

76 AVE

PRACTICAL

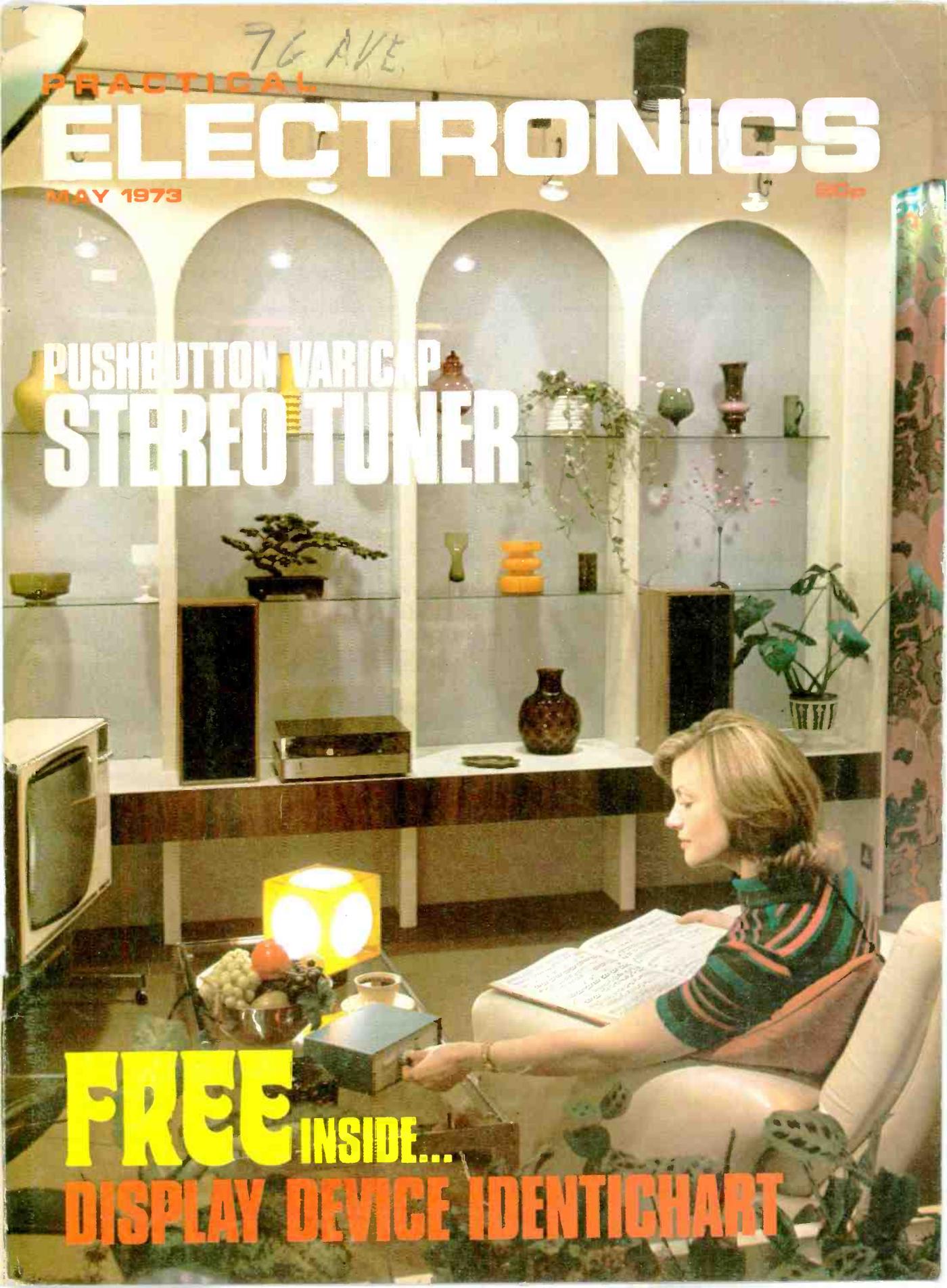
ELECTRONICS

MAY 1973

60¢

PUSHBUTTON VARICAP STEREO TUNER

FREE INSIDE...
DISPLAY DEVICE IDENTICHART



Why take the risk?

of damage to expensive transistors and integrated circuits, when soldering?

Use Antex low-leakage soldering irons



220-240 Volts or 100-120 Volts **Model X25**

The leakage current of the NEW X25 is only a few microamps and cannot harm the most delicate equipment even when soldered "live". Tested at 1500v. A.C. This 25 watt iron with it's truly remarkable heat-capacity will easily "out-solder" any conventionally made 40 and 60 watt soldering irons, due to its unique construction advantages. Fitted long-life iron-coated bit 1/8".

2 other bits available 3/32" and 3/16".

Totally enclosed element in ceramic and steel shaft Bits do not "freeze" and can easily be removed

PRICE: £1.75 (rec. retail) Suitable for production work and as a general purpose iron

Model CCN 220 volts or 240 volts

The 15 watt miniature model CCN, also has negligible leakage. Test voltage 4000v. A.C. Totally enclosed element in ceramic shaft. Fitted long-life iron-coated bit 3/32"

4 other bits available 1/8", 3/16" 1/4" and 1/16"

PRICE: £1.80 (rec. retail)

OR Fitted with triple-coated, (iron, nickel and Chromium) bit 1/8"

PRICE: £1.95 (rec. retail)

A SELECTION OF OTHER SOLDERING EQUIPMENT.



MODEL CN

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

MODEL CN2

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



MODEL G

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

MODEL SK.1 KIT



contains 15 Watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32", heat sink, solder, stand and "How to Solder" booklet.

PRICE £2.75 (Rec. retail)

MODEL SK.2 KIT

contains 15 Watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32", heat sink, solder and booklet "How to Solder"



PRICE £2.40 (Rec. retail)



MODEL MES.KIT

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

PRICE £1.95 (Rec. retail)



From radio or electrical dealers, car accessory shops or, in case of difficulty direct from:—
ANTEX LTD. FREEPOST
(no stamp required) **Plymouth**
PL1 1BR Tel: 0752 67377
Reg. No. 393594

ALL PRICES MENTIONED EXCLUSIVE OF V.A.T.

- Please send the ANTEX colour catalogue.
 Please send the following:

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

NAME _____

ADDRESS _____

PE5

PRACTICAL ELECTRONICS

VOLUME 9 No. 5 MAY 1973

CONSTRUCTIONAL PROJECTS

- PUSHBUTTON VARICAP STEREO TUNER** *by S. R. Beeching* 400
Easily constructed stereo tuner using varicap tuning modules
- P.E. DIGI-CAL—11** *by R. W. Coles* 406
Concluding article
- P.E. SOUND SYNTHESISER—4** *by G. D. Shaw* 420
Ramp generators and input amplifiers
- LOGIC TUTOR** *by G. D. Bishop and M. Hughes* 430
An educational aid on which a wide range of logic experiments can be performed

GENERAL FEATURES

- BRAIN X-RAY** *by K. R. Hill* 413
The EMI-Scanner—A computerised system for diagnosing brain diseases
- LOGIC TUTOR EXPERIMENTS—1** *by M. Hughes* 438
The first article in this new series deals with basic gates

NEWS AND COMMENTS

- EDITORIAL**—Stereo Radio Without Tears 399
- BOOK REVIEWS** 427, 446
Selected new books we have received
- KIT REVIEW** 428
The SUPACAL pocket calculator
- SPACEWATCH** *by Frank W. Hyde* 429
Skylab experiments
- POINTS ARISING** 438
Hi Fi Tape Link—P.E. Triffid I.C. Radio—A.F. Signal Generator
- ON THE FRINGE** *by Gerry Brown* 441
The more unusual aspects of electronics
- NEWS BRIEFS** 441
Design Council awards '73—Electronics Course
- INDUSTRY NOTEBOOK** *by Nexus* 442
What's happening inside industry
- PATENTS REVIEW** 445
Thought provoking ideas on file at the British Patents Office

SPECIAL DATA SHEET

- DISPLAY DEVICE IDENTICHART**
At-a-glance information on many types of readout devices

Our June issue will be published on Friday, May 11, 1973

© IPC Magazines Limited 1973. Copyright in all drawings, photographs and articles published in PRACTICAL ELECTRONICS is fully protected, and reproduction or imitations in whole or part are expressly forbidden. All reasonable precautions are taken by PRACTICAL ELECTRONICS to ensure that the advice and data given to readers are reliable. We cannot, however, guarantee it, and we cannot accept legal responsibility for it. Prices quoted are those current as we go to press. Subscription Rates including postage for one year, to any part of the world, £2.65.

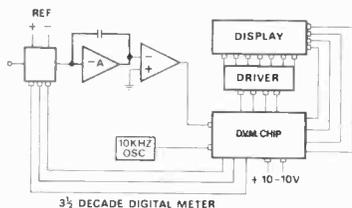
TERMS Retail mail order subject to £1.00 minimum order. Cash with order only. Trade and educational establishments M/AC on application (minimum £5.00). Postage 10p inland, 25p. Europe.

GUARANTEE: All goods carry full manufacturer's warranty. Get in touch today for a complete run-down of devices available from SCS (include SAE).

S.C.S. Components Ltd., P.O. Box No. 26, Wembley, Middlesex HA0 1YY Registered in London No. 888454



device of the month D.V.M. chip



Now you can construct your own D.V.M. with this new G.I. Microelectronics chip—a single MOS LSI chip containing all the logic necessary for a

3 1/2 Decade Digital Voltmeter utilising Dual Ramp integration. Just look at some of these features:

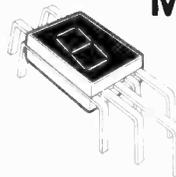
- * 3 1/2 Decade Display (± 1999 max. reading)
- * Automatic Polarity Detection
- * Overrange Indication
- * Chopper Output Provided
- * Up to 50 readings per second
- * 16 lead DIL package
- * Full G.I. Microelectronics warranty

complete D.V.M. logic for just

including application notes

£7.90
+
VAT

Compatible device M3 7 segment LED display



Also from Monsanto this display is ideal for use with D.V.M. chip. * 0.125" characters

- * Displays all numbers plus nine letters
- * Full specification included
- * Application notes for this unit are included in the specification on the D.V.M. chip—they are available separately, however, price: 25p.

*** SPECIAL OFFER ***

For six weeks only; a D.V.M. chip plus 4 digits for just £14.50 + V.A.T. Offer closes 31st May, 1973.

a superb 7 segment LED display for just

£2.70
+
VAT



KONTAKT 60

FOR INACCESSIBLE CONTACTS—More than just a cleaner. KONTAKT 60 guarantees perfect cleaning of contacts chemically in accordance with today's technology.

KONTAKT offers the following advantages:—

1. Dissolves oxides and sulphides the safe way without attacking contact substances.
2. Contains carefully selected solvents which do not attack plastics whereas they do dissolve resinified contact greases and dirt.
3. Contains *no silicone*.
4. Contains a light lubricant in order to avoid the contact paths being corroded.
5. Prevents further oxidation setting in.
6. Prevents "creep" currents.

Because of these outstanding properties KONTAKT 60 is one of the best and most popular contact cleansing agents in the world.

Users include: Rolls-Royce Ltd., C.E.G.B., South of Scotland Electricity Board, Trinity House Workshops, Kolster Brandes, Mullard, Plessey Cos., etc.

OTHER KONTAKT PRODUCTS ARE:

70 Protective Lacquer 80 Special Siliconized Polish
72 Insulating Spray 100 Antistatic Agent for Plastics
75 Cold Spray for Fault Location 101 Dehydration Fluid

Write for full details of above complete range of Kontakt products to:—

SPECIAL PRODUCTS DISTRIBUTORS LIMITED

81 Piccadilly, London, W.1 01-629 9556

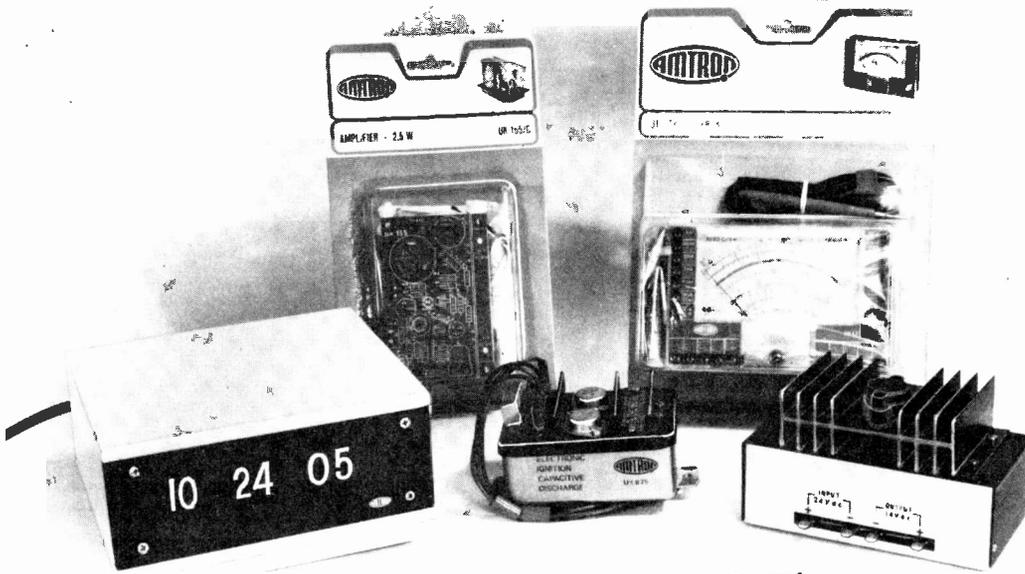


MULTIMETER Model 200H, 20,000 ohm/volt, £4.80. 30µA, 50µA or 100µA METERS, £2.50. POTENTIOMETERS Lin or Log, 12p; with DP Switch, 24p; Dual Ganged, 36p; special offer 5K with DP switch, 16p. JB3 Junction Box, £1.20; JB11, £1.95. 500µA TUNING METERS, 50p. CARTRIDGES: Compatible ACOS GP91-3, 90p; Stereo GP93-1, £1.15. CAPACITORS 100mF 25V, 5p; 220mF 25V, 5p; 400-200-50-16mF 300V, 30p; 0.1 500V d.c., 300V a.c., 4p. MINIATURE INDICATOR LAMPS (5 colours), 11p; 6 or 12V Bulbs for above, 4p. MAINS NEONS panel mounting (red, green, clear), 15p. HEADPHONES: High Impedance (2,000 ohm), 90p; Stereo (8 ohm), £1.95; Stereo/Mono 8/16 ohm £2.10. RECORDING TAPE, 5in LP 900ft, 45p; 5 1/2in LP 1,200ft, 60p; 7in LP 1,800ft, 81p.

Large S.A.E. for List No. 5. Special prices for quantity quoted on request. Add 10p for P. & P. on orders under £5.

M. DZIUBAS

158 Bradshawgate, Bolton, Lancs. BL2 1BA



There are 195 other good reasons for buying AMTRON electronic kits

Apart from the five items shown above, there are another 195 kits to choose from in the vast AMTRON range of electronic kits.

A few examples of equipment you can construct from AMTRON kits are:

Power supplies, preamplifiers, amplifiers, L.F. instruments, accessories for musical instruments, amateur and radio control transmitters and receivers, battery chargers, electronic car accessories, psychedelic lighting equipment, measuring instruments, tuners, receivers, I.C. digital equipment.

Only 1st class fully guaranteed components are used—solder is included with every kit.

Prices range from £1.10 to £80 and each kit is sold in protective blister pack containing complete instructions.

Should you experience any difficulty in obtaining AMTRON Kits please contact us direct.

PLEASE SEND FOR BROCHURE



TRADE & EDUCATION ENQUIRIES WELCOME

AMTRON U.K. 4 & 7 CASTLE STREET HASTINGS SUSSEX TELEPHONE HASTINGS 2875

WATFORD ELECTRONICS

35 CARDIFF ROAD, WATFORD, HERTS, ENGLAND
C.W.O. Please. P. & P. please add 10p to orders under £2
MAJL ORDER, CALLERS SATURDAYS ONLY

RESISTORS

High stability, low noise, carbon film resistors. Tubular miniature high power resistors.

Power Watts	Tolerance	Range	Values available	Price
1/4	5%	2.2-2.2M	E12	1p
1/2	5%	2.2-10M	E12	1p
1	5%	2.2-10M	E12	2p
4	10%	1-10 ohm	E12	6p

Quantity prices available for any selection. Ignore fractions on total order.

CAPACITORS. Electrolytic Gen. Purpose Miniature Axial Lead. 63V, μ F: 1, 1.5, 2.2, 3.3, 4.7, 6.8, 10, 15, 22, 47, 6p; 40V, 100 μ F, 6p; 25V, 150 μ F, 6p; 25V, 220 μ F, 11p; 25V, 470 μ F, 13p; 25V, 680 μ F, 20p; 25V, 1,000 μ F, 25p.

POLYESTER FILM CAPACITORS. Mullard C296 Series
400V d.c., μ F: 0.001, 0.0015, 0.0022, 0.0033, 0.0047, 0.0068, 0.01, 0.015, 0.022, 2.2p each; μ F: 0.033, 0.047, 0.068, 0.1, 4p each; μ F: 0.15, 6p; 0.33, 10p; 1.0, 22p; 10p; μ F: 0.33, 10p; μ F: 0.47, 13p.
160V d.c., μ F: 0.1, 0.15, 4p; 0.22, 5p; 0.33, 6p; 0.47, 7p; 0.68, 10p; 1.0, 13p.

Mullard C280 Series
400V d.c., μ F: 0.01, 0.015, 0.022, 3p each; 0.033, 0.047, 4p each.
250V d.c., μ F: 0.068, 0.1, 0.15, 4p each; 0.22, 0.33, 5p each; 0.47, 7p; 0.68, 10p; 1.0, 11p.

CERAMIC CAPACITORS. 50V d.c. Plaquette Body with 25mm leads.
Range: 22-10,000pF, 2p each.

JACK PLUGS AND SOCKETS

Standard screened	12p	2.5mm insulated	8p
Stereo screened	30p	3.5mm screened	10p
Standard socket	12p	2.5mm sockets	7p
Stereo sockets	15p	3.5mm sockets	7p

DIN PLUGS

2 pin, 3 pin, 5 pin (180 or 240), plugs 10p, sockets 8p.

TOGGLE SWITCHES

1-5A single pole single throw 15p. Double pole D/B throw 18p.
SLIDE SWITCH 1A 9p.

CASSETTE CONTACT C60, 40p; C90, 65p; C120, 75p. High quality. Low noise.

SEMICONDUCTORS, TRANSISTORS:

AC126 12p	BC109 8p	BFY50 22p	OC70 10p
AC127 12p	BC147 12p	BFY51 22p	OC71 10p
AC128 12p	BC148 12p	OC26 40p	OC72 10p
AD161 30p	BC149 12p	OC28 40p	2N2926R 9p
AD162 30p	BD131 60p	OC35 40p	2N29260 9p
AF117 12p	BC132 60p	OC42 10p	2N2926V 9p
BC107 8p	BF194 15p	OC44 10p	2N2926G 10p
BC108 8p	BF195 15p	OC45 10p	2N3055 55p

ZENER DIODES

BZY88 Series. Power Dissipation 400mW. 5% tolerance. Range: 3-30V to 30V. Price 12p each.

LINEAR IC'S (DIL packaging)

709 30p DIL Sockets 8 pin 23p; 14, 16 pin all 15p.
741 32p
723 80p

DIODES AND RECTIFIERS

OA85 7p; OA90 5p; OA91 5p; IN4001 6p; IN4004 7p; IN4007 7p.
Bridge Rectifier W01 1A 100V price 35p.

POTENTIOMETERS: Carbon Track

1K-2M log or linear, Single gang, 12p.
2K-2M log or linear, Dual gang, 37p.
5K-2M log or linear, Single gang w/switch, 24p.
Knobs for above, 10p.

PRESET POTS

Horizontal and Vertical
Mounting, 0.25W, 5p each.
Vertical, 0.1W, 3p each.

SLIDER POTENTIOMETERS

SINGLE 10K, 25K, 50K, 100K, log or linear price: 35p.
DUAL GANG 10K + 10K, etc. above values, log or linear price 50p.
KNOBS for above 10p each.

VEROBOARD

	0-1	0-15	0-15
2 1/2in x 3 1/2in	Matrix	Matrix	Matrix
2 1/2in x 5in	22p	16p	82p
3 1/2in x 5in	24p	24p	60p
3 1/2in x 3 1/2in	24p	24p	42p
3 1/2in x 5in	27p	27p	52p
1 7/8in x 2 1/2in	75p	57p	42p
Pkt of 50 pins	20p	20p	

17in x 5in (plain) 82p
17in x 3 1/2in (plain) 60p
17in x 2 1/2in (plain) 42p
PIN INSERTION TOOL 52p
SPOT FACE CUTTER 42p

WATFORD ELECTRONICS, 35 CARDIFF RD., WATFORD
Herts, England. Enclose 10p stamps for our comprehensive catalogue

Name

Address

B.H. COMPONENT FACTORS LIMITED

SPECIAL RESISTOR KITS (\pm W 5% or \pm W 5% CARBON FILM)
10E12 Kit: 10 of each E12 value, 10 ohms—1M, a total of 610, £2.80 net
25E12 Kit: 25 of each E12 value, 10 ohms—1M, a total of 1,525, £6.50 net

POLYESTER CAPACITORS MULLARD C280 250V
 μ F: 0.01, 0.015, 0.022, 0.033, 0.047, 3p each; 0.068, 0.1, 0.15, 4p each; 0.22, 5p; 0.33, 7p; 0.47, 8p; 0.68, 10p; 1.0, 13p; 1.5, 20p; 2.2, 23p.

MULLARD POLYESTER CAPACITORS C296 SERIES
160V: (μ F) 0.01, 0.015, 0.022, 2p; 0.047, 0.068, 3p; 0.15, 0.22, 4p; 0.33, 5p; 0.47, 6p; 0.68, 1.0, 10p.
400V: (μ F) 0.001, 0.0015, 0.0022, 0.0033, 0.01, 2p; 0.015, 0.033, 3p; 0.068, 4p.

MINIATURE ELECTROLYTIC MULLARD C426 SERIES (5p each)
(μ F/V) 1/63, 4/40, 8/40, 10/40, 10/64, 16/40, 20/64, 25/25, 32/10, 40/16, 64/10, 80/16, 80/25, 100/6.4, 125/16, 200/6.4, 200/10, 320/6.4, 125/10.

MULLARD C437: (μ F/V) 64/64, 9p; 160/25, 9p; 160/40, 11p; 640/6.4, 9p; 1600/6.4, 14p.

ELECTROLYTIC CAPACITORS. Tubular and large can
(μ F/V) 2.5/50, 3p; 4/10, 10/25, 16/15, 20/25, 25/15, 25/25, 40/16, 64/10, 200/6, 250/10, 4p; 10/6, 10/50, 25/50, 32/50, 50/10, 64/25, 100/25, 5p; 50/50, 64/40, 250/15, 1,000/3, 6p; 100/50, 250/25, 400/10, 500/10, 500/12, 640/10, 1,000/6, 8p; 500/25, 10p; 500/50, 12p; 1,000/12, 10p; 1,000/25, 2,000/12, 2,500/12, 15p; 1,000/50, 35p; 2,000/25, 25p; 2,000/25, 30p; 2,500/50, 55p; 3,000/50, 65p; 5,000/50, 85p; 1,000/100, 60p; 8/350, 12p; 16/350, 17p; 32/350, 22p.

MINIATURE CERAMIC PLATE CAPACITORS
50V: (pF) 22, 27, 33, 39, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 820, 1K, 1K5, 2K2, 3K3, 4K7, 6K8. (μ F) 0.01, 0.015, 0.022, 0.033, 2p; 0.047, 30V, 3p; 0.1, 100V, 5p.

CARBON FILM RESISTORS \pm W 5%, 10 ohms—2.2M, \pm W 5%, 22 ohms—1M, 1p each or 100 for 55p; 1,000 for £4.

METAL FILM RESISTORS \pm W 5%, 22 ohms—10M, 1 1/2p each or 100 for £1.

VEROBOARD 0-1 0-15
2 1/2 x 5in 25p 25p
2 1/2 x 3 1/2in 23p 17p
3 1/2 x 5in 29p 30p
3 1/2 x 3 1/2in 25p 25p
2 1/2 x 1in 2 for 12p 12p
2 1/2 x 5in (plain) 12p
2 1/2 x 3 1/2in (plain) 11p
5 x 3 1/2in (plain) 20p
Insertion tool 54p 54p
Track cutter 40p 40p
Pins, pkt. 25 8p 8p

IN4001 6p
IN4002 7p
IN4003 8p
IN4004 9p
IN914 6p
IN914 30p
OC71 12p
OC75 15p
OC83 18p

QUANTITY DISCOUNT
SPECIAL BULK BUY PRICES
ARE AVAILABLE BY
QUOTATION FOR LARGE
PROJECTS

VAT, Please add VAT at the
standard rate after 1st
April

Screened wire, yd. 5p
Twin screened wire, yd. 9p
Stereo s.c. wire, yd. 9p
Quad screened wire, yd. 19p
3 core circ. mains cable White, 3 yds. 24p
Neon bulb 90V wire ended 5 for 20p
Preset skeleton pots 1K-1M 5p

C.W.O. only. P. & P. 10p on orders below £5.
Discount: £10—10%, £20—15%.
Export Order enquiries welcome

Dept. P.E. 61, CHEDDINGTON ROAD, PITSTONE
Near LEIGHTON BUZZARD, BEDS, LU7 9AQ
Tel.: Cheddington 668446 STE. (0296)
Inquiries—S.A.E. Catalogue FREE Callers please phone first.

IT'S
FREE

FULLY ILLUSTRATED
ELECTRONIC COMPONENTS CATALOGUE

If you have not yet seen our latest catalogue, drop us a line right away and we will be delighted to forward a copy to you. In it you will find many useful components at very competitive prices, plus details of how you can receive **ONE POUNDS WORTH** of goods **ABSOLUTELY FREE**. Phone now 037-42 79033, or write to:
MAPLIN ELECTRONIC SUPPLIES
P.O. BOX 3, RAYLEIGH, ESSEX SS6 8LR

You may telephone any time of the day or night. Out of office hours your message may be left on our answering machine.

LOOK! HERE ARE JUST A FEW OF THE THOUSANDS OF LOW-PRICED ITEMS IN THE CATALOGUE
EVERYTHING GUARANTEED BRAND NEW MARKED BY MANUFACTURER

BC107/8/9, 10p each; 2N3819, 24p;
TIS43 (SS43), 28p; μ A7815 (T03 case). Fairchild voltage regulator, 15V 1.5A max. (with free mounting kit), £2.30.

P.E. SOUND SYNTHESISER
Your search ends here!

We shall be stocking all the components for this exciting project. Price lists will be available from us each month as the parts lists are published by P.E. Please send an S.A.E. if you would like our price lists and we will send you the ones currently available. Alternatively if you would like to receive the price lists for the whole project send 25p now and we will automatically send each list as it becomes available.

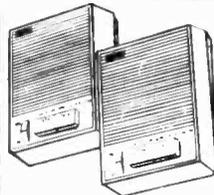
Until further notice
PRICE REDUCED
8 PIN DIL OP AMP
741C 36p

SPECIAL IC. for organ builders, 7 stage frequency divider in one 14 pin DIL package £2.63 or special price for pack of 12, £25.
Why not ask us to slip a data sheet in with your catalogue.

Postage and packing **FREE** in UK. But we have to ask you to send a 10p handling charge with order under 50p.

gspk

(sales)



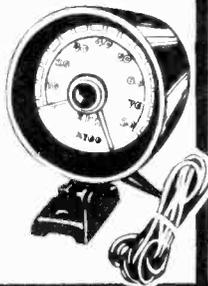
D1075 Wireless Intercom

The great merit of wireless intercoms is that separate connecting wires are not necessary providing the stations are on the same electrical mains circuit. Communication can be up to a distance of 2 of a mile providing the power lines used are on the same side of the distribution transformer, and several stations can even be operated on the same circuit. Solid state model D1075 is fully transistorised and each unit incorporates a talk-listen button with locking bar; ON/OFF volume control and a pilot light. The lawn moulded cabinets can be desk located or wall mounted and are supplied already fitted with 1.25 metres of heavy duty lead. Operating Frequency: 160kHz. Speaker: 130mm. Microphone: Dynamic 55mm. Power Output: 120mW. Size: 98 x 40 x 130mm. Printed Circuit: 3 transistors, 1 diode.

£11.60

SOLID STATE TACHOMETER

Functionally styled for under or over dashboard installation, this electronic tachometer fits all 4-cycle, 4-cylinder, or 2-cycle, 2-cylinder 12V vehicles. Negative or positive earth. Calibrated white on black 0-8,000 r.p.m. in 100 r.p.m. divisions together with settable "danger" line, simple installation 2 screws, 4 wires. 80mm (3in) dia. dial, 50mm deep. On adjustable angle bracket. Sealed black crackle finish.



£6.86

SPECIAL OFFER !

AUTO BURGLAR ALARM PLUS "POP-OUT" CIGARETTE LIGHTER

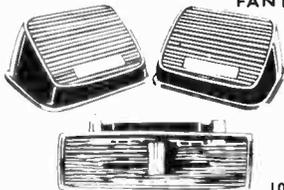
Designed for easy installation on any car (whether 6 or 12V) this device activates the horn when a theft is attempted of equipment or personal belongings. This neat unit reacts when the vehicle is disturbed or rocked and continues its warning for 15 sec. after tampering. The sensitivity of the device is adjustable and controlled by a separate ON/OFF panel which can be located wherever convenient. Supplied with connecting wires and screws in attractive bubble pack, containing installation instructions and diagrams. 150 65 20mm plus panel 65 x 45 x 20mm.



£2.10 FOR BOTH

FANTAVOX STEREO LOUDSPEAKER SYSTEM

These high quality speaker enclosures are made of tough black moulded plastic and have been designed for fitting on to almost any vehicle surface. The smart louvred fronts are silver trimmed and house heavy duty 5in (125mm) ceramic loudspeakers rated at 3/5 watts, 8 ohms impedance. Already wired with generous length connecting leads and supplied in packs of speaker pairs complete with fixing screws. Each cabinet measures 190 x 105 x 165mm.



1052 FADER CONTROL

Weight: 0.55 kg.

Neat, custom-made appearance slide fader control for balance of front and rear speaker volume. Simulated wood finish panel which can be quickly fitted below car dash. Supplied with generous connecting cable and fitting screws. Will suit 4, 8, 16 ohm installations. 100 x 38 x 30mm (including knob but excluding fitting bracket).

All for £4.70

420ES MICROSCOPE

An extremely modestly priced yet efficient microscope capable of magnification up to 750 times with clear sharp images. This model is of the self-illuminating type and incorporates an easily rotatable four-position turret magnifying lens with rack and pinion focusing. The crackle black metal body houses the batteries for adjustable illumination. Packed in carton with built-in carrying handle and full notes for user. A sample slide also provided. 105mm at base; 180mm high. Weight: 0.40 kg.



£4.95

G5555 PROFESSIONAL STEREO HEADPHONE

Lightweight materials are skilfully used in the construction of this model in black crackle moulding and kid-soft leathercloth with contrasting bright metal. Each ear pad houses a highly efficient 60mm reproducer unit and features ear muffs removable for cleaning. 10-self-coiled lead plug fitted. Frequency Response: 20-20,000Hz. Impedance: 4-16 ohms. Sensitivity: 110dB. Power: 0.5W. Weight: 0.39kg.



£9.25

"SPRITE" LIGHTWEIGHT STEREO HEADPHONE

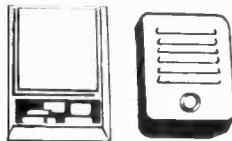
An outstanding achievement following lengthy development by one of the world's leading audio manufacturers, the T.T.C. "Sprite" offers the following specification: Extreme lightness (only 150 grammes) (5oz); Instant wearing adjustment with sliding earpieces and flexible headband; Highly efficient Mylar reproducer units; Removable, washable foam padded ear muffs; 3-metre lightweight lead with stereo plug fitted. Frequency Response: 30-13,000Hz. Sensitivity: 105dB. Power: 0.2W. Impedance: 4-16 ohms. Weight: 0.15kg.



£2.25

D1019 "Doorphone" with Metal Unit

Three transistor solid state two-way intercom system with specially engineered weatherproof slave unit in heavy gauge metal. Sensible design features include rain protective speaker louvres, simple push-pull button, internal socket connecting lead and removable back plate for wall and door panel mounting. Master unit in high impact white moulding has complementary silver "pinhole" grille and silver black panels with ON/OFF volume control and push-to-talk switch. 60mm dynamic speaker/microphones are used for both units. 120mW output. 9V internal battery operation. Master unit: 77 x 40 x 105mm. Slave unit: 70 x 32 x 90mm. Supplied with battery, lead and staples. £3.90



DF100 MICROPHONE

Bijou sized model in matt silver finish with machined capping to insert housing and supplied with unique pocket/lapel clip which also doubles as a desk support. Supplied with tavalier cord, 2 metre lead fitted 3.5mm moulded plug and packed in the latest style click-fast case manufactured from smart durable padded plastic.



Impedance: 200 ohms. Sensitivity: 82dB. Frequency: 100-9,000Hz. Size: 13mm dia. x 92mm.

£3.50

TI-C1000 MINI-METER

£2.70

This is the most compact and reliable multimeter on the market and features easy switch selection, 1,000 ohm/volt 2-jewel meter movement with zero and needle adjustment. Easy to read scale in two colours. Ranges: A.C. Voltage: 0-10V, 50V, 250V, 1,000V. D.C. Voltage: 0-10V, 50V, 250V, 1,000V. D.C. Current: 0-1-100mA. Resistance: 0-150K ohms.



Please fill in the coupon and send with 10p (refundable on ordering) for catalogue. ALL CALLERS WELCOME

To G.S.P.K. (Sales) Limited, Dept. P.E., Head Office, Hookstone Park, Harrogate, Yorkshire HG2 7BU. Mon. to Fri. 9 a.m. - 5 p.m.

Name

Address

P.E.

SEW PANEL METERS

CLEAR PLASTIC PANEL METERS

USED EXTENSIVELY BY GOVERNMENT DEPARTMENTS, INDUSTRY, EDUCATIONAL AUTHORITIES, ETC.
 • LOW COST • QUICK DELIVERY • OVER 200 RANGES IN STOCK • OTHER RANGES TO ORDER

TYPE SW.100 100mm x 80mm Fronts

30μA	£3-80
50-0-50μA	£3-80
100μA	£3-80
100-0-100μA	£3-70
500μA	£3-50
1mA	£3-40
20V d.c.	£3-40
50V d.c.	£3-40
300V d.c.	£3-40
1 amp. d.c.	£3-40
5 amp. d.c.	£3-40
VU Meter	£4-15



Type MR.85P. 4 1/2in. x 4 1/2in. Fronts

50mA	£3-10
100mA	£3-10
500μA	£3-10
1 amp.	£3-10
5 amp.	£3-10
15 amp.	£3-10
30 amp.	£3-20
20V d.c.	£3-10
50V d.c.	£3-10
150V d.c.	£3-10
300V d.c.	£3-10
15V a.c.	£3-10
300V a.c.	£3-10
200μA	£3-30
500μA	£3-20
500-0-500μA	£3-10
1mA	£3-10
1-0-1mA	£3-10
5mA	£3-10
10mA	£3-10
50μA	£3-95
50-0-50μA	£3-40
100μA	£3-40
100-0-100μA	£3-30
200μA	£3-30
500μA	£3-20
500-0-500μA	£3-10
1mA	£3-10
1-0-1mA	£3-10
5mA	£3-10
10mA	£3-10

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

50μA	£2-40
100μA	£2-85
100-0-100μA	£2-75
500μA	£2-55
1mA	£2-20
5mA	£2-20
10mA	£2-20
50μA	£2-20
500μA	£2-20
1mA	£2-20
5 amp.	£2-20
10 amp.	£2-20
20 amp.	£2-20
30 amp. a.c.	£2-20
50μA	£2-30
50-0-50μA	£2-30
100μA	£2-30
100-0-100μA	£2-30
200μA	£2-30
500μA	£2-30
1mA	£2-20
5mA	£2-20
10mA	£2-20
50μA	£2-20
500μA	£2-20
1mA	£2-20
5 amp.	£2-20
10 amp.	£2-20
20 amp. a.c.	£2-20
30 amp. a.c.	£2-20

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

50μA	£3-70
50-0-50μA	£3-00
100μA	£3-00
100-0-100μA	£2-90
200μA	£2-90
500μA	£2-65
500-0-500μA	£2-40
1mA	£2-40
10mA	£2-40
50μA	£2-40
500μA	£2-40
1mA	£2-40
5 amp.	£2-40
10 amp.	£2-40
15 amp.	£2-40
20 amp.	£2-40
30 amp.	£2-55
50 amp.	£2-75
5V d.c.	£2-40

Type SD.830 82.5mm x 110mm Fronts

10mA	£2-50
50mA	£2-50
100mA	£2-50
500μA	£2-50
1 amp.	£2-50
5 amp.	£2-50
10 amp.	£2-50
50μA	£2-75
50-0-50μA	£2-70
100μA	£2-70
100-0-100μA	£2-70
200μA	£2-70
500μA	£2-55
1mA	£2-50
5mA	£2-50

Type SD.640 63.5mm x 85mm Fronts

50μA	£2-60
50-0-50μA	£2-55
100μA	£2-55
100-0-100μA	£2-55
200μA	£2-55
500μA	£2-35
1mA	£2-35
5mA	£2-35
10mA	£2-35
50μA	£2-35
500μA	£2-35
1mA	£2-35
5 amp.	£2-35
10 amp.	£2-35
20 amp. a.c.	£2-35
30 amp. a.c.	£2-35
50μA	£2-40
50-0-50μA	£2-40
100μA	£2-40
100-0-100μA	£2-40
200μA	£2-40
500μA	£2-40
1mA	£2-40
5mA	£2-40
10mA	£2-40

Type SD.460 46mm x 59.5mm Fronts

50μA	£2-40
50-0-50μA	£2-35
100μA	£2-35
100-0-100μA	£2-35
200μA	£2-35
500μA	£2-20
1mA	£2-15
5mA	£2-15
10mA	£2-15
50μA	£2-35
500μA	£2-35
1mA	£2-35
5 amp.	£2-35
10 amp.	£2-35
20 amp. a.c.	£2-35
30 amp. a.c.	£2-35

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

Send for illustrated brochure on SEW Panel Meters—discounts for quantities.

"SEW" BAKELITE PANEL METERS

200mA	£1-75
300mA	£1-75
500mA	£1-75
750mA	£1-75
1 amp.	£1-75
2 amp.	£1-75
5 amp.	£1-75
10 amp.	£1-75
3V d.c.	£1-75
10V d.c.	£1-75
15V d.c.	£1-75
20V d.c.	£1-75
50V d.c.	£1-75
100μA	£1-95
200μA	£1-95
500μA	£1-80
1mA	£1-75
500-0-500μA	£1-75
1mA	£1-75
1-0-1mA	£1-75
2mA	£1-75
5mA	£1-75
10mA	£1-75
20mA	£1-75
30mA	£1-75
150mA	£1-75
VU Meter	£2-30

Type S-80 80mm square Fronts

50μA	£2-60
50-0-50μA	£2-60
100μA	£2-60
100-0-100μA	£2-60
200μA	£2-60
500μA	£2-45
500-0-500μA	£2-15
1mA	£2-15
1-0-1mA	£2-15
5mA	£2-15
10mA	£2-15
20mA	£2-15
30 amp. a.c.	£2-15
100mA	£2-15
500mA	£2-15
VU Meter	£3-40

"SEW" EDUCATIONAL METERS

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

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

50μA	£5-50
100μA	£5-10
1mA	£4-85
50-0-50μA	£5-10
1-0-1mA	£4-85
1A d.c.	£4-85
5A d.c.	£4-85
10V d.c.	£4-85
20V d.c.	£4-85
50V d.c.	£4-85
300V d.c.	£4-85
300V a.c.	£5-10
5V/50V d.c.	£5-10

POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range ex-stock. Single hole fixing, 1/2in. dia. shafts. Bulk quantities available.

25 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. 90p. Post 10p.

50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. £1-15. Post 10p.

100 WATT. 15/10/25/50/100/250/500/1000 or 2500 ohms. £1-65. Post 15p.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

S-260 General Purpose Bench Mounting

1 amp.	£7-00
2.5 amp.	£8-05
5 amp.	£11-75
8 amp.	£15-90
10 amp.	£22-50
12 amp.	£23-60
20 amp.	£29-00
25 amp.	£58-00
40 amp.	£82-50

S-260 Panel Mounting

1 amp.	£7-00
2.5 amp.	£7-00

Please add postage

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

AUTO TRANSFORMERS

60W	£2-10	P. & P. 18p
150W	£2-70	P. & P. 18p
300W	£3-60	P. & P. 23p
500W	£5-25	P. & P. 33p
1000W	£7-50	P. & P. 38p
1600W	£10-20	P. & P. 43p
2250W	£17-25	P. & P. 50p
5000W	£36-00	P. & P. £1

230 VOLT A.C. 50 CYCLES RELAYS

Brand new, 3 sets of changeover contacts at 5 amp. rating. 50p each. Post 10p (100 lots £40). Quantities available.

HONEYWELL DIGITAL VOLTMETER VT.100

Can be panel or bench mounted. Bench meter measures 1V d.c. but can be used to measure a wide range of a.c. and d.c. volt, current and ohms with optional plug in cards. Specification: Accuracy: ±0.2, 1 digit. Resolution: 1mV. Number of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1.000). Input impedance: 1000 Meg ohm. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100V d.c. Input: Fully floating (3 poles). Input power: 110-250V a.c. 50/60 cycles. Overall size: 5 1/2in x 2 1/2in x 8 1/2in. AVAILABLE BRAND NEW AND FULLY GUARANTEED. £35.50. Carr. 30p.

240° Wide Angle 1mA Meters

MW1-6 60mm square	£3-97
MW1-8 80mm square	£4-97

Post extra

RP214 REGULATED POWER SUPPLY

Solid state. Variable output 0-24V d.c. up to 1 amp. Dual scale meter to monitor voltage and current. Input 220/240V a.c. Size 185 x 85 x 102mm. £8-97. Post 25p.

PS.200 REGULATED P.S.U.

Solid state. Variable output 5-20V d.c. up to 2 amp. Independent meters to monitor voltage and current. Output 220/240V a.c. Size 7 1/2in x 5 1/2in x 3 1/2in. £19-95. Post 25p.

PS.1000B REGULATED POWER SUPPLY

Solid state. Output 6, 9 or 12V d.c. up to 3 amps. Meter to monitor current. Input 220/240V a.c. Size 4 1/2in x 3 1/2in x 6 1/2in. £11-97. Post 25p.

230V/240V SMITHS SYNCHRONOUS GEARED MOTORS

Built in gearbox. All brand new and boxed. 30 RPH CW; 2 RPH CW; 20 RPH CW; 2 RPH ACW; 30 RPH CW. 50p each, Post 12p.

LB4 TRANSISTOR TESTER

Tests PNP or NPN transistors, Audio induction. Operates on two 1.5V batteries. Complete with all instructions, etc. £4-50. Post 20p.

LB3 TRANSISTOR TESTER

Tests IC0 and B. Pnp/pnp. Operates from 9V battery. Complete with all instructions, etc. £3-95. Post 20p.

MCA.220 AUTOMATIC VOLTAGE STABILISER

Input 88-125V a.c. or 176-250V a.c. Output 120V a.c. or 240V a.c. 200VA rating. £11-97. Post 50p.

SEND S.A.E. FOR LIST OF SEMICONDUCTORS AND VALVES

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

KAMODEN 72.200

MULTI TESTER
High sensitivity tester. 200,000 o.p.v. Overload protection. Mirror scale. Ranges: 0/0.0/0.3/3/30/120/600/1,200V d.c., 0/3/12/60/300/1,500V a.c. 0/60µA/1.2mA/120mA/600mA/1.2A d.c. 0/12µA a.c. — to +63dB. 0/2KΩ/200KΩ/2MΩ/200MΩ. £18-95. Post 30p.



KAMODEN HM-350 TRANSISTOR TESTER

High quality instrument to test Reverse Leak current and D.C. current. Amplification factor of NPN, PNP, transistors, diodes, SCR's, etc. 4" x 4 1/2" clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. £12 50. Post 30p.



KAMODEN HMG-500 INSULATION RESISTANCE TESTER

R a n g e 100 to 1000 Megohms, 500 Volt. Battery operated. Wide range clear meter 4 1/2" x 4". Complete with deluxe carrying case, batteries, instructions. £19-95. Post 30p.



ARF-300 AF/RF SIGNAL GENERATOR
All transistorised, compact, fully portable. AF sine wave 18 Hz to 220 KHz. AF square wave 18 Hz to 100 KHz. Output sine/square 10V. P.P. RF 100 KHz to 200 MHz. Output Iv. maximum. Operation 220/240V. A.C. Complete with instructions and leads. £29-95. Post 50p.

HAND HELD 2-WAY WALKIE TALKIES

Industrial quality in robust metal cases. Battery operation. Volume and squelch controls. Call button and press to talk button. Telescopic aerial. Complete carrying cases.
2 channel £52-50 Pair. Post 50p.
3 channel £79-50 Pair. Post 50p.
(Note: Licence required for operation in U.K.)

HOMER INTERCOMS

Ideal for home, office, stores, factories, etc. Supplied complete with batteries, cable and free instructions.
2 Station, £2-97, 3 Station £5-25, Post 15p.
4 Station £6-92, Post 17p.



EMI SPEAKERS
Model 350. 13in x 8in with single tweeter/crossover, 20-20,000Hz. 15W RMS. Available 8 or 15 ohms. £7-25 each. Post 37p.
Model 450. 13in x 8in with twin tweeter/crossover, 55-13,000Hz. 8W RMS. Available 8 or 15 ohms. £3-82 each. Post 25p.

SPECIAL OFFER! STEREO SPEAKERS

Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size: 14 1/2in x 9in x 7 1/2in. 8 ohms. 8W RMS. 16W peak. Complete with DIN lead. £12-95. Carr. 50p.

EA.41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, guitar etc., and output into your amplifier. Volume control, depth of reverberation control. Beautiful walnut cabinet. 7in x 3in x 4 1/2in. £5-97. Post 15p.



UNR-80 RECEIVER



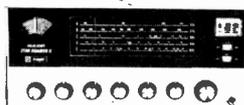
4 Bands covering 550kHz-30MHz. BFO. Built-in Speaker 220/240V a.c. Brand new with instructions. £15-75. Carr. 37p.



UR-1A SOLID STATE COMMUNICATION RECEIVER

4 Bands covering 550kHz-30MHz. FET. S Meter. Variable BFO for SSB. Built-in Speaker, Bandspread, Sensitivity Control. 220/240V a.c. or 12V d.c. 12 1/2in x 4 1/2in x 7in. Brand new with instructions. £25. Carr. 37p.

SKYWOOD CX203 COMMUNICATION RECEIVER



Solid state. Coverage on 5 bands 200-420 kHz and 0-55 to 30MHz. Illuminated slide rule dial. Bandspread. Aerial tuning. BFO, AVC, ANL, "S" meter. AM/CW/SSB. Integrated speaker and phone socket. Operation 220/240V a.c. or 12V d.c. Size 325 x 296 x 150 mm. Complete with instructions and circuit. £32-50. Carr. 30p.

LAFAYETTE HA-800 SOLID STATE RECEIVER

General coverage 150-400kHz, 650 kHz-30MHz. FET front end, 2 mech. filters, product detector, variable BFO, noise limiter. S Meter, Bandspread. RF Gain. 15in x 9 1/2in x 8 1/2in. 18lbs. 220/240V a.c. or 12V d.c. Brand new with instructions. £50. Carr. 50p.



TRIO 9R59DS COMMUNICATION RECEIVER
4 band covering 550kHz-30MHz continuous and electrical bandsread on 20, 15, 20, 40 and 80 metres. S valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW. ANL. Variable BFO. S meter. Sep. bandsread dial. 1F frequency 455kHz. Audio output 1.5W. Variable RF and AF gain controls 115/250V a.c. Size 7in x 13in x 10in with instruction manual. £49 50. Carr. paid.

ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9V battery. Inputs 5MVA/100MV. Output 50MW. £5-97. Post 15p.



HA-10 STEREO HEADPHONE AMPLIFIER

All silicon transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9V battery. Inputs 5MVA/100MV. Output 50MW. £5-97. Post 15p.



1021 STEREO LISTENING STATION

For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6in x 4in x 2 1/2in. £2-25. Post 15p.



MP7 MIXER PREAMPLIFIER

3 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9 1/2in x 5 1/2in x 3in. Inputs Mics: 3 x 3mV 50K. 2 x 2mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K. £8-97. Post 20p.

HI-FI EQUIPMENT SAVE UP TO 33% OR MORE

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



FANTASTIC OFFER! NIKKO TRM50 STEREO AMPLIFIER



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

List price £59-50
OUR PRICE
£39-95
Carriage 50p

NIKKO TRM 50 SYSTEM



NIKKO TRM50 17+17W rms stereo amplifier, Garrard AP76 plinth and cover, Goldring G800E cartridge, pair of Linton 2 speakers and all leads.

OUR PRICE **£93-95** Carr. and Ins. £1-50

LEAK DELTA 30 SYSTEM



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

OUR PRICE **£109-95** Carr. and Ins. £1-50

TELETON SAQ206B SYSTEM



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

OUR PRICE **£51-50** Carr. and Ins. £1-50

AUDIOTRONIC ACP-8 8-TRACK CAR PLAYER



Attractive black and silver finish. 12V neg. earth. Slider controls for volume, tone and balance. Channel selector button with red pilot lamp. Complete with speakers, mounting brackets and instructions.

ONLY **£12-50** P. & P. 40p.

AUDIOTRONIC ACR3500 CAR RADIO



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

OUR PRICE **£6-50** P. & P. 50p

AUDIOTRONIC ACR. 1 PUSH BUTTON CAR RADIO

Push button tuning of one LW and five MW stations of your choice. 12V Pos. or Neg. earth. Complete with speaker, mounting brackets and instructions.

OUR PRICE **£8-95** P & P. 50p.

MONOTONE 6750 SYSTEM



Monotone AM/FM 4+4W stereo tuner amplifier, Garrard 2025 T/C, plinth and cover, stereo cartridge, pair of matching speakers and all leads.

OUR PRICE **£30-50** Carr. and Ins. £1

WHARFEDALE LINTON SYSTEM



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

OUR PRICE **£95-95** Carr. and Ins. £1-25
LINTON RECEIVER SYSTEM £125. Carr. and Ins. £1-50.

AMSTRAD 8000 II SYSTEM



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

OUR PRICE **£45-50** Carr. and Ins. £1



B.S.R. TD8 8-TRACK STEREO TAPE DECK

Integrated preamps (output 126mV) to feed into any stereo amplifier. Automatic and manual programme selector. 4 pole synchronous motor. 210/240V a.c.

OUR PRICE **£12-75** Carr. 50p.

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



SINCLAIR PROJECT 60 PACKAGE DEALS

2x Z30/Stereo 60/PZ5 £15-95. P. & P. 37p
 2x Z30/Stereo 69/PZ6 £18-00. P. & P. 37p
 2x Z50/Stereo 60/PZ8 £20-25. P. & P. 37p

Transformer for PZ8 £2-97 extra
 Active Filter Unit £4-45 extra
 Pair of Q16 Speakers £10-70 extra
 Sinclair Project 60S £20-97. P. & P. 37p

All other Sinclair Products in stock: 2000 Stereo Amplifier. £22-95. 3000 Stereo Amplifier. £28-95. 2000/3000 Stereo Tuner. £28-95. P. & P. 50p.



List Price £2-98
OUR PRICE £1-80
 P. & P. 10p.

★ TRANSISTORISED FM TUNER ★

3 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6in x 4in x 2 1/2in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88-108MHz. Really built ready for use. Fantastic value for money. £5-95. Post 12p. Stereo multiplex adaptors £4-97.

TE 1018 DE-LUXE MONO HIGH IMPEDANCE HEADSET

Sensitive, soft earpads, adjustable headband. Magnetic, impedance 2,600 ohms. £1-97. Post 15p.

KOSS BARGAIN! S3XC STEREO HEADPHONES

Extremely sensitive high quality headphones. Impedance 4-16 ohms. 10-15,000Hz. Soft sponge ear cushions. 10ft coiled lead. Brand new and boxed. (List £9-50).
OUR PRICE £6-50 P. & P. 30p.

HOSIDEN DH0-2S STEREO HEADPHONES

Wonderful value and excellent performance combined. Adjustable headband. 8 ohm impedance. 20-12,000 cps. Complete with lead and plug. ONLY £2-37. Post 12p.

TE-1035 STEREO HEADPHONES

Low cost high performance stereo headphones. Foam rubber ear cups. Adjustable headband. 8 ohm impedance. 25-18,000Hz. With lead and stereo jack plug. ONLY £1-97. Post 12p.

ROTEL BARGAINS!



STEREO AMPLIFIERS

RA210 8 + 8 watt £22-50
 RA310 15 + 15 watt £24-95
 RA610 32 + 32 watt £51-95
 RA810 40 + 40 watt £72-95
 RA1210 60 + 60 watt £89-95

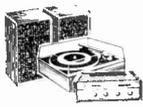
P. & P. 50p extra

AM/FM STEREO RECEIVERS

RX150 7 1/2 + 7 1/2 watt £36-95
 RX200 10 + 10 watt £46-50
 RX400 20 + 20 watt £57-50

P. & P. 75p

ROTEL RAZ10 SYSTEM



8 + 8 watt amplifier, BSR MP60, plinth and cover, G800 cartridge, pair of Medway T138 speakers and all leads.

OUR PRICE £54-50

Carr. & Ins. £1-25

ROTEL RX150 SYSTEM



AM/FM 7 1/2 + 7 1/2 watt stereo tuner amplifier, BSR MP60, plinth and cover, G800, pair of Denton 2 speakers and all leads.

OUR PRICE £76-50

Carr. & Ins. £1-25

ROTEL BARGAIN!

RH700 STEREO PHONES



Soft leather ear cushions. Impedance 8-16 ohm. 20-20,000Hz. 15ft coiled lead. Brand new and boxed.

OUR PRICE £6-75

P. & P. 30p

HOSIDEN DH-08S DE-LUXE STEREO HEADPHONES



Features unique mechanical 2 way units and fitted adjustable level, controls. 8 ohm impedance. 20-20,000cps. Complete with spring lead and stereo jack plug £7-97. Post 12p

BH.001 HEAD SET AND BOOM MICROPHONE



Moving coil. Ideal for language teaching, communications. Headphone imp. 16 ohms. Microphone imp. 200 ohms. £4-62. Post 15p.

AKAI BARGAINS



CASSETTE (P. & P. 50p)

CS35D Deck £44-95
 CS35 Recorder £57-75
 CS35/S8 Speakers £67-95
 GX40D Deck £57-75
 GX40 Recorder £67-95
 GX40T Deck/Receiver £101-25
 GX45 Deck £78-25
 GX45D Dolby Deck £84-30
 GX46 Recorder £90-75
 GX65D Dolby Deck £93-40
 CARTRIDGE (P. & P. 50p)
 CR81 Deck with amps. £86-20
 CR81D Deck £54-10
 CR81T Recorder/Receiver £93-70
 CR80S8 4 channel Recorder £114-95
 CR80D8S 4 channel Recorder £94-95

ROTEL RAZ10 SYSTEM

4000DS Dust Cover £29-95
 1721L Recorder £60-35
 X5000 Recorder £89-50
 X201D Deck £108-20
 GX22D Deck £123-95
 GX280D Deck £138-40
 GX370 Deck £211-50

TAPE/CASSETTE (P. & P. 75p)

GX1900D Deck £144-50
TAPE/CARTRIDGE (P. & P. 75p)
 X1810D Deck £138-40
TAPE/CASSETTE/CARTRIDGE (P. & P. 75p)
 X2000SD Recorder £180-75

MICROPHONES (P. & P. 50p)

ADM11 Dynamic (pair) £7-50
RECEIVERS (P. & P. 75p)
 AA6300 20 + 20 watt £81-95
 AA8030 25 + 25 watt £84-50
 AA8080 40 + 40 watt £114-25
 AA8090 65 + 65 watt £150-50

DOLBY SYSTEM NOISE REDUCTION UNIT



Improves the performance of cassette and semi-professional recorders. Reduces tape hiss by 3dB at frequencies above 3000Hz. Controls for all frequencies above 3000Hz and 10dB input levels and noise reduction on record and replay. 2 meters for Dolby level. Off tape monitoring. Frequency response: 20Hz to 15kHz ±1dB 10kHz-35dB. Size 1 1/2in x 9in x 3 1/4in. A.e. 200/250V.
OUR PRICE £32-50

AUDIOTRONIC LOW NOISE TAPE CASSETTES

Top Hi-Fi quality in library cases.
 Type 5 10 25
 C60 £1-29 £2-53 £5-99
 C90 £1-85 £3-62 £8-59
 C120 £2-29 £4-48 £10-63

P. & P. Post Free
 Tape Head/Cleaner 30p each

AUDIOTRONIC 8-TRACK BLANK TAPE CASSETTES

Type 1 5 10
 40M £1-75 £3-50 £6-50
 80M 99p £4-70 £8-90

P. & P. 5p Post free

SPECIAL OFFER OF NEAT EQUIPMENT



Identical specification to Neat G30 static balance arm but two-tone chrome and black finish. Complete with head shell, pick up rest and plug-in phono leads. Brand new and fully guaranteed.
OUR PRICE £7-50 P. & P. 25p
 Neat G30B Arm, £8-40. P. & P. 25p
 Neat V70 Cartridge (original pack), £2-15
 Neat V70S Cartridge (bulk pack), £1-50
 Neat V70E Cartridge, £3-35
 Neat V60MH Cartridge, £3-15.
 (P. & P. 12p extra on last four items).

RECORD DECKS

Carriage and Packing 50p
BSR McDONALD
 C114 Mini £3-95
 C129 Mono £5-50
 C137 £7-00
 510/TPD1 £13-95
 610 £9-90
 610/TPD1 £14-85
 710 £18-20
 810 £24-50
 710/810 Plinth and Cover £28-35
 MP60 £7-65
 MP60/G800 £10-25
 MP60/TPD1 £12-60
 MP60/TPD2 £11-25
 HT70 £10-97
 HT70/G800 £13-60
 HT70/TPD1 £15-95

GARRARD
 2025 T/C Stereo £6-40
 SP25 III/Accos £8-50
 SP25 III/Ceramic £9-50
 SP25/M75-6 £13-90
 AP76 £15-55
 SL65B £11-15
 SL72B £17-75
 SL95B £25-25
 401 £23-50
 ZERO 100A £30-30
 ZERO 100S £27-95

CONNOISSEUR
 BD1 Kit £8-65
 BD1 Chassis £10-75
 BD1/SAU2/Plinth/Cover £26-15
 BD2/SAU2/Chassis £21-15
 BD2/SAU2/Plinth/Cover £26-75

GOLDRING
 G99 £10-85
 G101P/C £16-75
 G109/2 £18-85
 GL72 £17-85
 GL72/P £23-20
 Plinth/G99/2 £5-35
 LID 72 £23-70
 GL75 £23-75
 GL75P £29-30
 GL69/2 £5-55
 PL172/P £2-87
 LD 75 £2-87
 GL83P/C £49-50

PLINTHS AND COVERS

Carriage and Packing 50p
 Budget SP25, etc. £2-95
 Budget AP76/Zero 100S £3-95
 Budget BSR £2-95
 SME 2000 System £26-40

RECORD DECK PACKAGES

Carriage and Packing 75p.
 Complete units with stereo cartridge ready wired in plinth with cover.
GARRARD
 2025 TC/9TAH(C) £10-65
 SP25 III/G800 £15-95
 SP25 III/M44E £17-25
 SP25 III/M44F £16-75
 SP25 III/M55E £18-25
 SP25 III Module/M75-6 £18-99
 AP76/G800 £23-95
 AP76/G800E £25-85
 AP76/M44E £24-95
 AP76/M75E £26-25
 AP76/M75EJ £31-70
 AP76/M75EJ £27-85
 AP76 Module/M75-6 £26-95
 AP96 Module/M75-6 £30-40
 ZERO 100S Module/M93E £41-85

BSR McDONALD
 C114/87M £6-85
 MP60/G800 £15-50
 MP60/TPD1/G800 £15-20
 MP60/M44-7 £16-75
 HT70/TPD1/G800 £18-60

GOLDRING
 GL75/G800 £34-10
 GL75/G800E £36-75

GOODMANS
 TD100/G800 Teak £42-95
 TD100/G800 White £44-75

LEAK
 Delta/M75-6 £43-95

PHILIPS
 GA105/GP200 £13-80
 GA160/GP200 Teak £20-00
 GA212/GP400 £45-25
 GA308/GP400 Teak £22-50

PIIONEER
 PL12D (less cartridge) £32-50
 PL15C (less cartridge) £45-35
 PL41D (less cartridge) £104-75
 PL50 (less cartridge) £98-90
 PL61 £112-99
 PLA35 £75-45

WHARFEDALE
 Linton/M44-7 £23-70

V.A.T. INFORMATION

All prices quoted are subject to 10% Value Added Tax. This must be added to the total value of goods ordered (including postage/carriage).
CREDIT TERMS FOR CALLERS ACCESS & BARCLAYCARD WELCOME

Note: All items correct at time of printing but subject to change without notice.
 E. & O. E.

G.W. SMITH & CO (Radio) LTD
 Personal Callers Welcome - All Branches Open 9-6 Mon. to Sat.

10 TOTENHAM CT. RD. LONDON, W.1
 27 TOTTENHAM CT. RD. LONDON, W.1
 257/258 TOTTENHAM CT. RD. LONDON, W.1
 3 LISLE STREET, LONDON, W.C.2
 34 LISLE STREET, LONDON, W.C.2
 311 EDGWARE ROAD, LONDON, W.2

Tel: 01-637 2232
 Tel: 01-636 3715
 Tel: 01-580 0670
 Tel: 01-437 8204
 Tel: 01-437 9156
 Tel: 01-262 0387

All Mail Orders to 11-12, Paddington Green, London, W.2
 Tel: 01-262 8562

ELECTROKIT

Now available from one company are kits for many of the articles published in the Electronics, Radio and TV Journals. Examples of our range are:

SCORPIO IGNITION SYSTEMS (P.E. Nov. 1971), £9.50. This kit includes all the parts for the assembly of this popular and reliable system. The hardware and the construction data are included.

DRILL SPEED CONTROLLER (E.E. Aug. 1972). Kit consists of resistors, rectifiers, thyristor and tag board as specified in the article, price £1.15. Kit with M.K. box, switch and plate included. £2.30.

ELECTRONIC PIANO (P.E. Sept. 1972). We can supply the various sections for this article in kit form:

Power Supply, £6.60, including all semiconductors, resistors, capacitors, transformer, heat sink and hardware less P.C.B.

Preamp and Tremelo, £3.20, complete with switches, hardware and electronic components, less P.C.B.

Main Amp., £4.20, complete with IC-12, electronic components and P.C.B.

13 Pitch Boards, £39.50. Kit contains all the resistors, capacitors and semiconductors as published, but not the P.C.B.'s or the inductor.

LIGHT DIMMER. Kit contains all parts including circuit and construction data, 480 watts, fully suppressed. Price £2.10.

MUSIC MAKER ELECTRONIC ORGAN (P.W. Nov. 1972). Complete kit £4.40 or kit less resistors, P.C.B. and plastic box, £2.80. Stylus not supplied.

MIGHTY MIDGET (P.W. Jan. 1973). Kit contains all parts, less the battery, box and knob, £2.25.

TRIFFID RADIO (P.E. Feb. 1973). Kit includes all parts listed, less "tuning coil" and "miscellaneous components", £4.95. Ferrite rod and wire optional extra at 50p. P.C.B. optional extra at 65p.

We shall be offering kits for most articles published in the popular electronics magazines and will be pleased to quote prices.



Send for details of kits available (please enclose S.A.E.). All kits sent POST FREE within the limits of the U.K.

Please note. We reserve the right to withdraw kits without prior notification.

Please note, prices shown do not allow for V.A.T. Please add 10% to your order.

ELECTROKIT

12 Lauderdale Road, London, W.9

Telephone 01-286 0011

Mon.-Fri. 9.30-5.30

Thurs. 9.30-6.30

ERSIN



for fast, easy reliable soldering

Ersin Multicore Solder contains 5 cores of non-corrosive flux, instantly cleaning heavily oxidised surfaces. No extra flux is required.

EASY-TO-USE DISPENSERS



Size 5
Savbit alloy
18 swg, 18p
(illustrated).
Size 19A
60/40 alloy
18 swg, 18p
Size 15
60/40 alloy
22 swg, 22p

IDEAL FOR HOME CONSTRUCTORS

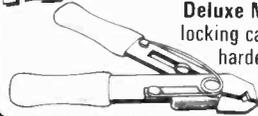
Size 1 cartons in 40/60, 60/40 and Savbit alloys in 7 gauges 25p



Size 12
for Service Engineers and Electricians.
75ft of 18 swg
Savbit alloy. 75p



NEW! BIB WIRE STRIPPER AND CUTTER



Deluxe Model 9 Automatic opening spring, locking catch, plastic-covered handles. Case hardened and precision ground. Adjusts to most wire sizes. Cuts and strips flex, splits plastic twin flex. 75p

Prices shown are recommended retail, excluding V.A.T. From Electrical and Hardware Shops. If unobtainable, send 10p p&p direct to: **Multicore Solders Ltd.**, Hemel Hempstead, Hertfordshire HP2 7EP



AMAZING MINI-DRILL



FOR PRECISION MODEL WORK

ABRASIVE
SPEAR DRILL
BURR
NIP
BRUSH

+ 6 TOOLS

Indispensable for precision drilling, grinding, polishing, etching, gouging, shaping. Precision power for the enthusiast. Shockproof. Completely portable power from 4½ volt external battery. So much more scope with MINI-DRILL. Super Kit (extra power, interchangeable chuck) £5.44 p.p. 13p. De Luxe Professional Kit with 17 tools £8.41 p.p. 23p. Money Ref. Guarantee.

MERLIN SUPPLY CO.

Dept. PE5D, Nailsea, Bristol BS19 2LP

STEREO IC DECODER

HIGH PERFORMANCE PHASE LOCKED LOOP (as in 'W.W.' July '72)
MOTOROLA MC1310P

EX STOCK DELIVERY

Specn. Separation: 40dB 50Hz-15kHz. Distortion: 0.3%, I/P level: 560mV rms. O/P level: 485mV rms per channel. Input impedance: 50k. Power requirements: 8-12V @ 16mA. Will drive up to 75mA stereo 'on' lamp or LED.

KIT COMPRISES FIBREGLASS PCB

(Printed and tinned), Resistors, I.C., Capacitors, Preset Potm. and Instructions. Only £3.50 post free.

LIGHT EMITTING DIODE (Red)

Suitable as stereo 'on' indicator. For above with panel mounting clip and instructions. Only 35p + p.p.

MC1310P only £2.77 + p.p. 6p

14 PIN DIL SOCKETS. 16p each.

SPECIAL OFFER

IN4002 100V 1A RECT. DIODES. Full Specification Devices. ONLY 6p each V.A.T. at 10% from April 1st must be added to all prices.

Fi-Comp Electronics

BURTON ROAD, EGGINGTON, DERBY DE6 6GY

(*All prices include V.A.T.)
YES, "YOU'VE GOT THE WHOLE WORLD IN YOUR HANDS"! ALMOST UNBELIEVABLE! Think of the year 1984 and what might be produced. Then—now—get the fantastic **ASTRAD 17** and see for yourself that the incredible Russians have done it all NOW! It's the radio perfectionist's dream come true! **THIS ONE SUPERSEDES ALL EARLIER MODELS!** It will probably make your present radio seem like a "crystal set"! Complete with optional battery eliminator for both battery and mains use! We're almost giving them away at only £19.47—a mere fraction of even today's Russian miracle price! We challenge you to compare performance and value with £80 radios! Done it all quickly, after receiving goods test 7 days, refund if not delighted. Or call. Elegant black & chrome finish face, set in fabulous Cabinet built case—constructed of fine Russian hardwood in beautiful Teak Veneer finish—prevents vibration, ensures purer & sweeter tone than ever! Volume controlled from a whisper to a roar that would fill a hall! Much wider band spread, for absolute "pin-point" station selection! Plus "MAGIC EYE" tuning level indicator for ultra perfect tuning sensitivity! Yes, the Russians have surpassed themselves, proving again their fantastic ability in the field of electronics and brilliantly reflecting their advanced micro-circuitry techniques in the field of spacehip and satellite communications. **YES, EVERY WAVEBAND** instantly at your fingertips including Standard Long, Medium, Short and Ultra Short Waves to cover the four corners of earth during 24 hours a day including all normal transmissions. VHF, FM, USW, AM: LW, MW, SW, gets, locally, local & new stations not yet operational, and messages from all over the world! Expensive **TURRET TUNER** side control waveband selection unit (as used on expensive T.V.'s!). Every waveband clicks into position giving incredible ease of station tuning! Genuine push-pull output! ON/OFF volume and separate Treble and Bass tone controls for utter perfection of reproduction and tone! Press-button dial illumination! Take it anywhere—runs economically on standard batteries (obtainable everywhere) or direct through battery eliminator from 220/240V AC mains supply. Internal ferrite rod aerial plus built-in "rotatable" telescopic aerial extending to 39in approx. It's also a fabulous **CAR RADIO**. Can also be used through extension amplifier, tape recorder or public address system. **SIZE 14in x 10in x 4 1/2in** over—Magnificently designed, made to give years of perfect service. (U.K. service facilities & spares available for years & years to come, if ever necessary!). With **WRITTEN GUARANTEE**, manual with simple operating instructions & circuit diagram. **ONLY £19.47** (with mains/battery eliminator £1.62 extra). **BOX, POST, ETC. 55p.** **BUT WAIT!** for only 50p extra, you get the sensational **"COMPUTERISED" WORLD TUNING GUIDE** (it enables you to time, pinpoint & get transmissions the whole world over—even a child can do it in a flash—it even lets you know when to tune into the U.K. when abroad, NO GUESSING! NO MESSING!) **PLUS** Standard "longlife" batteries **PLUS** ultra sensitive earphone for personal listening. (Sorry—We cannot change these new radios for any earlier model purchased.) Send quickly to Uxbridge Road address, or call at either Store. **But: HURRY! SHOPERTUNITIES SAVE YOU £££.**

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

**THIS FANTASTIC
 EARTH SHRINKER**

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

**BRAND NEW
 FABULOUS ASTRAD 17**
 PORTABLE RADIO & COMMUNICATIONS
 RECEIVER



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

BATTERY MODEL
£19.47 **BOX POST ETC. 55p**
MAINS/BATTERY ELIMINATOR £1.62 extra

FIRST TIME EVER!
 *NOW AVAILABLE WITH
 fabulous "COMPUTERISED"
WORLD TUNING GUIDE!
 *RE GUESSWORK—
 INSTANT DATA at your fingertips—
 enables you to **TUNE IN A FLASH!**
 to transmissions the world over!

THIS OFFER ONLY FROM US!

BUY ONE FROM US! **SAVE £21.60 NOW!**
Fabulous BRAND NEW SOLID STATE
BATTERY/MAINS AC Combined V.H.F. AM/FM RADIO and CASSETTE TAPE RECORDER & PLAYER
 This equipment's got EVERYTHING!
 WITH REMOTE CONTROL MICROPHONE
RECOMMENDED RETAIL PRICE £44
OUR PRICE £22.40 **CARR. ETC. 39p**

(*All prices include V.A.T.)
 Shopertunities "thunder" ahead with an offer that's FANTASTIC (even by our standards!). We've snapped up 500 magnificent machines. Latest sensation in the world of sound! First-class makers! Fabulous VHF, AM, FM Radio AND Cassette Tape Recorder & Player combined & it also runs off standard batteries or mains. (Simply plug in the 220/240V AC line cord.) Record and play back anything, anywhere! **RECOMMENDED RETAIL PRICE GENUINELY £44! WE OFFER AT ALMOST HALF PRICE!** Wonderful features: ★ Press-button Keyboard Control Panel or latest MASTER SWITCH CONTROL! ★ "MAGIC EYE" Visual Battery check/recording level indicator or built-in automatic Leveller! ★ Separate ON/OFF and HI-LO volume controls! ★ Heavy duty built-in speaker! ★ Earphone (for personal listening or "monitoring") and extension speaker sockets! ★ Remote control microphone! ★ Built-in swivel telescopic extension aerial (24in approx.). Magnificently made case with carry handle. (DESIGNS VARY SLIGHTLY.) Takes standard 30, 60, 90 or 120-minute Cassette Tapes, obtainable everywhere. AND the amazing built-in full circuit VHF, AM/FM Radio gives you superb clarity of tone, incredible station selection. Unique rotating Station Selector Dial—gets, locally, city and region stations in every part of the country, plus B.B.C. National, VHF. Picks up dozens of foreign stations. **Fabulous in your car!** You could pay £££'s more for a Car Radio or Car Cassette player ALONE! **£22.40, carr. etc., 39p.** Complete with simple instructions, remote control microphone with on/off switch and microphone stand, **WITH WRITTEN GUARANTEE.** Send quickly, after receiving goods, test 7 days, refund if not delighted. Or call. **BONUS OFFER:** Batteries and Cassette Tape 28p extra if required.

FIRST TIME EVER! *SAVE £15.21!
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 £11.76 **POST ETC. 34p**

(*All prices include V.A.T.)
 THE ONE STEP FORWARD EVERYONE HAS WAITED FOR! NOW a superb deluxe portable **BATTERY/MAINS** tape recorder and player—and incredible Shopertunities bring it to you for **ONLY £12.49!** Due to our cut price we cannot name first-class makers—but rest assured you're getting one of the **BEST!** Expensive "PIANO KEYBOARD" CONTROL PANEL (or latest MASTER SWITCH control) AND AUTOMATIC LEVEL CONTROL. No fiddling with awkward tape and reels, just "slap-in" a cassette and off you go! (Takes 30, 60, or 90 minute standard cassette tapes, obtainable everywhere.) Amazing performance ensures perfect tapings and superb reproduction! Remote control microphone. Rapid Rewind! Fast forward! Beautiful tone from a whisper to a roar! Completely self contained—record anywhere, indoors or out! Runs on standard batteries AND 220/240V AC mains. Separate jacks for remote control microphone, etc. Size 9 1/2in x 5in x 2 1/2in approx. Design can vary slightly. With carry handle. **WRITTEN GUARANTEE** and full instructions. (Recommended selling price £26.97!) **OUR PRICE ONLY £11.76, post, etc. 34p.** *Send quickly, after receiving goods test 7 days—refund if not delighted.

Order by post to Uxbridge Road address or call at either store.
 Bargains galore at both stores—(COMMERCIAL TRAVELLERS PLEASE!
 NOTE: Merchandising office at Holborn Store.)

Dept. PE/28, 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.

SHOPERTUNITIES LTD.

RST VALVE MAIL ORDER CO.

16a WELLFIELD ROAD, LONDON SW16 2BS
SPECIAL EXPRESS MAIL ORDER SERVICE
Express postage 1p transistor, over ten post free
INTEGRATED CIRCUITS 5p + 1p each add

	Sp		Sp		Sp		Sp		Sp
1N21	0-17	AFZ12	1-00	BYZ10	0-85	OAZ211	0-82	Z8170	0-30
1N23	0-20	ASY26	0-25	BYZ11	0-82	OAZ222	0-45	Z8271	0-18
1N85	0-88	ANV27	0-82	BYZ12	0-80	OAZ223	0-46	ZT21	0-85
1N363	0-88	ANV28	0-85	BYZ13	0-25	OAZ224	0-45	ZT43	0-85
1N266	0-60	ANV29	0-80	BYZ16	1-00	OAZ242	0-22	ZTX107	0-15
1N446	0-25	ANV36	0-25	BYZ16	0-62	OAZ244	0-22	ZTX108	0-12
1N725A	0-20	ANV60	0-17	BYZ16	0-62	OAZ246	0-23	ZTX300	0-12
1N914	0-07	ASY61	0-40	BYZ88C3	0-0	OAZ290	0-88	ZTX304	0-25
1N4007	0-20	ASY63	0-20	C111	0-65	OC16	0-50	ZTX500	0-16
18113	0-15	ASY65	0-20	CR81/05	0-25	OC16T	0-88	ZTX503	0-17
18131	0-13	ASY66	0-58	CR81/40	0-45	OC29	0-86	ZTX531	0-25
18202	0-23	ASZ21	0-42	CS113	2-50	OC29	0-50		
2G371	0-22	ASZ23	0-75	CS10B	3-18				
2G381	0-25	ATY10	0-98	DD000	0-15	OC23	0-60		
2Q414	0-30	ATY101	1-50	DD003	0-16	OC24	0-60		
2G417	0-22	BC107	0-10	DD006	0-18	OC25	0-87	7400	0-20
2N404	0-22	BC108	0-10	DD007	0-40	OC28	0-25	7401	0-20
2N487	0-15	BC109	0-10	DD008	0-88	OC29	0-60	7402	0-20
2N698	0-40	BC113	0-15	DD1	0-05	OC29	0-60	7403	0-20
2N706	0-10	BC115	0-20	DD4	0-05	OC29	0-60	7404	0-20
2N706A	0-12	BC116	0-25	GD5	0-33	OC30	0-40	7405	0-20
2N708	0-15	BC118A	0-30	GD8	0-25	OC35	0-50	7406	0-30
2N709	0-63	BC118	0-25	GD12	0-05	OC36	0-60	7407	0-30
2N1091	0-33	BC121	0-20	GET102	0-30	OC36	0-60	7408	0-20
2N1131	0-25	BC122	0-20	GET103	0-22	OC41	0-25	7409	0-45
2N1132	0-25	BC125	0-68	GET113	0-30	OC40	0-30	7410	0-20
2N1302	0-18	BC126	0-65	GET114	0-15	OC43	0-40	7411	0-23
2N1303	0-18	BC140	0-55	GET115	0-45	OC44	0-17	7412	0-42
2N1304	0-22	BC147	0-15	GET116	0-50	OC44M	0-17	7413	0-30
2N1306	0-22	BC148	0-13	GET120	0-25	OC45	0-12	7414	0-30
2N1306	0-22	BC149	0-16	GET872	0-30	OC45M	0-18	7417	0-30
2N1307	0-25	BC157	0-15	GET875	0-25	OC46	0-27	7420	0-20
2N1308	0-25	BC158	0-12	GET880	0-37	OC47	0-60	7422	0-48
2N2147	0-75	BC160	0-63	GET881	0-25	OC59	0-60	7423	0-48
2N2148	0-60	BC169	0-13	GET882	0-25	OC59	0-65	7425	0-48
2N2180	0-60	BCY91	0-85	GET885	0-25	OC66	0-50	7427	0-50
2N2218	0-20	BCY92	0-55	GET885	0-25	OC66	0-50	7428	0-50
2N2219	0-20	BCY92	0-55	GET885	0-25	OC66	0-50	7428	0-50
2N2399A	0-15	BCY93	0-25	GET885	0-25	OC66	0-50	7428	0-50
2N2444	1-89	BCY94	0-30	GET885	0-25	OC66	0-50	7428	0-50
2N2613	0-28	BCY98	0-40	GET885	0-25	OC66	0-50	7428	0-50
2N2646	0-45	BCY99	1-00	GET885	0-25	OC66	0-50	7428	0-50
2N2904	0-20	BCY40	0-60	GET885	0-25	OC66	0-50	7428	0-50
2N2904A	0-25	BCY42	0-25	GET885	0-25	OC66	0-50	7428	0-50
2N2906	0-20	BCY70	0-15	GET885	0-25	OC66	0-50	7428	0-50
2N2907	0-23	BCY71	0-20	GET885	0-25	OC66	0-50	7428	0-50
2N2924	0-23	BCZ10	0-35	GET885	0-25	OC66	0-50	7428	0-50
2N2925	0-15	BCZ11	0-50	GET885	0-25	OC66	0-50	7428	0-50
2N2926	0-10	BD121	0-65	GET885	0-25	OC66	0-50	7428	0-50
2N3054	0-50	BD123	0-80	GET885	0-25	OC66	0-50	7428	0-50
2N3055	0-75	BD124	0-75	GET885	0-25	OC66	0-50	7428	0-50
2N3702	0-10	BFY11	1-02	GET885	0-25	OC66	0-50	7428	0-50
2N3705	0-10	BFY15	0-25	GET885	0-25	OC66	0-50	7428	0-50
2N3706	0-23	BFY17	0-50	GET885	0-25	OC66	0-50	7428	0-50
2N3707	0-12	BFY17	0-25	GET885	0-25	OC66	0-50	7428	0-50
2N3709	0-10	BFY173	0-25	GET885	0-25	OC66	0-50	7428	0-50
2N3710	0-10	BFY181	0-85	GET885	0-25	OC66	0-50	7428	0-50
2N3711	0-10	BFY182	0-85	GET885	0-25	OC66	0-50	7428	0-50
2N3819	0-35	BFY185	0-20	GET885	0-25	OC66	0-50	7428	0-50
2N6027	0-63	BFY194	0-17	GET885	0-25	OC66	0-50	7428	0-50
2N6088	0-33	BFY195	0-15	GET885	0-25	OC66	0-50	7428	0-50
28301	0-50	BFY196	0-15	GET885	0-25	OC66	0-50	7428	0-50
28304	0-75	BFY197	0-15	GET885	0-25	OC66	0-50	7428	0-50
28501	0-37	BFY861	0-25	GET885	0-25	OC66	0-50	7428	0-50
28798	0-20	BFY88	0-25	GET885	0-25	OC66	0-50	7428	0-50
AA129	0-20	BFY12	0-20	GET885	0-25	OC66	0-50	7428	0-50
AAZ12	0-30	BFY13	0-25	GET885	0-25	OC66	0-50	7428	0-50
AAZ13	0-12	BFY29	0-25	GET885	0-25	OC66	0-50	7428	0-50
AC107	0-37	BFY30	0-25	GET885	0-25	OC66	0-50	7428	0-50
AC126	0-20	BFY35	0-88	GET885	0-25	OC66	0-50	7428	0-50
AC127	0-25	BFY63	0-50	GET885	0-25	OC66	0-50	7428	0-50
AC128	0-20	BFY84	0-50	GET885	0-25	OC66	0-50	7428	0-50
AC187	0-25	BFY85	0-30	GET885	0-25	OC66	0-50	7428	0-50
AC188	0-25	BFY86	0-25	GET885	0-25	OC66	0-50	7428	0-50
ACY17	0-30	BFY87	0-25	GET885	0-25	OC66	0-50	7428	0-50
ACY18	0-25	BFY88	0-20	GET885	0-25	OC66	0-50	7428	0-50
ACY19	0-25	BFY10	1-00	GET885	0-25	OC66	0-50	7428	0-50
AF106	0-20	BFY90	1-25	GET885	0-25	OC66	0-50	7428	0-50
AF114	0-25	BSX76	0-15	GET885	0-25	OC66	0-50	7428	0-50
AF116	0-25	BSY26	0-18	GET885	0-25	OC66	0-50	7428	0-50
AF116	0-25	BSY27	0-17	GET885	0-25	OC66	0-50	7428	0-50
AF117	0-25	BSY61	0-50	GET885	0-25	OC66	0-50	7428	0-50
AF118	0-62	BSY90A	0-12	GET885	0-25	OC66	0-50	7428	0-50
AF119	0-20	BSY90	0-12	GET885	0-25	OC66	0-50	7428	0-50
AF124	0-25	BTY102/500R	0-85	GET885	0-25	OC66	0-50	7428	0-50
AF125	0-20	BTY102	0-75	GET885	0-25	OC66	0-50	7428	0-50
AF126	0-17	BTY42	0-92	GET885	0-25	OC66	0-50	7428	0-50
AF127	0-17	BTY79/100R	0-75	GET885	0-25	OC66	0-50	7428	0-50
AF139	0-30	BTY79	0-75	GET885	0-25	OC66	0-50	7428	0-50
AF176	0-55	BTY79	0-75	GET885	0-25	OC66	0-50	7428	0-50
AF176	0-85	BTY79	0-75	GET885	0-25	OC66	0-50	7428	0-50
AF180	0-52	BY100	0-15	GET885	0-25	OC66	0-50	7428	0-50
AF181	0-42	BY126	0-15	GET885	0-25	OC66	0-50	7428	0-50
AF186	0-40	BY127	0-17	GET885	0-25	OC66	0-50	7428	0-50
AFY19	1-18	BY182	0-85	GET885	0-25	OC66	0-50	7428	0-50
AFZ11	0-60	BYZ13	0-25	GET885	0-25	OC66	0-50	7428	0-50

Open daily to callers: Mon.-Fri. 9 a.m.-5 p.m.
Valves, Tubes and Transistors - Closed Sat. 1 p.m.-3 p.m.
Terms C.W.O. only | Tel. 01-677 2424-7

All orders subject to V.A.T. at 10% rate. This must be added to the total order including postage.

QUALITY COMPONENTS - BUDGET PRICES

PSYCHEDELIC LIGHTING UNIT IN KIT FORM

Make this fascinating three-channel unit from a kit which contains all components needed to produce a reliable and entertaining display. Takes its drive from the speaker terminals of a record player, tape recorder or portable radio. Will provide a brilliant 2kW of light, using normal 240 volt coloured lamps. Price per kit £9-45

HALF PRICE CABINET OFFER

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



METAL CABINETS

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

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

Approximate size in inches			Price
l	w	d	
8	6	3	£1-45
11	6 1/2	3	£1-85

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

FIXED VOLTAGE REGULATORS

TO3 case. Gives stabilised supply. MVR 5 volt, MVR 12 volt, MVR 15 volt. All priced at £1-50

CONTACT FLUID PEN

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

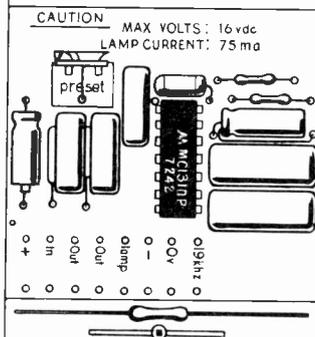
Our CATALOGUE, priced at 25p post free, shows the majority of the R.S. range of professional components. Most of these are available by return of post.

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

CELECTRON-E

P.O. Box No. 1, Llantwit Major, Glamorgan, Wales, CF6 9YN

Stereo radio from your existing tuner.



A complete set of parts from Jermyn to build a stereo decoder module that will convert your existing mono tuner for stereo reception whilst maintaining a high standard of reproduction.

The distortion is very low (typically 0.3% at 560 mV RMS composite input signal) with 40dB channel separation.

The stereo switching is automatic and there is a light emitting diode which acts as a stereo beacon.

The kit requires no coil and there are no alignment problems.

Fitting. The module requires a 10-16 volt power supply which can normally be tapped off the existing tuner. The signal input is taken off before the de-emphasis circuit which in practice means disconnecting one, or at the most, two capacitors. Any radio engineer will be able to spot these capacitors, but if you're really stuck send the circuit with a SAE to us and one of our engineers will indicate the output point. (This is the full extent of our involvement, no hardware please).

Of course, if you have a modern mono tuner with a multiplex output our module simply plugs in.

The outputs go via a screened twin cable to the tuner inputs of your stereo amplifier.

And the cost? £4.90 for the Kit with 100% tested integrated circuit. Also available assembled and aligned, checked and ready for use at £6.90 (includes 12 month guarantee). Beat that!

To Jermyn Industries Please rush me Kit(s), made up Stereo decoders. 82 Vestry Estate I enclose cheque/postal order for £ Sevenoaks Name Kent Address Block Capitals Please

SAXON ENTERTAINMENTS

STANDARD and CUSTOM-BUILT AUDIO and ELECTRONIC EQUIPMENT
NEW and SECONDHAND MUSICAL INSTRUMENTS. MAIN DISTRIBUTORS
FOR A.K.G. HIGH QUALITY MICROPHONES

SA25-SA35-SA100

LOW-PRICED AUDIO MODULES FOR
DOMESTIC and COMMERCIAL USE

New versions
using 3A
"Plastic Power"
Driver Transistors
now available



THESE THREE MODULES HAVE ENJOYED UNPARALLELED SUCCESS DURING THE FIRST FEW MONTHS OF THEIR BEING MADE AVAILABLE TO THE GENERAL PUBLIC. WE ARE PLEASED TO ANNOUNCE THAT WE CAN NOW OFFER FAST DISPATCH ON MOST OF OUR ADVERTISED ITEMS, INCLUDING THESE THREE MODULES.

SA25 £2-95 carr. free

25 WATTS R.M.S. 7 transistors, 7 diodes

SA35 £4-45 carr. free

35 WATTS R.M.S. 7 transistors, 7 diodes

SA100 £10-90 carr. free

100 WATTS R.M.S. 11 transistors, 6 diodes

ALL THREE MODULES HAVE OPEN AND SHORT CIRCUIT PROTECTION, AND THE SA100 IS PROOF AGAINST OVER-DISSIPATION AND FAULTY INDUCTIVE LOADS.

ONLY ADVANCED DESIGN TECHNIQUES MAKE THESE EXTRAORDINARILY LOW PRICES POSSIBLE.

BRIEF SPEC. FOR ALL THREE MODULES

Freq. response	20 40,000Hz 1dB
Distortion	0.2% at 1kHz
Loads	4 to 16 ohms
Quiescent current	15mA
Noise	Better than -75dB
Supply voltage	25 45V, SA25/35 40 70V, SA100
Size	4 1/2in 4in 1in (SA100) 4in 3in 1in (SA25, SA35)

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

POWER SUPPLIES FOR THE SA25/35 and SA100 AUDIO MODULES

PU45	Unstabilised supply for 2 SA25/35's, £4-90.
PU70	Unstabilised supply for one or two SA100's, £7-75, carr. 40p
PS45	Stabilised module for 2 SA25's or two SA35's, £3-50, carr. free
MT45	Transformer for above, heavy duty, £2-85, carr. 20p
MT30	Transformer for unstabilised supply complete with rectifier diodes mounted £3-50, carr. 20p
PS70	Stabilised supply module for one or two SA100's, £4-90, carr. free
MT70	Transformer for PS70, £4-90, carr. 40p

ALL MODULES ARE BUILT ON GLASS FIBRE P.C. BOARD AND ARE SUPPLIED FULLY TESTED

CALLERS AND MAIL
ORDER:
327-331 Whitehorse Road
W. Croydon, Surrey CRO 2HS
Tel. 01-684 6385

CALLERS ONLY:
OUR NEW DISTRIBUTORS
CIRCLE SOUND
328-330 The Banks
Rochester.
Medway 404199

BUSINESS
HOURS:
9.30 a.m. to
5.30 p.m.

TERMS OF BUSINESS: **C.W.O.** or **C.O.D.** (35p extra). All cash in regd. envelopes please! Telephone orders to our CROYDON BRANCH. TRADE AND EXPORT ENQUIRIES INVITED

OTHER SAXON PRODUCTS . . .

120 WATT HEAVY DUTY MODULE

Featuring a rugged class A driver stage, this module will run from all our mixers etc., and most other makes of mixer. It delivers 120W into an eight ohm load and employs 4 TO3 can (115V) output transistors.

SPECIFICATION

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

£13-90 + 20p carr. or with supply £18-95 + 40p carr.



NEW: 160 Watt version & supply £27-90

SINGLE CHANNEL SOUND/LIGHT CONVERTER

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

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



£8-90 carr. free



THREE CHANNEL SOUND TO LIGHT UNIT

Handling the total of 3,000W (3kW) this unit is unique for its price in that not only bass middle and treble but also master controls are provided. Two amplifier sockets eliminate the need for split leads, etc. Supplied in tough steel case for free-mounting or panel fixing. Fully guaranteed.

£19-75 carr. 30p

MONO VERSION £6-50, carr. 20p
(As illustrated below, S.A.E. details. 9V operation)
OUTPUTS UP TO 1V RMS



£15-80 carr. 30p
SAXON STEREO CONTROL UNIT

Two decks, and full headphone monitoring. The unit is mains operated and measures 17 1/2in x 3in x 4in deep and is finished with a smart white on black fascia. The controls are: Left/Right deck fader, volume, bass, treble, headphone selector and volume, microphone volume, bass, treble, mains on/off. THIS IS A MUST FOR THE HOME BUILT HIGH QUALITY DISCO-THEQUE AND IS COMPARABLE TO UNITS AT OVER TWICE THE PRICE. (N.B.—Stereo only has mic. input.)

COMPLETE AMPLIFIERS

THE CSE 100. £34-90 carr. free

This versatile unit is now available in a black vynidie case and so represents even better value than ever, delivering speech and music powers of up to 100W R.M.S. and continuous signal outputs of 70W.

Two individually controlled inputs with wide range bass and treble controls. Ideal for small groups, D.J.'s, etc.



The SAXON 100. £48-50, carr. free.

With an R.M.S. output of 120W speech and music, 100W continuous power, four individually controlled F.E.T. input stages and wide range bass and treble controls, this amplifier has established itself as a unit offering quality and reliability at low cost.

LOUDSPEAKERS British made bargains!!!

12in 25W 8/15 ohms £5-95, carr. 30p. 15in 50W 8/15 ohm. £14-50, carr. 50p. 12in 40W 15,000 gauss magnet system 8/15 ohm, £11-50, carr. 40p.

A.K.G. MICROPHONES suitable for disco, group or general P.A. use D11DHL ideal disco mike, only £9-45 (r.r.p. £11)

ALL PRICES SUBJECT TO VAT AT STANDARD RATE

600W 3 colour light boxes, smart rexine finish.
£15 carr. free

SEND S.A.E. FOR OUR A.K.G. PRICE LIST. DISCOUNTS ON ALL MICS.

CRESCENT RADIO LTD

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

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

COMPONENTS AND HI FI FOR THE HOME CONSTRUCTOR

OUR SHOPS ARE OPEN ALL DAY
FROM 9 A.M. TO 6 P.M. 6.30 P.M. ON FRIDAY
(WE CLOSE ALL DAY THURSDAY)

13 SOUTH MALL, EDMONTON, N.9 803 1685

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 I.M.P. input this amplifier will work as a record player, baby alarm, etc., amplifier.



£1.75

plus 13p P. & P.

TRI-VOLT BATTERY ELIMINATOR

Enables you to work your Transistor Radio, Amplifier or Cassette, etc., from the a.c. mains through this compact Eliminator. Just by moving a plug you can select the voltage you require, 6, 7, or 9 volt. This means all your transistor power pack applications can be handled by this one unit. Approx. size 2 1/2in x 2 1/2in x 3 1/2in. Our Price £2.75 plus 10p P. & P. Same model suitably wired for the Philips Cassette £3 plus 10p P. & P.



DIGITAL CLOCK KIT

24-hr. Nixie dig. clock kit. We supply: a complete set of components; a complete set of easy to follow instructions; printed circuits made to make construction as simple as possible; a cabinet and front panel to give a professional finish. All for the price of the components. £22.50 + 50p P. & P. Please send S.A.E. if you require more information.



AL20 5 WATT AUDIO AMPLIFIER

A low cost high quality 5 watt audio amplifier designed for use in stereo systems, record players and other audio equipment. Supply Voltage = 9 to 30 volts. Frequency = 50 to 25 kHz. Overall Size = 3in x 2 1/2in x 1 1/2in approx. Full technical data and diagrams with each module. All guaranteed and a bargain at £2.63 plus 5p P. & P.



V.A.T.
From 1st April, 1973, will you please include on your Total (Goods plus Postage and Packing) Value Added Tax at the Standard Stated Rate.

MINIATURE RELAY

6 volt 70 ohm. Single Pole Changeover = 40p plus 5p P. & P. Approx. size = 1 1/2in x 1 1/2in x 2in.

MAINS TRANSFORMER

Fused Primary 240V. Secondary 220V @ 50mA. 6.3V @ 1A. This transformer is made to a very high standard and is a small size: 2in x 2 1/2in x 2 1/2in. £6.8p plus 15p P. & P.



S.G. BROWN "DIPLOMAT" MONO-STEREO HEADSET

British made lightweight Headphones. Incorporate ceramic piezo electric transducers. Specific-ation:—Frequency 20-17,500 CPS. Impedance Predominantly capacitive, at 400MFD per earpiece can be regarded as 150K at 1KHz. Weight: 3.5oz. (98 grams). Please include 10p per set P.P. A Bargain at £1.50 each set.



TRI-VOLT CAR SUPPLY

Enables you to work your Transistor Radio, Amplifier or Cassette, etc. from the 12 volt car supply. Positive or negative earth. Approx. size = 2in. x 3 1/2in. x 1 1/2in. This converter supplies 6, 7, or 9 volts and is transistor regulated. A real money saving device for £2.50 plus 10p P. & P.

MINI LOUDSPEAKERS

2 1/2in 8 ohm, 50p; 2 1/2in 80 ohm, 50p; 2 1/2in 40 ohm, 50p. Please include 5p P. & P. on each L.S.



ADD LUXURY TO YOUR CAR

WITH A MOTOR DRIVEN CAR AERIAL

Spec.: 5 Section Extended Length 100cm Length under Fender 40cm Cable Length 120cm Supplied complete with Fixing Bracket and Control Switch. £6.75 P. & P.



EMI LOUDSPEAKER 450 10W 13in x 8in ± two 2.24in tweeters and cross-over. All wired and ready for use. This ever-popular 450 in 3-8-15 ohm imp. £3.75 plus 38p P. & P. each.

7in x 4in LOUDSPEAKER

A top quality speaker ideal where small size is important. Manufactured by E.M.I. for a well-known hi-fi set maker. Size: 7in x 4in. Impedance: 8 ohms. Flux: 38,000. Max. Free range: 90Hz to 12kHz. Power handling: 5W. Unbeatable. Price: £1.80. Free postage on this item.



CRESCENT CASSETTES

Top quality cassettes at unbeatable prices (complete with standard storage case): C60 28p, C90 38p, C120 48p plus 5p P. & P.



PSYCHEDELIC LIGHT CONTROL UNIT

Three Channel Bass Middle-Treble. 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 500V lamps to the output terminals of the unit, and you produce a fascinating sound-light display. (All guaranteed) £18.50 plus 38p P. & P.

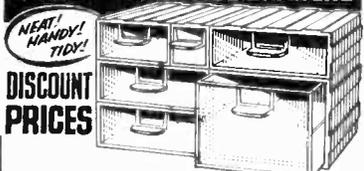


If you require more information please send S.A.E.

"CRESCENT" 100 WATT R.M.S. ALL PURPOSE AMPLIFIER U.BUILD.IT

We supply the three modules for you to build this Disco-Group-P.A. amplifier into the cabinet of your choice.
★ THE POWER AMP MODULE TP100W 170W r.m.s. sp. wave 300W instantaneous peak into 8 ohm (60W into 16 ohm). £14.28 carr. 45p
★ THE PRE-AMP MODULE Four control pre-amp, Vol. Bass, Treble, Middle controls. Designed to drive most amplifiers using F.E.T. first stage. £3.98 carr. 25p
★ THE POWER SUPPLY MODULE PS100 Is supplied complete with the mains transformer. £9.88 carr. 50p Complete fixing instructions are supplied and no technical knowledge is required to connect the three ready wired modules. A fantastic bargain. If you purchase all three modules. £25 carr. 75p Send S.A.E. for further details on this or our ready built amplifiers.

INTER-LOCKING PLASTIC STORAGE DRAWERS



Newest, nearest system ever devised for storing small parts and components: resistors, capacitors, diodes, transistors, etc. Rigid plastic units interlock together in vertical and horizontal combinations. Transparent plastic drawers have label slots/removable space dividers. Build up any size cabinet for wall, bench or table top.

BUY AT TRADE PRICES!

SINGLE UNITS (1D) (5ins 2 1/2ins 2 1/2ins). £1.25 DOZEN.
DOUBLE UNITS (2D) (5ins 4 1/2ins 2 1/2ins). £2.10 DOZEN.
TREBLE (3D) £2.20 for 8.

DOUBLE TREBLE 2 drawers, in one outer case (6D2), £3.25 for 8, EXTRA LARGE SIZE (6D1) £3.10 for 8.

PLUS QUANTITY DISCOUNTS!

Orders £6 and over DEDUCT 5% in the £ Orders £10 and over DEDUCT 7 1/2% in the £ Orders £20 and over DEDUCT 10% in the £

PACKING/POSTAGE/CARRIAGE: Add 35p to all orders under £5. Orders £10 and over, packing/postage/carriage free.

QUOTATIONS FOR LARGER QUANTITIES Please add V.A.T. to total remittance

IVORYET LIMITED (Dept. PE5) 124 Cricklewood Broadway, London, N.W.2 Tel. 01-450 4844

WORLD RADIO TV HANDBOOK 1973

A complete Directory of International Radio and TV £3.14

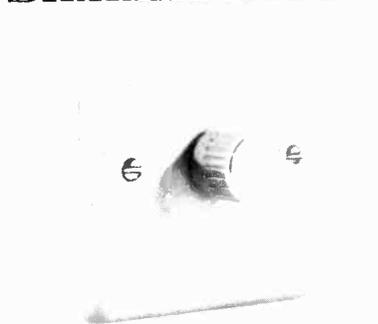
- SOLID STATE PROJECTS FOR THE EXPERIMENTER by W. Green. £1.30.
- ADVANCED RADIO CONTROL by E. L. Safford Jr. £1.10.
- TEN-MINUTE TEST TECHNIQUE FOR ELECTRONICS SERVICING by E. C. Carlson £1.10.
- BEGINNER'S GUIDE TO RADIO CONTROL by R. H. Warring. £1.70.
- SERVICING WITH THE OSCILLOSCOPE by Gordon J. King. £1.92.
- TRANSISTOR AUDIO AND RADIO CIRCUITS by Mullard. £1.92.
- 110 INTEGRATED CIRCUIT PROJECTS FOR THE HOME CONSTRUCTOR by R. M. Marston. £1.30.
- ELECTRONICS POCKET BOOK by J. P. Hawker. £1.70.
- COLOUR TV WITH PARTICULAR REFERENCE TO THE PAL SYSTEM by G. N. Patchett. £3.10.
- RADIO DATA REFERENCE BOOK by G. R. Jessop. £1.12.
- DIGITAL LOGIC BASIC THEORY AND PRACTICE by J. H. Smith. £1.60.

ALL PRICES INCLUDE POSTAGE

THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKIST of British and American Technical Books
19-21 PRAED STREET LONDON W2 1NP
Phone 01-723 4185
Closed Saturday 1 p.m.

Vary the strength of your lighting with a DIMMASWITCH



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

600 Watt—£3.52. Kit Form £2.97
300 Watt—£2.97. Kit Form £2.42

All plus 10p post and packing Prices include V.A.T. Please send C.W.O. to:

DEXTER & COMPANY
1 ULVER HOUSE, 19 KING STREET
CHESTER CH1 2AH Tel. 0244-25883
As supplied to H.M. Government Departments, hospitals, local authorities, etc.

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

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

VDR's & Thermistors

A15B	75p	GL23	£1.00	VA1005	15p
C21	15p	R53	£1.32	VA1026	13p
C24	13p	R54	£1.46	VA1033	13p
CZ13A	13p			VA1040	10p
E298 ED/A258	10p			VA1053	10p
E298 ZZ/06	10p			VA1055S	10p
GL16	£1			VA1034	10p

Potentiometers



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

log or lin less switch (& 1KΩ lin)
 log or lin with switch
 dual less switch
 dual with switch 10K, 100K & 1M log only
 10K log 10K antilog less switch

12p
24p
40p
52p
40p

Capacitors

disc ceramic		low voltage	
01μF 18v	5p	0.1μF 30v	5p
022μF 18v	5p	0.22μF 6v	5p
047μF 12v	5p	0.47μF 3v	5p
ceramic plate		30V	
1000pf	10p	4700pf	10p
2200pf	10p	10,000pf	10p

Slider Pots

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

Resistors

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

1W 10% Carbon Composition 3p each
 2W 10% Carbon Composition 6p each
 2 1/2W 5% Wire wound 9p each
 5W Wire wound 9p each
 10W Wire wound 10p each
 plus p. & p. 7p for up to 25 resistors plus 1p for each additional 25.

Eliminators



9 volt or 20mA (PP3) £1.25
 9 volt or 50mA £1.50
 6 - 8 volt 50mA £2.50
 9 - 9 volt 50mA £2.50
 7 1/2 volt for cassette recorders £2.00
 6, 7 1/2 or 9 volt £3.00
 3, 4, 6, 7 1/2, 9, 12 or 500mA (illus.) £3.99
 Car Battery Converter fully stabilised to provide 6, 7 1/2 or 9 volts (p & p 15p on all types) £4.99

Ceramic - plate 63V (C333)

1.8p	8.2p	33p	120pf
2.2p	10p	39p	150pf
3.3p	12p	47p	180pf
3.9p	15p	56p	220pf
4.7p	18p	68p	270pf
5.6p	22p	82p	330pf
6.8p	27p	100p	

all 5p. each

mylar film 100V

1000pf 2p	0.1μF 3p	0.068μF 4p
2000pf 2p	0.22μF 3p	0.1μF 4p
5000pf 2p	0.47μF 3p	0.2μF 5p

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

Diodes & Rectifiers

AA119	9p	BA156	15p	BY176	£1.50
AA120	9p	BA243	56p	BY182	£1.50
AA129	9p	OA47	10p	BY250	23p
BA102	25p	OA79	9p	IN4001	6p
BA115	17p	OA90	7p	IN4002	7p
BA130	10p	OA20	10p	IN4003	8p
BA145	20p	OA91	7p	IN4004	8p
BA148	20p	BY100	15p	IN4005	10p
BA154	13p	BY126	15p	IN4006	12p
BA155	14p	BY127	15p	IN4007	15p

SGS

EA1000



3 Watt Audio Amplifier
 Our Price inc. handbook £2.49

Presets



Vertical or Horizontal

0.1 watt 5p	0.25 watt 7p
100 1KΩ	10KΩ 100KΩ 1MΩ
250 2.5KΩ	25KΩ 250KΩ 2.5MΩ
500 5KΩ	50KΩ 500KΩ 5MΩ

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

metallised polyester 250V (C280)

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

metallised polyester 400V (C281)

0.1μF 4 1/2p	0.47μF 6p	22μF 10p
0.15μF 4 1/2p	0.68μF 6p	33μF 14p
0.22μF 4 1/2p	1μF 7p	47μF 15p
0.33μF 5 1/2p	1.5μF 8p	

FM TUNER
 chassis fully transistorised
 9 volt operation
OUR PRICE £6.25
 Matching stereo decoder £4.87
 Ask for model 101 No. 11.



10 + less 15%
 25 + less 25%
 100 + less 33 1/3%

5 Watt Audio Amplifier
 Our Price £3.99
 Less quantity discount



silvered mica 1% (>50pf) 500V

2.2pf-820pf	7p	4.7nf-5600pf	19p
1nf-2.2nf	9p	6800pf-0.1μF	29p
2.7nf-3.6nf	16p		

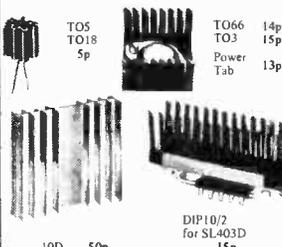
mixed dielectric 600V

0.1μF 7p	0.47μF 7p	22μF 16p
0.22μF 7p	0.68μF 8p	47μF 24p
0.33μF 7p	1μF 8p	1μF 33p

CHROMASONIC electronics

MAIL ORDERS: Where no p. & p. charge is shown, a minimum of 7p applies. p. & p. on overseas orders is charged at cost.
ADDRESS TO: M. O. Dept.
 56, Fortis Green Road, London, N10 3HN.
 Telephone 01-883 3705

Heat Sinks



TOS TO18 5p
 TO66 TO3 14p
 TO3 15p
 Power Tab 13p
 DIP10/2 for SLA403D 15p
 10D 50p

Transistors & Integrated Circuits

AC107	25p	BC147	10p	BF196	15p	OC81	18p	2N1304	22p	2N5172	15p
AC126	17p	BC149	10p	BF197	15p	OC140	20p	2N1711	25p	BZ78H ZENERS SERIES	10p
AC127	15p	BC149	10p	BF212	53p	OC170	23p	2N1893	30p	LO5571	£1.58
AC128	15p	BC157	12p	BFY50	24p	OC171	20p	2N2926	all 10p	LO5671	£1.58
AC176	15p	BC158	10p	BFY51	21p	2TX107	15p	2N3053	23p	LO3771	£1.50
AC187	25p	BC159	12p	BRY39	36p	2TX108	12p	2N3054	50p	LO3771	£1.50
AC187K	25p	BC159	15p	BSX21	26p	2TX109	15p	2N3055	49p	MC1303L	£1.75
AC188	25p	BC268	15p	BSY95A	14p	2TX300	12p	2N3702	12p	MC1330	80p
AC188K	25p	BD115	67p	BU106/02	£1.75	2TX301	15p	2N3703	12p	MC1350	75p
ACY20	20p	BD131	70p	MJE340	67p	2TX302	20p	2N3704	10p	MC1351	£1.00
AD140	40p	BD132	70p	MPF192	40p	2TX303	20p	2N3705	10p	MC1352	£1.00
AD149	40p	BO131/2M.P.		MPF103	37p	2TX304	25p	2N3706	10p	MFC4000A	45p
AD161	60p			MPF104	37p	2TX341	20p	2N3707	15p	MFC4000B	59p
AD162	60p			MPF105	40p	2TX500	15p	2N3708	12p	LM380	£1.45
AF114	18p	BF167	20p	MPF106	45p	2TX501	15p	2N3709	12p	SL403D	£1.50
AF115	18p	BF173	20p	OC28	40p	2TX502	20p	2N3710	12p	TAD100	£1.50
AF116	18p	BF180	25p	OC35	40p	2TX503	17p	2N3711	12p	FILTER LP115	£1.50
AF117	18p	BF181	30p	OC44	15p	2TX504	50p	2N3819	35p		
AF139	28p	BF184	25p	OC45	15p	2TX531	25p	2N3903	15p	uA709C	34p
BC107	10p	BF185	25p	OC71	11p	2N697	18p	2N3904	17p	uA710	45p
BC108	10p	BF194	15p	OC72	17p	2N706	12p	2N3905	21p	uA723C	85p
BC109	10p	BF195	15p	OC76	15p	2N708	15p	2N3906	12p	uA741C	47p

mixed dielectric 1000V

1000pf 6p	6800pf 9p	1μF 12p
2200pf 6p	0.1μF 9p	22μF 22p
3300pf 6p	0.22μF 9p	47μF 30p
4700pf 6p	0.47μF 12p	

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

10pf 9p	200pf 9p	1μF 5p
15pf 9p	220pf 9p	1500pf 5p
22pf 9p	250pf 9p	2000pf 5p
68pf 9p	270pf 9p	3000pf 5p
82pf 9p	300pf 9p	5000pf 5p
100pf 9p	750V DISC	10,000pf 5p
120pf 9p	470pf 5p	1000pf 5p through
140pf 9p	1000pf 5p	
150pf 9p	5000pf 5p	
180pf 9p	10,000pf 5p	1000pf 5p

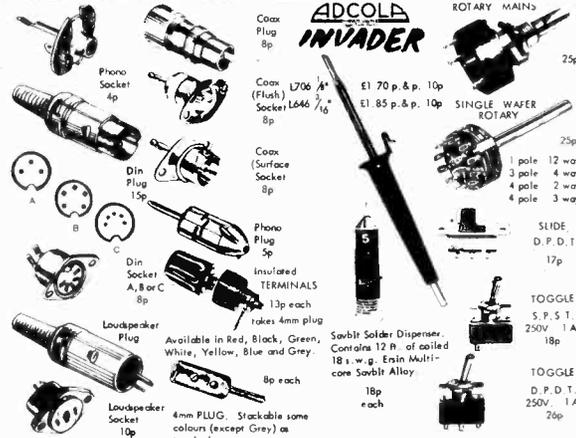
Veroboard

Copperclad		Plain
0.1"	0.15"	0.15"

2 1/2" x 1"	6p	6p	
2 1/2" x 3 1/2"	20p	16p (9)	10p
2 1/2" x 5"	24p	21p (7)	12p
3 1/2" x 3 1/2"	24p	21p (8)	-
3 1/2" x 5"	27p	27p (10)	17p
1 7/8" x 2 1/2"	67p	50p	37p
1 7/8" x 3 1/2"	90p	70p	52p
1 7/8" x 5"			75p

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

ADCOLA INVADER



COAX PLUG 8p
 COAX (SURFACE) SOCKET 8p
 PHONO SOCKET 4p
 PHONO PLUG 5p
 DIN SOCKET A, B or C 15p
 DIN SOCKET 15p
 INSULATED TERMINALS 13p each
 LOUDSPEAKER PLUG 8p each
 LOUDSPEAKER SOCKET 10p

ROTARY MAINS 25p
 SINGLE WAFER ROTARY 25p
 1 pole 12 way
 3 pole 4 way
 4 pole 2 way
 4 pole 3 way

Split Solder Dispenser. Contains 12 lb. of cailed 18 s.w.g. Ensin Multi-core Sablett Alloy

SLIDE D.P.D.T 17p
 TOGGLE S.P.S.T 250V 1A 18p
 TOGGLE D.P.D.T 250V 1A 26p

Mullard B Siemens Electrolytics

CAP μF	VOLTAGE					
	4	6.3	10	16	25	40
1	-	-	-	-	-	6p
1.5	-	-	-	-	-	6p
2.2	-	-	-	-	-	6p
3.3	-	-	-	-	-	6p
4.7	-	-	-	-	-	6p
6.8	-	-	-	-	-	6p
10	-	-	-	-	-	6p
15	-	-	-	-	-	6p
22	-	-	-	-	-	6p
33	-	-	-	-	-	6p
47	-	-	-	-	-	6p
68	-	-	-	-	-	6p
100	-	-	-	-	-	6p
150	-	-	-	-	-	10p
220	-	-	-	-	-	10p
330	-	-	-	-	-	10p
470	-	-	-	-	-	10p
680	-	-	-	-	-	10p
1000	-	-	-	-	-	10p
1500	-	-	-	-	-	10p
2200	-	-	-	-	-	10p
3300	-	-	-	-	-	10p
4700	-	-	-	-	-	10p
6800	-	-	-	-	-	10p

Quantity Prices on application

Aluminium Boxes
 Including baseplate and screws

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

Hi-Volt Electrolytics

1.2	4μF 450V	14p	32μF 450V	20p	
16μF	450V	15p	50μF 350V	20p	
8	8μF 450 V.W	18p	32	32μF 350 V.W	25p
8	16μF 450 V.W	20p	32	450 V.W	43p

Now! A FAST EASY WAY TO LEARN BASIC RADIO & ELECTRONICS



Build as you learn with the exciting new **TECHNATRON** Outfit! No mathematics. No soldering—you learn the *practical way*.

Learn basic Radio and Electronics at home—the fast, modern way. Give yourself essential technical “know-how”—like reading circuits, assembling standard components, experimenting, building—quickly and without effort, and enjoy every moment. B.I.E.T.'s simplified study method and the remarkable **TECHNATRON** Self-Build Outfit take the mystery out of the subject, making learning easy and interesting.

Even if you don't know the first thing about Radio now, you'll build your own Radio set within a month or so!

... and what's more, you will understand exactly what you are doing. The **TECHNATRON** Outfit contains everything you need, from tools to transistors—even a versatile Multimeter which we teach you to use. All you need give is a little of your spare time and the surprisingly low fee, payable monthly if you wish. And the equipment remains yours, so you can use it again and again.

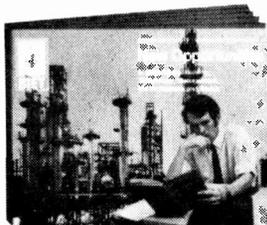
You LEARN—but it's as fascinating as a hobby.

Among many other interesting experiments, the Radio set you build—and it's a good one—is really a bonus. This is first and last a teaching course, but the training is as fascinating as any hobby and it could be the springboard for a career in Radio and Electronics.

A 14-year-old could understand and benefit from this course—but it teaches the real thing. The easy to understand, practical projects—from a burglar-alarm to a sophisticated Radio set—help you master basic Radio and Electronics—even if you are a “non-technical” type. And, if you want to make it a career, B.I.E.T. has a fine range of courses up to City and Guilds standards.

Specialist Booklet

If you wish to make a career in Electronics, send for your **FREE** copy of “**NEW OPPORTUNITIES**”. This brand new booklet—just out—tells you all about **TECHNATRON** and B.I.E.T.'s full range of courses.



FREE

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

Dept. BPE15, ALDERMASTON COURT, READING RG7 4PF

Accredited by the Council for the Accreditation of Correspondence Colleges.

POST THIS COUPON FOR FREE BOOK

CL **BPE15**

NAME (BLOCK CAPITALS)

AGE

ADDRESS

SUBJECT OF INTEREST

FM TUNER THOUSANDS NOW IN USE

NELSON-JONES

Reduced prices

Approved parts of this outstanding design (W.W. April 1971). Featuring 0.75µV sensitivity. Mosfet front end. Ceramic I.F. strip. Triple gang tuning, 4V r.m.s. output level, suitable for phase locked decoder, as below. Designer's own P.C.B. Tuner parts with box. Less than £11.50. S.A.E. please for lists. **NEW** Solid State Tuning Indicator and Dial-Chassis Kit. **High Performance Decoder** also available. **NEW** IC Stabilised PSU. SC, overload protected, low ripple. £3.55 p.p. 19p.

LIGHT EMITTING DIODES (Red)

Improved Type panel or PCB mounting with free mounting clip—clear or black. Order LED1A. Please add postage. **Monsanto** miniature PCB mounting with radial leads. Order LED2. Please add postage. **NOW ONLY 35p each with connection data.**

7 SEGMENT LED DISPLAY

0.325in Characters 0-9 and nine letters. TTL, DTL compatible. ONLY £2.46 each, p.p. 10P. BCD-7Seg Dec Driver, £1.30.

ELECTRONIC CALCULATOR

MODEL BC806

Pocket Size

Full 4 Function—will perform Addition, Subtraction, Multiplication and Division including Chain or Mixed Multiplication or Division as well as true credit balance. **Constant Key:** Fixed or Floating decimal point. Batteries and leather case supplied.

PRICE ONLY £46.25

(POST FREE)

(Mains adaptor £4.50)

V.A.T. at 10% from April 1st must be added to all prices.

INTEGREX LIMITED, DEPT. P.E.

P.O. BOX 45, DERBY DE1 1TW

Tel.: Repton (0283 89) 3580

New VAT EDITION



Lasky's Audio-Tronics Catalogue 1973

The new 1973 VAT edition of Lasky's famous Audio-Tronics Catalogue will be available in early April—FREE on request. The 48 tabloid size pages—many in full colour—have been reprinted with VAT price changes for your convenience, together with many new items. Over half the pages are devoted exclusively to every aspect of Hi-Fi (including Lasky's budget Stereo Systems and Package Deals), Tape Recording and Audio Accessories. Send for your copy now and see for yourself that VAT can mean a saving on many of the 1000's of items we offer.

FREE

Send this coupon with 15p for post and inclusion on our regular mailing list.

NAME

ADDRESS

PE11

LASKY'S RADIO LIMITED, 3-15 CAVELL STREET, LONDON E.1.

THIS IS THE FIRST PAGE OF THE GREAT BI-PAK SECTION

BRAND NEW FULLY GUARANTEED DEVICES

AC107 0-22	AD162 0-36½	BC148 0-11	BD137 0-49½	BF188 0-44	OC19 0-38½	2G371 0-17½	2N2219 0-22	2N3054 0-50½	2N4059 0-11
AC113 0-22	AD161 A	BC149 0-13	BD138 0-55	BF194 0-18	OC20 0-69½	2G371B 0-18	2N2220 0-24	2N3055 0-55	2N4060 0-13
AC115 0-25½	AD162(MP)	BC150 0-20	BD139 0-60½	BF195 0-18	OC22 0-42	2G373 0-18½	2N2221 0-22	2N3059 0-15½	2N4061 0-13
AC117K 0-22		BC151 0-22	BD140 0-66	BF196 0-16½	OC23 0-46	2G374 0-18½	2N2222 0-22	2N3091A 0-17½	2N4062 0-13
AC122 0-13	AD140 0-55	BC152 0-18½	BD155 0-88	BF197 0-16½	OC24 0-61½	2G377 0-33	2N2308 0-16½	2N3392 0-18½	2N4284 0-18½
AC129 0-18½	AF114 0-26½	BC153 0-31	BD175 0-66	BF200 0-49½	OC25 0-42	2G378 0-17½	2N2309 0-16½	2N3393 0-15½	2N4285 0-18½
AC126 0-18½	AF115 0-26½	BC154 0-33	BD176 0-66	BF222 1-04	OC26 0-27½	2G381 0-17½	2N2369A 0-16½	2N3394 0-15½	2N4286 0-18½
AC127 0-18½	AF116 0-26½	BC157 0-20	BD177 0-71	BF257 0-49½	OC28 0-55	2G382 0-17½	2N2411 0-26½	2N3395 0-18½	2N4287 0-18½
AC128 0-18½	AF117 0-26½	BC158 0-13	BD178 0-71½	BF258 0-66	OC29 0-55	2G401 0-33	2N2412 0-26½	2N3402 0-23	2N4288 0-18½
AC132 0-16½	AF118 0-38½	BC159 0-13	BD179 0-77	BF259 0-93½	OC35 0-46	2G414 0-33	2N2646 0-51½	2N3403 0-23	2N4289 0-18½
AC134 0-16½	AF124 0-33	BC160 0-49½	BD180 0-77	BF262 0-60½	OC36 0-55	2G417 0-27½	2N2711 0-23	2N3404 0-31	2N4290 0-18½
AC137 0-16½	AF125 0-27½	BC161 0-55	BD185 0-71½	BF263 0-60½	OC41 0-22	2N398 0-33	2N2712 0-23	2N3405 0-46	2N4291 0-18½
AC141 0-16½	AF126 0-31	BC162 0-13	BD186 0-77	BF270 0-38½	OC42 0-26½	2N398A 0-60½	2N2714 0-23	2N3414 0-16½	2N4292 0-18½
AC141K 0-18½	AF127 0-31	BC168 0-13	BD187 0-77	BF271 0-38	OC44 0-26½	2N404 0-21	2N2904 0-18½	2N3415 0-16½	2N4293 0-18½
AC142 0-16½	AF129 0-33	BC169 0-13	BD188 0-77	BF272 0-88	OC45 0-14	2N404A 0-82	2N2904A 0-23	2N3416 0-31	2N5172 0-13
AC142K 0-18½	AF178 0-33	BC170 0-13	BD189 0-82½	BF273 0-38½	OC70 0-11	2N2424 0-46	2N2905 0-23	2N3417 0-31	2N5457 0-35
AC151 0-16½	AF179 0-55	BC171 0-15	BD190 0-82½	BF274 0-38½	OC71 0-11	2N2427 0-54	2N2905A 0-23	2N3525 0-82½	2N5458 0-35
AC154 0-22	AF180 0-55	BC172 0-15½	BD195 0-93½	BF275 0-38½	OC72 0-15½	2N298 0-46	2N2906 0-16½	2N3646 0-10	2N5459 0-44
AC155 0-22	AF181 0-49½	BC173 0-15½	BD196 0-93½	BF276 0-38½	OC74 0-15½	2N299 0-49½	2N2906A 0-20	2N3702 0-11	2N6301 0-55
AC156 0-22	AF186 0-49½	BC174 0-15½	BD197 0-98	BF277 0-38½	OC75 0-16½	2N299 0-49½	2N2907 0-22	2N3703 0-11	2N6302 0-48
AC157 0-26½	AF230 0-40½	BC175 0-24	BD198 0-98	BF278 0-38½	OC76 0-16½	2N299 0-49½	2N2908 0-24	2N3704 0-12	2N6303 0-48
AC162 0-22	AL102 0-71½	BC177 0-21	BD199 0-104	BF279 0-38½	OC77 0-27½	2N299 0-49½	2N2923 0-15½	2N3705 0-11	2N6303 0-60½
AC166 0-22	AL103 0-71½	BC178 0-21	BD200 1-04½	BF280 0-38½	OC81 0-16½	2N299 0-49½	2N2924 0-15½	2N3706 0-10	2N6304 0-77
AC167 0-22	ASV26 0-27½	BC179 0-21	BD205 0-88	BF281 0-38½	OC81D 0-16½	2N2706 0-30	2N2925 0-16½	2N3707 0-12	2N6305 0-92½
AC168 0-26½	ASV27 0-33	BC180 0-26½	BD206 0-88	BFY30 0-22	OC82 0-16½	2N2706A 0-10	2N2926 (G)	2N3708 0-07½	2N6306 0-92½
AC169 0-16½	ASV28 0-27½	BC181 0-26½	BD207 1-04½	BFY31 0-22	OC82D 0-16½	2N2708 0-13	2N2926 (H)	2N3709 0-10	2N6307 0-92½
AC176 0-22	ASV29 0-27½	BC182 0-11	BD208 1-04½	BFY32 0-22	OC83 0-22	2N2711 0-33	2N2926 (V)	2N3710 0-10	2N6311 0-61½
AC177 0-26½	ASV30 0-27½	BC183 0-11	BD209 1-10	BFY33 0-18½	OC84 0-22	2N2712 0-38½	2N2926 (W)	2N3711 0-12	2N6312 0-48
AC178 0-22	ASV31 0-27½	BC183 0-11	BD210 1-10	BFY35 0-26½	OC139 0-22	2N2718 0-26½	2N2926 (X)	2N3819 0-31	2N6322A 0-46
AC179 0-31	ASV32 0-27½	BC183L 0-11	BF117 0-49½	18X19 0-16½	OC140 0-22	2N2718A 0-55	2N2926 (Y)	2N3820 0-55	2N6323 0-61½
AC180 0-18½	ASV34 0-27½	BC184 0-13	BF118 0-77	18X20 0-16½	OC169 0-27½	2N2726 0-31	2N2926 (R)	2N3821 0-88	2N6324 0-77
AC180K 0-22	ASV55 0-27½	BC184L 0-13	BF119 0-77	18Y25 0-16½	OC170 0-27½	2N2727 0-31	2N2926 (S)	2N3822 0-31	2N6325 0-77
AC181 0-18½	ASV56 0-27½	BC186 0-31	BF121 0-49½	18Y26 0-16½	OC171 0-27½	2N2743 0-22	2N2926 (B)	2N3903 0-31	2N6326 0-77
AC181K 0-22	ASV57 0-27½	BC187 0-31	BF123 0-55	18Y27 0-16½	OC209 0-27½	2N2744 0-22	2N2926 (C)	2N3904 0-33	2N6327 0-77
AC187 0-24	ASV58 0-27½	BC207 0-12	BF125 0-49½	18Y28 0-16½	OC201 0-81	2N2745 0-15½	2N2926 (D)	2N3905 0-77	2N6328 0-48
AC187K 0-22	ASV59 0-27½	BC208 0-12	BF127 0-55	18Y29 0-16½	OC202 0-81	2N2748 0-22	2N2926 (E)	2N3906 0-30	2N6329 0-44
AC188 0-24	BC107 0-10	BC209 0-13	BF152 0-60½	18Y38 0-22	OC203 0-27½	2N2929 0-23	2N2926 (F)	2N3903 0-18½	2N6332 0-49½
AC188K 0-22	BC108 0-10	BC212L 0-12	BF153 0-49½	18Y39 0-22	OC204 0-27½	2N2930 0-23			
AC197 0-27½	BC109 0-11	BC213L 0-12	BF154 0-49½	18Y40 0-31	OC205 0-38½	2N2931 0-22			
AC198 0-22	BC113 0-11	BC214L 0-15½	BF155 0-77	18Y41 0-31	OC309 0-44	2N1132 0-24			
AC199 0-22	BC114 0-16½	BC225 0-27½	BF156 0-53	18Y45 0-14	OCPT1 0-47½	2N1302 0-15½			
AC199 0-22	BC115 0-16½	BC226 0-28½	BF157 0-60½	18Y50A 0-14	ORP12 0-47½	2N1303 0-15½	AA119 0-09	BY133 0-23	OA10 0-38½
AC21 0-22	BC116 0-16½	BCY30 0-26½	BF158 0-60½	18Y50 2-20	ORP60 0-18	2N1304 0-15½	AA120 0-09	BY164 0-55	OA47 0-07½
AC21 0-22	BC116 0-16½	BCY31 0-26½	BF159 0-60½	18Y51 0-16½	ORP61 0-44	2N1305 0-18½	AA129 0-09	BYX38/30	OA70 0-07½
AC29 0-18½	BC118 0-11	BCY32 0-33	BF160 0-44	C400 0-33	P346A 0-22	2N1306 0-23	AA130 0-10	BYZ10 0-46	OA79 0-07½
AC29 0-21	BC119 0-33	BCY33 0-24	BF162 0-44	C407 0-27½	P397 0-46	2N1307 0-23	AAZ13 0-11	BYZ10 0-38½	OA81 0-07½
AC29 0-38½	BC120 0-88	BCY34 0-27½	BF163 0-44	C424 0-22	ST140 0-14	2N1308 0-25½	BA100 0-11	BYZ11 0-33	OA85 0-10
AC30 0-31	BC125 0-13	BCY70 0-15½	BF164 0-44	C425 0-55	ST141 0-18½	2N1309 0-22	BA116 0-23	BYZ12 0-33	OA89 0-06½
AC31 0-31	BC126 0-20	BCY71 0-20	BF165 0-44	C426 0-88½	T1843 0-33	2N1613 0-25½	BA126 0-24	BYZ13 0-27½	OA91 0-06½
AC34 0-23	BC132 0-13	BCY72 0-15½	BF167 0-24	C428 0-22	U746 0-30	2N1711 0-22	BA148 0-15½	BYZ16 0-44	OA93 0-07½
AC35 0-23	BC134 0-20	BCY73 0-22	BF173 0-24	C441 0-16	OC301 0-21	2N1889 0-35	BA154 0-13	BYZ17 0-38½	OA200 0-06½
AC36 0-31	BC135 0-13	BCZ11 0-27½	BF176 0-38½	C442 0-33	OC302 0-21	2N1890 0-49½	BA155 0-15½	BYZ18 0-38½	OA202 0-07½
AC40 0-18½	BC136 0-16½	BCZ12 0-27½	BF177 0-38½	C444 0-38½	OC303 0-21	2N1893 0-40½	BA156 0-14½	BYZ19 0-31	SD10 0-05½
AC41 0-19	BC137 0-16½	BD121 0-66	BF178 0-33	C450 0-24	OC304 0-26½	2N2147 0-79	BY100 0-16½	CG62	SD19 0-05½
AC44 0-38½	BC139 0-44	BD123 0-71½	BF179 0-33	MAT100 0-21	OC306 0-44	2N2148 0-62½	BY101 0-13	(OA91 Eq.)	IN34 0-07½
AD130 0-42	BC140 0-33	BD124 0-66	BF180 0-33	MAT101 0-22	OC308 0-38½	2N2160 0-66	BY105 0-16½	(OA91 Eq.)	IN34A 0-07½
AD140 0-53	BC141 0-33	BD131 0-55	BF181 0-33	MAT120 0-21	OC309 0-38½	2N2162 0-38½	BY114 0-13	CG65-1	IN34B 0-06½
AD142 0-53	BC142 0-33	BD132 0-66	BF182 0-44	MAT121 0-22	OC310 0-38½	2N2163 0-38½	BY126 0-16½	(OA70 OA79)	IN916 0-06½
AD143 0-42	BC143 0-33	BD133 0-71½	BF183 0-44	MPP102 0-46	OC319 0-17½	2N2194 0-38½	BY127 0-16½	0-06½	IN414B 0-06½
AD149 0-55	BC145 0-49½	BD135 0-44	BF184 0-27½	MPP104 0-40½	OC344 0-20	2N2217 0-24	BY128 0-16½	OA5	18021 0-11
AD161 0-36½	BC147 0-11	BD136 0-44	BF185 0-33	MPP105 0-40½	OC345 0-17½	2N2218 0-22	BY130 0-17½	OA58L	18951 0-06½

DIODES AND RECTIFIERS

AA119 0-09	BY133 0-23	OA10 0-38½
AA120 0-09	BY164 0-55	OA47 0-07½
AA129 0-09	BYX38/30	OA70 0-07½
AA130 0-10	BYZ10 0-46	OA79 0-07½
AAZ13 0-11	BYZ10 0-38½	OA81 0-07½
BA100 0-11	BYZ11 0-33	OA85 0-10
BA116 0-23	BYZ12 0-33	OA89 0-06½
BA126 0-24	BYZ13 0-27½	OA91 0-06½
BA148 0-15½	BYZ16 0-44	OA93 0-07½
BA154 0-13	BYZ17 0-38½	OA200 0-06½
BA155 0-15½	BYZ18 0-38½	OA202 0-07½
BA156 0-14½	BYZ19 0-31	SD10 0-05½
BY100 0-16½	CG62	SD19 0-05½
BY101 0-13	(OA91 Eq.)	IN34 0-07½
BY105 0-16½	0-06½	IN34A 0-07½
CG65-1	CG65-1	IN34B 0-06½
(OA70 OA79)	0-06½	IN916 0-06½
0-06½	0-06½	IN414B 0-06½
OA5	0-38½	18021 0-11
OA58L	0-23	18951 0-06½

Cut these 3 pages out and keep for reference

NEW COMPONENT PAK BARGAINS

Pak No.	Qty.	Description	Price
C 1	250	Resistors mixed values approx. (count by weight)	0-55
C 2	200	Capacitors mixed values approx. (count by weight)	0-55
C 3	50	Precision Resistors -1%, and -0.1% mixed values	0-55
C 4	75	1/4 W Resistors mixed preferred values	0-55
C 5	5	Pieces assorted Ferrite Rods	0-55
C 6	2	Tuning Ganes, MW/LW VHF	0-55
C 7	1	Pack Wire 50 meters assorted colours	0-55
C 8	10	Reed Switches	0-55
C 9	3	Micro Switches	0-65
C10	15	Assorted Pots & Pre-Sets	0-55
C11	5	Jack Sockets 3 x 3.5m 2 x Standard Switch Types	0-55
C12	40	Paper Condensers preferred types mixed values	0-55
C13	20	Electrolytics Trans. types	0-55
C14	1	Pack assorted Hardware - Nuts/Bolts, Grimeets, etc.	0-55
C15	4	Mains Toggle Switches, 2 Amp D/P	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	3	Relays 6-24V Operating	0-55
C20	4	Sheets Copper Laminate approx. 10in x 7in	0-55

Please add 10p post and packing on all component packs, plus a further 10p on pack Nos. C1, C2, C19 and C20

The largest selection

NEW LOW PRICED TESTED S.C.R.'S

	PIV							
	50	100	200	400	600	800		
	2p	2p	2p	2p	2p	2p	2p	2p
1A TO5	0.25	0.27	0.30	0.47	0.58	0.89		
3A TO6	0.27	0.30	0.40	0.61	0.82	0.77		
5A TO6	0.28	0.31	0.54	0.81	0.75	0.88		
5A TO64	0.38	0.51	0.54	0.81	0.75	0.88		
7A TO48	0.51	0.55	0.82	0.73	0.84	0.99		
10A TO48	0.55	0.64	0.67	0.82	1.06	1.32		
16A TO48	0.58	0.69	0.82	1.02	1.37	1.65		
30A TO48	1.26	1.54	1.78	1.92		4.40		

SIL. RECTS. TESTED

	PIV							
	50	100	200	400	600	800		
	2p	2p	2p	2p	2p	2p	2p	2p
PIV 300mA 700mA 1A	1.5A	3A	10A	30A				
DO7	8016	8016	8016	8016	8016	8032A		
50 0.04	0.05	0.05	0.07	0.15	0.23	0.66		
100 0.04	0.05	0.05	0.14	0.17	0.25	0.82		
200 0.05	0.10	0.08	0.15	0.22	0.28	1.17		
400 0.06	0.14	0.07	0.22	0.30	0.40	1.30		
600 0.07	0.17	0.11	0.25	0.37	0.49	2.04		
800 0.11	0.19	0.12	0.27	0.40	0.61	2.20		
1000 0.12	0.27	0.15	0.33	0.50	0.69	2.75		
1200		0.36		0.42	0.62	0.82		

ZENER DIODES (DO-7 Case), range 2-33V, 14p each.

1.5W	2p	2p
2-33V	20p each	10V
(50-10 Stud), range		
2-33V	33p each	

10 amp POTTED BRIDGE RECTIFIER on heat sink. 100PIV. 99p each

NEW LINE Plastic Encapsulated 2 Amp. BRIDGE RECTS.
 50V RMS 35p each
 100V RMS 40p each
 400V RMS 50p each
 Size 15mm x 6mm.

UNIJUNCTION TRANSISTORS

Direct replacement for T1S43 and EX3000 also electrically equivalent to 2N2646 Qty.: 1-24 30p each. 25-99 27p each. 100+ 22p each.

CADMIUM CELLS

ORP12 47p
 ORP60, ORP61 44p each

GENERAL PURPOSE NPN SILICON SWITCHING TRANS. TO-18

SIM. TO 2N706/8. BSY 27/28/95A. All usable devices no open or short circuits. ALSO AVAILABLE in PNP Sim. to 2N2906. BCY70. When ordering please state preference NPN or PNP.

	2p	2p
20	For	0.55
30	For	1.10
100	For	1.92
500	For	8.25
1000	For	14.30

SIL. G.P. DIODES 2p

300mV	30	0.55
40PIV(Min.)	100	1.65
Sub-Min.	300	5.50
Full Tested	1,000	9.90

Ideal for Organ Builders.

GENERAL PURPOSE GERM. PNP

REPLACES - OC25-28-29-30-35-36. NKT 401-403. 404-405-406-409-431-452-453. T13027-3028. 2N250A. 2N456A-457A-458A. 2N511 A. B. 2G220-222, ETC. VCEO 80V VCEO 50V IC 10A PT. 30 WATTS Hfe 30-170.

PRICE	1-24	25-99	100 up
	47p each	44p each	40p each

2N3055
 115 WATT SIL POWER NPN
 55p EACH

AD161/162 PNP M/P COMP GERM TRANS. OUR LOWEST PRICE OF 60p PER PAIR

SILICON 50 WATTS MATCHED NPN/PNP
 BIP 19 NPN TO-3 Plastic. BIP 20 PNP. Brand new. VCEO 100V/VCEO 50V/IC 10A. HFE type 100/ft 3mHZ. OUR PRICE PER PAIR: 1-24 prs: 60p 25-99 prs. 61p 100 prs. 55p

KING OF THE PAKS Unequaled Value and Quality

SUPER PAKS NEW BI-PAK UNTESTED SEMICONDUCTORS

Satisfaction GUARANTEED in Every Pak, or Money Back.

Pak No.	Description	Price
U 1	120 Glass Sub-Min. General Purpose Germanium Diodes	0.55
U 2	60 Mixed Germanium Transistors AF/FF	0.55
U 3	75 Germanium Gold Bonded Sub-Min. like OA5, OA47	0.55
U 4	40 Germanium Transistors like OC81, AC128	0.55
U 5	60 200mA Sub-Min. Silicon Diodes	0.55
U 6	30 Sil. Planar Trans. NPN like B8Y5A, 2N706	0.55
U 7	16 Sil. Rectifiers TOP-HAT 750mA VLTG. RANGE up to 1000	0.55
U 8	50 Sil. Planar Diodes DO-7 Glass 250mA like OA200/202	0.55
U 9	20 Mixed Voltages, 1 Watt Zener Diodes	0.55
U10	20 BAY30 charge storage Diodes DO-7 Glass	0.55
U11	25 PNP Sil. Planar Trans. TO-5 like 2N1132, 2N2904	0.55
U12	12 Silicon Rectifiers Epoxy 300mA up to 800 PIV	0.55
U13	30 PNP-NPN Sil. Transistors OC200 & 28 104	0.55
U14	150 Mixed Silicon and Germanium Diodes	0.55
U15	25 NPN Sil. Planar Trans. TO-5 like BFV51, 2N697	0.55
U16	10 3 Amp Silicon Rectifiers Stud Type up to 1000PIV	0.55
U17	30 Germanium PNP AF Transistors TO-5 like ACY 17-22	0.55
U18	8 6 Amp Silicon Rectifiers BYZ13 Type up to 600 PIV	0.55
U19	25 Silicon NPN Transistors like BC108	0.55
U20	12 1.5 Amp Silicon Rectifiers Top Hat up to 1000 PIV	0.55
U21	30 AF. Germanium Alloy Transistors 2G300 Series & OC71	0.55
U23	30 MADT's like MHz Series PNP Transistors	0.55
U24	20 Germanium 1 Amp Rectifiers GJM Series up to 300 PIV	0.55
U25	25 300MHz NPN Silicon Transistors 2N708, B8Y27	0.55
U26	30 Fast Switching Silicon Diodes like IN914 Micro-Min.	0.55
U27	12 NPN Germanium AF Transistors TO-1 like AC127	0.50
U29	1 1 Amp SCR's TO-5 can, up to 600 PIV CR81/25-600	1.15
U30	15 Plastic Silicon Planar Trans. NPN 2N2926	0.55
U31	20 Silicon Planar Plastic NPN Trans. Low Noise Amp 2N3707	0.55
U32	25 Zener Diodes 400mV DO-7 case 3-18 volts mixed	0.55
U33	15 Plastic Case 1 Amp Silicon Rectifiers IN4000 Series	0.55
U34	30 Silicon PNP Alloy Trans. TO-5 BCY26 2N302/4	0.55
U35	25 Silicon Planar Transistors PNP TO-18 2N2906	0.55
U36	25 Silicon Planar NPN Transistors TO-5 BFY50/51/52	0.55
U37	30 Silicon Alloy Transistors SO-2 PNP OC200, 2N3011	0.55
U38	20 Fast Switching Silicon Trans. NPN 400MHz 2N3011	0.55
U39	30 RF. Germ. PNP Transistors 2N1303/5 TO-5	0.55
U40	10 Dual Transistors 6 lead TO-5 2N2060	0.55
U41	25 RF Germanium Transistors TO-5, OC45, NKT72	0.55
U42	10 VHF Germanium PNP Transistors TO-1 NKT667, AF117	0.55
U43	25 Sil. Trans. Plastic TO-18 A.F. BC113/114	0.55
U44	20 Sil. Trans. Plastic TO-5 BC115/NPN	0.55
U45	7 3A SCR. TO66 up to 500PIV	1.10

Code No's. mentioned above are given as a guide to the type of device in the pak. The devices themselves are normally unmarked.

SILICON PHOTO TRANSISTOR. TO-18 Lens end NPN Sim. to BP x 25 and P21. BRAND NEW. Full data available. Fully guaranteed. Qty.: 1-24 25.99 100 up Price each 69p 44p 38p

F.E.T.'S

2N3819	81p	2N5458	35p
2N3820	55p	2N5459	44p
2N3821	38p	BPW10	66p
2N3823	31p	MIP105	40p

NEW 6TH EDITION TRANSISTOR EQUIVALENTS BOOK.

A complete cross reference and equivalents book for European, American and Japanese Transistors. Exclusive to BI-PAK 99p each.

A LARGE RANGE OF TECHNICAL AND DATA BOOKS ARE NOW AVAILABLE EX STOCK. SEND FOR FREE LIST.

QUALITY TESTED SEMICONDUCTORS

Pak No.	Description	Price
Q 1	20 Red spot transistors pnp	0.55
Q 2	16 White spot R.F. transistors pnp	0.55
Q 3	4 OC77 type transistors	0.55
Q 4	6 Matched transistors OC44/45/81/81D	0.55
Q 5	4 OC75 transistors	0.55
Q 6	5 OC72 transistors	0.55
Q 7	4 AC128 transistors pnp high gain	0.55
Q 8	4 AC126 transistors pnp	0.55
Q 9	7 OC81 type transistors	0.55
Q10	7 OC71 type transistors	0.55
Q11	2 AC127/128 Complementary pairs pnp/npn	0.55
Q12	3 AF116 type transistors	0.55
Q13	3 AF117 type transistors	0.55
Q14	3 OC171 H.F. type transistors	0.55
Q15	7 2N2926 Sil. Epoxy transistors mixed colours	0.55
Q16	2 GET880 low noise Germanium transistors	0.55
Q17	5 npn 2 x BT.141 & 3 x ST.140	0.55
Q18	4 MADT'S 2 x MAT 109 & 2 x MAT 120	0.55
Q19	3 MADT'S 2 x MAT 101 & 1 x MAT 121	0.55
Q20	4 OC44 Germanium transistors A.F.	0.55
Q21	4 AC127 npn Germanium transistors	0.55
Q22	20 NKT transistors A.F. R.F. coded.	0.55
Q23	10 OC200 Silicon diodes sub-min.	0.55
Q24	8 OA81 diodes.	0.55
Q25	15 IN914 Silicon diodes 75PIV 75mA	0.55
Q26	8 OA95 Germanium diodes sub-min IN69	0.55
Q27	2 10A 600 PIV Silicon rectifier 18425R	0.55
Q28	2 Silicon power rectifiers BYZ13	0.55
Q29	4 Silicon transistors 2 x 2N696, 1 x 2N697, 1 x 2N698	0.55
Q30	7 Silicon switch transistors 2N706 npn	0.55
Q31	6 Silicon switch transistors 2N708, npn	0.55
Q32	3 pnp Silicon transistors 2 x 2N1131, 1 x 2N1132	0.55
Q33	3 Silicon npn transistors 2N1711	0.55
Q34	7 Silicon npn transistors 2N2369, 500MHz (code P397)	0.55
Q35	3 Silicon pnp TO-5, 2 x 2N2904 & 1 x 2N2905	0.55
Q36	7 2N3646 TO-18 plastic 300MHz npn	0.55
Q37	3 2N3053 npn Silicon transistors	0.55
Q38	7 pnp transistors 4 x 2N3703, 3 x 2N3702	0.55

ELECTRONIC SLIDE-RULE

The MK Slide Rule, designed to simplify Electronic calculations features the following scales: Conversion of Frequency and Wavelength. Calculation of L, C and fo of Tuned Circuits. Reactance and Self Inductance. Area of Circles. Volume of Cylinders. Resistance of Conductors. Weight of Conductors. Decibel Calculations. Angle Functions. Natural Log and "e" Functions. Multiplication and Division. Squaring, Cubing and Square Roots. Conversion of kW and Hp. A must for every electronic engineer and enthusiast. Size: 2cm x 4cm. Complete with case and instructions. Price each: £3-68p

INTEGRATED CIRCUIT PAKS

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

Pak No.	Contents	Price	Pak No.	Contents	Price	Pak No.	Contents	Price
UIC00	= 12 x 7400	0.55	UIC46	= 5 x 7446	0.55	UIC86	= 5 x 7486	0.55
UIC01	= 12 x 7401	0.55	UIC47	= 5 x 7447	0.55	UIC87	= 5 x 7487	0.55
UIC02	= 12 x 7402	0.55	UIC48	= 5 x 7448	0.55	UIC88	= 5 x 7488	0.55
UIC03	= 12 x 7403	0.55	UIC05	= 12 x 7450	0.55	UIC89	= 5 x 7489	0.55
UIC04	= 12 x 7404	0.55	UIC03	= 12 x 7451	0.55	UIC90	= 5 x 7490	0.55
UIC05	= 12 x 7405	0.55	UIC53	= 12 x 7453	0.55	UIC91	= 5 x 7491	0.55
UIC06	= 8 x 7406	0.55	UIC54	= 12 x 7454	0.55	UIC92	= 5 x 7492	0.55
UIC07	= 8 x 7407	0.55	UIC60	= 12 x 7460	0.55	UIC93	= 5 x 7493	0.55
UIC08	= 8 x 7408	0.55	UIC70	= 8 x 7470	0.55	UIC94	= 5 x 7494	0.55
UIC09	= 8 x 7409	0.55	UIC71	= 8 x 7471	0.55	UIC95	= 5 x 7495	0.55
UIC10	= 12 x 7410	0.55	UIC72	= 8 x 7472	0.55	UIC96	= 5 x 7496	0.55
UIC11	= 12 x 7411	0.55	UIC73	= 8 x 7473	0.55	UIC100	= 5 x 74100	0.55
UIC12	= 12 x 7412	0.55	UIC74	= 8 x 7474	0.55	UIC121	= 3 x 74121	0.55
UIC13	= 8 x 7413	0.55	UIC75	= 8 x 7475	0.55	UIC141	= 3 x 74141	0.55
UIC14	= 8 x 7414	0.55	UIC76	= 8 x 7476	0.55	UIC151	= 3 x 74151	0.55
UIC15	= 8 x 7415	0.55	UIC77	= 8 x 7477	0.55	UIC154	= 3 x 74154	0.55
UIC16	= 8 x 7416	0.55	UIC78	= 8 x 7478	0.55	UIC183	= 3 x 74183	0.55
UIC17	= 8 x 7417	0.55	UIC79	= 8 x 7479	0.55	UIC193	= 3 x 74193	0.55
UIC18	= 8 x 7418	0.55	UIC80	= 5 x 7480	0.55	UIC199	= 3 x 74199	0.55
UIC19	= 5 x 7419	0.55	UIC81	= 5 x 7481	0.55			
UIC20	= 5 x 7420	0.55	UIC82	= 5 x 7482	0.55			
UIC21	= 5 x 7421	0.55	UIC83	= 5 x 7483	0.55			
UIC22	= 5 x 7422	0.55						
UIC23	= 5 x 7423	0.55						
UIC24	= 5 x 7424	0.55						
UIC25	= 5 x 7425	0.55						
UIC26	= 5 x 7426	0.55						
UIC27	= 5 x 7427	0.55						
UIC28	= 5 x 7428	0.55						
UIC29	= 5 x 7429	0.55						

-the lowest prices!

74 Series T.T.L. I.C.'s

BI-PAK STILL LOWEST IN PRICE. FULL SPECIFICATION GUARANTEED. ALL FAMOUS MANUFACTURERS



1		25		100+	
SN7400	0-16½	0-15½	0-13	SN7486	0-35
SN7401	0-16½	0-15½	0-13	SN7489	6-05
SN7402	0-16½	0-15½	0-13	SN7490	0-73½
SN7403	0-16½	0-15½	0-13	SN7491	1-10
SN7404	0-16½	0-15½	0-13	SN7492	0-73½
SN7405	0-16½	0-15½	0-13	SN7493	0-73½
SN7406	0-38½	0-34	0-31	SN7494	0-84
SN7407	0-38½	0-34	0-31	SN7495	0-84
SN7408	0-20	0-18½	0-17½	SN7496	0-95½
SN7409	0-20	0-18½	0-17½	SN74100	1-81
SN7410	0-16½	0-15½	0-13	SN74104	1-06½
SN7411	0-27½	0-26½	0-26½	SN74105	1-06½
SN7412	0-38½	0-34	0-31	SN74107	0-44
SN7413	0-32	0-29½	0-28½	SN74110	0-60½
SN7416	0-47½	0-44	0-42	SN74114	1-37½
SN7417	0-47½	0-44	0-42	SN74118	1-10
SN7420	0-16½	0-15½	0-13	SN74119	1-48½
SN7422	0-55	0-53	0-49½	SN74121	0-44
SN7423	0-55	0-53	0-49½	SN74122	1-54
SN7425	0-55	0-53	0-49½	SN74123	3-08
SN7426	0-49½	0-46	0-44	SN74141	0-73½
SN7427	0-49½	0-46	0-44	SN74143	1-85
SN7428	0-77	0-71	0-68	SN74150	3-30
SN7430	0-16½	0-15½	0-13	SN74151	1-10
SN7432	0-49½	0-46	0-44	SN74153	1-32
SN7433	0-88	0-82½	0-77	SN74154	1-98
SN7437	0-70½	0-68	0-66	SN74155	1-54
SN7438	0-70½	0-68	0-66	SN74156	1-54
SN7440	0-73½	0-70	0-68	SN74157	2-08
SN7441	0-73½	0-70	0-68	SN74160	1-98
SN7442	0-73½	0-70	0-68	SN74161	1-98
SN7443	1-43	1-37½	1-32	SN74162	4-40
SN7444	1-43	1-37½	1-32	SN74163	4-40
SN7445	1-98	1-94½	1-92	SN74164	2-42
SN7446	1-06½	1-03½	1-02	SN74165	2-47½
SN7447	1-10	1-06½	1-04½	SN74169	3-85
SN7448	1-10	1-06½	1-04½	SN74174	2-58
SN7450	0-16½	0-15½	0-13	SN74175	1-78
SN7451	0-16½	0-15½	0-13	SN74176	2-75
SN7453	0-16½	0-15½	0-13	SN74177	2-75
SN7454	0-16½	0-15½	0-13	SN74180	2-20
SN7460	0-16½	0-15½	0-13	SN74181	6-05
SN7470	0-82	0-78½	0-76	SN74182	2-20
SN7472	0-32	0-28½	0-26½	SN74183	3-85
SN7473	0-49½	0-46	0-44	SN74190	2-14
SN7474	0-49½	0-46	0-44	SN74191	2-09
SN7475	0-49½	0-46	0-44	SN74192	2-14
SN7476	0-44	0-43	0-42	SN74193	2-20
SN7480	0-73½	0-70	0-68	SN74194	2-97
SN7481	1-32	1-26½	1-21	SN74195	2-20
SN7482	0-86½	0-84	0-83	SN74196	1-98
SN7483	1-21	1-15½	1-04½	SN74197	1-87
SN7484	1-10	1-04½	0-99	SN74198	6-06
SN7485	3-98	3-85	3-74	SN74199	6-05

LINEAR I.C.'s—FULL SPEC.

Type No.	Price
BP201C—8L201C	0-69½ 0-58½ 0-49½
BP710C—8L701C	0-69½ 0-55 0-49½
BP702C—8L702C	0-69½ 0-55 0-49½
BP702—72702	0-58½ 0-49½ 0-44
BP709—72709	0-39½ 0-37½ 0-33
BP709P—μA709C	0-39½ 0-37½ 0-33
BP710—72710	0-48½ 0-46 0-44
BP711—μA711	0-49½ 0-47½ 0-44
BP711—72741	0-56 0-50 0-45
μA709C	0-31 0-28½ 0-26½
TAA263	0-77 0-66 0-60½
TAA293	0-99 0-82½ 0-77
TAA350	1-87 1-74 1-65
EA1000	2-89½

ROCK BOTTOM PRICES

LOGIC DTL 930 Series I.C.'s	Price
Type No.	1-24 25-99 100 up
BP930	0-13 0-12 0-11
BP932	0-14 0-13 0-12
BP933	0-14 0-13 0-12
BP935	0-14 0-13 0-12
BP936	0-14 0-13 0-12
BP944	0-14 0-13 0-12
BP945	0-27½ 0-26½ 0-24
BP946	0-13 0-12 0-11
BP948	0-27½ 0-26½ 0-24
BP951	0-71½ 0-68 0-60½
BP962	0-13 0-12 0-11
BP9093	0-44 0-42 0-39½
BP9094	0-44 0-42 0-39½
BP9097	0-44 0-42 0-39½
BP9099	0-44 0-42 0-39½

NUMERICAL INDICATOR TUBES



MODEL	CD66	GR116	3015F Minifon
Anode Voltage (Vdc)	170min	170min	5
Cathode Current (mA)	2-3	14	8
Numerical Height (mm)	16	13	9
Tube Height (mm)	47	32	22
Tube Diameter (mm)	19	13	12 wide
I.C. Driver Rec.	HP41 or 141	BP41 or 141	BP47
PRICE EACH	£1-87	£1-70	£1-09

RTL MICROLOGIC CIRCUITS

	Price each
Epoxy TO-5 case	1-24 25-99 100 up
μL900 Buffer	38p 36p 29p
μL914 Dual 21/p gate	38p 36p 29p
μL923 J-K flip-flop	55p 51p 49p

Date and Circuits Booklet for IC's Price 8p.

DUAL IN LINE SOCKETS

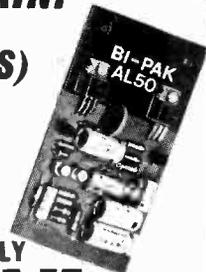
	1-24	25-99	100+
T8014	0-33	0-30	0-27½
T8016 16 pin type	0-38½	0-35	0-33
BP814 14 pin type (low cost)	0-16½	0-14½	0-12
BPS16 16 pin type (low cost)	0-17½	0-15½	0-13

BI-PAK DO IT AGAIN!

50W pk 25w (RMS)

0.1% DISTORTION!
HI-FI AUDIO AMPLIFIER

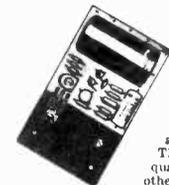
THE AL50



- * Frequency Response 15Hz to 100,000—1dB.
- * Load—3, 4, 8 or 16 ohms.
- * Distortion—better than 0.1% at 1KHz.
- * Signal to noise ratio 80dB.
- ONLY £3-57½ each
- * Supply voltage 10-35 Volts.
- * Overall size 63mm × 105mm × 13mm.

Tailor made to the most stringent specifications using top quality components and incorporating the latest solid state circuitry and ALRO was conceived to fill the need for all your A.F. amplification needs. FULLY BUILT—TESTED—GUARANTEED.

STABILISED POWER MODULE SPM80



AP80 is especially designed to power 2 of the AL50 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 MT80, the unit will provide outputs of up to 1.5 amps at 35 volts. Size: 68mm 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 £3-24½

TRANSFORMER BMT80 £2-14½ p. & p. 27½p

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 AL50 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 switch 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
Harmonic Distortion	better than 0.1%
Inputs: 1. Tape Head	1-25mV into 50K Ω
2. Radio, Tuner	35mV into 50K Ω
3. Magnetic P.U.	1-5mV into 50K Ω
All input voltages are for an output of 250mV. Tape and P.U. inputs equalised to RIAA curve within ± 1dB from 20Hz to 20kHz.	
Bass Control	+ 15dB at 20kHz
Treble Control	+ 15dB at 20kHz
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 82mm x 35mm

ONLY £13-14½

SPECIAL COMPLETE KIT COMPRISING 2 AL50's, 1 SPM80, 1 BMT80 & 1 PA100 ONLY £25-30 FREE p. & p.

All prices quoted in new pence 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 10p. Overseas add extra for airmail. Minimum order 50p. Cash with order please.

Guaranteed Satisfaction or Money Back

DISCOUNTS UPTO

60%

Global's GOLDEN Guarantee

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

GARRARD SP25 Mk. III Special Purchase. **£17.45**
Limited number available
Garrard SP25 Mk. III
Goldring G800
Teak plinth and tinted cover
All leads supplied.
Please add £1.25 P. & P. & Ins.

TURNTABLES

Please add 75p P. & P. & Ins.
Connoisseur BDI Chassis £12.75
Garrard SP25 Mk. III £9.90
Garrard AP76 £17.20
Garrard SL65B £13.95
Garrard 401 £28.75
Garrard Zero 100 (Auto) £36.90
Garrard Zero 100 (Single) £35.80
BSR MP60 £9.40
Goldring GL72 £20.90
Goldring GL72 P £27.45
Goldring GL75 £26.85
Goldring GL75 P £34.95
Goldring 101 P.C. £20.00
Wharfedale Linton + cart. £25.90
Thorens TD125AB Mk. II £27.95
Thorens TD160 AB & C £53.95

TUNERS

Please add 85p P. & P. & Ins.
Amstrad Multiplex 3000 £28.75
Armstrong 523 £39.50
Armstrong 524 £31.45
Rogers R/brook FET4 (Chassis) £37.25
Rogers R/brook FET4 (Cased) £43.50
Rogers R/bourne FET4 (Chassis) £45.00
Rogers R/bourne FET4 (Cased) £49.50
Sinclair PR060 (Module) £17.45
Sinclair 2000/3000 Tuner £29.90
Leak Delta FM (Cased) £53.60
Leak Delta AM/FM (Cased) £63.75
Alpha Highgate FT150 £37.95
Metrosound FMS 20 £38.70
Philips RH 690 £33.00

TUNER/AMPLIFIERS

Please add £1 P. & P. & Ins.
Alpha Highgate 150 £48.95
Armstrong 525 (Teak cased) £69.45
Armstrong 526 AM/FM £77.25
(Teak cased) £119.00
Leak Delta 75 £32.50
Telton 2100 £98.90
Goodmans One Ten £87.95
Goodmans Mod 90 £49.50
Rotel 150 £75.50
Rogers Ravensbrook (Teak cased) £77.00
Rogers R/brook (Chassis) £72.00
Alpha FR 3000, New product £72.00

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

GLOBAL AUDIO DISCOUNT WAREHOUSES

Dept. (PE5), 174 Pentonville Road, London, N.1. Tel. 01-278 1769
Or: 4 High View Parade, Redbridge Lane East, Woodford Avenue Ilford, Essex. Tel. 01-550 1086

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

MAIL ORDERS: Order with confidence. Send Postal Order. Cheque, Money Order, Bank Draft, Giro or Cash by Registered Mail. **CALLERS:** Please note that cheques can only be accepted together with cheque cards (not Barclay Card).

AMPLIFIERS

Please add 85p P. & P. & Ins.
Amstrad 8000 Mk. II £14.95
Amstrad IC2000 £27.50
Amstrad Integra 4000 £21.45
Armstrong 521 (Teak cased) £43.90
Alpha Highgate 212 £24.85
Alpha Highgate FA300 £32.25
Alpha Highgate FA400 £35.65
Leak Delta 30 £44.85
Leak Delta 70 £54.90
Metrosound ST20E £24.20
Metrosound T60 £45.95
Pioneer SA600 & 610 £57.25
Pioneer SA5000A £71.95
Pioneer SA1000 £96.95
Rogers R/brook (Chassis) £37.95
Rogers R/brook (Cased) £41.50
Rogers R/bourne (Chassis) £49.95
Rogers R/bourne (Cased) £52.75
Sinclair PR060 2 / Z 30 PZ5 £14.70
Sinclair PR060 2 / Z 30 PZ6 £16.70
Sinclair PR060 2 / Z50 PZ8 £22.95
7 Trans £4.20
Sinclair AFU (Filter Unit) £18.25
Sinclair 605 £21.50
Sinclair 2000 Mk. II £28.00
Sinclair 3000 Mk. II £42.95
Wharfedale Linton £22.95
Telton SAQ 307 £52.95
Rotel RA310 £52.95
Rotel RA610

SPEAKERS

Please add £1.50 per pair P. & P. & Ins.
Price per pair
Amstrad 138 £13.90
Wharfedale Denton 2 £29.50
Wharfedale Linton 2 £35.85
Wharfedale Melton 2 £45.90
Wharfedale Dovedale 3 £59.80
Celestion Ditton 120 £38.40
Celestion Ditton 15 £50.90
Celestion Ditton 25 £84.95
Celestion County (new prod) £34.50
Goodmans Double Maxim £47.40
Goodmans Mezzo 3 £45.90
Goodmans Magister £82.95

Special bulk purchase
£2.90*

Plus 65p P. & P. & Ins.
Finished in teak veneer with tinted dust cover. (Fully assembled). For Garrard SP25: 2025TC: 3000; A160: 2000; 2500; 3500; 5100; 1025; SL65B. Also for BSR, McDonald MP60 and others. For AP76, AP75, SL72B; SL75; SL95B*. £4.20 + 65p. P. & P. & Ins. Also finished in walnut to match Japanese equipment - at no extra.

CARTRIDGES

Please add 10p P. & P. & Ins.
Goldring G850 £3.35
Goldring G800 £4.70
Goldring G800E £7.50
Goldring G800 Super E £14.15
Shure M3D £3.70
Shure M44E £4.75
Shure M55E £5.55
Ortofon SL15 £15.85
Sonotone 9TAHC £1.35



ELECTRONIC ORGAN KITS

★ Portable—4 octave keyboard with 10 voices, 3 pitches—vibrato, £145.29. ★ Console—5 octave keyboard with 10 voices, 3 pitches. Keyboard can be split into solo and accompaniment. Vibrato, built in amplifier and speaker £250.93. ★ Console—2 × 4 octave keyboards and 13 note pedal board, 29 voices, Vibrato, Delay Vibrato, Sustain, Reverberation, Precussion, Wah Wah, £406.00. ★ Console—2 × 5 octave keyboards and 32 note pedal board, 32 voices. Vibrato, Delay Vibrato, Sustain Reverberation, Precussion, 3 Couplers, etc., at £572.55.

ALL COMPONENTS CAN BE BOUGHT SEPARATELY. SEND 50p FOR LATEST CATALOGUE, WHICH INCLUDES SPECIALIZED COMPONENTS, HI-FI EQUIPMENT AND ELECTRICAL HOUSEHOLD APPLIANCES.

ELVINS ELECTRONIC MUSICAL INSTRUMENTS

8 PUTNEY BRIDGE ROAD, LONDON, S.W.18
TEL. 01-870 4949

P.E. SOUND SYNTHESISER

Get away to a flying start with this exciting Space Age project. Precision cut metal parts to form modular units as described in the March issue are available NOW.
A. Power supply subframe with tab drillings only £1.35 (P. & P. 25p).
B. Circuit board support plates fully drilled, 94p.
Panels drilled with locating holes only: C. 20mm, 18p; D. 38mm, 21p; E. 60.5mm, 28p; F. 64mm, 31p; G. Module locking rods complete, £1.20 ea. SAVE MONEY by obtaining a complete kit of hardware which comprises 1 off each A, C, D, F, 5 off E, and 7 off B, G £17.42, Post Free. REGULATED POWER SUPPLY fully assembled and GUARANTEED by "SCOPE" Designs & Mfg. Ltd. Voltage rails adjustable from 8-17V. Nom. 15-0-15V at 500mA per rail. Stab. ratio 250 : 1; Ripple and Noise 500µV at full load. Load regulation < 1% zero to full load, line regulation < 1% for 10% change in mains voltage. Size 4in × 2½in × 7in fits easily into power supply subframe. Terrific value at £19.50 Post Free. (Include 15p for insurance if required.)
High Quality components for oscillator/inverter and ramp generator/input amp. modules. SAE for free lists.

EATON AUDIO

P.O. Box No. 3
ST. NEOTS
HUNTINGDON
PE19 3JB

TERMS: MAIL ORDER ONLY. C.W.O. Cheques or crossed P.O. payable to Eaton Audio. Minimum order £2. Where P. & P. charges are not shown please add 10p in the £1 to orders under £5. Orders over £5 will be sent free of P. & P. All prices subject to V.A.T. increases from 1st April.

**LARGE STOCKS,
ATTRACTIVE DISCOUNTS
DEPENDABLE SERVICE**

ELECTROVALUE

Electronic Component Specialists

TRANSISTORS BY SIEMENS AND NEWMARKET

2N3055 npn silicon power	60p
AC153K pnp germanium low power	25p
AC176K npn germanium low power	23p
AD161 npn germanium medium power	42p
AD162 pnp germanium medium power	40p
AF139 pnp germanium UHF	33p
NPN: BC107 13p, BC108 12p, BC109 13p, BC167 10p, BC168 9p, BC169 10p.	
PNP: BC177 15p, BC178 14p, BC179 15p, BC257 9p, BC258 8p, BC259 9p.	

Standard groupings available.

BD135 npn medium power	26p
BD136 pnp medium power	27p

DIODES

OA90, OA91, OA95, 6p each; OA200, 9p; OA202, 10p.

Other semiconductors: AC128, 17p; AF117, 35p; BFY51, 19p. Full lists and technical data will be found in Catalogue No. 6.

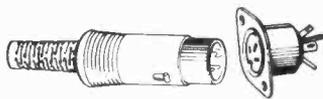
SIEMENS' THYRISTORS

0-8A 400V 56p, 600V 70p, 3A 400V 60p, 600V 88p.

ZENER DIODES full range E24 values: 400mW: 2.7V to 36V, 14p each; 1W: 6.8V to 82V, 21p each; 1.5W: 4.7V to 75V, 48p each. Clip to increase 1.5W rating to 3 watts (type 266F) 4p.

DIN PLUGS AND SOCKETS

by Hirshmann, 4A rating



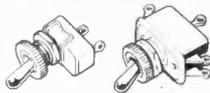
2 way LS —socket 10p, plug 12p
3 way scr.—socket 10p, plug 12p
5 way scr.—socket 11p, plug 15p

TRANSISTOR ACCESSORIES

TO3 cover, 7p; Heat sinks 1°C/W, type 6W1, undrilled, 60p.

SWITCHES

1011 SPST toggle, 20p; 409 DPDT toggle, 29p (these are chrome plated, 2.5A rating); 7201 sub-miniature DPDT 250V a.c./2A, 48p.



ROTARY SWITCHES

Radiospares Miniature Mako-switch (in assembly kit form). Shaft, 48p. Wafers, MBB-2P5W, IP11W; BBM1P12W, 2P6W, 3P4W, 4P3W, 6P2W, 6p each.

WAVECHANGE SWITCHES

IP12W, 2P6W, 3P4W, 413W, 32p each.



ELECTROLYTIC CAPACITORS

Rated voltage: 3V	6.3V	10V	16V	25V	40V	AXIAL LEAD	
						Capacity μ F	7p
0.47	—	—	—	—	—	7p	7p
1.0	—	—	—	—	—	7p	7p
2.2	—	—	—	—	7p	7p	7p
4.7	—	—	7p	—	—	7p	7p
10	—	7p	7p	7p	7p	7p	7p
22	—	7p	7p	7p	7p	7p	8p
47	7p	7p	7p	7p	7p	7p	8p
100	7p	7p	7p	7p	7p	8p	12p
220	7p	7p	7p	7p	7p	10p	26p
470	7p	8p	9p	9p	12p	17p	24p
1,000	9p	12p	12p	17p	20p	23p	40p
2,200	14p	16p	22p	25p	36p	40p	—
4,700	23p	26p	37p	40p	—	—	—
10,000	37p	40p	—	—	—	—	—

RESISTORS — 10%, 5%, 2%

Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99	100 up
C	1/20W	5%	82 Ω —220K Ω	E12	9	8	7.5
C	1/8W	5%	4.7 Ω —470K Ω	E24	1	0.9	0.75 nett
C	1/4W	10%	4.7 Ω —10M Ω	E12	1	0.9	0.75 nett
C	1/2W	5%	4.7 Ω —10M Ω	E24	1.2	1	0.8 nett
C	1W	10%	4.7 Ω —10M Ω	E12	2.5	2	1.6 nett
MO	1/2W	2%	10 Ω —1M Ω	E24	4	3	3 nett
WW	1W	10% \pm 120 Ω	0.22 Ω —3.9 Ω	E12	7	7	6
WW	3W	5%	1 Ω —10K Ω	E12	7	7	6
WW	7W	5%	1 Ω —10K Ω	E12	9	9	8

Codes: C = carbon film, high stability, low noise. MO = metal oxide, Electrofil TR5, ultra low noise. WW = wire wound, Plensley.

Values: E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades. E24 denotes series: as E12 plus 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and their decades.

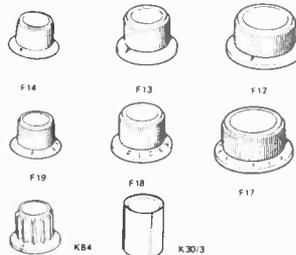
Prices are in pence each for quantities of the same ohmic value and power rating. NOT mixed values. (Ignore fractions on total value of resistor order.)

EVERYTHING BRAND NEW, GUARANTEED TO MAKERS' SPEC. NO SECONDS OR REJECTS

KNOB

All grub screw fitting for pin shafts. Black. For other types —see Catalogue No. 6, p. 54.

F.14 (20mm) pack of 2, 32p; F.13 (26mm) pack of 2, 38p; F.12 (33mm) pack of 2, 40p; F.19 (20mm) pack of 2, 32p; F.18 (26mm) pack of 2, 38p; F.17 (33mm) pack of 2, 40p; KB.4 (20mm) pack of 4, 40p; K30/3 (17mm) aluminium, 24p each.



POTENTIOMETERS

Rotary, carbon track, double wipe

SINGLE P20 lin. 100 Ω to 2.2M Ω , 12p; JP20 Log. 4.7K Ω to 2.2M Ω , 12p; Dual gang lin. 4.7K Ω to 2.2M Ω , 42p; Dual log. 4.7K Ω to 2.2M Ω , 42p; Log/antilog, 10K, 22K, 47K, 1M Ω only, 42p; Dual antilog, 10K only, 42p. Any type with 2A D.P. mains switch, 12p extra.

Only decades of 10, 22 and 47 available in ranges quoted.

DUAL CONCENTRIC DP20 in any combination of P20 values, 60p; with switch, 72p.

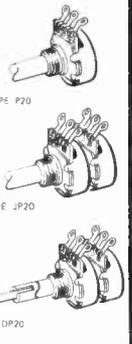
SLIDER

Lin. or log. 10K to 1 meg. in all popular values, each 26p.

Control knobs blk/white/red/yel/gr/blue/dk. grey/lt. grey, 5p each.

CARBON SKELETON PRE-SETS

Small high quality, PR lin. 100 Ω , 220 Ω , 470 Ω , 1K, 2K2, 4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M, 5M, 10M Ω . Vertical or horizontal mounting, 5p each.



TRANSFORMERS—MAINS

MT3 30V/2A plus 4 taps	£2.85
MT103 50V/1A plus 4 taps	£2.55
MT104 50V/2A plus 4 taps	£3.50
MT127 60V/2A plus 4 taps	£3.80
13TOS 13V/1A, CT	£1.25
2BTOS 12+12V, 2-0-2V.	£1.65

IT'S ALL IN THE LATEST ELECTROVALUE CATALOGUE

No. 6 (4th printing) contains details of 100's of semiconductors; ICs with circuit diagrams, R's and C's of practically every kind, accessories, components, tools, materials, etc., information and equivalent tables, etc. Well illustrated (96 pages, 5 1/2" x 8 1/2") 25p post free with refund voucher for 25p allowable on orders over £5 or more.

with 25p refund voucher

DISCOUNTS

All items offered for sale in accordance with our stated terms of business, copy of which available on request.

Not allowed on net price items. 10% on orders for £5 or more. 15% on orders of £15 or more. Prices subject to alteration without prior notice. Prices quoted DO NOT include V.A.T. Orders received after 31st March must be accompanied by an additional 10% of the net value of the order.

POSTAGE AND PACKING FREE

SURCHARGE 10p on small mail orders under £2. Overseas orders carriage and insurance charged at cost.

ELECTROVALUE

(Dept. PE5), 28 ST. JUDE'S ROAD, ENGLEFIELD GREEN, EGHAM, SURREY TW20 0HB
Hours: 9—5.30, Sat. 1 p.m. Tel.: Egham 3603 Telex 264475
Eng. Reg. No. 1047769 Registered Office: 28 St. Jude's Rd., Englefield Green, Egham, Surrey TW20 0HB



**A FIRST FOR HOME CONSTRUCTORS
A POCKET CALCULATOR KIT FROM S.C.S
A £4 DISCOUNT TO READERS OF PE**



- Just look at some of these features:
- * 8 digit, fully floating decimal point.
 - * 4 function with a constant on all functions.
 - * Does not limit on over or underflow.
 - * Provides 8 significant figures plus decimal point position over 99 decades.
 - * Rechargeable batteries.
 - * Carrying case.
 - * Charger.
 - * Touch key board.
 - * Weighs just 8 oz.
 - * Measures 5½" x 3" x 1½".
 - * Full after-sales service.
 - * 1 year guarantee.

A unique, three-way link up between S.C.S., a major calculator manufacturer and Practical Electronics allows us to offer you a fully guaranteed pocket calculator. Powered by a second generation MOS LSI chip from General Instrument Microelectronics, this offer brings home-constructors full manufacturers service facilities.

Available fully assembled for £47.50 + V.A.T. (tested and guaranteed). List price in kit form: £39 + V.A.T. **LESS SPECIAL £4 DISCOUNT TO ALL P.E. READERS.**

Offer closes 31st July 1973, so don't delay... send in for your pocket calculator kit today... and don't forget to use your discount voucher.

£4 DISCOUNT VOUCHER

I enclose a cheque to the value of £35 + V.A.T. to cover the cost of the S.C.S. Pocket Calculator Kit. (All cheques should be made payable to S.C.S. Components Ltd.)

NAME _____

ADDRESS _____

S.C.S. Components Ltd., P.O. Box No. 26, Wembley, Middlesex HA0 1YY
Registered in London No. 888454



STEREO RADIO WITHOUT TEARS

THE stereo tuner described this month has a number of interesting features which reflect some of the current approaches to domestic receiver design, as practised by set manufacturers.

In the field of domestic radio receivers, the integrated circuit has yet to make its full contribution. Various subsections of the conventional superheterodyne circuit have been designed and produced in monolithic form, but all these devices require additional discrete components in order to function. Thus the apparent labour- and material-saving advantages of i.c.s are largely nullified. The chief problem is one of inductances and capacitances. This real difficulty associated with monolithic circuits has encouraged further investigation into less conventional receiver designs where there is no dependence on LC tuned circuits. For example, the phase-locked-loop or synchronous detector receiver has been much discussed of late, as a likely future substitute for the classic superhet.

The i.c. has however made a noteworthy contribution to stereo receiver design. Single chip phase-locked decoders have been around for some time, and they represent perhaps the most highly developed integrated circuitry, with the highest component density, found at present in a sound receiver. A less exciting but important function performed by the i.c. is as a power supply regulator—a vital role in v.h.f. receivers incorporating varicapacitance diode (truly electronic) tuning.

The completely integrated high quality receiver will emerge eventually; whether as a single chip, or as a set of two or three i.c.s each covering a major portion of the system, only the i.c. and set designers and manufacturers will have a clue at this moment in time. While awaiting the inevitable, the ultimate in integration, set makers have in recent years been employing several methods. One popular approach is a different form of integration—using pre-adjusted circuit modules, containing conventional discrettes. Mass production of complex receivers is thus greatly simplified and the need for critical alignment operations on the assembly line eliminated.

This approach has obvious attractions for the home constructor, especially where a complicated and highly sensitive piece of equipment such as a stereo tuner is concerned. This month's design illustrates the use of modules, i.c.s, and discrete components. Thus as a system it is interesting and instructive. It demonstrates how available circuit devices can be judiciously co-ordinated to produce a "state of the art design" for the modestly equipped home constructor.—F.E.B.

Editor
F. E. BENNETT

Editorial
D. BARRINGTON
G. GODBOLD
S. R. LEWIS B.Sc.

Art Dept.
J. D. POUNTNEY *Art Editor*
J. A. HADLEY
R. J. GOODMAN
S. W. R. LLOYD

Advertisement Manager
D. W. B. TILLEARD
Phone: 01-634 4202

P. J. MEW
Phone: 01-634 4210

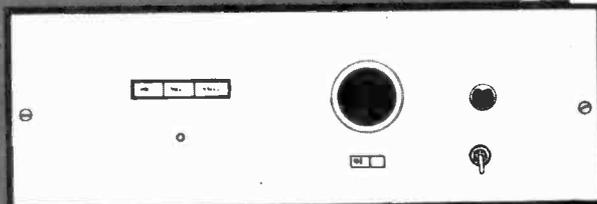
C. R. BROWN, *Classified*
Phone: 01-634 4301

Editorial & Advertising Offices:
Fleetway House, Farringdon St.,
London EC4A 4AD
Phone: *Editorial* 01-634 4452
Advertisements 01-634 4202

PUSHBUTTON

VARICAP

STEREO TUNER



By S.R.BEECHING

UP TO recent times the only methods of tuning radios were either the variable capacitor or the variable inductor. Using either system the result was the same, mechanics in the form of pulleys and pointers were needed to physically move either the vanes of the capacitor or the core of the inductor. Any constructor who attempted to build such a radio faced not only these mechanical problems but also the problem of alignment, particularly difficult in v.h.f. radios.

Two new tuner modules recently produced by Mullard go a long way to overcoming all these difficulties; they are pre-aligned and the tuning is electronic, not mechanical, i.e. there are no moving parts.

VARICAP TUNING

The tuner module uses a "varicap" diode for varying the tuning frequency. A varicap diode is one which takes advantage of the fact that the width of the depletion layer in a reverse biased diode varies with the reverse voltage. Thus one is effectively changing the gap between two plates of a

capacitor. The capacitances involved are small and thus at the moment varicap tuning is restricted to v.h.f. tuners.

In the Mullard LP1186 module the tuning is carried out by applying a voltage between 2 and 17 volts to its input. Because the tuning is electronic this opens up a whole field of possibilities, in particular that of remote tuning.

THE MODULES

The tuner module type LP1186 has three stages, a tuned aerial and r.f. stage, giving good image and i.f. rejection, a separate oscillator stage for good signal handling, and a mixer stage with a double-tuned i.f. output circuit. The main characteristics of this module are shown in Table 1.

The LP1185 is an f.m.-i.f. amplifier module whose main characteristics are summarised in Table 2. Both modules require a supply voltage of 9V and this is also adequate to cover the broadcast band when applied to the varicap diode.

Cover photo by courtesy of London Electricity

Only a few components are needed around the modules for decoupling and de-emphasis. Automatic frequency control (a.f.c.) is available though this may be removed by shorting to ground when tuning weak stations.

STEREO DECODER

An MC1310P integrated circuit stereo decoder is used to split the output of the LP1185 into right and left channel signals. The integrated circuit has the advantage over some of the earlier types in that it needs no coils. It has automatic stereo switching and an indicator driver capable of driving a 60mA bulb. A light emitting diode (l.e.d.) is shown in the circuit together with a resistor necessary to drop the voltage to the 1.5V needed for an l.e.d.

Table 3 gives some of the data on the i.c. stereo decoder.

CIRCUIT DIAGRAM

The full circuit diagram excluding the tuning unit and the power supply are shown in Fig. 1. The input from the aerial is fed into pin B of the tuner module. The tuning voltage is applied to pin C. Capacitor C1 is only really necessary if there is a large separation between the tuning unit and the tuner and may be omitted. A.F.C. is taken from pin F of the output module and fed back to pin D of the tuner. Switch S1 removes this a.f.c. by shorting to earth.

The signal is then fed into pin 2 of the stereo decoder. D1 is the stereo indicator lamp. VR1 is used to adjust the frequency of voltage controlled oscillator which forms part of the stereo decoder.

Components C9, R4, C10, R5 are de-emphasis components needed to compensate for the pre-emphasis of the high frequency signals which is introduced at the transmission end.

Output is taken to the DIN output socket via C11 and C12.

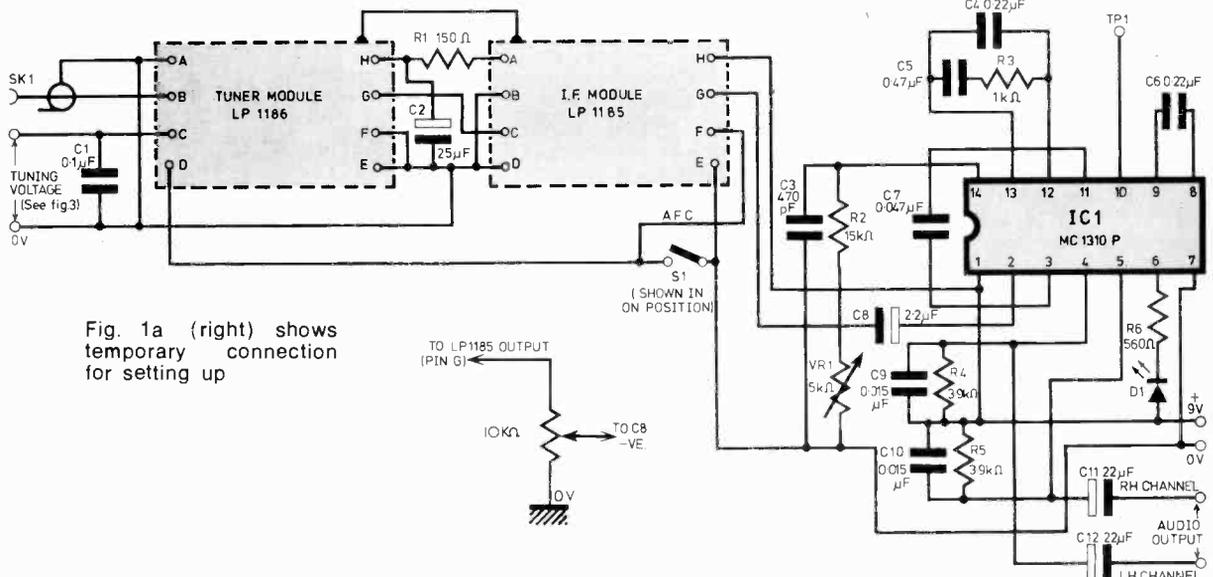


Fig. 1a (right) shows temporary connection for setting up

Fig. 1. Circuit diagram of the stereo tuner. The shaded boxes indicate ready built pre-aligned units. The tuning voltage unit is shown in Fig. 3

Table 1:
SUMMARY OF THE CHARACTERISTICS
OF THE LP1186 F.M. TUNER MODULE

Tuning range	87.4 to 104.5MHz
Tuning voltage	2 to 12V
Bandwidth at -3dB points	300kHz
Aerial impedance	75Ω
Power gain ($f_{in} = 95\text{MHz}$)	30dB
Noise factor ($f_{in} = 95\text{MHz}$)	6.5dB

Table 2:
SUMMARY OF THE CHARACTERISTICS
OF THE LP1185 F.M.-I.F. AMPLIFIER
MODULE

Centre frequency	10.7MHz \pm 50kHz
I.F. bandwidth at -3dB points	250kHz
Sensitivity for 40mV output	300μV (min) 60μV (max)
F.M. output at limiting (1mV input)	180mV
Signal-to-noise level with 150μV input	60dB
A.M. rejection	40dB

Table 3:
SUMMARY OF THE CHARACTERISTICS
OF THE MC1310P STEREO DECODER I.C.

Maximum input signal	500mV r.m.s.
Pilot capture range	\pm 3%
Distortion	< 0.3%
Maximum stereo indicator current	70mA

POWER SUPPLY

In a varicap tuner the power supply is very important as the tuning voltage must be very stable and ripple free. The power supply circuit is shown in Fig. 2.



Photograph of the complete tuner showing the front panel layout

The low voltage from the transformer is rectified by the diode bridge D2-5, smoothed by the large capacitor C13 and applied to the input of the integrated circuit regulator IC2. VR2 is used to tap off a fraction of the output voltage to feed back into the input of the i.c. Here it is compared with a reference voltage generated within the i.c. and the output is adjusted to make the two equal. Thus VR2 can be used to accurately set the output voltage.

The i.c. used will keep the output voltage to within 0.2 per cent of the nominal voltage for loads up to 100mA and within 0.03 per cent of nominal for power supply variations, provided that there is more than three volts between input and output. Because this i.c. also supplies the stereo decoder and hence the stereo indicator lamp it is best to keep the lamp current as low as possible hence the use of an l.e.d.

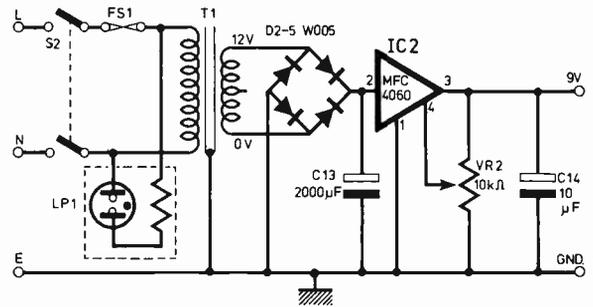


Fig. 2. Circuit diagram of the power supply unit. This not only supplies power to the modules but also provides the stabilised voltage necessary for tuning

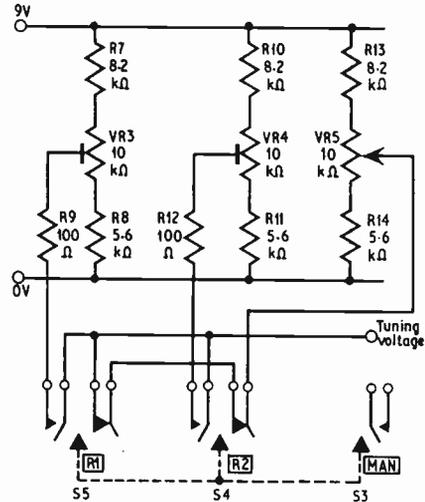


Fig. 3. A suggested tuning unit. This provides two preset voltages with a third manually variable voltage. The number of preset voltages really only depends on the size of the push button unit. There is also no reason why this tuning unit should not be mounted remote from the tuner itself. S3 is simply used to cancel the other two switches

TUNING UNIT

As mentioned earlier, a tuning voltage of between two and nine volts will adequately cover the normal broadcast band. A suggested switching system is shown in Fig. 3. This system gives two preset stations and one manually variable setting. The number of preset stations may be extended *ad infinitum* depending only on the number of push buttons in the unit.

The circuit board shown will accommodate six preset potentiometers. Thus a six-button unit or a six-way rotary switch can be used.

Padding resistors are added at either end of the potentiometers so that fine tuning is easier, although this somewhat restricts the tuning range. Fig. 4 shows the relationship between tuning voltage and frequency and this allows calculations to be carried out on the best settings for each station. The padding resistors are mounted with the potentiometers forming small pillars.

CONSTRUCTION

Construction is simple if the printed circuit board (Fig. 5) or the layout recommended are followed. Note that the orientation of the i.c.s is critical, a small spot indicates pin 1. Assemble the power supply components first (Fig. 6). Set VR2 to midway then switch on and test the output with a voltmeter, adjusting VR2 to give a 9V output.

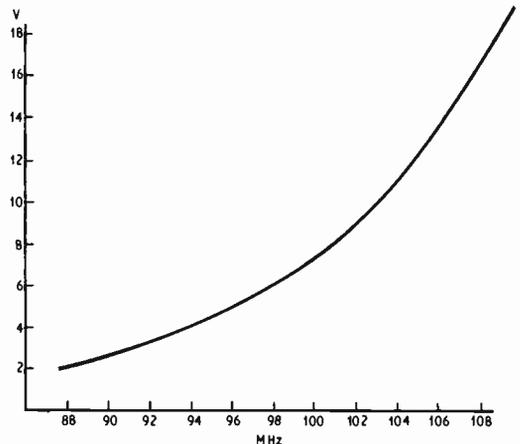


Fig. 4. Relationship between the tuning voltage and the frequency as measured in the prototype

CIRCUIT BOARD

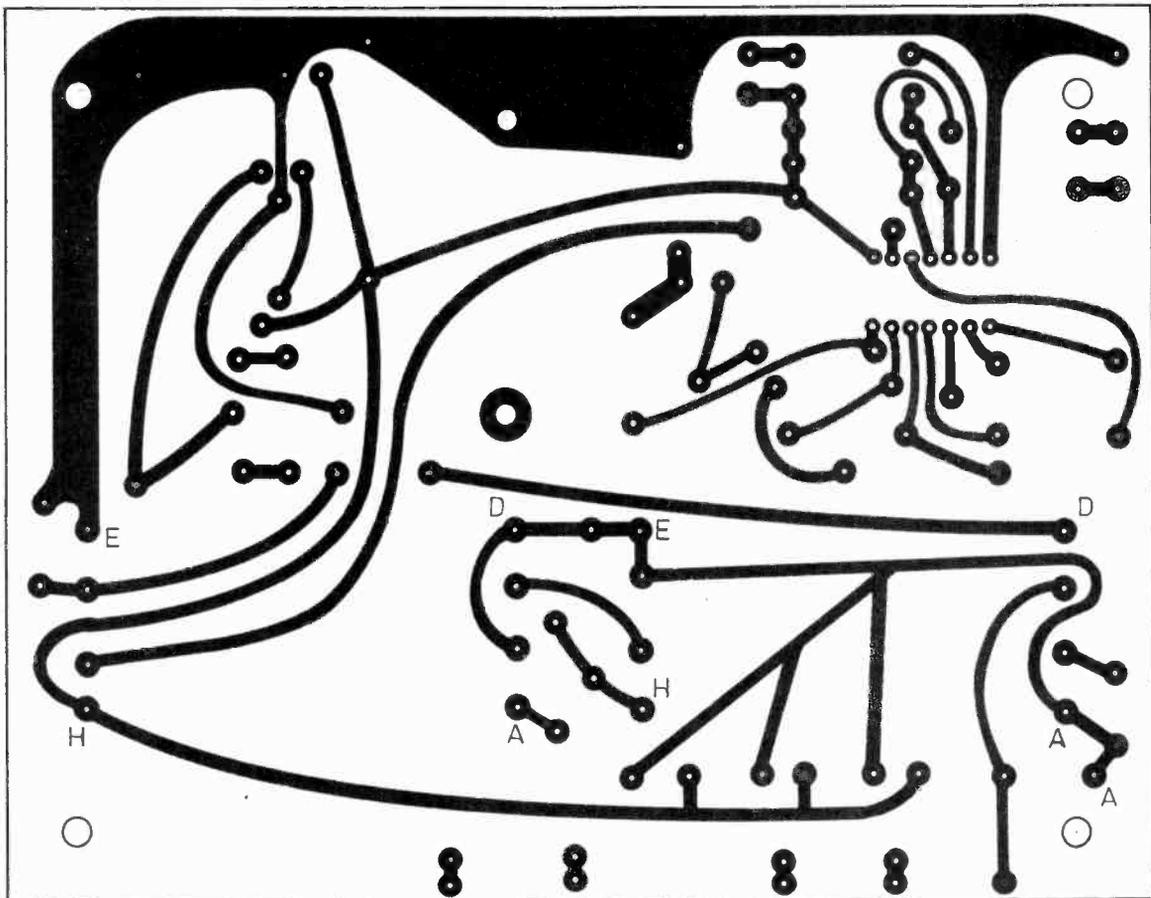


Fig. 5. The underside of the printed circuit board. The black areas indicate copper, the white areas being etched away

COMPONENTS . . .

Resistors

R1	150Ω	R4	3.9kΩ	R7	8.2kΩ	R10, R13	8.2kΩ
R2	15kΩ	R5	3.9kΩ	R8	5.6kΩ	R11, R14	5.6kΩ
R3	1kΩ	R6	560Ω	R9	100Ω	R12	100Ω

All $\frac{1}{4}W \pm 10\%$ carbon except R2 5%

Potentiometers

VR1	5kΩ skeleton preset
VR2	10kΩ skeleton preset
VR3, VR4	10kΩ skeleton preset (2 off)
VR5	10kΩ carbon linear

Capacitors

C1	0.1μF	C8	2.2μF 64V elect.
C2	25μF 12V elect.	C9	0.015μF
C3	470pF 2%	C10	0.015μF
C4	0.22μF	C11	22μF 25V elect.
C5	0.47μF	C12	22μF 25V elect.
C6	0.22μF	C13	2,000μF 25V elect.
C7	0.047μF	C14	10μF 16V elect.

Diodes

D1	Light emitting diode 1.5V 20mA (WestHyde)
D2-5	W005 or any 50 p.i.v. $\frac{1}{2}A$ bridge rectifier

Integrated Circuits

IC1	Motorola MC1310P
IC2	Motorola MFC4060

Transformer

T1 Mains primary, 12V 100mA secondary

Modules

Tuner Module Mullard Type LP1186
I.F. Module Mullard Type LP1185

Switches

S1 Miniature rocker or slide on/off switch
S2 Miniature d.p.d.t. toggle switch
S3-5 3 way pushbutton unit, each switch cancelling the other two

Miscellaneous

FS1 100mA fuse and fuseholder
SK1 Coaxial socket
SK2 5 pin 180° DIN socket, panel mounting
LP1 Mains neon indicator with integral resistor
PL1 Mains panel mounting plug Bulgin type P360
3-way tag strip, printed circuit board, case, 6BA and 8BA nuts and bolts

Printed circuit board and modules can be obtained from B & B Electronics, 64 Manners Road, Balderton, Newark, Notts.

After checking the power supply attach the other components. Note the link between the cases of the two modules. Do not attach C8 at this stage. Push button units vary as to the type of contact arrangement. If you are not sure use a continuity tester, e.g. a battery and bell or lamp to find two contacts which make when the appropriate button is pressed.

As mentioned before there is no reason why the push button units should not be mounted remote from the tuner.

SETTING UP AND TESTING

Prior to testing and final setting up, ensure that a good aerial is available and also an amplifier for monitoring. A v.h.f. aerial will be needed for low noise stereo although a v.h.f. television aerial or a length of wire will suffice for initial checks.

Before setting up is explained, some description of the stereo decoder is useful to understand what is going on. Fig. 7 shows a block diagram of the stereo decoder i.e.

The audio input is buffered and separated from the 19kHz pilot tone which is fed to two modulators which act as phase discriminators; modulator 1 is the input to the phase locking loop and modulator 2 is used as the stereo detector and indicator. Each provide an output which is proportional to the phase difference between the pilot input and the regenerated 19kHz signal (TP1). The output from modulator 1 controls the frequency of a 76kHz oscillator which is then divided by two to give a 38kHz signal necessary for decoding. The regenerated 38kHz is divided by two to give 19kHz which is fed back to the modulators, forming part of the phase locked loop.

If this regenerated 19kHz differs in phase from the 19kHz pilot then the modulator will correct the 76kHz oscillator thus locking it to the pilot tone. The resultant output from modulator 2 triggers a Schmitt trigger which switches on the stereo indicator and feeds the regenerated 38kHz to the decoder. With mono transmissions the audio comes out of the decoder outputs simultaneously, no pilot tone being present.

INTERWIRING

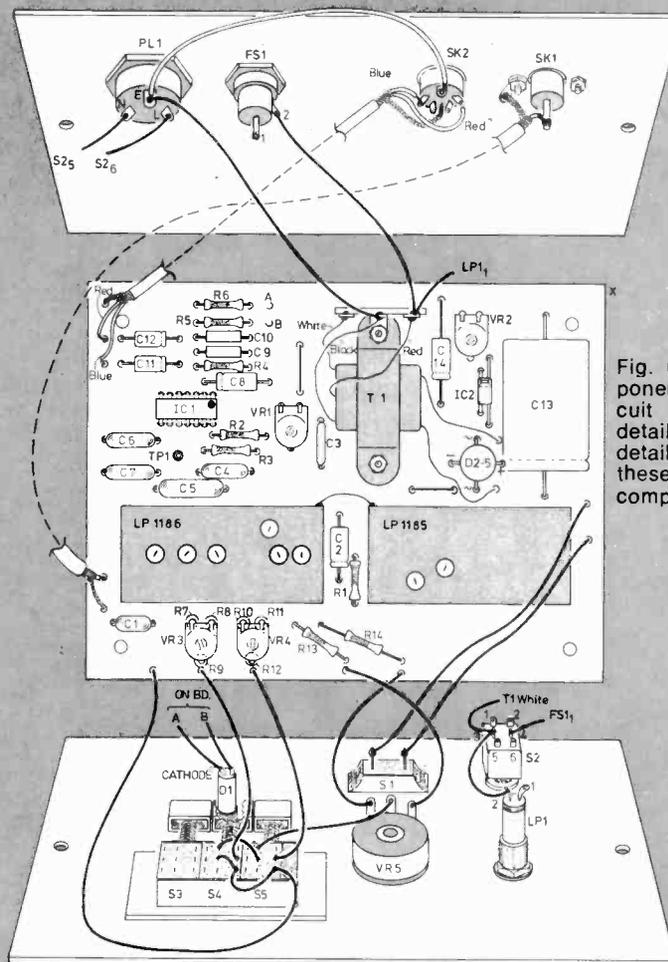


Fig. 6. Layout of the components on the printed circuit board and interwiring details. Front panel drilling details are not given as these will depend on the components used

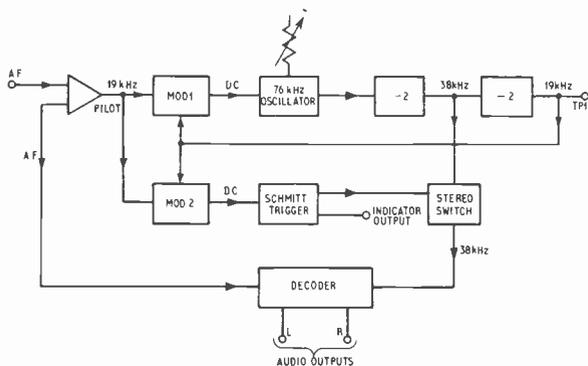


Fig. 7. Block diagram of the MC1310P stereo decoder i.c.

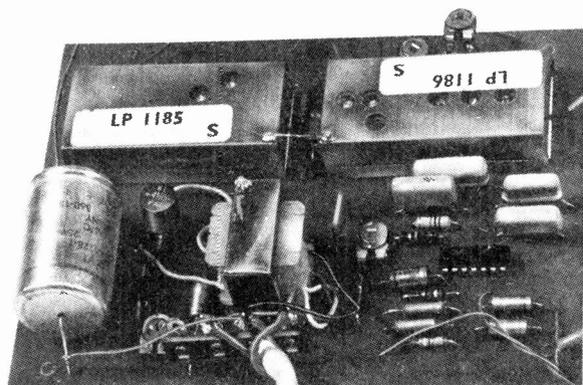
OSCILLATOR ADJUSTMENT

There are two ways to set VR1, the object being to set the oscillator to 76kHz with no pilot or input signal.

Connect the tuner to an aerial and an amplifier with C8 in position on the board, then switch on. It should be possible to tune into a station at least in mono (ignore the indicator lamp if it should come on). Switch off the a.f.c. and tune slightly away from the station, then switch back to a.f.c.; the station should pull in, if the signal is strong. Leave the a.f.c. on and tune to a known stereo broadcast. Rotate VR1 until the stereo indicator just lights and a stereo output is heard. There will probably be a good deal of background noise especially with a poor aerial.

If an oscilloscope is available monitor TPI with the tuner locked onto a station. Remove the input signal and reset the frequency to this measured value.

An alternative method of setting up is to reduce the signal level to the decoder thus reducing the range of VR1. Connect the positive end of C8 to the board but connect a 10 kilohm potentiometer between its negative end and the LP1185 output (see Fig. 1a). Switch on and tune to a stereo broadcast then adjust this potentiometer to give maximum audio output. Adjust VR1 until the stereo indicator lights then alternately reduce the output with the potentiometer and adjust VR1 until the setting of VR1 is very sharp or critical, this being the correct setting. ★



Photograph of the internal layout of the tuner

NEXT MONTH

General Purpose Timer

A new Integrated Circuit, the 555, provides the main circuit elements of a timing unit suited to application in the home, darkroom, workshop or factory. Covering delay times from milliseconds to hours, the 555 may in addition be used for pulse modulation or as an oscillator or in other applications. The device in its various guises is discussed in detail so that the constructor may design his own circuits. In addition, this issue includes a constructional feature on a timer using the 555.

Wide Range Pulse Generator

A simple circuit using only two ICs, some odd components and a suitable supply, creates a pulse box capable of covering 1Hz to 1 MHz in switched ranges.

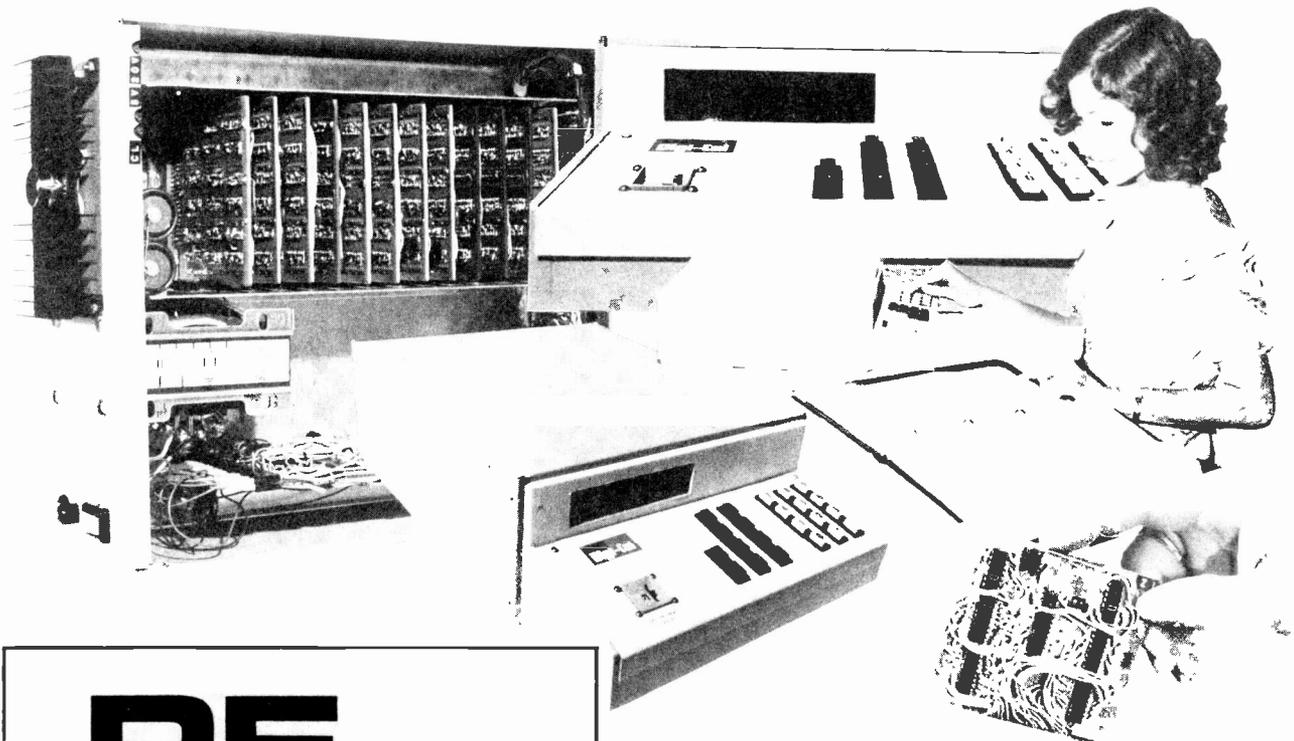
Autotone

A novel single tone melody instrument based on a digital system. With the Autotone simple tunes can be composed and the results memorised for instant replay at the desired tempo.

The June Issue is on sale May 12 1973

PRACTICAL
ELECTRONICS

CONCLUDING ARTICLE



PE

By R.W. COLES

PART 11

OVERFLOW LOGIC AND OVF BOARD

THIS final part of the Digi-Cal series describes the remaining logic housed on the under-chassis overflow (OVF) board, and attempts to knit together the loose ends which have been left dangling in earlier articles. Testing and troubleshooting information is also given.

OVERFLOW (OVF) BOARD

The existence of the OVERFLOW board was established in Part 2, when it was mentioned that this board is mounted copper side uppermost under the chassis, spaced from it by two 6BA nuts on each of the supporting bolts.

The OVF identity was not given to this board in Part 2 but is used here for ease of reference, the majority of the logic housed on this board being concerned with the OVERFLOW circuitry.

The Veroboard panel itself is mounted in the copper up fashion to facilitate the use of this board as an interconnection and power bus medium in

addition to its job of housing logic. This mounting method also permits the easy addition of circuitry without access to the underside of the board, the only compromise necessary being that of neatness, since the solder is "on display" together with the components.

INTERCONNECTIONS

The OVF board carries the +5V and ground line power buses, from which the other logic cards are supplied. Any other logic lines which are employed, e.g. the FUNCTION CODE A and B are also allocated a copper strip for bus use to permit a tapping to be made where required.

Programme functions are distributed from the OVF board by means of a series of terminal pins which act as distribution points, the decision as to which functions require this treatment being left to the individual constructor as layouts will undoubtedly vary.

OVERFLOW LOGIC

The OVERFLOW logic is required to detect and indicate any errors resulting from the incorrect operation of the calculator, indication being provided via the red OVF lamp on the keyboard. If this lamp comes on at all during a calculation then an improper operation has been attempted and the only course open is to depress the CLEAR key which also resets the OVF circuits.

There are several ways in which an error condition can occur, an error being a state which would result in an incorrect answer being given. Detection of these states requires a combination of three separate logic groups whose areas of responsibility are as follows:

(a) ENTRY OVERFLOW. If too many digits are entered into the E REGISTER, the most significant data can be destroyed by being shifted out of the end of the register. This condition must be detected.

(b) A REGISTER OVERFLOW. If during a multiplication sequence, the product exceeds the capacity of the A REGISTER then the CARRY STORE will stay set at the end of an addition which is an indication of OVERFLOW.

(c) ANSWER OVERFLOW. The Digi-Cal A REGISTER has a ten digit capacity although only eight digits are displayed, the other two positions in the register being for transient use during programme execution. Should either of these two positions contain other than zeros at the end of a programme sequence then an OVERFLOW has occurred.

This type of OVERFLOW can occur during ADDITION, MULTIPLICATION and when a negative answer is produced in complement form.

OVF CIRCUITS

The active circuitry of the OVF board is shown in Fig. 11.1, where it can be seen that in addition to the OVF logic proper, IC141 and IC146 perform the functions of constant store buffering and E² gating respectively.

Bistable BS2 of IC144 acts as the common OVF latch, which is set by an output from any of the three separate OVERFLOW detection circuits, and which controls the OVF lamp driver on the KEYBOARD logic board. The OVF latch is cleared when the CLEAR key is depressed in response to an OVF indication.

The NOR section of IC145 which is a four-wide two-input AND-OR-INVERT gate combines the inputs from three detection circuits to drive the BS2 PRESET input, an output from any of the three resulting in a SET LATCH signal.

ENTRY OVERFLOW LOGIC

IC142 and G1 of IC143 are used to detect E REGISTER overflows. The system used here to monitor the B.C.D. outputs of the most significant digit position of the register with IC142, which, in this application, can be considered as a four-input positive NOR gate with a common disable input.

The output of IC142 is gated with the E CLOCK to generate the OVF output when necessary.

Gate IC142 is in fact waiting for one or more of its inputs to go to a logic 1, indicating that the most significant digit of the E REGISTER contains other than decimal zero.

On the arrival of a further clock pulse an error output is generated to set the latch.

A problem arises here since by using the straightforward E CLOCK an error output would be produced one step too early. What is really needed is an E CLOCK "pre-pulse" which comes and goes before the register itself is clocked. At first sight this is an impossible requirement to meet; however, by using the inherent propagation delays of the gates involved, such an arrangement can be achieved.

What happens is that when a B.C.D. output other than zero appears in the most significant position of the register a 1 input to pin 9 of IC145 results.

Much later, when another number key is pressed the rising E CLOCK on IC145, pin 10 will result in an error output to pin 8, setting the latch. Even before the clock rises on pin 10, the unbuffered E CLOCK operates the common disable input connected to pins 1, 3, 5 and 9 of IC142 removing the 1 input to IC145, pin 9.

The result at the output of IC145 is an extremely narrow pulse which in practice could be too narrow to set the latch BS2. The way to stretch this pulse is to increase the propagation delay through IC142 and G1 of IC143, and this can be conveniently achieved by increasing the capacitive load on the output of IC142.

A capacitor C_x is shown on the diagram and can be added if the error output is found to be too short on test; the value used should be between 200pF and 1,000pF.

No such capacitor was necessary on the prototype.

A REGISTER OVERFLOW LOGIC

The operation of the A REGISTER detection logic is quite straightforward; in this case the task is simply to detect the presence of a stored carry at the end of ten clock pulses during a multiplication or addition.

The rising edge of the END OF TEN output from board CB triggers a monostable made up of BS1 of IC144 and G2 of IC143. The indication that the clock sequence is at an end is gated with the CARRY SENSE output from board AD, in G3.

The output of G3 is gated with an inverted FUNCTION CODE A (which is an indication of the arithmetic operation being performed) in the AND section of IC145 to produce the ERROR output at pin 8.

ANSWER OVERFLOW LOGIC

Detecting an integer in the two most significant A REGISTER positions seems on the face of it to be quite straightforward, but in practice such considerations as lack of space on the A boards to install i.c. gates, and lack of edge contacts on the A boards to allow external i.c. gates pose some problems.

The only practical solution is to construct a special gate using discrete components which operates as a positive logic NOR. This design requires only the installation of four diodes, and the utilisation of only one edge contact on each A board.

The problem of the low logic 1 levels associated with TTL outputs is overcome by clamping the emitter of TR22 of the gate to about $\frac{1}{2}V_{cc}$, and using TR23 to regenerate suitable logic levels to interface with IC145 pin 13.

Pin 1 of IC145 gates the ERROR output from the discrete component gate with what is effectively an END OF PROGRAMME signal (DISPLAY A) so that valid transient outputs from TR23 during programme execution have no effect on the OVF LATCH.

OVF BOARD

DESTINATION OF OVF TERMINATIONS

- a ENTER K (from keyboard)
- b RECALL K (from keyboard)
- c E² (from programme)
- d TRANSFER A to Z (from programme)
- e A1/25, A2/25
- f DISPLAY A (from programme)
- g AD/36
- h CB/35
- i FUNCTION CODE A (from keyboard)
- j ED/3
- k E3/32
- l E3/31
- m E3/30
- n E3/29
- o ED/4
- p CLEAR (from keyboard)
- q E1/28, E2/28, E3/28
- r E1/27, E2/27, E3/27
- s Z1/25
- t Z2/24
- u OVF (to keyboard)

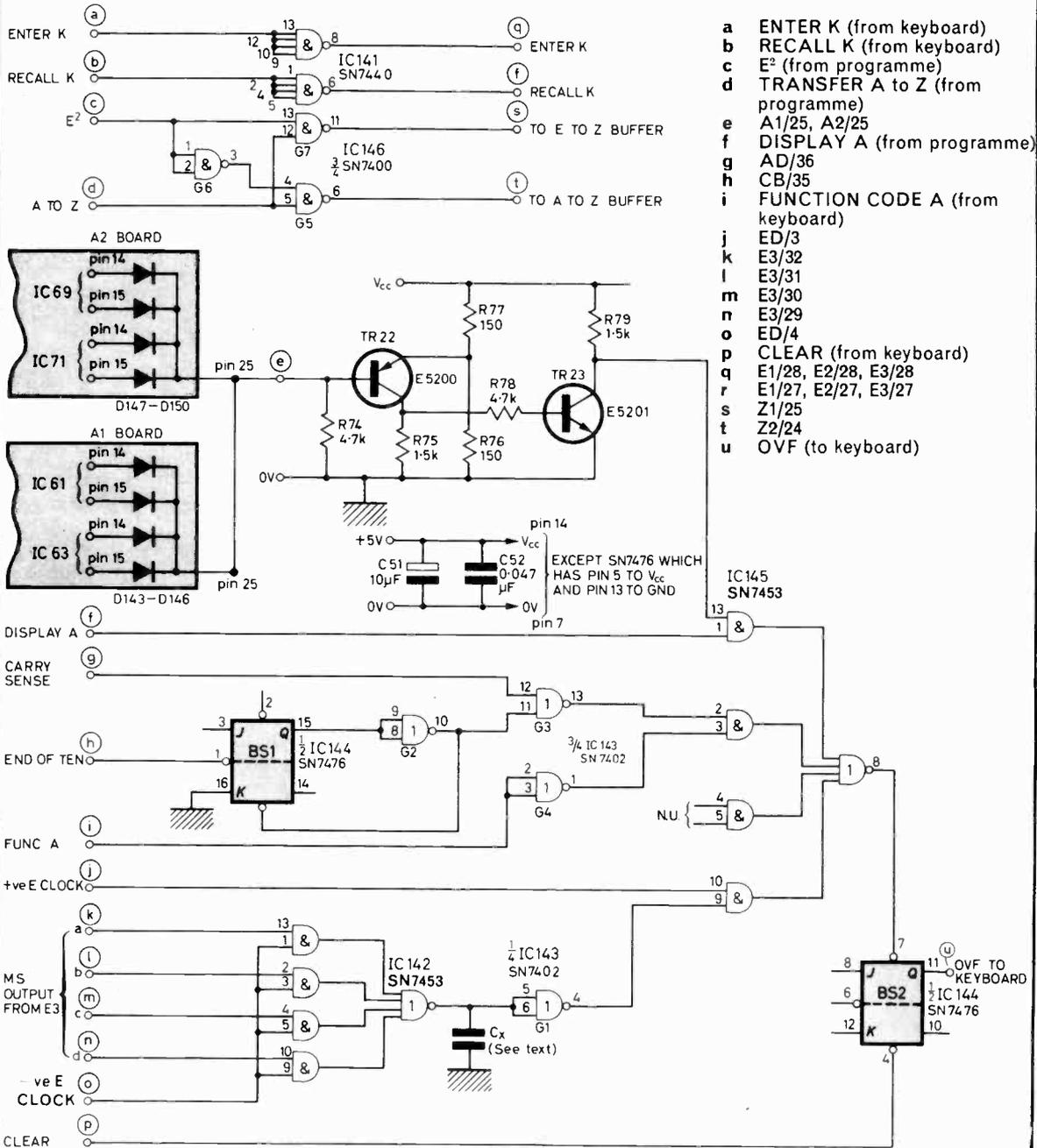


Fig. 11.1. Circuit diagram of the various units contained on the OVF board

DIVIDE OVERFLOW

No logic has been included to show that an OVERFLOW during a DIVISION operation has occurred.

Logic to fulfil this function would be simple to design and could use pins 4 and 5 of IC145 as an access to the OVF LATCH, but this was not carried out on the prototype because a divide overflow is very obvious to the operator by virtue of the fact that no answer is produced on the display.

E SQUARED GATING

It was only after the component location stage of Digi-Cal design that it was realised that the addition of a very few gates could produce an automatic E^2 facility to complement the basic arithmetic functions.

The gating required is so simple that the incorporation on the OVF board is quite straightforward.

The object of the three gates shown in Fig. 11.1 as part of IC146 is to divert the A to Z transfer command from the PROGRAMME to the E to Z buffer gate when the E^2 latch on the PROGRAMME board is set.

This simple operation causes the MULTIPLY programme to multiply the number in the E REGISTER by itself. The normal command to transfer the A REGISTER contents to the Z REGISTER is blocked and the E to Z transfer substituted, resulting in the number E being both multiplier and multiplicand.

CONSTANT STORE BUFFERS

IC141 is an SN7440 buffer gate which is interposed between the KEYBOARD outputs and the constant store to provide the drive and inversion

OVF LOGIC CONSTRUCTION

Although the E^2 logic and the constant store buffers will have to be wired up before the testing stage, it is best to leave the OVF detection logic until the calculator is operating correctly. Connecting up these circuits before proper operation is realised could lead to confusion.

Having both the i.c.s and the wiring on the copper side of the board takes a little getting used to when soldering, but there are no special problems to look out for, and circuit tracing is really much easier. The board layout is shown in Fig. 11.2, and mounting position in Fig. 11.3.

OVERALL TESTING

It would be a very optimistic constructor indeed who wired up the whole Digi-Cal, switched on, and expected it to work perfectly first time.

There will no doubt be wiring errors, perhaps a faulty i.c. (there were three in the prototype), and a dry joint or two.

The policy of piecemeal testing suggested in previous parts will undoubtedly have eliminated most

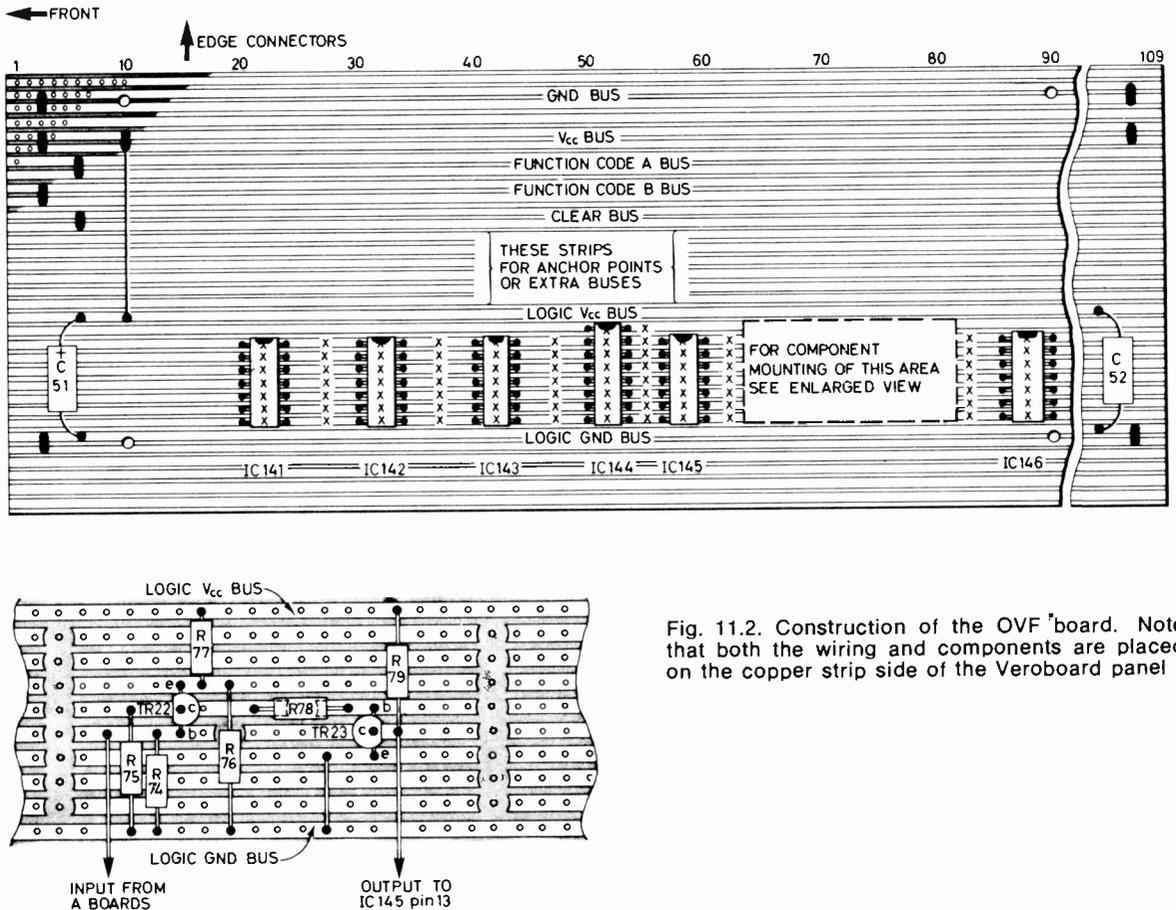


Fig. 11.2. Construction of the OVF board. Note that both the wiring and components are placed on the copper strip side of the Veroboard panel

COMPONENTS . . .

OVF BOARD

Resistors

R74	4.7k Ω
R75	1.5k Ω
R76	150 Ω
R77	150 Ω
R78	4.7k Ω
R79	1.5k Ω

Capacitors

C51	10 μ F 15V elect.
C52	0.047 μ F
C _x	(see text)

Diodes

D143-150 West Hyde type "red" or any small silicon diode (8 off)

Transistors

TR22	E5200	} (West Hyde)
TR23	E5201	

Integrated Circuits

IC141	SN7440
IC142	SN7453
IC143	SN7402
IC144	SN7476
IC145	SN7453
IC146	SN7400

Miscellaneous

11in \times 3.6in \times 0.1in matrix Veroboard panel

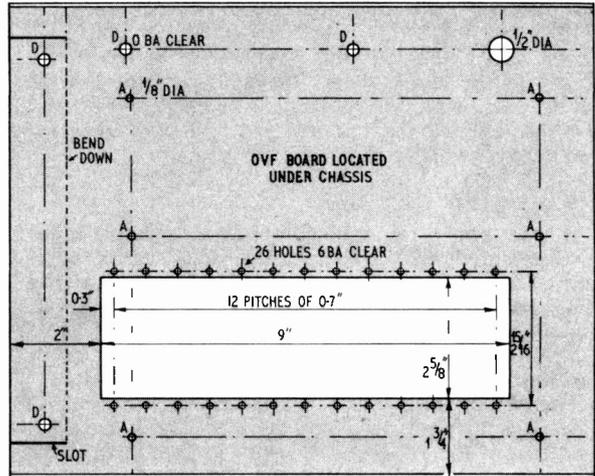


Fig. 11.3. The OVF board is mounted on the underside of the chassis in the four holes marked "A" in the main chassis plate

faults, and certainly the constructor who has reached the final testing stage, which basically involves making the programmes work as required, will be sure that all the boards are fundamentally serviceable.

The first hurdle to be cleared is the correct operation of the ADD/SUBTRACT programme and when this has been achieved (with a slow clock speed if desired) the bulk of the arithmetic section can be given a clean bill of health.

The MULTIPLY and DIVIDE programmes can then be tackled in turn and if any problems are encountered a thorough understanding of the way the calculator should be operating will soon sort these out.

It cannot be stressed enough that after gathering evidence via a multimeter and display, the best strategy in solving a problem is to sit down with a paper and pencil and ponder the possible causes: aimless probing will get you nowhere.

CLOCK SPEED

The ultimate objective of the testing phase is to increase the clock speed to as high a rate as possible while maintaining correct operation.

In the prototype a speed of over 1MHz was obtained despite the far from ideal underchassis "bird's nest" wiring resulting from prototype modifications.

Constructors should be able to do better than this easily since all improvements have been incorporated in the published designs and any advance achieved in this respect will be rewarded by a shorter maximum multiplication time, important when operating near to the maximum capacity of the machine. ★

Corrections. We apologise for these errors which occurred during the course of Digi-Cal articles.

Part 3, Fig. 3.2. Capacitors C3, C4, C5 and C6 should be connected between +5V and GND, not as shown. The strobe outputs from IC7 are reversed, i.e. pin 12 should be strobe 8 and pin 4 should be strobe 1.

Part 4, Fig. 4.2. Switch S19 is shown twice, the K switch should be S5. S13 is shown twice, the **Decimal Point** switch should be S3. Both are shown correctly on Fig. 4.5. The diode labelled D103 on IC26 should be D101.

Part 5, Fig. 5.8. The K switch should be labelled **Recall K** output.

Part 6, Fig. 6.10. Connection from the Z1 and Z2 sockets to the E1, E2 and E3 boards show the pin numbers incorrectly. Correct destinations can be found by adding 22 to each of the pin numbers associated with the E boards, e.g. Z1/1 should go to E3/31. Also Z1/19 should go to AD/41, and Z1/20 to AD/42. Z2/19 goes to AD/39; Z2/20 to AD/40, not as shown. Z2/44 should go to Z1/42 and Z2/42.

A1/1 should go to AD/27; A1/10 to AD/31; A1/11 to AD/32.

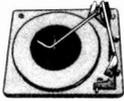
A2/1 should go to AD/25; A2/10 to AD/29; A2/11 to AD/30.

Fig. 6.7. CP in IC77 and 78 should go to pin 3 not 2.

ALL OUR PRICES INCLUDE V.A.T.

BSR LATEST SUPERSLIM STEREO & MONO

Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. AC 200/250V Size 13½ x 11½ in. Above motor board 3 in. below motor board 2½ in.



with STEREO and MONO XTAL £8.25 Post 25p.

BSR PLAYER

Heavy duty 4-speed motor with separate pick-up arm fitted LP/78 stereo com. patible cartridge



£5.50 Post 25p

E.M.I. WOOFER AND TWEETER KIT £5.75

Available separately Post 25p. Woofer £4.25 Tweeter £1.50 Comprising a fine example of a Woofer 10½ x 8½ in. with a massive Ceramic Magnet, 44oz. Gauss 13,000 lines. Aluminium Cone centre to improve middle and top response. Also the E.M.I. Tweeter 9½ in. square has a special light weight paper cone and magnet flux 10,000 lines. Crossover condenser and full instructions supplied. Impedance Standard 8 ohms Maximum Power 12 watts Useful Response 35 to 18,000 c/s Base Resonance 45 c/s SUITABLE ENCLOSURE 20 x 13 x 9 in. MODERN DESIGN. TEAK WOOD FINISH



£9.90 Post 25p

SPECIAL OFFER! SMITH'S CLOCKWORK 15 AMP TIME SWITCH

Single pole two-way. Surface mounting with fixing screws. Will replace existing wall switch to give light for return home, garage, automatic anti-burglar lights, etc. Variable knob. Turn on or off at full or intermediate settings. Two types available 0 to 60 minutes or 0 to 8 hours. Makers last list price £4.50. Brand new and fully guaranteed. Fully insulated. OUR PRICE £1.50. P. & P. 15p or £3 pair. (PLEASE STATE TYPE A OR B WHEN ORDERING)



WEYRAD P50 — TRANSISTOR COILS

RAEW Ferrite Aerial 72p	Spare Cores 3p
Osc. P50/1AC 33p	Driver Trans. LFDT4 58p
I.F. P50/2C 470 kc/s 36p	Printed Circuit, PCA1 58p
3rd I.F. P50/3C 36p	J.B. Tuning Gang 65p
P51/1 or P51/2 36p	Weyrad Booklet 10p
P50/3V 36p	OPT1 58p
Mullard Ferrite Rod 8 x .in. 20p	6 x .in. 20p.

VOLUME CONTROLS

Long spindles. Midset Size 5 K. ohms to 2 meg. LOG or LIN. L/S 15p. D.P. 25p. STEREO L/S 55p. D.P. 75p. Edge 5K.S.P. Transistor 25p.

80 Ohm Coax 4p yd.

BRITISH AERIALITE AERIAL-AIR SPACED 40 yd. £1.40; 60 yd. £2. FRINGE LOW LOSS 10p. Ideal 825 and colour 10p yd

8in. or 10in. ELAC HI-FI SPEAKER

Dual cone plasticised roll surround. Large ceramic magnet. 50-60,000 c/s. Bass resonance 55 c/s. 8 ohm impedance. 8in 10 watts, 10in 12 watts music power.



£3.75 Post 25p

E.M.I. 13½ x 8in. SPEAKER SALE!

With twin tweeters. And crossover. 10 watt. State 3 or 8 or 15 ohm. As illustrated. Post 25p



£2.75

TEAK CABINET 18 x 10 x 9in. £5.50 Post 25p

BRITISH MADE STEREO MULTIPLEX DECODER

Brand New. 7 transistors Plus integrated circuit. Fibre-Glass printed circuit board. Size 21 x 8½ x 1. Pre-Aligned. Complete with stereo beacon indicator. 12V d.c. operation. 400mV Output for 100mV Input. Full instructions for any FM Tuner. Some technical experience essential. £6.95 Post 15p

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½ in sides 6 x 4in 45p; 8 x 4in 55p; 10 x 7in 65p; 12 x 8in 85p; 14 x 9in 90p; 16 x 9in 90p; 12 x 3in 50p; 16 x 10in 15p; ALUMINIUM PANELS 18 s.w.g. 6 x 4in 8p; 8 x 4in 15p; 14 x 3in 16p; 10 x 7in 19p; 12 x 5in 20p; 12 x 8in 28p; 16 x 6in 28p; 14 x 9in 34p; 12 x 12in 40p; 16 x 10in 50p. Paxolin Panel 10 x 8in 15p.

RADIO COMPONENT SPECIALISTS

Illustrated Colour Brochure, Radio Books and Component Lists 10p. (Minimum posting charge 15p.)

ANOTHER R.C.S. BARGAIN! 4 TRANSISTOR MONO AMPLIFIER

Powerful 3 watt output, 15 ohm. AC mains operated with transformer. 3-Controls, volume, treble, bass and On/Off switch with knobs. Ready made on printed circuit board. Fused inputs and outputs. Famous make, size 8in wide x 4in deep x 3in high.

Suitable 7" x 4" speaker, £1. Price £5.95 Post 25p

R.C.S. STABILISED POWER PACK KITS

All parts and instructions with Zener Diode, Printed Circuit, Bridge Rectifiers and Double Wound Mains Transformer input 200/240V a.c. Output voltages available 6 or 9 or 12 or 15 or 18 or 20V d.c. at 100mA or less PLEASE STATE VOLTAGE REQUIRED. £2.20 Post 15p Details S.A.E. Size 3½ x 1½ x 1½ in.

R.C.S. GENERAL PURPOSE TRANSISTOR PRE-AMPLIFIER BRITISH MADE

Ideal for Mike, T.P.U., Guitar, etc. Can be used with Battery 9-12V or H.T. line 200-300V a.c. operation. Size: 1½ x 1½ x 1½ in. Response 25 c/s to 25 kc/s, 26 dB gain. For use with valve or transistor equipment. 99p Full instructions supplied. Details S.A.E.

GARRARD DECCA DISCO DECK £18.50 Post 25p

Single-play Stereo/Mono Deram transcription head and arm. 4 speeds, 10 in. turntable. Anti-rumble filter. Bias made on printed circuit board. compensation. Laboratory motor.



METAL PLINTH AND PLASTIC COVER

Cut out for most Garrard or B.S.R. Most will fit with cover in position. 12½ x 14½ x 7½ in high. Latest Design. Covered in black leatherette. £4.95 Post 35p

ALSO AVAILABLE IN SOLID NATURAL MAHOAGANY WAX POLISHED FINISH—AT SAME PRICE

MAINS TRANSFORMERS

250-0-250 80mA 6.3V 4A	All post 25p each	£1.50
250-0-250 80mA 6.3V 3.5A, 6.3V 1A, or 5V 2A		£2.50
350-0-350 80mA, 6.3V 3.5A, 6.3V 1A, or 5V 2A		£3
300-0-300V 120mA, 6.3V 4A C.T., 8.3V 2A		£3.25
MINIATURE 200V, 20mA, 6.3V 1A, 2½ x 2½ x 2in		75p
BIDGET 220V 45mA, 6.3V 2A, 2½ x 2½ x 2in		90p
HEATER TRANS. 6.3V 3A		60p
GENERAL PURPOSE LOW VOLTAGE. Tapped outputs at 2A, 3A, 4A, 5A, 6A, 8A, 10A, 12A, 15A, 18A, 24A and 30V		£2.25
1A, 6A, 8A, 10A, 12A, 18A, 20A, 24A, 30A, 36A, 40A, 48A, 60V		£2.25
2A, 6A, 8A, 10A, 12A, 18A, 20A, 24A, 30A, 36A, 40A, 48A, 60V		£3.25
5A, 6A, 8A, 10A, 12A, 18A, 20A, 24A, 30A, 36A, 40A, 48A, 60V		£3.75
3A, 5A, 8A, 13V		£1.00
Ditto 5A		£1.20
3A, 5A, 8A, 10A, 13V. 5.0-5.0V		£1.30
Ditto 5A		£1.50

AUTO TRANSFORMERS. 115V to 230V or 230V to 115V. 150W £2.25; 500W £6.25; 750W £10; 1000W £14.

CHARGER TRANSFORMERS. Input 200/250V. For 6 or 12V, 1½A, £1.50; 2A, £1.80; 4A, £2.50.

BATTERY CHARGERS. 1½A £2; 3A £3; 4A £4; 5A £4.50. FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12V outputs. 1½A 40p; 2A 55p; 4A 85p. LUCAS 2DS500 Full wave Bridge 70V, 5A 85p.

MAINS ISOLATING TRANSFORMER

Primary 0-110-240V. Secondary 0-240V. 3A. 720W. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. OUR PRICE £10 Carr. Famous make. (Value £18) 50p Can be used as 800W auto transformers 240-110V.

NEW TUBULAR ELECTROLYTICS CAN TYPES

2/350V.. 14p	250/25V 14p	50+50/350V 35p
4/350V 14p	500/25V 20p	60+100/350V 58p
8/450V 14p	1000/25V 35p	32+32/250V 18p
16/450V 15p	1000/50V 47p	32+32/450V 30p
32/450V 20p	8+16/450V 18p	35+50/325V 50p
25/25V 10p	8+16/450V 20p	32+32+32/350V 43p
50/50V 10p	16+16/450V 25p	100+50+50/350V 48p
100/25V 10p	32+32/350V 25p	

LOW VOLTAGE ELECTROLYTICS

1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 10p. 500mF 12V 15p; 25V 20p; 50V 30p. 1000mF 12V 17p; 25V 35p; 50V 47p; 100V 70p. 2000mF 6V 25p; 25V 42p; 50V 57p. 2500mF 50V 62p; 3000mF 50V 47p; 50V 65p. 5000mF 6V 25p; 12V 42p; 25V 57p; 35V 85p; 50V 95p.

CERAMIC, 1pF to 0.01mF, 4p. Silver Mica 2 to 5000pF, 4p.

PAPER 0.50V-0.1 4p, 0.5 13p; 1mF 15p; 2mF 150V 15p. 500V-0.01 to 0.05 4p; 0.1 5p; 0.25 8p; 0.47 25p. SILVER MICA. Close tolerance 1%, 2.2-500pF 8p; 560-2,200pF 10p; 2,700-5,600pF 20p; 6,800pF 0.01, mid 30p each. TWIN GANG. "0.0" 208pF+176pF, 50V 47p. Slow motion drive 365pF+365pF with 25pF+25pF, 50p; 500pF standard 45p; single gang 500pF 75p; small 3-gang 500pF £1.40. SHORT WAVE SINGLE. 10pF, 30p, 25p, 55p, 50p, 55p. NEON PANEL INDICATORS 250V AC/DC. Amber 20p. RESISTORS. 1W, 1/4W, 1W, 20%, 1p; 2W, 5p; 10p; to 10M. HIGH STABILITY. 1W 2%, 10 ohms to 6 meg., 10p. Ditto 5%. Preferred values 10 ohms to 10 meg., 4p. WIRE-WOUND RESISTORS 5 watt, 10 watt, 15 watt, 10 ohms to 100K 10p each; 0.5 ohm to 8.2 ohms 10p. TAPE OSCILLATOR COIL Valve type 35p.

ALL MODELS "BAKER SPEAKERS" IN STOCK Hi Fi Enclosure Manual containing 20 plans, designs, crossover data and cubic tables. 42p Post Free

BAKER 12in. MAJOR £10



Post 25p 30-14,500 c/s. 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s. Rated 20W. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. £12.50 Post 25p

BAKER "BIG-SOUND" SPEAKERS Post 25p 'Group 25' 12in. £8.80 25W 3 or 8 or 15 ohm 'Group 35' 12in. £9.90 35W 3 or 8 or 15 ohm 'Group 50' 15in. £22.00 50W 8 or 15 ohm

TEAK VENEERED HI-FI SPEAKER CABINETS. For 12in or 10in dia. speaker 20 x 13 x 9in, £9.90. Post 25p. For 13 x 8in or 8in speaker 16 x 10 x 9in, £5.50. Post 25p. For 10 x 6in or 6in speaker 16 x 8 x 6in, £4.40. Post 25p. LOUDSPEAKER CABINET WADDING 18in wide, 15p 1lb.

GOODMANS 6½in. HI-FI WOOFER

8 ohm. 10W. Large ceramic magnet. Special Ceric cone surround. Frequency response £4 30-12,000 c/s. Ideal P.A. Columns. Hi-Fi Enclosure Systems, etc. 8in Standard Cone 12W £4.50 Post 25p



ELAC CONE TWEETER

The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 c/s to 18,000 c/s. Size 3½ x 3½ x 2in deep. Rating 10W, 3 ohm or 15 ohm models. £1.90 Post 10p. Crossover 95p

SPEAKER COVERING MATERIALS. Samples Larke S.A.E.

Horn Tweeters 2-16kc/s. 10W 8 ohm or 15 ohm £1.85. De Luxe Horn Tweeters 2-18kc/s, 15W, 15 ohm £3. TWIN-WAY 3,000 c/s. CROSSOVERS 3 or 8 or 15 ohm 95p. LOUDSPEAKERS P.M. 3 OHMS. 7x4in. £1.25; 6½in. £1.50; 8 5in. £1.60; 10in. £2.00; 8in. £1.75; 10 x 6in. £1.00. SPECIAL OFFER! 8ohm, 2½in, 2½in; 35 ohm, 2in, 3in, 25 ohm, 2½in dia., 3in dia., 5in dia. £1 EACH TYPE 15 ohm, 3½in dia., 3in dia., 7 x 4in, 8 x 5in. 3 ohm, 2½in, 2in, 3½in, 4in dia., 3 in ohms £1.50. RICHARD ALLAN TWIN CONE LOUDSPEAKERS 8in. diameter 4W, 10in diameter 5W; 12in diameter, 6W; 3 or 8 or 15 ohm models, £2.20 each. Post 15p. VALVE OUTPUT TRANS. 25p; MIKE TRANS. 50.1 25p. 5 WATT MULTI-RATIO, 3, 8 and 15 ohms 80p. Mike trans. mu metal 100.1 £2.25.

MAJOR 100 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

4 inputs speech and music, 4 way mixing. Response 10-30,000 c/s. Matches loudspeakers, 8 15 ohm A.C. 200/250V. Separate Treble and Bass controls. Guaranteed. Details S.A.E. £49 Post Free



BARGAIN AM TUNER. Medium Wave. Transistor Superhet, Ferrite aerial. 9v. £4.95

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical hi-lights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9V. STEREO VERSION OF ABOVE £5.95. £3.95

BARGAIN FM TUNER 88-108 Mc/s Six Transistor. 9V. Printed Circuit. Calibrated slide dial tuning. Walnut Cabinet. Size 7 x 5 x 4in. £14.85

BARGAIN FM TUNER as above less cabinet £9.85

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control and on/off switch, 9 volt. £4.50

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p.

OUTLET BOXES. SURFACE OR FLUSH 25p. BALANCED TWIN RIBBON FEEDER 300 ohms. 5p yd. JACK SOCKET Std. open-circuit 14p, closed circuit 23p. Chrome Lead-Socket 45p. Phono Plugs 5p. Phono Socket 5p. JACK PLUGS Std. Chrome 15p; 3.5mm Chrome Lead. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10. DIN SOCKETS 2-pin 3-pin 18p; 5-pin 15p. DIN PLUGS 3-pin 18p; 5-pin 25p. VALVE HOLDERS. 5p. CERAMICS 3p; CANS 5p.

E.M.I. TAPE MOTORS. 120 volts A.C. each. 1,200 r.p.m. 4 pole or 2 in series 240 volts A.C. Size 3, 2½ x 2½ in (illustrated). Post 25p.

E.M.I. GRAM MOTORS. 120V or 240V a.c. 2,400 r.p.m. 2 pole 70mA. Spindle £1 x 1 in. Size 2, 2½ x 2½ in. Post 25p

337 WHITEHORSE ROAD, CROYDON Open 9-6. Wed. 9-1. Sat. 9-5 (Closed for lunch 1.15-2.30) Buses 50, 68, 159. Rail Selhurst. Tel. 01-684-1665

YATES ELECTRONICS

(FLITWICK) LTD.

ELSTOW STORAGE DEPOT
KEMPSTON HARDWICK
BEDFORD

C.W.O. PLEASE. POST AND PACKING
PLEASE ADD 10p TO ORDERS UNDER £2.

Catalogue which contains data sheets for most of the
components listed will be sent free on request.
10p stamp appreciated.

OPEN ALL DAY SATURDAYS

ALL PRICES SUBJECT TO V.A.T.

RESISTORS

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

Power watts	Tolerance	Range	Values available	Price
1	5%	4.7Ω-2.2MΩ	E24	1p
1	10%	3.3MΩ-10MΩ	E12	1p
1	2%	10Ω-1MΩ	E24	3.5p
1	10%	1Ω-3.9Ω	E12	1p
1	5%	4.7Ω-1MΩ	E12	1p
1	10%	1Ω-10Ω	E12	6p
4	10%	1Ω-10Ω	E12	5.5p

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

DEVELOPMENT PACK

0.5 watt 5% Iskra resistors 5 off each value 4.7Ω to 1MΩ.
E12 pack 325 resistors £2.40. E24 pack 650 resistors £4.70.

POTENTIOMETERS

Carbon track 5kΩ to 2MΩ, log or linear (log 1/4W, lin 1/4W).
Single, 12p. Dual gang (stereo), 40p. Single D.P. switch 24p.

SKELETON PRESET POTENTIOMETERS

Linear: 100, 250, 500Ω and decades to 5MΩ. Horizontal or vertical P.C.
mounting (0.1 matrix).
Sub-miniature 0.1W, 5p each. Miniature 0.25W, 6p each.

TRANSISTORS

AC107 15p	AF125 20p	BD132 75p	OC28 50p	2N3702 13p
AC126 12p	AF126 20p	BD133 75p	OC35 50p	2N3703 12p
AC127 12p	AF127 20p	BF115 25p	OC42 12p	2N3704 13p
AC128 12p	AF139 32p	BF173 20p	OC44 12p	2N3705 12p
AC131 12p	AF178 32p	BF177 28p	OC45 12p	2N3706 11p
AC132 12p	AF180 40p	BF178 32p	OC70 12p	2N3707 12p
AC176 12p	AF181 40p	BF179 32p	OC71 12p	2N3708 10p
AC187 22p	BC107 9p	BF180 32p	OC72 12p	2N3709 11p
AC188 22p	BC108 9p	BF181 32p	OC81 12p	2N3710 11p
AD140 50p	BC109 9p	BF194 15p	OC82D 12p	2N3711 11p
AD149 15p	BC147 13p	BF195 15p	2N2904 20p	2N4062 12p
AD161 3p	BC148 13p	BF197 15p	2N2926R 9p	40360 35p
AD162 36p	BC149 13p	BF200 32p	2N2926G 9p	40361 35p
AF114 20p	BC157 14p	BFY50 20p	2N2926Y 9p	40362 40p
AF115 20p	BC158 14p	BFY51 20p	2N2926G 9p	40408 40p
AF116 20p	BC159 14p	BFY52 20p	2N2926G 9p	40408 40p
AF117 20p	BC187 22p	BUJ05 225p	2N3054 58p	ZTX302 15p
AF117 36p	BC187 22p	BUJ05 225p	2N3054 58p	ZTX500 15p
AF124 22p	BD131 75p	OC26 45p	2N3055 60p	ZTX502 20p

ZENER DIODES

400mW 5% 3.3V to 30V, 12p.

WIRE WOUND POTS, 3W, 10, 25,

50Ω and decades to 100kΩ, 35p.

DIODES

RECTIFIER

BY127 1250V	1A	12p	OA85	7p
BZY10 800V	6A	25p	OA90	5p
BZY13 200V	6A	20p	OA91	5p
IN4001 50V	1A	7p	OA202	7p
IN4004 400V	1A	8p	IN4148	5p
IN4007 1000V	1A	10p	BA114	8p

BRUSHED ALUMINIUM PANELS

12in x 6in = 25p; 12in x 2 1/2in = 10p; 9in x 2in = 7p

SLIDER POTENTIOMETERS

86mm x 9mm x 16mm, length of track 59mm.
SINGLE 10K, 25K, 100K, log, or lin, 40p.
DUAL GANG, 10K + 10K etc. log, or lin, 60p.
KNOB FOR ABOVE 12p.
FRONT PANEL 65p.
1/4 Gauge panel 12in x 4in with slots cut for use
with slider pots. Grey or matt black finish com-
plete with fixings for 4 pots.

TERMISTORS

VA10555	15p
VA10665	15p
VA1077	15p
R53	£1.35

THYRISTORS

2N5060 50V 0.8A 30p.
2N5064 200V 0.8A 47p.
CR5140 400V 1A 25p.
106F 50V 4A 40p, 106D
400V 4A 55p.

MULLARD POLYESTER CAPACITORS C296 SERIES

100V: 0.001μF, 0.0015μF, 0.0022μF, 0.0033μF, 0.0047μF, 2 1/2p. 0.0068μF, 0.01μF, 0.015μF, 0.022μF, 0.033μF, 3p. 0.047μF, 0.068μF, 0.1μF, 4p. 0.15μF, 6p. 0.22μF, 7 1/2p. 0.33μF, 11p. 0.47μF, 13p.
160V: 0.01μF, 0.015μF, 0.022μF, 0.033μF, 0.047μF, 0.068μF, 3p. 0.1μF 3 1/2p. 0.15μF 4 1/2p. 0.22μF, 5p. 0.33μF, 6p. 0.47μF, 7 1/2p. 0.68μF, 11p. 1.0μF, 13p.

MULLARD POLYESTER CAPACITORS C280 SERIES

250V P.C. mounting: 0.01μF, 0.015μF, 0.022μF, 3p. 0.033μF, 0.047μF, 0.068μF, 3 1/2p. 0.1μF, 4p. 0.15μF, 0.22μF, 5p. 0.33μF, 6 1/2p. 0.47μF, 8 1/2p. 0.68μF, 11p. 1.0μF, 13p. 1.5μF, 20p. 2.2μF, 24p.

MYLAR FILM CAPACITORS 100V

0.001μF, 0.002μF, 0.005μF, 0.01μF, 0.02μF, 2 1/2p. 0.04μF, 0.05μF, 0.068μF, 0.1μF, 3 1/2p.

CERAMIC DISC CAPACITORS

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

ELECTROLYTIC CAPACITORS—MULLARD O15/6/7 RANGE REPLACES C426, C457 RANGES.

(μF/v) 1/0.63, 1.5/63, 2.2/63, 3.3/63, 4.7/63, 6.8/40, 10/25, 10/63, 15/16, 15/40, 15/63, 22/10, 22/25, 22/63, 33/6.3, 33/40, 47/4, 47/10, 47/25, 47/40, 47/63, 68/6.3, 68/16, 100/4, 100/10, 100/25, 100/40, 150/6.3, 150/16, 150/25, 220/4, 220/10, 220/16, 330/4, 330/10, 470/6.3, 5p each, 68/63, 150/40, 220/25, 330/16, 470/10, 680/6.3, 1,000/4, 9p, 100/63, 150/63, 220/40, 470/25, 680/16, 1,000/10, 1,500/6.3, 12p, 220/63, 470/40, 680/25, 1,000/16, 1,500/10, 2,200/6.3, 15p, 330/63, 680/40, 1,000/25, 1,500/16, 2,200/10, 3,300/6.3, 4,700/4, 18p.

SOLID TANTALUM BEAD CAPACITORS

Value	Power	Value	Power	Value	Power
0.1μF	35V	2.2μF	35V	22μF	16V
0.22μF	35V	4.7μF	35V	33μF	10V
0.47μF	35V	6.8μF	25V	47μF	6.3V
1.0μF	35V	10μF	25V	100μF	3V

VEROBOARD

0.1	0.15
2 1/2 x 3 1/2	22p
2 1/2 x 5	24p
3 1/2 x 3 1/2	24p
3 1/2 x 5	27p
17 x 2 1/2	75p
17 x 3 1/2	100p
17 x 5 (plain)	82p
17 x 3 1/2 (plain)	—
17 x 2 1/2 (plain)	—
2 1/2 x 5 (plain)	—
2 1/2 x 3 1/2 (plain)	—
Pin insertion tool	52p
Spor face cutter	42p
Pkt. 50 pins	20p

JACK PLUGS AND SOCKETS

Standard screened	18p	2.5mm insulated	8p
Standard insulated	12p	3.5mm insulated	8p
Stereo screened	35p	3.5mm screened	13p
Standard socket	15p	2.5mm socket	1p
Stereo socket	18p	3.5mm socket	8p

D.I.N. PLUGS AND SOCKETS

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

BATTERY ELIMINATOR

£1.50
9V mains power supply. Same size as PP9 battery.

LARGE (CAN) ELECTROLYTICS

1600μF 64V	74p	2500μF 64V	80p	4500μF 16V	50p
2500μF 40V	74p	2800μF 100V	£2.60	4500μF 25V	£1.68
2500μF 50V	58p	3200μF 16V	50p	5000μF 50V	£1.10

HIGH VOLTAGE TUBULAR CAPACITORS—1,000 VOLT

0.01μF	10p	0.047μF	13p	0.22μF	20p
0.022μF	12p	0.1μF	13p	0.47μF	22p

POLYSTYRENE CAPACITORS 160V 2 1/2%

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

SMOKE AND COMBUSTIBLE GAS DETECTOR—GDI

The GDI is the world's first semiconductor that can convert a concentration of gas or smoke into an electrical signal. The sensor decreases its electrical resistance when it absorbs deoxidizing or combustible gases such as hydrogen, carbon monoxide, methane, propane, alcohol, North Sea gas, as well as carbon-dust containing air or smoke. This decrease is usually large enough to be utilized without amplification. Full details and circuits are supplied with each detector.
Detector GDI1, £2. Kit of parts for detectors including GDI and P.C. board but excluding case. Mains operated detector £5.20. 12 or 24V battery operated audible alarm £7.30. As above for PP9 battery, £6.40.
PRINTED BOARD MARKER 97p
Draw the planned circuit onto a copper laminate board with the P.C. Pen, allow to dry, and immerse the board in the etchant. On removal the circuit remains in high relief.

LARGE RANGE ITT/TEXAS IC's NOW IN STOCK

PRICES ARE CALCULATED ON TOTAL NUMBER ORDERED REGARDLESS OF MIX

1-11	12-24	25-99	100+	7448	185	175	170	165	74118	100	82	73	64
7400	18	16	14	13	7450	18	16	14	74121	43	40	38	36
7401	18	16	14	13	7451	18	16	14	74141	100	95	90	85
7402	18	16	14	13	7453	18	16	14	74145	150	140	135	130
7403	18	16	14	13	7454	18	16	14	74150	330	280	250	220
7404	20	18	16	14	7460	18	16	14	74151	110	100	95	89
7405	20	18	16	14	7470	30	28	25	74153	120	110	105	95
7406	50	45	40	35	7472	40	38	36	74154	200	180	170	160
7407	56	50	44	38	7473	40	36	32	74155	150	120	100	86
7408	36	30	27	23	7474	40	38	36	74156	130	120	100	96
7409	36	30	27	23	7475	55	52	50	74180	155	136	112	105
7410	38	16	14	13	7476	40	36	32	74190	195	190	185	180
7411	23	21	20	18	7480	100	95	90	74191	195	190	185	180
7412	36	30	27	23	7490	100	115	110	74192	200	190	180	164
7413	34	28	26	22	7481	100	96	90	74193	200	180	170	150
7416	45	43	39	34	7482	100	97	95	74196	200	190	180	170
7420	18	16	14	13	7484	120	115	110	74197	200	195	180	170
7421	35	30	27	23	7485	250	245	240					
7425	32	29	27	23	7486	45	42	37					
7430	20	18	16	14	7487	75	67	60					
7432	40	36	32	28	7490	100	92	85					
7440	20	18	16	14	7491A	100	79	79					
7441	80	75	70	65	7492	75	70	65					
7442	80	75	70	65	7493	75	68	60					
7443	125	120	115	115	7494	95	80	85					
7447	175	165	150	120	7495	105	100	95					
					7496	100	95	90					
					74100	250	240	235					

LINEAR IC's

709	14 pin DIL	32p
741	8 pin DIL	34p
741	14 pin DIL	

THE EMI SCANNER

BRAIN X RAY

A NEW COMPUTERISED SYSTEM FOR DIAGNOSING BRAIN DISEASE

by K. R. HILL

THE EMI-Scanner is a computerised X-ray transverse axial tomography system using new techniques invented in the Central Research Laboratories of EMI Ltd. It has been developed by EMI in conjunction with Department of Health and Social Security after a four year research and development programme.

The equipment is able to produce pictures of cross sectional slices of the human brain. The basic system consists of a number of units:

1. The Scanning Unit which scans the patient with X-rays to produce a series of intensity output readings.
2. The X-ray Control Unit which controls the X-rays and the operation of the Scanning Unit.
3. The Computer Unit which stores and processes the data.
4. The Viewing Unit which displays the results on a cathode ray tube screen.
5. The X-ray generating system.

THE BASIC PROBLEM

The conventional X-ray photograph taken of the human body suffers from a serious drawback in that it is attempting to portray a three-dimensional object on a two-dimensional photographic plate. The X-ray picture indicates the X-ray intensity after it has passed through the object being examined. Typically the X-rays will have passed through bone, tissue, fat, blood, etc. and the resulting picture produced will be confused due to the superimposition of the various materials. Frequently the diagnostician is attempting to detect a small variation in the X-ray absorption of tissue (which may indicate some abnormality such as a tumour) when the area of interest is masked by a nearby bone. This situation is shown in Fig. 1.

The human brain poses a considerable problem for radiologists because it is totally enclosed in the protective bone of the skull. In an attempt to overcome some of the limitations of the conventional skull X-ray, several more sophisticated techniques have been developed such as angiography, ventriculography, and radioactive isotope brain scanning. These techniques, while giving some improvement in diagnoses, can cause considerable discomfort to the patient as well as in some cases requiring a team of highly trained staff to perform them. In addition to this the patient may need to be hospitalised after examination.



THE MACROBERT AWARD

For the invention of a new X-ray technique, Mr Godfrey Hounsfield and EMI Limited won the 1972 MacRobert Award.

This Award, often described as the Nobel Prize for engineering, consists of a Gold Medal and £25,000 prize money. It is presented annually, in recognition of the technological innovation contributing most significantly to the prestige and prosperity of the United Kingdom.

It was instituted by the MacRobert Trusts in 1968 and is administered by the council of Engineering Institutes, which is the federal body for 15 chartered engineering institutes.

This is the first time the award has been made in the field of electronics. In his citation for the Award, the Chairman of the MacRobert Award Evaluation Committee said, "One of the medical referees consulted during the evaluation stated that no comparable discovery has been made in this field since Röntgen discovered X-rays in 1895, and we agree with him."

"The EMI-Scanner system developed by Mr Hounsfield within the Central Research Laboratories of EMI is epoch-making, because it breaks away from the photographic techniques for recording X-ray pictures which in principle have remained unchanged since Röntgen's day . . ."

"There is another aspect of EMI-Scanner which is remarkable. In these modern days it is rarely that one finds great developments which are the work of one man. The EMI-Scanner is different: the submission for the MacRobert Award was prepared not by the inventor, but by EMI, who stated, 'Mr Hounsfield has been the guiding expert throughout all aspects of the work. The EMI-Scanner was as much a one-man invention as anything can be these days' . . ."

THE NEW TECHNIQUE

The EMI-Scanner offers considerable advantages to both the diagnostician and the patient.

This new system uses X-rays to produce pictures of slices of the head as shown in Fig. 2. The head of the patient rests in a rubber head cap, and a gantry, on which is mounted the X-ray tube and detectors, is able to rotate around the head to perform the scanning sequence shown in Fig. 3. With the gantry in the 0° start position, the X-ray tube and detectors move so as to make a linear pass of the head. The whole gantry then rotates 1° and the X-ray tube and detectors move back to make a further linear pass.

The gantry then rotates a further 1° and this sequence of linear passes and 1° rotations is repeated until a total rotation of 180° has been achieved. Each complete scan does in fact yield results for two contiguous slices of the head as shown in Fig. 4. The thickness of each slice can be adjusted to either 0.8cm or 1.3cm by means of collimators in the X-ray beam. The two pictures from a single patient scan are achieved by using two detectors each with its own associated data processing channel.

The X-ray detectors used are photomultipliers with sodium iodide scintillating crystals. During each linear pass of the head, 160 readings of X-ray intensity are made by each detector so that for each complete scan of 180° a total of $180 \times 160 = 28,800$ readings are taken. The 160 readings are controlled by means of a glass grating consisting of alternately transparent and opaque sections. This grating moves with the X-ray tube and detectors, and passes between a lamp and photodiode. The output from this photodiode controls the operation of electronic circuits which measure the output of each detector.

For each complete scan the scanning system yields a set of 28,800 readings from each of the two detectors plus an additional set of 28,800 reference readings of the X-ray intensity before passing through the patient's head. These three sets of readings are put into digital form by an analogue to digital converter and stored in the buffer section of a magnetic disc pack. This is illustrated in the block diagram of the system Fig. 5.

DATA PROCESSING

These readings of X-ray intensity now have to be used to solve many thousands of simultaneous equations so that the X-ray absorption value at each point in the slice can be calculated. This operation is performed by a mini-computer, which, by means of a specially written computer program, is able to call-up these readings from the disc store and process them. The computation, which takes about five minutes for each picture, results in 6,400 output values in digital form which are stored in the main storage section of the magnetic disc pack.

PICTURE DISPLAY

The 6,400 digital values can be called-up on command and converted into analogue form where they may be used to build up a picture on the cathode ray tube screen of the Viewing Unit. This picture consists of a matrix of 80×80 picture points, the brightness of each point representing the X-ray absorption of the tissue.

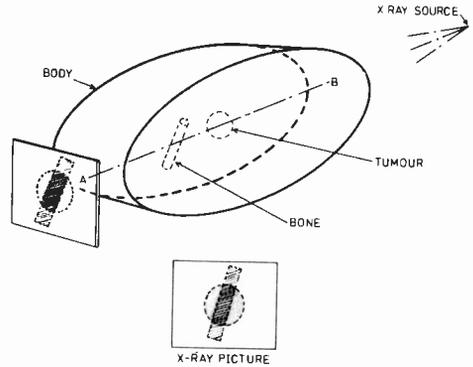


Fig. 1. Conventional X-ray technique

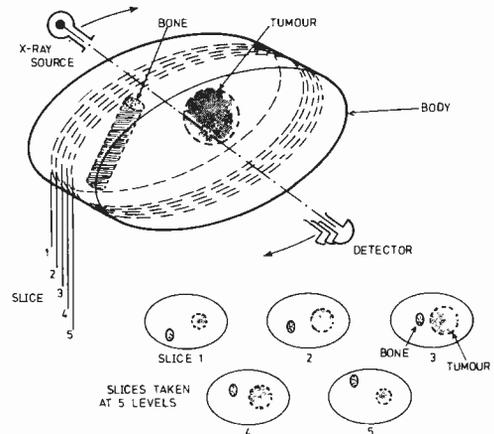


Fig. 2. Computerised transverse axial technique

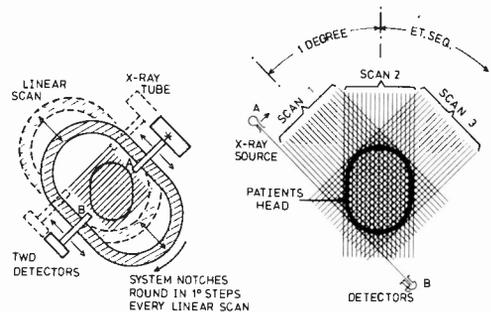


Fig. 3. Motion of scanning frame and detectors for producing two contiguous slices

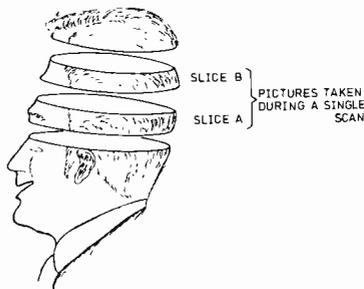


Fig. 4. Two slice planes taken during a single scan

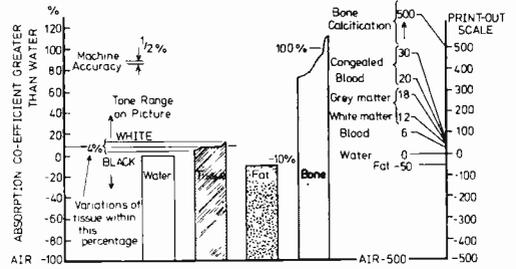


Fig. 6. X-ray absorption chart

An alternative method of displaying the results is to use a line printer which will print out the numerical values of the X-ray absorption coefficient at each point of the 80×80 matrix.

The chart shown in Fig. 6 illustrates the range of measurement of the system. The left-hand scale shows the percentage X-ray absorption coefficient greater or less than that of water and the vertical blocks show the coefficients for materials commonly encountered in clinical radiology, i.e. blood, tissue, bone, etc. The right-hand scale on the chart shows the scale actually used on the equipment, with dense bone at +500, water at 0 and air at -500. The system is accurate to within $2\frac{1}{2}$ units on a range 0 to 500.

In order that the diagnostician can select the information which is displayed on the Viewing Unit there are two very important controls—window width and window level.

The window width control selects the range of X-ray absorption values which yields black to peak white on the cathode ray tube screen.

The window level control enables this selected band to be moved up or down the scale of absorption values. As an example with the window level

control set at +15 (centre of the band) and the window width set at 20 all tissue with X-ray absorption values less than +5 would appear black and all values greater than +25 would appear white. Values between +5 and +25 would appear of different brightness values between black and peak white.

An illustration showing the effect of the window level control is shown in Fig. 8. The top left-hand picture shows the control set at -50; all values less than -60 appear black, all values greater than -40 appear white. The dark ring represents air trapped in the hair of the patient. The top centre picture shows the control set at 0 with the saline fluid-filled ventricles just beginning to show. The top right- and lower left-hand pictures show intermediate settings of the control to show detail of brain tissue at +10 to +20. The lower right-hand picture shows the control set at +50 with the white ring representing the bone of the skull. These pictures clearly show that the diagnostician can select the displayed picture to suit the material under examination.

By switching the window width control to a "measure" position, which yields 1 digit black to peak white on the display, it is possible to measure the X-ray absorption at any chosen point in the picture.

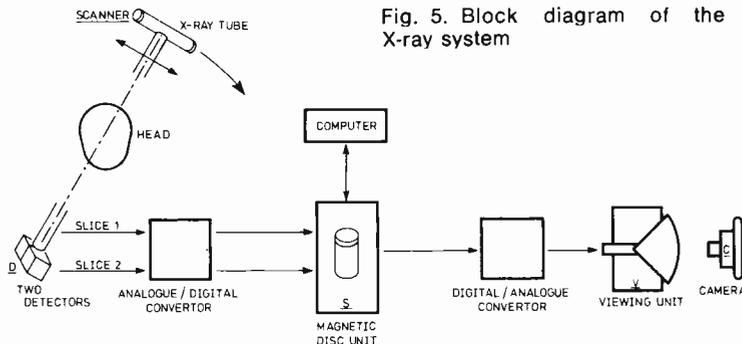


Fig. 5. Block diagram of the computerised X-ray system

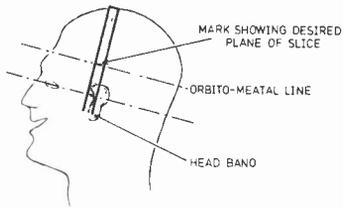


Fig. 7. Marking the slice planes on a headband

The window level control is adjusted until the point under examination is just changing from black to white. The absorption value can then be read off directly from the window level scale.

PATIENT PREPARATION

As each complete scan of the patient yields results on only two 1.3cm thick slices of the head it may be necessary to perform three or four such scans to cover the major part of the brain. If, however, it is desired to locate the examination at a certain point this is done very easily. Firstly an adhesive white tape is fixed over the head of the patient to form a head-band. This is then marked to show the orbito-meatal line, which is an imaginary line drawn between the corner of the eye and the meatus of the ear, used as a reference point. If for example the diagnostician requires to examine a slice 5cm above this position on the head-band. This is illustrated in Fig. 7.

At this point the patient's head is inserted in the machine and the rubber head cap is collapsed onto the skull by means of water pressure to expel the air. The patient's head within the head cap is located

in a plastic cone on which is printed a scale, and the mark denoting the chosen plane of slice is then read off against this scale. This reading is noted and the patient is then moved either into or out of the machine by means of a hand-wheel beneath the diagnostic table until a pointer and scale indicate the same value as the head cone reading. The patient has then been set in the machine such that a slice either side of the marked plane is examined.

A range of different plastic head cones is available in order to accommodate heads of various sizes and also to allow the head to be tilted for certain special examinations.

Each patient is normally allocated an identifying number which the radiographer can enter into the machine store before each scan by means of thumb-wheel switches on the X-ray Control Unit. This number appears on the pictures and print-outs for that scan and so gives a positive link between the patient and the result.

The computer normally processes each set of readings in serial order from the buffer store. However, should the diagnostician require the results from a certain patient quickly, then the computer can be instructed to give priority processing to a selected picture.

APPLICATIONS

As with any X-ray technique the EMI-Scanner system relies on the fact that the various structures found in the brain must have different X-ray absorption values in order that they can be differentiated. Even though the system is extremely sensitive there may be cases where the use of a contrast medium can be an advantage. Typically a small quantity of an X-ray opaque substance such as iodine can be injected intravenously into the patient.

If for instance there is a lesion which takes up the contrast medium more than the surrounding normal tissue then the diseased area will show up clearly on the picture, and, using the EMI-Scanner system, will continue to do so for several hours. The use of contrast media in this way should be compared with the technique used in angiography where the fluid is injected into the arterial system of the body and the effect lasts for only a few seconds.

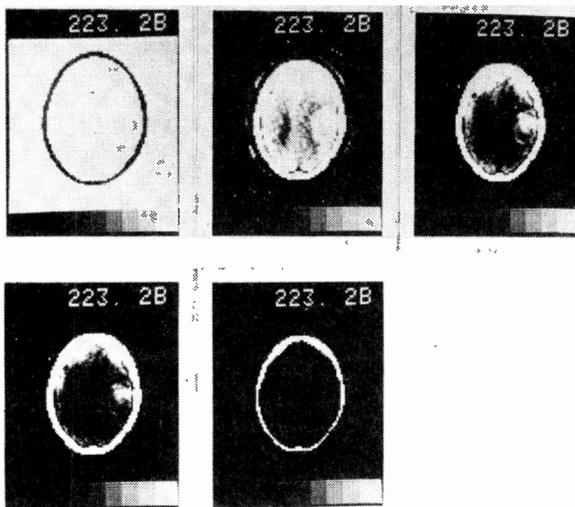
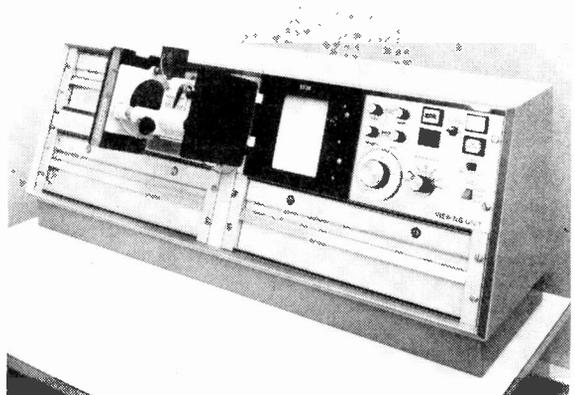


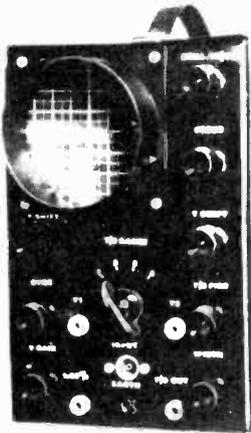
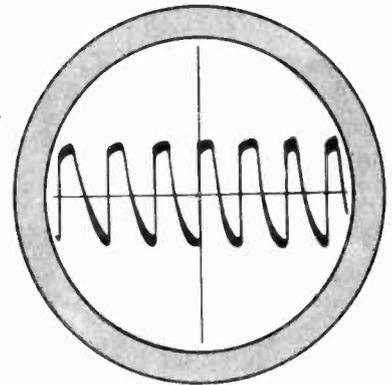
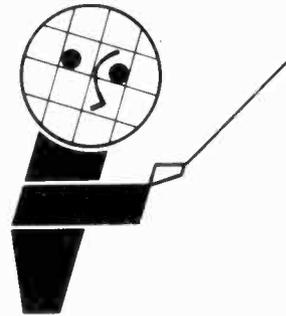
Fig. 8 (left). Effect of the "window level" control
The Viewing Unit



look! electronics really mastered

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

no previous knowledge
no unnecessary theory
no "maths"



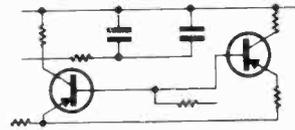
RAPY

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

1/ BUILD AN OSCILLOSCOPE

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

2/ READ, DRAW AND UNDERSTAND CIRCUIT DIAGRAMS



as used currently in the various fields of electronics.

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

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

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

FREE POST NOW for BROCHURE

or write if you prefer not to cut page

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

NAME

BLOCK CAPS

ADDRESS

PLEASE EL53

special free gift also to all our students

PCB'S FROM PHONOSONICS



VERSATILE LIGHT EFFECTS PCB (Mk. 2)

All PCB's Fibreglass, Drilled, Roller Tinned. Circuit and Layout Diagrams. Free with each PCB. Rotary Pots supplied as standard except where stated. PCB's designed by Phonosonics except where stated otherwise.

DESIGNS PUBLISHED IN P.E.

AURORA (Apr./Aug. 71) Multichannel Sound Controlled Light S/c's (excl. SCR's), Rs, Cs, Cores, Pots, 8 ch., £17.75; 4 ch., £10.15. Power Supply (supplies 8 chans.), unstab., £2.85; stab., £3.65. PCB (4 1/2in x 1 1/2in) for P/A and 4 chans. incl. pots, £2.35. PCB (4 1/2in x 5in) for PSU, Sync. Gen, 8 cores, 8 SCR's, £1.35.

A.F. SIGNAL GENERATOR (Nov. 72) S/c's, Rs, Cs, Pots, Sw's. PCB (2 1/2in x 4in) also holds Sw's, £3.15.

AUDIO MIXER (Jan. 72) Rs, Cs, Pots (i.c. excl.), PCB (1 1/2in x 2in), £1.55.

BIOLOGICAL AMPLIFIER (Jan./Feb. 73)—Pre-amp Set S/c's, Rs, Cs, Pots (i.c.'s excl.), PCB (1 1/2in x 3 1/2in), £2.90.

DOOR BELL YODELLER (Apr. 71)—S/c's, Rs, Cs, Pots, Transformer, Loudspeaker, PCB (3in x 3 1/2in), £7.70.

ELECTRONIC PIANO (Sept. 72/Jan. 73) Lower Prices! PA/Trem—Rs, Cs, Pots (excl. 2K), £1.70. PCB as publ., £1.50. Power Supply—Rs, Cs, £1.10. PCB as publ., 90p. Pitch 1-12—Rs, Cs, £1.90 each set. Pitch 13—Rs, Cs, £1.30. Pitch PCB as publ., £1.80 each. Combined sets for PA/Trem, PSU, all 13 Pitch—Rs, Cs, Pots (excl. 2K), £23.70. PCB's, £23.20.

GEMINI STEREO AMP (Nov. 70/Mar. 71) Stereo Sets and PCBs Pre-Amp—S/c's, £1.85. Cs, Pots, Maka-Sw's—with 1W 2% M.O. Rs, £11.60—with 1/2W 5% C.F. Rs, £9.35—with 1/4W 5% C.F. Rs, £8.90. PCB (3 1/2in x 10 1/2in) for kits with M.O. or 1/4W C.F. Rs. Holds pots and Maka-Sw's, £2.10. Main Amp—Rs, Cs, Pots, £5.40. PCB (3 1/2in x 5in), £1.40. PSU—Rs, Cs, Pot, £3.70. PCB (2in x 4in), 75p.

GEMINI STEREO TUNER (Apr./Jun. 72) Rs, Cs, Pot, £3.80. PCB as published, £1.80.

HI-FI TAPE LINK (Mar./Apr. 73)—PCB, etc., in preparation.

LOGICAL RADIO CONTROL (Dec. 71/Jan. 72)—Sets incl. PCB as publ., Rs, Cs, S/c's and Pots (where req.) but excl. I.C.'s. Coder 1 and Clock Pulse Gen., £3.75. Coder 2A, £3.60. Coder 2B, £3.85. Decoder, £1.45.

MODEL SERVO CONTROL (Feb./Mar. 72)—Sets incl. PCB as publ., Rs, Cs, S/c's and Pots (where req.) but excl. I.C.'s. Servo Amps: "A", £2.15; "B", £3.70; "C", £2.20. Fail-Safe, £1.30.

MICROPHONE MIXER (Apr. 69)—S/c's, Rs, Cs, Pots, PCB (3 1/2in x 4 1/2in)—also holds pots, £4.10.

PHOTOPRINT PROCESS CONTROL (Jan./Feb. 72) Finds exposure, controls timing, stabilises mains voltage. S/c's, SCR, LDR, Rs, Cs, Pots, Relay, Keyswitch, T/former. PCB (3 1/2in x 5 1/2in) also holds pots, relay, keyswitch, £8.80.

SOUND SYNTHESISER (Current Series)—Details on request.

TAPE NOISE LIMITER (Feb. 72)—Mono Circuit S/c's, Rs, Cs, Pot, PCB (1 1/2in x 3in), £2.20. Regulated Power Supply (will feed 2 units) and PCB (1 1/2in x 2 1/2in), £3.20.

TRIFFID (Feb. 73)—PCB As Published, 60p.

ULTRASONIC TRANSMITTER-RECEIVER (May 72) Rs, Cs, Pot, S/c's, Relay, Dual PCB (2in x 5 1/2in), £3.90.

VERSATILE LIGHT EFFECTS UNIT (Jun. 72)—Single Channel Sound Controlled Light—also has built-in variable strobe. S/c's (excl. SCR), Rs, Cs, Pots, T/formers, Keyswitch, £8.85. PCB (3 1/2in x 7 1/2in) also holds Pots, Sw, T/former (T/77), £1.50.

SOME OTHER DESIGNS AVAILABLE

VIBRASONIC GUITAR PRE-AMP. (Practical Wireless Sept. 70)—Incl. Mic P/A, 2 Guitar P/A, Tremulant and Tone Controls, Master Volume. S/c's, Rs, Cs, Rotary Pots, LDR, Lamp, Coupling T/former, £7.75. PSU, £2.80. PCB (4in x 1 1/2in) also holds rotary or slider pots, £2.30.

REVERBERATION UNIT (Practical Wireless Nov.-Dec. 72) S/c's, Rs, Cs, Slider Pots T/former, £6.80. PCB (2in x 1 1/2in) also holds sliders (compatible with publ. panel) £1.20.

8 WATT AMPLIFIER (Practical Wireless Nov. 72) Main Amplifier—S/c's, Rs, Cs, Pot (Mono Set), £3.90. PCB (2 1/2in x 3in) (Mono). 60p. Pre-amp—S/c's, Rs, Cs, Pots, Maka-Sw., Mono, £2.50; Stereo, £5.20. PCB (3 1/2in x 7 1/2in) (Stereo)—also holds all pots and Maka-Sw., £1.50.

AURORA AUXILIARY CONTROL UNIT (2 variable freq. strobe gens. and 4 variable amplitude freq. gens.), Rs, Cs, Pots, S/c's, £3.25. PCB (3 1/2in x 5 1/2in), also holds all pots, £1.35.

THYRISTORS (400V P.I.V.), 1A 50. 3A 55. 7A 70p. 16A 95p.

SLIDER POTS (PCB Mounting), Mono, 40p; Dual, 60p; Knobs, 13p.

S.A.E. for Free List of these and other designs.

Orders: U.K. 10p P. & P. Overseas P. & P. at cost.

V.A.T.—All Prices V.A.T. Exclusive.

PHONOSONICS, Dept. P.E.5, 25 Kentish Road, Belvedere, Kent DA17 5BW. Mail Order only

Just hold this while I switch on.



Sorry about that, Roger.

BAND-AID* Washproof Plasters.

© Johnson & Johnson LTD

* TRADE MARK

AUTOMATIC EMERGENCY SUPPLY

250v 50 Hz—150 watt Inverter. Full kit of parts excluding meter. Circuit as appeared in December P.W. Complete kit—£16.95 + 80p. P. & P.

OTHER INVERTERS AVAILABLE IN KIT FORM

150 Watt—£13.50 + 60p P. & P. 75 Watt—£7.80 + 60p P. & P.
300 Watt—£17.90 + 85p P. & P. 40 Watt—£5.20 + 40p P. & P.
25 Watt—£2.60 + 20p P. & P.

All above operate from 12v. battery and give 250v.-50Hz. Output. 24 volt types are also available, alternative outputs or taps can be supplied. Transformers and/or Transistors can be supplied separately.

SPECIAL OFFER

12v. Fluorescent lights, suitable for tents, caravans, houses or secondary lighting for factories, hotels, etc. 12 inch—8 watt—£3.40 post paid. 21 inch—13 watt—£4.20 post paid. Large discounts available for quantities.

TEXAN AMPLIFIER

Fibre glass P.C. board—£2.00 + 10p P. & P.
Transformer—£4.00 + 30p P. & P.
Other components including Teak Cabinet—£24.00 + Postage.

ASTRO ELECTRONICS

6 BARNES ROAD, CHESTERFIELD, DERBYSHIRE

LED's			
TIL302 4 for	£10	I.C.'s	
6 for	£14	MM531 I Clock	£12.50
DL34 4 digits	£15	ZN414 Radio	£1.10
TIL360 6 digits	£18	Sig555 Mono/astab.	£0.90
TIL209 4 for	£1	CA3082 7-seg. driv.	£2.10
50 for	£10		
CALCULATORS		KITS (incl. I.C. sockets)	
Advance Mini	£45	Calculator	£41
Advance Exec. 8	£45	Digitronic (6)	£36
Advance Exec. 16-1	£95	Digitronic (4)	£32
Advance Exec. 16-2	£110	Bywood clock kit	£34
Post & Packing I.C.'s, LED's, 10p.		P.E. Calculator Kit	£34.50
KITS, CALC's, METERS 50p.		ADD 10% VAT TO ALL ORDERS	



Buy it with ACCESS

You may telephone your order and pay by ACCESS.
ANSAFONE — 24-hour service.

LATEST! New Digital Clock
I.C.'s available with alarms.
S.A.E. for details:

BYWOOD

ELECTRONICS
181 EBBERS ROAD, HEMEL
HEMPSTEAD, HERTS. 0442 62757

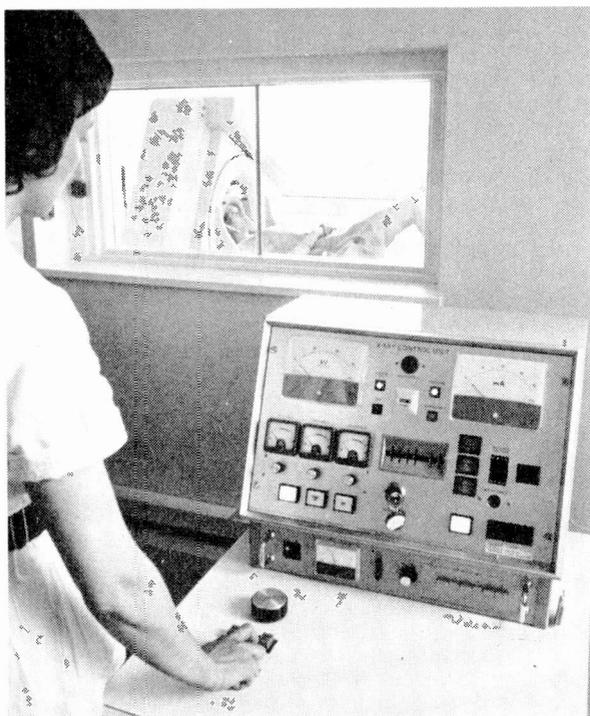


View of a patient in position on the scanning unit

TECHNICAL DETAILS

The circuit techniques used are in general of a conventional nature incorporating both discrete components and integrated circuits mounted on printed circuit boards. Both the Scanning Unit control electronics and the viewing Unit contain a large amount of logic circuitry.

The X-ray Control Unit



A feature of the system is the high degree to which the various controls are interlocked to ensure safe and correct operation by non-technical operators. As an example of this, the scanning sequence cannot be started until four conditions are satisfied:

1. That the scanning gantry is in the start position.
2. That the operator has set the patient's identifying code on the thumbwheel switches.
3. That the computer is ready to receive data into the disc buffer.
4. That the operator has removed the safety key from the Scanning Unit control panel and has inserted it in the X-ray Control Unit.

The status of these interlocks is clearly shown by means of indicating lamps so that the operator can check visually before starting the sequence.

The system for generating the X-rays is designed to give good stability and incorporates regulators for both voltage and current to the X-ray tube. Three-phase a.c. mains is converted to 100V 150Hz by a power conversion unit, which is then fed to the e.h.t. transformer. The output voltage is full wave rectified and smoothed to give an output of up to $\pm 70\text{kV}$ w.r.t. earth for the X-ray tube.

The X-ray tube is a fixed anode type, the cathode being aligned to give a line rather than a spot focus.

CONCLUSION

This system is being confidently predicted by many radiologists as one which will revolutionise the use of X-rays. The significance of this new technique has already been noted in Great Britain where its inventor, Mr G. N. Hounsfield, of the Central Research Laboratories of EMI Ltd., has recently received the MacRobert Award for outstanding innovation in engineering.

ACKNOWLEDGEMENT

The writer wishes to thank the Directors of EMI Ltd. for permission to publish this article. ★

PE Sound Synthesiser

4

RAMP GENERATORS & INPUT AMPLIFIERS

By G.D. Shaw



THIS month, the operation and construction of the ramp generators and input amplifiers will be described together with guidelines on using the various modules, so far described, in combination.

RAMP GENERATOR

The ramp generator to be described is effectively a sawtooth oscillator capable of working down to very low frequencies. At the low end of its working range the output of the device may be considered to be slowly changing d.c. and, unlike the v.c.o. which produces an output waveform swinging about zero, the output of the ramp generator is single-ended, that is, swinging from zero to about $-3.5V$.

The reason for this arrangement is that the ramp generator is considered essentially as a device for programming other voltage controlled modules all of which require control voltages of one polarity only. This requirement, incidentally, does not mean that alternating voltages cannot be used for programming and, as will be shown, many interesting effects can be obtained when the control voltages vary about zero.

As with the v.c.o. the principle of operation is that of the linear integrator although the circuit shown in Fig. 4.1 is very much simpler.

IC1 is the integrator which receives its positive control voltage either from VR1, an external source, or from both in combination. IC2 is a comparator which, since single ended operation is required, utilises a reference voltage set by R7-R8 and transistor TR1 to discharge the integrating capacitor C1. The reference voltage also determines the peak ramp output voltage of the circuit.

CIRCUIT OPERATION

The operation of the circuit is as follows. The divider R7/R8 provides $-3.5V$ at the non-inverting input of IC2 and effectively biases TR1 off. Assuming that the R1 input to IC1 is open circuit, a positive voltage derived from VR1 is applied to the inverting input of IC1 via R2 and the integrator begins to ramp negatively at a rate determined essentially by R2/C1.

When the ramp output voltage applied to the inverting input of IC2 is equal to or greater than

the reference voltage the comparator switches to its positive saturation state, turns on TR1, and discharges C1 via R6 and R7.

The sawtooth output waveform is taken from the junction of R4 and R5 via VR4 while a pulse output is available from the emitter of TR1. Note that this requires to be a.c. coupled if it is to be used effectively.

CONSTRUCTING THE RAMP GENERATORS

Construction of the ramp generators is perfectly straightforward, the recommended circuit board layout being shown in Fig. 4.2. Note that both ramp generators (RG1/RG2) are built on one circuit board and that power supply decoupling is not required.

The method of construction should generally follow that employed for the v.c.o. module. Components should be mounted to the front panel and prewired before the panel is secured to the circuit board support plate. Note, however, that in this case the main wiring harness from the ramp generators should leave the front panel at the top and pass over the top edge of the circuit boards while the wiring to the input amplifiers should be as short as possible and routed direct to the appropriate circuit board.

A detail of the panel component wiring and board layout is shown in Fig. 4.3. The McMurdo plug should now be prewired and mounted into the support plate.

TESTING

When assembly of one of the ramp generators has been completed make temporary connections to power supply leads and front panel controls and connect a resistor of at least 10 megohms across the integrating capacitor C1. Set VR2 and VR1 to their minimum values, VR3 to its mid-position, and switch on the power supply. Observe the integrator output on the oscilloscope and adjust VR3 for zero offset. Switch off and remove the 10 megohm resistor.

Set VR2 to its mid-position and switch on again. A sawtooth waveform of about 7Hz should now be observed. Gradually reduce the setting of VR2 until the slope of the ramp begins to show slight rippling.

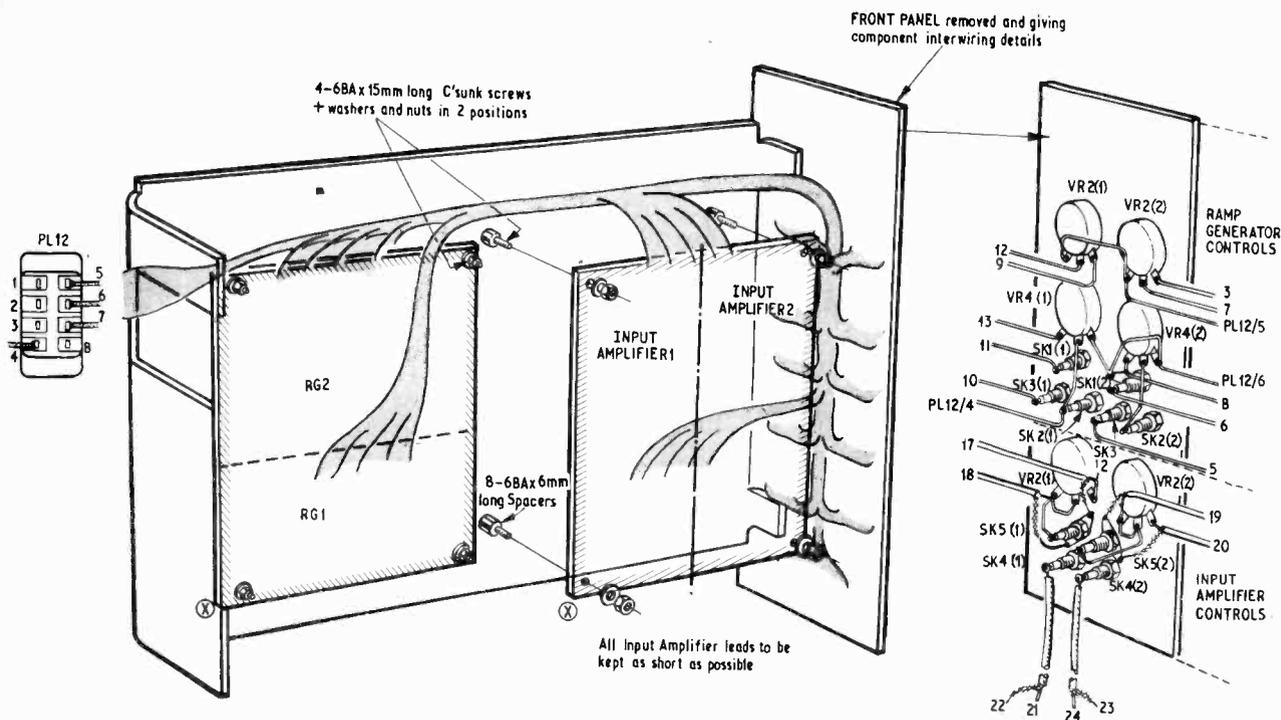


Fig. 4.3. Control panel wiring and board layout of ramp generator module. A lead should be taken from SK2(2) to PL12/8

COMPONENTS . . .

RAMP GENERATOR (2 OFF)

Resistors

R1, R2	270k Ω (2 off)
R3	24k Ω
R4	47 Ω
R5	680 Ω
R6	82 Ω
R7	560 Ω
R8	1.5k Ω
R9	10k Ω

All 2% $\frac{1}{2}$ watt metal oxide

Capacitors

C1	1 μ F polyester 25V
C2	1,000pF polystyrene

Integrated Circuits

IC1, IC2	741C 8 pin D.I.L. (2 off)
----------	---------------------------

Transistor

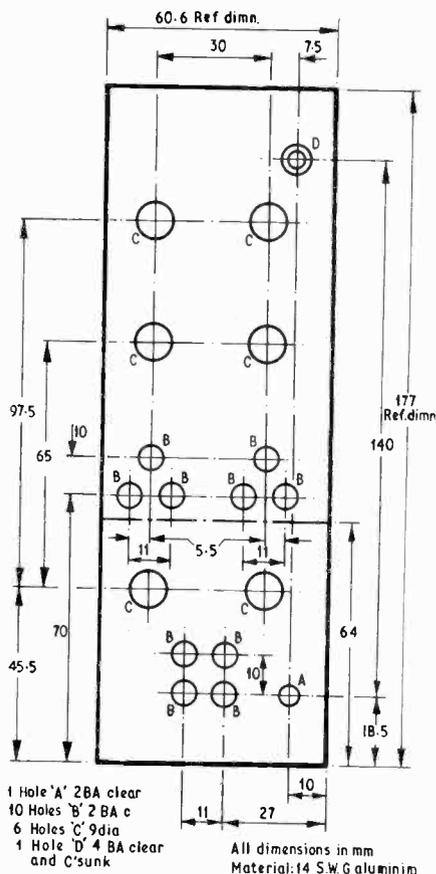
TR1	OC140
-----	-------

Potentiometers

VR1	500 Ω horizontal carbon preset
VR2	10k Ω miniature moulded carbon linear potentiometer
VR3	10k Ω horizontal carbon preset
VR4	10k Ω miniature moulded carbon linear potentiometer

Miscellaneous

SK1-SK3 2mm miniature sockets (3 off), 2 Elma knobs, 34 \times 17 way 0.1in matrix Veroboard



INPUT AMPLIFIER

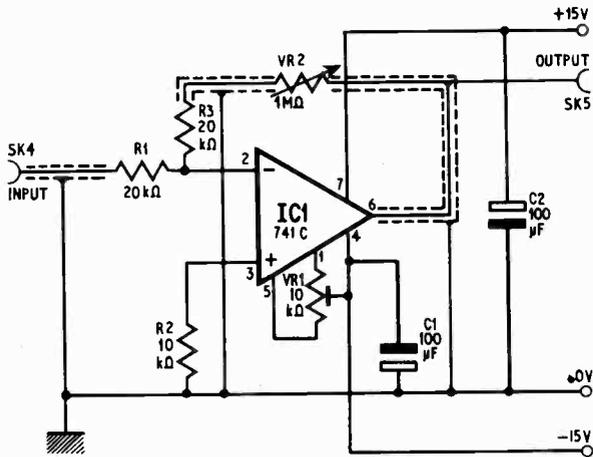


Fig. 4.4. Circuit of an input amplifier

COMPONENTS . . .

INPUT AMPLIFIERS (2 OFF)

Resistors

- R1 20k Ω
- R2 10k Ω
- R3 20k Ω
- All 2% $\frac{1}{2}$ watt metal oxide

Capacitors

- C1, C2 100 μ F elect. 25V (2 off)

Potentiometers

- VR1 10k Ω horizontal linear preset
- VR2 1M Ω linear miniature moulded carbon

Integrated Circuit

- IC1 741C 8 pin D.I.L.

Miscellaneous

- SK4, SK5 2mm miniature sockets (2 off), 34 \times 17 way 0.1in matrix Veroboard, 1 Elma type knob

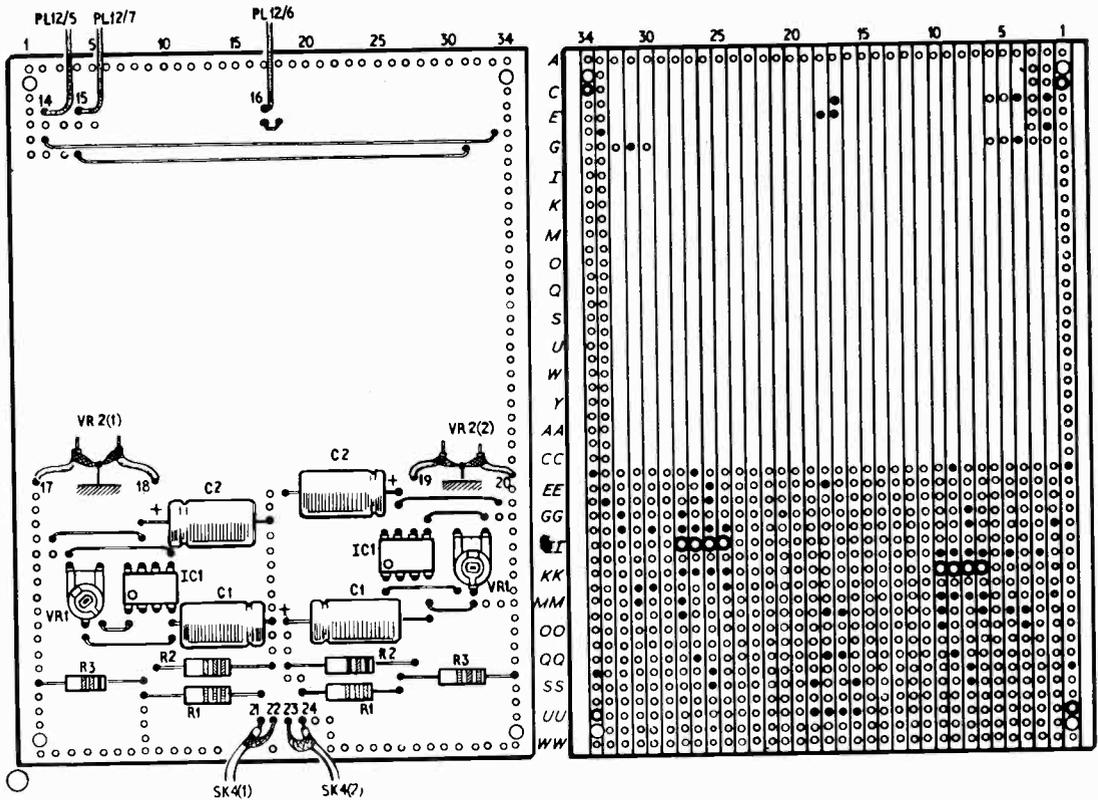


Fig. 4.5. Circuit board layout of input amplifiers

Increase the setting of VR1 until the rippling disappears and make further reductions in the setting of VR2, adjusting VR1 as necessary to keep the slope ripple free. Note that at the minimum setting of VR2 the ripple effect is at very low frequency and shows itself more as a hesitancy in the motion of the oscilloscope trace.

With careful adjustment, and the component values shown, it is possible to achieve a low frequency of 0.01Hz but it is almost impossible to remove ripple entirely at this frequency and generally it is best to set the low end of the range to 0.05Hz to ensure stability. The upper frequency limit with the 1.0 μ F integrating capacitor is about 15Hz.

In the prototype instrument one ramp generator was built as described and the second was built with an integrating capacitor of 0.47 μ F thus giving an upper frequency limit of about 30Hz with very little sacrifice to the v.l.f. end of the range. Such a procedure is recommended since the higher frequency is very useful in the production of rapidly changing, complex sound patterns.

When both ramp generators have been built and tested, mount the circuit board on the support plate in the position remote from the front panel (Fig. 4.3).

INPUT AMPLIFIERS

The input amplifier theoretical circuit is shown in Fig. 4.4 and the circuit board layout in Fig. 4.5.

Although very simple in design rather more care is required in the component layout if hum pick-up is to be avoided, this latter problem tending to occur more when the gain control VR1 is at its maximum setting. Note that screened wire is used to connect the input sockets and gain controls to the circuit board. These wires should be trimmed as closely as possible to the required length and led directly to the circuit board without being formed into a harness.

The only setting up required is the adjustment of the offsets. VR2 should be set to maximum, the input grounded and, with the power supply on, adjusted to give an output level of precisely zero.

Reference to block diagram in Part One will show that Oscillator 1 is programmed directly by Ramp Generator 1 through the medium of a prewired interconnection. Accordingly tag 4 on the ramp generator McMurdo socket (SK12) should be connected to tag 1 on the v.c.o. socket (SK8). This direct connection may be over-ridden by inserting either an open circuit or grounded jack plug into the external programming socket of the v.c.o. Alternatively a jack plug coupled to a patch cord may be used to provide programming from another source.

It is recommended that grounded jack plugs are used if precise manual control of v.c.o. frequency is required.

PROGRAMME DATA SHEET

The completion of this module provides the constructor with greater facilities for the production of programming waveforms and some quite complex sound structures. With the addition of the v.c.o. module there are now seven separate circuits and 12 controls to manipulate. There is thus a need for a method of logging control settings and interconnections so that any given sound structure may be repeated at a later date.

Details of a data sheet which will prove ideal for the purpose are given in Fig. 4.6. Control settings

would normally be recorded in the circles on the front panel representation while module interconnections would be indicated by a dot in the appropriate square on the grid matrix. Data recorded in the figure relates to the production of a type of bird song which will be described in detail in a later article.

USING THE CONSTRUCTED MODULES

The provision of the input amplifiers allows waveforms from the oscillators and/or ramp generators to be mixed either additively or subtractively when used in combination with the voltage inverter. The permutation of all the possible settings of amplitude and frequency controls implies that an enormous range of sound structures may be produced and, whereas it is beyond the scope of this article to cover all the possibilities, a number of simple experiments are suggested for guidance.

Starting with the ramp generators, Fig. 4.7a shows the type of relationship which may be observed on the oscilloscope when one ramp generator is running at ten times the frequency of the other. With the output of a v.c.o. coupled to a suitable power amplifier and its frequency control at zero, application of either of the waveforms shown will cause the v.c.o. frequency to be swung from the lowest end of the range to an upper frequency determined by the amplitude of the ramp generator waveform.

Since the upper frequency limit of the v.c.o. is dictated by the saturation level of the differential stage and since the gain of this stage is 10 then a programming waveform amplitude of about 1.4V will drive the v.c.o. to its maximum frequency.

Fig. 4.7b shows the effect of mixing the waveforms shown in Fig. 4.7a additively. To achieve this, route the outputs of the ramp generators to separate input amplifiers which have their gain controls set to zero, i.e. unity gain, and then to the inputs of the voltage inverter. Observation of the output of this latter device reveals the composite waveform.

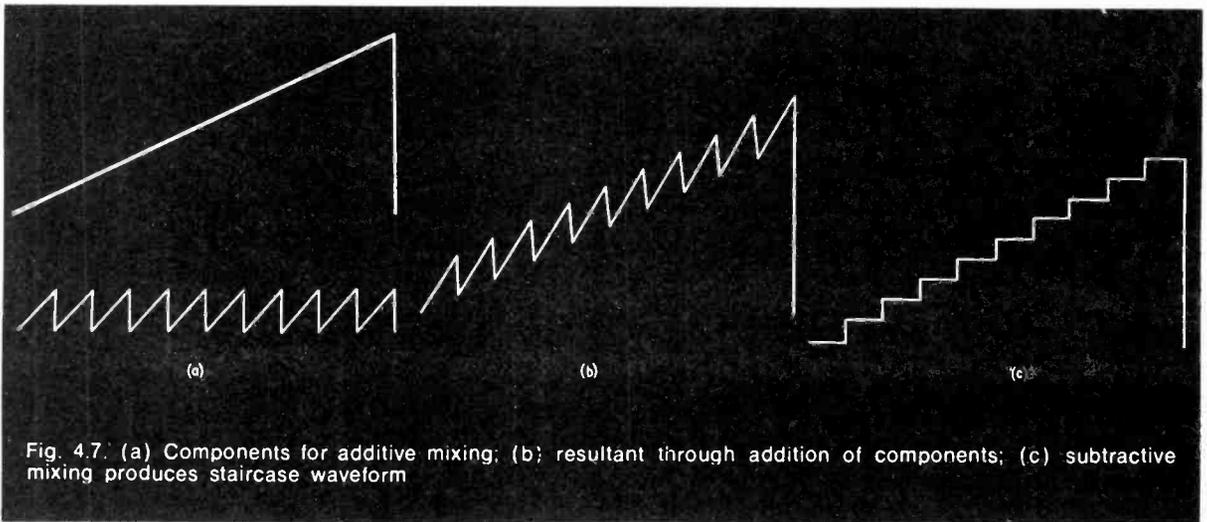
With the ramp generator output levels adjusted so that the maximum combined level is about 1.4V route the voltage inverter to the input of the v.c.o. The result is an undulating sound the lowest frequency of which is continuously rising at a rate set by the frequency of the slowest running ramp generator.

SUBTRACTIVE MIXING

Fig. 4.7c shows the effect of subtractive mixing of the ramp generator waveforms. Achievement of the staircase form is as follows.

Set the amplitude of the slowest ramp generator output to 1.4V and route this to the voltage inverter via an input amplifier set to unity gain. Route the second ramp generator to the voltage inverter direct. Since this now sees the inputs from the ramp generators at opposite polarities the result is subtractive mixing which, when the amplitudes are at the correct levels, produces a staircase as shown.

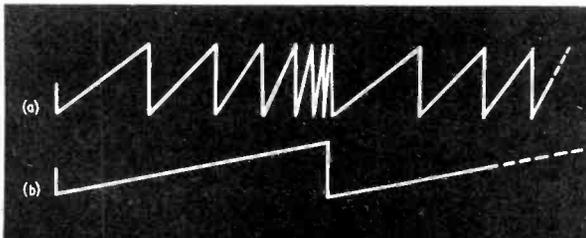
Application of this waveform to the v.c.o. produces a rising, arpeggio-like sound. A falling arpeggio may be produced by reversing the routing of the ramp generators with the slowest direct to the voltage inverter, and fastest to the voltage inverter via the input amplifier. In this latter case the frequency control of the v.c.o. has to be set to its maximum level since the waveform from the voltage inverter is now positive going.



FIXING THE V.C.O. LIMITS

In these examples the v.c.o. has been programmed through its maximum working range but it is, of course, possible to achieve the same effect within very precise frequency limits. For example, suppose it is wished to provide an arpeggio rising from 130Hz

to 520Hz, the frequency control of the v.c.o. is set to give the voltage required to produce 130Hz. The fact that the ramp output will, at times, be zero volts will not affect the l.f. performance limit since the v.c.o.s were originally set up with a link simulating a zero-volt programming input. Thus from Fig. 3.4 in last month's article it will be seen that the initial setting of the v.c.o. will require an input of about 24mV. Also it will be seen that a frequency of 520Hz requires an input of about 42mV and thus the output amplitude of the combined ramp generator signal will have to be (42-24)mV. In a similar manner the manipulation and adjustment of the manual and automatic voltage sources can set the programmed sequence almost anywhere in the working range of the v.c.o.



PROGRAMMING THE RAMP GENERATORS

The monotonous repetition of the ramp generator output can be considerably varied by application of programming voltages to its own external control input. Fig. 4.8 illustrates the effect of applying a steadily rising voltage to the control input.

The voltage has been derived from the output of the other ramp generator running at a fairly low frequency and routed via one of the input amplifiers set to provide a peak ramp output of positive 14V. The resultant output of the programmed ramp generator consists of a series of ramps gradually increasing in frequency as the programming voltage rises to its peak, the aural effect when used to programme a v.c.o. being a kind of bounce.

For the best effect the programmed ramp generator should be running at about twenty times the frequency of the other.

An extension of the above system is shown in the block diagram Fig. 4.9. In this case one of the v.c.o.s is also providing a programming waveform which is first amplified to provide an output swing of $\pm 7V$. This is then combined, in the voltage inverter, with the output of the programming ramp generator set to its maximum output level. The voltage inverter is then routed to the programmed generator which has

Fig. 4.8(a). Programmed ramp generator output
(b) programming waveform

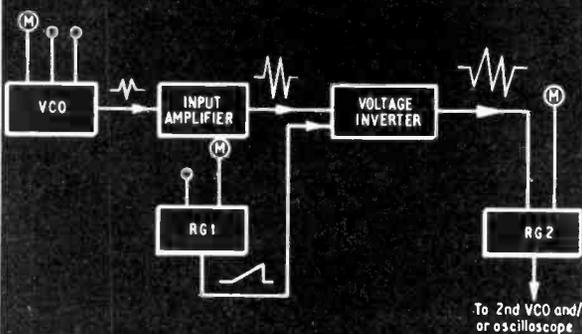


Fig. 4.9. Block diagram for ramp generator programming

been set to run at about 7Hz, the overall result being a bounce which is changing its rate in a pattern depending on the relative frequencies of the programming sources.

EXPERIMENTAL COMBINATION

There are many other combinations of the programming devices all of which result in the production of characteristic sounds. The constructor is encouraged to investigate these as widely as possible noting the control settings and interconnections which produce sounds of particular interest.

It should be noted that even quite small adjustments to amplitude and frequency of programming waveforms can cause relatively great changes in the sound structure. This is particularly the case when amplitudes are adjusted in complex programming waveforms such that the waveform changes potential, i.e. crosses zero. In these cases the v.c.o. will cease to oscillate for as long as the programming waveform remains positive and thus, for a fairly rapidly changing waveform, the long term output of the v.c.o. will resemble a series of tone bursts of varying frequency.

The use of positive going programming waveforms to the v.c.o. should be investigated with care, particularly when the manual frequency control is at or near zero. The sudden application of a large positive input will cause an unpleasant click due to the increase in v.c.o. output voltage as it goes into saturation. Similarly a low potential positive input applied for a prolonged period will, on its removal, give rise to a click when the v.c.o. comes out of saturation.

USING A RECORDER

It is perhaps prudent, at this stage, to mention that a tape recorder is a most necessary adjunct to the Synthesiser if the full potential of the instrument is to be realised. This is essential because, although live performance is possible, it is somewhat limited due to the design of the keyboard which is monophonic. In order to produce complex realisations, it is necessary to employ a recorder in order that multitracking of one form or another may be used to blend or superimpose consecutive series of sound structures into a comprehensive whole.

In a similar manner many sound effects may be enhanced by the addition or superimposition of secondary sounds. This procedure can be particularly useful when complex effects such as storms, battles or woodland birdsong are being synthesised.

Quite apart from the creative aspects of using the tape recorder another important reason for its application with the Synthesiser lies in the establishment of a taped library of sounds.

Many excellent books and articles have been written on this subject but, in the field of creative recording, T. Dwyer's "Composing with Tape Recorders" (Oxford University Press 1971) contains much useful information.

NOTE:

The power supply transformer in Part 2 has 0-30, 0-30V separate secondaries. R1 and R6 should be 5.6k Ω 2% $\frac{1}{2}$ watt metal oxide resistor. IC2 should be insulated from chassis with a mica washer. In Part 3, VR2 is 100k Ω .

Next month: Sample Hold and Noise Generator.



BOOK REVIEWS

ELECTRONIC MUSIC PRODUCTION

By Alan Douglas

Published by Sir Isaac Pitman & Sons Ltd

148 pages 5 $\frac{1}{2}$ in \times 8 $\frac{1}{2}$ in. Price £2.75

ELECTRONIC MUSIC PRODUCTION presents a very much "up to the minute" look at the use of electronics in the production of music with special reference to the synthesiser and the applications of voltage control. The book is divided into four main sections. 1—Properties of conventional musical instruments. 2—Musical scales, temperament and tuning; concord and discord. 3—Electronic music generators. 4—Electronic music and the composer. Additionally there are two appendices which provide, in the first, a detailed specification of the Synthi 100, a highly advanced synthesiser designed for interfacing with a computer and, in the second, details of MUSYS documentation standards together with an example drawn from part of a composition programmed on the Synthi 100. Finally there is a comprehensive bibliography and index.

Electronic Music Production is a lucidly written book packed with data much of which will be new to the reader. There are plenty of clear line illustrations and circuit diagrams and there is little doubt that this book will be "required" reading for all students of electronic music—amateur and professional alike.

G.D.S.

LOGIC AND LOGIC DESIGN

By B. Girling and H. G. Moring

Published by International Textbook Company

328 pages, 9in \times 6in. Price £5.80

ABASIC understanding of logic is essential for anyone interested in the design of computers and associated logic systems. This book, based on a course of lectures given at The City University, provides an excellent introduction to logic, starting from basic number and set theory. It covers the Computer Science requirements for a B.Sc. degree and each chapter concludes with a bibliography and a set of questions with solutions.

This book is very well written and concepts are explained with the aid of copious clearly drawn diagrams. The book does not deal at all with engineering considerations in logic circuit design, concentrating rather on the logical concepts involved. As well as all the standard aids to logic design many up to date references are quoted so that modern concepts can be understood.

With the increasing interest in Computer Science this book will no doubt find its way into many degree courses as the standard reference work. It is well bound and excellently printed and though the price is rather high it is good value for money.

S.R.L.

POCKET CALCULATOR KIT REVIEW



Supacal Calculator

Obtainable from S.C.S. Components Ltd., P.O. Box 26, Wembley, Middx HA0 1YY.

Price £39 (+ V.A.T.) with special £4 discount to P.E. readers.

IMMEDIATELY upon opening the box containing the SUPACAL calculator kit the decision should be made as to whether one is sufficiently equipped in terms of both tools and experience to undertake the construction of the calculator. *Should there be any doubt in this respect, it is strongly recommended that the services of a more experienced friend or colleague be recruited for this work.* The minimum tools required for building the kit are a good soldering iron of 10 to 25 watts with a bit preferably no more than a sixteenth of an inch diameter, also a pair of side cutters, a pair of long nosed pliers, and a good light.

Many solder joints have to be made in a small area and a certain degree of skill is needed to avoid short circuits and dry joints. Fine solder is provided with the kit and this greatly simplifies the construction.

COMPONENT PACKING

All components come in plastic bags marked with the value of the components contained, but it is as well to check these values against those required as it is always better to be safe than sorry. Because the printed circuit board has tracks both sides many solder joints have to be made on both sides of the board; this is tedious but it is essential to make good connections.

The display board and the inverter board for the 25V i.c. supply come as ready made units and this eases the constructor's task enormously. The keyboard is already fitted into the top half of the case and wiring to the main circuit board is simple, though here again solder joints have to be made top and bottom of the board.

HANDLING PRECAUTIONS

The calculator i.c. comes in a piece of protective conductive foam and the handling precautions in the instructions should be carefully followed. A socket is provided for the i.c. so the usual problems of soldering to an m.o.s. integrated circuit are overcome.

Instructions for the insertion of all components are given and these are easy to follow. A circuit diagram

and point-to-point wiring diagram are also supplied. Total construction time for the SUPACAL was three and a half hours in this reviewer's case. Any difficulties will probably be caused by poor soldering and a good light is useful for checking.

The kit suppliers offer a back-up service in the form of a fixed price repair facility and this ensures a fully working calculator no matter how much of a mess you made of the construction. Once the calculator is working then all parts are guaranteed for one year.

CALCULATOR CONSTRUCTION

Now something about the calculator itself. It is housed in a strong plastics case and uses two rechargeable batteries for its power source. A ready built charger is provided with the kit; fully charged batteries give about eight hours working. There is an automatic fade-out facility which switches off the display (which consumes about half the total power) approximately ten seconds after a key has been pressed.

The keyboard uses conductive rubber contacts which give the machine an extremely light touch; in fact the switches are almost too sensitive, some care being needed not to enter a digit unintentionally.

CAPABILITY

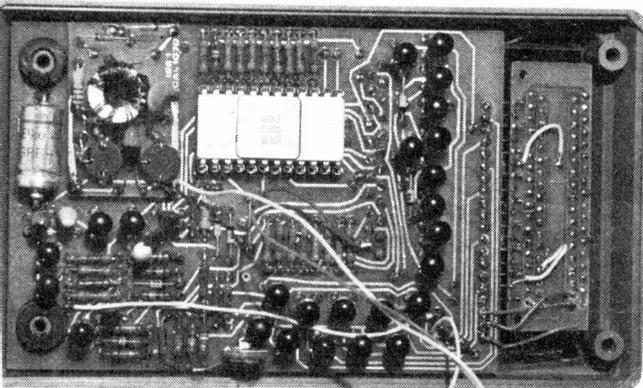
The calculator can handle all four arithmetic operations with all calculations being in floating point, with eight digits being displayed. There is a stored constant facility which, unlike most other calculators, can be used with *all* four functions. Another advantage of this calculator is that it will not overflow. Other calculators will ignore any entries over eight digits long; the SUPACAL stores not only the eight digits entered but also stores an exponent up to 10^{79} ; the true decimal point position is found by dividing by powers of ten until the point appears on the display. This enables more accurate answers to be found.

INSIDE THE POCKET CALCULATOR

How does the pocket calculator work? The "heart" is the second generation single chip MOS LSI circuit type C500 manufactured by General Instruments Microelectronics. It contains within its 4,000 active devices all the logic necessary for performing eight digit, four function plus constant and floating decimal point, calculations.

The chip contains a read-only-memory (ROM) of 2,000 bits, a random-access-memory (RAM) of 100 bits and associated control logic, dividers and timing circuits for clocking and multiplexing. The chip simply requires a 25V supply and a clock input of 50kHz to 100kHz, a keyboard, display, and circuits to drive the display and it becomes a fully operational calculator.

The display interface is by means of discrete buffer/driver transistors for segment and digit driving. The display is multiplexed, i.e. each digit is only driven for one-ninth of the time, there being nine i.e.d. digits with seven segment format.





BY FRANK W. HYDE

SKYLAB EXPERIMENTS

The number of activities that have been planned for the *Skylab* project are extensive. The work periods are 28 days for the first crew and up to 56 days for the next two crews.

In some experiments the astronauts will be used to study the effect of prolonged weightlessness. So far the longest time in the weightless state has been 18 days. This was by three Russian astronauts during the *Soyuz 9* flight.

One of the after effects that became noticeable after the *Soyuz* flight was a curious random stumbling which each astronaut suffered but for varying times. All had returned to normal within three weeks.

As the Russians always operate the "shirt sleeve" mode as it were, the *Skylab* experiments will be comparable though, of course, the available area for movement will be greater.

There will be specific exercises which each member of *Skylab* crew will do. These, together with studies of the changes induced in muscles, bones and the blood chemistry will enable a better assessment to be made of the space-induced effects.

Each man will have a special standardised diet to follow. With a special spring balance designed for zero gravity use, the astronauts will measure and record the mass of food they eat.

The spring balance is a coil spring to which is attached the item to be measured. The oscillation of the spring is measured electronically. The period of the oscillation depends upon the mass and on the known properties of the spring. In a similar way the astronauts will check their body weight using a spring chair.

Other experiments to be carried out are the study of crystal growth

of metals and alloys together with solidification properties by using an electric furnace. One special study will be that of the possibility of producing doped semiconductors of high chemical uniformity. It is thought that in zero gravity the effects of thermal convection in a gravity field will be avoided.

The changes in flammability which have been noticed in short periods of weightlessness in aircraft will also be studied. On many occasions it has been noted that flames tend to go out when the weightless condition has been reached.

EARTH RESOURCES STUDY

Because the orbit of the space station will be inclined by 50° to the equator something like 75 per cent of the earth's surface will be covered and the station will return every five days over a given area. This provides a unique opportunity to study earth resources. Some 132 experiments originating from about 24 countries will be undertaken.

Observations will be made with cameras both in the visible and the infra-red part of the spectrum, together with the microwave sweeps. The moisture in the soil, the vegetation type and its condition will be determined by comparing the photographs from different spectral areas.

The experiments are varied and the chart below gives some details.

These are but a few of the experiments agreed by NASA and there are many more suggestions involving, in some cases, on-board equipment and in others the use of data collected. NASA accepted 19 experiments from the total of 3,400 proposals sifted by the Science Teachers Association.

The results of the first period will undoubtedly influence the later programmes particularly on the effects of weightlessness.

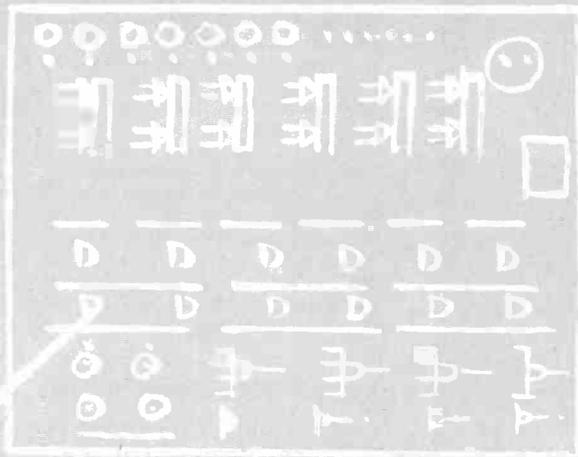
SOLAR OBSERVATION

The experiments involving solar observation are designed to both add to existing data and check the present thinking. Several of the station's telescopes are under automatic control from Earth. This has many advantages since there will be intervals between the change of crews when the station will be unmanned; continuous operation of the selected instruments is important.

The white light coronagraph will measure the brightness of the corona and the polarisation. This will be done at distances varying between 1.5 and 6.0 solar radii from the Sun. The instrument has a number of sizes of occulting discs which are controllable and prevent the direct light from the Sun from reaching the objective lens. The scattered light is reduced to 10⁻¹⁰ of the mean solar radiance.

CHART 1

<i>Experiment</i>	<i>Originator</i>	<i>Observation</i>
Ecological	Joseph Otterman	Identification of land in Israel suitable for wheat and date palms.
Ecological	US Department of Agriculture	Seek infestation areas by pine beetles in South Dakota.
Environment	Japan	Effect of human activities on the environment.
Astronomical	High School Students	Skylab telescopes to look for "cloud moons" thought to be 60° ahead and 60° behind the moon in its orbit.
		Inspection of solar photos for planet between Sun and Mercury.
Biological	High School Students	Radishes grown in weightless conditions to show effect of light and gravity on direction of root and shoot growth.
		Observe spider making web to detect any differences due to gravity.



LOGIC TUTOR

By G. D. Bishop and M. Hughes

To many, the fundamental principles involved in computing are a foreign language. In this article the construction of a comprehensive Logic Tutor is described. Elsewhere in this issue is the first article on using the Tutor providing an introduction to digital logic theory with practical exercises so that at the end of the series a full understanding of computing should be gained.

TUTOR FUNCTIONS

The Logic Tutor is designed to demonstrate the AND, NAND, NOR and OR gates in NAND logic form. Other circuit functions demonstrated are flip-flops, counters and shift registers.

To demonstrate logic theory it is necessary to construct a basic bread board on which exercises can be carried out. This panel can be seen in the photograph with the various symbolic functions marked upon it.

The complete tutor can be made, using entirely bought parts, for about £9. This can, of course, be reduced by judicious shopping.

LOGIC BOARD

In the prototype a 13in × 10in × 4in wooden box was used for housing the Tutor electronics, the logic board forming the lid.

The latter is drilled as in Fig. 1 using a 1.2mm drill for the terminal pin holes. Other holes should be shaped to suit the switches, lamps and digital indicator purchased but at this stage none of these components should be mounted. The logic symbols

COMPONENTS . . .

DISPLAY CIRCUITS

Resistors

R1-R11 100Ω (see text) (11 off)
 R12-R17 1kΩ (6 off)
 R18 47kΩ
 R19-R28 470Ω (10 off)
 All 10% ¼ watt carbon

Transistors

TR1-TR32 BC108 or any 300mW n.p.n. silicon planar switching transistor (32 off)

Lamps

LP1-LP10 Round M.E.S. bulbs 1.5V, 0.2A

Cold cathode tube

V1 Hivac GF2M or Mullard ZM1026

LOGIC CIRCUITS Integrated Circuits

IC1-IC6 945 D.I.L. (6 off)
 IC7-IC10 946 D.I.L. (4 off)
 IC11-IC12 930 D.I.L. (2 off)
 IC13 962 D.I.L.
 IC14 933 D.I.L.
 IC15 945 D.I.L.

Diodes

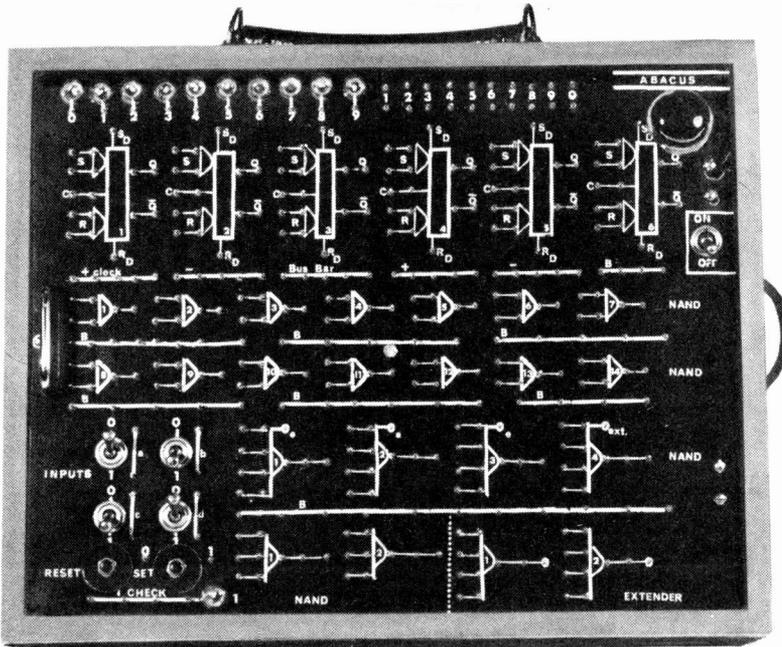
D1-D2 OA91 (2 off)

Capacitors

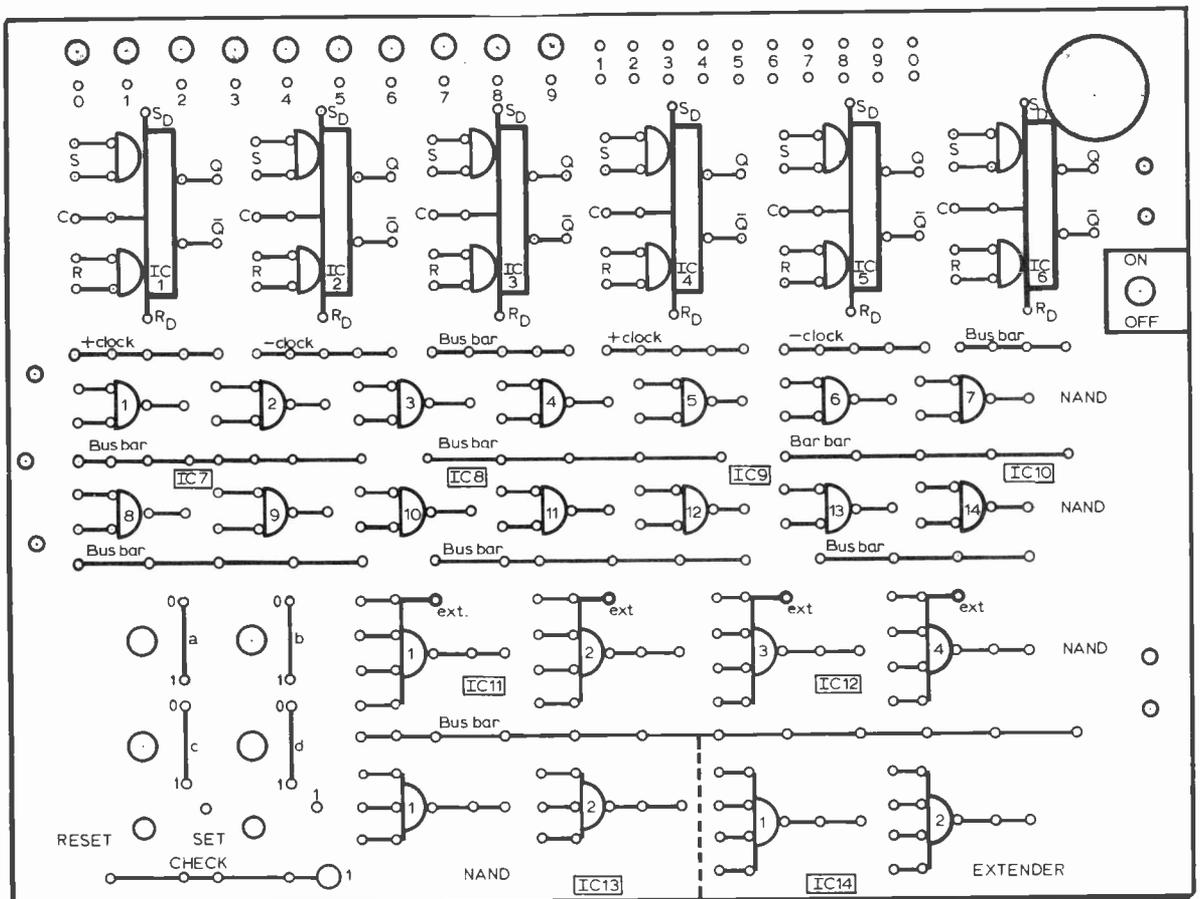
C1-C2 100µF elect. 6V (2 off)

Switches

S1 Mains on/off toggle
 S2-S5 Single pole, changeover toggle (4 off)
 S6-S7 Miniature push button switches
 LP11 Round M.E.S. bulb 1.5V, 0.2A
 D.I.P. Veroboard 6in × 3½in



The completed Logic Tutor showing the front panel layout



All holes shown thus  are to be made to suit components available

Veripins to be interwired under the board as indicated by heavy solid lines

Fig. 1. Layout of logic board showing drillings and symbols

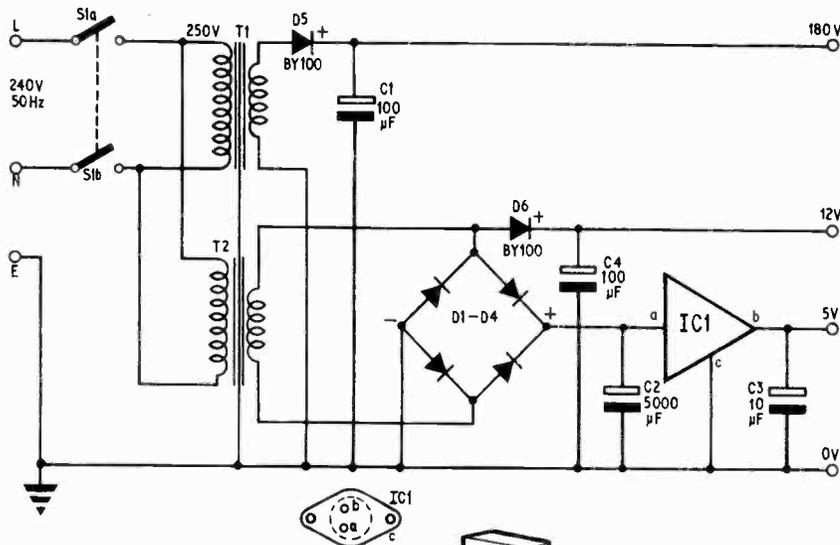
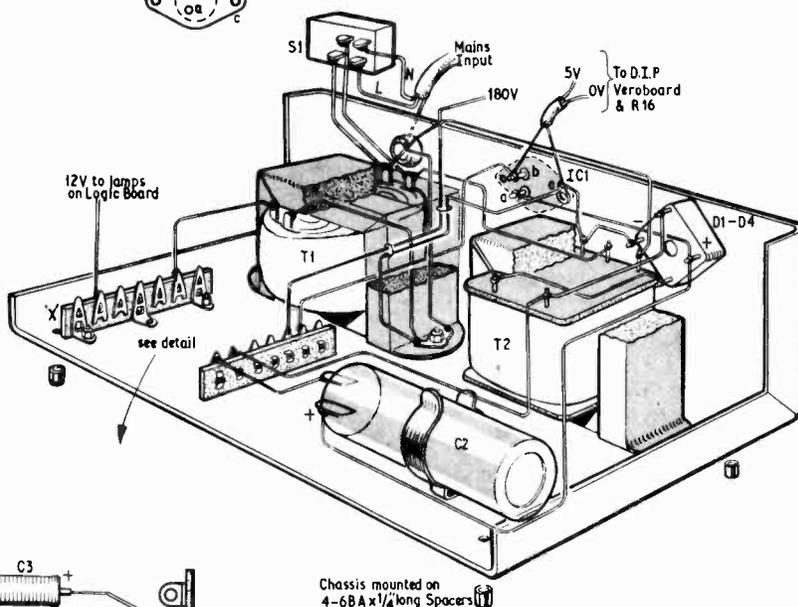


Fig. 2. Circuit diagram of power supply



Chassis mounted on 4-6BA x 1/4 long Spacers

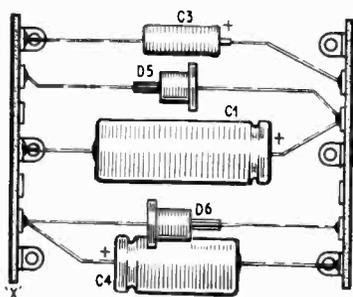


Fig. 3. Component layout and wiring for the power supply unit

COMPONENTS . . .

POWER SUPPLY UNIT

Capacitors

C1 100µF elect. 350V	C3 10µF elect. 15V
C2 5,000µF elect. 15V	C4 100µF elect. 15V

Rectifiers

D1-D4 REC41A Silicon Bridge Rectifier
D5-D6 BY100 (2 off)

Regulator

IC1 5V-600mA monolithic voltage regulator (R.S. type MVR-5V or similar)

Transformers

T1 240V primary; 150V, 10mA secondary
T2 240V primary; 9V, 1A secondary

Miscellaneous

18 s.w.g. aluminium as required, 12 way tag strip, double-sided terminal pins and pick-up tags 1.2mm diameter (R.S. types)

on the board indicate six RS/JK flip-flops, fourteen two-input NAND gates, four four-input NAND gates, two three-input NAND gates and two four-input extenders (AND). Most logic functions can be demonstrated with these.

The logic symbols are marked on the drilled board with paint or Letraset. These should be lacquered for permanent fixing after the double-sided terminal pins are pressed into the 1.2mm holes. These pins have a shoulder to facilitate insertion without risk of pushing the pin right through the board.

POWER SUPPLY

The next item to be tackled is the power supply which feeds the integrated circuits with a stabilised 5 volt, and the output displays.

To observe the logic outputs two alternative displays can be used; lamps to indicate outputs singly or a cold cathode numerical indicator. Although included this item can be dispensed with if costs are to be kept down.

The display supply requirements are 12V for the lamps and 180V for the neon indicator. The circuit diagram in Fig. 2 show how these outputs are derived.

The power supply unit is mounted on an 18 s.w.g. aluminium sub-frame as in Fig. 3, which also gives the interwiring details.

When the wiring is complete the output voltages should be checked with a meter before any loads are connected. If everything is functioning satisfactorily the sub-frame can be screwed to the base of the box.

D.I.P. MOUNTING AND WIRING

The fifteen D.I.P. integrated circuits are mounted on a D.I.P. Veroboard (Fig. 4) in the orientation shown. Pin numberings for the i.c.s are identical as indicated on the key. When the i.c.s are soldered the wire links are added.

The next job is to connect the i.c.s to the logic board. In Fig. 5 the board symbol input and output pins are related directly to the numbered i.c. pins on the Veroboard so that point-to-point wiring can be made. To illustrate this; to wire IC1 to its corresponding logic board symbol, IC1 pins are connected to the underside of the logic board at the corresponding pin numbers (Fig. 5(a)).

Next the two-input NAND gates are wired (IC7-IC10), the four-input (IC11-IC12), the three-input

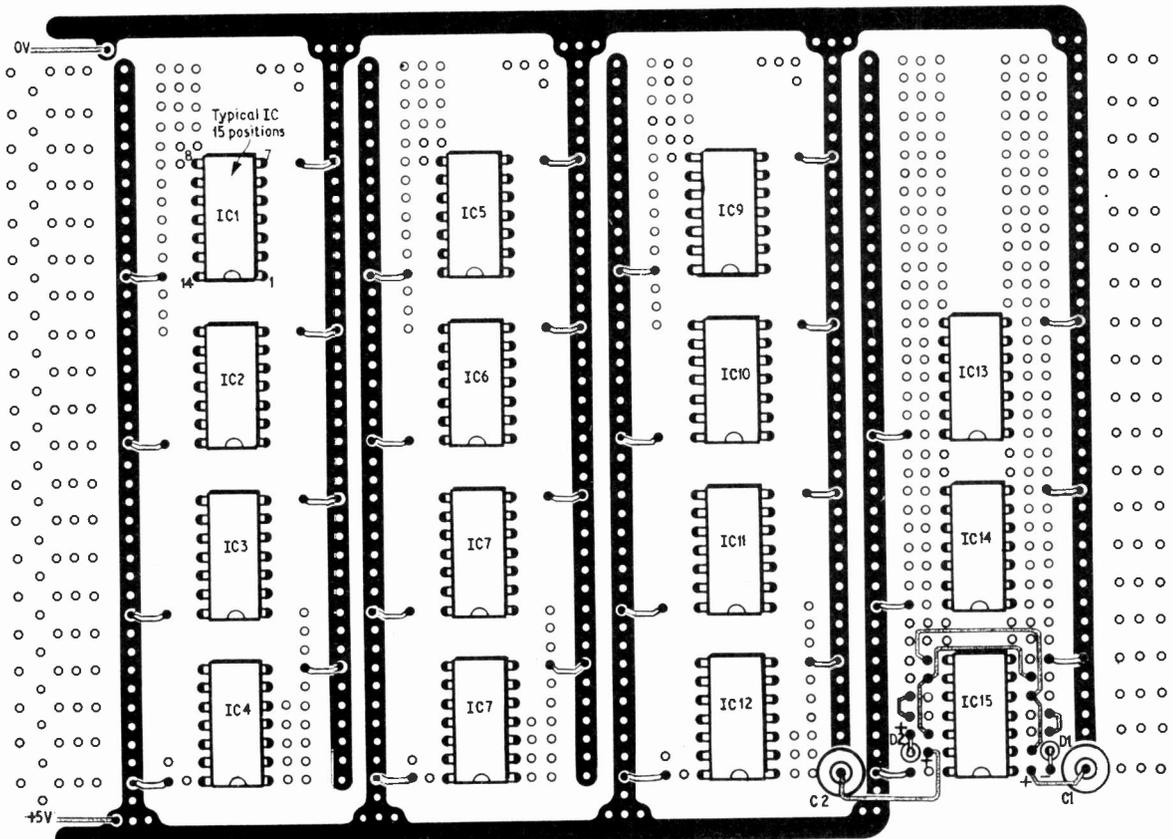


Fig. 4. Wiring and layout of the fifteen D.I.P. integrated circuits on the D.I.P. Veroboard

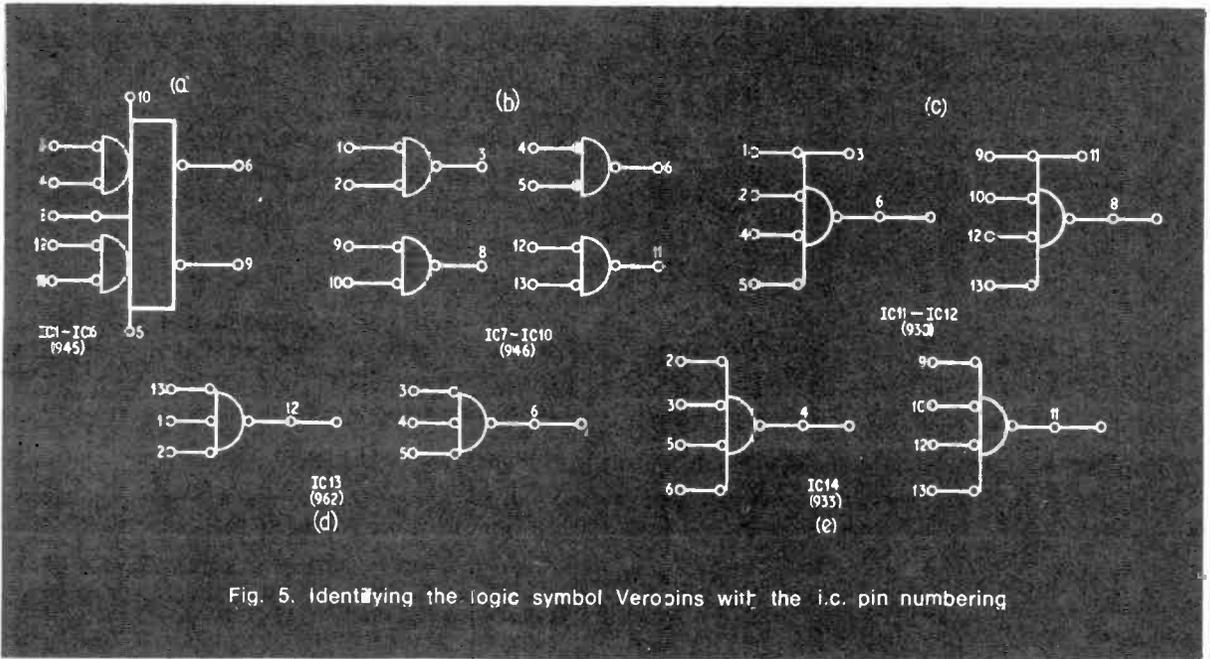


Fig. 5. Identifying the logic symbol Verocins with the i.c. pin numbering

(IC13), and finally the four-input gates (IC14) all being wired according to the relevant gate symbol of Fig. 5. The Veroboard can be fixed finally to the underside of the front panel with nuts, screws and stand off bushes.

LOGIC SWITCHES

Four switches are provided (S2-S5) for logic 0 or 1 inputs to the gates. Here, 0 corresponds to 0 volts and 1 to 5 volts as indicated in Fig. 6. A switch output is taken from either of two Verocins at the switch pole. Wiring for all four switches is given later in Fig. 10.

CLOCK GENERATOR

Most counting circuits can best be demonstrated by applying a clock input of about 2 to 4Hz. This function is provided on the logic board by a 946 i.c. connected as a free running multivibrator (Fig. 7). The timing elements include two 100µF capacitors.

Two outputs are available from this circuit, positive and negative square wave clock pulses. The pins for these are adjacent to the JK flip-flops (Fig. 1). It should be noted that the adjacent "bus-bars" alternatively marked "B" are earth returns to complete signal paths when patching leads. Wiring for the clock generator IC15 is included in Fig. 4.

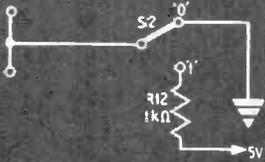


Fig. 6. Input switch circuit

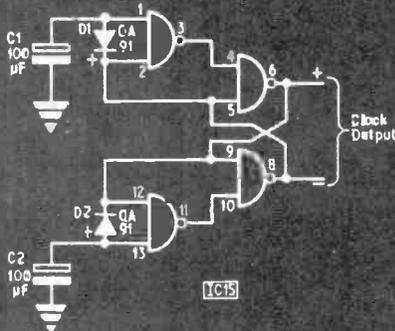


Fig. 7. Circuit diagram of the clock generator

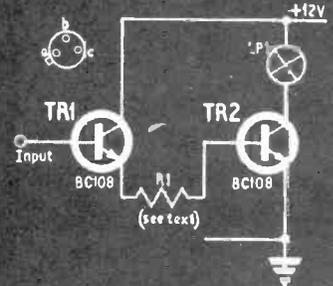


Fig. 8. Lamp driver circuit:

SUPERSOUND 13 HI-FI MONO AMPLIFIER

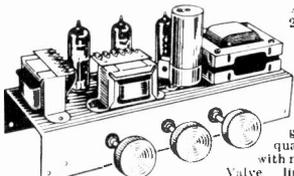


A superb solid state audio amplifier. Brand new components throughout, 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13W r.m.s. into 8 ohm. Frequency response 12Hz-30KHz \pm 3db. Fully integrated pre-amplifier stage with separate Volume, Bass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

PRICE £10-50

P. & P. 25p.

DE LUXE STEREO AMPLIFIER



A.c. mains 200-240 volts. Using heavy duty fully isolated mains transformer with and rectifier. Separate Bass, Treble and Volume controls. Full wave rectification giving adequate smoothing with negligible hum. Valve line up: -2> ECL82, Triode Pentodes.

1> E280 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate "balance" control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11in. x 4in. x. Overall height including valves 5in. Ready built and tested to a high standard. **Price £8-92.** P. & P. 45p.

NEW! POWER SUPPLY UNIT

200-240V A.C. input. Four switched fully smoothed D.C. outputs giving 6V and 7V and 9V and 12V at 1 amp continuous (14 amp intermittent). Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case, overall size 6" x 3 1/2" x 2 1/2". Suitable for Transistor Radios, Tape Recorders, Amplifiers, etc., etc. Ready built and tested.

PRICE £4-50

P. & P. 35p.

BLACK ANODISED 16g. ALUMINIUM HEAT SINKS. For TO3, complete with mica's and bushes. Size 2 1/2in x 3in approx. 25p pair. P. & P. 5p.

HIGH GRADE COPPER LAMINATE BOARDS. 8" x 6", 5 for 50p. P. & P. 13p.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0-210-240V. Secondary combinations: 0-5-10-15-20-25-30-35-40-60V half wave at 1 amp or 10-0-10, 20-0-20, 30-0-30V, at 2 amps full wave. Size 3inL, 3 1/2inW x 3inD. Price £1-85. P. & P. 30p.

BRITISH MADE SOLID STATE ALL SILICON STEREO AMPLIFIER. 15 watts rms per channel output. Freq. res. 20Hz to 20KHz. Suitable for magnetic or ceramic pickup tape mic., etc., built-in switchable scratch filter, rumble filter and loudness control. 60 m/m slider controls for base, treble and volume. 10 m/m push button function, selector switch. This amplifier has specification and performance usually only found in amplifiers costing twice as much. Each amplifier supplied, tested and fully guaranteed. Finish in the most attractive contemporary style teak cabinet. Size 16 1/2in. x 9 1/2in. x 4 1/2in. Makers' recommended price £42-15. Our price (while stocks last) £32-50 plus 70p p. & p. plus V.A.T. Send S.A.E. for full details of specification.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER. For P.U. Tape, Mike, Guitar, etc., and suitable for use with valve or transistor equipment. 9-18V. Battery or from H.T. line 200/300V. Frequency response 15Hz-25KHz. Gain 26dB. Solid encapsulation size 1 1/2 x 1 1/2in. Brand new - complete with instructions. Price 88p. P. & P. 13p.

HANDBOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES

A must for servicemen and home constructors. Including many 1000's of British, U.S.A., European and Japanese transistors. ONLY 40p. Post 5p.

V.A.T. Prices in this advertisement (incl. P. & P.) will be subject to V.A.T. as from 1st April, 1973.

4-SPEED RECORD PLAYER BARGAINS
Mains models. All brand new in maker's packing. **LATEST B.S.R. C109/C120 4-SPEED AUTOCHANGER.** With latest mono compatible cartridge £26-97. Carr. 50p. With stereo cartridge £27-97. Carr. 50p.
Garrard SP25 Mk. III with heavy precision machined die cast turntable. £10-95. Carr. 50p.

SPECIAL BARGAIN OFFER! PRECISION ENGINEERED PLINTHS

Beautifully constructed in heavy gauge "Colorcoat" plastic coated steel. Resonance free. Designed to take Garrard 1025, 2000, 2025CT, 2500, 3000, 3500, 5100, SP25 II and III, EL65B, AT60, etc., or B.S.R. C109, C129, A21, etc. Black leatherette finish. Size 12 1/2in x 14 1/2in x 3 1/2in high (approx. 7 1/2in high, including rigid smoked acrylic cover). **NOW ONLY £4-50**
P. & P. 35p.

LATEST ACOS GP91/18C Mono Compatible Cartridge with T/O stylus for LP/EP/78. Universal mounting bracket. £1-50. P. & P. 8p.

SONOTONE STAMC COMPATIBLE STEREO CARTRIDGE T/O stylus. Diamond Stereo LP and Sapphire 78. ONLY £2-50. P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £3. P. & P. 10p.

LATEST RONETTE T/O Stereo Compatible Cartridge for EP/LP/Stereo/78. £1-63. P. & P. 10p.

LATEST RONETTE T/O Mono Compatible Cartridge for EP/LP/78 mono or stereo records on mono equipment. £1-50. P. & P. 10p.

QUALITY RECORD PLAYER AMPLIFIER MK II

A top-quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84 and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. w. x 3d. x 6h. Ready built and tested. **PRICE £3-95.** P. & P. 40p. **ALSO AVAILABLE** mounted on board with output transformer and speaker ready to fit cabinet below. **PRICE £5-25.** P. & P. 50p.

SPECIAL OFFER!! HI-FI LOUSPEAKER SYSTEM

Beautifully finished teak finish enclosure with most attractive Tyan-Vnair front. Size 16in high x 10 1/2in wide x 6in deep. Fitted with E.M.I. Ceramic Magnet 13in x 8in bass unit, two H.F. tweeter units and crossover. Max. power handling 10W. Available 3, 8 or 15 ohm impedance.

Our Price £8-40

Carr. 65p.
CABINET AVAILABLE SEPARATELY £4-50. Carr. 60p.
Also available in 8 ohm with EMI 13in x 8in. bass speaker with parasitic tweeter. £6-50. Carr. 65p.

LOUSPEAKER BARGAINS

5in 3 ohm £1-05. P. & P. 15p. 7 x 4in 3 ohm £1-15. P. & P. 20p. 10 x 6in 3 or 15 ohm £1-80. P. & P. 30p. E.M.I. 8 x 5in 3 ohm with high flux magnet £1-92. P. & P. 20p. E.M.I. 13in x 8in with high flux ceramic magnet with parasitic tweeter 3, 8, or 15 ohm £3-20. P. & P. 30p. E.M.I. 13 x 8in. 3 or 8 or 15 ohm with two inbuilt tweeters and crossover network £4-20. P. & P. 30p.
EMI CERAMIC MAGNET HEAVY DUTY TWEETER. Approx. 3 1/2in. Available 3 or 8 or 15 ohms. £1-25 plus 15p p. & p.

BRAND NEW. 11in 15w H/D Speakers, 3 or 15 ohm. Current production of well known British maker. Now with Hihux ceramic ferrohar magnet assembly £8-75. Guitar models: 25w £8-75. 35w £8-50. P. & P. 38p each.



SPECIAL OFFER!

LIMITED NUMBER OF BRAND NEW ELAC 10" TWIN CONE LOUSPEAKERS. With large ceramic magnet and plasticised cone surround. 8 ohm impedance. £2-75. P. & P. 25p.

12in "RA" TWIN CONE LOUSPEAKER 10 watts peak handling, 3, 8 or 15 ohm, £2-20. P. & P. 30p.
35 ohm SPEAKERS 3" ONLY 83p. P. & P. 13p.
"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER Size 1 1/2in x 1 1/2in x 1 1/2in deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz-20KHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details. Only £5-95 each. P. & P. 25p.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Usually £1-75 yd., our price 75p yd. length. P. & P. 15p per yd. (min. 1 yd.). S.A.E. for samples.

HI-FI STEREO HEADPHONES

Adjustable headband with comfortable foam ear-muffs. Wired and fitted with standard stereo 3 1/2in jack plug. Frequency response 30-15,000Hz. Matching impedance 8-16 ohms. Easily converted for mono. **PRICE £2-95.** P. & P. 15p.

HIGH IMPEDANCE CRYSTAL STICK MIKES. OUR **PRICE £1-05.** P. & P. 8p.

CENTRE ZERO MINIATURE MOVING COIL METER. 100uA for balance or tuning. Approx. size 1in x 1 1/2in. Limited number 75p. P. & P. 10p.

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



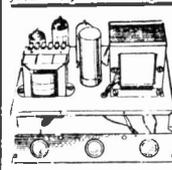
NEW FURTHER IMPROVED MODEL WITH HIGHER OUTPUT AND INCORPORATING HIGH QUALITY READY DRILLED FIBRE GLASS PRINTED CIRCUIT BOARD WITH COMPONENT IDENTIFICATION CLEARLY MARKED FOR EVEN EASIER CONSTRUCTION

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

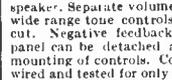
Fully detailed 7-page construction manual and parts list free with kit or send 18p plus large S.A.E. **PRICES AMPLIFIER KIT, £10-50** P. & P. 15p. (Magnetic input components 30p extra) **POWER PACK KIT, £3** P. & P. 30p. **CABINET, £3** P. & P. 30p.

(Post Free if all units purchased at same time). Full after sales service. Also available ready built and tested, £20-50. Post Free.

Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi-Fi Discotheque use, etc.



3-VALVE AUDIO AMPLIFIER HA34 MK II Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7in w. x 4in. d. x 4 1/2in h. Incorporates ECC83, EL84, E280 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only **£4-95.** P. & P. 35p.

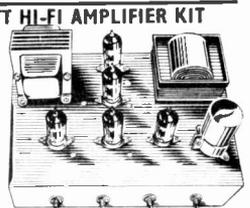


HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. £4-10. P. & P. 40p.

HARVERSON'S SUPER MONO AMPLIFIER
A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx 3.5 watts. Volume and tone controls. Chassis size only 7in. wide x 3in. deep x 6in. high overall. A.C. mains 200/240V. Supplied absolutely Brand New, completely wired and tested with good quality output transformer.

OUR ROCK BOTTOM BARGAIN PRICE £2-95 P. & P. 35p

10'14 WATT HI-FI AMPLIFIER KIT
A stylishly finished inonaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 5-15 Ω speaker and 2 independent volume controls and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and E280 rectifier. Simple instruction booklet 13p (Free with parts). All parts sold separately. ONLY £7-97. P. & P. 55p. Also available ready built and tested £10-97. P. & P. 60p.



PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

Open 9-5.30 Monday - to Saturday
Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station

HARVERSON SURPLUS CO. LTD.

Dept. PE, 170 High St., Merton, London, S.W.19 Tel. 01-540 3985

SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

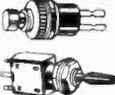
MAIL ORDERS: Some items have a postage and handling charge shown against them. Where p. & p. is not shown the charge is 13p for any selection. When both classes of goods are ordered the charge is 13p plus any p. & p. charges shown. (Overseas extra). Telephone 01-692 4412.

GARLAND BROS. LTD.

DEPTFORD BROADWAY, LONDON, SE8 4QN

SWITCHES

Standard toggle switches:
SW20—S.P.S.T. 20p; SW21—D.P.D.T. 25p.
Miniature toggle switches:
SW18—S.P.S.T. 51p; SW19—D.P.D.T. 64p.
Slider switches, SW3—D.P.D.T. 15p.
Wafer switches (rotary)—26p each
SW4—1 pole, 12 way
SW5—2 pole, 6 way
SW6—3 pole, 4 way
SW7—4 pole, 2 way
SW8—4 pole, 3 way.



PLINTH

to suit Garrard 2025, SP25 etc. Teak finish, complete with Perspex cover. Very attractive appearance.
£3 95 plus 55p p. & p.



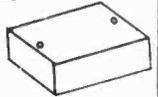
J-BEAM FM4S AERIAL

4 element, all channel aerial for stereo radio. £6 10 plus 50p p. & p.



PLASTIC BOXES

for constructional projects. White, with lid and screws.
BP1 4 1/2ins x 3 1/2ins x 1 1/2ins—37p.
BP2 6ins x 4ins x 2 1/2ins—37p.



EQUIPMENT CASES

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



ALUMINIUM BOXES

with lids and screws
Type L. W. D. Price p. & p.
GB7 5 1/2in 2 1/2in 1 1/2in 42p 16p
GB8 4in 4in 1 1/2in 42p 16p
GB9 4in 2 1/2in 1 1/2in 42p 14p
GB10 5 1/2in 4in 1 1/2in 49p 19p
GB11 4in 2 1/2in 2in 42p 14p
GB12 3in 2in 1in 36p 15p
GB13 6in 4in 2in 57p 20p
GB14 7in 5in 2 1/2in 69p 21p
GB15 8in 6in 3in 89p 29p
GB16 10in 7in 3in £1 00 29p



* These sizes fit standard veroboards

MINIATURE SPEAKERS



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

GROOV-KLEEN

de luxe model £2 11 83



V.A.T.

Prices in this advertisement include V.A.T.

STEREO HEADPHONES

Eagle SES. 8Ω
40-16,000Hz
Complete with cable and stereo jack plug.
£3 43 Plus 24p p. & p.



10 WATT AMPLIFIER module

Input: 30mV into 10kΩ for 100V
40 - 16,000 Hz.
Output: 3-8-16Ω
Power Supply 12V
£4 70 plus 24p p. & p.



BATTERY HOLDERS

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



CONSOLE CASES

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

Type	W.	A	B	C	D	Price p. & p.
	in	in	in	in	in	
GB20	8	9	3 1/2	2	3	£1 56 33p
GB21	10	9	3 1/2	2	3	£1 74 33p
GB22	12	9	3 1/2	2	3	£1 89 33p



DYNAMIC MICROPHONE UD130HL

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



£6 60 plus 24p p. & p.

MICROPHONE FLOOR STAND

Professional, heavy quality with folding tripod base. Telescopic stem extends to 59ins. Chrome finish.
£6 20 plus 45p p. & p.



MICROPHONE HOLDER

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

TAPE ERASER

erases a whole reel of tape in seconds. 240V. A.C. Full instructions.
£2 20 plus 22p p. & p.



CATALOGUE

15p
POST FREE

SCREENED CABLES

Single for mics, audio leads, etc. 5 1/2p yd. Twin, as above, common screen 10p yd. Stereo, two cores, individually screened 11p yd. Four core with common screen 23p yd. Four core, individually screened 30p yd. Coiled screened leads, 20 feet long £1 05 each.

PLUGS

Car aerial 15p
Co-axial 10p
D.I.N. 2 pin (speaker) 11p
D.I.N. 3 pin 15p
D.I.N. 4 pin 15p
D.I.N. 5 pin, 180° 14 1/2p
D.I.N. 5 pin, 240° 16 1/2p
D.I.N. 6 pin 14 1/2p
Jack, 2 1/2mm unscreened 10p
Jack, 2 1/2mm screened 11p
Jack, 3 1/2mm unscreened 9p
Jack, 3 1/2mm screened 13p
Jack, 1/2in unscreened 13p
Jack, 1/2in screened 22p
Jack, stereo, unscreened 38p
Jack, stereo, screened 38p
Phono, plastic top 5p
Phono, plated metal 13p
Wander, red or black 3 1/2p
Banana 4mm, red or black 6 1/2p



SOCKETS

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

MINIATURE ELECTROLYTICS

1 00μF 63V 7p	150μF 25V 8p
1 5μF 63V 7p	150μF 40V 13p
2 2μF 63V 7p	150μF 63V 15p
3 3μF 63V 7p	220μF 4V 7p
4 7μF 63V 7p	220μF 10V 7p
6 8μF 40V 7p	220μF 16V 8p
6 8μF 63V 7p	220μF 25V 13p
10μF 25V 7p	220μF 40V 15p
10μF 63V 7p	220μF 63V 22p
15μF 16V 7p	330μF 4V 7p
15μF 40V 7p	330μF 10V 8p
15μF 63V 7p	330μF 16V 13p
22μF 10V 7p	330μF 63V 26p
22μF 25V 7p	470μF 6 3V 8p
22μF 63V 7p	470μF 10V 13p
33μF 16V 7p	470μF 25V 15p
33μF 40V 7p	470μF 40V 22p
33μF 63V 7p	680μF 6 3V 13p
47μF 4V 7p	680μF 16V 15p
47μF 10V 7p	680μF 25V 22p
47μF 25V 7p	680μF 40V 26p
47μF 40V 7p	1000μF 4V 13p
47μF 63V 8p	1000μF 10V 15p
68μF 6 3V 7p	1000μF 16V 22p
68μF 16V 7p	1000μF 25V 26p
68μF 63V 13p	1500μF 6 3V 15p
100μF 10V 7p	1500μF 10V 22p
100μF 25V 7p	1500μF 16V 26p
100μF 40V 8p	2200μF 6 3V 22p
100μF 63V 15p	2200μF 10V 26p
150μF 6 3V 15p	3300μF 6 3V 26p
150μF 16V 7p	4700μF 4V 26p

TRANSFORMERS

all with 0-250 Volt primaries.

Miniature
MM6 6V, 500mA+6V, 500mA.
MM12 12V, 250mA+12V, 250mA.
MM20 20V, 150mA+20V, 150mA.
£1 42 plus 14p p. & p.
L.T.
LT1 6-3V, 1-5A—82p plus 20p p. & p.
LT2 6-3V, 3A—96p plus 28p p. & p.
LT3 12V, 1-5A—96p plus 28p p. & p.
LT4 12V, 3A—£1 45 plus 33p p. & p.
LT5 9-0-9V, 0-5A—83p plus 23p p. & p.
LT6 12-0-12V, 1A—£1 04 plus 29p p. & p.
Multi-tapped
MT30/2 0-12-15-20-24-30V, 2A—£2 15 plus 33p p. & p.
MT60/1 0-5-20-30-40-60V, 1A—£2 31 plus 33p p. & p.
MT60/2 0-5-20-30-40-60V, 2A—£3 25 plus 37p p. & p.
Charger
CT/01 1A—£1 16 plus 28p p. & p.
CT/02 2A—£1 43 plus 33p p. & p.
CT/03 4A—£1 76 plus 33p p. & p.
Secondaries 0-5-11-17V.
Speaker Matching 3-8-16Ω
Example: 16Ω speaker to 8Ω amplifier.
99p plus 22p p. & p.

VEROBOARD

Size	0-1 Matrix	0-15 Matrix
2 1/2in x 3 1/2in	25p	18 1/2p
2 1/2in x 5in	28p	28 1/2p
3 1/2in x 3 1/2in	28 1/2p	28 1/2p
3 1/2in x 5in	32p	35p
1 7/8in x 2 1/2in	87p	66p
1 7/8in x 3 1/2in	£1 18	94p

Spot face cutter—44p
Pins, either size, pack of 36—21p
Edge connectors:
24 way, 0-1—37 1/2p 36 way, 0-1—48 1/2p
24 way, 0-15—37 1/2p 16 way, 0-15—25p

BONDED ACRYLIC FIBRE

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

CONTROLS

Log. or Lin.
Single, less switch, 15p
Single, D.P. switch, 26p
Tandem, less switch, 44p
5kΩ, 10kΩ, 25kΩ, 50kΩ, 100kΩ, 250kΩ, 500kΩ, 1MΩ, 2MΩ

BATTERY ELIMINATORS

suitable for transistor radios and similar light current equipment; input 240V, A.C.
Output: PP6—6V D.C.; PP9—9V D.C.
Price £1 65 plus 15p p. & p.

CASSETTE OWNERS!

For Philips and similar cassette recorders. PU12 power unit for connection to 12V + or - E cars, giving 7 1/2V stabilised output—£3 55+16p p. & p.
PP75 mains power supply, output 7 1/2V D.C.—£3 15+16p p. & p.
Both units are complete with cables and 5 pin D.I.N. plug.

CASSETTE MICROPHONE

Low impedance dynamic with remote control switch. Fitted 2 1/2mm and 3 1/2mm plugs. £2 20 plus 15p p. & p.

ELECTROLYTICS

1μF 450V 21p	1000μF 50V 46p
2μF 450V 22p	2000μF 25V 43p
4μF 450V 15 1/2p	2000μF 50V 58p
8μF 450V 18 1/2p	2500μF 25V 50p
16μF 450V 20p	2500μF 50V 66p
25μF 25V 7 1/2p	3000μF 25V 53p
25μF 50V 11p	5000μF 25V 66p
32μF 450V 10p	5000μF 50V £1 21
50μF 50V 11p	8-8μF 450V 20p
100μF 50V 12p	8-16μF 450V 22p
250μF 25V 15 1/2p	16-16μF 450V 30p
250μF 50V 19p	16-32μF 450V 69p
500μF 25V 20p	32-32μF 450V 54p
500μF 50V 27 1/2p	50-50μF 350V 42p
1000μF 25V 30p	

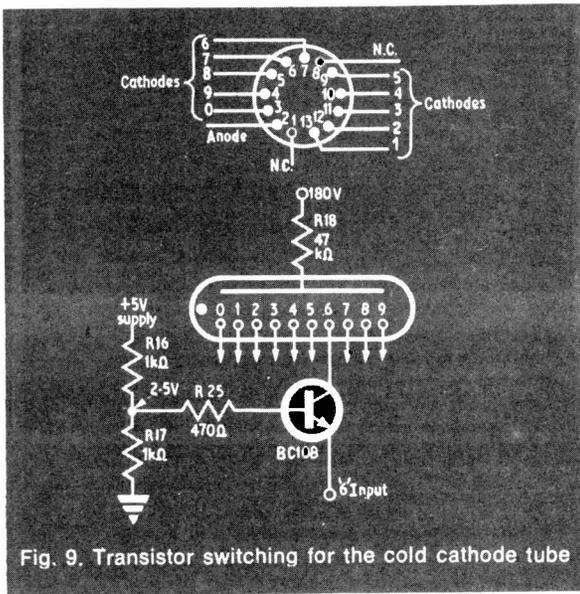


Fig. 9. Transistor switching for the cold cathode tube

WIRING THE INDICATORS

If the lamp bulbs are screw types these can be screwed into the holes provided. The cold cathode tube should be a press fit and glued finally into position.

The lamp driving circuits consist of two transistors and a resistor (Fig. 8) with the inputs connected to adjacent Veropins (0-9). The value of the series resistor may have to be tailored so that the appropriate lamp gives the required light output. The limits to be expected here are 27 ohms to 220 ohms. All drive circuitry is mounted close to each lamp base.

Each cathode of the indicator tube is switched by a transistor (Fig. 9) the emitter of each being connected to board Veropins numbered 1-0. A wiring detail of the transistor drive circuits indicators and switches is given in Fig. 10.

DISPLAY CHECKS

Connections to the indicator tube can be made with the same tags as used for terminating the patching leads, this saves the cost of a special valve base. For a rigid transistor assembly the supply lines and earth returns should be of stiff copper wire.

The first test is with the indicator which should glow as soon as its 180V supply is connected. All the numbers will glow until a particular cathode is grounded when all the current passes via one number which cancels off the others.

If this test is satisfactory connect the 5V supply to the panel and check that the indicator lamps light when the logic inputs are applied to their terminals, remembering that "off" corresponds to 0 and "on" corresponds to 1.

PATCHING LEADS

Some leads can now be terminated with tags for patching exercises. These should be of 12in, 8in, 4in and 2in lengths. More short leads will be required than long leads and it facilitates easy location of a particular length if the lengths are of one given colour.

The Logic Tutor should now be functioning and simple exercises can be performed to get the feel of the instrument. See page 438. ★

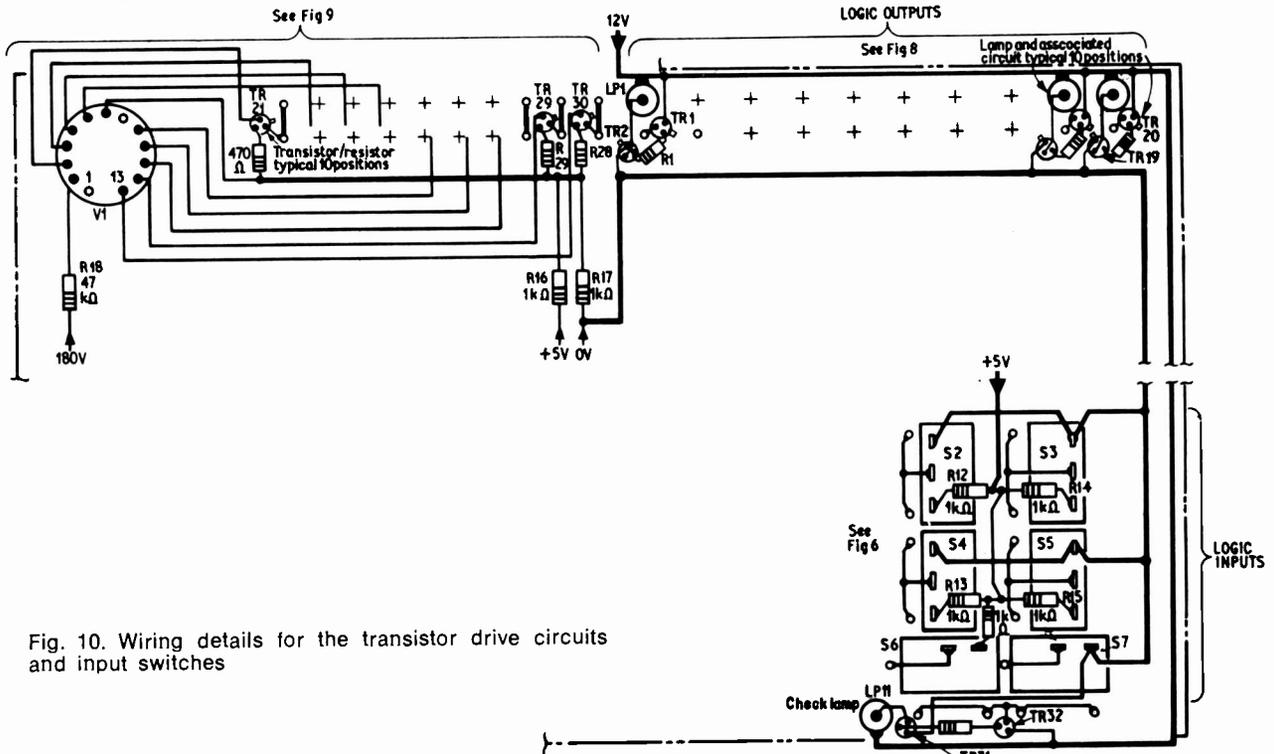
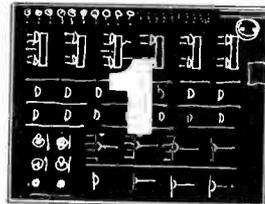


Fig. 10. Wiring details for the transistor drive circuits and input switches

LOGIC TUTOR EXPERIMENTS..



AND and OR GATES

IN DIGITAL LOGIC there are two states, these are low and high or off and on states. In positive logic, which is the type used in the Logic Tutor, the off or low state is 0V and the on or high state 5V. These two conditions we also know as logical 0 and logical 1 respectively.

The simplest gate which allows or stops a 0 or 1 input is the AND gate formed by an arrangement of diodes as in Fig. 1.1.

TRUTH TABLES

If there is no connection to either input the output will rise to 5V since no current flows through the resistor but if either input is grounded current flows to ground thereby reducing the output to zero volts.

This is logically expressed in logic truth tables and the output sequence is expressed as A.B which is the Boolean Algebra way of representing A AND B. So in the circuit both A AND B must be 1 in order that the output is 1.

PROVING IT

To electrically check the truth table connect the four logic input switches to the inputs of EXTENDER 1 and the output

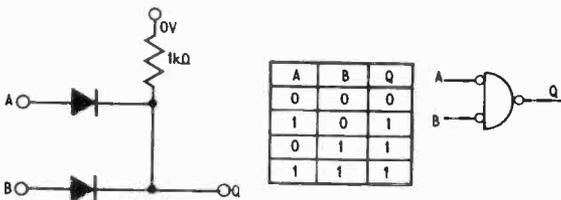


Fig. 1.1. AND gate and truth table

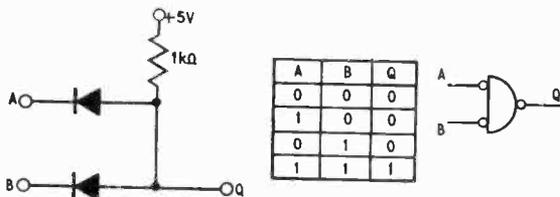


Fig. 1.2. OR gate and truth table

of this to the CHECK lamp. Operating the switches will show that the lamp lights only when all inputs are logical 1.

OR GATE

If the diodes of the AND gate are reversed and the supply is changed to 0V an OR gate is formed as in Fig. 1.2. In this gate the output is always 1 if any input is 1, that is, the diodes will conduct if the input goes to 5V but the output return to zero if no input is connected or the inputs are grounded.

It is not possible to demonstrate an OR gate on the tutor since it is seldom used on its own.

The OR function is normally expressed as a combination of NAND functions known as a wired OR functions which will be demonstrated in a later exercise. The OR function is written as A OR B; symbolically this is $A + B$.

by M. Hughes

POINTS ARISING

HI FI TAPE LINK (March, April 1973)

In Components List, Page 213, R121, 220Ω was omitted. In Fig. 6 page 328, R13 adjacent to C12 should be R12. TR9 and TR109 base diagram, drain and gate connections reversed. On underside wiring collector of TR103 should go directly to R102 not via point marked TO SK2 PIN. In Table 3 TR10 collector voltage is dependent on VR5. First paragraph page 332 should read "collectors of TR10 and TR110 is 12 volts".

P.E. SYNTHESISER

See note on page 427

P.E. TRIFFID I.C. RADIO (February 1973)

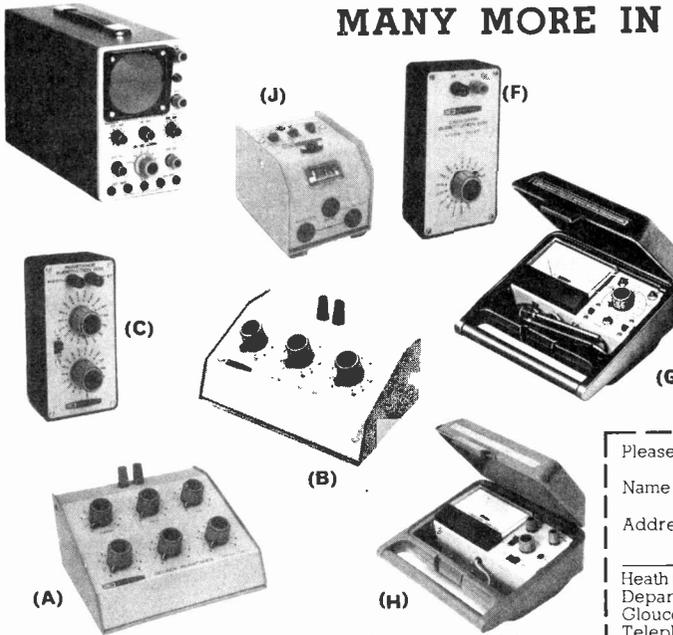
R7 should be 4.7kΩ not 10kΩ as specified. R17 should be 10Ω not 10kΩ as in the components list. High gain transistors *must* be used for TR2 and TR3. Fig. 7. Transistor TR4 should read c.b.e. not as shown.

A.F. SIGNAL GENERATOR (November 1972)

VR2 should be 10kΩ not 1kΩ as shown in Fig. 1 and components list. In Fig. 3 C5 and C7 to S1 have been reversed, i.e. C5 should be where C7 is shown.

10 Action Packed Instrument kits from Heath

MANY MORE IN THE LATEST CATALOGUE



- (A) Decade Resistance Box, K/IN-17.
- (B) Decade Capacitor Box, K/IN-27.
- (C) Resistance Sub Box, K/IN-37.
- (D) Service Scope, K/OS-2.
- (E) Popular VVM, K/IM-18D (Not illustrated).
- (F) Capacitor Sub Box, K/IN-47.
- (G) Solid-state VVM, K/IM-17U.
- (H) Transistor Tester, K/IT-18.
- (I) RF Signal Generator, K/RF-1U (Not illustrated).
- (J) Transistor/Diode Checker, K/IT-27.

Many other instruments/Hi-Fi kits in wide range.

Please send me the FREE Heathkit catalogue

Name

Address

Heath (Gloucester) Limited
 Department PE/5/73
 Gloucester GL2 6EE
 Telephone 0452 29451



Continuous Credit and No-Deposit Terms available

Ever had Component Problems?

1. Problems of choosing your components?
2. Problems of getting them quickly?
3. Problems of locating a supplier?



HOME RADIO (COMPONENTS) LTD have created a catalogue and an organisation that between them solve your problems simply & economically

PUT US TO THE TEST

FIRST YOU'LL NEED THE CATALOGUE.
 SEND COUPON with 75p CHEQUE or P.O.
 YOU'LL NEVER SPEND 15 BOB BETTER!

The price of 75p applies only to catalogues purchased by customers in the UK and to BFPO addresses.

Please write your Name and Address in block capitals

Name

Address



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

Henry's

YOUR COMPLETE AUDIO-ELECTRONIC STORES

More of everything at the right price. All your electronic requirements within 200 yards - call and see for yourself.

INTEGRATED CIRCUITS

Why buy alternatives when you can buy the genuine article from us at competitive prices from stock. **BRANDED FROM TEXAS I.T.T. FAIR-CHILD**

Type	1/11	12/24	25/99	Type	1/11	12/24	25/99	Type	1/11	12/24	25/99
SN7400	0.20	0.18	0.16	SN7450	0.20	0.18	0.16	SN74145	1.50	1.40	1.30
SN7401	0.20	0.18	0.16	SN7451	0.20	0.18	0.16	SN74150	8.35	8.05	8.15
SN7402	0.20	0.18	0.16	SN7452	0.20	0.18	0.16	SN74151	1.10	0.95	0.90
SN7403	0.20	0.18	0.16	SN7453	0.20	0.18	0.16	SN74152	1.35	1.27	1.20
SN7404	0.20	0.18	0.16	SN7454	0.20	0.18	0.16	SN74153	2.00	1.75	1.55
SN7405	0.20	0.18	0.16	SN7455	0.20	0.18	0.16	SN74154	1.55	1.47	1.35
SN7406	0.20	0.18	0.16	SN7456	0.20	0.18	0.16	SN74155	1.55	1.47	1.35
SN7407	0.20	0.18	0.16	SN7457	0.20	0.18	0.16	SN74156	1.80	1.70	1.50
SN7408	0.20	0.18	0.16	SN7458	0.20	0.18	0.16	SN74157	2.60	2.40	2.25
SN7409	0.20	0.18	0.16	SN7459	0.20	0.18	0.16	SN74158	2.60	2.40	2.25
SN7410	0.20	0.18	0.16	SN7460	0.20	0.18	0.16	SN74159	2.60	2.40	2.25
SN7411	0.28	0.22	0.20	SN7461	0.20	0.18	0.16	SN74160	3.40	3.25	3.10
SN7412	0.42	0.40	0.35	SN7462	0.20	0.18	0.16	SN74161	4.00	3.50	3.00
SN7413	0.30	0.27	0.25	SN7463	0.20	0.18	0.16	SN74162	4.00	3.50	3.00
SN7414	0.30	0.27	0.25	SN7464	0.20	0.18	0.16	SN74163	4.00	3.50	3.00
SN7415	0.30	0.27	0.25	SN7465	0.20	0.18	0.16	SN74164	4.00	3.50	3.00
SN7416	0.30	0.27	0.25	SN7466	0.20	0.18	0.16	SN74165	4.00	3.50	3.00
SN7417	0.30	0.27	0.25	SN7467	0.20	0.18	0.16	SN74166	4.00	3.50	3.00
SN7418	0.30	0.27	0.25	SN7468	0.20	0.18	0.16	SN74167	4.00	3.50	3.00
SN7419	0.30	0.27	0.25	SN7469	0.20	0.18	0.16	SN74168	4.00	3.50	3.00
SN7420	0.45	0.43	0.35	SN7470	0.20	0.18	0.16	SN74169	4.00	3.50	3.00
SN7421	0.45	0.43	0.35	SN7471	0.20	0.18	0.16	SN74170	4.00	3.50	3.00
SN7422	0.45	0.43	0.35	SN7472	0.20	0.18	0.16	SN74171	4.00	3.50	3.00
SN7423	0.45	0.43	0.35	SN7473	0.20	0.18	0.16	SN74172	4.00	3.50	3.00
SN7424	0.45	0.43	0.35	SN7474	0.20	0.18	0.16	SN74173	4.00	3.50	3.00
SN7425	0.45	0.43	0.35	SN7475	0.20	0.18	0.16	SN74174	4.00	3.50	3.00
SN7426	0.45	0.43	0.35	SN7476	0.20	0.18	0.16	SN74175	4.00	3.50	3.00
SN7427	0.45	0.43	0.35	SN7477	0.20	0.18	0.16	SN74176	4.00	3.50	3.00
SN7428	0.45	0.43	0.35	SN7478	0.20	0.18	0.16	SN74177	4.00	3.50	3.00
SN7429	0.45	0.43	0.35	SN7479	0.20	0.18	0.16	SN74178	4.00	3.50	3.00
SN7430	0.70	0.61	0.44	SN7480	0.20	0.18	0.16	SN74179	4.00	3.50	3.00
SN7431	0.70	0.61	0.44	SN7481	0.20	0.18	0.16	SN74180	4.00	3.50	3.00
SN7432	0.70	0.61	0.44	SN7482	0.20	0.18	0.16	SN74181	4.00	3.50	3.00
SN7433	0.70	0.61	0.44	SN7483	0.20	0.18	0.16	SN74182	4.00	3.50	3.00
SN7434	0.70	0.61	0.44	SN7484	0.20	0.18	0.16	SN74183	4.00	3.50	3.00
SN7435	0.70	0.61	0.44	SN7485	0.20	0.18	0.16	SN74184	4.00	3.50	3.00
SN7436	0.70	0.61	0.44	SN7486	0.20	0.18	0.16	SN74185	4.00	3.50	3.00
SN7437	0.70	0.61	0.44	SN7487	0.20	0.18	0.16	SN74186	4.00	3.50	3.00
SN7438	0.70	0.61	0.44	SN7488	0.20	0.18	0.16	SN74187	4.00	3.50	3.00
SN7439	0.70	0.61	0.44	SN7489	0.20	0.18	0.16	SN74188	4.00	3.50	3.00
SN7440	0.70	0.61	0.44	SN7490	0.20	0.18	0.16	SN74189	4.00	3.50	3.00
SN7441	0.70	0.61	0.44	SN7491	0.20	0.18	0.16	SN74190	4.00	3.50	3.00
SN7442	0.70	0.61	0.44	SN7492	0.20	0.18	0.16	SN74191	4.00	3.50	3.00
SN7443	1.00	0.95	0.90	SN7493	0.20	0.18	0.16	SN74192	4.00	3.50	3.00
SN7444	1.00	0.95	0.90	SN7494	0.20	0.18	0.16	SN74193	4.00	3.50	3.00
SN7445	1.00	0.95	0.90	SN7495	0.20	0.18	0.16	SN74194	4.00	3.50	3.00
SN7446	1.00	0.95	0.90	SN7496	0.20	0.18	0.16	SN74195	4.00	3.50	3.00
SN7447	1.00	0.95	0.90	SN7497	0.20	0.18	0.16	SN74196	4.00	3.50	3.00
SN7448	1.00	0.95	0.90	SN7498	0.20	0.18	0.16	SN74197	4.00	3.50	3.00
SN7449	1.00	0.95	0.90	SN7499	0.20	0.18	0.16	SN74198	4.00	3.50	3.00
SN7450	1.00	0.95	0.90	SN7500	0.20	0.18	0.16	SN74199	4.00	3.50	3.00

PRICES OF 7400 SERIES ARE CALCULATED ON THE TOTAL NUMBER ORDERED REGARDLESS OF MIX
LARGER QUANTITY PRICES PHONE (01) 402 4891
HIGH POWER SN 74 HOOS Now in stock—send
LOW POWER SM 74 LOO for list No. 36

A SELECTION OF SEMI-CONDUCTORS FROM STOCK

AA730 10p	BC147 12p	BU105 2.25	OC44 15p	T1843 35p	2N3055 55p
AA742 15p	BC169C 12p	BY100 15p	OC45 15p	V405A 25p	2N3440 75p
AAZ13 10p	BC182 10p	BY126 15p	OC57 50p	ZTX108 12p	2N3442 1.25
AC107 35p	BC214 15p	BY127 15p	OC71 15p	ZTX300 12p	2N3525 75p
AC126 25p	BCY32 75p	BYZ13 85p	OC72 25p	ZTX301 15p	2N3614 55p
AC127 25p	BCY34 85p	CI06D 85p	OC77 45p	ZTX302 18p	2N3615 75p
AC128 25p	BCY43 1.35	CI07A 85p	OC81 25p	ZTX303 15p	2N3702 10p
AC176 25p	BCY42 30p	CI08 75p	OC83 25p	ZTX304 15p	2N3703 10p
AC187 25p	BCY43 30p	CI09 75p	OC84 25p	ZTX305 15p	2N3705 10p
AC188 25p	BCY55 2.60	LM309K	OC120 25p	ZTX306 15p	2N3714 1.80
ACY17 80p	BCY70 15p	(TO3) 1.87	OC171 30p	2N404 30p	2N3771 1.75
ACY20 80p	BCY71 20p	MAT121 25p	OC200 45p	2N527 35p	2N3773 2.00
ACY21 20p	BCY72 15p	MJE5340 50p	OC201 75p	2N598 15p	2N3790 2.25
ACY39 55p	BCY87 2.90	NK175 40p	OC202 80p	2N697 15p	2N3819 35p
AD140 50p	BCZ11 50p	MJE520 75p	OC203 50p	2N706 15p	2N3820 35p
AD149 50p	BD124 80p	MJE2955	OC217 1.25	2N930 20p	2N3866 85p
AD181 35p	BD131 75p	1.10	ORP12 50p	2N987 45p	2N3903 15p
AD182 35p	BD132 80p	MJE3055	ORP60 40p	2N1131 25p	2N3906 12p
AF117 20p	BF115 25p	75p	P346A 20p	2N1132 25p	2N4061 12p
AF118 50p	BF157 25p	MPP105 40p	RAS310A	2N1302 18p	2N4062 12p
AF124 25p	BF173 25p	NK175 40p	OC201 45p	2N1304 25p	2N4129 15p
AF139 30p	BF179 30p	NK1216 40p	RA8508A	2N1305 25p	2N4271 35p
AF186 40p	BF180 30p	NK1217 40p	55p	2N1307 25p	2N4547 30p
AF239 40p	BF194 15p	NK1403 70p	TAL263 75p	2N1308 25p	2N5777 55p
AS927 30p	BF195 15p	NK1404 50p	2N1209 39p	2N1613 20p	2N6001 1.00
AS928 25p	BF261 25p	OA5 50p	TIP29A 50p	2N1671 1.00	2N6012 10.00
BA102 30p	BF262 25p	OA10 35p	TIP30A 80p	2N2147 75p	2N6018 6.25
BA115 15p	BF213 25p	OA51 10p	TIP31A 80p	2N2160 55p	2N6026 8.50
BA145 15p	BFX34 75p	OA91 7p	TIP32A 70p	2N2217 25p	2N6031 80p
BAX13 5p	BFX37 30p	OA200 7p	TIP33A	2N2221 20p	2N6033 65p
BAX16 7p	BFX88 20p	OA202 10p	1.00	2N2222A	2N6034 95p
BC107 10p	BFY50 20p	OC16 75p	TIP34A	25p	40250 50p
BC108 10p	BFY51 20p	OC20 85p	1.80	2N2369A	40360 40p
BC109 10p	BFY52 20p	OC23 85p	TIP35A	15p	40361 40p
BC109C 12p	BFY64 20p	OC25 40p	2.50	2N2926 (alt)	40402 50p
BC113 15p	BFY90 80p	OC28 65p	TIP36A	8.00	40408 50p
BC117 20p	BLY36 50p	OC35 50p	1.00	coils	40486 75p
BC143 35p	BX20 15p	OC36 65p	TIP41A 75p	2N3053 20p	40636 1.00
	BXY27 15p	OC42 40p	TIP42A 85p	2N3054 50p	40430 1.00

QUANTITY DISCOUNTS

10% 12+ : 15% 25+ : ANY ONE TYPE
20% 100+ : 25% 250+
From above sections except Integrated Circuits and Special Offers where discounts are included.
Minimum order value £1 please.
Postage 7p on all orders.

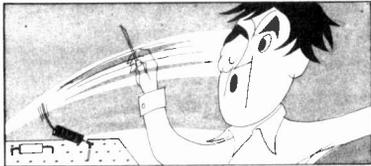
SPECIAL OFFERS! SEMI-CONDUCTORS

BFY90 59p	2N2926 10p
1000 MC/S	All Colours
25 + 50p	25 + 9p
100 + 45p	100 + 8p
500 + 40p	500 + 6p
	1000 + 5p
AF117 Mullard 25p	2N3819 Texas 35p
25 + 17p	25 + 30p
100 + 15p	100 + 25p
500 + 12p	500 + 20p
	1000 + 15p
OC107 Mullard 25p	BC107, BC108, BC109 10p each
25 + 20p	All Makes
100 + 15p	25 + 8p
500 + 15p	100 + 7p
1000 + 13p	500 + 6p
	1000 + 5p
BY127 Mullard 15p	AD161, AD162 35p each
25 + 12p	25 + 32p
100 + 10p	100 + 28p
500 + 9p	500 + 25p
1000 + 8p	1000 + 22p
OA202 10p	2N3055 20p
25 + 8p	25 + 18p
100 + 7p	100 + 15p
500 + 6p	500 + 12p
1000 + 5p	1000 + 10p
OC35 Mullard 50p	2N3055 55p
25 + 45p	25 + 50p
100 + 40p	100 + 35p
500 + 35p	500 + 30p
1000 + 30p	1000 + 33p

ZENER DIODES

400 M/W 5%
Miniature
BZY 88 Range
All voltages
3-3 - 33 Volt
10p each.

Gerry Brown . . . ON THE FRINGE



SHEER CUSSINESS

The number of times I have heard people justifiably complain about having put a screwdriver down on the floor while adjusting some piece of equipment, only to find, on going to pick it up, that the darned thing had surreptitiously "hopped it". If that didn't happen, one could lay even odds that the four screws, previously lying on your left-hand side, had somehow learned to interpret the structure of the DNA molecule enabling them to grow legs of their own.

Screwdrivers are not, however, exclusive in possessing a mind of their own, oh no. Indeed, the effect is not entirely foreign to the wrong side of hot buttered crumpets, marmalade toast, and (on occasion) the resistor that you've just soldered into position (and for which you are enduring agonies in order to prove that you just don't make dry joints) flying off at one end and treating both you and your starboard eye to a good "dollup" of molten solder! Soad's Law, for that is the nice way of putting what this effect has come to be known as, is almost certainly

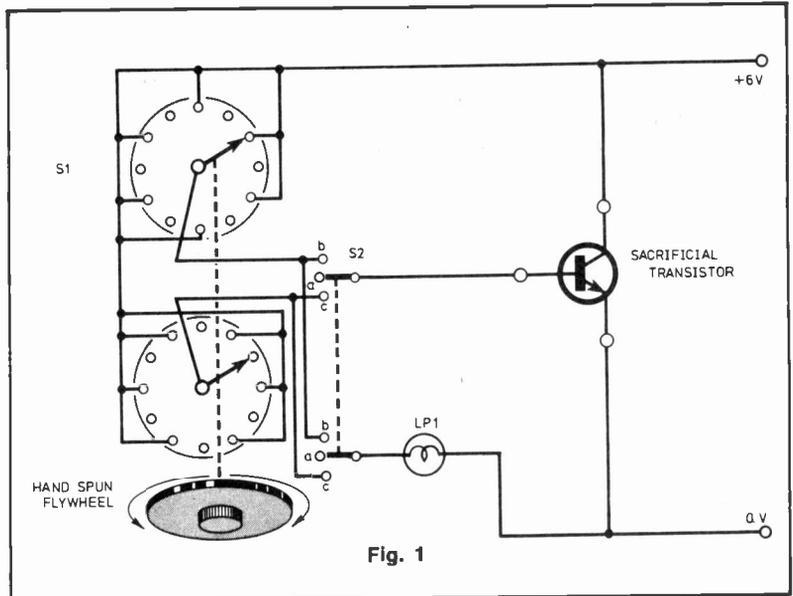


Fig. 1

the one which equates with the belief that "If something can go wrong, then it will".

My old friend Denis has an interesting theory about the effect (also, in ancient literature, referred to as the 4th Law) and has recently put it to the test. He believes, you see, that Soad still exists somewhere, and further that he controls his meddling from either the Moon, or that other satellite which the earth is supposed to have.

The test, which you may have already proved unwittingly, is accomplished by employing a "sacrificial" circuit like the one I've shown in Fig. 1. With such an arrangement one can easily establish how far away this bloody-minded individual is.

First set switch S1 to position "a", then select the most expensive transistor you have, and connect it into circuit. Spin the flywheel-driven

rotary switch (the normal wafer type, but with mechanical "click" and "end stops" removed). When it has come to a standstill, decide quite deliberately to yourself whether to operate switch S2 to "b" or "c". This done, now operate the switch quickly to the *opposite* position of your choice; but do it within 2-68 seconds, I implore you.

Provided the decision is made within this time, I'm told it has never been known to "do-in" a transistor. This being so, it looks certain that this ubiquitous enemy of mankind must inhabit a world about a quarter of a million miles from here, composed, for the most part, of dud transistors, brand-new screwdrivers, and fluff-covered "jam-butties".

Judging from his discussion a couple of months back, I have a shrewd suspicion that Frank Hyde knows something of the fella's co-ordinates but is not letting-on!

NEWS BRIEFS

1973 Design Council Awards

Two electronics companies feature prominently among this year's Design Council Awards for consumer goods. Sinclair Radionics win an award for the Sinclair Executive calculator and Rank Radio International win an award for the Wharfedale "Isodynamic" headphones.

The Sinclair Executive pocket calculator was launched in June 1972 and now, nine months later, sales are running at nearly £100,000 per month and profits of £300,000 are forecast for the financial year ending in April this year.

The Wharfedale Isodynamic headphones also introduce some technological advances to achieve a quality of sound previously only reached in headphones costing well over twice as much.

The Wharfedale system combines the best of the

electrostatic method with the simplicity and price advantage of the electromagnetic method by using a lightweight diaphragm driven evenly all over its surface by magnetic means.

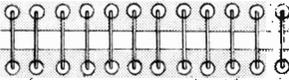
Launched in London last year, sales for the first year are expected to reach 100,000 units and in fact Wharfedale are having difficulty meeting the demand.

New Electronics Course at Keele University

AMONG nine new courses announced by Keele University is a new degree course in Electronics. There is great demand for honours Electronics, it being one of the major growth areas in scientific studies. There is particular interest in Electronics where it overlaps with such areas as cybernetics, information theory and "bioelectronics".

Three and four year courses will be on offer, and amongst the permissible combinations of courses over three years will be Electronics and Music.

For further information please contact the Director of Information Services or Professor D. J. E. Ingram, Department of Physics, University of Keele, Keele, Staffordshire ST5 5BG.



INDUSTRY NOTEBOOK

By Nexus



PRICE WAR CONTINUES

A phenomenon of the electronics industry is that while everything else seems to be shooting up in price, many electronic products persist in going down. This is mainly due to the nature of the beast. High technology demands big investment in R and D and, more often than not, a further major investment in production equipment. So new products tend to start their life as high cost items capitalising on improved performance. Then, as production increases, there is the so-called "learning curve" which, when mastered, gives fewer rejects and higher production rates. By this time, other firms are getting into the same market and any monopoly position that may have been attained is soon eroded. Add these factors together and you can see the reason why prices tumble.

No less an authority than Dr Ian Mackintosh, 20 years in the semiconductor business and now a leading consultant, goes as far as to suggest in a recent press interview that aggressive pricing is the key to success. Essentially, he maintains, semiconductors is a volume industry and nobody gets volume without competitive prices. He cites the 1971 price war in TTL devices as nothing new and forecasts a similar war in MOS devices.

Certainly, ready availability of devices and lowered prices are working their way through into products. Look at digital multimeters. The Solartron 4440 is billed in the advertisements as low-cost at £115. Along comes Sinclair with the DM1 at £49. Not to be left out of the act, Advance Electronics introduce the Alpha DMM8 at £55.

It wasn't all that long ago that a digital panel meter was listed at

£99. Today you can get one for well under £50. Of course, the products I have mentioned are not all to the same specifications and therefore not directly comparable but the trend is there—downwards in price.

The trend is most obvious in consumer products—in radio, TV, tape recorders, pocket calculators. Look around and shop around—you can see it happening. I find it intriguing that some of my friends in manufacturing industry claim it is often cheaper to buy their employers' products through cut-price retail outlets than through their own staff shops.

The biggest shock, however, comes not through price competition between existing technologies and derivatives thereof, but when a completely new technology threatens to displace the old. Semiconductor memory manufacturers may well spend restless nights following the disclosures that IBM researchers have developed amorphous film bubble memories and got them into experimental use. Moreover, IBM say the new process cuts bubble memory costs ten-fold as well as conferring advantages such as extremely high density packaging.

EUROCONTROL

It was quite an experience attending the signing of Eurocontrol's latest commercial contracts for the new KARLDAP air traffic control centre at Karlsruhe. The signing was between Plessey Radar, Thomson-CSF and AEG-Telefunken on the one hand, and Eurocontrol officials on the other, and covered the supply of electronic equipment to the value of over £5 million. We had full simultaneous translations of the proceedings which took place in the Eurocontrol Brussels HQ beneath the flags of the member nations.

Plessey Radar's share was worth £1.25 million. Good for Britain, of course, but what was most pleasing was to be in at a ceremony where nations and companies were working amiably together towards a common good.

ERNIE Mk. II

Having never won a penny on Premium Bonds it was interesting to visit the newly installed ERNIE Mk II at Lytham St Annes and see for myself that everything was fair and above board and that my lack of success was nothing more than bad luck.

The original ERNIE, now honourably retired, was built by the Post Office and did a marvellous job. The success of Premium Bonds has been so staggering that Old ERNIE was too sluggish to cope

with the draw. It was taking ten working days to generate the prize list. New ERNIE picks out the winners of over 90,000 prizes each month in just three hours. This is remarkable when you remember that each random number generated has to be checked against a master file to see if it has been sold or not.

New ERNIE was designed by Dr Roger Harding of Plessey Telecommunications under a contract worth £250,000. Plessey has also supplied a smaller system to New Zealand who run a similar Bonds scheme. Plessey now have ERNIE on offer world-wide and could secure more orders from governments who wish to run similar savings schemes.

To-date, ERNIE has paid out 10 million winners with nearly £350 million of prizes. Average odds of winning are 10,350 to 1. Don't despair—there will be even more prizes in future.

GROWTH

Several sectors of electronics are now showing good growth. VAT has helped Pitney-Bowes in selling electronic cash registers which have calculating power and produce cash receipts showing the amount of VAT paid. Sales are well up on the forecasts. NCR is another company gearing up to get in on the electronic point-of-sale business.

Over £3.5 million is said to have been invested in getting a production line going at Dundee for the NCR 280 retail terminal and first orders have been taken in the UK. In the United States the order book is reported as being 20,000 units of which 4,500 have been installed. Dundee output is planned to match a sales forecast of over 1,000 units this year rising to over 4,000 units by 1975.

Finally, MDS Data Processing Ltd. report big European sales for the 2400 Key Display System, a key-to-disc data entry system for computers. In 14 months more than 500 systems have been ordered which, together, use 6,000 key-stations.

AEROSPACE EXPORT DRIVE

More than 100 British aerospace companies will be in Paris for this year's air show in June. Electronics companies will be well represented during what promises to be a boom exhibition despite setbacks on the Concorde programme. Last year's exports were in the region of £400 million for the industry as a whole with electronic nav aids and guided missiles accounting for a big chunk.

Build yourself a TRANSISTOR RADIO

WITH AFTER SALES SERVICE

ROAMER 10 WITH VHF INCLUDING AIRCRAFT

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

Built-in ferrite rod aerial for MW/LW. Retractable, chrome plated 7 section telescopic aerial, can be angled and rotated for peak short wave and VHF listening. Push-pull output using 600mW transistors. Car Aerial and tape record sockets. 10 transistors plus 3 diodes. Fine tone moving coil speaker. Ganged tuning condenser with VHF section. Separate coil for Aircraft Band. Volume/on/off, wave change and tone controls. Attractive case in black with silver blocking. Size 9in x 7in x 4in.

Easy to follow instructions and diagrams. Parts price list and easy build plans 30p (FREE with parts). Earpiece with plug and switched socket for private listening 33p extra.

TOTAL BUILDING COSTS

£9.35

P.P. & INS. 52p
(OVERSEAS P. & P. £1.05)



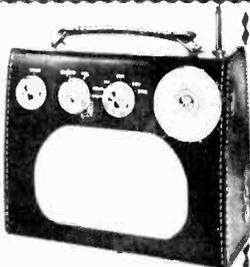
ROAMER EIGHT

Mk. I

NOW WITH VARIABLE TONE CONTROL

7 TUNABLE WAVEBANDS: MW1, MW2, LW, SW1, SW2, SW3 AND TRAWLER BAND. Built-in ferrite rod aerial for MW and LW. Retractable chrome plated telescopic aerial for short waves. Push-pull output using 600mW transistors. Car aerial and tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9in x 7in x 4in approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 25p (FREE with parts). Earpiece with plug and switched socket for private listening 33p extra.

TOTAL BUILDING COSTS **£7.68** P.P. & INS. 47p
(OVERSEAS P. & P. £1.05)



ROAMER SEVEN

Mk. IV

7 TUNABLE WAVEBANDS: MW1, MW2, LW, SW1, SW2, SW3 AND TRAWLER BAND. Extra

medium waveband provides easier tuning of Radio Luxembourg, etc. Built-in ferrite rod aerial for MW and LW. Retractable 4 section 34in chrome plated telescopic aerial for SW. Socket for car aerial. Powerful push-pull output. 7 transistors and 2 diodes, including micro-alloy R.F. transistors. Fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with curving handle. Size 9in x 7in x 4in approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 25p (FREE with parts). Earpiece with plug and switched socket for private listening 33p extra.

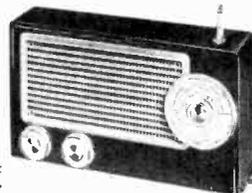
TOTAL BUILDING COSTS **£6.58** P.P. & INS. 47p
(OVERSEAS P. & P. £1.05)



ROAMER SIX

6 TUNABLE WAVEBANDS: MW, LW, SW1, SW2, TRAWLER BAND PLUS AN EXTRA MW BAND FOR EASIER TUNING OF LUXEMBOURG, ETC. Sensitive ferrite rod aerial and telescopic aerial for short waves. 3in speaker. 8 stages. 6 transistors and 2 diodes including micro-alloy R.F. transistors, etc. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9in x 5 1/2in x 2 1/2in approx. Easy build plans and parts price list 25p (FREE with parts).

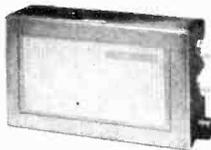
TOTAL BUILDING COSTS **£4.38** P.P. & INS. 31p
(OVERSEAS P. & P. £1.05)



POCKET FIVE

3 TUNABLE WAVEBANDS: MW, LW, TRAWLER BAND WITH EXTENDED MW BAND FOR EASIER TUNING OF LUXEMBOURG, ETC. 7 stages. 5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5 1/2in x 1 1/2in x 3 1/2in. Easy build plans and parts price list 10p (FREE with parts).

TOTAL BUILDING COSTS **£2.50** P.P. & INS. 24p
(OVERSEAS P. & P. 65p)

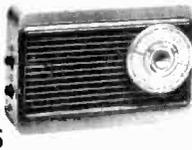


TRANSONA FIVE

5 TRANSISTORS AND 2 DIODES

3 TUNABLE WAVEBANDS: MW, LW AND TRAWLER BAND. 7 stages. 5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone moving coil speaker. Attractive case with red speaker grille. Size 6 1/2in x 4 1/2in x 1 1/2in. Easy build plans and parts price list 10p (FREE with parts).

TOTAL BUILDING COSTS **£2.75** P.P. & INS. 25p
(OVERSEAS P. & P. 65p)

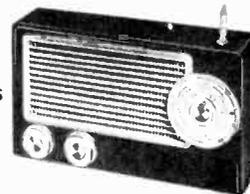


TRANS EIGHT

8 TRANSISTORS AND 3 DIODES

6 TUNABLE WAVEBANDS: MW, LW, SW1, SW2, SW3 AND TRAWLER BAND. Sensitive ferrite rod aerial for MW and LW. Telescopic aerial for short waves. 4in speaker. 8 improved 15p transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9in x 5 1/2in x 2 1/2in approx. Push-pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 25p (FREE with parts).

TOTAL BUILDING COSTS **£4.95** P.P. & INS. 33p
(OVERSEAS P. & P. £1.05)



NEW! "EDU-KIT"

BUILD RADIOS, AMPLIFIERS, ETC. FROM EASY STAGE DIAGRAMS. FIVE UNITS INCLUDING MASTER UNIT TO CONSTRUCT. Components include: Tuning Condenser; 2 Volume Controls; 2 Slider Switches; Fine tone moving coil speaker; Terminal Strip; Ferrite Rod Aerial; 2 Plugs and Sockets; Battery Clips; 4 Tag Boards; Balanced Armature Unit; 10 Transistors; 4 Diodes; Resistors; Capacitors; Three 3in Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction. Parts price list and easy build plans 25p (FREE with parts).

ALL PARTS INCLUDING CASE AND PLANS **£6.05** P.P. & INS. 33p
(OVERSEAS P. & P. £1.05)

RADIO EXCHANGE LTD

61a HIGH ST., BEDFORD MK40 1SA. Tel. 0234 52367
Reg. no. 788372

I enclose £ _____ please send items marked

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

Parts price list and plans for

Name _____

Address _____

P. E. 53

FULL AFTER SALES SERVICE

★ Callers side entrance "Lavell" Shop
★ Open 10-1, 2.30-4.30 Monday-Friday, 9-12 Saturday
★ PLEASE NOTE: ALL PRICES NOW INCLUDE V.A.T.

TRANSISTES

I DOCKYARD, STATION ROAD, OLD HARLOW, ESSEX
Phone Harlow 37739

P/P 10p. Price list S.A.E. (Saturday callers welcome)

ALL PRICES INCLUDE VAT

£19.50 ELECTRONIC DIGITAL CLOCK

(For complete kit of parts including case.)



This 4 digit 24 hour clock is available to readers at this special price for 1 month only. Parts would normally cost over £25. Kit of parts includes twelve IC's, indicators, and a smart white plastic case.

74 Series TTL

1 25		1 25		1 25		1 25	
SN7400	16p	SN7423	55p	SN7450	16p	SN7489	6-05p 5-85p
SN7401	16p	SN7425	50p	SN7451	16p	SN7490	74p 72p
SN7402	16p	SN7427	49p	SN7453	16p	SN7491	1-10p 1-04p
SN7403	16p	SN7428	77p	SN7454	16p	SN7492	74p 72p
SN7404	16p	SN7430	16p	SN7460	18p	SN7493	74p 72p
SN7405	16p	SN7432	39p	SN7470	33p	SN7494	85p 72p
SN7406	38p	SN7433	94p	SN7472	33p	SN7495	85p 72p
SN7407	38p	SN7437	72p	SN7473	41p	SN7496	85p 72p
SN7408	20p	SN7438	72p	SN7474	41p	SN74100	1-80p 1-75p
SN7409	17p	SN7440	16p	SN7475	50p	SN74104	1-08p 1-06p
SN7410	17p	SN7441	77p	SN7476	44p	SN74105	1-08p 1-06p
SN7411	27p	SN7442	74p	SN7480	73p	SN74107	44p 42p
SN7412	38p	SN7443	1-43p	SN7481	1-32p 1-28p	SN74110	81p 58p
SN7413	32p	SN7444	1-43p	SN7482	97p 95p	SN74111	1-37p 1-27p
SN7416	47p	SN7445	2-00p	SN7403	1-20p 1-15p	SN74118	1-10p 1-05p
SN7417	47p	SN7446	1-07p	SN7484	1-10p 1-05p	SN74119	1-47p 1-37p
SN7420	18p	SN7447	1-10p	SN7485	3-86p 3-85p	SN74121	44p 41p
SN7422	55p	SN7448	1-10p	SN7486	36p	SN74122	1-64p 1-43p



* Devices may be mixed to qualify for Price Breaks
* 100 Plus less 10% off 25 plus break

Electrolytic Capacitors

4 VOLT		16 VOLT		40 VOLT	
47µF	6½p	15µF	6½p	47µF	6½p
100µF	6½p	33µF	6½p	100µF	9p
220µF	6½p	68µF	6½p	150µF	10p
330µF	6½p	150µF	6½p	220µF	11p
1000µF	13p	220µF	9p	470µF	19p
4700µF	29p	680µF	17p	680µF	25p
		1000µF	17p	1000µF	25p
		1500µF	25p	2000µF	44p
		2000µF	43p		

6.3 VOLT		25 VOLT	
33µF	6½p	10µF	6½p
68µF	6½p	22µF	6½p
150µF	6½p	47µF	6½p
470µF	11p	100µF	8p
680µF	13p	150µF	8p
1500µF	18p	220µF	10p
2200µF	18p	470µF	13p
3300µF	26p	680µF	20p
		1000µF	22p
		1500µF	22p
		2200µF	39p
		5000µF	68p

10 VOLT		40 VOLT	
22µF	6½p	6-8µF	6½p
47µF	6½p	15µF	6½p
100µF	6½p	33µF	6½p
220µF	8p	470µF	13p
330µF	10p	680µF	20p
470µF	11p	1000µF	22p
1000µF	11p	1500µF	22p
1500µF	20p	2000µF	24p
2200µF	24p		

BARGAIN PACKS

Unmarked Packs	Pack of 25 1N4148 55p
Unmarked Packs	Pack of 10 BC108 BC107 (Plastic can) 55p
Unmarked Packs	Pack of 10 Plastic BC109 55p
Unmarked Packs	Pack of 10 BC169 (unmarked) but tested 55p
Unmarked Packs	2N2646 (unmarked) 33p each
Unmarked but fully tested	Pack of 10 2N2928G unbranded but tested 55p

Linear Integrated Circuits

301 DIL	50p	723c DIL	89p
301 TO99	55p	723c TO99	85p
301 8 PIN DIL	69p	741c 8 PIN DIL	89p
301A DIL	89p	741c 14 PIN DIL	39p
301A TO99	89p	741c TO99	41p
301A 8 PIN DIL	69p	747c DIL	46p
307 DIL	89p	748c DIL	39p
307 TO99	89p	748c TO99	41p
307 8 PIN DIL	89p	1437 DIL	1-27p
308 TO99	6-45p	1458 TO99	1-27p
308A TO99	6-40p	1458 TO99	1-27p
709c DIL	35p	3046 DIL	84p
709c TO99	81p	7503 DIL	1-27p



Transistors

AC107 16p	BC128 38p	BF960 29p	OC44 14p
AC126 14p	BC142 33p	BF929 18p	OC45 14p
AC127 18p	BC143 33p	BF930 18p	OC70 23p
AC128 13p	BC144 30p	BF930 37p	OC71 14p
AC142K 22p	BC145 28p	BFX84 28p	OC72 14p
AC141K 20p	BC147 9p	BFX85 35p	OC81 14p
AC170 16p	BC148 9p	BFX86 32p	OC83 22p
AC187 13p	BC149 9p	BFX87 28p	OC84 25p
AC187K 20p	BC153 16p	BFX88 28p	TIP29A 53p
AC188 13p	BC154 17p	BFY50 21p	TIP30A 64p
AC188K 20p	BC157 13p	BFY51 17p	TIP31A 64p
AC191 24p	BC158 12p	BFY52 17p	TIP32A 73p
AC191K 23p	BC159 14p	BFY54 38p	TIP33 41-06
AC191 25p	BC167 13p	BFY90 72p	TIP34A 40p
AC192 23p	BC168 11p	BX5-20 18p	TIP35A 41-54
AC192 25p	BC169 11p	C407 22p	TIP35A 41-54
AC192 25p	BC177 15p	C426 33p	2E-68 18p
AC192 25p	BC179 15p	C428 31p	TIP36A 18p
AD140 40p	BC182L 9p	C450 17p	23-19 AA119 11p
AD142 44p	BC183L 9p	MP8111 35p	TIP41A 79p
AD143 38p	BC184L 11p	MP8112 42p	TIP42A 91p
AD149 38p	BC186 33p	MP8113 35p	TIP42A 91p
AD150 60p	BC212L 11p	MP8121 33p	TIP42A 91p
AD161 28p	BC213L 11p	MP8122 44p	2N1131 22p
AD162 28p	BC214L 11p	MP8123 50p	2N1132 25p
AD162 28p	BC258 8p	NKT211 28p	2N1613 22p
AF114 14p	BC259 8p	NKT212 28p	2N1614 14p
AF115 14p	BC267 14p	NKT214 25p	2N1711 26p
AF116 14p	BC268 15p	NKT217 55p	2N1715 25p
AF117 14p	BC300 40p	NKT261 23p	2N1715 25p
AF118 92p	BC301 32p	NKT271 20p	2N2905 45p
AF124 27p	BC302 30p	NKT274 20p	2N2924 18p
AF139 39p	BC303 50p	NKT275 25p	2N2926 10p
AF239 41p	BC359 8p	NKT403 71p	2N3053 25p
AL100 77p	BCY70 17p	NK7405 83p	2N3054 45p
AL102 66p	BCY71 37p	NK7603F 8p	2N3055 52p
AL103 55p	BCY72 17p	86p	2N3405 44p
AS276 31p	BD123 68p	NKT613G 57p	2N3663 57p
AS276 31p	BD130 50p	86p	2N3702 9p
AU103 90p	BD131 68p	NKT674 26p	2N3703 9p
AU110 61p	BD132 90p	NKT677C 9p	2N3704 9p
AU111 77p	BD135 42p	24p	2N3705 9p
BC107 9p	BD136 50p	NKT713 32p	2N3706 9p
BC108 9p	BD141 1-87p	NKT773 27p	2N3707 9p
BC109 9p	BD142 50p	OC19 55p	2N3708 9p
BC113 151p	BF139 33p	OC20 55p	2N3709 9p
BC116 16p	BF173 29p	OC22 29p	2N3710 9p
BC125 15p	BF177 28p	OC25 28p	2N3711 9p
BC126 25p	BF178 29p	OC28 33p	2N3794 17p
BC132 16p	BF179 35p	OC29 33p	2N3819 28p
BC134 16p	BF194 15p	OC35 35p	40361 50p
BC135 16p	BF196 17p	OC36 35p	40362 50p
BC137 16p	BF244 27p	OC41 14p	40363 50p

MULLARD POLYESTER'S

MULLARD POLYESTER CAPACITORS C280 SERIES
250V P.C. mounting: 0.01µF, 0.015µF, 0.022µF, 31p, 0.033µF, 0.047µF, 0.068µF, 4p, 0.1µF, 41p, 0.15µF, 0.22µF, 61p, 0.33µF, 7p, 0.47µF, 91p, 0.68µF, 12p, 1-0µF, 14p, 1-5µF, 22p, 2-2µF, 27p

MULLARD POLYESTER CAPACITORS C295 SERIES
400V: 0.001µF, 0.0015µF, 0.0022µF, 0.0033µF, 0.0047µF, 21p, 0.0068µF, 0.01µF, 0.015µF, 0.022µF, 0.033µF, 31p, 0.047µF, 0.068µF, 0.1µF, 41p, 0.15µF, 61p, 0.22µF, 81p, 0.33µF, 12p, 0.47µF, 14p.

100V: 0.01µF, 0.015µF, 0.022µF, 0.033µF, 0.047µF, 0.068µF, 3p, 0.1µF 31p, 0.15µF, 41p, 0.22µF, 61p, 0.33µF, 61p, 0.47µF, 81p, 0.68µF, 12p, 1-0µF, 14p.

VOLUME CONTROLS

Potentiometers
Carbon track 500 Ω to 2-2M Ω
Log or Linear
Single 13p. Dual gang (stereo) 44p
Log type with D.P. switch 13p extra.

SLIDE POTENTIOMETERS

58mm. TRACK
SINGLE GANGED, LOG or LIN 1k to 1M.
45p each
TWIN GANGED, LOG or LIN 1k to 600k.
68p each.

CARBON SKELETON PRESETS

Small high quality type (linear only).
All values 100-5 meg ohms.
-1 watt 5p each
-2.5 watt 6p each

VEROBOARD

0-15 Matrix Matrix
19p 26p
24in x 3in 28p 28p
31in x 3in 28p 28p
3in x 5in 33p 32p
6in x 17in (plain) 94p
Vero Pins (bag of 36) 22p
Vero cutter, 50p; Pin insertion Tools (0-1 and 0-15 matrix) at 61p.

SLIDE SWITCH

SPST 11p each. D.P.D.T. 13p each.

MINIATURE NEON LAMPS

240V or 110V 1-4 5p, 5 plus 4p each.

MINITRON DIGITAL INDICATOR TYPE 3015F

Reads 0-9 and decimals
(Data Sheet on request)
ONLY £1.50
16 DIL Socket 33p
Driven by 7447 1-05

RECTIFIERS

P.L.V.	1 AMP	1-5 AMP
50	IN4001 44p	PL4001 8p
100	IN4002 44p	PL4002 9p
200	IN4003 54p	PL4003 10p
400	IN4004 64p	PL4004 10p
600	IN4005 8p	PL4005 8p
800	IN4006 9p	PL4006 15p
1000	IN4007 10p	PL4007 20p

BRIDGE RECTIFIERS

P.L.V.	1 AMP	2 AMP	5 AMP	10 AMP
60	33p	58p	£1.76p	£2.20p
100	35p	57p	—	—
200	37p	60p	£1.98p	£2.31p
400	40p	64p	£2.15p	£2.42p
600	44p	66p	£2.42p	£2.72p
800	49p	—	—	—

THYRISTORS

PIV	50	100	200	300	400
1 Amp	28	25	41	44	53
3 Amps	44	50	60	66	66
7 Amps	—	98	1-01	—	1-24

RESISTORS

1/4 watt 5%, carbon 1p each
1/4 watt 10%, carbon 1p each
1 watt 10%, carbon 2½p each
Range 10 ohms to 4.7 meg.
1/4 watt m/o 2% 3p each
Range 10 - 1 meg ohms

Unmarked but fully tested
2N3055 33p
10 plus 27p

FULLY MARKED TYPES

AD161, AD162	M/P	59p
1-9	10 plus	53p
BC107-BC108 BC109		9p
1-9	10 plus	8p
100-99		61p
BC 182L-3-4-212-4		9p
1-9	10 plus	8p

AC127 or AC128
1-9 13p
10 plus 11p
100 plus 11p

ZENER DIODES

400 M/W 50s
Miniature
BZY 88 Range
All voltages
3.3 - 33 Volt
9p each

PATENTS REVIEW...

CAR WARNING CIRCUIT

A Company which is very active in the field of patents for car safety devices is Joseph Lucas (Industries). Their latest device, BP 1 297 385, triggers an alarm if a driver attempts to leave his vehicle without removing the ignition key.

In the patent circuit, Fig. 1, the car battery has its negative terminal earthed to chassis and its positive terminal connected to one side of a car internal rooflight LP1.

The other side of the light is earthed to chassis via three separate parallel paths. One of these paths contains switch S1 which is operated by the passenger door of the vehicle and closes when the door is open. The second path contains a switch S2 which is manually controlled from within the vehicle.

The third parallel path contains a diode D1 and switch S3 in series. Switch S3 is operated by the driver's door and closes when the door is opened. Closure of any one of the switches S1, S2, S3 energises LP1.

The "live" side of switch S3 is connected to the positive battery terminal via an alarm buzzer or bell in series with a resistor R1.

An *npn* transistor TR1 has its collector-emitter path connected across the alarm and its base connected to the positive battery terminal through resistor R2 and to earth via switch S4. The switch S4 is ganged to the ignition switch and closes when the ignition key is in position.

When the car is being driven, S4 is closed and current flows through R2; no current flows through the alarm or the transistor. When the driver stops the vehicle and removes the ignition key, S4

BP 1 297 385

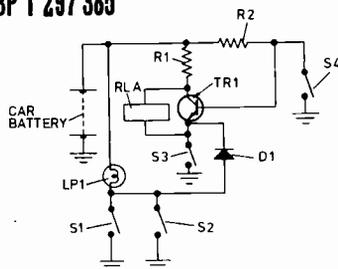


Fig. 1

opens. As the driver gets out of the car the act of opening his door closes S3 and TR1 is turned on by current flow through resistor R1. This short circuits the alarm, which thus cannot sound.

In the event that the driver forgets to remove his ignition key, S4 stays closed and no base current reaches the transistor when S3 closes (as the driver opens his door). In this case the alarm receives current via R1 and sounds the alarm.

The presence of the diode D1 ensures that the alarm cannot be operated when one or both of the switches S1 and S2 are operated.

BUTLER-TYPE OSCILLATOR CIRCUIT

BP 1 282 853

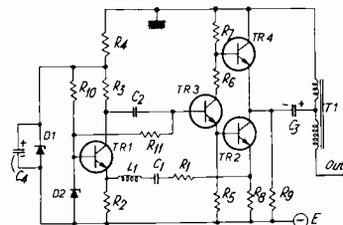


Fig. 1

International Standard Electric Corporation in BP 1 282 853 discloses a Butler-type oscillator circuit of the generally known type in which a first and second transistor have their emitters coupled by a series resonant circuit.

The first transistor has its base biased to a fixed potential and its collector coupled to the base of the second transistor to limit feedback amplitude. The output signal is in the form of a clipped sine wave so in some uses, e.g. in telephony where distortion may cause the faulty operation of receiving equipment, the clipped signal must be corrected by filtering. The filterers necessary can, however, be bulky and costly in comparison with other miniaturised components.

What ISEC suggest is a modified Butler-oscillator with three *npn* transistors TR1, TR2 and TR3 and a buffer output stage formed from an *npn* transistor TR4 mounted in emitter follower configuration.

CIRCUIT PROTECTION

Connecting a car battery into circuit the wrong way round can cause damage, e.g., in the generating and regulating circuits of the vehicle. A diode can be used to block wrong polarity currents but where the circuit carries heavy surges, the diode is at risk.

In BP 1 293 046 Pal-Magnetron Narodni Podnik of Czechoslovakia describe three closely related simple ways of connecting circuits which must carry heavy currents and are sensitive to polarity.

The circuit, Fig. 1, shows a relay with its contacts RLA1 in series with a battery and the coil in series with diode D1 and switch S1. The coil, D1 and S1 are connected in parallel with the battery.

The contacts RLA1 are normally open and the diode D1 ensures that current will flow through the relay coil (when S1 is closed) only if the battery is connected with the correct polarity. Incorrect polarity will cause the diode to block current flow through the coil with the result that the contacts stay open and the polarity sensitive load is safeguarded.

The circuit in Fig. 2 shows RLA1 contacts connected as in Fig. 1 but diode D1 is used in parallel with the coil. A resistor R1 is connected in series with the coil and S1.

Again, current flows through the relay coil only if the battery is correctly connected, but in this case if the polarity is wrong the diode D1 will conduct and, in effect, put a short across the relay coil stopping it operating. The resistor R1 prevents the full short circuit current from passing through the diode when the battery is connected incorrectly.

BP 1 293 046

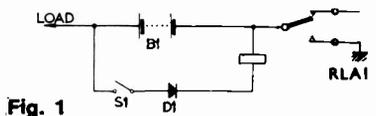


Fig. 1

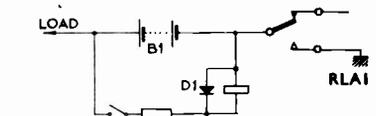
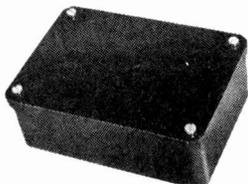


Fig. 2

'YOUR CASE' NOW SOLVED

BLACK P.V.C. BOXES AVAILABLE



IDEAL FOR ELECTRONIC APPARATUS
AND SPECIAL RIG ENCLOSURES

- ★ ROBUST MOULDING
- ★ ALL INSULATED
- ★ EASY TO CUT AND DRILL
- ★ SELF FINISH
- ★ WILL NOT CORRODE
- ★ WILL NOT BURN

Length	Width	Depth	Price each	P. & P. each
4 in.	4 in.	1½ in.	38p	13p
4 in.	4 in.	2 in.	41p	14p
6 in.	3 in.	1½ in.	38p	14p
6 in.	4 in.	2 in.	52p	14p

ALLOW 21 DAYS FOR DELIVERY

**ADAPTABOX, DEPT. PE
26 WELBY GARDENS
GRANTHAM, LINCS.**



BOOK REVIEWS

THE RADIO AND ELECTRONIC ENGINEER

(The Journal of the Institution of Electronic and
Radio Engineers)

VOL. 43 No. 1/2 January/February 1973.

It is unusual to review a Journal, but this particular publication is of especial and topical interest to all who are involved in any way with semiconductors. The January/February issue of the *Radio and Electronic Engineer* is almost entirely devoted to special contributions from leading British scientists and engineers who have been associated with semiconductor developments during the past 25 years. Collected together are 18 papers, each written with authority based upon intimate involvement and covering some particular aspect of the design, development, manufacture or application of discrete active devices and integrated circuits.

As a technical record of the first twenty-five years of semiconductors, including their impact and influence upon different specialised fields of application, this issue of the *Radio and Electronic Engineer* warrants a place on the bookshelf of any electronics enthusiast.

Copies may be obtained from the IERE Publications Sales Department, 9 Bedford Square, London, WC1B, price £2.00 per copy, post free.

HANDBOOK OF BASIC ELECTRONIC EQUIPMENT

By W. Oliver

Published by Foulsham Technical

102 pages, 5½ in × 9 in. Price £1.75

THE AUTHOR of this book will be known to all readers of Foulsham-Sams books as the man who translates American into English. The main idea behind this book seems to be that of giving readers some technical background on basic equipment but mainly information on suppliers.

However, if one is going to give technical information it is essential not to give wrong information. The note inside the front cover states that "mathematics . . . have been minimised so that the book will be easily understood by even beginners". After reading the book it makes me wonder whether Mr Oliver knows any maths! For instance, on capacitors: "the total effective capacity of capacitors in series is the sum of the individual capacitors"; or on resistors: "2K and 4K in parallel, then in series with the 3K, gives you roughly 1,333 ohms" (yes, very roughly, in actual fact 4,333 ohms); the term EMF is used where potential drop is meant; a varactor is described as a "very special kind of diode" whereas all diodes exhibit varactor action.

If one is going to present technical information, especially for beginners then one has got to be a little more accurate than this. No, I am afraid I would not recommend this book to any beginner; the suppliers addresses may be useful but as a technical work it leaves very much to be desired.

S.R.L.



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
P.O. BOX 156, JERSEY

NAME : _____

ADDRESS : _____ E .53

BLOCK CAPS please

VARIABLE VOLTAGE TRANSFORMERS

INPUT 230/240V a.c. 50/60 OUTPUT VARIABLE 0-260V

All Types from ½ to 50 amp from stock.

SHROUDED TYPE

1 amp, £7.00
2.5 amp, £8.05
5 amp, £11.75
10 amp, £22.50
15 amp, £25.00

20 amp, £49.00
25 amp, £58.00
37.5 amp, £81.00
50 amp, £98.00



(Panel Mounting) ½ amp, £4.75.
1 amp, £7.00, 2½ amp, £8.05. All carriage paid.

2.5 amp
OPEN TYPE

DOUBLE ENDED MOTOR UNIT

Powerful, continuously rated, 2-speed. Either 6 or 12 volt D.C. operation. PRICE £2 incl. P. & P.



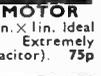
12 VOLT D.C. MOTOR

Powerful 1 amp REVERSIBLE motor. Speed 3750 r.p.m. complete with external gear train (removable) giving approx. final speed of either 125 r.p.m. or 240 r.p.m. Size: 4½in x 2½in dia. Either type price 95p incl. P. & P.



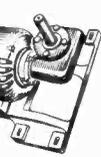
REVERSIBLE SPLIT PHASE MOTOR

250 r.p.m., 100-115/210-240V A.C., 2in. x 1in. Ideal for rim-drive models, display, etc. Extremely powerful for size (including small capacitor). 75p incl. P. & P.



PARVALUX TYPE SD19 230/250 VOLT A.C. REVERSIBLE GEARED MOTORS

30 r.p.m., 40 lb. ins. Position of drive spindle adjustable to 3 different angles. Mounted on substantial cast aluminium base. Ex-equipment. Tested and in first-class running order. A really powerful motor offered at a fraction of maker's price. £6.80. Incl. P. & P.



PARVALUX Type: SD1.5/86896/OJ

230/250V A.C. 50 r.p.m. 7 lb/in. Continuously rated. Less base. £6.30. Post Paid.

TYPE: SD1.5/89400/OM

230/250V A.C. 50 r.p.m. 22 lb/in. Continuously rated. Incl. base. £7.30. Incl. P. & P.

The above motors are new and unused.



PARVALUX TYPE SD2. 200/250 VOLT A.C./D.C. HIGH SPEED MOTOR

Speed 9,000 r.p.m. approx. or 3,200 r.p.m. if used with built-in governor, or variable speed over a wide range if used in conjunction with our Dimmer Switch, illustrated below. PRICE £2. Incl. P. & P.



600 WATT DIMMER SWITCH.

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



240V A.C. SOLENOID FLUID VALVE

VWill handle liquids or gases up to 7 p.s.i. Forged brass body stainless steel core and spring. ½ in. b.s.p. inlet/outlet. Precision made, British mfg. PRICE: £1.95. Incl. P. & P. Special quotation for quantity. (New in makers' carton)



24-HOUR TIMER

Can be adjusted to give a switching delay of between 2 hrs. to 24 hrs. Driven by 200/250V A.C. synchronous motor. 15 amp c/o contacts. Mfg. Grater Controls Ltd. Supplied with scale calibrated 0-10 (2 hrs. per division). Brand New. £2. Incl. P. & P.



HONEYWELL PROGRAMME TIMERS

240V. A.C. 5 r.p.m. motor. Each cam operating a c/o micro switch. Cams are individually variable, allowing innumerable combinations. Ideally suited for machinery control, automation, etc. Also in the field of entertainment, for chaser lights, animated displays, etc. 15 cam model £6. Incl. P. & P. 10 cam model £5. Incl. P. & P. 2 cam model with 15 r.p.m. motor £2. Incl. P. & P.



SIMPLE 12 CAM PROGRAMMER 240V A.C. 15 RPM MOTOR with 4 adjustable cams and 8 that may be profiled to individual requirements, £3.75. Incl. P. & P.

36V 30 AMP. A.C. or D.C.

VARIABLE L.T. SUPPLY UNIT

INPUT 230/240V a.c. OUTPUT CONTINUOUSLY VARIABLE 0-36V



Fully isolated. Fitted in robust metal case with Voltmeter. Ammeter Panel Indicator and handles. Input and output fully fused. Ideally suited for Lab. or Industrial use. £70. Incl. P. & P.

MOTOROLA MAC 11/6 PLASTIC TRIAC 400 PIV. 10 AMP

Now available **EX STOCK**. Supplied with full data and applications sheet. Price £1.12. Incl. P. & P. Suitable DIAC (RCA 40583) 30p each.

STROBE! STROBE! STROBE!

Build a Strobe Unit, using the latest type Xenon white light flash tube. Solid state timing and triggering circuit. 230/250V a.c. operation.

EXPERIMENTERS' ECONOMY KIT Speed adjustable 1 to 30 flash per sec. All electronic components including Veroboard S.C.R. Unijunction Xenon Tube and instructions £6.55. Incl. P. & P.

NEW INDUSTRIAL KIT

Ideally suitable for schools, laboratories, etc. Roller tin printed circuit. New trigger coil, plastic thyristor. Speed adjustable 1-80 f.p.s. approx. ½ output of Hy-Lyght. Price £11. Incl. P. & P.

HY-LYGH T STROBE MK III

Designed and produced for use in large rooms, halls and the photographic field and utilizes a silica tube, printed circuit, also a special trigger coil. Speed adjustable 0-20 f.p.s. approx. greater than many (so called 4 Joule) strobes. £12.50. Incl. P. & P.

THE 'SUPER' HY-LYGH T KIT

Approx. four times the light output of our well proven Hy-Lyght strobe. Incorporating:

- Heavy duty power supply.
- Variable speed from 1-13 flash per sec.
- Reactor control circuit producing an intense white light.

Never before a Strobe Kit with so HIGH an output at so LOW a price. ONLY £20.75. Incl. P. & P.

ATTRACTIVE, ROBUST, FULLY VENTILATED METAL CASE, Super Hy-Lyght Kit including reflector. £7.45. Incl. P. & P.

For Hy-Lyght Kit including reflector. £4.45. 7-inch **POLISHED REFLECTOR** Ideally suited for above Strobe kits. Price 66p. Incl. P. & P.

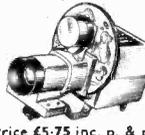
FROM APRIL 1st V.A.T. (at the standard rate) MUST BE ADDED TO ALL PRICES

RAINBOW STROBE FOUR LIGHT CONTROL MODULE

Will operate four of our Hy-Lyght or Super Hy-Lyght Strobes in either 1, 2, 3, 4 sequence; 2+2; or all together. Thoroughly tested and reliable. Complete with full connection instructions. Price: £18.75. Incl. P. & P. Send S.A.E. for details.

COLOUR WHEEL PROJECTOR

Complete with oil-filled colour wheel. 100 watt lamp. 200/240V A.C. Features extremely efficient optical system. £18.50+35p. P. & P. 6 INCH COLOUR WHEEL As used for Disco lighting effects, etc. Price £5.75 incl. p. & p.



BIG BLACK LIGHT

400Watt. Mercury vapour ultra violet lamp. Outer bulb designed to absorb visible light and transmit u.v. rays. Extremely compact and powerful source of u.v. Innumerable industrial applications also ideal for stage, display, discos, etc. P.F. ballast is essential with these bulbs. Price of matched ballast and bulb £16.50. Incl. P. & P. Spare bulb £7.30. Incl. P. & P.



BLACK LIGHT FLUORESCENT U.V. TUBES

4ft. 40 watt. Price £5.80 incl. P. & P. (For use in standard bi-pin fluorescent fittings). MINI 9 in. 6 watt black light U.V. tube. £1.45. Incl. P. & P. Complete ballast unit and holders for 9 in. tube. £1.85.

Superior Quality Precision Made

NEW POWER RHEOSTATS



100 WATT. 1 ohm, 10A; 5 ohm, 4.7A; 10 ohm, 3A; 25 ohm, 2A; 50 ohm, 1.4A; 100 ohm, 1A; 250 ohm, 0.7A; 500 ohm, 0.45A; 1 kΩ, 280 mA; 1.5 kΩ, 230mA; 2.5 kΩ, 2A; 3.5kΩ, 5 kΩ, 1.40mA. Diameter 3½in. Shaft length ½in. dia. ½in. All at £1.73. Incl. P. & P.
50 WATT. 1/5/10/25/50/100/250/500/1/1-5/2-5/5kΩ. All at £1.23. Incl. P. & P.
25 WATT. 10/25/50/100/250/300/500/1/1-5/2-5/3-5/5kΩ. All at 98p. Incl. P. & P.
Black Silver Skirted knob calibrated in Nos. 1-9. 1½in. dia brass bush. Ideal for above Rheostats, 18p ex.

RELAYS SIEMENS, PLESSEY, Etc. MINIATURE RELAYS

Col.(1)	1	2	3	4
Coil ohms	52	4-6	6M	63p*
Col. (2)	52	4-6	4 c/o	78p*
Working d.c. volts	150	6-12	4 c/o	78p*
Col. 3	230	6-12	2 c/o	63p*
Contracts	410	10-18	4 c/o	73p*
Col. (4)	600	12-24	4 c/o	78p*
Price	600	9-18	2 c/o	63p*
HD=	700	16-24	4M 2B	63p*
Heavy duty	700	15-35	2 c/o HD	73p*
	700	16-24	6M	65p*
	700	6-12	1 c/o HD	50p*
Incl. Base	700	20-30	6 c/o	75p
	1,250	24-36	4 c/o	63p*
All prices	2,500	36-45	4M 2B	63p*
incl. P. & P.	2,400	30-48	4 c/o	50p*
	9,000	40-70	2 c/o	50p*
	15k	85-110	6M	50p*

12 VOLT D.C. RELAY 140 ohm coil

Type 1: Three sets c/o contacts rated at 5 amps. 78p incl. P. & P. (Similar to illustration below.)
Type 2: 4-8 volt, 3 c/o HD, 67 ohm coil. 78p.

SPECIAL OFFER 700 ohm 4 c/o. Ex. new equipment. £50 per 100 incl. bases (minimum 100).

'DIAMOND H' 230 VOLT A.C. RELAYS (Unused)

Three sets c/o contacts rated at 5 amps. PRICE: 60p. Incl. P. & P. (100 lots £40 including P. & P.)
24 volt A.C. 3 c/o 60p. Incl. P. & P.



MINIATURE LATCHING RELAY

Manufactured by Clare-Elliott Ltd. Type F. 2 c/o permanent latching in either direction. Coil 1150 ohm, 15-30 Volt D.C. Size ½ high, ¾ wide, ¾ thick. Complete with 3' leads. New 73p. Incl. P. & P.

UNISELECTOR SWITCHES

NEW 4 Bank 25 Way

24V d.c. operation. £5.88.

P. & P. 25p. 6 Bank 25 Way

24V d.c. £6.75. Incl. P. & P.

8 Bank 25 Way, 24V d.c. operation. £7.88. Incl. P. & P.



"HONEYWELL" PUSH BUTTON PANEL MOUNTING MICRO SWITCH ASSEMBLY

Each bank comprises a c/o rated at 10 amps 240V. A.C. Black knob 1 in. Fixing hole ½ in. ONE bank 30p; TWO bank 40p; THREE bank 55p; incl. P. & P. Quot. for quantity.



"HONEYWELL" LEVER OPERATED MICRO SWITCH

15 amps 250 volt A.C. c/o contacts. Types N39, N95, N100, N101 NEW in maker's carton. PRICE: 10 for £1.90 incl. P. & P.



Very special offer MICRO SWITCH

5 amp c/o contacts. Fitted with removable metal panel assembly. Ex. P.O. 20 for £1 incl. post. (Min. order 20.)

METER BARGAIN

BALANCE/LEVEL METERS

100-0-100 Micro Amp. Size 1½in x 1½in + ½in. Price only 75p including P. & P.



AMMETERS NEW! 2½in. Flush

fund. Available in D.C. Amps 1, 5, 15, 20 or A.C. Amps 1, 5, 10, 15, 20, both types £1.75 incl. P. & P. 0-300V. A.C. £1.90 incl. P. & P.



INSULATION TESTERS NEW!

Test to I.E.E. Spec. Rugged metal construction, suitable for bench or field work, constant speed clutch. Size L 8in, W 4in, H 6in, weight 6lb. 1,000V, 1,000 megohms. £34.00 Incl. P. & C.
500V, 500 megohms, £28 incl. P. & C.



All Mail Orders—Callers—Ample Parking
Dept. PE5, 57 BRIDGMAN ROAD
CHISWICK, LONDON W4 5BB
Phone 01-995 1560
Showroom open Mon.-Fri.

SERVICE TRADING CO.

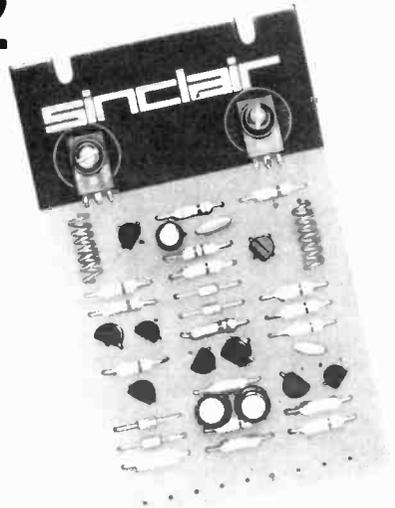
Personal callers only. Open Sat.
9 LITTLE NEWPORT STREET
LONDON WC2H 7JJ
Phone 01-437 0576

Sinclair Project 60

Now—the Z.50 Mk.2

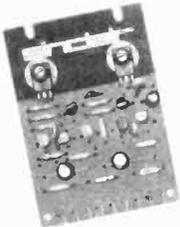
with built-in automatic transient overload protection

When originally introduced, the Sinclair Z.50 proved how it was possible to design and produce a popularly priced modular power amplifier having characteristics to challenge the world's costliest amplifiers. Many thousands of Z.50's are now giving excellent service day in, day out. But we have also learned that constructors do not always use their Z.50's ideally. That is why we have introduced modifications whereby risk of damage through mis-use, is greatly reduced and performance further enhanced. The Z.50 Mk.2 has improved thermal stability, more accurately regulated D.C. limiting to ensure more symmetrical output voltage swing and clipping and still less distortion at lower power. Z.50 Mk.2 is compatible with all other Project 60 modules, and may be incorporated to advantage in existing systems. Eleven silicon epitaxial planar transistors are now used, two more than in the original Z.50. Circuitry has been re-designed, making this versatile high performance amplifier better than ever.



with free manual
£5.48

Z.30 the power amplifier for quality and economy

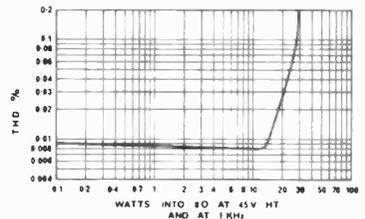


with free manual
£4.48

The Z.30 provides excellent facilities for the constructor requiring a high fidelity audio system of less power than that available from Z.50's. Using a power supply of 35 volts, Z.30 will deliver 15 watts RMS into 8 ohms, or 20 watts RMS into 3 ohms using 30 volts. Total harmonic distortion is a fantastically low 0.02% at 15 watts into 8 ohms with signal to noise ratio better than 70 dB unweighted. Input sensitivity 250mV into 100K ohms. Size 80 x 57 x 13 mm (3 1/4 x 2 1/2 x 1/2). Z.30, Z.50 and Z.50 MK.2 modules are compatible and interchangeable.

Brilliant new technical specifications

Input impedance 100 K Ω
Input (for 30w into 8 Ω) 400mV
Signal to noise ratio, referred to full o/p at 30v HT 80dB or better
Distortion 0.02% up to 20W at 8 Ω . See curve
Frequency response 10Hz to more than 200 KHz \pm 1dB
Max. supply voltage 45v (4 Ω to 8 Ω speakers) (50v 15 Ω speakers only)
Min. supply voltage 9v
Load impedance – minimum : 4 Ω at 45v HT
Load impedance – maximum : safe on open circuit



Typical Project 60 applications

System	The Units to use	together with	Units cost
Simple battery record player	Z.30	Crystal P.U., 12V battery volume control, etc.	£4.48
Mains powered record player	Z.30, PZ.5	Crystal or ceramic P.U. volume control, etc.	£9.45
12W RMS continuous sine wave stereo amp. for average needs	2 x Z.30s, Stereo 60; PZ.5	Crystal, ceramic or mag. P.U., F.M. Tuner, etc.	£23.90
25W RMS continuous sine wave stereo amp. using low efficiency (high performance) speakers	2 x Z.30s, Stereo 60; PZ.6	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc.	£26.90
80W (3 ohms) RMS continuous sine wave deluxe stereo amplifier. (60W RMS into 8 ohms)	2 x Z.50s, Stereo 60; PZ.8, mains transformer	As above	£34.88
Indoor P.A.	Z.50, PZ.8, mains transformer	Mic., guitar, speakers, etc., controls	£19.43

F.M. Stereo Tuner (£25) & A.F.U. (£5.98) may be added as required.

Guarantee

If, within 3 months of purchasing any product direct from Sinclair Radionics Ltd., you are dissatisfied with it, your money will be refunded at once. Many Sinclair appointed Stockists also offer this same guarantee in co-operation with Sinclair Radionics Ltd.

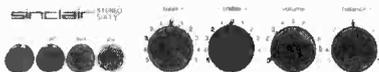
Each Project 60 module is tested before leaving our factory and is guaranteed to work perfectly. Should any defect arise in normal use, we will service it at once and without any charge to you, if it is returned within two years from the date of purchase. Outside this period of guarantee a small charge (typically £1.00) will be made. No charge is made for postage by surface mail. Air Mail is charged at cost.

sinclair

Sinclair Radionics Ltd., R.O. London Rd., St. Ives, Huntingdonshire PE17 4HJ (Phone: St. Ives 64311). Regd. Bus. No. England 699483.

the world's most advanced high fidelity modules

Stereo 60 Pre-amp/control unit



Designed specifically for use on Project 60 systems, the Stereo 60 is equally suitable for use with any high quality power amplifier. Since silicon epitaxial planar transistors are used throughout, a really high signal-to-noise ratio and excellent tracking between channels is achieved. Input selection is by means of press buttons, with accurate equalisation on all input channels. The Stereo 60 is particularly easy to mount.

SPECIFICATIONS—Input sensitivities: Radio — up to 3mV, Mag. p.u. 3mV correct to R.I.A.A. curve ± 1 dB $\cdot 20$ to 25,000 Hz. Ceramic p.u. — up to 3mV. Aux — up to 3mV. Output: 250mV. Signal to noise ratio: better than 70dB. Channel matching: within 1dB. Tone controls: TREBLE $+12$ to -12 dB at 10KHz. BASS $+12$ to -12 dB at 100Hz. Front panel: brushed aluminium with black knobs and controls. Size: 66 x 40 x 207mm.

Built, tested and guaranteed. **£9.98**

Project 60 Stereo F.M. Tuner

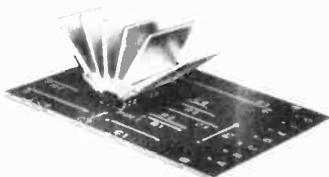


The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. tuner with fantastically good results. Other advanced features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stereo decoder and switchable squelch circuit for silent tuning between stations. In terms of high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with most other high fidelity systems.

SPECIFICATIONS—Number of transistors: 16 plus 20 in I.C. Tuning range: 87.5 to 108MHz. Sensitivity: 7μ V for lock-in over full deviation. Squelch level: Typically 20μ V. Signal to noise ratio: >65 dB. Audio frequency response: 10Hz — 15KHz (± 1 dB). Total harmonic distortion: 0.15% for 30% modulation. Stereo decoder operating level: 2μ V. Cross talk: 40dB. Output voltage: 2 x 150mV R.M.S. maximum. Operating voltage: 25–30VDC. Indicators: Stereo on, tuning. Size: 93 x 40 x 207mm.

Built and tested. Post free. **£25**

Super IC.12 Integrated circuit high fidelity amplifier



Having introduced Integrated Circuits to hi-fi constructors with the IC.10, the first time an IC had ever been made available for such purposes, we have followed it with an even more efficient version, the Super IC.12, a most exciting advance over our original unit. This needs very few external resistors and capacitors to make an astonishingly good high fidelity amplifier for use with pick-up, F.M. radio or small P.A. set up, etc. The free 40 page manual supplied, details many other applications which this remarkable IC. make possible. It is the equivalent of a 22 tran-

sistor circuit contained within a 16 lead DIL package, and the finned heat sink is sufficient for all requirements. The Super IC.12 is compatible with Project 60 modules which would be used with the Z.50 and Z.30 amplifiers. Complete with free manual and printed circuit board.

SPECIFICATIONS

Output power: 6 watts RMS continuous (12 watts peak). 6–8 Ω . Frequency Response: 5Hz to 100KHz ± 1 dB. Total Harmonic Distortion: Less than 1%. (Typical 0.1%) at all output powers and frequencies in the audio band (20V). Load Impedance: 3 to 15 ohms. Input Impedance: 250 Kohms nominal. Power Gain: 90dB (1,000,000,000 times) after feedback. Supply Voltage: 6 to 28V. Quiescent current: 8mA at 28V. Size: 22 x 45 x 28mm including pins and heat sink.

Manual available separately 15p post free.

With FREE printed circuit board and 40 page manual.

£2.98 Post free

Power Supply Units The new PZ.8 Mk.3



The most reliable power supply unit ever made available to constructors. Brilliant circuitry makes failure from over load and even direct shorting of the output impossible. This is due to an ingenious re-entrant current limiting principle which, as far as we know has never before been available in any comparable unit outside the most expensive laboratory equipment. Ripple and residual noise have been reduced to the point of almost total elimination. This is, of course, the perfect unit for Project 60 assemblies, particularly where the new Z.50 MK.2 amplifiers are used. Nominal working voltage — 45.

PZ.8 Mk.3—£7.98

(Mains transformer, if required) £5.98

PZ.5 30v. un stabilised

(not suitable for Project 60 tuner) £4.98

PZ.6 35v. stabilised

(not suitable for IC. 12) £7.98

Project 605



the easy way to
buy and build
Project 60
without
soldering

Project 605 in one pack contains one PZ.5, two Z.30's, one Stereo 60 and one Masterlink, which has input sockets and output components grouped on a single module and all necessary leads cut to length and fitted with clips to plug straight on to the modules thus eliminating all soldering.

Complete with comprehensive manual, post free
All you need for a superb 30 watt high fidelity stereo amplifier

£29.95

Order form

Please send

I enclose cash/cheque/money order.

Name _____

Address _____

PE/5/73

SINCLAIR RADIONICS LTD., LONDON ROAD
ST. IVES, HUNTINGDONSHIRE PE17 4J

sinclair

ALARMING NEWS!

DIRECT SUPPLY AND ADVISORY SERVICE TO ANYONE WISHING TO INSTALL THEIR OWN PROFESSIONAL QUALITY ALARM SYSTEM.

BURGLAR ALARM CONTROL UNITS: solid state, fitted with key-switch, lamp and test button and internal battery. From £15.50.
6in BELLS, SIRENS, mains and low voltage, self-contained high security bells. From £4.20.

MICROWAVE radar detectors, will penetrate glass/wood, can be completely concealed. Incredible performance. From £75.
ULTRASONIC intruder detectors, works on Doppler principle. From £47.

INFRA RED invisible light rays D.C. and modulated, transmitters and receivers. From £14 per pair.

LASER VOICE/TONE pulse or modulated rays.

ANALYSED VIBRATION detector systems.

ULTRASONIC INTER-ROOM communicators, using mains wiring.
LIGHT AND SOUND detectors.

D.C. POWER SUPPLIES, mains driven/low voltage power packs, miniature spillproof re-chargeable batteries. From £9.90.

SPECIAL INSTALLATION HARDWARE:
4 and 6 core cable, Figure 8 twin, special cable clips, self-adhesive lead foil pin. Take-off blocks, special junction boxes, snap wire, door/window contacts, self-adhesive window vibration detectors, heat, smoke and gas detectors, pass-locks, high security mortise shunt locks. Floor and stair pressure pads.

Data sheets 6p per item plus 6p P. & P. Overseas please add extra.

STOP PRESS!

FOR THE FIRST TIME AVAILABLE, CONTRACTS DIRECT WITH THE ORIGINAL DESIGNER TO MARKET A VIABLE AND SUCCESSFUL A.C. BALANCED BRIDGE HIGH SECURITY SOLID STATE REMOTE INDICATOR OR CONTROL SYSTEM. HUNDREDS OF SERIOUS CIRCUIT APPLICATIONS. Cannot be open or short circuited or substituted without detection. There is no other system invented that can do this. Stability proved over 16,000 hours. Can detect and indicate a capacity or resistive imbalance of as little as 24% for F.S.D. Unit response approximately 1.0 micro-sec. Mains 240V 2VA. Stab. power supply with provision for standby batteries. Report from independent consultant available.

J. WILKINSON, Security Consultant

**Bank Road Works, Bowness on Windermere
Westmorland**

Stamped addressed envelope for price list.

Telephone orders not accepted. Callers only by appointment.

FERRANTI ZN414 MICROCIRCUIT RADIO

**AS SEEN
ON TV!**

Only £1.32

WITH FREE DATA

**WE ARE SPECIALISTS IN FERRANTI
SEMICONDUCTORS**

BFS59	15p	ZTX310	9p	ZTX504	43p	ZS170	10p
BFS60	20p	ZTX311	10p	ZTX510	17p	ZS171	13p
BFS61	20p	ZTX312	10p	ZTX530	21p	ZS172	16p
BFS96	15p	ZTX313	11p	ZTX531	22p	ZS174	17p
BFS97	23p	ZTX314	13p	ZTX550	17p	ZS176	23p
BFS98	20p	ZTX320	31p	ZTX551	17p	ZS178	38p
ZTX107	9p	ZTX330	15p	2N3555	72p	ZS270	11p
ZTX108	8p	ZTX331	16p			ZS271	16p
ZTX109	11p	ZTX382	13p			ZS272	18p
ZTX112	14p	ZTX383	15p			ZS274	19p
ZTX213	14p	ZTX384	18p			ZS276	26p
ZTX214	15p	ZTX450	17p			ZS278	37p
ZTX300	12p	ZTX451	17p				
ZTX301	13p	ZTX500	12p				
ZTX302	17p	ZTX501	13p				
ZTX303	14p	ZTX502	17p				
ZTX304	21p	ZTX503	14p				

DIODES

ZS120 8p

ZS121 10p

ZS122 13p

ZS123 16p

ZS124 18p

ZS140 25p

ZS141 43p

ZS142 33p

ZENERS
KS030A to
KS180A—
all types 19p

ALL DEVICES TOP GRADE, BRAND NEW, AND FULLY GUARANTEED
WE CAN SUPPLY ANY FERRANTI DEVICE. Send S.A.E. for quotation.
R.C.A. CA3090Q £4.73; CA3075 £1.49.
MOTOROLA, MJE2955 £1.17; MJE3055 72p; 2N4444 £2.48.
P.E. TRIFFID, ZT1711 24p; 2N1132 25p.
POSTAGE AND PACKING 10p. Free over £2. Send S.A.E. for our
full price list and data sheet.

ALL PRICES INCLUDE V.A.T.

DAVIAN ELECTRONICS

PO BOX 38, OLDHAM, LANCs. OL2 6XJ

S-DECS AND T-DECS

S-DECS £1.44

T-DECS £2.88

µ-DEC A £3

16 bit IC,
carriers £1.20



IC RADIO CHIP TBA651

As featured in July Practical Wireless IC of the month feature. Contains RF Amp, oscillator, mixer, IF Amps, detector, voltage stabiliser and wide range AGC circuitry. With data £2.10.

SINCLAIR EQUIPMENT

IC12 £2

Z50 £4.25

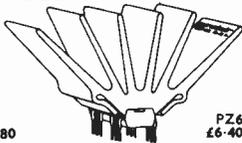
PZ5 £3.97

Z30 £3.50

Project 60
tuner £16.80

AFU £4.50

stereo 60 £7.80



PZ6

£6.40

Sinclair Executive Calculator, £55.
New Sinclair Digital Multimeter, £44.
System 2000 Amplifier, £22.

DELUXE KIT FOR THE IC12

Includes all parts for the printed circuit and volume, bass and treble controls needed to complete the mono version £1.45. Stereo version with balance control £3.30.

POWER UNITS FOR THE IC12

A set of components to construct a 28V 0.5 Amp power supply £2.27. Also suitable Sinclair PZ5 fully constructed £3.97.

PREAMPLIFIER KITS FOR THE IC12

Type 1 for magnetic pickups, mics, and turners, with 3 position equalisation switch. Mono model £1.20. Stereo model £2.20. Type 2 for ceramic or crystal pickups. Mono 60p. Stereo £2.20.

PROJECT 60 KIT

£2.50

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

SWANLEY ELECTRONICS

32 Goldslee Road, Swanley, Kent

Mail order only. Postage 10p per item. Lists 10p.

Add 10% extra to all prices for VAT
Official credit orders from schools, etc., welcome.

OSMABET LTD. We make transformers amongst other things

AUTO-TRANSFORMERS

500W, £8.85; 750W, £12; 1,000W, £15; 1,500W, £21; 2,000W, £27; 3,000W, £37.50; 4,000W, £52.50.

LOW VOLTAGE TRANSFORMERS

Prim. 200/240V a.c. 6.3V 1.5A, £1.05; 3A, £1.30; 6A CT £2.05; 12V 1.5A, £1.35; 3A CT, £2.15; 6A CT, £2.30; 18V 1.5A CT, £2.15; 24V 1.5A CT, £2.15; 3A CT, £2.30; 6A, £4.30; 8A, £6.75; 12A, £8.40; 40V 3A CT, £2.75; 50V 3A CT, £1.0.

MIDGET RECTIFIER TRANSFORMERS

For FW rect., 200/240V a.c. 9-0-9V 0.3A, 12-0-12V 0.25A or 20-0-20V 0.15A, £1.45 each; 9-0-9V 1A, £1.15; 12-0-12V 1A or 20-0-20V 0.75A, £1.35 each.

O/P TRANSFORMERS FOR POWER AMPLIFIERS

P.P. sec. tapped 3-7-5-15 ohms, A-A 6K 30W (KT66, etc.), £4.65; A-A 3K 50W, £7.50; 100W (KT84, KT88, etc.), £15.50. Multi O/P 10W, £2.25.

MAINS TRANSFORMERS POWER AMPLIFIERS

Prim. 200/240V a.c., TX6 sec., 425-0-425V 500 Ma, 6.3V CT 6A, 6.3V CT 6A, 0-5-6.3V 3A, £14.25; TX1 425-0-425V 250Ma, 6.3V CT 4A, 6.3V CT 4A, 0-5-6.3V 3A, £9.25V 100Ma, 6.3V 2A, £2.70.

G.E.C. MANUAL OF POWER AMPLIFIERS

Covering valve amplifiers of 30 to 400W, with price list of transformers and chokes specified, 30p.

Bernards Amplifier Manual, 5 to 1,000W, 75p.

LOUDSPEAKERS FOR POWER AMPLIFIERS

PANE 15W w/tweeter, £4.99; 50W, £10.90; 60W, £12.90; 100W, £22.50; BAKER 25W, £6.40; 35W, £7.20; Hi-Fi Major Module, 20W w/tweeter and Xover 30-17kHz, £2.90; EM1 13in x 8in, type 150, 30 or 15Ω only, brand new to clear at only £1.75.

LOUDSPEAKERS

2 1/2in 8 or 16Ω, 2 1/2in 25Ω, 3in 30Ω, 75p; 3 1/2in 3 or 15Ω 4in 8 or 15Ω, 3, 8, 15 or 25Ω, 5in x 3in 3, 8, 15Ω, £1.05 each; 6 1/2in 3Ω, 6in x 4in 25Ω, 7in 0 4in 3 or 15Ω, 8 x 2 1/2in 3Ω, £1.25; 6in x 3in 3, 8, 15 or 25Ω, £1.50; 10in 15Ω, £2.50; 10in x 6in 3Ω, £2.25.

SPEAKER AUTO MATCHING TRANSFORMERS

12W, 3 to 8 or 15Ω, up or down, £1.05.

BULK TAPE ERASERS

Instant erasure, tape spools, cassettes, demagnetise tape heads a.c. 200/240V, £2.50 plus 25p P. & P.

BATTERY ELIMINATORS, 200/240 V a.c.

Output 6V £1.60; 9V £1.50; for cassettes 7.5V £2; tapped output 6V-7.5V-9V with plug £2.50.

PAPER CONDENSERS

Subular W/E 2-2 mfd. 250V Xovers, etc., 15p, £5 100. Block 4 mfd, 800V, 75p, 1,000V, £1.25.

V.A.T. extra on all orders

Carriage extra on all orders, etc.

S.A.E. ENQUIRIES-LISTS, MAIL ORDER ONLY

46 Kenilworth Road, Edgware, Middx. HA8 8YG

Tel. 01-958 9314

EX COMPUTER PRINTED CIRCUIT PANELS

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

SPECIAL BARGAIN PACK

25 boards for £1 (25p).

ELECTROLYTICS

10,000µ 75V, 68,000µ 16V, 10,000µ 35V, 4 1/2 x 2 1/2in dia., 25,000µ 25V, 20,000µ 30V, 8,000µ 55V, 40,000 10V, 4 1/2 x 3in dia. 50p (12p), 15,000µ 15V, 4 1/2 x 2in dia. 20p (10p), 2,000µ 25V wire ended, 3 x 1in dia. 15p (5p) or 12 for £1.50 (15p).

250 MIXED CAPACITORS 60p (8p)

250 MIXED RESISTORS 60p (8p)

200 SI PLANAR DIODES

untested 50p (5p)

SUB-MIN. CO-AX. PLUGS & SKTS.

4 pairs 50p (5p)

MINIATURE GLASS NEONS

12 for 50p (5p)

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

MICRO SWITCHES, MIXED

8 for 50p (8p)

PAPST EXTRACTOR/BLOWER FANS

100cfm 4 1/2 x 4 1/2 x 2in £3.50 (28p)

QUARTZ HALOGEN BULBS

12V 55W 50p (5p)

Postage and package for each item shown in brackets.

KEYTRONICS

(Mail Order only)

**44 EARLS COURT ROAD
LONDON W8**

01-478 8499



MAINS MOTOR
Precision made—as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at 65p. Postage 20p for first one then 10p for each one ordered.

MUSIC ON TAPE

A further buy enables us to offer these at an even lower price—namely 65p each or 3 for £2.50. Send for list of titles. We can't repeat when sold out.

BALANCED ARMATURE UNIT

500 ohm, operates as speaker or microphone, so useful in intercom or similar circuits. 35p each. £3-80 doz.



CAR ELECTRIC PLUG

Fits in place of cigarette lighter. Useful method for making a quick connection into the car electrical system. 38p each or 10 for £3.42.



12 VOLT 1/2 AMP POWER PACK

This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 mH/4" smoothing. Price £2-00, plus 20p post & packing.



Heavy Duty Mains Power Pack. Output voltage adjustable from 15-40V in steps—maximum load 250W—that is from 6 amp at 40V to 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 £5-75 plus 65p post.

MAINS RELAY BARGAIN

Special this month are some single, double and treble pole changeover relays. Contacts rated at 15 amps. Operating coil wound for 240V A.C. Good British Make. Unused. Size approx. 1 1/2" x 1". Open construction. Single pole 25p each 10 for £2-25. Treble pole 35p each 10 for £3-15.



DOOR INTERCOM

Know who is calling and speak to them without leaving bed or chair. Outfit comprises microphone with call push button, connectors and master intercom. Simply plugs together. Originally sold at £10. Special snip price £3-50 plus 20p postage.



TYPE 25 RELAYS

These are miniature relays. Size approx. 1 1/4in. high x 1 1/2in. wide x 3in. deep, 4 changeover silver/gold contacts. Contact rating lamp 100V D.C. Fitted with a plug socket. Coil operates approx. 250mV. D.C. Available with the following coils: 28 ohm for 1-2.5v, 45 ohm for 4-7.5v, 52 ohm for 4.9-6v, 90 ohm for 5-5.11-5v, 130 ohm for 10-15v, 330 ohm for 17-30v, 1250 ohm for 27-44v, 2500 ohm for 31-65v, 580 ohm for 27-44v, 75p each, 10 for £6-75. Also one with 16,500 ohm coil but this has only 2 heavy duty changeover gold contacts. Price 85p.



MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at 20p each £1-80 for ten, your assortment.



REED SWITCHES

Glass encased, switches operated by external magnet—gold welded contacts. We can now offer 3 types:

Miniature, 1" long x approximately 1/2" diameter. Will make and break up to 1/2 A up to 300V. Price 13p each, £1-20 dozen.

Standard, 2" long x 3/4" diameter. This will break currents of up to 1A, voltage up to 250V. Price 10p each, 90p per dozen.

Flat. Flat type, 2" long, just over 1/2" thick, flattened out, so that it can be fitted into a smaller space or a larger quantity may be packed into a square solenoid. Rating 1A 200V. Price 30p each, £3 per dozen.

Small ceramic magnets to operate these reed switches 8p each, 90p dozen.

Dry Reed Relays. Solenoids on moulded bobbins within magnetic shields—printed circuit or panel mounting.

Ref.	Coil Resistance	Reed Switches	Price
71005	2 K	1 normally open	25p
81916	5 K	1 normally open	25p
05003	4 K	1 normally closed	75p
05004	1500 & 500 ohms	1 normally open	35p
Multiple Reed Relay. Ref. 53001. Contains 13 normally open reeds within a solenoid. Operates on 600 mW. Coil resistance 9K ohms. Price £1-95 each.			
Multiple Reed Relay. Ref. 631. 2 normally open 1 normally closed coil resistance 30 ohms. Price 75p.			

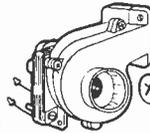


MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied. Model 1153 300mW power output 65p. Model 1172 750mW power output 85p. Model EP9000 4 watt power output £1-65. EP9001 twin channel or stereo pre amp. £1-60. 10% discount if 10 or more ordered.

CENTRIFUGAL BLOWER

Miniature mains driven centrifugal type blower unit by Woods. Powerful but specially built for quiet running—driven by cushioned induction motor with specially built low noise bearings. Overall size 4 1/2" x 4 1/2" x 4". When mounted by flange, air is blown into the equipment but to suck air out, mount it from centre using clamp. Ideal for cooling electrical equipment or fitting into a cooker hood, film drying cabinet or for removing fume smoke when soldering etc. etc. A real bargain at £1-85.



GOOD COMPANION I.C. VERSION

We can now offer these again in I.C. version using Ferranti ZN414 and Mullard AF Module 1172. Cabinet size approx. 11in wide x 8in high x 3in deep. Complete assembly instruction—Excellent tone wood cabinet £5-75.



MIGHTY MIDGET

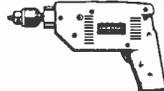
Probably the thinnest possible radio, as described in Practical Wireless, 4 January 73. All electronic parts £2 post paid.

THIS MONTH'S SNIP

10 AMP DIMMER/CONTROLLER

For the control of lighting of stage or studio or portable equipment in workshops, etc. This has socket outlets each controlled by 5 AMP Solid State regulator. Also fitted with master switch fuse and neon indicator and terminating with 6 feet of flex. Overall length 17in., 3 1/2in. x 1 1/2in. deep. £7-50, plus 25p P. & P.

PORTABLE ELECTRIC DRILL



Very superior quality made by a famous Dutch Toolmaker. Model No. ASRM30. 300W—2 speed 2,200/3,000. With jin chuck and chuck key, also separate side handle and hammer facility for dealing with concrete, etc. An equivalent British made drill would cost £15. £9-95—similar model but without the hammer attachment £7-95.

Have either model on approval for 7 days.

DISTRIBUTION PANELS

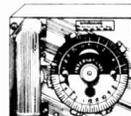
Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 7 feet of heavy cable. Wired up ready to work. £2-25 plus 20p post and insurance.

CAPACITOR DISCHARGE CAR IGNITION



This system which has proved to be amazingly efficient and reliable was first described in the Wireless World about a year ago. We can supply kit of parts for an improved and even more efficient version (Practical Wireless, June). Price £5-95 plus 20p post. When ordering please state whether for positive or negative systems. De-luxe model including printed circuit board etc. £6-65

24-HOUR TIME SWITCH



Made by Smiths, these are A.C. mains operated, NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. Two completely adjustable time periods per 24 hours. 5A changeover contacts will switch circuit on or off during these periods. £2-50 post and ins. 25p. Additional time contacts 50p pair.

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.



BATTERY CONDITION TESTER



Made by Mallory but suitable for all batteries made by Ever Ready and others, most of which are zinc carbon types but also mercury manganese—nickel—silver oxide and alkaline batteries may be tested. The tester puts a dummy load on the battery and the meter scale indicates the condition depending upon which section the pointer rests. The section reads "replace", "weak" or "good". The tester is complete in its case, size 3 1/2" x 6 1/2" x 2" with leads and prods. Price £2-25 plus 20p postage.

SPIT MOTOR



200-250V Induction Motor, driving a Charter gear box with 1 1/2" of output drive shaft running at 5 revs per minute. Intended for roasting chickens also suitable for driving models—windmills, coloured disc lighting effect, etc. etc. £1-65 plus 20p post and insurance.



CONTROL DRILL SPEEDS

DRILL CONTROLLER

NEW IKW MODEL

Electrically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1-50. Made up model also available. £2-50.

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 300mA (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 only £1.

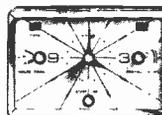
BURGLAR ALARM



So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc. 24in x 18in £1-40. 13in x 10in £1.

PP3 BATTERY CHARGER

Almost 3 times the life can be obtained from PP3 battery if you re-charge it from the mains—this really to use charger with instructions only 50p.



ISA ELECTRICAL PROGRAMMER

Learn in your sleep: Have radio playing and kettle boiling as you awake—switch on lights to ward off intruders—have a warm house to come home to. All these and many other things you can do if you invest in an electrical programmer. Clock radio with alarm with 15 amp. on/off switch. Switch-on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price £1-95 + 20p p. & p. or with glass front chrome bezel 70p extra.

BAKELITE INSTRUMENT CASE



Size approx. 6 1/2" x 3 1/2" x 2 1/2" deep with brass inserts in four corners and bakelite panel. This is a very strong case suitable to house instruments and special rigs, etc. Price. 45p each. Paxolin lid 10p extra.

TELEPHONES



Complete as illustrated. Save your legs, time and temper, simply by putting in some telephones. Ex. G.P.O. not new—but guaranteed in good condition and serviceable. Supplied with diagram and instructions showing how to connect. Price £1 each + 50p post or 2 for £2-50 post paid. Also available separately, dials and handsets 80p each + 20p p & p

20 WATT INVERTER

Smart and Brown—For van lighting or camping etc. Will light a 2ft. 20 watt standard fluorescent tube from a 12V car battery, current approx. 2A. Very well made unit using die cast chassis. Size 11 1/2" x 2 1/2" x 1 1/2". Price £5-50 complete with lamp holders and tube clips.

ROCKER SWITCH

13 amp self-flxing into an oblong hole. Size approximately 1 1/2" x 1 1/2" 8p each, 10 for 72p.



SLIDE SWITCHES

Slide Switch, 2-pole changeover panel mounting by two 6B.A. screws. Size approx. 1 1/2in x 1/2in rated 250V lamp, 7p each, 10 for 65p. Ditto as above but for printed circuit 6p each 10 for 54p. Sub Miniature Slide Switch, DPDT 19mm (1in approx.) between fixing centres. 18p each or 10 for £1-08. SP Change over spring return 250V 1 amp, 10p.

SPRING COIL LEADS

as fitted to telephones, 4 core 15p each, 10 for £1-25. 3 core 10p each, 10 for 90p.

Please add V.A.T.
10% on total orders
after April 1st

J. BULL (ELECTRICAL) LTD.

(Dept. P.E.), 7 Park Street, Croydon CRO 1YD
Callers to 102/3 Tamworth Road, Croydon

TRANSFORMERS

MAINS ISOLATING SERIES
Primary 200-250 Volts Secondary 240 Volts Centre Tapped (120V) and Earth Shielded

ALSO AVAILABLE WITH 115/120V SEC. WINDING

Ref. No.	VA (Watts)	Weight lb oz	Size cm.	P & P £ p
07	20	1 11	7.0 x 6.0 x 6.5	1.77 30
100	60	3 8	8.9 x 8.0 x 7.7	2.62 36
61	100	5 12	10.2 x 8.9 x 8.3	2.88 52
30	200	9 8	12.0 x 10.3 x 10.0	4.83 52
62	250	12 4	9.5 x 12.7 x 11.4	6.38 67
55	350	15 0	14.0 x 10.8 x 12.4	8.55 82
63	500	27 0	17.1 x 11.4 x 15.9	11.32 *
92	1000	40 0	17.8 x 17.1 x 21.6	22.70 *
128	2000	63 0	24.1 x 21.6 x 15.2	37.50 *

AUTO SERIES (NOT ISOLATED)

Ref. No.	VA (Watts)	Weight lb oz	Size cm.	Auto Taps	P & P £ p
113	20	1 11	7.3 x 4.3 x 4.4	0-115-210-240	0.93 22
64	75	1 14	7.0 x 6.4 x 6.0	0-115-210-240	1.82 30
4	150	3 0	8.9 x 6.4 x 7.6	0-115-200-220-240	2.20 36
66	300	6 0	10.2 x 10.2 x 9.5	4.28 52
67	500	12 8	14.0 x 10.2 x 11.4	6.35 67
84	1000	16 8	11.4 x 14.0 x 14.0	11.54 82
93	1500	28 9	13.5 x 14.9 x 16.5	16.72 **
95	2000	40 0	17.8 x 16.5 x 21.6	21.82 **
73	3000	45 8	17.4 x 18.1 x 21.3	29.70 **

TOTALLY ENCLOSED 115V AUTO TRANSFORMERS
115V 500 Watt totally enclosed auto transformer, complete with mains lead and two 115V outlet sockets, £8.63. P & P 67p.
Also available a 20 Watt version, £1.84. P & P 22p.

LOW VOLTAGE SERIES (ISOLATED)

Ref. No.	Ampls.	Weight lb oz	Size cm.	Secondary Windings	P & P £ p
111	0.5	0.25	7.6 x 5.7 x 4.4	0-12V at 0.25A x 2	0.93 22
213	1.0	0.5	8.3 x 5.1 x 5.1	0-12V at 0.5A x 2	1.11 22
71	2	1	7.0 x 6.4 x 6.0	0-12V at 1A x 2	1.46 22
18	4	2	8.3 x 7.0 x 7.0	0-12V at 2A x 2	2.04 36
70	6	3	10.2 x 7.6 x 8.6	0-12V at 3A x 2	2.46 42
108	8	4	10.0 x 8.3 x 8.2	0-12V at 4A x 2	2.73 52
72	10	5	7.9 x 10.8 x 10.2	0-12V at 5A x 2	3.23 52
17	16	8	12.1 x 9.5 x 10.2	0-12V at 8A x 2	4.99 52
115	20	10	12.1 x 11.4 x 10.2	0-12V at 10A x 2	6.35 67
187	30	15	13.3 x 12.1 x 12.1	0-12V at 15A x 2	11.73 82
226	60	30	17.0 x 14.5 x 12.5	0-12V at 30A x 2	21.57 **

30 VOLT RANGE

Ref. No.	Ampls.	Weight lb oz	Size cm.	Secondary Taps	P & P £ p
112	0.5	1	8.3 x 3.7 x 4.9	0-12-15-20-24-30V	1.11 22
79	1.0	2	7.0 x 6.4 x 6.0	1.48 36
3	2.0	3	8.9 x 7.0 x 7.6	2.21 36
20	3.0	4	10.2 x 8.9 x 8.6	2.72 42
21	4.0	6	10.2 x 10.0 x 8.6	3.23 52
51	5.0	6	12.1 x 10.0 x 8.6	4.02 52
117	6.0	7	12.1 x 10.0 x 10.2	4.80 52
88	8.0	10	14.0 x 11.7 x 10.0	6.20 67
89	10.0	12	14.0 x 10.2 x 11.4	7.85 67

50 VOLT RANGE

Ref. No.	Ampls.	Weight lb oz	Size cm.	Secondary Taps	P & P £ p
102	0.5	1 11	7.0 x 7.0 x 5.7	0-19-25-33-40-50V	1.46 30
103	1.0	2 10	8.3 x 7.3 x 7.0	2.13 36
104	2.0	5 0	10.2 x 8.9 x 8.6	2.96 42
105	3.0	6 0	10.2 x 10.2 x 8.3	4.01 52
106	4.0	9 4	12.1 x 11.4 x 10.2	5.31 52
107	6.0	12 4	12.1 x 11.7 x 13.3	7.85 67
118	8.0	18 9	13.3 x 13.3 x 12.1	10.25 97
119	10.0	19 12	16.5 x 11.4 x 15.9	12.85 97

60 VOLT RANGE

Ref. No.	Ampls.	Weight lb oz	Size cm.	Secondary Taps	P & P £ p
124	0.5	2 4	8.3 x 9.5 x 6.7	0-24-30-40-48-60V	1.48 36
126	1.0	3 0	8.9 x 7.6 x 7.6	2.06 36
127	2.0	5 6	10.2 x 8.9 x 8.6	3.23 42
125	3.0	8 8	11.9 x 9.5 x 10.0	4.52 52
123	4.0	10	12.1 x 9.5 x 11.4	6.35 67
120	6.0	16 12	13.3 x 12.1 x 12.1	9.20 82
122	10.0	23 2	16.5 x 12.7 x 16.5	15.23 **

LEAD ACID BATTERY CHARGER TYPES

Ref. No.	Ampls.	Weight lb oz	Size cm.	P & P £ p
45	1.5	1 9	7.0 x 6.0 x 6.0	1.47 30
5	4.0	3 11	10.2 x 7.0 x 8.3	2.23 42
86	6.0	12	10.2 x 8.9 x 8.3	3.27 52
146	8.0	6 4	8.9 x 10.2 x 10.2	3.84 52
50	12.5	11 14	13.3 x 10.8 x 12.1	5.72 67

All ratings are continuous. Standard construction; open with solder tags and wax impregnation. Enclosed styles to order.

FULL SPEC. TRANSISTORS

BC107/108/109 90p each	2N 3055 60p each	AD 161/162 60p pair
25 + 7p	+ mica and bushes	+ mica and bushes
100 + 63p	25 + 55p	25 + 55p
500 + 6p	100 + 45p	100 + 50p
Minimum order 10 pieces this range.	500 + 40p	500 + 45p
		1000 + 40p

ELECTROSIL RESISTORS • AVOMETERS

PLEASE ADD 10% FOR V.A.T.

BARRIE electronics

11 MOSCOW ROAD, QUEENSWAY
LONDON W2 4AH Tel: 01-229 6681/2
NEAREST TUBE STATIONS: BAYSWATER, QUEENSWAY

HARTLEY TYPE 13A. ONLY
£18. Double Beam Oscilloscope. TB2Hz-750kHz. Band width 5-5MHz. Sensitivity 33Mv/cm. Calibration markers 100kHz and 1MHz. A completely reliable general purpose oscilloscope. Supplied with CIRCUIT DIAGRAM and Mains lead. Carr. £1.50.

As above. Complete with all accessories. £25. Carr. £1.50. Many other oscilloscopes available.

FIRST TIME EVER at £42.50
Solartron CD7152 Double Beam Oscilloscope d.c.—9MHz; 3mV/cm; trigger delay; crystal calibrator; 4in flat faced tube. In good working condition. Carriage £1.50.

GRATICULES. 12cm x 14cm in High Quality plastic. 30p each. P. & P. 5p.

MODERN TELEPHONES type 706. Two tone grey, £3.75 each. The same but black, £2.75 each. P. & P. 25p each.

AS NEW type 706 BLUE, £5 each. P. & P. 25p.

Also **TOPAZ YELLOW £4.50** each. P. & P. 25p.

STANDARD GPO DIAL TELEPHONE (black) with internal bell, 87p each. P. & P. 50p. Two for £1.50. P. & P. 75p. All telephones complete with bell and dial.

20Hz to 200kHz WB SINE AND SQUARE GENERATOR. Four ranges. Independent amplitude controls, thermistor stabilised. Ready to use. 9V supply required. £6.85 each. P. & P. 25p. (Not cased, not calibrated.)

WOBBULATOR. Sweeps 8 to 45MHz ready to use. 6.3V a.c. required. £9 each. P. & P. 25p. (Not cased, not calibrated.)

CAPACITOR PACK. 50 Brand new components only 50p. P. & P. 17p.

POTS—10 different values. Brand new—50p. P. & P. 17p.

COMPONENT PACK consisting of 2:2 pole 2 amp push on/off switches; 4 pots, various, brand new; 250 resistors ½ and ¼ watt, many high stabs, etc. Fine value at 50p per pack. P. & P. 17p.

P.C.B. packs 5 & D. Quantity 2 sqft—no tiny pieces. 50p plus P. & P. 20p.

FIBRE GLASS as above £1 plus P. & P. 20p.
5 CRYSTALS 70 to 90kHz. Our choice, 50p. P. & P. 15p.
Matched pairs, 50p per pair. P. & P. 15p.

TRIMMER PACK. 2 Twin 50/200pF ceramic 2 Twin 10/60pF ceramic; 2 min strip with 4 preset 5/20pF on each; 3 air spaced preset 30/100pF on ceramic base. ALL BRAND NEW, 25p the lot. P. & P. 10p.

ELECTRONIC TIMER UNITS—wall or bench mounting—2 Hybrid timer boards may be removed leaving excellent 12V battery charger; d.c. Power supply, etc. Price only £2.50 incl. carriage.

LIGHT EMITTING DIODES (Red) from Hewlett-Packard. Brand New 38p each. Holder 1p each. Information 5p.

PHOTOCELL equ. OCP71, 13p each.

PHOTO-RESIST type Clare 703. Two for 50p.

AMERICAN OSCILLOSCOPE type USM24. A 10 meg scope—all min values complete with circuit diagram. Mains input 115 volt 50 cycles therefore £20. Carr. £1.50.

DELIVERED TO YOUR DOOR 1 cwt of Electronic Scrap chassis, boards, etc. No Rubbish. FOR ONLY £3.50.

OPEN 9 a.m. to 7.30 p.m. ANY DAY

CHILTMEAD LTD

7/9 ARTHUR ROAD, READING, BERKS.

(rear Tech. College)

Tel.: Reading 582605/65916

PRACTICAL ELECTRONICS "SCORPIO" ELECTRONIC IGNITION SYSTEM



This Capacitor-Discharge Electronic Ignition system was described in the November and December issues of Practical Electronics. It is suitable for incorporating in any 12V ignition system in cars, boats, go-karts, etc., of either pos. or neg. earth and up to six cylinders. The original coil, plugs, points and contact-breaker capacitor fitted in the vehicle are used. No extra or special components are required.

Helps to promote easier starting (even under sub-zero conditions), improved acceleration, better high-speed performance, quicker engine warm-up and improved fuel economy. Eliminates excessive contact-breaker point burning and the need to adjust point and spark-plug gaps with precision.

Construction of the unit can easily be completed in an evening and installation should take no longer than half an hour. A complete complement of components is supplied with each kit together with ready-drilled roller-tinned professional quality fibre-glass printed-circuit board, custom-wound transformer and fully-machined die-cast case. All components are available separately. Case size 7½in x 4½in x 2in, approx.

Complete assembly and wiring manual 25p, refundable on purchase of kit. Price: £10.50 plus 50p P. & P.

PSYCHEDELIC LIGHTING UNIT Mk. 3



This unit represents a natural progression from our phenomenally successful Mk. 1 and 2 Units. As before the drive voltage is derived directly from the amplifier output or across the speakers. The unit converts the audio frequency signals into a three-coloured light display; the colour depending on the frequency of the signal and the intensity on the loudness of the audio source.

The unit is constructed on professional fibre-glass printed-circuit board material and uses latest full-wave triac circuitry. There is a master-level control, together with independent sensitivity controls for each channel. The original minimum ambient light level controls have been redesigned permitting their use as faders; allowing dimming from max. to zero at the turn of a knob. R.F.I. suppression is now incorporated as standard as well as provision for D.J. "Pulse-Flash" controls. The choice of two inputs enables operation from both high and low power amplifiers. Max. power 15kW per channel at 240V a.c.

Complete assembly built and tested. Size 9in x 7in x 3in. Price £25 carr. paid.

PLEASE NOTE ALL THE ABOVE PRICES ARE SUBJECT TO V.A.T. ADJUSTMENT

DABAR ELECTRONIC PRODUCTS

98a Lichfield Street, Walsall, Staffs. WSI 1UZ

TELEPHONE: WALSALL 34365

TELEGRAMS: DABELEC Walsall Staffs.

BRITAIN'S FASTEST SERVICE!



A SELECTION FROM OUR COMPREHENSIVE CATALOGUE

ALL ITEMS ARE BRAND NEW AND FULLY GUARANTEED

AA119	6p	BCY58	18p	CA3043	£1.73	OA81	8p	1N4007	19p	2N6027(D13T1)
AC107	50p	BCY70	15p	CA3044	£1.47	OA90	6p	1N4148	4p	
AC128	25p	BCY71	30p	CA3045	86p	OA95	5p	1N5400	18p	3N84
AC127	25p	BCY72	15p	CA3048	£2.34	OA97	5p	1N5400	25p	3N128
AC128	24p	BD124	75p	CA3052	£1.80	OA200	5p	1N5408	25p	3N140
AC128/AC176	40p	BD131	75p	CA3065	£1.42	OA202	7p	1544	4p	3N152
		BD132	75p	CA3088E	£1.70	OC20	97p	15920	7p	3015F
AC151	20p	BD137/132	£1.50	CA3090Q	£4.78	OC25	37p	15940	6p	3015G
AC152	25p	BDY20	92p	CD4001AE	54p	OC28	70p	155009	80p	7400
AC153	50p	BF115	23p	CD4009AE	£1.16	OC29	76p	155012	80p	7401
AC176	20p	BF163	35p	CD4011AE	54p	OC35	60p	155015	75p	7402
AC153/176K	62p	BF167	25p	CD4012AE	54p	OC36	65p	155018	75p	7403
AC187K	17p	BF173	35p	CD4013AE	£1.11	OC41	40p	155024	75p	7404
AC188K	23p	BF177	25p	CD4015AE	£2.92	OC42	40p	155047	75p	7405
AC187/188K	40p	BF178	31p	CD4017AE	£2.92	OC44	20p	2N404	23p	7408
AC171	27p	BF180	35p	CD4018AE	£2.92	OC45	20p	2N696	15p	7409
AC178	20p	BF194	15p	CD4022AE	£3.25	OC71	20p	2N697	17p	7410
AC195	20p	BF195	15p	CD4024AE	£2.92	OC72	20p	2N698	30p	7413
ACV20	20p	BF196	15p	CR1051C	45p	OC75	25p	2N706	12p	7420
ACV21	19p	BF200	35p	CR1401C	60p	OC76	25p	2N706A	12p	7425
ACV22	10p	BF254	14p	CRS3/05AF		OC77	40p	2N708	16p	7430
AD140	55p	BF255	15p		£1.08	OC81	20p	2N911	50p	7440
AD149	50p	BFX13	25p	CRS3/40AF		OC81D	20p	2N914	20p	7442
AD151	49p	BFX29	25p		£1.53	OC83	23p	2N918	42p	7443
AD162	49p	BFX34	25p	CZ6		OC84	25p	2N929	25p	7444
AD161/162	£1.04	BFX85	34p	D10 (NTGD10)		OC139	25p	2N930	28p	7445
AF106	32p	BFX86	25p		40p	OC170	25p	2N1131	24p	7446
AF114	25p	BFX87	30p	IRT84	£2.90	OC171	30p	2N1132	24p	7447
AF115	25p	BFX88	24p	LIC709C/5	42p	OCPT1M	45p	2N1332	17p	7450
AF116	25p	BFY50	15p	LIC709C/8	42p	ORP12	50p	2N1303	17p	7451
AF117	25p	BFV51	15p	LIC723C/5	£1.05	ORP60	40p	2N1304	24p	7453
AF118	25p	BFV52	15p	LIC723C/8	£1.25	ORP61	40p	2N1305	24p	7454
AF124	25p	BFY53	17p	LIC741C/5	15p	ORP69	50p	2N1306	30p	7460
AF125	24p	BFY90	£1.05	LIC741C/8	40p	PN70	9p	2N1307	30p	7470
AF126	17p	BP101	75p	MC1302L	£1.75	PN71	9p	2N1308	34p	7472
AF139	47p	BPX66	£1.35	MC1305P	£2.80	PN71	7p	2N1309	34p	7473
AF186	40p	BRX39	40p	MC1307P	£1.65	PN107	7p	2N1310	34p	7474
AF239	50p	BSY19	16p	MC1310P	£2.95	PN108	7p	2N1359 (CR1)	60p	7475
AF279	50p	BSY20	16p	MC1312P	£2.75	PN109	7p	401C	60p	7475
ASV26	25p	BSX21	20p	MC1330P	£2.00	PN3819(2N3819)	2N1613	15p	7476	
ASV27	35p	BSY27	20p	MC1352P	£2.00	2N1711	20p	2N1711	15p	7480
ASV28	22p	BSY29	25p	MC4024P	£2.20	ST2	28p	2N1893	54p	7482
ASV29	30p	BSY95A	12p	MC4044P	£2.20	SL103A	50p	2N2218	33p	7483
BA138	15p	BY100	20p	MFC6030	£1.63	SL403A (Rect)	2N2218A	44p	7486	
BA X16	8p	BY127	22p	MFC6040	£1.15	60p	2N2219	38p	7490	
BB103	15p	BZV9/400R	92p	MFC8010	£1.38	SL803A	80p	2N219A	53p	7491A
BB104	28p	BT106	£1.20	MFC8020	£1.12	LC403	2N2368	17p	7492	
BB105	32p	BZY88C3V3	13p	MFC9020	£2.12	(LC Amp.)	£1.50	2N2369	17p	7493
BC107	10p	BZY88C3V6	13p	MJE371	68p	TAA263	75p	2N2369A	17p	7494
BC107/BC177	24p	BZY88C3V9	13p	MJE370	65p	TAA293	97p	2N2484	42p	7495
		BZY88C4V3	13p	MJE521	62p	TAA310	£1.25	2N2646	45p	7496
BC108	24p	BZY88C4V7	13p	MJE2955	£1.06	TAA320	75p	2N2904	44p	74100
BC108/BC178	24p	BZY88C5V1	13p	MJE3055	66p	TAA361	45p	2N2904A	49p	74107
BC109	23p	BZY88C5V6	13p	MJ480	97p	TAD101	£1.21	2N2905	65p	74121
BC109/BC179	24p	BZY88C6V8	13p	MJ491	£1.35	TIL112	£2.00	2N2924	18p	74150
		BZY88C7V5	13p	MJ802	£4.12	TIL209	35p	2N2925	20p	74151
BC109C	11p	BZY88C8V2	13p	MJ802/MJ4502		TIP31A	60p	2N2926	10p	74153
BC140	30p	BZY88C9V1	13p		£8.56	TIP32A	70p	2N3053	27p	74154
BC147	14p	BZY88C10V	13p	MJ900	£1.80	TIP41A	85p	2N3054	60p	74155
BC148	9p	BZY88C11V	13p	MJ1000	£1.50	TIP42A	£1.00	2N3055	60p	74156
BC149	10p	BZY88C12V	13p	MJ4502	£4.44	TIS43	30p	2N3391A	29p	74190
BC157	12p	BZY88C13V	13p	MPF102	37p	VA1066S	15p	2N3325	£1.04	74191
BC158	11p	BZY88C15V	13p	MPF103(2N5457)		VA1039	15p	2N3702	10p	74192
BC159	12p	BZY88C16V	13p		49p	VA1040	15p	2N3703	10p	74193
BC147/157	22p	BZY88C18V	13p	MPF104(2N5458)		VA1077	15p	2N3704	10p	74196
BC148/158	22p	BZY88C20V	13p		49p	W05	30p	2N3705	10p	74197
BC149/159	22p	BZY88C22V	13p	MPF105(2N5459)		W01	31p	2N3706	10p	42250
BC167	11p	BZY88C24V	13p		46p	W02	32p	2N3707	10p	40309
BC168	10p	BZY88C27V	13p	NKT0033	96p	W04	33p	2N3708	8p	40310
BC169	11p	BZY88C30V	13p	NKT211	25p	W06	35p	2N3709	10p	40311
BC169C	12p	BZX61C7V5	23p	NKT212	25p	W08	44p	2N3710	10p	40312
BC177	14p	BZX61C8V2	23p	NKT213	25p	ZT X107	11p	2N3711	10p	40320
BC178	13p	BZX61C9V1	23p	NKT216	46p	ZT X300	11p	2N3712	25p	40360
BC179	14p	BZX61C10V	23p	NKT217	50p	ZT X302	18p	2N3820	60p	40361
BC182	10p	BZX61C11V	23p	NKT220	25p	ZT X303	15p	2N3822	30p	40406
BC182L	10p	BZX61C12V	23p	NKT221	18p	ZT X304	23p	2N3866	£1.10	40407
BC183	9p	BZX61C13V	23p	NKT274	18p	ZT X314	11p	2N3904	28p	40408
BC183L	10p	BZX61C15V	23p	NKT275	20p	ZT X320	30p	2N3906	28p	40409
BC184L	12p	BZX61C16V	23p	NKT279A	12p	ZT X330	18p	2N4058	13p	40410
BC212	12p	BZX61C20V	23p	NKT281	29p	ZT X500	14p	2N4059	11p	40430
BC212L	12p	BZX61C22V	23p	NKT3571	75p	ZT X501	15p	2N4061	11p	40432
BC238	10p	BZX61C24V	23p	NKT401	71p	ZT X502	18p	2N4062	11p	40468A
BC238/308	23p	BZX61C27V	23p	NKT402	77p	ZT X503	17p	2N4444	£2.20	40512
BC257	9p	BZX61C30V	23p	NKT403	65p	ZT X504	45p	2N4871	40p	40512
BC258	8p	CA3004	£2.25	NKT404	60p	1N914	4p	2N5245	45p	40576
BC259	9p	CA3005	£1.50	NKT405	79p	1N3754	20p	2N5457(MPF103)	40p	40600
BC307	12p	CA3011	92p	NKT406	62p	1N4001	7p	2N5457	40p	40601
BC308	10p	CA3013	£1.30	NKT407	29p	1N4002	7p	2N5458(MPF104)	40p	40602
BCY30	25p	CA3014	£1.52	NKT713	29p	1N4003	10p	2N5459(MPF105)	40p	40669
BCY31	48p	CA3018	88p	NKT714	29p	1N4004	12p	2N5777	45p	40739
BCY32	50p	CA3019A	£1.19	NKT781	29p	1N4005	12p			
BCY33	20p	CA3020	£1.55	NTGD10	40p	1N4006	12p			
BCY34	25p	CA3028A	88p	OA47	8p	1N4007	12p			
BCY38	30p	CA3035	£1.52	OA79	8p	1N4008	12p			

ELECTROLYTIC AXIAL LEADS

Mfd.	Working Voltage	Price	Mfd.	Working Voltage	Price
1.0	40v	7p	100	16v	6p
1.0	100v	5p	100	25v	6p
2.2	25v	7p	100	40v	7p
2.2	63v	5p	100	63v	10p
4.7	40v	5p	220	25v	8p
10	25v	5p	220	40v	9p
10	63v	6p	1000	25v	16p
22	40v	6p	2200	25v	30p
47	25v	6p	4700	16v	33p
47	40v	6p			

CAPACITORS—METALLISED POLYESTER

Stock values: MFD
0.01, 0.015, 0.022, 0.033
0.047, 0.068, 0.10
0.150, 0.220

Price each
3p
4p
5p
7p
8p
11p
12p
14p
15p
20p
24p

CAPACITORS—POLYSTYRENE

Stock values: MFD
100pF, 150pF, 220pF, 330pF, 470pF, 560pF, 680pF, 820pF, 1000pF, 1500pF, 2200pF, 3300pF, 4700pF, 5600pF, 6800pF, 8200pF

Price each

GUNTON ELECTRONIC IGNITION KIT £9.35 INC. VAT

READY BUILT UNIT GUARANTEED 5 YEARS £11.55 INC. VAT

Patents Pending. 12 volt only—state pos. or neg. earth. Capacitive discharge ignition is recognised as being the most efficient system and will give you:

- ★ Continuous Peak-Tuned Performance
- ★ Up to 30% reduced fuel consumption
- ★ Easier All-weather Starting
- ★ Increased Acceleration and Top Speed
- ★ Longer Spark Plug Life
- ★ Increased Battery Life
- ★ Elimination of Contact Breaker Burn
- ★ Purer Exhaust Gas Emission



Kit includes absolutely everything for assembly: Ready drilled Case and Hardware Printed Circuit Board, Cables, Coil Connectors, Silicon Grease Nuts and Bolts, etc. 8 page illustrated instructions cover fitting of all types of tachometers. Call in for a workshop demonstration. S.A.E. all enquiries please, or Phone 33652. (Many letters from satisfied customers.)

SCORPIO: Transformer £2.42. Printed Circuit Board 83p
All prices include carriage and V.A.T.

ALUMINIUM BOXES

Complete with baseplate and screws

AT DIRECT FROM MANUFACTURERS' PRICES WITH RETURN OF POST SERVICE

Type No	L	W	D	Price
7*	5 1/4	2 1/2	1 1/2	44p
8*	4	4	1 1/2	44p
9*	4	2 1/2	1 1/2	44p
10*	5 1/4	4	1 1/2	53p
11	4	2 1/2	2	44p
12	3	2	1	39p
13	6	4	2	59p
14	7	5	2 1/2	68p
15	8	6	3	88p
16	10	7	3	96p

* These sizes accept standard veroboard range. All prices include carriage and V.A.T. 20% discount on 10 or more boxes. 30% discount on orders over £10.

Dept. PE5, ELECTRONICS DESIGN ASSOCIATES
82 BATH STREET, WALSALL WS1 3DE

COMPARE OUR PRICES

Speaker Bargains	£p	ACOS GP91/28C or GP91/38C stereo compatible	1-05
E.M.I. 13in x 8in 3, 8 & 15 ohms	2-00	ACOS GP94 stereo ceramic	1-75
plain	2-25	ACOS GP95 stereo crystal	1-35
with tweeter	3-50	ACOS GP96 stereo ceramic	1-75
twin tweeter		9THAC Sonotone stereo ceramic (diamond)	1-95
Type 350-20 watt with tweeter 8 ohms, P.P. 37p	7-25	9THAC Sonotone stereo ceramic (diamond) slimline	1-95
8in x 6in 3, 8 & 15 ohms	1-30	ACOS GP67/2C mono crystal	65
7in x 4in 3 & 8 ohms	1-05	ACOS GP101 compatible crystal	75
FANE 8in 8 ohm, dual cone	2-30	19-TI Sonotone stereo crystal	90
CELESTION 8in 15 ohm	1-50	Postage 5p per cartridge	
BAKER GROUP 25 12in 25W 8 or 15 ohm	5-75		
Postage 25p per speaker			
2 1/2in 8 or 64 ohm P.P. 10p	50		

Kit-form cabinets, teak	£7.75	Battery Eliminators	
(17in x 10in x 6in)		240v input 6 or 9v d.c. output at 150 mA	1-99
with a 13in x 8in or 8in cut out		240v input 6, 7 1/2 or 9v output at 300 mA	2-99
(12in x 12in x 6in) with a 8in x 5in or 8in cut out.	2-25	12v d.c. input (for cars) 6, 7 1/2 or 9v d.c. output at 300 mA	2-99
(please specify cut out)		P. & P. 10p	
Add 35p per Cabinet for post & packing			

Microphone Bargains	£p	Tapes—"MYLAR" base finest quality British made.	
MIC45 "ACOS" metal case, crystal hand	95	5in 600ft 36p	5 1/2in 1800ft 85p
CM 20 Crystal Hand	45	5in 900ft 45p	7in 1200ft 55p
DX143 Dynamic, cassette-type stick	1-00	5 1/2in 1200ft 55p	7in 1800ft 80p
DM160 PLANET stick metal, switch crystal	1-45	5 1/2in 900ft 45p	7in 2400ft 95p
DM160 Dynamic uni-dir, ball metal	3-75	Postage 9p each	
UD130 50K/600 ohm uni-dir, ball metal	4-50		
TW209 Lesson dual imp ball metal uni-dir	5-75		
Condenser Mike uni-dir 600 ohm	7-95		
Guitar mike	45		
Lapel type, crystal	40		
Postage 17p each			

Cartridges—with standard fittings & styli	£p	Plastic Library Cases for 5in Reels 16p	
GOLDRING G850	3-25	5 1/2in Reels 19p	
GOLDRING G800	4-95	7in Reels 21p	
		P. & P. 5p each	

THIS MONTH'S SPECIAL OFFER
Amstrad Stereo Headphones Model HPS 5A with v. controls. Recommended retail price £8.95. Our price £3.95. P. & P. 25p

Slight price alterations due to V.A.T. will effect certain of our items after April 1st.

RIVERSDALE ELECTRONICS

ALL OUR MERCHANDISE IS FULLY GUARANTEED

Mail Order Dept. E5/73, P.O. Box 470, Manchester M60 4BU
SEND 25p FOR COMPLETE CATALOGUE

ZIGGY'S 2001 ELECTRONICS Co. Ltd. RARE BARGAINS



SPECS. MULTIMETER U4324. Sensitivity 20,000 OPV DC. Usually high current ranges. 3 amp, a.c./d.c. Voltages AC3 to 900V d.c. 0.6 to 1200V. Resistance 500 ohms-20-200-2,000kΩ. Transmission level -10 to +12dB. This high quality instrument has diode protection. Complete with test leads, batteries, etc. PRICE £8 plus 25p post, etc.

MULTIMETER 4312. Similar to above but special features include 6 amp current range and instrument is housed in metal case with carrying handle. (Illustrated leaflet sent on request.) ONLY £8.50 plus 25p P. & P.

EAGLE LT700 TRANS., LT44 TRANS. Our price 32p each, postage 6p.

ARE YOU HUMBLED ABOUT YOUR RUMBLE? SP25 drive wheels, 65p plus 5p P. & P. MP60 drive wheels, 55p plus 5p P. & P.

SUBMINIATURE TOGGLE SWITCHES—very useful, very small. S/P, 25p, DP/ST, 33p; DP/DT, 45p. Postage 5p each, over 10, postfree.

SUBMINIATURE MAINS TRANSFORMERS. Eagle MT6, 6-0-6, 100 M/A, 80p, postage 10p. MT 12, 12-0-12, 50 M/A, 80p, postage 10p.

MINIATURE TYPE MAINS TRANSFORMERS. Eagle Type MT280, 6-0-6 280 M/A, £1.20. MT150, 12-0-12, 150M/A, £1.20. MT100, 24-0-24, 100 M/A, £1.20. R/S types, 13V, 0.5 amp. C. Tapped, £1.06, 16 3V, 0.3 amp. C.T., £1.06. Postage 15p on miniature size.

DIAMOND STYLI FOR SONOTONE 9THAC, LP178, 65p plus 5p P. & P. LP/LP, 95p plus 5p P. & P.

FOR SPEEDY DELIVERY OF THESE MINT CONDITION COMPONENTS PLEASE SEND C.W.O. TO ZIGGY'S 2001 ELECTRONICS CO. LTD., DEPT. P.E.3, 34 MABLEY STREET, LONDON, E.9.

N.B.—After 1st April please add 10% for VAT—Sorry.

ELECTRONIC BARGAINS

COMPAKS

Manufacturers' fall-outs which include functional and part-functional units. Ideal for learning and experimenting.

PAK 1 13 mixed 7400 series	66p
PAK 2 10 unijunction T1543	55p
PAK 3 6 S.C.R.'s	55p
PAK 4 50 silicon and germanium NPN and PNP transistors	55p

Valve Equivalent Book 40p
Transistor Equivalent Book 40p
List over 3,000 equivalents

ACOUSTIC WADDING

Bonded Acrylic Fibre lin thick. Per square yard 50p

VYNNIA SPEAKER CLOTH Black—Black and Silver—Black and Gold

Sizes:	60p
18in x 25in	
36in x 25in	£1.10
36in x 50in	£2.20

Send S.A.E. for samples

SOLDERING IRONS

	Retail Price	Our Price
Antex CN240	£1.98	£1.50
Antex CN240	£1.87	£1.49
Antex X25	£1.92	£1.54

FERRANTI RADIO CHIP

ZN414 £1.23

AMPLIFIER MODULE

5 watt, 9 volt supply, 4, 8 or 16 Ω speaker, £3.30

Fully Guaranteed. Mail order only. P. & P. 13p. Cheque or P/O to:

T. F. J. ELECTRONICS
25 EASTBURY COURT
LEMSFORD ROAD
ST. ALBANS, HERTS.

4-STATION INTERCOM



Solve your communication problems with this 4-Station Transistor Intercom system (1 master and 3 Subs), in de-luxe 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 96ft and other accessories. P. & P. 40p.

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 with lock system. Price £14.40. P. & P. 35p extra.

INTERCOM/BABY ALARM



Same as 4-Station Intercom for two-way instant communication. Ideal as Baby Alarm and Door Phone. Complete with 6ft connecting wire. Battery 14p. P. & P. 25p.

Transistor TELEPHONE AMPLIFIER

Why not boost business efficiency with this incredible De-Luxe Telephone Amplifier. Take down long telephone messages or converse without holding the handset. A useful office aid. On/off switch. Volume control. Battery 14p extra. P. & P. 22p. Full price refunded if not satisfied in 7 days.

WEST LONDON DIRECT SUPPLIES (PE/5)
189 KENSINGTON HIGH STREET, LONDON, W.8

**BRAND NEW
GUARANTEED**

SEMICONDUCTORS & COMPONENTS

**RETURN OF POST
SERVICE**

WE SUPPLY NEARLY ALL THE COMPONENTS FOR PROJECTS IN THIS MAGAZINE

TRANSISTORS

2N109	0.49	2N3055	0.60	2N3459	0.33	AF290	0.35	BCY31	0.40	BFX30	0.25
2N174	1.40	2N3390	0.20	2N3459	0.40	AF239	0.41	BCY32	0.60	BFX37	0.33
2N176	0.75	2N3391	0.20	3N128	0.63	AF240	0.72	BCY33	0.25	BFX44	0.83
2N274	0.75	2N3391A	0.22	3N138	1.65	AF279	0.54	BCY34	0.35	BFX63	2.48
2N305	0.75	2N3392	0.18	3N139	1.42	AF280	0.54	BCY38	0.40	BFX68	0.30
2N307	0.42	2N3393	0.22	3N140	0.92	AFY42	0.75	BCY39	0.05	BFX84	0.24
2N376	1.00	2N3394	0.12	3N141	0.81	AFY41	0.55	BCY40	0.60	BFX85	0.30
2N384	0.93	2N3402	0.17	3N142	0.58	AL103	0.70	BCY43	0.15	BFY86	0.25
2N388A	0.40	2N3403	0.12	3N152	0.92	AL103	0.70	BCY43	0.15	BFY87	0.27
2N404	0.23	2N3404	0.19	3N153	0.81	ASV26	0.30	BCY38	0.21	BFX88	0.25
2N406	0.75	2N3405	0.27	3N154	0.94	ASV27	0.36	BCY39	0.21	BFX89	0.45
2N456A	0.75	2N3414	0.10	3N159	1.17	ASV28	0.28	BCY40	0.66	BFY10	0.35
2N457A	0.80	2N3415	0.10	3N200	2.49	ASV29	0.30	BCV67	0.84	BFY11	0.45
2N491	3.25	2N3416	0.15	LM741CN		ASV30	0.20	BCV70	0.17	BFY17	0.90
2N584	0.28	2N3417	0.21	(L1.1)	0.70	ASV31	0.20	BCV71	0.20	BFY18	0.35
2N591	0.34	2N3570	1.25	L741C		ASV32	0.15	BCV72	0.13	BFY19	0.35
2N696	0.18	2N3571	1.12	(T05)	0.40	ASV33	0.15	BCV73	0.47	BFY20	0.18
2N697	0.15	2N3572	0.97	40050	0.55	BC107	0.14	BCV88	0.40	BFY29	0.40
2N698	0.25	2N3702	0.10	40251	0.81	BC108	0.13	BCY89	0.20	BFY37	0.20
2N699	0.20	2N3703	0.10	40390	0.30	BC113	0.14	BCZ10	0.35	BFY41	0.43
2N706	0.10	2N3704	0.10	40310	0.50	BC114	0.12	BCZ11	0.50	BFY43	0.65
2N708	0.15	2N3706	0.09	40313	0.50	BC115	0.15	BCZ12	0.75	BFY50	0.18
2N709	0.40	2N3707	0.10	40318	0.92	BC116	0.15	BD116	0.75	BFY51	0.18
2N711	0.50	2N3708	0.07	40322	0.92	BC117	0.21	BD123	0.82	BFY53	0.15
2N718	0.21	2N3709	0.09	40360	0.40	BC118	0.11	BD124	0.80	BFY56	0.34
2N719	0.20	2N3710	0.09	40361	0.40	BC119	0.27	BD131	0.57	BFY64	0.41
2N720	0.50	2N3711	0.09	40362	0.48	BC121	0.14	BD132	0.57	BFY75	0.40
2N721	0.55	2N3712	0.95	40362	0.50	BC123	0.28	BD135	0.48	BFY78	0.22
2N914	0.22	2N3713	1.08	40363	0.48	BC125	0.15	BD136	0.49	BFY78	0.38
2N916	0.20	2N3714	1.15	40384	0.58	BC126	0.20	BD137	0.55	BFY90	0.55
2N919	0.50	2N3715	1.23	40406	0.40	BC132	0.30	BD138	0.63	BRY39	0.29
2N929	0.20	2N3716	1.20	40407	0.40	BC134	0.11	BD139	0.71	BXX19	0.13
2N930	0.20	2N3717	1.20	40408	0.50	BC135	0.11	DD140	0.23	BXX20	0.12
		2N3718	1.20	40409	0.50	BC136	0.15	DD141	0.15	BXX21	0.20
		2N3719	1.20	40410	0.55	BC137	0.15	DD142	1.50	BXX22	0.20
		2N3720	1.20	40411	0.55	BC138	0.24	DDY17	1.50	BXX27	0.34
		2N3721	1.20	40412	0.55	BC140	0.34	DDY18	1.75	BXX28	0.25
		2N3722	1.20	40413	0.55	BC141	0.39	DDY19	1.97	BXX29	0.25
		2N3723	1.20	40414	0.55	BC142	0.24	DDY20	0.80	BXX30	0.88
		2N3724	1.20	40415	0.55	BC143	0.21	DDY21	0.85	BXX39	0.78
		2N3725	1.20	40416	0.55	BC144	0.24	DDY22	0.65	BXX60	0.54
		2N3726	1.20	40417	0.55	BC145	0.21	DDY61	0.65	BXX62	0.42
		2N3727	1.20	40418	0.55	BC147	0.11	DDY62	0.52	BXX76	0.15
		2N3728	1.20	40419	0.55	BC148	0.11	BF115	0.23	BXX77	0.20
		2N3729	1.20	40420	0.55	BC149	0.13	BF117	0.43	BXX78	0.25
		2N3730	1.20	40421	0.55	BC153	0.18	BF119	0.68	BXX79	0.28
		2N3731	1.20	40422	0.55	BC154	0.18	BF121	0.25	BXX94	0.20
		2N3732	1.20	40423	0.55	BC157	0.14	BF123	0.27	BXX95	0.15
		2N3733	1.20	40424	0.55	BC158	0.13	BF125	0.25	BXX97	0.15
		2N3734	1.20	40425	0.55	BC159	0.14	BF127	0.27	BXX97	0.15
		2N3735	1.20	40426	0.55	BC160	0.37	BF152	0.20	BXX98	0.15
		2N3736	1.20	40427	0.55	BC167B	0.13	BF153	0.29	BXX98	0.15
		2N3737	1.20	40428	0.55	BC168B	0.11	BF154	0.18	BXX99	0.15
		2N3738	1.20	40429	0.55	BC168C	0.11	BF158	0.23	BXX51	0.25
		2N3739	1.20	40430	0.55	BC169	0.14	BF159	0.22	BXX52	0.25
		2N3740	1.20	40431	0.55	BC170	0.13	BF160	0.23	BXX53	0.25
		2N3741	1.20	40432	0.55	BC171	0.11	BF161	0.41	BXX54	0.30
		2N3742	1.20	40433	0.55	BC172	0.13	BF163	0.20	BXX56	0.79
		2N3743	1.20	40434	0.55	BC172	0.11	BF166	0.31	BXX56	0.15
		2N3744	1.20	40435	0.55	BC173	0.10	BF167	0.21	BXX78	0.40
		2N3745	1.20	40436	0.55	BC182L	0.10	BF173	0.22	BXX79	0.40
		2N3746	1.20	40437	0.55	BC183	0.09	BF177	0.29	BXX79	0.40
		2N3747	1.20	40438	0.55	BC183L	0.09	BF178	0.35	BXX90A	0.09
		2N3748	1.20	40439	0.55	BC184	0.11	BF179	0.43	BXX91A	1.42
		2N3749	1.20	40440	0.55	BC184L	0.11	BF180	0.35	BC105	2.25
		2N3750	1.20	40441	0.55	BC186	0.25	BF181	0.34	C111	0.53
		2N3751	1.20	40442	0.55	BC187	0.25	BF182	0.40	C407	0.18
		2N3752	1.20	40443	0.55	BC188	0.11	BF183	0.17	C408	0.15
		2N3753	1.20	40444	0.55	BC189	0.10	BF184	0.17	C425	0.45
		2N3754	1.20	40445	0.55	BC206	0.11	BF185	0.25	C426	0.25
		2N3755	1.20	40446	0.55	BC207	0.10	BF194	0.14	C428	0.25
		2N3756	1.20	40447	0.55	BC208	0.09	BF195	0.16	C444	0.28
		2N3757	1.20	40448	0.55	BC211	0.30	BF196	0.15	D40N3	0.62
		2N3758	1.20	40449	0.55	BC212	0.10	BF197	0.15	GET11	0.45
		2N3759	1.20	40450	0.55	BC212L	0.12	BF198	0.18	GET11B	0.25
		2N3760	1.20	40451	0.55	BC214L	0.14	BF199	0.18	GET114	0.20
		2N3761	1.20	40452	0.55	BC236	0.16	BF200	0.40	GET115	0.50
		2N3762	1.20	40453	0.55	BC237	0.08	BF224J	0.14	GET119	0.35
		2N3763	1.20	40454	0.55	BC238	0.09	BF225J	0.19	GET120	0.40
		2N3764	1.20	40455	0.55	BC239	0.09	BF237	0.22	GET133	0.20
		2N3765	1.20	40456	0.55	BC251	0.22	BF238	0.22	GET136	0.20
		2N3766	1.20	40457	0.55	BC252	0.18	BF244	0.16	GET138	0.20
		2N3767	1.20	40458	0.55	BC253	0.23	BF245	0.33	GET139	0.20
		2N3768	1.20	40459	0.55	BC257	0.09	BF246	0.43	GET173	0.15
		2N3769	1.20	40460	0.55	BC258	0.09	BF247	0.49	GET180	0.30
		2N3770	1.20	40461	0.55	BC259	0.13	BF254	0.17	GET183	0.20
		2N3771	1.20	40462	0.55	BC261	0.20	BF255	0.17	GET187	0.20
		2N3772	1.20	40463	0.55	BC262	0.18	BF257	0.47	GET189	0.22
		2N3773	1.20	40464	0.55	BC263	0.23	BF258	0.53	GET189S	0.25
		2N3774	1.20	40465	0.55	BC300	0.42	BF259	0.55	MA8001	0.16
		2N3775	1.20	40466	0.55	BC301	0.34	BF261	1.23	MA8002	0.47
		2N3776	1.20	40467	0.55	BC302	0.27	BF264	1.45	MA8002	0.47
		2N3777	1.20	40468	0.55	BC303	0.54	BF270	0.21	MA8003	0.47
		2N3778	1.20	40469	0.55	BC304	0.45	BF274	0.45		
		2N3779	1.20	40470	0.55	BC307	0.10	BF272	0.49		
		2N3780	1.20	40471	0.55	BC307A	0.10	BF273	0.15		
		2N3781	1.20	40472	0.55	BC307V1	0.10	BF274	0.17		
		2N3782	1.20	40473	0.55	BC308	0.09	BF457	0.53		
		2N3783	1.20	40474	0.55	BC308A	0.09	BF458	0.65		
		2N3784	1.20	40475	0.55	BC309	0.09	BF459	0.65		
		2N3785	1.20	40476	0.55	BC309A	0.10	BF821A	1.75		
		2N3786	1.20	40477	0.55	BC309B	0.10	BF828	0.74		
		2N3787	1.20	40478	0.55	BC313	0.30	BF861	0.27		
		2N3788	1.20	40479	0.55	BC327	0.24	BF896	0.30		
		2N3789	1.20	40480	0.55	BC328	0.22	BFW10	0.61		
		2N3790	1.20	40481	0.55	BC337	0.19	BFW11	0.61		
		2N3791	1.20	40482	0.55	BC338	0.19	BFX13	0.23		
		2N3792	1.20	40483	0.55	BCY30	0.35	BFX29	0.30		

AF290	0.35	BCY31	0.40	BFX30	0.25	BCY32	0.60	BFX37	0.33
AF239									

* Denotes VAT has been absorbed in the price without increase on VISCOUNT audio systems.

Increase with VAT!

VISCOUNT III AUDIO STILL ONLY £52* COMPLETE

14 + 14w. r.m.s. 40Hz to 40kHz ± 3dB. Total distortion at 10w. at 1kHz - 0.1%. This is real value for money! We have designed 2 systems and the heart of them both is the Viscount III amplifier. A unit of great eye appeal with teak finished cabinet. FET's (Field effect, transistors) are incorporated on the input stages, just like top priced units. FET's give you more of the signal you want and almost none of the hiss you don't. Both units have output sockets for headphones and tape recorder.

For both systems we have chosen the famous Garrard SP25 Mk. III deck, with fitted magnetic cartridge, which comes complete with simulated teak plinth and tinted acrylic cover.

The exclusive Duo loudspeaker systems are incomparable for quality within their price range. Large speakers in extremely substantial cabinets. There's a choice of the Duo II's for the smaller room or the big Duo III's for real bass response.

PRICES: SYSTEM 1

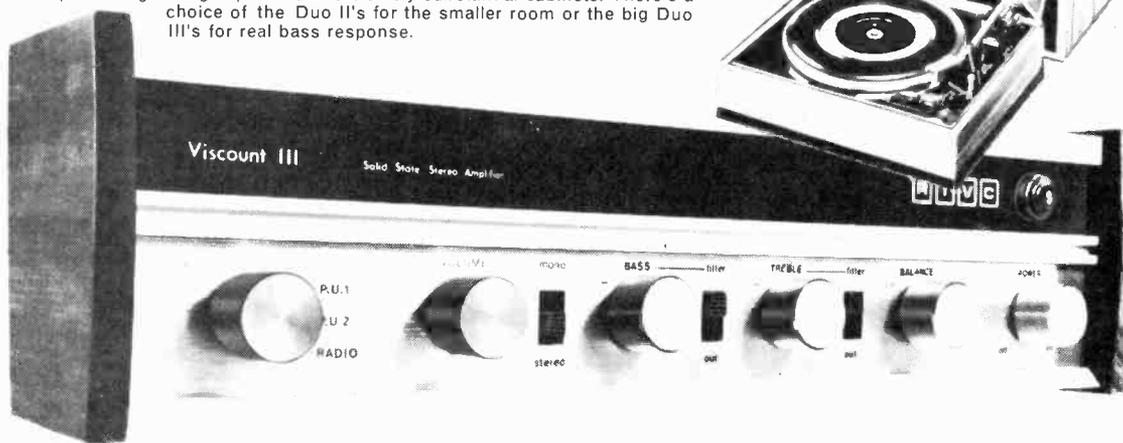
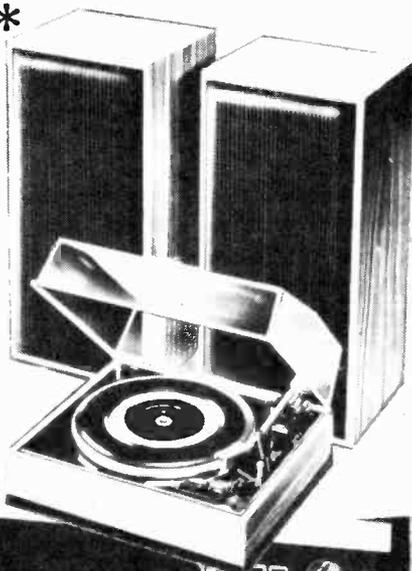
Viscount III R 101 amplifier	£24.20 + £1 p & p
2 Duo Type II speakers	£15.40 + £2.20 p & p
Garrard SP25 Mk. III with MAG. cartridge plinth & cover	£25.00 + £1.75 p & p
total	£64.60

Available complete for only **£52*** + £3.50 p & p

PRICES: SYSTEM 2

Vicount R 101 amplifier	£24.20 + £1 p & p
2 Duo Type III speakers	£35.20 + £3.30 p & p
Garrard SP25 Mk. III with MAG. cartridge plinth & cover	£25.00 + £1.75 p & p
total	£84.40

Available complete for **£69*** + £4 p & p



SPEAKERS: Duo Type II Size approx. 17in. x 10½in. x 6½in. Drive unit 13in. x 8in. with parasitic tweeter. Max. power 10 watts ohms. Simulated Teak cabinet. £15.40 a pair (inc. VAT), £3.30 p. and p. Duo Type III Size approx. 23½in. x 11½in. x 9½in. Drive unit 13½in. 8½in. with H.F. speaker. Max. power 20 watts. 8 ohms. Freq. range 20Hz to 20KHz. Teak veneer cabinet.

SPECIFICATION R101: 14 watts per channel into 3 to 4 ohms (suitable 3-15 ohms.) Total distortion @ 10W 1kHz @ 0.1%. P.U.1 (for ceramic cartridges) 150mV into 3 Meg. P.U.2 (for magnetic cartridges) 4mV @ 1kHz into 47K equalised within idB R.I.A.A. Radio 150mV into 220K. (Sensitivities given at full power). Tape out facilities: headphone socket, power out 250mW per channel. Signal-to-noise ratio. (all controls at max.)—P.U.1. and radio — 65dB, P.U.2 — 58dB. Cross talk better than — 35dB on all inputs. Size approx. 13½in. x 9in. x 3½in. Send S.A.E. for fully illustrated brochure. 12 month's written guarantee.

ONLY FROM US

TIMES OF OPENING: Acton—Mon.—Sat. 9.30-5.
Closed all day Wed.
Edgware Rd.—Mon.—Sat. 9.30-5. Closed all day Thurs

VISIT OUR SHOWROOMS **RTVC**
Radio and TV Components (Acton) Ltd.
21d High Street, Acton, London W3 6NG
323 Edgware Road, London W2
Mail orders to Acton. Terms C.W.O.
Goods not despatched outside U.K.
All enquiries S.A.E.

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

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

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

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

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

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

ICS your key to the door of opportunity

Tick or state subject of interest and post to:
International Correspondence Schools
Dept. 230H, Intertext House, Stewarts Road
London SW8 4UJ

Subject of interest

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

Name

Address

.....

Occupation Age

Accredited by the Council for the Accreditation of Correspondence Colleges

BELLING LEE INSULATED TERMINALS. Red or Black, 5 amp max. 10p pair, p.p. 31p

BERCOSTAT WIREWOUND RHEOSTAT. 50 volt, 800 Ω , 25 watts, 2in dia. 25p, p.p. 71p.

FINNED ALUMINIUM HEATSINK. 9in x 11in. Ready drilled. 20p, p.p. 61p.

SUB-MIN. CROC. CLIPS. Red or Black, insulated 4p. Min. quantity, 6, p.p. 31p.

GARRARD MAG. TAPE DECKS: 11 p.p.s., 50V, solenoid operated brakes, etc. Main voltage motors £7-40 each, p.p. £1-23.

4in PLAINAIR FANS. Complete, capacitor, ex equip. 2,500 r.p.m. £3-50, p.p. 40p.

ELECTRIC MOTORS. HOOVER OR CROMPTON PARKINSON. 250V. Single phase a.c.
1 h.p., 1,440 r.p.m., £3-75, p.p. £1.
1 h.p., 1,425 r.p.m. or 2,800 r.p.m., £6-75, p.p. £1-25.
1 h.p., 1,440 r.p.m., £2-25, p.p. 75p.

AUDIO CONNECTORS
3 pin Din Plug 13p each.
5 pin Din Plug A type, B type 13p ..
2 pin Din Speaker Plug/Socket 10p ..
3 pin Din Line Socket 13p ..
3.5mm Jack Plug Screened 10p ..
Standard Jack Plug 10p ..
Screened Standard Jack Plugs 15p ..
Stereo Jack Plug 18p ..
Screened Stereo Jack Plug 18p ..

Phono Plugs: Red or Black 3p each. P.p. on above items 34p.

MAINS NEONS
Red or Green. Size: 1in x 3in x 11in. 15p, p.p. 31p.

LEVER ACTION P.O.1000 TYPE SWITCHES
Lock 4-pole changeover, 15p, p.p. 34p. Ex equip.
Lock 2-pole changeover, 10p, p.p. 34p. Ex equip.

AUDIO LEADS
Screened Phono Leads 46in long, 15p.
3.5mm JACK/3.5mm JACK 7ft 6in long, 40p.
3-Pin Din A Type, 3-PIN A TYPE. Approx. 5ft long, 70p.
P.p. on above items 34p.

MULLARD & MALLORY SCREW TERMINAL CAPACITORS 4,500pF 64V, 7,100pF 40V, 50p each. 20,000 30V, 25,000 25V, 35,000 15V, 30p each, p.p. 16p.

MULLARD FULLWAVE RECTIFIERS
6-48V, 15 amp, 75p, D.P. 10p.

BELLING LEE 1.5 amp in-line rubber covered interference suppressor, 25p, p.p. 8p.

RUBBER 3 PIN 5 AMP NON-REVERSIBLE CABLE CONNECTORS, 20p, p.p. 34p.

SOLENOIDS 12 VOLT PULL ACTION
2in x 1in x 1in, 40p, p.p. 8p.

40 REED SWITCHES WITH MAGNETS. Operated by 10 push buttons 10in x 6in x 1in, 50p, p.p. 23p.

SIEMENS [MINIATURE] RELAY. Four pole changeover dust cover/base 48V, 2500, 50p, p.p. 5p new.

OMRON MK2 MIDGET POWER RELAY. 12V d.c. Double pole changeover. New, 70p, p.p. 5p.

STC MINIATURE RELAY 290 Ω , perspex cover, Two pole changeover 6-15V new, 35p, p.p. 3p.

GARDNER'S POTTED TRANSFORMER, 0-250V. Input: 18V 500mA, 50V 150mA, 6V 250mA output. Size: 3in x 2 1/2in x 2 1/2in, £1, p.p. 20p. Ex equip. tested.

TELESCOPIC AERIALS
Chromed 7in closed, 28in extended, 6 section ball jointed base, 23p, p.p. 8p new.

MULLARD 4 DM 180 INDICATORS in plastic holder/cover, ex equip., size approx. 1 1/2in x 1 1/2in x 1in, 36p, p.p. 8p.

PRINTED CIRCUIT BOARD/19 ACY 19's 10 OA200
Diodes: 1 reel relay: 1 AZ 229 zener ass. capacitor/resistors. Power supply 22V, 250 mA d.c. Output 240V a.c. £1, p.p. 20p. Ex equip.

WIRING CABLE
Size: 1-020. Various colours. 350yd, 80p, p.p. 26p.

TOGGLE SWITCHES. Double throw. Double pole. Ex equip. new condition, 75p doz., p.p. 13p.

TOGGLE SWITCHES. Single pole, double throw. Ex equip., new condition, 50p doz., p.p. 13p.

PAINTON PLUG SOCKETS. Type 159 series. Working voltage 350V a.c./d.c. current, max. 3 amp a.c./d.c. 7 pin plug and socket, 50p, p.p. 6p. 15 pin plug and socket, £1, p.p. 6p. 31 WAY PLUG AND SOCKET, £1-50, p.p. 6p.

CASH WITH ORDER PLEASE

**FIELD
ELECTRIC
LIMITED**
3 Shenley Road
Borehamwood, Herts.
Adjacent Elstree Mainline Station
Tel.: 01-953 6009



LOUDSPEAKER BARGAINS

Fane Pop 100W, 18", 8/15 ohm	£21-45
Fane Pop 60W, 15", 8/15 ohm	£12-26
Fane Pop 50W, 12", 8/15 ohm	£10-17
Fane Pop 25/2 25W, 8/15 ohm	£3-94
Fane Pop 15 12" 15W, 8/15 ohm	£4-40
Fane 122/104 or 122/12	£9-90
Fane Crescendo 15", 8 or 15 ohm	£37-50
Fane Crescendo 12", 8 or 15 ohm	£24-20
Fane 8" d/cone 808T, 8 or 15 ohm	£2-64
Fane 8" d/cone, roll surr. 807T, 8 or 15 ohm	£3-16
Baker Group 25, 3, 8 or 15 ohm	£6-00
Baker Group 35, 3, 8 or 15 ohm	£7-50
Baker De Luxe 12" d/cone	£9-62
Baker Major	£7-50
EMI 13" x 8", 3, 8 or 15 ohm	£2-25
EMI 13" x 8" type 150 d/cone, 3, 8 or 15 ohm	£2-58
EMI 13" x 8" type t/w, 3, 8 or 15 ohm	£3-85
EMI 13" x 8" type 350, 8 ohm	£2-25
EMI 6 1/2" 93850, 4 or 8 ohm	£2-80
Elac 9" x 5" 59RML09, 15 ohm	£2-53
Elac 9" x 5" 59RMLL4, 8 ohm	£2-53
Elac 6 1/2" d/cone 6RM220, 8 ohm	£2-59
Elac 6 1/2" d/cone, roll surr. 6RM171, 8 ohm	£3-22
Elac 4" tweeter TW4, 8 or 15 ohm	£1-21
Celestion P58 for Unitek	£2-16
Celestion MFL000 25W horn, 8 or 15 ohm	£10-45
Elac 5" 3 ohm	£1-75
Elac 7" x 4", 3 or 8 ohm	£1-52
Elac 8" x 5", 3, 8 or 15 ohm	£1-93
Wharfedale Bronze 8 RS/DD	£3-11
Wharfedale Super 8 RS/DD	£5-50
Wharfedale Super 10 RS/DD	£9-80
Goodmans 8P, 8 or 15 ohm	£3-80
Goodmans 10P, 8 or 15 ohm	£4-49
Goodmans 12P, 8 or 15 ohm	£11-55
Goodmans 15P, 8 or 15 ohm	£17-05
Goodmans 18P, 8 or 15 ohm	£19-70
Goodmans Twinaxiom 8	£6-79
Goodmans Twinaxiom 10	£7-61
Goodmans Axent 100	£6-60
Eagle DT33 dome tweeter, 8 ohm	£4-95
Eagle HT15 tweeter, 8 ohm	£3-46
Eagle CT5 tweeter, 8 ohm	£1-21
Eagle MT10 tweeter	£3-30
Eagle CT10 tweeter	£1-92
Eagle Xovers CN23, 28, 216 Kef T27	£1-10
Kef T15	£2-50
Kef B110	£6-16
Kef B200	£7-42
Kef BL39	£10-72
Kefik 2	£12-75
Richard Allan 12" d/cone, 3 or 15 ohm	£2-20
Richard Allan 8", 3, 8 or 15 ohm	£2-27
10" x 6", 3, 8 or 15 ohm	£1-92
8" x 5", 3 or 8 ohm	£1-38
7" x 4", 3 or 8 ohm	£1-38
3", 8 ohm or 80 ohm	65p
2 1/2", 64 ohm	65p
Speaker matching transformer, 3/8/15 ohm	£1-10
Adastra Hiten 10", 10W, 8 or 15 ohm	£2-80
Adastra Top 20 12", 25W, 8 or 15 ohm	£6-32

Stephen speaker kits and cabinets—send for illustrated brochure and list of recommended speakers.

Car stereo speakers—ask for leaflet.

PA/Disco amplifiers (carr. and ins. £1):

Baker 100W	£46-00
Linear 30/40	£25-00
Linear 40/60	£30-00
Linear 80/100	£50-00

FREE with speaker orders over £7—"Hi-Fi Loudspeaker Enclosures" book.

All units guaranteed new and perfect. Prompt despatch.

Carriage and insurance 25p per speaker. (Tweeters and Crossovers 15p each.)

All prices quoted inclusive of V.A.T.

**WILMSLOW
AUDIO, Dept. PE**
**SWAN WORKS, BANK
SQUARE, WILMSLOW
CHESHIRE SK9 1HF**

BI-PRE-PAK

SUPPLIERS OF SEMI-CONDUCTORS TO THE WORLD

COMPLETE TELEPHONES



EX. G.P.O. NORMAL
HOUSEHOLD TYPE

ONLY 95p

POST & PACKING 35p EACH



TELEPHONE DIALS

Standard Post Office type
Guaranteed in working order.

ONLY 25p

POST & PACKING 15p

TESTED AND GUARANTEED PAKS

B79	4	IN4007 Sil. Rec. diodes, 1,000 PIV 1 amp. plastic	50p
B81	10	Reed Switches, mixed types large and small	50p
B99	200	Mixed Capacitors. Approx. quantity, counted by weight	50p
H4	250	Mixed Resistors. Approx. quantity counted by weight	50p
H7	40	Wirewound Resistors. Mixed types and values	50p
H9	2	OCPT1 Light Sensitive Photo Transistor	50p
H28	20	OC2001/2/3 PNP Silicon uncod'd TO-5 can	50p
H30	20	1 Watt Zener Diodes, Mixed Voltages 6.8-43V	50p
H35	100	Mixed Diodes, Germ. Gold bonded, etc. Marked and Unmarked	50p
H38	30	Short lead Transistors, NPN Silicon Planar types	50p
H39	10	Integrated circuits 6 gates BMC 962, 4 flip flops BMC 945	50p
H40	20	BFY 50.2, 2N696, 2N1613, NPN Silicon uncod'd TO-5	50p
H41	2	BD131, BD132, Complementary Plastic Transistors	50p
UNMARKED UNTESTED PAKS			
B1	50	Germanium Transistors PNP, AF and RF	50p
B66	150	Germanium Diodes Min. glass type	50p
B83	200	Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ.	50p
B84	100	Silicon Diodes DO-7 glass equiv. to OA200, OA202	50p
B86	100	Sil. Diodes sub. min. IN914 and IN916 types	50p
B88	50	Sil. Trans. NPN, PNP equiv. to OC200/1 2N706A, BSY95A, etc.	50p
H6	40	250mW. Zener Diodes DO-7 Min. Glass Type	50p
H15	30	Top Hat Silicon Rectifiers, 750mA. Mixed volts	50p
H16	15	Experimenters' Pak of Integrated Circuits. Data supplied	50p
H17	20	3 amp. Silicon Stud Rectifiers, mixed volts	50p
H20	20	BY126/7 Type Silicon Rectifiers 1 amp. plastic. Mixed volts	50p
H34	15	Power Transistors, PNP, Germ. NPN Silicon TO-3 Can	50p

MAKE A REV COUNTER FOR YOUR CAR

The 'TACHO BLOCK'. This encapsulated block will turn any 0-1mA meter into a linear and accurate rev. counter for any car with normal coil ignition system.

£1 each



OVER
TRANSISTORS
IN STOCK **1,000,000**

We hold a very large range of fully marked, tested and guaranteed transistors, power transistors, diodes and rectifiers at very competitive prices. Please send for free catalogue.

600,000 Silicon planar plastic transistors. Unmarked, untested, factory clearance. A random sampling showed these to be of remarkably high quality.

Audio PNP, similar to ZTX500, 2N3702/3, BCY70, etc.

Audio NPN, similar to ZTX300, 2N3708/9, BC107/8/9, BC168/9, etc.

R.F. NPN and switching NPN Types also. Please state type of transistor required when ordering.

ALL AT 500 for £3, 1,000 for £5, 10,000 for £40

OUR VERY POPULAR 3p 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 ZTX300 range.

TYPE "H": PNP Silicon, similar ZTX500 range.

**8 RELAYS FOR
VARIOUS TYPES £1**
P & P 25p

VALUE ADDED TO YOU On orders of £4 or over. See below:

Please read very carefully:

We will give a discount to customers who send in an order for £4 or over. This discount will be equal to the V.A.T. rate current at this time. If your order does amount to £4 or over, all you need to send is the total cost of goods and postage as stated in this advertisement. No addition for V.A.T. is needed.

V.A.T. for orders under £4: If the total cost of goods plus postage and packing is less than £4, kindly add 10% (10p in the £) to your remittance. Incorrect amounts will delay your order.



A CROSS HATCH GENERATOR FOR £3.50 !!!

YES, a complete kit of parts including Printed Circuit Board. A four position switch gives X-hatch, Dots, Vertical or Horizontal lines. Integrated Circuit design for easy construction and reliability. This is a project in the September edition of Practical Television.

This complete kit of parts costs £3.50, post paid.

A MUST for Colour T.V. Alignment.

Our famous PI Pak is still leading in value for money.

Full of Short Lead Semiconductors & Electronic Components, approx. 170. We guarantee at least 30 really high quality factory marked Transistors PNP & NPN, and a host of Diodes & Rectifiers mounted on Printed Circuit Panels. Identification Chart supplied to give some information on the Transistors.

Please ask for Pak P.I. Only 50p. 10p P & P on this Pak.

FREE CATALOGUE

FOR
TRANSISTORS,
RECTIFIERS,
DIODES,
INTEGRATED
CIRCUITS,
FULL PRE-PAK
LISTS



100,000 Plastic Power Transistors

in stock, more on way!

NOW IN TWO RANGES

These are 40W and 90W Silicon Plastic Power Transistors of the very latest design, available in NPN or PNP at the most shattering 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	20p	18p	16p
Range 2	24p	22p	20p

Range 2	VCE Min. 40	HFE Min. 40	
40 watt	1-12	13-25	26-50
90 watt	30p	28p	26p
	35p	33p	30p

Complementary pairs matched for gain at 3 amps. 10p extra per pair. Please state NPN or PNP on order.

INTEGRATED CIRCUITS. We stock a large range of I.C.s at very competitive prices (from 10p each). These are all listed in our FREE Catalogue, see coupon below.

METRICATION CHARTS now available. This fantastically detailed conversion calculator carries thousands of classified references between metric and British (and U.S.A.) measurements of length, area, volume, liquid measure, weights, etc. Pocket Size, 15p, Wall Chart, 18p.

LOW COST DUAL IN LINE I.C. SOCKETS

14 pin type at 15p each | Now new low 16 pin type at 16p each | profile type.

BOOKS

We have a large selection of Reference and Technical Books in stock.

These are just two of our popular lines: **B.P.I. Transistor Equivalents and Substitutes** 40p

This includes many thousands of British, U.S.A., European and C.V. equivalents. **The Iliffe Radio Valve & Transistor Data Book 9th Edition.** 75p

Characteristics of 3,000 valves and tubes. 4,500 Transistors, Diodes, Rectifiers and Integrated Circuits. Post and Packing 21p. Send for lists of these English publications.

N.B.—Books are void of V.A.T.

Please send me the FREE Bi-Pre-Pak Catalogue.

NAME

ADDRESS

MINIMUM ORDER 50p. CASH WITH ORDER PLEASE. Add 10p post and packing per order. OVERSEAS ADD EXTRA FOR POSTAGE.

BI-PRE-PAK LTD

DEPT. A. 222-224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX

TELEPHONE: SOUTHEM (0702) 46344

Practical Electronics Classified Advertisements

RATES: 9p per word (minimum 12 words). Box No. 20p extra. Semi-Display £7 per single column inch. Advertisements must be prepaid and addressed to Classified Advertisement Manager, "Practical Electronics" IPC MAGAZINES LTD., Fleetway House, Farringdon Street, London EC4H 4AD

COURSES

NEWCASTLE UPON TYNE POLYTECHNIC

B.Sc. Physical Electronics

You could use and extend your existing knowledge of electronics by enrolling for the above four-year sandwich course and open up exciting career prospects in industrial electronics, semiconductor and computer research and development, automation, nuclear energy, and medical physics.

For further details and application forms, contact: Dr. J. L. Clark, Head of Department, Department of Physics and Physical Electronics, Ellison Building, Ellison Place, Newcastle upon Tyne NE1 8ST.

London Borough of Enfield
Trent Park College of Education
Cockfosters, Barnet, Herts.

TECHNOLOGY TEACHING 3-YEAR COURSE FOR MEN AND WOMEN

VACANCIES exist on the Course starting in September, 1973 for Mature Students (over 24 years) wishing to become teachers of Technology, for whom there is an increasing demand in Schools. Learning through problem solving situations forms an essential part of the Certificate Main subject "TECHNOLOGICAL STUDIES", involving techniques and methods of craft, Science and Mathematics, and offering a wide range of practical experience.

Applications will be considered from students with various qualifications and types of experience, together with an interest in the development of practical solutions to a wide range of problems.

Grants are available. Prospectus, information and application forms from:

The Academic Registrar, Trent Park College of Education, Cockfosters, Barnet, Herts.

D. B. Denny, Chief Education Officer.

FULL TIME COURSES in Electronics and Television. These are nine-month courses, starting September 1973, leading to City and Guilds Certificates. Extensive laboratory work is included, and there are, in most cases, no fees for those under 18 enrolment. Full details from: SECTION 272, Electrical and Electronic Engineering Department, Southall College of Technology, Beaconsfield Road, Southall, Middx.

LADDERS

LADDERS, 241ft £9-80, cnrr. 80p. Leaflet (Dept. PEE), HOME SALES LADDER CENTRE, Baldwin Road, Stourport, Wores. Tel. 029-93 2574.

SITUATIONS VACANT

MEN!
£50 p.w.
can be yours

Jobs galore! 144,000 new computer personnel needed by 1977. With our revolutionary, direct-from-America, course, you train as a Computer Operator in only 4 weeks! Pay prospects? £2500+p.a. After training, our exclusive appointments bureau—one of the world's leaders of its kind—introduces you FREE to world-wide opportunities. Write or 'phone TODAY, without obligation.

London Computer Operators
Training Centre
M85, Oxford House
9-15 Oxford Street, W.1
Telephone 01-734 2874

127 The Piazza, Dept. M85
Piccadilly Plaza, Manchester 1
Telephone 061-236 2935

ULSTER: THE NEW UNIVERSITY MAGEE UNIVERSITY COLLEGE, LONDONDERRY INSTITUTE OF CONTINUING EDUCATION

Applications are invited for the following technical posts:—

Ref: 73/129/148/30 TECHNICIAN: Duties: Language Laboratories, recording studio and ancillary audio services.

Ref: 73/130/149/31 TECHNICIAN: Duties: Operation and maintenance of CCTV services and preparation of programme material.

Qualifications: HNC or equivalent, plus at least seven years' previous experience.

Salary scale: £1,881-£2,241 per annum.

Application forms and further particulars should be obtained from The Registrar, The New University of Ulster, Coleraine, Co. Londonderry, N. Ireland (quoting appropriate ref. no.) to whom completed applications, including the names and addresses of three referees, should be returned not later than 31st May, 1973.

TEKTRONIX U.K. LIMITED

have vacancies for

PRODUCT SERVICE TECHNICIANS

to repair and recalibrate our range of oscilloscopes and other products at our Harpenden office.

A good knowledge of basic electronics is necessary and a flair for fault-finding would be an advantage.

We offer good working conditions, profit sharing, non-contributory life assurance and pension schemes.

Please write or telephone: R. M. Garrett, Tektronix U.K. Limited, 36/38 Coldharbour Lane, Harpenden, Herts. Telephone: Harpenden 61251, Ext. 25.

BOOKS AND PUBLICATIONS

★ KILRIMONT BOOKS ★

Understanding Electronic Components, £3.50; Transistor Circuit Design Tables, £2.80; Digital Logic, £1.50; Audio Technicians Bench Manual, £3; Using an Oscilloscope, 70p*; TV Technicians Bench Manual, £2.50; Computer Science, £2; Introduction to Semiconductor Devices, £1.90.

Many others, please send for lists. Please add 5p postage where starred.

KILRIMONT BOOKS (D), Kilrिमont House, London Road, Braintree, Essex CM7 8QL.

THOSE 1,000 BANBURY UFO's! Details of our Prediction (and list) S.A.E. Numerous Charts, Map, Detectors. R. & E. PUBLICATIONS, Highlands, Needham Market, Suffolk.

DIGITAL COMPUTER Logic and Electronics. A four volume Self-Instructional course, £2.99 post free. Money back assurance. CAMBRIDGE LEARNING, 8a Rose Crescent, Cambridge.

FOR SALE

SEEN MY CAT? 5,000 items. Mechanical and Electrical Gear, and materials. S.A.E. K. R. WHISTON, Dept. PE, New Mills, Stockport.

TV LINE OUT-PUT TRANSFORMERS

Tidman Mail Order Ltd., 236 Sandycroft Road, Richmond, Surrey TW9 2EQ
01-948 3702

COMPLETE SET P.E. With Blueprints for sale, offers please. H. KNIGHT, Retford House, Robin Lane, High Bentham, Lancaster.

FIBRE OPTICS

Flexible Light Pipe for conveying light to inaccessible positions. Fibroflex Type 1, Glass 1-14mm effective dia. PVC sheathed. 44p per metre. (VAT inc.), P. & P. 10p. Any quantity.

Polariser Sheet up to 1sq. ft. max. size. 161p per sq. in. (VAT inc.), P. & P. up to 6 in. square 10p; over 6 in. square 30p

- ★ Cut down glare
- ★ See those nice tubes
- ★ Cross them for light control
- ★ Make your own strain gauge for plastics and glass

Circuit Board Etching Kits. Full instructions. £1-37; (VAT inc.), P. & P. 14p

Photographic CDS Light Cells—used (with part of original circuit free). 33p (VAT inc.), Post free.

All items are strictly C.W.O.

From: **ARVIN SERVICE COMPANY**
12 CAMBRIDGE ROAD
ST. ALBANS

TAPE DECK BARGAIN. Two in one 7" and 5" spools 7 1/2 i.p.s. Relay operated. Six motors. Auto-reverse. Originally from units costing £450. Working £38. Spare deck £10. 02796 (HARLOW) 25539.

AERIALS

DIRECT FROM MANUFACTURER—a comprehensive catalogue of UHF and VHF/FM aerials, fixing brackets, chimney lashings, clamps, masts, amplifiers, cable, etc., for the D.I.Y. enthusiast. Complete with useful installation hints. Send 3p stamp to CLAYDEW ENTERPRISES (PE), 261 Hardess Street, London, S.E.24.

WANTED

TOP PRICES PAID

for new valves and components

Popular T.V. and Radio types

KENSINGTON SUPPLIES

(B) 367 Kensington Street
Bradford 8, Yorks.

WANTED: Built or partly built Heathkit A.F.M.2 Tuner. 64 Green Lane, Coventry.

WANTED URGENTLY: Manual for millard high speed valve tested (E7600 Mk. II), buy or borrow, also test cards for above. Write Box 50.

SERVICE SHEETS

SERVICE SHEETS for Televisions, Radios, Transistors, Tape Recorders, Record Players, etc., from 5p with free Fault-Finding Guide. S.A.E. orders/inquiries. Catalogue 15p. HAMILTON RADIO, 47 Bohemia Road, St. Leonards, Sussex. Telephone Hastings 29066.

SERVICE SHEETS, Radio, TV, etc. 8,000 models. Catalogue 15p. S.A.E. enquiries. TELRAY, 11 Mauldland Bank, Preston.

EDUCATIONAL

ENGINEERS. Get a technical certificate. Postal courses in Engineering, Electronics, Radio, TV, Computers, Draughtsmanship, Buildings, etc., FREE book from: BIET (Dept. ZC BPE 26), Aldermaston Court, Reading, RG7 4PF. Accredited by CAUC.

RECEIVERS AND COMPONENTS

CASED AMPLIFIERS

2 x ECC83, EL84, EZ80. 20V I/P sensitivity 2W O/P into 7in x 1in 3Ω speaker. All contained in polished cabinet with non-standard single motor deck. Tested with circuit, £3 (£1). Special cassettes required now available, £1 (25p). Spare heads, 40p.

COMPUTER PANELS

Lots of transistors inc. power types, diodes, R's, C's, pot cores, etc. Some boards broken, but good value at 31b for £1 (25p), 71b for £2 (40p).

1,000 R's and C's £3

Amazing variety of resistors, including: carbon film, metal oxide, hi-stabs, 1%, 2% and 5%, 1/4W, 1/2W and 1W from a few ohms to a few megohms. Also mica, ceramic, foil, paper, electrolytic, polystyrene capacitors. About 1,000 components, £3 (30p).

FERRIC CHLORIDE

Anhydrous technical quality in sealed 1lb packs, 40p (15p); 10lb, £3-50 (50p).

Components: BC107-8-9, 8p ea., 14 for £1; 709C, 25p; 741C, 25p; 723C, 40p; 2N3055, 35p; 1N4003, 7p; 1N4006, 11p; Crofon 1610 Light Guide, 64 filament, £1 per metre, 5+80p; 10+70p. Surplus capacitors MFD/V: 0-47/350, 6p; 2/150, 2p; 8/350, 8p; 8/450, 10p; 25/25, 5p; 500/50, 12p; 550/6, 3p; 1000+500/18, 12p—lots of others. Lots of odd units, scopes, meggers, aov's, sig. gens, etc., at shop for cars. S.A.E. list. Post in brackets, small parts 3p.

GREENWELD (PE8)

24 Goodhart Way, West Wickham, Kent. Tel. 01-777 2001. Shop at 21 Deptford Broadway, S.E.8. Tel. 01-692 2009.

U.K. ORDERS—ADD VAT TO TOTAL

MICROCIRCUITS: 709 28p; 710 36p; 723 37p; 741 32p; 748 37p; PA230 70p; 5L407A £1; 8ET Op. Amp. £1.63.
TRANSISTORS: 2N696 14p; 2N697 14p; 2N706A 11p; 2N1613 16p; 2N1711 16p; 2N2218 19p; 2N2219 19p; 2N2219A 19p; 2N2904 17p; 2N2926 Red 6p, Orange 7p, Yellow 8p, Green 9p; 2N3053 15p; 2N3054 40p; 2N3055 35p; 2N3702 10p; 2N3703 10p; 2N3704 10p; 2N3705 9p; 2N3706 9p; 2N3709 8p; 2N3710 9p; 2N3711 9p; 2N4058 12p; 2N4059 9p; 2N4061 11p; 2N4062 11p; AC107 28p; AC126 12p; AC127 12p; AC176 15p; ACY17 23p; ACY21 17p; AF114 14p; AF115 14p; AF116 14p; AF117 14p; AF124 22p; BC107A 7p; BC107B 8p; BC108A 8p; BC108B 8p; BC108C 8p; BC109B 7p; BC109C 7p; BC125 14p; BC147A 9p; BC167A 10p; BC168B 9p; BC169B 10p; BC177 13p; BC178 12p; BC179 16p; BCY70 15p; BCY71 22p; BD142 35p; BF115 20p; BF194 13p; BFX29 24p; BFX84 20p; BFX86 15p; BFX87 24p; BFX88 15p; BFX50 15p; BFX51 15p; BFX52 15p; BL747A 40p; BSX20 12p; OC44 12p; OC45 12p; OC71 12p; OC72 12p; OC81 18p; OC83 24p. ME Series available.
RECTIFIERS: 1 amp—50V 3p; 100V 4p; 200V 4p; 400V 5p; 800V 6p; 1000V 7p.
ZENERS: BZY88 Series 2.7V to 33V 8p each.
DIODES: 1N916 4p; OA90 6p; OA200 7p; OA202 8p; SCR IR 2D (400V A) £1.14.
LED PANEL LAMP with Bush & Data 40p.
CARBON FILM 1/4W 5% RESISTORS, E12 values 22 to 2-2M Ω 1p each or 7p per 10 of ONE VALUE.
DALO ETCH RESIST FILLED FIBRE TIP PEN 80p.
MINIATURE METAL GLAZE RESISTORS 1/16W 5% 4p each. 1k Ω THERMISTOR 9p. 2N3819 26p.
TESTED TRANSISTOR CIRCUITS BOOKLET 40p.
ITT POCKET MULTIMETER 27 ranges £17. (Above Prices on Feb. 23. Check our list.)
JEF ELECTRONICS (P.E.5)
York House, 12 York Drive, Grappenhall, Warrington WA4 2EJ. Mail Order Only. C.W.O. P. & P. at cost. 10p min. List free.

SINCLAIR 1G12 with P.C. Components, all mounted £2-78 P. & P. 10p. S.A.E. for list of kits. (Mail Order Only.) J. K. ALLEN, 7 Pandfield Crescent, St. Albans, Herts.

COMPUTER PANELS. 9in x 7 1/4in long lead trans. and comps. E4, 8 trans., 27p (10p); E45, 16 trans., 44p (10p); E47, 10 trans., 33p (10p). Panels with epoxy and T018 Silicon transistors 4, 60p (12p). **MC METERS.** 2in or 3in, three assorted, £1-15 (25p). **WIRE ENDED NEONS.** 10, 50p (8p); 20, 82p (8p). Bank of 5 with 5 (407 driver Trans., 50p (8p). Bank of 30 ditto, £2-20 (15p). **MAINS STEPPING SWITCH 22 WAY** with reset. 88p (15p). Resettable counter, 5 figure 18/22V, will work on 12V. £2-20 (15p). **SILICON DIODES 650V 1A.** 10 on the board, 35p (6p). **7400 SERIES I.C. ON PANEL(S).** 10, 82p (8p). **COPPER CLAD PAX. PANELS.** 5 1/2in x 5 1/2in, for 33p (10p). **MIXED POLYSTYRENE/S. MICA CAPS.** 100, 50p. **71b ASSORTED COMPONENTS, £1-60.** **21b ASSORTED COMPUTER PANELS, £1-60.** S.A.E. 9in x 4in for list of computer panels, etc.

J.W.B. RADIO

75 Hayfield Road, Salford 6, Lancs
Postage in brackets Mail order only

BRAND NEW COMPONENTS by return. Electrolytic, 16V, 25V, 50V-0-47, 1, 2-2, 4-7, 10 mfd, 4p; 22, 47, 43p; (50V, 5p); 100, 51p (50V, 7p). Subminiature head-type tantalum 0-1/35V, 0-22/35V, 0-47/35V, 1/35V, 2-2/35V, 4-7/35V, 10/16V, 8p. Mylar Film 100V, .001, .002, .005, .01, .02, 2p; .04, .05, 3p; 1, 3p. Polystyrene 63V E.12 series 10pF-1,000pF, 2p. Miniature Highstab resistors E.12 series, 5% carbon film 1 Ω-10M Ω, (10% over 1 Meg.) Metal Film 1/4W, 10 Ω-2-2M Ω and 1W, 22 Ω-10M Ω, all 2p each. Postage 8p. THE C.R. SUPPLY CO., 127 Chesterfield Road, Sheffield, S8 0RN.

5—N-Channel FETs 3819E—£1

Full specification devices complete with circuit details for building voltmeter, timer, ohmmeter, etc. Send 10p for full list of field effect transistors and other top quality transistors available at bargain prices.

REDHAWK SALES LTD.

45 Station Road, Gerrards Cross, Bucks.
MAIL ORDER ONLY

P.E. SYNTHESISER KNOB KIT

Complete kit as Feb. issue £3-91 post free
43 knobs, 7 calibrated discs.

DE LUXE KIT as above but £5-89 post free
calibrated for programming.

Inclusive postage and V.A.T.

RE-AN PRODUCTS LTD.

Burnham Road, Dartford, Kent
Tel.: Dartford 20785

DRY REED INSERTS



Overall length 1-85" (Body length 1-1"). Diameter 0-14" to switch up to 500 mA at up to 250V D.C. Gold clad contacts. 69p per doz.; £4-12 per 100; £30-25 per 1,000; £275 per 10,000. All carriage paid.

G.W.M. RADIO LTD.

40/42 Portland Road, Worthing, Sussex 0903 34897

VISIT AUTO TRACTION. Thousands of bargains in surplus radio equipment. Meters, motors, relays, TR/TX, telephone equipment, aircraft equipment. S.A.E. enquiries. 27a Arragon Road, Twickenham, Middx. 01-892 9489.

RADIO & TELEVISION AERIAL BOOSTERS £2-95, five television valves 45p. 50p bargain transistor packs, bargain £1 resistor and capacitor packs, UHF-VHF televisions £7-50. Carr. £1-50. S.A.E. for 3 leaflets. VELCO ELECTRONICS, Bridge St., Ramsbottom, Bury, Lancs.



TELEVISION TRAINING (MONOCHROME AND COLOUR)

This private College provides theoretical and practical training in Radio and TV Servicing. Courses of 16 months' duration, with daily attendance, are available for beginners and shorter courses for men with previous training in Electronics and Radio. Next course commences April 16th. Training courses in Marine Radiocommunication and Radar are also available. Write for prospectus to: **London Electronics College, Dept. B/5, 20 Penywern Road, Earls Court, London SW5 9SU. Tel. 01-373 8721.**

100 WATT AMPLIFIER

Fully protected, transformerless, 9 transistor circuit. Input 500 mV. Output into 8 ohms. 0-1% distortion.
Printed circuit board and full instructions. £1.45p + 10p P. & P. S.a.e. for list of component bargains.
EDMUNDS COMPONENTS, 134 NORTH END ROAD, LONDON, W14. (Mail order only)

PRECISION POLYCARBONATE CAPACITORS

Close tolerance. High stability. All 63V d.c.
0.47µF: ±5% 80p; ±2% 40p; ±1% 60p
1.0µF: ±5% 40p; ±2% 50p; ±1% 60p
2.2µF: ±5% 50p; ±2% 60p; ±1% 70p
4.7µF: ±5% 70p; ±2% 80p; ±1% £1-15
0.8µF: ±5% 85p; ±2% £1-15; ±1% £1-50
10µF: ±5% £1-10; ±2% £1-40; ±1% £1-80
15µF: ±5% £1-80; ±2% £2-10; ±1% £2-70

TANTALUM BEAD CAPACITORS. Values available 0.1, 0.22, 0.47, 1.0, 2.2, 4.7, 6.8µF at 35V, 10µF 25V, 15µF 20V, 22µF 15V, 33µF 10V, 47µF 6V, 100µF 3V—all at 9p each; 6 for 50p; 14 for £1. Special pack 6 of each value (78 capacitors) £5.

NEW 1-TRANSISTORS. BC107, BC108, BC109. All at 9p each; 6 for 50p; 14 for £1. All brand new and marked. Full spec. devices. May be mixed to qualify for quantity prices. AF178 —40p each; 3 for £1.

POPULAR DIODES. IN914, 7p each; 8 for 50p; 18 for £1. IN916, 9p each; 6 for 50p; 14 for £1. 1S44, 5p each; 11 for 50p; 24 for £1. All brand new and marked.

NEW LOW PRICE—400 mW Zeners. Values available 4.7, 5.6, 6.8, 7.5, 8.2, 9.1, 10, 11, 12, 13.5, 15V. Tol. ±5% at 5mA. All new and marked. Price 10p each; 6 for 50p; 14 for £1. Special offer 6 off each voltage (66 zeners) £4.50.

RESISTORS. Carbon film 5%, ¼W at 40°C, ¼W at 70°C. Range from 2.2Ω to 2.2MΩ in E12 series, i.e. 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decads. High stability, low noise. All at 1p each; 8p for 10 of any one value; 70p for 100 of any one value. Special pack—10 off each value 2.2Ω to 2.2MΩ (730 resistors) £5.

440V A.C. CAPACITORS. 0.1µF, size 1½in × ½in, 25p; 0.25µF, size 1½in × ½in, 30p; 0.47 and 0.5µF, size 1½in × ½in, 35p; 1.0µF, size 2in × ½in, 45p; 2.0µF, size 2in × 1in 75p.

SILICON PLASTIC RECTIFIERS 1-5A— Brand new wire-ended D027, 1000PIV at 8p each or 4 for 30p; 4000PIV at 9p each or 4 for 34p; 800PIV at 14p each or 4 for 50p.
5p post and packing on all orders below £5.
Please add 10% VAT to all orders

MARCO TRADING
(Formerly V. ATTWOOD)
Dept. E5, The Matings, Station Road
Wem, Shropshire

BEDFORD ELECTRONICS

2 Grove Place · Bedford
Bedford 51961

YOUR LOCAL COMPONENTS SUPPLIER

FREE CATALOGUE ON REQUEST

COMPONENTS GALORE. Pack of 500 mixed components manufacturers surplus plus one used. Pack includes resistors, capacitors, transistors, diodes, I.C., gang, pots, etc. Tremendous value. Send £1 plus 10p postage C.W.O. to CALEDONIAN COMPONENTS, Fosterton Firs, Strathore Road, Thornton, Effe.

SURPLUS to industrial requirements Packs of 50 mixed miniature Electrolytic Capacitors, £1 per pack of 50 plus 10p P. & P. C.W.O. BLORE-BARTON LTD., Reedham House, Burnham, Bucks.

IRISH READERS! Up to 20% off stereo amplifiers, tuners, decks, speakers, etc. FREE catalogue. BEIRNE BRON. (PE), Auburn Terrace, Athlone, Co. Westmeath.

RESISTORS. All Preferred. Valves ¼ watt 5%, 0.8p each. Postage 5p. COOMBER, 10 Temple Street, Brighton.

Trampus electronics

Add 10% VAT (¼) to all prices. All brand new, no rejects. Money Back Warranty.
5V DIGITAL INDICATOR: 0-9DP socket and filter £1.45.
LED TYPE 1" 0-9DP DIL £2.25 each; 6x £2-10 each. 4 digit type £11.
LIGHT EMITTING DIODES. All with data and panel clip. TTL 209 1" dia. 28p. Red 1" dia. type 33p. Green 75p.
INFRARED beam LED £1-10.
GAS detector £1-60. Ultrasonic transducer £2.
DALO PCB resist marking pen 89p. Copper board 12" x 6" SRBP 40p. FeC etch PAK 19p.
INTEGRATED CIRCUITS: with data if required.
IC LITE SWITCH: Photo amp/trigger 40mA/11-20V relay or TTL 87p. DIL relay £1-10.



IC digital clock

MOS/LSI type. 28 pin, 4 or 6 digit, 12/24hr. Chip with socket £18; PCB £1-60; KIT £21-49.
DVM voltmeter £12. Data 39p. 3W AF amp £1-24.
741 D18 pin 28p; 709 19p; D11 29p; 744 29p; mono 710 35p; 555 TIMER/monostable osc. clock 93p.
REGULATORS. 1A 5 to 20V £1-49; 723 57p.
RECEIVER ZN414 £1-19. Mini Rx Kit £1-99.
1310 stereo decoder for tuner £2-89. KIT £3-45.

NEW LOW PRICES

GATES 7400/1/2/3/4/5/10/20/30/40/50, etc., 14p each. 7413 27p; 7441 73p; 7447 £1-09; 7470, 7472 28p; 7473, 7474 36p; 7475 60p; 7476 32p; 7490 59p; 7492 67p; 7490 89p; 7493 £1-10; 7496 37p; 7493 73p; 7494 83p; 7495 83p; 7496 89p; 74121 45p; 74141 89p; 74190/91/92/93/96 £2-39. DTL
DIP/IC case 10mm high 16 pin 35p.

DIL SOCKETS: 8 pin or high profile 8/14/16 pin 13p.
SEMICONDUCTORS:
2N3055 40p; BC107 8p; BC108 8p; BC109 8p; BC147/8/9 10p; BC167/8/9 13p; BC177/8/9 15p; BC182/3/4 10p; BC162/3/4 11p; BCY70/72 18p; BD131/2 55p; BFY505/52 13p; T1843 UJT 24p; 2N700 11p; 2N289 18p; 2N2909 8p; 2N2646 40p; 2N3053 17p; 2N3055 40p; 2N3614 55p; 2N3702/3/4/5/6/7/8/9/10/11 AD 9p each.
FETS: 2N3819 27p; 2N3823 29p; SCR 400V: 1A 28p; 4A 55p. TRANSFORMER: 1A 6 and 12V £1.
CAPACITORS: Disc 22pF to 0.1µF 4p. 25V electrolytic 10, 50, 100µF 5p; 1,000µF 15p. PRESETS 5p each. RESISTORS 1W 5%, 11p each. CARBON POTS 12p each. Dual 40p. Switch +12p. All Din Plugs 13p; sockets 8p; Vero RRP.

FLUORESCENT LIGHTS 12VOLT £2.79

13" 8 watt fully built with diffuser.
TRIO and CODAR communications and Hi-Fi retailers. ELECTRONIC ORGANS from 487.
PW ELECTRONIC CAR IGNITION KIT £6.67.
VAT: YOU MUST ADD 10% (¼) to all prices.
FREE CAT. S.A.E. Data sheets 8p each. P. & P. 8p. C.W.O.

P.O. BOX 29, BRACKNELL, BERKS.

25 TESTED TRANSISTORS, PNP to 1 TO5, 50p. 815a Hesse Road, Hull, East Yorks.

MISCELLANEOUS

ENAMELLED COPPER WIRE

S.W.G.	1lb Reel	½lb Reel
10-14	£1-15	65p
15-19	£1-15	65p
20-24	£1-18	68p
25-29	£1-25	75p
30-34	£1-30	80p
35-40	£1-40	85p

Please add 10% to all above prices to cover VAT
The above prices cover P. & P. in U.K. Supplied by
INDUSTRIAL SUPPLIES
102 Parrswood Rd., Withington, Manchester 20
Telephone No. 061-224 3553

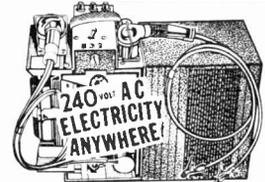
MUSIC

If your interest is in **SYNTHESISERS** and other **ELECTRONIC MUSIC** projects, you need our 1973 catalogue of circuit assemblies and units. Detailed and informative, complete with project layouts. Send 20p P.O. to:
TAYLOR ELECTRONIC MUSIC DEVICES
P.O. Box 42, Chester CH1 2PW

AT LAST YOU CAN TRANSMIT AND FORGET ABOUT LICENCE EXAMINATIONS

because this Ministry approved transmitter/receiver kit does not use R.F.
Your transmissions will be virtually SECRET since they won't be heard by conventional means. Actually it's TWO KITS IN ONE because you get the printed-circuit boards and components for both the transmitter AND receiver. You're going to find this project REALLY FUN-TO-BUILD with the EASY-TO-FOLLOW instructions. An extremely flexible design with quite an AMAZING RANGE—LANGUAGE LABORATORIES, SCOUT CAMPS, etc.

GET YOURS! SEND £5-80 (inc. VAT) NOW (S.A.E. for details) MAIL ORDER ONLY
TO: 'BOFFIN PROJECTS'
DEPT. KE2010
4 CUNLIFFE ROAD
STONELEIGH, EWELL, SURREY



ASTOUNDING new MARK 7 AC POWER UNIT with TWO OUTPUTS and LOW BATTERY DRAIN gives the MOST BRILLIANT and BEST EVER INTERNATIONAL PERFORMANCE of all time from 12 volt CAR BATTERY. Fantastic for a VAST RANGE of HUNDREDS of makes and types of 200-240 volt AC and UNIVERSAL AC/DC ELECTRICAL APPLIANCES and EQUIPMENT within its scope. Wonderful for FLUORESCENT TUBES up to the GIANT 8ft. 125 watt size. RECHARGES YOUR BATTERY from any other battery by using any motorist's AC MAINS battery charger. Should be £14 + £1 delivery. OUR PRICE (UNUSED but as marked) ONLY £6-90 + £1 delivery. 8 day's approx. against cash. C.O.D. with pleasure. (Send SAE for details)

Dept PE, BROADWAY DISTRIBUTORS, The Generator Centre, House of Time, 273 Broadway, Rossall, Fleetwood, Lancs.

Build the Mullard C.C.T.V. Camera
Kits are now available with comprehensive construction manual (also available separately at 65p.)
SEND 5"x7" S.A.E. FOR DETAILS TO:

CROFTON ELECTRONICS
15/17 Cambridge Road, Kingston-on-Thames, Surrey KT1 3NG

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 boards—masters, negatives and boards, one-off or small numbers. Send 6p for list. RAMAR CONSTRUCTOR SERVICES, 29 Shelbourne Road, Stratford-on-Avon, Warwks.

SWITCHES UNUSUAL

PRESSURE MAT—flexible, hard-wearing plastic mat containing 180 contacts. Contacts close when pressed, open when released. Rating 50V, 1A. Size 30in × 24in. £3-50.

MINI MAT—size 24in × 7in. £2. (Construction as above but more sensitive). Suitable for burglar alarm, counter, footswitch, games. Uses limited by imagination.

POSTAGE 15p PER ITEM. C.W.O.

ELECTRONIC SWITCHING DEVICES
P.O. Box 10, Aspley, P.D.O. Nottingham
For further details send S.A.E.

PSYCHEDELIC MINI-STROBE

A very POWERFUL, POCKET-SIZED STROBE-LIGHT that is SELF-CONTAINED and you can take anywhere. Go to parties and really BRAIN-FREEZE them with DAZZLING PSYCHEDELIC EFFECTS and STOP-MOTION FLASHES. Boffin's new MINI-STROBE kit constitutes a fully solid-state electronic device which is COMPLETE with FUTURISTIC case/reflector unit, printed-circuit board, electronics, and source-lamp—the only extra is a battery which you can buy locally. The whole thing can be easily built in a few hours.

A veritable FLICKERING FASCINATOR! Adjustable flash-rate.

GET ONE (or two) NOW and BEGIN STEALING THE THUNDER at DISCOS and PARTIES with your own POCKET-LIGHTNING!

SEND £2.10 (inc. VAT) for YOUR MINI-STROBE. MAIL ORDER ONLY

To: **Boffin Projects**
4 Cunliffe Rd., Stoneleigh, Ewell, Surrey

ONE CHIP CALCULATOR

MOS INTEGRATED CIRCUIT

- Add, subtract, multiply, divide
- 12-digit display
- Fixed decimal point at 0, 2, 3 or 4
- Automatic lockout of "unsafe" p & p incl. repeat operation
- True credit balance sign display
- Automatic overflow indication
- Leading zero suppression
- Data Sheet 50p (refund on purchase)

£12.50

O'DRISCOLL

68 Hammer Hill, Haslemere, Surrey GU27 3QZ
Tel. 0428-2058

FIBRE OPTIC SUPPLIERS

P.O. BOX 702 · LONDON W10 6SL

FLEXIBLE LIGHT CONDUIT is used almost like wire to convey light to inaccessible positions for inspection, panel indicators, photo-electric and other applications.

FIBROFLEX SIZE 1 glass fibre flexible light conduit, 1-14 mm active dia. bundle sheathed in P.V.C. Supplied complete with epoxy resin + 10 ferrules. Prices: 5 metres, £2.97; 10 m, £4.40; 25 m, £6.60; 50 m, £11; 100 m, £17.60.

CROFON 1610 1-80 mm active dia., 64 filament plastic light conduit. Prices: 1 metre, £1.43; 2m, £2.86; 5 m, £6.60; 10 m, £11; 25 m, £22; 50 m, £42.35.

PLASTIC OPTICAL MONOFILAMENT. Type FP 20, 0.5 mm dia. unsheathed. 100 m, £3.85; 200 m, £6.60; 500 m, £13.75. Type FP 40, 1.0 mm dia. unsheathed. 10 m, £2.20; 25 m, £4.40; 50 m, £8.25; 100 m, £14.30.

MARE'S TAILS: Spray of several thousand glass fibres, ready to use as part of decorative displays. £11 each.

HN 32 LINEAR POLARIZER 0.030" thick. 32% luminous transmittance, 0.005% extinction. Applications leaflet, inc. light intensity control, stress analysis, glare reduction, etc., supplied with orders. 2" x 2" square, £1.43 per pair; 3" sq., £2.75 per pair; 4" sq., £4.40 per pair. Prices shown above include V.A.T., postage and packing. Send S.A.E. for full range of products, price list and samples.

DIMMIT

range of light dimmers

- ★ attractive standard wall mounting models for home and office, etc.
- ★ commercial modules for studio, stage, disco and clubs, etc.
- ★ professional modules for industrial use on heaters, lamps, motors, etc.

Rotary and slider control versions. Ratings available: 400W, 1KW, 2KW.

Send 10p for complete catalogue and price list. Discount for quantities.

DEPT. 11
YOUNG ELECTRONICS

54 Lawford Road, London NW5 2LN
Tel. 01-267 0201

OWN BUSINESS OPPORTUNITY

exists in Scottish Highlands. Rural community needs: (1) R, TV and electrical repairs—constant demand; (2) Cottage manufacture of electronic gadgets for sale by post. Good train link Glasgow and London. Cottage available from early September. Local and national support for right men and women. Initiative, and own car or van, essential. Some own capital an advantage. Write, in confidence, Box 49.

Versatile

10 in ONE



MINI-LAB

Comprising:

- AC and DC Voltmeter • Audio Generator • Ohm Meter • Resistance Substitution • Capacitance Substitution • DC Ammeter • Battery Supply • RF Signal Generator • RF Field Strength Indicator.

This new, unique instrument combines all you need for testing. Money back if not satisfied.

£11.25

plus 25pp.&p.

Cash with order or send S.A.E. for illustrated data sheet to:

J. H. ASSOCIATES LTD. (Dept. PE)
Cricketfield Lane, Bishop's Stortford, Herts

HARDWARE—Screws, nuts, washers and other useful items in small quantities. Sheet aluminium to individual requirements, punched/drilled. Send 6p for list. RAMAR CONSTRUCTOR SERVICES, 29 Shelbourne Road, Stratford-on-Avon, Warwickshire.

GLASS FIBRE P.C. BOARD—large supplies available. ¼ in single sided one ounce copper, 2p per 3 sq in (under 1ft); 75p per sq ft (over 1ft). ½ in double sided one ounce copper, 1p per sq in (under 1ft); £1 per sq ft (over 1ft). Please add 10p per sq ft postage and packing. We can cut to your size at 1p per cut. SOLID STATE LIGHTING, The Firs, Smallworth Lane, Garboldisham, Diss, Norfolk.

ELECTRONICS FANATICS

whether beginner or advanced — we offer a range of over 35 SUPER projects.

Have you ever wanted to build A MACHINE THAT LEARNS? Or perhaps make a TEACHING DEVICE? Maybe you fancy the idea of an ELECTRONIC FANTASY MACHINE? How about a "Thing" capable of REPRODUCING ITSELF? Whatever your electronic turn-of-mind, there's just GOT TO BE LOADS TO INTEREST YOU in the science-fiction-world of BOFFIN.

GET YOUR CATALOGUE — SEND JUST 15p NOW!

MAIL ORDER ONLY

TO: BOFFIN PROJECTS

4 CUNLIFFE ROAD
STONELEIGH, EWELL
SURREY

Designs by GERRY BROWN and JOHN SALMON and presented on TV.

NEW WATTMETERS. Portable, multirange wattmeters. From: METER REPAIRS, 39 Chesholm Road, London, N16 0DS.

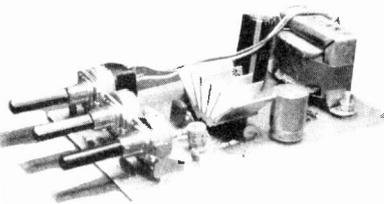
EXPERIMENTERS! Hundreds of unusual items cheap. 1973 catalogue 5p. (Mail Order Only.) GRIMSBY ELECTRONICS, 64 Tenney Road, Cleethorpes, Lincs.

ALUMINIUM SHEET to individual sizes or in standard packs, 3p stamp for details. RAMAR CONSTRUCTOR SERVICES, 29 Shelbourne Road, Stratford-on-Avon, Warwks.

CLEARING LABORATORY, scopes, V.T.V.M.'s, V.O.M.'s, H.S. recorders, transcription turntables, electronic testmeters, calibration units, P.S.U.'s, pulse generators, D.C. null-potentiometers, bridges, spectrum analysers, voltage regulators, sig-gens, MC relays, components, etc. Lower Beeding 236.

RAYMER MICROCHIP

RE500



SPECIFICATIONS

OUTPUT 5W RMS (10W peak)
FREQUENCY RESPONSE 10Hz to 50kHz ± 3dB
TOTAL HARMONIC DISTORTION less than 1%

LOAD IMPEDANCE 4 to 16 ohms
INPUT IMPEDANCE 100kΩ nominal
POWER GAIN 40dB typical
SIZE 140mm x 80mm x 45mm
With free instruction sheet
PRICE £6.93 (inc. VAT) + 25p P. & P.

Guaranteed 12 months against failure in normal use. This advanced high-fidelity integrated amplifier is completely self-contained and only requires connecting to mains, speaker and input.

Ideally suited for:
MONO RECORDED PLAYERS
MONO CONVERSION TO STEREO
STEREO CONVERSION TO QUADRAPHONIC
(× 2 Microchip + Decoder)
TV AMPLIFIER
TAPE AMPLIFIER

PA INSTALLATIONS
AUDIO ALARM, ETC.

TRADE ENQUIRIES WELCOMED

NAME.....

ADDRESS.....

PLEASE SEND.....

I enclose P.O./Cheque/Money Order

**RAYMER ELECTRONICS LTD., STANLEY ROAD
CAMBRIDGE CB5 8LB**

Reg. Bus. 1031205

BUILD A PROFESSIONAL SYNTHESISER



You too can build a professional synthesiser like the one illustrated using the professionally-proven range of Dewtron modules. **NEW MODUMATRIX** modular matrix system replaces clumsy patching. 3 and 4 octave keyboards and contacts.

VCO-2 STABLE, PRECISION V/C OSCILLATOR gives SINE, TRIANGULAR AND SQUAREWAVE outputs, 1 volt/octave voltage control. £22 each or £25 each 2 or more matched. **SHE-1 SAMPLE, HOLD AND ENVELOPE MODULE** gives variable attack, sustain, touch-sensitive playing when used with VCO-2 signals. £15.

Modules (except VCO-1) guaranteed two years.

With over 7 years' unblemished reputation in these pages, Dewtron continues to lead in new technical developments in electronic sound effects! Ask any of our customers. See our products in the music stores, too. Suppliers of special equipment to a leading group. Our modules are used in professional equipment by other manufacturers and in our own built synthesisers, e.g. "Gipsy" G.I. Approved by the Association of Musical Instrument Industries. Send 15p for full catalogue of our famous musical effects.

D.E.W. LTD. 254 Ringwood Road, FERNDOWN, Dorset BH22 9AR

using **Dewtron** (Regd. Trademark)

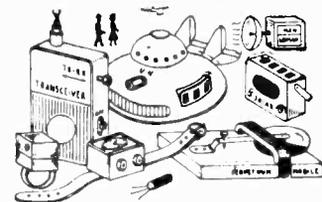
PROFESSIONAL MODULES
CASH SAVINGS

by buying modules and parts in bulk!
All modules are available separately:
Ring Modulator RM2, £8. Voltage-controlled Oscillator VCO1, £10.50, giving sawtooth and square-wave outputs. Envelope shapers, ES1, self-triggered or ES2 keyboard-triggered, either type £13. White noise type WN1, £7. Voltage-controlled amplifier VCA1, £10. Voltage-controlled selective amplifier (filter for waa-waa, etc.) SA1, £12. Voltage-controlled Phase PH1, £17. Automatic Announcement Fader module for fading of music by microphone announcement, AF1, £9. etc., etc. ALL MODULES ARE BUILT, TESTED AND SEALED FOR LONG LIFE. Simply connect coloured wire connections as per easy instructions, build cabinet and wire in controls and patchboard connections! Joystick controls £4.50. REVERB Module and spring unit £15.

PRINTED CIRCUIT KIT

BUILD 60 INTERESTING PROJECTS ON A PRINTED CIRCUIT CHASSIS WITH PARTS and TRANSISTORS from your SPARES BOX

CONTENTS: (1) 2 Copper Laminate Boards 4 1/2in x 2 1/2in. (2) 1 Board for Matchbox Radio. (3) 1 Board for Wristwatch Radio, etc. (4) Resist. (5) Resist Solvent. (6) Etchant. (7) Cleanser/Degreaser. (8) 16-page Booklet *Printed Circuits for Amateurs*. (9) 2 Miniature Radio Dials SW/MW/LW. Also free with each kit: (10) Essential Design Data. Circuits, Chassis Plans, etc. for 60 TRANSISTORISED PROJECTS. A very comprehensive selection of circuits to suit everyone's requirements.



EXPERIMENTER'S
PRINTED CIRCUIT KIT

70p

Postage & Pack. 10p (UK)

Commonwealth:

SURFACE MAIL 15p

AIR MAIL 60p

Australia, New Zealand,
South Africa, Canada

(1) Crystal Set with biased Detector. (2) Crystal Set with voltage-quadrupler detector. (3) Crystal Set with Dynamic Loudspeaker. (4) Crystal Tuner with Audio Amplifier. (5) Carrier Power Conversion Receiver. (6) Split-Load Neutralised Double Reflex. (7) Matchbox or PhotoCell Radio. (8) "TRI-FLEXON" Triple Reflex with self-adjusting regeneration (Patent Pending). (9) Solar Battery Loudspeaker Radio. The smallest 3 designs yet offered to the Home Constructor anywhere in the World. 3 Subminiature Radio Receivers based on the "Triflexion" circuit. Let us know if you know of a smaller design published anywhere. (10) Postage Stamp Radio. Size only 1 1/4in x 0 7/8in x 0 2 1/2in. (11) Wristwatch Radio 1 1/2in x 0 9/16in x 0 3/4in. (12) Ring Radio 0 7/8in x 0 7/8in x 0 5 1/2in. (13) Bacteria-powered Radio. Runs on sugar or bread. (14) Radio Control Tone Receiver. (15) Transistor P/P Amplifier. (16) Intercom. (17) 1-valve Amplifier. (18) Reliable Burglar Alarm. (19) Light-Seeking Animal. Guided Missile. (20) Perpetual Motion Machine. (21) Metal Detector. (22) Transistor Tester. (23) Human Body Radiation Detector. (24) Man/Woman Discriminator. (25) Signal Injector. (26) Pocket Transceiver (Licence required). (27) Constant Volume Intensity Control of Matchbox by Induction. (28) Inductive-Loop Transmitter. (29) Pocket Triple Reflex Radio. (31) Wristwatch Transmitter/Wire-less Microphone. (32) Rain Alarm. (33) Ultrasonic Switch/Alarm. (34) Stereo Pre-amplifier. (35) Quality Stereo Push-Pull Amplifier. (36) Light-Beam Telephone "Photophone". (37) Light-Beam Transmitter. (38) Silent TV Sound Adaptor. (39) Ultrasonic Transmitter. (40) Thyristor Drill Speed Controller. (41) Light Dimmer. (42) I.C. Pre-amplifier. (43) I.C. Amplifier. (44) I.C. Intercom. (45) I.C. Radio. (46) Raudive Voices Receiver. (47) Biofeedback Amplifier. (48) Brainwave Detector. (49) Proximity Switch. (50) Laser Projector. (51) 10 Photoelectric Circuits, Simple Alarms, Long Range Alarms, Projector, etc.

YORK ELECTRICS, Mail Order Dept.
335 BATTERSEA PARK ROAD, LONDON, S.W.11

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

A.M.C. ELECTRONICS LTD.

SCORPIO ELECTRONIC IGNITION UNIT

COMPLETE KIT WITH
ALL PARTS AND
COMPREHENSIVE CONSTRUCTION
AND FAULT FINDING DATA

COMPLETE KIT £11.00 + V.A.T. post paid.
DATA 10p + V.A.T. S.A.E. (Foolscap please).
TRANSFORMER £2.30 + V.A.T. post paid.
P.C.B. GLASS FIBRE 65p + V.A.T. post paid.
LATEST NEWS — P.E. TRIFFID. P.C.B. 65p post free.
Please add 15p to orders under £1.50. Send S.A.E. for other itemised prices.

AMCEL, MAIL ORDER 160 DRAKE STREET, ROCHDALE
LANCASHIRE OL16 1PY

BAKER 12in. MAJOR £9

30-14,500 cps. Double cone woofer and tweeter combination. Baker ceramic magnet assembly, flux density 145,000 gauss. BASS RESONANCE 40 c.p.s. 20 watt RMS.

MAJOR MODULE KIT **£11.50**

30-17,000 cps. with tweeter, crossover and baffle.

BAKER LOUDSPEAKERS

V.A.T.— ADD 10%

Regent 12 in. 15W	£8	Superb 12 in. 20W	£15	Group 25 12 in. 25W	£8
Major 12 in. 20W	£9	Auditorium 12 in. 25W	£14	Group 35 12 in. 35W	£9
Deluxe 12 in. 15W	£10	Auditorium 15 in. 35W	£20	Group 50 15 in. 50W	£20

BAKER LOUDSPEAKER CO., BENSHAM MANOR PASSAGE
THORNTON HEATH, SURREY Tel. 01-684 1665

FREE!

Over 150 ways to engineer a better future

HIGHER PAY

A BETTER JOB

SECURITY

find out how in just 2 minutes

That's how long it will take you to fill in the coupon. Mail it to B.I.E.T. and we'll send you full details and a free book. B.I.E.T. has successfully trained *thousands* of men at home - equipped them for higher pay and better, more interesting jobs. We can do as much for YOU. A low-cost B.I.E.T. home study course gets results fast - makes learning easier and something to look forward to. There are no books to buy and you can pay-as-you-learn.

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

Others have done it, so can you

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

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

"My training with B.I.E.T. quickly changed my earning capacity and, in the next few years, my earnings increased fourfold".—Student C.C.P., Bucks.

FIND OUT FOR YOURSELF

These letters—and there are many more on file at Aldermaston Court—speak of the rewards that come to the man who has given himself the specialised know-how employers seek. There's no surer way of getting ahead or of opening up new opportunities for yourself. It will cost you a stamp to find out how we can help you. Write to **B.I.E.T. Dept. BPE04 Aldermaston Court, Reading RG7 4PF.**

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.

<input type="checkbox"/> MECHANICAL	<input type="checkbox"/> Man. Prod.—cont.	<input type="checkbox"/> Construction-cont.
<input type="checkbox"/> A.M.S.E. (Mech.)	<input type="checkbox"/> Quality Control	<input type="checkbox"/> Building
<input type="checkbox"/> Boiler Inspect.	<input type="checkbox"/> Salesmanship	<input type="checkbox"/> Building Drawing
<input type="checkbox"/> & Operation	<input type="checkbox"/> Storekeeping	<input type="checkbox"/> Build. Foreman
<input type="checkbox"/> C & G Eng. Crafts	<input type="checkbox"/> Work Study	<input type="checkbox"/> Carpentry & Join.
<input type="checkbox"/> C & G Fabricat.	<input type="checkbox"/> Works	<input type="checkbox"/> Civil & Municipal
<input type="checkbox"/> Diesel Eng.	<input type="checkbox"/> Management	<input type="checkbox"/> Engineering
<input type="checkbox"/> Eng. Inspection	<input type="checkbox"/> DRAUGHTSMANSHIP	<input type="checkbox"/> Constructional
<input type="checkbox"/> Eng. Metallurgy	<input type="checkbox"/> A.M.I.E.D.	<input type="checkbox"/> Engineering
<input type="checkbox"/> Inst. Eng. & Tech.	<input type="checkbox"/> Design of Elec.	<input type="checkbox"/> Construction
<input type="checkbox"/> Inst. Motor Ind.	<input type="checkbox"/> Machines	<input type="checkbox"/> Surveyors
<input type="checkbox"/> Mainten. Eng.	<input type="checkbox"/> Die & Press Tool	<input type="checkbox"/> Institute
<input type="checkbox"/> Mechanical Eng.	<input type="checkbox"/> Design	<input type="checkbox"/> Clerk of Works
<input type="checkbox"/> Sheet Metal Work	<input type="checkbox"/> Electrical	<input type="checkbox"/> Council Eng.
<input type="checkbox"/> Welding	<input type="checkbox"/> Draughtsman-	<input type="checkbox"/> Geology
	<input type="checkbox"/> ship	<input type="checkbox"/> Health Eng.
	<input type="checkbox"/> Gen. Draughts-	<input type="checkbox"/> Heat & Vent.
	<input type="checkbox"/> manship	<input type="checkbox"/> Hydraulics
<input type="checkbox"/> ELECTRICAL &	<input type="checkbox"/> Jig & Tool Des.	<input type="checkbox"/> Inst. of Builders
<input type="checkbox"/> ELECTRONIC	<input type="checkbox"/> Tech. Drawing	<input type="checkbox"/> Inst. Works &
<input type="checkbox"/> A.M.S.E. (Elec.)	<input type="checkbox"/> RADIO & TELE-	<input type="checkbox"/> Highway Sup.
<input type="checkbox"/> C & G Elec. Eng.	<input type="checkbox"/> COMMUNICATIONS	<input type="checkbox"/> Painting & Dec.
<input type="checkbox"/> C & G Elec. Inst.	<input type="checkbox"/> Colour TV	<input type="checkbox"/> Public Hygiene
<input type="checkbox"/> C & G Elec. Tech.	<input type="checkbox"/> C & G Radio/TV/	<input type="checkbox"/> Road Engineer.
<input type="checkbox"/> Computer Elect.	<input type="checkbox"/> Electronics	<input type="checkbox"/> Structural Eng.
<input type="checkbox"/> Elec. Maths	<input type="checkbox"/> C & G Telecomm.	<input type="checkbox"/> Surveying
<input type="checkbox"/> Elec. Science	<input type="checkbox"/> Tech.	<input type="checkbox"/> GENERAL
<input type="checkbox"/> Electronic Eng.	<input type="checkbox"/> Prac. Rad. Elec.	<input type="checkbox"/> Agricultural Eng.
<input type="checkbox"/> Electrical Eng.	<input type="checkbox"/> (with kit)	<input type="checkbox"/> Council of Eng.
<input type="checkbox"/> Install. & Wiring	<input type="checkbox"/> Radio Amateurs	<input type="checkbox"/> Inst.
<input type="checkbox"/> Meters	<input type="checkbox"/> Exam.	<input type="checkbox"/> Farm Science
<input type="checkbox"/> & Measuring	<input type="checkbox"/> Radio Servicing	<input type="checkbox"/> General Educat.
<input type="checkbox"/> Instruments	<input type="checkbox"/> & Repairs	<input type="checkbox"/> Gen. Plastics
<input type="checkbox"/> MANAGEMENT &	<input type="checkbox"/> Radio & TV Eng.	<input type="checkbox"/> Pract. Maths
<input type="checkbox"/> PRODUCTION	<input type="checkbox"/> Trans. Course	<input type="checkbox"/> Pract. Slide Rule
<input type="checkbox"/> Auto. Control	<input type="checkbox"/> TV Maint. & Serv.	<input type="checkbox"/> Pure & Applied
<input type="checkbox"/> Computer Prog.	<input type="checkbox"/> AUTO & AERO	<input type="checkbox"/> Maths
<input type="checkbox"/> Electronic Data	<input type="checkbox"/> Aero Eng.	<input type="checkbox"/> Refrigeration
<input type="checkbox"/> Processing	<input type="checkbox"/> A.M.I.M.I.	<input type="checkbox"/> Rubber Tech.
<input type="checkbox"/> Estimating	<input type="checkbox"/> A.E.C. Cert.	<input type="checkbox"/> Sales Engineers
<input type="checkbox"/> Foremanship	<input type="checkbox"/> Auto Engineer.	<input type="checkbox"/> Tech. Report
<input type="checkbox"/> Inst. Cost & Man	<input type="checkbox"/> Auto Repair	<input type="checkbox"/> Writing
<input type="checkbox"/> Accountants	<input type="checkbox"/> C & G Auto. Eng.	<input type="checkbox"/> Timber Trade
<input type="checkbox"/> Inst. Marketing	<input type="checkbox"/> Garage	<input type="checkbox"/> University Ent.
<input type="checkbox"/> Management	<input type="checkbox"/> Management	
<input type="checkbox"/> Metrication	<input type="checkbox"/> MAA/IMI/Dipl.	
<input type="checkbox"/> Motor Trade Man.	<input type="checkbox"/> Motor Vehicle	
<input type="checkbox"/> Network Plan.	<input type="checkbox"/> Mechanics	
<input type="checkbox"/> Numerical Cont.	<input type="checkbox"/> CONSTRUCTIONAL	
<input type="checkbox"/> Operational	<input type="checkbox"/> A.M.S.E. (Civil)	
<input type="checkbox"/> Research	<input type="checkbox"/> Architecture	
<input type="checkbox"/> Personnel Man.		
<input type="checkbox"/> Planning Eng.		
<input type="checkbox"/> Production Eng.		

Coaching for many major exams including ONC, C & G, etc.

G.C.E.

58 'O' & 'A' LEVELS SUBJECTS Over 10,000 group passes

POST TODAY FOR A BETTER TOMORROW

To B.I.E.T., Dept. BPE04, Aldermaston Court, Reading RG7 4PF BPE04

NAME _____
Block Capitals Please
ADDRESS _____

OTHER SUBJECTS _____ AGE _____

Accredited by C.A.C.C.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

Published approximately on the 15th of each month by IPC Magazines Ltd., Fleetway House, Farringdon Street, London, E.C.4. Printed in England by Chapel River Press, Andover, Hants. Sole Agents for Australia and New Zealand: Gordon & Gotch (A/asia) Ltd., South Africa: Central News Agency Ltd., Rhodesia and Zambia: Kingstons Ltd., East Africa: Stationery and Office Supplies Ltd. Subscription Rate (including postage): For one year to any part of the world £2.65 (£2.15.0).

Practical Electronics is sold subject to the following conditions, namely, that it shall not, without the written consent of the Publishers first given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, and that it shall not be lent, resold or hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or attached to or as part of any publication or advertising, literary or pictorial matter whatsoever.

Henry's

BUILD THE TEXAN

YOUR COMPLETE AUDIO-ELECTRONIC STORES

More of everything at the right price. All your electronic requirements within 200 yards - call and see for yourself.

BUILD THE

TEXAN

★ FREE TEAK CASE with complete kits!

FEATURES: New slim design with 6 ICs, IC sockets, 10 silicon transistors, 4 rectifiers, 2 zeners. Special Gardners low field slim line transformer. Fibreglass PC panel. Complete chassis work.

HIGH QUALITY & STABILITY ARE PREDOMINATE FEATURES —DEVELOPED BY TEXAS ENGINEERS FOR PERFORMANCE, RELIABILITY AND EASE OF CONSTRUCTION.

FACILITIES: On/off switch indicator, headphone socket, separate treble, bass, volume and balance controls, scratch and rumble filters, mono/stereo switch, Input selector: Mag. P.U., Radio Tuner, Aux. Can be altered for Mic, Tape, Tape head etc. (Parts list Ref. 20 on request). Constructional Details Ref. No. 21. 30p.

SPECIAL KIT PRICE **£28.50** P. & P. 45p
COMPLETE WITH FREE TEAK CABINET

20 + 20 WATT INTEGRATED I.C. STEREO AMPLIFIER

(As featured in "Practical Wireless" May to August 1972)



SLIM DESIGN WITH SILVER TRIM

Overall chassis size 14 1/2 in. x 6 in. x 2 in. high

Designer approved kits distributed by Henry's!

ELECTRONIC KITS
Henry's introduce new huge range of audio and electronic kits now in stock, everything supplied, tremendous value. Detailed list Ref. No. 14 on request.

IC RECEIVER
ZN414 Radio integrated circuit as featured in Practical Wireless, January, 1973; Practical Electronics, February, 1973. Price £1.20.

BATTERY TAPE DECK
Garrard 9V tape deck with heads, etc. As previously advertised. Limited quantity. £9.50. Post 30p.

LEARN A LANGUAGE
Recorded Cassettes with step by step phrase books. French, German, Spanish, Italian. £1.36 per course. £5.00 per set of four.

DISCO SPOTBANK
As illustrated on the front cover of Practical Wireless, April, 1973. £12.75. P. & P. 35p.

HI-FI EQUIPMENT
Warehouse prices with BIG DISCO UNITS plus demonstrations (for callers) and GUARANTEES.

FREE 24-page detailed brochure (Ref. No. 17).
★ You can see the savings ★

HIGH QUALITY CASSETTES
The best U.K. low noise tapes but at a special price. "Living Sound" cassettes meet the highest international standard (IEC 35A). Fantastic price savings.

	C60	C90	C120
3 for	£1.00	£1.33	£1.62
6 for	£1.80	£2.57	£3.15
10 for	£2.80	£4.20	£5.00

RRP 70p 97p £1.47
Full guarantee. Post paid. Made by EMI especially for Henry's.
See earlier page of this magazine for transistors and semiconductor devices.

ULTRASONIC TRANSDUCERS
Operate at 40kc/s up to 100 yds. Ideal remote switching and signalling. Complete with data and new I.C. circuits.
PRICE PER PAIR £5.90. Post 10p.

MARRIOTT TAPE HEADS
4 TRACK MONO or 2 TRACK STEREO
"17" High Impedance £2.00
"18" Med. Impedance £2.00
"36" Med.-Low Imp. £3.50
Erase Heads for above 75p
"63" 2 track mono — High Impedance £1.75
"43" Erase Head for above 75p

7 SEG & NIXIE TUBES
(Post 15p per 1 to 6)
XN3, XN13, GNE 0-9 side view with data, 85p.
GNP-7, GNP-8 0-9 side view with decimal points and data, 95p.
3015F 7 seg. £2 each, £7 per 4 with data.
12 and 24 hour clock circuits. Ref. No. 31 15p.

MINIATURE AMPLIFIER
5 transistor. 300mW o/p. Fitted volume and sensitivity control 9 volt operated. £1.75 each, p.p. 15p.

QUALITY SLIDER CONTROLS
60mm stroke singles and ganged. Complete with knobs. 5kΩ, 10kΩ, 25kΩ, 100kΩ, 250kΩ, 500kΩ. 1 meg. Log and Lin. 40p each, 10kΩ, 25kΩ, 50kΩ, 100kΩ, 250kΩ, Log and Lin. ganged. 60p each.

LOW COST HI-FI SPEAKERS



E.M.I. Size 1 3/4 in x 8 1/2 in and Ceramic Magnet

TYPE 150 6 watt, 3, 8 or 15 ohms £2.20. Post 22p.

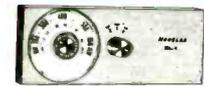
TYPE 150TC Twin cone version £2.75. Post 22p.

TYPE 450 10 watt with twin tweeters and crossover, 3, 8 or 15 ohms. £3.85. Post 25p.

TYPE 350 20 watt with tweeter and crossover, 8 and 15 ohms. £7.70. Post 28p.



POLISHED CABINETS 150, 150TC, 450 £4.60. Post 30p.
ASSEMBLED IN POLISHED CABINETS (8 OHM)
SERIES 6 (Assembled 150TC) per pair £16.50. Post 70p.
SERIES 8 (Assembled 450) per pair £18.95. Post 70p.



ML3 MW/LW TUNER TO BUILD

Uses Mullard Module. Slow motion tuning. Built-in battery. Ferrite aerial. Overall size 7 in x 2 1/2 in x 3 1/2 in. TOTAL COST TO BUILD £4.85. Post 15p. All parts sold separately—Leaflet No. 6.

"BANDSPREAD" PORTABLE TO BUILD



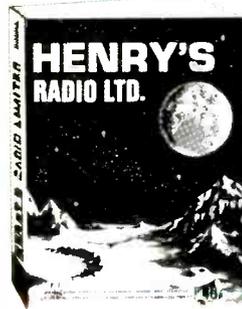
Printed circuit all transistor design using Mullard RF/IF Module. Medium and Long Wave bands plus Medium Wave Bands spread for extra selectivity. Wave Bands push-pull output, fibre glass PVC covered cabinet, car aerial. Attractive appearance and performance. TOTAL COST TO BUILD £7.98, p.p. 32p (Batt. 22p). All parts sold separately—Leaflet No. 2.

CATALOGUE

Fully detailed and illustrated covering every aspect of Electronics—plus data, circuits and information. 10,000 Stock lines at Special Low Prices and Fully Guaranteed.

PRICE 55p Post paid (40p FOR CALLERS)
PLUS! FIVE 10p VOUCHERS

Send to this address—Henry's Radio Ltd. (Dept. PE), 3 Albemarle Way, London, E.C.1.—for catalogue by post only. All other mail and callers to "303", see above.



TEST EQUIPMENT

Just a selection

SE250B Pocket Pencil Signal Injector, £1.90
SE500 Pocket Pencil Signal Tracer, £1.50
TH13D Robust 2 K/Volt, £6.55; with case £4.95
TE15 Grid Dip Meter 440 KHz—280 MHz, £13.45
500 30 K/Volt Multimeter, £9.25; with leather case, £10.50
200H/20K/Volt Multimeter, £4.20; with case £4.95
AF105 50K/Volt Multimeter, £8.50; with case, £9.50
U4341 AC/DC Multimeter with transistor tester with steel case, £10.50
TE20D RF Generator 120KHz—500MHz, £15.95. Carr. 35p
TE22D Audio Generator 20Hz—200KHz, £17.50. Carr. 35p
CI-5 3in Pulse Scope 10Hz—10MHz, £39.00. Carr. 50p
TE65 Valve Voltmeter 28 ranges, £17.50. Carr. 40p
ALL NOMBEX MODELS IN STOCK



BUILD THIS VHF FM TUNER

5 TRANSISTORS 300kc/s BANDWIDTH PRINTED CIRCUIT. HIGH FIDELITY REPRODUCTION. MONO AND STEREO. A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately.

Free Leaflet No. 3 & 7. TOTAL £6.97, p.p. 20p.
Decoder Kit £5.97. Tuning meter unit £1.75.
Mains unit (optional) Model PS900 £2.47. Post 20p.
Mains unit for Tuner and/or Decoder PS6/12 £3.25. Post 20p.



PA—DISCO—LIGHTING

UK's Largest Range—Write phone or call in. Details and demonstrations on request.

DJ30L 3 Channel sound to light unit, 3kW, £29.50
DJ40L 3 Channel Mic (Built-in) to light, 3kW, £38.75
DJ70S 70 watt Disco amp/mixer, £49.75
DISCOAMP 100 watt Disco amp/mixer, £65.85
DJ105S 30 watt Disco amp/mixer, £32.25
Amp. Feedback Quality Mic., £11.50
DJ500 50 watt PA amplifier, £43.95
DJ700 70 watt £52.75
Group 300 150 watt rms Group Valve amplifier, £86.00
● Portable discos—details on request
● Credit terms for callers



FIBRE OPTICS · LIGHTING · MICS · EFFECTS · PROJECTORS · SPOTS · DIMMERS · STANDS · MIXERS · SPEAKERS
Everything for PA — Disco — Lighting. FREE Stock List Ref. No. 18.

SINCLAIR PROJECT 60 MODULES

—SAVE POUNDS

Z30 £3.57 Z50 £4.37
STEREO 60 £7.97 PZ5 £3.97
PZ6 £6.37 PZ8 £4.77.
Transformer for PZ8 £2.95.
Active Filter Unit £4.45.
Stereo FM Tuner £16.95.
IC12 £1.80 Q16's £15 pair.
Post, etc. 20p per item.



PACKAGE DEALS Post 25p
2 x Z30, Stereo 60, PZ5 £15.95
2 x Z30, Stereo 60, PZ6 £18.00
2 x Z50, Stereo 60, PZ8 £20.25
Transformer for PZ8 £2.95
PROJECT 60S KIT £19.95

VAT Prices DO NOT include Value Added Tax. From 1st April, 1973, 10% must be added and shown separately to your total order (inc. of carriage and packing). Help us to help you receive your order without delay.

Henry's RADIO LIMITED
EDGWARE ROAD, W2

404-406 Electronic Components and Equipment 01-402 8381
354-356 High Fidelity and Tape Equipment 01-402 5854/4736
309 PA-Disco-Lighting High Power Sound 01-723 6963
303 Special offers and bargains store
All mail to 303 Edgware Road, London W2 1BW

Open—9 am-6 pm
6 days a week
(309 closed Thursday)
All stores open all day Saturday