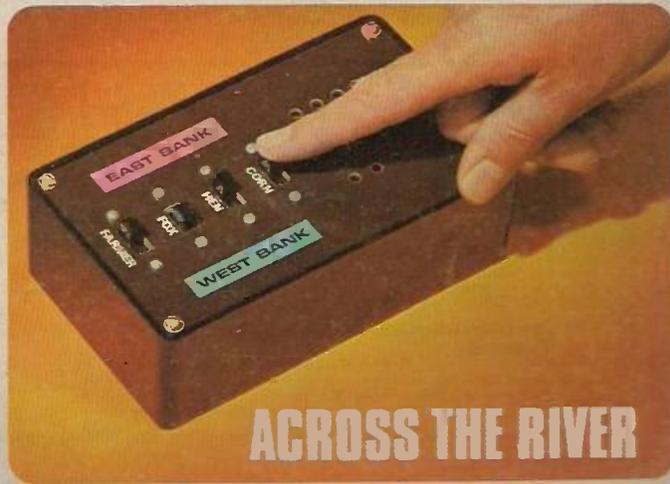


An exciting hobby.... for everyone

everyday electronics

DEC.74
20p

FREE! **INSIDE...**
this Double Sided
Four Fold
DATA CHECK CARD



New Beginner's Series

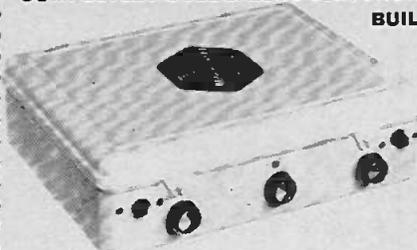
**BEGIN
HERE**



NEW EDU-KIT MAJOR

COMPLETELY SOLDERLESS ELECTRONIC CONSTRUCTION KIT.

BUILD THESE PROJECTS WITHOUT
SOLDERING IRON OR SOLDER.



★ 4 Transistor Earpiece Radio ★ Signal Tracer ★ Signal Injector ★ Transistor Tester NPN-PNP ★ 4 Transistor Push Pull Amplifier ★ 6 Transistor Push Pull Amplifier ★ 7 Transistor Loudspeaker Radio MW/LW ★ 5 Transistor Short Wave Radio ★ Electronic Metronome ★ Electronic Noise Generator ★ Batteries Crystal Radio ★ One Transistor Radio ★ 2 Transistor Regenerative Radio ★ 3 Transistor Regenerative Radio ★ Audible Continuity Tester ★ Sensitive Pre-Amplifier.

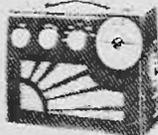
★ 24 Resistors ★ 21 Capacitors ★ 10 Transistors ★ 31 loudspeakers ★ Earpiece ★ Mica Baseboard ★ 3 12-way connectors ★ 2 Volume controls ★ 2 Slider Switches ★ 1 Tuning Condenser ★ 3 Knobs ★ Ready Wound MW/LW/SW Coils ★ Ferrite Rod ★ 6½ yards of wire ★ 1 yard of sleeving, etc. ★ Parts price list and plans 50p (FREE with parts).

Total Building Costs

£7-23 P.P. & Ins. 44p.
(Overseas P & P £1-85p.)
(+ 8% VAT 57p)

ROAMER TEN

with VHF including aircraft. 10 Transistors. Latest 4" 2 watt Ferrite Magnet Loudspeakers. 9 Tunable Wavebands. MW1, MW2, LW, SW1, SW2, SW3, Travler Band, VHF and Local Stations also Aircraft Band. Built in Ferrite Rod Aerial for MW/LW. Chrome plated 7 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600 mw Transistors. Car Aerial and Tape Recording Sockets. 10 Transistors plus 3 Diodes. 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 plans 50p (FREE with parts). Total building costs **£8-50** P.P. & Ins. 52p (Overseas P & P £1-85) (+ 8% VAT 68p)



NEW EVERYDAY SERIES

Build this exciting New series of designs

E.V. 5 6 Transistors and 2 diodes. MW/LW. Powered by 4½ volt Battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" x 5½" x 2½" approx.

Parts price list and Plans 20p. Free with parts.
Total Building Costs **£2-95** P.P. & Ins. 30p (Overseas P & P £1-25p) (+ 8% VAT 23p)

E.V. 6 Case and looks as above. 6 Transistors and 3 diodes. Powered by 9 volt battery. Ferrite rod aerial, 3" loudspeaker, etc., MW/LW coverage. Push Pull output. Parts price list and Plans 30p. Free with parts.

Total Building Costs **£3-60** P.P. & Ins. 30p (Overseas P & P £1-25p) (+ 8% VAT 29p)

E.V. 7 Case and looks as above. 7 Transistors and 3 diodes. Six wavebands, MW/LW, Travler Band, SW1, SW2, SW3, powered by 9 volt battery. Push Pull output. Telescopic aerial for short waves. 3" loudspeaker. Parts price list and easy build plans 35p. Free with parts.

Total Building Costs **£4-08** P.P. & Ins. 31p (Overseas P & P £1-85) (+ 8% VAT 32p)

ROAMER EIGHT Mk 1 NOW WITH VARIABLE TONE CONTROL

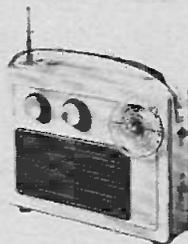
7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Travler Band. Built in Ferrite Rod Aerial for MW and LW. Chrome plated Telescopic aerial can be angled and rotated for peak short wave listening. Push pull output using 600mw transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Latest 4" 2 watt Ferrite Magnet Loudspeakers: 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 plans 50p (FREE with parts).

Total Building Costs **£6-98** P.P. & Ins. 47p (Overseas P. & P. £1-85) (+ 8% VAT 56p)



NEW ROAMER NINE

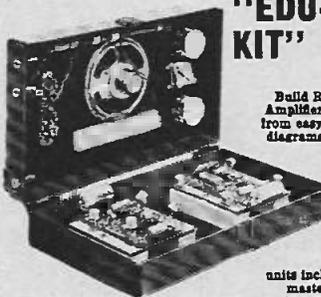
WITH V.H.F. INCLUDING AIRCRAFT



Nine Transistors, 9 Tunable wavebands as Roamer Ten, built in ferrite rod aerial for MW/LW. Retractable chrome plated telescopic aerial for VHF and SW. Push Pull output using 600 mw transistors. 9 Transistors and 3 diodes, tuning condenser with V.H.F. section, separate coil for aircraft, moving coil loudspeaker, volume ON/OFF and wavechange control. Attractive all white case with red grille and carrying strap. Size 9½" x 7" x 2½" approx. Parts Price list and Plans 40p (FREE with parts)

Total Building Costs **£6-95** P.P. & Ins. 44p. (Overseas P & P £1-85p) (+ 8% VAT 53p)

"EDU-KIT"



Build Radios, Amplifiers, etc. from easy stage diagrams. Five

units including master unit to construct

Components include:

Tuning Condenser: 2 Volume Controls: 2 Slider Switches: Fine 3" Tone Moving Coil Speaker: Terminal Strip: Ferrite Rod Aerial: Battery Clips: 4 Tag Boards: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ½" Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction. Parts price list and plans 40p (FREE with parts).

Total Building Costs **£5-50** P.P. & Ins. 35p (Overseas P & P £1-85) (+ 8% VAT 44p)

ROAMER SIX Case and looks as Trans-Eight

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3, Travler band plus an Extra Medium waveband for aerial tuning of Luxembourg etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 2in. 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 5½" x 2½in. approx. Plans and parts price list 35p (FREE with parts).

Total Building Costs **£3-98** P.P. & Ins. 31p (Overseas P. & P. £1-85) (+ 8% VAT 32p)

POCKET FIVE Now with 3" loudspeaker

3 Tunable wavebands. M.W./L.W. and Travler Band. 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, attractive Black and Gold Case. Size 6½" x 4½" x 3½" approx. Plans and parts price list 20p. (Free with parts).

Total Building Costs **£2-50** P.P. & Ins. 26p (Overseas P & P £1-25p) (+ 8% VAT 20p)



TRANSONA FIVE now with 3" loudspeaker

Wavebands, transistors and speaker as Pocket Five. Larger Case with Red Speaker Grille and Tuning Dial. Plans and parts price list 20p (Free with parts).

Total Building Costs **£2-75** P.P. & Ins. 26p (Overseas P & P £1-25p) (+ 8% VAT 21p)

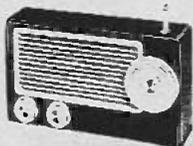


TRANS EIGHT

8 TRANSISTORS and 3 DIODES

6 Tunable Wavebands; MW, LW, SW1, SW2, SW3 and Travler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 5in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9" x 5½" x 2½in. approx. Push pull output. Battery economiser switch for extended battery life. Ampic power to drive a larger speaker. Parts price list and plans 35p (FREE with parts).

Total Building Costs **£4-48** P.P. & Ins. 33p (Overseas P & P £1-25) (+ 8% V.A.T. 36p)



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

RADIO EXCHANGE CO

61a HIGH STREET, BEDFORD, MK40 1SA

Tel. 0234 52367

Reg. no. 788372

I enclose £..... for.....

Name.....

Address.....

(Dept. E.E.12.)



*I've often wondered -
How CAN you compare
one catalogue with
another?*

After all, few firms can give you more than a brief description. Take the *Home Radio Components Catalogue* for instance. They could have said that the cover is in full colour and shows Barbara Hepworth's beautiful "Theme on Electronics". Or that it consists of no less than 240 pages of quality art paper, has over 1,700 illustrations, and lists about 6,800 different items.



What really counts however, is *the organisation behind the catalogue*, and in this connection I give full marks to Home Radio Components, because from my experience they really *care* about helping their customers. But don't merely take my word for it—find out for yourself. The best way to do that is to get a copy of their catalogue right away. Just send them a cheque or postal order for 98 pence (65p for the catalogue and 33p for postage, packing and insurance). By the way, they include 14 coupons in the catalogue, each worth 5 pence if used as directed, so you can get not only the cost of the catalogue back, but 5p towards the postage as well. If that's not philanthropy I don't know what is! It's just one of the ways Home Radio Components think of their customers. *Send for your catalogue today—you'll never regret it.*

65p. plus 33p POST AND PACKING

Send off the coupon today. It's your first step to solving your component buying problems.

The price of 98p applies only to customers in the U.K. and to BFPO Addresses.

Please write your Name and Address in block capitals

NAME.....

ADDRESS.....



HOME RADIO (Components) LTD., Dept. EE,
234-240 London Road, Mitcham, Surrey CR4 3HD

(Regn. No.
London 912966)

CRESCENT RADIO LTD.

11-15 & 17 MAYES ROAD, LONDON N22 6TL
(also) 13 SOUTH MALL, EDMONTON, N.9

MAIL ORDER DEPT.
11 MAYES ROAD, LONDON N22 6TL
Phone 888 3206 & (EDM.) 803 1685

ABS PLASTIC BOXES

Handy boxes for construction projects. Moulded extrusion ribs for P.C. or chassis panels. Fitted with 1mm front panels.

1005 = 105mm x 78mm x 45mm = 51p.
1008 = 150mm x 74mm x 47mm = 89p.
1007 = 185mm x 124mm x 60mm = 89p.
1011 = 106mm x 74mm x 45mm = 59p.
(slipping front)

CLEAR PLASTIC PANEL METERS

Size 69mm x 46mm x 35mm these meters require a 38mm hole for mounting.

ME8 = 0 to 50 micro amp Full Scale
ME7 = 0 to 100 micro amp " "
ME8 = 0 to 500 micro amp " "
ME9 = 0 to 1mA " "
ME10 = 0 to 5mA " "
ME11 = 0 to 10mA " "
ME12 = 0 to 50mA " "
ME13 = 0 to 100mA " "
ME14 = 0 to 500mA " "
ME16 = 0 to 1 amp " "
ME15 = 0 to 50 volts A.C. Full Scale
ME17 = 0 to 300 volts A.C. Full Scale
ME18 = "8" Meter
ME19 = "VU" Meter

OUR PRICE £3.00



LOW VOLTAGE AMPLIFIER

5 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



LIGHT EMITTING DIODES

TL 209 (Red) with Clip 22p each
TL 209 (Green) with Clip 38p each
TL 209 (Yellow) with Clip 80p each
Med 600 T092 Type 16p each

LED READOUTS

Litronix
DL707 3 Character 14 Pin DIL £2.00
DL701 As above but ±1 £2.00
DL747 6 Character £2.82
Minitron
3015 7 Segment 16 Pin DIL £1.18
3016G As above but ±1 £1.18

CLOCK CHIP

CT7001 MOS/LBI Digital Clock/Calendar Chip plus full Circuits and Information Leaflet £8.95
Circuits and Information Sheet 15p
L4704 Led Display for above £1.85
Or 4 for £8.25

3 KILOWATTS PSYCHEDELIC LIGHT CONTROL UNIT



Three Channels: Bass—Middle—Trebble. Each channel has its own sensitivity control. Just connect the input of this unit to the loudspeaker terminals of an amplifier, and connect three 250V up to 1000W lamps to the output terminals of the unit, and you produce a fascinating sound-light display. (All guaranteed.)

£18.50 plus 38p P. & P.

U.K. CARR.
15p unless otherwise stated

V.A.T.
8% VAT to be added to all orders

Send 20p for a CRESCENT CATALOGUE

VEROBOARD

	-1	-15	Plain-15
2 1/2 x 3 1/2	82p	24p	15p
2 1/2 x 5	84p	34p	18p
3 1/2 x 3 1/2	84p	84p	...
3 1/2 x 5	89p	45p	...
1 7/8 x 2 1/2	1.06p	77p	60p
1 7/8 x 3 1/2	1.46p	1.16p	75p
1 7/8 x 5	1.85p	...	1.10p

Pin Insertion tool 83p
Spot face Cutter 45p
Pkt 36 pins (state -1 or -15) 25p

LOUDSPEAKERS

2 1/2" 8 ohm 50p
2 1/2" 40 ohm 50p
2 1/2" 80 ohm 50p
5" 8 ohm ceramic £1.25
6 1/2" 8 ohm Dual cone ceramic £2.50
10" 8 ohm Dual cone ceramic £3.75
7" x 4" 8 ohm ceramic £1.80
8" x 5" 8 ohm Permanent Magnet £1.80
*EMI 13 x 8" 450 Kit 3-8-15 ohm £3.75
*Fane Ultra high power loudspeakers.
*Pop 25/2 20 watt 16ohm 12" £8.13
*Pop 55 50 Watt 8/15ohm 12" £14.50
*Pop 60 50 Watt 15ohm 12" £11.81
*Pop 60 60 Watt 8/15ohm 15" £16.40
*Pop 100 100 Watt 8/15ohm 15" £27.00
*Carry on L/S over 13" x 8" and 12" 50p per L/S.

S. G. BROWN "DIPLOMAT" HEADSET

Finest quality British made Light weight Headphones. Incorporates 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).
A Bargain at £1.25 each set

TWO WAY STEREO ADAPTOR

Stereo Jack plug to two stereo line sockets complete with 110 mm of cable. For plugging two stereo inputs into one. A Bargain at 85p.

STEREO/MONO HEADPHONE VOLUME CONTROL BOX

Plug Stereo phones into this control box and you then incorporate a right and left hand volume control and a stereo/mono switch. Complete with stereo jack plug and 2 m cable. A Bargain at £1.

12-0-12 VOLT 500mA/240 VOLT PRIMARY TRANSFORMER

approx. size — 60mm x 40mm x 50mm. Fixing centres—75mm.
A REAL BARGAIN AT £1.20 each.

DECON-DALO

33 PC ETCH RESIST PEN
The Decon-Dalo 33PC is a unique instrument for the professional and amateur electronics engineer. Enabling him to prepare in minutes a perfect printed circuit board.

OUR PRICE 80p + VAT

POWER PACKS

PP1 Switched 3-6-7.9volt. 400mA Transistor & Zener Stabilised On/Off switch & Polarity Reversal switch, in a black metal case £5.25 each
PP2 Switched 6-7.9 volt. Battery Eliminator. Approx size 2 1/2" x 2 1/2" x 3 1/2". Ideal for cassette recorders. £2.75 each (Philips type £3.00)
PP3 Car converter. From 12v Pos. or Neg to 6-7.9 volt. Easy to fit and transistor regulated £2.50 each.



"I MADE IT MYSELF"

Imagine the thrill you'll feel! Imagine how impressed people will be when they're hearing a programme on a modern radio you made yourself.

Now! Learn the secrets of radio and electronics by building your own modern transistor radio!

Practical lessons teach you sooner than you would dream possible.

What a wonderful way to learn—and pave the way to a new, better-paid career! No dreary ploughing through page after page of dull facts and figures. With this fascinating Technatron Course, you learn by building!

You build a modern Transistor Radio... a Burglar Alarm. You learn Radio and Electronics by doing actual projects you enjoy—making things with your own hands that you'll be proud to own! No wonder it's so fast and easy to learn this way. Because learning becomes a hobby! And what a profitable hobby. Because opportunities in the field of Radio and Electronics are growing faster than they can find people to fill the jobs!

No soldering — yet you learn faster than you ever dreamed possible.

Yes! Faster than you can imagine, you pick up the technical know how you need. Specially prepared step-by-step lessons show you how to read circuits—assemble components — build things — experiment. You enjoy every minute of it! You get everything you need. Tools. Components. Even a versatile Multimeter that we teach you how to use. All included in the course. AT NO EXTRA CHARGE! And this is a course anyone can afford. (You can even pay for it by easy instalments).

So fast, so easy, this personalised course will teach you even if you don't know a thing today!

No matter how little you know now, no matter what your background or education, we'll teach you. Step by step, in simple easy-to-understand language, you pick up the secrets of radio and electronics. You become a man who makes things, not just another of the millions, who don't understand. And you could pave the way to a great new career, to add to the thrill and pride you receive when you look at what you have achieved. Within weeks you could hold in your hand your own transistor radio. And after the course you can go on to acquire high-powered technical qualifications, because our famous courses go right up to City & Guilds levels.

Send now for FREE 76 page book — see how easy it is — read what others say!

Find out more now! This is the gateway to a thrilling new career, or a wonderful hobby you'll enjoy for years. Send the coupon now. There's no obligation.

POST TODAY FOR FREE BOOK



To: ALDERMASTON COLLEGE DEPT. BEE85 READING RG7 4PF

BEE 85

Yes, I'd like to know more about your course. Please send me free details—plus your big, 76-page book that tells about all your courses.

NAME

ADDRESS



HOME OF BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

Everyday Electronics, December 1974



and make no mistake

AUDIOTRONIC Model ATM1

Top value 1,000 opv pocket multimeter. Ranges: 0/10/50/250/1000 volt AC and DC. DC current 0-1mA/100mA. Resistance: 0/150k ohms. Decibels: -10 to +22dB. Size 90 x 80 x 28mm. Complete with test leads.



OUR PRICE £3.25 P&P 15p

AUDIOTRONIC Model ATM5

Jewel movement, attractively moulded case with edgewise ohms adjustment. Ranges: 0.3/15/150/300/1200V AC. (2500 opv). 0.6/30/300/600V DC. (5000 opv). 0-300 uA/0-300mA DC. Resistance: x 10 & x 100. -10 to +16dB. Supplied with battery test leads and data booklet. Size: 121 x 73 x 29mm.



OUR PRICE £3.95 P&P 20p

MODEL TH12

20,000 opv. Overload protection. Slide switch selector. 0/0.25/2.5/10/50/250/1000V AC. 0/10/50/250/1000V AC. 0/50uA/25/250mA DC. 0/3k/30k/300k/3 Megohms. -20 to +50dB.



OUR PRICE £5.95 P&P 30p

HIKOKI 720X VOM

A versatile, accurate measuring instrument. 20,000 opv. 0/5/25/100/500/1000V DC. 0/10/50/250/1000V AC. 0-50uA/250mA. 0-20k/2 Megohms.



OUR PRICE £5.97 P&P 30p

MODEL PL436

20,000 opv DC. 8000 opv AC. Mirror scale. -8.3/12/30/120/600V DC. 3/30/120/600V DC. 50/600uA/60/600mA. 10/100k/1 Meg/10 Meg Ohm. -20 to +48dB.



OUR PRICE £6.97 P&P 30p

U4323 MULTIMETER

20,000 opv. Simple unit with audio/IF oscillator. Suitable for general receiver tuning. Ranges: 0.5/2.5/10/50/250/1000V DC. 2.5/10/15/250/500/1000V AC. 0.05/0.5/5/50mA DC. Resistance: x 10, x 100, x 1,000, x 10,000 (50k, 500k, 5k/1 centrascale). Battery operated. Size: 160 x 97 x 40mm. Supplied in carrying case complete with test leads.



OUR PRICE £7.70 P&P 30p

HIKOKI 730X

30,000 opv. Overload protection. Ranges: 6/30/60/300/600/1200V DC. 12/60V DC. 12/60/120/600/1200V AC. 60uA/30mA 300mA. 2k/200k/2 Meg Ohm. -10 to 63dB.



OUR PRICE £7.50 P&P 30p

U4324 MULTIMETER

High sensitivity, overload protected. 20,000 opv. Ranges: 0.6/1.2/3/12/30/60/120/600/1200V DC. 3/6/15/60/150/300/600/900V AC. Current: 0.06/0.6/6/60/600mA/1.2A DC. 0.3/30/300mA/3A AC. Resistance: 25/500 ohms/0.5/5/50/500k ohms/5 Mohms. Decibels: -10 to +12dB. Size 167 x 98 x 63mm. Supplied complete with test leads, spare diode and instructions.



OUR PRICE £9.25 P&P 30p

U435 MULTIMETER

20,000 opv. Ranges: 75mV/2.5/10/25/100/250/500/1000V DC. 2.5/10/25/100/250/500/1000V AC. Current: 50uA/175/25/100mA/0.5/2.5A DC. 0.5/2.5/10mA. 0.5/2.5/5A AC. Resistance: 0.3/30/300k ohms. Size: 205 x 110 x 84mm. Supplied complete with leads, crocodile clips and steel carrying case.



OUR PRICE £8.75 P&P 30p

U4312 MULTIMETER

extremely sturdy instrument for general electrical use. 6670V. 0/0.3/1.5/7.5/30/100/500/1000V DC. 900V DC & 75mV/0/0.3/1.5/7.5/30/60/150/300/600/900V AC. 0/300uA/1.5/15/150/60/600mA/1/1.5/8A DC. 0/1/5/6/15/60/150/600mA/1.5/6A AC. 0/200/3k/30k ohms. DC accuracy 1%. AC 1.5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions.



OUR PRICE £10.25 P&P 50p

U91 Clamp VOLT AMMETER

For measuring AC voltage and current without breaking circuit. Ranges: 300/600V AC. Current: 10/25/100/250/500A. Accuracy: Size: 283 x 94 x 36mm. Complete with carrying case, leads and fuses.



OUR PRICE £13.50 P&P 30p

MODEL 500

30,000 opv with overload protection. Mirror scale. 0/0.5/2.5/10/25/100/250/500/1000V DC. 0/2.5/10/25/100/250/500/1000V AC. 0/50/500/500mA/2A DC. Current: 500k/6 Meg/60 megohms. Case for above £1.75



OUR PRICE £13.95 Carr. paid

HIKOKI 750X VOLT-OHM-MILLIAMMETER

43 ranges: 0-0.3/0.5/1.5/3/6/12/30/60/150/300/600/1200V DC. 10-20/150/300/600/1200V AC. Current: 0-30/60uA/1.5/3/15/30/150/300 mA/6/12A. Resistance 0-3/300k/3/30Mohms. Decibels: -10 to +17dB. Output: 0.3/15/120/60/120/300V. Accuracy: ± 3% DC, ± 4% AC. Sensitivity: 50,000 opv DC, 5,000 opv AC. 4 inch meter. Built in protection. Size: 67 x 102 x 153mm.



OUR PRICE £11.95 P&P 40p

TMK MODEL TW50K

46 ranges, mirror scale. 50kV/4 AC. 0.25/1/2.5/5/10/25/50/125/250/500/1000V AC. DC current 25/50uA/2.5/5/25/50/100mA/10A. Resistance: 10k/100k/1 Meg/10 Meg ohms. -20 to +81.5dB.



OUR PRICE £12.50 P&P 20p

HIKOKI MODEL 700X

100,000 opv. Overload protection. Mirror scale. 0.3/0.6/1.2/1.5/3/6/12/30/60/120/300/600/1200V DC. 1.5/3/6/12/30/60/150/300/600/1200V AC. 15/30/150/300/600/150/500mA/6/12A DC. 2k/200k/2M/20M Ohms. -20 to +63dB.



OUR PRICE £14.95 P&P 30p

Model HT100B4 MULTIMETER

Overload protection, shock proof circuits. 9.5uA Meter with mirror scale. Sensitivity 100kV. Polarity change switch. Ranges: 0.5/2.5/1.5/50/250/500/1000V DC. 2.5/10/50/250/1000V AC. DC resistance: 0-20/200k/2/20 Meg ohms. DC current: 10/250uA/2.5/25/250 mA/10A. AC current: 0-10A. -20 to +62dB. Operates from 2 x 1.5V batteries. Size: 180 x 134 x 79mm.



OUR PRICE £17.50 P&P 40p

MODEL AS.1000 VOM

100,000 opv. Mirror scale. Built-in meter protection. 0/3/12/60/120/300/600/1200V DC. 0/6/30/120/300/600V AC. 0/10uA/6/60/300mA. 12 Amp. 0/2k/200k/2M/200 Meg Ohm. -20 to +17dB.



OUR PRICE £17.50 P&P 30p

MODEL C7202EN

20,000 opv. DC. 10,000 opv. AC. Mirror scale. 6/25/50/250/500/1000/2500V DC. 10/50/100/500/1000V AC. DC Resistance x10, x100 (30k centrascale) DC Current: 50uA/2.5mA/250mA. -20 to +48dB.



OUR PRICE £6.50 P&P 30p

KAMODEN HM720B FET VOM

Input impedance 10 Megohms. Ranges: 0/25/100/500/1000V DC. 0/2.5/10/50/250/1000V AC. 0/25uA/2.5/25/250 mA DC. 0/5k/50k/500k/5 M 500 Megohms.



OUR PRICE £21.00 P & P 40p

KAMODEN 360 MULTIMETER

High sensitivity. DC 100kOhm/V AC 10kOhm/V. 5" mirror scale, overload protected. ed. Ranges: 0.5/2.5/10/50/250/1000V DC. 5/10/50/250/1000V AC. Current: 0.01mA/0.5/5/50/500mA/10A. Resistance: 0.1/1/10/100 ohms/10/100k ohms/10/100M Ohms. Decibels: -20 to +62dB. Battery operated. Size: 180 x 140 x 80mm. Supplied complete with test leads etc.



OUR PRICE £17.50 P & P 40p

TMK MODEL 117 FET ELECTRONIC VOLT METER

Battery operated. 11 Meg Input, 26 ranges. Large 4" mirror scale. Size: 149x117x66mm. 0.3-12000V DC. 0.3-300V RMS AC. 6-300V DC. DC current 0.12-12mA. Resistance up to 2000M Ohms. Decibels: -20 to +45dB. Supplied complete with leads and instructions.



OUR PRICE £18.50 P&P 20p

TMK 100K LAB TESTER

100,000 opv. 6.5" scale. Buzzer switch. Short circuit check. Sensitivity 100,000 opv DC. 5kV/4 AC. DC Voltage: 0.5/5/10/50/250/1000V AC. 3/10/50/250/500/1000V DC. Current: 10/100/2.5/10A. Resistance: 1k/10k/100k/10 Meg/100 Meg ohms. Decibels: -10 to +45dB. Plastic case with carrying handle. Size: 190 x 172 x 99mm.



OUR PRICE £19.95 P&P 20p

370WTR MULTIMETER

Features AC current ranges: 20,000 opv. 0/0.5/2.5/10/50/250/500/1000V DC. 0/2.5/10/50/250/500/1000V AC. 0/50uA/10/100 mA/1/10A DC. 0/100mA/10A AC. 0/5k/50k/150k/5 Meg/50 Meg. Decibels: -20 to +62dB.



OUR PRICE £19.95 P&P 30p

KAMODEN 72.200 Multitester

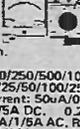
High sensitivity. 200,000 opv. Overload protected. Mirror scale. Ranges: 0.06/3/30/120/600/1200V DC. 0/3/12/60/300/1120V AC. 0/10uA/1mA/120mA/600mA/12A DC. 0/12A AC. -20 to +63dB. 0/2k/200k/2 Meg/200 Megohms.



OUR PRICE £22.50 P&P 30p

U4317 MULTIMETER

High sensitivity. Instrument for field and laboratory work. Knife edge pointer, 36mm mirror scale. Overload protection. Ranges: 100mV/0.5/2.5/10/25/50/100/250/500/1000/1000V DC. 0.5/2.5/10/25/50/100/250/500/1000V AC. Current: 50uA/0.5/1/5/10/50/250mA/1.5A DC. 0.25/0.5/1/5/10/50/250mA/1.5A AC. Resistance: 0.5/10/100/200 ohms/1/3/30/300k ohms. Decibels: -5 to +10dB. Battery operated. Size: 210 x 115 x 50mm. Supplied in carrying case complete with test leads.



OUR PRICE £16.50 P&P 40p

MODEL C720BFM

30,000 opv DC. 15,000 opv AC. 6/3/15/60/300/600/1200V DC. DC/30/120/600/1200V V. AC. DC Resistance x1, x10, x100 (100k centrascale) DC Current: 30uA/3/30/600mA. -20 to +83dB.



OUR PRICE £8.95 P & P 30p

MODEL U4311 Sub-standard Multi-range Volt-Ammeter

Sensitivity: 330 Ohms/Volt AC and DC. Accuracy: 0.6% DC. 1% AC. Scale length: 165mm. 0/200/750uA/1.5/3/7.5/15/30/75/150/300/750mA/1.5/3/7.5/15/30/75/150/300/750V AC. Automatic cut out device. Supplied complete with test leads, manual and test certificates.



OUR PRICE £52.00 P&P 50p

MODEL AF.105 VOM

50,000 opv. Mirror scale. Meter protection. 0/3/3/2/50/120/300/600/1200V DC. 0/6/30/120/300/600/1200V DC. 0/30uA/6/60/300mA/10A. Mirror: 10/100/100 Meg Ohms. -20 to 17dB.



OUR PRICE £12.50 P&P 30p

L83 TRANSISTOR TESTER

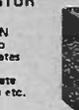
Tests ICD and B. PNP/NPN. Operates from 9V battery. Instructions supplied.



OUR PRICE £3.95 P&P 20p

L84 TRANSISTOR TESTER

Tests PNP or NPN transistors. LED indication. Operates on two 1.5V batteries. Complete with instructions etc.



OUR PRICE £4.50 P&P 20p

KAMODEN TT35 TRANSISTOR TESTER

High quality instrument to test reverse leak current and DC current. Amplification factor of PNP and NPN transistors, SiC P's etc. 4" square clear scale meter. Operates from internal batteries. Complete with instructions, leads carrying handle.



OUR PRICE £17.50 P & P 40p

U4341 Multimeter & Transistor Tester

27 ranges. 16,700 opv. Overload protected. Ranges: 0.3/3/15/30/60/300/3000V DC. 1.5/7.5/30/150/300/750V AC. Current: 0.06/0.5/6/60/600mA/10A. Resistance: 0.06/0.6/6/60/600k/2 Mohms. Battery operated. Supplied complete with probes, leads and steel carrying case. Size: 115 x 215 x 90mm.



OUR PRICE £19.50 P&P 30p

S100TR MULTIMETER TRANSISTOR TESTER

100,000 opv. Mirror scale. Overload protection. 0/0.1/0.5/3/12/30/120/600V DC. 0/6/30/120/600V AC. 0/12/600uA/12/300mA/6/12A DC. 0/10k/1 Meg/100 Meg. -20 to +50dB. 0.01-0.2 MPFD. Transistor tester measures Alpha, Beta and ICD. Complete with instructions, batteries and leads.



OUR PRICE £19.95 P&P 25p

SWR METER MODEL SWR3

Handy SWR meter for transistor antenna alignment, with built-in field strength meter. Accuracy 5%. Impedance 52 Ohm indicator 100uA DC. Full scale 5 section collapsible antenna. Size 145 x 50 x 60mm.



OUR PRICE £4.25 P&P 30p

ALL PRICES EXCLUDE VAT

Also see following pages

C16 PULSE OSCILLOSCOPE

For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth: 10MHz. Sensitivity at 100kHz VRMS/mm: 0.1-25. HOR. AMP. Bandwidth: 500kHz. Sensitivity at 100kHz VRMS/mm: 0.3-25. Preset triggered sweep 1-3000usec. Free running 20-200 Hz in nine ranges. Calibrator pulse 220 x 360 x 430mm. 115-230V AC. **OUR PRICE £43.00** Carr. paid



RUSSIAN C116 Double Beam OSCILLOSCOPE

5 MHz pass band. Separate Y1 and Y2 amplifiers. Rectangular 5 x 4" CRT. Calibrated triggered sweep from 0.2usec. to 100msec/sec/cm. Free running time base, 50Hz-1MHz. Built-in time base Calibrator and amplitude Calibrator. Supplied complete with all accessories and instruction manual. **OUR PRICE £87.00** Carr. paid



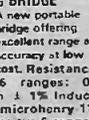
MODEL TE15 GRID DIP METER

Operates as Grid Dip Oscillator. Absorption Wave Meter and Oscillating Detector. Frequency range 400kHz-280MHz in six coils. 500uA meter, 9V battery operation. Size: 180 x 80 x 40mm. **OUR PRICE £19.95** P&P 30p



TRANSISTORISED L.C.R. A.C. BR/B' MEASURING BRIDGE

A new portable bridge offering excellent range and accuracy at low cost. Resistance: 6 ranges: 0.1 ohm-11.1 megohm ± 1% Inductance: 6 ranges: 1 microhenry 131 henries ± 2% Capacity: 6 ranges: 10pt-1110 mfd ± 2% Turns Ratio: 6 ranges: 1:1/1000-1:11100 ± 1% Bridge Voltage at 1.000cps. Operated from 9-volt battery. 100 microamp meter indication. Size 7 1/2" x 5" x 2" **OUR PRICE £25.00** P&P 30p



TE16A TRANSISTORISED SIGNAL GENERATOR

5 ranges, 400kHz to 30 MHz. An inexpensive instrument for the handy-man. Operates on 9V battery. Wide easy to read scale. 800kHz modulation. Size: 149 x 149 x 32mm. Complete with instructions and leads. **OUR PRICE £8.97** P&P 30p



TE-200 RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 kHz-500 MHz on 6 bands. Directly calibrated. Variable R.F. attenuator audio output. Xtal socket for calibration 220/240V a.c. Brand new with instructions. Size 140mm x 215mm x 170mm. **OUR PRICE £17.50** P&P 50p



TE22 SINE SQUARE WAVE AUDIO GENERATOR

Sine 20cps to 200kHz on 4 bands. Square 20 cps to 20 kHz. Output impedance 5000 Ohms. 200/250V AC operation. Supplied brand new guaranteed, with instruction manual and leads. **OUR PRICE £24.95** P&P 50p



ARF 300 AF/RF SIGNAL GENERATOR

All transistorised compact fully portable. AF sine wave 18Hz to 220 kHz. AF square wave 18Hz to 100k Hz. Output Square/Sine wave 10V. P-P RF 100kHz to 200MHz. Output 1V maximum. 220/240V AC operation. Complete with instructions and leads. **OUR PRICE £37.50** P&P 50p



MODEL MG100 SINE SQUARE WAVE AUDIO GENERATOR

Wave 19- 100,000 Hz Square Wave. Output Sine or Square wave 10V P to P. Size 110 x 80 x 90mm. Operation 220/240V. A.C. **OUR PRICE £19.95** P&P 50p

SPECIAL BARGAIN! FERGUSON 3406 HI-FI SPEAKERS

High quality 2 way speaker systems. 25 Watts. 4-8 ohms. 40Hz-18kHz. Size: 960 x 340 x 255mm. approx. Wood grain finish with black fronts. **OUR PRICE £22.50** PR. P&P £1



POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiring. Continuous rating. Simple hole fixing. 1/2" diameter shafts. Bulk quantities available. **25 WATT 10/25/50/100/500/1000/2500 ohms. £1.15 P&P 10p**
50 WATT 10/50/100/250/500/7500/5000 ohms. £1.62 P&P 10p
100 WATT 1/5/10/25/50/250/500/2500 ohms. 300 Ohms £2.34 P&P 15p



EMI LOUSPEAKERS

Model 350 13 x 8" wide single tweeter/crossover. 20-20,000Hz. 15 watts RMS. Available 8 or 15 ohms. **OUR PRICE £7.50** each P&P 37p
Model 450 13 x 8" with twin tweeter/crossover. 55-13,000Hz. 8 watts RMS. Available 8 or 15 ohms. **OUR PRICE £3.62** each P&P 35p



SPECIAL PURCHASE LIMITED QUANTITY! Tansy 12" DR/B Bass Speakers

8 ohms 30 watt. Heavy duty. Ideal for Hi-Fi P.A. Group. **OUR PRICE £12.50** P&P 60p



PS200 Regulated POWER SUPPLY UNIT

Solid state. Variable output 5-20V DC. up to 2 Amp. Independent meter to monitor voltage and current. Output 220/240V A.C. Size: 190 x 136 x 98mm. **OUR PRICE £19.95** P&P 50p



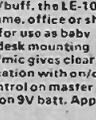
AUDIOTRONIC LE-102A INTERCOM

Beautifully made and finished in two tone ivory/buff. The LE-102A is useful in the home, office or shop and is suitable for use as baby alarm. Wall or desk mounting. 57mm speaker/mic gives clear 2-way communication with on/off and volume control on master unit. Operates on 9V batt. Approx. 601t lead. **OUR PRICE £3.95** P&P 30p



TRITON 4318 PORTABLE 8 TRACK CARTRIDGE PLAYER WITH MW/LW RADIO

Will play 8 track stereo cartridge monoaurally. Channel selector switch. Covers medium and long wave bands. Volume and tone controls. Earphone socket. Battery/ Mains operation. **OUR PRICE £11.95** P & P 50p



EA41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, gully etc. and output to your amplifier. Volume control and depth of reverberation control. Beautiful cabinet. 184 x 77 x 108mm. **OUR PRICE £7.50** P&P 30p



SPECIAL PURCHASES! RECORD DECK PACKAGE

by Famous Manufacturer GARRARD SP25 Mark 111 with 800 RPM cartridge in luxurious plinth with cover. **OUR PRICE £13.95** P & P 75p
GARRARD SP25 Mark 111 Record deck fitted KX 40A cartridge. **OUR PRICE £9.95** P & P 50p

LH025 STEREO HEADPHONES

Light weight headphones with padded ear pieces. 4/16 ohms 20-20,000Hz. Complete with 6 1/2" lead and plug. **OUR PRICE £1.97** P&P 30p



DH025 STEREO HEADPHONES

Wonderful value and excellent performance. Combined adjustable head band. Impedance 8 ohms. 20-12,000Hz. Complete with lead and plug. **OUR PRICE £2.25** P&P 30p



TE1035 Stereo HEADPHONES

Low cost with excellent response. Foam rubber earcups. Adjustable headband. 8 ohms impedance. Frequency response 20Hz-18kHz. Complete with cable and stereo jack plug. **OUR PRICE £2.60** P&P 30p



SDHVV MONO/STEREO HEADPHONES

Volume control for each channel. 4/16 ohms impedance. Frequency response 20Hz-18kHz. Complete with 10ft. coiled lead and jack plug. **OUR PRICE £4.97** P&P 30p



BH001 HEADSET and Boom Microphone

Moving coil. Ideal for language teaching, communications etc. Headphone impedance 16 ohms. Microphone impedance 200 ohms. **OUR PRICE £5.95** P&P 30p



HANIMEX HRC 3075 CASSETTE TUNER

Covers Medium and FM wavebands. Slider volume and tone controls. Battery/ Mains operation. Will record direct from radio or through built in condenser microphone. Complete with batteries, earphone, and cassette. **OUR PRICE £24.30** P & P 50p



SPECIAL BARGAIN!! STEREOSOUND SPEAKERS

Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size: 368 x 228 x 190mm. 8 ohms. 8 watts RMS. 16 watts peak. Complete with Din lead. **OUR PRICE £12.95** PR. P&P 50p



FM TUNER CHASSIS

6 transistor high quality tuner. Size only 153 x 101 x 63mm. 3 IF stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Covers 88-108MHz. Ready built, ready for use. Fantastic value for money. **OUR PRICE £8.95** P&P 20p
Stereo Multiplex Adaptor £3.95 extra



SPECIAL OFFER! SAVE OVER 50%

AMSTRAD 8000/2 Stereo amplifier 7 watts per channel rms. Inputs for tuner tape, phono. Headphone socket. List price £29.95. **OUR PRICE £12.95** P & P 60p

SPECIAL OFFER! CONVERT YOUR STEREO SYSTEM TO 4D SOUND FOR UNDER £16.

Exclusive offer of GOODWIN 4-CHANNEL CONVERTER and a pair of AD15 10 watt 8 ohm bookshelf speakers enables you to add 4D sound to your existing system. Complete with simple connection details. Normal retail value £25.50. **OUR PRICE £15.80** P & P £1.
GOODWIN CONVERTER available separately £3.95 P & P 50p.



Model A1018 FM TUNER

6 transistor high quality unit—3 IF stages and double tuned discriminator. For use with most amplifiers. Covers 88-108MHz. Powered by 9V battery. **OUR PRICE £13.50** P&P 30p
Stereo multiplex adapter £5.95 extra.

ELECTRONIC CALCULATORS

We carry a tremendous range of both pocket and desk calculators from as little as £9. Owing to the demand it is not possible to include them in this advertisement, so send for our latest price list or call into any branch.

SINCLAIR SYSTEM 2000 STEREO AMPLIFIER AND TUNER

Amplifier output 8 watts per channel RMS. Distortion less than 0.06%. Silicon transistors. Two pick-up plus radio and tape inputs. Hi-Fi Diode detector. Excellent Value. List £39.95. **OUR PRICE £27.50** P & P 60p.

2000 AMPLIFIER

Amplifier output 8 watts per channel RMS. Distortion less than 0.06%. Silicon transistors. Two pick-up plus radio and tape inputs. Hi-Fi Diode detector. Excellent Value. List £39.95. **OUR PRICE £27.50** P & P 60p.

2000 FM TUNER

Excellent selectivity and sensitivity. Twin dual-varicap tuning. 4 pole ceramic filter. 19 transistor stereo demodulator giving 40 dB separation. Distortion 0.2% output. Fantastic Value. List £39.95. **OUR PRICE £27.50** P & P 60p.

SINCLAIR IC12 INTEGRATED CIRCUIT AMPLIFIER

Complete with printed circuit mounting board. **OUR PRICE £1.50** P & P 15p.

SINCLAIR Project 80 Modules

240 Power Amp. £5.95 P & P 15p
750 Power Amp. £7.45 P & P 15p
Stereo 80 Pre-Amp. £13.95 P & P 15p
Active Filter Unit. £7.45 P & P 15p
FM Tuner. £13.95 P & P 15p
Stereo Decoder. £8.95 P & P 15p
P25 Power Supply. £5.95 P & P 30p
P26 Power Supply. £8.95 P & P 30p
P28 Power Supply. £8.45 P & P 30p
Transformer for P28. £2.45 P & P 30p
IC20 Stereo Amp. kit. £7.95 P & P 15p
P220 Power Supply kit. £5.45 P & P 30p
SINCLAIR Project 80 Packages
2x240 Stereo 80/P28 £28.60
2x240 Stereo 80/P28 £31.30
2x250 Stereo 80/P28 £33.55 P & P 35p each

TE1021 Stereo Listening Station

For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. Two gain controls, speakers on-off slide switch, stereo headphone socket. **OUR PRICE £22.25** P&P 15p

AUDIOTRONIC LOW NOISE CASSETTES

TYPE	10	25
C60	£1.57	£3.00 £7.08
C90	£2.24	£4.25 £10.00
C120	£2.73	£5.17 £12.24

AUDIOTRONIC 8 TRACK CARTRIDGES

TYPE	Each	5	10
40M	£5.50	£4.20	£7.50
80M	£1.15	£5.40	£10.25

P&P Cassettes 3p, Cartridges 5p each OVER 10 of either POST FREE!

MPT MIXER-PREAMPLIFIER

5 Microphone inputs each with individual gain controls. Complete with simple connection details. Battery operated. Size: 235 x 127 x 76mm. Inputs: Mic, 3 x 3xV2 50k 2.5M Ohms. Phono. Mag. 4mV 50k; Phono Ceramic 100mV 1 Meg. Output 250mV 100k. **OUR PRICE £8.97** P&P 20p

AUDIOTRONIC AH401 Stereo Headphone Amplifier

All effect, transistor amplifier operates from magnetic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9V battery. INPUTS: 5mV and 100mV. Output: 50mV per channel. **OUR PRICE £8.50** P&P 30p

HIGH QUALITY CONSTRUCTION KITS

JUSTY KIT WE ARE APPOINTED STOCKISTS AT ALL BRANCHES

All kits are complete with comprehensive easy to follow instructions and covered by full guarantee.

- Post and Packing 15p per kit.
- AF20 Mono amplifier..... £5.61
 - AF25 Mixer..... £3.29
 - AF30 Mono pre-amplifier..... £3.20
 - AF35 Emmitter amplifier..... £4.42
 - AF30 0.5W mic. amplifier..... £4.86
 - AF305 Intercom..... £7.67
 - AF310 2 Mono Amplifier..... £7.55
 - M160 Multi vibrator..... £2.18
 - M1302 Transistor tester..... £8.33
 - M191 VU Meter..... £5.37
 - M192 Stereo balance meter..... £5.93
 - LF380 Quadraphonic device..... £ 6.42
 - AT5 Automatic light control..... £2.78
 - AT30 P7 to cell switch unit..... £ 8.68
 - AT50 400W triac light dimmer/speed control..... £5.18
 - AT56 2 200W triac light dimmer/speed control..... £4.75
 - AT60 1 channel light control..... £10.82
 - AT65 3 channel light control..... £16.52
 - GU330 Tremolo unit..... £ 8.10
 - HF61 Diode detector..... £26.33
 - HF65 FM transmitter..... £3.21
 - HF75 FM receiver..... £3.66
 - HF310 FM tuner..... £16.32
 - HF325 Fluxer FM tuner..... £26.33
 - HF330 Decoder (HF310/325) £10.55
 - GF310 Stereo pre amplifier for use with 2 x AF310..... £22.85
 - GP312 Circuit board..... £5.33
 - GP304 Circuit board..... £5.02
 - HF395 broadband aerial amp. £2.10
 - NT10 Stabilised power supply 100mV 9V..... £6.27
 - NT300 Stabilised p. supply..... £13.16
 - NT310 Power Supply 240V A.C. or 2 x 18V D.C. at 2amps..... £5.64
 - NT305 Voltage converter..... £8.64
 - NT315 Power supply 240V AC 100-5/15V DC 500mA..... £12.06

Amateur Electronics by Justy Kit—the professional book for the amateur—covers the subject from basic principals to advanced electronic techniques. Complete with circuit board for AE1 to AE10 listed below. **OUR PRICE £3.30** (No VAT) P&P 25p plus VAT.

- AE1 100mW output stage..... £1.55
- AE2 Pre-amp..... £1.32
- AE3 Diode receiver..... £ 2.05
- AE4 Flasher..... £1.26
- AE5 Astable multi-vibrator..... £1.14
- AE6 Monostable multi-vibrator..... £1.11
- AE7 RC generator..... £1.08
- AE8 Bass filter..... £1.05
- AE9 Treble filter..... £1.05
- AE10 CCIR filter..... £1.05

Also see previous page
ALL PRICES EXCLUDE VAT

SEW PANEL METERS

SEW PANEL METERS ARE STOCKED AT OUR
3 LISLE ST., 311 EDGWARE RD., & 152 FLEET
ST., BRANCHES or order by post.

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

Over 200 ranges in stock—other ranges to order. Quantity discounts available. Send for fully illustrated brochure.



CLEAR PLASTIC MODEL SD640

Size: 85 x 64mm

50uA	£3.80		
100uA	£3.75		
200uA	£3.70		
500uA	£3.65		
50.0-500uA	£3.75		
100.0-1000uA	£3.70		
1mA	£3.65		
5mA	£3.65		
10mA	£3.65		
50mA	£3.65	10V DC	£3.65
100mA	£3.65	20V DC	£3.65
500mA	£3.65	50V DC	£3.65
1A DC	£3.65	300V DC	£3.65
5A DC	£3.65	15V AC	£3.75
10A DC	£3.65	30V AC	£3.75
5V DC	£3.65	VU Meter	£3.90



*Items with asterisk are Moving Iron type, all others are Moving Coil

CLEAR PLASTIC MODEL SD830

Size: 110 x 83mm

50uA	£4.30		
100uA	£4.25		
200uA	£4.20		
500uA	£4.15		
50.0-500uA	£4.25		
100.0-1000uA	£4.20		
1mA	£4.10		
5mA	£4.10		
10mA	£4.10		
50mA	£4.10	10V DC	£4.10
100mA	£4.10	20V DC	£4.10
500mA	£4.10	50V DC	£4.10
1A DC	£4.10	300V DC	£4.10
5A DC	£4.10	15V AC	£4.20
10A DC	£4.10	30V AC	£4.20
5V DC	£4.10	VU Meter	£4.40



CLEAR PLASTIC MODEL MR 65P

Size: 86 x 78mm

50uA	£3.95		
100uA	£3.85		
200uA	£3.80		
500uA	£3.75		
50.0-500uA	£3.85		
100.0-1000uA	£3.80		
1mA	£3.70		
5.0-1000uA	£3.70		
1mA	£3.70		
5mA	£3.70		
10mA	£3.70	300V DC	£3.70
50mA	£3.70	15V AC	£3.80
100mA	£3.70	50V AC	£3.80
500mA	£3.70	300V AC	£3.80
1A DC	£3.70	500V AC	£3.80
5A DC	£3.70	S Meter 1mA	£4.10
10A DC	£3.70	VU Meter	£3.70
15A DC	£3.70	1A AC	£3.70
30A DC	£3.85	5A AC	£3.70
50A DC	£4.05	10A AC	£3.70
10V DC	£3.70	20A AC	£3.70
15V DC	£3.70	30A AC	£3.70
20V DC	£3.70	50mA AC	£3.70
50V DC	£3.70	100mA AC	£3.70
150V DC	£3.70	200mA AC	£3.70
		500mA AC	£3.70



CALL INTO YOUR NEAREST LASKY S BRANCH OR SEND COUPON BELOW FOR NEW 16 PAGE HI-FI PRICE LIST

CENTRAL LONDON

481 OXFORD ST.	01-493 8441
3 LISLE ST. WC2	01-437 8204
34 FLEET ST. WC2	01-437 9155
118 EDGWARE RD. W2	01-733 9789
193 EDGWARE RD. W2	01-733 6211
207 EDGWARE RD. W2	01-723 3271
311 EDGWARE RD. W2	01-262 0387
346 EDGWARE RD. W2	01-723 4453
382 EDGWARE RD. W2	01-723 4194
100 FLEET ST. EC4	01-353 5812
152/3 FLEET ST. EC4	01-353 2833
10 TOTENHAM CT. RD.	01-437 2232
27 TOTENHAM CT. RD.	01-436 3715
33 TOTENHAM CT. RD.	01-436 2605
42/45 TOTENHAM CT. RD.	01-636 0845
257/8 TOTENHAM CT. RD.	01-580 0670

ESSEX

86 SOUTH ST. ROHFORD	20218
205/206 CHURCHILL WEST,	0702 612241
VICTORIA CIRCUS, SOUTHDEN	

KENT

53/57 CAMDEN RD., TUNBRIDGE WELLS	0892-23242
-----------------------------------	------------

LEICESTERSHIRE

45 MARKET PLACE, LEICESTER	0533-537678
----------------------------	-------------

NORTHAMPTONSHIRE

73 ABBINGTON STREET,	
NORTHAMPTON (Opening November)	

STAFFORDSHIRE

30 WULFRUN WAT, WOLVERHAMPTON	Now Open
-------------------------------	----------

SURREY

1046 WHITGIFT CENTRE, CROYDON	
27 EDEN ST. KINGSTON	01-481 3027
38/40 EDEN ST., KINGSTON	01-546 7845
32 HILL ST. RICHMOND	01-948 1441

WARWICKSHIRE

116 CORPORATION ST., BIRMINGHAM	021-236 3503
---------------------------------	--------------

ALL BRANCHES OPEN FROM 9am to 6pm MON. TO SAT

West End Service Centre for Personal Callers 87 Tottenham Court Rd W 1

BARCLAYCARD & ACCESS

Phone your order to 01-200 0037 or call into any branch

OUR CUSTOMER SERVICES DIVISION at head office will answer all your enquiries - just ring 01-200 1321

EXPORT Personal exports arranged for overseas visitors. Goods specially packed, insured and despatched to all parts of the world at minimum cost exclusive of VAT. Payment by bank transfer, certified cheque, postal order or money order in any currency.

NO DEPOSIT TERMS available on most goods for personal callers

CHEQUES TO THE VALUE OF £50. ACCEPTED FROM PERSONAL SHOPPERS WITH BANKERS' CASH. IN OTHER CASES AND FOR AMOUNTS IN EXCESS OF £25. PLEASE ALLOW TIME FOR CLEARANCE. BANKERS DRAFTS ACCEPTED.

All prices correct as 1870.74 but subject to change without notice E.&O.E.

A member of the Associated Group of Companies

CLEAR PLASTIC MODEL SW100

Size: 100 x 60mm

50uA	£4.60		
100uA	£4.50		
500uA	£4.30		
50.0-500uA	£4.50		
100.0-1000uA	£4.45		
1mA	£4.30		
1A DC	£4.30		
5A DC	£4.30		
20V DC	£4.30	150V AC	£4.45
50V DC	£4.30	300V AC	£4.45
300V DC	£4.30	VU Meter	£4.90



CLEAR PLASTIC MODEL MR 45P

Size: 50 x 50mm

50uA	£3.20		
100uA	£3.15		
200uA	£3.10		
500uA	£3.05		
50.0-500uA	£3.00		
100.0-1000uA	£2.95		
1mA	£2.95		
5mA	£2.95		
10mA	£2.95		
50mA	£2.95	300V AC	£3.05
100mA	£2.95	S Meter 1mA	£2.95
500mA	£2.95	VU Meter	£3.40
1A DC	£2.95	1A AC	£2.95
5A DC	£2.95	5A AC	£2.95
10V DC	£2.95	10A AC	£2.95
50V DC	£2.95	20A AC	£2.95
300V DC	£2.95	30A AC	£2.95
15V AC	£2.95		



BAKELITE MODEL S80 Enlarged Window

Size: 80 x 80mm

50uA	£4.50		
100uA	£4.45		
200uA	£4.40		
500uA	£4.35		
50.0-500uA	£4.45		
100.0-1000uA	£4.40		
1mA	£4.20		
5mA	£4.20		
10mA	£4.20		
50mA	£4.20	10V DC	£4.20
100mA	£4.20	20V DC	£4.20
500mA	£4.20	50V DC	£4.20
1A DC	£4.20	300V DC	£4.20
5A DC	£4.20	15V AC	£4.20
10A DC	£4.20	30V AC	£4.20
5V DC	£4.20	VU Meter	£4.70



EOGWISE MODEL PE70

Size: 90 x 34mm

50uA	£4.15		
100uA	£4.10		
200uA	£4.05		
500uA	£3.90		
50.0-500uA	£4.10		
100.0-1000uA	£4.05		
1mA	£3.85		
300V AC	£3.95		
VU Meter	£4.30		



MODEL ED107 EDUCATIONAL METER

Size: 100 x 90 x 150mm including terminals

A 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.



50uA	£8.50		
100uA	£7.90		
50.0-500uA	£7.90		
1mA	£7.60		
1.0-1mA	£7.60	20V DC	£7.60
1A DC	£7.60	300V DC	£7.60
5A DC	£7.60	500mA/5A DC	£8.60
5V DC	£7.60	5V/15V DC	£8.60
10V DC	£7.60	1/5A DC	£8.60
15V DC	£7.60	1A/15A DC	£8.60

CLEAR PLASTIC MODEL MR 38P

Size: 42 x 42mm

50uA	£3.18		
100uA	£3.05		
200uA	£3.00		
500uA	£2.85		
50.0-500uA	£3.05		
100.0-1000uA	£3.00		
1mA	£2.80		
1.0-1mA	£2.80		
2mA	£2.80		
5mA	£2.80		
10mA	£2.80		
20mA	£2.80		
50mA	£2.80	20V DC	£2.80
100mA	£2.80	50V DC	£2.80
150mA	£2.80	100V DC	£2.80
200mA	£2.80	150V DC	£2.80
300mA	£2.80	300V DC	£2.85
500mA	£2.80	500V DC	£2.85
750mA	£2.80	750V DC	£2.90
1A DC	£2.80	300V AC	£2.90
2A DC	£2.80	50V AC	£2.90
5A DC	£2.80	150V AC	£2.90
10A DC	£2.80	300V AC	£2.90
3V DC	£2.80	500V AC	£2.90
10V DC	£2.80	S Meter 1mA	£2.80
15V DC	£2.80	VU Meter	£3.20



CLEAR PLASTIC MODEL MR 52P

Size: 60 x 60mm

50uA	£3.70		
100uA	£3.50		
500uA	£3.35		
50.0-500uA	£3.55		
100.0-1000uA	£3.45		
1mA	£3.30		
10mA	£3.30		
50mA	£3.30		
100mA	£3.30	20V DC	£3.30
500mA	£3.30	50V DC	£3.30
1A DC	£3.30	100V DC	£3.30
5A DC	£3.30	1A AC	£3.30
10V DC	£3.30	5A AC	£3.30
20V DC	£3.30	10A AC	£3.30
50V DC	£3.30	20A AC	£3.30
300V DC	£3.30	30A AC	£3.30
15V AC	£3.40		
30V AC	£3.40		



BAKELITE MODEL MR 65

Size: 80 x 80mm

25uA	£5.25		
50uA	£4.00		
100uA	£3.95		
500uA	£3.80		
50.0-500uA	£3.95		
100.0-1000uA	£3.90		
1mA	£3.60		
1.0-1mA	£3.60		
2mA	£3.60		
5mA	£3.60		
10mA	£3.60		
50mA	£3.60	300V DC	£3.60
100mA	£3.60	30V AC	£3.60
500mA	£3.60	50V AC	£3.60
1A DC	£3.60	1A AC	£3.60
2A DC	£3.60	300V AC	£3.60
5A DC	£3.60	500V AC	£3.60
10A DC	£3.60	VU Meter	£4.10
15A DC	£3.60	150V AC	£3.60
30A DC	£3.60	5A AC	£3.60
50A DC	£3.60	10A AC	£3.60
100A DC	£3.60	20A AC	£3.60
150A DC	£3.60	30A AC	£3.60
200A DC	£3.60	50A AC	£3.60
50V DC	£3.60	500mA AC	£3.60
150V DC	£3.60	100mV DC	£3.75



CLEAR PLASTIC MODEL SD460

Size: 59 x 46mm

50uA	£3.60		
100uA	£3.45		
200uA	£3.40		
500uA	£3.35		
50.0-500uA	£3.45		
100.0-1000uA	£3.40		

ENGINEERS

FREE

YOURSELF FOR A BETTER JOB WITH MORE PAY!

Do you want promotion, a better job, higher pay? "New Opportunities" shows you how to get them through a low-cost home study course. There are no books to buy and you can pay-as-you-learn.

This helpful guide to success should be read by every ambitious engineer. Send for this helpful 76 page **FREE** book now. No obligation and nobody will call on you. It could be the best thing you ever did.



CUT OUT THIS COUPON
CHOOSE A BRAND NEW FUTURE HERE!

Tick or state subject of interest. Post to the address below.

- | | | |
|--|---|---|
| Electrical Engineering <input type="checkbox"/> | General Radio and TV Engineering <input type="checkbox"/> | CITY AND GUILDS Electrical Technicians <input type="checkbox"/> |
| Electrical Installations and Wiring <input type="checkbox"/> | Radio Servicing, Maintenance and Repairs <input type="checkbox"/> | CITY AND GUILDS Telecommunications <input type="checkbox"/> |
| Electrical Draughtsmanship <input type="checkbox"/> | Transistor Technology <input type="checkbox"/> | Radio Amateurs' Exam. <input type="checkbox"/> |
| Electrical Mathematics <input type="checkbox"/> | CITY AND GUILDS Installations and Wiring <input type="checkbox"/> | etc. etc. |
| Electronic Engineering <input type="checkbox"/> | | |
| Computer Programming <input type="checkbox"/> | | |

ALDERMASTON COLLEGE

Dept BEE 95, Reading RG7 4PF

NAME (Block Capitals Please)

ADDRESS

BEE 95

Other subjects

Accredited by O.A.C.C.

Age

Member of A.B.C.C.

HOME OF BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

SPARKRITE Mk II
Electronic Ignition...

Better on all points
Because you keep your points!

The SPARKRITE MK. 2 is a full capacitive discharge electronic system. Specifically designed to retain the points assembly - with all the advantages and none of the disadvantages. No misfire because contact breaker bounce is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high rpm. Contact breaker burn is eliminated by reducing the current to about 1/50th of normal, thus avoiding arcing. But you can still revert to normal ignition if need be. In seconds. If points go (very unlikely) you can get replacements anywhere. All these advantages.

- Fitted in 15 minutes.
- Up to 20% better fuel consumption.
- Instant all weather starting.
- Cleaner plugs - they last 5 times longer without attention.
- Faster acceleration.
- Faster top speeds.
- Coil and battery last longer.
- Efficient fuel burning with less air pollution.

The kit comprises everything needed

Ready drilled scratch and rust resistant case, metalwork, cables, coil connectors, printed circuit board, top quality 5 year guaranteed transformer and components, full instructions to make positive or negative earth system, and 6 page installation instruction leaflet.

WE SAY IT IS THE BEST SYSTEM AT ANY PRICE!

PRICES

D.I.Y. Kit only £10.93 incl. VAT and P & P

Ready Built Unit £13.85 incl. VAT and P & P

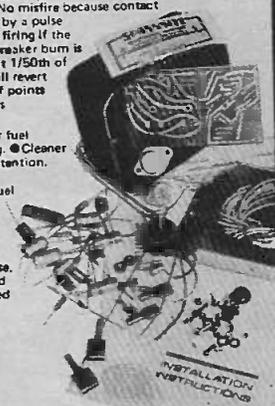
(Both to fit all cars with coil/distributor ignition up to 8 cylinders).

We can supply units for any petrol-engined vehicle (boat, motorcycle etc) with coil/contact breaker ignition.

Details on request. Call in and see us for a demonstration.

ELECTRONICS DESIGN ASSOCIATES

(Dept. EE.12) 82 Bath Street, Walsall WS1 3DE Phone 33652



Order NOW direct from:-

DISCOUNTS UP TO 60%

FANTASTIC OFFER



GARRARD SP25 MKIV Plinth & Cover
Garrard SP25 MKIV deck, Goldring G800 Cartridge, Teak finished Plinth/Cover (Non Hinged) All Leads.
GLOBAL'S PRICE £19.80
Carr. & Ins. £1.93

TURNTABLES

Please add £1.05 for p. & d. & Ins.
Garrard SP25 Mk IV Chassis £12.95
Garrard 86SB P/C Cart (Mod) £47.50
Garrard 86SB Chassis £22.40
Garrard 401 Chassis £32.00
Garrard Zero 100SB(CN) £32.70
Goldring 101 Mk II P/C G800 £23.70
Goldring GL75 P/C G800 £38.95
Goldring GL75 P/C G800 £44.40
Goldring GL85 P/C £63.50
Pioneer PL 12D P.O.A.
Sansui SR 212 P.O.A.
Thorens TD125 MkII £72.25
Thorens TD125AB MK II £111.95
Thorens TD160 ABC £38.95
Thorens TD16S ABC £52.95

Transcriptor Saturn With Vestigial Arm £63.95

AMPLIFIERS

Please add £1.05 for p & d & Ins
Amstrad Integra 4000 Mk II £25.75
Amstrad IC2000 Mk III £31.95
Amstrad 8000 Mk III £18.50
Amstrad 8000 Mk III £43.10
Eagle A.A.8 £51.25
Metro-Sound ST20E MkII £26.15
Metro-Sound ST40 £33.25
Metro-Sound ST60 £46.75
Sansui AU101 £29.95
Sinclair 2000 £44.95
Sinclair 4000 £30.50
Telefun GA202 £23.95
Telefun SAQ208B £27.20

COMBINATION UNITS

Please add £1.10 for p & d & Ins
Goodmans Compact 80 (Teak) £131.15
Goodmans Compact 90 £189.99
Goodmans Compact 1-10 (Teak) £191.00

TUNERS

Please add £1.05 for p & d & Ins.
Amstrad MLX 3000 £26.25
Eagle A.A.8 £45.95
Eagle TST 152 £32.95
Metro-Sound FMS 20 Mk II £33.35
Telefun T300 P.O.A.

Telefun S1202 £38.60
Sinclair 2000 Mk III £29.95
Sinclair 4000 £37.45

TUNER/AMPLIFIERS

Please add £1.21 for p & d & Ins
Amstrad 5000 £56.95
Goodmans Module 80 £72.50
Goodmans Module 90 £32.90
Goodmans 1-10 Module £168.50

SPEAKERS

Add £1.82 for p & d & Ins per Pair
Amstrad 1500 £25.65
Amstrad 2500 £29.95
Caleston County £45.25
Caleston Ditton 15 £45.50
Caleston Ditton 25 £129.95
Caleston Ditton 66 £141.45
Caleston Ditton 44 £188.95
Caleston Hadleigh £39.25
Goodmans Dimension 8 £127.95
Goodmans Havant SL £44.50
Goodmans Maglsters £107.75
Goodmans Magnum K2 SL £84.85
Goodmans Ministe £21.00
Goodmans Mezo 3SL £84.60

SPEAKER KITS

Please add £1.82 Carr. and Ins.
Wharfedale Linton Kit £17.80
Wharfedale Glendale Kit £31.80
Wharfedale Doveedale Kit £47.25
Wharfedale Denon 2 £29.25
Wharfedale Doveedale £27.80
Wharfedale Glendale £52.65

CARTRIDGES

Please add 12p for p & d & Ins
Goldring G800H £3.85
Goldring G800E £6.20
Goldring G800 £3.40
Goldring G800 £3.40
Shure V15 Type 3 £28.40
Shure M75EJ Type 2 £7.90

Shure M75EJ Type 2 £9.10
Shure 91ED £8.20
Shure M3D £3.10
Sonotone 9 TACHD £1.30

FABULOUS OFFER



AMSTRAD IC2000 Mk III STEREO SYSTEM

Amstrad IC2000 Mk III with increased power 25+25 watts amplifier. Complete with a pair of Amstrad Acoustra 2500 speakers, Garrard SP25 Mk IV deck, G800 Cart. Plinth/Cover (Non Hinged) all Leads.
GLOBAL'S PRICE £80.75
Carr. & Ins. £3.30

STEREO HEADPHONES

Please add 42p for p & d & Ins.
Koss ESP 6 £47.85
Koss ESP 6 £64.50
Koss ESP 9 £29.99
Koss K7/11 Red Devil £11.70
Koss K6 £12.25
Koss K6/LC £14.90
Koss KD727E £18.35
Koss 747 £19.95
Koss HV1/LC £23.60
Koss PRO 5/LC £27.15
Koss K7/11 Black £9.90
Sennheiser HD414 £10.75
Sennheiser HD424 £15.55

GLOBAL AUDIO

Please Note Every effort is made to ensure prices listed are correct at time of going to press, but are subject to alteration without prior notice. (E&OE)

FULL 12 MONTH AFTER SALES SERVICE
We give a **FULL 12 MONTH GUARANTEE** on all products purchased at any branch parts and labour absolutely **FREE**

BIRMINGHAM
Tivoli Shopping Centre,
1536 Coventry Road, Yardley
Tel: 021-706 9949

ESSEX
4 High View Parade,
Redbridge Lane East,
Woodford Avenue, Hford,
Tel: 01-550 1086

LONDON
328 Edgware Road, W2.
Tel: 01-262 3847

174 Pentonville Road, N1,
Tel: 01-278 1769

120 Notting Hill Gate, W11
Tel: 01-229 1437

50 Stamford Hill, N16,
Tel: 01-896 4699

PORTSMOUTH
12 London Road, North End
Tel: 0705 68321

READING
46 Market Place,
Tel: 0734 595331

WALSFORD
105 St Albans Rd. Tel: 39832

H.P. FACILITIES AVAILABLE FOR PERSONAL CALLERS ONLY

MAIL ORDERS
TO: 174 PENTONVILLE ROAD, LONDON, E1.
Order with confidence. Send Postal Order, Cheque, Money Order, Bank Draft, Giro or Cash by Reg. Mail.

NO HIDDEN PRICES AT GLOBAL AUDIO - ALL OUR PRICES ARE SHOWN WITH VAT INCLUDED

PERSONAL CALLERS VERY WELCOME!
COMPARE OUR PRICES WITH ANY IN THE BOOK!
OPEN MONDAY TO SATURDAY 9.30 am - 6 pm
LATE NIGHT FRIDAY OPEN UNTIL 7 pm

Please Note All Cheques, Money Orders, Postal Orders, Bank Draft, or Giro to be made payable to MAULTMEAD LTD.

ELECTROVALUE

APPOINTED STOCKISTS FOR SIEMENS QUALITY PRODUCTS

Present

top quality electronic components for price-minded buyers

112 p. CATALOGUE · FREE POSTAGE (U.K.) · ATTRACTIVE DISCOUNTS · SPECS. GUARANTEED

A 100 OF THE BEST

From our transistor stock

2N1307	47p	BC149C	14p
2N2646	51p	BC158B	15p
2N3053	28p	BC169	15p
2N3054	60p	BC167B	13p
2N3055	70p	BC168B	12p
2N3702	11p	BC169B	12p
2N3703	10p	BC189C	13p
2N3704	11p	BC179B	26p
2N3705	10p	BC182L	26p
2N3794	18p	BC184L	28p
2N3819	25p	BC212L	12p
2N4062	11p	BC214L	14p
2N4443	93p	BC257A	14p
2N5082	42p	BC259B	14p
2N5163	20p	BCY58	38p
2N5459	32p	BD130	90p
40381	48p	BD131	48p
40382	44p	BD132	52p
40602	46p	BD135	37p
40636	£1-38	BD136	39p
40689	£1-10	BDY20	83p
AC128	17p	BF194	15p
AC151R	23p	BF139	23p
AC153	27p	BF179	23p
AC153K	37p	BFX29	33p
AC176	24p	BFX84	27p
AC176K	38p	BFY51	23p
AC187K	31p	BRV39	45p
AC188K	29p	BY164	51p
AD133	£1-92	C106B1	42p
AD136	£1-11	C106D1	62p
AD149	65p	C1406	78p
AD161	42p	MJ481	£1-20
AD182	48p	MJ491	£1-35
AF200U	70p	MJ2955	80p
AF239	80p	MJE371	83p
BA196	36p	MJE521	81p
BA138	31p	MJE2955	£1-12
BB103	24p	MJE3055	68p
BB105	34p	OA91	60p
BC107A	15p	SD14	80p
BC107B	15p	TIP31A	79p
BC108B	14p	TIP32A	80p
BC108C	14p	TIP41A	80p
BC109B	18p	WO2	30p
BC109C	18p	ZTX300	14p
BC147A	12p	ZTX304	23p
BC147B	13p	ZTX500	14p
BC148B	12p	ZTX504	45p

100s MORE IN CATALOGUE 7

BAXANDALL SPEAKER KIT

As designed by P. J. Baxandall and described originally in "Wireless World." Simple to assemble, fantastically good results and a greater money saver. Carries 10 watts RMS, 15 ohms impedance. Size 18in x 12in x 10in. Complete kit, including pack-flat cabinet, £14-90.

The size and weight of this product obliges us to charge 70p part cost of cart. in U.K. Equaliser Assembly, £2-30. Loudspeaker Unit 59RM109, £2-45. Cabinet Kit (to Baxandall design), £10-45. Cross-over choke for additional woofer to above, £1-50.

DISCOUNTS

Available on all items except those shown with NETT PRICES 10% on orders from £5 to £14-99, 15% on orders £15 and over.

FREE POSTAGE

in U.K. for pre-paid mail orders. For mail orders for £2 list value and under there is an additional handling charge of 10p. Overseas orders - carriage charged at cost. Giro A/C No.

38/671/4002

RESISTORS

Code	Watts	Ohms	1 to 9	10 to 99	100 up
(see note below)					
C	1/3	4-7-470K	1-3	1-1	0-9 nett
C	1/2	4-7-10M	1-3	1-1	0-9 nett
C	3/4	4-7-10M	1-5	1-2	0-97 nett
C	1	4-7-10M	3-2	2-5	1-92 nett
MO	1/2	10-1M	4	3-3	2-3 nett
WW	1	0-22-3-9Ω	11	10	8
*WW	3	1-10K	9	8	6
*WW	7	1-10K	11	10	8

* Values under 12Ω, add 40%.

Codes:

C - carbon film, high stability, low noise.
MO - metal oxide, Electrooil TR5 ultra low noise.
WW - wire wound, Plessey.

Values: All E12 except C 1/3, C 1/2 and MO 1/2.
E12: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
E24: as E12 plus 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and their decades.

Tolerances:
5% except WW 10% ± 0-05Ω below 10Ω and 1/2 MO 2%.
Prices are in pence each for quantities of the same ohmic value and power rating. NOT mixed values. (Ignore fractions of one penny on total value of resistor order). Prices for 100 up in units of 100 only

POTENTIOMETERS ROTARY, CARBON TRACK.

Double wipers for good contact and long working life	
P.20 SINGLE linear	100 ohms to 4-7 megohms. each 14p
P.20 SINGLE log.	4-7 Kohms to 2-2 megohms. each 14p
JP.20 DUAL GANG 1in.	4-7 Kohms to 2-2 megohms. each 48p
JP.20 DUAL GANG log.	4-7 Kohms to 2-2 megohms. each 48p
JP.20 DUAL GANG Log/antilog	10K, 22K, 47K, 1 megohm only. each 48p
JP.20 DUAL GANG antilog	10K only 48p

2A DP maies switch for any of above 14p extra.

Decades of 10, 22 and 47 only available in ranges above.

Skeleton Carbon Presets, Type PR, horizontal or vertical. 6p each

SLIDER

Linear or log mono 4-7K to 1 meg. in all popular values each 30p

STEREO, matched tracks, lin. or log in all popular values from 4-7K to 1 meg. 60p

Ecutechon plates, mono, black, white or light grey. each 10p

Control knobs, blk/wht/red/yel/gn/ blue/dk. grey/lt. grey. each 7p

ELECTROLYTIC CAPACITORS

Axial Lead	3V	6-3V	10V	16V	25V	40V	63V	100V
0-47	—	—	—	—	—	—	11p	8p
1-0	—	—	—	—	—	—	11p	8p
2-2	—	—	—	—	11p	—	8p	9p
4-7	—	—	—	—	11p	—	8p	9p
10	—	—	—	—	—	—	8p	9p
22	—	—	—	—	—	—	8p	9p
47	8p	—	8p	8p	8p	8p	8p	10p
100	9p	8p	8p	8p	8p	8p	8p	10p
220	8p	8p	8p	8p	8p	8p	8p	10p
470	9p	10p	10p	11p	13p	17p	24p	45p
1,000	11p	13p	13p	17p	20p	25p	41p	—
2,200	15p	18p	23p	26p	37p	45p	—	—
4,700	26p	30p	39p	44p	58p	—	—	—
10,000	42p	46p	—	—	—	—	—	—

MINITRON DIGITAL INDICATORS

3015F Seven segment filament compatible with standard logic modules, 0-9 and decimal point: 9mm characters in 16 lead DIL £1-20
Suitable BCD decoder driver 7447 £1-15
3015G showing + or - & 1 dec. pt. 25p

LEDS (Light Emitting Diodes)

Photo Cells, each 46p

ANTEX Soldering Irons

CN240	£2-15	Spare bits	32p
CCN240	£2-78	Spare bits	40p

DESOLDER BRAID

5 ft strip 79p

WAVECHANGE SWITCHES

1 pole 12 way; 2 pole 6 way each 29p
3 pole 4 way; 4 pole 3 way each 29p
TAG STRIP 28 way 11p

NUTS, SCREWS, etc.

in lots of 100 each
4BA NUTS 28p; 6BA NUTS 28p
1/4" 4B Screws 28p; 1/8" 6BA Screws 24p
Threaded pillars 6BA, 1/8" hexagonal £1-68
£1-12

Plain spacers 1/8" round

Other sizes available

ENAMEL COPPER

WIRE IN 2 ounce reels

16, 18, 20, 22 SWG 24p
24, 26, 28, 30 SWG 40p
32, 34 48p; 36, 38, 40 50p

DIN CONNECTORS

1 way loudspeaker	10p	Socket Plug	12p
3 way audio	10p	10p	12p
5 way audio 180	12p	15p	15p
5 way audio 240	12p	15p	15p
6 way audio	13p	15p	15p

EV CATALOGUE 7

12d printing—Green and yellow

112 pages, thousands of items; illustrations; diagrams; much useful technical information. The 2nd printing has been updated as much as possible on prices. It costs only 25p post free including refund voucher for 25p for spending refund voucher goods list value £5 or more.

QUALITY GUARANTEE

All goods are sold on the understanding that they conform to manufacturers' specifications and satisfaction is guaranteed as such—no rejects, 'seconds' or sub-standard merchandise is offered for sale.

Prices quoted do not include V.A.T. for which 8% must be added to total net value of order. Every effort is made to ensure the correctness of information and prices at time of going to press. Prices subject to alteration without notice.

ELECTROVALUE LTD

28, ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY TW20 0HB
Telephone Egham 3603 Telex 264475 Shop hours 9-5.30 daily; Sat. 9-1 p.m.

NORTHERN BRANCH: 680, Burnage Lane, Burnage, Manchester M19 1NA
Telephone (061) 432 4945 Shop hours 9-1 p.m. 2-5.30 daily; Sat. 9-1 p.m.

U.S.A. CUSTOMERS are invited to contact ELECTROVALUE AMERICA, P.O. Box 27, Swarthmore PA 19081.

All postal communications, mail orders etc. to Head Office at Egham address, Dept. EE.12. S.A.E. with enquiries requiring answers.

The largest selection

EX COMPUTER BOARDS

Packed with transistors, diodes, capacitors and resistors—COMPONENT VALUE £1.50.
3 for ONLY 55p + p & p 30p
SPECIAL ONE as above PLUS Power Transistors ONLY 55p each + p & p 15p
PAXOLINE BOARDS 7 1/2" x 9" approx. 4 for 80p + p & p 20p.

FIBRE-GLASS PRINTED CIRCUIT BOARDS

1 1/4" x 4" approx. 2 for 55p

DECON-DALO 33PC Marker

Etch resistant printed circuit marker pen 95p each

VEROBOARDS

Packs containing approx. 50sq. ins. various sizes, all -1 matric 55p

REPANCO CHOKES & COILS

RF Chokes
CH1. 2.5mH 25p CH2. 5.0mH 30p
CH3. 7.5mH 35p CH4. 10mH 35p
CH5. 1.5mH 25p

CODES

DRX1 Crystal set 81p DRR2 Dual range 45p

COIL FORMERS & CORES

NORMAN 1/2" Cores & Formers 8p
1" Cores & Formers 10p

SWITCHES

DP/DT Toggle 36p SP/ST Toggle 30p

FUSES

1 1/4" and 20mm. 100mA, 200mA, 250mA, 500mA, 1A, 1.5A, 2A
QUICK-BLOW 5p ea.

EARPHONES

Crystal 2.5mm plug 42p
Crystal 3.5mm plug 42p
8 ohms 2.5mm plug 22p
8 ohms 3.5mm plug 22p

DYNAMIC MICROPHONES

R1223. 200 ohms plus on/off switch and 2.5mm and 3.5mm plugs £1.85

3-WAY STEREO HEADPHONE JUNCTION BOX

H1012 £1.87

2-WAY CROSSOVER NETWORK

K 4007. 80 ohms Imp. Insertion loss 3dB £1.21

CAR STEREO SPEAKERS

(Angled) £3.85 per pair.

BI-PAK

CATALOGUE AND LISTS

Send S.A.E. and 10p.

INSTRUMENT CASES



(Black Vinyl covered)

No.	Length	Width	Height	Price		
BV1	8"	x	6 1/2"	x	2"	£1.10
BV2	11"	x	6"	x	3"	£1.45

ALUMINIUM BOXES

BA1	5 1/2"	x	2 1/2"	x	1 1/2"	42p
BA2	4"	x	4"	x	1 1/2"	42p
BA3	4"	x	2 1/2"	x	1 1/2"	42p
BA4	5 1/2"	x	4"	x	1 1/2"	50p
BA5	4"	x	2 1/2"	x	2"	42p
BA6	3"	x	2"	x	1"	34p
BA7	7"	x	5"	x	2 1/2"	70p
BA8	8"	x	6"	x	3"	90p
BA9	8"	x	4"	x	2"	58p

P & F 10p on each box

VISIT OUR COMPONENT SHOP

18 BALDOCK ST., WARE, Herts. (A10)

Open Mon.-Sat. 9.5.30 p.m. Tel. 61593

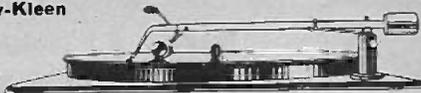
BIB HI-FI ACCESSORIES

De Luxe Groov-Kleen

Model 42 £1.95

Chrome Finish

Model 60 £1.50



Ref. B Stylus & Turntable Cleaning Kit 34p
Ref. 36A. Record/Stylus Cleaning Kit 33p
Ref. 43. Record Care Kit £2.42
Ref. 31. Cassette Head Cleaner 58p
Ref. 32. Tape editing Kit £1.68
Model 9. Wire Stripper/Cutter 83p

Ref. 46. Spirit level 62p
Ref. P. Hi-Fi Cleaner 31p
Ref. 32A. Stylus Balance £1.37
Ref. J. Tape Head Cleaning Kit 62p
Ref. 66. Hi-Fi Stereo Hints & Tips 42p
Ref. 45. Auto changer groove cleaner £1.08

ANTEX SOLDERING IRONS

X25. 25 watt £2.05
CCN 240. 15 watt £2.48
Model G. 18 watt £2.28
SK2. Soldering Kit £3.25
STANDS: ST3. Suitable for all models £1
SOLDER: 18SWG Multicores 7oz £1.61
22SWG 7oz £1.41. 18SWG 22oz 51p
22SWG Tube 33p

ANTEX BITS AND ELEMENTS

Bits No. 42p
102 For model CN240 3/32" 42p
104 For model CN240 3/16" 42p
1100 For model CCN240 3/32" 42p
1101 For model CCN240 3/8" 42p
1102 For model CCN240 1" 42p
1020 For model G240 3/32" 42p
1021 For model G240 1/8" 42p
1022 For model G240 3/16" 42p
50 For model X25 3/32" 45p
51 For model X25 1/8" 45p
52 For model X25 3/16" 45p

ELEMENTS

ECN 240 £1.30 ECEN 240 £1.82
EG 240 £1.07 EX 25 £1.15

ANTEX HEAT SINKS 10p

V.A.T. included in all prices. Please add 10p P. & P. (U.K. only). Overseas orders—please add extra for postage.

NEW COMPONENT PAK BARGAINS

Pack No.	Qty.	Description	Price
C1	200	Resistors mixed values approx. count by weight	0.55
C2	150	Capacitors mixed values approx. count by weight	0.55
C3	50	Precision Resistors 1%, 2% mixed values	0.55
C4	75	4th W Resistors mixed preferred values	0.55
C5	5	Pieces assorted Ferrite Rods	0.55
C6	2	Tuning Gangs, MW/LW VHF	0.55
C7	1	Pack Wire 50 metres assorted colours	0.55
C 8	10	Reed Switches	0.55
C 9	3	Micro Switches	0.55
C10	15	Assorted Pots & Pre-Sets	0.55
C11	5	Jack Sockets 3 x 3.5m 2 x Standard Switch Type	0.55
C12	30	Paper Condensers preferred types mixed values	0.55
C13	20	Electrolytics Trans. types	0.55
C14	1	Pack assorted Hardware—Nuts/Bolts, Grommets etc.	0.55
C15	5	Mains Slide Switches	0.55
C16	20	Assorted Tag strips & Panels	0.55
C17	10	Assorted Control Knobs	0.55
C18	4	Rotary Wave Change Switches	0.55
C19	2	Relays 6—24V Operating	0.55
C20	1	pack sheet of Copper Laminates 20 sq. ins	0.55

PLUGS AND SOCKETS

PLUGS
PS 1 D.I.N. 2 Pin (Speaker) 0-11
PS 2 D.I.N. 3 Pin 0-12
PS 3 D.I.N. 4 Pin 0-15
PS 4 D.I.N. 5 Pin 180° 0-16
PS 5 D.I.N. 5 Pin 240° 0-18
PS 6 D.I.N. 6 Pin 0-17
PS 7 8.I.N. 7 Pin 0-18
PS 8 Jack 2.5mm Screened 0-18
PS 9 Jack 3.5mm Plastic 0-12
PS 10 Jack 3.5mm Screened 0-18
PS 11 Jack 1" Plastic 0-15
PS 12 Jack 1" Screened 0-22
PS 13 Jack Stereo Screened 0-38
PS 14 Phone 0-10
PS 15 Car Aerial 0-22
PS 16 Co-Axial 0-15

INLIE SOCKETS

PS 21 D.I.N. 2 Pin (Speaker) 0-14
PS 22 D.I.N. 3 Pin 0-20
PS 23 D.I.N. 5 Pin 180° 0-20
PS 24 D.I.N. 5 Pin 240° 0-20
PS 25 Jack 2.5mm Plastic 0-18
PS 26 Jack 3.5mm Plastic 0-18
PS 27 Jack 1" Plastic 0-20
PS 28 Jack 1" Screened 0-35
PS 29 Jack Stereo Plastic 0-30
PS 30 Jack Stereo Screened 0-38
PS 31 Phone Screened 0-18
PS 32 Car Aerial 0-22
PS 33 Co-Axial 0-22

SOCKETS

PS 35 D.I.N. 2 Pin (Speaker) 0-08
PS 36 D.I.N. 3 Pin 0-11
PS 37 D.I.N. 5 Pin 180° 0-11
PS 38 D.I.N. 5 Pin 240° 0-11
PS 39 Jack 2.5mm Switched 0-12
PS 40 Jack 3.5mm Switched 0-12
PS 41 Jack 1" Switched 0-20
PS 43 Jack Stereo Switched 0-30
PS 43 Phone Single 0-08
PS 44 Phone Double 0-10
PS 46 Co-Axial Surface 0-10
PS 47 Co-Axial Flush 0-20

LEADS

LS 1 Speaker lead 2 pin D.I.N. plug to open ends approx. 3 metres long (coiled) 0-20

CABLES

CP 1 Single Lapped Screen 0-07
CP 2 Twin Common Screen 0-11
CP 3 Stereo Screened 0-13
CP 4 Four Core Common Screen 0-23
CP 5 Four Core Individually Screened 0-30
CP 6 Microphone Fully Braided Cable 0-10
CP 7 Three Core Main Cable 0-09
CP 8 Twin Oval Main Cable 0-07
CP 9 Speaker Cable 0-05
CP 10 Low Loss Co-Axial 0-18

CARBON POTENTIOMETERS

Log and Lin
4.7K, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M
VC 1 Single less Switch 0-15
VC 2 Single D.P. Switch 0-23
VC 3 Tandem Less Switch 0-48
VC 4 1K Lin Less Switch 0-15
VC 5 100K Log anti-Log 0-48

HORIZONTAL CARBON PRESETS

0-1 watt 0-08 each
100, 220, 470, 1K, 2.2K, 4.7K, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M, 4.7M

IT'S NEW IT'S POWERFUL AND— IT LOOKS GOOD!

(15 + 15w R.M.S.)

THE LEGIONAIRE

STEREO AMPLIFIER

ORDER NOW— ONLY £39.95 p & p 50p.

Or write for full details

WORLD SCOOP JUMBO SEMICONDUCTOR PACK

Transistors - Germ. and Silicon Rectifiers - Diodes - Triacs - Thyristors - LO's and Zeners ALL NEW AND CODED.

APPROX 100 PIECES

Offering the amateur a fantastic bargain Pak and an enormous saving—identification and data sheet in every Pak.

Only £2 p. & p. 20p

RECORD STORAGE/ CARRY CASES

7" EP. 18 1/2" x 7" x 8", (60 records) £2.10
12" LP. 13 1/2" x 7 1/2" x 12 1/2", (50 records) £2.95

CASSETTE CASES

Holds 12. 10" x 3 1/2" x 5". Lock & Handle. £1.30

SPECIAL PURCHASE

253055. Silicon Power Transistors NPN. Famous manufacturers out-of-spec devices free from open and short defects—every one able! 115w. 705. Metal Case.

OUR SPECIAL PRICE 8 for £1

LOW COST CAPACITORS

·01UF 400v. 3p. each
500UF 50v. Elect. 10p each

REPANCO TRANSFORMERS

240v. Primary. Secondary voltages available from selected tappings 4v, 7v, 8v, 10v, 14v, 15v, 17v, 19v, 21v, 25v, 51v, 33v, 40, 50 and 25v-0-25v.

Type	Amps.	Price	P & P
MT50/1	1	£1.93	30p
MT50/1	1	£2.42	35p
MT50/2	2	£3.30	40p

CARTRIDGES

AC08
GP91-18C 200mV at 1.2cm/sec £1.35
GP93-1 250mV at 1cm/sec £1.85
GP96-1 100mV at 1cm/sec £2.80
TTC
J-2005 Crystal/Hi Output £1.05
J-2006 1/2" Comp. £1.20
J-2008 Stereo/Hi Output £1.75
J-2103 Ceramic/Med Output £1.95
J-2203 Magnetic 5mV/5cm/sec, including stylus £4.85
J-2203S Replacement stylus for above £3.00
AT-35 Audio-technica magnetic cartridge 4mV/5cm/sec £3.30

CARBON FILM RESISTORS

The E12 Range of Carbon Film Resistors, 1/8th watt available in PAKS of 50 pieces, assorted into the following groups:—
R1 50 Mixed 100 ohms-820 ohms 50p
R2 50 Mixed 1K ohms-8.2K ohms 50p
R3 50 Mixed 10K ohms-82K ohms 50p
R4 50 Mixed 100K ohms-1 Meg. ohms 50p
THESE ARE UNBEATABLE PRICES—JUST 1p EACH INCL. V.A.T.

BI-PAK SUPERIOR QUALITY LOW - NOISE CASSETTES

C60. 36p C90. 48p C120. 60p

-the lowest prices!

BI-PAK QUALITY COMES TO AUDIO!

AL10/AL20/AL30 AUDIO AMPLIFIER MODULES



The AL10, AL20 and AL30 units are similar in their appearance and in their general specification. However, careful selection of the plastic power devices has resulted in a range of output powers from 3 to 10 watts R.M.S. The versatility of their design makes them ideal for use in record players, tape recorders, stereo amplifiers and cassette and cartridge tape players in the car and at home.

Parameter	Conditions	Performance
HARMONIC DISTORTION	Po = 3 WATTS f=1KHz	0.25%
LOAD IMPEDANCE	—	8-16 Ω
INPUT IMPEDANCE	f=1KHz	100 k Ω
FREQUENCY RESPONSE ±3dB	Po=2 WATTS	50Hz-25KHz
SENSITIVITY for RATED O/P	Vs=25V, RL=8 Ω f=1KHz	75mV, RMS
DIMENSIONS	—	3" x 2 1/2" x 1"

The above table relates to the AL10, AL20 and AL30 modules. The following table outlines the differences in their working conditions.

Parameter	AL10	AL20	AL30
Maximum Supply Voltage	25	30	30
Power output for 2% T.H.D. (RL = 8 Ω f = 1 KHz)	3 watts RMS Min.	5 watts RMS Min.	10 watts RMS Min.

AUDIO AMPLIFIER MODULES

AL 10. 3 watts RMS	£2.19
AL 20. 5 watts RMS	£2.59
AL 30. 10 watts RMS	£3.01

POWER SUPPLIES

PS 12. (Use with AL10, AL20, AL30) 88p
SPM 80. (Use with AL60) £2.25
FRONT PANELS SP 12 with Knobs £1.10

PRE-AMPLIFIERS

PA 12. (Use with AL10 & AL20) £4.35
PA 100. (Use with AL30 & AL60) £13.15

TRANSFORMERS

T461 (Use with AL10) £1.88 P & P 15p
T538 (Use with AL20, AL30) £1.93 P & P 15p
BMT80 (Use with AL60) £2.15 P & P 25p

PA 12. PRE-AMPLIFIER SPECIFICATION

The PA 12 pre-amplifier has been designed to match into most budget stereo systems. It is compatible with the AL 10, AL 20 and AL 30 audio power amplifiers and it can be supplied from their associated power supplies. There are two stereo inputs, one has been designed for use with *Ceramic cartridges while the auxiliary input will suit most †Magnetic cartridges. Full details are given in the specification table. The four controls are, from left to right: Volume and on/off switch, balance, bass and treble. Size 152mm x 84mm x 35mm.

Frequency response—20Hz-50KHz (-3dB)
 Bass control—±12dB at 60Hz
 Treble control—±14dB at 14KHz
 *Input 1. Impedance 1 Meg. ohm Sensitivity 300mV
 †Input 2. Impedance 30 K ohms Sensitivity 4mV

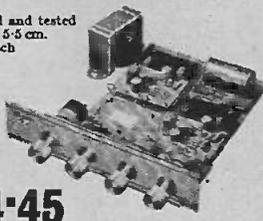
Look for our

SEMICONDUCTOR ADVERTISEMENTS in
 Practical Wireless Wireless World Radio Constructor

ALL PRICES INCLUDE V.A.T.

The STEREO 20

The 'Stereo 20' amplifier is mounted, ready wired and tested on a one-piece chassis measuring 20 cm x 14 cm x 5.5 cm. This compact unit comes complete with on/off switch volume control, balance, bass and treble controls, Transformer, Power supply and Power amps. Attractively printed front panel and matching control knobs. The 'Stereo 20' has been designed to fit into most turntable plinths without interfering with the mechanism or alternatively, into a separate cabinet. Output power 20w peak. Input 1 (Cer.) 300mV into 1M. Freq. res. 25Hz-25kHz. Input 2 (Aux.) 4mV into 30K. Harmonic distortion: Bass control ±12dB at 60Hz typically 0.25% at 1 watt. Treble con. ±14dB at 14kHz.



£14.45

TC20 TEAK VENEERED CABINET

For Stereo 20 (front board undrilled) size 10 1/2" x 8 1/2" x 3", £3.95, plus 30p postage

SHP80 STEREO HEADPHONES

4-16 ohms impedance. Frequency response 20 to 20,000Hz Stereo/mono switch and volume controls £4.95

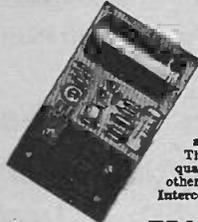
NOW WE GIVE YOU 50w PEAK (25w R.M.S.) PLUS THERMAL PROTECTION! The NEW AL60 Hi-Fi Audio Amplifier FOR ONLY £3.95

- Max Heat Sink temp. 90°C
- Frequency Response 20Hz to 100KHz
- Distortion better than 0.1% at 0.1KHz
- Supply voltage 15-50 volts
- Thermal Feedback
- Latest Design Improvements
- Load—3, 4, 8 or 16 ohms
- Signal to noise ratio 80dB
- Overall size 63mm x 105mm x 13mm

Especially designed to a strict specification. Only the finest components have been used and the latest solid state circuitry incorporated in this powerful little amplifier which should satisfy the most critical A.F. enthusiast.



STABILISED POWER MODULE SPM80



SPM80 is especially designed to power 2 of the AL60 Amplifiers, up to 15 watt (r.m.s.) per channel simultaneously. This module embodies the latest components and circuit techniques incorporating complete short circuit protection. With the addition of the Main Transformer BMT80, the unit will provide outputs of up to 1.5 amps at 25 volts. Size: 63mm x 105mm x 30mm. These units enable you to build Audio Systems of the highest quality at a hitherto unobtainable price. Also ideal for many other applications including:—Disc Systems, Public Address Intercom Units, etc. Handbook available 10p

PRICE £3.25

TRANSFORMER BMT80 £2.15 p. & p. 28p STEREO PRE-AMPLIFIER TYPE PA100

Built to a specification and NOT a price, and yet still the greatest value on the market, the PA100 stereo pre-amplifier has been conceived from the latest circuit techniques. Designed for use with the AL60 power amplifier system, this quality made unit incorporates no less than eight silicon planar transistors, two of these are specially selected low noise NPN devices for use in the input stages. Three switched stereo inputs, and rumble and scratch filters are features of the PA100, which also has a STEREO/MONO switch, volume, balance and continuously variable bass and treble controls.

SPECIFICATION

Frequency Response 20Hz-20KHz ±1dB better than 0.1%
 Harmonic Distortion 3-25 mV into 50K Ω
 Inputs: 1. Tape Head 75 mV into 50K Ω
 2. Radio, Tuner 3 mV into 50K Ω
 3. Magnetic P.U.
 All input voltages are for an output of 250mV. Tape and P.U. inputs equalised to RIAA curve within ±1dB from 20Hz to 20KHz.
 Bass Control ±15dB at 20Hz
 Treble Control ±15dB at 20 KHz
 Filters: Rumble (High Pass) 100Hz
 Scratch (Low Pass) 8KHz
 Signal/Noise Ratio better than -65dB
 Input overload ±26dB
 Supply ±35 volts at 20mA
 Dimensions 292mm x 69mm x 35mm

ONLY £13.15

SPECIAL COMPLETE KIT COMPRISING 2 AL50's, 1 SPM80, 1 BMT80 & 1 PA100 ONLY £25.30 FREE p. & p.

MK 60 AUDIO KIT

Comprising: 2 x AL60, 1 x SPM80, 1 x BMT80, 1 x PA 100, 1 front panel, 1 kit of parts to include on-off switch, neon indicator, stereo headphone sockets plus instruction booklets. Complete Price: £28.75 plus 30p postage

TEAK 60 AUDIO KIT

Comprising: Teak veneered cabinet size 16 1/2" x 11 1/2" x 3 1/2", other parts include aluminium chassis, heatsink and front panel bracket, plus back panel and appropriate sockets etc. Kit Price: £9.95 plus 30p postage

Giro No. 388-7006

Please send all orders direct to warehouse and despatch department

BI-PAK

P.O. BOX 6, WARE - HERTS

Postage and packing add 11p. Overseas add extra for airmail.

Minimum order 55p. Cash with order please.

Guaranteed Satisfaction or Money Back

Now - two fascinating ways to enjoy saving money!

NEW! Sinclair Scientific kit **£19.95** (INC. VAT)

Britain's most original calculator now in kit form

The Sinclair Scientific is an altogether remarkable calculator.

It offers logs, trig, and true scientific notation over a 200-decade range - features normally found only on calculators costing around £100 or more.

Yet even ready-built, the Sinclair Scientific costs a mere £32.35 (including VAT).

And as a kit it costs under £20!

Forget slide rules and four-figure tables!

With the functions available on the Scientific keyboard, you can handle directly

- sin and arcsin,
- cos and arccos,
- tan and arctan,
- automatic squaring and doubling,
- log₁₀, antilog₁₀, giving quick access to x^y (including square and other roots),
- plus, of course, addition, subtraction, multiplication, division, and any calculations based on them.

In fact, virtually all complex scientific or mathematical calculations can be handled with ease.

So is the Scientific difficult to assemble?

No. Powerful though it is, the Sinclair Scientific is a model of tidy engineering.

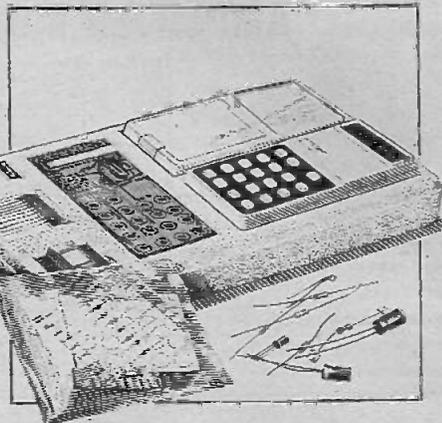
All parts are supplied - all you need provide is a soldering iron and a pair of cutters. Complete step-by-step instructions are provided, and our Service Department will back you throughout if you've any queries or problems.

Of course, we'll happily supply the Scientific or the Cambridge already built, if you prefer - they're still exceptional value. Use the order form.

Components for Scientific Kit (illustrated)

1. Coil
2. LSI chip
3. Interface chips
4. Case mouldings, with buttons, windows and light-up display in position
5. Printed circuit board
6. Keyboard panel
7. Electronic components pack (diodes, resistors, capacitors, etc)
8. Battery assembly and on/off switch
9. Soft carrying wallet
10. Comprehensive instructions for use

Assembly time is about 3 hours.



Features of the Sinclair Scientific



- 12 functions on simple keyboard
Basic logs and trig functions (and their inverses), all from a keyboard as simple as a normal arithmetic calculator's. 'Upper and lower case' operation means basic arithmetic keys each have two extra functions.

- Scientific notation
Display shows 5-digit mantissa, 2-digit exponent, both signable.

- 200-decade range
10⁻⁹⁹ to 10⁺⁹⁹.

- Reverse Polish logic
Post-fixed operators allow chain calculations of unlimited length - eliminate need for an = button.

- 25-hour battery life
4 AAA manganese alkaline batteries (e.g. MN2400) give 25 hours continuous use. Complete independence from external power.

- Genuinely pocketable
4 1/3" x 2" x 11/16".
Weight 4 oz. Attractively styled in grey, blue and white.

Sinclair Cambridge kit

Now only
£14.95
(INC. VAT)

At its new low price, the original Sinclair Cambridge kit remains unbeatable value.

In less than a year, the Cambridge has become Britain's most popular pocket calculator.

It's not surprising. Check the features below – then ask yourself what other pocket calculator offers such a powerful package at such a reasonable price.

Components for Cambridge Kit

1. Coil
2. LSI chip
3. Interface chip
4. Thick film resistor pack
5. Case mouldings, with buttons, window and light-up display in position
6. Printed circuit board
7. Keyboard panel
8. Electronic components pack (diodes, resistors, capacitors, transistor)
9. Battery clips and on/off switch
10. Soft wallet

Assembly time is about 3 hours.

Take advantage of this

money-back, no-risk offer today
The Sinclair Cambridge and Scientific kits are fully guaranteed. Return either kit within 10 days, and we'll refund your money without question. All parts are tested and checked before despatch – and we guarantee any correctly-assembled calculator for one year. (This guarantee also applies to calculators supplied in built form.)

Simply fill in the preferential order form below and slip it in the post today.

Scientific

Price in kit form £19.95 inc. VAT.

Price built £32.35 inc. VAT.

Cambridge

Price in kit form £14.95 inc. VAT.

Price built £21.55 inc. VAT.

Features of the Sinclair Cambridge



- Uniquely handy package. 4 1/3" x 2" x 1 1/16", weight 3 1/2 oz.
- Standard keyboard. All you need for complex calculations.
- Clear-last-entry feature.
- Fully-floating decimal point.
- Algebraic logic.
- Four operators (+, -, ×, ÷), with constant on all four.
- Powerful constant with separate 'K' button.
- Constant and algebraic logic combine to act as a limited memory, allowing complex calculations on a calculator costing less than £15.
- Calculates to 8 significant digits.
- Clear, bright 8-digit display.
- Operates for weeks on four AAA batteries.

To: Sinclair Radionics Ltd,
FREEPOST St Ives,
Huntingdon, Cambs. PE17 4BR

Please send me

- Sinclair Scientific kit at £19.95
 Sinclair Scientific built at £32.35
 Sinclair Cambridge kit at £14.95
 Sinclair Cambridge built at £21.55

All prices include 8% VAT.

*I enclose a cheque for £....., made out to Sinclair Radionics Ltd, and crossed.

*Please debit my *Barclaycard/ Access account. Account number

--	--	--	--	--	--	--	--	--	--

*Delete as required.

Signed _____

Name _____

Address _____

Please print. FREEPOST – no stamp needed.

EE/12/74

sinclair

Sinclair Radionics Ltd,
FREEPOST St. Ives,
Huntingdon, Cambs. PE17 4BR.

Reg. No: 699483 England. VAT Reg. No: 213 8170 88.

everyday electronics

PROJECTS...
THEORY.....

TRANSMITTING IN FREE SPACE

Just eighty years ago (as near as makes no difference) a young man barely in his twenties persevering with his experiments in an attic finally achieved the success he so earnestly sought. A key depressed at one end of the room caused a buzzer to sound at the opposite end of the room. There were no physical connections between the transmitting and receiving apparatus. Thus was wireless telegraphy born.

That initial success of young Guglielmo Marconi set in train great and staggering developments in communications without the use of intervening wires. Today, life as we know it would not be possible without the great variety of services we have become dependent upon (knowingly or unknowingly) and which are borne along on electromagnetic waves.

Yet, somewhat ironically, the technique that gives freedom from wires is not freely available for all and sundry to use for themselves as they wish. (Could young Guglielmo ever have imagined the restrictions that would be imposed upon future generations of amateur experimenters by his own brilliant success!)

It is a fact, though apparently not always properly understood, that any form of transmission in the radio frequency spectrum is subject to regulations based on the Wireless and Telegraphy Act. It is illegal to make transmissions (regardless of power) without a proper licence from the Home Office (Radio Regulatory

Division). There are various kinds of transmitting licences. These are granted for specific purposes and permit operation only within particular frequency bands allocated exclusively for such purposes.

This in a few words makes clear the legal position in the UK, frustrating though it may be to budding experimenters. It should explain also why we do not (despite frequent requests) publish designs for radio transmitters, other than those intended for few exceptional applications where licences to operate will be granted with the minimum of formality to ordinary members of the general public. Model control and metal sensing devices are two obvious examples.

All is not lost, however. Sound or pressure waves operating above normal human hearing range can be employed in a rather similar fashion to electromagnetic waves for remote control, signalling, and certain other purposes over short distances through air.

Ultrasonic waves cannot provide a complete alternative to radio waves of course. But for certain limited purposes they offer an ideal solution to the problem of how to dispense with undesirable interconnecting wires. Furthermore, this technique has the great advantage that it can be used without let or hindrance from officialdom—as yet!

Fred Bennett

Our January Issue will be published on Wednesday, December 18

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

© IPC Magazines Limited 1974. 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. 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. 3 NO. 12

DECEMBER 1974

CONSTRUCTIONAL PROJECTS DATA CHECK CARD

ULTRASONIC REMOTE CONTROL Part I Receiver by J. B. Dance	670
ACROSS THE RIVER A novel game for everyone by F. G. Rayer	684
TRANSISTOR ASSISTED IGNITION 6V version alterations	690
M. W. REFLEX RECEIVER A simple set with loudspeaker output by R. A. Penfold	694

GENERAL FEATURES

EDITORIAL	668
RUMINATIONS by Sensor	674
THE WORLD OF THE I.C. by S. R. McClland	675
BEGIN HERE I Passive Components by Donald Maynard	680
COUNTER INTELLIGENCE A retailer comments by Paul Young	687
PHYSICS IS FUN Opposite Charges by Derrick Daines	688
MULTIMETER COMPETITION RESULTS	693
SHOP TALK Component buying and new products by Mike Kenward	698
JACK PLUG AND FAMILY Cartoon	698
PROFESSOR ERNEST EVERSURE The Extraordinary Experiments of. by Anthony J. Bassett	701
DOWN TO EARTH Induced Hum by George Hylton	705

Publisher's Annual Subscription Rate, including postage Inland £2.95, Overseas £3.00. International Giro facilities Account No. 5122007. State reason for payment "message to payee". Address to Everyday Electronics, Subscription Department, Carlton House, Great Queen Street, London, WC2E 9PR. Binders for volumes 1 to 3 (state which) and indexes for volume 1 and 2 available for £1.25 and 30p respectively, including postage, from Binding Department, at the above address.

We are unable to supply back copies of Everyday Electronics or reprints of articles and cannot undertake to answer readers' letters requesting designs, modifications or information on commercial equipment or subjects not published by us. An s.a.e. should be enclosed for a personal reply. Letters concerning published articles should be addressed to: The Editor, those concerning advertisements to: The Advertisement Manager, both at the address shown opposite.



**Avoid disappointment
Place a regular
order with your
newsagent NOW**

It's invisible... it's inaudible... Make it

ULTRASONIC

A simple ultrasonic transmitter and receiver employing integrated circuits for ease of construction and reliability.

THIS article describes how a simple ultrasonic transmitter and receiver can be constructed for a host of applications such as remote control, intruder alarm, signalling system, leak testing, garage door opening, object counter etc.

When a 40kHz ultrasonic beam from the transmitter falls on the receiver, a relay in the latter closes and can be used to carry out any desired operation. The maximum operating range in the open air is about 12 metres (40 feet).

Integrated circuits are employed in the design so that the number of components required is greatly reduced. Unlike many other ultrasonic circuit designs, the relay specified for this receiver is not a delicate reed relay, but one which has two pairs of large change over contacts. Each pair of contacts can switch up to 10A at 250V a.c.

TRANSDUCERS

The transducers used in the circuits to be described contain piezoelectric "bimorph" plates which resonate at the ultrasonic frequency concerned. These plates are a few square millimeters in area and are sealed in the transducer.

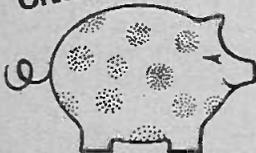
FOR GUIDANCE ONLY

ESTIMATED COST* OF COMPONENTS including V.A.T.

£8.30

excluding case

*Based on prices prevailing at time of going to press



In the transmitter a square-wave voltage of the ultrasonic frequency is applied to the transducer. The latter produces ultrasonic pressure waves which are just like sound waves except that their frequency is much too high for them to be detected by the human ear. Ultrasonic waves are much more directional than ordinary sound waves.

A similar transducer in the receiver converts the incoming waves into a 40kHz electrical signal.

The voltage across the terminals of the receiver transducer varies greatly with its distance from the transmitter, but is normally in the range of some tens of microvolts up to hundreds of millivolts. This signal must therefore be amplified considerably before it can be used to operate a relay.

The transducers will operate only at or near to their resonant frequency. If the transmitter circuit feeds signals to the transmitter transducer at any other frequency, the ultrasonic output will be very small.

The transducer in the transmitter behaves like a miniature loudspeaker which will operate at only one frequency, whilst the one in the receiver acts like a microphone which is sensitive only to signals near to its resonant frequency.

A relatively new type of miniature transducer, the 96D-40, was selected for use in the prototype equipment. It is available as the "T" and "R" versions which are designed for use in the transmitter and in the receiver respectively.

Although it is possible to interchange these units, optimum results can be expected only if a "T" type unit is used in the transmitter and an "R" type unit in the receiver.

Both types have an identical appearance. They have a metal grille at the front of the unit through which the ultrasonic waves pass. There are two connecting pins at the back, one of which is connected to the metal case of the device.

THE RECEIVER

The low level signal from the transducer in the receiver must be amplified at 40 kilohertz to bring the level up to a few volts. The gain

work for you — (No licence required!)

REMOTE CONTROL

PART 1 RECEIVER

By J.B. DANCE

required is around 80db if the transmitter is well away from the receiver.

The two transducers are themselves frequency selective and it is not necessary to include circuits to control the bandwidth of the system.

The amplification at 40 kilohertz can be carried out using discrete transistors, but it was felt that the use of an integrated circuit would be desirable to reduce the circuit complexity. A type TAA 930B i.c. was selected.

This device contains four cascaded wide-band differential amplifier stages and is intended for use in the sound section of television receivers at a 5.5 megahertz intermediate frequency.

Each amplifier stage is coupled to the succeeding one by an internal emitter-follower buffer stage in an arrangement which allows a high gain to be obtained with good stability.

RECEIVER CIRCUIT

The complete circuit of the receiver unit is shown in Fig. 1. All of the decoupling capacitors

are 10 microfarads in value so that the impedance of these capacitors is less than 0.5 ohm at 40 kilohertz.

The output from the "R" type transducer is applied to the input of the TAA 930B pins 4 and 6.

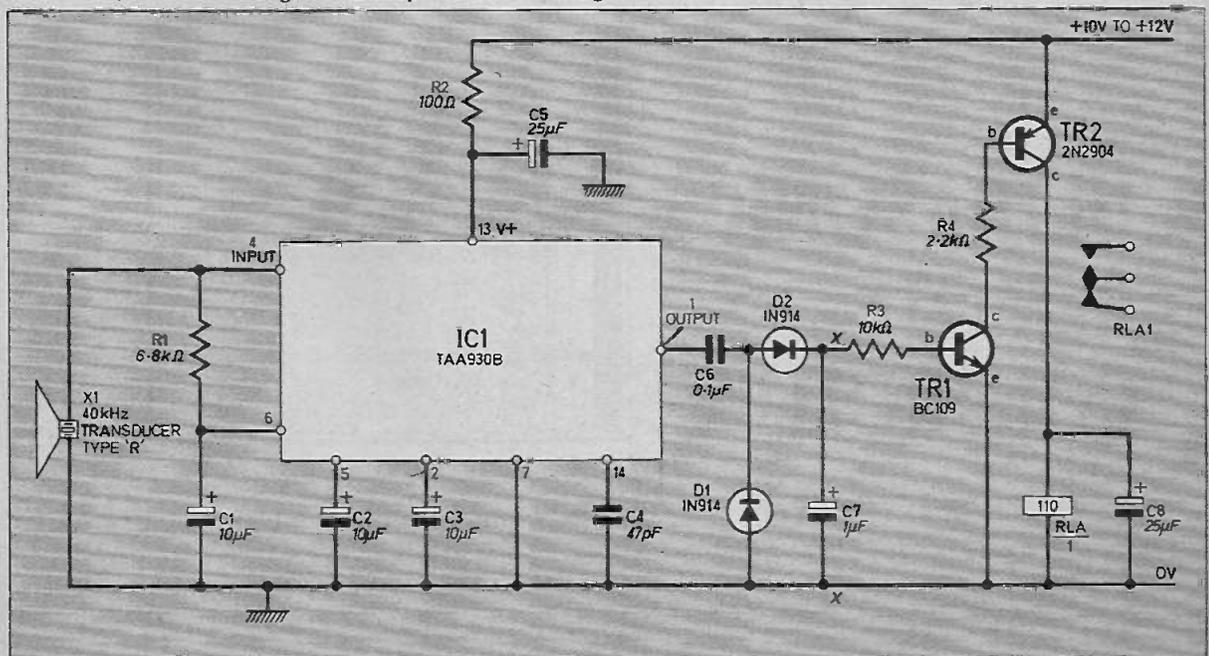
In order that the metal case of the transducer can be earthed, the connection to pin 6 is made via C1.

The input impedance of the TAA 930B is typically 15 kilohm, but the resistor R1 must be included in the circuit to bias the input stage correctly. The input capacitance of the device, 8 picofarads, is negligible when compared with that of the transducer.

The differential amplifier stages of the TAA 930B incorporates a limiter circuit so that the output at pin 10 of the device is twice the emitter-base voltage of a forward biased silicon transistor.

In practice this means that a square wave output of just over 1 volt at 40 kilohertz is

Fig. 1. Complete circuit diagram of the ultrasonic receiver.



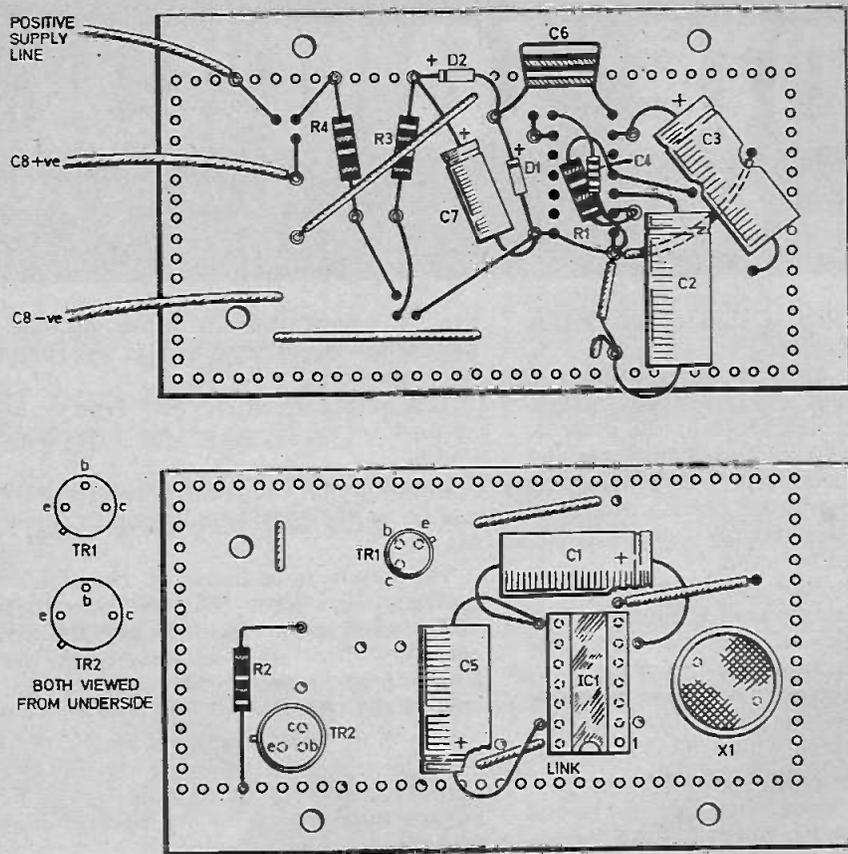


Fig. 2. Layout and wiring of both sides of the component panel.

ULTRASONIC REMOTE CONTROLLER

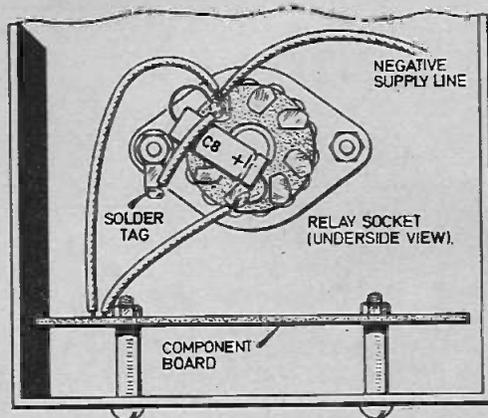


Fig. 3. Wiring of RLA1 and C8 to the circuit panel. RLA1 socket has been mounted in the case side so that space is left inside the case for a battery or power supply.

obtainable at pin 10 no matter what the input level from the transducer provided that the latter exceeds the minimum threshold of 50 microvolts at pin 4.

Initially it had been intended to use the output from pin 10. However, this signal is internally coupled to further circuits inside the integrated circuit which were designed for use as an f.m. detector. It was found that a 40 kilohertz signal of about 8 volts could be obtained from pin 1 of the device and this proved very satisfactory for the operation of the succeeding circuits shown in Fig. 1.

A 47 picofarad capacitor, C4, is connected from the output of pin 14 to ground, since this was found to improve r.f. stability.

The voltage at pin 14 is fed through an internal emitter-follower to pin 1 where a low impedance output (100 to 150 ohm) is available. The capacitor C6 blocks the steady voltage at the output.

DIODE PUMP

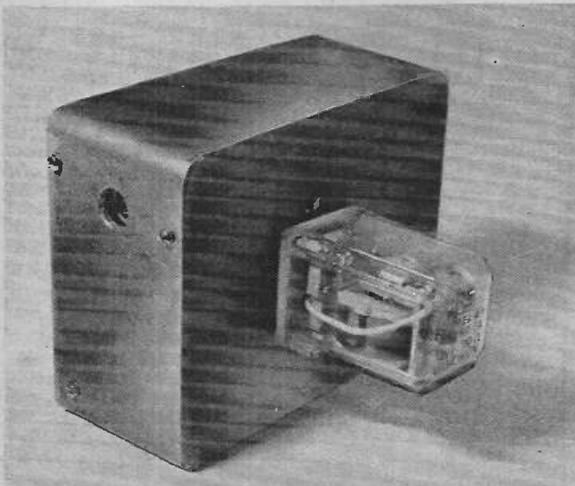
The two diodes D1 and D2 form a diode pump circuit. Each cycle of the 40 kilohertz voltage at pin 1 causes a certain amount of charge to be "pumped" into C7.

A high impedance voltmeter connected across C7 will give a reading up to about 8V as the transmitter transducer is pointed at the receiver transducer. The voltmeter may consist of a 50 μ A meter in series with a 200 kilohm resistor.

RELAY DRIVE CIRCUIT

When the voltage across C7 exceeds about 0.5 volt, a current is driven into the base of the high gain transistor TR1 and causes it to conduct. A current of about 5 milliamps can then flow from the base of TR2 into the collector of TR1.

Photograph of the completed unit.



Components....

Resistors

- R1 6.8k Ω
- R2 100 Ω
- R3 10k Ω
- R4 2.2k Ω
- All $\pm 10\%$ $\frac{1}{4}$ W carbon

Capacitors

- C1 10 μ F elect. 15V
- C2 10 μ F elect. 15V
- C3 10 μ F elect. 15V
- C4 47pF polystyrene 15V
- C5 25 μ F elect. 15V
- C6 0.1 μ F polyester 63V
- C7 1 μ F elect. 15V
- C8 25 μ F elect. 25V

Semiconductors

- TR1 BC109 silicon *n*p*n*
- TR2 2N2904, 2N2905 or 2N1132 silicon *p*n*p*
- D1, D2 IN914 (2 off)
- IC1 TAA930B integrated circuit and holder
- X1 96D-40(R) ultrasonic transducer [96D-40(T) required for the transmitter] (Hall Electronics)

Miscellaneous

- RLA1 12V relay (coil resistance 100 Ω or greater) with at least 1 set of changeover contacts rated as required (R.S. plug-in type 1A used in prototype); socket to suit relay if required; 0.1 inch matrix component board 90 x 50mm; connecting wire; on-off switch if required; battery and connectors (see text); case approx. 120 x 100 x 55mm; 6BA fixings.

The *p*n*p* transistor TR2 therefore becomes saturated and almost the whole of the supply voltage appears across the output relay.

The capacitor C8 absorbs the transient voltage generated when the current ceases to flow through the relay. It also increases the time constant of the circuit and helps to prevent the relay from "chattering" rapidly when the input signal is barely adequate to switch on the relay.

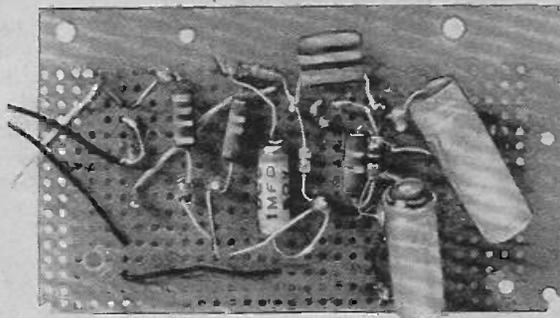
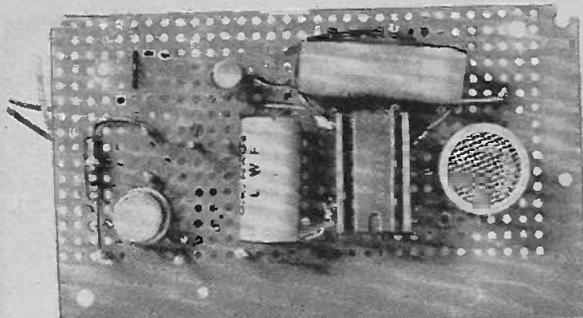
POWER SUPPLY

The absolute maximum permissible power supply voltage to the TAA 930B is 15 volts, but 12 volts should be regarded as the upper limit for the circuit of Fig. 1. The current required by the device is about 15 milliamps from a 12 volts supply or about 11 milliamps from a 9 volt supply.

When the relay is switched on, an additional current of about 100 milliamps will be required.

In some applications a smaller relay may be used. This will reduce the current taken by the receiver when the relay is energised and this can be important if the power supply is a battery.

SEE
**SHOP
TALK**



Two photographs showing the construction of the prototype circuit board.

RECEIVER CONSTRUCTION

The prototype receiver was housed in an Eddystone die-cast box size 120 x 95 x 55mm. The circuit is built on a piece of 0.1in matrix board size 85 x 50mm. Both sides of the board are used for mounting the components and the layout of each side is shown in Fig. 2. Cut the board to size and drill the fixing holes.

Begin construction by inserting the Veropins and integrated circuit holder and then one by one, position and solder the other components on the board, leaving the transistors and diodes till last. A heatshunt should be used on the latter when soldering. The pin of the transducer connected to its metal case should be earthed.

The die-cast box should now be prepared to accept the relay socket and the latter fitted in place.

Now offer up the board to one of the shorter sides of the case and a 12mm diameter hole drilled in line with the transducer and the fixing holes drilled to secure the board in this position.

Mount the component board using 6BA fixings and spacers to ensure that the transducer does not touch the die-cast box, otherwise vibrations from the relay may be picked up, and then wire the board to the relay socket (Fig. 3).

In some applications the receiver will be switched on for long periods. It is then most convenient to employ a mains power supply in the box rather than a battery; a suitable supply can be obtained from the *Battery Eliminator*, E.E. Nov. '74.

Next month: the transmitter, testing and applications.

Ruminations By Sensor

Down on the Farm

Electronics is slowly finding a place in agriculture. The electronically operated fencer is now used extensively throughout the industry and has earned the respect of the farmer and his stock. Cattle are not slow to discover when a fencer is not working and invariably do so before the farmer does. They then seem to take a particular pleasure in dragging the wire around the field and pulling all the insulator posts out of the ground, this, of course, in addition to breaking out of the grazing area where the electric fence was intended to keep them.

The result of their uncontrollable wanderings is, at best, a

great nuisance; hence the farmer's insistence on reliability.

Perhaps surprisingly, electronic equipment can be more robust than the equipment it replaces—the simple transistor operated grain moisture meter comes to mind in this category. It's predecessor was more a laboratory instrument than a general farm tool, consequently, it was not used as often or as widely as was desirable. Kept in a box at the back of the wardrobe in the farmer's bedroom, it could well be overlooked during the hustle and bustle of harvest time.

X Marks the Spud

The electronic potato harvester is currently the most exciting development in farm machines. It enables one man—the tractor driver—to carry out the harvesting. On the earlier potato harvesters, a squad of workers rode on the machine and sorted stones and clods of earth from the potatoes as they were raised from the ground; the new machine is fitted

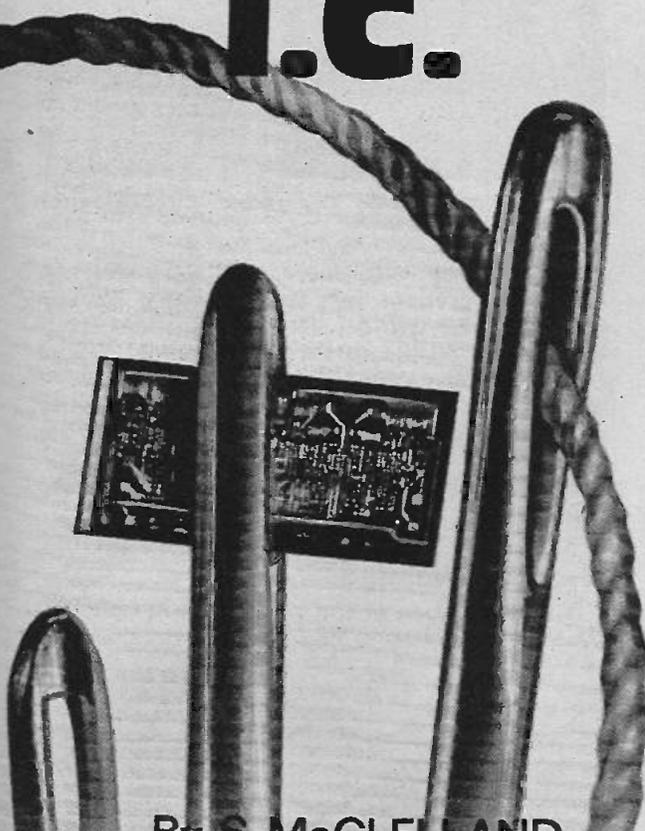
with an electronic sorting unit in which X-ray beams distinguish potatoes from stones and earth clods and actuate sorting fingers to separate the crop from the rubbish.

Every effort has been made to simplify the electronic equipment, and simple replacement parts are available that can be fitted easily by the tractor driver.

The savings in time and labour are considerable and the electronic unit is claimed to be reliable in operation. Other vegetables and bulbs can be harvested with the aid of special fittings.

The manufacturers point out that the electronic sorting devices works at faster-than-human speeds, is more accurate and does not need a tea-break. However the tractor driver still needs his tea-break—but electronics may have the answer to this, too, a tractor guided by a magnetic tape can be made to follow a predetermined course around the field and will continue to run until it breaks down or runs out of fuel!

the WORLD of the I.C.



By S. McCLELLAND

THE integrated circuit, or i.c., as it is generally known, is possibly the ultimate concept in electronics. It certainly stretches one's imagination even to think of an entire electronic circuit on a tiny silicon chip—a chip perhaps no larger than the central dot of the marker used at the end of this article!

However, the increasing importance of i.c.s in electronics is not only because of their minute size but also because they offer us increased reliability over conventional circuits.

Often they alone can perform as specified over long periods of time in extreme and variable conditions, and provide the vital link from man or machine to civilisation. In this context, the Apollo moon-programme immediately

springs to mind.

These microcircuits also have much more down-to-earth applications—domestic uses in circuitry for colour TV sets and ultra-miniature radios, and commercial uses as in ever more complex computers and pocket calculators.

Simple to use and even simpler to replace, integrated circuits are producing an electronics revolution comparable with the impact of the transistor itself.

FROM THE TRANSISTOR

To begin with, let's look at a conventional low power silicon transistor. If it's of the usual cylindrical can type, it will occupy a small volume, typically rather less than a cubic centimetre.

However, the active part of the device, the silicon chip, is very much smaller than this (perhaps one thousandth of the volume of the can). Even then, the actual transistor is considerably smaller than the chip. In other words, the vast bulk of the physical transistor is either unused or used only for the protection and support of its tiny semiconductor. Not much more volume would be needed if more transistors were included in the package. In fact, if we could find some way of electrically isolating the transistors, we could even produce many of them on the same chip.

This can be achieved but one would think that the only components permitted in such an assembly would be those normally produced from semiconductors, i.e. transistors and diodes.

However due to the unusual properties of semiconductors, particularly those of the *pn* junction, other components such as resistors and capacitors can be formed. In fact, almost all the components to be found in a normal electronic circuit can be manufactured simultaneously on the same silicon chip, even, in theory at least, an entire circuit.

We have arrived at the i.c.

TO THE I.C.

The technology of the i.c. although complete in itself, has much in common with that of the transistor. Both usually begin life, for example, as a very pure crystal of silicon which is doped to give *p* or *n* type silicon.

The actual manufacturing processes of both devices are similar too. They rely on the phenomenon of *diffusion*—the name given to the entrance and subsequent spread of one substance into another. In this case, special impurity atoms are allowed to diffuse into the silicon wherever *p* and *n* type regions are wanted. Devices of both types which are conventional (i.e. are not field-effect) are made by the same process. It is the silicon planar epitaxial process.

MAKING AN I.C.

In the silicon planar process, i.c. chips, like transistors, are mass produced in thin slices, which is why they are such inexpensive pieces of a highly complex technology.

They begin life as a circular slice of *p* type silicon upon which a very thin layer of *n* type silicon is specially grown. This layer is called the epitaxial layer and it will be the one to receive the impurity diffusions. We now have a composite slice about 25cm² in area and only about 0.3mm thick but it will yield many hundred i.c. chips. Let us follow the manufacture of a single *npn* transistor of one of these chips in the slice.

FORMING TRANSISTORS

The slice has a layer of silicon oxide formed on it initially by heat treatment. In the area selected for the base of the transistor the oxide layer is etched away, exposing the slice beneath (Fig. 1).

This etching is defined and controlled by a method rather like "photographic stencilling" using a photographic mask and light sensitive chemicals. The process is similar to making a printed circuit board or contact print in photography. The slice is now placed in an atmosphere of *p* type impurity which diffuses into the epitaxial layer via its etched areas. The un-etched oxide acts as a barrier to diffusion elsewhere.

After the formation of this *p* type (base) region, the slice is re-coated with oxide and the etching process is repeated with a smaller area of oxide. This time *n* type impurity is allowed to diffuse into central part of the base region to form the emitter region.

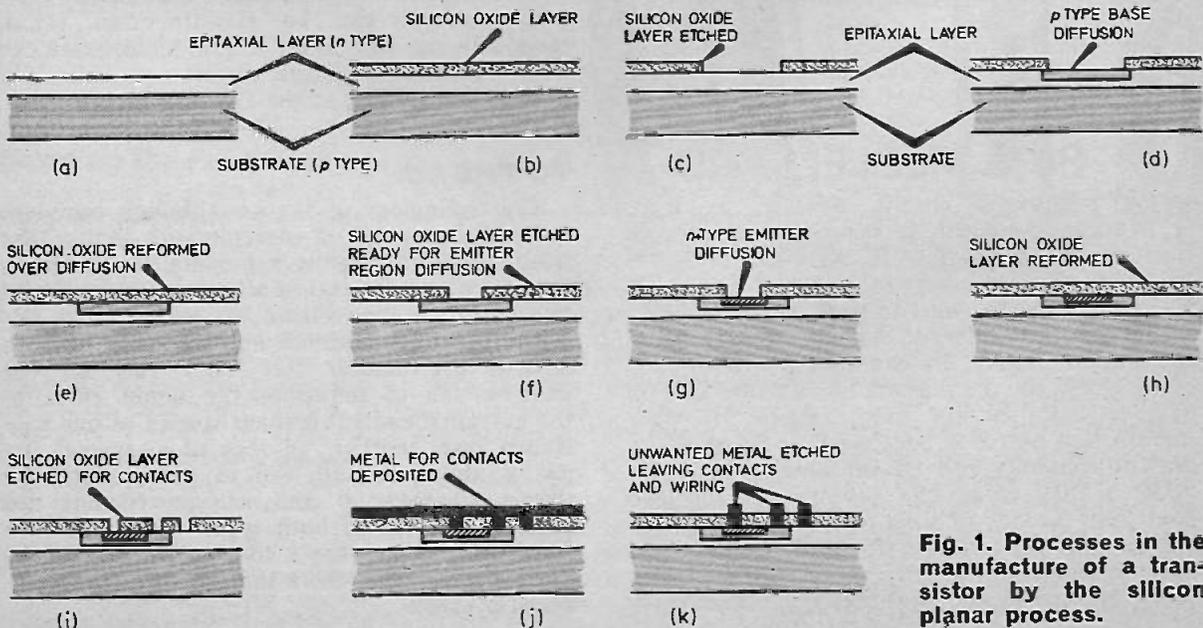
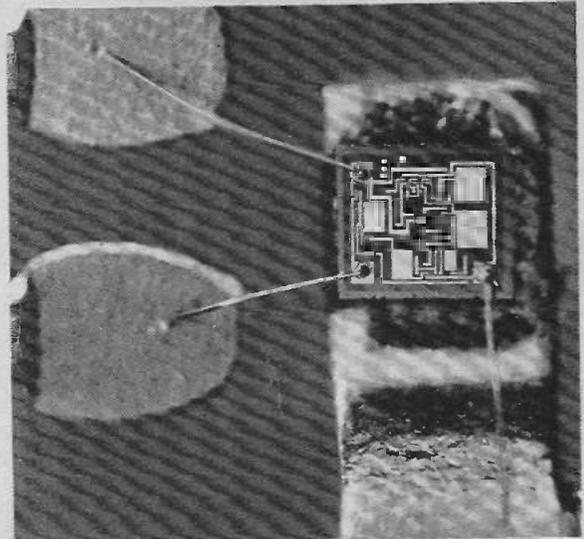


Fig. 1. Processes in the manufacture of a transistor by the silicon planar process.



The Ferranti ZN414 integrated circuit—much magnified.

The slice is once more oxidised and then etched to prepare for the deposition of aluminium which will act as the component interconnections on the surface of the slice. A final etching removes the unwanted metal. Thus it can be seen that in cross section the familiar *npn* transistor structure is built up. All the regions reach the surface of the slice, the epitaxial layer itself acting as the collector of the transistor.

N+ REGIONS

The description of the silicon planar epitaxial process as applied to i.c.s above is considerably

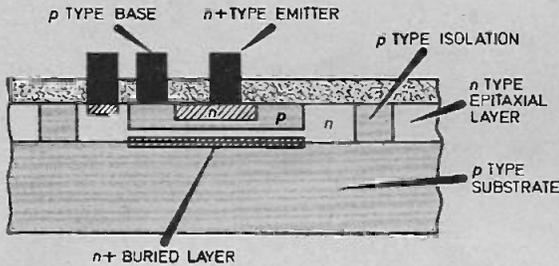


Fig. 2. Schematic drawing of an actual i.c. transistor.

simplified. In practice the first diffusion is not the base diffusion but a diffusion of n type material into the p type substrate before the epitaxial layer has been grown, forming an $n+$ region (Fig. 2).

This diffusion takes place under the collector region of the transistor and will of course be covered over by the epitaxial layer. It is therefore called the "buried layer" and its function is to combat the collector resistance problems which arise from having the collector in such a configuration.

Two other $n+$ regions will be seen. One is the actual emitter diffusion, the other a diffusion which takes place simultaneously at the position of the collector contact to reduce contact resistance.

OTHER COMPONENTS

If a diode is required in the circuit, a transistor is made as above, and then one of its pn junctions is simply short-circuited to leave a diode junction.

Capacitors, provided they are of small value, can be formed from diodes by employing the capacitive properties of the pn junction. Resistors, too, are easily formed. They are merely p type diffusions in the epitaxial layer of varying length and thickness.

ISOLATION

All the components above—transistors, diodes, capacitors and resistors will be formed in the same epitaxial layer of the same i.c. chip. They will therefore be electrically interconnected through this layer as well as by the wiring on top of the slice. Clearly, these short-circuits are unacceptable in i.c. chips but the amazing versatility of the pn junction comes to our rescue once again.

A p type "ring" is formed by diffusion around the position of each component by diffusion. The diffusion takes place early in the manufacturing process—between the buried $n+$ diffusion and the base diffusion—and penetrates the epitaxial layer so deeply that it reaches the p type layer underneath it. Thus a "shell" of p type material surrounds each component.



Holding a 120 component decade counter chip.

When this is connected to a negative potential, a reverse biased pn junction is formed between it and the epitaxial layer and the short circuits are eliminated.

ENCAPSULATION

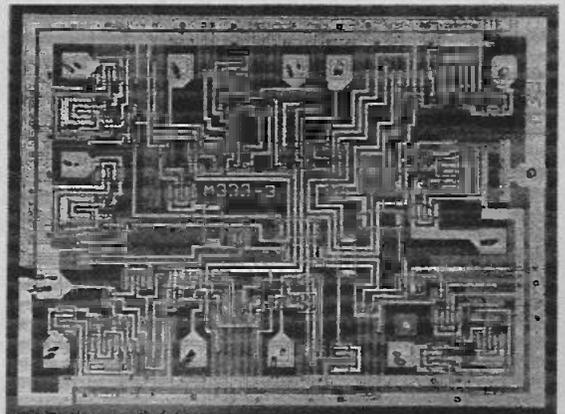
Each i.c. on the slice is tested before the slice is broken up into individual, identical chips each of which is bonded to a supporting "header" in preparation for packaging. The package will protect the tiny delicate i.c. chip and enable it to be easily connected to circuits in the outside world.

There are several types of i.c. packages available, the more usual ones being the TO-configurations (like conventional transistor housings) and the dual-in-line (d.i.l.) configurations which are rectangular blocks of plastic. The metal "flatpack" system is also available.

MOS DEVICES

Until now only bipolar i.c.s have been discussed, but there also exists a i.c. technology

An enlarged view of an i.c. chip.



parallel to, and employing, field effect transistors (f.e.t.s). These are the metal-oxide-silicon (MOS) devices. There are three contacts: source, gate and drain in f.e.t.s, roughly corresponding to the emitter, base and collector respectively in bipolar devices.

Here, however, the resemblance ends. Because of the different principles on which MOS devices operate, they can be made considerably smaller than bipolar devices of similar function. This arises partly because no isolating channels between components are needed. The fact that the device doesn't need an epitaxial layer either makes some stages of the manufacturing processes easier but the device has certain special problems associated with it, particularly concerned with the gate.

The design of the MOS makes is particularly suitable for digital applications, and it is very useful where size is at a premium. For example, the Sinclair Executive pocket calculator uses an MOS chip containing 7,000 transistors. (This calculator now costs less than £30).

CDI TECHNOLOGY

Although MOS devices are more suitable for some applications than bipolar devices, they are less suitable for other applications. Thus, until recently, no general technology has existed. However, several paths have been explored and the collector diffusion isolation (CDI) process, largely developed by Ferranti Ltd., appears to be an extremely promising one.

Already, using this technology which combines the advantages of the two previously mentioned technologies, Ferranti have introduced a t.r.f. i.c. tuner, the ZN414. This chip needs only a few external components to turn it into a radio receiver—yet the actual chip is only about 0.5mm² in area!

SPECIFICATION

In each stage of the manufacture of an i.c., precision work is required for the device to perform as specified. For example, the epitaxial layer in bipolar i.c.s must be carefully grown although it is only of the order of a hundredth of a millimetre thick, while exacting manufacturing techniques, indeed, are needed to form a silicon oxide layer about one ten thousandth of a millimetre thick for MOS device gates!

Even before the manufacture proper of an i.c., the amount of impurities in the silicon crystal to be processed must be known with little error. In an i.c., as in every other semiconductor device the semiconductor properties of the silicon depends on the extent to which it is "doped" with *p* and *n* impurities.

TEMPERATURE

The semiconductor properties also depend upon the temperature at which the device is



The Sinclair Executive pocket calculator.

operated and this is another critical factor which must enter its design.

For military purposes an i.c. has often to be designed to withstand an incredible temperature range—one of 180 degrees C is typical. This is equivalent to requiring the i.c. to operate below arctic temperatures and then, not long afterwards, at temperatures well above the boiling point of water! Commercial applications don't usually call on i.c.'s to be so rugged. They employ less tolerant devices with temperature characteristics more like conventional transistors.

LINEAR AND DIGITAL

All electronic devices—whether integrated or discrete—fall into two classes, those which are linear and those which are digital in operation. Linear devices have no particular electrical states of operation but instead function over a continuous range. Amplifiers, for example, are in this class—they must provide a faithful reproduction of a continuously changing input signal.

Digital devices, on the other hand, are designed to handle only particular levels of signal—usually only two levels in fact. Thus, at any time digital devices will be in only one of two states. Bistables are a good example of this type of device. Both linear and digital devices are found in i.c. form, but because the latter is the more important type, only it and the principles underlying it will be discussed.



An engineer works on a visual display unit which employs MOS memory chips.

BINARY OPERATION

The two states in digital electronics are usually taken to be an "on" or "high" state and an "off" or "low" state. In practice the high level will be of the order of a few volts (positive, with *npn* devices) and the low level about 0 volts.

So that we can perform calculations with digital systems we assign numerical values to the two states—the high state is "1", the low state "0". Using only these two numbers we can build up a counting system—called the **binary system** to distinguish it from our normal or denary counting methods using ten as a base.

LOGIC

If we can predict the output of a digital circuit i.e. whether the output will be "0" or "1" for a given input or combination of inputs at "0" or "1", we say the circuit is operating **logically** i.e. we are using the principles of logic to get our results. Conversely, if we want to produce a certain output from a certain input or combination of inputs we can again use logic principles to tell us what basic circuit (called a **logic element** or **function**) or arrangement of basic circuits we need to achieve this.

If you have been wondering what i.c.s have to do with this, this is where they come in. There are only a few logic elements but large numbers of them are often needed to make a digital system. They can be regarded as the building blocks of digital devices, so each element must be as cheap as possible to manufacture and use.

Integrated circuits offer us, by the mass production methods of their manufacture real economy, and also reliability and a great complexity in a very small space. Thus they are ideally suited to the requirements of large digital systems.

DTL AND TTL

In most industrial fields, there is more than one solution to a given problem. It is no less true in microelectronics where there are several different ranges of i.c.s with the same logic function. The differences have arisen from the manufacturers' attempts to improve speed or power dissipation, say of a logic element, and it is really a matter of the customer deciding for himself what particular electrical characteristics are important in his digital systems and then deciding accordingly.

Thus we have in bipolar digital i.c.s, logic elements the active components of which are diodes and transistors using diode-transistor logic (DTL) and also logic elements the active components of which are only transistors using transistor-transistor logic (TTL). Some other abbreviations for alternative systems the reader may find are RTL (resistor-transistor logic) and ECL (emitter-coupled logic). TTL is now used extensively and the others are seldom found.

USING I.C.S

Although i.c.s are internally far more complicated than transistors the constructor should find them considerably easier to work with than discrete components.

The same basic rules still apply to i.c.s as to discretes, and they include:

- (1) Using soldering irons specifically adapted to such miniature work and soldering as quickly as possible. In fact, soldering problems can be largely eliminated if you use an i.c. holder.
- (2) Checking that i.c. leads are correctly connected up and that no shorts are present at i.c. package connections.
- (3) Checking power supplies especially in digital systems.

THE FUTURE—L.S.I. AND T.S.I.

In the future more and more electronic circuits will become integrated. In the predictable future there seems to be an era of **total system integration** (t.s.i.) where entire, almost ready to use, circuit systems are manufactured on a single chip.

We have seen the beginnings of this already with large scale integration (l.s.i.) techniques where much of the system is already integrated and needs relatively few discrete interface components to make it work. So, for as long as consumer demand continues, we can look forward to further exciting and spectacular developments in the world of the integrated circuit. □

ACKNOWLEDGEMENTS

The author wishes to thank the following firms for their help: Ferranti Ltd., Mullard Ltd., Sinclair Radionics Ltd., Texas Instruments Ltd.

BEGIN HERE

PART ONE BASIC COMPONENTS

By DONALD MAYNARD



FOR a newcomer to electronics, the prospect of building anything from a circuit diagram can be daunting. In this short series of articles it is intended to help newcomers by giving them practical information about components and also about methods of construction.

In this first part we take a look at resistors, capacitors, inductors, transformers and potentiometers. The second part is concerned with semi-conductors and we will go on to see how to test the various components and how to assemble them together to make up a circuit.

RESISTORS

A resistor is a component which dissipates power, usually in the form of heat. Its use is summed up in the relationship called Ohm's law:

$$V = I \times R$$

where V is the voltage across the resistor in volts, I is the current through the resistor in amps and R is the value of the resistor in ohms. The symbols for a resistor are shown in Fig. 1.1. Either we can use the resistor to change the voltage at a point in the circuit, or we can use it to alter the current at a given point.

The resistor's value can be determined from the coloured bands around it. There are three bands which give us this information (Fig. 1.2). The bands are coloured and each band corresponds to a number as shown in Table 1.1.

If the bands are brown, red and orange for example, then the value is $12 \times 1,000$ or 12,000 ohms; 1,000 ohms is usually called a kilohm or $k\Omega$ while 1,000,000 is called a megohm or $M\Omega$. The last band indicates the tolerance, or variation, in the actual resistor value. Gold indicates a plus or minus 5 per cent ($\pm 5\%$) tolerance while silver shows that it is plus or minus 10 per cent ($\pm 10\%$). If no band is present the tolerance is ± 20 per cent. Some older types of

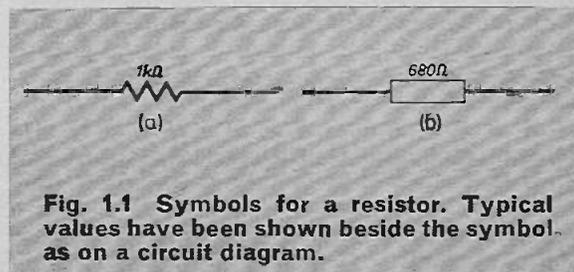


Fig. 1.1 Symbols for a resistor. Typical values have been shown beside the symbol as on a circuit diagram.

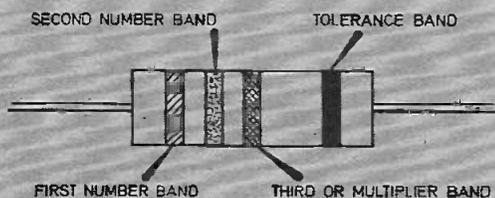


Fig. 1.2 The resistor and significance of the coloured bands

TABLE 1.1 Resistance Colour Code

Colour	Number	Multiplier
Black	0	× 1
Brown	1	× 10
Red	2	× 100
Orange	3	× 1,000 (kΩ)
Yellow	4	× 10,000
Green	5	× 100,000
Blue	6	× 1,000,000 (MΩ)
Violet	7	× 10,000,000
Grey	8	× 100,000,000
White	9	× 1,000,000,000

Tolerance—no band ±20%, silver band ± 10%, gold band ± 5%, red band ±2%, brown band ±1%. Gold and silver are sometimes used as multipliers, they represent ×0.1 and ×0.01 respectively.

resistor have the colours in the form of a general body colour (1st. number), one end another colour (2nd. number) and a spot or band in the middle (multiplier).

In general, the larger the resistor, the more power it can handle. The rating in watts can vary from $\frac{1}{8}$ W up to several watts. This power is simply the voltage (V) multiplied by the current (I) through it. Using Ohm's law we can say that the power (P) dissipated by a resistor is $P = V \times I = I^2 R = \frac{V^2}{R}$ where R is the resistor's value.

There is no electrical disadvantage in using a resistor that is physically larger than required, only the disadvantage of increased mechanical size and possibly cost.

CAPACITORS

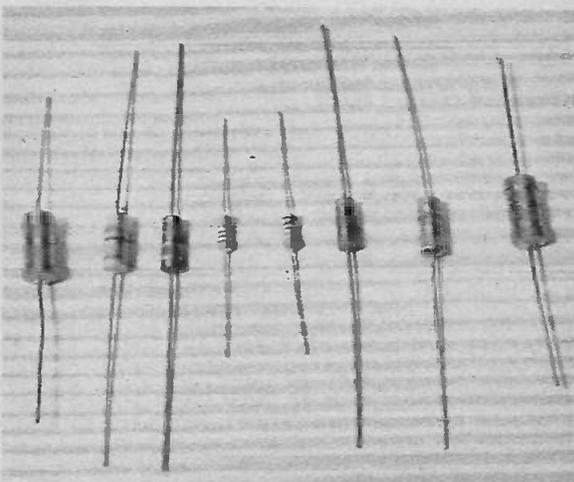
The old name for a capacitor was condenser, but the new name is more in keeping with its function. It has the capacity for storing energy. The simplest way of thinking about a capacitor is that it will pass an alternating current (a.c.) through it but not a direct current (d.c.).

The other important point is that if a d.c. voltage, say from a battery, is applied across a capacitor, ideally that voltage will remain there until either a component such as a resistor connected across it, or you happen to touch both ends simultaneously, when the capacitor will

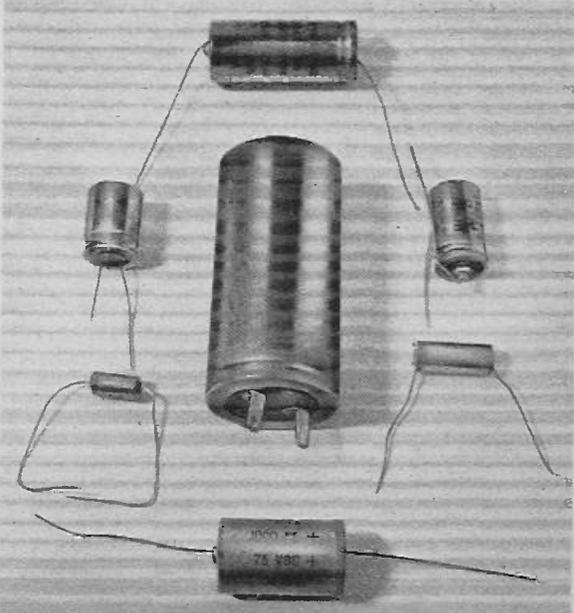


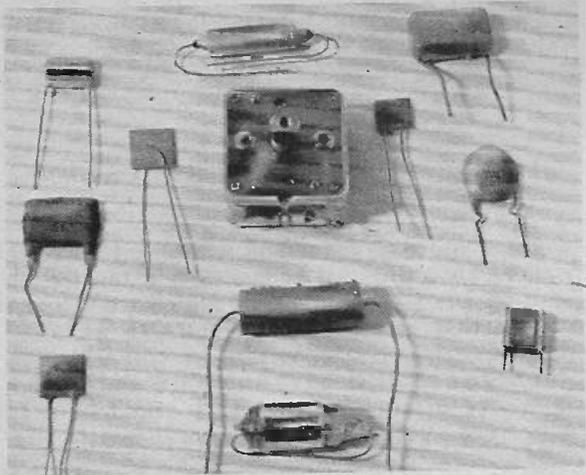
Fig. 1.3 Symbols for capacitors (a) fixed (b) variable (c) electrolytic

lose its voltage by passing a current through you! In case this makes you decide to give up without going any further, I had better hasten to add that at most of the voltages we meet these days—9, 12, 18, or similar—no sensation will be felt at all. Beware, though, if the voltage should be a hundred or more it could be very dangerous. Various symbols are shown in Fig. 1.3.



A selection of resistors (above) and some electrolytic capacitors (below).





A selection of capacitors—a variable type is shown in the centre.

CONSTRUCTION

Basically, a capacitor consists of two plates separated by an insulating material called the dielectric. The dielectric may be air, paper, ceramic, polystyrene or any other suitable material. For larger values of capacitance an electrolyte is used for the dielectric and this has the property of greatly increasing the energy storage capability of the capacitor. A steady potential is usually necessary for these, and so on circuit diagrams the positive side of the capacitor is shown as an open block (Fig. 1.3.c).

Variable capacitors (Fig. 1.3.b) have rotating vanes separated by an air gap. The amount of overlap of the vanes, and therefore the capacitance, is then variable.

Capacitance is measured in Farads, although a one Farad capacitor would be very large indeed. Practically, capacitors are marked either in microfarads (μF) or in picofarads (pF). There are a million picofarads in one microfarad, and a million microfarads in one Farad. Occasionally one meets nanofarads (nF) and one nanofarad is a thousand picofarads.

Some small capacitors are colour coded in a similar fashion to resistors (Fig. 1.4). The values can be worked out in pF from Table 1.1. The bottom two bands indicate the tolerance and working voltage.

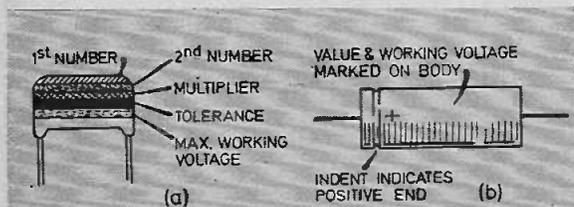


Fig. 1.4 (a) Colour coding of a "banded" capacitor (b) an electrolytic capacitor.

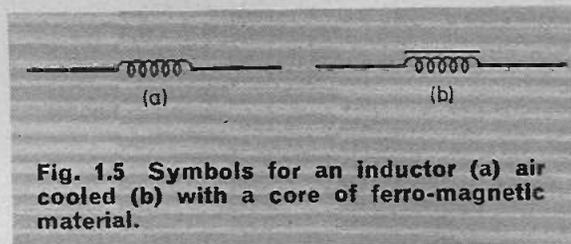


Fig. 1.5 Symbols for an inductor (a) air cooled (b) with a core of ferro-magnetic material.

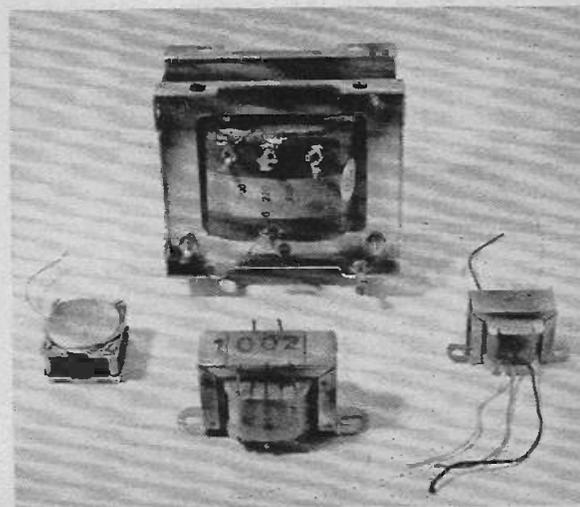
It is important that the working voltage of the capacitor is not exceeded and that, in the case of the electrolytic capacitor, the polarity is correct. (Note the indented positive end shown in Fig. 1.4.b).

INDUCTORS

Inductors may be considered to be the inverse of capacitors in that they tend to pass a direct current but not an alternating one. They are coils of wire usually wound around a former. To obtain higher values of inductance, some form of ferrous material may be used in the core and round the outside of the coil.

An important feature of the inductor is that if a voltage source is removed from across it, a "back e.m.f." is set up in the coil which will try and maintain the original current. Symbols for the inductor are shown in Fig. 1.5. The unit of inductance is the Henry, although we usually use millihenrys or microhenrys (mH and μH respectively). There are a thousand microhenrys to one millihenry and a thousand millihenrys in one Henry.

Inductors are perhaps the most difficult component to identify once they have left the manufacturer's box. Often they are wound by the constructor himself on either home-made or commercial formers. When they are used to stop



A selection of transformers—a pot core type inductor is shown on the left.

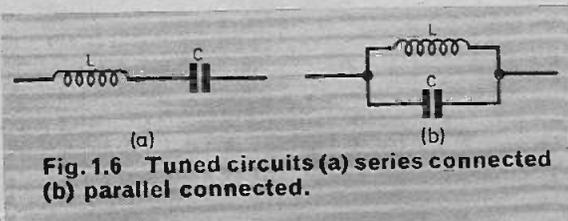


Fig. 1.6 Tuned circuits (a) series connected (b) parallel connected.

a.c. signals from appearing in other parts of the circuit they are usually called radio frequency chokes (r.f.c.). Inductors may also be used with capacitors to form tuned circuits.

TUNED CIRCUITS

A tuned circuit (Fig. 1.6), consisting of an inductor L and a capacitor C , will, ideally, either pass one frequency and stop all others, or else will stop one frequency and pass the others. A measure of the selectivity of a circuit is its Q (for quality) factor.

At the resonant frequency (f_0 , measured in hertz or cycles per second) the series circuit (Fig. 1.6.a) has a low loss but the parallel circuit (Fig. 1.6.b) has a high loss. When we talk about loss in this context we mean the ratio of voltage across, to current in, the circuit. This is also termed its impedance (Z). The impedance of specific components sometimes has another name, e.g. resistance (R) for resistors and reactance (X) for inductors and capacitors.

TRANSFORMERS

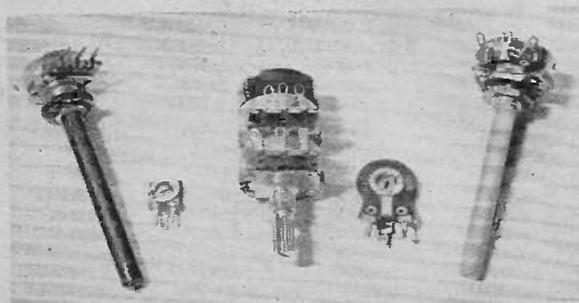
Transformers are used to modify alternating voltages or currents, and also to isolate one part of a circuit from another. Two transformers are shown in Fig. 1.7. We can denote everything on the primary, or input, side by the suffix "1", the secondary, or output side, having the suffix "2"; T_1 and T_2 are the number of turns on the primary and secondary respectively. Then:

$$\frac{V_2}{V_1} = \frac{T_2}{T_1} \quad \frac{I_2}{I_1} = \frac{T_1}{T_2}$$

and

$$\frac{Z_2}{Z_1} = \frac{V_2 \times I_2}{V_1 \times I_1} = \left(\frac{T_2}{T_1}\right)^2$$

In a transformer for converting mains voltage (240 volts) to a low voltage, say 6 volts, the



A selection of preset and standard potentiometers.

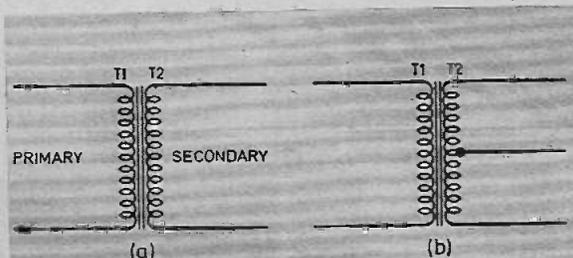


Fig. 1.7 Symbols for transformers—both are with laminated cores (a) with two winding (b) with a tapped secondary winding.

primary winding will have many turns of relatively fine wire while the secondary will have far fewer turns but of thicker wire to take a heavier current.

If the transformer is tapped (Fig. 1.7.b), a voltage will appear across each winding proportional to the number of turns in each section. The overall voltage across the secondary will still be in accordance with the relationship shown above. For any transformer its size will depend on the secondary current required. The larger the current the larger the transformer.

Some transformers (those used in the intermediate frequency [i.f.] sections of radios for example) are purchased with capacitors connected across the windings. This has the effect of tuning the transformer in much the same way as when we connected the inductor and capacitor together. This causes the transformer to be selective in the band of frequencies that can pass from input to output.

POTENTIOMETERS

The potentiometers that we meet are used as variable resistors or as potential dividers. Shown schematically in Fig. 1.8, they are made either of a high resistance wire wound round a former, or else they utilise a track made from a carbon compound. The slider (B or E) moves along the carbon track or coiled wire changing the relative resistance between A to B and B to C (or D to E and E to F). If B is connected to A , then we have a variable resistor from effectively zero up to the maximum value of resistance i.e. A to C .

Values are again in ohms but in addition we may have a linear, logarithmic or antilogarithmic variation in resistance as the spindle is turned. If unspecified, a linear type would normally be used. Logarithmic types are used for volume controls as the human ear responds to change in volume in a logarithmic, rather than linear way.

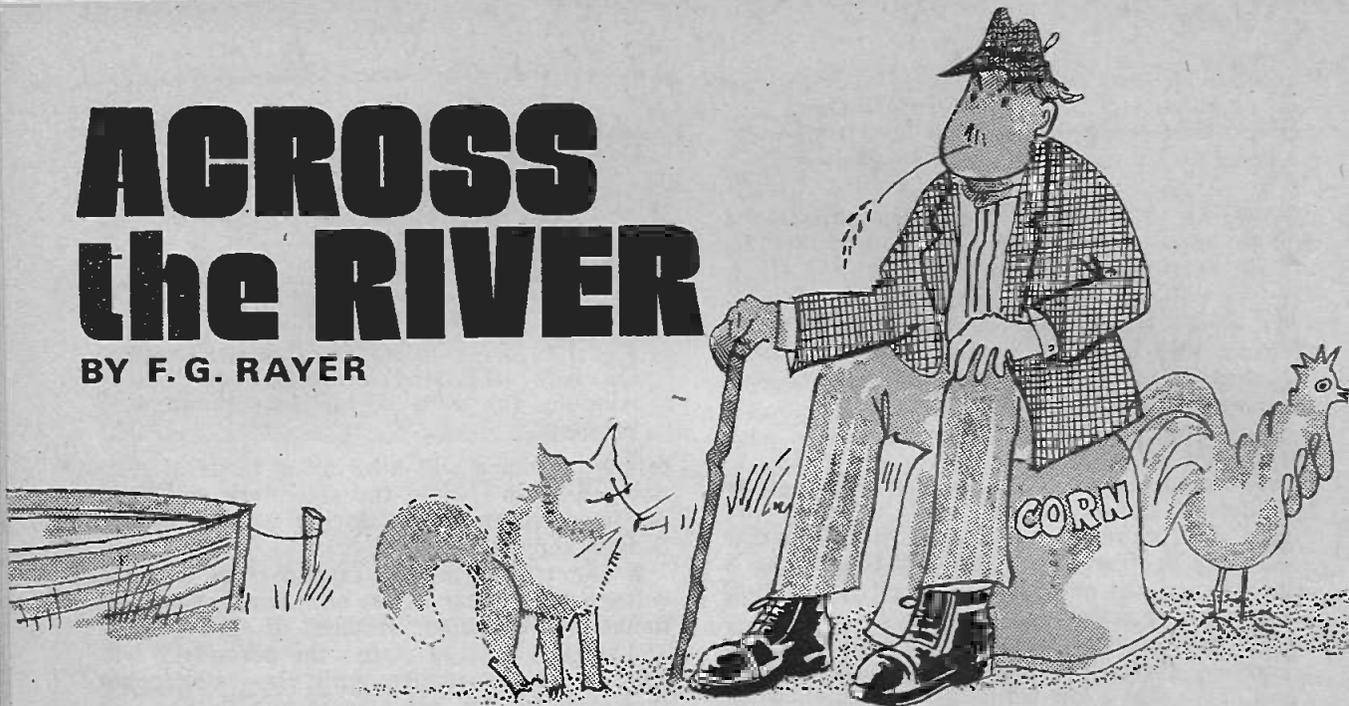


Fig. 1.8 Symbols for a potentiometer.

Next month: semiconductor devices.

ACROSS the RIVER

BY F. G. RAYER



An interesting electronic puzzle for all the family.

This solo game is played electronically, and is derived from an old puzzle. Once the solution is seen, it is extremely easy, but until this moment it can be very puzzling. The whole unit is self contained, and can be handed to any one who wishes to try their skill.

A story leads up to the presentation of the puzzle, and the attempt at a solution is then made by moving switches, which are wired to produce a warning sound when an error is made.

STORY

Once upon a time a farmer was carrying a fox, a hen, and a sack of corn. When he reached the east bank of a shallow river he found that he could only carry any one item at a time in the small boat. His problem is to get the items to the west bank of the river safely.

If he carries the corn over first, thus leaving the hen with the fox on the east bank, the fox will attack the hen. If he carries the fox over first time, leaving the hen with the corn, the hen will eat the corn. On the other hand, if he carries the hen over to the west bank first, leaving the fox and corn together on the east bank, this is so far in order, and he can leave the hen safely on the west bank, and return to fetch the fox or corn. But now, if he carries the fox over, and leaves it with the hen on the west bank, the fox will attack the hen while he returns for the corn. Should he take the corn over at this stage, the hen on the west bank will eat it while he returns for the fox.

So what does the farmer do to transport his items, one at a time, with safety?

The problem may appear impossible, but a solution does in fact exist. It will be observed from the story that hen and corn, or fox and hen, may safely be on one bank together when the farmer is present, as he would of course prevent the danger to hen or corn, which may arise when he is not present.

CIRCUIT

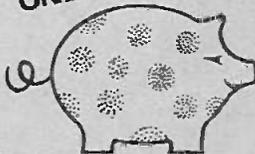
The complete circuit diagram is shown in Fig. 1; TR1, TR2 and the associated components form an oscillator, and values were chosen in an attempt to produce a sound which might be looked upon as that made by a startled hen.

However, almost any two audio *pnp* transistors are likely to work satisfactorily in a multi-vibrator of this type, and none of the component values are critical. They may, in fact, be modified to change the sound produced, as may the battery voltage.

The switch network completes the circuit only when a mistaken move is made (e.g., fox left alone with hen) and this sounds the warning speaker.

In Fig. 1, all the switches are at the east bank

FOR
GUIDANCE
ONLY



ESTIMATED COST*
OF COMPONENTS
including V.A.T.

£2.20

excluding case

*Based on prices prevailing at
time of going to press

position. The problem is thus to move them all to the other position without completing the circuit. A maximum of two switches are allowed to be moved at one time, one being the farmer.

As example, if the farmer should take the fox across, the battery negative circuit is completed via A of S2, B of S3, C of S4 and D of S1, sounding the warning. (That is, hen is eating corn which is an unsatisfactory attempt).

SWITCHES AND LOUDSPEAKER

In the prototype the four switches were mounted on the removable lid of a plastic case of dimensions 160×90×50mm. A metal case is also suitable provided precautions are taken to ensure there is no shorting of the battery or other components against the case walls.

Four standard-size slide switches were chosen as these are inexpensive, robust, and more easily operated than miniature types.

Begin construction by making the slots and fixing holes in the front panel (lid) to accommodate the slide switches and then drill a matrix of holes to suit the loudspeaker. Glue (or screw) the latter in position and then secure the four switches. Now wire up in accordance with Fig. 2.

OSCILLATOR BOARD

The oscillator components were wired on a short length of standard tagboard, as shown in Fig. 2, a screw afterwards fixing this to the base of the case. The transistors should be soldered in last of all and a heatshunt used on their leads to prevent thermal damage.

As mentioned previously, C1 and C2 need not be the same values, nor need the two transistors be the same type number. Reducing the values of R2 and R3 will raise the pitch, and increasing the values of C1 and C2 will lower it.

Solder two flying leads to the tag board and connect these to the loudspeaker and solder the

Components....

Resistors

R1 5.6k Ω
R2 100k Ω
R3 1M Ω
All $\frac{1}{4}$ W carbon $\pm 10\%$

SEE
**SHOP
TALK**

Capacitors

C1 0.047 μ F
C2 0.047 μ F

Transistors

TR1 AC128 germanium *npn* or similar
TR2 AC128 germanium *npn* or similar

Miscellaneous

S1, 2, 3, 4 d.p.d.t. standard slide switch 4 off)
LS1 80 ohm loudspeaker (65mm dia.)
B1 9 volt PP4
Battery clips for PP4; plastic or metal case, 160 x 90 x 50mm; standard tagboard 3-way.

lead between board and S1. Finally solder the two battery leads in position and secure the board to the base of the case, and connect the battery. The battery can be held in position by means of a Terry-clip or a home-made aluminium bracket.

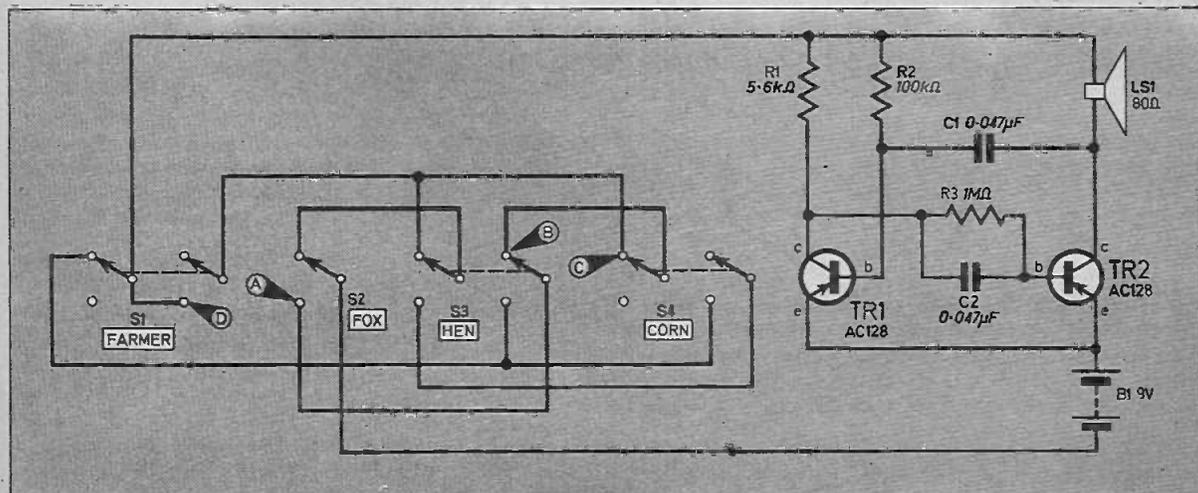
LABELS AND USE

Labels should be marked CORN, HEN, FOX and FARMER and placed near the appropriate switches.

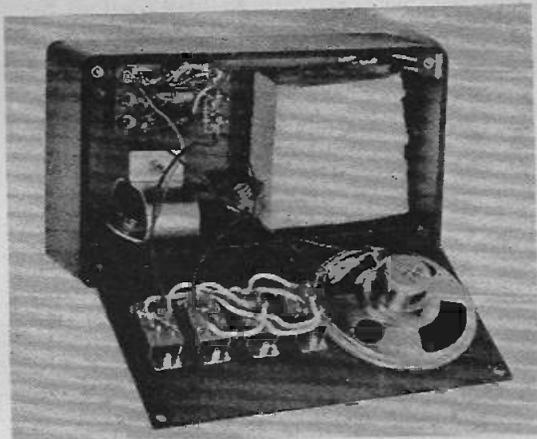
Some embellishment would be possible for children, such as a panel drawn and painted with a river, with pictures for the corn, hen, etc., as in our heading design.

Though the "old story" was preferred, it would

Fig. 1. The complete circuit diagram for the Across the River puzzle.



ACROSS the RIVER



Photograph of the completed prototype.

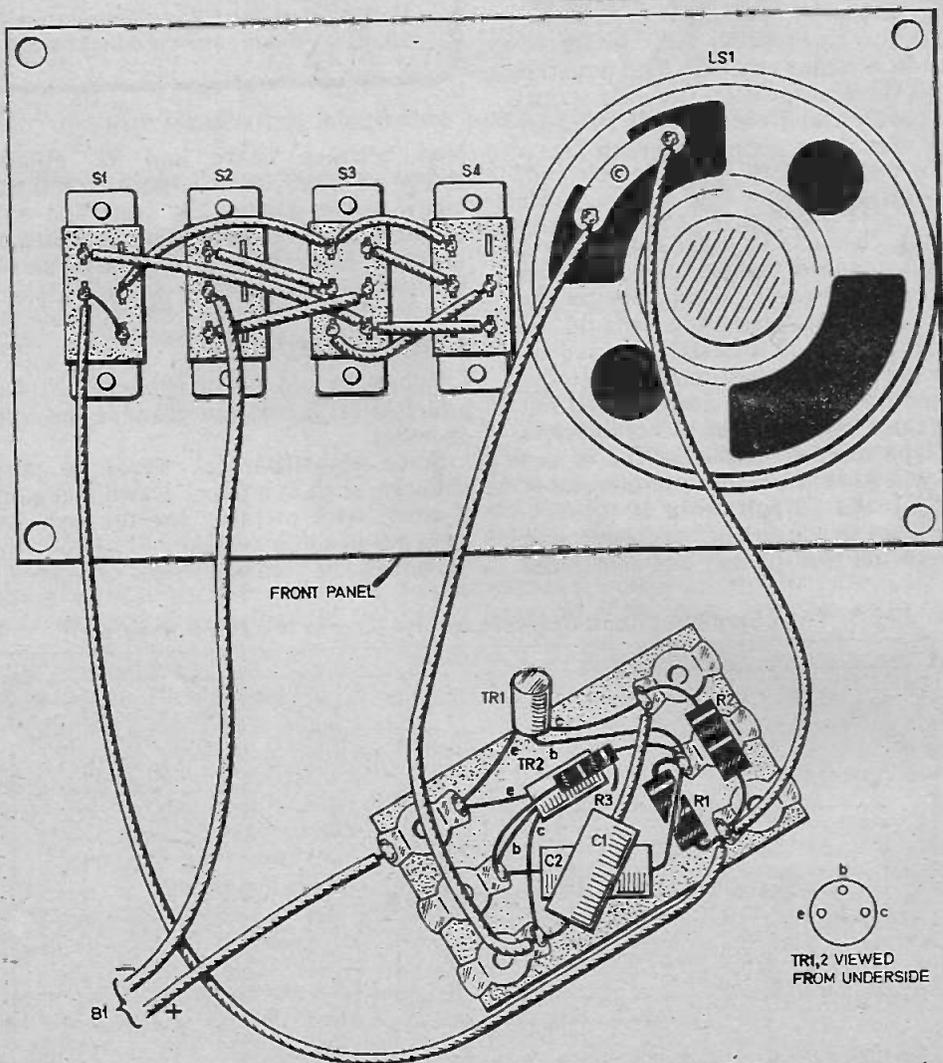
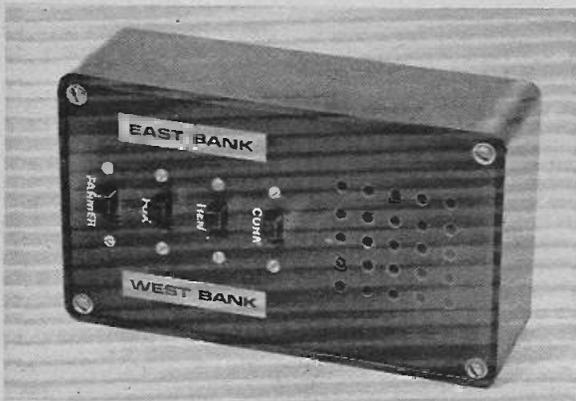


Fig. 2. The layout of the components on the tag board and complete wiring up details.



Violent Anarchist are left alone, the Violent Anarchist will attack the Pacifist. Though it is, of course, in order to leave the Bomb with the Pacifist, unattended by the Policeman.

Check that wiring is correct by following the moves already given. No warning is produced with all switches at the East Bank or all at the West Bank, or with Fox and Corn unattended either side, or with any combination where the Farmer is present.

SOLUTION

As with many things, this is easy when the secret is known. All start at the East Bank.

- (1) Farmer carries Hen over, leaving Fox and Corn at East Bank.
- (2) Farmer returns to East Bank.
- (3) Farmer carries Fox to West Bank.
- (4) Farmer returns to East Bank taking Hen with him.
- (5) Farmer carries Corn to West Bank.
- (6) Farmer returns to East Bank.
- (7) Farmer carries Hen to West Bank. □

be possible to modify or up-date this. For example, the Corn, Hen, Fox and Farmer may become a Bomb, Violent Anarchist, Pacifist and Policeman respectively.

If the Violent Anarchist is left alone with the Bomb, he will explode it, while if Pacifist and



...Counter Intelligence

BY PAUL YOUNG

A retailer discusses component supply matters.

AT THE end of September (when the birds migrate south in search of millionaire husbands) the British winter will soon be on us, between then and Christmas many thousands will join the ranks of the electronic hobbyist. This is hardly surprising when you weigh up the advantages.

All you need is the corner of a kitchen table, a few simple tools, some bits and pieces and an indulgent wife or mother. Then for a few hours a day you are a would be Faraday, Fleming, or Davey. Even if initially, your knowledge is nil, there are such excellent magazines as EVERYDAY ELECTRONICS to guide you along the right lines.

We retailers naturally have a vested interest in keeping it that way. We know that inevitably we must lose a few novices by the sheer frustration of being unable to obtain the right parts easily and quickly.

BEGINNERS

It is with the beginners and

particularly the last few in mind, that I direct this article. With any hobby, a certain amount of patience is required and electronics is no exception, so let me assume that you're raring to go and just need a few vital components to get started. How do you set about it. A few of you may be fortunate enough to have some good shops locally but the majority will have to rely on mail order firms which brings me to my first point, which is this. No one firm will be able to supply 100 per cent of your wants and it is as well to accept that from the very beginning.

So your first task is to read through the more popular electronic magazines and purchase as many varied component catalogues as you can afford. I assure you this is a good investment and even if your outlay is a pound or two, spread over a year or so its fairly small, and many firms return their catalogue price when you make purchases. If you find all your wants in any one of them, try that firm out first, but be resigned to dealing with three or four.

Now to deal with the actual ordering. If the firm concerned enclose an order form—use it. It is quicker for them to deal with their own order forms than scraps of paper. If not, I suggest you buy a duplicate order book not smaller than 200 x 120mm from W. H. Smiths or Rymans. These have about 100 duplicate pages and carbon paper. Put your address at the top in block letters and then put down your requirements, with the quantity you require first.

If the firm has catalogue numbers use them, if not make sure your descriptions are adequate, i.e., if you order a pot, say if its log. or lin. do not forget to write down colours if applicable. Now carefully check prices and totals and if you pay by cheque do make sure (a) you sign it, (b) the date is correct, (c) that the words and figures agree.

DELAY

Don't be worried if a week or ten days goes by before the arrival of your goods, that excellent organisation the Post Office is very undermanned at present. One way of avoiding frustration is to plan ahead i.e., while you are constructing one project select your next project and order the bits for that.

Physics is FUN!

By Derrick DAINES



OPPOSITE CHARGES

I am told that I have left one or two things unexplained.

- (1) Why do the tufts of the electroscope not fly apart until the charged plastic sheet is lifted off the table?
- (2) Why does the hair of the head lift when a charged sheet is brought near it, but not actually touching?
- (3) Why do all these static experiments work best in a dry atmosphere?

The first two questions are really the same question couched in different terms. But let's do experiments to see it.

Charge a plastic sheet by rubbing it with wool; prove it with the electroscope. Now lay the sheet down again—the tufts of the electroscope collapse. Remove the electroscope and pass the hand over the sheet, stroking it gently. Replace the electroscope and lift the sheet. The electroscope remains collapsed.

Stroking with the hand
conducts away the charge

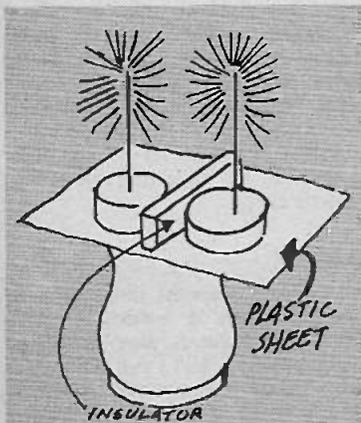


Fig. 1. On removing a charged plastic sheet the tufts remain extended.

Make a second tufted electroscope (it won't take long). Now put the discharged plastic sheet on a tall insulator, such as a vase or china mug, and on it put the two tufted electroscopes, just touching.

Charge another sheet of plastic film and bring it up close to one of the tufts. Both tufts will fly out, just what we would expect! Take the charged sheet away—both tufts collapse. Fine—nothing odd about that. Now try this.

Bring the charged sheet near to one of the tufts again—both fly apart. Now holding the sheet steady, slide between the metal boxes of the electroscopes an insulator, such as a piece of glass or plywood about 50mm wide. Leave it there and remove the charged sheet. The tufts stay up, Fig. 1.

What on earth has happened? Let us assume for the sake of argument that the charged sheet had a negative charge on it. The tufts nearest to it become positively charged.

As long as the two metal boxes were touching, the second tuft also had a positive charge, but when we insert the insulator the second tuft assumed a negative charge. Removing the charged sheet thus left the two tufts of opposite polarity attracting each other and hence unable to collapse.

You can prove that they are opposite polarity by bringing the charged sheet close to each tuft in turn and observing their different behaviour; one repelled by the sheet, one attracted by it, Fig. 2.

We can say then that when a charge is brought close to an insulator a charge of opposite polarity is induced on its surface. This is of vital consequence to electronics, since capacitors depend entirely upon this effect.

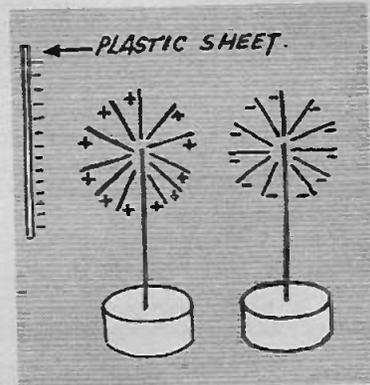


Fig. 2. Bringing a charged plastic sheet up to the two electroscopes shows that the tufts are oppositely charged.

When the charged sheet is lying on the table, an equal and opposite charge is therefore present on the surface of the table! We will return to this point another time, Fig. 3.

As for the third question, dry atmosphere, you can see that if the table and sheet have equal and opposite charges, there is a tendency for the negative electrons to migrate across the gap, thus cancelling out. This tendency is increased in a damp atmosphere. This, too, we will return to another time.

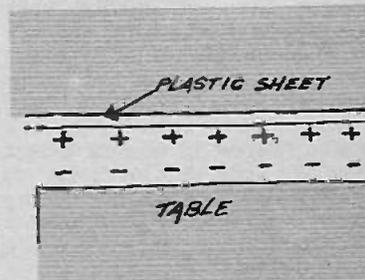
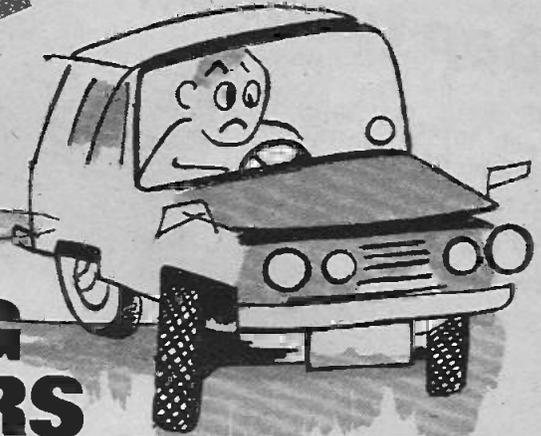


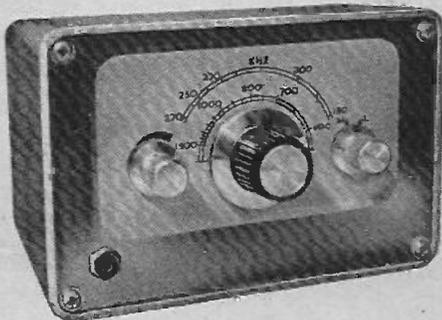
Fig. 3. A charged plastic sheet lying on a table top causes the table to acquire an equal and opposite charge.

NEXT MONTH...



ICE WARNING FOR CARS

Don't get caught out by ice this winter! Build this simple device to give you an audible and/or visual warning when the temperature outside the car falls to freezing point.



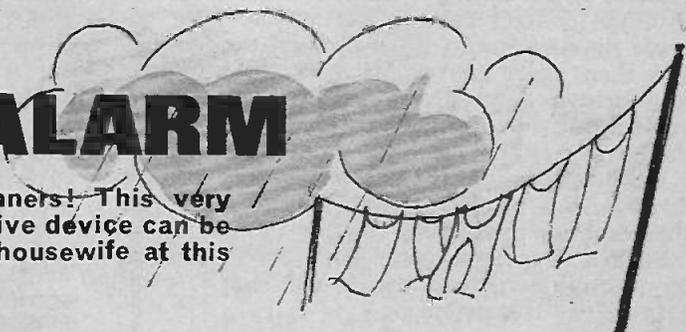
2 Band SUPERHET TUNER...

A m.w. and l.w. tuner that can be used with almost any amplifier. Employing ready-made i.f. transformers this tuner is easy to build but provides good sensitivity and selectivity.



RAIN ALARM

Just right for beginners! This very simple and inexpensive device can be a great help to the housewife at this time of the year.

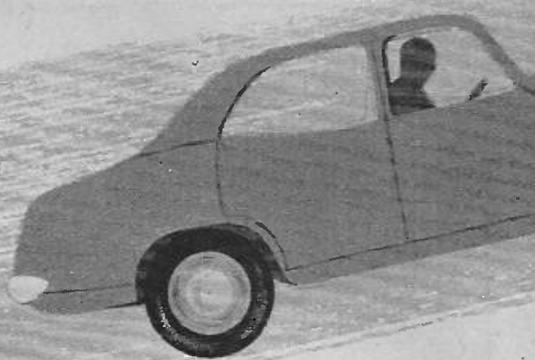


everyday electronics

JANUARY
ISSUE ON
SALE 18
DECEMBER

keep tuned up with...

Great interest in this system has warranted this revised article which embodies details for BOTH 6V and 12V systems.



TRANSISTOR ASSISTED IGNITION

6V VERSION

Eliminates electrical wear of contact breaker points

THE Transistor Assisted Ignition system described in the April issue of EVERYDAY ELECTRONICS can be adapted for use with 6 volt systems without any great difficulty. However, it is first necessary to check the current taken by the coil to ensure that it is not excessive. The current is checked by inserting a current meter capable of measuring 5 amp or more in series with the contact breaker connection. Next remove the distributor cap, switch on the ignition and then short the points with an insulated screwdriver. Any current reading less than 4 amps is satisfactory and you may proceed with the project.

Beware, also, that the unit is designed for cars fitted with a negative earth system only, you should verify this before starting the project.

Such a simple design is not easy to achieve for positive earth cars due to the lack of comparable pnp transistors.

PRINCIPLE

Each revolution of a four cylinder engine requires the points to produce two sparks to fire the engine. The points start to deteriorate after a few hundred miles as a result of producing all these sparks and by the time the car is serviced, at say 6,000 miles, the points may be in a very poor condition. This deterioration affects the timing, reduces the power available at the plugs and can give a noticeable drop in performance.

The simple ignition system described main-

tains performance between services; in fact the points will experience no electrical wear at all. However, the points should be replaced after 24,000 miles to reduce the risk of failure through spring fatigue.

Fitting the unit to a vehicle which already has worn points can produce an immediate improvement. However, this unit should not be confused with the more complicated "capacity discharge-ignition systems" which are designed to improve performance.

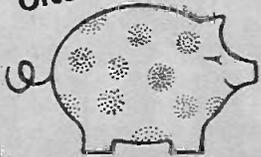
Warning. Although simple, this project should not be attempted as a first project. A high standard of soldering is necessary for the unit to work under the adverse conditions found in a car engine compartment.

THE CIRCUIT

A switch is incorporated into the unit so the normal car circuit can be easily restored in the event of failure, or suspected failure. This feature, together with the circuit design requires

ESTIMATED COST*
OF COMPONENTS
including V.A.T.
£4.50
excluding case

FOR GUIDANCE ONLY



*Based on prices prevailing at time of going to press

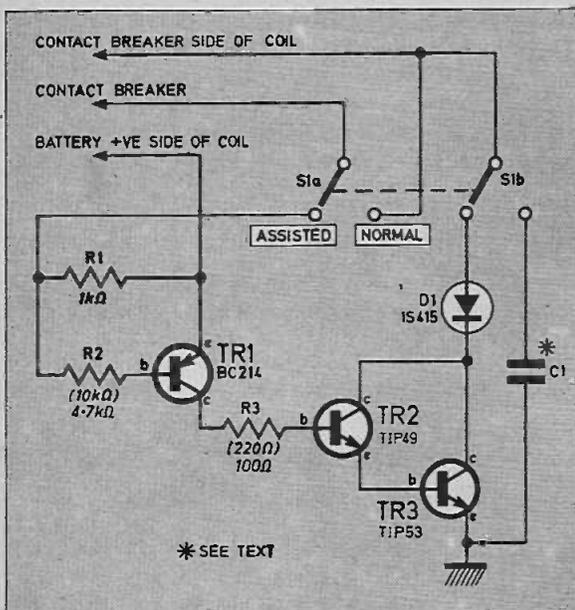


Fig. 1. The complete circuit diagram of the Transistor Assisted Ignition. Values in brackets are for the 12V version.

that the capacitor (sometimes referred to as a condenser) be removed from the distributor and fitted into the unit (see "testing" and "installation" later).

The complete circuit diagram is shown in Fig. 1. The points are connected via switch S1a (in the position shown) and resistor R2 to transistor TR1. When the points are open, TR1 is cut off by R1, fed from the positive battery connection. Each time the points close the base of TR1 is connected to earth through R2 switching it into its conduction state. The current passing through the points is about 7mA (13mA for 12V system), instead of the 3 amp or so normally required.

The current flowing through the collector of TR1 and R3 in turn switches on TR2, which in turn switches on TR3 thereby connecting the coil to earth every time the points close. Thus TR3 takes the place of the points and passes the 3 amps or so required by the coil. Diode D1 is necessary to protect TR2 and TR3 from high voltage spikes generated when the points open.

If S1 is switched to the "normal" position the points are connected directly to the coil. In this position the capacitor is connected across the points in the conventional manner, except that the capacitor is housed in the diecast case instead of the distributor.

CONSTRUCTION

The prototype unit was housed in a diecast aluminium case measuring 115×90×50mm. All the components are mounted on the lid of the case as shown in Fig. 2. The exact positioning of the components is not critical and can be estimated from the full-size photograph of Fig.

2. Begin construction by drilling all the components' fixing holes in the lid.

The wire attached to the capacitor is taken to an insulated terminal and screwed into position. Make the insulated terminal by bolting a 4BA nylon screw and nut through the lid and then screwing a 25mm 4BA tapped metal spacer onto the nylon screw thread projecting above the nylon nut.

The diode and power transistors must be mounted very carefully on their mica washers; insulating bushes must be used for fixing TR2 and TR3; check after fitting that they are properly insulated from metal lid. If in doubt use two mica washers on the transistors, or mica washers from larger power transistors.

All wiring must be mechanically fixed to each solder point and soldered to a high standard. Under the adverse operating conditions which this unit has to work poor soldering will very quickly give rise to failure.

The capacitor C1 must be removed from the distributor and mounted without modification to its leads, the capacitor can then easily be returned to the distributor if required. All distributor capacitors are bolted to earth with a metal clip. The lid must be drilled to suit the particular capacitor fitted to the car.

TESTING

No car owner will willingly fit an untested unit to his car, nor allow the capacitor to be removed from the distributor. Fortunately the unit can easily be tested without removing the capacitor.

First remove the centre lead from the distributor and fix it with adhesive tape so that the

Components

Resistors

- R1 1k Ω
- R2 4.7k Ω (10k Ω , 12V)
- R3 100 Ω (220 Ω , 12V)
- All $\frac{1}{4}$ watt $\pm 5\%$ metal oxide

Semiconductors

- TR1 BC214 silicon *npn*
- TR2 TIP49, TIP50, or TIP53 silicon *npn*
- TR3 TIP53 silicon *npn*
- D1 1S415 or similar 4 amp 450V stud cathode type

Miscellaneous

- S1 double-pole double-throw 250V 3A with insulated toggle. Diecast aluminium box, 115 x 90 x 50mm; 5 way tag strip; mica washers and bushes to suit TR2 and TR3; insulating washer/bush to suit D1; 25mm long 4BA tapped metal spacer; 4BA nylon nut and bolt; 6BA nuts, bolts and washers (6 off each); 6BA 6mm long spacers (2 off); rubber grommet; solder tags, 2BA (2 off) 4BA (1 off).

SEE
**SHOP
TALK**

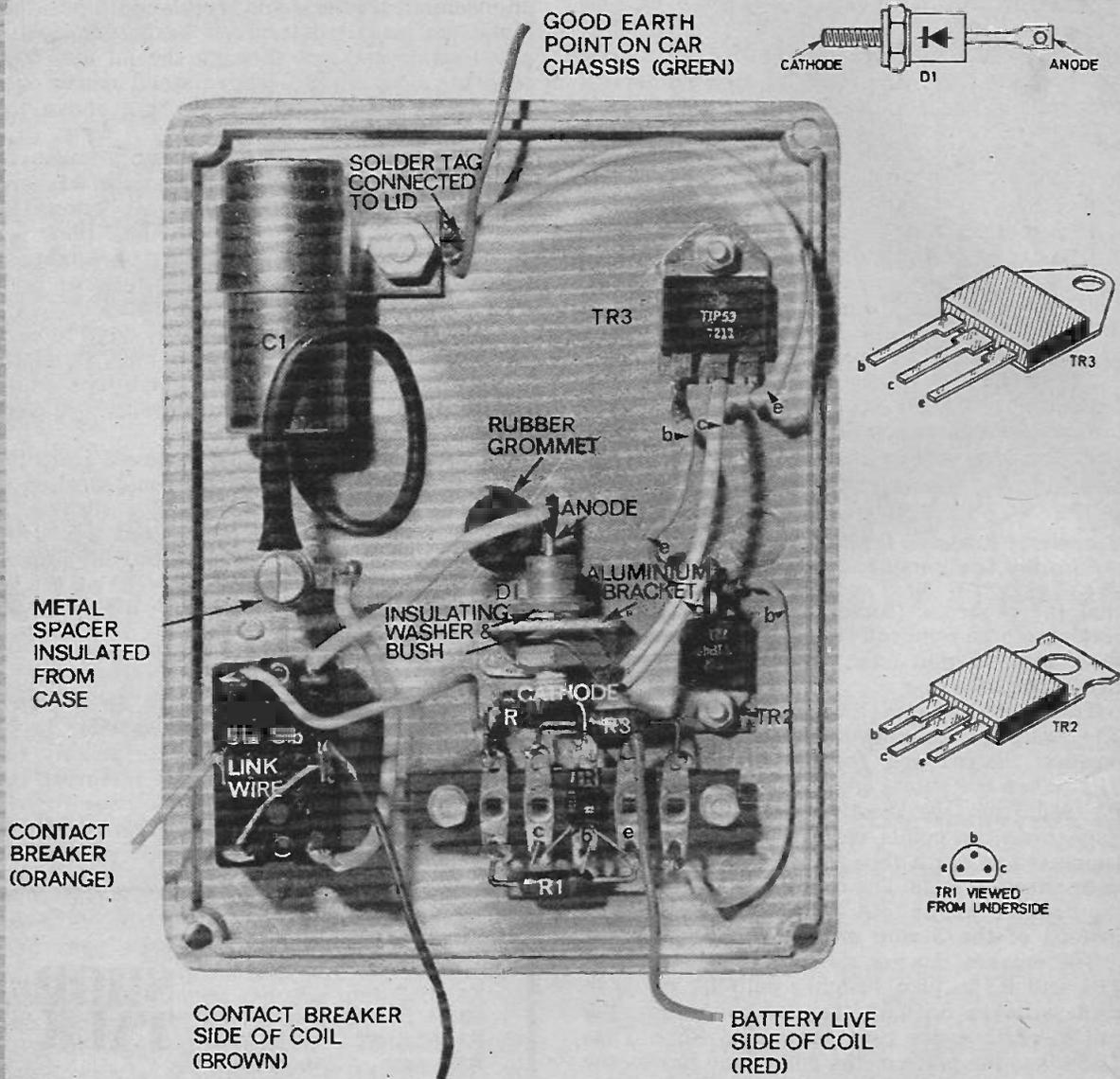


Fig. 2 (above). Position and wiring up details of the components on the lid of the diecast box. Wires leave the case through the grommet.

TRANSISTOR ASSISTED IGNITION



Photograph of the completed unit.

metal end is about 6mm from some earthed point on the car. This will enable you to see when a spark is generated.

Secondly disconnect from the ignition coil, the wire leading to the contact breaker. This connection may be labelled CB on some coils. Twist the brown lead from the ignition unit onto this connection. The red lead is twisted onto the other side of the coil without removing the existing wiring. Thirdly, connect the green wire to an earth point such as under the mounting clip of the coil. The system is now ready to test.

Switch the unit to "assisted" and switch on the car ignition, then dab the orange wire on and off an earthed point. Each time the orange wire breaks contact from earth it should make a spark leap from the centre lead of the coil to its nearest earth point 6mm away.

The "normal" switch position may be tested the same way, but don't touch the bare end of the orange wire. Use an insulated screwdriver to push the wire firmly against the earth point for this test. When this test is complete turn the ignition off and reconnect the two leads so that the car is ready for use again.

INSTALLATION

The unit is installed in a cool part of the engine compartment not forgetting to mount it

on some form of rubber shock absorbers. It is very important to remove the capacitor (condenser) from the distributor and refit it into the unit immediately prior to installation.

Due to the inherent voltage drop of about 1.2 volts across D1 and TR3 the system may not be able to provide a good enough spark for cold starting or for starting with a low battery voltage. This voltage drop will be no more than that experienced with a normal system operating with worn points. (The points should be cleaned, or a new set installed, and adjusted before installation.)

To overcome the starting difficulty simply switch to the normal position during very bad weather or when the battery voltage is low. Because the points will have been saved from electrical wear by the ignition system they will be able to provide a much better spark than would be the case had the normal system been in continual use—thus in an indirect way the system can help with cold weather starting. It is not advisable to switch over to the assisted position with the engine running.

There is no doubt that with this system changing the points and retiming can be carried out at very much greater intervals than would otherwise be the case, thus saving the cost of the unit in a relatively short period. □

EVERYDAY ELECTRONICS "MULTIMETER" COMPETITION

Winners

First: (Chinaglia Dino multimeter) Mr. Frederick J. Pavey, Petersfield, Hants

Second: (Chinaglia Minor multimeter) Mr. David E. Young, Ashford, Kent

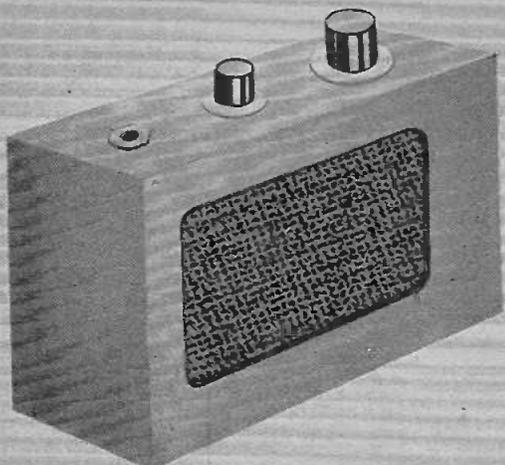
Third: (Chinaglia Minor multimeter) Mr. K. Reed, Bracknell, Berks.

Runners-up: (each wins a Chinaglia Cito pocket multimeter) Mr. W. Barry, East Boldon, Co. Durham; Mr. I. Brownlee, Stranraer; Mr. M. Coles, Clynder, Dunbartonshire; Mr. I. Juliff, Livingston, West Lothian; Mr. P. Kimmance, Horton, Bristol; Mr. J. Malham, Selby, Yorks; Mr. C. Mannix, Liverpool; Mr. J. Noonan, Stoke Poges, Bucks; Mr. N. Patrick, Orpington, Kent; Mr. R. Thomson, Salford, Lancs.



Left: Mr. Frederick J. Pavey (right) being presented with the Dino multimeter (1st prize) by the editor, Mr. F. E. Bennett (left) in the presence of sponsor Mr. Alberto Coniglio (Managing Director, Chinaglia U.K.). Right: runner-up, Mr. David E. Young receives his Minor multimeter.





m.w. REFLEX RECEIVER

By R.A. PENFOLD

THIS article describes a five transistor m.w. receiver, which for simplicity uses a t.r.f. circuit. It is not of the pocket portable type, and measures approximately 200×150×90mm., which allows a well spaced layout to be used, and this greatly simplifies construction.

The internal 150×100mm loudspeaker can be driven by a maximum output power of around 250mW r.m.s. A home made plywood case with an aluminium front panel is used.

The set does not have a performance equal to that of a more complicated superhetrodyne circuit, but stations, Radio 1, 3, and 4, plus a few continental stations can be received at full volume on the prototype receiver. A class B output stage is used, and this gives a reasonable battery life (type PP3) at normal listening levels.

REFLEX CIRCUIT

The circuit diagram of the receiver is shown in Fig. 1. This consists of a reflex stage, TR1, followed by a conventional four transistor a.f. amplifier using a complementary output stage.

A reflex amplifier is one which gives amplification at r.f., and when the r.f. signal has been detected, then amplifies the resultant audio signal.

Thus a single transistor provides two stages of gain and Fig. 2 shows the effective circuitry around TR1 during r.f. amplification and detection (Fig. 2a), and during a.f. amplification (Fig. 2b).

Referring to Figs. 1 and 2, L1 is the tuned winding on the ferrite aerial, and C2 is the tuning capacitor. The high impedance signals across L1 are matched into the low input impedance of TR1 by L2. Capacitor C4 provides d.c. blocking.

Resistor R1 is the biasing resistor for TR1, and L3 is its collector load. Components R2 and C3 form an r.f. decoupling network, and prevent the r.f. signal from entering other parts of the circuit via the supply lines.

Coils L3 and L4 form a wideband transformer, and unlike L1 and L2 which only operate over a narrow range of frequencies at one time, these operate satisfactorily over the entire m.w. band.

The signal across L3 is therefore induced into L4, and from here fed via C5 to an ordinary diode detector, D1. Capacitor C4 smoothes the positive r.f. half cycles remaining after detection, leaving an insignificant d.c. bias, and the required audio signal.

In Fig. 2 there are two capacitors marked "C4", but if reference is made to Fig. 1 it will be seen that this is in fact one component, and that it is used twice. It will also be seen that the audio signal across C4 is coupled into the base circuit of TR1 via L2.

At audio frequencies L3 has a negligible reactance, and appears as a virtual short circuit, and can be ignored. Resistor R1 still operates as the biasing resistor, and R2 now becomes the collector load for TR1.

The reactance of C6 is too high at audio frequencies to have any noticeable effect on the circuit, and can also be ignored. This leaves the simple a.f. amplifier circuit of Fig. 2b. The amplified audio signal appears across R2; and is coupled via C7 to the volume control, VR1.

REGENERATION

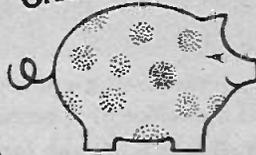
The two main disadvantages of this type of circuit are that the r.f. amplification is fairly low, there being only one stage of this, and the selectivity (the ability of the receiver to reject signals in close proximity to the desired one) is poor as there is only one tuned circuit. Both these can be improved by adding regeneration, and this is the purpose of C3.

FOR
GUIDANCE
ONLY

ESTIMATED COST*
OF COMPONENTS
including V.A.T.

£4.60

excluding case



*Based on prices prevailing at
time of going to press

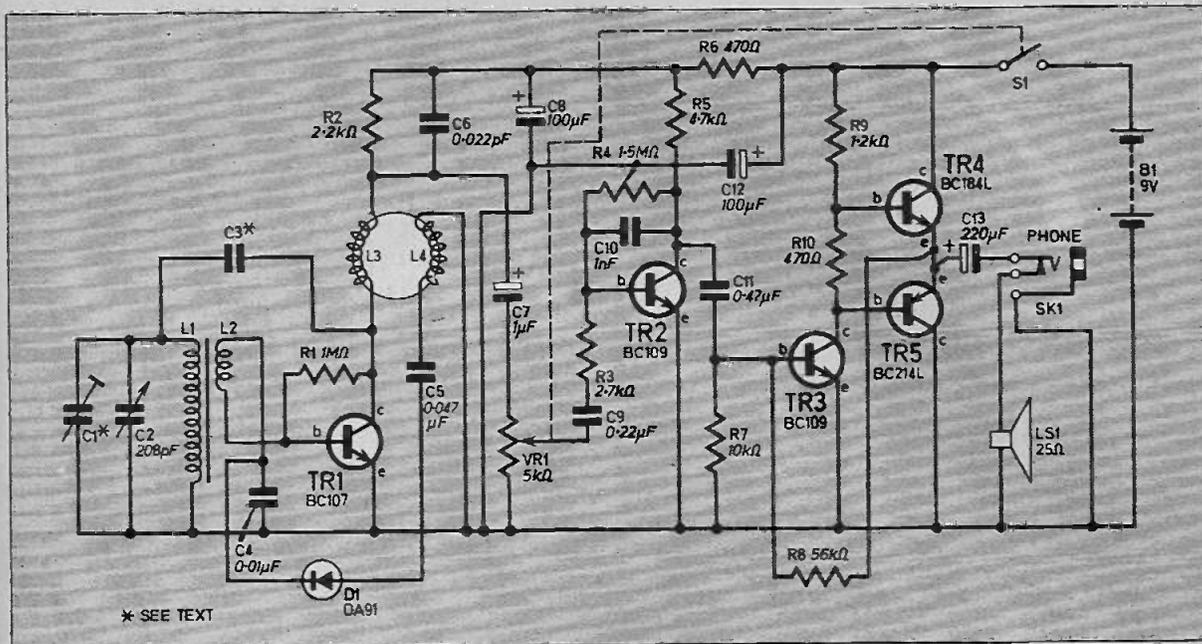


Fig. 1. The complete circuit diagram of the receiver.

This merely couples some of the amplified r.f. at TR1 collector back to the tuned circuit, where it is sent back through the circuit for amplification for a second time. This differs from reflexing in that the signal has not been detected, and is still at r.f.

There is a limit to the amount of regeneration that can be applied, and if this is exceeded, TR1 will oscillate, and the receiver will be unable to resolve signals properly. Capacitor C3 has an extremely low value, and merely consists of two pieces of wire in close proximity to one another.

AUDIO AMPLIFIER

The amplifier is quite conventional, and has a high gain common emitter input stage, TR2, a common emitter driver stage, TR3, and a complementary emitter follower output stage, TR4 and TR5.

A break contact on the earphone socket disconnects one of the speaker leads when the earphone plug is inserted. Any type of earphone can be used, although ideally a magnetic phone of about 60 to 250 ohms impedance should be used.

WIDEBAND TRANSFORMER

There is no ready made component suitable for use as the wideband transformer, and this is home made using an FX1593 ferrite ring, and two lengths of 38 s.w.g. enamelled copper wire. Details of this are shown in Fig. 3.

There is no need to keep the two windings particularly neat, but an attempt should be made to keep the turns of each coil running in the same general direction along the core.

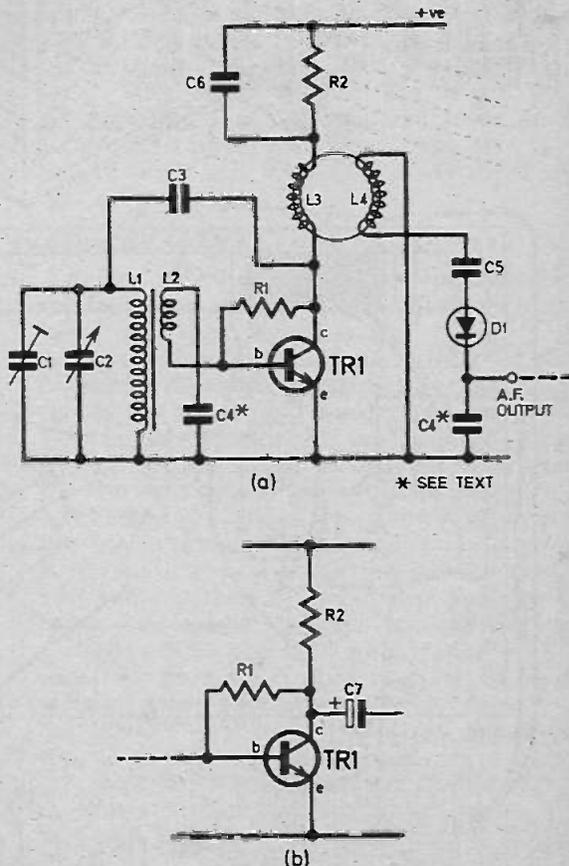


Fig. 2. The same circuit being used to amplify r.f. and then detected r.f. (a.f. signals).

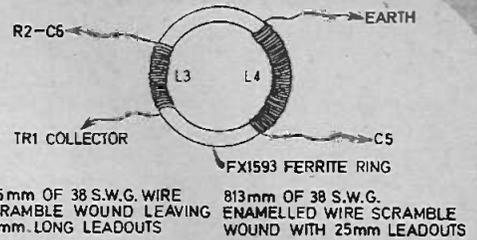
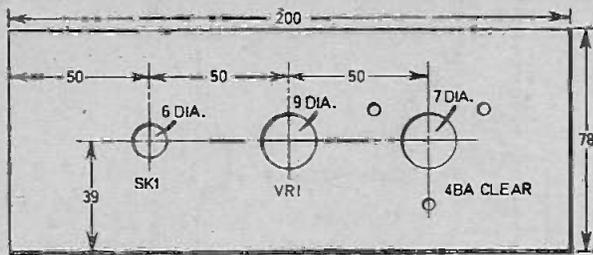


Fig. 3. Winding details of the wideband transformer.

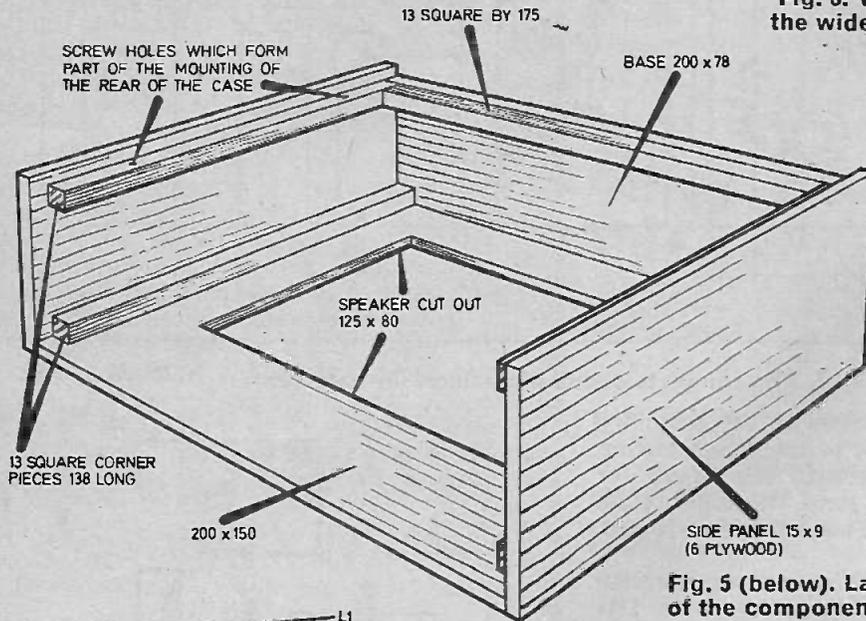
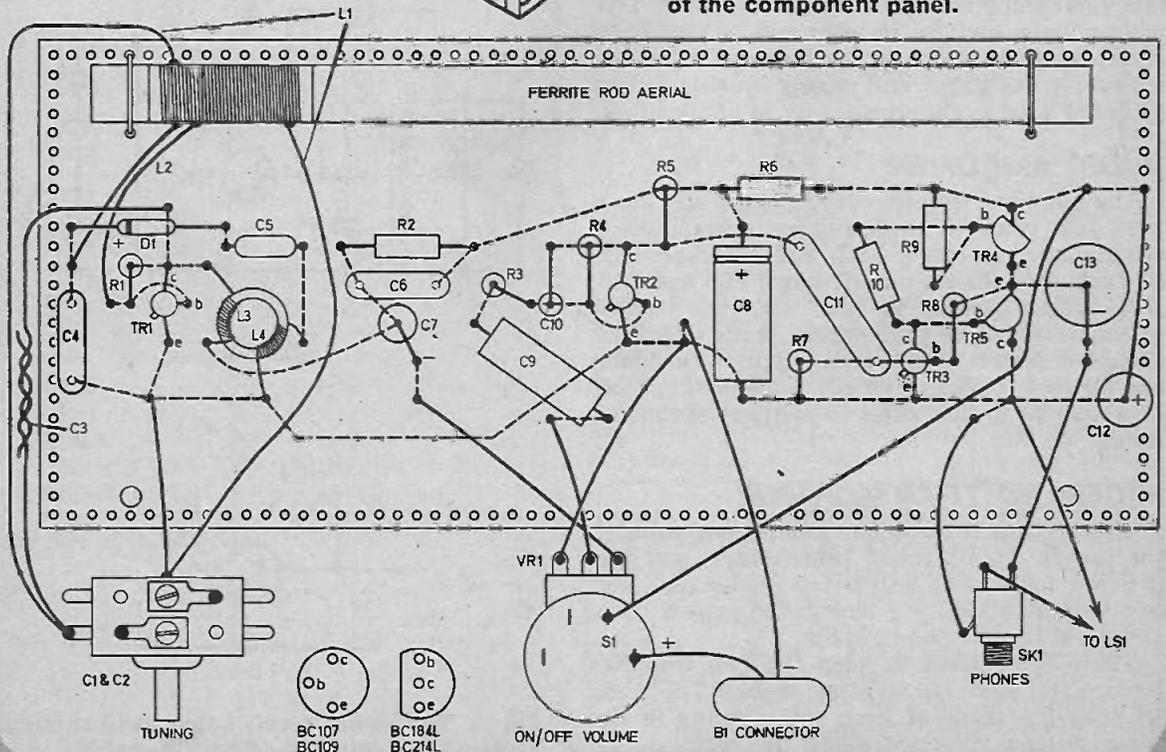


Fig. 4. Details of the prototype case and front panel.

Fig. 5 (below). Layout and wiring details of the component panel.



Components....

Resistors

R1 1M Ω	R6 470 Ω
R2 2.2k Ω	R7 10k Ω
R3 2.7k Ω	R8 56k Ω
R4 1.5M Ω	R9 1.2k Ω
R5 4.7k Ω	R10 470 Ω

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

Capacitors

C1	Trimmer section of C2
C2	208pF (front part of 208-176 Jackson 00, with trimmers)
C3	See text
C4	0.01 μ F
C5	0.047 μ F
C6	0.022 μ F
C7	1 μ F elect. 16V
C8	100 μ F elect. 10V
C9	0.22 μ F Mullard C280
C10	1nF polystyrene
C11	0.47 μ F Mullard C280
C12	100 μ F elect. 10V
C13	220 μ F elect. 10V

SEE
**SHOP
TALK**

Semiconductors

D1	OA91
TR1	BC107 silicon npn
TR2, 3	BC109 silicon npn (2 off)
TR4	BC184L silicon npn
TR5	BC214L silicon pnp

Miscellaneous

VR1	5k Ω log. pot with switch (S1)
L1/L2	Denco MW/5FR ferrite aerial
L3/4	FX1593 ferrite ring and 38 s.w.g. enamelled copper wire
LS1	25 ohm loudspeaker (150 x 100mm size used in prototype)
B1	9V PP3 battery and clips
SK1	3.5mm jack socket with switch and ear-phone with plug to suit, control knobs (2 off), 0.1 inch matrix component board 150 x 65mm, materials or ready made plastic case, connecting wire, 6BA fixings.

THE CASE

The case is home made from 6mm plywood and 12mm square timber, Fig. 4 shows constructional details of this, and also details of the aluminium front panel. The various wooden parts of the case can be either pinned or glued together (or both).

It is advisable to make the speaker cut-out before assembly. It can be made using a fret saw. A piece of speaker fret is glued behind this, and then the speaker glued to the fret.

The front panel is glued to the four corner pieces. The back of the case is made from 6mm ply, and is drilled so that four wood screws can pass through this, and into the four corner pieces, so holding the back in place. The case is finished by being covered with a self adhesive plastics material (Contact, Fablon, etc).

A mounting bracket is required for the com-

ponent panel, and this is made from 18 s.w.g. aluminium. This fits behind the front panel, and is held in place by C2, VR1, and SK1 when these are mounted on the front panel. For the time being these are mounted on the bracket. The component panel is mounted on the bracket by two 6mm long 6BA bolts.

COMPONENT PANEL

A diagram showing the component side of the component panel, and all external connections is given in Fig. 5. The ferrite rod is tied to the board by two tethers made from thin p.v.c. sleeving. The coil former is slid along the rod to one end, as shown in the diagram. The coil assembly L3/L4 can be secured to the panel in the same way as the ferrite rod.

The other components can then be mounted, and their leadouts bent over at right angles on the reverse side of the panel. These are then soldered together, as shown in the diagram, the underside wiring is shown dotted. Where leads pass close to each other, and there is a danger of a short circuit, one of the leads should be insulated with p.v.c. sleeving.

At any points where interconnecting leads are too short to reach one another, extension leads made from thin tinned copper wire (about 22 s.w.g.) are used to join them.

Connections to SK1, VR1, etc. can then be made. The leads to LS1 are about 300 to 450mm long. The two insulated leads forming C3 are each about 8 to 12mm long, and preferably of single core wire. C1 is ready wired across C2.

ADJUSTMENTS

Before mounting the component assembly in the case, the unit should be checked for mistakes, and then turned on.

Initially, the two wires comprising C3 should be kept well apart. Rotating the spindle of C1 should enable several stations to be received. The two wires forming C3 should now be brought together. If this causes an increase in sensitivity, the two lead outs of L2 should be swapped.

It should be checked that the frequency coverage is correct. If this is found to be incorrect, adjusting C1 should enable this to be amended. The unit can then be mounted in the case. The battery is wedged between two corner pieces.

Capacitor C3 can then be adjusted. The two wires are brought as close together as possible without either quality seriously breaking up, or the circuit oscillating (which is heard as a whistle as the receiver is tuned over a station).

It may be possible to twist the wires together as shown in the diagram, but in many cases they will only be able to be brought to within 25mm or so of each other. They can in this circumstance, be taped to the side of the case to ensure that they are not accidentally moved once correctly adjusted. □

New products and component buying for constructional projects

SHOP TALK

By Mike Kenward

WHEN is a toy not a toy? That is a question one could ask about the Fischertechnik range of construction kits. We recently received an invitation to the launch of their range in this country (the product is of German origin) and wondered quite why they thought an "electronic" magazine would be interested. It turned out that they produce electro-mechanical and electronic kits that can be used to control and drive the models made from the basic kits. The electronics are supplied in module form with sensors—light sensitive, heat sensitive etc.—supplied as plug-in parts. A modular relay is also provided to drive the model motors or lights.

The basic construction set (suitable for age 6 upwards) costs £12.05 and to this can be added a motor kit £6.95 and an elec-

tronics kit £14.55, however, the range and versatility are vast.

The kits are made of moulded nylon (non-toxic) are guaranteed against breakage—the electronic parts are also said to be protected against damage from wrong connection. They should be available from your local toy shop by the time you read this.

Ultrasonic Remote Controller

The receiver for the *Ultrasonic Remote Controller* requires one or two parts that are not generally available—the TAA 930B integrated circuit and the ultrasonic transducer.

Phoenix Electronics Ltd, can supply the i.c.—they do advertise in our pages—the i.c. costs £1.23 including VAT.

The transducer costs £3.75 and it would be a good idea to get the "R" and "T" versions in one go (receiver and transmitter) since the "T" will be required for the construction detailed next month. Total cost for the two including p. and p. and VAT is £7.00. They come from Hall Electronics, 48 Avondale Rd., Leyton, E17.

Other components in the receiver should not be difficult to get—almost any metal case could be used to house the unit.

M.W. Reflex Receiver

Once again just a couple of unusual components are required for the *M.W. Reflex Receiver*. The ferrite ring is available from Henry's Radio and the ferrite aerial from Denco for 66p plus VAT, plus postage—a total of

85p. Denco are at 355/9 Old Road, Clacton-on-Sea, Essex, CO15 3RH.

The case for the receiver can be home made or the complete unit could be housed in one of the plastic cases that are generally available.

The River

None of the components specified for *The River* should be difficult to get hold of. The 75 or 80 ohm speaker may need looking for, but most of the larger supplies should be able to provide it for you.

The tagboard used to mount the components is becoming rather outdated but does provide a simple and satisfactory base for this unit.

Ignition System

As regular readers of this page will know after the publication of the original *Transistor Assisted Ignition* system A. Marshall ran out of the TIP49 transistors and have still not been able to replenish their stocks. This means that two TIP53 transistors have to be used instead—at an increase in cost.

Once Marshalls receive some more 49's they will resume supply at the lower price (£2.85); until then, the cost of the semiconductors (diode and all transistors) from them is £3.80 including postage and packing and VAT. Since it is very difficult to say quite when supplies from the manufacturers will resume we suggest readers send the larger amount—those who send off in a few months time may get a refund!

JACK PLUG & FAMILY...





Now there's Doram, you need never wait for electronic components.

7-day service.

Buy the new Doram catalogue and you could have your components within 7 days of our receipt of your order.

If you don't, you'll have your money back and no questions asked.

What you won't get is a tedious wait. Which goes on. And on. And on. And on.

You know just where you are with Doram.

Millions of components.

Doram is a brand-new deal for serious amateurs. It's a complete door-to-door components service operated by mail order.

You buy the Doram catalogue for 25p (that's a yearly reference book for the price of a pint!) and then you order from it.

We're big enough to offer you stocks of millions of components on over 4,000 product lines.

And so confident of our service that if we can't supply the part you want within 7 days of receiving your order, we'll give you your money back. Immediately.

No-quibble guarantee.

It's just about impossible to buy a defective part from us. Because our checking is so pains-taking.

But even if the unthinkable does happen—and you're unlucky—then we'll still make you happy quickly.

Because we offer a no-quibble replacement part service.

And our guarantee is guaranteed by the fact that we belong to the biggest electronics distribution Group in Britain.

All branded goods.

All goods supplied are branded goods. Made by big-name manufacturers like RS, Mullard, SGS-ATES, Ferranti, Siemens etc.

Doram brings the amateur the sort of service only professionals have enjoyed before.

So don't delay. Use the coupon. Send today for your first Doram catalogue. It can make your life a whole lot easier.

For 25p that can't be bad, can it?

I ENCLOSE 25p.* PLEASE SEND ME THE NEW DORAM CATALOGUE.

Name _____

Address _____

Doram Electronics Limited,
PO Box TR8,
Wellington Road Industrial Estate,
Wellington Bridge, Leeds LS12 2UF.

*This will be refunded on orders of £25 (less VAT) or more received by us before March 31st, 1975.

DORAM
EE 1/2174

BI-PRE-PAK

SUPPLIERS OF SEMI-CONDUCTORS TO THE WORLD



Telephone Corner

COMPLETE TELEPHONES
Normal Household Type

EX. G.P.O. **only 99p** P & P 45p each

TELEPHONE DIALS

Standard Post Office type, Guaranteed in working order.
only 25p POST & PACKING 16p

Tested and Guaranteed Paks



- B79 4 IN4007 Sil. Rec. diodes, 1,000 PIV lamp plastic 50p
- B81 10 Reed Switches, 1" long, 1/4" dia. High Speed P.O. type 50p
- H35 100 Mixed Diodes, Germ. Gold bonded, etc. Marked and Unmarked. 50p
- H38 30 Short lead Transistors, NPN Silicon Planar types 50p
- H36 6 Integrated Circuits, 4 Gates BMC 962, 2 Flip Flops BMC 945 50p
- H41 2 Sil Power transistors comp pair BD131/132 50p
- H63 4 2N3055 type NPN Sil. power transistors. Below spec. devices 50p
- H64 4 3B19 N Channel FETs 2N3819 in plastic case 50p



Unmarked Untested Paks

- B1 50 Germanium Transistors PNP, AF and RF 50p
- B66 150 Germanium Diodes Min. glass type 50p
- B83 200 Transistors, manufacturers rejects, AF, RF, Sil. and Germanium 50p
- B84 100 Silicon Diodes DO-7 glass equiv. to OA200, OA202 50p
- B88 100 Sil. Diodes sub. min. IN914 and IN918 types 50p
- H34 15 Power Transistors, PNP, Germ. NPN Silicon TO-3 Can. 50p
- H67 10 3B19N Channel FETs plastic case type 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.
£1.00p each

Electronic Transistor Ignition £6.00

Complete kit p. & p. 11p
Now in kit form, we offer this "up-to-the-minute" electronic ignition system. Simple to make, full instructions supplied with these outstanding features. Transistor and conventional switchability, burglar proof lock-up and automatic alarm, negative and positive compatibility.

Extension Telephones

Ideal for childrens toys **70p each** P & P. 25p.

New X Hatch

Our new vastly improved Mark Two Cross Hatch Generator is now available
Essential for alignment of colour guns on all colour T.V. receivers. Featuring plug in IC's and a more sensitive sync. pick-up circuit. The case is virtually unbreakable—ideal for the engineer's toolbox—only measures 3" x 5 1/2" x 3".
Ready built unit **£9.95** Complete kit **£7.95**

(Includes p. & p. but no batteries)



LM380 AUDIO IC

We have just received a large consignment of LM380 IC's. These are specially selected to a higher grade and are marked with the number SLS0745.
This fantastic little 3watt audio IC only requires two capacitors and two potentiometers to make an amplifier with volume and tone control. The quality is good and has to be heard to be believed.

Our special price **£1.00 ea** complete with data and projects book

Over 1,000,000 Transistors in stock

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.

Our very popular 4p transistors

TYPE "A" PNP Silicon alloy, TO-5 can
TYPE "B" PNP Silicon, plastic encapsulation
TYPE "E" PNP Germanium AF or RF
TYPE "F" NPN Silicon plastic encapsulation
TYPE "G" NPN Silicon similar ZTX 300 range

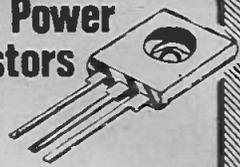
8 RELAYS FOR various types £1.00p p & p 27p

UHF TV Tuner Units

Brand new by a famous manufacturer

Data supplied **£2.50**

Plastic Power Transistors



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.		HFE Min 15.	
40 Watt	1-12	13-25	26-50
90 Watt	24p	18p	16p
		24p	20p
Range 2. VCE. Min. 40.		HFE Min 40	
40 Watt	1-12	13-25	26-50
90 Watt	30p	28p	28p
		35p	33p

Please state NPN or PNP on order.

High Speed Magnetic Counters 4 digit (non-reset) 24V or 48V 4 x 1 x 1 in 33p p & p 50.

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 12p Wall Chart 18p

LOW COST DUEL IN LINE I.C. SOCKETS
14 pin type at 15p each Now new low profile 16 pin type at 17p each type

BOOKS

We have a large selection of Reference and Technical Books in stock. Details are in our latest Catalogue. Send for it TODAY, using the coupon below. N.B. Books are sold of V.A.T.
Send for lists of publications

Our famous P1 Pak is still leading in value

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.1. only **50p**

Please send me the FREE Bi-Pre-Pak Catalogue I enclose large SAE with 5p stamp

NAME

ADDRESS

Please add current VAT rate
MINIMUM ORDER 50p. CASH WITH ORDER PLEASE. Add 15p post and packing per order
OVERSEAS ADD EXTRA FOR POSTAGE
BUY THESE GOODS WITH ACCESS

BI-PRE-PAK LTD

Dept. D. 222-224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX.
TELEPHONE: SOUTHEND (0702) 46344.

The Extra-ordinary Experiments of Professor Ernest Eversure

by Anthony John Bassett



Professor Ernest Eversure, or the Prof. as his friends call him, has been experimenting in electronics for more years than anyone can remember and we thought that you might like to hear of, and perhaps repeat, some of his extraordinary experiments. Anthony J. Bassett will be recounting some of the experiments every month so why not follow the Prof's work and learn along with young Bob, his friend.

AS THE ROBOT drew even nearer to him, the startled Professor saw that the unusual movements caused by Bob's oscillator seemed to be making the robot perform a strange dance. Despite this, the robot seemed to be keeping to its original instructions. It seemed to dance towards the Prof. in time with Bob's tune. It gently placed the ohm-meter on the work bench, then danced off and disappeared amongst the equipment at the other end of the room.

The Prof. interrupted Bob's musical attempts, which were now taking the form of a series of gently rising and falling notes, rather like the electronic music sometimes heard from the soundtrack of a science-fiction fantasy film, and pointed out to him that the ohm-meter had now arrived.

What the robot had brought was actually a multimeter but Bob picked it up and switched it to a resistance range. He soon found, by applying the test probes of the meter to various pencils, that each one did in fact have a different resistance (as deduced from his experiments described

in the last issue) and that by sliding the probes to different distances apart along the pencil line on his piece of Paxolin, different resistance readings appeared on the meter scale.

Meanwhile, the Prof. had prepared a few more experimental resistors similar to the ones described earlier. He had painted graphite paste around the solder tags, but had not yet put a carbon conducting track across from one tag to the other.

"Now," said the Prof., "We can use these to produce a number of different values of carbon resistor."

"Can I do some?" asked Bob. The Prof. gave some of the partly made resistors to Bob and together they began to make a variety of resistors.

Bob painted resistors with wide tracks between the tags, medium tracks, and narrow tracks down to about 1mm. Some of the tracks were made up of several layers of mixture and some consisted of only one thin layer. The Prof. had meanwhile made up another mixture of graphite and quick-drying varnish using more graphite so

that the mixture was a thick paste which could be spread like butter. He spread a thick layer of this from one tag to the other about 3mm wide by 3mm deep on some resistors. Bob painted a thin zig-zag line from one tag to another.

After a break for lunch the pair returned to the now dry resistors and Bob began using the multimeter to measure the resistance values of the various resistors they had made.

The resistors covered a really wide range of values. The lowest value was the one with the thickest, deepest track and this measured 12 ohms. The highest value was the one with the thin zig-zag track and this measured about four megohms. Between these were resistors of a variety of values and Bob knew immediately that it should be possible to make any value of resistor from a few ohms up to a few megohms, quite easily.

"Suppose I wanted to make a 15 ohm resistor, Prof?" asked Bob. "Could I alter the 12 ohm resistor sufficiently?"

"Yes," said the Prof. "Just use a craft knife to scrape off some of the mixture and the value will rise."

Bob connected the meter to the 12 ohm resistor and checked the resistance reading. He left the meter leads connected while carefully scraping away thin layers of

graphite mixture. As the mixture was removed, the meter reading gradually changed... 12 ohms... 13 ohms... 14 ohms... 15 ohms... 15.5 ohms... "Whoops! I've taken too much off!" said Bob, looking wryly at the meter reading. The Prof. picked up a very soft lead pencil and carefully rubbed the surface of the resistor, using very light pressure. Gradually, the meter reading crept back down to 15 ohms.

"Now, let's try some high value resistors. We should be able to trim the values of all these resistors to our preferred values," the Prof. stated. He changed the range on the multimeter and connected it to the four megohm resistor. Bob saw that the meter needle moved to the same reading as previously. Using a typist's ink eraser, the Prof. very carefully rubbed the fine carbon track, using very light pressure. The meter reading altered slowly as he did so, until a reading of five megohms was obtained.

"Prof.," said Bob, "The carbon line on that four megohm resistor is very thin and while you were altering it to five megohms suppose you rubbed a little too hard and broke the line?"

"If I broke the line," replied the Prof., "It would break the electrical connection so that no current would flow through the resistor. The meter would then read open-circuit. Let me demonstrate." The Prof. rubbed the line with the eraser and as he did so, the meter needle moved even higher until at one point the carbon track was severed and the meter swung to read open-circuit.

"Now," said the Prof. "We can repair the break in the carbon track quite easily by rubbing it with a hard pencil, or by using more graphite mixture." He selected a 8H pencil and rubbed it carefully across the track at the point of the break. The meter needle began to move and gradually crept back to five megohms.

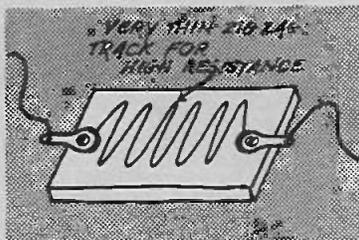
"If we wanted a lower value resistor, say one megohm, just by continuing to rub with the pencil, the value will become lower." The Prof. demonstrated by continuing to rub with the pencil. The meter reading went back to four then lower, three, two, one megohm. "To go much lower, we would have to use a much softer pencil," observed the Prof. He used the eraser to bring the resistor up

once again to five megohms.

"It all looks so simple, Prof.," remarked Bob. "But I'm sure I would not find it so easy to alter such fine lines to the accuracy you have just demonstrated!"

"The higher the value of the resistor you are making and the finer the carbon track which you must produce, the more difficult this becomes," agreed the Prof. "But if you start off by making resistors of a few kilohms, rather than a few megohms, it is much easier to do."

"I see. So if I practice first with some of these other resistors

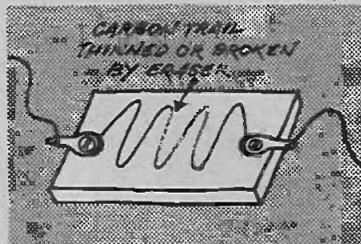


One of the Prof's experimental resistors. This one uses a zig-zag track to obtain high resistance

with the wider tracks, I could tackle more difficult ones later."

"Now that we can make resistors of almost any value," said Bob, "we should be able to connect a few of them together to make a simple note selector for my musical note generator. Something similar to a keyboard!"

"Yes," agreed the Prof. I will show you how to build a note selector, using a number of resis-



The value of the resistor can be raised by rubbing away the track

tors which we can make and connect together on a single piece of printed circuit board or Paxolin. It will enable you to use the oscillator to produce melodies or to produce musical notes which can be tape-recorded to make some electronic sound effects!"

At this moment an amazing sound effect became apparent in the laboratory. An electronic tone rising and falling like a siren.

"Oh, no!" wailed Bob. "I know that sound. It is the alarm signal for your latest experiment. It's out of control and could be dangerous. We cannot go near it and if we don't stop it soon it could synchronise the brain wave patterns of everyone nearby. What can we do, Prof.? "Think of something quickly!"

To Bob's amazement, the Prof. seemed impervious to the blaring alarm signal and completely unaware of the obvious danger. Could it be that the experiment had already begun to affect his brain wave patterns?

Continued next month!

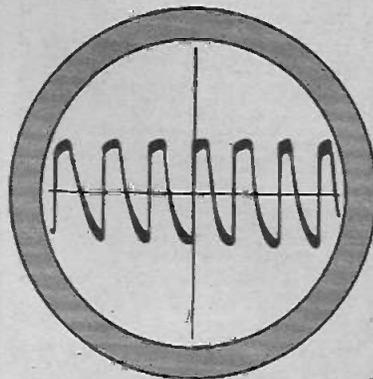
Oh, no! wailed Bob. I know that sound. It is the alarm signal for your latest experiment."



look! electronics really mastered

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

no previous knowledge
no unnecessary theory
no "maths"



RAPY

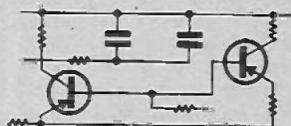
BUILD, SEE AND LEARN

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**, Dept. EEL 114, P.O. Box 156, JERSEY. Please send your free brochure, without obligation, to:

we do not employ representatives

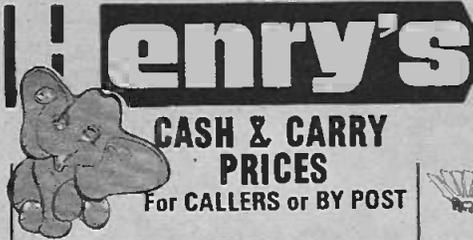
NAME

BLOCK CAPS

ADDRESS

PLEASE

special free gift also to all our students



TRANSISTORS, VALVES AND SEMI-CONDUCTOR DEVICES · ANY QUANTITIES
UK'S LARGEST STOCKISTS

FREE NEW '74/75
SEMI-CONDUCTOR
AND VALVE LISTS
Ref No. 36
on request

**CASH & CARRY
PRICES**
For CALLERS or BY POST

(G.B. Carr./Pack. 15p per item)

Ref. No.	Description	Price
1	D1203 Telephone Amplifier—Suction	£4-95
2	D1201 Telephone Amplifier—Cradle	£7-50
3	T1206 2 Station Intercomm	£4-95
4	T1306 3 Station Intercomm	£9-95
5	T1406 4 Station Intercomm	£12-50
6	TA1A 2 Station Telephones Intercomm	£13-50
7	W1 2 Station Wireless Intercomm	£18-20
8	DP303 Door Phone Intercomm	£7-00
9	PK3 ETCH your own printed circuits	£2-25
10	EA41 Reverberation amplifier	£11-75
11	U550 Ultrasonic switch	£18-45
12	XP4002 Photoelectric alarm system	£13-50
13	Solid state tachometer	£11-30
14	Power dash transistor assisted ignition	£13-50
15	Car auto lock	£2-75
16	4 amp 6-12 volt battery charger	£4-85
17	FF21 Car radio/tape quad adaptor	£4-68
18	Fully disappearing car aerial	£2-00
19	Electric disappearing car aerial	£7-80
20	ET (F1009) Morse Code Key/Buzzer	£1-70
21	VH 105 aircraft band converter	£4-50
22	LM300 50K Disc mic.	£12-95
23	DF50B 50K Communications mic.	£5-75
24	Car lighter 24 volt adaptors 300mA (state 6/7/9 volt)	£1-95 ea.
25	STC time delay module	£1-30
26	Gravenire 931A photo electric unit (with data)	£3-50
27	3 ch. 3 x 500 watt sound to light	£21-50
28	3 ch. 3 x 1000 watt sound to light plus over	£41-25
29	150W. light display projector with wheel	£23-50
30	MMI (B2005 4 channel 9 volt mixer	£4-20
31	MX100 deluxe 4 channel mixer	£6-78
32	H67 (G1320) Stereo headphone amplifier	£10-50
33	MPI12 6-CH. Slider control mixer	£27-95
34	RE208 stereo phone adaptor	£2-25
35	MD802 stereo phones	£2-20
36	CIS1200 stereo phones	£2-75
37	CIS 250 stereo phones	£6-50
38	GI301 and GI305 stereo phone controls	£2-95
39	Car stereo speakers in pods. Special offer	£2-95 pr.
40	Crystal lapel microphone	£1-00
41	E1052 car speakers front/rear fader	£1-00
42	Bib Groove Clean (Ref. No. 42)	£1-76
43	Bib Record care kit (Ref. No. 43)	£2-20
44	Bib cassette recorder care kit (Ref. No. 26A)	£1-96
45	Bib cassette Tape splicing kit (Ref. No. 24)	£1-64
46	BASF reel-reel Hobby Box	£2-40
47	2000 OHM Headphones	£1-50
48	4000 OHM Headphones	£1-55
49	Cassette Recorder Mic. (2 1/2 x 3 1/2 mm Plugs)	£1-85
50	420 ES Microscope	£5-70
51	UP050 Low cost 9 volt eliminator	£2-25
52	RE 527K Tape Head Demagnetiser	£1-70
53	BC808 % Pocket calculator	£16-65
54	BC817 Memory pocket calculator	£18-30
55	BCM 850 % and memory calculator	£27-95
56	Antex soldering iron kit (SK1)	£3-30
57	Bib record care kit (Ref. No. 59)	£1-17
60	Spe Chassis punch kits	£5-50
61	Longs desoldering tool	£5-50
62	1 amp in line mains suppressors	£2-50
63	B552 (E1013) 7 way stereo speaker switch	£2-20
64	Weller 8200D-PK expert gun kit	£2-20
65	'S' Dec breadboard	£1-98
66	'2' Dec breadboard	£4-29
67	'4' Dec breadboard	£7-50
68	'T' Dec breadboard	£3-65
69	Instant head soldering gun	£2-30
70	40 watt soldering iron	£1-90

ELECTRONIC COMPONENTS

Ceramic Filters
Miniature 10-7 MHZ filters 40p pair.

ZN414 Radio IC with circuit £1-20

Strobe Tubes
ZFT8A (similar to 4A) £4-00
ZFT12A £5-00

7 segment indicators
3015F with data £1-70 ea

Spring delay units
HR42 9" twin spring £3-30
pp 20p HR16" twin spring £2-85 pp 25p

IC Clock
MM 5314 single chip clock with CCT £9-00

Ultrasonic transducers
with data/circuits £5-90 pr

Fibra optics
0-01" diam. mono filament £5-50 per 100 metres
0-13" diam. 64 fibres £1 per metre
15m diam mares tails £10-50 each

Radio Control XTALS
Matched pair for 465 KHZ IF £2-00 pr. for all superhet trans. RX's.

Handsets
Lightweight telephone handsets brand new complete with diagrams for intercomms £3-00 pr.

MARRIOT TAPE HEADS
17" High Impedance £2-50
18" Med. Impedance £3-50
36" Med. Impedance £5-00
63" 2 track mono £1-75
High Imp. £1-75
Erase Heads for 17" 18" and 36" 75p
43" Erase Head for 63" 75p
Stereo Cassette Head £1-20
Bobbin UL290 Erase £1-50
(Post. etc. 15p any quantity)



TEST EQUIPMENT MULTI-METERS

(Carr./packing 35p)

U4324, 20k/V with case £9-25

U435, 20k/V with steel case £8-75

U4313, 20k/V with steel case £12-50

U4317, 20k/V with case £16-50

U4341, 33k/V plus transistor tester steel case £10-50

U4323, 20k/V plus 1KHZ 465KHZ OSC with case £7-70

ITH-2, 20k/V slim type £5-95

TH131D (L330) 2k/V Robust £7-50

TP55N, 20k/V (Case £2-00) £8-25

TP105 2k/V £6-25

TW20S 20k/V £10-00

TW50K 50k/V £11-25

EP10KN 10k/V £11-25

AF105 50k/V Deluxe (case £1-90) £12-50

S100TR 100k/V Plus trans. tester £22-50



General Test Equipment

(† carr./packing 50p. * carr./packing 30p) unless stated

New Revolutionary SuperTester 680R 680R Multi-tester £18-50

Accessories

Transistor tester £11-00

Electronic volt. £18-00

Amplamp £11-95

Temp. probe £11-95

Gauss meter £11-95

Signal injector £5-95

Phase Sequence £5-95

EHT Probe £5-95

Shunts 25/50/10A £4-50

13100 IMA Stripchart recorder £44-00

ITE40 AC Multi voltmeter £19-75

ITE15 Grid pit meter 440KHZ-28MHZ £19-95

2TE65 28 Range valve voltmeter £22-50

1TE20D RF Generator 120KHZ-500MHz £18-95

1TE22D AF Gen 20HZ-200KHZ £19-95

*HM350 In circuit transistor tester £19-50

*C3025 Deluxe meter 1-300 MHZ £6-95

*TT145 Compact transistor tester £14-75

1G3-36 R/C osc. 20HZ-200 KHZ £19-75

*C3042 SWR Meter £5-75

*SE350A Deluxe signal tracer £12-95

*SE400 Mini-lab all in one tester £13-50

C1-5 Scope 500,000 KHZ (carr. £1) £43-00

*C30435 CH F/A meter 1-300MHZ £5-75

Resistance sub box Post. etc. £2-40

Capacitor 20p £2-10

2 amp var. transformers (car. £1) £6-45

Radio activity counter 0-10 (carr. £1) £9-97



QUALITY CASSETTE TAPES

"Living Sound" made specially for Henry's by EMP Tapes Ltd.

5 screw type with library case

Post paid (GB)

	3 for	6 for	10 for	25 for
C60	£1-10	£2-00	£3-15	£7-50
C90	£1-47	£2-85	£4-65	£11-37
C120	£1-83	£3-54	£5-60	£14-00



SPECIAL OFFER CASSETTE STORAGE

Rotating unit up to 32 cassettes stackable £3-60 pp 15p

Car unit with bracket for 10 cassettes £2-80 pp 10p

ELECTRONIC COMPONENTS & EQUIPMENT

(Please enclose large SAE with all enquiries)

BUILD YOURSELF

MW/LW Portable radio £7-98 pp 32p

MW/LW Radio tuner £5-25 pp 20p

9 volt regulated power supply £2-15 pp 15p

15 watt inverter £5-20 pp 30p

40 watt inverter £6-80 pp 40p

Sinclair micrometric radio £2-25 pp 15p

MULTI-KITS

Ready to use and use again. Educational and practical All transistor circuits with full handbooks.

10 in 1, 10 projects £5-95 Post 20p

50 in 1, 50 projects £13-95 post 25p.

150 in 1, 150 projects £21-50 Post 30p

Radionic X 20, 20 (Elec.) Projects £4-95 Post 20p

Radionic X 40, 40 (Radio) Projects £9-45 Post 20p

PA-DISCO-LIGHTING Equipment



Without doubt UK's Best range of modular and complete equipment. Lighting, mixing, microphones, accessories, speakers, amplifiers, lenses, etc., etc. FREE stock lists (Ref. No. 18) on request CALL IN AND SEE FOR YOURSELF AT HENRY'S DISCO CENTRE 309 EDGWARE ROAD 01-724 6963.

AMTRON KITS

310 Radio control receiver £3-29

300 4-channel R/C trans £6-61

345 Superhet R/C receiver £6-61

65 Simple transistor tester £1-66

115 Bwatt amplifier £4-50

120 12watt amp £4-73

125 Stereo control unit £6-61

127 Noise reduction unit £9-55

157 Private TV loop Trans. £4-95

130 Mono control unit £4-16

605 Power Supply for 115 £5-31

610 Power supply for 120 £5-31



615 Power supply for 2 x 120 £6-64

230 AM/FM aerial amplifier £3-29

240 Auto parking light £6-90

275 Mic. preamp £6-98

525C 120-160 MHZ VHF tuner £11-31

5705 LF generator 10Hz-1mHz £21-45

5755 Sq. wave generator 20Hz-20KHz £19-77

590 SWR meter £9-47

630 STAB Power supply 6-12V 0-25-0-1A £9-24

690 DC motor speed Gov. £3-31

700 Electronic Chaffinch £7-92

707 Windscreen wiper timer £7-97

760 Acoustic switch £12-57

780 Metal Detector (electronics only) £10-91

790 Capacitive Burglar alarm £7-92

835 Guitar preamp. £4-99

840 Delay car alarm £6-99

875 CAP. Discharge ignition for car engine (-Ve Earth) £13-19

80 Scope Calibrator £2-65

255 Level indicator £6-98

525 120-160MHz VHF timer £11-31

715 Photo cell switch £8-97

795 Electronic continuity tester £4-97

860 Photo timer £15-51

235 Acoustic Alarm for driver £8-61

465 Quartz XTAL checker £9-90

220 Signal injector £2-65

390 VOW £13-62

432 Testak £21-83

670 Buffer Battery Charger £7-59

Henry's RADIO
EDGWARE ROAD, W2

Electronic Centres
404-406 Electronic Components & Equipment 01-402 8381
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

Hi Fi and Electronics Centres Open 9 am - 6 pm

Prices correct at time of preparation. Subject to change without notice. E.&O.E

DOWN TO EARTH

By GEORGE HYLTON

"My transistor radio hums when placed close to an electric clock on the bedside table, but only when it's tuned into a station. What is happening?"

Well, here's a deceptively simple question! Hum—mains hum, that is—can get into circuits in at least three ways: leakage through imperfect insulation; capacitive coupling; magnetic coupling. I'm going to stick my neck out and declare in a firm, confident tone that the present case is clearly one of magnetic coupling.

MODULATION HUM

The really clinching clue, as I see it, is the observation that the hum appears only along with a programme. This makes it almost certain that we have a case of what's usually called "modulation hum." Modulation is usually thought of as something that happens at radio transmitters rather than at receivers. It's the term used to describe how the audio programme-signal is impressed on the radio frequency carrier wave which the transmitter broadcasts.

In an amplitude-modulated (a.m.) transmission the strength (amplitude) of the carrier wave is made to vary in sympathy with the programme. In an f.m. transmission it's the frequency of the carrier wave that varies. Either way, some form of modulation circuit is involved. Receivers, oddly enough, also contain bits of circuitry which are quite capable of functioning as modulators, even though that's not their purpose, e.g., frequency changers, amplifiers, and detectors.

If you apply to any of these two signals simultaneously, one a high frequency, the other a low frequency, and at the right relative strengths, then the strength of the high frequency will be made to vary in sympathy with the low one, just as in an a.m. transmission.

In our reader's case, the h.f. signal is the carrier frequency

of the incoming station. The low frequency is the 50Hz mains, picked up from the electric clock.

Why am I so confident that it's a case of magnetic pickup? Well, both clocks and transistor radios are usually in well-insulated plastic cases, which more or less rules out leakage. It would be hard to get the clock and radio close enough together to cause an appreciable amount of capacitive pickup. But transistor a.m. radios have a beautifully efficient gadget inside them for picking up magnetic signals, in the shape of a ferrite rod aerial.

AERIAL

It's true that the aerial isn't designed to work at 50Hz, but it does. Not as well as at r.f., of course, but well enough to pick up a good strong signal from the magnetic field of the clock motor. The input circuitry of the average transistor portable is on the lines of Fig. 1. The first transistor is a frequency changer, to which the incoming transmissions are applied via the coupling winding of the ferrite rod aerial (L2) and the local oscillation via the winding of the oscillator coil in the emitter circuit.

The 50Hz signal that does the

damage is the one induced in L2. A much bigger one is induced in L1 but the impedance of the aerial tuning capacitor C1 is so enormous at 50Hz that practically no current circulates. A 50Hz signal in L2 on the other hand can get straight to the base of TR1.

This 50Hz signal, if strong enough, produces a 50Hz variation in the collector current. Since the gain of a transistor in this sort of circuit is a function of its collector current, any other signals present (including the incoming station) are subject to a gain which varies at 50Hz. The transistor is acting as a modulator.

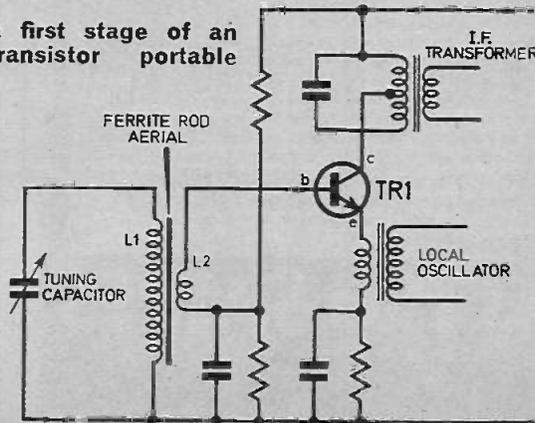
The h.f. signals which go into the i.f. amplifier are now all modulated not only with the audio programme but with 50Hz. When applied to the detector after i.f. amplification the 50Hz comes out along with the programme. Hence the hum.

Moreover, it's not just the incoming r.f. carriers that get modulated at 50Hz but the modulation sidebands as well, so the 50Hz and the programme get quite inextricably entangled, and every audio tone which emerges from the loudspeaker has a 50Hz wobble on it.

OTHER RECEIVERS

It makes no difference if the first stage of the receiver is a radio-frequency amplifier instead of a frequency-changer. The possibility of hum modulation is still there. So t.r.f. receivers can pick up hum, too. It's less likely in f.m. receivers, but still possible, because the oscillator coil may pick up hum, which pushes the frequency around at 50Hz and so produces a genuine 50Hz frequency modulation on all incoming signals!

Fig. 1. The first stage of an average transistor portable radio.



JOSTY KITS FROM ELECTRO SPARES

The Josty appointed stockists

*** ALL KITS POST FREE! * ALL PRICES INCLUDE VAT!**

It makes practical sense to invest in Josty Kits. They come complete with everything you need - all the components ready to use, including even the solder. Plus easy-to-understand, fully comprehensive instructions, and a cast-iron guarantee. Just look at the list of Josty Kits available now from Electro Spares. Remember, every price includes VAT, and every Kit is post free.

Model No.	Josty Kit Retail Price List	Total RRP inc. VAT	AT30 Photo Cell Switching Unit	AT50 400w Triac Light Dimmer Speed Control	AT56 2.200w Triac Light Dimmer Speed Control	AT5 Automatic Light Control	GU330 Tremelo Unit for guitars, etc.	HF61 Diode Detector	HF65 Frequency modulated FM transmitter	HF75 FM Transistor Receiver	HF310 FM Tuner Unit	HF325 De-Luxe FM Tuner Unit	HF330 Stereo Decoder for use with HF310 or HF325	GP310 Stereo Pre-Amp to use with 2, AF310	GP312 Basis circuit board	
AF20	Mono Transistor Amplifier	5-28														
AF25	Mixer	3-96														
AF30	Mono Transistor Pre-Amplifier	2-87														
AF35	Emitter Amplifier	2-50														
AF80	Small 0-5 W Amplifier for microphone	4-65														
AF305	Intercom	8-28														
AF316	Mono Amplifier (for Stereo use two)	6-50														
M160	Multivibrator	1-88														
M1302	Transistor Tester	9-30														
M191	Vu-Meter	5-01														
M192	Stereo Balance Meter	5-47														
LF380	Quadrophonic Device	12-50														
AT60	Psychedelic Light Control, Single Channel	8-58														
AT65	Psychedelic Light Control, 3 Channel	16-00														
AT25	Window Wiper Robot	6-40														

'AMATEUR ELECTRONICS'

Specially produced by the makers of Josty Kits to give you a professional insight into the fascinating world of electronics. Written with the amateur in mind from start to finish. "Amateur

Electronics" is an ideal introduction to the whole subject - from first principles to advanced electronic techniques. The price includes a circuit board for making ten Josty Kit projects. Only £3.30, plus 20p p & p. No VAT. Send S.A.E. now for a free 8-page colour brochure all about Josty Kits and Amateur Electronics.



COMPONENT LISTS FOR "EVERYDAY ELECTRONICS" PROJECTS

You only need to have constructed a few projects as published in "Everyday Electronics", to know what a problem it is to get every component just when you need it. Electro Spares have devised the complete solution. Now you can get lists of all the components required for any of the projects in this issue. Just send us a stamped addressed envelope, and tell us which project you are interested in. The list shows a separate price for each item, as well as a price for the complete kit. You can buy any one or more components to suit yourself.

GUARANTEED COMPONENTS FROM ELECTRO SPARES
Every single component you buy from us is a new branded product from a reputable manufacturer. And it carries the manufacturer's full guarantee.

Save money - and time - buy all your components from one source

ELECTRO SPARES

The Component Centre of the North
288 ECCLESALL RD., SHEFFIELD S11 8PE (B)
Tel: Sheffield (0742) 668888

Trannies

- 4 Bush House Harlow, Essex
- ★ Price inclusive of VAT
- ★ Retail shop open 9-5.30 Mon to Sat.
- ★ Post & Packing 15p

£1 BARGAIN PACKS

- £1 10 NPN Power transistors (like 2N3055) tested no opens no shorts.
- £1 30 Plastic FET'S like 2N3819 U/Test random test shows good yield.
- £1 30 Plastic power NPN transistors like 2N3055 untested.
- £1 250 mixed capacitors.
- £1 500 mixed resistors.
- £1 25 potentiometers.
- ★ Any 5 packs £4.50 ★ p. & p. 10p per pack.

We stock a large range of electronic semi-conductors at competitive prices. Our new '74 catalogue is now available at 20p.

Electrolytic Capacitors

6-3 VOLT	16 VOLT	40 VOLT
68µF 6p	220µF 9p	47µF 6p
150µF 6p	680µF 17p	100µF 9p
470µF 11p	1000µF 17p	68µF 10p
680µF 13p	1500µF 21p	220µF 11p
1500µF 18p	2000µF 43p	470µF 19p
2200µF 18p		680µF 25p
3300µF 26p	25 VOLT	1000µF 25p
	10µF 6p	2200µF 44p
	47µF 6p	
	100µF 6p	63 VOLT
	220µF 8p	1µF 6p
	330µF 10p	2-2µF 6p
	470µF 10p	4-7µF 6p
	1000µF 11p	6-8µF 6p
	1500µF 20p	10µF 6p
	2200µF 24p	470µF 26p
		68µF 18p
		1000µF 11p
		150µF 13p
		220µF 19p
		330µF 22p
		470µF 26p
		1000µF 44p

MULLARD POLYESTER CAPACITORS C280 SERIES
250V P.C. mounting: 0-01µF, 0-015µF, 0-22µF, 3p, 0-33µF, 0-47µF, 0-68µF, 4p, 0-1µF, 4p, 0-15µF, 0-22µF, 5p, 0-33µF, 7p, 0-47µF, 9p, 0-68µF, 12p, 1-0µF, 14p, 1-5µF, 22p, 2-2µF, 27p.

MULLARD POLYESTER CAPACITORS C296 SERIES
400V: 0-001µF, 0-0015µF, 0-0022µF, 0-0033µF, 0-0047µF, 2p, 0-0068µF, 0-01µF, 0-015µF, 0-022µF, 0-033µF, 3p, 0-047µF, 0-068µF, 0-1µF, 4p, 0-15µF, 6p, 0-22µF, 8p, 0-33µF, 12p, 0-47µF, 14p.

Volume Controls
Potentiometers
Carbon track 500Ω to 2-2 meg Ω Log or Linear.
Single 13p. Dual gang (stereo) 44p.
Single type with D.P. switch 26p.

Veroboard
matrix 0-15 0-1 matrix matrix
2½ x 3½ 17p 22p
2½ x 5 22p 24p
3½ x 3½ 22p 24p
3½ x 5 28p 28p
3½ x 7 60p 79p
3½ x 17 81p £1-05
Pin insertion tool 82p
Spot face cutter 52p 52p
Pack of 36 pins 42p 42p
20p 20p

Resistors
½ watt 5% carbon 1p
½ watt 5% carbon 1p
½ watt 10% carbon 3p

YOUR CAREER in RADIO & ELECTRONICS ?

Big opportunities and big money await the qualified man in every field of Electronics today—both in the U.K. and throughout the world. We offer the finest home study training for all subjects in radio, television, etc., especially for the CITY & GUILDS EXAMS (Technicians' Certificates); the Grad. Brit. I.E.R. Exam.; the RADIO AMATEUR'S LICENCE; P.M.G. Certificates; the R.T.E.B. Servicing Certificates; etc. Also courses in Television; Transistors; Radar; Computers; Servo-mechanisms; Mathematics and Practical Transistor Radio course with equipment. We have OVER 20 YEARS' experience in teaching radio subjects and an unbroken record of exam successes. We are the only privately run British home study College specialising in electronics subjects only. Fullest details will be gladly sent without any obligation.

To: British National Radio & Electronics School, Dept E.E.C. 114 P.O. Box 156, Jersey, C.I.

Please send FREE BROCHURE to

NAME Block

ADDRESS Caps.

..... Please

BRITISH NATIONAL RADIO AND ELECTRONICS SCHOOL

Marshall's

4. Marshall (London) Ltd, Dept. EE
 42 Cricklewood Broadway London NW2 3HD Telephone 01-452 0161/2 Telex 21492
 & 85 West Regent Street Glasgow G2 2OD Telephone 041-332 4133

Everything you need is in our
New Catalogue
 available now price 20p
 (100 pages of prices and data)

Call in and see us 9-5.30 Mon-Fri
 9-5.00 Sat
 Trade and export enquiries welcome

Popular Semiconductors

2N456 0-75	2N2647 1-12	2N3905 0-24	ACY28 0-20	BC169B 0-13	BD132 0-50	BFY19 0-62	MJ490 0-98
2N456A 0-75	2N2904 0-22	2N3906 0-27	ACY30 0-58	BC169C 0-13	BD135 0-43	BFY20 0-50	MJ491 1-38
2N457A 1-35	2N2904A	2N4036 0-63	AD142 0-59	BC170 0-11	BD136 0-49	BFY29 0-40	MJE340 0-45
2N490 3-16	2N2905 0-24	2N4037 0-42	AD143 0-45	BC171 0-13	BD137 0-55	BFY50 0-23	MJE2955 1-12
2N491 0-58	2N2905A	2N4038 0-16	AD149V 0-06	BC172 0-11	BD138 0-71	BFY51 0-23	MJE3055 0-68
2N492 3-99	2N2905A	2N4059 0-09	AD150 0-63	BC182 0-12	BD139 0-87	BFY53 0-18	MPB111 0-32
2N493 4-20	0-26	2N4060 0-11	AD161 0-45	BC182L 0-12	BD140 0-87	BFY90 0-75	MPB112 0-40
2N696 0-22	2N2906 0-19	2N4061 0-11	AD162 0-45	BC183 0-09	BDY20 1-05	BR139 0-20	MPF102 0-30
2N697 0-16	2N2906A	2N4062 0-11	AD161 pr 1-05	BC183L 0-09	BF115 0-23	BR139 0-20	MPF102 0-30
2N698 0-40	0-21	2N4126 0-20	AD162 1-05	BC184 0-11	BF116 0-23	BU104 2-00	MPSA05 0-25
2N699 0-45	2N2907 0-22	2N4289 0-84	AF109R 0-24	BC184L 0-11	BF117 0-43	BU105 2-25	MPSA06 0-26
2N706 0-14	2N2907A	2N4919 0-84	AF15 0-24	BC183 0-25	BF119 0-58	CI06A 0-46	MPSA55 0-26
2N706A 0-16	0-24	2N4920 0-99	AF116 0-25	BC187 0-27	BF121 0-25	CI06B 0-50	MPSA56 0-27
2N708 0-17	2N2924 0-14	2N4921 0-73	AF117 0-20	BC207 0-12	BF123 0-27	CI06E 0-65	NESS5V 4-78
2N709 0-42	2N2926 0-11	2N4922 0-84	AF118 0-55	BC208 0-11	BF125 0-25	CI06E 0-43	NESS60 0-40
2N711 0-30	2N3053 0-25	2N4923 0-83	AF124 0-10	BC212K 0-10	BF152 0-20	CA3020A	NE561 4-48
2N718 0-23	2N3054 0-60	2N5172 0-22	AF125 0-30	BC212L 0-16	BF153 0-21	CA3046 0-70	NE565A 4-48
2N718A 0-20	2N3055 0-75	2N5172 0-22	AF126 0-28	BC214L 0-21	BF154 0-16	CA3048 2-11	OC23 1-35
2N720 0-50	2N3390 0-26	2N5175 0-26	AF127 0-28	BC237 0-09	BF158 0-27	CA3089E1-96	OC29 0-76
2N721 0-55	2N3391 0-23	2N5176 0-32	AF139 0-39	BC238 0-09	BF159 0-27	CA3089E2-96	OC35 0-60
2N914 0-22	2N3391A	2N5190 0-92	AF170 0-25	BC239 0-09	BF160 0-23	CA3090Q	OC42 0-50
2N916 0-28	0-29	2N5191 0-95	AF172 0-25	BC251 0-20	BF161 0-42	4-23	OC45 0-32
2N917 0-32	2N3392 0-13	2N5192 1-24	AF178 0-55	BC252 0-18	BF163 0-32	CD4000 0-51	OC71 0-25
2N929 0-19	2N3393 0-13	2N5193 0-41	AF179 0-65	BC253 0-16	BF166 0-32	CD4001 0-51	OC72 0-20
2N1302 0-19	2N3403 0-13	2N5245 0-43	AF180 0-58	BC257 0-09	BF167 0-29	CD4002 0-51	OC81 0-20
2N1303 0-19	2N3402 0-18	2N5457 0-49	AF186 0-46	BC258 0-09	BF173 0-24	CD4009 1-07	OC83 0-24
2N1304 0-24	2N3403 0-19	2N5458 0-45	AF200 0-35	BC259 0-13	BF177 0-29	CD4010 1-07	ORF12 0-55
2N1305 0-24	2N3440 0-59	2N5459 0-49	AF239 0-51	BC261 0-20	BF178 0-35	CD4011 0-51	RS3 1-20
2N1306 0-31	2N3441 0-97	40361 0-48	AF240 0-72	BC262 0-18	BF179 0-43	CD4015 2-66	RL54 0-15
2N1307 0-24	2N3442 1-69	40362 0-50	AF241 0-54	BC263 0-16	BF180 0-34	CD4016 1-02	SC35D 1-68
2N1308 0-25	2N3414 0-10	40363 0-88	AF280 0-54	BC300 0-12	BF181 0-34	CD4020 2-96	SC40D 1-89
2N1309 0-36	2N3415 0-10	40389 0-46	AL102 0-75	BC301 0-34	BF182 0-40	CD4023 0-51	SC41D 1-32
2N1671 1-44	2N3416 0-15	40394 0-56	AL103 0-70	BC302 0-29	BF183 0-40	CD4024 1-90	SC45D 1-89
2N1671A	2N3417 0-21	40395 0-65	BC107 0-16	BC303 0-54	BF184 0-30	CD4027 1-56	SC46D 1-96
2N1671B 1-54	2N3638 0-15	40406 0-44	BC108 0-18	BC307 0-10	BF185 0-12	CD4028 2-34	SC50D 2-60
2N1671C	2N3638A	40407 0-33	BC109 0-19	BC307A 0-10	BF194 0-12	CD4029 3-79	SC51D 2-39
2N1711 0-42	2N3639 0-27	40409 0-52	BC113 0-15	BC308 0-09	BF195 0-13	CD404 2-11	SL414A 1-80
2N1907 5-50	2N3702 0-11	40411 2-25	BC116 0-17	BC308B 0-09	BF197 0-15	CD4044 2-11	SL623 4-59
2N2102 0-50	2N3703 0-12	40414 3-55	BC117 0-21	BC309 0-10	BF198 0-18	CD4047 1-65	TAA263 1-00
2N2147 0-78	2N3704 0-12	40415 3-55	BC118 0-11	BC309A 0-10	BF199 0-18	CD4049 0-90	TAA350 2-10
2N2148 0-94	2N3705 0-12	40583 0-23	BC119 0-29	BC310 0-10	BF200 0-42	CD4050 0-90	TAA621 2-03
2N2160 0-60	2N3706 0-09	40601 0-67	BC121 0-23	BC312 0-21	BF207 0-20	LM101A 2-03	TAA661B 1-80
2N2192 0-40	2N3707 0-13	40602 0-46	BC125 0-16	BC337 0-19	BF238 0-22	LM309K 1-88	TAD100 1-50
2N2192A	2N3708 0-70	40603 0-53	BC126 0-23	BC338 0-19	BF244 0-11	LM702C 0-75	Filter 0-70
2N2913 0-40	2N3709 0-11	40604 0-56	BC132 0-30	BC339 0-64	BF245 0-33	LM709T098	TBA271 0-64
2N2193A	2N3710 0-12	40633 1-10	BC134 0-13	BCY31 0-64	BF246 0-58	8D1L 0-48	TBA641B 1-25
2N2194 0-61	2N3711 0-11	40669 1-00	BC135 0-13	BCY32 1-15	BF247 0-38	14D1L 0-38	TBA800 1-50
2N2194A	2N3712 0-96	40673 0-70	BC136 0-17	BCY33 0-45	BF254 0-17	LM723C 0-90	TBA810 1-50
2N2218A	2N3713 1-20	AC107 0-51	BC137 0-17	BCY34 0-49	BF255 0-16	LM741T099	TIL209 0-30
2N2218B	2N3714 1-33	AC113 0-16	BC138 0-24	BCY38 0-55	BF257 0-46	0-40	TIP29A 0-49
2N2219 0-23	2N3715 1-50	AC117 0-20	BC140 0-34	BCY39 1-50	BF258 0-59	8D1L 0-40	TIP30A 0-58
2N2219A	2N3716 0-80	AC126 0-20	BC141 0-29	BCY40 0-87	BF259 0-95	14D1L 0-38	TIP31A 0-62
2N2220 0-26	2N3717 2-20	AC128 0-20	BC142 0-23	BCY42 0-18	BF321A 0-32	LM747 1-00	TIP32A 0-74
2N2220A	2N3718 1-80	AC128 0-20	BC143 0-25	BCY58 0-21	BF528 0-92	LM7488D1L	TIP33A 1-01
2N2221 0-21	2N3719 2-65	AC151V 0-25	BC145 0-21	BCY59 0-22	BF561 0-27	0-60	TIP34A 1-51
2N2222 0-26	2N3720 1-15	AC152V 0-17	BC147 0-12	BCY70 0-17	BF598 0-25	LM7805 2-00	TIP35A 2-90
2N2222A	2N3721 0-20	AC153 0-25	BC148 0-13	BCY71 0-22	BFX30 0-37	14D1L 0-73	TIP36A 3-70
2N2223 0-21	2N3722 2-69	AC153 0-25	BC149 0-12	BCY72 0-13	BFX30 0-37	LM7805 2-50	TIP41A 0-90
2N2224 0-20	2N3723 1-40	AC153 0-25	BC149 0-18	BCY84 0-32	BFX44 0-32	MCI3003p	TIP295 0-93
2N2225 0-21	2N3724 0-10	AC176 0-18	BC154 0-18	BCY88 2-42	BFX63 2-28	1-26	TIP3055 0-63
2N2226 0-25	2N3819 0-37	AC176K 0-25	BC157 0-14	BCY89 0-97	BFX68 0-30	MCI310 2-2	ZTX300 0-10
2N2227 0-25	2N3820 0-38	AC187K 0-23	BC158 0-13	BD115 0-75	BFX84 0-24	0-70	ZTX500 0-15
2N2368 0-25	2N3823 1-42	AC188K 0-34	BC159 0-14	BD116 1-00	BFX85 0-28	MCI40 0-90	ZTX500 0-21
2N2369 0-37	2N3900 0-21	ACY18 0-24	BC160 0-37	BD121 0-75	BFX87 0-28	MJ481 1-14	ZTX530 0-18
2N2369A	2N3901 0-23	ACY19 0-24	BC161 0-18	BD122 0-32	BFX89 0-25		
2N2369B	2N3902 0-24	ACY20 0-22	BC168B 0-13	BD124 0-67	BFX89 0-25		
2N2646 0-55	2N3904 0-27	ACY21 0-26	BC168C 0-11	BD131 0-40	BFY18 0-52		

PW Teletennis Kit as featured on BBC Nationwide and in the Daily Mail 2 Oct '74. Ideal game for whole family. No need to modify your TV set, just plugs in to aerial socket.

Parts list as follows: A Resistor Pack £1-00 p & p 20p; B Potentiometer Pack £1-25 p & p 20p; C Capacitor Pack £3-10 p & p 20p; D Semiconductor Pack £14-50 p & p 20p; E IC Sockets £4-00 p & p 20p; F Transformer £1-15 p & p 25p; G PCB's £7-50 p & p 20p; H Switches £4-50 p & p 20p; I UHF Modular Kit £7-20 p & p 20p.

Special Prices—complete kit excluding case £42.00 p & p 50p. Sections A-F incl. £23.50 p & p 30p. Assembly instructions with complete kit or 75p on request.

P.C. Marker Pen Dalo 33pc Price 87p. Zeners 400MW 2.7V-43V 11p, 1W 3.3V-120V 17p. IC Sockets 8D1L—16p, 14D1L—17p, 16D1L—20p.

Liquid Crystals—£13.00. Ex stock S.A.E. for details of CMOS battery operated clock kit using LCD's.

Scorpio Car Ignition Kit—£11.50. 1 VAT 1HF 440V 1 1440V £1 10. B5T80246 £1.05 Transformer £2.75. Minitor £1.55. DL 707 £2.35 or 4 for £8.00.

Resistors	Tol	Price	Tant Beads	Value
± 5%	1p	—	1/35	14p
± 5%	1-5p	—	22/35	14p
± 5%	2p	—	47/35	14p
1	10%	2-5p	2.2/35	14p
2	10%	6p	4.7/35	18p
2½	5%	7p	10/16V	18p
5	5%	9p	47/6-3V	10p
10	5%	10p	100/3V	20p

Veroboard	Copper	Plain
2½x3½	1	13 1/2 15
2½x5	28p	20p — 14p
2½x5	30p	30p — 14p
3½x3½	30p	30p —
3½x5	34p	35p — 24p
3½x7	£1.21	95p 76p 69p
Pins x 36	24p	24p
x 200	89p	89p

Trade and Retail Supplied

Potentiometers	Linear or Log	Single Double
Rotary Pots	18p	45p
Rotary Switched	28p	—
Sliders	30p	80p

Full range of Capacitors stocked. See catalogue for details

Presets Horizontal or Vertical -1W 6p -2W 6p -3W 6p

Construction Kits	Price
AV7 Aerial Amps	£2.04
UH570 Transmitter	£2.74
VAT Receiver for above	£2.22
EW18 Electronics dice	£6.33
EW20 Electro. Dice + Sen.	£7.79

OUR NEW GLASGOW SHOP IS NOW OPEN
 VAT all prices exclusive p & p 20 Mail Order

Integrated Circuits TTL (SN 7400 Series)

SN7400 16p	SN7410 16p	SN7437 35p	SN7454 16p	SN7484 95p	SN74107 43p	SN74154 1-66	SN74176 1-74
SN7401 16p	SN7411 25p	SN7438 35p	SN7460 16p	SN7485 1-58	SN74118 1-00	SN74155 1-55	SN74180 1-44
SN7401A 16p	SN7412 35p	SN7439 35p	SN7470 30p	SN7486 45p	SN74119 1-92	SN74157 1-00	SN74181 5-18
SN7402 16p	SN7413 35p	SN7440 35p	SN7471 38p	SN7487 38p	SN74120 37p	SN74160 1-58	SN74190 1-95
SN7403 16p	SN7414 30p	SN7441 59p	SN7472 44p	SN7489 44p	SN74121 1-10	SN74161 1-58	SN74191 1-95
SN7404 24p	SN7415 35p	SN7442 85p	SN7473 48p	SN7490 75p	SN74122 1-10	SN74162 1-58	SN74192 2-05
SN7405 24p	SN7416 37p	SN7443 1-00	SN7474 50p	SN7491 65p	SN74123 72p	SN74163 1-58	SN74193 2-05
SN7406 45p	SN7417 37p	SN7444 1-30	SN7475 50p	SN7492 65p	SN74124 1		

FIRST TIME EVER! *SAVE £15.12!

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 £11.85
POST ETC. 50p

Due to price we cannot name makers—but rest assured you're getting one of the BEST! Expensive "PIANO KEYBOARD" CONTROL PANEL (or latest MASTER SWITCH control) and AUTOMATIC LEVEL CONTROL. No fiddling with awkward tape and reels, just "slap-in" a cassette. Superb taping & reproduction! Takes 30, 60 or 90 minute standard cassette tapes. Beautiful tone from a whisper to a roar! Remote control microphone! Rapid rewind! Fast forward! Complete—record anywhere, indoors or out! Runs on standard batteries AND 220/240v. A.C. mains. Separate jacks for remote-control microphone, etc. 9 1/2in. x 5in x 2 1/2in. approx. Designs can vary slightly. With carry handle. WRITTEN G'TEE and instructions. (Importers recommended selling price £26.97!) **OUR PRICE £11.85**, post, etc., 50p. * Send quickly, test on mail order 7 days' approval from receipt of goods. Refund if not delighted. **BONUS OFFER:** Cassette tape, batteries and microphone stand 55p if required. **ALSO** Super de luxe model with VHF AM/FM radio (recommended retail price £44!), only £22.15, carr. 50p (batteries and cassette tape 45p extra if required)

CALLERS: ACCESS & BARCLAYCARDS ACCEPTED AT STORES.

SHOPERTUNITIES LTD.

SAVE £21.56!

FABULOUS BRAND NEW
**SOLID STATE AC/DC
MAINS/BATTERY**

COMBINED **V.H.F.
AM/FM RADIO
AND CASSETTE TAPE RECORDER
AND PLAYER**



IMPORTERS RECOMMENDED
SELLING PRICE **£44.51!**

OUR PRICE £22.95
CARR. ETC. 50p

Latest sensation in the world of sound! First class makers! Fabulous VHF AM/FM RADIO and CASSETTE TAPE RECORDER & PLAYER combined! Runs off standard batteries or Mains (simply plug in mains 220/240v. A.C. line cord supplied)—NOW you can record & play back anything, anywhere! IMPORTERS RECOMMENDED SELLING PRICE £44.51! WE OFFER AT ALMOST HALF PRICE! Fantastic specification: "Automatic recording level control! "Monitor switch! Expensive calibrated "slider" volume and tone controls! Latest "MASTER SWITCH" fast forward, stop, play & rapid rewind control! "Superb built-in speaker! "Takes standard 30, 60, or 90 minute Cassette tapes, obtainable everywhere. "Earphone & extension speaker sockets PLUS separate input/output DIN jack socket! "Built-in swivel 7 section telescopic aerial (25" approx.) "Magnificent case (approx. 10ins. high) in luxurious Black & Silver finish with "teak-finish" speaker grille. "Built-in carry handle. "Wonderful VHF AM/FM Radio with instant switch-over waveband selection & pin-point station tuner. Superb clarity and tone. Amazing station selection home & abroad including local reception of city & regional stations in every part of the country (even those scheduled for the future) plus BBC National VHF. Also fabulous in Car! You could pay £44's more for a Radio or Car Cassette player ALONE! Yes, only £22.95 carr. etc., 50p, complete with remote control microphone, etc., Written Guarantee & simple instruction. **BONUS OFFER:** Batteries, Cassette Tape, personal listening earpiece, and microphone stand, all for only 55p extra, if required. Send total £24 (to include Bonus, carr. etc.) and test on 7 days mail order approval from receipt of goods. **REFUND IF NOT DELIGHTED.** Or call at either Shopertunities store.

Dept. EE/30, 164 UXBRIDGE RD. (facing Shepherds Bush Green), LONDON W12 8AQ. (Thurs. 1, Fri. 7). Also at 37/39 HIGH HOLBORN (opposite Chancery Lane), LONDON, W.C.1. (Thurs. 7 p.m.). BOTH OPEN MON. TO SAT. 9 A.M. TILL 6 P.M.



**become
a RADIO-AMATEUR!**

learn how to become a radio-amateur in contact with the whole world. We give skilled preparation for the G.P.O. licence

free! Brochure, without obligation to:

BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL
Dept EEB 124 P.O. Box 156, JERSEY

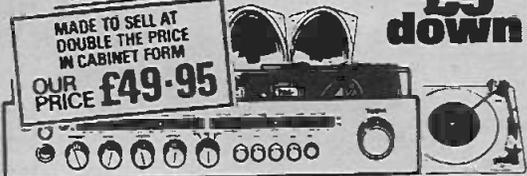
NAME: _____

ADDRESS: _____

BLOCK CAPS please

QUALITY STEREO SOUND

ALMOST $\frac{1}{2}$ PRICE OFFER! SOLENT AUDIO SYSTEM



MADE TO SELL AT DOUBLE THE PRICE IN CABINET FORM
OUR PRICE £49.95

£5 down

*Stereo Tuner Amplifier chassis with AM/FM radio covering long medium short and Stereo FM wavebands. Separate Base and Treble controls. Power output 7 watts R.M.S. per channel (frequency response 25-20,000 Hz) Tape record and playback facilities. Dimensions 18" x 8 1/2" x 3 1/2". The very latest BSR automatic record deck with cue and pause control. Two matching elliptical speaker units.

Order early limited stocks available cash price £49.95. Credit Sale £5.00 deposit 9 monthly payments of £5.75 (Total Credit price £56.75). P. & P. £2.50. Send £7.50 today.

Chassis only available for cash at £35.00.

Full 12 months Guarantee.

CALLERS WELCOME.

Stereo headphones supplied with every order.

LEWIS radio E.E. 12/74. 100 CHASE SIDE SOUTHGATE LONDON N14 5PL Telephones: 01-886 9666/3733

RECORD PLAYBACK HEADS (TRUVOX)

Individual prices of these are:
 2 track record playback heads 50p each.
 4 track record playback heads 75p each.
 Erase heads are also available separately:
 2 track 35p; 4 track 55p.
 MV metal mounting shields 35p each.
 7 track-heads already fixed on heavy mounting plate with shield £1.22.

CONTROL DRILL SPEEDS

DRILL CONTROLLER NEW IKW MODEL
 Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1.95 plus 25p post and insurance. Made up model also available. £2.95 plus 25p post & p.

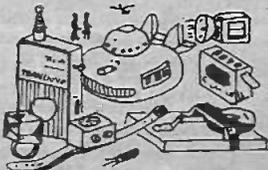
TIME SWITCH

Smith's mains driven clock with 15 amp switch, also notes showing how you can wake up with music playing, kettle boiling or come home to a warm house, warn off burglars, keep pets warm, halve your heating bills, etc. £1.95.



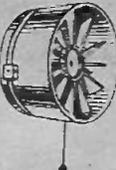
EXPERIMENTER PRINTED CIRCUIT KIT BUILD 60 INTERESTING PROJECTS

CONTENTS: (1) 2 Copper Laminate Boards 4 1/2 in. x 2 1/2 in. (2) 1 Board for Matchbox Radio. (3) 1 Board for Wristwatch Radio, etc. (4) Resistor Degreaser. (5) 16-page Booklet Printed Circuits for Amateurs. (6) 2 Miniature Radio Dials SW/MW/LW. Also free with each kit. (10) Essential Design Data Circuits, Chassis Plans, etc. for 60 TRANSISTORISED PROJECTS. Circuits to suit everyone's requirements. Price £1, post paid.



EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic ft. per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc. It's so quiet it can hardly be heard. Compact, 5 1/2" casing with 8 1/2" fan blades. Kit comprises motor, fan blades, sheet steel casing, pull switch, mains connector, and fixing brackets. £2.75 + 20p P. & P.



ONLY £1

FOR 7

ELECTRIC MOTORS

7 powerful battery motors as used in racing cars and power model. Output and type vary to make them suitable for hundreds of different projects—tools, toys, models, etc. All brand new, reversible and for 1 1/2 to 12v. Bats. wiring diagrams included. Post and VAT 30p.

FREE

TELESCOPIC AERIAL

For portable, car radio or transmitter. Chrome plated—six sections, extends from 7 1/2 to 47 1/2 in. Hole in bottom for 6BA screw. 42p. KNUCKLED MODEL FOR F.M. 55p

LIGHT DIMMER KIT

For dimming up to 250W without heat sink or 750W with heat sink. This comprises, quadric, variable control potentiometer, condenser, resistors, tag strip for mounting and data. Price £1.50.

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.**

THYRISTOR LIGHT DIMMER

For any lamp up to 1kw. Mounted on switch plate to fit in place of standard switch. Virtually no radio interference. Price £2.95, plus 20p post and insurance. Industrial model 5A £3.30. Not on plate.



MULLARD UNILEX STEREO SYSTEM

There is no doubt that it is a good system, we believe that for the money it is without comparison. We demonstrate gladly at our Tamworth Road depot. Prices of the individual items for this—
 1 Unilex Amplifier Ref. EP.9000 £1.90
 1 Unilex Pre-Amp Ref. EP.5001 £1.80
 1 Unilex Power Unit Ref. EP.9002 £2.30
 1 Control panel kit with open aluminium faced knobs £2.30. Or the complete outfit—£11.30 post paid.
 Pair of 15 ohm speakers made by E.M.L. are also available if required, £3.30 the pair. No extra postage if ordered with the above, otherwise add 25p.



DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. £2.75 plus 25p P. & P.

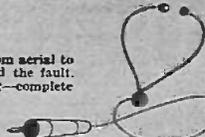
THIS MONTH'S SNIP

SOUND TO LIGHT UNIT

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450w). Unit in box all ready to work. £7.95 plus 95p V.A.T. and postage.

RADIO STETHOSCOPE

Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything—complete kit comprises two special transistors and all parts including a probe for crystal earpiece. £3.20 twin stetho-sec instead of earpiece 85p extra post and ins. 20p



SWITCH TRIGGER MATS

So thin it is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc. 24in x 18in £1.69. 13in x 10in £1.21.



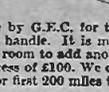
SHORTWAVE CRYSTAL SET

Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19.25-31.39 & 49 metre bands. Kit contains chassis front panel and all the parts. £1.25 crystal earphone 85p.



WANT A CHEAP OSCILLOSCOPE

We offer this month a laboratory type instrument made by G.F.C. for their communications laboratory in a steel case with carrying handle. It is mains operated and has its own internal time base and plenty of room to add another base if you wish. Probable cost of this instrument is in excess of £100. We offer this tested and in working order. £17.50 plus £2 carriage for first 200 miles then £1 for each 100 miles after.



MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 5v, 9v, 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only £1.10, plus 20p postage.

PORTABLE CABINET OFFER

A nicely made portable cabinet, soft padded black finish intended for portable stereo system. Dimensions as sketch. With motor board cut out for Garrard SP 25. This was obviously a very costly cabinet originally made for a deluxe record player. Offered at £1.95 plus £1 carriage free if bought with the Garrard or BBR record decks.



TANGENTIAL HEATER UNIT

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters. Complete motor, impeller, 2kw. element allowing switching 1, 2kw. and with thermal safety cut-out. Can be fitted into any metal line or cabinet. Only needs control switch. £2.75. Don't miss this. Control Switch, 44p. P. & P. 40p.



MULTI-SPEED MOTOR

Six speeds are available 500, 850 and 1,100 r.p.m. and 8,000, 12,000 and 15,500 r.p.m. Shaft is 1/2 in. diameter and approximately 1 in. long. 230/240v. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2 in. dia. x 3 in. long. Price £1 plus 30p postage and insurance.



MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied.
 Model 1153 500mW power output 72p
 Model 1172 750mW power output 94p
 Model EP9000 4 watt power output £1.60
 EP 9001 twin channel or stereo pre-amp. £1.99

SPIT MOTOR

200-250V induction motor, driving a Carter gearbox with a 1 1/4" output drive shaft running at 5 revs p.m. Intended for roasting chickens, also for driving models—windmills, coloured disc fighting effects, etc. £2.25 plus 20p post and ins.

NUMICATOR TUBES

For digital instruments, counters, timers, clocks, etc. Hi-vac XN.3. Price 39p each. 10 for £3.



SEALED RELAYS

8TC sealed relays, Bakera type ref. 6945. These are metal encased plug in with two pairs changeover contacts. Approx. size 1 1/4" high x 1 1/4" x 1 1/4". We understand these are vacuum sealed. Two types available 6v (45 ohms coil) price £1.50; 24v (700 ohms coil) price £1.75. Sealed relay 8TC sealed relay. Arain, type 6945, sealed metal STC case plug in but for 12v operation (170 ohms coil) and with 2 pairs normal open contacts. £1.25.

AM/FM TUNER

Unit made by the American GEC company. 8 transistor, all-wired ready to work. Complete with tuner condenser, needs only scale and pointer. Times AM range 540 to 1620 KHz. FM range 88 to 108 MHz. Switches for on-off and AFC. Output for MXP or direct. Special snip price £5 plus 30p post. Three or more post free.

20 WATT CAMPING LIGHT

Also makes good car emergency light. This uses a standard 2 foot 20 watt tube and operates from a 12v. car battery drawing approx. 1A. This gives illumination per amp/hour of battery life far in excess to filament lamps and in fact to the miniature 8-13 watt camping lights often offered. Complete unit ready to operate, in a strong white enamelled metal frame. These would normally sell at £6, are unused but slightly soiled and we offer these at 24.50 plus 40p post and packing.

MAINS MOTOR

Previously made as used in record decks and tape recorders—ideal also for extractor fans, blower, heaters, etc. New and perfect. Snip at 65p. Postage 20p for one then 10p for each one ordered. 1 1/2" stackmotor £1.10.

6 DIGIT COUNTER

Rechargeable. 440 ohm coil up to 25 impulses per second. Ex-equipment but guaranteed perfect. £2.20 each. 4 digit counter as specified for telephone charge calculator 75p.



PRESSURE SWITCH

Containing a 15 amp. change over switch operated by a diaphragm which in turn is operated by air pressure through a small metal tube. The operating pressure is adjustable but is set to operate in approx. 10 in. of water. These are quite low pressure devices and can in fact be operated simply by blowing into the inlet tube. Original use was for washing machines to turn off water when tub has reached correct level but no doubt has many other applications £1.38, each.



12 VOLT 1 1/2 AMP POWER PACK

This comprises double 230/240V mains transformer with full wave rectifier and 2000 mH/d smoothing. Price £2.20 + P. & P. 20p.

Heavy Duty Mains Power Pack. Output voltage adjustable from 15-40V in steps—maximum load 250W—that is from 6 amp at 40V to 15 amp at 15V. This really is a high power heavy duty unit with dozens of workshop uses. Output voltage adjustment is very quick—simply interchange push on leads. Silicon rectifiers and smoothing by 3,000mF. Price £8.35 plus 65p post.

TERMS:—

Add 8% V.A.T.
 Send postage where quoted—other items, post free if order for these items is £6.00. otherwise add 30p.

J. BULL (ELECTRICAL) LTD.
 (Dept. E.E.), 102/103 TAMWORTH ROAD,
 GROEDON CRO IXX.

Everyday Electronics Classified Advertisements

RATES: 11p per word (minimum 12 words). Box No. 30p. extra. Semi-display—£7.50 per single column inch. Advertisements must be prepaid and addressed to Classified Advertisement Department, "EVERYDAY ELECTRONICS," I.P.C. Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD.

EDUCATIONAL

C AND G EXAM

Make sure you succeed with an ICS home study course for C and E Electrical Installation Work & Technicians Radio/TV/Electronic Technicians. Telecommus Technicians and Radio Amateurs.

COLOUR TV SERVICING

Make the most of the current boom! Learn the techniques of servicing Colour and Mono TV sets through new home study courses, approved by leading manufacturers.

TECHNICAL TRAINING

Home study courses in Electronics and Electrical Engineering, Maintenance, Radio, TV, Audio, Computer Engineering and Programming. Also self-build radio kits. Get the qualifications you need to succeed.

Free details from:

INTERNATIONAL

CORRESPONDENCE SCHOOLS,

Dept 7318, Intertext House, London SW8 4UJ.
Or Phone 01-422 9911

FOR SALE

CABINET DEMO DECK. All E.E. to date. Many spare components. £12.00 o.n.o. Leatherhead 77164.

MICROPHONES: AKG D109, £12.65; AKG D202EL, £43.45; AKG D190C, £18.70; AKG D190E, £20; AKG D224, £55; Sennheiser MD211N, £49.50; Sennheiser MD413N, £29.70. All brand new and boxed. Send CWO to J. J. Francis (Wood Green) Ltd., Manwood House, Matching Green, Harlow, Essex. Tel: Matching 476.

RECEIVERS and COMPONENTS

TUNBRIDGE WELLS. Components from Ballard's, 108, Camden Road, Tunbridge Wells. Tel: Tunbridge Wells 31803. S.a.e. for all enquiries.

3 ASS. M.C. METERS £1.15 (35p). LARGE COMPUTER PANELS. 35-50 Transistors, Long Leads 85p (30p).
COPPER CLAD PAX PANELS 51" x 51", 6—50p c.p. 71" x 9", 6—£1.30 c.p.
SILICON DIODES 650V 1kA. 10 on Tagboard 50p c.p.
T.V. CONVERGENCE PANELS 2 x AC128 3 Slugged Colls, 3 Slide Switches, 11 W.W. Pots, 3 Carbon Presets, 2 Ferrite Chokes etc. £1.10 c.p.
VALUPAKS. P9 100 S/Mica Caps 67p c.p. send 10p for Lists of others plus Panels etc. Refund on purchase.

J.W.B. RADIO

2 Barnfield Crescent, Sale, Cheshire M33 1NL
Postage in brackets Mail Order only

LOWEST COST IC SOCKETS. Use Soldercon IC socket pins for 8 to 40 pin DIL's. In strips of 100 pins: 100+ pins 70p, 300+ 50p, 1000+ 40p. Instructions supplied. 20p p&p for orders under £2. Add 8% VAT. SINTEL, 55e Aston Street, Oxford.

RADIO, TV and other valves. Large stocks 1930 to 1974. Many obsolete types. SAE for quotation. Price List 15p. Also available a large range of Transistor and Still. Cox Radio, The Parade, East Wittering, Sussex. West Wittering 2023.

COMPONENTS GALORE. Pack of 500 mixed components manufacturers surplus plus once used. Pack includes Resistors, carbon and W.W., capacitors various, transistors, diodes, trimmers, potentiometers etc. Send £1+10p p. and p. c.w.o. to CALEDONIAN COMPONENTS, Strathore Road, Thornton, Fife.

MISCELLANEOUS

SUPERB instrument cases by Bazelli, manufactured from heavy duty P.V.C. faced steel. Hundreds of Radio, Electronic and Hi-Fi enthusiasts are choosing the case they require from our range of over 200 models. Generous trade discount, prompt dispatch. Free literature, Bazelli, Department No. 24, St. Wilfrids, Foundry Lane, Halton, Lancaster, LA2 6LT.

AERIAL BOOSTERS-£3.30

We make three types of aerial boosters B45-UHF-TV, B12-VHF-TV, B11-VHF-Radio.

VALVES BARGAINS

ANY 5-50p, 10-75p, 100-£3.30.
ECC82, EF80, EF183, EF184, PCC189, PCF80, PCF82, PCL82, PCL84, PCL85/805, PFL200, PL36, PL504, PY800, PY88.
COLOUR TV VALVES—PL508, PL509, PY500-25p each.
Prices include VAT, P&P 10p. SAE—leaflet

Electronic Mail Order Ltd, 62 Bridge Street, Ramsbottom, Bury, Lancs. Tel RAMS 3636.

AUTUMN BONANZA!

B.B. SUPPLIES offer:—

LEVER key switch, 4-pole, lock-off-lock, in black plastic stackable case app. 120mm x 120mm x 25mm. Brand new 75p
PUSH button switching unit, 3 two-pole c/o units, one cancels others, room for one more unit. App. 75mm x 60mm x 35mm. Brand new (wired and numbered) 50p
RELAY, 24 volt, 3600 ohms, 4 c/o contacts, size: 40mm x 33mm x 15mm (wired and covered). Brand new 50p
LAMP fitting, 6 volt—contained in hammer finished, grey steel box on wood plinth. Ideal case for small projects. Size app. 75mm x 75mm x 70mm. Brand new 50p
SPECIAL price until 28.2.75 for all 4 above items + useful accessories: £2.00
4T Sferarising earpieces (salvaged) 20p

All prices include VAT and p. & p. Many other Govt. surplus, new and shand items at bargain prices. S.A.E. for Autumn Catalogue of electronic parts to:

38 HEATHWOOD GARDENS, SWANLEY
KENT BR8 7HN

CONSTRUCTION AIDS. Screws, nuts, spacers, etc., in small quantities. Aluminium panels punched to spec. or plain sheet supplied. Fascia panels etched aluminium to individual requirements. Printed circuit board-masters, negatives and boards, one-off or small numbers. Send 6p for list. RAMAR CONSTRUCTOR SERVICES, 29 Shelbourne Road, Stratford-on-Avon, Warks.

Sinclair CALCULATORS

SENSATION !!

CAMBRIDGE 8D... £15.95
SCIENTIFIC... £25.95

Write now—BRET EXPORTS
Dept. "P", 16 Hengistbury Rd., Southbourne, Bournemouth.
Please add 8% VAT + 45p P.&P.



TREASURE TRACER

MK III Metal Locator

- Varicap tuning
- Britain's best selling metal locator kit
- Weighs only 22oz.
- Speaker and earphone operation
- Knocks down to only 17in.
- Prebuilt search coil assembly
- Thoroughly professional finish
- As seen on BBC1 and BBC2 TV
- You only need soldering iron, screwdriver, pliers and snips
- Five transistor circuit

Send s.a.e. for leaflet

Complete Kit P&P 45p

£9.80

Built, tested and guaranteed P&P 45p. — £1.10 VAT

£13.75

MINIKITS ELECTRONICS,
35b LANGLEY DRIVE, WANSTEAD
LONDON, E11 2LN (Mail order only)

BEGINNERS, a complete course in electronics for only £3.45, post free. Basic electricity, switching and amplifier circuits. Instructions and components provided. For details of this and other kits send S.A.E. to Electrolern, Lyburn Lodge, Nomansland, Wiltshire.

LOUDSPEAKERS

Speakers, kits and cabinets for D.I.Y., Hi Fi, P.A., Disco, etc. by EMI, Fane, Goodmans, Baker, Elac, Richard Allan, Wharfedale, etc.

Send for free booklet "Choosing a speaker"

WILMSLOW AUDIO

Dept. H, Swan Works, Bank Square,
Wilmslow, Cheshire SK9 1HF
Tel. Wilmslow 29599

PSYCHEDELICATESSEN

is the only way to describe the paradise of FREAKY gear now available from Boffin.

LOOK!

Kits

NO LICENCE EXAM. Transmitter/Receiver	£6.90
Variable-rate, BRIGHT-FLASH. Pocket Mini-Strobe	£2.90
Ready-Made Experimental Modules	
Maxi-Volt SPARK GENERATOR (tinch spark), 15,000 Volts.	£1.90
Mini DREAM-LABORATORY	£3.20
SENSITIVE non-anatomical electronic STETHOSCOPE	£3.20
Electronic "VOICE-THROWER"	£3.20
GHOST-HUNTING AID	£3.20
PEOPLE DETECTOR	£3.20
SPEAK-THRU-WATER-FONE	£3.20
PSYCHEDELIC MEDITATION AID	£3.20
Bird-Watchers' REMOTE MONITOR	£3.20
Psychological CROSS-EYED EARS	
Device	£6.40
'Big Ear' SOUND-CATCHER	£3.20

(All prices include VAT, packing & postage)

Send remittance to:

BOFFIN PROJECTS

4 Cunliffe Road, Stonelaign,
Ewell, Surrey
(Mail order U.K. only)

Or for more details, send 20p for lists, plus free design project sheet

GADGETS GALORE!!

Alarms — Test Gear — Musical Instruments
Timers — Audio — Disco — Sound Effects
★ **READY BUILT & TESTED** ★
Sample prices: Signal Injector £1.85
Signal Tracer £2.95
PRICES INCLUDE U.K. POSTAGE & BATTERIES
Mail Order Only—SAE list to:
**G. K. SERVICES, 83 Westdale Rd.,
London SE14 3BQ**

FERRIC CHLORIDE

Anhydrous technical quality in sealed 1lb packs
1lb 80p; 3lb £1.60; 10lb £4.40.

COMPUTER PANELS

3lbs asstd £1.40; 7lb £2.60; 56lb £16. 12 high quality panels with trim pots, IC's, power transistors etc £2.50. 100 panels £14. Pack of boards containing at least 500 components Inc. at least 50 transistors 90p.

3 WATT TAPE AMPLIFIERS

2x ECC83, EL84, EZ80 on 12½x3" chassis with tone & volume controls, 3 watts output to 7x4" 3Ω speaker (provided) £3.00. Also in case 14x13x9" with non-standard tape deck £4.50. Suitable cassettes £1.08, tape 74p, head 30p.

7lb BARGAIN PARCELS

Hundreds of resistors, capacitors, pots, switches + PC boards with transistors & diodes and loads of odds & ends. Still only £2.25.

PC ETCHING KIT

Contains Ferric chloride, DALO etch-resist pen, 100 sq. ins. copper laminate board, etching dish, abrasive powder and Instructions £3.30.

VEROBOARD

Offcuts, 100 sq. ins (no tiny pieces) £1.10. 500 assorted resistors £1.40. 150 mica, ceramic, poly capacitors 80p. 250 1%, 2%, 5% Hi-stabs £1.30. LEO III COMPUTER, all parts available.

GREENWELD ELECTRONICS [EE8]

Mail order, retail & wholesale shop 51, Shirley Park Road, Southampton, Tel (0703) 772501. Also callers at 21 Deptford Broadway SE8, Tel 01-692 2009 & 38 Lower Addiscombe Rd, Croydon, Tel 01-688 2550.
ALL PRICES QUOTED INCLUDE 8% VAT AND POSTAGE. SAE LIST, ENQUIRIES.

FLUORESCENT LIGHT KIT

12v
8w

You can build this reverse polarity proof light for use in homes, garages, caravans, for camping, or emergency lighting. Everything is supplied: the tube, white enamelled metalwork, first quality components, P.C.B., instructions, etc.
Price only £3-19
Ready built £3-78
Diffuser only 59p extra

ALUMINIUM BOXES

Prices include 8d. screws, and V.A.T.
Post and packing 10p extra on all orders.

	7"	8"	9"	10"	11"	12"	14"	16"	20"
1	5d	6d	7d	8d	9d	10d	11d	12d	13d
2	6d	7d	8d	9d	10d	11d	12d	13d	14d
3	7d	8d	9d	10d	11d	12d	13d	14d	15d
4	8d	9d	10d	11d	12d	13d	14d	15d	16d
5	9d	10d	11d	12d	13d	14d	15d	16d	17d
6	10d	11d	12d	13d	14d	15d	16d	17d	18d
7	11d	12d	13d	14d	15d	16d	17d	18d	19d
8	12d	13d	14d	15d	16d	17d	18d	19d	20d
9	13d	14d	15d	16d	17d	18d	19d	20d	21d
10	14d	15d	16d	17d	18d	19d	20d	21d	22d
11	15d	16d	17d	18d	19d	20d	21d	22d	23d
12	16d	17d	18d	19d	20d	21d	22d	23d	24d
13	17d	18d	19d	20d	21d	22d	23d	24d	25d
14	18d	19d	20d	21d	22d	23d	24d	25d	26d
15	19d	20d	21d	22d	23d	24d	25d	26d	27d
16	20d	21d	22d	23d	24d	25d	26d	27d	28d

Order now to—

ELECTRONICS DESIGN ASSOCIATES
DEPT E.E.
82 Bath St., Walsall, WS1 3DE. Phone 33652

SERVICE SHEETS

SERVICE SHEETS for over 6,000 models of Television, Radios, Transistors, Stereo, Tape Recorders, Record Players, etc., at only 30p plus S.A.E. with free Fault-Finding Guide. Over 50,000 sheets in stock for 10,000 models. S.A.E. enquiries. Catalogue 20p plus S.A.E. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex. Telephone Hastings 429066.

4-STATION INTERCOM



£14.95

Solve your communication problems with this 4-Station Transistor Intercom system (1 master and 3 Subs), in robust plastic cabinets for desk or wall mounting. Call/talk/listen from Master to Subs and Subs to Master. Ideally suitable for Business, Surgery, Schools, Hospital, Office and Home. Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 50p

MAINS INTERCOM NEW MODEL
No batteries—no wires. Just Plug in the mains for instant two-way, loud and clear communication. On/off switch and volume control. Price £23.75 per pair P. & P. 60p

INTERCOM / BABY ALARM



OUR PRICE ONLY £6.50

Same as 4-Station Intercom for two-way instant communication. Ideal as Baby Alarm and Door Phone. Complete with 66ft. connecting wire and Battery. P. & P. 40p

TELEPHONE AMPLIFIER



£6.45

Why not boost business efficiency with this incredible Telephone Amplifier. Take down long telephone messages or converse without holding the handset. A useful office aid. On/off switch. Volume Control. Complete with Battery. P. & P. 30p. Full price refunded if not satisfied in 7 days.

WEST LONDON DIRECT SUPPLIES (E/E)
169 KENSINGTON HIGH STREET, LONDON. W.8.

INSTRUMENTAL AUDIO EFFECTS

SUPER "FUZZ" UNIT KIT. CONNECTS BETWEEN GUITAR & AMPLIFIER. OPERATES FROM 9v BATTERY (not supplied). ALL COMPONENTS AND PRINTED CIRCUIT BOARD WITH FULL INSTRUCTIONS. KIT PRICE: £3.00 post paid.

CREATE "PHASE" EFFECT ON YOUR RECORDS, TAPES ETC., UNIQUE CIRCUITRY ENABLES YOU TO CREATE PHASE EFFECT AT THE TURN OF A KNOB. OPERATES FROM 9v BATTERY (not supplied) COMPLETE KIT OF COMPONENTS WITH PRINTED CIRCUIT BOARD & FULL INSTRUCTIONS. KIT PRICE: £3.00 post paid.

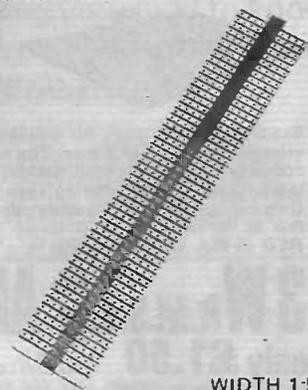
MAIL ORDER ONLY.
S.A.E. ALL ENQUIRIES.
PLEASE ADD V.A.T. TO ALL ORDERS

DABAR ELECTRONIC PRODUCTS

88, LICHFIELD STREET,
WALSALL, STAFFS. WS1 1UZ

VEROSTRIP

LENGTH 8'5"



WIDTH 1'5"

Available from your Local Retailer

0.1 and 0.15 pitch Vero Strip is suitable for all applications where Tag Boards can be used.



VERO ELECTRONICS LTD.
INDUSTRIAL ESTATE
CHANDLERS FORD HANTS.

ELECTRONI-KIT

Electronic fun for all ages

The most versatile electronics kits. All components are beautifully encapsulated in unbreakable transparent plastic blocks. Perfect connections are made WITHOUT SOLDERING, SCREWING OR WIRING

INCREDIBLE VALUE. Build, dismantle and rebuild projects any number of times and invent your own experiments too.

COMPLETELY SAFE. Instructive and FUN—all kits operate from 9v. battery only.

VALUABLE MANUALS included with every kit. No previous knowledge is required, even with the largest kits.

KIT 2A—30 projects £10.45. Radios, amplifiers, alarms, microphones, Morse, etc. **KIT 3A—100 projects £20.45.** As 2A plus electronic birds, cats, sirens, organs, metronome, guns, light and sound, burglar alarms, etc.

3ADX—105 projects £25.25. As 3A plus solar cell experiments and complete sophisticated control panel, etc.

4ADX—150 projects £33.95. As 3ADX plus Relay and Meter experiments; ion concentration—, volume—, out-put—, field intensity—, volt—, resistance meters, ammeter, illuminometer, etc. and many, many more.

ADD-ON parts and manuals available as required.

The three larger kits include Electrical experiments too.

All prices include Battery, Manual, VAT & p. & p.

Cheque/P.O. (or 6p for literature) to:

Satisfaction guaranteed
**ELECTRONI-KIT LTD, 408 St. John's Street,
London, EC1. [01-278 4579]**

BI-PRE-PAK Audio Bargains



**STEREO
DECODER**
£4.50

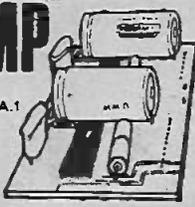
incl. P. & P.

Ready-built unit, ready for connection to the IF stages of existing FM Radio or Tuner. The very latest 2nd Generation coil less integrated circuit design, operating on this phase locked loop system, offering even better stereo separation. Only owing to our bulk buying capacity are we able to offer this at the old price. LED stereo indicator lights available. **RED at 25p. GREEN at 40p.**

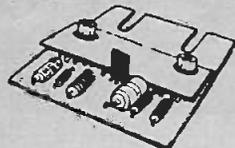
3 W.R.M.S. I.C. AMP
only **£1.50**

incl. P. & P.
Order Code I.C.A.1

on P.C. Board with all components
or 2 on one board for £2.60
Order Code I.C.A.1/S
These amps. are supplied with a free booklet
on connecting up, specifications and easy to
build projects using the I.C.A.1



5W & 10W AMPS



5W ONLY £1.80
10W ONLY £2.26

incl. P. & P.

These matchbox size amplifiers have an exceptionally good tone and quality for the price. They are only 2 1/4" x 1 1/2". The 5W amp will run from a 12V car battery making it very suitable for portable voice reinforcement such as public functions. Two amplifiers are ideal for stereo. Complete connection details and treble, bass, volume and balance control circuit diagrams are supplied with each unit. Discounts are available for quantity orders. More details on request. **Cheapest in the UK. Built and tested.**

Now available for 5 & 10W AMPS

Pre-assembled printed circuit boards 2" x 3" available in stereo only, will fit .15 edge connector.

Stereo Pre-Amp 1 (Pre 1). This unit is for use with low gain crystal or ceramic pick-up cartridges. **£1.10**

Stereo Pre-Amp 2 (Pre 2). This unit is for use with magnetic pick-up cartridges. **£1.55**

Stereo Tone Control (STC). This unit is an active tone control board and when used with the right potentiometers will give bass and treble boost and cut. **£1.10**

Instruction leaflet supplied with all units. Post and packing included in prices. VAT at current rate.

enclose £..... for..... Decoders/.....

3W Amps/..... 5W Amps/..... 10W Amps/.....

Stereo Pre-Amps 1..... Stereo Pre-Amps 2.....

Stereo Tone Controls.....

(Please insert quantities and delete those not applicable)

Name.....

Address.....

BI-PRE-PAK Dept. D, 222/224 West Road,
Westcliffe-on-Sea, Essex SS0 9DF
Co. Regn No. 820919 Telephone: Southend (0702) 46344

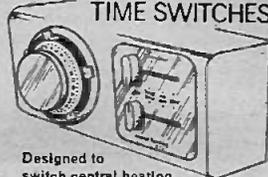
SOLDERING GUN



£2.70
VAT PAID
P & P 33p

New surplus stock as illustrated. AC240 volts. Input power 100 VA. Instant heat at touch of trigger switch in handle. Constructed in robust plastic casing with work light in front and 4" x 3" core cable.

PROGRAMME TIME SWITCHES



Designed to switch central heating and hot water on/off twice a day. Suitable for any electrical appliance up to 3 amps 240 volts A.C.

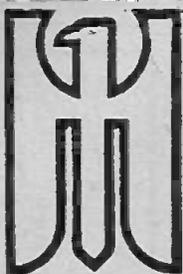
£5.40

VAT paid.
P & P 28p
Mounted in robust white plastic casing Drilled for fixing on back supplied with wiring instructions. Ideal for shop lighting and many other applications.

**SAE FOR CATALOGUE WITH MANY
OTHER BARGAINS TO**

**C. W. WHEELHOUSE & SON,
9/13 BELL ROAD,
HOUNSLOW.**

PHONE 01-570-3501.



**Phoenix
Electronics
(Portsmouth) Ltd.**

139-141 Havant Road,
Drayton, Portsmouth, Hants

PO6 2AA

Full member of AFDEC—the industry's association of franchised electronic component distributors.

Our prices include VAT at the current rate—and carriage on all goods is free.

Send for our catalogue and price list—we'll mail that to you free, too.

**COMPONENTS FOR I.C. APPLICATIONS BY
MR. J. B. DANCE**

SAJ110	£1.96	SAJ180	£1.96	SAK110/115	£1.23
TAA775G	£1.23	TAA930A	£1.23	TBA790KSD	£1.96
TBA800	£1.96	TBA950	£1.76	TCA250	£1.96

Please send your catalogue—free!

Name.....

Address.....

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 today and we'll send you full details and a free book. We have 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 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 in 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 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 College, 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 Aldermaston College, Dept. BEE80, Reading RG7 4PF.

ALDERMASTON COLLEGE

Dept. BEE80, Reading GR7 4PF

HOME OF BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

Practical Radio & Electronics Certificate course includes a learn while you build **3 transistor radio kit.**

Everything you need to know about **Radio & Electronics** maintenance and repairs for a **spare time income** and a **career** for a better future.

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.

MECHANICAL	DRAUGHTSMANSHIP	Construction Surveyors Institute
Society of Engineers	Institute of Engineers	L.C.S.I.
A.M.S.E. (Mech)	Designers (A.M.I.E.D.)	City & Guilds General Building (all branches)
Institute of Engineer & Technicians (A.M.I.F.)	General Draughtsmanship	Heating & Vent. Inst. Clerk of Works
CITY & GUILDS	Elec. Draughtsmanship	Site Surveying
Gen. Mech. Eng. Maintenance Eng. Welding	Architectural Draughtsmanship	Health Engineering
Gen. Diesel Eng. Sheet Metal Work	Technical Drawing	Road Construction Quantities
Eng. Inspection		Estimates
Eng. Metallurgy		Hydraulics
		Structural Eng.
ELECTRICAL & ELECTRONIC	RADIO & TELECOMMUNICATIONS	GENERAL
CITY & GUILDS	City & Guilds Telecoms.	Agricultural Eng.
Gen. Electrical Engineering	Gen. Radio & TV Eng.	Council of Eng. Institutions
Electrical Installations	Radio Amateurs' Exam	Farm Science
Electrical Maths	Radio Servicing	Plastics
Computer Electronics		Supplementary courses for Nat. Certificates.
Electronic Eng. Practical Radio & Electronics (with kit)	AUTOMOBILE & AERONAUTICAL	
	Institute of the Motor Industry	
MANAGEMENT & PRODUCTION	A.M.I.	
Institute of Cost & Management Accnts.	MAA/DMI	
Computer Programming	City & Guilds Auto Eng.	
Works M'nt	Gen. Auto Eng. Motor Mechanics	
Work Study	Auto Diesel Eng. Garage M'nt	
Gen. Production Eng. Estimating & Planning	AEC Aero Engineering Exams	
Storekeeping	Gen. Aero Eng.	
Management Skills	CONSTRUCTIONAL	
Quality Contr.	Institute of Building	
	L.I.O.B.	
	A.B.T. Clerk of Works	

G.C.E.
—choose from 58 'O' & 'A' level subjects

Coaching for many exams, including C & G

POST TODAY FOR A BETTER TOMORROW

To Aldermaston College,
Dept. BEE80, Reading RG7 4PF

BEE80

NAME.....
Block capitals please

ADDRESS.....

OTHER SUBJECTS.....

AGE.....

Accredited by C.A.C.C.

Member of A.B.C.C.

Henry's SO MUCH MORE - AND YOU PAY LESS VAT WITH HENRY'S LOW PRICES

UK's No. 1 for Electronics and Hi Fi



You can build the Texan and Stereo FM Tuner TEXAN 20 + 20 WATT IC STEREO AMPLIFIERS

Features glass fibre PC board, Gardeners low field transformer, 6-IC's, 10-transistors plus diodes, etc. Designed by Texas Instruments engineers for Henry's and P.W. 1972. Supplied with full chassis work, detailed construction handbook and all necessary parts. Full input and control facilities. Stabilised supply. Overall size 15 1/2" x 22" x 6 1/2" mains operated. Free teak sleeve with every kit. **£28.50 (GB post paid)** (also built and tested £35)



STEREO FM TUNER Features capacity diode tuning, lead and tuning meter indicators, stabilised power supply—mains operated. High performance and sensitivity with unique station indication IC stereo decoder. Overall size in teak sleeve 8" x 22" x 6 1/2". Complete kit with teak sleeve **£21.00 (GB post paid)** (also built and tested £24.95)

JOIN THE LARGE BAND OF HAPPY CONSTRUCTORS!

TRANSISTORISED MODULES

AMPLIFIERS (All single channel unless stated)	£ p
4300 9 volt 300 MW	1.75
2004 9 volt 250 MW	2.70
104 9 volt 1 watt	3.10
304 9 volt 3 watt	3.95
555 12 volt 3 watt	4.10
555ST 12 volt 1 1/2 + 1 1/2 watt	5.95
E1208 12 volt 5 watt	5.10
608 24 volt 10 watt	4.95
410 28 volt 10 watt	4.95
620 45 volt 30 watt	9.95
Z40 30/35 volt 15 watt	5.45
Z60 45/50 volt 25 watt	6.95
SA6817 24 volt 6 + 6	10.20

AMPLIFIERS with controls	£ p
E1210 12 volt 2 1/2 + 2 1/2 watts 8 ohms, Stereo	8.25
R500 Mains 5 watts 4-16 ohms, Mono	6.30
SAC14 Mians 7 + 7 watts 8 ohms, Stereo	11.75
SAC30 Mains 15 + 15 watts 8 ohms, Stereo	14.95
QA038 9 volt 1 1/2 + 1 1/2 watts 8 ohms, Stereo	6.95
CA068 12 volt 3 + 3 watts 8 ohms, Stereo	10.50

FM Modules	£ p
Mullard LP 1186 FM tuner (front end) with data 10.7 MHz O/P	4.85
Mullard LP 1185 10.7 MHz IF unit with data	4.50
Gorler Permeability FM tuner (front end) 10.7 MHz O/P	4.20

FM and AM tuners and decoders	£ p
FM 5231 (Tu 2) 6 volt fm tuner	7.95
TU 3 12 volt version (FM use with Decoder)	7.95
SD4912 Stereo Decoder for Tu 3, 12 volt	6.30
SP62H 6 volt stereo FM tuner	14.95
A1007 9 volt MW-AM tuner	11.95
Sinclair 12/45 volt FM tuner stereo recorder for above	7.45
A1018 9 volt FM tuner in cabinet	13.95
A1005M (S) 9-12 volt Stereo decoder FM for above	7.50
I062 12 volt Stereo decoder general purpose	6.50

PREAMPLIFIERS	£ p
Sinclair Stereo 60 Preamplifier	6.75
E1300 Cart/Tape/Mic Inputs 9 volt	2.85
E1310 Stereo 3-30 mV mal cart 9 volt	4.75
FF3 Stereo 3 mV tape head 9 volt	4.95
3042 Stereo 5-20 mV Mag. cart. mains	5.95
EQ25 Mono 3-250 mV Tape/Cart/Play 9 volt	5.95

Power Supplies Mains input (* chassis-rest case)	£ p
470C674/9V300mA with adrs	2.25
PS00 9 volt 500mA	3.20
HC244R 3/6/7 1/2 x 9. 400 MA	3.20
stabilised	5.50
*P11 24v. 1/2 amp. 3-30	3.30
*P15 28v. 1/2 amp	3.30
*P1080 12V 1A 4-70	7.8
SE101A 3/6/9/12V. 1 amp stabilised	12.75
SE800A 1-15 VOLT 0-1A stabilised	4.20
	17.50

SINCLAIR MODULES & KITS	£ p
SINCLAIR PROJECT 80	11.95
ST80 Stereo preamplifier	11.95
Audio Filter Unit	6.95
Z40 15 Watt Amplifier	5.45
Z60 25 Watt Amplifier	6.95
PZ5 Power Supplies for Lor Z240-98	7.98
PZ6 Power Supplies (S Tab) for 1 or 2 Z40	7.98
PZ8 Power Supplies (S Tab) for 1 or 2 Z60	7.98
TRANSFORMER FOR PZ8	3.95
FM TUNER	11.95
STEREO DECODER	7.95
IC20 power amp kit	7.95
PZ20 power supply for 1 and 2 IC20	5.45

Sinclair Special Purchases
*Project 60 stereo preamp **£6.75 (post 20p)**
*Project 605 Kit **£19.95 (post 25p)**

TRANSISTORS/SEMICONDUCTORS
UK's largest stockists of branded guaranteed devices at low prices.
EXTRA DISCOUNTS
Any one type, Extra 10... for 12 | 15... 25 | 20... 100 |
The above also applies to mixed 5N74 series IC.
Get your free stock list now—new '74-'75 edition now available (Ref. No. 36).

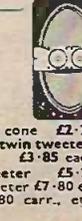
EXCLUSIVE DECCA KELLY SPEAKERS

12 watt speaker / tweeter systems 8 in bass/midrange, Pilelinex domed HF radiator plus crossover. Built into veneered cabinets size 18 x 12 x 6 1/2 in. PRICE £19.50 pair (carr., etc. £1.00)



EMI SPEAKERS SPECIAL PURCHASE

13in x 8in chassis speakers (Carr./packing 30p each or 50p pr.)
*150 TC 10 watts 8 ohms twin cone **£2.20**
*450 10 watts 4, 8, 15 ohm with twin tweeters and crossover **£3.85** each
EW 15 watt 8 ohm with tweeter **£5.25**
350 20 watts 8, 15 ohm with tweeter **£7.80** ea.
* Polished wood cabinet £4-80 carr., etc. 35p each or 50p pair.



PHILIPS 8 WATT FLUORESCENT UNIT EXCLUSIVE PURCHASE

Brand new Philips 12 volt operated 8 watt fluorescent tube units for standby lighting. Complete with tube and instructions. Price £3.50 p & p 25p.



EXCLUSIVE 5 WATT IC AMPLIFIERS

Special purchase 5 watt output 8-16 ohm load. 30 volt max. DC operation, complete with data. Price £1.50 each or 2 for £2.85 Printed Circuit Panels. 50p.



UHF TV TUNERS

625 line receiver UHF transistorised tuners FM UK operation. Brand new. (Post/packing 25p each). TYPE C variable tuning **£2.50**
TYPE B 4-button push-button (adjustable) **£3.50**

HENRY'S HOME ENTERTAINMENT CENTRES

London
354/6 Edgware Rd. W2 01-402 5854
376/8 Edgware Rd. W2 01-723 0818
372 Edgware Rd. W2 01-402 8140
120 Shaftesbury Ave. W1 01-437 9692
230 Tottenham Court Rd. W1 01-580 1785
144 Burnt Oak 8'way, Burnt Oak, Edgware 01-952 7402
190/4 Station Rd., Harrow, Middlesex 01-863 7788
Oue of Town
256 Banbury Rd., Summertown, Oxford (0865) 53072
55 Gloucester Rd., Bristol 7 (0272) 45791

JUSTY KITS IN STOCK

(Post etc. 15p each)	£ p
AF20 Mono Transistor Amp	5.61
AF25 Mixer	3.30
AF30 Mono Trans. Pre-amp	3.20
AF35 Emitter Amplifier	2.43
AF80 Small 0.5 Wv. Amplifier for Microphone	4.86
AF305 Intercom	7.68
AF310/2 Mono Amplifier (for Stereo use two)	7.56
M160 Multivibrator	2.19
M1302 Transistor Tester	8.34
M191 Vu-Meter	5.37
M192 Stereo Balance Meter	5.94
LF380 Quadraphonic Device	8.43
AT60 Psychedelc Light Control. Single Ch.	10.82
AT65 Psychedelc Light Control. 3 Chan.	16.53
AT25 Window Wiper Robot	5.82
AT30 Photo Cell Switching Unit	6.69
AT50 400w Triac Light Dimmer Sp. Cont.	5.19
AT56 2.200w Triac Light Dimmer Sp. Cont.	6.75
AT5 Automatic Lt. Cont.	3.75
GU330 Tremolo Unit for Guitars, etc.	8.10
HF61 Diode Detector	3.87
HF65 Frequency Modulated FM Transmitter	3.21
HF75 FM Transis. Receiver	3.66
HF310 FM Tuner Unit	16.31
HF325 De-luxe FM Tuner Unit	26.34
HF330 Stereo Decoder for use with HF310/325	10.56
GP310 Stereo Pre-amp (for use with 2 AF310)	22.98
GP312 Basis Circuit Board	10.02
GP304 Basis Circuit Board	5.33
HF380 Aerial Amp. for LW to VHF	6.03
HF395 Broadband Aerial Amp	2.10
NT10 Power Supply 100mA for 9V Stab. 12V Unstabile	27
NT300 Professional Stab. Power Supply	13.17
NT310 Power Pack 2 x 15 volt 2A	5.64
NT305 Voltage Converter	5.64
NT330 Power Pack AF310/GP304	6.27
NT315 P/S 240V ac to 4.5-15V dc 500mA	12.06
AE1 Output Stage 100mW	1.56
AE2 Pre-amplifier	1.32
AE3 Diode-receiver	2.02
AE4 Flasher	1.26
AE5 Stable Multivibrator	1.24
AE6 Monostable Multivibrator	1.11
AE7 RC Generator	1.08
AE8 Bassfilter	1.06
AE9 Treblefilter	1.06
AE10 CCIR-filter	1.06

FREE STOCK LISTS
No. 36 Transistors/valves/semiconductors
No. 18 Disco-lighting—high power sound
No. 17 Hi-Fi TV-Tape Equipment
Send large stamped addressed envelope with all enquiries.

SUPPLIERS OF ELECTRONICS FOR OVER 30 YEARS 8% VAT TO BE ADDED TO ALL ORDERS VAT-UK ONLY

Henry's RADIO
EDGWARE ROAD, W2

Electronic Centres
404-406 Electronic Components & Equipment 01-402 8381
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
Prices correct at time of preparation. Subject to change without notice. E.&O.E