

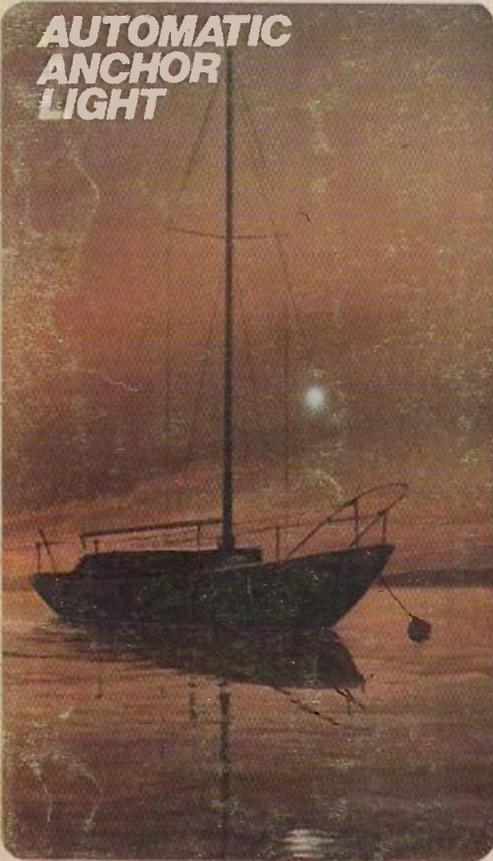
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everyday electronics

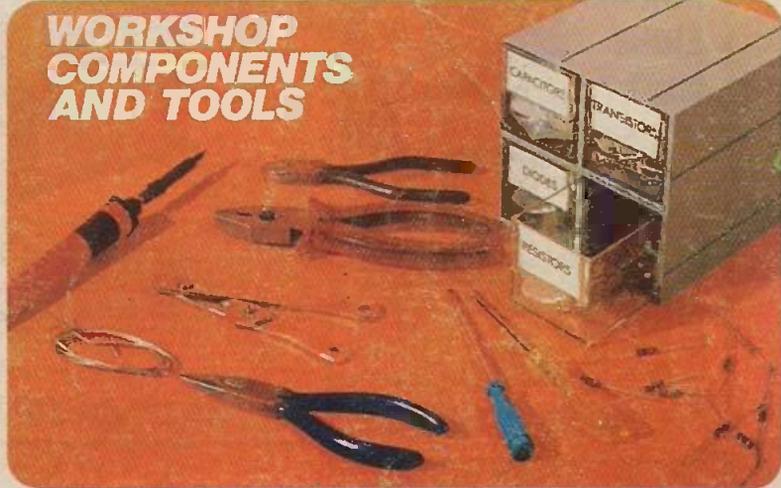
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ROAMER 10 WITH VHF INCLUDING AIRCRAFT

10 TRANSISTORS. 9 TUNABLE WAVEBANDS, MW1, MW2, LW, SW1, SW2, SW3, TRAWLER BAND. VHF AND LOCAL STATIONS ALSO AIRCRAFT BAND

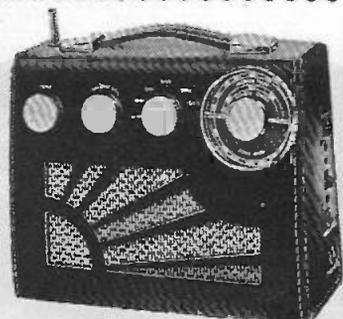
Built in Ferrite Rod Aerial for MW/LW. Retractable, chrome plated 7 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600mV Transistors. Car Aerial and Tape Record Sockets. 10 Transistors plus 3 Diodes. Fine tone moving coil speaker. Ganged Tuning Condenser with VHF section. Separate coil for Aircraft Band. Volume on/off. Wave Change and tone Control. Attractive Case in black with silver blocking. Size 9" x 7" x 4". Easy to follow instructions and diagrams. Parts price list and easy build plans 30p (FREE with parts). Earpiece with plug and switched socket for private listening 35p extra.

Total building cost

£9-35

P. P. & Ins. 52p

(Overseas P. & P. £1-05)



ROAMER EIGHT Mk I

NOW WITH VARIABLE TONE CONTROL



7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Retractable chrome plated Telescopic aerial for Short Waves. Push pull output using 400mV transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams. Parts Price List and Easy Build Plans 25p (FREE with parts). Earpiece with plug and switched socket for private listening 35p extra.

Total building cost **£7-68** P. P. & Ins. 47p.

(Overseas P. & P. £1-05)

ROAMER SEVEN MK IV

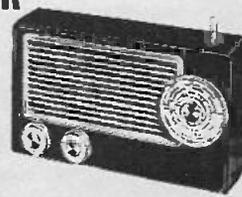


7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for MW and LW. Retractable 4 section 24in. chrome plated telescopic aerial for SW. Socket for Car Aerial. Powerful push-pull output. 7 transistors and 2 diodes. fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with carrying handle Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 25p (FREE with parts). Earpiece with plug and switched socket for private listening 35p extra.

Total building costs **£6-58** P. P. & Ins. 47p.

(Overseas P. & P. £1-05)

ROAMER SIX



6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 Trawler band plus an extra Medium waveband for easier tuning of Luxembourg etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 5in. Speaker. 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 5 1/2 x 2 1/2in. approx. Easy build plans and parts price list 25p (FREE with parts).

Total building costs **£4-38** P. P. & Ins. 31p.

(Overseas P. & P. £1-05)

POCKET FIVE

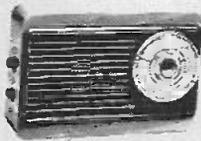


3 Tunable Wavebands: MW, LW, Trawler Band with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, super-sensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5 1/2 x 1 1/2 x 3 1/2in. Easy build plans and parts price list 10p (FREE with parts).

Total building costs **£2-50** P. P. & Ins. 24p.

(Overseas P. & P. 65p)

TRANSONA FIVE

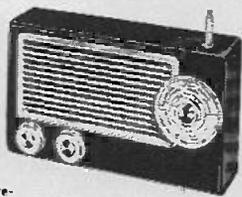


5 TRANSISTORS AND 2 DIODES
3 Tunable Wavebands: MW, LW and Trawler Band. 7 stage—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser volume control, fine tone moving coil speaker. Attractive case with red speaker grille. Size 6 1/2 x 4 1/2 x 1 1/2in. Easy build plans and parts price list 10p (FREE with parts).

Total building costs **£2-75** P. P. & Ins. 25p.

(Overseas P. & P. 65p)

TRANS EIGHT



8 TRANSISTORS AND 3 DIODES

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 5in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 x 5 1/2 x 2 1/2in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 25p (FREE with parts).

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| ROAMER EIGHT | <input type="checkbox"/> | TRANS EIGHT | <input type="checkbox"/> |
| TRANSONA FIVE | <input type="checkbox"/> | ROAMER SIX | <input type="checkbox"/> |
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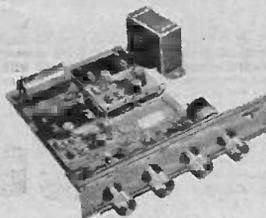
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0.1% DISTORTION

- Frequency Response 15Hz to 100,000—1dB.
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- Signal to noise ratio 80dB.
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Tailor made to the most stringent specifications using top quality components and incorporating the latest solid state circuitry the AL50 was conceived to fill the need for all your A.F. amplification needs.

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

SPECIFICATION:

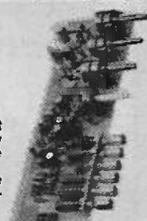
Frequency response 20Hz—20kHz $\pm 1dB$
 Harmonic distortion better than 0.1%
 Inputs: 1. Tape head 1-25mV into 50K Ω
 2. Radio, Tuner 35mV into 50K Ω
 3. Magnetic P.U. 1-5mV into 50K Ω

All Input voltages are for an output of 250mV.
 Tape and P.U. inputs equalised to RIAA curve within $\pm 1dB$ from 20Hz to 20kHz.

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Bass control $\pm 15dB$ at 20Hz
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 Filters: Rumble (high pass) 100Hz
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 Supply +35 volts at 20mA
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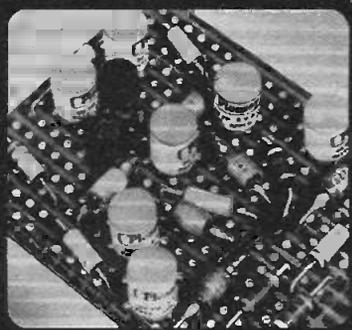


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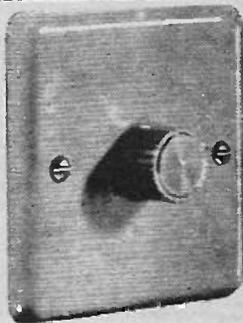
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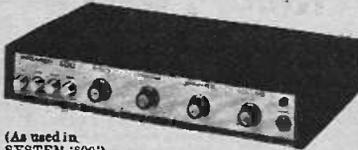
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ONLY **£16.50** Carr. 50p.

Mk. II Version available with Teak Finish Cabinet. £17.87. Carr. 50p.

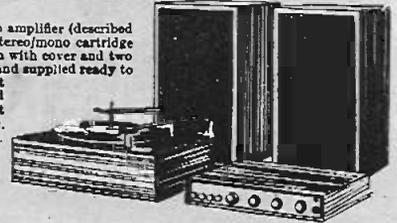
PREMIER HI-FI STEREO SYSTEMS

SYSTEM "800"

Consists of the Premier 800 Mk II all transistor stereo amplifier (described left) Garrard auto/manual record player; unit fitted stereo/mono cartridge with diamond stylus and mounted in teak finish plinth with cover and two cloth front loudspeaker systems. Absolutely complete and supplied ready to plug in and play. The 800 Mk II amplifier has an output of 5 watts per channel with inputs for ceramic and magnetic pick-up, tape and tuner also tape output socket and headphone socket. Controls: Bass, Treble, Volume, Balance, Selector. Mono/Stereo switch. Headphone socket. Power on/off. Teak finish cabinet with aluminium front panel. Size: 12½in x 8½in x 2½in.

£36.59

Carr. £1.75



SYSTEM "TWO"

as above but with slotted front teak finish loudspeakers, Garrard SP25 Mk. III and magnetic cartridge.

£46.50

Carr. £1.75

SYSTEM "THREE"

This consists of KLINGER KC903 stereo amplifier giving 6 watts rms per channel with Bass, Treble, Volume and Balance Controls. Inputs for Magnetic and Ceramic pick-up, tuner, tape in and out. Stereo headphone socket. Garrard SP25 Mk. III in teak finish plinth with cover and fitted Sonotone 9TAHCD diamond stereo cartridge. A pair of HBF Speakers size 16½" x 10½" x 9" fitted EMI units complete the matching system.

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Gives the best possible reproduction of records, radio and tape at a reasonable price. Fitted with all the controls and facilities you're ever likely to want, the Paragon gives you a degree of

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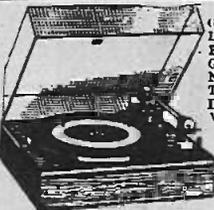
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Wharfedale Linton + cart. £23-02
Thorens TD125AB Mk. II. £31-14
Thorens 125 £54-26
Thorens TD160 AB & C £46-50

TUNERS

Please add 93p P. & P. & Ins.
Amstrad Multiplex 3000 £25-42
Rogers R/brook FET4 (Chassis) P.O.A.
Rogers R/brook FET4 (Cased) £33-45
Rogers R/bourne FET4 (Chassis) P.O.A.
Rogers R/bourne FET4 (Cased) £41-25
Sinclair PR060 (Module) £14-19
Sinclair 2000/3000 Tuner £26-12
Leak Delta FM (Cased) £49-44
Leak Delta AM/FM (Cased) £56-43
Alpha Highgate FT150 £33-50
Metrosound FMS20 £34-32
Pioneer TX 500A £48-40
Pioneer TX 600 £65-45

TUNER/AMPLIFIERS

Please add £1 P. & P. & Ins.
Alpha Highgate 150 £43-34
Pioneer SX 440 £63-41
Pioneer SX 525 £67-23
Pioneer SX 626 £19-35
Leak Delta 75 £110-00
Goodmans One Ten £88-55
Goodmans Mod90 £75-90
Rotal 150 £43-61
Rotal 200 £55-27
Rogers Ravensbrook £67-26
Rogers R/brook (Chassis) £62-26
Alpha FR 3000, New product £61-32

All prices correct at time of press E. & O. E. and are subject to alterations.

AMPLIFIERS

Please add 93p P. & P. & Ins.
Amstrad 8000 Mk. II £16-50
Amstrad IC2000 £28-38
Amstrad Integers 4000 £25-30
Alpha Highgate FA300 £35-91
Alpha Highgate FA400 £40-64
Leak Delta 30 £51-04
Leak Delta 70 £63-25
Metrosound ST20E £27-17
Metrosound ST60 £51-26
Pioneer SA600 £67-43
Pioneer SA500A £35-36
Pioneer SA1000 £108-67
Rogers R/brook (Chassis) £41-19
Rogers R/brook (Cased) £45-04
Rogers R/bourne (Chassis) £54-28
Rogers R/bourne (Cased) £58-24
Sinclair PR060 2 X Z30/PZ5 £16-39
Sinclair PR060 2 X Z30/PZ6 £19-47
Sinclair PR060 2 X Z50/PZB/Trans £25-24
Sinclair AFU (Filter Unit) £4-95
Sinclair 405 £21-45
Sinclair 2000 Mk. II £24-14
Sinclair 3000 Mk. II £31-02
Wharfedale Linton £48-23
Teleton SAQ 307 £25-41
Rotel RA310 £35-20
Rotel RA610 £56-87

SPEAKERS

Please add £1-65 per pair P. & P. & Ins. Price per pair
Amstrad 138 £14-02
Wharfedale Denton 2 £26-23
Wharfedale Linton 2 £32-83
Wharfedale Melton 2 £50-60
Wharfedale Dovedale 3 £68-31
Celestion Ditton 120 £35-31
Celestion Ditton 15 £43-31
Celestion Ditton 25 £92-29
Celestion Country (new prod.) £31-68
Goodmans Douze Maxim £42-29
Goodmans Mezzo 3 £51-37
Goodmans Magister £84-42

Special bulk purchase £3-02*



Plus 71p P. & P. & Ins. Finished in teak veneer with tinted dust cover. (Fully assembled). For Garrard SP25; 2025TC; 3000; AT60; 2000; 2500; 3500; 5100; J025; SL65B; BSR; McDonald MP60. £3-08, P. & P. 71p. For AP76; AP75; SL72B; SL75; SL95B. £4-51 + 71p. P. & P. & Ins. Also finished in walnut to match Japanese equipment—at no extra.

CARTRIDGES

Please add 11p P. & P. & Ins.
Goldingr G850 £3-08
Goldingr G800 £4-34
Goldingr G800E £6-98
Goldingr G800 Super E £12-10
Shure M3D £3-85
Shure M44E £5-06
Shure M55E £5-00
Sonotone 9TAHC £1-43



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on main road leading to the East and West Country

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YES, "YOU'VE GOT THE WHOLE WORLD IN YOUR HANDS"!! ALMOST UNBELIEVABLE! Think of the year 1984 and what might be produced then—now get the fantastic **ASTRAD 17** and **SEE** for yourself that the incredible Russians have done it all NOW! It's the radio perfectionist's dream come true! **THIS ONE SUPER-SEDES ALL EARLIER MODELS!** It will probably make your present radio seem like a "crystal set"! Complete with optional battery eliminator for both battery and mains use! We're almost giving them away at only £19.47—a mere fraction of even today's Russian miracle price! We challenge you to compare performance and value with £80 radios! * Send quickly, after receiving goods test 7 days—refund if not delighted. Elegant black & chrome finish case, set in fabulous Cabinet built case—constructed of fine Russian hardwood in beautiful Teak Veneer finish—prevents vibration, ensures purer and sweeter tone than ever! Volume controlled from a whisper to a roar that would fill a hall! Much wider band spread, for absolute "pin-point" station selection! Plus "MAGIC EYE" tuning level indicator for ultra perfect tuning sensitivity! Yes, the Russians have surpassed themselves, proving again their fantastic ability in the field of electronics and brilliantly reflecting their advanced micro-circuitry techniques, in the field of space communications. **Yes, EVERY WAVEBAND** instantly at your fingertips including Standard Long, Medium, Short and Ultra Short Waves to cover the four corners of the earth during 24 hours a day, including all normal transmissions. VHF: FM/USW, AM: LW, MW, SW, gets locally, local and new stations not yet operational, and messages from all over the world! Expensive **TURRET TUNER** side control waveband selection unit (as used on expensive T.V.'s!) Every waveband clicks into position giving incredible ease of station tuning! Genuine push-pull output! ON/OFF volume and separate Treble and Bass tone controls for utter perfection of reproduction and tone! Press-button dial illumination! Take it anywhere—runs economically on standard batteries or direct through battery eliminator from 220/240V AC mains supply. Internal ferrite rod aerial plus built-in "rotatable" telescopic aerial extending to 39 ins approx. It's also a fabulous **CAR RADIO**. Can also be used through extension amplifier, tape recorder or public address system. SIZE 14ins x 10ins x 4ins overall approx. Magnificently designed, made to give years of perfect service. (U.K. service facilities and spares available for years and years to come, if ever necessary). With **WRITTEN GUARANTEE** manual with simple operating instructions and circuit diagram. **ONLY £19.47** (with mains/battery eliminator £1.62 extra). **BOX, POST, ETC. 55p.** * **BUT WAIT**, for only 50p extra you get the sensational "COMPUTERISED" **WORLD TUNING GUIDE** (it enables you to time, pinpoint & get transmissions the whole world over—even a child can do it in a flash—it even lets you know when to tune into the U.K., when abroad. (NO GUESSING/NO MESSING!) **PLUS** Standard "longlife" batteries **PLUS** ultra sensitive earphone for personal listening (Sorry—We cannot change these new radios for any earlier model purchased.)

THOUSANDS OF MILES REDUCED TO INCHES? 1973 RUSSIAN RADIO TECHNOLOGY SHRINKS THE WORLD! * COMPUTERISED?

THIS FANTASTIC EARTH SHRINKER

BRAND NEW FABULOUS ASTRAD 17

PORTABLE RADIO & COMMUNICATIONS RECEIVER

WORLD WIDE RECEPTION
RECEPTION STATIONS FROM THE FOUR CORNERS OF THE EARTH

"MAGIC EYE" tuning level indicator

YES, 24,901 miles SHRUNK TO ONLY 14" x 10" x 4" inches approx?

28 TRANSISTORS AND DIODES!

WAVEBANDS:
 STANDARD LONG and MEDIUM
 Plus 5 SHORT WAVEBANDS
 Plus ULTRA SHORT WAVES
 (V.H.F. AM, FM, MW, LW, USW.)

*** MUST YOU PAY UP TO £80?**

FIRST TIME EVER!
 * NOW AVAILABLE WITH **fabulous "COMPUTERISED" WORLD TUNING GUIDE!**
 NO MORE GUESSWORK—
 INSTANT DATA at your fingertips—enables you to **TUNE IN A FLASH** to transmissions the world over!

BATTERY MODEL £19.47 **BOX POST ETC. 55p**

MAINS/BATTERY ELIMINATOR £1.62 extra

THIS OFFER ONLY FROM US!

BUY ONE FROM US! **SAVE £21.60 NOW!**

fabulous BRAND NEW SOLID STATE

BATTERY/MAINS AC Combined V.H.F. AM/FM RADIO and CASSETTE TAPEREORDER & PLAYER

WITH REMOTE CONTROL MICROPHONE

RECOMMENDED RETAIL PRICE £44

OUR PRICE £22.40 **CARR. ETC. 39p**

This equipment's got EVERYTHING!

(All prices include V.A.T.)
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Cassette TAPE RECORDER & PLAYER

FIRST CLASS MAKERS

With remote control microphone.

WE COULD CHARGE UP TO £26.97!

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"SEW" BAKELITE PANEL METERS



Type MR.65. 3 1/2 in. square fronts	
1 amp.	\$2-16
5 amp.	\$2-15
15 amp.	\$2-15
30 amp.	\$2-15
50 amp.	\$2-15
5V. D.C.	\$2-15
10V. D.C.	\$2-16
20V. D.C.	\$2-15
50V. D.C.	\$2-15
150V. D.C.	\$2-15
300V. D.C.	\$2-15
50mV. D.C.	\$2-40
100mV. D.C.	\$2-40
30V. A.C.	\$2-20
50V. A.C.	\$2-20
100-0-100μA	\$2-20
100-0-100μA	\$2-20
500μA	\$2-45
500-0-500μA	\$2-15
5 amp. A.C.	\$2-15
10 amp. A.C.	\$2-15
20 amp. A.C.	\$2-15
50 amp. A.C.	\$2-15
500mA	\$2-15
VU Meter	\$3-40

Type S-80 80 mm. square fronts	
50μA	\$2-50
60-0-50μA	\$2-40
100μA	\$2-40
100-0-100μA	\$2-30
500μA	\$2-50
1mA	\$2-55
20V. D.C.	\$2-85
50V. D.C.	\$2-85
300V. D.C.	\$2-85
1 amp. D.C.	\$2-85
5 amp. D.C.	\$2-85
300V. A.C.	\$2-85
VU Meter	\$3-70

"SEW" EDUCATIONAL METERS



Type ED.107. Size overall 100mm x 60mm x 108mm. A wide range of high quality moving coil instruments ideal for school experiments and other bench applications. The mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

50μA	\$2-50	20V. d.c.	\$4-85
100μA	\$2-50	50V. d.c.	\$4-85
1mA	\$4-85	300V. d.c.	\$4-85
50-0-50μA	\$2-50	Dual range	
1-0-1mA	\$4-85	500mA/5A d.c.	\$2-10
1A d.c.	\$4-85	5V/50V d.c.	\$2-10
5A d.c.	\$4-85		
10V. d.c.	\$4-85		

Type SW.100 100 x 80 mm.	
50μA	\$3-80
60-0-50μA	\$3-80
100μA	\$3-80
100-0-100μA	\$3-70
600μA	\$3-50
1mA	\$3-40
20V. D.C.	\$3-40
50V. D.C.	\$3-40
300V. D.C.	\$3-40
1 amp. D.C.	\$3-40



5 amp. D.C. \$3-40
300V. A.C. \$3-40
VU Meter \$4-16

Type SD.830 82.5mm x 110mm Fronts	
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 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
5mA	\$2-50
VU Meter	\$3-00

Type SD.640 63.5mm x 85mm Fronts	
50μA	\$2-80
60-0-50μA	\$2-55
100μA	\$2-55
100-0-100μA	\$2-55
200μA	\$2-55
600μA	\$2-55
1mA	\$2-55
5mA	\$2-55
10mA	\$2-55
50mA	\$2-55
100mA	\$2-55
800mA	\$2-85
1 amp.	\$2-85
5 amp.	\$2-85
10 amp.	\$2-85
5V. D.C.	\$2-85
10V. D.C.	\$2-85
20V. D.C.	\$2-85
50V. D.C.	\$2-85
300V. D.C.	\$2-85
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
60-0-50μA	\$2-35
100μA	\$2-35
100-0-100μA	\$2-35
200μA	\$2-35
600μA	\$2-35
1mA	\$2-35
5mA	\$2-35
10mA	\$2-35
50mA	\$2-35
100mA	\$2-35
1 amp.	\$2-35
5 amp.	\$2-35
10 amp.	\$2-35
5V. D.C.	\$2-35
10V. D.C.	\$2-35
20V. D.C.	\$2-35
50V. D.C.	\$2-35
300V. D.C.	\$2-35
15V. A.C.	\$2-30
300V. A.C.	\$2-30
VU Meter	\$2-55

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Type MR.85P. 4 1/2 in. x 4 1/2 in. fronts	
50μA	\$3-95
60-0-50μA	\$3-40
100μA	\$3-40
100-0-100μA	\$3-30
200μA	\$3-30
500μA	\$3-20
600-0-500μA	\$3-10
1mA	\$3-10
1-0-1mA	\$3-10
5mA	\$3-10
10mA	\$3-10
50mA	\$3-10
100mA	\$3-10
500mA	\$3-10
1 amp.	\$3-10
5 amp.	\$3-10
10 amp.	\$3-10
20 amp.	\$3-10
30 amp.	\$3-10
15V. D.C.	\$3-10
30V. D.C.	\$3-10
50V. D.C.	\$3-10
150V. D.C.	\$3-10
300V. D.C.	\$3-10
15V. A.C.	\$3-10
30V. A.C.	\$3-10
50V. D.C.	\$3-10
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50
10mA	\$2-50
50mA	\$2-50
100mA	\$2-50
500mA	\$2-50
1 amp.	\$2-50
5 amp.	\$2-50
10 amp.	\$2-50
20 amp.	\$2-50
30 amp.	\$2-50
15V. A.C.	\$2-30
30V. A.C.	\$2-30
50V. D.C.	\$2-30
100-0-100μA	\$2-75
500μA	\$2-55
1mA	\$2-50
5mA	\$2-50

MULTIMETERS for EVERY purpose!



TS60 POCKET MULTIMETER
High-precision at low-cost.
Ranges: D.C. 15V, 150V, 1,000V (10,000 opv), A.C. 15V, 150V, 100V (1,000 opv), D.C. Current 150mA. Resistance 100k ohms. \$1.85. Post 15p.

MODEL 1092 TESTMETER
4,000 O.P.V.
0/3/15/150/800/1200 V.
D.C. 0/6/30/300/600 V.
A.C. 0/300mA/300 MA
0/10K/1 meg Ω
Decibels -10 to +18db
\$2.75 each +15p P. & P.



HIKOI MODEL 720X
20,000 O.P.V.
Overload protection
5/25/100/500/1000 VDC.
10/50/250/1000 VAC
50μA/250mA. 20K/2 meg
ohm. -5 to +62db.
\$4.97. P. & P. 15p.

HIKOI MODEL 730X
30,000 O.P.V. Overload
protection. 6/30/60/300/
600/1200 VDC. 12/60/120/
600/1200 VAC. 60μA/30
mA/300 mA. 2K/300K/2
megohm. -10 to +63db.
\$5.50. P. & P. 15p.

**KAMODEN 72.200
MULTITESTER**
High sensitivity tester.
200,000 o.p.v. Overload
protection. Mirror scale.
Ranges:
0/1-06/1-3/1-30/120/
600/1200V D.C.
0/3/12/60/300/
11,200V. A.C.
0/6μA/1-2mA/120mA/
600mA/12A. D.C.
0/12A. A.C.
0/20 to +33db.
0/2K/200K/2 meg/
200 meg ohms.
\$18.95. Post 30p

MODEL TE-200
20,000 O.P.V. Mirror scale,
overload protection. 0/5/25/125/
1,000V. D.C. 0/10/80/250/
1,000V. A.C. 0/50/120/250
mA. 0/60K/6 meg Ω -20 to +82db.
\$2.95. P. & P. 15p.

MODEL 500
30,000 O.P.V. with over-
load protection mirror scale
0/5/2-5/10/25/100/250/600/
1,000V. D.C. 0/2-5/10/25/
100/250/500/1,000V. A.C.
0/50μA/5/50/600mA. 12
amp. D.C. 0/60K/6 Meg/
60 Meg Ω
\$2.87. Post paid.

HIKOI MODEL 750X
50,000 o.p.v. 42 ranges 0-3 to
1,200V D.C. 0-3 to 1,200V
A.C. 0-30μA/300mA. 0-8K/50
meg ohms. -10 to +17db.
\$2.97. Post 20p.

HT10084 MULTI-METER
Features A.C. current ranges.
100,000 o.p.v. Mirror Scale,
Overload protection.
0/5/2-6/10/50/250/500/1000 V
D.C.
0/2-5/10/50/250/1000 V. A.C.
0/10/250μA/2-5/25/250 MA/
10 Amp. D.C.
10 Amp A.C. 0/20K/200K/
2 MEG/20 MEG Ω -20 +62db.
\$15.50. P. & P. 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.
0/50μA/1/10/100mA/1/10 Amp
D.C.
0/100mA/1/10 Amp A.C.
0/5K/50K/500K/5 MEG/ 30
MEG Ω
-20 +62db.
\$15. P. & P. 25p.

RUSSIAN 22 RANGE MULTIMETER
Model U437 10,000 o.p.v.
A first class versatile in-
strument 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 100μA/1/10/
100mA/1A. Resistance
300 ohms/3/30/300K/8m Ω.
Complete with batteries,
test leads, instructions and
sturdy steel carrying case.
O.T.B. PRICE \$5.97. P. & P. 25p

ROUND SCALE TYPE PENCIL TESTER
MODEL T.S.68
Completely portable, simple
to use pocket sized tester.
Ranges: 0/5/30/300V. AC
and DC at 2,000 o.p.v.
Resistance 0-20K ohms.
ONLY \$1.97 P. & P. 15p.

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. 50μA / 250mA. 6K / 6
meg ohms. -20 to +22 dB.
\$2.75. Post 20p.

MODEL TH-12
20,000 o.p.v. Overload pro-
tection. Slide switch selector
0 / -25 / 2-5 / 10 / 50 / 250 /
1000V. D.C. 0 / 10 / 50 / 250 /
1000V. A.C. 0 / 50μA / 25 /
250mA. D.C. 0 / 3K / 30K /
300K / 3 meg -20 to +50dB
\$2.97. Post 15p.

MODEL TE-300
30,000 O.P.V. Mirror scale,
overload protection 0/5/15/60/
300/1200 V.D.C. 0/6/30/150/600/
1,500V. A.C. 0/30μA/6mA/
60mA/300mA/600mA. 0/8K/
80K/300K/3 meg. ohm -20 to
+63 db. \$5.97. P. & P. 15p.

MODEL PL436
20k Ω/Volt D.C. 8k Ω/
Volt A.C. Mirror scale.
-3/12/30/120/600 V
D.C. 3/30/120/600 V
A.C. 50/600μA/60/600
mA. 10/100K/1 Meg/10
Meg Ω -20 to +48db.
\$2.97. P. & P. 15p.

TMK MODEL TW-50K
45 ranges, mirror scale,
50K/Vol. D.C. 5K/Volt A.C.
D.C.: Volta -125, -25, 1-25,
2-5, 5, 10, 25, 50, 125, 250,
500, 1000V. A.C. Volta: 1-5,
5, 10, 25, 50, 125, 250, 500,
1000V. D.C. Current: 25,
50μA, 2-5, 5, 25, 40, 200,
500mA, 4, 10 amp. Resistance:
10K, 100K, 1 MEG, 10 MEG
Ω. Decibels: -20 to +81-6db
\$2.50. P. & P. 17p.

MODEL K228A
Taut band suspension.
Overload protection.
Polarity reversing
switch. 30,000 o.p.v.
0 / 5 / 2-5 / 15 / 50 / 250 /
500 / 1000 / 2500V. D.C. 0 / 15 / 50 / 150 /
500 / 1000V. A.C. 0 / 50μA / 5 / 50 / 150 /
500mA / 5 A. D.C. 0 / 3K / 300K / 3 meg.
\$2.95. Post 20p.

HIKOI MODEL 700X
100,000 O.P.V. Overload
protection. Mirror scale.
5/5/12-1/21-3/36/112/30/60/
120/300/600/1200V DC
1-5/5/6/12/20/60/150/300/600/
1200 V. A.C.
16/30μA/3/6/30/60/180/300mA
6/12 AMP. DC. 2K/200K/2
Meg/2 Meg ohm -20 to
+62db. \$13.50. P. & P. 20p.

MODEL C-7080 EN
Giant 8" mirror scale.
20,000 o.p.v. 0 / -25 / 1 /
2-5 / 10 / 30 / 250 / 1000 /
500/200 V. D.C. 0 / 2-5 / 10 / 50 /
50 / 250 / 1000 / 5000V.
A.C. 0 / 50μA / 1 / 10 / 100 /
500mA / 10 amp. D.C.
0 / 2K / 200K / 20 meg
-20 to +50 dB.
\$13.95. Post 35p.

U4312 MULTIMETER
Extremely sturdy instrument for general
electrical use. 667 o.p.v.
0/3/1-5/7-5/30/60/150/300/
600/900 VDC and 75mV.
0/3/2-5/7-5/30/60/150/300
600/900 VAC.
0/300μA/2-5/15/60/150
600mA/1-5/6 AMP. D.C.
0/1-5/6/15/60/150/600mA/
1-5/6 AMP. A.C.
0/200Ω/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 plus P. & P. 25p.

Selected TEST EQUIPMENT

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

Model S-100TR MULTIMETER/ TRANSISTOR TESTER
100,000 o.p.v. mirror scale, overload protection. 0/1-10/6/3/13/30/120/600 V DC. 0/6/30/100/600 V AC. 0/1/2/600μA/12/300mA/12 AMP DC. 0/10 K/1 MEG/10MEG. -20 to +60db. 0-01-9 MFD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. \$13.50. P/P 25p.

MODEL 449A IN CIRCUIT TRANSISTOR TESTER
Checks true A.C. beta In / out. Checks Ico. Checks diodes In / out. Checks SCR, etc. Beta SCR 10 - 500. LO 2 - 50. Ico. 0-5000μA. 220/240 V A.C. operation \$17.50. Post 25p.

KAMODEN HM. 720B F.E.T. V.O.M.
Input impedance 10 meg ohms.
Ranges:
0 / 25 / 1 / 2-3 / 10 / 50 / 250 / 1000V. D.C.
0 / 2-5 / 10 / 50 / 250 / 1000V. A.C.
0 / 35μA / 2-5 / 25 / 250 MA. D.C. 0 / 20 to +62db
0 / 5K / 50K / 500K / 5meg / 500meg ohms.
\$14.95. Post 30p

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 / 150μA / 120mA. D.C. 0 / 1K / 10K / 10 meg / 100 meg ohms \$15.97. Post 15p.

CI-5 PULSE OSCILLOSCOPE
For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/10mm. -3-25; Preset triggered sweep 1-3,000usec.; free running 20-200,000Hz in nine ranges. Calibrator pipe. 220 x 260 x 430mm. 115-230V. AC operation. \$29.00. Carr. paid.

TO-3 PORTABLE OSCILLOSCOPE
Sin. tube, V amp. Sensitivity 0-1v p-p/CM. Bandwidth 1-5 cps-1.5 MHz. Input Imp. 2 meg Ω 25pF X amp. sensitivity 0.9v p-p/CM. Bandwidth 1-300-300KHz. 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. \$47.50. Carr. 50p.

RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPE
5 mcs Pass Band. Separate X1 and X2 amplifiers. Rectangular 5m. x 4in. C.R.T. Calibrated triggered sweep from -2 usec. to 100 milli-sec. per cm. Free running time base 50 o/s-1 mcs/s. Built-in time base calibrator and amplitude calibrator. Supplies complete with all accessories and instruction manual \$87. Carr. Paid.

TE-16A TRANSISTORISED SIGNAL GENERATOR
8 ranges 400KHz-30MHz. An inexpensive instrument for the handyman. Operates on 9V battery. Wide easy to read scale. 800KHz modulation. 5 1/2 x 5 1/2 x 3 1/2 in. Complete with instructions and leads. \$7.97. 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% L 1 Ω H - 11 Ω 6 Ranges ±2% TURNS RATIO 1:1/1000-1:1/100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts, 100μA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 5 x 2 1/2 in. \$20. P. & P. 25p.

MODEL TE15 GRID DIP METER
Transistorized. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 450K-230MHz. 12 coils. 500μA Meter. 9V battery operation. Size 180 x 80 x 40mm. \$12.50. Post 20p.

BELCO AF-5A SINE SQUARE WAVE C.R. 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 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.

MODEL AT201 DECADE ATTENUATOR
Frequency range 0-200KHz. Attenuation 0-111db. 0-1db step. Impedance 600 ohms. Max. input power 30dbm. Size 180 x 90 x 55mm. \$12.50. Post 37p.

TE-65 VALVE VOLTMETER
28 ranges. D.C. volts 1.5-1,500V. A.C. volts 1.5-1,500V. Resistance up to 1,000 megohms. 200/240V. A.C. operation. Complete with probe and instructions. \$17.50. P. & P. 30p. Additional probes available. R.F. \$2.14; H.V. \$2.50.

MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER
Sensitivity 330 ohms/Volt AC and DC. Accuracy 5% D.C. 1% AC. Scale length 165mm. 0/300/750μA/1-5/1-5/7-5/15/30/75/150/300/750mA/1-5/1-5/7-5/AMP DC 0/3/7-5/15/30/75/150/300/750mA/1-5/3/300/750mV/1-5/3/7-5/150/300/750V/1-5/1-5/7-5/15/30/75/150/300/750V A.C. Automatic cut off. Supplied complete with test leads, manual and test certifi cates. \$49.00. Post 50p.

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

KAMODEN HM.350 TRANSISTOR TESTER

High quality instrument to test Reverse Leak current and DC current. Amplification factor of NPN, PNP, transistors, diodes, SCR's etc. 4" x 4 1/2" clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. £12.50. Post 30p.

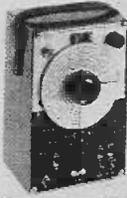


KAMODEN HMG-500 INSULATION RESISTANCE TESTER

Range 0-1000 Meg-ohms, 500 Volt. Battery operated. Wide range clear meter 4 1/2" x 4". Complete with deluxe carrying case, batteries, instructions. £19.95. Post 30p.



ARF-300 AF/RF SIGNAL GENERATOR



All transistorised, compact, fully portable. AF sine wave 18 Hz to 220 KHz. AF square wave 18 Hz to 200 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.

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: 1mV. 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: 3 1/2 in. x 2 13/16 in. x 8 3/16 in. AVAILABLE BRAND NEW AND FULLY GUARANTEED. £35.50. Carr. 50p.



HAND HELD 2-WAY WALKIE TALKIES

Industrial quality in robust metal cases. Battery operation. Volume and squelch controls. Call button and press to talk buttons. Telescopic aerial. Complete carrying cases. 2 channel £52.50 Pair. Post 50p. 3 channel £79.50 Pair. Post 50p. Licence required for operation in U.K.



EMI LOUSPEAKERS

Model 350. 13" x 8" with single tweeter/crossover. 20-20,000 Hz. 15 watt RMS. Available 8 or 16 ohms. £7.25 each P. & P. 37p.

Model 450. 13" x 8" with twin tweeter/crossover. 15-13,000 Hz. 8 watt RMS. Available 8 or 16 ohms. £3.82 each P. & P. 25p.

SPECIAL OFFER! STEREO SPEAKERS

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

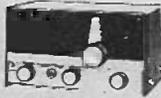
EA.41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, phone, 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 in. £5.97. P. & P. 15p.



UNR-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.



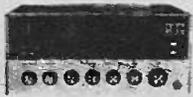
UR-1A SOLID STATE COMMUNICATION RECEIVER

4 Bands covering 550Kc/s-30Mc/s. FET 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" Brand new with instructions. £25. Carr. 37p.



SKYWOOD CX203 COMMUNICATION RECEIVER

Solid state. Coverage on 6 bands 200-420 KHz and -55 to 30 MHz. Illuminated slide scale dial. Bandspread. Aerial tuning BFO. AVC. ANL. 9' meter. AM/CW/SSB. Integrated speaker and phone socket. Operation 220/240v AC or 12v DC. Size 325 x 256 x 180 mm. Complete with instructions and circuit. £22.50. Carr. 50p.



LAFAYETTE HA-600 SOLID STATE RECEIVER

General coverage 150-400Kc/s. 550 Kc/s-30Mc/s. FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter. S. Meter. Bandspread. RF Gain. 12" x 9 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 coverage 150-400Kc/s to 30 Mc/s. continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW. ANL. Variable BFO. 9 meter. Sep. bandspread dial. IF frequency 455 Kc/s. audio output 1.5w. Variable RF and AF gain controls 115/250v. A.C. Size 7" x 13" x 10" with instruction manual. £49.50. Carr. Paid.



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. P. & P. 15p.



1021 STEREO LISTENING STATION

For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" x 4" x 2 1/2". £2.25. P. & P. 15p.



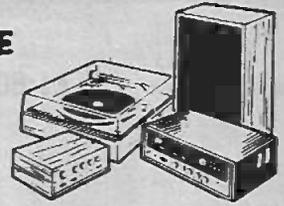
MP7 MIXER PREAMPLIFIER

5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9 1/2" x 5" x 9". Inputs Mics: 3 x 3mV 50K. 2 x 3mV 600 ohm. Phone meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K. £3.97. P. & P. 20p.



HI-FI EQUIPMENT SAVE UP TO 33 1/3% OR MORE

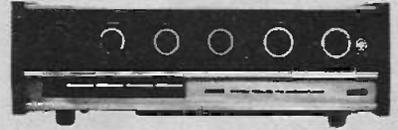
SEND S.A.E. FOR FULL DISCOUNT PRICE LISTS AND PACKAGE OFFERS!



FANTASTIC OFFER! NIKKO TRM 50 STEREO AMPLIFIER

17 + 17 watts rms stereo amplifier with inputs for Magnetic and Crystal phone, Tuner, Tape, Aux and Tape Monitor. Outputs for two pairs of stereo speakers and Tape. Stereo headphone socket. Full range of controls including loudness control, scratch filter, etc. Size 13" x 9 1/2" x 3 1/2". Unrepeatable offer—limited stocks!

List price £59.50
OUR PRICE
£39.95
Carrage 50p



AKAI BARGAINS!



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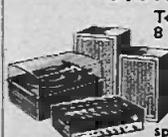
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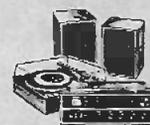
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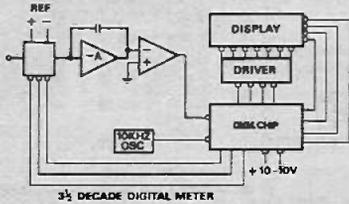
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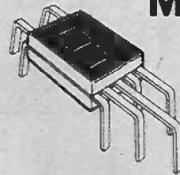
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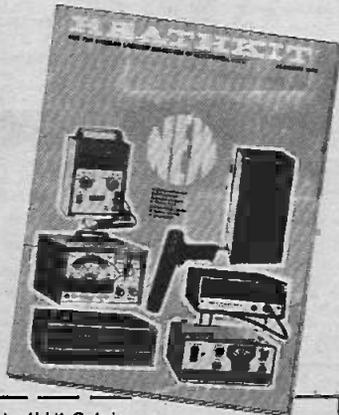
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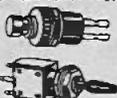
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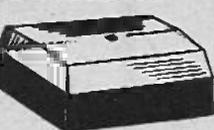
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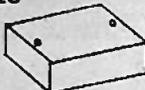
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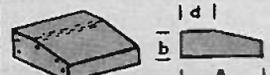
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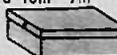
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GB12	3 1/2	2 1/2	1 1/2	36p 15p
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6.8μF	63V	7p	220μF	25V	13p
6.8μF	63V	7p	220μF	25V	13p
10μF	25V	7p	220μF	40V	15p
10μF	63V	7p	220μF	63V	22p
15μF	16V	7p	330μF	4V	7p
15μF	40V	7p	330μF	10V	8p
15μF	63V	7p	330μF	16V	13p
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22μF	63V	7p	470μF	10V	13p
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47μF	25V	7p	680μF	40V	26p
47μF	40V	7p	1000μF	4V	13p
47μF	63V	8p	1000μF	10V	15p
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68μF	16V	7p	1000μF	25V	26p
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Single, less switch, 15p
Single, D.P. switch, 26p
Tandem, less switch, 44p
5kΩ, 10kΩ, 25kΩ, 50kΩ, 100kΩ, 250kΩ, 500kΩ, 1MΩ, 2MΩ

BATTERY ELIMINATORS

suitable for transistor radios and similar light current equipment. Input 240V, A.C.
Output: PP6—6V D.C.; PP9—9V D.C.
Price £1.63 plus 15p p. & p.

CASSETTE OWNERS!

For Philips and similar cassette recorders. PU12 power unit for connection to 12V + or - E cars, giving 7 1/2V stabilised output—£3.53 + 16p p. & p.
PP75 mains power supply, output 7 1/2V D.C.—£2.15 + 16p p. & p.
Both units are complete with cables and 5 pin D.I.N. plug.

CASSETTE MICROPHONE

Low impedance dynamic with remote control switch. Fitted 2 1/2mm and 3 1/2mm plugs. £2.20 plus 15p p. & p.



PLUGS

Car aerial 13p
Co-axial 10p
D.I.N. 2 pin (speaker) 11p
D.I.N. 3 pin 15p
D.I.N. 4 pin 15p
D.I.N. 5 pin, 180° 14p
D.I.N. 5 pin, 240° 16p
D.I.N. 6 pin 16p
Jack, 2mm unscreened 10p
Jack, 2mm screened 11p
Jack, 3mm unscreened 9p
Jack, 3mm screened 13p
Jack, 1in unscreened 13p
Jack, 1in screened 13p
Jack, stereo, unscreened 22p
Jack, stereo, screened 22p
Phono, plastic top 37p
Phono, plated metal 37p
Wander, red or black 37p
Banana 4mm, red or black 61p



SOCKETS

Car aerial 9p
Co-axial, surface 9p
Co-axial, flush 10p
D.I.N. 2 pin (speaker) 11p
D.I.N. 3 pin 15p
D.I.N. 5 pin, 180° 10p
D.I.N. 5 pin, 240° 10p
Jack, 2mm 11p
Jack, 3mm 11p
Jack, 1in unscreened 16p
Jack, 1in switched 16p
Jack, stereo, switched 26p
Phono, single 5p
Phono, 2 on a strip 7p
Phono, 3 on a strip 10p
Phono, 4 on a strip 11p
Wander, single, red or black 37p
Wander, twin strip 7p
Banana 4mm red, or black 61p

LINE SOCKETS

Car aerial 13p
Co-axial 10p
D.I.N. 2 pin (speaker) 11p
D.I.N. 3 pin 15p
D.I.N. 5 pin, 180° 17p
D.I.N. 5 pin, 240° 17p
Jack, 3mm 16p
Jack, 1in screened 34p
Jack, stereo, screened 37p
Phono, plated metal 15p

TRANSFORMERS

all with 0-250 Volt primaries.
Miniature
MM6 6V, 500mA +6V, 500mA.
MM12 12V, 250mA +12V, 250mA.
MM20 20V, 150mA +20V, 150mA.
£1.42 plus 14p p. & p.
L.T.
LT1 6.3V, 1.5A—£2p plus 20p p. & p.
LT2 6.3V, 3A—£4p plus 28p p. & p.
LT3 12V, 1.5A—£2p plus 28p p. & p.
LT4 12V, 3A—£1.45 plus 33p p. & p.
LT5 9-0-9V, 0.5A—£3p plus 23p p. & p.
LT6 12-0-12V, 1A—£1.04 plus 29p p. & p.
Multi-tapped
MT30/2 0-12-15-20-24-30V, 2A—£2.15 plus 33p p. & p.
MT60/1 0-5-20-30-40-60V, 1A—£2.31 plus 33p p. & p.
MT50/2 0-5-20-30-40-60V, 2A—£2.25 plus 37p p. & p.
Charger
CT/01 1A—£1.16 plus 28p p. & p.
CT/02 2A—£1.43 plus 33p p. & p.
CT/03 4A—£1.76 plus 33p p. & p.
Secondaries 0.5-1-1.7V.
Speaker Matching 3-8-16Ω
Example: 16Ω speaker to 8Ω amplifier.
99p plus 22p p. & p.

everyday electronics

PROJECTS.
THEORY...

EXPERIENCE COUNTS

What is it all about? *Learning by experience*, that's what life is all about, as they say. True enough, yet we don't individually have to learn everything the hard way, repeating the same old mistakes as others before us. Life is made much easier by taking due note of other people's experiences whenever these are likely to assist.

Anyone contemplating having a go at electronics for the first time will certainly find a great accumulation of experience to draw upon. Such valuable know-how, based upon the experience of older hands who have been wielding the soldering iron for some considerable time, appears regularly in these pages.

GETTING STARTED

One of the questions in the prospective constructor's mind is bound to be concerned with stocking-up; in other words, what kind of components and tools should be acquired initially? Well a selection of essential tools is reasonably easy to make. Components are a little more difficult: for one reason, due to their very variety; and for another, because the personal interests and preferences of each individual will direct his constructional activities towards particular types of projects. Nevertheless, it is possible to suggest a general basic collection of circuit components that experience has shown will satisfy a great many needs.

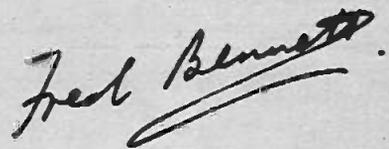
This very helpful information is passed on to readers in this month's feature *Workshop Com-*

ponents and Tools. The raw beginner can get off to a good start and benefit from a "veteran's" experience. And that, after all, is mainly what it's all about—whether life in general or electronics in particular.

SEMICONDUCTOR CHART

The large variety of discrete semiconductor devices currently available can be perplexing to the constructor. Yet although such devices are listed by the hundreds in retailers advertisements, the requirements of most constructors are generally met by the use of perhaps just a few dozen different devices.

In order that the constructor may see the wood despite the trees, a special semiconductor wall chart is presented free with every copy of this month's EVERYDAY ELECTRONICS. This chart will, we are certain, be welcomed by all constructors and become a valuable and useful adornment to many a private workshop or den. Compiled by the EVERYDAY ELECTRONICS editorial team, the selection of devices has been made in the light of practical experience coupled with recognition of the more usual demands of the average constructor.



Our June issue will be published on Friday, May 18

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EASY TO CONSTRUCT SIMPLY EXPLAINED



VOL. 2 NO. 5

MAY 1973

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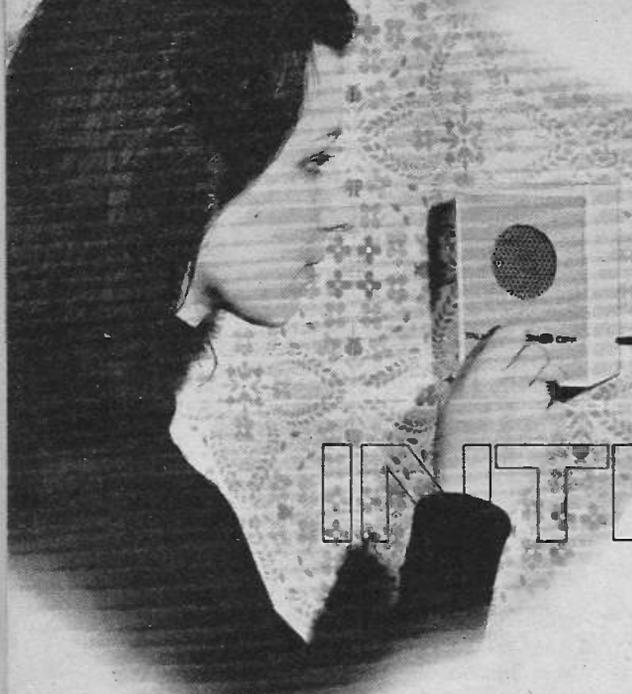
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Demo Deck Reprint

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.



**JOHN!...
LUNCH IN FIVE
MINUTES...**

INTERCOM

BY R.A.PENFOLD

A two way easily connected intercom for the home.

COMMERCIALLY produced intercoms, even the most simple ones, can be rather expensive. By building one's own unit, however, the cost can be reduced. The intercom described in this article can be built fairly cheaply and has a performance equal to that of many commercially produced units.

Three transistors are used, one germanium type, and two silicon types. Home made cabinets constructed from plywood are used to house the two units; these are very simple to construct. The circuit has been used with connecting wires up to 50 feet in length with perfectly adequate results, and wires of much greater length could probably be used.

The method by which the remote station calls the main station is very simple, and only a standard three core "mains" cable is needed to connect the two units.

THE CIRCUIT

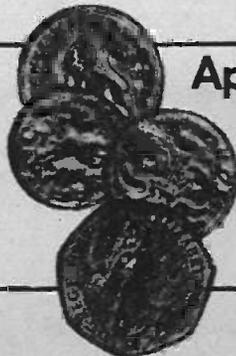
A complete circuit diagram of the intercom is given in Fig. 1. As is usual with this type of equipment, for communication in one direction the loudspeaker is used as such, and for communication in the opposite direction it is used as a moving coil microphone. This does create the problem that the amplifier has to have an input, and output impedance equal to that of the loudspeaker, which is usually rather low. This can be eased by using a high impedance

loudspeaker; speakers of 75 ohm impedance are used in this circuit.

The signals produced by the microphone are coupled to the base of TR1, by capacitor, C2. This capacitor will block direct currents, thus preventing TR1 base from being earthed through the "microphone," but will pass the a.c. signals produced by the "microphone."

Any radio signals which are picked up in the connecting cables, are filtered from the circuit by C1. The unit should first be tried without C1, and this capacitor should only be added if interference from radio stations is evident in the output.

Transistor TR1 and its associated components form the input stage. Resistors R1 and R2 form a potential divider, which provides a small biasing voltage for TR1, enabling it to amplify the signal from the loudspeaker. Resistor R3 is the collector load resistor, across which the output



**Approximate cost
of components
including V.A.T.**

**£ 3.00 plus case
and wire**

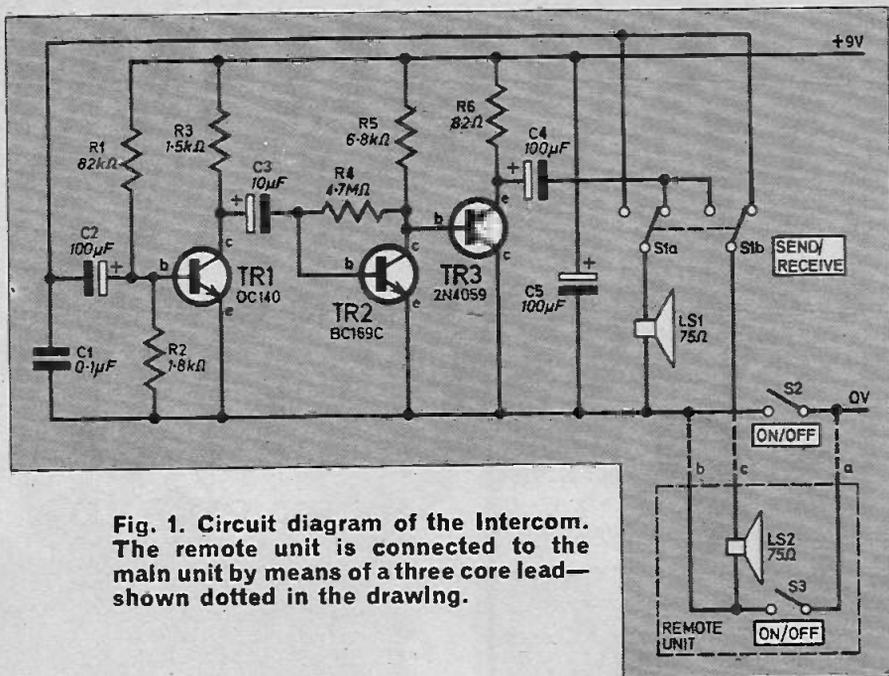


Fig. 1. Circuit diagram of the Intercom. The remote unit is connected to the main unit by means of a three core lead—shown dotted in the drawing.

signal is developed. The output from TR1 is coupled by C3 to the base of TR2. Transistor TR2 is operated as a voltage amplifier, R5 being the load resistor. The stage is biased by a single resistor, R4.

Transistor TR3 is a *pn*p transistor which is wired as an emitter follower. This stage has no voltage gain, but is used as an impedance transformer, matching the high impedance output of TR2, with the low impedance of the loudspeaker. Or, in other words, the output of TR2 is at a sufficient voltage, but with insufficient current to operate the loudspeaker, TR3 is therefore used as a current amplifier and R6 is the emitter load resistor for TR3.

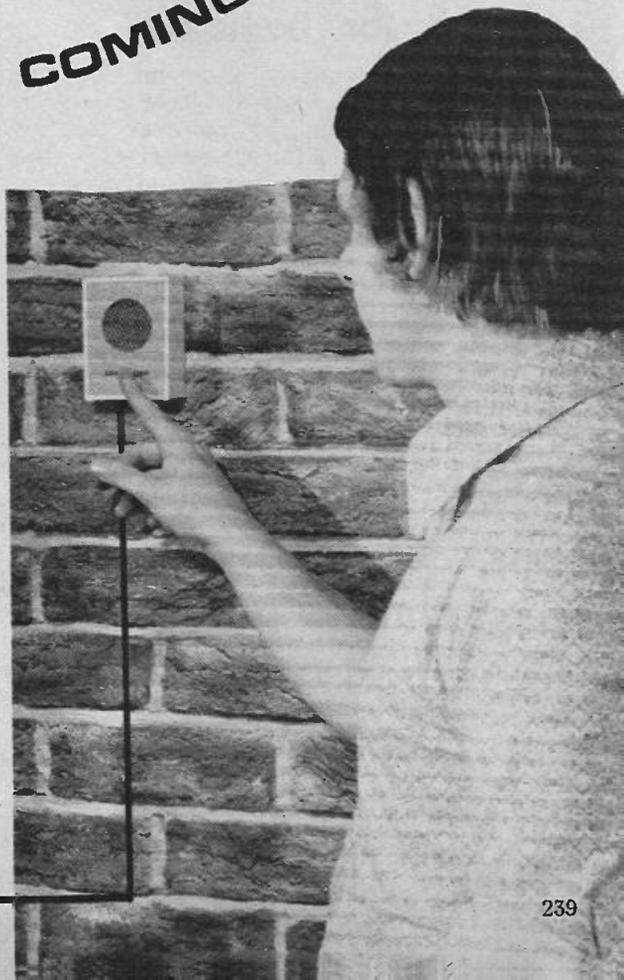
As the voltage required at TR3 base to bias the transistor, is the same as that present at TR2 collector, the two may be direct coupled, no coupling capacitor being required. Capacitor C4 couples the output from TR3 emitter, to the loudspeaker.

Capacitor C5 is the supply decoupling capacitor. This is used to smooth the supply against changes in voltage, caused by loading of the battery on current peaks. This causes the supply voltage to drop, which causes the voltage at TR1 base to drop also. This voltage drop will be in opposition to the input signal, and so will tend to have a cancelling effect on it. Therefore, without this capacitor, the gain of the amplifier is reduced.

SWITCHING

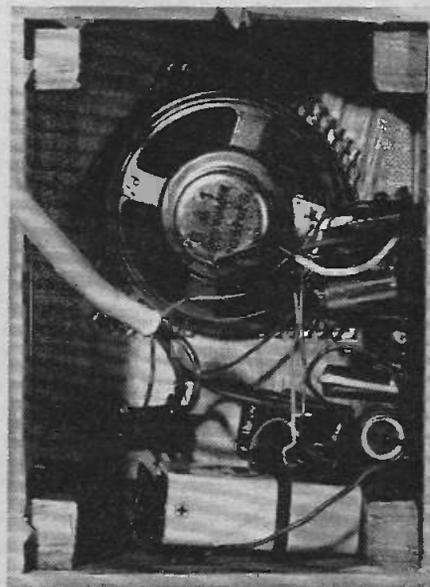
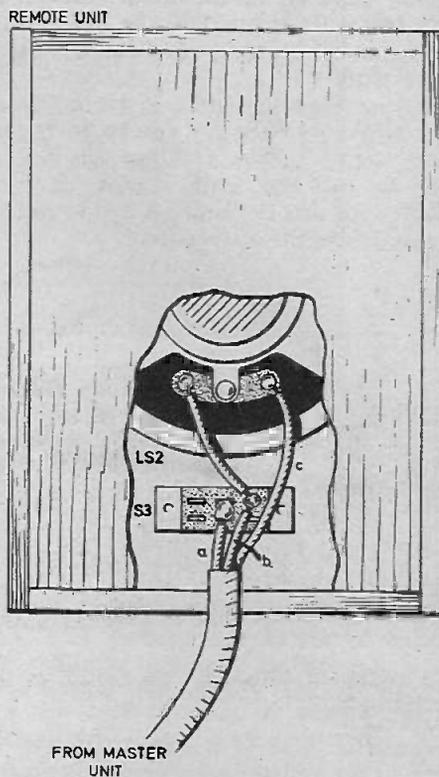
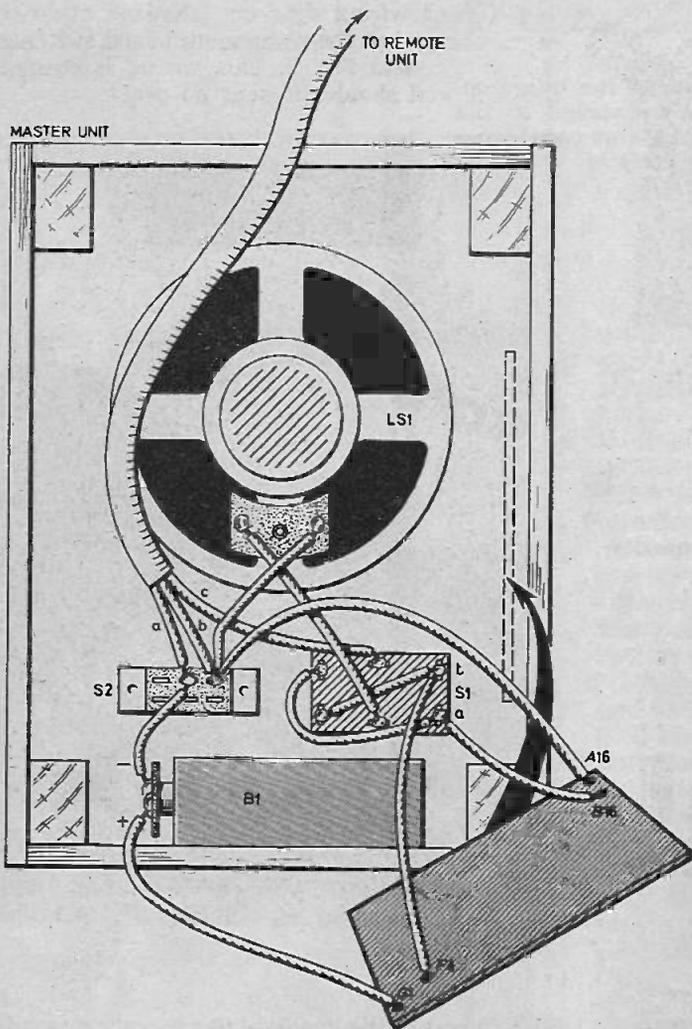
The switching of the circuit is fairly simple, S1 is the send/receive switch, and is situated in the

COMING!



INTERCOM

Fig. 3. Layout and wiring of the master unit (below) and the remote unit (right) showing basic case construction and interconnecting lead.



The completed prototype master intercom unit

main station. This is shown in the receive position in the circuit diagram, with LS1 connected to the output of the amplifier and LS2 connected to the input (acting as the microphone).

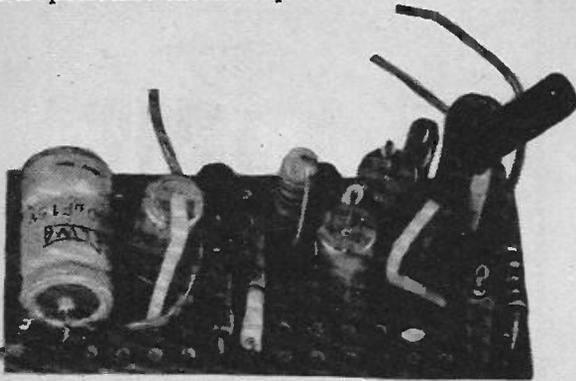
Switches S2, and S3 are both on-off switches, S2 being situated in the main station, and S3 in the remote station. For the main station to call the remote station, S2 is turned on, and S1 is set to send.

The send receive switch is spring loaded, so that it will automatically return to the receive position when released. Thus for the remote station to call the main station, it is merely necessary to turn the unit on by closing S3, and then speak into the microphone.

All the components, except the speakers, and the switches, are mounted on a piece of Veroboard, measuring 1.1 inches by 2.5 inches by 0.15 inch matrix. A wiring diagram of this board is shown in Fig. 2. The copper strip is broken in two places, as indicated on the diagram.

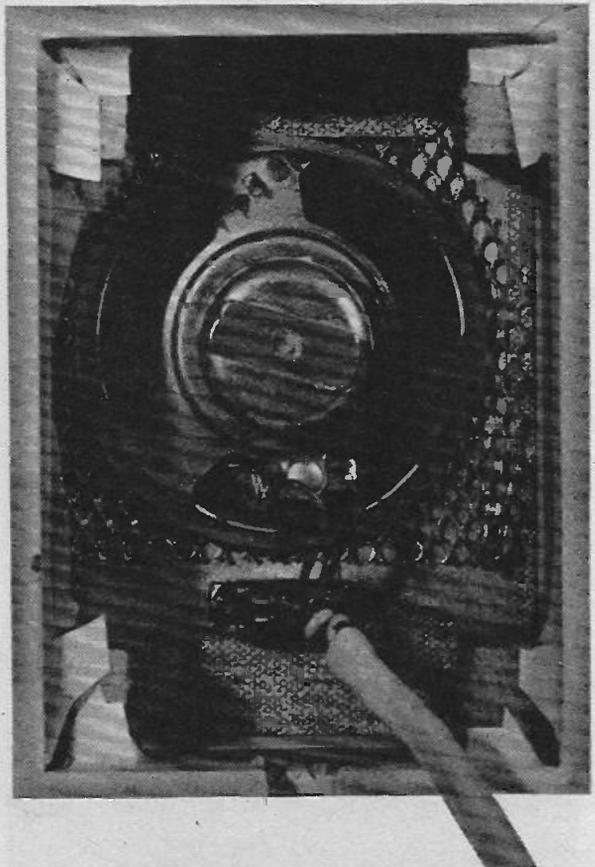
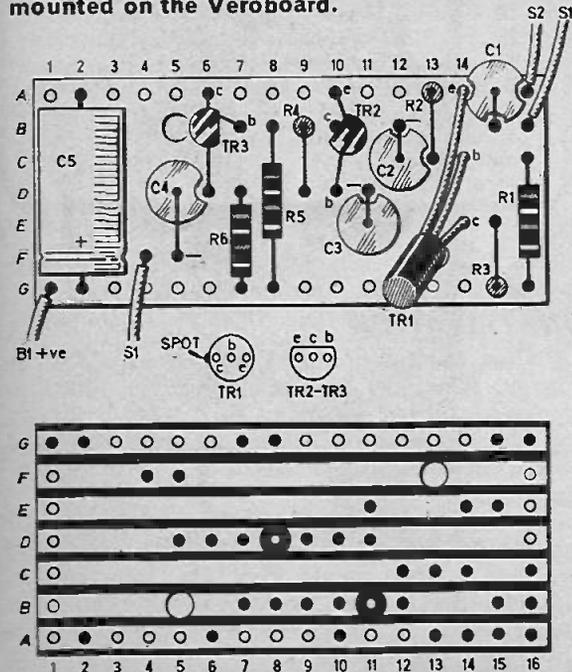
A germanium transistor is used for TR1, and so special care must be taken when soldering this component into position. Its lead out wires should be left full length, and it should be soldered into place using a heat shunt on each lead as it is soldered. Care should be taken not to overheat the other two transistors when soldering them in, but these are silicon types which are far less easily damaged by heat than are germanium types.

A second wiring diagram, showing the connections between the component board, switches, etc., is given in Fig. 3. This wiring is straight forward, and should present no problems.



The Veroboard housing the amplifier used in the intercom.

Fig. 2. Layout and wiring of the components mounted on the Veroboard.



Photograph of the inside of the complete remote unit.

CASES

Two cases are required, one for the main station, and one for the remote station. Commercially produced cases could be used, but this would greatly increase the cost of the intercom,

as home made cases can be made from offcuts for virtually nothing. For the prototype the two cases were constructed from some $\frac{1}{8}$ inch 3 ply, and a short length of $\frac{1}{2}$ inch square timber, at a very low cost.

The method of construction is illustrated in Fig. 3. As will be seen from the diagram, the cases consist of four corner pieces, to which the top, bottom, and sides are glued, and pinned. The corner pieces are two thicknesses of ply shorter than the width of the panels. This is so the front, and rear panels can be recessed into the case, and will fit flush.

These panels must be made so that they fit tightly into place, as it is only the tightness of this fit that holds them in place. It is not an easy task to cut these panels to precisely the correct size, and it is probably best to cut them slightly too large, and then file them down until they fit correctly.

To enable the backs of the cases to be removed, a small notch must be cut into the centre of the lower edge of each rear panel. A screwdriver or knife blade may then be pushed into the notch, and the back levered off.

The speaker cut outs can be made with a fret or coping saw and a half round file. Cut out the diameter circle required, and then smooth the edges using the file. A piece of expanded metal or speaker fret is glued behind each cut out.

Photograph of the completed remote unit—a neat appearance can be achieved with careful case construction and finishing.



The cases may be finished by painting, or covered with plastic material such as Fablon.

Once the units are complete they can be connected together with a length of 3 core lead (about 6 feet) and tested by using one unit on either side of a closed door; this is necessary to prevent acoustic feedback. Two people will be required for testing, each calling the other in turn. Current consumption of the unit should be approximately 15 mA.

Components

Resistors

- R1 82k Ω
 - R2 1.8k Ω
 - R3 1.5k Ω
 - R4 4.7M Ω
 - R5 6.8k Ω
 - R6 82 Ω
- All $\pm 10\%$ \pm W carbon

SEE
**SHOP
TALK**

Capacitors

- C1 0.1 μ F (if required—see text)
- C2 100 μ F elect. 12V
- C3 10 μ F elect. 12V
- C4 100 μ F elect. 12V

Transistors

- TR1 OC 140 germanium *n*p*n*
- TR2 BC 169C silicon *n*p*n*
- TR3 2N4059 silicon *p*n*p*

Miscellaneous

- LS1, LS2 Small 75 Ω moving coil loudspeakers (2 off)
 - S1 D.P.D.T. biased toggle switch
 - S2 S.P.S.T. slide switch
 - S3 S.P.S.T. slide switch
- Battery, 9V PP3 type and connector,
2.5 x 1.1 x 0.15 inch matrix Veroboard,
3 core "mains" type flex of length required,
materials for cases (see text), connecting
wire, fixing screws.

INSTALLATION

When the two units have been satisfactorily tested, they may be installed in the positions required—either by fixing to a wall or simply by placing them on a shelf or work top—and wired together with a length of 3 core "mains" type lead.

If radio interference is picked up in use, C1 should be added to the circuit board as shown in Fig. 2, this should cure the interference. Interference is most likely to occur at night in strong signal areas where the lead between the two units is fairly long. □

Workshop Components and Tools

By Mike Hughes



I AM often asked by people who are just taking an interest in "home electronics" what sorts of components and tools they ought to consider buying to set themselves up. This is an impossible question to answer unless one knows the precise interests of the person, from where he intends to get his designs or even his income!

Years ago, I remember asking the self same question myself, unfortunately of a semi-professional amateur, and his answer left me in a daze of confusion. I am sure, to this day, that he used the opportunity to try and impress me with his own affluence and his highly sophisticated expertise.

The result was that I retired into my 12-year-old shell convinced that, unless one was to invest—what appeared to me—a considerable portion of the national economy into the hobby I had set my sights on, I did not stand a chance in hell of mending a fuse let alone get involved in the intricacies of building a radio set or what-have-you.

INITIAL PROBLEMS

I must make allowances for the fact, that in those days, amateur electronics did not have the popularity it enjoys today and there was comparatively little commercial competition, hence prices tended to be extremely high. Notwithstanding the prices involved, I was still left with the quandary of how to invest my pocket money.

Occasionally my mentor (at that time *Practical Wireless*), would publish a supposedly useful article suggesting the "ideal" layout of the electronic experimenter's workshop with impressive lists of test equipment, dimensions of workbenches and even the recommended height of bookshelves—for speedy reference purposes.

This was of great help to me with my "two bob" a week income, and even with my extremely tolerant parents, I found the proposition of turning the sitting room into a fully equipped and furnished laboratory was to fall on deaf ears!

Even the comforting proposals that much of the test equipment could be made from the "junk box" was not of much practical help to me. First, my junk box contained no more than a few dog-eared resistors of doubtful ohmic value, most of which had been salvaged from pre-war radio sets with an average lead-out wire length of about a quarter inch—if any at all! Secondly, I did not, at that time, know the difference between a voltmeter and an ohmmeter.

In all fairness to my semi-professional friend, he did help swell the dimensions of the junk box during the periodic clear-outs of his luxurious "pad", but then I was left with another problem—how to identify those brown bakelite cases with tangles of waxed protruding wires.

To this day I still have a few of these anonymous components that have defied identification during the years.

DECIDING FACTORS

All this, of course, is history and the development of the home electronics industry has put a new complexion on things, and the introduction of new standards in magazine design philosophy has removed many of the supply problems that I, and many others, experienced just after the war.

The modern beginner is still left with a slight problem, and that is to know what sort of stock of everyday components he ought to have to be able to involve himself in building a prototype

at a moment's notice—without having to wait on the postman bringing supplies from the various mail order houses.

Cost is still, and always will be, a limiting factor, but nowadays one can effect quite a saving if one buys reasonable quantities of components at a time, particularly by keeping an eye open for bargains and buying *before* you need parts.

TRENDS

The trend now is away from the junk box. Most writers who publish designs try to ensure that *every* component specified is a currently available modern device that can be obtained from several sources. Occasionally "clangers" are dropped, but by and large this policy prevents the eternal disappointments that I encountered.

The cynic might say that this policy is simply to satiate the requirements of advertisers, this is not true; if anything, the opposite is the case.

By adopting a "current component only" policy, more suppliers are able to comply with design requirements, hence there is a better availability of components, and because of the semi-standardisation of types, there is now a very healthy competition in the business for our custom.

STOCKING UP

I will now attempt to do the impossible and make a few suggestions as to what one might

consider a float stock of standard components that will frequently crop up in published designs. At the same time I shall make a few personal comments on what I think would be a useful complement of equipment and tools that could be acquired over a period of time.

To get a rough idea of typical component stocks I carried out a survey of my own situation and was surprised that, on the whole, the requirements were not as vast as I originally thought.

The important thing about any stock is that once you have established it, you must maintain it; this way you do not notice the expense so much! If you adopt a policy of always replacing what you have used, you will find that the following basic list will keep you "in business" quite satisfactorily—unless you intend to get involved in some very specialised large project.

When I replace components into stock, I always try (funds permitting) to put in slightly more than I take out; also if I have to obtain *one* specialised component that is not currently "in stock", I usually try to buy two or three—unless it is expensive. This way you will be surprised how quickly you can set yourself up in a fairly painless way.

I'm not suggesting that you go out and buy every component on the list in one go, but I think it a reasonable suggestion that over the years, you try to build up this sort of inventory.

As listed, the components would cost in the region of £15.

Components

Resistors

10 off each of the following:

560 Ω , 1k Ω , 2.2k Ω , 4.7k Ω , 6.8k Ω , 10k Ω , 22k Ω , 47k Ω , 68k Ω , 100k Ω , 470k Ω , 1M Ω (All $\frac{1}{2}$ watt carbon $\pm 10\%$)

2 off each (3W rating):

2.2 Ω , 10 Ω , 56 Ω , 100 Ω , 220 Ω

Potentiometers

2 off 10k Ω linear carbon

1 off 100k Ω log. carbon

2 off each: 1k Ω , 10k Ω , 100k Ω skeleton presets, miniature type

Capacitors:

1 off 2500 μ F 25V electrolytic

2 off 500 μ F 25V electrolytic

4 off 100 μ F 25V electrolytic

4 off 16 μ F 25V electrolytic

2 off 1 μ F polyester

4 off each of the following polyester types: 0.47 μ F, 0.1 μ F, 0.047 μ F, 0.01 μ F, 4,700 pF, 1,000 pF

1 off 200 pF, 1 off 500 pF trimmers

Transistors

12 off general purpose silicon *npn* BC108, BC109 or 2N2926

6 off general purpose silicon *pnp* 2N3702

6 off general purpose germanium *pnp* OC44

2 off high power germanium *pnp* OC26

1 off high power silicon *npn* 2N3055

Diodes

12 off silicon signal diodes 1N4148

12 off germanium signal diodes OA91

6 off general purpose 1A rectifiers 1N4004

Photo-cells

1 off photo conductive cell ORP12

1 off phototransistor OCP71

Transformers

1 off mains/multi-tapped low voltage 1A secondary

1 off mains/6.3V 1A heater type

Lamp holders

2 off panel mounting MES holders with lenses

Bulbs

2 off 6V 0.06A MES bulbs

Neons

1 off mains indicator (panel mounting with lens and resistor)

1 off bare neon (60/70V) without resistor

Components

Switches

- 2 off mains rated 1A double-pole toggle switch
- 1 off 3-pole 4-way rotary
- 1 off 4-pole 3-way rotary

Ferrites

- 1 off 6in. length $\frac{3}{8}$ in. dia. aerial rod
- 1 off pot core with bobbin type LA1

Plug/socket pairs

- 1 off polarised two pin panel mounting
- 1 off standard $\frac{1}{4}$ in. jacks

Meters

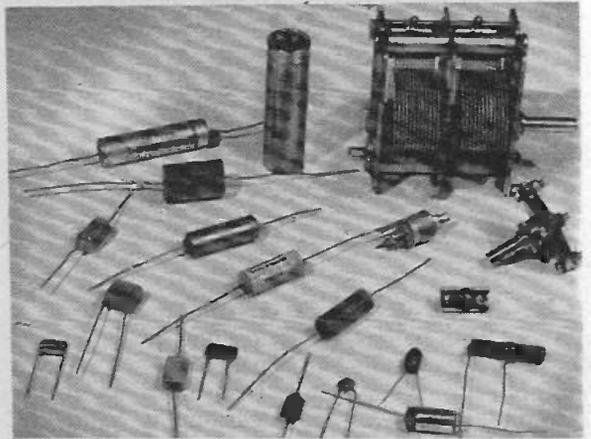
- 1 off miniature $50\mu\text{A}$ movement
- 1 off edge wise "level meter"

Loudspeaker

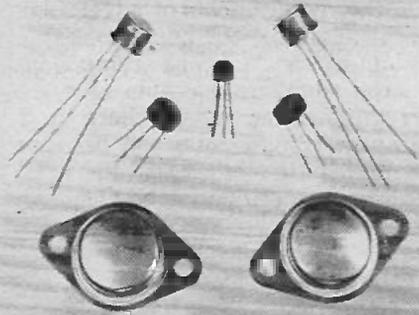
- 1 off 35 ohm 2 to 6 inch diameter

Miscellaneous

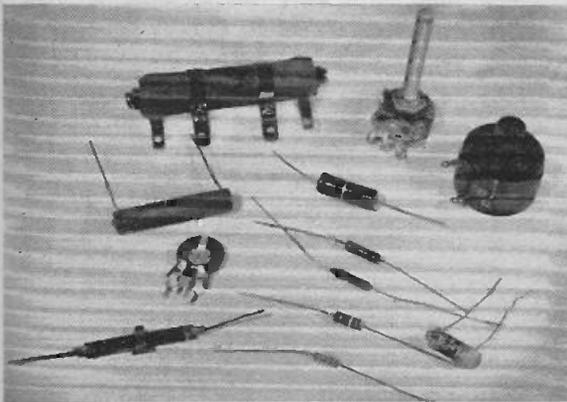
An assortment of the following:
Tag strips, group boards, Veroboard, BA nuts bolts and washers (mainly 4 BA and 6BA), 4BA and 6BA solder tags, $\frac{3}{8}$ in. and $\frac{1}{4}$ in. grommets, 22s.w.g. tinned copper wire, 32s.w.g. enamelled copper wire, multistrand flexible connecting wire, solid conductor connecting wire, twin mains rated flex, three core mains rated cable.



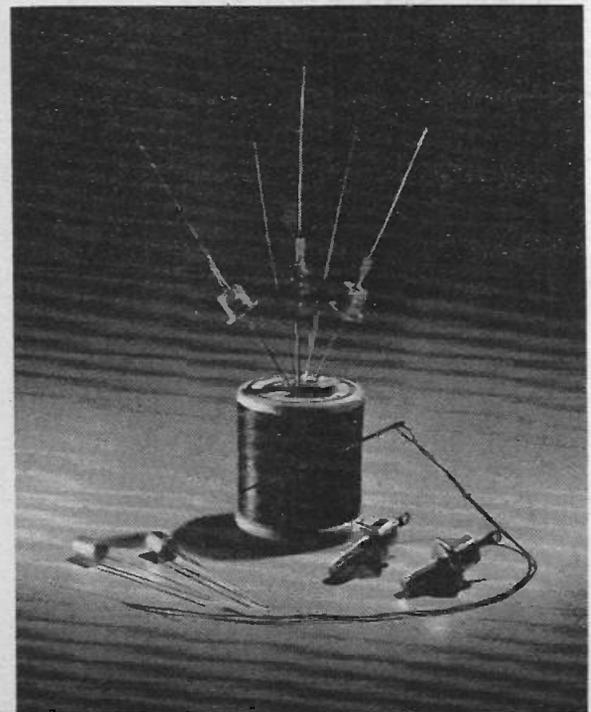
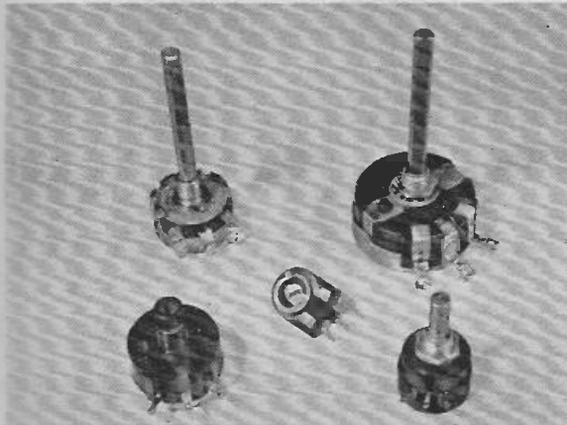
Selection of fixed and variable capacitors.



A group of common semiconductors, above and below.



A selection of fixed and variable resistors.



Photograph of reed relays, connectors, switches, lampholder and transformer.



Tools

Soldering iron

1 off 15/25W with $\frac{1}{16}$ in. diameter bit mains iron for normal light duty work.

1 off Weller "Expert" instant heat iron—for the occasional repair job that has to be done quickly and for heavy duty work (not suitable for normal construction work).

Solder

1 off 1 lb reel of resin cored $\frac{1}{16}$ or 22 s.w.g. solder.

Screwdrivers

1 off $\frac{1}{4}$ in. blade pocket screwdriver (with neon tester)

1 off $\frac{1}{4}$ in. blade, long shafted screwdriver with insulated handle.

Side cutters

1 pair

Pliers

1 pair heavy duty combination pliers

1 pair light duty taper-nosed pliers

Drill and bits

1 off either hand drill or electric drill with stand
Assortment from $\frac{1}{16}$ in. dia to $\frac{3}{8}$ in. dia. drill bits

Chassis punches

One or two selected sizes or tank cutter

Wire strippers

1 pair

Hammer

1 off medium/light weight

Hacksaw

1 off small "Eclipse" type

1 off heavy duty for cutting sheet metal

Files

1 off half-round 6 in. medium cut.

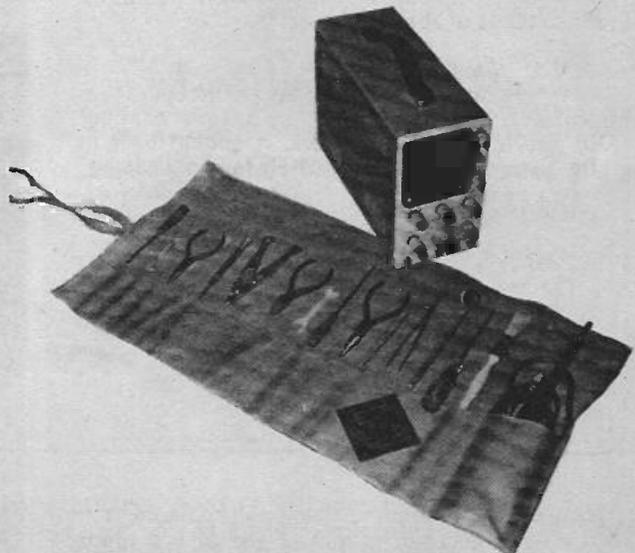
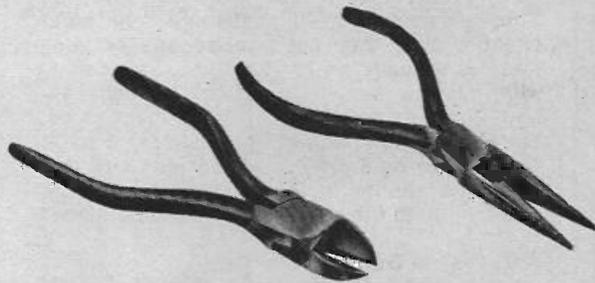
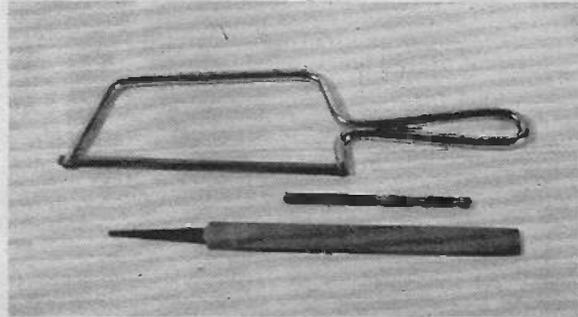
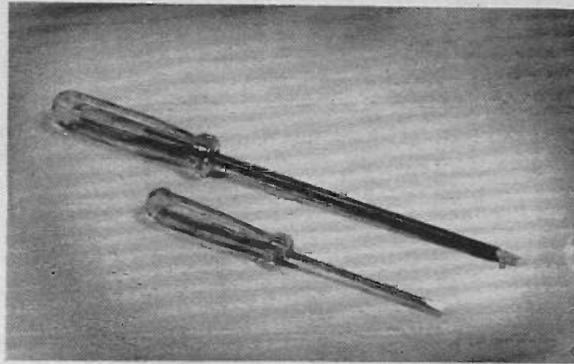
1 off round 6 in. medium cut.

Snips

1 pair of tinmans snips for cutting sheet metal

Vice

1 off small vice with shaped jaws for holding circular section materials



Photograph of an oscilloscope and a constructors tool kit. (Heathkit).

Test Gear

This is where the biggest expense lies and one would not suggest that you consider buying all the items suggested in one go, but over a period of a number of years.

Multimeter

One of these is essential from the word go. It is not worth buying a cheap low sensitivity one. Much better wait until you can afford a 20,000 ohm per volt version having (typically) d.c. volts from 3V to 1,000V, a.c. volts 6V to 1,000V, d.c. current from 50 μ A to 5A and two or three resistance ranges.

Variable power supply

I think that this can justifiably be called a test instrument because you can frequently find faults by checking the voltage ranges over which a piece of equipment will work. A useful range is from 0 to 20V d.c. at about 1A.

Oscilloscope

The beginner would probably think this an unnecessary luxury, but I do not think so. Simple service oscilloscopes are now much cheaper than they used to be and certainly there is virtually no limit to what you can do with even a simple instrument. Ideally you should get as expensive an instrument as you can afford, and I personally think there is better value in buying a £25 service oscilloscope than the rest of the instruments mentioned here put together (with the exception of the multimeter).

A.F. Signal Generator

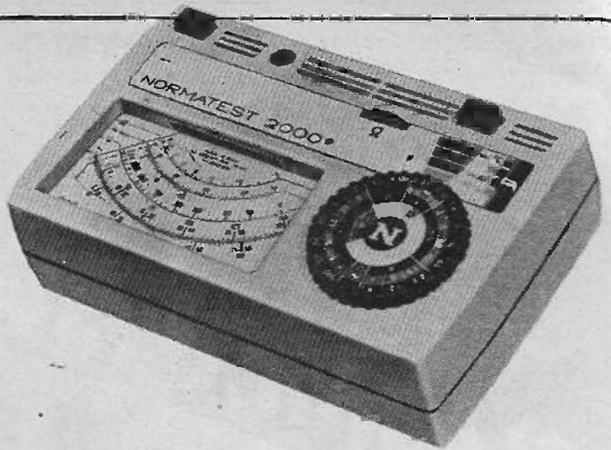
Very useful for general work, provided it covers the range of frequencies from 30Hz to 100kHz with sine and square wave output at amplitudes of about 1V.

R.F. Signal Generator

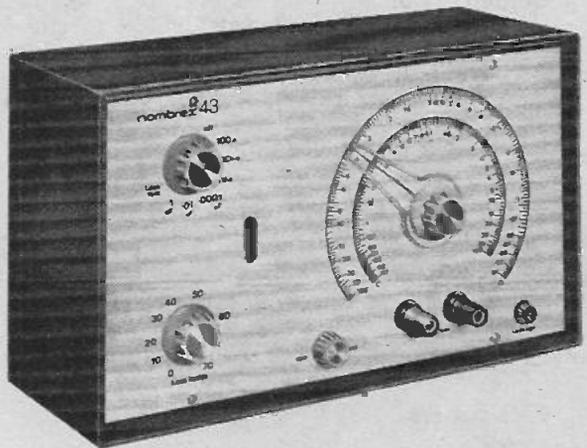
This is rather a luxury for the general purpose amateur, but is a necessity for anyone wanting to specialise in radio work. It should have a frequency range of from 100kHz to about 50MHz and have facility for internal or external modulation.

RC Bridge

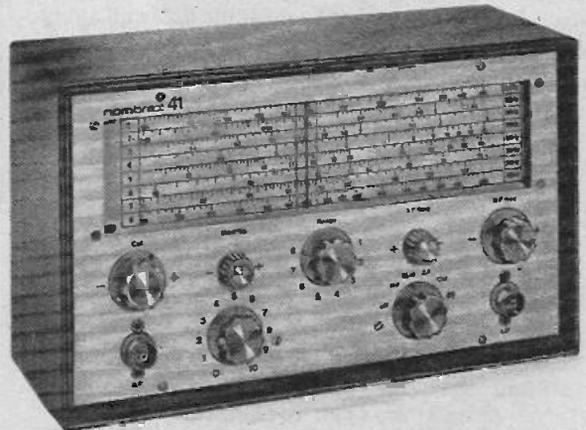
For the man with "everything". This is very much a luxury tool and is not frequently required. When, however, you want to measure capacitance or inductance, there is no real substitute. This ought to be the last on your list of "buys".



A photograph of one of the many multi-meters available on the market.



The Nombrex R.C. Bridge (above) and R.F. Signal Generator (below)



No doubt I shall be accused of the same crime that I have accused others of by daring to suggest this formidable list, but I stress that there is never an excuse for saying you need all the

tools and instruments at the same time. It is more important that you regard the latter two sections as being the "most" you are likely to require. □



FLASHING LIGHT METRONOME



A simple flashing light unit for use in the musical field and the laboratory.

by Paul Townsend

THERE are two good reasons for using a flashing light circuit rather than a circuit that generates an audible tone, firstly, an audible signal gets lost amongst amplified music, and secondly, a flashing light is less annoying than a continuous clicking sound.

CIRCUIT

The complete circuit diagram of the Flashing Light Metronome is shown in Fig. 1.

At first sight it appears to be a Wheatstone bridge followed by a two transistor amplifier. In fact the circuit is an oscillator which has an advantage over the more conventional multi-vibrator circuit in that it requires only one timing capacitor. The circuit operates as follows.

At the start of the cycle, the current drawn by the circuit is small, so the voltage drop across the load, LP1, is negligible.

The voltage at point A is determined by the values of VR1, R1 and R2 and is a reference voltage.

Approximate cost of components including V.A.T.

£1.10



At the beginning of the cycle, the voltage at point B will be equal to the supply voltage, but will drop as the capacitor C1 becomes charged. When the voltage at point B has become 0.6V negative with respect to point A, transistor TR1 becomes forward biased and turns on, i.e. conducts.

Capacitor C1 now commences to discharge through TR1, R4 and the base/emitter junction of TR2, turning on the latter. A large current thus flows through LP1, and the latter lights up.

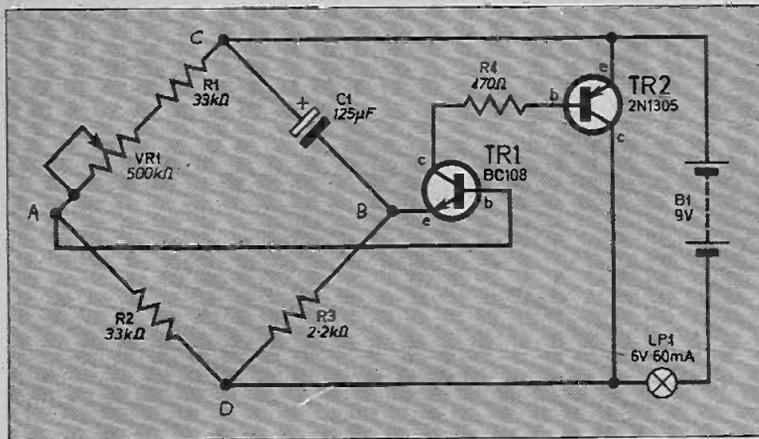


Fig. 1. The complete circuit diagram of the Flashing Light Metronome.

The voltage drop across LP1 is practically equal to the supply voltage, and so point D is effectively clamped to this voltage.

Point C is directly connected to the supply and point B is a negative with respect to C because of the capacitor charge. Thus sufficient base current can for the moment be applied to TR1 to hold it on.

The value of R4, however, is so low that the capacitor is discharged very quickly hence decreasing the negative potential at point B.

Eventually, this potential will drop to less than 0.6V with respect to point A, with the effect that TR1 turns off (i.e. stops conducting). This cuts off the base supply path to transistor TR2 so that it too turns off. The current through LP1 drops to its normal value (non illuminating) and the whole process is repeated.

The cycle is repeated continuously at a rate dependent on the values of C1, the resistors R1 to R4 and the setting of VR1.

CONSTRUCTION

The unit is constructed on a piece of 0.15in. matrix Veroboard size 11 x 7 holes. The component layout on the Veroboard and the wiring of the board to the other components—located in an old tin previously used for tobacco—is shown in Fig. 2.

Begin assembly by making the necessary cut-outs on the Veroboard copper strips as detailed and solder the components in position as indicated in Fig. 2.

The transistors should be soldered in position last of all and a heatshunt should be used on the transistor legs to prevent thermal damage. Now attach the flying leads.

Obtain a suitable tin or other case for the unit and fix S1, VR1 and LP1 holder in positions as shown. In the prototype these components were fitted to the base of the tin so that access to the battery was obtained by merely removing the lid. Layout is not critical and may be varied to suit individual requirements.

Wire up the component board to S1, VR1 and LP1 as shown.

To prevent shorting of any components of the component board with the case, it is recommended that a layer of Sellotape or insulating tape be used to line the inside of the case.

CALIBRATING

Make up a scale as shown in Fig. 3 and stick this to the front panel of the unit such that the knob is at the centre of the semicircle.

With the knob screwed securely in position, position it so that its pointer or marking is coincident with the first radius of the semicircle. Turn on the unit and count the number of flashes of LP1 that occur in one minute. Mark this number alongside this radius outside the semicircle. Repeat for all other positions.

Positions between those marked can be interpolated.

It must be remembered that if the knob is removed at any time calibration must be carried out again.

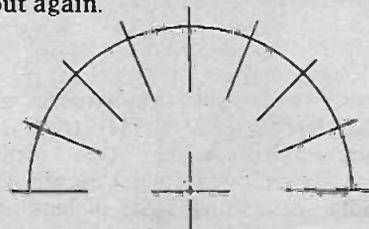


Fig. 3. A full-sized drawing of the scale used on the prototype unit. Use this (or a copy of this) to make your own calibrated scale as detailed in the text.

SOME USES

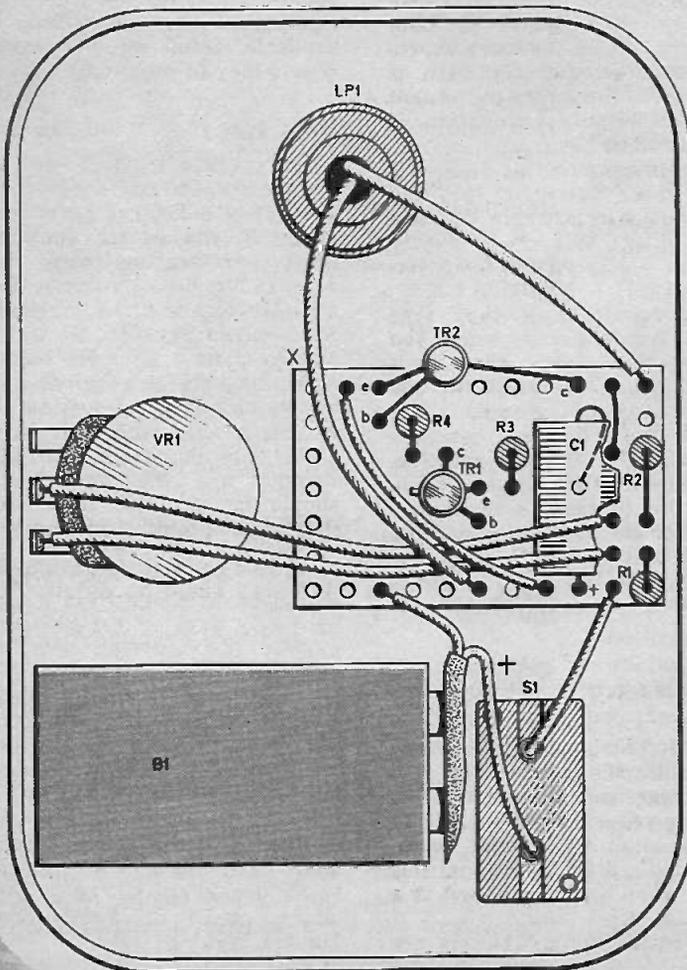
The Flashing Light Metronome will probably be employed mostly in the musical field where it will be used as a timing reference for the purpose of keeping "in beat" by both the soloist and group musicians.

When used by musicians, the Flashing Light Metronome can also be used as a "tempo recorder". When the desired tempo of a particular tune has been decided, a person outside

Continued over and on page 260.

FLASHING LIGHT METRONOME

Photograph (right) shows the completed Flashing Light Metronome housed in a used 2oz. tobacco tin with the lid removed.



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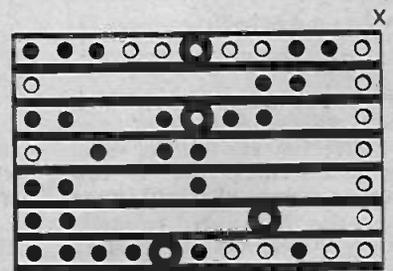


Fig. 2. The layout of the components on the Vero-board with regions of copper strip on the reverse side to be removed. The board is shown wired up to the other components housed in a two-ounce tobacco tin.

No doubt you have all heard enough about V.A.T. by now, just to make it worse we are going to try (notice the wording) and tell you just how it is likely to affect electronic components, kits and equipment.

The position according to the government is fairly clear but when one comes to investigate individual cases it is not quite so simple. Starting with the few "electronic" items, apart from components, that will, by the time you read this, have gone up in price; these are stereo amplifiers, larger chassis and cabinet speakers (over 12 inches in diameter or the sum of the diameters of the speakers in an enclosure) and headphones, these will all go up about 10 per cent.



All components will go up about 10 per cent and, in most cases so will the cost of kits for electronic equipment. There are a few instances where kits will come down and these are generally radio or tuner kits which have been subject to purchase tax e.g. Sinclair Micromatic and the range of Radionic kits.

Unfortunately the fact that many radio kits have in the past escaped purchase tax by one means or another now means that they will go up in price. Suppliers such as Radio Exchange Co. have not in the past paid purchase tax so now their products will go up by 10 per cent—a similar thing will happen to most kits.

Heath (Gloucester) Ltd., say that many of their kits which con-

tain tuners or radios have been subject to tax but this is often only on part of the unit (e.g. the tuner unit in a tuner-amplifier) so in these cases the price may rise slightly.

From all this it looks very much as if most hi fi and audio gear—except amplifiers will be coming down in price while most kits will be going up. If in doubt contact the firm concerned, all but one firm we spoke to were very helpful and most took the trouble to explain their position fully.

One point which may have mixed blessings—all books have been zero rated, this means that they will all remain the same price as pre V.A.T.—including EE! However, this also means that component suppliers may find it easier not to sell technical books, we hope this is not going to be the case.

Home Intercom

Few buying problems concerning components for the *Home Intercom*. The small 75 ohm speakers will be the most expensive items—around 50p each is reasonable. The larger component suppliers usually have them if the local firms have not.

The interconnecting wire is simply three core mains lead and Woolworths is probably the best place to get this cheaply—they can also supply Fablon for covering the cases.

Make sure S1 is a biased type d.p.d.t. toggle switch when you buy it—this means that it is spring loaded to return to one position when released. The 2N4059 transistor used is available from A. Marshall and Son, 28 Cricklewood Broadway, London, NW2, this firm sell a vast range of semiconductors and integrated circuits and produce a catalogue. BI-PAK, P.O. Box 6, Ware, Herts can also supply the 2N4059.

Flashing Light Metronome

All components for the *Flashing Light Metronome* should be easily obtainable. We suggest that you use a bigger case than that shown and fit a rather larger 9V battery as the small types tend to be exhausted fairly quickly in this circuit when the unit is used at a high flash rate.

The small case and battery are

excellent if you want to carry the unit around and if it is not likely to be used for long periods.

Automatic Anchor Light

Provided you can get the case parts—a chemist and pet food shop should supply—the *Automatic Anchor Light* should present few component problems.

Substitutes for the ORP12 photocell are quite suitable and the bulb can be purchased from any garage or car equipment shop. The small switch used is fairly expensive (about 45p) and is available from most of the larger component suppliers.

If you cannot get the Paxolin or Bakelite tube, try Home Radio who sell 6 inch lengths in various diameters from $\frac{1}{4}$ inch to 2 $\frac{1}{8}$ inch. The p.v.c. tube generally available is not suitable for this application as it expands with the heat from the bulb and cannot then be removed from the cap—we know, we tried.

Wire to connect the lamp to the supply should be plastic covered. Waterproof plugs and sockets are available from most chandlers should they be required.

Beta Bass

The magnets used in the pick-ups for the *Beta Bass* are probably going to be difficult to get in some areas. If you cannot get them from your local hardware shop write to Mr. Brookes, James Neill and Co. (Napier St.), Napier St., Sheffield S11 8HB. He will be able to quote a price for four or eight magnets as required (one or two pick-ups); we suggest you enclose a s.a.c. with your letter.

The machine heads (for bass strings) and the bass bridge should be available from most shops selling musical instruments.

The steel plate used for the tailplate on the bass version should be available from a local hardware shop or garage—some schools and colleges also use metal in their workshops. The tailplate could be chrome plated if required and again a garage should be able to help with this.

The transformer specified in the original articles is necessary for use with the home made pick-ups detailed in the text, this is available from Zeta Windings for £1.85 including postage. Their address is 26 All Saints Road, London, W11.

BRIGHT IDEAS



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

I have found that, especially when undertaking such projects as the building of a hi-fi system, it is possible to make an error in the positioning of the electronic component. This is also true for smaller projects as an error could cause the whole project to fail.

In the light of such a situation I have come up with a satisfactory solution. This is to affix a small strip of paper on either four or two side of the Veroboard, and to letter or number the paper to correspond with the rows of holes in the board. This method has so far proved to be very successful on several projects and ensures a more accurate positioning of components.

S. Smith,
Blackpool

I have often found that, when soldering on Veroboard or printed circuit board, solder blocks up several holes. A simple remedy to this is to take a paper clip or a pin and push it as far as it will go into the blocked hole. Then with a soldering iron, one heats the pin. The solder melts and the pin passes through the hole thus clearing it.

One word of warning, do make sure that solder will not adhere to the clip or pin.

S. Whitt,
London, N.W.4

In an earlier issue of *EVERYDAY ELECTRONICS* a reader stressed the fact that knotting a mains cable could damage the wire. I have found a simple and safe way of preventing mains cables from being pulled out of equipment.

A clamp is made from two flex clamps from a pair of old mains plugs. One clamp has its screws tightened up until the thread in the clamp breaks and the screws can turn freely. Then it is placed over the cable and the second clamp is tightened up.

S. Yare,
Middlesbrough

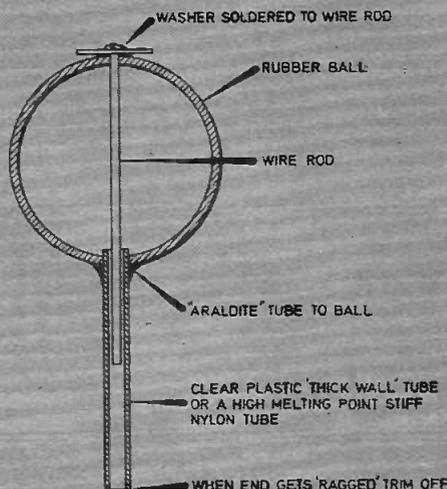
This idea of a cheap solder remover has been tried and tested by me and found to suit my requirements. Materials; 1 rubber ball (approx. 2½ inches to 3 inches dia.) 1 washer (steel, outside dia. ½ inch, with a ⅜ inch hole in the centre) 1 piece of coat hanger wire (⅜ inch x 3½ inch long) 1 piece

of nylon or plastic clear tube (with inside dia. that will take the coathanger wire with an easy fit).

The wire is cut so that when the ball is compressed fully it will just protrude out of the end of the plastic tube. With the right type of ball and tube a suitable solder remover will result; drawing attached. Sizes and material are only general, my requirements were found in my scrap boxes.

The fixing of tube is important. I found Araldite to be satisfactory. To use the remover, compress ball until rod is near end of the tube, grip the tube, trapping ball in the compressed position, hold the tube firmly on molten solder and release grip, to allow ball to retract.

E. Wall,
Charlton



I have found a way of picking up screws and small ferrous objects dropped inside equipment or other awkward places. Screw or glue a small button magnet onto the end of a telescopic aerial, a nice size is about 4 inches, extending to 24 inches. The aerial can be extended to the length required and the magnet will pick up the lost part.

The pick-up can be carried in the breast pocket and save much time and frustration.

P. J. Gardner,
Welwyn Garden City

I enclose a very cheap home made tunable coil made out of an old lipstick case.

The lipstick is taken out of the case and discarded. In its place fits a piece of ferrite rod, the slug, which is secured in the case by Plasticine or Araldite. The coil is wound around the case to individual specifications. By turning the bottom of the case the slug moves up and down.

I have successfully made a crystal radio out of a coil like this and it is cheaper than commercial types.

Alan Hunt,
Nuneaton

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. If similar ideas are submitted by two or more readers the first received will be published.

BASS

By B.W. Terrel Bsc

MODIFICATIONS TO THE BETA GUITAR

DUE to the demand from readers for details of constructing a four string solid electric bass guitar, it has been decided to modify the *Beta Electronic Guitar* featured in the November 1972 issue of *EVERYDAY ELECTRONICS* for this purpose.

It can be fitted with or without the electronics effects—this is left entirely to the constructor.

To convert to a bass guitar, modifications are necessary to the fretboard, tailplate, nut, head and pick-ups in conjunction with the blueprint and details given in the November and December 1972 issues of *EVERYDAY ELECTRONICS*.

The existing structure of the *Beta* is robust enough to handle the additional heavier type bass strings.

BASS PICK-UPS

Although the pick-ups described in the December 1972 issue of *E.E.* can be used on the bass version of the *Beta*, they will not give a completely satisfactory output signal because the signal strength derived from each string depends on the position of the magnetic pole pieces below each string.

The previously used Eclipse 821 button magnets are unsuitable due to the spacing between the poles of the buttons. It is recommended that four Eclipse M4520L magnets be used for each pick-up.

These should be glued to a piece of Veroboard measuring 16 x 8 holes x 0.15in matrix cut as shown in Fig. 1a. Araldite is a suitable adhesive. Pay attention to the polarities of the magnetic poles.

With the enamel cleaned off one end of a length of 30 s.w.g. enamelled copper wire,

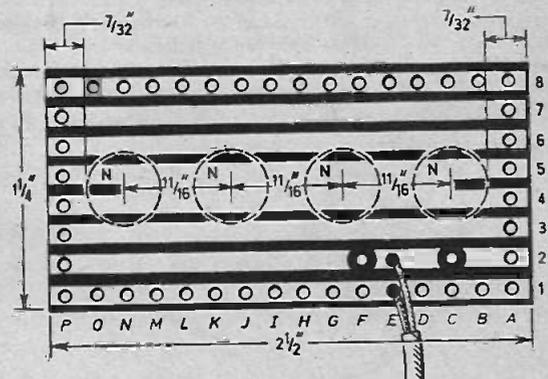


Fig. 1a. The positions of the four magnets to be glued to the plain side of the Veroboard pick-up base.

solder this in location E2 on the Veroboard and wind on 100 turns in a clockwise direction and solder the other end in location E1.

Brush or spray the coil assembly with paint or laquer to hold firm.

Repeat the above procedure for the second pick-up (if required).

Construction of the pick-up covers are detailed in the December 1972 issue of *E.E.*; fit the coil assembly to the cover as previously detailed, Fig. 1b.

Solder lengths of screened cable to the pick-ups as shown, so that the lengths will reach the pick-up selector switch in the control section.

These pick-ups will still need the matching transformer type M218, available from Zeta Windings.

BETA

BASS

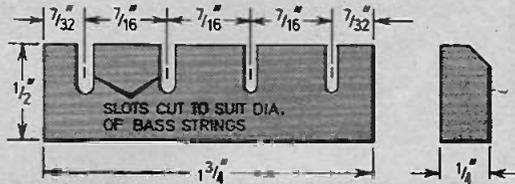


Fig. 2 (above). Cutting details for the nut.

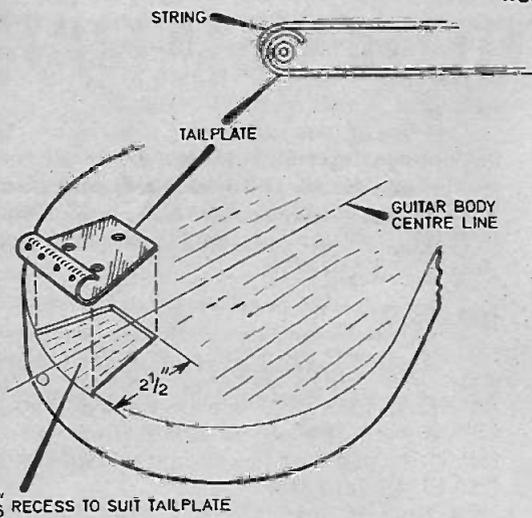


Fig. 3 (above). The position of the bass tailplate on the guitar body.

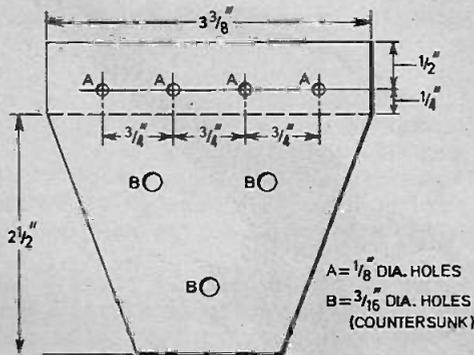


Fig. 4. Details of the bass tailplate.

Fig. 5 (right). Shows approximate positions of machine head holes.

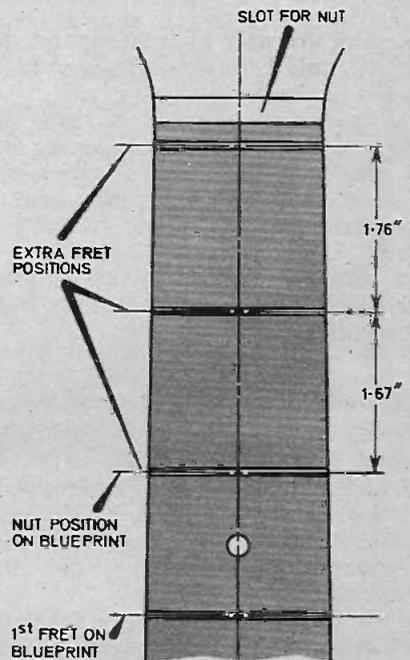
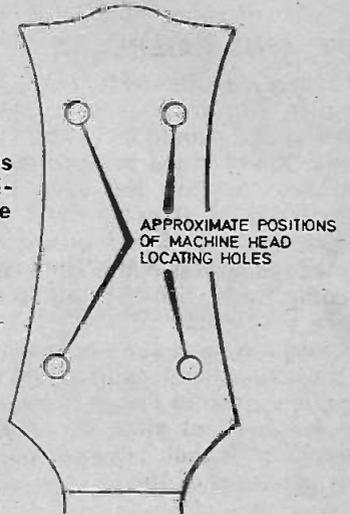


Fig. 6. The bass end of the fret-board giving details of extra fret positions.

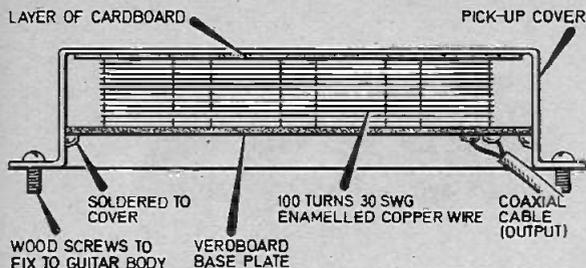


Fig. 1b. Method of fixing the pick-up coil assembly into its cover (see E.E. Dec. 72).

NUT AND TAILPLATE

The nut must be made to suit only four strings. Perspex, $\frac{1}{4}$ in thick is suggested as a suitable material and should be cut and shaped as shown in Fig. 2 and glued in position as before.

A new tailplate has been designed to cope with the extra stress present when using bass strings, see Fig. 3 for position and cut-out to be made on guitar body. The plate must be made to come flush with the guitar body, for this is where the bridge will stand. Do not make the previous elliptical cut-out as shown on blueprint.

Dimensions and drilling details for the tailplate are given in Fig. 4. A suitable material for this is $\frac{1}{16}$ in steel plate or similar tough metal; aluminium is not recommended. Affix to the body by means of lin. to $1\frac{1}{2}$ in. No. 10 screws.

HEAD

Since there are only four strings on standard bass guitars, only four machine head holes need to be made in the head.

Approximate drilling details of these holes are shown in Fig. 5, but the exact spacing from the edge of the head, and the hole diameters will vary with types of machine heads used.

Special bass guitar machine heads (designed to withstand more stress than those on six-stringed guitars) should be used; these are recognised by having larger turning heads and thicker spindles.

FRETBOARD

The fretboard needs to be re-designed at the bottom end, Fig. 6 gives details.

Using the blueprint (E.E. November 1972), Fig. 2a showing the plan view of the fretboard, project the centre line and tapering side lines onto a piece of paper glued to the blueprint. Projection should be about 4in.

Using the dimensions of Fig. 6 mark the new fret positions and draw in across the centre line.

Now measure $18\frac{1}{2}$ in along the centre line down the fretboard, from where the nut slot meets the fretboard, and mark perpendicular to the centre line. The new fretboard will end here.

Materials

Steel plate $3\frac{1}{2}$ in. \times $3\frac{3}{8}$ in. \times $\frac{1}{16}$ in.

Magnets Eclipse M4520L (80lb.)

Perspex $\frac{1}{4}$ in. \times $\frac{1}{2}$ in. \times $1\frac{3}{4}$ in.

Veroboard 16 \times 8 holes \times 0.15in. matrix (2 off).

Wire 30 s.w.g. enamelled copper.

Miscellaneous Adjustable bass bridge. Set of bass strings.

SEE
**SHOP
TALK**

As a check that you have done this correctly, count the total number of fret positions from the nut to the end of the fretboard, you should have a total of 17.

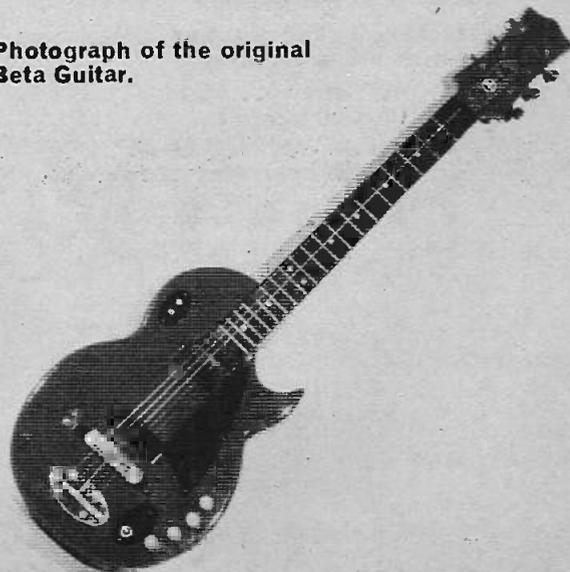
Modifying this way eliminates any need to extend the neck. When the fretboard is secured to the neck, the latter will need to be slightly shaved down along its length to suit the slightly narrower width of the fretboard.

The finger position holes should be made as previously described. Ignore those on the blueprint diagram of the fretboard, and mark new ones at fret positions, 3, 5, 7, 9, 12, 16. Remember that the fret nearest the nut should be counted as fret number zero.

BRIDGE

Once again, no details have been given for making a bridge as these are best purchased. An adjustable type is recommended. Position the bridge such that its distance from the twelfth fret is the same as the distance from the twelfth fret to the zero fret. □

Photograph of the original Beta Guitar.



AUTOMATIC ANCHOR LIGHT

A simple, all solid state, design to switch the light on at dusk and off at dawn.
By Mike Kenward

An automatic anchor light is particularly useful on a small boat which may have to be moored unattended for long periods in an area where anchor lights are required, or for an overnight stay in a bay or estuary, when the crew can go ashore for the day safe in the knowledge that the riding light will turn itself on as dusk falls.

CIRCUIT DESIGN

Three main criteria governed the design of the circuit. They were, the unit should not be affected by the atmosphere—thus no relay should be used. Operation should be fast to avoid a “half on” bulb and unnecessary power wastage, and the unit should be cheap and easy to build.

The final circuit consists of a modified Schmitt trigger that changes from one state to another depending on the resistance of the photocell PCC1 (Fig. 1). The resistance of PCC1 varies between about 200 ohm in bright sunlight to 10 megohm in total darkness.

CIRCUIT OPERATION

Preset potentiometer VR1 is used to set the light level at which the trigger will alter state.

As the resistance of PCC1 rises with the falling of night, TR1 will start to turn on and TR2 will start to turn off. As soon as this happens the potential on TR2 emitter will try to turn TR1 on even more and a feedback loop is set up, making the operation from TR2 on to fully off occur very quickly.

In the initial condition (TR1 off, TR2 on) the Darlington pair TR3 and TR4 will be turned off. When the Schmitt changes state the base of TR3 will be taken positive and it will conduct, causing TR4 to saturate and thus turn on LPI.

The overall gain of TR3 and TR4 is in the region of 100,000 hence, for one amp to flow in TR4 (6V, 6W bulb), only 10 μ A needs to flow in



**Approximate cost
of components
including V.A.T.
£2.40 plus case
and wire**

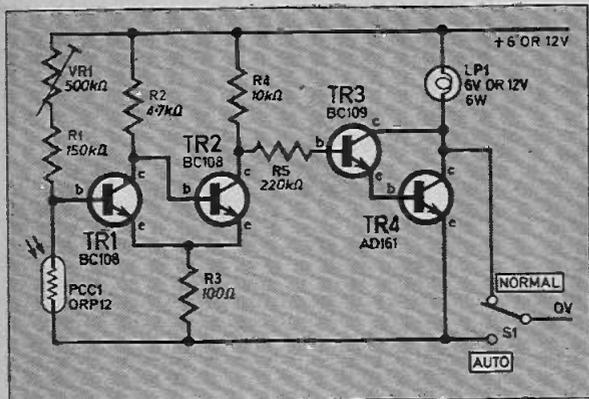


Fig. 1. The circuit diagram of the Automatic Anchor Light.

TR3 base. If, because of this high gain, which is used to ensure TR4 saturates, lamp LP1 is on low power when it should be off, the value of R4 can be increased until the Darlington pair is full off.

As daylight breaks and the resistance of PCC1 begins to fall the circuit will revert to the original state with TR4 and hence LP1 turned off. In this condition the current taken from the battery is about 4 milliamps, hence the unit can be left to operate for long periods without flattening the battery due to current taken during daylight hours.

The Schmitt trigger presents some hysteresis and hence once LP1 is lit, the ambient light level must rise by a reasonable amount for it to turn off again. This means that the lamp will not flash on and off with small changes in light level (unless light from LP1 is reflected onto the photocell).

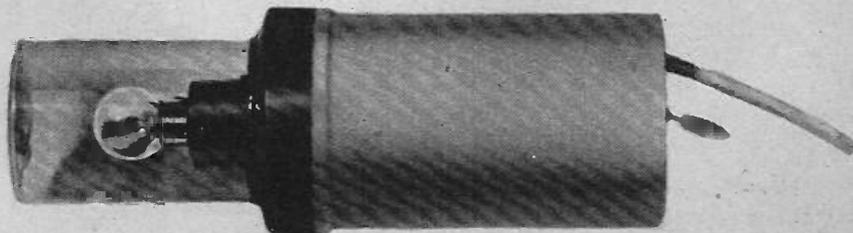
Switch S1 is included to enable the unit to be switched from manual to automatic operation. This switch may be left out if not required.

LAMP

The current taken by LP1 must not exceed the rating of TR4 (1 amp). Due to the slight voltage drop (about 300mV) across TR1 the bulb will not, in fact, be across the full supply and this factor will aid bulb reliability.

The bulb used for both 6V and 12V operation should be a 6W type (of the appropriate voltage). Although up to a 12W bulb could be used

Photograph of the completed Automatic Anchor Light.



Components....

Resistors

- R1 150k Ω
- R2 4.7k Ω
- R3 100 Ω
- R4 10k Ω
- R5 220k Ω
- All $\frac{1}{4}$ W \pm 10% carbon

SEE

**SHOP
TALK**

Transistors

- TR1 BC 108 silicon *n*p*n*
- TR2 BC 108 silicon *n*p*n*
- TR3 BC 109 silicon *n*p*n*
- TR4 AD 161 germanium *n*p*n*

Miscellaneous

- PCC1 ORP12 light dependent resistor
- VR1 500k Ω skeleton preset potentiometer
- LP1 6V or 12V 6W bulb (depending on supply)
- S1 S.P.D.T miniature toggle switch
- Veroboard $2\frac{3}{4}$ x $1\frac{1}{2}$ x 0.15 inch matrix, aluminium for heatsink $2\frac{1}{2}$ in. x 1in. x 18 s.w.g.
- Materials for lamp holder; grommet about $\frac{3}{8}$ inch diameter, rubber foot, paxolin or bakelite tube $\frac{3}{8}$ inch outside diameter. Materials for case; plastic, screw top "Tetramin" container, clear plastic "Dop" shampoo container. Connecting wire, two core plastic covered lead for supply, 4BA fixings, Araldite, small grommet for supply lead.

on a 12V supply (governed by the rating of TR4) no more than 6W should be used in a similar lamp to the prototype due to the design of the bulb housing—bulbs under 6W should not be used as this is below the required power for an anchor light.

FORMS OF CONSTRUCTION

Construction can take a number of forms depending on the requirements. For instance the electronics can be housed in a small case mounted away from the actual lamp and connected to a battery or the ships supply and the lamp by twin leads. Alternatively the electronics can be fitted within one of the fixed anchor lights available from chandlers and connected to the ships supply or other battery by a twin lead.

AUTOMATIC ANCHOR LIGHT

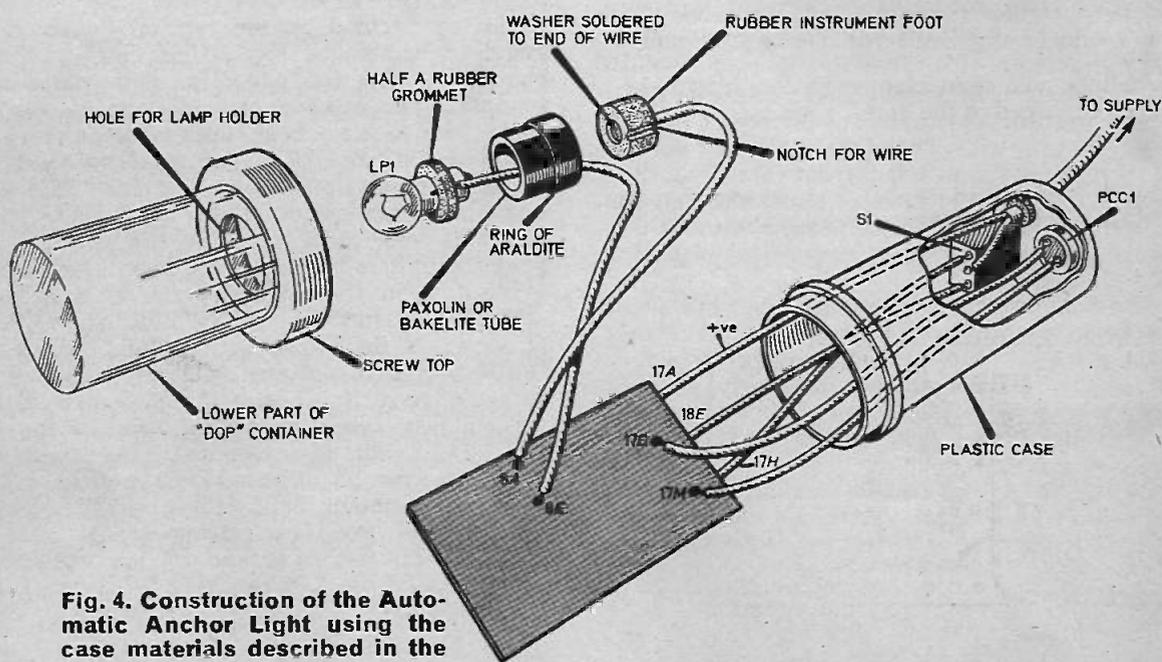
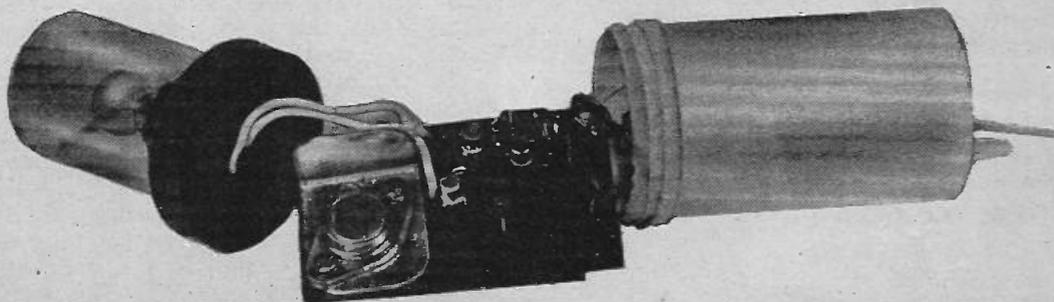


Fig. 4. Construction of the Automatic Anchor Light using the case materials described in the text.

The prototype unit ready for final assembly.



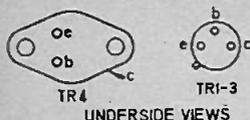
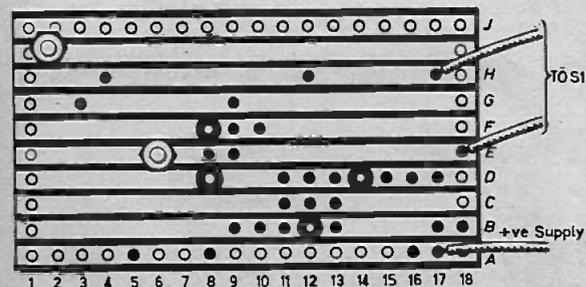
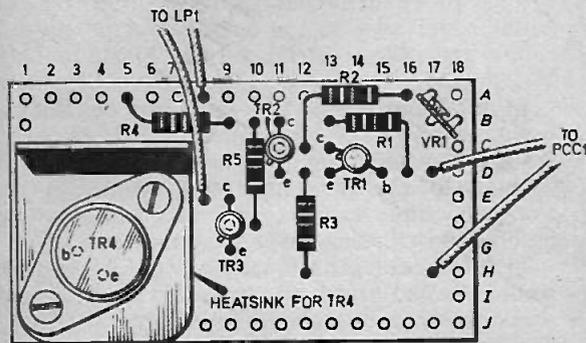
The complete unit could be self contained within a commercial plastic dome lamp together with a battery and control switch. Finally the unit may be constructed complete, as in the prototype, housed in the case design shown in the photographs and diagrams.

Since the unit will work from below 6V to the above 12V the supply is not critical—provided it remains reasonably steady—only the lamp will need to be altered to suit the supply (normal 6V, or 12V batteries can be used).

The complete unit can be made very compact (about 3 inches by $1\frac{3}{4}$ inches diameter) and virtually watertight by enclosing it in a small plastic screw top container such as that used to hold tropical fish food (Tetramin); this type of container was used for the prototype and the unit can thus be mounted on the mast or rigged as and when required.

If the electronics are to be installed inside an existing lamp housing the shape of the board may have to be altered to enable all components to be fitted in. The switch S1 could be mounted remotely and connected, with the supply, by a three core lead to the unit if required.

Fig. 2. Veroboard layout and wiring diagram. TR4 is not isolated from the heat sink.



UNDERSIDE VIEWS

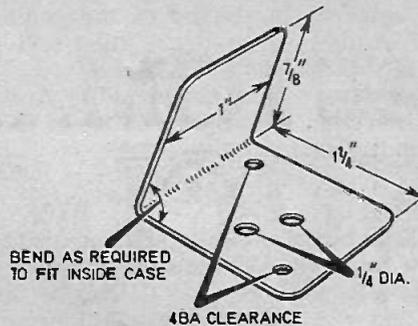


Fig. 3. The heat sink used for TR4. The emitter and base pins must not touch the heat sink, which is bent to hold the board firmly inside the case.

CONSTRUCTION

Having decided on the type of construction required commence by cutting the board and small heat sink for TR4 (Fig. 3) to shape and mounting the components as shown in Fig. 2. Make sure to use a heat shunt between the iron and TR1, TR2 and TR3 when soldering them in.

Next connect up the switch S1 and PCC1 with enough flexible lead to allow for their mounting positions and, after checking the wiring, connect the unit to the lamp and supply as shown.

With S1 in the normal position, lamp LP1 should be on, in the automatic position the lamp is on or off depending on the light falling on PCC1. Switch to automatic, adjust VR1 to mid track and cover PCC1 with one hand, LP1 should immediately come on. With light falling on PCC1, LP1 should extinguish. Potentiometer VR1 can now be adjusted so that LP1 lights when the ambient light falling on PCC1 is at the required level (i.e. getting dark).

If the lamp flashes on and off this is probably due to light from LP1 reaching PCC1 and causing feedback.

CASE

The case can be made next. The prototype unit used a fish food container, as mentioned previously, for the base and the lower part of a "Dop" shampoo bottle for the lamp cover. These items can have their lettering removed using metal polish, this produces a professional looking unit without the need for painting.

The mounting holes for PCC1, S1 and the grommet for the supply lead are shown in Fig. 4; these should be cut using the actual components for size. Next cut the hole in the case lid to take a $\frac{3}{4}$ inch diameter Bakelite or Paxolin tube—this material is used because of its heat resistance (LP1 and the dome get quite warm).

The lamp is mounted in a $\frac{3}{4}$ inch length of the tube using a grommet and rubber instrument foot as shown in Fig. 4. The tube is then pushed

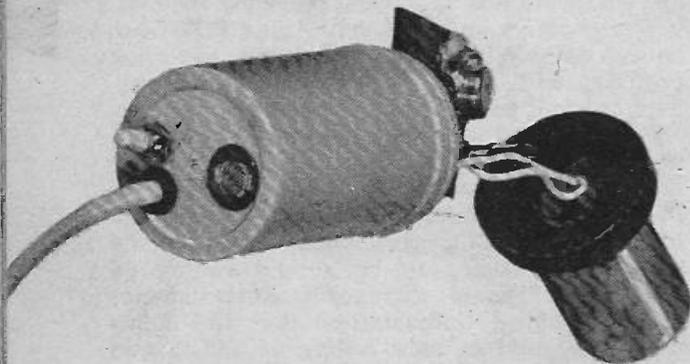
into a hole cut in the lid of the container, a ring of Araldite around the tube will stop it going right through.

The case can now be completed by Aralditeing a 2 inch section of the Dop bottle to the lid as shown in the photographs.

FINISH

The final board and all the components on it can now be painted if required to protect them from the elements. Next PCC1 can be mounted in the end of the tube using Araldite, and S1, the board and LP1 inserted in the case. Finally S1 and the grommet around the connecting lead can be sealed with silicon grease or Vaseline.

The unit can be permanently mounted in a convenient position or put up when required. A two pin sealed plug in the supply lead will facilitate easy connection, whilst a conveniently placed large Terry clip will make fitting a simple matter. Alternatively a terylene cord tied around the unit, under the lid of the case, with a loop over the lamp housing will enable the unit to be hung up or connected to a halliard for hoisting aloft. □



The light ready for completion. Note the positions of the switch and the photocell.

PLEASE
TAKE NOTE

The Indicator Audible Warning (April issue) was shown in Figs. 1 and 2 with incorrect battery polarity. The positive and negative leads should be transposed.

Flashing Light Metronome; continued from page 249.

Components....

Resistors

R1	33k Ω
R2	33k Ω
R3	2.2k Ω
R4	470 Ω

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

SEE

**SHOP
TALK**

Potentiometers

VR1	500k Ω log. carbon
-----	---------------------------

Capacitors

C1	125 μ F elect. 16V
----	------------------------

Transistors

TR1	BC108 silicon npn
TR2	2N1305 silicon pnp

Miscellaneous

LP1	6V 60mA bulb and suitable holder
S1	On/off switch
B1	9V PP3 or larger type if possible

Veroboard, 0.15in. matrix 11 x 7 holes; suitable case; battery connector.

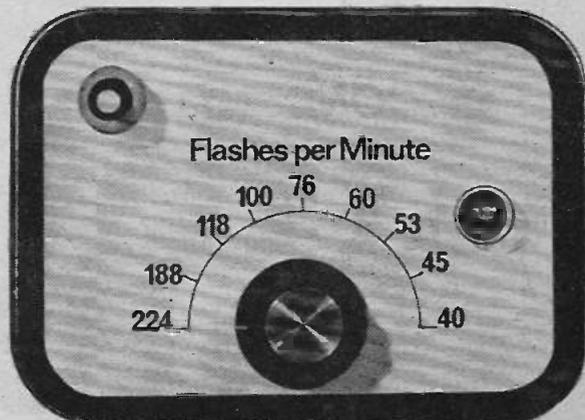
the group or band can set the unit to coincide with the tempo of the tune. The reading is then taken from the scale and this is noted for this particular tune.

This procedure could be repeated for the whole repertoire, so the correct tempo could be called upon by a setting on the Flashing Light Metronome.

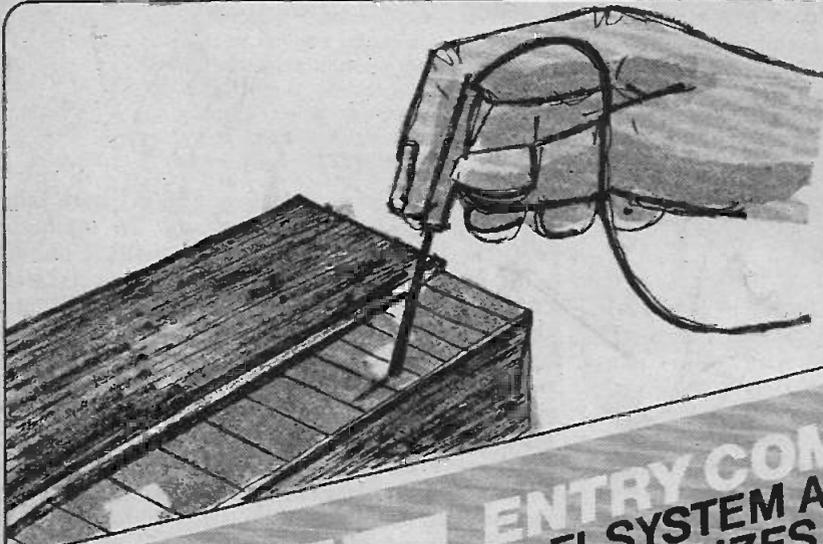
In the laboratory, the unit can be used in various oscillatory experiments such as determining the value of "g" (acceleration due to gravity) by the pendulum bob experiment for example, and various magnetic experiments involving oscillating suspended magnets.

In these cases, the Flashing Light Metronome would be adjusted so that its flashing rate coincided with one complete revolution (i.e. the periodic time, T) and the value of the frequency ($1/T$) read off directly from the scale. □

Photograph of the completed Flashing Light Metronome.



NEXT MONTH



MINI-ORGAN

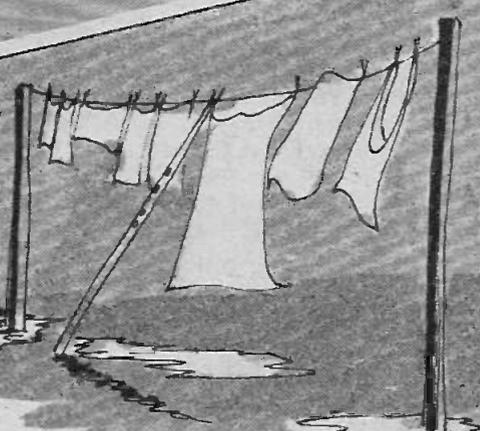
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JUNE ISSUE
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MAY 18

DEMO CIRCUITS

By MIKE HUGHES

6

The Bistable

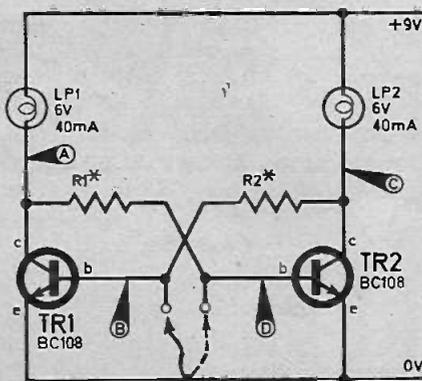
DURING the next few months we shall be looking at a family of circuits known as **multivibrators**. Those of you who follow *Teach In* will remember one of them—the **astable multivibrator**—but there are two others; the **monostable** and the **bistable**. This month we shall talk about the latter.

THE BISTABLE

In electronic terms the bistable is one of the more elementary circuits to understand but nevertheless is extremely useful and with it one can carry out some rather interesting experiments. It is not used quite so frequently in E.E. projects as its cousin the astable but it is certain that you will come across it from time to time—particularly if you ever get involved in the field of digital electronics.

Its main application is where an electronic circuit is required to “remember” something that happens, so that an indication can be given or alternatively an action can be carried out as a result of the occurrence. The latter may sound rather philosophical and does require an understanding of digital logic so we shall not dwell on that aspect. Instead we shall concern ourselves only with the application of the circuit as a “remembering indicator.”

Fig. 6.1. The basic bistable circuit using LP1 and LP2 as indicators.



* SEE TEXT

BASIC CIRCUIT

The basic circuit shown in Fig. 6.1 uses lamps LP1 and LP2 as the indicators. To make one of these lamps switch on the transistor beneath must be capable of passing enough collector current to make the filament glow. Although the bulbs are 40mA 6V it is better to assume that about 100mA could flow through the filament to get maximum illumination—then the possibility of a bulb being less sensitive than normal is of no concern.

To pass collector current in the transistor, base current must flow. The base current required can be calculated by dividing the collector current by the d.c. current gain of the transistor (h_{FE}). A BC108 has a typical h_{FE} of 200 but sometimes a particular device can have a gain as low as 100; therefore it is better to assume the worst case in the calculations.

Assuming therefore that the lamp needs 100mA and that h_{FE} for the transistor is 100 the base current needed to switch the lamp on is:

$$\frac{I_c}{h_{FE}} = \frac{100}{100} = 1\text{mA}$$

Under normal circumstances this base current would be supplied through a resistor that connects the base of the transistor to some positive voltage (usually the positive power rail). In the case of the bistable there is a slightly different arrangement. Resistor R2—the base current control resistor for TR1—is connected to the collector of TR2.

Assuming that TR2 is not conducting; R2 is effectively still connected to the positive rail through LP2. The base current control resistor is therefore R2 in series with LP2 and we can calculate the total resistance value that will give 1mA of base current in TR1 (assume there is absolutely zero current flowing in TR2 hence its presence in the circuit does not affect our calculations).

The total resistance must be not greater than the supply rail voltage less the base emitter forward voltage drop of the transistor divided by the base current required

$$\text{i.e. } \frac{9-0.6}{1} = 8.4 \text{ kilohms}$$

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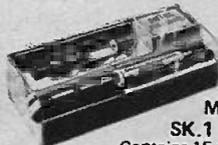
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0.25μF	3p	0.22μF	5p	1.5μF	20p
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0.25μF	5p	0.15μF	7p		

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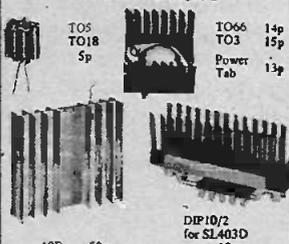
0.1μF	7p	0.047μF	8p	2.2μF	16p
0.22μF	7p	0.068μF	8p	4.7μF	24p
0.33μF	7p	0.1μF	8p		

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AC188	25p	BC208	15p	BSY85A	14p	ZTX300	12p	2N3072	12p	MC1300	£1.75
AC188K	25p	BD111	67p	BU106/02	61.75p	ZTX301	15p	2N3703	12p	MC1550	75p
AC200	20p	BD153	70p	MJE340	67p	ZTX302	20p	2N3704	10p	MC1551	£1.00
AD140	40p	BD132	70p	MPP122	46p	ZTX303	20p	2N3705	10p	MC1552	£1.00
AD149	40p	BD131/2M.P.	70p	MPP143	37p	ZTX304	25p	2N3706	10p	MFC4008	40p
AD161	60p		189p	MPP104	37p	ZTX341	20p	2N3707	12p	MFC4010	55p
AD162	60p	BF160	21p	MPP105	48p	ZTX500	15p	2N3708	12p	LM380	£1.45
AF114	18p	BF167	20p	MPP106	45p	ZTX501	15p	2N3709	12p	SL4000	£1.50
AF115	18p	BF173	20p	OC28	40p	ZTX502	20p	2N3710	12p	TAD100	£1.50
AF116	18p	BF180	25p	OC35	40p	ZTX503	17p	2N3711	12p	HILITE PL115	£1.50
AF117	18p	BF181	30p	OC44	15p	ZTX504	16p	2N3819	12p		
AF139	28p	BF184	25p	OC45	15p	ZTX531	25p	2N4803	15p	A700C	45p
BC107	10p	BF185	25p	OC71	11p	2N667	18p	2N3904	17p	A710	48p
BC108	10p	BF194	15p	OC72	17p	2N706	12p	2N3905	21p	A725C	£1.85
BC108	10p	BF195	15p	OC76	15p	2N708	15p	2N3906	12p	A741C	80p

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	4	6.3	10	16	25	40
1	-	-	-	-	-	60
1.5	-	-	-	-	-	60
2.2	-	-	-	-	-	60
3.3	-	-	-	-	-	60
4.7	-	-	-	-	-	60
6.8	-	-	-	-	-	60
10	-	-	-	-	-	60
15	-	-	-	-	-	60
22	-	-	-	-	-	60
33	-	-	-	-	-	60
47	-	-	-	-	-	60
68	-	-	-	-	-	60
100	-	-	-	-	-	60
150	-	-	-	-	-	60
220	-	-	-	-	-	60
330	-	-	-	-	-	60
470	-	-	-	-	-	60
680	-	-	-	-	-	60
1000	-	-	-	-	-	60
1500	-	-	-	-	-	60
2200	-	-	-	-	-	60
3300	-	-	-	-	-	60
4700	-	-	-	-	-	60

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2 1/2" x 3 1/2"	20p	16p (7)	10p
2 1/2" x 5"	24p	21p (7)	12p
3 1/2" x 3 1/2"	24p	21p (8)	13p
3 1/2" x 5"	27p	27p (10)	17p
4 1/2" x 2 1/2"	67p	50p	37p
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11	4"	2 1/2"	2"	35p	8p
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8-16μF	450V	15p	32-32μF	450V	25p	
16-16μF	450V	25p	50-50μF	350V	35p	

About 100 ohms of this will be contributed by the internal resistance of LP2 so R2 must have a value of less than 8.3 kilohm for LP1 to light up when TR2 is not conducting. In practice this resistor usually has a very much smaller value just to be on the safe side (you can experiment with this value later).

Exactly the same argument is used to calculate the value of R1 which is the base control resistor for TR2.

CIRCUIT OPERATION

Having assumed one of the transistors is not conducting, to make the lamp on the opposite side of the circuit switch on, follow this argument through carefully and it can be seen that if LP1 is lit it automatically ensures that TR2 is not conducting and similarly for LP2 and TR1. If LP1 is lit it means that TR1 is fully conducting and that the voltage at point A is virtually zero. Because of this no base current can be generated in TR2 and the latter is switched off. Transistor TR2 does not, therefore, draw current through LP2 and TR1 is free to draw base current through R2 and LP2 from the positive rail.

If TR1 is deliberately switched off (this can be done by diverting its base current to ground by shorting point B to the negative rail) the voltage at A will now rise up towards the positive supply voltage and at a certain level sufficient base current will be supplied to TR2 to make it switch on and LP2 will light up; the voltage at C falls to almost zero.

Removing the short circuit from the base of TR1 will not affect the circuit because TR2 has now diverted what was the base current.

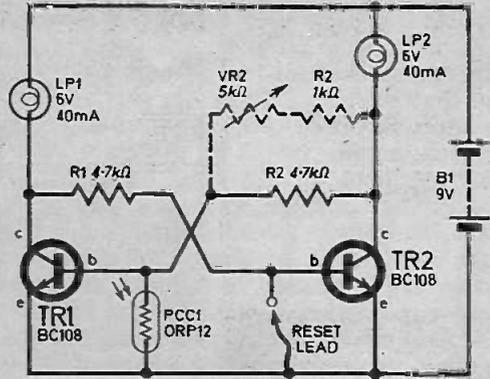


Fig. 6.2. Practical, light operated bistable circuit.

The circuit thus "remembers" the action of shorting point B to ground and indicates it by lighting LP2.

Short point D to ground and LP2 goes off as LP1 lights up; remove the short circuit and LP1 remains lit. The lamps indicate that the base of the opposite side has been shorted to ground and the circuit remembers this indefinitely—until the supply is switched off.

PRACTICAL CIRCUIT

Make up the circuit on the Demo Deck and check the operation. Make R1 and R2 4.7 kilohms. Short points B and D *only* to the negative rail—if they are accidentally connected to the positive rail unlimited base current will flow through the transistors and probably burn out the base emitter junction!

Alternatively make up the circuit of Fig. 6.2 which uses a light dependent resistor between

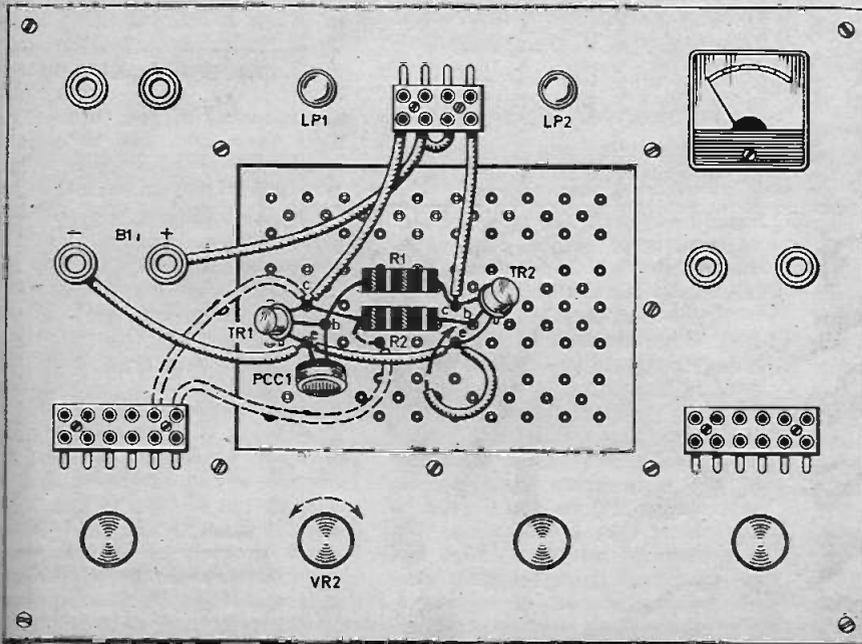


Fig. 6.3. The circuit of Fig. 6.2, wired up on the Demo Deck. The photo-cell PCC1 switches the bistable as the light level rises.

the base of TR1 and ground. When sufficient light falls on PCC1 it shunts most of the base current to ground and TR1 stops conducting. Put the circuit in a dimly lit room and "reset" it by shorting the base of TR2 to ground (LP1 will be illuminated); switch on the main light in the room or hold a light close to PCC1 and the bistable will change state and stay in its new state irrespective of how many times the main light is switched on and off. This simple application could be used to indicate an intruder in the house who had switched on the lights.

If the circuit is not very sensitive to the room lighting, try increasing the values of R1 and R2. If too sensitive reduce them to not less than 1 kilohm. Alternatively use VR2 of Demo Deck (5 kilohm) in series with a 1 kilohm resistor as a substitute for R2 and then set the sensitivity to suit the light level using VR2.

The circuit of Fig. 6.2 and the modification incorporating VR2 is shown wired up on the Demo Deck in Fig. 6.3.

If the circuit of Fig. 6.1 is required, simply omit PCC1 and construct the remaining circuit, not using VR2. The reset lead (from TR2 emitter) can then be used to switch the circuit from one state to the other by connecting it to TR1 or TR2 base.

Next Month: The differential amplifier

Ruminations

By Sensor

Who done it?

One of the favourite programmes on television, with my family, is Dr. Who. The writers and designers involved in this serial must have a lot of fun designing the electronic equipment and cleverly giving us just sufficient information about it to make it seem plausible. The police telephone box "Tardis," which is so much bigger inside than it is outside, is driven by some power that has never been defined but the control console has been seen to contain printed circuit modules and some things that look rather like valves.

Large screen television, completely flat and without any evidence of a cathode ray tube, seems to be capable of reception from all over the universe—no difficulty with different line fre-

quency systems or aerial polarisation planes! Dr. Who is a peaceful man and is always able to extricate himself from dangerous and violent situations without recourse to violence himself, a refreshing change from the "shoot your way out of it" type adventure serial.

Take over Mr. Spock

Another television programme, in similar vein, is "Star Trek". The Starship "Enterprise", we have been told, is powered by some form of atomic energy. Its crew is not only international and interracial but also interplanetary.

Under their commander Captain Kirk these masters of high technology navigate themselves to the ends of the universe with the aid of their talking computers and their detecting and sensing equipment. They are able, by means of the transporter beam, to dematerialise and be transferred to the planet they are orbiting. This is a mode of transport which has interested me since boyhood, none of the frustrations of missing a bus, a crowded compartment, no trouble from draughty windows or

overheated carriages!

But there are always the same people on the "Enterprise" bridge. Has there been no improvement in working hours since the late twentieth century? No-one seems to eat or to sleep or even to get tired. Has the enjoyment of a good steak and a bottle of wine been taken away from the hominids of the future? Perhaps they are able to simulate electronically the sensual delight of a good meal and a warm bed.

We are shown nothing of their private lives though they are obviously well educated and civilised. The spaceship is well armed but her "phasors" are not used destructively and can be set to stun as well as destroy. Their databanks hold all the history of every part of the known universe, the knowledge is at their finger tip or more accurately, at their request to the computer. But yet do they not see any of the beauty around them in the planets they visit? In their off-duty hours (if any) do they command the computer to play a Beethoven Sonata or recite from Hamlet? "Fascinating", as Mr. Spock would say.

Good Companions...

PE



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

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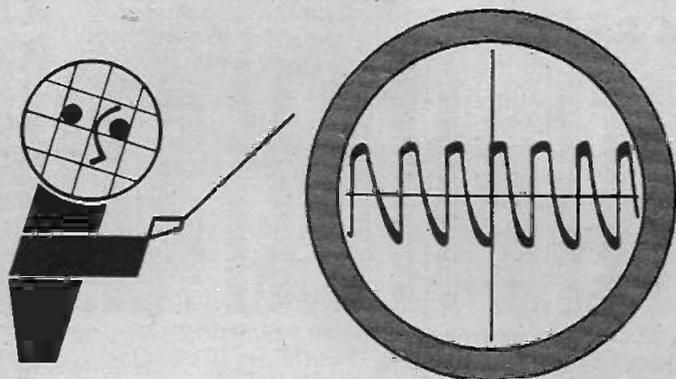
The May issue of P.E. is now on sale. It features a Push Button Stereo Tuner. This design uses ready-made modules, and can therefore be built by the average constructor in only a few hours.

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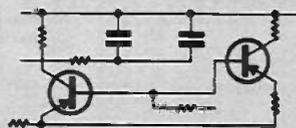
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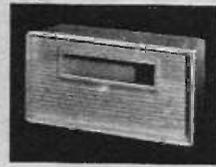
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470µF	11p	100µF	8p	6.8µF	64p
680µF	13p	220µF	10p	10µF	64p
1500µF	18p	470µF	13p	2.2µF	64p
2200µF	18p	680µF	20p	4.7µF	64p
3300µF	26p	1000µF	22p	6.8µF	64p
		220µF	39p	10µF	64p
		5000µF	68p	22µF	64p
				68µF	10p
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1 watt 10% carbon 2p each
Range 10 ohms to 4.7 meg.
1 watt 10% 2% 3p each
Range 10-1 meg ohms

DATA PAGE DATA PAGE

CAPACITORS

Many capacitors utilize a colour code, in particular the Mullard C280 series, solid tantalum types and some tubular or disc ceramic types which use a 4 or 5 colour dot code. The data below shows how to interpret the value from the colours. In most cases the temperature coefficient of the capacitors used in circuits published in this magazine is of no consequence.

The 4 and 5 dot colour code have the same significance (see Table 1) except that the first dot on the 5 dot system is the temperature coefficient.

TABLE 1

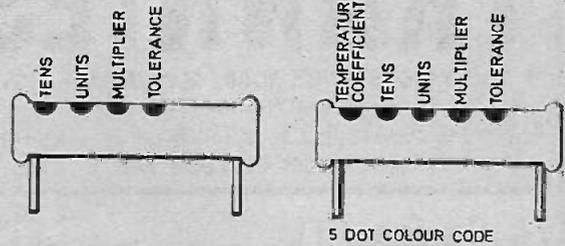
Colour Code Scheme
As Used For Mullard C280 Series and Ceramics

Colour	Tens & Units	Multiplier	Tolerance	Voltage
Black	0	x 1pF	±20%	—
Brown	1	x 10pF	±1%	—
Red	2	x 100pF	±2%	250V
Orange	3	x 1,000pF	±2.5%	—
Yellow	4	x 10,000pF	—	400V
Green	5	x 100,000pF	±5%	—
Blue	6	—	—	—
Violet	7	—	—	—
Grey	8	—	—	—
White	9	—	±10%	—

TABLE 2

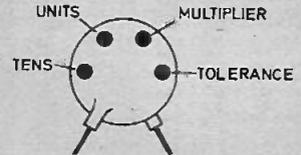
Colour Code Scheme
As Used For Tantalum Capacitors

Colour	Voltage	Tens & Units	Multiplier
Brown	—	1	x 10 μ F
Red	—	2	x 100 μ F
Orange	35V	3	—
Yellow	6.3V	4	—
Green	16V	5	—
Blue	20V	6	—
Violet	—	7	—
Grey	25V	8	x 0.01 μ F
White	3V	9	x 0.1 μ F
Black	10V	0	x 1 μ F
Pink	35V	—	—

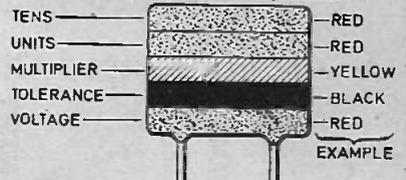


CERAMIC TYPES

4 DOT COLOUR CODE
HAS THE SAME SIGNIFICANCE
AS FOR C280 TYPE



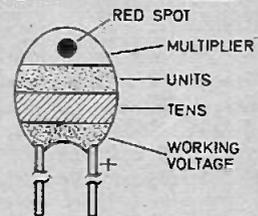
MULLARD C280 POLYESTER TYPE



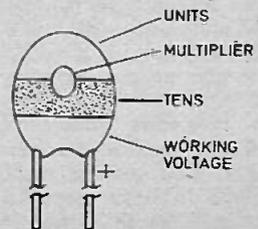
EXAMPLE:—

CAPACITANCE = 22 x 10,000pF
= 220,000pF OR 0.22 μ F
TOLERANCE = ±20%
VOLTAGE = 250V

SOLID TANTALUM TYPES



WHEN VIEWED WITH SPOT SHOWING
POSITIVE LEAD IS AS MARKED



REMEMBER
TO USE THE
POSTCODE



Readers Letters

Bakelite Receiver

Sensor was right about the old Bakelite sets (January issue). Most of my projects are made from discarded radios purloined from the local tip and, if I find a set worth servicing I take it home and do so. I had a collection of more than 12 sets at one time. My friends after seeing some of them bought one or two.

L. Whitney
Cheshire

Word of warning

Having read the *Bright Ideas* article in the April edition, I feel that I should write to you about Mr. Screeney's idea for a drilling jig for power transistors, especially v.h.f. types containing Beryllia, the dust of which is toxic and breathing this dust, or letting it enter a cut could cause permanent injury.

Beryllia is also contained in power diodes, thyristors, some ceramic materials and some heat sink washers.

M. R. Charlton
Southampton

Traditional

I have been taking your magazine, *EVERYDAY ELECTRONICS*, since December 1972, and have just realised that a long tradition has just come to an end. Having had a great interest in the subject since I was about 12 (I am now 22) I have bought all kinds of magazines relating to this subject and borrowed many books from the library, and after ten years of trying to understand the simple basics of electronics (theory) I can now honestly say I have found someone who understands the beginner's problems.

This magazine must rank amongst the greatest teachers of the world. Also another tradition that seems to have come to an end is the OC45, OC71 and OC72 tradition. At one time I didn't think you could build a piece of

equipment without one or two of these mysterious devices. I would really like to thank you for a wonderful magazine.

S. G. Brooks
Lancashire

Brilliance

After reading the article describing how to make the night light switch, it made me think how cumbersome it would be if a reader wished to connect this to ceiling light in a room. After thinking, I realised how easy it would be to make this an ordinary double wall switch. This I feel would be much more convenient. One switch is used as an on-off switch in the normal way, and this is connected in series with the second switch which has the diode wired across the contacts. Thus when the second switch is in the off position the current flows through the diode giving a dimmed lamp and in the on position the switch shorts out the diode giving full brilliance.

S. Huntley
Havant

Readers of *EVERYDAY ELECTRONICS* in this area may like to know that the Reading and District Amateur Electronics Club now meets every Monday and Wednesday at 7.30 p.m. at the Presentation College, Bath Road, Reading, in the electronics workshop. Periodical lectures and instruction also take place.

Beginners and advanced are invited to pay us a visit on any evening mentioned above.

E. C. Hemkin
Berks.

I would be obliged if an explanation could be given to questions arising among several fellow constructors as to which type of capacitor should be used for a particular application and whether to use salvaged and tested capacitors of one type, or to purchase equal valued capacitors to suit a given circuit diagram depicting capacitors of different construction.

J. J. Swain
Luton

Many of the capacitors we list are not quoted as specific types or with voltage ratings. In such cases polyester, polycarbonate and ceramic capacitors are probably the cheapest and smallest to use but any type could be used (except tantalum or electrolytic).

The voltage rating of most capacitors is generally above 100V and it is normally of no concern in our low voltage transistor projects—where it is of concern we quote a minimum voltage rating. A few ceramic capacitors have low voltage ratings (down to 3V) in such cases we suggest that you use a capacitor of over 100V and you won't go wrong.

Electrolytic and tantalum capacitors are always specified in our lists and these types only should be used where quoted. The voltage rating is more important on these types and is normally quoted by us. Do not use a lower rated capacitor and it is best not to use a capacitor with a voltage rating higher than about four times that quoted.

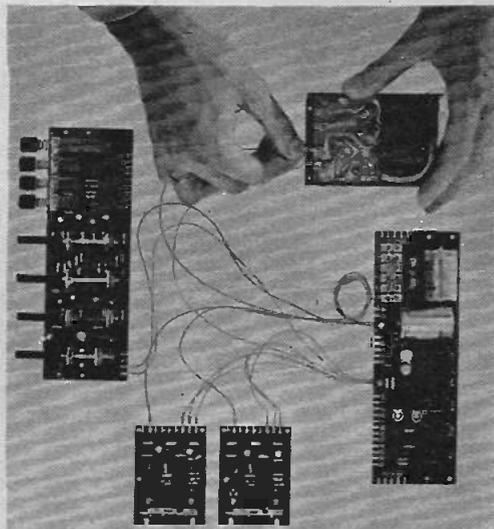
In most cases the value of electrolytics is not very critical and if you have to substitute you can usually use a slightly higher capacitance value.

If you write to us for advice, and wish to have a personal reply you must include a s.a.e. Unfortunately, we cannot prepare special designs, circuits or wiring diagrams to meet individual requirements, nor can we answer queries concerning commercial equipment, or subjects, designs or modifications not published by us.

For all technical and editorial matters, write to: The Editor, *Everyday Electronics*, Fleetway House, Farringdon Street, London, EC4A 4AD. Phone 01-634 4452.

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Everyday Electronics, May 1973

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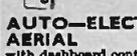
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Dry Film Lubricant. In aerosol can for easy application and for putting lubricant into places where the normal oil can't reach. Home and everyday use. We have purchased a large quantity of these from the Liquidator and are able to offer them to you for about half of the original list price. 80p per (8 oz.) can or 12 cans for \$8 post paid. The lubricant is I.O.I. from 1169.



MULTI-SPEED MOTOR

8ix speeds are available 500, 850 and 1,100 r.p.m. and 8,000, 12,000 & 15,000 r.p.m. Shaft is 1/2 in. diameter and approximately 1 in. long. 230/240v. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2 in. dia. x 3 in. long. Price 89p plus 25p 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 86p. Postage 20p for first one then 10p for each one ordered. 1" stackmotor 85p. 1 1/2" stackmotor \$1.



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—50-60 w. \$1.20. Kit E—85 w. \$1.80. Kit F for 9ft. 125 w. tube \$1.75. Kit MF1 is for 6in., 9in. and 12in. miniature tubes \$1. Kit MP2 for 21in. 13 w. miniature tube \$1. Postage on Kits 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 15p for each kit ordered. Kit F 33p then 23p for each kit ordered. Kit MF1 18p on first kit then 15p on each two kits ordered.

I CHIP RADIO

Ferranti's latest device ZN414—gives results better than superhet. Supplied complete with technical notes and circuits. \$1.25 each. 10 for \$11.

Hi-Q TUNER COMPONENTS

For experimenting with the ZN414. KIT NO. 1. Plesey Miniature Tuning Condenser with built in LW switch and 3" ferrite slab and litz wound MW coil. 65p. KIT NO. 2. Air spaced tuning condenser 6" ferrite rod litz wound MW and LW coils. 85p. KIT NO. 3. Air spaced TC with slow motion drive 8" ferrite rod, with litz wound LW and MW coils. \$1. KIT NO. 4. Permeability tuner with fast and slow motion drive and LW loading coils. 45p.

HOURLY MINUTE TIMER

Made by Smiths. Complete with control knob and calibrated dial. Useful in kitchen, office, dark-room, etc. Bargain at 50p.



HONEYWELL PROGRAMMER

This is a drum type timing device, the drum being calibrated in equal divisions for switch setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control, Boiler firing, Dispensing and Vending machines, Display lighting animated and signs, Signalling, etc. Price from makers probably over \$10 each. Special snip price \$6.75 plus 25p post and insurance. Don't miss this terrific bargain.



MIGHTY MIDGET

Probably the tiniest possible radio, as described in Practical Wireles January 73. All electronics 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

(430 Amp Switch). Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric 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 25. Special snip price \$11.50 Post and ins. 23p.

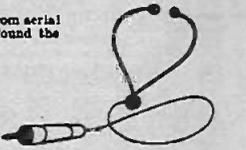


MULLARD UNILEX

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—\$2.80 each. In addition and made to Mullard Specification we offer: Standard Control Unit with esutecobson—\$3.50 Knobs—Set of 4—50p Unit—\$3.50 with Set of 6 Knobs—75p Mullard Unilex Handbook—25p.

RADIO STETHOSCOPE

Easiest way to locate fault—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 being a \$2—twin stethoscope instead of earpiece 75p extra—post and ins. 30p.



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 11A 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 60p pair.



FORTYLITE

Fluorescent lighting units with polyester choke and finished white enamel. 40 ins. model, ideal kitchen, bedroom, hallway, porch, loft etc. With tube assembled ready to instal. \$1.99.

HONEYWELL THERMOSTAT

Made by Honeywell for normal air temperatures 40°-80°F (6-25°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 1/2" x 3 1/4" deep—can be mounted on conduit box or directly on wall. Price \$1.25 each for ten for \$11.95.

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 fux smoke when soldering etc. A real bargain at \$1.85.



BATTERY CONDITION TESTER

Made by Mallory but suitable for all batteries made by Ever Read, and others, most of which are zinc carbon type but also mercury zincagnane—lead—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 complete reads "replace", "weak" or "good". The tester is complete in its case, size 3 1/2" x 6 1/2" x 2 1/2" 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.

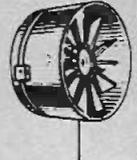
SNAP ACTION SLIDE SWITCH

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



EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic ft. per hour. Suitable for kitchen, bath-rooms, factories, changing rooms, etc., it's so quiet it can hardly be heard. Compact, 6 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. & F.



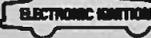
AC CONDENSERS

In addition to the normal uses as motor starters, power factor correction etc. These make very good voltage droppers for working low voltage appliances from mains. The voltage working quoted is AC and condensers are usually suitable for working on DC at 2 1/2 times the quoted AC voltage.

1.5 mfd 400v 25p	5 mfd 670v 60p	12 mfd 250v 70p
2 mfd 440v 30p	6-25 mfd 250v	15 mfd 250v 80p
3-4 mfd 440v 40p	60p	20 mfd 275v 90p
3-5 mfd 250v 30p	8 mfd 250v 50p	
		8 mfd 440v 75p

CD CAR IGNITION

This system which has proved to be amazingly efficient. We offer kit of parts as P.V. 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.



12 VOLT 1 1/2 AMP POWER PACK

This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 mfd/4 smoothing. Price \$2.00 + p. & p. 20p.



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, colour-ed disc lighting effects, etc. \$1.85 plus 20p post and ins.



SOLDER GUN

A must for every busy man, gives almost instant heat also flame-adjusted. 100 watt \$2.25 plus post and ins. 20p.



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. KNUCKLED MODEL FOR P.M. 60p



TREASURE TRACER

Complete Kit (except wood battens) to make the metal detector as the circuit in Practical Wireles, August issue. \$2.95 plus 20p post and insurance

IMMERSION HEATERS BY REMPLY

Standard fitting for domestic water tanks, made by the famous Remply Company. Complete with sealing washers suitable for 200-240 volts A.C. Depth into tank 11", 2kw or 3kw \$1.50 plus 20p each post and insurance.



MAINS OPERATED SOLENOIDS

Model TTB—small but powerful. 1 1/2" pull—Approx. size 1 1/2" x 1 1/2" x 1 1/2". 60p. Model 400/1 1/2" 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 1/2". \$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 reckoning your time at \$1 per hour see how quickly our resettable fuse (auto circuit breaker) will pay for itself. Price only \$1 each or \$11 per dozen, specify 5, 10 or 15 amp—simply fit in place of switch.



VAT is not included in these prices. Please add 10% to your total bill.

RECORD PLAYBACK HEADS (TRUVOX)

Individual prices of these are—
 2 track record playback heads 45p each.
 4 track record playback heads 85p each.
 Erase heads are also available separately—
 2 track 16p—4 track 26p.
 New metal mounting shields 85p each.
 3 track heads already fixed on heavy mounting plate with shield 95p.

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

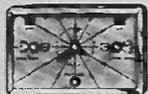
DRILL CONTROLLER NEW IKW MODEL

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. £1.60 plus 13p post and insurance. Made up model also available. £2.25 plus 13p post & p.

HIGH ACCURACY THERMOSTAT
 Uses differential comparator I.C. with thermostat as probe. Designer claims temperature control to within 1/10th of a degree. Complete kit with power pack £5.50.

WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. 50p post free.



15A 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 logger. A beautiful unit. Price £1.95 + 20p p & p or with glass front chrome bezel 75p extra.

EDUCATIONAL KITS—all with pictorial instructions



THIS BALANCE KIT FREE

Receive 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 place balance kit. Price of kits 40p each post paid. Special price for all 7 kits £8.75 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.

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. Finds up tacks, nails and any small parts showing how magnetism works.

KA8 Current and Resistance Kit. Twenty-nine parts, including bench and light bulb. Conduct 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.

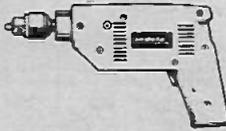
TERMS:—10% discount if ten of an item ordered, send postage where quoted—other terms, post free if order for these over £6.00 otherwise add 20p.

TWO WAY INTERCOM AUTOMATIC ANCHOR LIGHT

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

THYRISTOR LIGHT DIMMER

Domestic model for any lamp up to 250 watt. Mounted on switch plate to fit in place of standard switch. Virtually no radio interference. Price £2.95. Industrial model 5 amp module with control knob £3.00.



PORTABLE ELECTRIC DRILL

Very superior quality made by a famous Dutch toolmaker. Model No. AEM-230, 360W—2 speed 2200/3000. with 1/2" chuck and chuck key, also separate side handle and hammer facility for dealing with concrete, etc. An equivalent British made drill would cost £16.00.

£9.95—similar model but without the hammer attachment £7.95. Have either model on approval for 7 days.



DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 15 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 33p P. & I.

THIS MONTH'S SNIP

Kettle Elements. Made by the famous A.K.I. Co. complete with washers and combined fixing ring and plug shroud. Normal 2 round pin and flat pin earth connection and overload reset push button. 2 models—1 1/2 ins. (approx) suitable for Swan and other similar models—1 1/2 ins. (approx) suitable for G.R.C., Hotpoint, etc. All quick boil 2 1/2 K.W. elements at 240v—Price £1.25p each.

BARGAIN PARCEL OF SEVEN MOTORS FOR £1

A bargain parcel of 7 motors for £1. Some not as large as a postage stamp and only 1/2" thick, largest is 1 1/2" x 1 1/2" dia. Some work off 1 1/2v some as high as 18v. The 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 4 1/2v. Don't miss this wonderful snip.

STANDARD WAFER SWITCHES

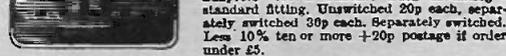
Standard size 1 1/2" wafer—silver-plated 8-amp contact, standard 1" spindle 3" long—with locking washer and nut.

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							
4 poles	40p	40p							
5 poles	40p	40p							
6 poles	40p	40p							
7 poles	70p	70p	70p	95p	£1.20	£1.20	£1.20	£1.20	£1.20
8 poles	70p	70p	70p	95p	£1.20	£1.20	£1.20	£1.20	£1.20
9 poles	70p	70p	70p	95p	£1.45	£1.45	£1.45	£1.45	£1.45
10 poles	70p	70p	70p	95p	£1.20	£1.45	£1.45	£1.45	£2.70
11 poles	70p	70p	70p	95p	£1.20	£1.45	£1.45	£1.45	£2.95
12 poles	70p	70p	70p	95p	£1.20	£1.45	£1.45	£1.45	£3.20

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

Model 1183 500m watt power output 65p.
 Model 1172 750m watt power output 85p.
 Model EP9000 4 watt power output £1.45p.
 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 25.



50 MICRO AMMETER Squares, panel mounting type. 33

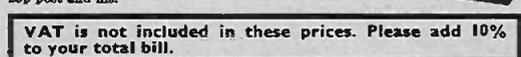
INTEGRATED CIRCUIT BARGAIN

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

DON'T MISS THIS TERRIFIC BARGAIN.

GOOD COMPANION

We can now offer these again in i.c. version using Ferranti ZN414 and Mullard AP Modules 1172. Excellent tone wood cabinet. Cabinet size approx. 11in wide x 8in high x 3in deep. Complete assembly instructions £5.75 plus 25p post and ins.



VAT is not included in these prices. Please add 10% to your total bill.

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 lach up. Size approx. 9 1/2" x 8 1/2" x 3 1/2" 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 8" A elliptical 6" x 3 1/2" 10,000 gauss. The amplifier proper is a Newmarket model ref. P.C.A. Price £3.50 each. 10 for £31.50. Post and insurance 20p.

BAKELITE INSTRUMENT CASE

Size approx. 6 1/2" x 3 1/2" 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. par lid 10p extra.

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 each + 50p post or 2 for £2.50 post paid. Also available separately, dials and handsets 50p each + 20p post.

ROCKER SWITCH

13 amp self-fixing 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 6B.A. screws. Size approx. 1 1/2" x 1 1/2" rated 25W lamp. 7p each. 10 for 85p. Ditto as above but for printed circuit 6p each 10 for 54p. Sub Miniature Slide Switch. DPDT 19mm (£1n approx.) between fixing centres. 18p each or 10 for £1.08. SP Change over spring return 260v 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 60p, or 6 for £1. post paid.

HOME SENTINEL INTRUDER ALARM £3.75
SNAP INDICATOR 75p
WINDSCREEN WIPER CONTROL £2.25
RECORD PLAYER £5.50 (amplifier components only)

DEMO DEC £7.00
FUZZ BOX £1.85
PHOTOGRAPHIC COLOUR TEMPERATURE METER £2.65
ASTRON RADIO £3

REMOTE TEMPERATURE COMPARATOR £4.25
ELECTRO LAUGH £2
RAIN WARNING ALARM £1.80
WA-WA PEDAL £2.90
SIGNAL INJECTOR 80p
SOIL MOISTURE METER £3.00

SIMPLE CALCULATOR £2.20
DC POWER SUPPLY £5.00
BABY ALARM £4.00
AUDIO TONE GENERATOR £2.60
METAL LOCATOR £4.00
LIGHT TO SOUND CONVERTER £1.70
THRU LENS LIGHTMETER £3.50
DRILL SPEED CONTROLLER £2.00

ELECTRONOME £1.75
SHAVEN INVERTER £3.75
I.R. BURGLAR ALARM £3.50
L & M RADIO TUNER £2.50
TAPE POWER SUPPLY MAINS £2.00

CAR £1.10
ELECTRONIC MOUSE-TRAP £3.75
REACTORMATIC £3.00
RADIO CONTROL RECEIVER £3.00
RADIO CONTROL TRANSMITTER £5.50
BIT SAVER £1.50
ICE WARNING DEVICE £1.40
BETA TREBLE BOOST & FUZZ £6.00
AUDIO COLOUR UNIT £6.50
U.H.F. TV AERIAL £1.50
DAMP LOCATOR £1.15
ENLARGER & EXPOSURE METER £4.50
EGG TIMER £3.75
NEON NOVELTY £1.50
MAINS PACK FOR NEON NOVELTY £0.85

J. BULL (ELECTRICAL) LTD.

(Dept. E.E.), 7 Park Street, Croydon CRO 1YD

Callers to: 102/3 Tamworth Road, CROYDON.

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, 68,000µ 16v, 10,000µ 35v, 4½ x 2½ in. dia., 25,000µ 25v, 20,000µ 30v, 8,000µ 55v, 40,000µ 10v, 4½ x 3 in. dia. 50p (12p). 15,000µ 15v, 4½ 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)
200 Si PLANAR DIODES 50p (5p) untested

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 4½ x 4½ x 2 £3-50 (28p)

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

Postage and package for each item shown in brackets.

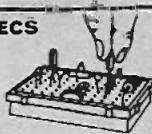
KEYTRONICS

(Mail Order only)

44 EARLS COURT ROAD
LONDON W8.
01-478 8499

S-DECS AND T-DECS

S-DECS £1-44
T-DECS £2-88
µ-DEC A £3-00
16 dit IC carriers £1-20



IC RADIO CHIP TBA651

As featured in July Practical Wireless IC of the month feature. Contains RF Amp, oscillator, mixer, IF Amps, detector, voltage stabilizer and wide range AGC circuitry. With data £2-18.

SINCLAIR EQUIPMENT

IC12 £2-00

Z50 £4-25

PZ5 £3-97

Z30 £3-50

Project 60 tuner £16-80

AFU £4-50

stereo 60 £7-80

Sinclair Executive Calculator £55-00
New Sinclair Digital Multimeter £44-00
System 2000 Amplifier £22-00

DELUXE KIT FOR THE IC12

Includes all parts for the printed circuit and volume, bass and treble controls needed to complete the mono version £1-45. Stereo version with balance controls £3-30.

POWER UNITS FOR THE IC12

A set of components to construct a 28V 0.5 Amp power supply £2-27. Also suitable Sinclair PZ5 fully constructed £3-97

PREAMPLIFIER KITS FOR THE IC12

Type 1 for magnetic pickups, mics and tuners, with 3 position equalization switch, Mono model £1-20. Stereo model £2-20. Type 2 for ceramic or crystal pickups. Mono 60p. Stereo £1-20

PROJECT 60 KIT £2-50

Our extremely popular kit contains the extra capacitors, DIN plugs and sockets, cables and fuse holder needed to complete Project 60.

SWANLEY ELECTRONICS

32 Goldsel Road, Swanley, Kent
Mail order only. Postage 10p per item. Lists 10p.
*** Add 10% extra to all prices for VAT ***
Official credit orders from schools etc. welcome.

B.H. COMPONENT FACTORS LTD.

VAT: Please add 10% to the order value including P. & P.

SPECIAL RESISTOR KITS. (1W or ½W 5% Carbon Film) 10E12KIT, 10 each E12 value, 100ohms-1M. A total of 610. £2-80 net

25E12KIT, 25 each E12 value, 100ohms-1M. A total of 1525. £6-50 net

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AC129 25p	BCY39 1-00	GET111 55p	OC81 25p	ZTX341 20p	2N3702 10p
AC176 25p	BCY42 1-00	GET116 55p	OC83 25p	ZTX500 15p	2N3704 10p
AC187 85p	BCY43 85p	GET380 45p	OC140 25p	ZTX503 17p	2N3705 10p
AC188 25p	BCY44 85p	GM309 55p	OC13 80p	ZX301 15p	2N3714 1-30
AC197 30p	BCY70 15p	(T08) 1-87	OC71 15p	2N404 20p	2N3771 1-75
ACY30 20p	BCY71 20p	MAT121 25p	OC200 45p	2N527 35p	2N3772 8-00
ACY31 20p	BCY72 15p	MJE340 50p	OC201 75p	2N596 15p	2N3790 2-25
ACY39 85p	BCY87 2-00	MJE370 70p	OC202 80p	2N697 15p	2N3819 2-25
AD140 50p	BD211 2-00	MJE520 75p	OC203 50p	2N706 15p	2N3820 50p
AD149 50p	BD212 50p	MJE520 75p	OC271 1-25	2N820 20p	2N3866 85p
AD161 35p	BD131 2-00	MJE520 75p	OC272 50p	2N897 15p	2N3903 15p
AD162 35p	BD182 80p	MJE520 75p	ORP60 10p	2N1131 25p	2N3906 1-10
AD163 35p	BD183 80p	MJE520 75p	P346A 20p	2N1132 25p	2N4061 1-10
AD171 30p	BF116 25p	MPP105 40p	RAS101AF 15p	2N1302 15p	2N4062 1-10
AD172 30p	BF167 25p	NKT214 20p	RAS808AF 15p	2N1304 25p	2N4126 15p
AD173 30p	BF173 25p	NKT216 40p	TAA263 75p	2N1305 25p	2N4671 85p
AD186 40p	BF180 20p	NKT217 40p	TIP209 20p	2N1307 25p	2N4557 20p
AF239 40p	BF194 15p	NKT403 70p	TIP280A 50p	2N1205 25p	2N5777 55p
AY297 20p	BF195 15p	NKT404 50p	TIP30A 50p	2N1613 20p	2S8001 1-00
AY298 20p	BF261 25p	OAS 50p	TIP31A 50p	2N1671 1-00	2S8012 10-00
BA103 20p	BF298 25p	OA10 35p	TIP32A 70p	2N2147 75p	2S8018 6-25
BA115 7p	BFX13 25p	OAS1 10p	TIP33A 70p	2N2160 55p	2S8026 9-90
BA145 15p	BFY37 75p	OAS1 7p	TIP34A 70p	2N2217 25p	2S301 50p
BAK13 5p	BFY37 80p	OAS20 7p	TIP3AA 1-00	2N2221 25p	2S302 55p
BAK16 7p	BFY38 20p	OAS20 7p	TIP3AA 1-00	2N2222A 25p	2S324 85p
BC107 10p	BFY50 20p	OC16 75p	TIP3AA 1-50	2N2269A 25p	40250 60p
BC108 10p	BFY51 20p	OC20 95p	TIP3AA 1-50	2N2369A 15p	40360 40p
BC109 10p	BFY52 20p	OC23 85p	TIP3AA 2-50	2N2906 20p	40361 40p
BC109C 10p	BFY54 50p	OC25 40p	TIP3AA 2-50	2N2926 (all	40362 50p
BC111 15p	BFY80 50p	OC23 85p	TIP3AA 2-50	col.) 10p	40408 60p
BC117 20p	BX320 15p	OC35 50p	TIP41A 75p	col.) 10p	40488 75p
BC143 25p	BSY27 15p	OC38 65p	TIP42A 75p	2N3053 20p	40636 1-10
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25 + 17p	25 + 30p
100 + 15p	100 + 25p
500 + 12p	500 + 20p
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OC170 Mullard 25p	BC107, BC108, BC109 10p each
25 + 20p	All Makes
100 + 18p	25 + 9p
500 + 15p	100 + 7p
1000 + 13p	500 + 6p
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25 + 12p	each
100 + 10p	25 + 32p
500 + 9p	100 + 22p
1000 + 6p	500 + 25p
	1000 + 22p
OA202 10p	2N3053 20p
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1000 + 5p	1000 + 10p
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25 + 45p	25 + 50p
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400 M/W 5% Miniature
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 Any one type.
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 Any one type.

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 729C D.I.L. 95p
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 741C T09 53p
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 747C T09 81-10
 747C D.I.L. 81-10
 77741P D.I.L. 60p
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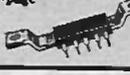
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SC		

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RESISTORS

1/4W Iskra high stability carbon film—very low noise—capless construction.
1/4W Mullard CR25 carbon film—very small body size 7.5 x 2.5mm. 1/4W 2% Electrofil TR5.

Power watts	Tolerance	Range	Values available	Price
1/4	5%	4-7Ω-2.2MΩ	E24	1-99 100+
1/4	10%	3-3MΩ-10MΩ	E12	1-0p 0-8p
1/4	2%	10Ω-1M	E24	3-5p 3-0p
1/4	10%	10Ω-3.9Ω	E12	1-0p 0-8p
1/4	5%	4.7Ω-1MΩ	E12	1-0p 0-8p
1/4	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 1/4W, lin 1/4W).
Single, 12p. Dual gang (stereo), 40p. Single D.P. switch 24p.

SKELETON PRESET POTENTIOMETERS

Linear: 100, 250, 500Ω and decades to 5MΩ. Horizontal or vertical P.C. mounting (0.1 matrix).
Sub-miniature 0-1W, 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	90p	2N3703	12p
AC127	12p	AF126	20p	BD133	75p	OC35	50p	2N3704	13p
AC128	12p	AF127	20p	BF115	25p	OC42	12p	2N3705	12p
AC131	12p	AF139	22p	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	30p	BC108	9p	BF181	32p	OC81	12p	2N3711	11p
AD149	45p	BC109	9p	BF184	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	12p	2N2926G	9p	40362	40p
AF115	20p	BC157	14p	BFY30	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	225p	2N3055	60p	ZTX502	20p

ZENER DIODES

400mW 5% 3-3V to 30V, 12p.

LINEAR IC's (DIL)

709 32p 747 85p 14 and 16 pin
741 28p 748 35p 16p

DIODES

RECTIFIER	1250V	1A	12p	SIGNAL	7p
BY127	800V	6A	25p	OA85	5p
BZV10	200V	6A	20p	OA90	5p
BZV13	200V	6A	20p	OA91	5p
IN4001	50V	1A	7p	OA202	7p
IN4004	400V	1A	8p	IN4148	8p
IN4007	1000V	1A	12p	BA114	8p

BRUSHED ALUMINIUM PANELS

12in x 6in=25p; 12in x 2 1/2in=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 PANELS

18 Gauge panel 12" x 4" with slots cut for use with slider pots. Grey or matt black finish complete with fixings for 4 pots.

THERMISTORS

VA10555 15p

VA10665 15p

VA1077 15p

VA1005 15p

VA1026 15p

VA1033 15p

R53 £1-35

COMPACT CASSETTES

C90 65p C120 85p

MULLARD POLYESTER CAPACITORS C296 SERIES

400V: 0-001μF, 0-0015μF, 0-0022μF, 0-0033μF, 0-0047μF, 2p, 0-0068μF, 0-01μF, 0-015μF, 0-022μF, 0-033μF, 3p, 0-047μF, 0-068μF, 0-1μF, 4p, 0-15μF, 6p, 0-22μF, 7p, 0-33μF, 11p, 0-47μF, 13p.

160V: 0-01μF, 0-015μF, 0-022μF, 0-033μF, 0-047μF, 0-068μF, 3p, 0-1μF 3p, 0-15μF, 4p, 0-22μF, 5p, 0-33μF, 6p, 0-47μF, 7p, 0-68μF, 11p, 1-0μF, 13p.

250V P.C. mounting: 0-01μF, 0-015μF, 0-022μF, 3p, 0-033μF, 0-047μF, 0-068μF, 3p, 0-1μF, 4p, 0-15μF, 0-22μF, 5p, 0-33μF, 6p, 0-47μF, 7p, 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, 2p, 0-04μF, 0-05μF, 0-068μF, 0-1μF, 3p.

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, 68/6-3, 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
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 (μF/V): 10/12, 50/12, 100/12, 200/12, 5/25, 10/25, 25/25, 800/25. 5p each

VEROBOARD

21 x 3 1/2 0-15
21 x 5 0-17
3 1/2 x 3 1/2 22p 0-15
3 1/2 x 5 24p 0-15
17 x 2 1/2 24p 0-15
17 x 3 1/2 28p 0-15
17 x 3 1/2 75p 0-15
17 x 3 1/2 100p 0-15
17 x 5 (plain) 82p
17 x 3 (plain) 82p
17 x 2 1/2 (plain) 42p
2 1/2 x 5 (plain) 11p
2 1/2 x 3 1/2 (plain) 11p

Pin insertion tool 32p
Spot face cutter 32p
P.C. 50 pins 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 18p
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

9V mains power supply. Same size as PP9 battery £1-80

LARGE (CAN) ELECTROLYTICS

1600μF 64V 74p 3200μF 16V 50p
2500μF 40V 74p 4500μF 16V 30p
2500μF 50V 58p 4500μF 25V £1-68
2500μF 64V 80p 5000μF 50V £1-10
2800μF 100V £2-60

HIGH VOLTAGE TUBULAR CAPACITORS—1,000 VOLT

0-01μF 10p 0-047μF 13p 0-22μF 20p
0-022μF 12p 0-1μF 16p 0-47μF 22p

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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 2 1/2 10pF to 1,000pF E12 Series 4p each values.

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97p Draw the planned circuit on to a copper laminate board with the P.C. Pen, allow to dry and immerse the board in the etchant. On removal the circuit remains in high relief.

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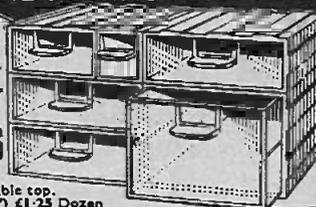
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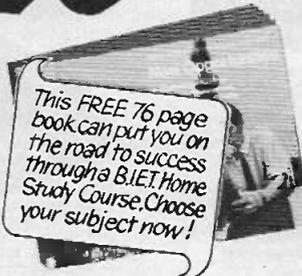
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