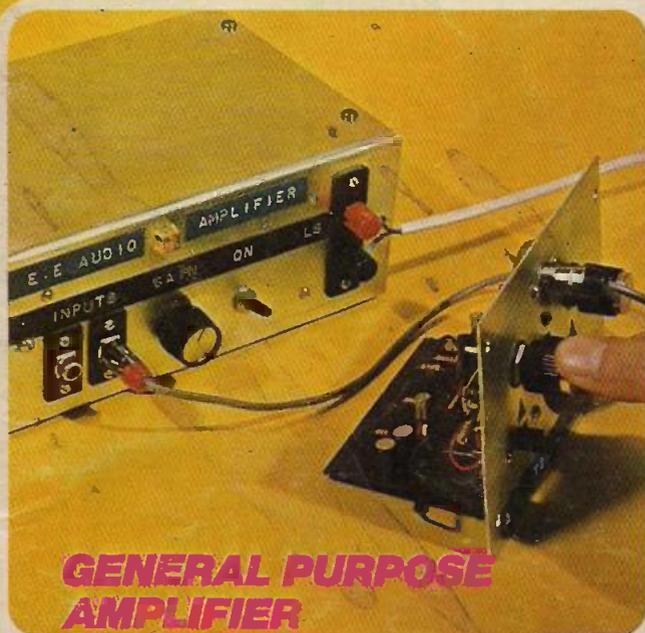


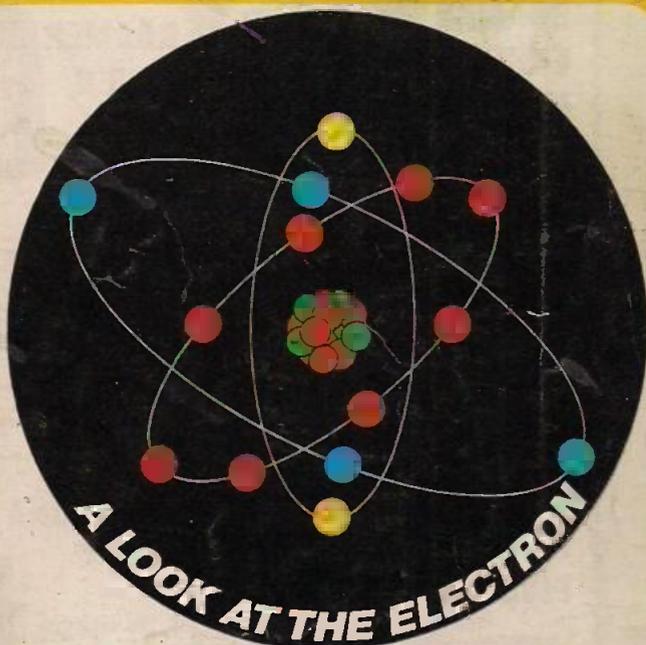
An exciting hobby.... for everyone

# everyday electronics

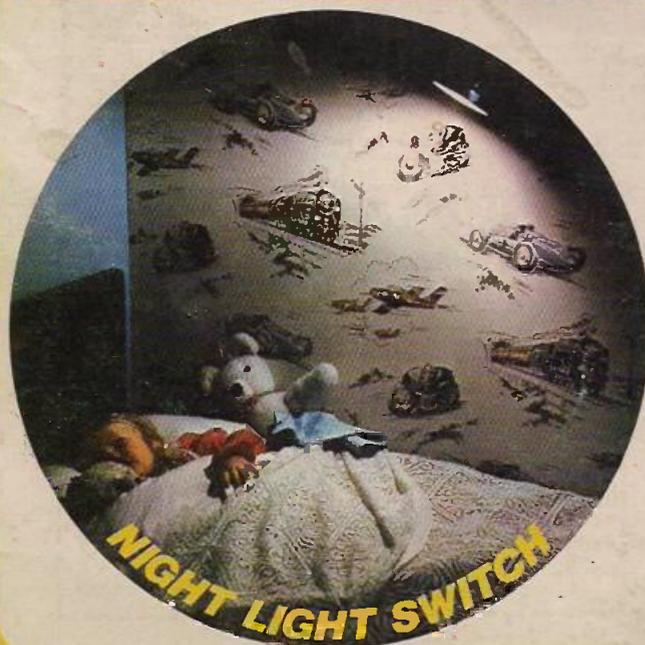
APRIL 73  
15p



**GENERAL PURPOSE  
AMPLIFIER**



**A LOOK AT THE ELECTRON**



**NIGHT LIGHT SWITCH**



**INDICATOR AUDIBLE  
WARNING**

# Build yourself a TRANSISTOR RADIO

WITH AFTER SALES SERVICE

## 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 600mw Transistors. Car Aerial and Tape Record Sockets. 10 Transistors plus 3 Diodes. Fine tone moving coil speaker. Ganged Tuning Condenser with VHF section. Separate coil for Aircraft Band. Volume on/off. Wave Change and tone Control. Attractive Case in black with silver blocking. Size 9" 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 30p extra.

Total building cost

**£8.50**

P. P. & Ins. 50p

Overseas P. & P. £1)



## ROAMER EIGHT Mk I

NOW WITH VARIABLE TONE CONTROL



7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Retractable chrome plated Telescopic aerial for Short Waves. Push pull output using 600mw transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 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 30p extra.

Total building cost **£6.98** P. P. & Ins. 45p. (Overseas P. & P. £1)

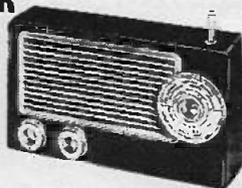
## ROAMER SEVEN MK IV



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 30p extra.

Total building costs **£5.98** P. P. & Ins. 45p. (Overseas P. & P. £1)

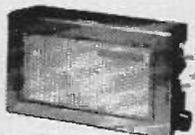
## ROAMER SIX



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. 3in. Speaker. 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 6 1/2 x 2 1/2in. approx. Easy build plans and parts price list 25p (FREE with parts).

Total building costs **£3.98** P. P. & Ins. 30p. (Overseas P. & P. £1)

## 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 6 1/2 x 1 1/2 x 3 1/2in. Easy build plans and parts price list 10p (FREE with parts).

Total building costs **£2.29** P. P. & Ins. 23p. (Overseas P. & P. 63p)

## TRANSONA FIVE

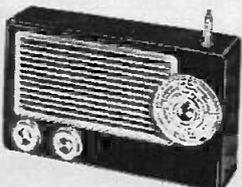


5 TRANSISTORS AND 2 DIODES

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 **£2.50** P. P. & Ins. 24p. (Overseas P. & P. 63p)

## TRANS EIGHT



8 TRANSISTORS and 3 DIODES

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 x 6 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).

Total building costs **£4.48** P. P. & Ins. 32p. (Overseas P. & P. £1)

## NEW! "EDU-KIT"

BUILD RADIOS, AMPLIFIERS, ETC., FROM EASY STAGE DIAGRAM. FIVE UNITS INCLUDING MASTER UNIT TO CONSTRUCT.

COMPONENTS INCLUDE:  
Tuning Condenser: 2 Volume Controls: 2 Slider Switches: Fine Tone Moving Coil Speaker: Terminal Strip: Ferrite Rod Aerial: 2 Plugs and Sockets: Battery Clips: 4 Tag Boards: Balanced Armature Unit: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three 1/2 knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction.  
Parts price list and easy build plans 25p (FREE with parts).

All parts including **£5.50** P. P. & Ins. 32p. Case and Plans



(Overseas P. & P. £1)

## RADIO EXCHANGE CO

61a HIGH ST., BEDFORD, MK40 1SA. Tel. 0234 52367

I enclose £..... please send items marked.

- |               |                          |              |                          |
|---------------|--------------------------|--------------|--------------------------|
| ROAMER TEN    | <input type="checkbox"/> | ROAMER SEVEN | <input type="checkbox"/> |
| ROAMER EIGHT  | <input type="checkbox"/> | TRANS EIGHT  | <input type="checkbox"/> |
| TRANSONA FIVE | <input type="checkbox"/> | ROAMER SIX   | <input type="checkbox"/> |
| POCKET FIVE   | <input type="checkbox"/> | EDU-KIT      | <input type="checkbox"/> |

Parts price list and plans for.....

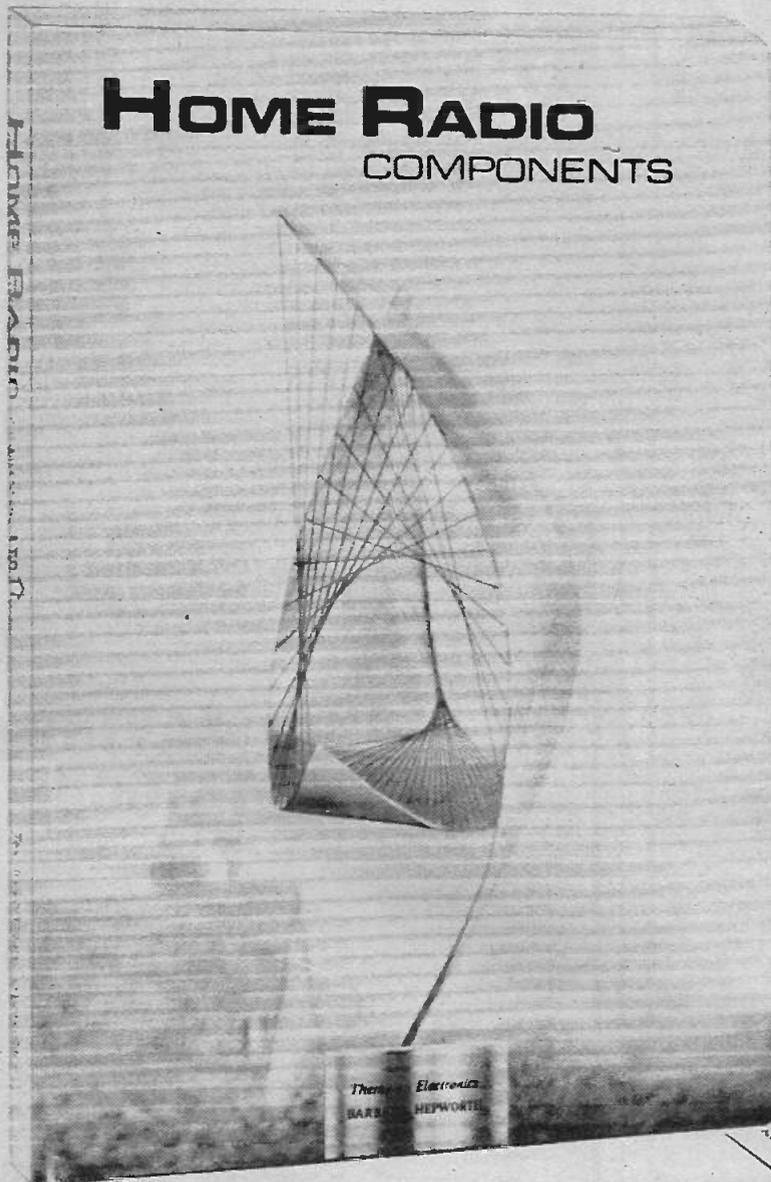
Name.....  
Address.....  
Regn. No. 788372 (Dept. E.E.18.)

FULL AFTER SALES SERVICE

• Callers side entrance "Lavells" Shop  
• Open 10-1, 2.30-4.30 Mon.-Fri. 9-12 Sat.

VAT PRICE ADJUSTMENTS AS FROM APRIL 1, 1973

# The Catalogue you MUST have!



250 pages 11 $\frac{3}{4}$ " x 8 $\frac{1}{4}$ "

6,785 electronic components clearly listed and indexed

1,750 pictures

10 free Vouchers each worth 5p.

Price list regularly updated

Bookmark with useful list of technical abbreviations

Details of our popular Credit Account Service and our Easy Ordering System are included in the catalogue.

Only 55p. plus 20p POST AND PACKING

**POST THIS COUPON**  
with cheque or P.O. for 75p.

The price of 75p applies only to customers in the U.K. and to BFPO addresses

Name \_\_\_\_\_

Address \_\_\_\_\_



HOME RADIO (Components) LTD. (Regn. No. London 912966)  
Dept. EE, 234-240 London Road, Mitcham CR4 3HD

# DISCOUNTS UP TO

# 60%

**Global's GOLDEN Guarantee**

WE GUARANTEE THAT WITHIN 7 DAYS OF PURCHASE IF ANY ITEM OF GOODS IS FOUND TO BE REMUNERALLY DEFECTIVE WE WILL REPLACE THE SAID GOODS WITHOUT QUESTION. AFTER 7 DAYS GOODS ARE COVERED BY MANUFACTURERS 12 MONTHS GUARANTEE.

## GARRARD SP25 Mk. III

Special Purchase. Limited number available

Garrard SP25 Mk. III £17.45

Goldring G800

Teak plinth and tinted cover

All leads supplied.

Please add £1.25 P. & P. & Ins.

## TURNTABLES

Please add 75p P. & P. & Ins.

Connoisseur BDI Chassis £12.75

Garrard SP25 Mk. III £9.90

Garrard AP76 £17.20

Garrard SL65B £13.95

Garrard 401 £28.75

Garrard Zero 100 (Auto) £36.90

Garrard Zero 100 (Single) £35.80

BSR MP60 £9.40

Goldring GL72 £20.90

Goldring GL72/P £27.45

Goldring GL75 £26.85

Goldring GL75/P £34.95

Goldring 101/P.C. £20.00

Wharfedale Linton + cart. £25.90

Thorens TD125AB Mk. II. £91.45

Thorens TD160 AB & C £53.95

## TUNERS

Please add 85p P. & P. & Ins.

Amstrad Multiplex 3000 £28.75

Armstrong 523 £39.50

Armstrong 524 £31.45

Rogers R/brook FET4 (Chassis) £37.25

Rogers R/brook FET4 (Cased) £43.50

Rogers R/bourne FET4 (Chassis) £45.00

Rogers R/bourne FET4 (Cased) £49.50

Sinclair PR060 (Module) £17.45

Sinclair 2000/3000 Tuner £29.90

Leak Delta FM (Cased) £53.60

Leak Delta AM/FM (Cased) £63.75

Alpha Highgate FT150 £37.95

Metrosound FMS20 £38.70

Philips RM690 £33.00

## TUNER/AMPLIFIERS

Please add £1 P. & P. & Ins.

Alpha Highgate 150 £48.95

Armstrong 525 (Teak cased) £69.45

Armstrong 526 AM/FM (Teak cased) £77.25

Leak Delta 75 £119.00

Teleton 2100 £32.50

Goodmans One Ten £98.90

Goodmans MOD90 £87.95

Rotal 150 £45.50

Rotal 400 £75.50

Rogers Ravensbrook (Teak cased) £77.00

Rogers R/brook (Chassis) £72.00

Alpha FR 3000, New product. £72.00

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



# GLOBAL AUDIO DISCOUNT WAREHOUSES

Dept (EE4) 174 Pentonville Road, London, N1. Telephone 01-278 1769

Or: 4 High View Parade, Redbridge Lane East, Woodford Avenue, Ilford, Essex. Tel: 01-550 1086.

Open Monday to Saturday 9.30 a.m. to 6 p.m. LATE NIGHT FRIDAY 7 p.m.

**MAIL ORDERS.** Order with confidence. Send Postal Order, Cheque, Money Order, Bank Draft, Giro or Cash by Registered Mail. **CALLERS.** Please note that cheques can only be accepted together with cheque cards (incl Barclay Card).

2 minutes from KING'S CROSS. EUSTON & ST. PANCRAS on main road leading to the East and West Country

## AMPLIFIERS

Please add 85p P. & P. & Ins.

Amstrad 8000 Mk. II £14.95

Amstrad IC2000 £27.50

Amstrad Integra 4000 £22.50

Armstrong 521 (Teak cased) £43.90

Alpha Highgate FA300 £24.85

Alpha Highgate FA400 £32.25

Leak Delta 30 £35.65

Leak Delta 70 £44.85

Metrosound ST20E £54.90

Metrosound ST60 £24.20

Pioneer SA500 & 610 £45.95

Pioneer SA500A £37.25

Pioneer SA1000 £31.95

Rogers R/brook (Chassis) £96.95

Rogers R/brook (Cased) £37.95

Rogers R/bourne (Chassis) £41.50

Rogers R/bourne (Cased) £49.95

Sinclair PR060 2 X Z30/PZ5 £14.70

Sinclair PR060 2 X Z30/PZ6 £16.70

Sinclair PR060 2 X Z50/PZ8/Trans £22.95

Sinclair AFU (Filter Unit) £4.20

Sinclair 605 £17.95

Sinclair 2000 Mk. II £21.50

Sinclair 3000 Mk. II £28.00

Wharfedale Linton £39.70

Teleton SAQ 307 £22.95

Rotel RA310 £24.95

Rotel RA610 £52.95

## SPEAKERS

Please add £1.50 per pair

P. & P. & Ins.

Price per pair

Amstrad 138 £13.90

Wharfedale Denton 2 £29.50

Wharfedale Linton 2 £35.85

Wharfedale Melton 2 £45.90

Wharfedale Drivedale 3 £59.80

Celestion Ditton 120 £38.40

Celestion Ditton 15 £50.90

Celestion Ditton 25 £84.50

Celestion County (new prod.) £24.50

Goodmans Double Maxim £47.40

Goodmans Mezzo 3 £45.95

Goodmans Magister £82.95

Special bulk purchase

£2.90\*

Plus 65p P. & P. & Ins.

Finished in teak veneer with tinted dust cover. (Fully assembled). For Garrard SP25; 2025TC; 3000; AT60; 2000; 2500; 3500; 5100; 1025; SL65B. Also for McDonald MP60 and others.

For: AP76; AP75; SL72B; SL75; SL95B\* £4.20 + 65p. P. & P. & Ins.

Also finished in walnut to match Japanese equipment—at no extra.

## CARTRIDGES

Please add 10p P. & P. & Ins.

Goldring G850 £3.35

Goldring G800 £4.70

Goldring G800E £7.50

Goldring G800 Super E £14.15

Shure M3D £3.70

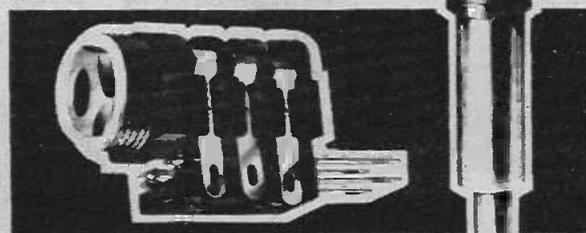
Shure M44E £4.75

Shure M55E £5.55

Ortofon SL15 £15.85

Sonotone 9TAHC £1.35

# Are you alright for Jacks?



Ask for Rendar Jack plugs and sockets at your local stockist. They come in a wide variety of configurations, and in cases of difficulty can be ordered DIRECT from the Rendar factory.

Standard, mini and sub-miniature sizes... plugs in both screened and unscreened versions... socket bodies in high melting point thermoplastic... several unique features (some protected by UK and US Patents)... Post Office and NATO specifications.

If you want to study all the facts and figures, all the ingenious construction details, send for the Rendar Electronic Components Catalogue of technical data sheets covering their entire range of products.

The cost of the catalogue is 25p, including P & P, and it's money very well spent!



## RENDAR®

Rendar Instruments Ltd., Victoria Road Burgess Hill, Sussex. Tel. Burgess Hill 2642-4  
Cables: Rendar, Burgess Hill

# THE MONEY SAVING CATALOGUE

No. 6  
4th printing



96 pages (8½ x 5½) packed with bargains in famous name transistors, resistors, capacitors, pots + I.C. circuits and diagrams; components, accessories, etc + valuable technical data, illustrations, etc. Everything is brand new, to makers' spec.—It's all in our fascinatingly informative catalogue. Yours for 25p. post free (U.K. only) and the voucher included allows you 25p. off when your order is for £5 or more.

SEND FOR YOUR COPY TO-DAY!

WITH 25p REFUND VOUCHER

- DISCOUNTS  
10% on orders £5 or more.  
15% on orders £15 or more.  
except certain items charged nett GUARA
- POST/PACKING  
Free in U.K. on orders above £2.  
10p surcharge on orders under £2.

# ELECTROVALUE

ELECTROVALUE LTD.

Reg. No. 1047769

(Ev. 4) 28 ST. JUDES RD., ENGLEFIELD GRN., EGHAM, SURREY, TW20 0HB.  
Hours: 9—5.30: Sat. 1 p.m. Tel: Egham 3603 Telex 264475  
R.O. — 28 St. Judes Rd., Englefield Green, TW20 0HB

# is this the price you pay?

Probably, if you're still using an ordinary soldering iron. Ordinary soldering irons can cause damage to transistors and integrated circuits — damage which wastes time and costs money. Now, with the unique ANTEX X25 and CCN low leakage soldering irons no harm can come to the most delicate equipment, even when soldered 'Live'.

**(You could be making quite a saving).**

*(All prices mentioned exclusive of V.A.T.)*



**MODEL X25**  
220-240 Volts or 100-120 Volts.  
The leakage current of the NEW X25 is only a few microamps and cannot harm the most delicate equipment even when soldered "live". Tested at 1500v. A.C.

This 25 watt iron with its truly remarkable heat-capacity will easily "out-solder" any conventionally-made 40 and 60 watt soldering irons, due to its unique construction advantages.

Fitted long-life iron-coated bit 1/8". 2 other bits available 3/32" and 3/16". Totally enclosed element ceramic and steel shaft. Bits do not "freeze" and can easily be removed.

**PRICE: £1.75**  
(rec. retail)

Suitable for production work and as a general purpose iron.

**MODEL CCN**  
220 volts or 240 volts. The 15 watt miniature model CCN also has negligible leakage.

Test voltage 4000v. A.C. Totally enclosed element in ceramic shaft. Fitted long-life iron-coated bit 3/32". 4 other bits available 1/8", 3/16", 1/4" and 3/64".

**PRICE: £1.80** (rec. retail)  
OR Fitted with triple-coated, iron nickel and Chromium bit 1/8".  
**PRICE: £1.95** (rec. retail)

**MODEL G**  
18 watt miniature iron, fitted with long life iron-coated bit 3/32". Voltages 240, 220 or 110. **PRICE: £1.83** (rec. retail).

**MODEL CN**  
Miniature 15 watt soldering iron fitted 3/32" iron-coated bit. Many other bits available from 3/64" to 3/16". Voltages 240, 220, 110, 50 or 24. **PRICE: £1.70** (rec. retail)

**MODEL CN2**  
Miniature 15 watt soldering iron fitted with nickel plated bit 3/32". Voltages 240 or 220. **PRICE: £1.70** (rec. retail)

**MODEL MES.KIT**  
Battery-operated 12v. 25 watt iron fitted with 15' lead and 2 heavy clips for connection to car battery. Packed in strong plastic wallet with booklet "How to Solder"

**PRICE: £1.95** (rec. retail)

**MODEL SK.1 KIT**  
Contains 15 watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32", heat sink, solder, stand and "How to Solder" booklet.

**PRICE: £2.75** (rec. retail)

**MODEL SK.2 KIT**  
Contains 15 watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32", heat sink, solder, stand and "How to Solder" booklet.

**PRICE: £2.40** (rec. retail)

---

**ANTEX**

From radio or electrical dealers, car accessory shops or in case of difficulty direct from: —  
**ANTEX LTD. FREEPOST**  
(no stamp required) **PLYMOUTH**  
PL1 1BR Tel: 0752 67377.

Please send the ANTEX colour catalogue.

Please send the following:

.....

.....

.....

I enclose cheque/P.O./Cash (Giro No. 2581000)

NAME .....

ADDRESS .....

.....

.....

EE4

# CRESCENT RADIO LTD

11 & 40 MAYES ROAD, LONDON N22 6TL 888 3206

MAIL ORDER  
DEPT.  
No. 11  
MAYES RD.  
LONDON  
N22  
6TL

COMPONENTS AND HI FI  
FOR THE HOME CONSTRUCTOR  
OUR SHOPS ARE OPEN ALL DAY  
FROM 9 A.M. TO 6 P.M. ON FRIDAY  
(WE CLOSE ALL DAY THURSDAY)  
13 SOUTH MALL, EDMONTON, N-9 803 1685



### CRESCENT CASSETTES

Best quality LOW NOISE Cassettes, complete in standard storage case. Please note our new low price.

C60 38p  
C90 38p  
C150 48p

Please include 5p P. & P.

### ADD LUXURY TO YOUR CAR WITH A MOTOR DRIVEN CAR AERIAL

5 Section  
Extended Length 100cm  
Length under Fender 40cm  
Cable Length 120cm  
complete with Fixing Bracket and Control Switch. **£5.75** plus 25p P. & P.



### "CRESCENT" DIGITAL CLOCK KIT

24 Hour Nixie Digital Clock Kit We Supply:

- ★ A complete set of components
  - ★ A complete set of easy to follow instructions
  - ★ Printed circuits made to make construction as simple as possible
  - ★ A cabinet and front panel to give a professional finish.
- All for the price of the components. £22.50 + 50p. P. & P. Please send S.A.E. for more information.

### MINIATURE RELAY

6 volt 70 ohm.  
Single Pole Changeover.  
Approx. size  $1\frac{1}{2} \times 1 \times 1$ .

**40p** plus 5p P. & P.



### TRI-VOLT BATTERY ELIMINATOR

Enables you to work your transistor radio, amplifier, or cassette, etc. from A.C. mains through this compact eliminator. Just by moving a plug you can select the voltage you require—5v, 7.1v or 9 volts. This means all your transistor power pack applications can be handled by this one unit. Approx. size:  $2\frac{1}{2} \times 2\frac{1}{2} \times 3\frac{1}{2}$ . **OUR PRICE—£2.75** + 10p. P. & P. Same model suitably wired for the Philips Cassette—**£3.00** + 10p. P. & P.

### TRI-VOLT CAR CONVERTER

Enables you to work your Transistor Radio, Amplifier or Cassette etc. from the 12 volt car supply positive or neg. earth. This converter supplies 6, 7.1 or 9 volts and is transistor regulated. Approx. size:  $2\frac{1}{2} \times 3\frac{1}{2} \times 2$ . Very easy to fit and a real money saving device for **£2.50** + 10p. P. & P.

### WAFER SWITCHES

- 1 pole 12 way
  - 2 pole 2 way
  - 2 pole 3 way
  - 2 pole 4 way
  - 2 pole 5 way
  - 3 pole 4 way
  - 4 pole 3 way
- 18p each. Please inc. 5p P. & P. Up to 3 switches.



### ALUMINIUM CHASSIS

Made from 18 gauge aluminum 4 sided chassis with corner brackets. All are  $2\frac{1}{2}$ " depth.

- 6 x 3—41p
- 6 x 4—45p
- 8 x 6—58p
- 10 x 7—83p
- 12 x 3—58p
- 12 x 6—61p
- 12 x 8—86p
- 14 x 3—66p
- 14 x 9—94p
- 16 x 6—86p
- 16 x 10—1.08p

Please send 10p per chassis P. & P.



### V.A.T.

From the 1st April 1973 you will please include on your total account (Goods plus Carriage) Value Added Tax at the Standard Rated Rate

### INTEGRATED CIRCUIT SOCKETS

A must for the experimenter interested in I.C.s. 14 pin, 16p each. 16 pin, 16p each. Please include 5p P. & P. per 3 sockets.



### BARGAIN BOARDS

Components galore for the experimenter. Ex computer boards with: Resistors, Capacitors and useful Transistors.



Now at this unbeatable price: 15p each. 7 Boards **£1.10p** P.&P.

### EA1000 3 WATT AUDIO AMPLIFIER MODULE

An Audio Amplifier designed around the TAA621 Linear I.C.—Supply Voltage ... 9-24V Speaker Imp. ... 8-16 ohm Frequency ... 50Hz-25KHz Overall Size ...  $2\frac{1}{2} \times 3\frac{1}{2} \times 1\frac{1}{2}$  in. Ideal Amplifier for radios, record players, stereo units, etc. Full technical data and diagrams with each module. All guaranteed and a bargain at **£2.63** + 5p P. & P.



### POTENTIOMETERS

- All types 1" and less diameter.
  - SINGLE EX DUAL
  - 5K Log or 5K
  - 10K Lin Less 10K
  - 25K Switch 25K Less
  - 50K 12pa. 50K Switch
  - 100K 100K Double 40p.
  - 250K Pole 250K 500K each
  - 1M Switch 1M
  - 2M 2M
- 24p ea. Up to 3 Pots. Please add 5p. P. & P.



### MINIATURE RELAYS

British made Relays. Size— $1\frac{1}{2} \times 1 \times 1$ " All two changeovers with 250V, 1.5A. contacts and suitable for fitting on 1mm Veroboard. Type Volts Current Ohms. 27/A 12v 17mA 700Ω 21/A 12v 28mA 430Ω 12/A 6v 33mA 185Ω 80p each. Please include 5p P. & P up to 3 Relays.

### S. G. BROWN "DIPLOMAT" MONO/STEREO HEADSET

Finest quality British made Light weight Headphones. Incorporate ceramic piezo electric transducers. Specification:—Frequency—20-17,500 CPS. Impedance—Predominantly capacitive, at -001MFD per earpiece can be regarded as 150K at 1Kcs. Weight—3.5oz. (98 grams). Please include 10p per set P.P. A Bargain at **£1.50** each set.



### LOW VOLTAGE AMPLIFIER

6 transistor amplifier complete with volume control. Is suitable for 9V d.c. and a.c. supplies. Will give about 1W at 8 ohm output. With high IMP Input this amplifier will work as a record player, baby alarm, etc., amplifier. **£1.75** plus 13p P. & P.



### LOUDSPEAKER BARGAINS

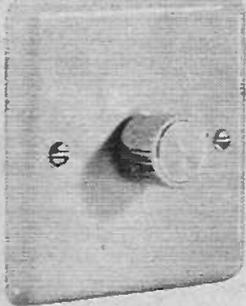
E.M.I. 450 set 3.8. 15 ohm **£3.75** plus 38p. P. & P. E.M.I. 350 set 8 ohm. **£7.00** plus 38p. P. & P.

### MINI LOUDSPEAKERS

2 1/2" (67mm) 8ohm — 50p each  
2 1/2" (67mm) 40ohm — 50p each  
2 1/2" (67mm) 80ohm — 50p each  
Please include 5p. P. & P. up to 3 Mini-Loudspeakers



## Vary the strength of your lighting with a DIMMASWITCH



The DIMMASWITCH is an attractive and efficient dimmer unit which fits in place of the normal light switch and is connected up in exactly the same way. The white mounting plate of the DIMMASWITCH matches modern electric fittings. Two models are available, with the bright chrome knob controlling up to 300 w or 600 w of all lights except fluorescents at mains voltages from 200-250 v, 50Hz. The DIMMASWITCH has built-in radio interference suppression:

600 Watt **£3.20** Kit Form **£2.70**  
300 Watt **£2.70** Kit Form **£2.20**

All plus 10p post and packing \*from 1st April please add appropriate percentage of V.A.T. increase. Please send C.W.O. to:—

**DEXTER & COMPANY**  
2 ULVER HOUSE, 19 KING STREET,  
CHESTER CH1 2AH Tel: 0244-25883

### EX COMPUTER PRINTED CIRCUIT PANELS

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

### SPECIAL BARGAIN PACK

25 boards for **£1 (25p)**.

### ELECTROLYTICS

10,000μ 75v, 33,000μ 40v, 10,000μ 35v, 4 1/2 x 2 1/2 in. dia., 25,000μ 25v, 20,000μ 30v, 8,000μ 55v, 40,000μ 10v, 4 1/2 x 3 in. dia. 50p (12p). 15,000μ 15v, 4 1/2 x 2 in. dia. 20p (10p). 2,000μ 25v wire ended, 3 x 1 in. dia. 15p (5p) or 12 for **£1.50 (15p)**.

250 MIXED CAPACITORS 60p (8p)  
250 MIXED RESISTORS 60p (8p)  
200 SI PLANAR DIODES 50p (5p) untested

ASSORTED RELAYS 8 for **£1 (25p)**  
SUB MIN. CO-AX PLUGS & SKTS. 4 pairs 50p (5p)

MINIATURE GLASS NEONS 12 for 50p (5p)  
REED RELAYS, MIXED 10 for 50p (5p)  
MICRO SWITCHES, MIXED 8 for 50p (8p)

PAPST EXTRACTOR/BLOWER FANS 100 cfm 4 1/2 x 4 1/2 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

## The New Styled "MULTI-MINI" TWIN-VICES



An extra "Pair of hands" for those tricky jobs

ASSEMBLY—SOLDERING—GLUING—WIRING—DRILLING ETC.

- INDEPENDENT ADJUSTMENT OF THE TWO VICE HEADS TO ANY ANGLE WITH POSITIVE LOCKING.
- JAWS WILL FIRMLY GRIP, ROUND, FLAT, SQUARE, OR HEXAGONAL PARTS.

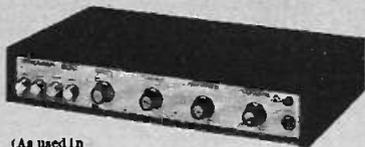
TWIN VICE: **£8.95 (25p P. & P.)**

Also available

SINGLE VICE: **£5.45 (21p P. & P.)**

CANLEY ENGINEERING (SALES)  
LTD. DEPT. C/E4  
OSBORNE ROAD, COVENTRY CV5 6EA  
TEL: (0203)-77163/4.

## PREMIER 800 STEREO AMPLIFIER



(As used in SYSTEM '800')

A truly high quality stereo amplifier—compare the specification, compare the price. Output: 5 watts per channel. Frequency response: 30-20,000 Hz = 2 db. Distortion: 1%. Output Impedance 8 ohms nom. Inputs equalised to R.L.A.A. Magnetic 4mV. Ceramic 100mV. Tuner 100mV. Tape 100mV. Tape out 150mV. Din sockets for inputs and outputs. Controls: Bass, Treble, Volume, Balance, Selector. Mono/Stereo switch. Stereo headphone socket. Attractive slim line design black leatherette cabinet with aluminium front panel. Size 12½" x 6½" x 2½".

ONLY £15-00 Carr. 50p.

Mk. II Version available with Teak Finish Cabinet. £16-25. Carr. 50p.

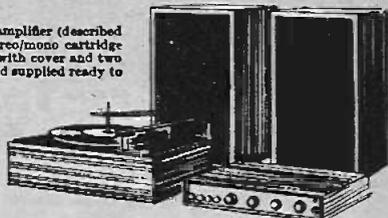
## PREMIER HI-FI STEREO SYSTEMS

### SYSTEM "800"

Consists of the Premier 800 Mk II 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 6½in x 2½in.

£35-00

Carr. £1-75



### SYSTEM "TWO"

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

£45-00

Carr. £1-75

### SYSTEM "THREE"

This consists of KLINGER KC003 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 STACHD diamond stereo cartridge. A pair of HMF Speakers size 16½" x 10½" x 9" fitted EMI units complete the matching system.

£57-75

Carr. £1-75

**FREE**

LEADS AND PLUGS SUPPLIED WITH ALL SYSTEMS

## PREMIER PARAGON STEREO HI-FI AMPLIFIER



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

sophistication that is usually only found with amplifiers costing twice its price. It has bass and treble slide controls, volume and balance knobs, and eight push-buttons. There's also a standard stereo jack socket on the front panel, plus a ceramic/magnetic cartridge switch and a mains outlet socket on the back panel. Specifications 10 + 10 watts into 8 ohms. Power/frequency response: 0dB 10 watts into 8 ohms - 2dB 20Hz - 20KHz. Distortion typically less than 0.25%. Inputs for Magnetic phono (4mV) Ceramic phono (50mV) Radio/Tape (100mV). High and low filters. Teak finish cabinet. Size: 12½" x 5½" x 10½".

£28-00 P. & P. 50p.

### PREMIER STEREO SYSTEM '65'

Consists of the Premier Paragon Stereo Amplifier, Garrard SP25 III in teak finish plinth with cover and fitted Goldring G800 stereo magnetic cartridge plus a pair of Marauden Hall Annex 100 Loudspeaker Systems. Complete with Free leads and plugs. £65 Insurance £1-75

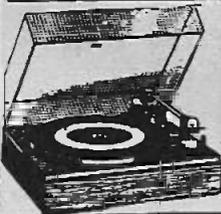
## NEW PREMIER COMPACT STEREO SYSTEM



All transistor stereo amplifier mounted into teak finish plinth with cover and Garrard 2025 T/C autochanger and a pair of matching teak finish cloth front speaker systems.

- ★ Output 4 watts rms per channel.
- ★ Separate volume, bass, treble and balance controls.
- ★ Stereo/Mono ceramic cartridge.
- ★ Tape/Tuner input and Tape output sockets.
- ★ Complete with all leads ready to use.

PREMIER PRICE ONLY £30 Carr. & Ins. £1-50



GARRARD SP25 MK III SINGLE RECORD PLAYER FITTED GOLDRING 800 MAGNETIC STEREO CARTRIDGE COMPLETE IN TEAK PLINTH WITH COVER. Total list price over £34.

PREMIER PRICE

£17-95

P. & P. £1

### VERITAS STEREO/MONO SOUND MIXER

Battery operated audio mixer, Size 6 x 3 x 2in. suitable for crystal microphones low impedance microphone, with transformer, radio, tape, etc. Max. input 1.5v. Max. output 2.5v. Gain 6 dB. Standard jack plug socket inputs, phono/plugs output. Attractive teak wood grain finish case.



PREMIER PRICE £3-47 P. & P. 15p

### E.M.I. 13x8in. HI-FI SPEAKERS

Fitted two 2½in tweeters and crossover network. Impedance 8 or 16 ohm. Handling capacity 10W. Brand new.

£3-47 P. & P. 50p

## QUALITY RECORDING TAPE

SPECIALLY MANUFACTURED IN U.S.A. FROM EXTRA STRONG PRE-STRETCHED MATERIAL. THE QUALITY IS UNEQUALLED. TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped—attractively boxed.

TT3 3' 450'	POLYESTER	87p	DT8 5½' 1800'	POLYESTER	£1-18
DT3 3½' 600'	POLYESTER	87p	TT3 5½' 2400'	POLYESTER	£1-87
EP3 5' 800'	P.V.C.	42p	BT 7' 1200'	P.V.C.	63p
LP3 5' 900'	ACETATE	50p	LP7 7' 1800'	ACETATE	75p
DT5 5' 1800'	POLYESTER	76p	DT7 7' 2400'	POLYESTER	£1-26
LP6 5½' 1200'	ACETATE	76p	TT7 7' 2800'	POLYESTER	£1-50

TAPE SPOOLS 3" 5p, 5½" 7p, 7" 9p. Post and Packing 3" 5p, 5½" 6p, 7" 10p (3 reels and over Post Free).

## NEW BRANCH NOW OPEN

56 GEORGE STREET, LONDON W1H 5RF  
Tel: 01-935 7197

"Litteroid" Soldering Iron. Lightweight ¼" pencil bit. Ideal for regular bench use and around the home. 25 watts. 240 volt A.C. £1 50 P. & P. 15p.

### METER BARGAIN

MODEL LT 102 MULTIMETER  
A precision made pocket sized test meter, ideally suited for testing electronic circuits or electronic appliances. Supplied complete with test lead and batteries. RANGES—DC Voltage: 15, 150, 600 (1,000 opV). AC Voltage: 15, 150, 600 (1,000 opV). DC Current: 150mA. Resistance: A-100K ohms. (centre 2-5 Kohms) £8-47 p. & p. 25p complete with test leads and battery.



### HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2½in. speaker units with soft padded ear muffs. Adjustable headband. 8 ohms impedance. Complete with 6ft lead and stereo jack plug.

£2-47 P. & P. 25p.



ROGERS LEVENSBROOK SEMI-PROFESSIONAL MODEL (as illustrated). (List £18-50).  
OUR PRICE £11.00  
AKAI AHE95 £5.50  
SENNHEISER £8.99 HD414 P. & P. 25p each



## E.M.I.

### LOW NOISE CASSETTES in library cases

C60 (List 71p) 45p  
C90 (List 99p) 65p  
C120 (List £1-49) 85p P. & P. 10p



### LOW-NOISE COMPACT CASSETTES

Screw fixing—fully guaranteed. In Library cases.

	EACH	3 for	6 for	10 for
C60	29p	81p	£1-56	£2-50
C90	40p	£1-11	£2-16	£3-50
C120	52p	£1-40	£2-76	£4-50

P. & P. 10p each (5 and over 15p)

# PREMIER RADIO

23, TOTTENHAM COURT ROAD, LONDON, W.1 Tel: 01-636 3451



# Would you spend an hour a day to earn more money in Electronics- Television-Radio?

If you're willing to give up one hour or more a day we can help you get into the lucrative growth industries of electronics, television, radio.

And if you're already *in*, we can help you get on!

With our know-how and our wide experience in teaching, plus your determination to study, we can turn your interest into the technical knowledge you need for success. Once you've got the qualifications you need, you'll be in a good position to take full advantage of the opportunities which exist today in all fields of electronics - in television (colour and black/white) and in radio. (We teach you the theory and practice of valve and transistor portable circuits while you build your own 5 valve receiver, transistor portable and high grade test instruments).

With ICS you study at home - at your own pace, when you choose, in the time you've got available. Your ICS tutors will give you all the help and encouragement you need to pass any exams you want to take.

Don't waste another day. Take your first step *now* towards a better paid, more assured future. Send for your FREE Careers Guide today.

**ICS** your key to the door  
of opportunity

Tick or state subject of interest and post to:  
International Correspondence Schools, Dept. 231 E.  
Intertext House, Stewarts Road, London SW8 4UJ.

Subject of interest \_\_\_\_\_

- Society of Engineers Graduateship (Electrical Engineering)
- C & G Telecommunications Technicians Certificates
- C & G Electrical Installation Work
- C & G Certificate in Technical Communication Techniques
- MP1 General Certificate in Radio Telegraphy
- Audio, Radio & TV Engineering & Servicing
- Electronic Engineering, Maintenance, Engineering systems, Instrumentation & Control systems
- Computer Engineering and Technology
- Electrical Engineering, Installations, Contracting, Appliances
- Self-build radio courses

Name \_\_\_\_\_

Address \_\_\_\_\_

Occupation \_\_\_\_\_

Age \_\_\_\_\_

Accredited by the Council for the Accreditation of Correspondence Colleges

## QUALITY COMPONENTS - BUDGET PRICES

### PSYCHEDELIC LIGHTING UNIT IN KIT FORM

Make this fascinating three-channel unit from a kit which contains all components needed to produce a reliable and entertaining display. Takes its drive from the speaker terminals of a record player, tape recorder or portable radio. Will provide a brilliant 2Kw of light, using normal 240 volt coloured lamps. Price per kit ... £3.45

### HALF PRICE CABINET OFFER

As a special introductory offer, one of the metal cabinets described below will be supplied with each kit at the additional price of only 70p. At this fantastic give-away price, stocks of cabinets are certain to disappear fast, so send your order today to avoid being disappointed. Please note that this special offer is not available separately.



### METAL CABINETS

These attractive steel cabinets are PVC covered in a range of colours, and offer a really economically-priced unit for the home constructor. The chassis, which has a white PVC finish, provides an easily accessible building area, with an integral fascia panel. The cabinet is supplied complete with rubber feet.

Colours available include Green, Grey, Black, White, Blue and Brown. Every effort will be made to supply a selected colour, but please give alternatives if possible.

Approximate size in inches

l	w	d	Price
7	6	3	£1.45
11	6 1/2	3	£1.85

Other sizes to special order. Please send S.A.E. for quotation.

### FIXED VOLTAGE REGULATORS

T03 case. Gives stabilized supply. MVR 5 volt, MVR 12 volt, MVR 15 volt. All priced at ... £1.50

### CONTACT FLUID PEN

Contains a special oil which cleans and lubricates contacts and bearings. Helps to eliminate arcing. Supplied in a snorkel dispenser with pocket clip. Price each ... 55p

Our CATALOGUE, priced at 25p post free, shows the majority of the R.S. range of professional components. Most of these are available by return of post.

All orders over 50p POST FREE. S.A.E. with all queries please.

**CELECTRON-E**  
P.O. Box No. 1, Llantwit Major, Glamorgan, Wales, CF8 9YN

# ELECTROKIT

**DRILL SPEED CONTROLLER** (E.E. Aug. 1972)  
Complete kit includes MK box, plate and socket £2.30

**BIT SAVER** (E.E. Dec. 1972)  
Kit includes all the parts less the Microswitch lever £1.70

**MIGHTY MIDGET** (P.W. Jan. 1973)  
Kit includes all parts less the Battery, the Box or Knob £2.25

### "SCORPIO" CAPACITOR DISCHARGE

**IGNITION SYSTEM** (P.E. Nov. 1971)  
Complete kit with construction data £9.50

### LIGHT DIMMER:

Complete kit including MK plate and full construction data £2.10

We are offering various other kits published in most other popular Electronics magazines and will be pleased to forward details on receipt of a stamped addressed envelope.

FREE POST AND PACKING

## ELECTROKIT

12 Lauderdale Road, London, W.9  
Telephone 01-286 0011

MON.-FRI. 9.30-5.30  
THURS. 9.30-6.30

Everyday Electronics, April 1973

YES, "YOU'VE GOT THE WHOLE WIDE 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 £20.75—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 astounded. Elegant black & chrome finish fascia, set in fabulous Cabinet built case—constructed of fine Russian hardwood in beautiful Teak Veneer finish—prevents vibration, ensures purer & 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 spaceship and satellite 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 & new stations not yet operational, and messages from all over the world! Expensive TURBO 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! Push-button dial illumination! Take it anywhere—runs economically on standard batteries (obtainable everywhere) 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 & spares available for years to come, if ever necessary.) With WRITTEN GUARANTEE manual with simple operating instructions & circuit diagram. ONLY £20.75 (with mains/battery eliminator £1.48 extra). BOX, POST, ETC. 50p. ★ BUT WAIT, for only 55p 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.) HURRY! SHOPERTUNITIES SAVE YOU £2's & £2's!

## THOUSANDS OF MILES REDUCED TO INCHES?

### 1973 RUSSIAN RADIO TECHNOLOGY SHRINKS THE WORLD! \*COMPUTERISED?

**THIS FANTASTIC EARTH SHRINKER**



YES, 24,901 miles SHRUNK TO ONLY 14 x 10 1/2 x 4 1/2 inches approx?

**BRAND NEW FABULOUS ASTRAD 17**

PORTABLE RADIO & COMMUNICATIONS RECEIVER

**WORLD WIDE RECEPTION**  
THOUSANDS OF TRANSMISSION STATIONS FROM IN FRONT OF YOUR CORNERS OF THE EARTH!

"MAGIC EYE" tuning level indicator

**\*COMPARE ITS PERFORMANCE with £80 RADIOS!**

**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!

**THIS OFFER ONLY FROM US!**

**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.)

**BATTERY MODEL: £20.75** BOX POST ETC. 50p

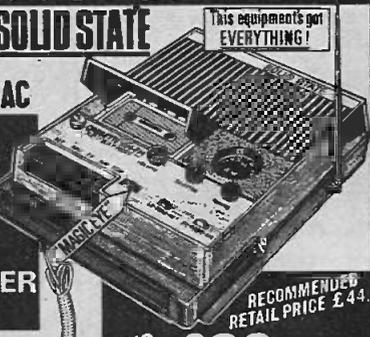
**MAINS/BATTERY ELIMINATOR £1.48 extra**

**BUY ONE FROM US!**

**SAVE £20.25 NOW!**

fabulous BRAND NEW **SOLID STATE** This equipment's got EVERYTHING!

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



RECOMMENDED RETAIL PRICE £44.

**OUR PRICE £23.75** CARR. ETC. 35p

WITH REMOTE CONTROL MICROPHONE

Shopertunities "thunder" ahead with an offer that's FANTASTIC (even by our standards). We've snapped up 500 magnificent machines. Latest sensation in the world of sound! First-class makers! Fabulous VHF, AM, FM Radio AND Cassette Tape Recorder & Player combined & it also runs off standard batteries or mains. (Simply plug in the 220/240V AC line cord.) Record and play back anything, anywhere! RECOMMENDED RETAIL PRICE GENUINELY £44! WE OFFER AT ALMOST HALF PRICE! Wonderful features: ★ Press-button Keyboard Control Panel or latest MASTER SWITCH CONTROL! ★ "MAGIC EYE" Visual Battery check/recording level indicator or built-in automatic Leveller! ★ Separate ON/OFF and HI-LO volume controls! ★ Heavy duty built-in speaker! ★ Earphone (for personal listening or "monitoring") and extension speaker sockets! ★ Remote control microphone! ★ Built-in swivel telescopic extension aerial (24in approx.)! Magnificently made case with carry handle. (DESIGN VARY SLIGHTLY.) Takes standard 30, 60, 90 or 120-minute Cassette Tapes obtainable everywhere. AND the amazing built-in full circuit VHF, AM/FM Radio gives you superb clarity of tone, incredible station selection. Unique rotating Station Selector Dial—gets, locally, city and regional stations in every part of the country plus B.B.C. National, VHF. Picks up dozens of foreign stations. Fabulous in your car! You could pay £44's more for a car Radio or Car Cassette player ALONE! OUR FANTASTIC PRICE ONLY £23.75, CARR. ETC. 35p. Complete with simple instructions, remote control microphone with on/off switch and microphone stand. WITH WRITTEN GUARANTEE. Send quickly, after receiving goods—test 7 days—refund if not delighted. Or call.

**BONUS OFFER:** Batteries and Cassette Tape 25p extra if required.

**FIRST TIME EVER! \*SAVE £14.48!**

**BRAND NEW AC/DC BATTERY/MAINS**

## Cassette TAPE RECORDER & PLAYER



With remote control microphone.

**FIRST CLASS MAKERS**

WE COULD CHARGE UP TO £26.97!

**OUR PRICE £12.49** POST ETC. 31p

THE ONE STEP FORWARD EVERYONE HAS WAITED FOR! NOW a superb de-luxe portable BATTERY/MAINS tape recorder and player—and incredible Shopertunities bring it to you for ONLY £12.49! Due to our cut price we cannot name first-class makers—but rest assured you're getting one of the BEST! Expensive "PIANO KEYBOARD" CONTROL PANEL (or latest MASTER SWITCH control) AND AUTO Matic LEVEL CONTROL. No fiddling with awkward tape and reels, just "slap-in" a cassette and off you go! (Takes 30, 60, or 90 minute standard cassette tapes obtainable everywhere.) Amazing performance ensures perfect tapings and superb reproduction! Remote control microphone. Rapid Rewind! Fast forward! Beautiful tone from a whisper to a roar! Completely self contained—record anywhere, indoors or out! Runs on standard batteries AND 220/240V AC mains. Separate jacks for remote control microphone, etc. Size 9 1/2in x 5in x 2 1/2in approx. Design can vary slightly. With carry handle. WRITTEN GUARANTEE and full instructions. ONLY £12.49 post, etc., 31p. BONUS OFFER (one per customer)—Cassette tape, set of standard batteries AND microphone stand all for 50p extra, if required. Send quickly, after receiving goods test 7 days—refund if not delighted. Or call at either store.

\*ALL PRICES SHOWN ARE CORRECT AT TIME OF PUBLISHING BUT ARE SUBJECT TO POSSIBLE ALTERATION IN THE EVENT OF V.A.T. OR OTHER FACTORS BEYOND OUR CONTROL\*

**SHOPERTUNITIES LTD.**

Dept. EE/18, 164 UXBRIDGE ROAD (facing Shepherds Bush Green), LONDON, W12 8AG. (Thurs. 1, Fri. 7). Also at 37/39 HIGH HOLBORN (opposite Leeson's), LONDON, WC1N 3DJ. (Thurs. 7 p.m.) BOTH STORES OPEN FROM MONDAY TO SATURDAY FROM 9 A.M. UNTIL 6 P.M.

# SEW PANEL METERS

## CLEAR PLASTIC PANEL METERS

USED EXTENSIVELY BY INDUSTRY, GOVERNMENT DEPARTMENTS, EDUCATIONAL AUTHORITIES, ETC.

- LOW COST
- QUICK DELIVERY
- OVER 200 RANGES IN STOCK
- OTHER RANGES TO ORDER

**Type SW.100 100 x 80 mm.**

50μA	£3.80
50-0-50μA	£3.80
100μA	£3.80
100-0-100μA	£3.70
500μA	£3.50
1mA	£3.10
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	£4.15

**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.	£2.60
20V. D.C.	£2.50
50V. D.C.	£2.50
300V. D.C.	£2.50
15V. A.C.	£2.75
300V. A.C.	£2.75
VU Meter	£3.00



**Type SD.640 63.5mm x 85mm Fronts**

50mA	£2.60
500mA	£2.35
50-0-50μA	£2.55
100μA	£2.55
100-0-100μA	£2.55
200μA	£2.55
500μA	£2.35
1mA	£2.35
5mA	£2.35
10mA	£2.35
50mA	£2.35
100mA	£2.35

500mA	£2.35
1 amp.	£2.35
5 amp.	£2.35
10 amp.	£2.35
5V. D.C.	£2.35
20V. D.C.	£2.35
50V. D.C.	£2.35
300V. D.C.	£2.35
15V. A.C.	£2.40
300V. A.C.	£2.40
VU Meter	£2.70

**Type SD.460 46mm x 59.5mm Fronts**

50μA	£2.40
50-0-50μA	£2.35
100μA	£2.35
100-0-100μA	£2.35
200μA	£2.35
500μA	£2.20
1mA	£2.15
5mA	£2.15
10mA	£2.15
50mA	£2.15
100mA	£2.15
500mA	£2.15

1 amp.	£2.15
5 amp.	£2.15
10 amp.	£2.15
5V. D.C.	£2.15
10V. D.C.	£2.15
20V. D.C.	£2.15
50V. D.C.	£2.15
300V. D.C.	£2.15
15V. A.C.	£2.30
300V. A.C.	£2.30
VU Meter	£2.55

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

**Type MR.85P. 4 1/2in. x 4 1/2in. fronts**

50mA	£3.10
100mA	£3.10
500mA	£3.10
1 amp.	£3.10
5 amp.	£3.10
15 amp.	£3.10
20 amp.	£3.20
20V. D.C.	£3.10
50V. D.C.	£3.10
150V. D.C.	£3.10
50-0-50μA	£3.40
100μA	£3.40
100-0-100μA	£3.30
200μA	£3.20
500-0-500μA	£3.10
500μA	£3.10
1-0-1mA	£3.10
5mA	£3.10
10mA	£3.10

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

50μA	£2.40
100μA	£2.40
100-0-100μA	£2.35
500μA	£2.35
1mA	£2.20
5mA	£2.20
10mA	£2.20
50mA	£2.20
100mA	£2.20
500mA	£2.20
1 amp.	£2.20
5 amp.	£2.20

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

50μA	£3.70
50-0-50μA	£3.00
100μA	£3.00
100-0-100μA	£3.00
200μA	£3.00
500μA	£2.85
500-0-500μA	£2.40
1mA	£2.40
5mA	£2.40
10mA	£2.40
50mA	£2.40
100mA	£2.40
500mA	£2.40
1 amp.	£2.40
5 amp.	£2.40
10 amp.	£2.40
15 amp.	£2.40
20 amp.	£2.40
30 amp.	£2.40
50 amp.	£2.75
5V. D.C.	£2.40

**Type MR.38P. 1 1/2 1/2in. square fronts**

500mA	£1.75
300mA	£1.75
500mA	£1.75
750mA	£1.75
1 amp.	£1.75
2 amp.	£1.75
5 amp.	£1.75
10 amp.	£1.75
3V. D.C.	£1.75
10V. D.C.	£1.75
15V. D.C.	£1.75
20V. D.C.	£1.75
30V. D.C.	£1.75
50V. D.C.	£1.75
100V. D.C.	£1.75
200μA	£1.85
500μA	£1.80
500-0-500μA	£1.75
1mA	£1.75
2mA	£1.75
5mA	£1.75
10mA	£1.75
20mA	£1.75
50mA	£1.75
100mA	£1.75
150mA	£1.75



**Type MR.45P. 2in. square fronts**

50μA	£2.50
50-0-50μA	£2.30
100μA	£2.30
100-0-100μA	£2.30
200μA	£2.30
500μA	£2.05
500-0-500μA	£1.85
1mA	£1.85
5mA	£1.85
10mA	£1.85
50mA	£1.85
100mA	£1.85
1 amp.	£1.85

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



**"SEW" EDGWISE METERS**

Type PE.70, 3 1/7 3/2in. x 1 1/2 3/2in. x 2 1/2in. deep

50μA	£2.40
50-0-50μA	£2.30
100μA	£2.30
100-0-100μA	£2.30
200μA	£2.30

**"SEW" BAKELITE PANEL METERS**

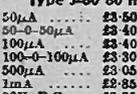
Type MR.65. 3 1/2in. square fronts

1 amp.	£2.15
5 amp.	£2.15
15 amp.	£2.15
30 amp.	£2.15
50 amp.	£2.15
5V. D.C.	£2.15
10V. D.C.	£2.15
20V. D.C.	£2.15
150V. D.C.	£2.15
300V. D.C.	£2.15
50mV. D.C.	£2.40
100mV. D.C.	£2.40
50V. A.C.	£2.20
50V. A.C.	£2.20
150V. A.C.	£2.20
300V. A.C.	£2.20
500mA A.C.	£2.15
1 amp. A.C.	£2.15
5 amp. A.C.	£2.15
10 amp. A.C.	£2.15
50 amp. A.C.	£2.15
150V. A.C.	£2.15
300V. A.C.	£2.15
50 amp. A.C.	£2.15
VU Meter	£3.40



**Type S-80 80 mm. square fronts**

50μA	£2.50
50-0-50μA	£2.40
100μA	£2.40
100-0-100μA	£2.30
500μA	£2.05
1mA	£1.85
5mA	£1.85
10mA	£1.85
50mA	£1.85
100mA	£1.85
1 amp.	£1.85



**"SEW" EDUCATIONAL METERS**

Type ED.107. Size overall 100mm x 90mm x 108mm

A new range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

50μA	£5.50
100μA	£5.10
1mA	£4.85
50-0-50μA	£5.10
1-0-1mA	£4.85
1A d.c.	£4.85
5A d.c.	£4.85
10V d.c.	£4.85
20V. d.c.	£4.85
50V. d.c.	£4.85
300V. d.c.	£4.85
Dual range	
500mA/5A d.c.	£5.10
5V/50V d.c.	£5.10



## POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush. Continuous rating. Wide range ex-stock. Single hole fixing. Fin. dia. shafts. Bulk quantities available.

25 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. 50P. P. & P. 10p.  
50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. £1.15 P. & P. 10p.  
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms. £1.65 P. & P. 15p.

**"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS**  
Excellent quality - Low price - Immediate delivery

£-280 General Purpose Bench Mounting

1 Amp	£7.00
2.5 Amp	£8.06
5 Amp	£11.75
8 Amp	£15.90
10 Amp	£22.50
12 Amp	£23.80
20 Amp	£49.00
25 Amp	£58.00
40 Amp	£82.50

£-280B Panel Mounting

1 Amp	£7.00
2.5 Amp	£8.06

Please add postage

**ALL MODELS**  
INPUT 230 V 50/60 CYCLES  
OUTPUT VARIABLE 0-250 VOLTS  
Special discounts for quantity




**AUTO TRANSFORMERS**  
0/115/220V. Step up or step down. Fully shrouded.

80 W	£2.10	P. & P. 18p
150 W	£2.70	P. & P. 18p
300 W	£3.30	P. & P. 23p
500 W	£5.25	P. & P. 33p
1000 W	£7.50	P. & P. 38p
1500 W	£10.20	P. & P. 43p
2250 W	£17.25	P. & P. 60p
5000 W	£35.00	P. & P. £1



**MCA.220 AUTOMATIC VOLTAGE STABILISER**

Input 88 125 VAC or 176 250VAC. Output 120V AC. or 240 VAC. 200 VA rating. £11.97, carr. 50p.



**BH.001 HEAD SET AND BOOM MICROPHONE**

Moving Coil. Ideal for language teaching, communications. Headphone imp. 16 ohms. Microphone imp. 200 ohms. £4.62. P. & P. 15p.



**240° Wide Angle IMA Meters**

MW 1-6 60mm square £3.97  
MW 1-8 80mm square £4.97

P. & P. extra



**RP214 REGULATED POWER SUPPLY**

Solid state. Variable output 0-24V DC up to 1 amp. Dual scale meter to monitor voltage and current. Input 220/240V AC. Size 185 x 85 x 105mm. £29.97 P. & P. 25p.



**PS.200 REGULATED P.S.U.**

Solid state. Variable output 5-20 volt D.C. up to 2 amp. Independent meters to monitor voltage and current. Output 220/240 V. A.C. Size 7 1/4" x 5 1/2" x 3 1/2". £14.97. P. & P. 25p.



**PS.1000B REGULATED POWER SUPPLY**

Solid state. Output 6, 9 or 12 volt DC up to 3 amps. Meter to monitor current. Input 220/240V AC. Size 4" x 3 1/2" x 6 1/2". £11.97. P. & P. 25p.



**230V/240V SMITHS SYNCHRONOUS GEARED MOTORS**

Built in gearbox. All brand new and boxed. 30 RPH CW: 2 RPH CW: 20 RPH CW: 2 RPH CW: 30 RPH CW: 50 RPH CW: 12p.



**LB4 TRANSISTOR TESTER**

Tests PNP or NPN transistors. Audio indication. Operates on two 1.5v batteries. Complete with all instructions, etc. £4.50. P. & P. 20 p.



**LB3 TRANSISTOR TESTER**

Tests IGO and B. PNP / NPN. Operates from 9V battery. Complete with all instructions, etc. £3.85. P. & P. 20p.



**HOMER INTERCOMS**

Ideal for home, office, stores, factories, etc. Supplied complete with batteries, cable and free instructions.

3 Station. £2.97. 3 Station £5.25. P. & P. 15p.  
4 Station £8.02. P. & P. 17p.



SEND SAE FOR LIST OF SEMI CONDUCTORS & VALVES

G. W. SMITH & CO. (RADIO) LTD.  
Also see next three pages

# MULTIMETERS for EVERY purpose!

# Selected TEST EQUIPMENT



**TS60 POCKET MULTIMETER**  
High-precision at low-cost.  
Ranges: D.C. 15V, 150V, 1,500V (10,000 oppv), A.C. 15V, 150V, 100V (1,000 oppv), D.C. Current 150mA.  
Resistance 100k ohms.  
\$1.85. Post 15p.

**ROUND SCALE TYPE PENCIL TESTER MODEL T.S.48**  
Completely portable, simple to use pocket sized tester.  
Ranges 0/3/30/300V 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.  
\$3.75. Post 20p.

**MODEL 1092 TESTMETER**

6,000 O.P.V.  
0/3/15/150/300/1200 V. D.C. 0/8/30/300/600V A.C. 0/300µA/300 mA  
0/10K/1 meg Ω  
Decibels -10 to +16db  
\$2.75 each +15p F. & P.



**HIOKI 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.

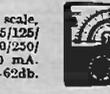
**HIOKI MODEL 730X**

30,000 O.P.V. Overload protection. 6/30/60/300/600/1200 VDC. 12/60/120/600/3000 VAC. 60µA/30 mA/300 mA. 2K/200K/2 megohm. -10 to +62db.  
\$5.50. P. & P. 15p.



**MODEL TE-200**

20,000 O.P.V. Mirror scale, overload protection. 0/5/3/125/1,000V. D.C. 0/10/50/250/1,000V. A.C. 0/50µA/250 mA/0/60K/6 meg Ω. -20 to +62db.  
\$3.85. P. & P. 15p.



**MODEL 500**

30,000 O.P.V. with overload protection mirror scale 0/5/2.5/10/25/100/250/500/1,000V. D.C. 0/2.5/10/25/100/250/500/1,000V. A.C. 0/50µA/5/50/500mA. 12 amp. D.C. 0/60K/6 meg Ω. 80 meg Ω.  
\$8.87. Post paid.



**HIOKI MODEL 750X**

50,000 o.p.v. 43 ranges 0-0.3 to 1,200V D.C. 0-3 to 1,200V A.C. 0-300µA/300mA. 0-3K/30 meg ohms. -10 to +17db.  
\$8.97. Post 20p.



**HT100B4 MULTI-METER**

Features A.C. current ranges. 100,000 o.p.v. Mirror Scale, Overload protection.  
0/5/2.5/10/50/250/500/1000 V. D.C.  
0/2.5/10/50/250/1000 V. A.C. 0/10/250µA/2.5/25/250 mA / 10 Amp. D.C.  
0/100 mA. 0/20K/200K/2 MEG/20 MEG. -20 to +62db.  
\$12.50. P. & P. 25p.



**370 WTR MULTI-METER**

Features A.C. current ranges. 20,000 o.p.v. 0/5/2.5/10/25/50/100 V. D.C. 0/2.5/10/50/250/500/1000V AC 0/50µA/1/10/100mA/1/10 Amp D.C. 0/100mA/1/10 Amp AC 0/5K/50K/500K/5 MEG/ 50 MEG. -20 to +62db.  
\$15. P. & P. 25p.



**RUSSIAN 22 RANGE MULTIMETER**

Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2-5/10/50/300/1000 V. D.C. 2/5/10/50/250/300/1000V A.C. DC Current 100mA/1/10/100mA/1A. Resistance 800 ohms/3/30/300K/3m Ω. Complete with batteries, test leads, instructions and sturdy steel carrying case.  
OUB PRICE \$5.97. P. & P. 25p.



**ARF-300 AF/RF Signal Generator**

All transistorized, compact, fully portable. AF sine wave 15 Hz to 220 KHz. AF square wave 15 Hz to 100 KHz. Output sine/square 10V. P-P. RF 100KHz to 200 MHz. Output 1V. maximum. Operation 220/240V. A.C. Complete with instructions and leads. \$29.95. Post 50p.



**MODEL TH-12**

20,000 o.p.v. Overload protection. 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  
\$4.97. Post 15p.



**MODEL TE-300**

30,000 O.P.V. Mirror scale, overload protection 0/6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30µA/30mA/60mA/300mA/600mA. 0/8K/2.5/80K/800K/8 meg ohm. -20 to +63 db. \$5.97. P. & P. 15p.



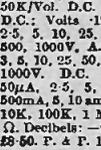
**MODEL PL436**

20k Ω/Volt D.C. 8k Ω/Volt AC. Mirror scale. 6/3/12/30/120/600 V. D.C. 0/120/120/600 V. A.C. 50/600µA/60/600 mA. 10/100K/1 Meg/10 Meg Ω. -20 to +46db.  
\$8.97. P. & P. 12p.



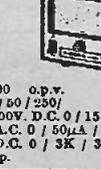
**THK MODEL TW-50K**

40 ranges, mirror scale. 50K/Volt. D.C. 5K/Volt A.C. D.C.: Volts -125, .25, 1.25, 2.5, 5, 10, 25, 50, 125, 250, 500, 1000V. A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50mA. 2.5, 5, 25, 50, 250, 500mA. 5, 10 amp. Resistance: 10K, 100K, 1 MEG, 10 MEG Ω. Decibels: -20 to +81.5db  
\$8.60. P. & P. 17p.



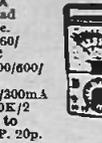
**MODEL KZ28A**

Auto band suspension. Overload protection. Polarity reversing switch. 30,000 o.p.v. 0 / 5 / 2.5 / 15 / 60 / 250 / 500 / 1000V. D.C. 0 / 15 / 50 / 150 / 500 / 1000V. A.C. 0 / 50µA / 5 / 50 / 150 / 500mA / 5A D.C. 0 / 3K / 300K / 3 meg Ω.  
\$8.96. Post 20p.



**HIKO MODEL 700K**

100,000 O.P.V. Overload protection. Mirror scale. 5/6/12/21/5/6/12/30/60/120/300/600/1200V DC 1/5/3/12/30/60/100/300/600/1200 V. A.C. 15/30µA/3/6/30/60/150/300mA 6/12 AMP. DC. 2K/200K/2 MEG/20 Meg ohm -20 to +63db. \$13.50. P. & P. 20p.



**MODEL C-7080 EN**

Giant o.p.v. mirror scale. 20,000 o.p.v. 0 / .25 / 1 / 2.5 / 10 / 50 / 250 / 1000 / 5000V. D.C. 0 / 2.5 / 10 / 50 / 250 / 1000 / 5000V. A.C. 0/30µA/1/10/100/500mA/10 amp. D.C. 0 / 2K / 200K / 20 meg Ω. -20 to +50 db.  
\$18.95. Post 35p.



**U4312 MULTIMETER**

Extremely sturdy instrument for general electrical use. 687 o.p.v. 0/3/15/7.5/20/60/150/300/600/900 VDC and 75mV. 0/3/15/7.5/30/60/150/300/600/900 VAC. 0/300µA/1.5/8/15/60/150/600mA/1.5/8 AMP. D.C. 0/2/5/15/30/150/600mA/1.5/8 AMP. A.C. 0/250Ω/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.



**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.  
\$7.60. Post 20p.



**Model S-100TR TRANSISTOR TESTER**

100,000 o.p.v. mirror scale/overload protection. 0/12/6/3/12/30/120/600 V DC. 0/6/30/120/600. V AC. 0/12/600µA/12/300mA/12 AMP DC. 0/10 K/1 MEG/100MEG. -20 to +50db. 0.01-2 MFD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. \$12.50. P/P 25p.



**MODEL 449A IN CIRCUIT TRANSISTOR TESTER**

Checks true A.C. beta in / out. Checks Ico. Checks leakage diodes in / out. Checks SCR, etc. Beta HI 10 - 500. LO 2 - 50. Ico 0-5000µA. 220/240 V. A.C. operation.  
\$17.50. Post 25p.



**TE-200 RF SIGNAL GENERATOR**

Accurate wide range signal generator covering 120 Kc/s 500 Mc/s on 5 bands. Directly calibrated Variable R.F. attenuator, audio output. Xial socket for calibration. 220/240V. A.C. Brand new with instructions \$16. Carr. 37p. Size 140 x 215 x 170 mm.



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



**CI-5 PULSE OSCILSCOPE**

For display of pulsed and periodic waveforms in electronic circuits. Variable AMP. Bandwidth 100KHz. Sensitivity at 100KHz VRMS/ mm. 1-.25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz, V RMS/mm. -3-25; Preset triggered sweep 1-3,000usec; free running 30-200,000usec in nine ranges. Calibrator pipe. 220 x 360 x 430mm. 115-230V. AC operation.  
\$39.00. Carr. paid.



**TO-3 PORTABLE OSCILSCOPE**

3in. tube, Y amp. Sensitivity 0.1v p-p/cm. Bandwidth 0.5 cps-1.5 MHz. Input imp. 2 meg Ω. 25pF X amp. sensitivity 0.9v. p-p/cm. Bandwidth 1-5cps-300KHz. Input imp. 2 meg Ω. 20pF. Time base. 3 ranges 10 cps 200 kHz. Synchronizer. Internal/external. Illuminated scale 140 x 215 x 330 mm. Weight 15lb. 220/240V. A.C. Supplied brand new with handbook. \$40.00. Carr. 50p.



**RUSSIAN CI-16 DOUBLE BEAM OSCILSCOPE**

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



**TE-16A TRANSISTORISED SIGNAL GENERATOR**

5 ranges 400KHz-30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800KHz modulation. 5/4 x 5 1/4 in. Complete with instructions and leads. \$7.87. Post 25p.



**TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE**

A new portable bridge offering excellent range and accuracy at a low cost. Ranges: E. 1Ω 11.1 meg Ω 6 Ranges ±1% L1 M H - 111 HENRY86 Ranges 2 = % C. 0.1pF - 1110mFd 6 Ranges ± 2%. TURNS RATIO 1:1/100-1:1/100. 6 Ranges ± 1%. Bridge voltage at 1,000 cps. Operated on 9 volts. 100µA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 5 1/2 in. \$20. P. & P. 25p.



**MODEL TE 15 GRID DIP METER**

Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440KHz-250Mc/s in 6 coils. 500µA Meter. 9V battery operation. Size 180 x 80 x 40mm.  
\$12.50. Post 20p.



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

Sine 18 x 200,000 Hz; Square 18 x 200,000 Hz Output max. +10 db. (10 K ohms) Operation internal batteries Attractive 2-tone case 7 1/2 x 6 x 2". Price \$17.50. Carr. 17p.



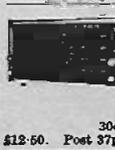
**MODEL MG-100 SINE SQUARE WAVE AUDIO GENERATOR**

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. Attenuator 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.P. \$2.124; H.V. \$2.50.



**MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER**

Sensitivity 330 ohm/Volt AC and DC. Accuracy 5%. D.C. 1% A.C. Scale length 165mm. 0/300/750µA/1.5/3/7.5/15/30/75/150/300/750mA/1.5/3/7.5/15/30/75/150/300/750V DC 0/3/7.5/15/30/75/150/300/750V AC. Automatic out. Supplied complete with test leads, manual and test certificates. \$49.00. Post 50p.



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

**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 8SB. 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 3 bands 200-420 KHz and -55 to 30 MHz. Illuminated slide rule dial. Bandspread. Aerial tuning B.F.O. AVC. ANL. 8" meter. AM/CW/8SB. Integrated speaker and phone socket. Operation 220/240v AC or 12v DC. Size 3 1/2 x 2 1/2 x 1 1/2 in. Complete with instructions and circuit. \$32.50. 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. 8. Meter. Bandspread. 2F Gain. 15" 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**

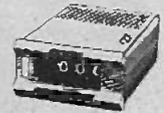
4 band covering 550Kc/s to 30 Mc/s. continuous and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. 8SB-CW. ANL. Variable BFO. 8 meter. Sep. bandspread dial. IF frequency 455 Kc/s. audio output 15w. Variable RF and AF gain controls 115/250v. A.C. Size: 7" x 12" x 10" with instruction manual. \$49.50. Carr. Paid.

**EMI LOUDSPEAKERS**

Model 350. 13" x 8" with single tweeter/crossover. 90-20,000 Hz. 16 watt RMS. Available 8 or 16 ohms. \$7.25 each P. & P. 37p.  
Model 450. 13" x 8" with twin tweeter/crossover. 55-13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. \$3.62 each. P. & P. 25p.

**HONEYWELL DIGITAL VOLTMETER VT.100**

Can be panel or bench mounted. Basic meter measures 1 volt D.C. but can be used to measure a wide range of AC and DC volt. current and ohms with optional plug in cards. Specification: Accuracy: ± 0.2, ± 1 digit. Resolution: 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: 5 1/2 in. x 2 1/2 in. x 8 3/16 in. AVAILABLE BRAND NEW AND FULLY GUARANTEED. \$35.50. Carr. 50p.



**SINCLAIR IC-12**



List Price £2.98

**OUR PRICE £1.80**  
P. & P. 10p

**SINCLAIR EQUIPMENT**



Project 60 Package offers:  
2 x Z30 amplifier, stereo 60 pre-amp, P25 power supply. \$15.95 Carr. 37p. Or with P26 power supply \$18.00 Carr. 37p. 2 x Z50 amplifier, stereo 60 pre-amp, P28 power supply. \$20.25 Carr. 37p.  
Transformer for P28. £2.97 extra.  
Add to any of the above \$4.45 for active filter unit and \$18.00 for pair of Q16 speakers. All other Sinclair products in stock.  
2000 Amp \$21.95 Carr. 37p.; 3000 Amp \$28.50 Carr. 37p.; Nocteric Amp \$43.95. Carr. 37p. IC12 \$1.99 P. & P. 10p.  
NEW PROJECT 605 - £20.97, Carr. 37p.

**EA.41 REVERBERATION AMPLIFIER**

Self contained, transistorised, battery operated. Simply plug in microphone, guitar, etc., and output into your amplifier. Volume control, depth of reverberation control. Beautiful walnut cabinet. 7 1/2 x 3 x 4 1/2 in. \$5.97. P. & P. 15p.

**SPECIAL OFFER! STEREO SPEAKERS**

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

**HA-10 STEREO HEADPHONE AMPLIFIER**

All silicon transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9v battery. Inputs 5MΩ/100MΩ. Output 50mW. \$5.97. P. & P. 15p.

**SPECIAL PURCHASE! NEAT G301 STATIC BALANCE PICK-UP ARMS**



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

**KAMODEN HM-350 TRANSISTOR TESTER**

High quality instrument to test Reverse Leak, current and D.C. 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 0-1,000 Megohms, 500 Volt. Battery operated. Wide range clear meter 4 1/2" x 4". Complete with deluxe carrying case, batteries, instructions. \$19.95. Post 30p.



**AKAI BARGAINS**

**SUPER MONEY SAVING OFFERS— BRAND NEW AND FULLY GUARANTEED**

CASSETTE (P. & P. 50p)		172LL Recorder	\$73.95
CS35 Deck	\$59.50	X5000 Recorder	\$59.95
CS35 Recorder	\$67.00	X201D Deck	\$138.95
CS35/CS88 Speakers	\$82.95	GX220D Deck	\$148.50
GXC40D Deck	\$67.95	GX221D Deck	\$169.95
GXC40 Recorder	\$82.95	GX280D Deck	\$240.40
GXC40T Deck/Receiver	\$128.95	GX370 Deck	\$258.95
GXC45 Deck	\$88.95	TAPE/CASSETTE (P. & P. 75p)	
GXC45D Dolby Deck	\$135.50	GX1900D Deck	\$177.95
GXC48 Recorder	\$115.95	TAPE/CARTRIDGE (P. & P. 75p)	
GXC60D Deck	\$111.95	X1810D Deck	\$169.95
GXC65D Dolby Deck	\$131.25	TAPE/CASSETTE/CARTRIDGE (P. & P. 75p)	
CARTRIDGE (P. & P. 50p)		X2000SD Recorder	\$223.20
CR81 Deck with amps.	\$80.95	MICROPHONES (P. & P. 50p)	
CR81D Deck	\$85.95	ADM.11 Dynamic (pair)	\$7.50
CR81T Recorder/Receiver	\$118.90	RECEIVERS (P. & P. 75p)	
CR808S 4 channel Recorder	\$145.00	AA6300 20 + 20 watt	\$79.95
CR808S 4 channel Recorder	\$121.95	AA8030 25 + 25 watt	\$106.95
TAPE (P. & P. 75p)		AA8050 40 + 40 watt	\$144.95
4000DS Deck	\$78.25	AA6500 65 + 65 watt	\$275.00
4000DS Dust Cover	\$4.75		

**DOLBY SYSTEM NOISE REDUCTION UNIT**



Improves the performance of cassette and semi-professional recorders. Reduces tape hiss by 3dB at 600Hz, 6dB at 1200Hz and 10dB for all frequencies above 3000Hz. Controls for input levels and noise reduction on record and replay, 2 meters for Dolby level. On tape monitoring. Frequency response: 20Hz to 15kHz ± 1dB. Impedance - 8ΩB. Size 10 1/2" x 8" x 3 1/2". AC 200/250V. OUR PRICE £32.50 Carr. 50p.

**1021 STEREO LISTENING STATION**

For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching, 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" x 4" x 2 1/2". \$22.85. P. & P. 15p.

**MPT MIXER PREAMPLIFIER**

5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 6 1/2" x 5" x 3". Inputs Mics: 3 x 3mV 50K; 2 x 3mV 600 ohm. Phono reg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K. \$8.97. P. & P. 20p.

**TE-1035 STEREO HEADPHONES**

Low cost high performance stereo headphones. Foam rubber ear cups. Adjustable head-band. 8 ohm impedance 25-18,000 Hz. With lead and stereo jack plug. ONLY \$1.97. P. & P. 15p.

**NEW GARRARD MODULES**



Popular range of Garrard decks with Shure cartridge fitted in deluxe plinth with hinged lid.  
SF25 III Module/M75-6 \$23.90  
SF25 Module/M75-6 \$23.95  
AP96 Module/M75-6 \$38.75  
Zero 100S Module/M93E \$52.60  
Carr. 50p extra any item.

**HOSIDEN DH-08S DE-LUXE STEREO HEADPHONES**

Features unique mechanical 2-way units and fitted adjustable lever, controls. 8 ohm impedance 20-20,000cps. Complete with spring lead & stereo jack plug \$7.97. P. & P. 15p.



**KOSS SP.3XC STEREO HEADPHONES**  
Wonderful value and excellent performance combined. Adjustable head-band. 8 ohm impedance. 20-12,000 cps. Complete with lead and plug. ONLY \$27.37. P. & P. 12p.



**HOSIDEN DH-02S STEREO HEADPHONES**  
Low Noise in Library cases.



**SPECIAL OFFER! ROTEL RH700 STEREO HEADPHONES**  
20-20,000Hz. 8-16 ohm. (List \$9.95). OUR PRICE \$8.75. P. & P. 25p.



**TRANSISTORISED FM TUNER**  
6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6 x 4 x 2 1/2 in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88-100Mc/s. Ready built ready for use. Fantastic value for money. \$8.97. P. & P. 12p. Stereo multiplex adaptors \$4.97.

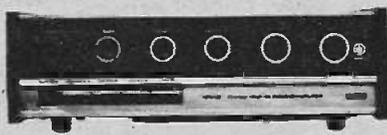


**HAND HELD 2-WAY WALKIE TALKIES**  
Industrial quality in robust metal cases. Battery operation. Volume and squelch controls. Call button and press to talk button. Telescopic aerial. Complete carrying cases.  
2 channel \$52.50 Pair. Post 50p.  
300 mW 300 mW \$52.50 Pair. Post 50p.  
8 channel \$79.50 Pair. Post 50p.  
2 watt. \$79.50 Post 50p.

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

# FANTASTIC OFFER!

## NIKKO TRM 50 STEREO AMPLIFIER



17 + 17 watts rms stereo amplifier with inputs for Magnetic and Crystal phono, Tuner, Tape, Aux and Tape Monitor. Outputs for two pairs of stereo speakers and Type 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**  
Carriage 50p

## NIKKO TRM.50 SYSTEM



NIKKO TRM50 17 + 17 watt rms. stereo amplifier, BSR MP60, plinth & cover, Goldring G800 cartridge, pair of Linton 2 speakers and all leads.

OUR PRICE **£94.95**

Carr. and Ins. £1.50

## LEAK DELTA 30 SYSTEM



Leak Delta 30 stereo amplifier, Goldring GL75, plinth, cover and G800 cartridge. Pair of Leak 150 speakers and all leads.

OUR PRICE **£123.50**

Carr. and Ins. £1.50

## TELETON SAQ206B SYSTEM



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

OUR PRICE **£53.50**

Carr. £1.50

Amplifier only, £22.95. Carr. 50p.

## AUDIOTRONIC ACR.3500 MW/LW CAR RADIO



Fully transistorised, dual waveband. Size 6 1/2" x 4 1/2" x 2". 12v. D.C. Neg. or Pos. earth. Complete with fixing kit, speaker and leads. ONLY £27.50. Post 20p.

## SUPER BARGAIN! AUDIOTRONIC ACP. 8 8-TRACK CAR STEREO TAPE PLAYER



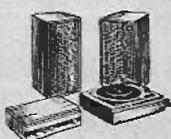
Tone, volume and balance controls. Track selector. Complete with matched pair of stereo speakers, connections and fittings. ONLY £15.95. Post 30p. (Illustration example only).

## BH.001 HEAD SET AND BOOM MICROPHONE



Moving Coil. Ideal for language teaching, communications. Headphone imp. 15 ohms. Microphone imp. 200 ohms. £4.82. P. & P. 15p.

## WHARFEDALE LINTON SYSTEM



Wharfedale Linton Amplifier, Linton Turntable, pair of Linton 2 speakers and all leads.

OUR PRICE **£106.00**

Carr. and Ins. £1.25

LINTON RECEIVER SYSTEM £155.00. Carr. & Ins. £1.25.

## AMSTRAD 8000 II SYSTEM

Amstrad 8000 II 7 + 7 watt amplifier. BSR MP60, plinth and cover, Goldring G800 cartridge, pair of Apollo speakers and all leads.

OUR PRICE **£48.25**

Carr. £1.00

Amplifier only, £16.95. Carr. 50p.



## B.S.R. TD85 8-TRACK STEREO TAPE PLAYER DECK

Integrated preamps (output 125 mV) to feed into any stereo amplifier. Automatic and manual programme selector. 4 pole synchronous motor. 210/240 V.

OUR PRICE **£16.25**

Post 50p

## SPECIAL PURCHASE!

FERGUSON 3414 STEREO TUNER AMPLIFIER TURNTABLE UNIT



10+10 watts rms. Five push buttons with separate scales for pre-tuning to desired FM station. Housed in a handsome walnut finished cabinet with BSR P128/MP60 record deck with Goldring G800H stereo magnetic cartridge. Offered complete with cover and a pair of matching Medway Speakers, size 18" x 11" x 8". TODAY'S VALUE AT LEAST £125!

OUR PRICE **£75.00**

Carr. & Ins. £1.50.

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

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



## SAVE £££'s PHILIPS GA308 TRANSCRIPTION TURNTABLE

2 speeds 33 1/3 and 45 rpm. Lightweight tubular counterbalanced arm. Belt driven low speed synchronous motor. Viscous damped pick up lift lower device. Complete with teak plinth and hinged cover.



GA308 PU with GP400 stereo magnetic cartridge (List Price £47.65). OUR PRICE £29.95 P. & P. 50p. LIMITED NUMBER ONLY!

## ROTEL BARGAINS!

All brand new and guaranteed



RA210 Amp ... £22.50  
RA310 Amp ... £34.95  
RA610 Amp ... £51.95  
RX150 Receiver ... £45.95  
RX200 Receiver ... £57.50  
RX400 Receiver ... £70.95  
P. & P. 50p extra any item.

## WHARFEDALE MID-RANGE HI-FI UNITS

As used in world famous system. 5" dia. Impedance 4/8 ohms. High flux ceramic magnet, 20 watts rms. Brand new £1.50. Carr. 37p.



## HOMER INTERCOMS

Ideal for home office, stores, factories, etc. Supplied complete with batteries, cable and free instructions.

2 Station, £2.97, 3 Station £5.25, P. & P. 15p  
4 Station £8.62, P. & P. 17p.

## CREDIT TERMS FOR CALLERS ACCESS & BARCLAYCARD WELCOME

## V.A.T. INFORMATION

All mail orders received on or after April 1st. will be subject to Value Added Tax.

THIS MUST BE ADDED TO THE TOTAL VALUE OF GOODS ORDERED (INCLUDING POSTAGE/CARRIAGE) AND ENCLOSED WITH ORDER.

## RECORD DECKS (P. & P. 50p)

B.S.R. McDONALD	
C114 Mini	£4.97
C129 Mono	£8.50
C137	£8.95
MP90	£9.50
810	£12.95
810	£31.25
210/TPD3	£8.75
MP60/G800	£12.95
MP60/TPD1	£18.05
MP60/TPD1/G800	£19.50
MP60/TPD2	£14.85
610/TPD1	£18.95
510/TPD1	£17.95
HT70	£18.99
HT70/G800	£17.25
HT70/TPD1	£20.35
HT70/TPD1/G800	£23.90
810 Plinth/Cover	£9.25



GOLDRING	
GL69/2	£18.50
GL72	£28.95
GL73/P	£27.50
Plinth 69/72	£7.00
LID 72	£2.25
GL75	£28.95
GL75P	£25.25
Plinth 75	£7.85
LID 75	£3.00
G99	£19.25
GL85P/C	£58.95
G101P/C	£20.50

LEAK Delta Turntable £52.50

MICRO-SEIKI MR111 £29.50  
MR111 Plinth & Cover £9.50

PHILIPS GA105 £16.95  
GA160 £27.00  
GA308PU Teak £29.95  
GA212 £56.75

FLONER PL12D £34.50  
PL13C £51.36  
PLA35 £82.95  
PL30 £113.25  
PLA1D £118.50  
PL61 £119.95

THORENS TD125 II £86.50  
TD125AB II £99.95  
TX25 £6.98  
TD160C £56.98  
TD150A II £35.98

WHARFEDALE Linton Turntable £26.95

PLINTH & COVERS (P. & P. 50p)  
Budget SP25, etc. £2.50  
Budget AP76/Zero 1008 £3.25  
Budget B.S.R. £34.50  
SME 2000 System

## RECORD DECK PACKAGES (P. & P. 50p)

Decks supplied with stereo cartridge ready wired in plinth with cover.



GARRARD	
2023TC/STAHCD	£12.75
SP25 III/G800	£18.50
SP25 III/M44-7	£19.75
SP25 III/M44-E	£20.95
AP76/M35E	£22.40
AP76/G800	£27.95
AP76/M55E	£30.50
AP76/M75EJ	£32.50
AP76/G800E	£34.75
AP76/M44E	£35.50
AP76/M75ED	£38.95

B.S.R. McDONALD MP60/G800 £17.50  
MP60/M44-7 £18.95

GOLDRING GL75/G800 £39.50  
GL75/G800E £42.50

10 TOTTENHAM CT. RD LONDON, W1  
27 TOTTENHAM CT. RD. LONDON, W1  
257/258 TOTTENHAM CT. RD. LONDON, W1  
3 LISLE STREET, LONDON, W.C.2  
34 LESTER STREET, LONDON, W.C.2  
31 EDGWARE ROAD, LONDON, W.2

Tel: 01-637 2232  
Tel: 01-636 3715  
Tel: 01-580 0670  
Tel: 01-637 2204  
Tel: 01-437 9155  
Tel: 01-262 0387

All Mail Orders to: 11-12, Paddington Green, London, W.2  
Tel: 01-282 5662

# G.W. SMITH & CO (Radio) LTD

Personal Callers Welcome - All Branches Open 9-6 Mon. to Sat.

# everyday electronics

PROJECTS.  
THEORY...

## COMPLICATED OR SIMPLE

In the popular mind anything described as "electronic" is still, all too commonly, interpreted as being necessarily of frightening complexity, and possessing deep secrets capable of being unravelled only by highly trained minds. The truth is, of course, that electronics *can* be fantastically complicated, but equally it can be delightfully simple.

Really it all boils down to a question of the kind and nature of service or function required, the degree of accuracy demanded, and any need to withstand special or particularly arduous environmental conditions. Electronic circuitry comes in all shapes and sizes, but the most highly involved and sophisticated designs rely upon precisely the same basic ideas as do the smallest and most modest of designs.

## AN INCENTIVE

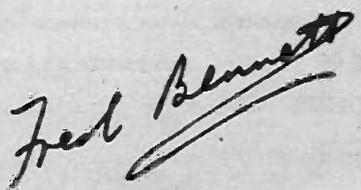
Designs for home constructors presented in this magazine come in the latter class. All EVERYDAY ELECTRONICS circuits are simple, and without any elaboration not strictly essential for the function they are intended to perform. Most importantly, they are good examples of uncomplicated circuits *applied to meet real everyday needs of ordinary people*. Needs that the electronic equipment manufacturers hardly even recognise, let alone attempt to satisfy. (To be fair, because of their novel character and sometimes

rather individualistic appeal, many of these projects are not altogether suitable for mass production operations.) So the private person has an additional incentive to build his own gadgets, and pieces of equipment. The alternative, so often, is to go without.

## WITH INTEREST

In the prevailing climate of ever-rising prices, it is worth reflecting on the large number of varied designs which can be built for a few pounds. As we have well demonstrated in these pages, this hobby need not involve any great outlay, but the amount expended will be amply returned—with interest.

Talking of interest, whoever embarks upon electronic construction—however simple—gains an insight into a tremendously fascinating world of technology. From quite modest beginnings, anyone can easily develop their interest and set out to acquire greater knowledge of this powerful technology which is rapidly assuming greater influence over every one of us, in all aspects of modern life.



Our May issue will be published on Thursday, April 19

EDITOR F. E. Bennett ● ASSISTANT EDITOR M. Kenward ● B. W. Terrell B.Sc.  
ART EDITOR J. D. Pountney ● P. A. Loates ● S. W. R. Lloyd  
ADVERTISEMENT MANAGER D. W. B. Tilleard

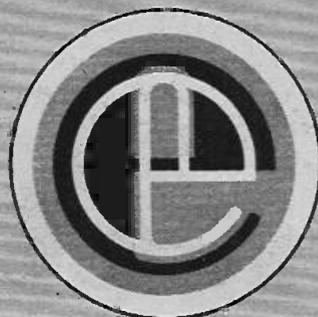
© IPC Magazines Limited 1973. Copyright in all drawings, photographs, and articles published in EVERYDAY ELECTRONICS is fully protected, and reproduction or imitations in whole or part are expressly forbidden.

All reasonable precautions are taken by EVERYDAY ELECTRONICS to ensure that the advice and data given to readers are reliable. We cannot, however, guarantee it, and we cannot accept legal responsibility for it. Prices quoted are those current as we go to press.

Subscription Rates including postage for one year, to any part of the world, £2.35.

Everyday Electronics, Fleetway House, Farringdon Street, London, E.C.4. Phone: Editorial 01-634-4452; Advertisements 01-634-4202.

..EASY TO CONSTRUCT  
..SIMPLY EXPLAINED



VOL. 2 NO. 4

APRIL 1973

## CONSTRUCTIONAL PROJECTS

<b>GENERAL PURPOSE AUDIO AMPLIFIER</b> For equipment testing or general use by F. C. Judd	182
<b>NIGHT LIGHT SWITCH</b> Simple control to dim a lamp by E. J. Byatt	197
<b>INDICATOR AUDIBLE WARNING</b> For car indicators or warning lamps by P. E. J. Lacey	201

## GENERAL FEATURES

<b>EDITORIAL</b>	180
<b>A LOOK AT THE ELECTRON</b> by S. McClelland	187
<b>BASIC ELECTRICITY</b> Part 6—The Transformer and Domestic Electricity by Maureen Birch	193
<b>PLEASE TAKE NOTE</b>	199
<b>READERS LETTERS</b> Your news, views and questions	204
<b>SHOP TALK</b> Component buying problems by Mike Kenward	206
<b>BRIGHT IDEAS</b> Readers' constructional hints	209
<b>DEMO CIRCUITS</b> 5 The Phase Shift Oscillator by Mike Hughes	210
<b>RUMINATIONS</b> by Sensor	214

### VALUE ADDED TAX

Prices quoted in this issue were correct at time of going to press. From April 1 1973 there will be no purchase tax, but a large number of goods will carry Value Added Tax.

# V.A.T.

# GENERAL PURPOSE

# AMPLIFIER

A 1 watt output audio amplifier, suitable for equipment testing or for general use.

By F. C. Judd.

**A** SMALL amplifier has many applications in the electronic construction workshop or in the home generally and can, in fact, be regarded either as a valuable piece of testing equipment or simply as a piece of audio gear. It can be used for testing or using any radio or electronic equipment that normally has no amplifier e.g., a radio tuner or a signal generator and in other ways such as testing microphones, gramophone pick-ups and tape record/replay units etc. or for guitar practice with electric guitars.

The amplifier described here is quite easy to build even though the circuit may look a little complex because of the mixture of *npn* and *npn* transistors. The amplifier will provide up to 1 watt output into an 8 ohm loudspeaker although any small speaker of say 5 to 15 ohms can be used.

Two inputs are provided one being rated at 5mV which is suitable for low level signal sources such as 200 ohm microphones or guitars whilst the other input, because the impedance is fairly high, can be used for ceramic or crystal pickups, radio tuners or the output from a tape recorder etc.

Both inputs are connected to the first stage of the amplifier via a gain control (VR1) so that signal levels can be adjusted to prevent overloading. The frequency response of the amplifier is -3dB at 100Hz to -3dB at 10,000Hz, not hi fi but certainly very acceptable for many applications.



## CIRCUIT

The circuit is shown in Fig. 1. One input (SK1) is taken via R1 which is an attenuator to provide an input sensitivity of about 500mV and also a fairly high input impedance. The other input (SK2) goes straight to the gain control VR1 and has a sensitivity of 5mV for 1 watt output from the amplifier.

The input transistor (TR1) which is an *npn* type, acts as a pre-amplifier and as a d.c. difference amplifier comparing the voltage derived from the potential dividing network R6, R3 and R2 with the voltage appearing between TR4 emitter and the common earth or positive supply rail. The high loop gain of the circuit keeps the small difference between these two voltages constant so that one has a definite relationship to the other regardless of spreads in the charac-



**Approximate  
cost of  
components  
£4 20 plus case  
and loudspeaker**

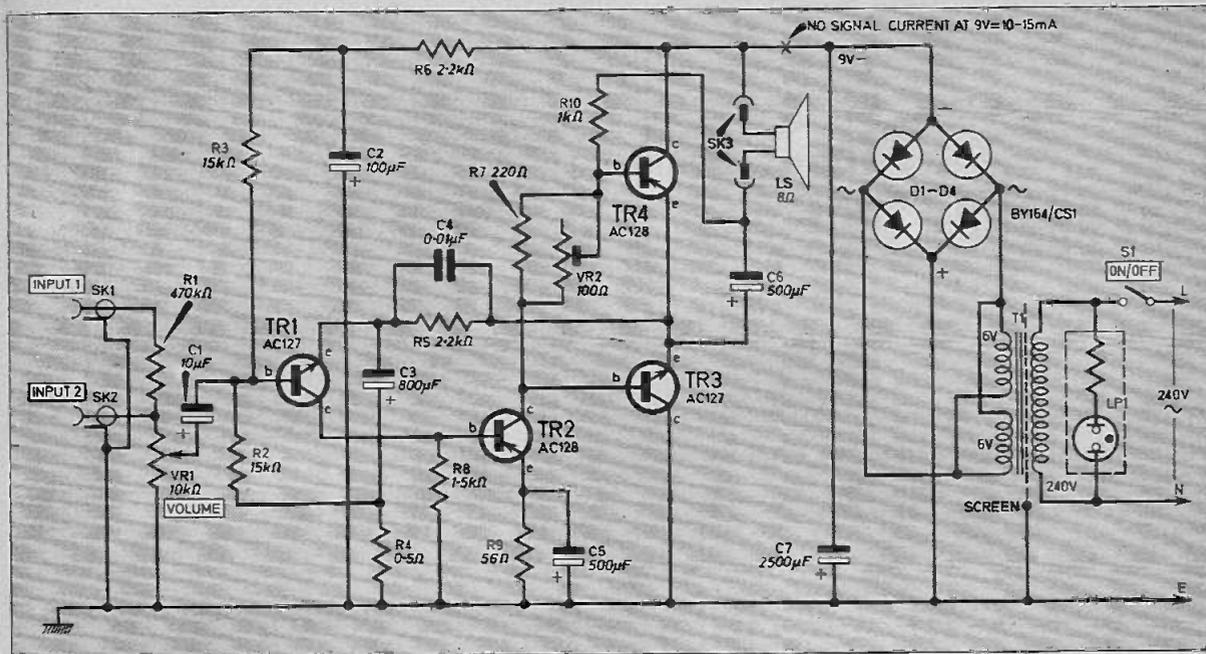


Fig. 1. Complete circuit diagram of the General Purpose Audio Amplifier.

teristics of the transistors and small variations in component values. Negative feedback is taken via R5 and C4 from the output stage to the emitter of TR1.

The amplifier circuit is powered from a 9V positive earth supply provided by transformer T1, the bridge rectifier D1-D4 and smoothing capacitor C7. Note that as the amplifier draws

a fairly large current at peak power levels (for a miniature transformer to supply) the transformer chosen has two 6V secondary windings which are connected in parallel to maintain the peak current requirements. If any transformer other than the one specified is used, it must have a 6V winding capable of supplying about 500mA current.

## Components....

### Resistors

R1 470k $\Omega$	R6 2.2k $\Omega$
R2 15k $\Omega$	R7 220 $\Omega$
R3 15k $\Omega$	R8 1.5k $\Omega$
R4 0.5 $\Omega$	R9 56 $\Omega$
R5 2.2k $\Omega$	R10 1k $\Omega$

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

### Capacitors

C1 10 $\mu$ F elect. 12V
C2 100 $\mu$ F elect. 12V
C3 800 $\mu$ F elect. 12V
C4 0.01 $\mu$ F
C5 500 $\mu$ F elect. 12V
C6 500 $\mu$ F elect. 12V
C7 2,500 $\mu$ F elect. 12V

### Variable Resistors

VR1 10k $\Omega$ log. carbon
VR2 100 $\Omega$ skeleton preset

### Semiconductors

TR1 AC127	germanium <i>npn</i>
TR2 AC128	germanium <i>ppn</i>
TR3 AC127	germanium <i>npn</i>
TR4 AC128	germanium <i>ppn</i>

SEE  
**SHOP  
TALK**

D1-D4 BY154/CSI or similar 50V, 0.5A bridge rectifier.

### Miscellaneous

SK1	Single phono socket
SK2	Single phono socket
SK3	Two-way connector for LS1
LS	8 $\Omega$ 5 to 8 inch moving coil loudspeaker capable of handling 1W. (5 to 15 $\Omega$ can be used).
T1	240V primary 6V, 500mA secondary, (Eagle type MT280 or similar—see text).
S1	Single pole mains on, off switch.
LP1	Mains neon indicator (incorporating resistor)

Case, 7 x 5 x 3 inches—universal chassis parts CU158 (2 off), CU145 (2 off), CU147 (2 off), control knob, heatsink clips, standard TO1 type (2 off), 0.15 inch matrix plain perforated Veroboard, 5 x 4 $\frac{1}{2}$  inches and 3 $\frac{1}{2}$  x 2 $\frac{1}{2}$  inches, aluminium angle for fixing brackets, connecting wire, 3 core mains lead and fused plug, 4BA fixings.

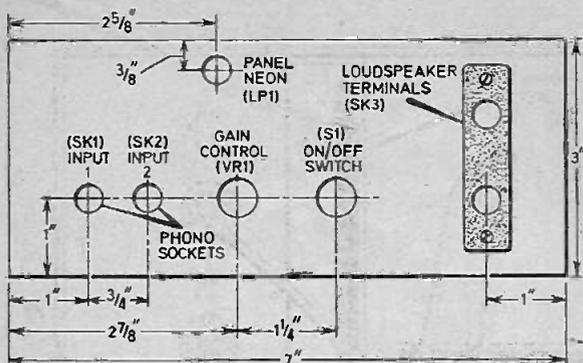


Fig. 2. Front panel details.

Fig. 3. Layout and wiring of the amplifier component board.

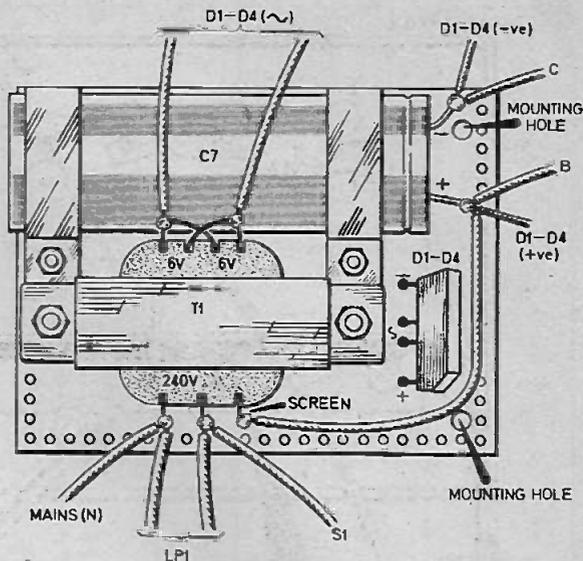
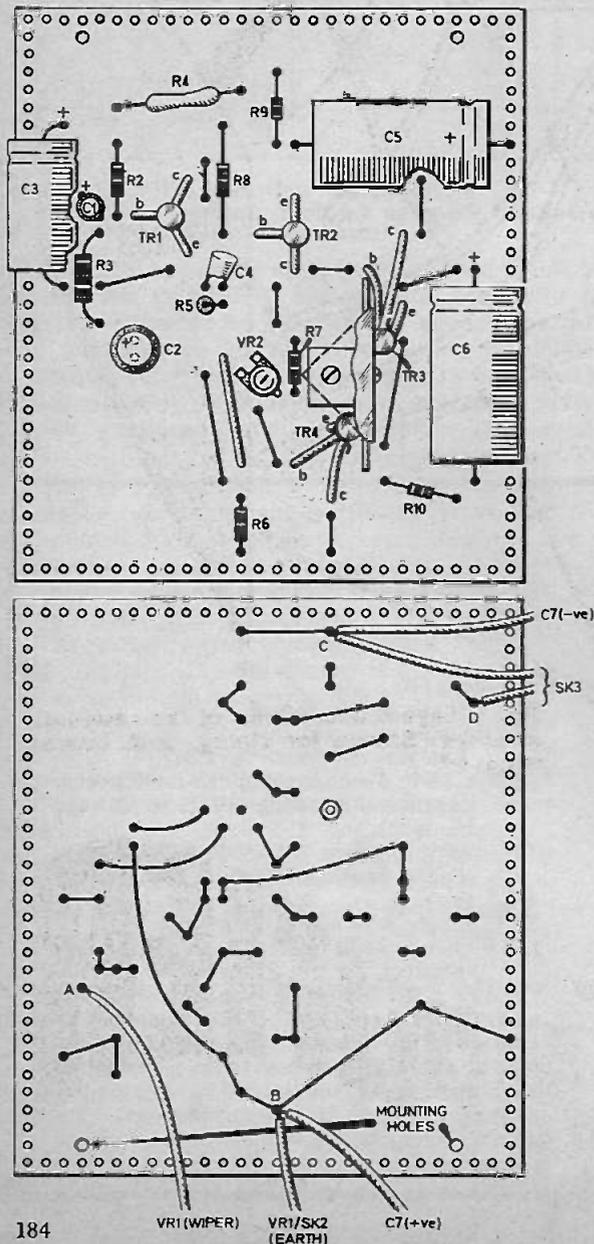


Fig. 4. Layout and wiring of the power supply.

## CONSTRUCTION

The prototype, as shown in the photographs, and Figs. 2 to 5, was housed in a box measuring 7 x 5 x 3 inches made from Home Radio universal chassis parts. Any similar size box can be used. The front panel, which carries the amplifier and power supply circuit boards, as well as input sockets and gain control should be made up as shown in Fig. 2.

The amplifier itself is arranged on a plain perforated circuit board measuring 5 x 4 1/2 inches, as shown in Fig. 3. Great care must be taken over wiring because of the d.c. coupling used throughout and because two transistors are *pnp* and two are *nnp* and can only be differentiated by their type number viz: TR1 and TR3 are *nnp* (AC127) and TR2 and TR4 are *pnp* (AC128). Connections are shown in Fig. 3 together with details of the heatsink for TR3 and TR4. Double check the wiring and particularly the position and connection of the transistors.

The small heatsink used on TR3 and TR4 is not suitable for continuous operation when the amplifier is enclosed in the aluminium case. To overcome this a small bracket should be fixed to the heatsink and this bracket screwed to the case by means of a self tapping screw. This will ensure that the unit is kept cool at all times.

The power supply is assembled on a circuit board measuring 3 1/4 x 2 3/4 inches as shown in Fig. 4. This is fairly straight forward but note the parallel connection of the two 6V secondary windings of the MT280 transformer T1.

The two circuit boards are positioned as shown in the photographs and wired up as shown in Fig. 5, which also shows the connections to the panel components; VR1 (gain control), the two input sockets, the loudspeaker terminals and mains on-off switch etc.

FRONT PANEL

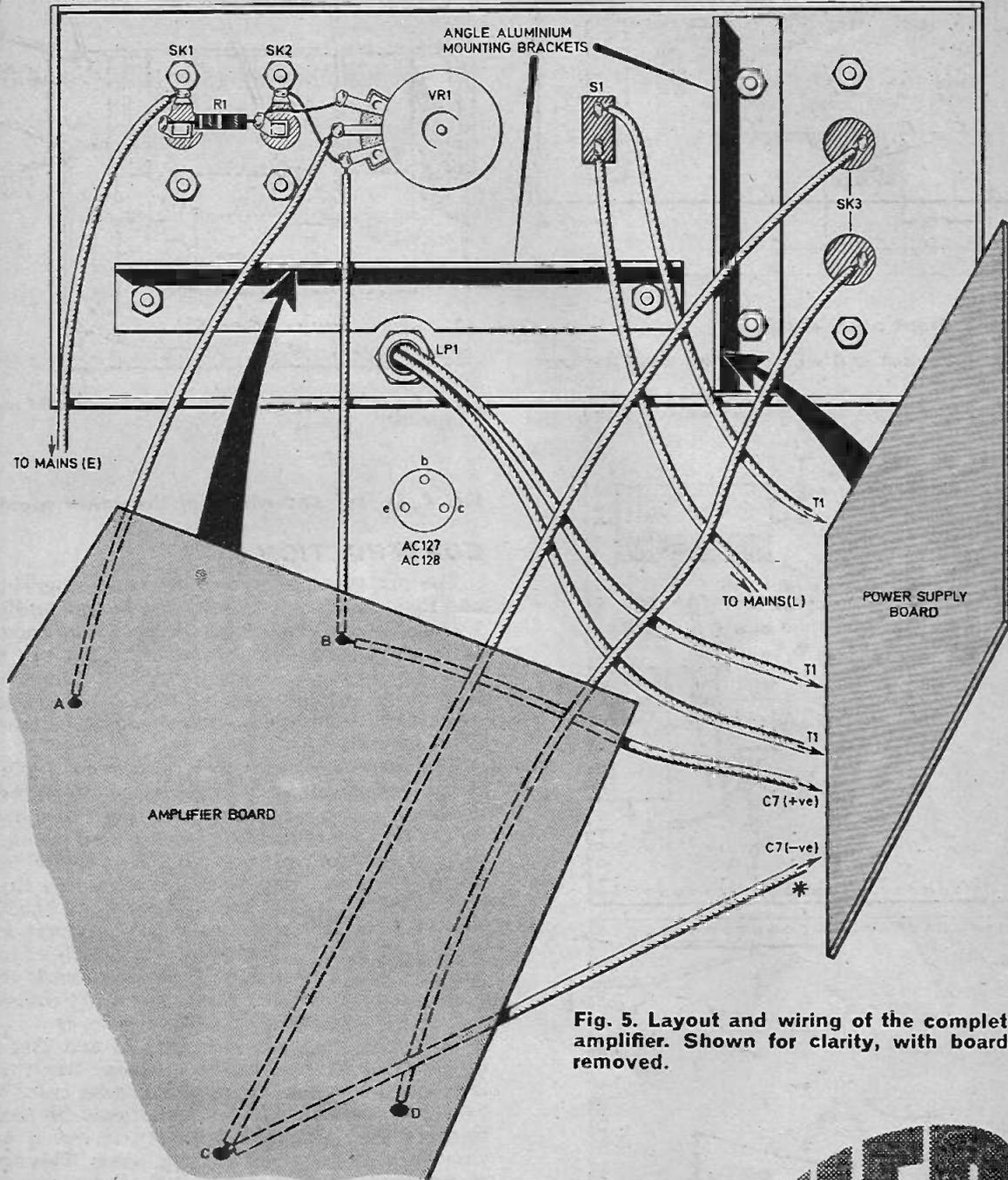
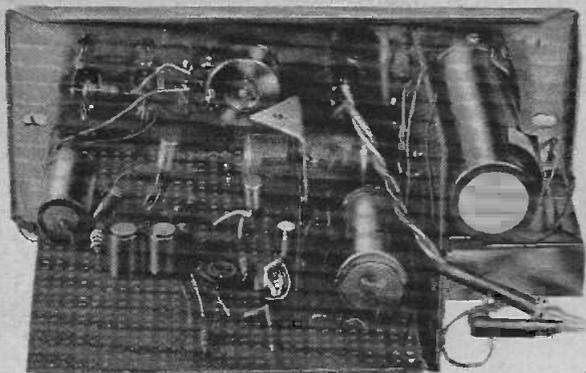


Fig. 5. Layout and wiring of the complete amplifier. Shown for clarity, with boards removed.

# GENERAL PURPOSE

# AMPLIFIER



## TESTING

It would be best to first check the power supply voltage by disconnecting the negative rail from the amplifier board and measuring the voltage between the power supply negative and positive i.e., across C7. This should be about 9V.

If a milli-amp meter is available connect at the starred point in Fig. 5 i.e., between the power supply negative (C7) and the negative rail of the amplifier board. With the supply on and with VR1 turned off, the current to the amplifier should be set to about 12mA by adjusting the preset VR2. If no milli-amp meter is available set VR2 with its slider to midway position.

Those able to check voltage and current should be able to obtain readings approximately equal to those shown in Table 1.

**Table 1: Amplifier Test Measurements**

Measurement	Current
Supply standing current (no input signal)	10- 15mA
Supply current (maximum power output)	100-150mA
Measurement (no input)	Voltage
Supply	9V
TR1 base	4V
emitter	4.2V
collector	0.4V
TR2 base	0.4V
emitter	0.25V
collector	4.8V
TR3 base	4.8V
emitter	4.9V
collector	0V
TR4 base	5.2V
emitter	4.9V
collector	9V

As mentioned earlier the loudspeaker may be any small 5 or 8 inch type of 5, 8, or 15 ohms impedance (preferably 8 ohms for optimum performance) capable of handling 1 watt. It should be housed in a suitable enclosure which may be a plywood box of about 12 by 12 inches (front) by about 6 inches deep and closed in at the back. The amplifier will operate well with the *MW/LW Radio Tuner* (described in September 1972 E.E.) and could be used for monitoring during tape recording as well as the various applications outlined at the beginning of this article.

## SAFETY

When operating the amplifier the loudspeaker should not be disconnected, nor should the output be short circuited as this could result in damage to the output transistors.

The amplifier should be connected to the mains supply by way of a three core mains lead and a mains plug fused at  $\frac{1}{2}$  amp. The chassis of the amplifier should be earthed as shown and the unit should not be used with any a.c./d.c. equipment such as a television or older type valve record player, unless it is fitted with proper amplifier output socket. □

# Good Companions...

# PE



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

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

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

The April issue of P.E. is now on sale. It includes these two simple projects,

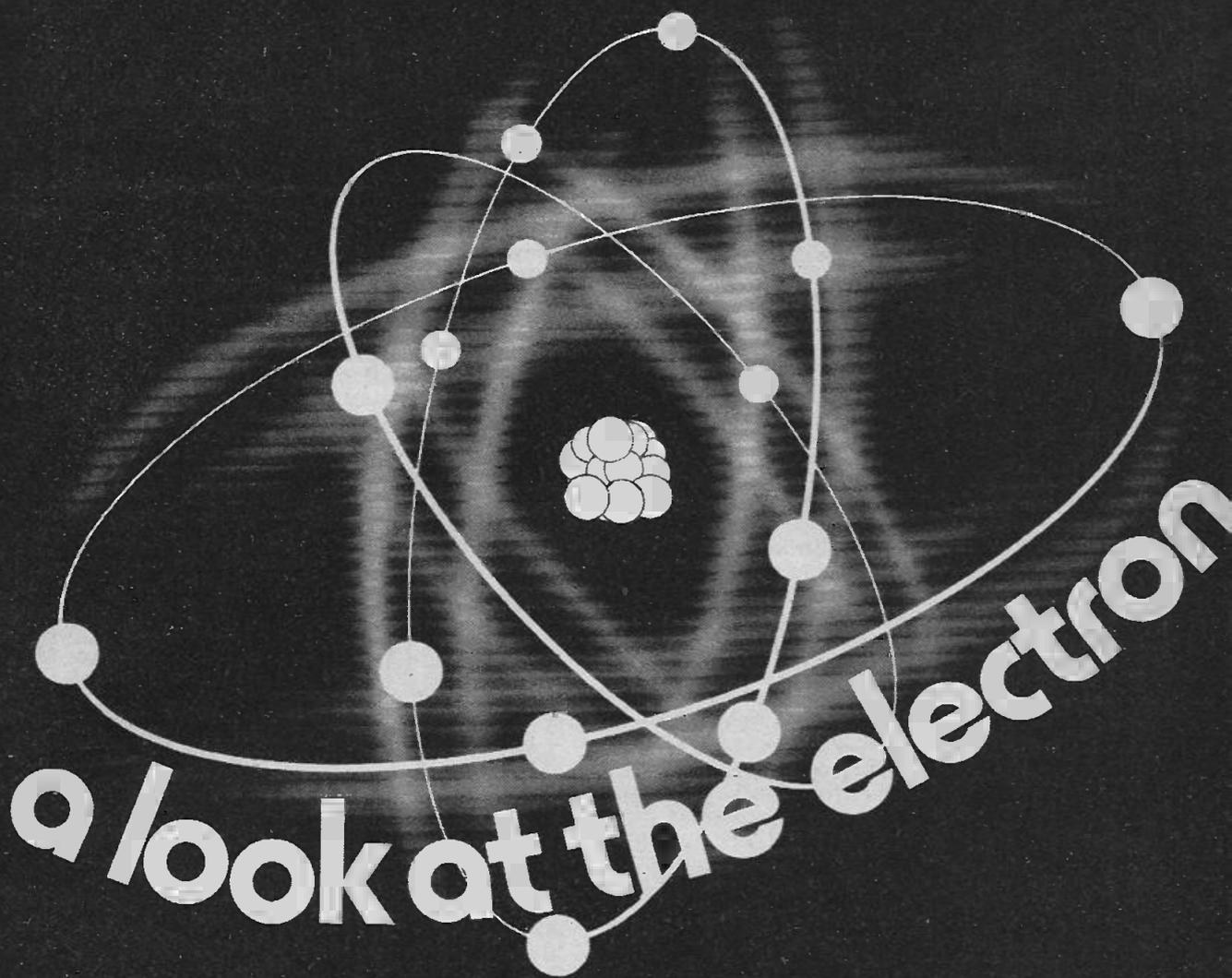
**A Security Alarm for the home**  
**A Mains Powered Battery Eliminator.**

The May issue of P.E. on sale April 13 will feature 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.

This issue will also contain a **Free Wall Chart** giving details of electronic display devices.

To avoid possible disappointment, place an order with your newsagent now.

PRACTICAL  
**ELECTRONICS**



# a look at the electron

By S. McClelland

**E**LECTRONICS is based on the behaviour of but one particle—the *electron*. However, this single particle is fascinating and so some features of its strange world will be briefly examined.

## THE ATOM AND THE ELECTRON

All matter is made up of atoms which in turn are composed of equal numbers of extremely minute positive charges (protons) in a central nucleus and negative charges (electrons) which circle around it rather like planets in a miniature solar system, so that the atom as a whole is electrically neutral.

Thus, it is mainly empty space—its diameter can be over 10,000 times that of the nucleus where most of the mass is concentrated. For example, consider Fig. 1, which shows the simple structure of an atom of sodium.

It will become apparent that atoms of different elements (e.g. sodium and carbon) are distinguished by their different numbers of protons, and hence, electrons.

The other particles in the nucleus with no charge, and called neutrons, need not concern us here since they only effect the mass of the atom and not its electrical properties.

## ENERGY LEVELS

Sodium has 11 protons, 11 electrons, and 12 neutrons. Work by the great physicist, Niels Bohr, in 1915, showed that the electrons in, for example, an atom of sodium, can only move in certain, well-defined orbits, each of which is associated with a particular energy, but that they can transfer from one to another of these so-called *energy levels* under certain circumstances if they could lose or gain a definite or

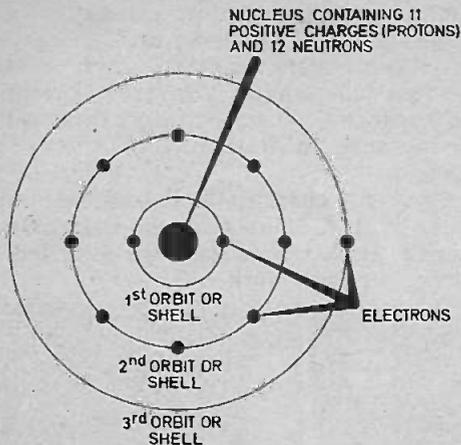


Fig. 1. The spatial arrangement (schematic) of electrons in an atom of sodium.

discrete amount of energy in the process.

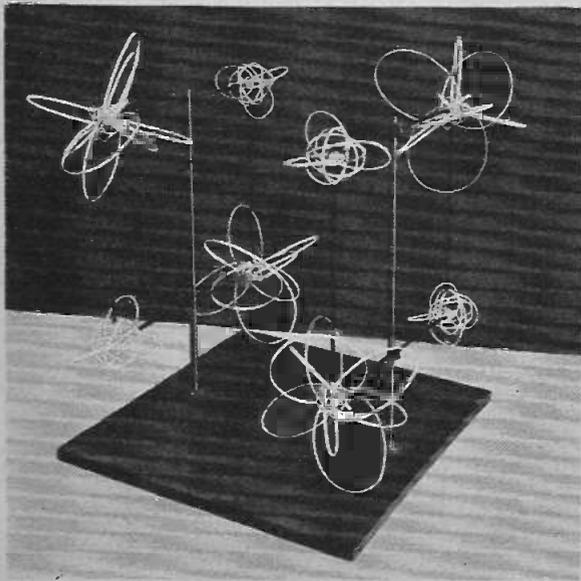
As an analogy, think of a lift in a department store moving up and down; in order to move up a floor the lift motor must be supplied with power (e.g. electricity), but to move down again a floor the motor can act as a generator and supply power since the lift can "freewheel" down as it were, under its own weight.

In ideal circumstances, we should be able to say that the particular amount of power originally supplied to the lift in ascending would be given out again by the lift in descending.

### VISUAL ENERGY CHANGE

We can show this on this sub-atomic scale, too. Sprinkle a few crystals of any compound of sodium, for example, table salt (sodium chloride)

A model of sodium chloride with Bohr orbits—lattice.



or washing soda (sodium carbonate) into a flame, a pronounced yellow colour will be given to the flame.

At first, some of the electrons in the sodium constituent of the compound will be promoted to higher energy levels as heat energy of the flame is supplied to them. However, they soon re-occupy their original orbits and, in doing so, they emit the energy (which just happens to be yellow light) that was originally donated to them to enable them to transit.

Since this energy output, in the form of emitted light, is found to be characteristic of the atoms present in a specimen (e.g. the sodium ion has an energy output corresponding to a particular yellow light), then unknown samples can be analysed on this basis. This is the technique used with the spectroscope and related instruments. (Fig. 2).

Although the straightforward Bohr theory became much more complicated when electrons were found to have properties associated with waves (see later), its essence can be readily understood.

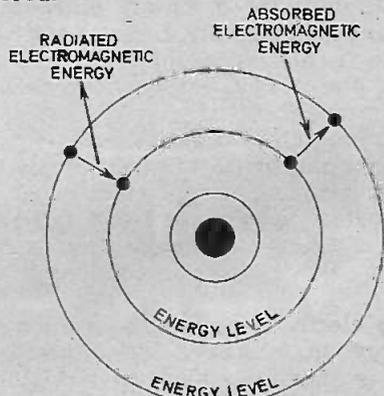


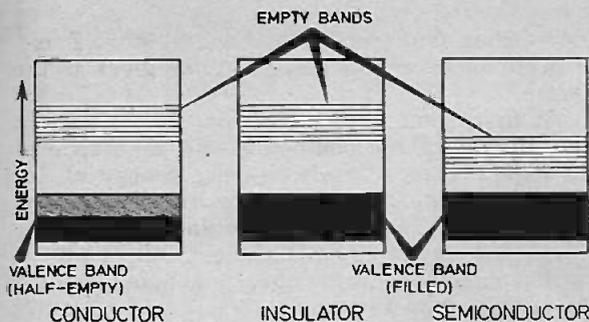
Fig. 2. Simple arrangement of two energy levels in an atom.

This concept of energy levels in atoms can be used to explain a wide range of phenomena from how a laser operates to the reasons for electrical conduction, insulation, and semi-conduction.

### CONDUCTORS, INSULATORS AND SEMICONDUCTORS

All solids are made up of regular arrangements of atoms called lattices. As a result of the atoms being packed quite closely together in a lattice, the narrow energy levels of each individual atom merge together with the equivalent levels of the other atoms, and comparatively wide energy bands are formed.

The energy band which holds the outer electrons in each atom, or valency electrons, is called the *valence band*, but as there are energy levels with no electrons, there are also empty energy bands.



**Fig. 3. Energy band diagrams. Note the relative spacing of the empty bands and valence band in the insulator and conductor.**

Now, for conduction to take place in a solid (i.e. the flow of current under an applied electromotive force) the valence electrons must be given enough energy to lift themselves into a higher energy level and thus move from atom to atom in the solid. This movement of charges constitutes an electric current. (Fig. 3.)

Electrons in *conductors* have no difficulty in doing this, since for a variety of reasons the valence band is half-empty. Hence, empty energy levels are easily accessible to the valence electrons, and they consequently need little energy to transfer.

On the other hand, *insulators* have no partially-empty bands and hence to reach empty energy levels, the valence electrons must reach a completely separate, empty band and this requires quite a lot of energy not normally available from low-voltage sources. No conduction, therefore, takes place.

Valence electrons in *semiconductors* require less energy to transfer, for although their structure is roughly similar to insulators, the space between the valence band and the next empty band of higher energy is relatively narrow. Indeed, the heat energy associated with room temperature can provide this energy, i.e. the substance conducts, while at very low temperatures insufficient energy is provided and therefore the semiconductor becomes an insulator.

The properties of a semiconductor can be modified by the introduction of carefully controlled, minute amounts of impurity atoms. The latter alter the natural arrangement of energy levels by introducing new levels and produce the familiar *p* and *n* type semiconductor so vital for the operation of the transistor.

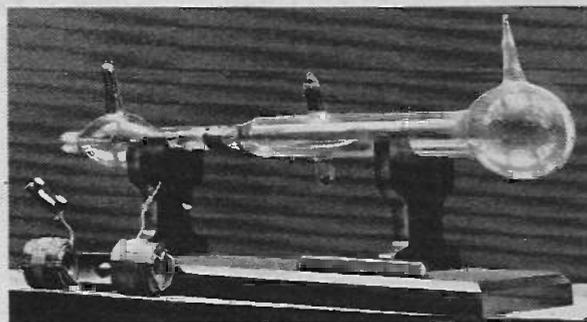
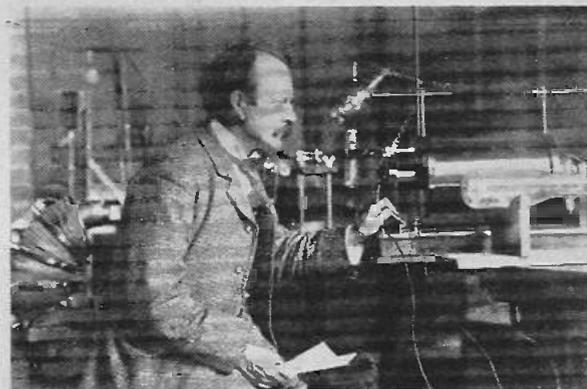
### PHYSICAL PROPERTIES

The electron is an extremely minute particle—almost two thousand times lighter than the proton. In fact, it belongs to a class of sub-atomic particles called *leptons* or *light particles*.

Although G. J. Stoney postulated the existence of the electron as the fundamental particle of electricity in 1881, the existence of the

particle was confirmed and an estimation made of its mass by J. J. Thomson at Cambridge in 1897. He was investigating rays from the cathode in a vacuum tube, and in a famous experiment he used apparatus not far removed from today's cathode-ray tube to determine their charge-to-mass ratio.

The electron's charge was determined accurately later by R. A. Millikan in the United States of America. Both physicists were awarded the Nobel Prize for their work.



**Upper photograph: The discoverer of the electron—J. J. Thomson. Lower, his apparatus for the determination of the charge to mass ratio of the electron.**

### QUANTIZATION

An interesting point to note is the basic nature of the electron's charge. No charged particle has yet been discovered that carries a charge less than that (numerically) of the electron, although physicists are presently suggesting that such fractionally-charged particles may exist called *quarks* in order to explain the structure of some strange particles.

The same point also applies to another property of the electron—its spin. The electron, besides orbiting the nucleus also appears to spin on its own axis, rather like a top, and this spin must always have a definite positive or negative value, corresponding to the "directions", as it were, in which it actually spins. It is found that any particle which possesses spin can only have this numerical value or simple multiples of it.

We say that properties, such as charge and spin, for which certain values only exist, are *quantized*.

Remote as they seem, these properties are related to many everyday phenomena; spin, for example, is thought to give rise to magnetism in some metals.

**Table 1: The Electron**

Parameter	Numerical value
Charge (e)	$1.6 \times 10^{-19}$ coulombs
Rest mass ( $m_0$ )	$9.11 \times 10^{-31}$ kilogrammes
Charge to mass ratio (e/m)	$1.76 \times 10^{11}$ coulombs/kilogramme

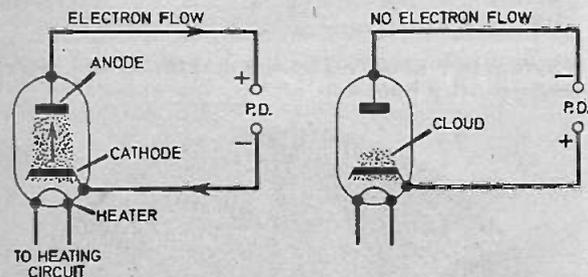
## PRODUCTION OF ELECTRONS

### (1) THERMIONIC EMISSION

Thermionic emission, as the name implies, is emission by heat. This takes place in ordinary valves and electron guns e.g. in cathode ray tubes.

In a simple diode valve, the nickel cathode is usually heated by a filament causing it to emit electrons in much the same way as heat energy causes liquids to evaporate. The electrons thus produced collect around the cathode until a positively biased anode attracts them and thus enables current to flow.

However, a negatively-biased anode (with respect to the cathode) repels these electrons back to the cathode, and no current flows, i.e. the device is a simple rectifier.



**Fig. 4. The diode valve, thermionic emission.**

### (2) PHOTOELECTRIC EMISSION

Electromagnetic radiation, e.g. light above a certain frequency, incident on certain elements (e.g. zinc) causes electrons to be emitted from the element. This phenomenon is known as the *photoelectric effect* and the emission as *photoelectric emission*.

It can be explained in terms of the minimum energy required to remove an electron from a particular energy level in an atom of the element, and it is used to advantage in the

various types of photoelectric cell or photocell e.g. the selenium solar cell which is used to produce electricity to power some spacecraft.

### (3) RADIOACTIVE DECAY

Some forms of the elements called isotopes are radioactive, that is, their atoms are so unstable that they spontaneously break up or decay to yield simpler entities.

Such decay, if it involves the production of electrons, is sometimes described as *Beta decay*, and it is thought to operate by a neutron inside an atom decaying to an electron, proton and a mysterious, ghostly particle called an *anti-neutrino*, which has no charge and travels at the speed of light.



**Stereoscopic photo of electron tracks using a cloud chamber.**

## DETECTION OF ELECTRONS

Once electrons have been produced they must obviously be detected and tracked. Ideally, we should like to see the paths of the particles as they interact with each other but we are talking of times of the order of minute fractions of a second and of particles whose size is almost infinitesimal.

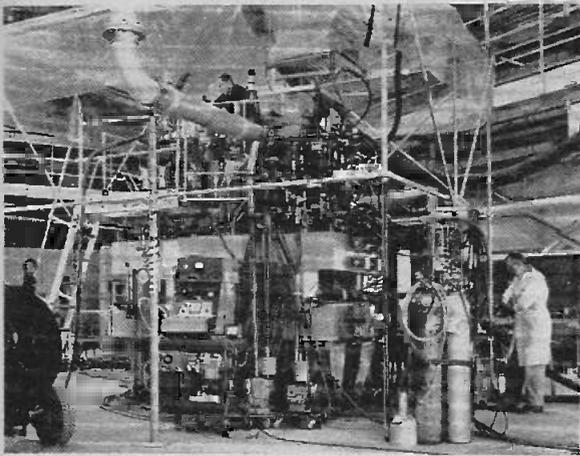
However, in an indirect way, we can effectively see the progression of the reactions and to do this instruments called cloud chambers and bubble chambers are used.

The operation of the bubble-chamber will be described as it has largely superseded the cloud chamber for experimental purposes, although both are based on largely the same principle.

### THE BUBBLE CHAMBER

In a bubble chamber, which is basically a big tank, liquid hydrogen is heated under pressure until it is just about to boil. Then the pressure is suddenly reduced and this places the liquid hydrogen into what is known as a "superheated state", i.e. it is for a short time considerably above its boiling point at that lower pressure.

To show that the boiling point of a liquid increases as the external pressure increases,



**The Brookhaven 20 inch bubble chamber, New York.**

think of an ordinary pressure-cooker in which it is possible to heat food well above the boiling point of water at normal pressure because the pressure inside is higher and so dictates that the water should boil at a greater temperature.

In the bubble chamber, the liquid hydrogen's temperature is such that bubbles will form around any alien body (e.g. dust, or charged hydrogen ions) so if an electron hurtles through the chamber, being charged, it will knock out some electrons from the hydrogen atoms and the latter will then become positively charged ions.

Bubbles will form around these ions and they will clearly define the path of the original electron.

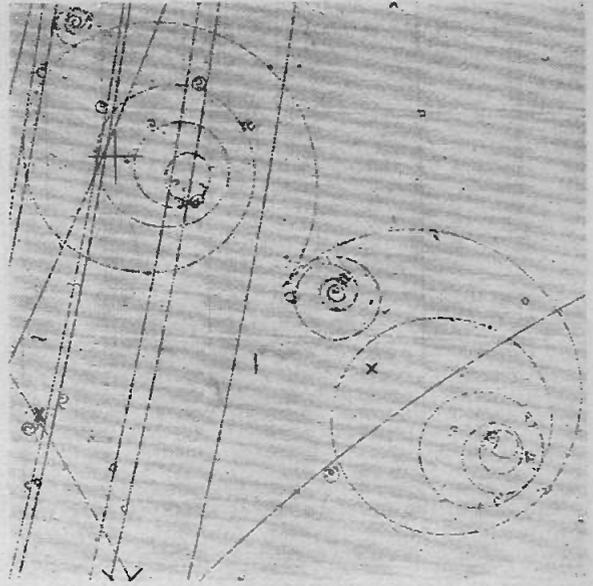
In other words, the apparatus is arranged so that boiling takes place selectively along the electron's track which can be seen and photographed as a line of bubbles. To make the bubbles, however, the original particle must be charged.

### **USE OF BUBBLE CHAMBER PHOTOGRAPHS**

The courses of many reactions can be inferred from bubble chamber photographs; for example, if a track apparently starts from nowhere in the picture, it can be deduced that an uncharged particle or non-ionizing radiation gave rise to the charged particle which made the track.

Very often, a bubble chamber is used in conjunction with an electromagnet to study the way a particle behaves in a magnetic field. A curved track will be produced by the particle and an examination of this yields mass, charge (oppositely-charged particles curve in different directions), momentum (mass multiplied by velocity) and other information about it.

Thus, although other instruments exist for the detection of charged particles, it will be seen that the bubble chamber is one of the most useful.



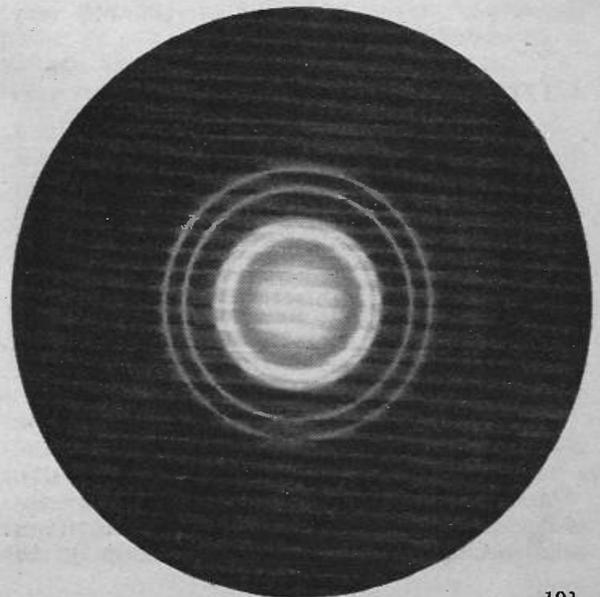
**Bubble chamber photograph of electron/positron pair creation and other tracks.**

### **WAVE ASPECT OF THE ELECTRON**

In the 1920's, the electron and all other particles were shown to behave like light itself and have both a particle and a wave aspect. This amazing and apparently contradictory situation arose because electrons were found to exhibit diffraction, a property associated with waves.

If light rays from a single source and of the same wavelength are allowed to pass through two (or more) small slits which are close together, each slit will act as a source itself and the waves emerging from the slits will interfere with each other (i.e. alternately reinforce and

**Photograph showing electron diffraction rings produced by gold foil.**



destroy each other) so that an image of light and dark bands forms on a screen placed in front of the slits.

Diffraction also occurs if a beam of electrons are projected through a metal foil, for example. The spaces between the atoms act as very tiny slits and the scattered electrons will build up a series of concentric rings on a suitably placed photographic plate as a result of being diffracted by the lattices in many directions.

Diffraction experiments such as this suggested that the wave associated with the electron possessed a wavelength of the order  $10^{-10}$ m.

As a result of this very difficult concept, first put forward by Louis de Broglie and developed by Erwin Schrödinger's wave mechanics, the philosophy of the atom was totally changed. Instead of speaking of definite electron orbits in the atom, we must speak of orbiting electron clouds separated by discrete intervals of energy which represent the probability of the electron's position at a given moment.

Werner Heisenberg also showed it was impossible to know both the exact position and velocity of an electron at the same time, since by examining the particle one must disturb, and therefore change its energy.

## ELECTRON MICROSCOPE

A more familiar result is the electron microscope (EVERYDAY ELECTRONICS, July 1972) which can be used to examine very small objects. This is because the waves associated with the electron have a much shorter wavelength than those of visible light on which the optical microscope depends, and hence its resolving power is greater.

As an analogy, think of the very small effect that the medium-sized ruts in a road would produce if you were driving a tractor with huge wheels, but you would soon discover they exist if you were trying to ride a bicycle with very small wheels across them.

## ANTIMATTER—THE POSITRON

In 1928, P. A. M. Dirac formulated a brilliant theory that indicated that every particle in existence should have its own "antiparticle"—its identical twin in every respect except that it would be oppositely charged.

Thus, the antiparticle of our, ordinary, negative electron would be a positive electron, or positron, as it came to be known.

The theory was triumphantly proved correct when in 1932, C. D. Anderson identified the positron in cloud chamber studies.

A simple analogy may help the reader to grasp the relationships between an electron and a positron but it must not be taken too literally.

Imagine a metal tray, the sort with groups of cup-shaped depressions, that are sometimes used to bake small pies for example. If all the

depressions were filled with pies that fitted them exactly, and you ignored the different textures of metal and pie you could not tell the difference between pie and tray, by touch alone.

However, if the pie was lifted from the depression you could immediately distinguish them merely by touch, the pie having a lower convex surface, the depression an upper concave surface. From something that was not detectable, we arrived at two things which were (Fig. 5).

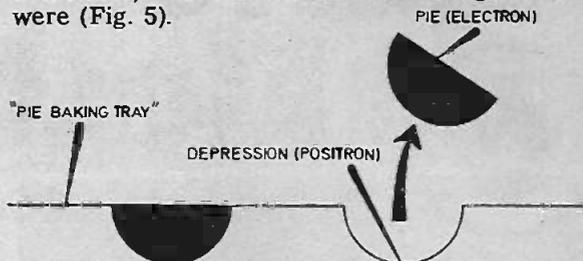


Fig. 5. Analogy of electron-positron pair creation.

## ELECTRON—POSITRON PAIR

In a similar way, it was theorized that the positron bears largely the same relation to the electron, as does the depression to the pie which occupies it.

As in the first instance, the electron and positron are undetectable in normal space, but if energy, in the form of electromagnetic radiation called gamma rays, is supplied, the electron is removed and exists independently from the vacancy it occupied i.e. the positron.

The process is called "pair-creation", and both particles can be identified in a bubble chamber.

However, the process is reversible—if an electron collides with a positron, both are destroyed and their matter liberated as energy. This is called "pair-destruction" and because ordinary matter is by far the more abundant of the two in our universe, free positrons have extremely short existences.

Positron-electron pairs are formed when cosmic rays, which originate from outer space, impinge upon our atmosphere. A cosmic ray "shower" takes place with many pair-creations and destructions.

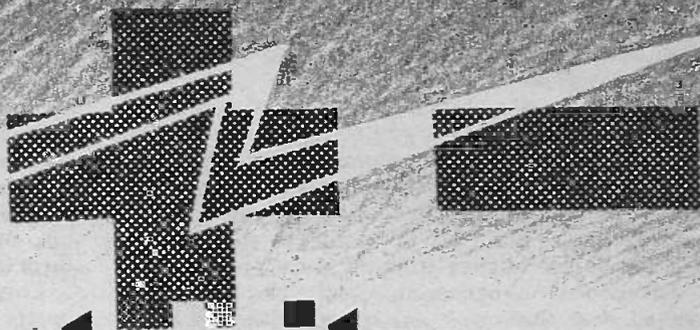
It is interesting to note that the positron was discovered by cosmic ray studies.

Physicists believe that the phenomena of antimatter may even be involved with the flow of "time" itself, and the possibility of other universes, besides our own, in existence.

## UNLIMITED ADVANCES

We have seen some features of the strange world of the electron. If this knowledge can be developed by physicists and then applied (as was brilliantly done in the invention of the transistor), the future indicates almost unlimited advances in electronics. □

# BASIC



# 6

# Electricity

The Transformer and Domestic Electricity By Maureen Birch

**A** TRANSFORMER is a device for changing the voltage level of an alternating supply and utilises the principle of induction caused by a change in magnetic field—similar to that described last month.

It consists of two coils of wire—electrically isolated from each other—wound on a core of magnetic material; this core, like that of a motor armature, is made up from laminated sheets of soft iron that are usually punched in the form of a shape that will interlock with itself to give a strong support to the coil, see Fig. 6.1. One coil is called the **primary** and the other the **secondary**.

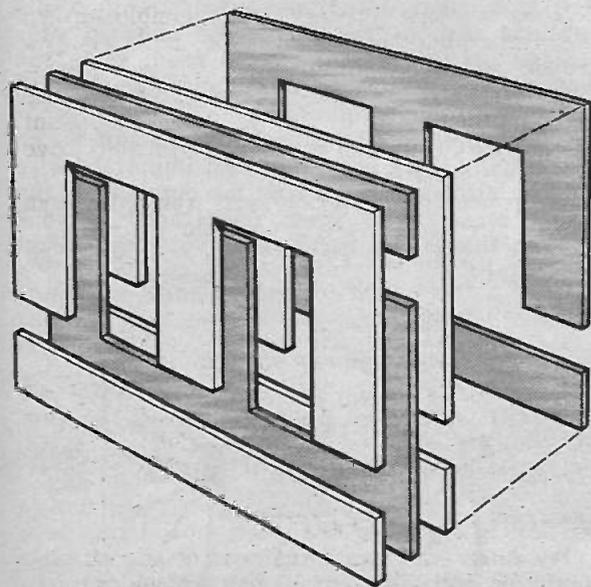


Fig. 6.1. Interlocking transformer laminations are stacked together through the bobbin and clamped firmly.

## TRANSFORMER ACTION

If an alternating current is passed through the primary (from an alternating voltage source), the magnetic field strength through the core also alternates and this constantly changing field strength induces an e.m.f. across the secondary winding which can be used to make a current flow in an external circuit.

If there are more turns on the secondary than the primary, the voltage output will be greater than the input by more or less the ratio of turns. You cannot get power for nothing and although the output voltage will be higher in the instance quoted, the current that the secondary can supply will be less.

Having less turns on the secondary than on the primary you can get a lower output voltage at higher current. To all intents and purposes, the input voltage multiplied by the input current will equal the output voltage multiplied by the output current.

As voltage multiplied by current gives us power we can say that a transformer will convert voltage levels with virtually no power loss, i.e. it is a very efficient process.

In actual fact there is always a small amount of power loss caused by electrical currents induced within the core itself and these dissipate themselves as heat. Laminating the core and insulating the laminations from each other reduces these currents—called **eddy currents**, and one of the qualities of a transformer is its ability to avoid these core losses.

## APPLICATIONS

Transformers (see Fig. 6.2) have many applications in electronics, the most common being to convert the 50Hz mains voltage to a low level so that we can drive transistor circuits.

A lesser understood application is to give electrical isolation between a piece of equipment and the mains. Many early radio sets were a.c./

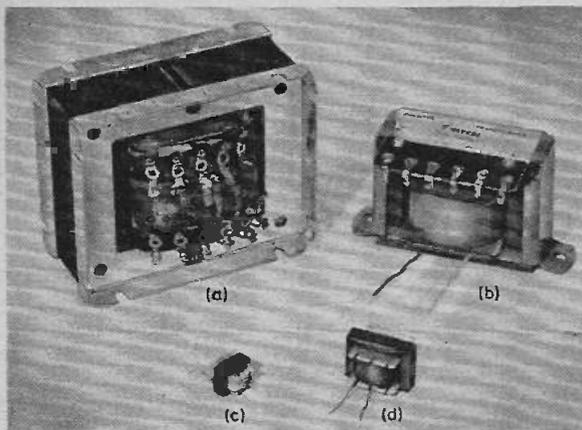


Fig. 6.2. Transformers: (a) Multiple tapped mains (b) low voltage tapped booster (c) and (d) transistor radio matching types.

d.c. and did not have transformers in them; older readers will probably remember the warnings on the back of such sets that the chassis could be live and there was a risk of electrocution if the metalwork of the chassis was touched.

We do not find this very frequently in radio sets today but the non-isolated television set is still with us and the unwary should never attempt to touch the chassis of any television set while it is plugged into the mains.

Many people tend to think that it is only the 25,000 volts inside the set that is dangerous; although it is, the dangers from a live chassis can be just as lethal.

## MATCHING

Transformers are also used in what we might call low power circuits in instances where we might need a reasonable voltage at fairly low current from a source that produces a very low voltage at reasonable current. This is typical of low impedance microphones (impedance being the resistance to alternating current) and frequently one has to match a microphone to an amplifier by means of a transformer.

A very common everyday type of transformer is the bell transformer that has several output

voltages available—these are generated simply by having a secondary coil with tappings taken from it at required intervals.

## A.C. NECESSARY

A transformer cannot give an output voltage unless the input current, and hence the field in the core, is varying, therefore you cannot step up, or step down the voltage of a battery directly.

This can be done indirectly by using the battery to power an oscillator that produces a varying current and then this current is applied to a transformer. This type of circuit is called a static inverter and is used frequently to drive fluorescent light tubes from car batteries.

## ELECTRICITY TO YOUR HOME

Transformers have enabled the Central Electricity Board to overcome one of the problems in the distribution of electricity throughout the country (see Fig. 6.3).

Electric current flowing through a wire causes heat, and this is equivalent to a loss of power; it is therefore more efficient when carrying current over long distances in overhead wires to keep the current as low as possible.

However, the recipients of the current still need power and the low current is compensated for by having it at very high voltages.

Usually the voltage produced at the generating station is stepped up by a transformer to 132,000 or 264,000 volts before being fed to the overhead cables of the national grid.

At major sub-stations this is stepped down to one or two thousand volts (kV) for local distribution by underground cable to the minor sub-stations such as the unmanned units in your village or at the end of the road. Here the voltage is transformed down again to the 240 volts we are all familiar with.

The supply enters your house on two wires, but usually there is a third most important wire which, although it carries no current in the usual sense, is of great importance to your safety; this is the earth wire, but more about this later.

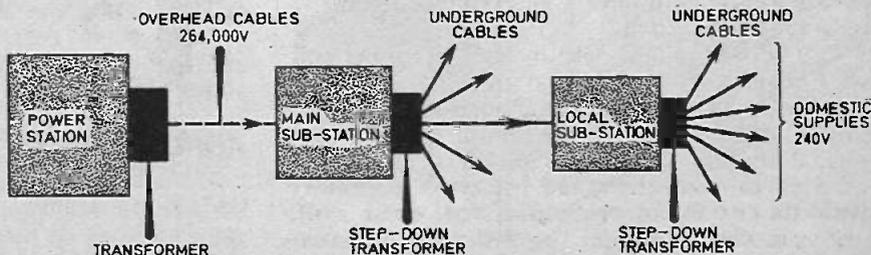


Fig. 6.3. How electricity is brought to your house from the power station.

## EARTH WIRE

The two wires that carry the main current into your house have designating names, one is called **neutral** and the other line (**live**).

As mentioned previously voltages are always measured with respect to something, because voltages are differences in potential between two points in a circuit. When considering electrical power on a reasonable scale one can say that the earth around us can be taken as a fairly stable potential reference.

The potential difference between the neutral line and earth is usually very small (there is always some difference—contrary to some people's belief) and never more than a volt or two in the worst case. Although you should never do it, you could, in theory, touch the neutral mains wire and not get an electric shock.

On the other hand the mains line lead has a varying potential difference between it and neutral and this 50Hz voltage gives rise to a sort of average level known as the r.m.s. level (r.m.s. stands for root mean-square) and this is usually 240 volts.

Because we are considering an alternating supply, this means that the mains line is varying by plus and minus 240 volts r.m.s. with respect to neutral which is to all intents and purposes, with respect to earth.

We have mentioned that the 240 volts is a sort of average and in actual fact the line voltage can rise to a peak of about 380 volts at the peaks of each cycle. Touching the line connection to the mains, and you are assured of getting a very nasty electric shock.

Obviously there is a big difference between the line and neutral wires and this is why one must take special care to see that they are connected to an appliance the right way round. The appliance will work quite satisfactorily if the leads are reversed but it immediately becomes dangerous.

## POINTS TO NOTE

All pieces of equipment, whether they are electric clocks, drills, radios or record players should be connected to the mains with a fuse in the line lead and in most instances the case (if it is metal) should have a good connection made between it and earth.

If a wire becomes loose inside the equipment, or it overheats and insulation starts to melt, there is a chance that the dangerous line lead might short circuit to the metal case; if you picked up the appliance and there was not a good earth connection, and you were in contact with the earth, concrete floor, or worse still, water in the bathroom, the 240 volts potential difference between line and earth would be applied across you and current would flow—this is what gives an electric shock.

Most of us have had a mild electric shock and

have survived; why were we not killed? The answer is quite simple—we were very lucky because we probably did not make a very good connection to ground and the current that flowed through us was not very great. Tap water is a conductor of electricity and is also very well connected to ground through underground pipes, hence electric shocks in the bathroom are invariably serious and frequently fatal.

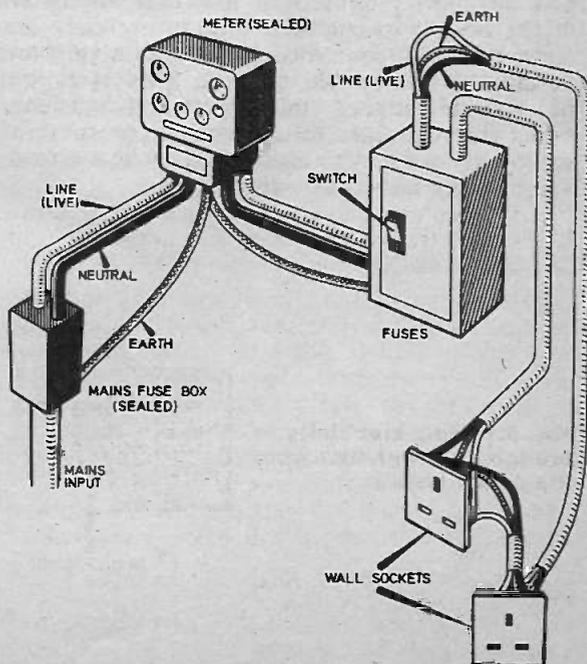
If, however, the case of the equipment is already connected to a good earth, the mains line will short directly to ground and a very high current will flow through the case and the earth wire—thus by-passing you.

This heavy current flows down the line lead and through the fuse which is made of low melting point wire and the heavy current rapidly heats up the fuse wire until it melts and breaks the circuit (via the fuse) on the line side.

A fuse can be made to have different amounts of current above which it will blow and one should always use a fuse with a current rating just higher than the current equipment will usually draw; then, even though you may not get a catastrophic short to earth, any sign of perished insulation etc, that gives rise to an increase in current will cause the fuse to melt—a good early indication that something needs attention.

Many people are tempted to replace the fuse with one of a higher current, this should never be done because the fuse blowing in the first place indicates a fault which should be rectified before the equipment is used again.

Fig. 6.4. Schematic drawing of part of a household "ring main".



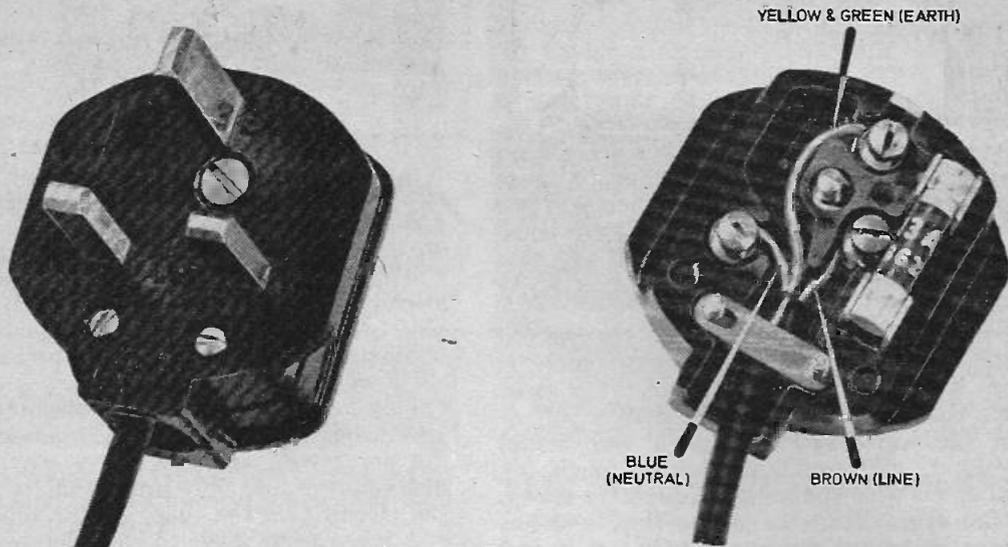


Fig. 6.5. Shows a 13A square-pin ring main plug with colour identification of the line, neutral and earth wires.

## MODERN DOMESTIC WIRING

Modern houses have a central fuse box with high current fuses feeding mains into ring main circuits around the house; these are recognised because they use the now common square-pin sockets and plugs see Fig. 6.5.

These sockets are designed to carry an *absolute maximum* current of 13 amperes, but because not all pieces of equipment need this sort of current, the plugs that are used with these sockets have a fuse cartridge that can have a rating of anything from 1 amp up to the maximum of 13 amps.

The fuse you use should be carefully matched to the appliance that is to be connected via that plug. Most of these plugs are supplied with a 13 amp fuse but this should not be used if you are going to run, say, a table lamp; a 2 amp fuse would be more than adequate.

## CALCULATION

Most pieces of equipment you buy indicate the amount of current they draw, but in some cases this is quoted indirectly as the amount of power they consume. This is measured in watts or thousands of watts (kilowatts). You can, however, calculate the current quite simply by dividing the number of watts by the supply voltage to arrive at the current.

For example, a 2,500 watt electric fire running from a 240 volt supply will draw a current of  $\frac{2,500}{240}$  amps, which is about 10.5 amps; a 100 watt electric light bulb on the same supply will draw just under half an amp.

## OLDER HOUSE WIRING

In older houses where round pin plugs are still in use, the circuit is protected by a fuse in the fuse box; these are usually rated at 5, 10 or 15 amps—depending on the type of circuit and on the thickness of wire used in the house wiring.

These plugs must be used with special care because it is too easy to break the rules and have a serious accident.

If you used a 3 kilowatt electric fire on a 5 amp circuit (and had quite wrongly substituted a 15 amp fuse in the fuse box), the fire would probably work and you might think all was well but this definitely would not be the case.

For a start, the plug would get hot and start to smoulder and worse still, the wiring behind the walls and perhaps along the wooden floor joists would also get hot, possibly red hot, and a major fire could start before you were aware of the danger.

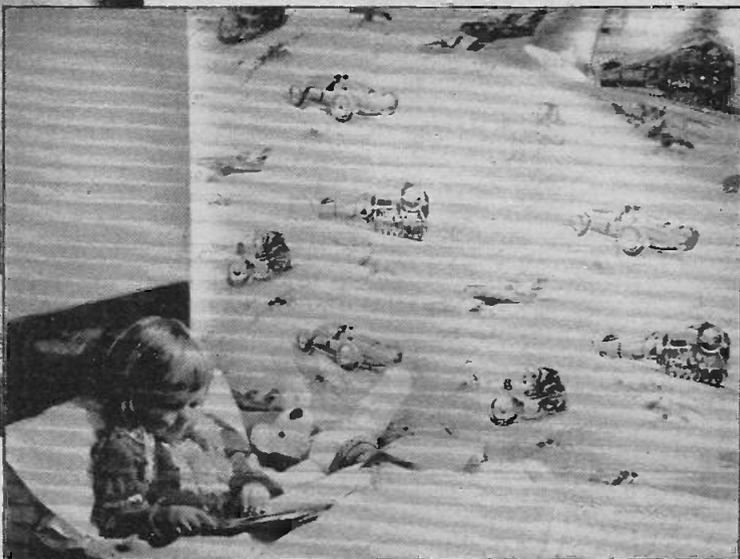
## ADAPTORS

Adaptors are available to extend the outputs from either square pin or round pin sockets. These are very useful but are a temptation to the unwary. Although several appliances can be plugged in where only one was previously, the supply wire in the wall is still the same and cannot carry any more current than the maximum quoted for the single socket.

Electricity in the house is a wonderful ally, but a dangerous enemy. Handled with care and in a sensible way it is quite safe, but the basic rules must be adhered to, to the letter, otherwise very unpleasant accidents can occur. □

# night

# light switch



By E. J. Byatt

## A simple control to dim a lamp.

**T**HIS simple design was created to meet two main requirements, namely to provide a dim light for use as a night light, television light or for illumination in a child's bedroom, whilst still providing full brilliance at the touch of a switch.

To enable the unit to be versatile it was decided to mount the switch in a separate case into which any lamp with a bulb of 200 watts or less may be plugged. The unit contains one switch to change from full to half power and a neon indicator to show when it is connected to the mains.

### CIRCUIT DESCRIPTION

The circuit (Fig. 1) is so simple that it requires very little explanation. Switch S1 is used to change from full to half power; in one position it connects the lamp directly across the mains supply, in the other position it connects the lamp in series with diode D1 across the supply.

Let us assume the diode to be perfect i.e. when the cathode is negative with respect to the anode (Fig. 2a) the diode is considered as a short circuit. When the cathode is positive with respect to the anode (Fig. 2b) the diode acts as an open circuit. However this circuit employs a.c. mains supply across the diode so the polarity

across the diode will be alternating equally in either direction. Therefore for half the supply wave, the diode will be open circuit and for the other half it will be a short circuit, consequently the voltage across the lamp during a series of sine waves will be as shown in Fig. 3. This is known as half-wave rectification and the shape of the wave is known as pulsating d.c.

In terms of input and output voltages the mean d.c. output is 0.45 times the r.m.s. input i.e.  $240 \times 0.45 = 108\text{V d.c.}$

Fig. 1. Circuit diagram of the Night Light Switch.

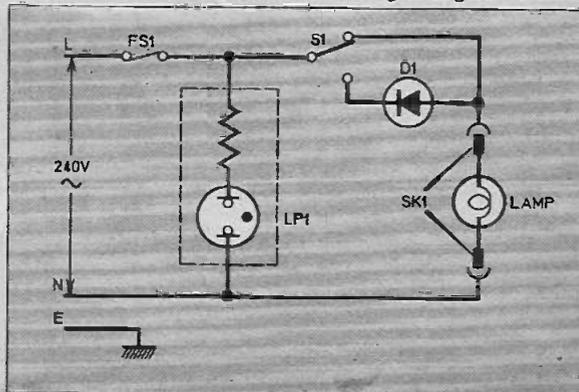




Fig. 2. Biasing of the diode (a) acts as a short circuit (b) as an open circuit.

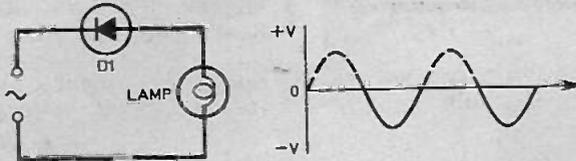


Fig. 3. Resultant output waveform with the diode in an a.c. circuit.

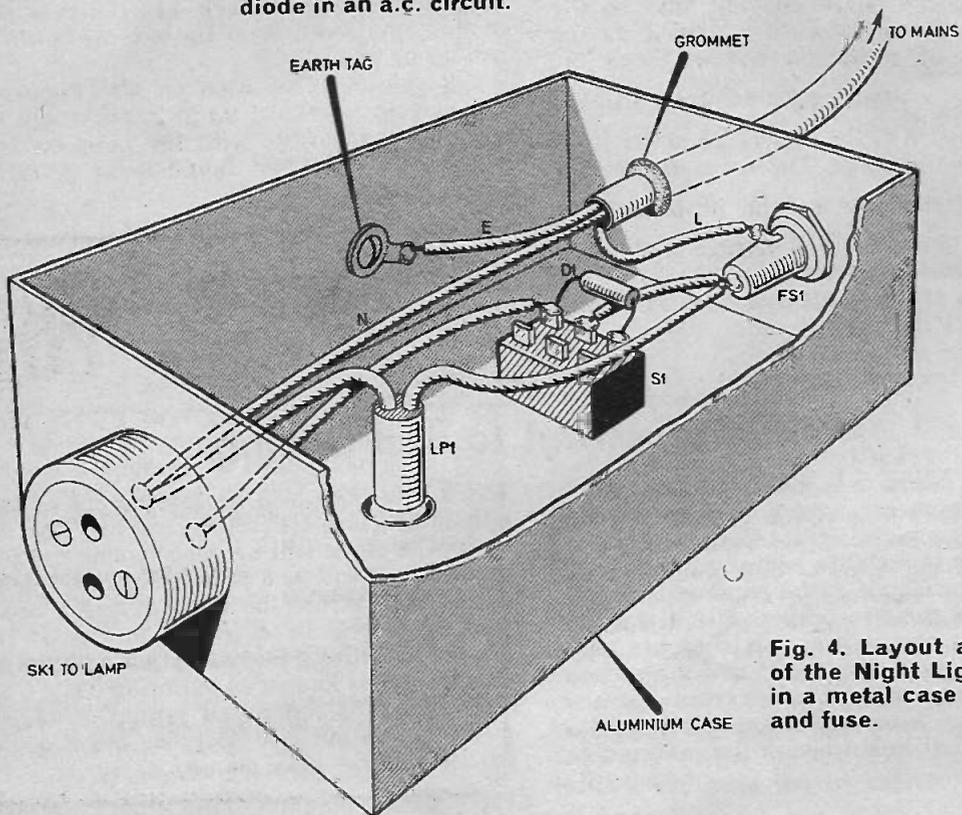


Fig. 4. Layout and wiring of the Night Light Switch in a metal case with earth and fuse.

# night light switch



Thus by switching the diode in circuit we are dropping the voltage level to the bulb by more than half.

### BRIGHTNESS

To calculate the effect this will have on the brightness of the lamp we must calculate the wattage used by particular lamps. Using the formulae  $\frac{V^2}{R}$ , where  $V$  is the voltage across the lamp (108V) and  $R$  is the resistance of the lamp we can find the wattage. The resistance of the lamp can be calculated by the formulae  $\frac{V^2}{W}$  where  $V$  is the normal rated voltage of the bulb and  $W$  the normal wattage.

Hence for a 100W, 240V lamp the resistance is

$$\frac{240 \times 240}{100} = 576 \text{ ohms}$$

Thus the resultant wattage will be

$$\frac{240 \times 240}{576} = 20 \text{ watts}$$

This figure is only a rough estimate as the actual resistance of the lamp varies with temperature and since, in the second case, the lamp is operated at a lower temperature than is normal, its resistance will not be exactly the same. However, it can be seen that the diode, which dissipates virtually no power, is reducing the lamp output by some 80 per cent.

As mentioned above, the diode dissipates virtually no power and hence not only is the output reduced by about 80 per cent, the power consumed is also reduced by a similar amount.

### CONSTRUCTION

The main thing to remember when constructing the unit is that mains voltage is employed and hence care must be taken to make sure the unit is safe. There are two ways of doing this; installing all the components inside an insulated plastic case or installing the components in a metal case which is properly earthed and with a fused supply.

The first method is probably the best, provided a suitable container that can be securely fixed together can be found. However, since small aluminium boxes are available from most com-

ponent suppliers and a fuse is never a bad precaution, we shall detail construction in an aluminium case as shown in Fig. 4.

Commence construction by cutting the case to hold S1, LP1 and SK1, the earth tag and a grommet for the three core mains lead to the supply. Next mount the components as shown and then wire them up, together with D1; the polarity of the diode is not important.

Check all connections and make sure that the earthing tag is making good contact to the case and is wired to the earth pin of a three pin plug. Insert a 1 amp fuse, plug a lamp into SK1 (not more than 200W bulb) and switch on. Change S1 from "half" to full power or vice versa and check the brilliance of the lamp.

If the fuse blows for any reason, indicator LP1 will extinguish, in such cases disconnect the mains supply and check the unit for faults before replacing FS1.

The unit can be used on all lamps—except fluorescent types—of up to 200W. Slight flickering may be noticed with the lamp on reduced power. This was not found to be annoying on the prototype unit. □

## Components . . . . SEE SHOP TALK

### Diode

D1 400V 1A silicon type

### Switch

S1 Single pole double throw mains toggle type

### Neon

LP1 Mains indicator incorporating resistor

### Socket

SK1 Two-way mains light socket (panel mounting)

### Fuse

FS1 Miniature fuse holder and 1 amp fuse

### Miscellaneous

Case—metal or plastic approx 3 × 2 × 1½ inches (see text), three core mains lead, mains plug, earth tag, 4BA fixing.

## PLEASE TAKE NOTE

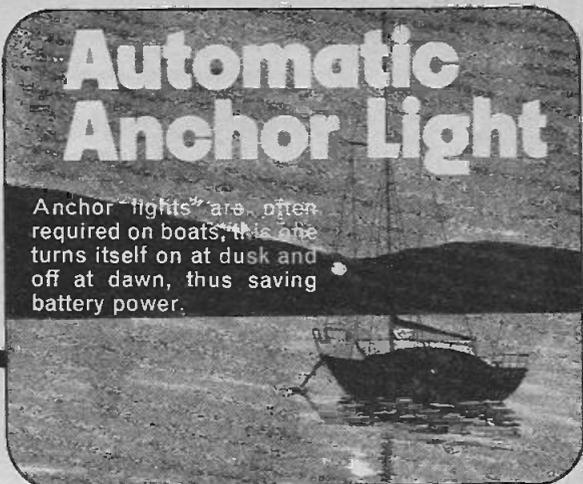
Egg Timer (March 1973 issue) a link should be made between C1 (negative) and the earth tag. The N and L on the mains lead should be transposed.

Beta Treble Boost and Fuzz (January 1973) a better fuzz may be produced if R2 is reduced; in some cases to as low as 15 kilohms.

# NEXT MONTH

## Automatic Anchor Light

Anchor lights are often required on boats; this one turns itself on at dusk and off at dawn, thus saving battery power.



## Intercom

Keep in touch with this simple, easily connected two way intercom.



## Workshop Components and Tools....

An article describing a suggested stock of components and tools that will enable the constructor to set up a useful workshop. Useful testgear is also detailed.

# FREE

inside

## Semiconductor Wall Chart

Semiconductor parameters and base connections on a coloured chart.

To ensure your copy of this special issue please order from your usual supplier now!

# everyday electronics

May issue on  
sale Thursday,  
April 19



# INDICATOR AUDIBLE WARNING

A useful unit to add to your car's indicator system.

By P. E. J. Lacey

**A**LTHOUGH most modern-car indicator systems are self cancelling with visual indication and audible indication (the "click" produced in the flasher unit) that the indicators are operating, this is quite often not enough.

You will often see a car being driven along a straight road with one indicator flashing when the driver has no intention of turning or pulling in. It has been left on accidentally when the self-cancelling mechanism didn't work, the visual indication is obscured by reflection and the "click" drowned by either engine or wind noise or even the radio.

It would therefore be helpful to the driver, and safer, for himself and others, if a distinct tone was evident when the indicators were activated, and remained on until the indicators were switched off.

This is what the Indicator Audible Warning unit provides when wired up to the car indicator system.

As can be seen, the unit uses only eight components and is very easy to construct; current consumption is only 30mA and operation will not generate interference on the radio.

## PRINCIPLE OF OPERATION

The complete circuit diagram of the Indicator Audible Warning unit is shown in Fig. 1.

Transistors TR1 and TR2, both connected in



Approximate  
cost of  
components  
£0.80 less  
switch

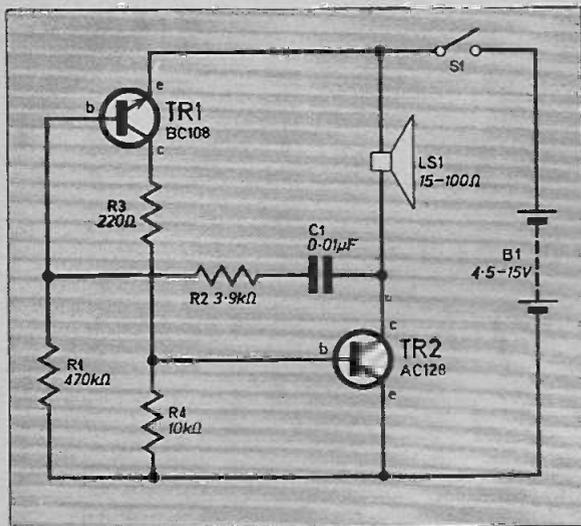


Fig. 1. The complete circuit diagram of the Indicator Audible Warning unit. Switch S1 is part of the car's in-built indicator system.

the common emitter mode, form a non-inverting compound amplifier in which voltage gain from TR1 collector is passed to TR2 base.

Transistor TR1 inverts the signal and TR2 re-inverts it so there is no overall inversion. Because of this, positive feedback is provided through the combination of R2 and C1, and the circuit oscillates.

Resistor R1 provides forward bias for TR1 and hence TR2. Excessive current is prevented from flowing through TR1, and TR2 base, by inclusion of resistor R3. The other resistor R4 ensures complete turn-off of TR2 by bypassing leakage currents.

In some respects the circuit's operation is similar to a conventional multivibrator, but the circuit is asymmetrical, and the same capacitor, C1, is used to time both halves of the oscillatory cycle.

When the circuit is switched on there is no charge on C1; resistor R1 biases TR1 into a partially conducting state and thus TR1 turns TR2 partially on.

Capacitor C1 then charges through R2, TR1's base-emitter junction and TR2; this charging current turns TR1 fully on and hence TR2 fully on. Eventually C1 is fully charged (the loudspeaker side being most positive), and this charging current no longer flows. The transistors would return to their partially conducting state if it were not for the positive feedback provided by R1 and C1.

The potential at TR2 collector now changes from almost zero volts towards  $-12V$ , and this change is transferred to TR1 base via C1 and R2; this is sufficient to turn TR1 off (and hence TR2 off).

Now, previously C1 was charged to nearly  $12V$ ; when the transistors turn off, the loud-

speaker side of C1 is taken to  $-12V$  (via LS1) and the other side must be (instantaneously) at  $-24V$ . The transistors remain in the off state while C1 discharges to zero volts through LS1, R2, and R1. As soon as this happens TR1 begins to conduct and the cycle repeats.

Thus it can be seen that the off-time is determined by R2 and R1 with C1, and the on-time is determined by R2 with C1.

## CONSTRUCTION

The layout of the components on the Veroboard is shown in Fig. 2. Begin assembly by making the one cut-out necessary on the reverse side of the Veroboard and drill the fixing hole.

Insert the resistors and capacitor in the positions indicated and solder. Solder on the flying leads and solder the correct two to the loudspeaker.

Next, using a heat shunt on the legs of the transistors, solder the latter in position, paying attention to the base connections of the transistors as shown.

## CHECKING OPERATION

Check that there is no shorting of components on the component side of the board, and that there are no solder bridges shorting adjacent copper strips on the reverse side of the board.

The unit should now be tested before mounting in the car. This is done quite easily by connecting the battery leads to any battery within the range 3 to 15 volts. When this is done a tone should be heard in the loudspeaker.

The pitch of this tone can be, if required, increased or decreased by decreasing or increasing respectively, the value of C1.

## Components....

### Resistors

R1	470kΩ
R2	3.9kΩ
R3	220Ω
R4	10kΩ

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

### Capacitors

C1	0.01μF
----	--------

### Transistors

TR1	BC108	silicon npn
TR2	AC128	germanium pnp

### Miscellaneous

LS1 15-100Ω miniature loudspeaker.  
Veroboard, 10 × 9 holes × 0.1 in. matrix;  
4BA nut, bolt and washer; connecting wire;  
on/off switch (optional, see text).

SEE  
**SHOP  
TALK**

# INDICATOR AUDIBLE WARNING

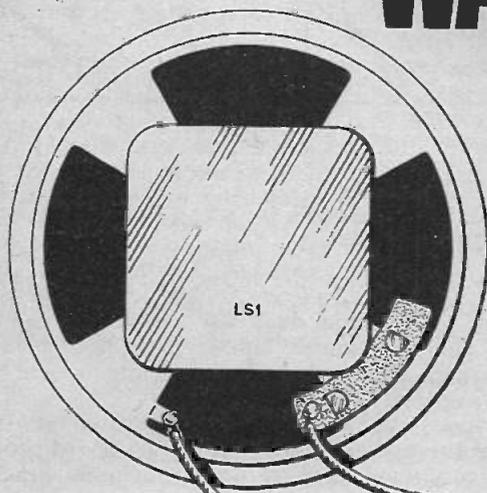
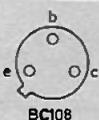
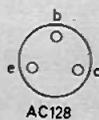
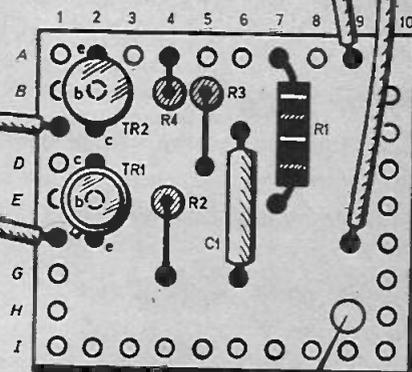


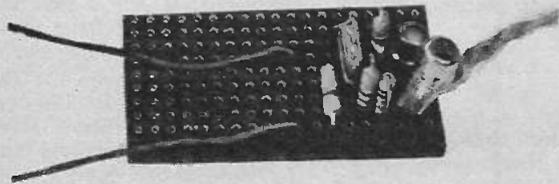
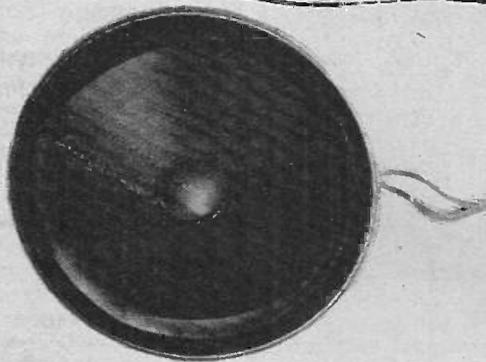
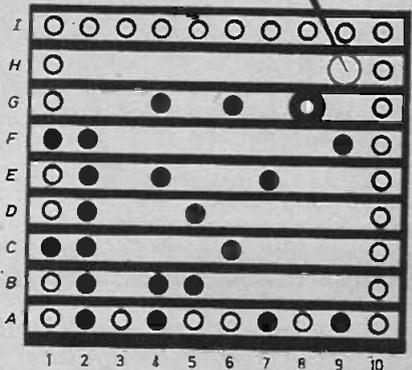
Fig. 2. The layout and wiring details of the components on the Veroboard. Also shown are the transistor base leadouts as seen from the underside.

+ve (VIA INDICATOR SWITCH)  
-ve  
RED

BLUE



FIXING HOLE



Photograph of the completed Indicator Audible Warning unit.

## FIXING/WIRING IN THE CAR

The unit can be used in cars with either negative or positive earth systems. Connect by means of an earth tag and small nut and bolt the appropriate supply lead to the bodywork of the car. Ensure that a good connection is made.

The other supply lead should be connected to the indicator warning bulb such that when the indicators are set to operate, power is supplied to the unit.

Consult the car electrical wiring diagram if in any doubt before connection.

When in use in the car, the device will be subject to considerable vibration and should therefore be mounted on a piece of foam rubber about half an inch thick; the dimensions of this pad should be slightly larger than those of the board itself; this will prevent shorting of the board if mounted against the car bodywork. The loudspeaker should be fixed in a similar fashion.

A further switch can be incorporated if desired in one of the supply leads so that the unit can be switched off when, for example, the indicator system is undergoing maintenance.

In normal use, the *Indicator Audible Warning* unit will "bleep" whenever the indicators are switched on.

## OTHER USES

This audible warning can be used for many

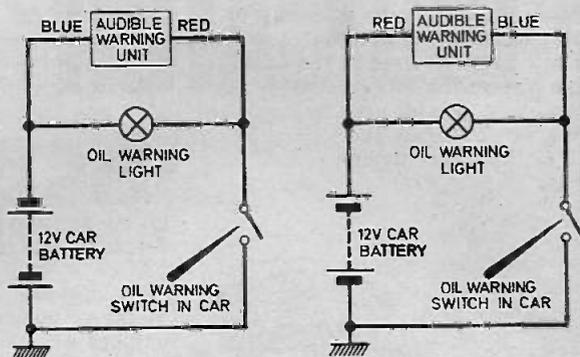
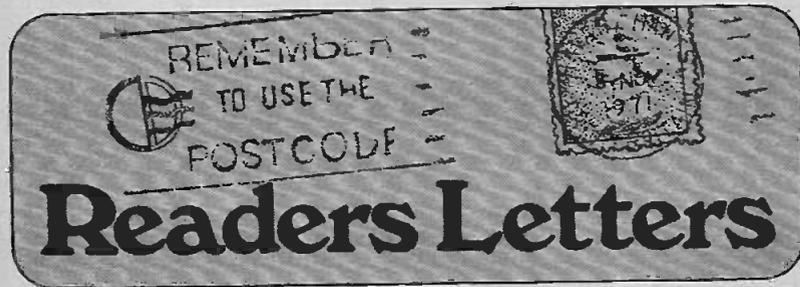


Fig. 3. Wiring details for using the unit as an oil warning indicator.

other applications such as: oil pressure warning; doorbell buzzer; morse practice oscillator; darkroom timing indicator; intruder alarm and many others.

When used for oil pressure warning, the unit should be connected across the oil warning light in the correct polarity mode depending on the car's earthing system, see Fig. 3. □



## Chemical Action

With reference to the article by T. A. Lindsey on the *U.H.F. TV Aerial*. While I cannot speak for the efficiency of this aerial he does use and suggest a rather unfortunate combination of materials in its construction i.e. brass fixings, galvanised Weldmesh (this is mainly a zinc coating) and aluminium angle. When these items get together in a damp or wet atmosphere they set up an electrolytic action where the material is eaten away ending in the collapse of the aerial with its attendant consequences; damage to property or person.

I trust that you will bring this to his notice so that he may make

an amendment to his design.

This, in the electrical contracting industry, we have to be very careful about.

Trusting that this magazine will continue with its very good work.

P. Ware,  
Bristol.

*It was suggested that the Weld-mesh could be painted for extra protection and that pop rivets could be used for construction (the outside of these are aluminium). If brass screws are used it will help if they are cadmium plated. If Expamet is used with pop rivets the complete aerial will be aluminium.*

## Interference

I was very interested in your article on *Radio Control Transmitter* in your December edition. I have built a single channel transmitter and receiver before but I was so pleased when I read the article by Mr. D. Bollen, to see it was crystal controlled, as the previous transmitter I built was of the super-regen type and was very unsuitable when I came to use it in conjunction with a model boat and there were other radio controlled models on the lake.

My transmitter interfered with other models and I had to pack up. My son and I were both very disappointed.

When I purchased the January edition of *EVERYDAY ELECTRONICS* and found that Mr. D. Bollen's article for the receiver was for the super-regen type I was very disappointed, I felt my troubles had started all over again in the fact that other transmitters would interfere with the receiver Mr. Bollen describes.

Could you please put my fears at rest with this matter and if this

*Everyday Electronics, April 1973*

is the case, could you get Mr. Bollen to let me have a radio controlled receiver circuit using crystal control, as he does say in your December edition that, quote, "The crystal X1 used in the prototype transmitter and receiver next month". I would greatly appreciate anything you could do for me in this predicament.

G. A. Rawlinson  
Wallasey

It is difficult to offer a great deal of reassurance to Mr. Rawlinson on the question of interference between different radio control systems in the small area of, say, a boating lake. So much depends on transmitter power output and depth of modulation, as well as receiver sensitivity and selectivity, and this applies to other people's equipment as well as one's own.

The usual approach to the problem of mutual interference is to employ a transmitter and super-het receiver using a matched pair of crystals, on the assumption that everybody else is doing the same; this arrangement will then offer thirteen channels within the 27MHz band (see page 704 November '72 issue of EE). Fair enough! Thirteen channels will allow thirteen models to be operated simultaneously provided that each user comes equipped with thirteen pairs of crystals from which to choose a vacant channel. At around £2 per pair this could be expensive.

There are other ways of avoiding interference, such as tuned audio filters for example, or digital techniques, but whichever way you look at it all solutions involve extra expense and a degree of circuit complexity that would be out of place in the pages of EE. As it stands, the single channel system published in the December '72 and January '73 issues of EE compares very favourably with similar commercial equipment, but is just as prone to interference problems.

Casting my mind back to the days when nearly all radio control receivers were broadly tuned, I am reminded of a very effective way of preventing interference called "etiquette". The principle here was for each operator to take his turn. If anyone disagreed and opted for anarchy, all the others would switch on their transmitters to "jam" the offen-

der, thus making it impossible for him to continue.

D. Bollen

The mention of a crystal for the receiver was inserted by us at the editing stage and was, in fact, an editorial mistake (Ed).

### S.O.S.

Could anyone supply me with the official address of TMK test meters in Japan please?

After writing to Radio Japan and telephoning several importers of these instruments in Great Britain I get a cold shoulder from them saying we can repair it but we cannot supply spare parts. An offer of £2 estimate was made for replacing a 20p variable resistor (ohms zero adjust).

I know everyone wants his fair share of the pudding but this is ridiculous. And to refuse giving the name and address of the original makers in Japan is darned right anti-social to say the very least. It makes one wonder how such cloak and dagger marketing is not revealed for what it is; sell quick and forget the rest.

W. D. Logan  
16 Spring Street  
Hollingworth  
Via Hyde, Cheshire

### ABC's of Transistors

Please could you tell me the difference between the gradings A, B and C on the BC108 transistor. Would the C grade (BC108C) transistor operate as well as other BC108's in a simple multivibrator circuit. I, and I expect many other readers, have not seen these gradings before on the BC108 and would be grateful if you could clear up this point.

Also could you think of any reason why a green 2N2926 would not work as well as a red 2N2926 in a Schmitt trigger designed for

the red type. I realise that the higher grade can generally be used as a substitute for a lower grade but could there be any exceptions.

David Hampton  
Brentwood

The letters A, B and C referred to above are used to signify the minimum gain ( $h_{FE}$ ) of the transistor. For an unlettered BC108 this parameter has a value of 110, for the A, B and C types it is 180, 290 and 520 respectively. All other transistor parameters are common and the lettered types should present no substitution problems in your multivibrator.

There is no reason, as far as we know, that a 2N2926 Green cannot be substituted for a 2N2926 Red transistor in a simple Schmitt trigger circuit. If your circuit does not function with the Green type, it could be due to the transistor being "dud". There could possibly be a case where the higher grade could not be substituted for the lower but this would be unusual.

### Buzz Buzz

Referring to your home made buzzer in the January edition of EVERYDAY ELECTRONICS I have since experimented with this device and have found that if you connect an electrolytic capacitor of 47µF, 10V across the phosphor-bronze strip screw and the contact screw, observing polarity, this will not only improve the performance of the buzzer but will also prevent interference with the TV and radio and also prevent a nasty shock which one would receive if one touched these two screws.

K. C. Cooper  
Crewe

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.

For all enquiries concerning advertisements or advertisers write to: The Advertisement Manager, Everyday Electronics, at the above address. Phone 01-634 4202.



A POINT of general interest concerning buying has been made by a reader recently. The point concerns the cost of items and is particularly related to the Adcola Invader soldering iron. Adcola Products quote the cost of the L646 iron in their advert as being £2.12 whilst elsewhere (in Chromasonics advert) it is quoted as £1.85.

The reason is that the price Adcola show is their recommended retail price, Chromasonics are cutting their profit margin and selling at less than this price. There is now no law against this and it applies to almost all goods—not just electronic equipment; so look before you buy.

More news concerning the Ardenite D1001 transformer for the *Radio Control Receiver* (January '73 issue). Since the note we published last month we have discovered that Ardenite have been taken over by EMI and EMI have agreed to make the transformer to order. Hence Home Radio have now been able to re-order and—after a delay for manufacture—will again be able to supply the original component.

Home Radio have agreed to do this because of the considerable interest in this project, so to give them an initial idea of how many transformers are still required we advise readers to order as soon as possible, but be prepared for a reasonable delay (probably a few weeks) while EMI set up and manufacture.

### Audio Colour Unit

We have received a number of enquiries concerning the *Audio Colour Unit*. Some people are having trouble in obtaining the transformers specified, this is because Eagle have now sold out and do not expect to have any more until April—substitute types can be used.

Another problem with the colour unit is the thyristors—some types are no good in this circuit due to the high gate voltage they require. If you can get type C106D (Henry's stock them) these should be excellent and can pass up to 25 amps on a suitable heat sink. Therefore up to about 5,000 watts can be used on each channel if required!

### Indicator Audible Warning

No case has been shown for the *Indicator Audible Warning* and none is required if the unit is mounted to the rear of the dashboard. However should a case be required the unit is small enough to fit inside many of the small plastic boxes or tubs that are used for food or pills etc.

Many chemists now use clear plastic tubs with push on plastic tops for pill containers—most will sell you one very cheaply (about 2p to 5p) if you ask. These are virtually waterproof and are excellent cases for small projects.

Many small loudspeakers are available and we suggest you look around for a cheap 15 to 100 ohm type—if you find one for less than 45p buy it.

### Night Light Switch

No problems with buying for the *Night Light Switch*, the only point to watch is that the neon indicator incorporates a resistor to enable it to be used on mains voltage.

Incidentally, since the article was edited and the drawings made we have realised that a single pole single throw switch could be used for S1—it would simply be across D1 and short it out in the "full light" position. If you use this type of switch you will save about 3p—worth mentioning?

### General Purpose Audio Amplifier

Few buying problems should arise from components needed for the *General Purpose Audio Amplifier*.

The transformer (Eagle MT-280) is available from many suppliers but if in difficulty, contact G.W. Smiths or Chromasonics. The case used for the prototype is constructed from universal chassis parts which regular constructors will now know as being available from Home Radio—other types of metal case can of course be used if required.

Heatsinks for T01 case transistors are generally available but a look at the *Bright Idea* for this purpose (page 209) may be helpful. Just to emphasise the point the component board is plain perforated Veroboard—that means no copper strips. If you cannot obtain the exact bridge rectifier quoted you can use any type with a rating of at least 50V at 0.5 amp.

The loudspeaker sockets used on this project are rather unusual and we have been unable to find the supplier of that exact type. A similar spring-loaded type with square tops is produced by Eagle and are available through a number of suppliers. Alternatively screw terminals could be used.

### V.A.T.

The "approximate cost of components" quotations in this issue do not include additions for value added tax. We will look at possible price increases in more detail next month. A brief note on V.A.T. appears this month on the contents page.

### Last Month's Cover

We sometimes get letters about suppliers not doing all they should—normally we can assist and help sort something out—but this time it is us that is in need of sorting out.

Two firms were good enough to assist us last month by supplying photographic "props" for our front cover and we omitted to thank them with an acknowledgement. We hope the firms will forgive us; we can make no excuses, only publish a belated acknowledgement.

Dixon's Photographic kindly loaned the enlarger, which was shown in use with the exposure meter.

Heals of Tottenham Court Road loaned the double egg cup, glass egg timer and table cloth.

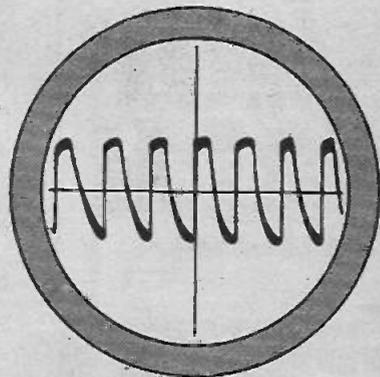
Our thanks to both of them.

*Everyday Electronics*, April 1973

# look! electronics really mastered

... practical  
... visual  
... exciting!

no previous knowledge  
no unnecessary theory  
no "maths"



RAPY

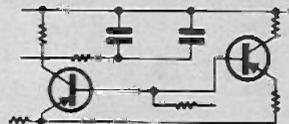
## BUILD, SEE AND LEARN

step by step, we take you through all the fundamentals of electronics and show how easily the subject can be mastered. Write for the free brochure now which explains our system.

### 1/ BUILD AN OSCILLOSCOPE

You learn how to build an oscilloscope which remains your property. With it, you will become familiar with all the components used in electronics.

### 2/ READ, DRAW AND UNDERSTAND CIRCUIT DIAGRAMS



as used currently in the various fields of electronics.

### 3/ CARRY OUT OVER 40 EXPERIMENTS ON BASIC ELECTRONIC CIRCUITS & SEE HOW THEY WORK, including:

valve experiments, transistor experiments amplifiers, oscillators, signal tracer, photo electric circuit, computer circuit, basic radio receiver, electronic switch, simple transmitter, a.c. experiments, d.c. experiments, simple counter, time delay circuit, servicing procedures.

This new style course will enable anyone to really understand electronics by a modern, practical and visual method—no maths, and a minimum of theory—no previous knowledge required. It will also enable anyone to understand how to test, service and maintain all types of electronic equipment, radio and TV receivers, etc.

**FREE** POST NOW  
for  
BROCHURE

or write if you prefer not to cut page

To: **BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL,**  
P.O. Box 156, JERSEY. Please send your free brochure, without obligation, to:  
*we do not employ representatives*

NAME

BLOCK CAPS

ADDRESS

PLEASE EEL. 43

**special free gift also to all our students**

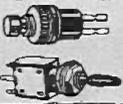
**MAIL ORDERS:** Some items have a postage and handling charge shown against them. Where p. & p. is not shown the charge is 13p for any selection. When both classes of goods are ordered the charge is 13p plus any p. & p. charges shown. (Overseas extra). Telephone 01-692 4412.

# GARLAND BROS. LTD.

## DEPTFORD BROADWAY, LONDON, SE8 4QN

### SWITCHES

Standard toggle switches:  
 SW20—S.P.S.T. 20p; SW21—D.P.D.T. 25p.  
 Miniature toggle switches:  
 SW18—S.P.S.T. 51p; SW19—D.P.D.T. 64p.  
 Slider switches, SW3—D.P.D.T. 15p.  
 Wafer switches (rotary)—24p each  
 SW4—1 pole, 12 way.  
 SW5—2 pole, 6 way.  
 SW6—3 pole, 4 way.  
 SW7—4 pole, 2 way.  
 SW8—4 pole, 3 way.



### PLINTH

to suit Garrard 2025, SP25 etc. Teak finish, complete with Perspex cover. Very attractive appearance. £3.95 plus 35p p. & p.



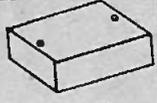
### J-BEAM FM5 AERIAL

4 element, all channel aerial for stereo radio. £6.10 plus 50p p. & p.



### PLASTIC BOXES

for constructional projects. White, with lid and screws. BPI 4 1/2ins x 3ins x 1 1/2ins—37p. BPI 6ins x 4ins x 2 1/2ins—37p.



### MINIATURE SPEAKERS

2 1/2in 8Ω  
 2 1/2in 8Ω  
 2 1/2in 80Ω  
 All at 68p each.



### GROOV-KLEEN

de luxe model 42. £2.15.



### STEREO HEADPHONES

Earle SE5. 8Ω  
 40-16,000Hz  
 Complete with cable and stereo jack plug. £3.43 Plus 24p p. & p.



## V.A.T.

Prices in this advertisement include V.A.T. If ordering before April 1st please deduct 10% from total order.

### BATTERY HOLDERS

For 4 x HP7. Long or short—22p.  
 Press studs, ready wired PP3 size—10p; PP9 size—13p.



### CONSOLE CASES

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

Type	W	A	B	C	D	Price p. & p.
	in	in	in	in	in	
GB20	8	9	3 1/2	2	3	£1.56 33p
GB21	10	9	3 1/2	2	3	£1.74 33p
GB22	12	9	3 1/2	2	3	£1.89 33p



### EQUIPMENT CASES

in plain aluminium with sloping front panel.

Type	H	W	D	Price p. & p.
	in	in	in	
SF1	2in	5 1/2in	2 1/2in	50p 13p
SF2	2in	7 1/2in	3 1/2in	66p 17p
SF3	2in	9 1/2in	4 1/2in	83p 20p



### ALUMINIUM BOXES

with lids and screws.

Type	L	W	D	Price p. & p.
	in	in	in	
GB7*	5 1/2in	2 1/2in	1 1/2in	42p 16p
GB8*	4in	4in	1 1/2in	42p 16p
GB9*	4in	2 1/2in	1 1/2in	42p 14p
GB10*	5 1/2in	4in	1 1/2in	49p 19p
GB11	4in	2 1/2in	1in	42p 14p
GB12	3in	2in	1in	36p 15p
GB13	6in	4in	2in	37p 20p
GB14	7in	5in	2 1/2in	69p 21p
GB15	6in	6in	3in	89p 29p
GB16	10in	7in	3in	£1.00 29p

\* These sizes fit standard veroboards

### DYNAMIC MICROPHONE UD130HL

This sensitive, quality microphone is uni-directional and is complete with mute switch and 20 feet of cable and plug. 100-12,000Hz. Dual impedance 600Ω and 50kΩ. £6.60 plus 24p p. & p.



### MICROPHONE FLOOR STAND

Professional, heavy quality with folding, tripod base. Telescopic stem extends to 59ins. Chrome finish. £6.25 plus 45p p. & p.



### MICROPHONE HOLDER

with swivel (as supplied with the mic. above). Fits most tubular mics. and stands. 57p.

### TAPE ERASER

erases a whole reel of tape in seconds. 240V. A.C. Full instructions. £2.20 plus 22p p. & p.



## CATALOGUE

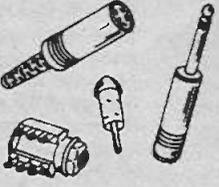
15p  
POST FREE

### SCREENED CABLES

Single for mics, audio leads, etc. 5 1/2 yd. Twin, as above, common screen 10p yd. Stereo, two cores, individually screened 11p yd. Four core with common screen 23p yd. Four core, individually screened 30p yd. Coiled screened leads, 20 feet long £1.05 each.

### PLUGS

Car aerial 15p  
 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, 2 1/2mm unscreened 10p  
 Jack, 2 1/2mm screened 11p  
 Jack, 3 1/2mm unscreened 9p  
 Jack, 3 1/2mm screened 13p  
 Jack, 4in unscreened 13p  
 Jack, 4in screened 22p  
 Jack, stereo, unscreened 22p  
 Jack, stereo, screened 31p  
 Phono, plastic top 5p  
 Phono, plated metal 13p  
 Wander, red or black 3p  
 Banana 4mm, red or black 6p



### SOCKETS

Car aerial 9p  
 Co-axial, surface 9p  
 Co-axial, flush 10p  
 D.I.N. 2 pin (speaker) 10p  
 D.I.N. 3 pin 11p  
 D.I.N. 5 pin, 180° 10p  
 D.I.N. 5 pin, 240° 10p  
 Jack, 2 1/2mm 11p  
 Jack, 3 1/2mm 11p  
 Jack, 4in unswitched 16p  
 Jack, 4in switched 18p  
 Jack, stereo, switched 26p  
 Phono, single 5p  
 Phono, 2 on a strip 7p  
 Phono, 4 on a strip 10p  
 Phono, 4 on a strip 11p  
 Wander, single, red or black 3p  
 Wander, twin strip 7p  
 Banana 4mm red, or black 6p

### LINE SOCKETS

Car aerial 15p  
 Co-axial 10p  
 D.I.N. 2 pin (speaker) 16p  
 D.I.N. 3 pin 17p  
 D.I.N. 5 pin, 180° 17p  
 D.I.N. 5 pin, 240° 17p  
 Jack, 3 1/2mm 16p  
 Jack, 4in screened 54p  
 Jack, stereo, screened 37p  
 Phono, plated metal 15p

### MINIATURE ELECTROLYTICS

1.0μF	63V	7p	150μF	25V	8p
1.5μF	63V	7p	150μF	40V	13p
2.2μF	63V	7p	150μF	63V	15p
3.3μF	63V	7p	220μF	4V	7p
4.7μF	63V	7p	220μF	10V	7p
6.8μF	63V	7p	220μF	16V	8p
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
22μF	10V	7p	330μF	63V	26p
22μF	25V	7p	470μF	6.3V	8p
22μF	63V	7p	470μF	10V	13p
33μF	6.3V	7p	470μF	25V	15p
33μF	16V	7p	470μF	40V	22p
33μF	40V	7p	680μF	6.3V	13p
47μF	10V	7p	680μF	16V	13p
47μF	10V	7p	680μF	25V	22p
47μF	25V	7p	680μF	40V	26p
47μF	40V	7p	1000μF	4V	13p
47μF	63V	8p	1000μF	10V	15p
68μF	6.3V	7p	1000μF	16V	22p
68μF	16V	7p	1000μF	25V	26p
68μF	63V	13p	1500μF	6.3V	15p
100μF	4V	7p	1500μF	10V	22p
100μF	10V	7p	1500μF	16V	26p
100μF	25V	7p	2200μF	6.3V	22p
100μF	40V	8p	2200μF	10V	26p
100μF	63V	15p	3300μF	6.3V	26p
150μF	6.3V	7p	4700μF	4V	26p
150μF	16V	7p			

### TRANSFORMERS

all with 0-250 Volt primaries.

**Miniature**  
 MH16 6V, 500mA +6V, 500mA.  
 MH12 12V, 250mA +12V, 250mA.  
 MH20 20V, 150mA +20V, 150mA.  
 £1.42 plus 14p p. & p.

**L.T.**  
 LT1 6.3V, 1.5A—82p plus 20p p. & p.  
 LT2 6.3V, 3A—96p plus 28p p. & p.  
 LT3 12V, 1.5A—96p plus 28p p. & p.  
 LT4 12V, 3A—£1.45 plus 33p p. & p.  
 LT5 9-0-9V 0.5A—83p plus 23p p. & p.  
 LT6 12-0-12V, 1A—£1.04 plus 23p 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.  
 MT60/2 0-5-20-30-40-60V, 2A—£2.25 plus 37p p. & p.

**Charger**  
 CT10/1 1A—£1.16 plus 28p p. & p.  
 CT10/2 2A—£1.43 plus 33p p. & p.  
 CT10/3 4A—£1.76 plus 33p p. & p.  
 Secondaries 0-5-1-117V.  
 Speaker Matching 3-8-16 Ω.  
 Example: 16 Ω speaker to 8 Ω amplifier. 99p plus 22p p. & p.

### VEROBOARD

Size Matrix  
 2 1/2in x 3 1/2in 25p  
 2 1/2in x 5in 28p  
 3 1/2in x 3 1/2in 28p  
 3 1/2in x 5in 32p  
 1 7/8in x 2 1/2in 37p  
 1 7/8in x 3 1/2in 41p  
 £1.18 94p  
 Spot face cutter—43p  
 Pins, either size, pack of 36—21p  
 Edge connectors:  
 24 way, 0-1—37p 36 way, 0-1—48p  
 24 way, 0-15—37p 16 way, 0-15—25p

**BONDED ACRYLIC FIBRE**  
 B.A.F. wadding, 18in wide, 1in thick. The ideal lining for speaker enclosures. 33p per yard. P. & p. 1yd 14p; each extra yard 4p.

### CONTROLS

Log. or Lin.  
 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 £1.65 plus 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—£3.55 + 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.

### ELECTROLYTICS

1μF	450V	21p	1000μF	50V	44p
2μF	450V	22p	2000μF	25V	43p
4μF	350V	15p	2000μF	50V	58p
8μF	450V	18p	2500μF	25V	50p
16μF	450V	20p	2500μF	50V	66p
25μF	25V	7p	3000μF	25V	53p
25μF	50V	11p	5000μF	25V	66p
32μF	450V	30p	5000μF	50V	£1.21
50μF	50V	11p	8-8μF	450V	20p
100μF	50V	12p	8-16μF	450V	20p
250μF	25V	13p	16-16μF	450V	30p
250μF	50V	19p	16-32μF	450V	69p
500μF	25V	20p	32-32μF	450V	54p
500μF	50V	27p	50-50μF	350V	42p
1000μF	25V	30p			

# 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.

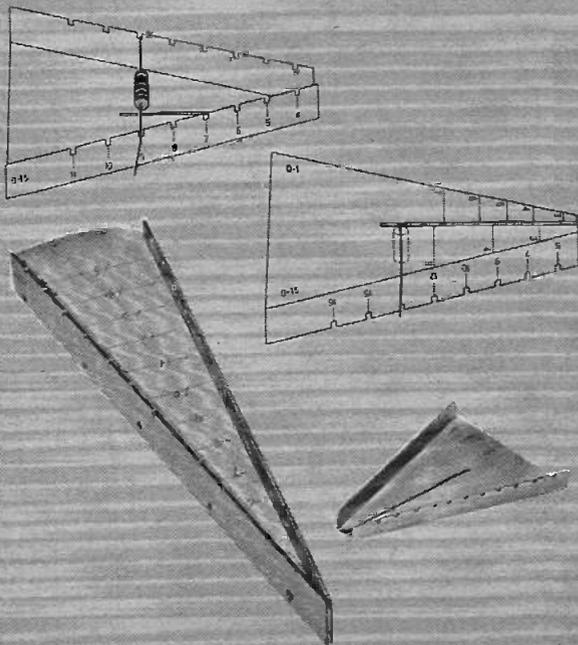
I am somewhere at the back of the class when it comes to electronics so to make up for it I try to be neat when making your projects. Whilst waiting for the next issue of *EVERYDAY ELECTRONICS* I made this gauge for bending wires to bridge the holes in the matrix boards.

I don't know whether something like this is on the market or whether it will be of interest but the one I made helps me. After bending the shape in aluminium and cutting the slot the calibrations were found by offering the matrix board (0.15inch and 0.1inch) to it and marking. The slot down the centre of the gauge is used for components that are to be mounted upright.

E. R. Wall,  
London, SE7

A similar gauge, of slightly different construction was suggested by Mr J. Bayley of Cornwall. This gauge is much larger and can be used while resting on the bench. One side is marked for 0.15inch matrix, the other for 0.1inch matrix.

The gauge is constructed with a wooden base having Formica or plastic sides pinned to it (left in photo).

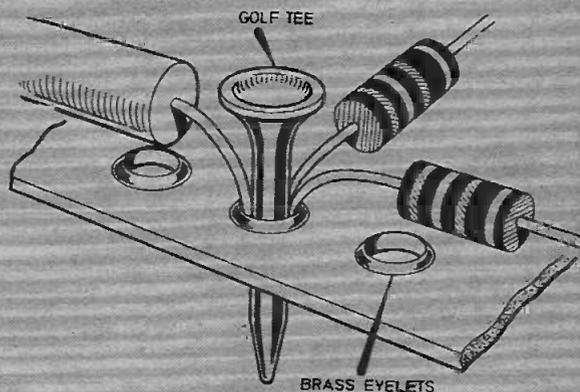


I would like to submit for possible publication in your Bright Ideas column a cheap and inexpensive solderless way of making up circuits before final and permanent assembly on a board.

Obtain from Woolworths some brass eyelets and press them into a piece of hardboard or Paxolin sheet, holes drilled to take them.

Components, up to about 8, can be secured in the eyelets using golf tees as shown in the drawing.

E. M. Terrell  
London, E15



I carry out a lot of experimental work using transistors and I find the problem of heat sinks and clamping sometimes frustrating. Fortunately I hit on the idea of using Terry Clips for the purpose and these have proved very satisfactory. Using one or two together they look a professional job, hold the transistor neatly and provide a small heat sink on their own.

R. Rigg,  
Rochdale, Lancs.

Could be useful for the General Purpose Amplifier in this issue (Ed.).

I would like to submit two Bright Ideas the first one is an aid for cleaning the tinned wires of resistors, capacitors or transistors before inserting them into a circuit board. A hard pencil rubber with a slit cut into one side about half way through is all that is needed.

Insert the lead to be cleaned into the slit, apply a slight pressure with the fingers and stroke the lead a few times. The lead will be clean and grease free due to the mild abrasive action of the rubber.

The other idea is as follows; a drilling jig for power transistors i.e. OC35, OC22, etc. Take a "dud" power transistor cut-off the "top hat" portion and remove the innards of the transistor. Punch out the base and emitter feed throughs and you will be left with an exact drilling jig. The same thing applies to old coil bases etc., cut the bases off and keep them as drilling jigs for any future projects.

P. Screeney,  
Sheffield,  
Bedfordshire.

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.

# DEMO CIRCUITS

5

By MIKE HUGHES

## The Phase Shift Oscillator

VERY frequently one needs to be able to produce an audio frequency sine wave—perhaps as a signal generator or as part of a piece of equipment. This month's circuit describes a very simple circuit that will produce a good quality sine wave of a fixed frequency using only resistors and capacitors to set the frequency, as opposed to large inductors.

In principle the oscillator can be designed to give an output from one cycle in several seconds to several kilohertz. To demonstrate the operation we shall design it to give a signal in the middle of the audible range and show how it can be modified. The active part of the circuit is called a phase shift oscillator.

### FEEDBACK

When a transistor is operated in a common emitter configuration as a simple amplifier the output signal at the collector is 180 degrees out of phase with the input at its base—in other words when the input signal goes in a positive direction the output goes in a negative sense. It may sound a silly application, but if the output was connected back to the input through a capacitor the signal fed back would negate the input signal and the level of the output would be reduced; this is called **negative feedback** and it is frequently used to help control the gain of an amplifier.

If the first stage of amplification is followed by a second, identical amplifier, and the output fed back from the second stage to the input of the first, the feedback signal would now be "in phase" with the original input signal (because the second transistor inverts the signal back to the way it was originally). The second transistor has given a further 180 degrees of phase shift and brought the signal back to where it started.

The fed back signal now enhances the input signal and the output will become greater faster until it reaches close on the supply voltage and the increase in the output starts to slow up (**positive feedback**). This means that the positively fed back signal starts to reduce and the output starts to fall. This fall is fed back and becomes self sustaining until the output level reaches a minimum.

This principle of positive feedback is used in most self sustaining, free running oscillators. To get a circuit to oscillate at a known frequency the components used in the positive feedback loop must be frequency dependant. These components (they could be resistors, together with capacitors or inductors in various combinations) allow feedback to occur only at the frequency we have chosen.

### PHASE

In the case of this month's circuit the fact that if a current passes through a resistor and capacitor in series with each other there is a difference in phase between the current through the resistor and the voltage across the capacitor is utilised. Look at the simple resistor, capacitor (RC) circuit of Fig. 5.1. If the input voltage

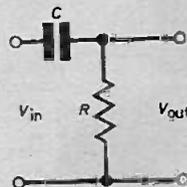


Fig. 5.1 Simple RC circuit.

starts to rise slowly (equivalent to a low frequency) the output will follow it but will be delayed by the fact the capacitor is, in effect, charging up through the resistor to the input voltage; if the input starts to fall again the output will follow but there is another delay because the capacitor is in effect discharging through the resistor.

The delay is governed by the time constant for the resistor and capacitor in question. At very low frequencies the delay approaches a quarter of the period of the input signal, i.e. when the input is maximum positive the output will be passing zero, and when the input is at zero the output will be passing maximum positive.

At very low frequencies capacitors show high reactance and therefore the impedance of our circuit is quite high while the value of the resistance may be quite low; this means that the potential divide effect of the circuit is high and

**ZN414 £1.25** POST FREE  
The I.C. Radio in a TO18 can. Supplied complete with data sheet No. 10 which contains specification, circuit and details and prices of components such as ferrite rods, compression trimmers etc.

**I.C. Sockets**  
Dual in line or Zig-Zag (Dial), 14 and 16 pin  
Our Price 1p per pin

**VDR's & Thermistors**

A15B	75p	GL23	£1.00	VA1005	15p
CZ1	15p	R53	£1.32	VA1026	13p
CZ4	13p	R64	£1.46	VA1033	13p
CZ13A	13p			VA1040	10p
E298 ED/A258	16p			VA1053	10p
E298 CZ/06	16p			VA1055S	10p
GL16	£1			VA1034	10p

**Potentiometers**



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

log or lin less switch (& 1KΩ lin) 12p  
log or lin with switch 24p  
dual less switch 40p  
with switch 10K, 100K & 1M 52p  
log only 40p  
10K log - 10K antilog less switch 40p

**Capacitors**

disc ceramic		low voltage	
01μF 18v	5p	0.1-μF 30v	5p
022μF 18v	5p	0.22-μF 5v	5p
047μF 12v	5p	0.47-μF 3v	5p
ceramic plate		30V	
1000pf	10p	4700pf	10p
2200pf	10p	10,000pf	10p

**Slider Pots**

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

**Resistors**

1 watt 5% Carbon Film - low noise  
Hi-Stabs  
All E24 values 1p each plus p. & p. 7p for up to 50 Resistors and a further 2p for each additional 50. Deduct 33% for 100 of one type or 25% for mixed orders over £1 in value.

1 W 10% Carbon Composition	3p each
2 W 10% Carbon Composition	8p each
2 1/2 W 5% Wire wound	9p each
5 W Wire wound	9p each
10 W Wire wound	10p each

plus p. & p. 7p for up to 25 resistors plus 1p for each additional 25.

**Eliminators**



9 volt or 20mA (PP3) £1.25  
6 volt or 50mA £1.50  
9 volt or 50mA £1.50  
6 + 6 volt 50mA £2.50  
9 + 9 volt 50mA £2.50  
7 1/2 volt for cassette recorders £2.00  
6.75 or 9 volt £3.00  
3.45, 6.75, 9, 12 or 500mA (flua.) £3.99  
Car Battery Converter fully stabilised to provide 6, 7 1/2 or 9 volts £4.99  
(p. & p. 15p on all types)

**Capacitors**

Ceramic - plate	63V (C333)		
1-8pf	8-2pf	33pf	120pf
2-2pf	10pf	39pf	150pf
3-3pf	12pf	47pf	180pf
3-9pf	15pf	56pf	220pf
4-7pf	18pf	68pf	270pf
5-6pf	22pf	82pf	330pf
6-8pf	27pf	100pf	

all 5p. each

**NEW LISTS**

LOUDSPEAKERS No. 4  
COILS AND INDUCTORS No. 5  
TRANSFORMERS No. 6  
(postage 5p)

**Diodes & Rectifiers**

AA119	9p	BA156	15p	BY176	£1-60
AA120	8p	BA243	50p	BY182	£1-50
AA129	9p	CA47	10p	BY250	23p
BA102	25p	OA79	9p	IN4001	8p
BA115	17p	OA90	7p	IN4002	7p
BA130	10p	OA91	7p	IN4003	8p
BA145	20p	QA200	10p	IN4004	8p
BA148	20p	BY100	15p	IN4005	10p
BA154	13p	BY126	15p	IN4006	12p
BA155	14p	BY127	15p	IN4007	15p

**Resistors**



3 Watt Audio Amplifier  
Our Price inc. handbook £2.48

**Presets**

Vertical or Horizontal  
0.1 watt 5p  
100 1KΩ 10K Ω 100K Ω 1M Ω  
250 2.5K Ω 25K Ω 250K Ω 2.5M Ω  
500 5K Ω 50K Ω 500K Ω 5M Ω

**Capacitors**

mylar film	100V	
10000pf 2p	0.1μF 3p	0.68μF 4p
20000pf 2p	0.2μF 3p	1-1μF 4p
50000pf 2p	0.4μF 3p	2-2μF 5p
	0.5μF 3p	

polystyrene 180V  
10pf to 10,000pf in multiples of 10, 15, 22, 33, 47 & 68. 3p each

**Diodes & Rectifiers**



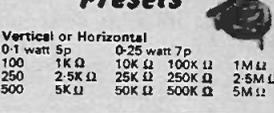
FM TUNER chassis fully transistorised 9 volt operation. OUR PRICE £6.25  
Matching stereo decoder £4.97 Ask for model list No. 1L

**Resistors**



10-less 18% 25+ less 25% 70+ less 33%  
3 Watt Audio Amplifier  
Our Price £3.00 Less quantity discount.

**Presets**



Vertical or Horizontal  
0.1 watt 5p  
100 1KΩ 10K Ω 100K Ω 1M Ω  
250 2.5K Ω 25K Ω 250K Ω 2.5M Ω  
500 5K Ω 50K Ω 500K Ω 5M Ω

**Capacitors**

silvered mica 1% (>50pf) 500V			
2-2pf-820pf	7p	4-7nF-5600pf	19p
1nF-2.2nF	9p	6800pf-0.1μF	23p
2-7nF-3.6nF	16p		

mixed dielectric 800V  
0.1μF 7p 0.47μF 7p 2.2μF 15p  
0.22μF 7p 0.68μF 8p 47μF 24p  
0.33μF 7p 1μF 8p 1μF 33p

**CHROMASONIC electronics**

**Heat Sinks**



TO5 TO18 5p  
TO66 TO63 14p 15p  
Power Tab 13p  
DIP10/2 for SL403D 15p

**Transistors & Integrated Circuits**

AC107	25p	BC147	10p	BF196	15p	OC81	16p	2N1304	22p	2N572	15p
AC128	17p	BC148	16p	BF197	15p	OC140	30p	2N1711	25p	SZ188	10p
AC127	15p	BC146	16p	BF272	50p	OC170	35p	2N1830	30p	ZENERS SERIES	
AC128	15p	BC187	12p	BF750	24p	OC171	30p	2N2928	all 16p	LOGIT	£1.50
AC176	15p	BC158	16p	BF951	21p	ZTX107	18p	2N3653	23p	LC871	£1.50
AC197	25p	BC198	12p	BR130	26p	ZTX108	12p	2N3654	50p	LC871T	£1.50
AC197K	25p	BC196	15p	BSX21	26p	ZTX109	12p	2N3655	40p	MC1303L	£1.75
AC126	25p	BC169	15p	BSX50A	14p	ZTX200	12p	2N3720	12p	MC1330	80p
AC108K	25p	BD115	87p	BU150/02	£1.75	ZTX208	20p	2N3750	12p	MC1350	75p
AC780	25p	BD131	70p	MJ340	87p	ZTX208	20p	2N3754	10p	MC1351	£1.80
AD145	40p	BD132	70p	MPF102	40p	ZTX303	25p	2N3755	10p	MC1352	£1.80
AD149	40p	BD131P/2M	P	MPF103	37p	ZTX304	25p	2N3758	10p	MFC4000B	40p
AD161	40p	BD132P	P	MPF104	37p	ZTX311	25p	2N3759	15p	MFC4010A	35p
AD182	40p	BF180	21p	MPF105	40p	ZTX500	15p	2N3759	12p	LM380	£1.46
AF114	18p	BF187	20p	MPF106	45p	ZTX501	15p	2N3759	12p	SL403D	£1.50
AF115	18p	BF173	20p	OC28	40p	ZTX502	17p	2N3710	10p	TAD100	£1.50
AF116	14p	BF180	25p	OC35	40p	ZTX503	17p	2N3711	10p	FR 182	£1.50
AF117	16p	BF181	30p	OC44	15p	ZTX504	50p	2N3819	35p	FR 182A	£1.50
AF120	20p	BF184	25p	OC45	18p	ZTX505	25p	2N3903	15p	PA78C	£1.85
BC107	10p	BF185	25p	OC71	11p	2N567	12p	2N3904	10p	PA78C	£1.85
BC108	10p	BF194	15p	OC72	17p	PN705	12p	2N3905	21p	PA78C	£1.85
BC109	16p	BF195	15p	OC78	15p	2N708	15p	2N3906	12p	PA78C	£1.85

**Capacitors**

10000pf 6p	68000pf 10p	1000V	
22000pf 6p	0.1μF 9p	200pf 9p	1μF 12p
33000pf 6p	0.1μF 9p	220pf 9p	2.2μF 12p
47000pf 6p	0.22μF 9p	470pf 9p	4.7μF 12p
	0.22μF 9p	0.47μF 12p	

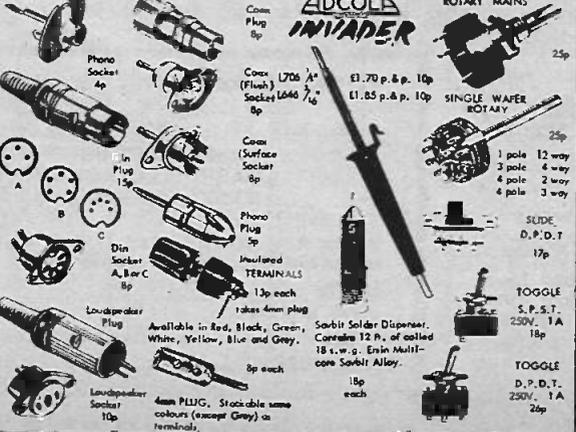
12KV d.c. 8KV d.c. HI-K 750V

**Veroboard**

2 1/2" x 1"	6p	6p	
2 1/2" x 3 1/2"	20p	16p (9)	10p
2 1/2" x 5"	24p	21p (7)	12p
3 1/2" x 3 1/2"	24p	21p (8)	
3 1/2" x 5"	27p	27p (10)	17p
1 7/8" x 2 1/2"	67p	50p	37p
1 7/8" x 3 1/2"	90p	70p	
1 7/8" x 5"			75p

Spot-face Cutter 36p  
Pin Insertion Tool 47p  
Terminal Pins 18p per pack of 36

**ADCOLA INVADER**



COAXIAL PLUGS  
Phono Socket 4p  
Coax (Finish) Socket L646 7/16 £1.70 p. & p. 10p  
Coax (Surface) Socket 8p  
Phono Plug 5p  
DIN Socket A, B, C 5p  
Insulated TERMINALS 13p each  
4mm PLUG. Storable same colour (except Grey) as terminals.  
Solder Solder Dispenser. Contains 12 p. of called 18.1 v. c. Fine Multi-colour Solder Alloy. 18p each

**Mullard B Siemens Electrolytics**

CAP μF		VOLTAGE						
		4	6.3	10	16	25	50	63
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

**Aluminium Boxes**

Including baseplate and screws

No.	L	W	D	Price	p. & p.
(7)	2 1/2"	5 1/2"	1 1/2"	35p	8p
(8)	4"	4"	1 1/4"	30p	8p
(9)	4"	4"	2 1/4"	35p	8p
(10)	4"	5 1/2"	1 1/4"	40p	8p
11	4"	4 1/2"	2"	35p	8p
12	3"	2"	1 1/2"	32p	9p
13	6"	4"	2"	50p	10p
14	7"	5"	2 1/4"	58p	12p
15	8"	6"	3"	75p	18p
16	10"	7"	3"	85p	20p

**Hi-Volt Electrolytics**

1: 2: 8μF 450V	14p	32μF	450V	28p
16μF 450V	15p	50μF	350V	28p
8-16μF 450 V.W.	18p	32-32μF 350 V.W.	25p	
8-16μF 450 V.W.	28p	32-32μF 450 V.W.	43p	
18-16μF 450 V.W.	25p	50-50μF 350 V.W.	35p	

# TRANNNIES

(Formerly C. R. HADLEY)

All our stocks are brand new with money back refund.

TRANSISTORS		MULLARD POLYESTER CAPACITORS C280 SERIES	
AC107 15p	AL102 59p	BD116 79p	OC14 12p
AC126 11p	AL103 49p	BD121 50p	OC45 18p
AC127 11p	AU103 85p	BD130 46p	OC71 12p
AC128 11p	AU111 95p	BD131 59p	OC72 12p
AC174 25p	BC107 8p	BF194 15p	OC81 13p
AC141K 20p	BC108 8p	BFY30 18p	OC83D 18p
AC142K 20p	BC109 8p	BSY95A 15p	OC83 20p
AD14 40p	BC154 20p	ME0402 18p	OC170 24p
AD150 44p	BC168 10p	ME0404 14p	OC200 25p
AD161 55p	BC169 11p	ME4401 10p	OC201 25p
AD162 M/P 65p	BC182L 8p	ME4402 12p	OC25 25p
AF114 15p	BC183L 8p	ME6002 14p	OC28 30p
AF116 15p	BC184L 8p	ME6101 14p	OC29 35p
AF117 15p	BC212L 8p	ME6102 15p	OC35 25p
		ME6111 33p	OC36 38p
		ME6112 34p	OC37 48p
		ME6113 34p	OC38 48p
		ME6114 34p	OC39 48p
		ME6115 34p	OC40 48p
		ME6116 34p	OC41 48p
		ME6117 34p	OC42 48p
		ME6118 34p	OC43 48p
		ME6119 34p	OC44 48p
		ME6120 34p	OC45 48p
		ME6121 34p	OC46 48p
		ME6122 34p	OC47 48p
		ME6123 34p	OC48 48p
		ME6124 34p	OC49 48p
		ME6125 34p	OC50 48p
		ME6126 34p	OC51 48p
		ME6127 34p	OC52 48p
		ME6128 34p	OC53 48p
		ME6129 34p	OC54 48p
		ME6130 34p	OC55 48p
		ME6131 34p	OC56 48p
		ME6132 34p	OC57 48p
		ME6133 34p	OC58 48p
		ME6134 34p	OC59 48p
		ME6135 34p	OC60 48p
		ME6136 34p	OC61 48p
		ME6137 34p	OC62 48p
		ME6138 34p	OC63 48p
		ME6139 34p	OC64 48p
		ME6140 34p	OC65 48p
		ME6141 34p	OC66 48p
		ME6142 34p	OC67 48p
		ME6143 34p	OC68 48p
		ME6144 34p	OC69 48p
		ME6145 34p	OC70 48p
		ME6146 34p	OC71 48p
		ME6147 34p	OC72 48p
		ME6148 34p	OC73 48p
		ME6149 34p	OC74 48p
		ME6150 34p	OC75 48p
		ME6151 34p	OC76 48p
		ME6152 34p	OC77 48p
		ME6153 34p	OC78 48p
		ME6154 34p	OC79 48p
		ME6155 34p	OC80 48p
		ME6156 34p	OC81 48p
		ME6157 34p	OC82 48p
		ME6158 34p	OC83 48p
		ME6159 34p	OC84 48p
		ME6160 34p	OC85 48p
		ME6161 34p	OC86 48p
		ME6162 34p	OC87 48p
		ME6163 34p	OC88 48p
		ME6164 34p	OC89 48p
		ME6165 34p	OC90 48p
		ME6166 34p	OC91 48p
		ME6167 34p	OC92 48p
		ME6168 34p	OC93 48p
		ME6169 34p	OC94 48p
		ME6170 34p	OC95 48p
		ME6171 34p	OC96 48p
		ME6172 34p	OC97 48p
		ME6173 34p	OC98 48p
		ME6174 34p	OC99 48p
		ME6175 34p	OC100 48p

**CAPACITORS**  
**MULLARD POLYESTER CAPACITORS C280 SERIES**  
 250V P.C. mounting: 0.01µF, 0.015µF, 0.022µF, 0.033µF, 0.047µF, 0.068µF, 0.1µF, 0.15µF, 0.22µF, 0.33µF, 0.47µF, 0.68µF, 1µF, 1.5µF, 2.2µF, 24p.

**MULLARD POLYESTER CAPACITORS C296 SERIES**  
 400V: 0.001µF, 0.0015µF, 0.0022µF, 0.0033µF, 0.0047µF, 0.0068µF, 0.01µF, 0.015µF, 0.022µF, 0.033µF, 0.047µF, 0.068µF, 0.1µF, 0.15µF, 0.22µF, 0.33µF, 0.47µF, 0.68µF, 1µF, 1.5µF, 2.2µF, 24p.

**ELECTROLYTIC CAPACITORS - MULLARD C426 SERIES**  
 50p each  
 (µF/V) 10/2.5, 20/2.5, 50/2.5, 100/2.5, 200/2.5, 500/2.5, 8/4, 32/4, 64/4, 125/4, 250/4, 400/4, 6/4, 16/4, 32/4, 64/4, 125/4, 250/4, 500/4, 1000/4, 100/6.4, 200/6.4, 400/6.4, 800/6.4, 1600/6.4, 4/10, 16/10, 32/10, 64/10, 125/10, 250/10, 2/16, 10/16, 20/16, 40/16, 80/16, 125/16, 1.5/25, 6.4/25, 13/25, 25/25, 50/25, 80/25, 1/40, 4/40, 8/40, 16/40, 32/40, 50/40, 0.64/64, 2.5/64, 5/64, 10/64, 20/64, 32/64.

**MULLARD C437 SERIES**  
 100/40, 100/25, 250/16, 400/10, 640/6.4, 800/4, 1000/2.5, 5p, 100/64, 160/40, 250/25, 400/16, 640/10, 1250/4, 1000/6.4, 1600/2.5, 18p, 160/64, 250/40, 400/25, 640/16, 1000/4, 1000/10, 1600/6.4, 2500/2.5, 18p, 250/64, 400/40, 640/25, 1000/4, 1000/16, 1600/10, 2500/6.4, 4000/2.5, 18p.

Miniature Fixed Ceramic Plates, 8p each.  
 Preferred values from 1.8p to 10,000p.

24, WOODHILL, HARLOW, ESSEX

Add 5p P. & F. Price list S.A.E. No callers please.

Phone: HARLOW 37739

## MINITRON DIGITAL INDICATOR TYPE 3015F

Reads 0-9 and decimals (Data Sheet on request)

ONLY £1.50 for one month only

16 DIL Socket Driven by 7447 30p 95p

### UPPER LOW PRICED LINEAR I.C.'S

DIODES	
1N4001 4p	301A To99 49p
1N4002 4p	301A DIL 45p
1N4003 5p	709C To99 25p
1N4004 7p	709C DIL 30p
0A90 6p	723C To99 87p
0A91 6p	723C DIL 90p
0A200 10p	741C To99 35p
0A202 8p	741C DIL 34p
1844 10p	741C 8p in DIL 34p
1N4149 4p	747C DIL 40p
W02 32p	748C To99 38p

**VOLUME CONTROLS**  
 Potentiometers  
 Carbon track 500 Ω to 2.2M Ω  
 Log or Linear  
 Single 12p. Dual gang (stereo) 42p.  
 Single type only with D.P. Switch 12p extra.

**RESISTORS**  
 1/2 watt 5% carbon 1p each  
 1 watt 10% carbon 1p each  
 range 2.7 Ω to 10M Ω type TR3  
 triple rated 1/4, 1/2, 1in oxide x 2%  
 range 10 Ω to 1M Ω 3p each

**SLIDE SWITCH**  
 SPST 10p each  
 SP Three Position 12p each

**MINIATURE NEON LAMPS**  
 240v or 110v 1-4 5p, 5 plus 41p each.

**CARBON SKELETON PRE-SETS**  
 Small high quality, type PR, linear only:  
 100 Ω, 220 Ω, 470 Ω, 1K, 2K, 4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M2, 4M7, 10M Ω. Vertical or horizontal mounting, 5p each.

**VEROBOARD**

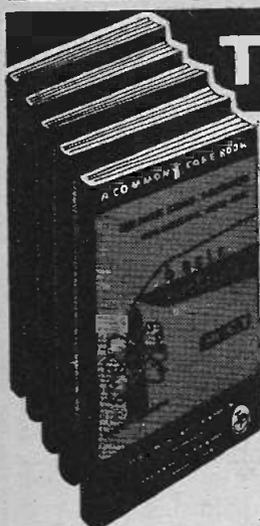
	0-15 Matrix	0-1 Matrix
21 x 31in	17p	23p
24 x 31in	25p	25p
31 x 31in	25p	25p
31 x 5in	30p	25p
5 x 17in (Plain)	83p	
Vero Pins (Bag of 38)	20p.	
Vero Cutter 45p.		
Pin Insertion Tools (-1 and .15 matrix)	at 55p.	

**ZENER DIODES**  
 400mW 5% 3.3V to 30V, 10p.

**LOW COST DUAL INLINE I.C. SOCKETS**  
 14 pin type at 15p each.  
 16 pin type at 16p each.

### TRANSISTOR EQUIVALENTS BOOK 40p

Pack of 20	Mix Pack of 20
1N4148 50p	1N4000 Series Diodes 50p
AC127 & AC128 1-9 10 plus 100 plus	AD161, AD162 M/P 1-9 10 plus 58p 45p
2N3055 1-9 10 plus	BC107-BC108 1-9 10-99 100 plus 88p 8p 6p
2N2926G 50p unbranded but tested	Pack of 10 Plastic BC109 50p Unmarked but fully tested
Unmarked but fully tested 2N3055 1-9 10 plus	TBA800 5 watt AF power Amp. £1.40 each



# The Pictorial Method

## BASIC ELECTRICITY (5vols) ELECTRONICS (6vols) TELEVISION (3vols)

You'll find it easy to learn with this outstandingly successful PICTORIAL METHOD. The essential facts are explained in the simplest language, one at a time, and each is illustrated by an accurate cartoon-type drawing. These clear and concise illustrations make study a real pleasure. The books are based on the latest research into simplified learning techniques. This easy-approach-to-learning method has proved beyond doubt that acquiring knowledge can be an enjoyable experience.

**YOUR 100% GUARANTEE**

Should you be, in any way dissatisfied with the MANUALS your money will be refunded by return of post.

### WHAT READERS SAY

These manuals have played an important part in my career. *K.W. West Drayton.*  
 My only regret is that I should have purchased these manuals years ago. *C.B. West Wickham*  
 I have studied many books but have learned more from Part One than from anything else. *B.A. Reading.*  
 These books create a sound basis on which to build a successful future. *R.G. Gt. Yarmouth.*

The series will be of exceptional value in training mechanics and technicians in Electricity, Radio and Electronics.

To The SELRAY BOOK CO., 60 HAYES HILL, HAYES, BROMLEY, KENT. BR2 7HP

Please find enclosed P.O./Cheque value £.....  
 BASIC ELECTRICITY 5 parts £4.50   
 BASIC ELECTRONICS 6 parts £5.40   
 BASIC TELEVISION 3 parts £3.60

Tick Set(s) required. Prices include Postage and Packing.  
**YOUR 100% GUARANTEE.** If after 10 days examination you decide to return the Manuals your money will be refunded in full.

NAME .....  
 BLOCK LETTERS  
 FULL POSTAL .....  
 ADDRESS .....

**POST NOW FOR THIS OFFER!**

the output voltage will be very small at low frequencies. If the frequency of the input signal is increased, the potential divide effect becomes less and the output signal will be larger, but the delay between input and output becomes less.

Using three such RC circuits cascaded into

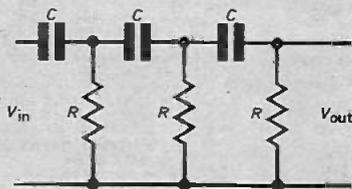


Fig. 5.2. Three RC circuits in cascade.

each other (Fig. 5.2), there will be a certain frequency (depending on the values of the respective resistors and capacitors) when a phase delay of one sixth of the waveform's period for each of the three stages will result (this is equivalent to 60 degrees phase shift). If all the resistance values are the same and identical values of capacitance employed, this frequency will be the same for each of the three stages. Each stage contributes 60 degrees of phase shift and therefore at this single frequency the resultant phase shift is  $3 \times 60$  or 180 degrees between input and output; lower frequencies will give more shift, higher frequencies less.

The important fact to grasp is that there is only one frequency that will give 180 degrees phase shift. Remember, though, that there is quite an attenuation caused by potential divide effects at each stage and therefore the output will be very much less than the input.

## OSCILLATOR

By connecting the phase shift network to a simple transistor amplifier between the output and the input, for one frequency only a signal

that is in phase with the input will be fed back and this will give positive feedback. Although the feedback signal is attenuated by the network the transistor acts as an amplifier and, provided the system is correctly designed—with sufficient current gain—the fed back signal will drive the output harder in one direction or the other (depending on which part of the cycle is considered).

Without going into the mathematics of it a current gain of at least 29 is required to get assured, self sustaining oscillation. Below 29 and the circuit will not oscillate; above 29 and the output waveshape will be distorted because the transistor could saturate. The critical frequency that undergoes 180 degrees phase shift for the network is given by:

$$f \text{ (in Hz)} = \frac{1}{2\pi \times R \times C \times \sqrt{6}}$$

where  $R$  is in ohms and  $C$  in farads.

## DEMO CIRCUIT

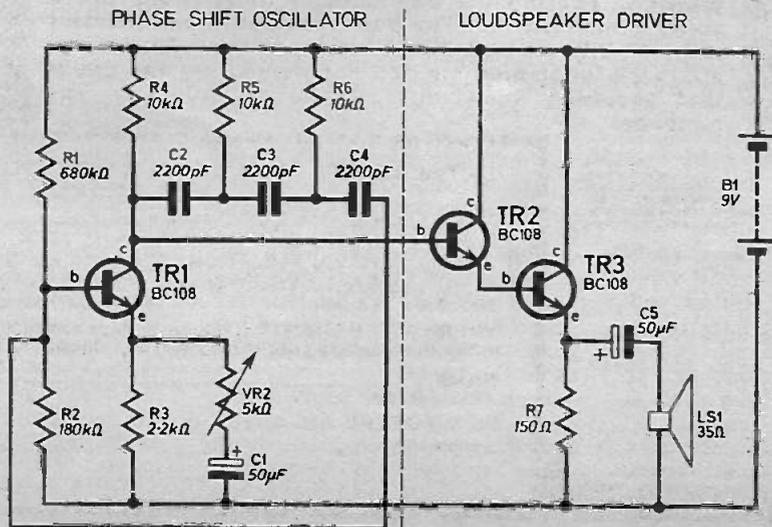
A working demonstration circuit is shown in Fig. 5.3; the phase shift network is clearly seen. Notice that  $R_4$  (the first resistor in the network) doubles as the collector load for  $TR_1$ . The frequency determining components  $R_4$ ,  $R_5$  and  $R_6$  together with  $C_2$ ,  $C_3$  and  $C_4$  should all have the same values for the above equation to hold true. The bias circuitry for the transistor is calculated to give a d.c. output that is approximately mid-rail when considering  $R_4$  as a normal collector load. The frequency of oscillation for the circuit shown is:

$$\frac{1}{2 \times \pi \times 10,000 \times 0.000000022 \times \sqrt{6}}$$

which is approximately 3 kilohertz.

By substituting a different set of capacitors (remember they should be of equal values) the circuit can be made to work at lower or higher

Fig. 5.3. A working demonstration Phase Shift Oscillator:



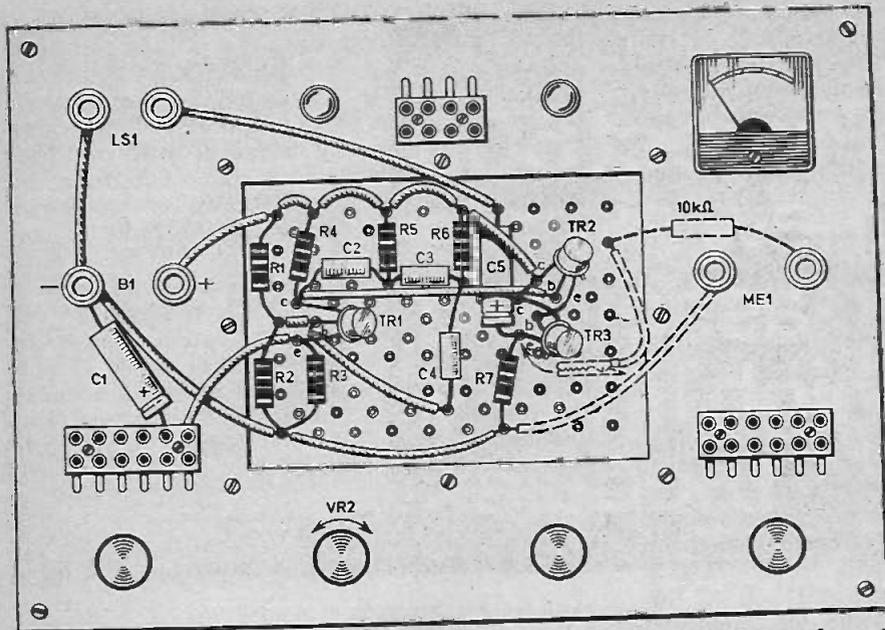


Fig. 5.4. Layout and wiring of Fig. 5.3. on the Demo Deck.

frequencies. Theoretically the values of R4, R5 and R6 could be changed but it would then be necessary to recalculate the bias components. Transistors TR2 and TR3 do not play an active role in the circuit; they are only there to couple in the loudspeaker to provide an interesting audio output. Ideally the overall current gain of the transistor amplifier (TR1) should be 29 and this can be set by adjusting VR2; it should be of the highest resistance value that will maintain

oscillation, reduce it to zero and you will see what we mean by the distortion of waveshape as the transistor starts to saturate.

If you have some  $1\mu\text{F}$  (non electrolytic) capacitors to use as C2, C3 and C4 the sinusoidal output can be monitored by substituting the loudspeaker and C5 with a d.c. meter as shown in Fig. 5.4. The frequency should be slow enough to give a measurable reading.

**Next Month:** A simple bistable.

## Ruminations

By Sensor

### "It was all right last night"

I have recently spent some time "on the other side of the fence"—that is, on the retail and servicing side of electronics, after very many years in manufacturing. It is often strange to hear the layman (or laywoman) try to describe what is wrong with the television set.

Phrases such as, "There can't be much wrong, it was all right last night." "It's vibrating and buzzing and I'm afraid to touch it" are very commonly used; though the rather startling "it went off with a bang and I switched it off" is not unusual.

The "knowledgeable" customer tries to be helpful—"it's the picture valve," or "the volume control's faulty" or even "the tube's

gone"—this was a colour television that merely needed tuning in. This customer became quite rude and abusive when politely asked why he thought the tube was faulty.

To the man in the street a "transistor" is a small portable radio and therefore faults occurring in television or radio are usually attributed to picture valves, power valves and sound valves. How easy would be the serviceman's lot if this were so! It is interesting and often amusing to receive a service call from a customer and then to read the serviceman's report on the set in question!

What shall we see when the public become familiar with integrated circuits? "It's the blue and yellow i.c." or "the p.c. board has gone" or "there's nothing lighting up in the back."

Then there is the hopeful optimist who comes into the service department with half a dozen valves wrapped in newspaper, after these have been tested and replacements purchased for the

weaker ones he would usually, after a day or so, ask for the service engineer to call. For the time taken to restore the circuit to its original configuration, subsequent to his attentions, and to diagnose the fault to a leaking decoupling capacitor he ends up with a fair bill, but perhaps he has enjoyed himself!

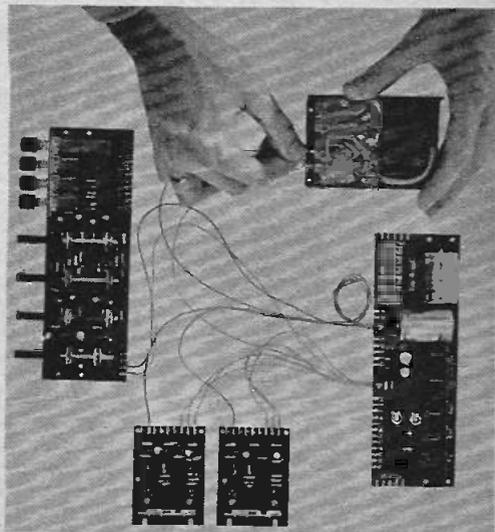
### A Bag of Mystery

I was invited to attend a Burns Supper and perhaps it was the quantity of whisky flowing but I thought how much alike are the integrated circuit and the haggis, that "great chieftain of the pudding race." Each containing many things and each in its protective encapsulation. When surrounded with its supporting components—the haggis with its neeps and tatties and the i.c. with its resistors and capacitors—what joy, what satisfaction from those perfections of man's achievements.

But I have yet to hear an address to the i.c!

*Everyday Electronics, April 1973*

# Project 605 the new simple way to assemble Sinclair high fidelity modules



For several years now you have been able to assemble your own high fidelity system to world beating standards using Sinclair modules. We have progressively improved these technically but hitherto the method of assembly at your end has remained the same — there has been no alternative to a soldering iron. Now for those who prefer not to solder, there is an alternative — Project 605.

In one neat package you can now obtain the four basic Project 60 modules plus a fifth completely new one — Masterlink — which contains all the input sockets and output components you previously bought separately. Also in the Project 605 pack are all the inter-connecting leads, cut to length and fitted at each end with plugs which clip straight onto the modules, eliminating soldering completely. The pack contains everything you need to build a complete 30 watt stereo amplifier together with a clear well illustrated Instruction Book. All you have to do is to arrange your modules in the plinth or case of your choice and then clip them together — the work of a few minutes.

Your hi-fi system will, as we said, match the finest in the world and you can add to it at any time to increase power or extend the facilities. For example a superb stereo FM Tuner unit is obtainable for only £25.

**Guarantee** If within 3 months of purchasing Project 605 directly from us, you are dissatisfied with it, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail. Air-mail charged at cost.

**sinclair**

Sinclair Radionics Ltd., London Road.,  
St. Ives, Huntingdonshire PE17 4HJ.  
Telephone: St. Ives (04806) 4311

## Specifications

**Output** — 30 watts music power (10 watts per channel R.M.S. into 3Ω).

**Inputs** — Mag. P.U. — 3mV correct to R.I.A.A. curve 20–25,000 Hz ± 1dB. Ceramic pick-up — 50mV. Radio — 50 to 150mV.

[Aux. adjustable between 3mV. and 3V.

**Signal to noise ratio** — Better than 70dB.

**Distortion** — better than 0.2% under all conditions.

**Controls** — Press buttons for on-off, P.U., radio and aux. Treble

+15 to —15 dB at 10 kHz. Bass +15 to —15 dB at 100 Hz.

**Volume, Stereo Balance.**

**Channel matching** within 1dB.

**Front panel** — brushed aluminium with black knobs.

Project 605 comprises Stereo 60 pre-amp/control

unit, two Z-30 power amplifiers, PZ-5 power supply

unit, the unique new Masterlink, leads and instructions

manual complete in one pack. Post free

**£29.95**

To SINCLAIR RADIONICS LTD., ST. IVES, HUNTINGDONSHIRE PE17 4HJ

Please send Project 605 post free  Details and list of stockists

Name .....

Address .....

for which I enclose £29.95 cheque/money order/cash. EE4/73



## KITS FOR PREVIOUS PROJECTS

Unless otherwise stated, kits contain electronic parts only. The case and special tools 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.

### HOME SENTINEL

"Ward off the unwanted intruder"—No elaborate setting up or wiring required. Kit of parts £3-95.

### "SNAP" INDICATOR

Press your button first and your opponent is alerted also suitable for Quiz games and reaction testing. Kit of parts 95p

### RECORD PLAYER

Good quality at a reasonable price—good enough for classical records and pop. Kit of parts £5-50.

### WINDSCREEN WIPER CONTROL

Wet dirty road—Drizzle—Fog—Smogged screen—Scraping wipers—combat these with add-on wiper control. Kit of parts £2-25.

### FUZZ BOX

Add weird and interesting effects to guitar playing with this solid state Fuzz box. Kit of parts £2-25.

### PHOTOGRAPHIC COLOUR TEMPERATURE METER

Must for colour photographer get the colours right gives quick indication of filters necessary for correction in any light. Can be used with natural or studio lighting. Kit of parts £3-25.

### ASTRON M.W. RADIO

A simple M.W. reflex circuit receiver—easy to build. £3-00.

### REMOTE TEMPERATURE COMPARATOR

Measures small temperature changes in liquids or gases—flah tank, photographic solution—thermostatically controlled rooms etc. Kit £4-75.

### RAIN WARNING ALARM

Keep your washing dry with this automatic alarm device. Kit £1-95.

### WAA WAA PEDAL

Add excitement and sound vibration to your music. Kit £3-25.

### ELECTRO LAUGH

Laughter simulator also useful electronic alarm. Kit of parts £2-00.

### SOIL MOISTURE METER

Many plants are killed through over-watering—this meter measures soil moisture at root depth—probes can be left permanently beside the plant—indicator remotely housed could monitor several plants. Kit £3-50.

### SIGNAL INJECTOR

A useful pocket instrument for fault finding in radios and amplifiers. Kit £1-1.

### BABY ALARM

Keep a check on the kids—this device will give you peace of mind as you watch T.V. Kit £4-50.

### SIMPLE CALCULATOR

Teaching aid for multiplication—can be used for quick checks. Kit £2-75.

### POWER SUPPLY UNIT

Just right for testing low voltage circuits—a simple stabilised supply providing 0-16 volts D.C. continuously variable. Kit £4-75.

### METAL LOCATOR

A simple easy to construct self-contained metal locator giving a meter indication of buried metal. Kit £4-50.

### AUDIO TONE GENERATOR

Makes electronic music—covers range from 50-2000 Hz. Specially designed for use with tape recorder. Kit £2-95.

### LIGHT TO SOUND CONVERTER

Produces an audio tone—the frequency of which is dependent on the light level. Kit £1-95.

### HEAVY INVERTER

Provides 240v 50Hz from 12 volt car battery—gives approx 10 watts which is enough for most shavers. Kit £3-95.

### ELECTRONOME

Electronic Metronome with pulse frequency continuously variable from 40-325 beats per minute. Kit £1-95.

### THROUGH LENS LIGHT METER

A simple light meter for use with single lens reflex camera. Kit £2-95.

### MEDIUM AND LONG WAVE RADIO TUNER

A simple radio tuner for use with almost any amplifier. Kit £2-95.

### INFRARED BURGLAR ALARM

Uses an invisible, reflected beam to detect intruders when beam is intercepted—a power output is switched on for up to one minute. Kit £3-95.

**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.

## INDICATOR AUDIBLE WARNING BEDSIDE LIGHT DIMMER GENERAL PURPOSE AMPLIFIER

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

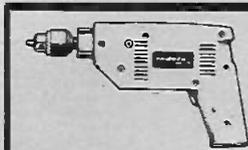
### THYRISTOR LIGHT DIMMER

Domestic model for any lamp up to 250 watt. Mounted on switch plate to fit in place of standard switch. Virtually no radio interferences. Price £2-95. Industrial model up to 5 amp (1250W) £3.



### DISTRIBUTION PANELS

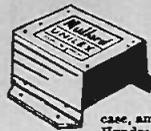
Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 5 feet of flex cable. Wired up ready to work. £2-25 plus 25p P. & L.



### PORTABLE ELECTRIC DRILL

Very superior quality made by a famous Dutch toolmaker. Model No. ASM 830. 300W—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 £15-00.

£9-95—similar model but without the hammer attachment £7-95. Have either model on approval for 7 days.



### 4 WATT AUDIO AMPLIFIER

Works off dry batteries, car battery or mains power pack. Only £1-65. This low price possible only because the make is over produced. Unrepeatable once stocks are cleared. Made by the famous Mullard company and carries their full guarantee. Complete in dustproof case, amplifier may be used for Mono or Stereo, music or speech. Hundreds of applications. Frequency response 50Hz-16kHz. Supplied complete with connection diagram and operating notes. FREE all purchasers receive Mullard booklet "Do It Yourself Stereo" tells all you need to know to build your own stereo system. Write today to avoid missing this terrific offer.

### CD CAR IGNITION

This system which has proved to be amazingly efficient. We offer kit of parts as P.W. Circuit £5-95 plus 20p p. & p. Deluxe model with prepared circuit board £8-95. When ordering please state whether for positive or negative systems.

### 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. etc. A real bargain at £1-85.



### 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 £5. 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 AF Modules 1173. 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.



### MIGHTY MIDGET

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



### 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. £1-50 plus 15p post and insurance. Made up model also available. £2-25 plus 15p post & p.

## KITS FOR PREVIOUS PROJECTS CONT. FROM LEFT HAND COL.

### CASSETTE TAPE POWER SUPPLIES

Two units to power a cassette tape player or recorder one from the mains Price £2-25. Two from the car battery—price £1-25.

### REACTOMATIC

A reaction testing game that can also be a quiz answering indicator. Kit £3-00.

### ELECTRONIC MOUSE TRAP

A humane mouse trap—catches them alive so that you can release them in the park. Kit £2-95.

### TRANSISTOR TESTER

A rapid tester for checking most transistors—tests transistors in an oscillator circuit and gives audible indication of goodness. Kit £1-85.

### RADIO CONTROL TRANSMITTER

A simple single channel transmitter for the radio control of boats, aeroplanes and other models. Kit £5-50.

### RADIO CONTROL RECEIVER

A single channel super regenerative receiver to work in with above transmitter. Kit £3-00.

### HIT SAVER

Prolongs life of soldering iron bit—prevents pitting. Kit £1-75.

### ICE WARNING DEVICE

A device that can be set to indicate 'ice' conditions or similar temperature levels. Kit £1-60.

### AUDIO COLOUR UNIT

Add a colour dimension to your audio equipment. This unit will modulate three lamps in accord with Bass—middle and treble notes of any music. Kit of parts £4-50.

### U.H.F. T.V. AERIAL

A simple aerial for U.H.F. to reception on your band could improve your reception immensely. Kit £1-50.

### DAMP LOCATOR

Easily carried in your pocket this little unit gives visible indication of damp. Kit £1-15.

### ENLARGER & EXPOSURE METER

For D.I.Y. photographer £4-50.

### EGG TIMER

Simple timer with audible warning. £3-75

### NEON NOVELTY

Interesting modern ornamental device £1-50.

### CONNECTING WIRE

100 yard coils—single strand 24 gauge copper P.V.C. covered. Available in popular colours—75p per coil.

### 8" x 5" P.M. SPEAKER

15 ohm—£1-50. This is a good quality speaker by a famous maker. High flux ideal for use with our Mullard 4 watt amplifier.

### 8 GANG TUNING CONDENSERS.

500pf each section ideal for transmitter or communications receivers. 65p.

### RECTIFIER PANELS

Contain 4 of IN40 (400v) free ended rectifiers, a glass enameled fuse, tuning current not known but believed low. Also 4 small wattage resistors at only 15p each, which is less than many shops charge for one of the rectifiers.

### 8 TRACK TAPE HEAD

For 1/2" or 1" tape. This is a brass enameled tape head and measures approx. 1/2" x 1/2" x 1/2". Resistance is approx. 20-0-20 ohms. These heads are beautifully made but we have no technical data, also have only a limited quantity. Price £5 each or 10 for £45.

### RECORD PLAYBACK HEADS (TRUVOX)

Individual prices of these are—  
2 track record playback heads 45p each.  
4 track record playback heads 65p each.  
Erase heads are also available separately—  
2 track 15p—4 track 25p.

### 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 mtd 400v 25p 5 mtd 870v 80p 12 mtd 250v 70p  
2 mtd 440v 30p 6-25 mtd 250v 15 mtd 250v 80p  
3-4 mtd 440v 40p 80p 20 mtd 275v 90p  
3-5 mtd 250v 80p 8 mtd 250v 50p 8 mtd 440v 75p

### TINIEST AUDIO UNIT

Although only the same size as an Oxo cube these are completely self contained and comprise microphone, 3 transistor amplifier with volume control and battery compartment and finally a dynamic earpiece. All in a plastic case. Made by Ardent (Boid), we believe at over £50 each. These are really hearing aids complete except for the ear tube but we are not selling these as hearing aids only for the micro midget parts they contain. Believed to be in perfect working order but not tested. Price £7-50 each.

## J. BULL (ELECTRICAL) LTD.

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

Callers to: 162/3 Tamworth Road, CROYDON.





# SAXON ENTERTAINMENTS.

STANDARD & CUSTOM-BUILT AUDIO & ELECTRONIC EQUIPMENT  
NEW & SECONDHAND MUSICAL INSTRUMENTS. MAIN  
DISTRIBUTORS FOR A.K.G. HIGH QUALITY MICROPHONES.

## SA25-SA35-SA100

LOW-PRICED AUDIO MODULES  
FOR DOMESTIC & COMMERCIAL USE



THESE THREE MODULES HAVE ENJOYED UNPARALLELED SUCCESS DURING THE FIRST FEW MONTHS OF THEIR BEING MADE AVAILABLE TO THE GENERAL PUBLIC. WE ARE PLEASED TO ANNOUNCE THAT WE CAN NOW OFFER FAST DISPATCH ON MOST OF OUR ADVERTISED ITEMS, INCLUDING THESE THREE MODULES.

**SA25 £2-95**

25 WATTS RMS. 7 transistors 7 diodes

**SA35 £4-45**

35 WATTS RMS. 7 transistors 7 diodes

**SA100 £10-90**

100 WATTS RMS. 11 transistors 6 diodes

ALL THREE MODULES HAVE OPEN & SHORT CIRCUIT PROTECTION, AND THE SA100 IS PROOF AGAINST OVER-DISSIPATION & FAULTY INDUCTIVE LOADS. ONLY ADVANCED DESIGN TECHNIQUES MAKE THESE EXTRA-ORDINARILY LOW PRICES POSSIBLE.

### BRIEF SPEC. FOR ALL THREE MODULES

Freq. response	15-40,000 Hz $\pm$ 1dB
Distortion	0-2% at 1 kHz
Loads	4 to 16 ohms
Quiescent current	15 mA
Noise	Better than -75 dB
Supply voltage	25-45 volts SA25/35 40-70 volts SA100
Size	4 1/2" x 4" x 1" (SA100) 4" x 3" x 1" (SA25/SA35)

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

### POWER SUPPLIES FOR THE SA25/35 & SA100 AUDIO MODULES

PU45	Unstabilized supply for 2 SA25/35	£4-90
PU70	Unstabilized supply for one or two SA100	£7-75 carr. 40p
MT45	Transformer for above, heavy duty	£2-85 carr. 20p
Stab PS45	Stabilized module for 2 SA25's or two SA35's	£3-50 carr. free
MT30	Transformer for unstabilized supply complete with rectifier diodes mounted	£3-90 carr. 20p
MT70	Transformer for PS70	£4-90 carr. 40p
PS70	Stabilized supply module for one or two SA100's	£4-90 carr. free

ALL MODULES ARE BUILT ON  
GLASS FIBRE P.C. BOARD  
AND ARE SUPPLIED FULLY TESTED

## OTHER SAXON PRODUCTS . . .

120 WATT HEAVY DUTY MODULE £13-90 + 20p carr. or with supply  
**£18-95** + 40p carr.

Featuring a rugged class A driver stage, this module will run from all our mixers, etc., and most other makes of mixer. It delivers 120 watts into an eight ohm load and employs 4 T03 can (115 watt) output transistors.

### SPECIFICATION

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



**NEW** 160 watt version & supply **£27-90**

### SINGLE CHANNEL SOUND/LIGHT CONVERTER

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

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



**£8-90** carr. free

### THREE CHANNEL SOUND TO LIGHT UNIT

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

**£19-75** carr. 30p

MONO VERSION £8-50 carr. 20p (As illustrated, S.A.E. details 9 volt operation) Outputs up to 1 volt RMS



**£15-80** carr. 30p

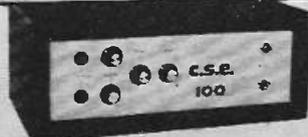
### SAXON STEREO CONTROL UNIT

Two decks, and full headphone monitoring. The unit is mains operated and measures 17 1/2" x 3" x 4" deep and is finished with a smart white on black fascia. The controls are: Left/Right deck fader, volume, bass, treble, Headphone Selector and volume, Microphone volume, bass, treble, mains on/off. THIS IS A MUST FOR THE HOME BUILT HIGH QUALITY DISCOTHEQUE AND IS COMPARABLE TO UNITS AT OVER TWICE THE PRICE. (N.B.—Stereo only has mic input.)

### COMPLETE AMPLIFIERS

The CSE 100. £34-90 carr. free

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



The SAXON 100 £48-50 carr. free



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

### LOUDSPEAKERS British made bargains!!

12" 25 watt 8/15 ohms £5-95 carr. 30p. 15" 50W/8/15 ohm £14-50 carr. 50p.  
12" 40 watt 15,000 gauss magnet system 8/15 ohm £11-50 carr. 40p.

### A.K.G. MICROPHONES suitable for disco, group or general P.A. use.

D11DHL rrp £11-00 our price £9-45 post free  
D190C High Z rrp £21-50 our price £17-45 post free  
D1000C 24 ct gold plate rrp £37-00 our price £32-00 post free

SEND SAE FOR  
OUR AKG PRICE  
LIST. DISCOUNTS  
ON ALL MIC'S.

### CALLERS & MAIL ORDER:

327-331 Whitehorse Road,  
West Croydon, Surrey.  
01-684 6385

### CALLERS ONLY:

OUR NEW  
DISTRIBUTORS

CIRCLE SOUND,  
328-330 The Banks, Rochester.  
Medway 404199

### BUSINESS HOURS:

9.30 a.m.  
to 5.30 p.m.

### TERMS OF BUSINESS:

C.W.O. or C.O.D. (35p extra)  
All cash in regd. envelopes please!  
Telephone orders to our CROYDON BRANCH.  
TRADE & EXPORT enquiries invited.

# BI-PRE-PAK

SUPPLIERS OF SEMI-CONDUCTORS TO THE WORLD

## COMPLETE TELEPHONES



EX. G.P.O. NORMAL HOUSEHOLD TYPE

**ONLY 95p**

POST & PACKING 35p EACH

## TELEPHONE DIALS

Standard Post Office type. Guaranteed in working order.

**ONLY 25p**

POST & PACKING 15p



## TESTED AND GUARANTEED PAKS

B79	4	IN4007 Sil. Rec. diodes. 1,000 PIV lamp plastic	50p
B81	10	Reed Switches, mixed types large and small	50p
B99	200	Mixed Capacitors. Approx. quantity, counted by weight	50p
H4	250	Mixed Resistors. Approx. quantity counted by weight	50p
H7	40	Wirewound Resistors. Mixed types and values.	50p
H9	2	OC771 Light Sensitive Photo Transistor	50p
H28	20	OC200/1/2/3 PNP Silicon uncodded TO-5 can	50p
H30	20	1 Watt Zener Diodes. Mixed Voltages 6.8 - 43V.	50p
H35	100	Mixed Diodes. Germ. Gold bonded, etc. Marked and Unmarked.	50p
H38	30	Short Lead Transistors. NPN Silicon Planar types.	50p
H39	10	Integrated Circuits. 6 Gates BMC 962. 4 Flip Flops BMC 945	50p
H40	20	BFY507, 2N496, 2N1613 PNP Silicon uncodded TO-5	50p
H41	2	Sil Power transistors comp pair. BD131/132	50p

## UNMARKED UNTESTED PAKS

B66	150	Germanium Diodes Min. glass type	50p
B83	200	Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ.	50p
B84	100	Silicon Diodes OO-7 glass equiv. to OA200, OA202	50p
B86	100	Sil. Diodes sub. min. IN914 and IN916 types	50p
B88	50	Sil. Trans. NPN, PNP equiv. to OC200/1 2N706A, BSY95A, etc.	50p
B1	50	Germanium Transistors PNP, AF and RF	50p
H6	40	250mW. Zener Diodes DO-7 Min. Glass Type	50p
H17	20	3 amp. Silicon Stud Rectifiers, mixed volts	50p
H15	30	Top Hat Silicon Rectifiers. 750mA. Mixed volts	50p
H16	15	Experimenters' Pak of Integrated Circuits. Data supplied	50p
H20	20	BY126/7 Type Silicon Rectifiers. 1 amp plastic. Mixed volts.	50p
H34	15	Power Transistors, PNP, Germ. NPN Silicon TO-3 Can.	50p

## MAKE A REV COUNTER FOR YOUR CAR

The 'TACHO BLOCK'. This encapsulated block will turn any 0-1mA meter into a linear and accurate rev. counter for any car with normal coil ignition system.

**£1 each**



OVER TRANSISTORS IN STOCK **1,000,000**

We hold a very large range of fully marked, tested and guaranteed transistors, power transistors, diodes and rectifiers at very competitive prices. Please send for free catalogue.

**600,000** Silicon planar plastic transistors. Unmarked, untested, factory clearance. A random sampling showed these to be of remarkably high quality.

Audio PNP, similar to ZTX500. 2N3702/3. BCY70 etc.  
Audio NPN, similar to ZTX300, 2N3708/9 BC107/8/9, BC168/9 etc.  
R.F. NPN and switching NPN Types also. Please state type of transistor required when ordering.  
All at 500 for £3, 1,000 for £5, 10,000 for £40 P. & P. 10p/1,000.

## OUR VERY POPULAR 3p TRANSISTORS

TYPE "A" PNP Silicon alloy, TO-5 can.  
TYPE "B" NPN Silicon, plastic encapsulation.  
TYPE "C" PNP Germanium AF or RF.  
TYPE "D" NPN Silicon plastic encapsulation.  
TYPE "E" NPN Silicon similar ZTX 300 range  
TYPE "G" NPN Silicon similar ZTX 500 range  
TYPE "H" PNP Silicon similar ZTX 500 range

**8 RELAYS FOR VARIOUS TYPES £1 P & P 25p**

VALUE ON ORDERS OF ADDED £4 OR OVER

TO YOU SEE BELOW

Please read very carefully: We will give a discount to customers who send in an order for £4 or over. This discount will be equal to the V.A.T. rate current at this time. If your order does amount to £4 or over, all you need to send is the total cost of goods; and postage as stated in this advertisement. No addition for V.A.T. is needed.

V.A.T. for orders under £4: if the total cost of goods plus postage and packing is less than £4, kindly add 10% (10p in the £) to your remittance. Incorrect amounts will delay your order.



## A CROSS HATCH GENERATOR FOR £3.50 !!!

YES, a complete kit of parts including Printed Circuit Board. A four position switch gives X-hatch, Dots, Vertical or Horizontal lines. Integrated Circuit design for easy construction and reliability. This is a project in the September edition of Television.

This complete kit of parts costs £3.50, post paid.

A MUST for Colour T.V. Alignment.

Our famous PI Pak is still leading in value for money.

Full of Short Lead Semiconductors & Electronic Components, approx. 170. We guarantee at least 30 really high quality factory marked Transistors PNP & NPN, and a host of Diodes & Rectifiers mounted on Printed Circuit Panels. Identification Chart supplied to give some information on the Transistors.

Please ask for Pak P.I. Only 50p. 10p P & P on this Pak.

FREE CATALOGUE FOR



TRANSISTORS, RECTIFIERS, DIODES, INTEGRATED CIRCUITS, FULL PRE-PAK LISTS

**100,000** Plastic Power Transistors in stock, more on way!

## NOW IN TWO RANGES

These are 40W and 90W Silicon Plastic Power Transistors of the very latest design, available in NPN or PNP at the most shatteringly low prices of all time. We have been selling these successfully in quantity to all parts of the world and we are proud to offer them under our Tested and Guaranteed terms.

Range 1. VCE	Min 15.	40W	Min 15.
40 Watt	1-12	13-25	26-50
90 Watt	30p	18p	16p
Range 2 VCE	24p	22p	20p
	Min. 40.	40W	Min 40.
40 Watt	1-12	13-25	26-50
90 Watt	20p	28p	26p
	35p	33p	30p

Complementary pairs matched for gain at 3 amps. 10p extra per pair. Please state NPN or PNP on order.

## INTEGRATED CIRCUITS

We stock a large range of I.C.s at very competitive prices (from 10p each). These are all listed in our FREE Catalogue, see coupon below.

## METRICATION CHARTS now available

This fantastically detailed conversion calculator carries thousands of classified references between metric and British (and U.S.A.) measurements of length, area, volume, liquid measure, weights etc. Pocket Size 15p. Wall Chart 18p.

## LOW COST DUAL IN LINE I.C. SOCKETS

14 pin type at 15p each } Now new low profile  
16 pin type at 16p each } type

## BOOKS

We have a large selection of Reference and Technical Books in stock.

These are just two of our popular lines:

B.P.I. Transistor Equivalents and Substitutes; 40p

This includes many thousands of British U.S.A., European and C.V. equivalents.

The **Hi-Fi Radio Valve & Transistor Data Book** 9th Edition; 75p

Characteristics of 3,000 valves and tubes, 4,500 Transistors, Diodes, Rectifiers and Integrated Circuits.

Postage and Packing 21p. Send for lists of these English publications. N.B. Books are void of V.A.T.

Please send me the FREE BI-Pre-Pak Catalogue.

NAME .....

ADDRESS .....

MINIMUM ORDER 50p. CASH WITH ORDER PLEASE. Add 10p post and packing per order OVERSEAS ADD EXTRA FOR POSTAGE

**BI-PRE-PAK LTD**

DEPT. E 222-224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX  
TELEPHONE: SOUTHEND (0702) 46344

# Everyday Electronics Classified Advertisements

## WANTED

WANTED — to buy — the following issues of **EVERYDAY ELECTRONICS**. Volume One. Numbers 1, 2, 5, 7, 8, 9, 10, 11, 12. Generous offers made. Box 5.

## RECEIVERS and COMPONENTS

**TRANSISTORS:** mint, branded top grade AD161/162 c.p.r., 60p; BC107/B, 12p; BC169C, 10p; 2N2926G, 12p; 2N3702, 10p; 2N3704, 10p. **Diodes:** OA90, 6p; IN4002, 5p. **Mail order only, UK postage 5p.** **AMATRONIX LTD.**, 396 Selsdon Rd., South Croydon, Surrey, CR2 0DE.

**COMPUTER PANELS** 5-BC108, Diodes, 4-50p (10p), Large panels 9" x 7 1/2". Long lead trans. and Compa. E4, 10 Trans 25p (10p) E45, 18 Trans. 40p (10p). Wire ended neons 10-45p (8p), 20-75p (8p). Silicon diodes 50V 1/4 amp, on tag boards 10-30p (5p). 22 way mains stepping switch with reset 80p (15p).

7lb assorted components £1-50  
2lb assorted computer panels £1-50

J. W. B. RADIO.

75 HAYFIELD ROAD, SALFORD 6, LANCAS.  
Postage in brackets. MAIL ORDER ONLY

Versatile

## 10 in ONE



## MINI-LAB

Comprising

- AC & DC Voltmeter ● Audio Generator
- Ohm Meter ● Resistance Substitution
- Capacitance Substitution ● DC Ammeter
- Battery Supply ● RF Signal Generator ● RF Field Strength Indicator

This new, unique instrument combines all you need for testing. Guaranteed, money back if not satisfied.

**£11.25**

+25p. p&p

Cash with order or send s.o.c. for illustrated data sheet to:

J. H. ASSOCIATES LTD. (Dept. EE)  
Crickfield Lane, Bishop's Stortford, Herts.

## Express Components

## E.E. PROJECTS!

### GENERAL PURPOSE AMPLIFIER

To receive this kit send amount shown in the approximate cost box

**FREE** Postage (U.K. ONLY)

17 Albert Sq. London, E15 1JH

## MISCELLANEOUS

**EXPERIMENTERS AND CONSTRUCTORS!** Hundreds of unusual items cheap. 1973 catalogue 5p. **GRIMSBY ELECTRONICS**, 64 Tennyson Road, Cleethorpes, Lincs. (Mail order only.)

## FREE

### TO ENGINEERS

Whatever your age or experience you must read New Opportunities. It describes the easiest way to pass A.M.S.E.

A.M.I.M.I., City & Guilds (all branches), Gen. Cert., etc., and gives details of courses in all branches of engineering Mechanics, Electrical, Civil, Auto, Aero, Radio, TV. Building, etc. You must read this book.



Send for your copy today—FREE!

B.I.E.T. BEE 03, (CX), Aldermaston Court, Reading, RG7 4PF

Accredited by the Council for the Accreditation of Correspondence Colleges

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

**TECHNICAL TRAINING** in Radio, TV & Electronics thro' world-famous ICS. For details of proven home-study courses write: ICS (Dept. 731H1), Intertext House, London SW8.

**SERVICE SHEETS** for Televisions, Radios, Transistors, Tape Recorders, Record Players, etc., from 5p with free Fault-Finding Guide, S.A.E. orders/enquiries. Catalogue 15p. **Hamilton Radio**, 47 Bohemia Road, St. Leonards, Sussex. Telephone Hastings 29066.

**DIGITAL COMPUTER Logic and Electronics.** Four volume self-instructional course. £2-95 including p. and p. Money back assurance. **CAMBRIDGE LEARNING (EE)** 8a, Rose Crescent, Cambridge.

## MEN! £50 p.w. can be yours

Jobs galore! 144,000 new computer personnel needed by 1977. With our revolutionary, direct-from-America, course, you train as a Computer Operator in only 4 weeks! Pay prospects? £2500 + p.a. After training, our exclusive appointments bureau—one of the world's leaders of its kind—introduces you FREE to world-wide opportunities. Write or phone TODAY, without obligation.

London Computer Operators Training Centre  
P12, Oxford House  
9-15, Oxford Street, W.1.  
Telephone: 01-734 2874  
127, The Piazza, Dept. 12,  
Piccadilly Plaza, Manchester 1.  
Telephone: 061-236 2935

**RADIO & TELEVISION AERIAL BOOSTERS** £2-95p, five television valves 45p. 50p bargain transistor packs, bargain £1 resistor and capacitor packs. **UHF-VHF** televisions £7-50, carr. £1-50p. S.A.E. for 3 leaflets. **VELCO ELECTRONICS**, Bridge Street, Ramsbottom, Bury, Lancs.

**TALKIE - CUBES!** These ingenious pocket-size novelties relay even faint sounds to any portable VHF radio in the house! They provide useful radio links between kitchen, garage, loft, baby's bedroom etc. Small external battery: **NO OTHER WIRES WHATSOEVER!** Each is fully built and tested, and outstanding value at only £3-90, two for £7. **R. S. Green**, 4 Colecroft Hill, Purley Surrey. Mail order only.

## PSYCHEDELIC MINI-STROBE

A very POWERFUL, POCKET-SIZED STROBE-LIGHT that is SELF-CONTAINED and you can take anywhere. Go to parties and really BRAIN-FREEZE them with DAZZLING PSYCHEDELIC EFFECTS and STOP-MOTION FLASHES. Boffin's new MINI-STROBE kit constitutes a fully solid-state electronic device which is COMPLETE with FUTURISTIC case/reflector unit, printed-circuit-board, electronics, and source-lamp—the only extra is a battery which you can buy locally. The whole thing can be easily built in a few hours. A veritable FLICKERING FASCINATOR! Adjustable flash-rats.

GET ONE (or two) NOW and BEGIN STEALING THE THUNDER at DISCOS and PARTIES with your own POCKET-LIGHTNING!

SEND £1-95 for YOUR MINI-STROBE.

To: Boffin Projects, 4 Cuncliffe Road, Stoneleigh, Ewell, Surrey.

**WORLD RADIO TV HANDBOOK 1973**, £2-80. Fortnightly World Radio Bulletin, £3-13 (ask for sample copy). How to Listen to the World, £1-90. Confidential Frequency List; stations' QSL policies, etc., £1-70. P&P 10p per book; deliveries first class. **David McGarva**, Box 114N, Edinburgh EH1 1HP. Giro account 17 412 0001.

## AT LAST YOU CAN TRANSMIT AND FORGET ABOUT LICENCE EXAMINATIONS

because this Ministry Approved transmitter/receiver kit does not use R.F. Your transmissions will be virtually SECRET since they won't be heard by conventional means. Actually it's TWO KITS IN ONE because you get the printed-circuit boards and components for both the transmitter AND receiver. You're going to find this project REALLY FUN-TO-BUILD with the EASY-TO-FOLLOW instructions. An extremely flexible design with quite an AMAZING RANGE—has obvious applications for SCHOOL PROJECTS, LANGUAGE, LABORATORIES, SCOUT CAMPS, etc.

GET YOURS! SEND £5-50 NOW  
S.A.E. for details

To: **BOFFIN PROJECTS, DEPT. KEE**, 4 CUNCLIFFE ROAD, STONELEIGH, EWELL, SURREY.

## Scorpio Electronic Ignition

Complete kit with comprehensive construction and fault finding data. £11 post paid. Data 10p Itemised prices. S.A.E. please.

## AMCEL MAIL ORDER

160 DRAKE ST., ROCHDALE  
Tel: 0706 46234

**CAR BATTERY**

**AUTO ADAPTOR**

BATTERY ELIMINATOR  
VARIABLE OUTPUT  
VOLTAGE SELECTOR  
6, 7.5, & 9 VOLTS  
STABILIZED

**OMNIA PRODUCTS**  
28 WILLOW GARDENS  
HOVE SUSSEX BN1 8ND

**£3.50**

+ VAT from APRIL

**MUSICAL MIRACLES**

KITS to build quality accessories:—

WAA-WAA All parts, electronic & mech. £2.95  
FUZZORAMA quality fuzz box £4.75 P&P 20p.  
BASS PEDAL 16" and 8" tones £2.35

BUILD A SYNTHESIZER OR AUTO RHYTHM  
from Dewtron professional modules

Cat. 15p from D.E.W. Ltd., 254 Ringwood  
Road, Ferndown, Dorset BH22 9AR

**ALUMINIUM BOXES—Copper Bronze,  
Gold or Grey. Panelled fronts, removable backs.**

- 4" x 3" x 1", 1 1/2", 2" — 40p, 42p, 44p
  - 4" x 4" x 1", 1 1/2", 2" — 41p, 43p, 45p
  - 4" x 5" x 1", 1 1/2", 2" — 46p, 48p, 50p
  - 4" x 6" x 1", 1 1/2", 2", 2 1/2" — 53p, 56p, 59p
- P. & P. 15p. 30 sizes available.

T. H. BARKER and Son.

Baines Paddock, Haverthwaite,  
Ulverston, Lancs.

**AMPLIFIERS**

**CASED AMPLIFIER £3**

Oak faced wooden case size 14" x 13" x 9" contains very sensitive amplifier using 2 ECC83, EL84, EZ80. 20uV I/P gives 2 watts O/P. Incorporates 4KHz tone detector, Tone & volume controls, 7" x 4" 3 Ohm speaker with extn. socket. Also included is a somewhat unusual solenoid operated tape deck with 4 pole motor. Standard mains operation. In good working condition, £3 + £1 carr.

**300 RESISTORS 60p.**

300 5% 60p (15p); 200 5% 60p (12p); 100 1% & 2% 60p (8p); 100 Metal Oxide 60p (8p). One of each pack £2 (25p).

Ferric Chloride, 11b 40p (15p); 101b £3.50 (40p).  
2N3055 35p (3p). BC107-8-9 8p or 14 for £1.  
Computer Boards, 31b £1 (25p); 71b £2 (40p).

**GREENWELD (E1)**

24 Goodhart Way, West Wickham, Kent.  
Tel: 01-777 2901 up to 10.30 p.m.  
Shop at 21 Dapford Broadway, S.E.8.  
Post in brackets. S.A.E. list.

**AERIALS**

**DIRECT FROM MANUFACTURER—**  
a comprehensive catalogue of UHF and  
VHF/FM aerials, fixing brackets,  
chimney lashings, clamps, masts,  
amplifiers, cable, etc., for the D.I.Y.  
enthusiast. Complete with useful in-  
stallation hints. Send 3p stamp to  
CLAYDEW ENTERPRISES (EE/1), 261  
Hardess Street, London, S.E.24.

**YATES ELECTRONICS  
(FLITWICK) LTD**

DEPT. E.E., ELSTOW STORAGE DEPT.  
KEMPSTON HARDWICK,  
BEDFORD.

C.W.O. PLEASE POST AND PACKING.  
PLEASE ADD 10p TO ORDERS UNDER £2.

Catalogue which contains data sheets for most of the  
components listed will be sent free on request  
10p stamp appreciated.

OPEN ALL DAY SATURDAYS

**RESISTORS**

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

Power watts	Tolerance	Range	Values available	Price
1/4	5%	4.7Ω-2.2MΩ	E24	100+
1/2	10%	3.3MΩ-10MΩ	E12	0-8p
1	2%	10Ω-1M	E24	0-8p
2	5%	1Ω-3.9Ω	E12	3-5p
5	10%	4.7Ω-1MΩ	E12	1-0p
10	10%	1Ω-10Ω	E12	1-0p
10	10%	1Ω-10Ω	E12	6p
10	10%	1Ω-10Ω	E12	5-9p

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 ±W, lin ±W).  
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	50p	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	32p	BF173	20p	OC44	12p	2N3706	11p
AC132	12p	AF178	32p	BF177	28p	OC45	12p	2N3707	12p
AC176	12p	AF181	40p	BF178	32p	OC70	12p	2N3708	10p
AC187	22p	AF181	40p	BF179	32p	OC71	12p	2N3709	10p
AC188	22p	BC107	9p	BF180	32p	OC72	12p	2N3710	11p
AD140	50p	BC108	9p	BF181	32p	OC81	12p	2N3711	11p
AD149	45p	BC109	9p	BF194	15p	OC82D	12p	2N4062	12p
AD161	33p	BC147	13p	BF195	15p	2N2904	20p	40360	35p
AD162	36p	BC148	13p	BF197	15p	2N2926R	9p	40361	35p
AF114	20p	BC149	13p	BF200	32p	2N2926O	9p	40362	40p
AF115	20p	BC157	14p	BFY50	20p	2N2926Y	9p	40408	40p
AF116	20p	BC158	14p	BFY51	20p	2N2926G	10p	ZTX302	15p
AF117	20p	BC159	14p	BFY52	20p	2N3054	58p	ZTX500	15p
AF117	38p	BC187	22p	BU105	225p	2N3055	60p	ZTX502	20p

**ZENER DIODES**

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

LINEAR	IC's (DIL)	DIL SOCKET
709 32p	747 85p	14 and 16 pin
741 28p	748 35p	16p

**DIODES**

RECTIFIER	DIODES	SIGNAL
BY127	1250V 1A	OA85 7p
BZ710	800V 6A	OA90 5p
BZ713	200V 6A	OA91 5p
IN4001	50V 1A	OA202 7p
IN4004	400V 1A	IN4148 8p
IN4007	1000V 1A	BA114 8p

**BRUSHED ALUMINIUM PANELS**

12in x 6in—25p; 12in x 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 ABDDVE 12p.  
FRONT PANEL 65p  
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, 2 1/2p, 0.0068μF, 0.01μF,  
0.015μF, 0.022μF, 0.033μF, 0.033μF, 3p, 0.047μF, 0.068μF, 0.1μF, 4p, 0.15μF, 6p, 0.22μF, 7 1/2p,  
160V: 0.01μF, 0.015μF, 0.022μF, 0.033μF, 0.047μF, 0.068μF, 3p, 0.1μF 3 1/2p, 0.15μF,  
4p, 0.22μF, 5p, 0.33μF, 6p, 0.47μF, 7 1/2p, 0.68μF, 11p, 0.1μF, 13p.

**MULLARD POLYESTER CAPACITORS C280 SERIES**  
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, 8 1/2p, 0.68μF, 11p, 0.1μF, 13p  
1.5μF, 20p, 2.2μF, 24p.

**MYLAR FILM CAPACITORS 100V.**

0.001μF, 0.002μF, 0.005μF, 0.01μF, 0.02μF  
2 1/2p, 0.04μF, 0.05μF, 0.068μF, 0.1μF, 3 1/2p.

**CERAMIC DISC CAPACITORS**

100pF to 10,000μF, 2p each

**ELECTROLYTIC CAPACITORS—MULLARD 015/6/7 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	12p
0.22μF 35V	4.7μF 35V	33μF 10V	
0.47μF 35V	6.8μF 25V	47μF 6-3V	
1.0μF 35V	100μF 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, 100/25. 5p each

**VEROBOARD**

0-1	0-15	JACK PLUGS AND SOCKETS
2 1/2 x 3 1/2	23p 17	Standard screened 18p 2.5mm insulated 8p
2 1/2 x 5	24p 15	Standard insulated 12p 3.5mm insulated 8p
3 1/2 x 3 1/2	24p 21p	Stereo screened 35p 3.5mm screened 13p
3 1/2 x 5	28p 28p	Standard socket 15p 2.5mm socket 8p
17 x 2 1/2	75p 75p	Stereo socket 18p 3.5mm socket 8p
17 x 3 1/2	100p 82p	D.I.N. PLUGS AND SOCKETS
17 x 5 (plain)	—	2 pin, 3 pin, 5 pin 180°, 5 pin 240°, 6 pin
17 x 3 1/2 (plain)	—	Plug 12p. Socket 8p.
17 x 2 1/2 (plain)	—	4 way screened cable 15p/metre
2 1/2 x 5 (plain)	—	6 way screened cable 22p/metre
2 1/2 x 3 1/2 (plain)	—	
Pin insertion tool 32p	32p	
Spot face cutter 42p	42p	
Pkt. 50 pins 20p	20p	

**LARGE (CAN) ELECTROLYTICS**

1600μF 64V	74p	3200μF 16V	50p
2500μF 40V	74p	4500μF 16V	50p
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

**SMOKE AND COMBUSTIBLE GAS DETECTOR—GDI**

£2.00  
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.

**PRINTED BOARD MARKER 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.

**POLYSTYRENE CAPACITORS**

160V 2 1/2p 10pF to 1,000pF E12 Series  
values. 4p each

More of everything at the right price. All your electronic requirements within 200 yards - call and see for yourself.

### INTEGRATED CIRCUITS

Why buy alternatives when you can buy the genuine article from us at competitive prices from stock. **BRANDED FROM TEXAS I.T.T. FAIR-CHILD**

Type	1/11	12/24	25/99	Type	1/11	12/24	25/99	Type	1/11	12/24	25/99
SN7400	0.20	0.18	0.18	SN7450	0.20	0.18	0.18	SN74145	1.50	1.40	1.30
SN7401	0.20	0.18	0.18	SN7451	0.20	0.18	0.18	SN74150	3.85	2.95	2.15
SN7402	0.20	0.18	0.18	SN7453	0.20	0.18	0.18	SN74151	1.10	0.95	0.90
SN7403	0.20	0.18	0.18	SN7454	0.20	0.18	0.18	SN74153	1.85	1.87	1.20
SN7404	0.20	0.18	0.18	SN7456	0.20	0.18	0.18	SN74154	2.00	1.75	1.55
SN7405	0.20	0.18	0.18	SN7470	0.20	0.27	0.25	SN74155	1.55	1.47	1.35
SN7406	0.30	0.27	0.25	SN7472	0.30	0.27	0.25	SN74157	1.80	1.70	1.50
SN7407	0.30	0.27	0.25	SN7473	0.40	0.37	0.35	SN74160	2.60	2.40	2.25
SN7408	0.20	0.18	0.18	SN7474	0.40	0.37	0.35	SN74161	2.60	2.40	2.25
SN7409	0.45	0.42	0.35	SN7475	0.55	0.52	0.50	SN74162	2.40	2.25	2.00
SN7410	0.20	0.18	0.18	SN7476	0.45	0.43	0.39	SN74163	3.40	3.25	2.70
SN7411	0.23	0.22	0.20	SN7478	0.80	0.75	0.87	SN74164	2.45	2.35	2.00
SN7412	0.42	0.40	0.35	SN7481	1.25	1.18	1.10	SN74165	1.55	1.47	1.35
SN7413	0.30	0.27	0.25	SN7482	0.30	0.27	0.25	SN74166	4.00	3.80	3.00
SN7414	0.30	0.27	0.25	SN7483	1.00	0.90	0.85	SN74167	6.25	6.00	5.10
SN7415	0.80	0.77	0.75	SN7484	0.90	0.85	0.80	SN74170	4.10	3.85	3.05
SN7420	0.20	0.18	0.18	SN7486	0.45	0.41	0.38	SN74174	2.00	1.75	1.40
SN7422	0.48	0.44	0.40	SN7489	0.75	0.70	0.65	SN74175	1.35	1.27	1.15
SN7423	0.48	0.44	0.40	SN7491	1.00	0.95	0.90	SN74176	1.60	1.55	1.20
SN7425	0.48	0.44	0.40	SN7492	0.75	0.70	0.65	SN74177	1.60	1.55	1.20
SN7427	0.48	0.44	0.40	SN7493	0.80	0.75	0.70	SN74180	1.55	1.50	1.20
SN7428	0.50	0.45	0.42	SN7494	0.80	0.75	0.70	SN74181	7.00	6.00	5.50
SN7430	0.20	0.18	0.18	SN7495	0.80	0.75	0.70	SN74182	2.00	1.80	1.60
SN7432	0.48	0.39	0.35	SN7496	1.00	0.97	0.95	SN74183	2.40	2.20	1.80
SN7433	0.70	0.61	0.44	SN7497	6.25	6.00	5.00	SN74184	2.40	2.20	1.80
SN7437	0.65	0.60	0.50	SN7498	1.45	1.35	1.20	SN74185	4.40	4.00	3.00
SN7438	0.45	0.40	0.30	SN7499	1.45	1.35	1.20	SN74190	1.95	1.85	1.75
SN7440	0.20	0.18	0.18	SN74100	1.45	1.35	1.20	SN74191	1.95	1.85	1.75
SN7441	0.75	0.78	0.70	SN74107	0.50	0.48	0.40	SN74192	2.00	1.90	1.80
SN7442	0.75	0.72	0.70	SN74110	0.80	0.70	0.60	SN74193	2.00	1.90	1.80
SN7443	1.00	0.95	0.90	SN74118	1.00	0.95	0.90	SN74194	2.50	2.25	1.60
SN7445	2.00	1.75	1.60	SN74119	1.00	1.78	1.65	SN74195	1.50	1.40	1.60
SN7446	2.00	1.75	1.60	SN74121	0.40	0.35	0.30	SN74196	1.50	1.40	1.80
SN7447	1.75	1.60	1.45	SN74122	1.35	1.25	1.10	SN74197	1.50	1.40	1.30
SN7448	1.75	1.60	1.45	SN74123	2.70	2.58	2.40	SN74198	4.80	3.70	3.35
				SN74141	1.00	0.95	0.90	SN74199	4.60	3.70	3.35

PRICES OF 7400 SERIES ARE CALCULATED ON THE TOTAL NUMBER ORDERED REGARDLESS OF MIX

LARGER QUANTITY PRICES PHONE (01) 402 4891  
HIGH POWER SM 74 400 Now in stock - send for list No. 36  
LOW POWER SM 74 400

### A SELECTION OF SEMI-CONDUCTORS FROM STOCK

AA730 10p	BC147 12p	BU106 2.25	OC44 15p	T1843 35p	2N3055 55p
AA742 15p	BC169C 12p	BY100 15p	OC45 15p	V405A 25p	2N3440 75p
AAZ15 10p	BU128 10p	BY126 15p	OC57 10p	ZTX108 15p	2N3842 1.25
AC107 35p	BC214 15p	BY217 15p	OC71 15p	ZTX300 12p	2N3925 75p
AC126 25p	BCY33 75p	BY213 35p	OC72 25p	ZTX301 15p	2N3914 60p
AC127 25p	BCY34 85p	Q16D 85p	OC77 45p	ZTX302 15p	2N3915 75p
AC128 25p	BCY39 1.00	QET11 55p	OC81 25p	ZTX341 20p	2N3920 10p
AC176 25p	BCY42 85p	QET11.5 55p	OC83 25p	ZTX500 15p	2N3704 10p
AC187 25p	BCY43 2.50	QET180 45p	OC140 55p	ZTX603 17p	2N3705 10p
AC188 25p	BCY55 2.50	LM309K	OC170 25p	2G301 30p	2N3714 1.80
ACY17 30p	BCY70 15p	(TOS) 1.87	OC171 50p	2N404 20p	2N3771 1.75
ACY20 20p	BCY71 20p	MA121 25p	OC200 45p	2N327 35p	2N3772 2.00
ACY31 20p	BCY72 15p	MJE240 75p	OC201 50p	2N696 15p	2N3790 2.25
ACY39 55p	BCY87 2.00	MJE520 75p	OC202 80p	2N697 15p	2N3819 15p
AD140 50p	BCZ11 50p	MJE520 75p	OC203 50p	2N706 10p	2N3820 50p
AD149 50p	BD124 60p	MJE2955	OC211 1.25	2N930 20p	2N3863 85p
AD161 35p	BD131 75p		ORP12 50p	2N987 45p	2N3903 15p
AD162 35p	BD132 80p	MJE3055 75p	ORP50 40p	2N131 55p	2N3906 12p
AF117 20p	BF115 85p	MPE105 40p	RASS10A 20p	2N132 25p	2N4061 12p
AF118 50p	BF127 25p	MPE105 40p		2N1302 18p	2N4062 12p
AF124 25p	BF173 25p	NKT214 20p		2N1804 22p	2N4126 15p
AF130 30p	BF179 30p	NKT216 40p		2N1805 22p	2N4271 85p
AF186 40p	BF180 30p	NKT217 45p		2N1807 25p	2N4467 80p
AF239 40p	BF194 15p	NKT403 70p		2N1808 25p	2N4777 55p
AFY27 30p	BF185 15p	NKT404 50p		2N1809 25p	2N5001 1.00
AS128 25p	BF261 25p	OAS 50p		2N1673 1.00	2B012 10.00
BA102 30p	BF288 25p	OAO 35p		2N2147 75p	2B018 6.25
BA115 7p	BFX13 25p	OAG1 10p		2N2160 85p	2B026 8.90
BA145 15p	BFX34 75p	OAG1 7p		2N2217 25p	2N301 60p
BAX13 5p	BFX37 30p	OA200 7p		2N2221 20p	2S002 85p
BAX16 7p	BFX38 20p	OA202 7p		2N2222A 20p	2R374 85p
BC107 10p	BFY60 20p	OC16 75p		TIP34A 1.00	40250 50p
BC108 10p	BFY51 20p	OC20 85p		TIP34A 1.50	40380 40p
BC109 10p	BFY52 20p	OC23 85p		TIP35A 15p	40381 40p
BC109C 15p	BFY64 50p	OC26 40p		TIP36A 2.00	40382 50p
BC113 15p	BFY90 50p	OC28 85p		2N2926 (all)	40428 50p
BC117 20p	BLT38 8.00	OC35 80p		col'd) 10p	40498 75p
BC148 85p	BSX20 16p	OC36 60p		TIP41A 75p	2N3053 20p
	BSX27 15p	OC42 40p		TIP42A 85p	40430 1.00

### QUANTITY DISCOUNTS

10% 12+ : 15% 25+ : ANY ONE TYPE  
20% 100+ : 25% 250+

From above sections except Integrated Circuits and Special Offers where discounts are included.  
Minimum order value \$1 please.  
Postage 7p on all orders.

### SPECIAL OFFERS! SEMI-CONDUCTORS

BFY90	59p	2N2926	10p
1000 MC/S		All Colours	
25 + 20p		25 + 9p	
100 + 17p		100 + 8p	
500 + 15p		500 + 5p	
		1000 + 3p	

AF117 Mullard	25p	2N3819 Texas	35p
25 + 17p		25 + 30p	
100 + 15p		100 + 25p	
500 + 12p		500 + 20p	
		1000 + 15p	

OC170 Mullard	25p	BC107, BC108, BC109	10p each
25 + 20p		All Makes	
100 + 18p		25 + 8p	
500 + 15p		100 + 7p	
1000 + 13p		500 + 6p	
		1000 + 5p	

BY127 Mullard	15p	ADI61, AD162	35p each
25 + 12p		25 + 32p	
100 + 10p		100 + 25p	
500 + 9p		500 + 22p	
1000 + 8p			

OA202	10p	2N3053	20p
25 + 8p		25 + 18p	
100 + 7p		100 + 15p	
500 + 6p		500 + 12p	
1000 + 5p		1000 + 10p	

OC35 Mullard	50p	2N3055	55p
25 + 45p		25 + 50p	
100 + 40p		100 + 45p	
500 + 35p		500 + 38p	
1000 + 30p		1000 + 33p	

### ZENER DIODES

400 M/W 5% Miniature  
BZY 88 Range  
All voltages  
E-3-33 Volt 10p each.

25+ 8p  
100+ 8p  
500+ 6.5p  
1000+ 6p  
Any one type.

1/2 Watt 5% Wire Ends Metal Case  
All voltages  
6.8-100 Volts  
80p each.

25+ 18p  
100+ 19p  
500+ 12p  
1000+ 10p  
Any one type.

3 Watt Plastic Wire Ends 5% 50Z Range  
All voltages  
6.8-100 Volts  
80p each.

SILICON RECTIFIERS WIRE ENDED PLASTIC  
Type P.I.V. 1-11  
1 amp miniature  
IN4001 50 6  
IN4002 100 7  
IN4003 200 8  
IN4004 400 8  
IN4005 600 10  
IN4006 800 12  
IN4007 1000 15  
1.5 amp miniature  
PL4001 50 8  
PL4002 100 9  
PL4003 200 10  
PL4004 400 10  
PL4005 600 12  
PL4006 800 15  
PL4007 1000 16

### LINEAR (O/P AMPS)

709C T05 75p  
709C T09 35p  
709C D.L.L. 85p  
728C T09 1.80p  
728C D.L.L. 90p  
728C T09 54-50  
741C T09 55p  
743C D.L.L. 55p  
747C T09 1.10p  
747C D.L.L.

72741P D.I.L. 1.10  
72748P D.I.L. 60p  
BINCLAIRE IC12 1.80  
TOSHIBA TH9012P 20 WATT AMP  
44-47 POST PAID TH9014P Prc Amp \$1.50

DATA AND CIRCUITS REF. 42 10p  
FREE WITH PURCHASES

### TRANSISTORS, IC's, TRIACS, BRIDGES, SCR's, LDR's

ONE AMP CR8 1/05 50 25p  
CR8 1/10 50 30p  
CR8 1/20 100 40p  
CR8 1/40 200 35p  
CR8 1/60 600 45p  
THREE AMP (T048) CR8 3/05 50 80p  
CR8 3/10 100 30p  
CR8 3/20 200 35p  
CR8 3/40 400 45p  
CR8 3/60 600 50p  
FIVE AMP (T065) CR8 5/400 400 60p  
SEVEN AMP (T048) CR8 7/100 100 60p  
CR8 7/200 200 80p  
CR8 7/400 400 70p  
CR8 7/600 600 95p  
SIXTEEN AMP SCR 16/100 100 65p  
SCR 16/200 200 70p  
SCR 16/400 400 80p  
SCR 16/600 600 81.00

### FLESSEY INTEGRATED CIRCUIT

2 Watt Amplifier SL403D Complete with 8-page booklet, circuits and data.

# FREE!

## Over 150 ways to engineer a better future

HIGHER PAY

A BETTER JOB

SECURITY

### find out how in just 2 minutes

That's how long it will take you to fill in the coupon. Mail it to B.I.E.T. and we'll send you full details and a free book. B.I.E.T. has successfully trained *thousands* of men at home - equipped them for higher pay and better, more interesting jobs. We can do as much for YOU. A low-cost B.I.E.T. home study course gets results fast - makes learning easier and something to look forward to. There are no books to buy and you can pay-as-you-learn.

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

#### Others have done it, so can you

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

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

"My training with B.I.E.T. quickly changed my earning capacity and, in the next few years, my earnings increased fourfold".—Student C.C.P., Bucks.

#### FIND OUT FOR YOURSELF

These letters - and there are many more on file at Aldermaston Court - speak of the rewards that come to the man who has given himself the specialised know-how employers seek. There's no surer way of getting ahead or of opening up new opportunities for yourself. It will cost you a stamp to find out how we can help you. Write to B.I.E.T. Dept. BEE15, Aldermaston Court, Reading RG7 4PF.

Published approximately the third Friday of each month by IPC Magazines Ltd., Fleetway House, Farringdon Street, London, E.C.4A 4AD. Printed in England by Index Printers Ltd., Stationery and Office Supplies Ltd., Subscription Rate (including postage): For one year to any part of the world £2.35. Everyday Electronics is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, and that it shall not be lent, resold or hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.



This FREE 76 page book can put you on the road to success through a B.I.E.T. Home Study Course. Choose your subject now!

CUT OUT THIS COUPON  
Tick or state subject of interest.  
Post to address below.

<input type="checkbox"/> MECHANICAL A.M.S.E. (Mech.) Boiler Inspect. & Operation C & G Engr. Crafts C & G Fabricat. Diesel Engr. Engr. Inspection Eng. Metallurgy Inst. Eng. & Tech. Inst. Motor Ind. Mainten. Engr. Mechanical Engr. Sheet Metal Work Welding	<input type="checkbox"/> Man. Prod.—cont. Quality Control Salesmanship Storekeeping Work Study Works Management DRAUGHTSMANSHIP A.E.I.D. Design of Elec. Machines Die & Press Tool Design Electrical Draughtsman-ship Gen. Draughts- manship Jig & Tool Des. Tech. Drawing ELECTRONIC & ELECTRONIC A.M.S.E. (Elec.) C & G Elec. Eng. C & G Elec. Inst. C & G Elec. Tech. Computer Elect. Elec. Maths Elec. Science Electronic Eng. Electrical Eng. Install. & Wiring Meters & Measuring Instruments	<input type="checkbox"/> Man. Prod.—cont. Quality Control Salesmanship Storekeeping Work Study Works Management DRAUGHTSMANSHIP A.E.I.D. Design of Elec. Machines Die & Press Tool Design Electrical Draughtsman-ship Gen. Draughts- manship Jig & Tool Des. Tech. Drawing RADIO & TELE-COMMUNICATIONS Colour TV C & G Radio/TV/ Electronics C & G Telecomm. Tech. Prac. Rad. Elec. (with kit) Radio Amateurs Exams Radio Servicing & Repairs Radio & TV Eng. Trans. Course TV Main. & Serv. AUTO & AERO Aero Eng. A.M.I.M.I. A.F.C. Cert. Auto Engineer. Auto Repair C & G Auto. Eng. Garage Management M.A./M.I. Dipl. Motor Vehicle Mechanics CONSTRUCTIONAL A.M.S.E. (Civil) Architecture	<input type="checkbox"/> Constructional-cont. Building Building Drawing Build. Foreman Carpentry & Join. Civil & Municipal Engineering Constructional Engineering Construction Surveyors Institute Clerk of Works Council Engr. Geology Health Eng. Heat & Vent. Hydraulics Inst. Works & Highway Sup. Painting & Dec. Public Hygiene Road Engineer. Structural Engr. Surveying GENERAL Agricultural Eng. Council of Eng. Inst. Farm Science General Educat. Gen. Plastics Pract. Maths Pract. Slide Rule Pure & Applied Maths Refrigeration Rubber Tech. Sales Engineers Tech. Report Writing Timber Trade University Eng.
---	---	--	---

Coaching for many major exams.  
Including ONC, C & G, etc.

**POST TODAY FOR A BETTER TOMORROW**

To B.I.E.T., Dept. BEE15, Aldermaston Court, Reading RG7 4PF ON BEE15

NAME \_\_\_\_\_  
Block Capitals Please  
ADDRESS \_\_\_\_\_  
\_\_\_\_\_

OTHER SUBJECTS \_\_\_\_\_ AGE \_\_\_\_\_

Accredited by C.A.C.C.

**BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY**

**G.C.E.**  
58 'O' & 'A'  
LEVELS SUBJECTS  
Over 10,000  
group passes

# Henry's

## YOUR COMPLETE AUDIO-ELECTRONIC STORES

More of everything at the right price. All your electronic requirements within 200 yards—call and see for yourself.

### BUILD THE TEXAN

★ FREE TEAK CABINET with complete kit!

**FEATURES.** New slim design with 6 - IC's, IC sockets, 10 silicon transistors, 4 rectifiers, 2 zeners. Special Gardners low field slim line transformer. Fibre glass PC panel. Complete chassis work.

**HIGH QUALITY & STABILITY ARE PREDOMINATE FEATURES** — DEVELOPED BY TEXAS ENGINEERS FOR PERFORMANCE, RELIABILITY AND EASE OF CONSTRUCTION.

**FACILITIES.** On/off switch indicator, headphone socket, separate treble, bass, volume and balance controls, scratch and rumble filters, mono/stereo switch, input selector; Mag. P.U. Radio Tuner, Aux. Can be altered for Mic., Tape, Tape-head, etc. (Parts list Ref. 20 on request). Constructional details Ref. No. 21 30p

SPECIAL KIT PRICE

£28-50

P & P 45p

COMPLETE WITH FREE TEAK CABINET Designer approved kits distributed by Henry's!

### 20 + 20 WATT INTEGRATED I.C. STEREO AMPLIFIER

(As featured in "Practical Wireless" May to August 1972)



★ SLIM DESIGN WITH SILVER TRIM Overall chassis size 14 1/2" x 6" x 2" high

**ELECTRONIC KITS**  
Henry's introduce new huge range of audio and electronic kits now in stock, everthing supplied, tremendous value. Detailed list Ref. No. 14 on request

**IC RECEIVER**  
ZN414 Radio integrated circuit as featured in Practical Wireless, January 1973, Practical Electronics, February 1973. Price £1.20.

**BATTERY TAPE DECK**  
Garrard 9 volt Tape Deck with heads, etc. As previously advertised. Limited quantity. £9.50, post 30p.

**LEARN A LANGUAGE**  
Recorded Cassettes with step by step phrase books. French, German, Spanish Italian. £1.49 per course. £3.50 per set of four.

**DISCO SPOTBANK**  
3 channel Disco Spotbank for use with any psychodelic lighting display. £12.75 p. & p. 35p.

**HI-FI EQUIPMENT**  
Warehouse prices with BIG DISCO UNITS plus demonstrations (for callers) and GUARANTEES. FREE—24 page detailed brochure (Ref. No. 17). You can see the savings!

**HIGH QUALITY CASSETTES**

The best UK low noise tapes but at a special price. the highest international standard (IEC 94A). Fantastic price savings.

	RRP each	3 for	6 for	10 for
C80	71p	1-102.00	3-10	
C50	98p	1-472.85	4-65	
C120	1-48	1-803.50	5-60	

Full guarantee. Post paid.

SEE EARLIER PAGE OF THIS MAGAZINE FOR TRANSISTORS & SEMI-CONDUCTOR DEVICES

### ULTRASONIC TRANSDUCERS

Operate at 40Kc/s up to 100 yds. Ideal remote switching and signalling. Complete with data and circuits. £5.90 per pair. Post 10p

### MARRIOT TAPE HEADS

4 TRACK MONO or 2 TRACK STEREO  
'17' High Impedance £2.00  
'18' Med. Impedance £2.00  
'36' Med.-Low Imp. £3.50  
Erase Heads for above 75p  
'63' 2 track mono—Hi Imp. £1.75  
'43' Erase Head for above 75p

### 7 SEG & NIXIE TUBES

(Post 15p per 1 to 6)  
XN3, XN13, GN6 0-9 side view with data, 85p.  
GNP-7, GNP-8 0-9 side view with decimal points and data, 95p.  
3015F 7 seg £2 each. £7 per 4 with data.  
12 and 24 hour clock circuits Ref. No. 31 15p.

### Miniature Amplifier

5 transistor, 300mW o/p. Fitted volume and sensitivity control, 9 volt operated. £1.75 each PIP 15p.

**Quality Slider Controls**  
60mm stroke singles and ganged. Complete with knobs. 5K, 10K, 25K, 100K, 250K, 500K, 1 meg, Log and Lin. 40p each, 10K, 25K, 50K, 100K, 250K, Log and Lin ganged. 60p each.

### LOW COST HI-FI SPEAKERS



E.M.I. Size 13 1/2" x 8 1/2". Large Ceramic Magnet. TYPE 150 6 watt, 3, 8 or 15 ohms £2.20. Post 22p.  
TYPE 150 TC Twin cone version £2.75. Post 22p.  
TYPE 450 10 watt with twin tweeters and crossover, 3, 8 or 15 ohms. £3.85. Post 25p.  
TYPE 350 20 watt with tweeter and crossover, 8 and 15 ohms. £7.70. Post 28p.



POLISHED CABINETS 150, 150TC 450 £4-60. Post 30p.  
ASSEMBLED IN POLISHED CABINETS (8 ohms) SERIES 6 (Assembled 150 TC) per pair £16-50. Post 70p  
SERIES 8 (Assembled 450) per pair £18-95. Post 70p

### ML-3 MW/LW TUNER TO BUILD



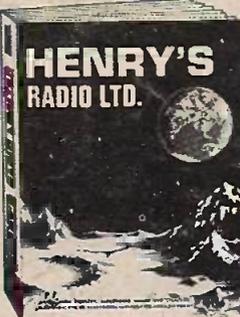
Uses Mullard Module. Slow motion tuning. Built in battery. Ferrite aerial. Overall size 7" x 2 1/2" x 3 1/2". TOTAL COST TO BUILD £4-85. Post 15p. All parts sold separately. Leaflet No. 6

### "BANDSPREAD" PORTABLE TO BUILD



Printed circuit all transistor design using Mullard RFF17 Module. Medium and Long Wave bands plus Medium Wave Bandsread for extra selectivity. Also slow motion geared tuning, 600 mW push-pull output, fibre glass PVC covered cabinet, car aerial. Attractive appearance and performance. TOTAL COST TO BUILD £7-98. p.p. 32p. (Battery 22p). All parts sold separately—Leaflet No. 2

### CATALOGUE



Fully detailed and illustrated covering every aspect of Electronics—plus data, circuits and information. 10,000 Stock lines at Special Low Prices and Fully Guaranteed.

PRICE 55p Post Paid (40p for CALLERS)

PLUS! FIVE 10p VOUCHERS

Send to this address—HENRY'S RADIO LTD. (Dept. P.V) 3 ALBEMARLE WAY, LONDON, E.C.1.—for catalogue by post only. All other mail and callers to "303" see above.

### TEST EQUIPMENT

Just a selection!  
SE250B Pocket Pencil Signal Injector £1-90  
SE500 Pocket Pencil Signal Tracer £1-50  
THL33D Robus 2K Volt £4-55 with case £4-95  
TE15 Grid Dip Meter 440 KHz-280 mHz £13-45  
500 30 K/V Multimeter £9-25 With leather case £10-50  
200H 20K/V Multimeter £4-20. With case £4-95  
AF105 50K/V Multimeter £8-50. With case £9-50  
U4341 AC/DC Multimeter with transistor tester with steel case £10-50  
TE20D RF Generator 120KHz-500MHz £15-95. Carr. 35p  
TE22D Audio Generator 20Hz-200KHz £17-50. Carr. 35p  
CI-5 3" Pulse Scope 10Hz-10mHz £39-00. Carr. 50p  
TE65 Valve Voltmeter 28 ranges £17-50. Carr. 40p  
ALL NONBEX MODELS IN STOCK



### PA-Disco-Lighting

UK's Largest Range—Write phone or call in. Details and demonstrations on request.

DJ30L 3 Channel sound to light unit, 3KW, £29-50  
DJ40L 3 channel Mic (built-in) to light, 3kW, £38-75  
DJ70S 70 watt Disco amp/mixer, £48-75  
DISCOAMP 100 watt amp/mixer, £68-85  
DJ10SS 30 watt Disco amp/mixer, £32-25  
Anti-Feedback Quality Mic., £11-50  
DJ500 50 watt PA Amplifier £43-95  
DJ700 70 watt £52-75  
GROUP 300 150 watt rms "Group" Valve Amplifier £86-00  
FIBRE OPTICS LIGHTING. — MICS. EFFECTS. PROJECTORS. SPOTS. DIMMERS — STANDS, MIXERS. SPEAKERS. Everything for PA — Disco — Lighting. FREE Stock List Ref. No. 18  
● PORTABLE DISCOS — DETAILS ON REQUEST  
● CREDIT TERMS FOR CALLERS



### BUILD THIS VHF FM TUNER

5 TRANSISTORS 300 kc/s BANDWIDTH, PRINTED CIRCUIT, HIGH FIDELITY REPRODUCTION. MONO AND STEREO  
A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately. Free Leaflet No. 3 & 7. TOTAL £6-97, p.p. 20p. Decoder Kit £5-97. Tuning meter unit £1-75. Mains unit for Tuner and/or Decoder P56/12 £3-25. Post 20p



### SINCLAIR PROJECT 60 MODULES —SAVE POUNDS!

Z30 £3-57; Z50 £4-37  
STEREO 60 PZ5 £3-97 £7-97; PZ8 £4-77  
PZ6 £4-37;



Transformer for PZ8 £2-95  
Active Filter Unit £4-45  
Stereo FM Tuner £16-95  
IC12 £1-80; Q16's £15 pr. Post etc. 20p per item

PACKAGE DEALS Post 25p  
2xZ30, Stereo 60, PZ5 £15-95  
2xZ30, Stereo 60, PZ6 £18-00  
2xZ50, Stereo 60, PZ8 £20-25  
Transformer for PZ8 £2-95  
PROJECT 60S KIT £19-95

### VAT

Prices DO NOT include Value Added Tax. From 1st April, 1973 10% must be added and shown separately to your total order (inclusive Post/packing). Help us to help you receive your order without delay. E & OE

**Henry's** RADIO LIMITED  
EDGWARE ROAD, W2

404-406 Electronic Components and Equipment 01-402 8381  
354-356 High Fidelity and Tape Equipment 01-402 5854/4736  
309 PA-Disco-Lighting High Power Sound 01-723 6963  
303 Special offers and bargains store  
All mail to 303 Edgware Road, London W2 1BW

Open—9 am-6 pm 6 days a week (309 closed Thursday)  
All stores open all day Saturday