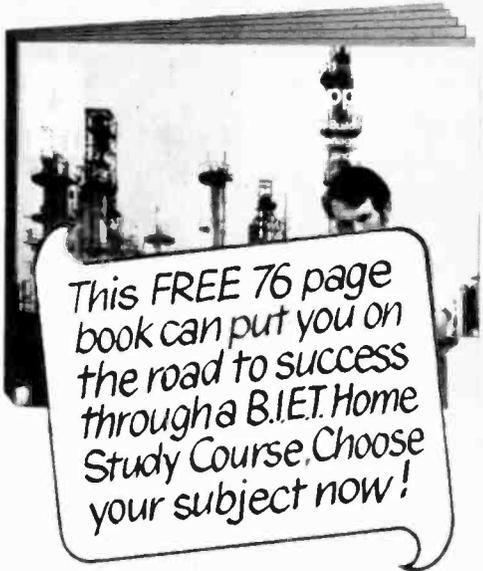
"Yesterday I received a letter from the Institution informing that my application for Associate Membership had been approved. I can honestly say that this has been the best value for money I have ever obtained - a view echoed by two colleagues who recently commenced the course". - Student D.I.B., Yorks.

"Completing your course, meant going from a job I detested to a job that I love, with unlimited prospects". - Student J.A.O. Dublin.

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C & G Elec. Inst.
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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 2 1/2 x 2 x 2in. £1.50 each.



NEED A SPECIAL SWITCH?

Double Leaf Contact. Very slight pressure closes both contacts. 7p each. 10 for 60p. Plastic pushrod suitable for operating. 5p each. 10 for 45p.



AUTO-ELECTRIC CAR AERIAL

with dashboard control switch—fully extendable to 40in or fully retractable. Suitable for 12V positive or negative earth. Supplied complete with fitting instructions and ready wired dashboard switch. £5.75 plus 25p post and insurance.



MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP8, PP7, PP9, and others. Kit comprises: mains transformer rectifier, smoothing and load resistors, condensers and instructions. Real snip only £1



MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 2 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at 20p each £1.80 for ten, your assortment.



DRY FILM LUBRICANT

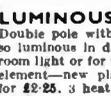
DRY Film Lubricant. In aerosol can for easy application and for putting lubricant into places where the normal oil can not reach. Home and everyday use. We have purchased a large quantity of these from the Liquidor and are able to offer them to you for about half of the original list price. 80p per (8 oz.) can or 12 cans for £3 post paid. The lubricant is I.C.I. Fluon L169.

MULTI-SPEED MOTOR
Six speeds are available 500, 850 and 1,100 r.p.m. and 8,000; 12,000 & 15,500 r.p.m. shaft is 1/8 in. diameter 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. x 5 in. long. Price 88p plus 23p postage and insurance.



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 65p. Postage 20p for first one then 10p for each one ordered. 1 1/2" stackmotor 85p. 1 1/4" stackmotor £1.



LUMINOUS CORD SWITCHES

Doubling pole with neon led into side so luminous in dark. Ideal for dark room light or for use with waterproof element—new plastic case. 25p, 10 for £2.25. 3 heat model 85p, 10 for £3.42.



FLUORESCENT CONTROL KIT

Each kit comprises seven items—choke, 2 tube ends, starter, holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A—15-20 w. £1. Kit B—30-40 w. £1. Kit C—80 w. £1.20. Kit E—65 w. £1.20. Kit F for 8ft. 125 w. tube £1.75. Kit MP1 is for 6in., 9in. and 12in. miniature tubes £1. Kit MP2 A and B 23p for one or two kits then 23p for each two kits ordered. Kits C, D and E 23p on first kit then 18p for each kit ordered. Kit F 23p then 23p for each kit ordered. Kit MP1 18p on first kit then 15p on each two kits ordered.



HEAT & LIGHT LAMP

Plugs into a lamp holder. Ideal in bathroom, toilet, over bed, etc. 80p plus 20p P. & P.

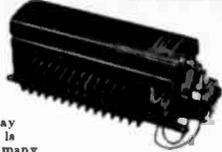
HOOR MINUTE TIMER

Made by Smiths. Complete with control knob and calibrated dial. Useful in kitchen, office, dark-room, etc. Bargain at 80p.



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 la mains operated 5 revs per min. Some of the many uses of this timer are: laundry control, Boiler firing, Dispensing and Vending machines, Display lighting animated signs, Signalling, etc. Price from makers probably over £10 each. Special snip price £5.75 plus 25p post and insurance. Don't miss this terrific bargain.



MIGHTY MIDGET

Probably the tiniest possible radio, as described in Practical Wireless, January 73. All electronic parts £2 post paid.

DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. £2.25 plus 23p P. & I



HORSTMANN "TIME & SET" SWITCH

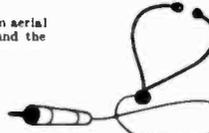
(A30 Amp 8w/6oh.) Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fire, etc. up to 14 hours from setting time or you can use the switch to give a boost on period of up to 3 hours. Equally suitable to control processing. Regular price probably around £5. Special snip price £1.50 Post and ins. 23p.

MULLARD UNILEX

This D.I.Y. Stereo Amplifier is still available complete at £7.00 for the four Mullard Modules, or Modules can be bought separately as follows:—4 watt amplifier module (2 required) Mullard Ref. No. E.P.9000—£1.45 each. Pre amp module Mullard Ref. No. E.P.9001—£1.80 each. Power module—Mullard Ref. No. E.P.9002—£2.30 each. In addition and made to Mullard Specification we offer:—Standard Control Unit with escutcheon—£2.50. Knobs—Set of 4—50p. De-luxe Control Unit—£3.50 with escutcheon. Set of 6 Knobs—75p. Mullard Unilex Handbook—25p.

RADIO STETHOSCOPE

Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV amplifier, anything—complete kit comprises two special transistors and all parts including probe tube and crystal earpiece. £2—twin stethoscope instead of earpiece 75p extra—post and ins. 20p.



24hr. REPEATING TIME SWITCH

Made by Smiths these are A.C. mains operated. NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. 2 completely adjustable time periods per 24 hours. 5 amp change-over contacts will switch circuit on or off during these periods £2.50 post and ins. 23p. Additional time contacts 50p pair.



ATLAS TWENTYLITE

Fluorescent lighting units with polyester choke and finished white enamel. 2ft. model, ideal kitchen, bedroom, hallway, porch, loft etc. With tube assembled ready to instal. £1.99 + 40p postage.



HONEYWELL THERMOSTAT

Made by Honeywell for normal air temperatures 40°-80°F (5-25°C). This is a precision instrument with a differential which can be adjusted to better than 1.5°F. A mercury switch breaks on temp. rise—the switch is operated by a coiled bi-metal element and adjustable heater is incorporated for heat anticipation. Elegantly styled and encased in an ivory plastic case with clear plastic windows thermometer above and switch setting scale below—size approx. 3-8" x 3-2" x 1-4" deep—can be mounted on conduit box or directly on wall. Price £1.25 each for ten for £11.25.

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 4 1/2" x 4 1/2" x 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 fuz smoke when soldering etc. etc. A real bargain at £1.85.



BATTERY CONDITION TESTER

Made by Mallory but suitable for all batteries made by Eveready and others, most of which are zinc carbon types but also mercury manganese—nickel—silver oxide and alkaline batteries may be tested. The tester puts a dummy load on the battery and the meter scale indicates the condition depending upon which section the pointer rests. The section reads "replace", "weak" or "good". The tester is complete in its case, size 3 1/2" x 6 1/2" x 2" with leads and prods. Price £2.50 plus 20p postage.

12 WAY SUB-MINIATURE MULTI-CORE CABLE

7.0076 copper cores each core P.V.C. insulated and of different colour. P.V.C. covered overall and approx. 3/16in. thick. Price 20p per yard.

SNAP ACTION SLIDE SWITCH

Rated 5a. 240v. Made by Arrow. Type fitted in the handles of electric drills, vacuums, etc. 5p each. 10 for 45p.

BATTERY CHARGER KIT

Comprising 3 amp 12V mains tra. and rectifier with wiring diagram. £1.25 + 25p P. & P.

BLACK HEAT ELEMENTS

Ideal for making convector and similar devices. Two joined in series approx. 1KW. Price 75p per pr. + 20p postage.



EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic ft. per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc. It's so quiet it can hardly be heard. Compact, 5 1/2" casing with 5 1/2" fan blades. Kit comprises motor, fan blades, sheet steel casing, pull switch, mains connector, and fixing brackets. £2.50 + 20p P. & P.

CD CAR IGNITION

This system which has proved to be amazingly efficient. We offer kit of parts as P.W. Circuit £5.95 plus 20p p. & p. Deluxe model with prepared circuit board £8.95. When ordering please state whether for positive or negative systems.

POWER PACKS

Made for driving racing cars, meccano models and battery motors etc. direct from the mains. Fully insulated and tamper proof. Standard model £2.50, ditto with reversing switch £3.50 or with reversing switch and speed controller £4.25.

SPIT MOTOR

200-250V induction motor, driving a Carter gearbox with a 1 1/2" output drive shaft running at 5 revs p.m. Intended for roasting chickens, also for driving models—windmills, coloured disc lighting effects, etc. £1.85 plus 20p post and ins.

AUTO TRANSFORMER

Primary 220-240V. Secondary 110-120V, well built and varnish impregnated. 250 watt intermittent rating. 150 watt continuous rating. Size approx. 3 1/2" x 3" x 3". £1.00 + 20p post & ins

SOLDER GUN

A must for every busy man, gives almost instant heat, also illuminates job. 100 watt £2.25 plus post and ins. 20p. BIG JOB! 250 watt model £4.75 plus post and ins. 40p.

TELESCOPIC AERIAL

for portable, car radio or transmitter. Chrome plated—six sections, extends from 7 1/2 to 47in. Hole in bottom for 6BA screw. 38p. KNUCKLED MODEL FOR F.M. 50p

TREASURE TRACER

Complete Kit (except wooden battery) to make the metal detector as the circuit in Practical Wireless, August issue. £2.95 plus 20p post and insurance

IMMERSION HEATERS BY REMPLOY

Standard fitting for domestic water tanks, made by the famous Remploy Company. Complete with sealing washers suitable for 200-240 volts A.C. Depth into tank 1 1/2". 2kw £1.50 plus 20p each post and insurance.

MAINS OPERATED SOLENOIDS

Model 772—small but powerful 1" pull rated approx. size 1 1/2" x 1 1/2" 80p. Model 400/1 1" pull Size 2 1/2" x 2 x 1 1/2" 75p.

Model TT10 1 1/2" pull size 3 x 2 1/2 x 2" £1.80 plus 20p post and insurance.

RESETTABLE FUSE

How long does it take you to renew a fuse? Time yourself when next one blows. Then reckon your time at £1 per hour see how quickly our resettable fuse (auto circuit breaker) will pay for itself. Price only £1 each or 10 for £9.00 specify 5, 10 or 15 amp—simply fit in place of switch.

LIGHT CELL

Almost zero resistant in sunlight increases to 10 K Ohms in dark or dull light, epoxy resin sealed. Size approx. 1in. dia. by 1in. thick. Rated at 600 MW, wire ended. 60p with circuit. Also O.R.P. 12 light cell 60p.

TAPE HEADS

We are gradually obtaining more information about the Truvox tape heads we have, we are told that these have been found in a very ingenious way so that winding may be coupled either in parallel or in series depending whether high or low impedance is required. We also have matching erase heads and now offer these in pairs. 1 record and 1 erase head. Price of the 2 track 48p per pair, 4 track 78p per pair. Pair mounted on plate 45p extra.

I.R.P.H. MOTOR

Made by the famous Smiths Company. 240v 50 cycle mains working. Ideal motor to drive clock mechanisms. Price £1 each or 10 for \$9.

CONTROL DRILL SPEEDS

DRILL CONTROLLER NEW I.K.W. MODEL

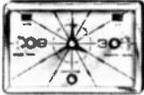
Electrically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1.50 plus 13p post and insurance. Made up model also available. 22-25 plus 13p post & p.

HIGH ACCURACY THERMOSTAT

Uses differential comparator I.C. with thermostat as probe. Designer claims temperature control to within 1/7th of a degree. Complete kit with power pack 25-50.

WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. 60p post free.

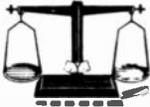


ISA ELECTRICAL PROGRAMMER

Learn in your sleep: Have radio playing and kettle boiling as you awake—switch on lights

to ward off intruders—have 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 £1.95 + 20p p & p or with glass front chrome bezel 78p extra.

EDUCATIONAL KITS—all with pictorial instructions



THIS BALANCE KIT FREE

Eagle educational kits. Japanese made these are excellent value for money. We do not expect to be able to repeat this offer once stocks are sold. Brief description of each kit is given below and with 3 kits or more we give FREE an accurate 11 piece balance kit. Price of kits 40p each post paid. Special price for all 8 kits £3.00 with free balance kit.

KA2 Lens Kit. Eleven parts, including candle, one concave lens, one convex lens, stage and slit frame, etc. Watch light rays bend as they pass through different lenses.

KA3 Water Pump Kit. Thirteen parts. Top of pump is transparent so that operating parts may be observed. Small parts are brightly coloured to be seen easily while working. Three types of pump may be made: Lift pump, Force Pump and Force Pump with reservoir and nozzle.

KA4 Buzzer Kit. Eleven parts. Transparent covers allow the operation of buzzer to be seen. Illustrates and teaches how electromagnetism with an automatic switch results in an operating buzzer.

KA5 2-Pole Motor Kit. Twenty-four parts including enamel wire, armature and pole piece, etc. Motor operates from 1½ volt battery. Illustrates and teaches how electro-magnetism operates a motor.

KA7 Electro-Magnet Kit. Fifteen parts, includes compass. Makes two electro-magnets, one with one layer of wire and one with several layers of wire. Picks up tacks, nails and any small parts showing how magnetism works.

KA8 Current and Resistance Kit. Twenty-nine parts, including bench and light bulb. Conducts interesting and educational projects to learn the application of "OHMS LAW" and see the difference in current and resistance with different types and lengths of wire.

KA9 Bell Kit. Eight parts, including bell and push button switch. Build a complete electric bell and see how the hammer is triggered to make the bell ring.

KA10 Morse Key buzzer and bell kit. 25 part kit easy to construct, simple to operate.

Where postage is not stated then orders over £5 are post free. Below £5 add 20p. Semiconductor add 5p post. Over £1 post free. S.A.E. with enquiries please.

AUDIO COLOUR UNIT DAMP LOCATOR UHF TV AERIAL

To receive parts for these and other products featured in this issue send quoted approximate amount and cash adjustment will be made later.

THYRISTOR LIGHT DIMMER

For any lamp up to 600 watt. Mounted on switch plate to fit in place of standard switch. Virtually no radio interferences. Price 22-25 plus 20p post and insurance.



TANGENTIAL HEATER UNITS

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing £15 and more. We have a few only. Comprises motor, impeller, 2kW. element and 1kW. element allowing switching 1, 2 and 3kW. and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only need control switch. 22-50. 2kW. Model as above except 2 kilowatts 22-50. Don't miss this. Control Switch 25p. P. & P. 40p.



DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. 22-25 plus 23p P. & 1

THIS MONTH'S SNIP

5 AMP VARIAC FOR £3

This heading is not quite accurate because it is not a variable transformer that we are offering but a solid state device which serves the same purpose in almost all applications and, of course, much smaller. Made by Ultra Electronics, can be fitted into ordinary switch box. Engrave a circle on the front plate, mark this off in divisions, fit a pointer knob, calibrate with your voltmeter (you will find the scale almost linear) you now have a power controller equal to a 5 amp variac costing £12 or more.

BARGAIN PARCEL OF SEVEN MOTORS



A bargain parcel of 7 motors for £1. Some not as large as a postage stamp and only 1" thick, largest is 1½" x 1½" dia. Some work off 1½v some as high as 18v. These motors are used in racing cars, power toys etc. The largest is so powerful that it will drive a Mini drill, model lathe, or similar. This is a 4 pole motor, optimum working 16-5v but very powerful even as low as 4v. Don't miss this wonderful snip.

STANDARD WAFER SWITCHES

Standard size 1½" wafer—silver-plated 5-amp contact, standard 1" spindle 2" long—with locking washer and nut.

No. of Poles	2 way	3 way	4 way	5 way	6 way	8 way	9 way	10 way	12 way
1 pole	40p	40p							
2 poles	40p	40p							
3 poles	40p	40p	40p	40p	70p	70p	70p	85p	85p
4 poles	40p	40p	70p	70p	70p	70p	70p	1.20	1.20
5 poles	40p	40p	70p	70p	95p	95p	95p	1.45	1.45
6 poles	40p	70p	70p	70p	95p	95p	95p	1.70	1.70
7 poles	70p	70p	85p	1.10	1.10	1.10	1.10	1.35	1.35
8 poles	70p	70p	85p	1.10	1.10	1.10	1.10	1.35	1.35
9 poles	70p	70p	85p	1.10	1.10	1.10	1.10	1.35	1.35
10 poles	70p	70p	85p	1.10	1.10	1.10	1.10	1.35	1.35
11 poles	70p	70p	85p	1.10	1.10	1.10	1.10	1.35	1.35
12 poles	70p	70p	85p	1.10	1.10	1.10	1.10	1.35	1.35



MULLARD AUDIO AMPLIFIERS. All in module form, each ready built complete with heat sinks and connection tags, data supplied.

Model 1153 600m watt power output 65p.
Model 1172 750m watt power output 65p.
Model EP9000 4 watt power output 81-45p.
10% discount if 10 or more ordered.



13 AMP TWIN GANG SOCKETS

Offered at less than wholesale price your opportunity to replace those dangerous adaptors—brown bakelite flush mounting—standard fitting. Unswitched 20p each, separately switched 30p each. Separately switched. Less 10% ten or more + 20p postage if order under £5.

50 MICRO AMPERES Square, panel mounting type. £2

INTEGRATED CIRCUIT BARGAIN

A parcel of integrated circuits made by the famous Plessey Company. A once-in-a-lifetime offer of Micro-electronic devices well below cost of manufacture. The parcel contains 5 ICs all new and perfect, first-grade device, definitely not sub-standard or seconds. 4 of the ICs are single silicon chip OP amplifiers. The 5th is a monolithic VFN matched pair. Regular price of parcel well over £4. Full circuit details of the ICs are included and in addition you will receive a list of many different ICs available at bargain prices 25p upwards with circuits and technical data of each. Complete parcel only 21p post paid. **DON'T MISS THIS TERRIFIC BARGAIN.**



MULLARD I.F. MODULE

This is a fully screened intermediate frequency module for amplification and detection of i.m. signals at 10-7MHz and a.m. signals at 470kHz. The first stage is used as an i.f. amplifier for i.m. and a self-oscillating mixer for a.m. operation, in conjunction with an external oscillator coil. 85p each. 10 for £7-85. With connecting dig.

POCKET CIRCUIT TESTER

Test continuity of any low resistance circuit, house wiring, car electric, Tests polarity of diodes and rectifiers. Also ideal size for conversion to signal injector (circuit supplied). 30p or 2 for 60p post paid.



AMPLIFIER IN CASE WITH SPEAKER

Marketed by British Relay under the name Luxator. This is in a very neat looking cabinet and is ideal around the home or in the workshop for trouble shooting or for testing out a quick laugh up Size approx. 9½" x 6½" x 3½" deep. Input is via a matching transformer and volume control and amplifier may be powered by an internal 9v battery or an external 110v source. Speaker is an R-A elliptical 6" x 3½" 10,000 Gauss. The amplifier proper is a Newmarket model ref. P.C.A. Price 22-50 each, 10 for £21-50. Post and insurance 20p.

BAKELITE INSTRUMENT CASE

Size approx. 6½" x 3½" x 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 45p each.



TELEPHONES

Complete as illustrated. Save your legs, time and temper, simply by putting in some telephones. Ex. G.P.O. not new—but guaranteed in good condition and serviceable.



supplied with diagram and instructions showing how to connect. Price £1.00 each + 50p post or 2 for £2-50 post paid. Also available separately, dials and handsets 80p each + 20p post.

ROCKER SWITCH

13 amp self-flxing into an oblong hole, size approximately 1" x 1" 8p each, 10 for 72p.



SLIDE SWITCHES

Slide Switch. 2-pole changeover panel mounting by two 6BA. screws. Size approx. 1in x ½in. rated 250V 10p. 6p each. 10 for 54p. 100 for £5-10. 500 for £24. Dials as above but for printed circuit 5p each 10 for 45p. 100 for £4-25. Sub Miniature Slide Switch. DPDT 19mm (1in approx.) between fixing centres. 18p each or 10 for £1-08. SP Change over spring return 250V 1 amp. 10p.



KITS FOR PREVIOUS PROJECTS

Unless otherwise stated, kits contain electronic parts only. The case and special items can be obtained locally. Also batteries are not included. Kits may be returned for refund if construction has not been started. We reserve the right to substitute components should deliveries be protracted so as to avoid undue delay.

Reprints of projects available 1 for 30p, 3 for 80p or 6 for £1-00, post paid.

HOME SENTINEL INTRUDER ALARM £3-75	SNAP INDICATOR	75p
WINDSCREEN WIPER CONTROL	RECORD PLAYER	£2-25
(amplifier components only)	DEMO DEC	£7-00
FUZZ BOX	PHOTOGRAPHIC COLOUR	£1-85
TEMPERATURE METER	ASTRON RADIO	£2-65
REMOTE TEMPERATURE	COMPARATOR	£4-25
ELECTRO LAUGH	RAIN WARNING ALARM	£1-80
W.A.W.A. PEDAL	SIGNAL INJECTOR	80p
SOIL MOISTURE METER	SIMPLE CALCULATOR	£2-20
DC POWER SUPPLY	TEMPERATURE METER	£2-65
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W.A.W.A. PEDAL	SIGNAL IN	

PARVALUX TYPE SD2. 200/250 VOLT A.C. D.C. HIGH SPEED MOTOR
Speed 9,000 r.p.m. if approx. or 3,200 r.p.m. if used with built in governor, or variable speed over a wide range if used in conjunction with our Dimmer Switch, illustrated
Other models available on request.



600 WATT DIMMER SWITCH



Easily fitted. Fully guaranteed. Will control up to 600W of all lights except fluorescent at mains voltage. Complete with simple instructions. £3 inc. P. & P.

REVERSIBLE SPLIT PHASE MOTOR
250 r.p.m. 100-115/210-240V A.C. 2in. x 1in. Ideal for fitting to models of all sizes. Extremely powerful for size including small capacitor. 75p. post paid.

METER BARGAINS

100 Micro Amp Balance/level meters. Size 1 1/2" x 1 1/2" x 1 1/2" deep 75p post paid.



AMMETERS NEW!

DC amps 1, 5, 15, 20. AC Amps 1, 5, 10, 15, 20. £1-95 incl. P. & P. 0-300V a.c. £1-90 incl. P. & P.



50 in 1 ELECTRONIC PROJECT KIT

50 easy to build Projects. No soldering, no special tools required. The kit includes Speaker, Meter, Relay, Transformer, plus a host of other components and a 56-page instruction leaflet. Some examples of the 50 possible Projects are: Sound Level Meter, 2 Transistor Radio, Amplifier, etc. Price £7-75. P. & P. 30p.

CRYSTAL RADIO KIT

Complete set of parts, including: Crystal Diode, Ferrite Aerial, Drilled Chassis, and Personal Ear Piece. No soldering, easy to build, full step by step instruction. £1-75 inc. post.

RAINBOW STROBE FOUR LIGHT CONTROL MODULE

In response to numerous requests, we now offer a mains operated fully isolated short-circuit-proof ready-built module, with variable flash rate. It will operate four of our My-Light or Super My-Light Strobes in either 1, 2, 3, 4 sequence; 2+2; or all together. Fantastic effects with or without colour filters. Modules can be connected together to operate 8 or 12 Strobes. Will work on long runs of up to 50 yards, so that your Strobes can be spaced out for maximum effect. Size of module is 5x6x1 1/2in. Easily fitted into your own equipment, or into a separate case. Thoroughly tested and reliable. Complete with full connection instructions. Price: £18-50 plus 25p P. & P. Send S.A.E. for details.

BIG BLACK LIGHT

450 Watt. Mercury vapour ultra violet lamp. Outer bulb designed to absorb visible light and to transmit u.v. rays. Extremely compact and powerful source of u.v. Innumerable industrial applications, also ideal for stage, discos, etc. P.F. Ballast is essential with the bulbs. Price of matched ballast & bulb £16-00. P. & P. Spare bulb £7-00. P. & P. 30p.

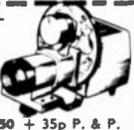


BLACK FLUORESCENT U.V. TUBES

4 ft. 40 watt. Price £5-80 incl. P. & P. (For use in standard bi-pin fluorescent fittings). MINI 9 inch 6 watt black light U.V. tube.

COLOUR WHEEL PROJECTOR

Complete with oil filled colour wheel. 100 watt lamp. 200/240 v AC. Features extremely efficient optical system. £18-50 + 35p P. & P.



VARIABLE VOLTAGE TRANSFORMERS

INPUT 230/140V a.c. 50, 60 OUTPUT VARIABLE 0.260V from 1/2 to 50 amp stock. SHROUDED TYPE

1 amp, £7-00 2.5 amp, £8-05
5 amp, £11-75
10 amp, £22-50 20 amp, £49-00
15 amp, £25-00 25 amp, £58-00
37.5 amp, £82-00 50 amp, £98-00
OPEN TYPE (Panel Mounting) 1/2 amp, £4-75.
1 amp, £7-00 2 1/2 amp, £8-05. All types carriage paid.



Superior Quality Precision Made NEW POWER RHEOSTATS

100 WATT. 1 ohm, 10A; 3 ohm, 4.7A; 10 ohm, 3A; 25 ohm, 2A; 50 ohm, 1.4A; 100 ohm, 1A; 250 ohm, 0.7A; 500 ohm, 0.45A; 1 kΩ, 280 mA; 1.5 kΩ, 230mA; 2.5 kΩ, 0.2A; 3.5 kΩ, 165mA 5 kΩ, 140mA. Diameter 3 1/2in Shaft length 1 1/2in. All at £1-65 each. P. & P. 7 1/2p.
50 WATT. 1/5/10/25/50/100/250/500/1k/1.5k/2.5k/5k. All at £1-15 each. P. & P. 7 1/2p.
25 WATT. 10/25/50/100/250/300/500/1k/1.5k/2.5k/3.5k. All at 90p each. P. & P. 7 1/2p.



RELAYS New SIEMENS PLESSEY, etc. Miniature Relays at competitive prices.

1	2	3	4	1	2	3	4
52	3-6	2 c/o	63p*	700	15-35	2 c/o HD	73p*
280	9-12	2 c/o	73p*	700	16-24	6M	65p*
410	10-18	4 c/o	73p*	1,250	24-36	4 c/o	63p*
700	16-24	4M 2B	63p*	2,500	36-45	6M	63p*
700	16-24	4 c/o	78p*	2,400	30-48	4 c/o	50p*
700	12-24	2 c/o	63p*	9,000	40-70	2 c/o	30p*
700	6-12	1 c/o HD	30p*	15k	85-110	6M	30p*
700	22-30	6 c/o	75p*				

(1) Coil ohms; (2) Working d.c. volts; (3) Contacts; (4) Price (HD) Heavy Duty. All Post Paid. Including Base.

12 VOLT D.C. RELAY 140 OHM COIL
Type 1: 3 sets c/o contacts 5 amp, 78p incl. P & P (similar to illustration below).
Type 2: 1 set of c/o contacts 60p incl. P & P.

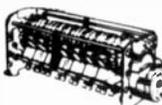
'DIAMOND H' 230 VOLT A.C. RELAYS
Three sets c/o contacts rated at 5 amps. Price: 50p P & P 10p. (100 lots £40-00 incl. P & P.) (UNUSED)



'KEY SWITCH' 230 VOLT A.C. RELAYS
One set c/o contacts rated at 7.5 amps. BOXED. Price: 40p. P & P 5p. (100 lots £32-00 incl. P & P.)

HONEYWELL PROGRAMME TIMERS

240V A.C. 5 r.p.m. motor. Each cam operating a c/o micro switch. Cams are individually variable, allowing innumerable combinations. Ideally suited for machinery control, automation, etc. Also in the field of entertainment, for lights, animated displays, etc.
15 cam model £5-75 + 25p. P. & P.
10 " " £4-75 + 25p. P. & P.
2 " " with 15 r.p.m. motor £1-75 + 25p. P. & P.
SIMPLE 12 CAM PROGRAMMER with 4 adjustable cams and 8 that may be profiled to individual requirements. Available with 15 or 13 r.p.m. motor £3-50 + 25p. P. & P.



STROBE! STROBE! STROBE!

Build a Strobe Unit, using the latest type Xenon white light flash tube. Solid state timing and triggering circuit. 230/250V a.c. operation. EXPERIMENTERS' ECONOMY KIT Speed adjustable 1 to 30 flash per sec. All electronic components including Veroboard S.C.R. Unijunction Xenon Tube and instructions £6-30, plus 25p P. & P.

NEW INDUSTRIAL KIT
Ideally suitable for schools, laboratories, etc. Roller tin printed circuit. New trigger coil, plastic thyristor. Speed adjustable 1-80 f.p.s. approx. 1/2 the output of Hy-Light. Price £10-50. P. & P. 50p.
HY-LIGHT STROBE MK III
Designed and produced for use in large halls and utilises a silica tube printed circuit. Speed adjustable 0-20 f.p.s. Light output greater than many (so called 4 joule) strobes. £12-00. P. & P. 50p.
SPECIALLY DESIGNED, FULLY VENTILATED METAL CASE, including reflector. £4-00 P. & P. 45p. Post paid with kit.

THE 'SUPER' HY-LIGHT KIT

Approx. four times the light output of our well proven Hy-Light strobe. Incorporating:
● Variable speed from 1-13 flash per sec.
● Reactor control circuit producing an intense white light. Never before a Strobe Kit with so HIGH an output at so LOW a price. ONLY £20 plus 75p P. & P.
ATTRACTIVE, ROBUST, FULLY VENTILATED METAL CASE specially designed for the Super Hy-Light Kit including reflector £7-00 P. & P. 45p.
7-inch POLISHED REFLECTOR
Ideally suited for above Strobe kits. Price 53p. P. & P. 13p or post paid with kits.
6" IN COLOUR WHEEL as used for disco lighting effects etc. £5-75 incl. P. & P.

EX COMPUTER PRINTED CIRCUIT PANELS

2 x 4 in. packed with semi-conductors and top quality resistors, capacitors, diodes etc. Our price 10 boards 50p (8p). With a guaranteed min. of 35 transistors—data included.

SPECIAL BARGAIN PACK

25 boards for £1 (25p).

ELECTROLYTICS

10,000µ 75v, 33,000µ 40v, 4 1/2 x 2 1/2 in. dia. 25,000µ 25v, 20,000µ 30v, 8,000µ 55v, 4 1/2 x 3 in. dia. 50p (12p). 15,000µ 15v, 4 1/2 x 2 in. dia. 20p (10p). 2,000µ 25v wire ended, 3 x 1 in. dia. 15p (5p) or 12 for £1-50 (15p).

250 MIXED CAPACITORS 60p (8p)

250 MIXED RESISTORS 60p (8p)

3A STUD RECTIFIERS, 100 p.i.v.

ASSORTED RELAYS 8 for £1 (25p)

SUB MIN. CO-AX PLUGS & SKTS. 4 pairs 50p (5p)

MINIATURE GLASS NEONS 12 for 50p (5p)

REED RELAYS, MIXED 10 for 50p (5p)

MICRO SWITCHES, MIXED 8 for 50p (8p)

PAPST EXTRACTOR/BLOWER FANS 100 cfm 4 1/2 x 4 1/2 £3-50 (28p)

QUARTZ HALOGEN BULBS 12v 55w 50p (5p)

Postage and package for each item shown in brackets.

KEYTRONICS

(Mail Order only)

44 EARLS COURT ROAD LONDON W8.

01-478 8499

B.H. COMPONENT FACTORS LIMITED

MULLARD POLYESTER C280 250V. (µF) 0-01, 0-015, 0-022, 0-033, 0-047, 3p, 0-068, 6-1, 0.15, 0.4, 0-22, 5p, 0-33, 7p, 0-47, 8p, 0-68, 10, 10.1, 0.18p, 1-5, 20p, 2-2, 23p.

MULLARD POLYESTER C286 160V. (µF) 0-01, 0-015, 0-022, 5p, 0-047, 0-068, 8p, 0-15 0-22, 0-33, 5p, 0-47, 6p, 0-68, 1-10p, 400V. (µF) 0-001, 0-0015, 0-0022, 0-0033, 0-01, 2p, 0-015, 0-033, 3p.

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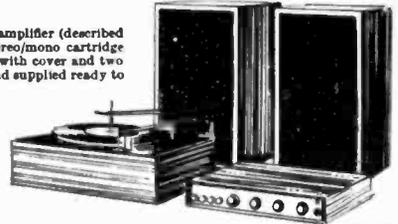
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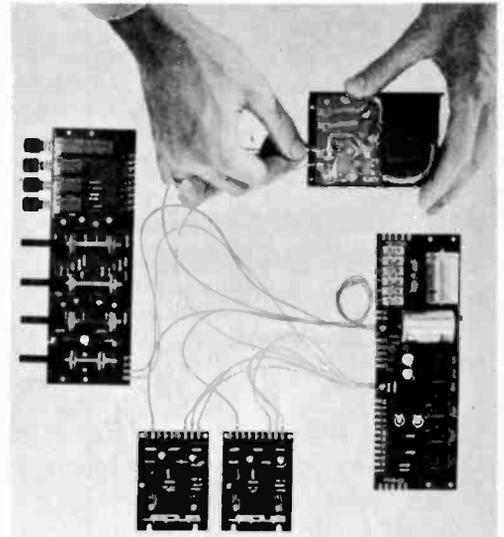
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MISCELLANEOUS

PSYCHEDELIC MINI-STROBE

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½W Iskra high stability carbon film—very low noise—capless construction.
½W Mullard CR25 carbon film—very small body size 7.5 x 2.5mm. ½W 2% Electrofil TR5.

Power watts	Tolerance	Range	Values available	Price
↓	5%	4-7Ω-2-2MΩ	E24	1-99 100+
↓	10%	3-3MΩ-10MΩ	E12	1-0p 0-8p
↓	2%	10Ω-1M	E24	3-5p 3-0p
↓	10%	1Ω-3-9Ω	E12	1-0p 0-8p
↓	5%	4-7Ω-1MΩ	E12	1-0p 0-8p
↓	10%	1Ω-10Ω	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 4-7Ω to 1MΩ.
E12 pack 325 resistors £2-40. E24 pack 650 resistors £4-70.

POTENTIOMETERS

Carbon track 5kΩ to 2MΩ, log or linear (log ½W, lin ½W).
Single, 12p. Dual gang (stereo), 40p. Single D.P. switch 24p.

SKELTON PRESET POTENTIOMETERS

Linear: 100, 250, 500Ω and decades to 5MΩ. Horizontal or vertical P.C. mounting (0-1 matrix).
Sub-miniature 0-1V, 5p each. Miniature 0-25W, 6p each.

TRANSISTORS

AC107	15p	AF124	22p	BD131	75p	OC26	45p	2N3702	13p
AC126	12p	AF125	20p	BD132	75p	OC28	50p	2N3703	13p
AC127	12p	AF126	20p	BD133	75p	OC35	50p	2N3704	13p
AC128	12p	AF127	20p	BF115	25p	OC42	12p	2N3705	12p
AC131	12p	AF139	32p	BF173	20p	OC44	12p	2N3706	11p
AC132	12p	AF178	32p	BF177	28p	OC45	12p	2N3707	12p
AC176	12p	AF180	40p	BF178	32p	OC70	12p	2N3708	10p
AC187	22p	AF181	40p	BF179	32p	OC71	12p	2N3709	11p
AC188	22p	BC107	9p	BF180	32p	OC72	12p	2N3710	11p
AD140	50p	BC108	9p	BF181	32p	OC81	12p	2N3711	11p
AD149	45p	BC109	9p	BF194	15p	OC82D	12p	2N4062	12p
AD161	33p	BC147	13p	BF195	15p	2N2904	20p	40360	35p
AD162	36p	BC148	13p	BF197	15p	2N2926R	9p	40361	35p
AF114	20p	BC149	13p	BF200	32p	2N2926O	9p	40362	40p
AF115	20p	BC157	14p	BFY50	20p	2N2926Y	9p	40408	40p
AF116	20p	BC158	14p	BFY51	20p	2N2926G	10p	ZTX302	15p
AF117	20p	BC159	14p	BFY52	20p	2N3054	58p	ZTX500	15p
AF117	38p	BC187	22p	BU105	25p	2N3055	60p	ZTX502	20p

ZENER DIODES

400mW 5% 3-3V to 30V, 15p.

LINEAR

µA709 40p µA741 45p
µA710 45p µA748 45p

IC's (DIL)

14 and 16 pin
16p

DIODES

RECTIFIER

DIODE	VOLTS	CURRENT	SIGNAL	PRICE
BY127	1250V	1A	OA85	7p
BZ10	800V	6A	OA90	5p
BZ13	200V	6A	OA91	5p
IN4001	50V	1A	OA202	7p
IN4004	400V	1A	IN4148	5p
IN4007	1000V	1A	BA114	8p

BRUSHED ALUMINIUM PANELS

12in x 6in—25p; 12in x 2½in—10p; 9in x 2in—7p.

SLIDER POTENTIOMETERS

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

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VA10555	15p
VA10665	15p
VA1077	15p
R53	£1-35
C90	65p
C120	85p

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, 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.

250V P.C. mounting: 0-01µF, 0-015µF, 0-022µF, 3p, 0-033µF, 0-047µF, 0-068µF, 4½p, 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—MULLARD 015/67 RANGE

REPLACES C426, C487 RANGES
(µF/V) 1-0/63, 1-5/63, 2-2/63, 3-3/63, 4-7/63, 6-8/40, 10/25, 10/63, 15/16, 15/40, 15/63, 22/10, 22/25, 22/63, 33/6-3, 33/40, 47/4, 47/10, 47/25, 47/40, 47/63, 68/16-3, 68/16, 100/4, 100/10, 100/25, 100/40, 150/6-3, 150/16, 150/25, 220/4, 220/10, 220/16, 330/4, 330/10, 470/6-3, 5p each, 68/63, 150/40, 220/25, 330/16, 470/10, 680/6-3, 1000/4 9p, 100/63, 150/63, 220/40, 470/25, 680/16, 1000/10, 1500/6-3 12p, 220/63, 470/40, 680/25, 1000/16, 1500/10, 2200/6-3, 15p, 330/63, 680/40, 1000/25, 1500/16, 2200/10, 3300/6-3, 4700/4, 18p.

SOLID TANTALUM BEAD CAPACITORS

0-1µF 35V	2-2µF 35V	22µF 16V	12p
0-22µF 35V	4-7µF 35V	33µF 10V	
0-47µF 35V	6-8µF 25V	47µF 6-3V	
1-0µF 35V	10µF 25V	100µF 3V	

ELECTROLYTIC CAPACITORS Miniature P.C. mounting

5p each
(µF/V): 10/12, 50/12, 100/12, 200/12, 5/25, 10/25, 25/25, 100/25.

VEROBOARD

2½ x 3½	0-1	0-15
2½ x 5	22p	17p
2½ x 5	24p	21p
3½ x 3½	24p	21p
3½ x 5	28p	28p
17 x 2½	75p	57p
17 x 3½	100p	78p
17 x 5 (plain)	—	82p
17 x 3½ (plain)	—	60p
17 x 2½ (plain)	—	42p
2½ x 5 (plain)	—	12p
2½ x 3½ (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.

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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 oxidizing 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.

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160V 2½p 10pF to 1,000pF E12 Series
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9p
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Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 18 months' guarantee. AC 200/250v. Size 12 1/2 x 11 1/2 in.

Above motor board 8 1/2 in. below motor board 2 1/2 in. with STEREO and MONO XTAL MONO-COMPATIBLE. Plays all records.



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Available separately. Woofer £4-25. Tweeter £1-90. Comprising a fine example of a Woofer 18 1/2 x 8 1/2 in. with a massive Ceramic Magnet, 44oz. Gauss, 13,000 lines. Aluminium Cone centre to improve middle and top response. Also the E.M.I. Tweeter 8 1/2 in. square has a special light-weight paper cone and magnet flux 10,000 lines. Crossover condenser and full instructions supplied.

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Maximum Power 12 watts
Useful Response 35 to 18,000 cps
Bass Resonance 45 cps

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MODERN DESIGN TEAK WOOD FINISH



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Single pole two-way. Makers list price £4.50. Brand new and fully guaranteed. Surface mounting with fixing screws. Will replace existing wall switch to give light for return home, garage, automatic anti burglar lights, etc. Variable knob. Turn on or off at full or intermediate settings. Two types available 0 to 80 minutes or 0 to 8 hours. OUR PRICE £1-50. P & P 15p or £3 part. Post Free. (Please state type when ordering).



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MINIATURE 200V. 200mA. 6-3v. 1a. 2 1/2 x 8 1/2 in.	75p
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16/450V... 15p	100/50V... 47p	32+32/450V... 38p
32/450V... 40p	8+4/450V... 50p	350+50/250V... 50p
25/25V... 10p	8+16/450V... 20p	32+32+32/350V... 48p
50/50V... 10p	16+16/450V... 25p	100+50+50/350V... 48p
100/25V... 10p	32+32/350V... 25p	

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CERAMIC 1pF to 0.01mF. 4p. Silver Mica 2 to 6000pF. 4p.
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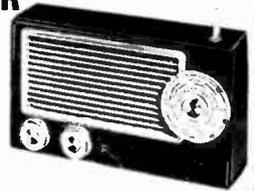


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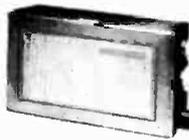
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TRANSONA FIVE



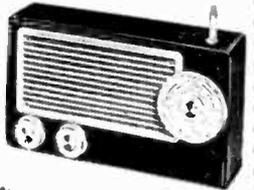
5 TRANSISTORS AND 2 DIODES

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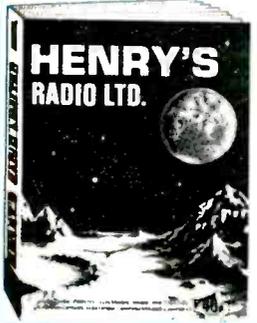
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