PRACTICAL WIRELESS

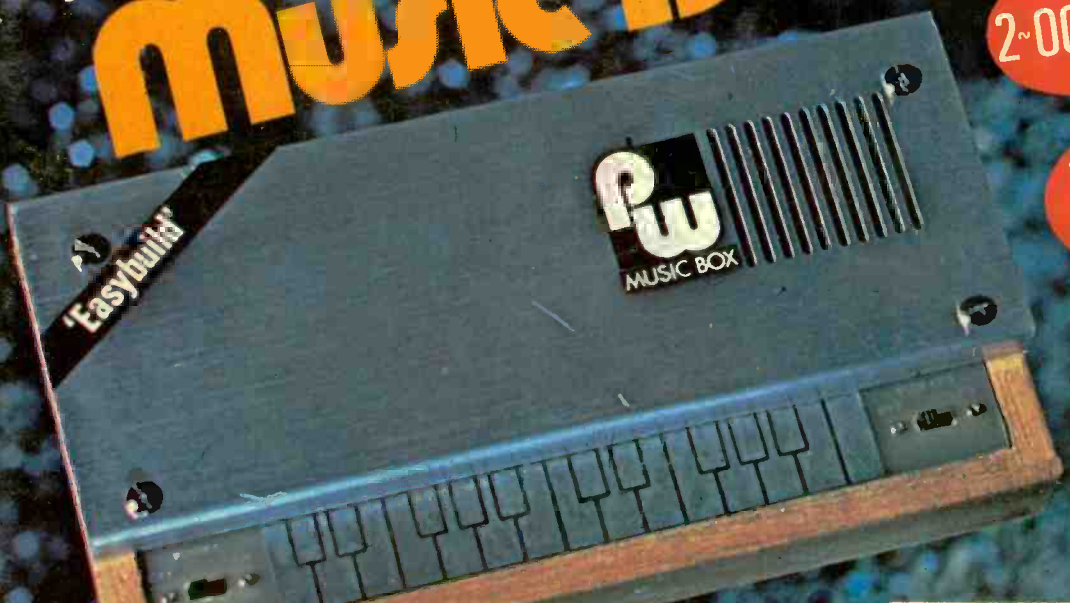
JANUARY 1976
35p

PW 'Easybuild' Music Box

2~OCTAVE

VARIABLE PITCH

VIBRATO



Also:

NEW SERIES~GENERAL SERVICING

I C REV COUNTER

EMERGENCY LIGHT UNIT

PRACTICAL WIRELESS

VOL. 51 NO. 9
ISSUE 827
JANUARY 1976

BRITAIN'S PREMIER MAGAZINE FOR THE DO-IT-YOURSELF RADIO AND ELECTRONICS CONSTRUCTOR

EDITOR
Lionel E. Howes, G3AYA

ASSISTANT EDITOR
Eric Dowdeswell, G4AR

ART EDITOR Peter Metalli

TECHNICAL EDITOR
Sam Lewis B.Sc. (Eng.)

PRODUCTION & NEWS EDITOR
Colin Riches

TECHNICAL SUB-EDITOR
Bill Tull

TECHNICAL ARTIST
Alan Martin

SECRETARIAL Susan King

ADVERTS MANAGER
01-634 4293 Roy Smith

CLASSIFIED ADVERTS
01-634 4301 Colin R. Brown

Published by IPC Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD. Tel. 01-634 4444

Binders (£1·90) and indexes 30p (inc. VAT) can be supplied by the Binders Dept at Carlton House, 66-68 Great Queen Street, London, WC2 5DD.

BACK NUMBERS
We regret that we are unable to supply back numbers of Practical Wireless. Readers are recommended to enquire at a public library to see copies. Requests for specific back numbers of *Practical Wireless* and *Television* can be published in our CQ Column.

● NEWS & COMMENT

● CONSTRUCTIONAL

● OTHER FEATURES

PCB SERVICE – ANNOUNCEMENT – Page 742

PUSH BUTTON CAR RADIO KIT— THE TOURIST TT*

NO SOLDERING REQUIRED

NOW BUILD YOUR OWN PUSH BUTTON CAR RADIO

Easy to assemble construction kit comprising fully completed and tested printed circuit board on which no soldering is required. All connections are simple push fit type making for easy assembly. Fine tuning push button mechanism is fully built and tested to mate with printed circuit board. **TECHNICAL SPECIFICATION:** (1) **Output** 4 watts RMS output. For 12 volt operation on negative or positive earth. (2) **Integrated circuit** output stage, pre-built three stage IF Module. **Controls** volume manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands. Size chassis 7" wide 2" high and 4¾" deep approx. **£9.50** +£1.05 p & p. Speaker including baffle and fixing strip £2.00 +45p p & p. Car Aerial Recommended — fully retractable £1.60 + 40p p & p.

The Tourist I Kit For the experienced constructor. If you can solder on a printed circuit board you can build this model. Same technical specification as Tourist TT. **Price £8.20** +£1.05 p & p.

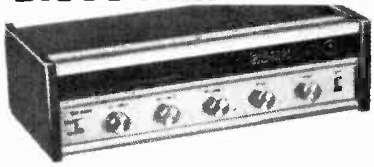
*STEREO 21 QUALITY SOUND FOR LESS THAN £24.00

Stereo 21, easy to assemble audio system kit. No soldering required.
The unit is finished in white P.V.C. and the acrylic top presents an unusually interesting variation on the modern deck plinth.
Includes — **BSR 3 speed deck**, automatic, manual facilities together with stereo cartridge.
Two speakers with cabinets.
Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.
Specifications — For the technically minded:
Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel. Output impedance 8–15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs — radio, tape, etc., and outputs for taping discs.
Overall Dimensions. Speakers approx 15½"×8"×4". Complete deck and cover in closed position approx. 15½"×12"×6".

Complete only £23.20 +£3.00 p & p.

Extras if required. Optional Diamond Styli **£1.60.**
Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance **£5.80.**

*DISCO AMPLIFIER



Reliant Mk IV Mono Amplifier, ideal for the small disco or house parties. Output 20 watts RMS into 8 ohms (suitable for 15 ohms).
Inputs *4 electrically mixed inputs. *3 individual mixing controls. *Separate bass and treble controls common to all 4 inputs. *Mixer employing F.E.T. (Field Effect Transistors). *Solid State circuitry. *Attractive styling.
INPUT SENSITIVITIES — Input — 1). Crystal mic. guitar or moving coil mic. 2 and 10mV. (Selector switch for desired sensitivity.) — Inputs — 2), 3), 4). Medium output equipment — ceramic cartridge, tuner, tape recorder, organs, etc. — all 250mV sensitivity. AC Mains, 240V operation. Size approx: 12½"×6"×3½". **£20.00** +£1.35 p & p.

8 TRACK HOME CARTRIDGE PLAYER

Elegant self selector push button player for use with your stereo system. Compatible with Viscount IV system, Unisound module and the Stereo 21. Technical specification Mains input, 240V. Output sensitivity 125mV.

Yours for only
£16.20 +£1.70 p & p.

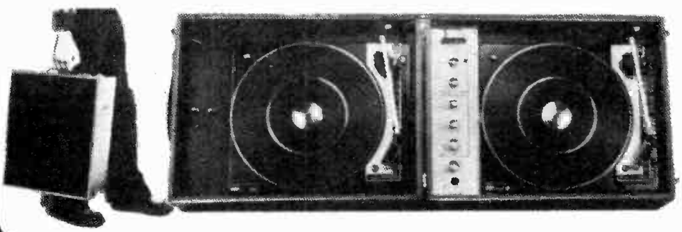
BUILD YOUR OWN STEREO AMPLIFIER*

For the man who wants to design his own stereo — here's your chance to start, with Unisound — pre-amp, power amplifier and control panel. No soldering — just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic power chips which ensure very low distortion over the audio spectrum. 240V. AC only.

Also available with 2 speakers (7"x4") £10 + £1.75 p & p. **£8.95** + £1.05 p & p.
Also available with the 'Compact' (see opposite page) easy build speaker kit £13.50 + £2 p & p

PORTABLE DISCO CONSOLE*

INCORPORATES: Pre-Amp with full mixing facilities, including switched input for mic with volume control, switched input for auxiliary with volume control, bass and treble controls, volume control and blend control for turntables. Two B.S.R. MP60 type single play professional series decks, fitted with crystal cartridges.



TECHNICAL SPECIFICATION:
Pre-amp — Output — 200mV. Auxiliary inputs — 200mV and 750mV into 1 meg. Mic input – 6mV into 100K. 240 volt operation. **Turntables capacity** — 7", 10" or 12" records. **Rumble, wow and flutter** Rumble Better than —35dB. Wow Better than 0.2%. Flutter Better than 0.06% (Gaumont kalee meter). **Finish** — Satin black mainplate with black turntable mat inlaid with brushed aluminium trim. Tonearm and controls in black and brushed aluminium.

Console size —
Unit Closed — 17¾"×13¾"×8¾" (app.)
Unit Open — 35¾"×13¾"×4¾" (app.)
This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.
The unit is finished in black PVC with contrasting simulated teak edging, diamond spun control knobs with matching control panel.

Yours for only
£49.00 +£6.50 p & p.

All prices include VAT at current rates

BARCLAYCARD — Buy it with Access

DO NOT SEND CARD
Just write your order giving your credit card number

Mail orders to Acton. Terms C.W.O. All enquiries stamped addressed envelope. Goods not despatched outside U.K.
Leaflets available for all items listed thus' Send stamped addressed envelope. All items subject to availability. Prices correct at 1st Dec. 1975 and subject to change without notice.

● Minimum order on ACCESS/BARCLAYCARD–£11.

R T V C

21C HIGH STREET, ACTON, LONDON W3 6NG
323 EDGWARE ROAD, LONDON W2
Personal Shoppers **EDGWARE RD**: 9 a.m.–5.30p.m. Half day Thurs
ACTON: 9.30a.m.–5p.m. Closed all day Wed.

The All Elektrik Wireless.

Electronically tuned MW/LW tuners:

MC720 3 Stage tuned MW HiFi tuner module, with IC RF/IF system and ceramic filter. kit price £8; built version (**MC9720**) £9.95.

MC722 2 stage varicap tuned **MW/LW** tuner, with **electronic** MW/LW switching and ferrite rod antenna; terminations to .2" edge connector kit price £8; built (**MC9722**) £10.45.

FM tunerheads

EF5600 5 varicap cct., AFC, AGC, mos input £10.00
EC3302 3 varicap cct., AFC, FET input £5.00.
8319 4 varicap cct., AFC, AGC, dual mosfet £9.
NT3302 3 mechanically tuned ccts. 366+366pF AM gang capacitor. FET FM input stage. £5.00.

Complete tuner systems/accessories and miscellaneous items

7252 Tunerset. 1uV for 26db S/N; .1% THD, with varicap tuning, full scan/lock facility. £24.

7253 Tunerset with PLL MPX decoder; 1.2uV for 26dB S/N; .7%THD (inc. decoder).£24.00.

7500 Teak cabinet and chassis/front panel for our various am/fm tuner modules and kits. With provision for 3 meters, long slider, 6 preset unit, 5 push button switches, LED etc. £10.00 (carriage £2.50 extra.)

7501 The International (see ETI Sept 75) FM tuner. Complete kit & cabinet. £40.00.

Misc. **G3XGP 2m converter kit.** (Complete excluding case) £7.50/**WS150 150mm slider £3 . MVAM1 £2.75; MVAM2 £1.05 Full list OA.**

Ambit is the UK's most comprehensive source for wireless components. Delivery for items in stock is by return of post. **Only first quality types are supplied.** *An SAE will bring you the current shortform price and information list. 40p will bring you the complete data information folder.* **Please remember to add VAT & PP.**

ambit international

37 High Street
Brentwood
Essex CM14 4RH
tel:216029 tlx:995194

Terms: UK prices exclude vat. UK postage and packing 20p per order. Europe 40p/4 oz at airmail rate. Min order £1.00.

ENGINEERS

FREE

YOURSELF FOR A

BETTER JOB WITH MORE PAY!

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

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

CUT OUT THIS COUPON

POST NOW

CHOOSE A BRAND NEW FUTURE HERE!

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

Build-As-You-Learn PRACTICAL RADIO AND ELECTRONICS (with kit) ☐
Electrical Engineering ☐
Electrical Installations and wiring ☐
Electrical Draughtsmanship ☐
Electrical Mathematics ☐
Electronic Engineering ☐
Computer Electronics ☐
Computer Programming ☐
Colour TV Servicing ☐
C&G Radio, TV & Electronic Mechanics ☐
General Radio and TV Engineering ☐
Radio Servicing, Maintenance and Repairs ☐
Transistor Technology ☐
CITY AND GUILDS Installations and Wiring ☐
CITY AND GUILDS Electrical Technicians ☐
CITY AND GUILDS Telecommunications ☐
Radio Amateurs' Exam etc. etc. ☐

To ALDERMASTON COLLEGE Dept. EPW-11, Reading RG7 4PF | EPW 11 |

Also at our London Advisory Office, 4 Fore Street Avenue, Moorgate London, EC2Y 5EJ Tel: 01-628 2721

NAME (Block Capitals Please) ....

ADDRESS ....

POST CODE ....

Other subjects .... Age ......

Accredited by C.A.C.C. *Member of A.B.C.C.*

HOME OF BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

PRICES INCLUDE VAT

KITS Hi-Fi Cabinets TEAK Veneer P & P 75p

17" x 10" x 7½" cut for 8" & Tweeter	£5·95
12" x 8" x 4½" cut for 8" x 5"	£3·75
18" x 12" x 7½" cut for 10" or 8" & Tweeter	£5·95

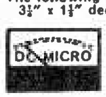
Complete with Instr. & Hardware.

MICROPHONES P & P 20p

UD 130 Cardioid Dyn. 50–50,000 C/S Dual imp.	£7·40
UD 147 Cardioid Dynamic	£9·50

MULTIMETER Model ITI—2
20,000 O.P.V.
AC 0–10, 50, 100, 500, 1000
DC 0–5, 25, 50, 250, 500, 2500
DC Current 0/50 µA 2·5, 250
Resistance 0/6K Ohms, 6 Meg Ohms
DB −20 to +22.
Capacitance 10pF, ·01µF, 0·1µF
£6·75 P & P 20p

PANEL METERS P & P 15p
The following range measure 4¼" x 3¼" x 1½" deep



2¼" diam, hole in panel reqd, ME6 0–50 µA, ME7 0–100 µA, ME8 0–500 µA, ME9 0–1 mA, ME10 0–5mA, ME11, 0–10 mA, ME12 0–50 mA, ME13 0–100 mA, ME14 0–500 mA, ME15 0–1 amp, ME16 0–50 volts AC, ME17 0–300 volts AC, ME18 "S", ME19 "VU"
FULL SCALE AT £3·25 EACH

JACK PLUGS P & P 12p per 12
Screened Chrome Plastic Body

2·5mm	14p	10p
3·5mm	14p	10p
Standard Mono	20p	12p
Standard Stereo	28p	20p

SPEAKERS Chassis P & P 40p (Tweeter 20p)

ELAC 8" 8 watt HF Cone	£2·90
ELAC 8" 15 watt Long Throw	£4·25
ELAC 10" 10 watt HF Cone	£3·95
ELAC 7" x 4" Cer. Mag.	£1·85
2½" Tweeters	£1·25

CARTRIDGES & STYLI P&P 20p

	Carts. (inc Styli)	Styli (D/Diam)
GOLDRING		
G800	£4·50	£2·60
G850	£3·50	£2·25
G800E	£9·00	£4·95
SHURE M44/7	£5·95	£4·75
M55/E	£6·95	£5·85
M75/EJII	£10·90	£7·25
M75/ED	£12·95	£9·25

CASSETTES & TAPES

	C60	C90	C120
EMI Sound Hog	38p	48p	58p
Compact Low Noise	32p	41p	50p
BASF LH	55p	75p	97p
LH Super	72p	90p	£1·00

P & P 25p per order 10 or more P & P FREE

Reel to Reel Recording Tape

	Std. Play	Long Play	
5" (600')	58p	74p	(900')
5¾" (900')	65p	90p	(1200')
7" (1200')	85p	£1·20p	(1800')

Up to 4 P & P 25p. Thereafter 10p

Prices correct at time of going to Press.

Venusound ltd Send 10p for Brochure!

63 Whitworth Street Manchester 1
Telephone 061·236 3921

NEW MULLARD & MAZDA VALVES

All individually boxed and guaranteed. Full trade discounts to bona fide companies. Price and availability lists on application.

EXPRESS POSTAGE
12p for 1 Valve. Each additional Valve add 2p in UK

DM70	0·69
DY86/7	0·53
DY802	0·53
EABC80	1·16
EB91	0·73
EBC81	0·89
EBF80	0·63
EBF83	0·66
EBF89	0·50
EC86	0·82
EC88	0·86
EC90	0·94
EC97	0·69
ECC81	0·54
ECC82	0·53
ECC83	0·53
ECC84	0·63
ECC85	0·78
ECC88	0·91
ECC189	0·77
ECF80	0·63
ECF82	0·90
ECF86	0·76
ECH81	1·29
ECH83	1·06
ECH84	1·17
ECL80	0·78
ECL82	0·69
ECL83	0·72
ECL86	0·73
EF80	0·53
EF83	1·10
EF85	0·53
EF86	1·30
EF89	1·30
EF91	1·35
EF92	1·51
EF95	1·63
EF183	0·69
EF184	0·69
EH90	0·91
EL34	1·06
EL36	1·15
EL84	0·53
EL86	1·06
EL95	0·78
ELL80	2·81
EM81	1·24
EM87	1·25
EY51	0·89
EY86/87	0·53
EY88	0·81
EZ80	0·63
EZ81	0·53
GY501	1·80
GZ34	0·91
PC86	1·05
PC88	1·05
PC97	0·53
PC900	0·65
PCC84	0·63
PCC85	0·90
PCC88	0·98
PCC89	0·73
PCC189	0·91
PCF80	0·63
PCF82	1·37
PCF86	0·73
PCF200	1·13
PCF201	1·13
PCF801	0·73
PCF802	0·78
PCF806	0·73
PCH200	1·30
PCL82	0·63
PCL83	0·73
PCL84	0·69
PCL85	0·72
PCL86	0·73
PCL805/85	0·73
PD500	2·11
PFL200	0·91
PL36	1·06
PL81	0·91
PL81A	1·06
PL82	0·48
PL83	1·29
PL84	0·78
PL500	1·02
PL504	1·02
PL508	1·30
PL509	1·77
PL802	1·77
PY33	0·73
PY81/800	0·56
PY82	0·70
PY88	0·63
PY500A	1·15
PY800	0·56
PY801	0·56
U26	1·22
U191	1·17
U193	0·56
UABC80	1·01
UBC81	0·80
UBF89	0·65
UCC85	0·66
UCH81	1·30
UCL82	0·78
UCL83	0·78
UL84	1·03
UY85	0·63
6/30L2/ECC804	1·20
6F23/EF812	1·16
30C1/PCF80	0·63
30C15/PCF800	1·22
30C17	1·29
30C18/PCF805	1·29
30F5/PF818	1·35
30FLI/PCE800	0·98
30FL2	1·02
30FL12	1·44
30FL14	1·20
30L1/PCC84	0·63
30L15/PCC805	1·35
30L17	1·12
30P4MR	1·63
30P1Z/PC801	1·22
30P19/PC802	1·06
30PL1/PCL801	1·35
30PL13/PCL800	1·47
30PL14/PCL88	1·72
30PL15	1·44

NEW VALVES

Individually boxed and guaranteed but of European or other origin at greatly reduced prices. Quotations for any valve not listed. Send SAE for lists.

AZ1	0·75
AZ31	0·60
CBL31	1·40
CL33	1·50
CY31	0·60
DAF91	0·40
DAF96	0·60
DCC90	1·85
DF91	0·40
DF96	0·60
DK91	0·50
DK92	1·00
DK96	0·75
DL92	0·50
DL94	0·48
DL96	0·55
DY86	0·45
DY87	0·45
DY802	0·47
EABC80	0·38
EAF42	0·70
EB91	0·30
EBC33	1·00
EBC41	0·75
EBC81	0·40
EBF80	0·40
EBF83	0·40
EBF89	0·32
EBL31	2·00
ECC81	0·45
ECC82	0·38
ECC83	0·38
ECC84	0·35
ECC85	0·45
ECC88	0·50
ECH35	1·50
ECH42	0·85
ECH81	0·35
ECH83	0·50
ECL80	0·60
ECL82	0·42
ECL83	0·75
ECL86	0·55
ECLL800	3·50
EF37A	1·20
EF39	1·25
EF80	0·35
EF85	0·45
EF86	0·50
EF89	0·35
EF91	0·40
EF92	0·50
EF95	0·45
EF98	0·80
EF183	0·40
EF184	0·40
EL32	0·60
EL33	3·00
EL34	0·70
EL36	0·60
EL37	2·50
EL41	0·90
EL42	1·65
EL84	0·35
EL95	0·60
ELL80	2·00
EM80	0·55
EM81	0·60
EM84	0·40
EM85	1·00
EM87	1·00
EY51	0·45
EY86	0·45
EZ40	0·60
EZ41	0·75
EZ80	0·30
EZ81	0·31
GY501	0·90
GZ30	0·65
GZ32	0·65
GZ34	0·75
GZ37	1·25
HN309	1·50
KT61	2·50
KT66	2·95
KT81 (7C5)	1·30
KT81	1·75
KT88	3·25
KTW61	1·50
MU14	1·00
N78	5·00
OA2	0·45
OB2	0·45
PC86	0·65
PC88	0·65
PC97	0·55
PC900	0·55
PCC84	0·45
PCC88	0·62
PCC89	0·55
PCC189	0·65
PCF80	0·40
PCF82	0·42
PCF86	0·65
PCF801	0·60
PCF802	0·55
PCF805	0·90
PCF806	0·80
PCF808	1·00
PCL82	0·45
PCL83	0·70
PCL84	0·50
PCL85	0·60
PCL86	0·50
PCL805/85	0·60
PD500	1·50
PEN45	0·85
PL36	0·63
PL81	0·55
PL82	0·50
PL83	0·50
PL84	0·50
PL500	0·85
PL504	0·85
PL508	0·90
PL509	1·55
PL802	1·25
PX25	3·50
PY33	0·63
PY81	0·50
PY82	0·45
PY83	0·50
PY88	0·63
PY500	1·10
PY81/800	0·50
PY801	0·55
SP41	3·00
SP61	0·85
T41	1·00
U14	0·75
U25	1·00
U26	0·85
U191	0·75
UABC80	0·40
UAF42	0·75
UBC41	0·60
UBC81	0·50
UBF80	0·50
UBF89	0·50
UCC85	0·50
UCH42	0·80
UCH81	0·50
UCL82	0·40
UCL83	0·70
UF41	0·75
UF89	0·50
UL41	0·85
UL84	0·50
UY41	0·55
UY85	0·45
VR105/30	0·40
VR150/30	0·45
1R5	0·50
1S5	0·40
1T4	0·40
3S4	0·50
3V4	0·85
5R4GY	1·00
5U4G	0·55
5Y3GT	0·65
5Z4G	0·65
6/30L2	0·90
6AK5	0·45
6AM5	1·00
6AQ5	0·50
6AS7G	1·00
6AT6	0·60
6AU6	0·40
6BA6	0·38
6BE6	0·45
6BH6	0·75
6BJ6	0·75
6BQ7A	0·55
6BR7	1·20
6BS7	1·40
6BW6	1·00
6BW7	1·00
6C4	0·40
6CD6G	1·60
6CH6	1·50
6CW4	1·00
6F23	0·90
6F25	1·00
6F28	0·75
6J5M	0·65
6J5G	0·45
6J6	0·35
6J7G	0·30
6J7M	0·65
6K6GT	0·80
6K7G	0·35
6K7M	0·45
6K8G	0·45
6K8M	0·70
6K25	1·00
6L6G	1·25
6Q7G	0·40
6Q7M	0·60
6SL7GT	0·55
6SN7GT	0·55
6SQ7GT	0·40
6U5G	1·50
6V6G	0·80
6V6GT	0·80
6X4	0·45
6X5G	0·45
6X5GT	0·55
7B6	0·80
7B7	0·80
7C5	1·30
7C6	1·00
7H7	0·80
7R7	0·80
7S7	3·25
7Y4	0·80
12AT6	0·45
12AT7	0·45
12AU6	0·50
12AU7	0·38
12AX7	0·38
12BA6	0·50
12BE6	0·60
30C1	0·40
30C15	1·00
30C17	1·00
30C18	0·90
30F5	1·00
30FL1	1·00
30FL2	1·00
30FL14	1·00
30L15	0·95
30L17	0·95
30P4MR	1·30
30P12	1·00
30P19	0·95
30PL1	0·95
30PL13	1·10
30PL14	1·10
35W4	0·60
35Z4GT	0·70
50CD6G	1·20
807	1·00
813ITT	14·00
813USSR	6·00
866A	1·20

TRANSISTORS-INTEGRATED CIRCUITS

EXPRESS POSTAGE
12p per order in UK

All transistors, I.C's offered are new and branded. Manufactured by Mullard, Texas, RCA, Ferranti, Motorola, ITT, Fairchild, Lucas, etc. Quantity discounts on application. Send SAE for full lists.

AA119	0·07
AAZ13	0.12
AAZ15	0·10
AC107	0·51
AC126	0·25
AC127	0·25
AC128	0·15
AC176	0·25
AC187	0·21
AC188	0·20
ACY21	0·35
ACY39	0·75
AD140	0·50
AD149	0·50
AD161	0·44
AD162	0·44
AF115	0·25
AF116	0·25
AF117	0·24
AF186	0·48
AF239	0·44
ASY27	0·33
ASY28	0·25
BA102	0·25
BA115	0·10
BC107	0·14
BC108	0·13
BC109	0·12
BC113	0·15
BC117	0·21
BC143	0·30
BC147	0·10
BC148	0·08
BC169C	0·15
BC182	0·12
BC182L	0·12
BC184L	0·13
BC338	0·15
BCY32	0·85
BCY33	0·38
BCY34	0·45
BCY70	0·18
BCY71	0·22
BCY72	0·15
BCZ11	0·65
BD121	1·00
BD124	0·65
BD131	0·42
BD132	0·50
BF115	0·20
BF167	0·25
BF173	0·28
BF179	0·33
BF180	0·36
BF181	0·35
BF194	0·10
BF195	0·13
BF197	0·15
BF200	0·32
BFS61	0·25
BFS98	0·25
BFW10	0·61
BFX29	0·28
BFX88	0·24
BFY50	0·20
BFY51	0·20
BFY52	0·20
BR100	0·40
BY100	0·27
BY126	0·14
BY127	0·15
BZX61 series	0·20
BZY88 series	0·10
CRS1-05	0·35
CRS1-40	0·50
CRS3-05	0·40
CRS3-40	0·65
MJE340	0·47
MJE370	0·68
MJE520	0·65
MJE2955	1·27
MJE3055	0·75
MPF102	0·40
MPF103	0·36
MPF104	0·35
MPF105	0·36
NKT404	1·00
OA5	0·72
OA10	0·40
OA79	0·10
OA81	0·18
OA91	0·07
OA200	0·08
OA202	0·06
OC16	1·00
OC20	2·00
OC23	1·25
OC25	0·40
OC28	0·66
OC35	0·55
OC36	0·60
OC42	0·40
OC44	0·20
OC45	0·20
OC71	0·18
OC72	0·28
OC76	0·30
OC77	0·55
OC81	0·29
OC81D	0·28
OC81Z	0·45
OC83	0·27
OC140	1·14
OC170	0·30
OC171	0·30
OC200	0·75
OC201	1·50
OC202	1·50
OC203	0·75
OCP71	1·20
ORP12	0·60
ORP60	0·55
TIC44	0·29
TIC226D	1·50
TIL209	0·20
ZTX107	0·12
ZTX108	0·10
ZTX300	0·13
ZTX301	0·14
ZTX302	0·18
ZTX304	0·24
ZTX500	0·13
ZTX501	0·15
ZTX503	0·16
ZTX531	0·25
ZTX550	0·18
1N914	0·06
IN4001	0·06
IN4002	0·07
IN4003	0·08
IN4004	0·08
IN4005	0·10
IN4006	0·12
IN4007	0·12
1N4009	0·06
1N4148	0·06
1S921	0·07
IS2033	0·20
IS2051A	0·20
IS2100A	0·20
1S3010	0·25
2N696	0·15
2N697	0·16
2N706	0·10
2N706A	0·12
2N1131	0·25
2N1132	0·24
2N1302	0·10
2N1303	0·18
2N1304	0·22
2N1305	0·22
2N1306	0·28
2N1307	0·28
2N1308	0·28
2N1309	0·30
2N1613	0·31
2N1614	0·45
2N2147	0·78
2N2160	0·78
2N2369A	0·16
2N2646	0·50
2N2904	0·20
2N2904A	0·25
2N2905	0·22
2N2905A	0·25
2N2906	0·20
2N2926	0·12
2N3053	0·18
2N3055	0·45
2N3525	0·91
2N3614	0·65
2N3615	0·65
2N3702	0·11
2N3703	0·12
2N3704	0·14
2N3705	0·15
2N3706	0·11
2N3707	0·13
2N3708	0·07
2N3709	0·10
2N3710	0·11
2N3711	0·11
2N3819	0·38
2N3820	0·50
2N3823	0·50
2N3903	0·15
2N3904	0·20
2N3905	0·25
2N3906	0·25
2N4058	0·15
2N4059	0·10
2N4060	0·13
2N4061	0·13
2N4062	0·14
2N4289	0·30
3N125	1·75
3N141	0·81
40360	0·40
40361	0·48
40362	0·40
40430	0·85

SN7400	0·16
SN7401	0·16
SN7402	0·16
SN7403	0·16
SN7404	0·26
SN7405	0·22
SN7406	0·42
SN7407	0·42
SN7408	0·28
SN7409	0·28
SN7410	0·16
SN7411	0·25
SN7412	0·30
SN7413	0·36
SN7416	0·36
SN7417	0·36
SN7420	0·16
SN7422	0·25
SN7423	0·37
SN7428	0·40
SN7430	0·16
SN7433	0·37
SN7437	0·37
SN7438	0·37
SN7440	0·22
SN7441AN	0·92
SN7442	0·79
SN7450	0·16
SN7451	0·16
SN7453	0·16
SN7454	0·16
SN7460	0·16
SN7470	0·36
SN7473	0·41
SN7474	0·42
SN7480	0·60
SN7483	1·10
SN7486	0·47
SN7490	0·55
SN7491AN	1·00
SN7492	0·70
SN7493	0·70
SN7494	0·80
SN7495	0·80
SN7496	0·95
SN7497	3·87
SN74100	1·89
SN74107	0·45
SN74110	0·58
SN74118	0·90
SN74119	1·68
SN74121	0·50
SN74122	0·70
SN74123	1·00
SN74141	0·90
SN74145	1·26
SN74150	1·75
SN74151	1·00
SN74154	2·00
SN74155	1·00
SN74156	1·00
SN74157	0·95
SN74170	2·52
SN74174	1·57
SN74175	1·10
SN74176	1·26
SN74190	2·00
SN74191	2·00
SN74192	2·00
SN74193	2·00
SN74194	1·30
SN74195	1·10
SN74196	1·20
SN74197	1·20
SN74198	2·77
SN74199	2·52

DIL SOCKETS	
14 pin	15p
16 pin	17p

VAT

To be added to all orders
VALVES & TRANSISTORS 25%
INTEGRATED CIRCUITS 8%

THIS MONTH'S

* OSCILLOSCOPE TUBES
Types CV 1526, DG 7-5, VCR 139A
All at £8·00 each, +p & p 25p.
Add 8% VAT

SPECIAL OFFER

TERMS OF BUSINESS: C.W.O. A/c's available to approved companies on application. Telephone and telex orders accepted. Export and trade enquiries welcomed. Lists, etc. on application. Open daily to callers 9 a.m.–5 p.m. Mon.–Sat. Closed Sat. 1–3 p.m. Prices correct when going to press.

RST VALVE MAIL ORDER CO.

16a Wellfield Rd., London, SW16 2BS
Tel: 01-677 2424 Telex: 946 708.

LASKYS FOR CHOICE

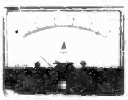
SEW PANEL METERS

STOCKED AT
481 Oxford Street 311 Edgware Road
42 Tottenham Court Rd. 3 Lisle Street
branches or by mail order.

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

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

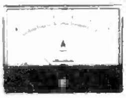
CLEAR PLASTIC MODEL SO640
Size: 85 x 64mm



50uA	£4.20
100uA	£4.15
200uA	£4.10
500uA	£4.05
50-0-50uA	£4.15
100-0-100uA	£4.10
1mA	£4.05
5mA	£4.05
10mA	£4.05
50mA	£4.05
100mA	£4.05
500mA	£4.05
1A DC	£4.05
5A DC	£4.05
10A DC	£4.05
5V DC	£4.05

10V DC	£4.05
20V DC	£4.05
25V DC	£4.05
50V DC	£4.05
300V DC	£4.05
15V AC	£4.15
300V AC	£4.15
VU Meter	£4.95

CLEAR PLASTIC MODEL SW100
Size: 100 x 80mm

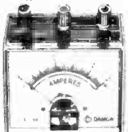


50uA	£5.05
100uA	£4.95
500uA	£4.75
50-0-50uA	£4.95
100-0-100uA	£4.90
1mA	£4.75
1A DC	£4.75
5A DC	£4.75
20V DC	£4.75
50V DC	£4.75
300V DC	£4.75

150V AC	£4.90
300V AC	£4.90
VU Meter	£6.25

MODEL ED107 EDUCATIONAL METER
Size: 100 x 90 x 150mm including terminals

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



50uA	£9.35
100uA	£8.70
50-0-50uA	£8.70
1mA	£8.40
1-0-1mA	£8.40
1A DC	£8.40
5A DC	£8.40
5V DC	£8.40
10V DC	£8.40
15V DC	£8.40

20V DC	£8.40
50V DC	£8.40
300V DC	£8.40
500mA/5A DC	£9.50
5V/50V DC	£9.50
5V/15V DC	£9.50
1A/15A DC	£9.50

CLEAR PLASTIC MODEL SO460
Size: 59 x 46mm

50uA	£3.85
100uA	£3.80
200uA	£3.75
500uA	£3.70
50-0-50uA	£3.80
100-0-100uA	£3.75
1mA	£3.65
5mA	£3.65
10mA	£3.65
50mA	£3.65
100mA	£3.65
500mA	£3.65
1A DC	£3.65
5A DC	£3.65
10A DC	£3.65

5V DC	£3.65
10V DC	£3.65
20V DC	£3.65
50V DC	£3.65
300V DC	£3.65
15V AC	£3.80
300V AC	£3.80
VU Meter	£4.65

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

ALL PRICES INCLUDE VAT

BARCLAYCARD & ACCESS Phone your order to 01-200 1321 or call into any branch

CLEAR PLASTIC MODEL SO830
Size: 110 x 83mm

50uA	£4.75
100uA	£4.65
200uA	£4.60
500uA	£4.55
50-0-50uA	£4.65
100-0-100uA	£4.60
1mA	£4.50
5mA	£4.50
10mA	£4.60
50mA	£4.50
100mA	£4.50
500mA	£4.50
1A DC	£4.50
5A DC	£4.50
10A DC	£4.50
5V DC	£4.50

10V DC	£4.50
20V DC	£4.50
50V DC	£4.50
300V DC	£4.50
15V DC	£4.60
300V AC	£4.60
VU Meter	£5.60

CLEAR PLASTIC MODEL MR 45P
Size: 50 x 50mm

50uA	£3.55
100uA	£3.50
200uA	£3.45
500uA	£3.30
50-0-50uA	£3.50
100-0-100uA	£3.45
500-0-500uA	£3.25
1mA	£3.25
5mA	£3.25
10mA	£3.25
50mA	£3.25
100mA	£3.25
500mA	£3.25
1A DC	£3.25
5A DC	£3.25
10V DC	£3.25
20V DC	£3.25
50V DC	£3.25
300V DC	£3.25

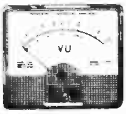
15V AC	£3.40
300V AC	£3.40
5 Meter 1mA	£3.75
VU Meter	£4.30
1A AC	£3.25*
5A AC	£3.25*
10A AC	£3.25*
20A AC	£3.25*
30A AC	£3.25*

CLEAR PLASTIC MODEL MR 38P
Size: 42 x 42mm

50uA	£3.45
100uA	£3.40
200uA	£3.30
500uA	£3.10
50-0-50uA	£3.40
100-0-100uA	£3.30
500-0-500uA	£3.05
1mA	£3.05
1-0-1mA	£3.05
2mA	£3.05
5mA	£3.05
10mA	£3.05
20mA	£3.05
50mA	£3.05
100mA	£3.05
150mA	£3.05
200mA	£3.05
300mA	£3.05
500mA	£3.05
750mA	£3.05
1A DC	£3.05
2A DC	£3.05
5A DC	£3.05
10A DC	£3.05
3V DC	£3.05

10V DC	£3.05
15V DC	£3.05
20V DC	£3.05
50V DC	£3.05
100V DC	£3.05
150V DC	£3.10
300V DC	£3.10
500V DC	£3.15
750V DC	£3.15
15V AC	£3.15
50V AC	£3.15
150V AC	£3.15
300V AC	£3.15
500V AC	£3.30
5 Meter 1mA	£3.50
VU Meter	£4.10

CLEAR PLASTIC MODEL MR 85P
Size: 120 x 110mm



50uA	£6.00
100uA	£5.95
200uA	£5.90
500uA	£5.80
50-0-50uA	£5.95
100-0-100uA	£5.90
500-0-500uA	£6.65
1mA	£5.75
1-0-1mA	£5.75
5mA	£5.75
10mA	£5.75
50mA	£5.75
100mA	£5.75
500mA	£5.75
1A DC	£5.75
5A DC	£5.75
15A DC	£5.75
30A DC	£5.95
10V DC	£5.75
20V DC	£5.75

50V DC	£5.75
150V DC	£5.75
300V DC	£5.75
15V AC	£5.85
300V AC	£5.85
5 Meter 1mA	£6.65
VU Meter	£7.10
1A AC	£5.75*
5A AC	£5.75*
10A AC	£5.75*
20A AC	£5.75*
30A AC	£5.75*

EDGWISE MODEL PE70
Size: 90 x 34mm

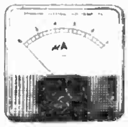
50uA	£4.55
100uA	£4.50
200uA	£4.45
500uA	£4.30
50-0-50uA	£4.50
100-0-100uA	£4.45
1mA	£4.25
10V DC	£4.25
300V DC	£4.35
VU Meter	£5.50

BAKELITE MODEL S80 Enlarged Window
Size: 80 x 80mm

50uA	£4.95
100uA	£4.90
500uA	£4.60
50-0-50uA	£4.80
100-0-100uA	£4.85
1mA	£4.60
1A DC	£4.60
5A DC	£4.60
20V DC	£4.60
50V DC	£4.60
300V DC	£4.60
300V AC	£4.75
VU Meter	£5.95

POSTAGE/PACKING & INSURANCE 15p

CLEAR PLASTIC MODEL MR 52P
Size: 60 x 60mm



50uA	£4.10
100uA	£3.85
500uA	£3.70
50-0-50uA	£3.85
100-0-100uA	£3.70
1mA	£3.65
5mA	£3.65
10mA	£3.65
50mA	£3.65
100mA	£3.65
500mA	£3.65
1A DC	£3.65
5A DC	£3.65
10V DC	£3.65
20V DC	£3.65
50V DC	£3.65
300V DC	£3.65
15V AC	£3.75
300V AC	£3.75

5 Meter 1mA	£4.20
VU Meter	£4.85
1A AC	£3.65*
5A AC	£3.65*
10A AC	£3.65*
20A AC	£3.65*
30A AC	£3.65*

BAKELITE MODEL MR 65 Size: 80 x 80mm

25uA	£5.80
50uA	£4.40
100uA	£4.35
500uA	£4.05
50-0-50uA	£4.35
100-0-100uA	£4.30
500-0-500uA	£3.95
1mA	£3.95
1-0-1mA	£3.95
5mA	£3.95
10mA	£3.95
50mA	£3.95
100mA	£3.95
500mA	£3.95
1A DC	£3.95
2A DC	£3.95
5A DC	£3.95
10A DC	£3.95
15A DC	£3.95
30A DC	£3.95
50A DC	£4.20
5V DC	£3.95
10V DC	£3.95
15V DC	£3.95
20V DC	£3.95
50V DC	£3.95
150V DC	£3.95

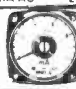
300V DC	£3.95
30V AC	£3.95*
50V AC	£3.95*
150V AC	£3.95*
300V AC	£3.95*
500V AC	£3.95*
VU Meter	£5.20
1A AC	£3.95*
5A AC	£3.95*
10A AC	£3.95*
20A AC	£3.95*
30A AC	£3.95*
50A AC	£3.95*
500mA AC	£3.95
50mV DC	£4.15
100mV DC	£4.15

CLEAR PLASTIC MODEL MR 65P
Size: 86 x 78mm

50uA	£4.35
100uA	£4.25
200uA	£4.20
500uA	£4.15
50-0-50uA	£4.25
100-0-100uA	£4.20
500-0-500uA	£4.10
1mA	£4.10
1-0-1mA	£4.10
5mA	£4.10
10mA	£4.10
50mA	£4.10
100mA	£4.10
500mA	£4.10
1A DC	£4.10
5A DC	£4.10
10A DC	£4.10
15A DC	£4.10
20A DC	£4.20
30A DC	£4.25
50A DC	£4.10
5V DC	£4.10
10V DC	£4.10
15V DC	£4.10
20V DC	£4.10
50V DC	£4.10
150V DC	£4.10

300V DC	£4.10
15V DC	£4.20
50V AC	£4.20
150V AC	£4.20
300V AC	£4.20
500V AC	£4.30
5 Meter 1mA	£4.85
VU Meter	£5.20
1A AC	£4.10*
5A AC	£4.10*
10A AC	£4.10*
20A AC	£4.10*
30A AC	£4.10*
50A AC	£4.10
50mA AC	£4.10*
100mA AC	£4.10*
200mA AC	£4.10*
500mA AC	£4.10*

240° Wide Angle 1mA METERS
MW1-8 80 x 80mm
£7.45 P & P Ins. 15p



REDUCED TO CLEAR
YAMABISHI VARIABLE VOLTAGE TRANSFORMERS
Excellent quality at low cost. Input: 230V 50/60Hz. Output 0–260V.
MODEL S260 BENCH MOUNTING

		P/P & Ins
1A	£7.30	£1.50
8A	£19.45	£1.50
10A	£23.75	£1.50
12A	£25.90	£1.50
20A	£60.45	£1.50
25A	£64.75	£1.50

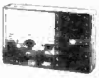
TMK 200 MULTIMETER KIT
Build yourself a quality 20000 opv multimeter and save money. Complete kit with meter scale, movement and rotary range selector ready mounted in cabinet. All parts, batteries, test prods and instructions. Ranges: 0/0.6/6/30/120/600/1200V D.C. 0/6/30/120/600/1200V A.C. Current: 0/0.6/6/60/600mA. Resistance: 0/10/100K/1/10 Meg ohms. Decibels: –20 to +63db. Size: 90 x 150 x 35mm

OUR PRICE £9.65 P/P & Ins 30p

HIOKI 730X
30,000 opv. Overload protection. 6/30/60/300/600/1200V DC. 12/60/120/600/1200V AC. 60/µA/30mA/300mA. 2K/200K/2 Meg Ohm. –10 to +63 dB.

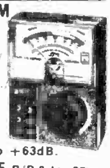
OUR PRICE £8.10 P/P & Ins 30p

U4323 MULTIMETER
20,000opv. Simple unit with audio/IF oscillator. Suitable for general receiver tuning. Ranges: 0.5/2.5/10/50/250/500/1000V DC. 0.5/5/50/500mA DC. Resistance: x 10, x 100, x 1,000, x 10,000 (50Ω, 500Ω, 5kΩ, 50kΩ centre scale) Battery operated. Size: 160 x 97 x 40mm. Supplied in carrying case complete with test leads.



OUR PRICE £8.60 P/P & Ins 60p

MODEL C7208FM
30,000 opv DC. 15,000 opv AC. 6/3/15/60/300/600/1200 V. DC. 6/30/120/600/1200 V. AC. DC Resistance x 1, x 10, x 100, x 1000 (50Ω centre scale). DC Current 30uA/3/30/600mA. –20 to +63dB.

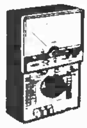


OUR PRICE £9.65 P/P & Ins 30p

BATTERY/LEVEL PANEL INDICATOR
Dial cut-out 18 x 12 mm approx.

OUR PRICE 95p P/P & Ins 15p Discounts for quantity.

U4324 MULTIMETER
High sensitivity.
20,000opv. Ranges: 0.6/1.2/3/12/30/60/120/600/1200V DC. 3/6/15/60/150/300/600/900V AC. Current: 0.06/0.6/6/60/600mA/3A DC. 0.3/3/30/300mA/3A AC. Resistance: 25/500 ohms/0.5/5/50/500k ohms/5 Mohms. Decibels: –10 to +12dB. Size 167 x 98 x 63mm. Supplied complete with test leads, spare diode and instructions.



OUR PRICE £10.60 P/P & Ins 60p

U4315 MULTIMETER
Sturdy 43-range multimeter for current and voltage in DC AC circuits with freq. 45–20kHz and DC resistance, capacitance, etc.
Ranges: DC 50 µA/100µA/0.5µA/1/5/25/100/500/2500; DC 75mV/1V/2.5/5/10/25/100/250/500/1000; AC 0.5 mA/1/5/25/100/500/2500; AC 1V/2.5/5/10/25/100/250/500/1000; DC 300Ω. DC 5kΩ/50/500/5000; –15db +2dB. Complete with steel carrying case and leads, manual.

OUR PRICE £10.80 P/P & Ins. 60p

MODEL T-2 MULTITESTER

RANGES
DC Voltage: 5-25-50-250-500-IK-2.5K (20,000 Ohms per Volt)
AC Voltage: 10-50-100-500-1000 Volts (10,000 Ohms per Volt)
DC Current: 0-50µA, 0-2.5MA, 0-250MA
Resistance: 0-6K, 0-6mg (300 ohm and 30K at center scale)
Capacitance: 10µµF to .001µF to 001µF to .1µF Decibels: -20 to 22 DB, includes leads, batteries, and soft carrying case!

OUR PRICE £9.95
P/P & Ins. 60p

LASKYS

U4312 MULTIMETER

extremely sturdy instrument for general electrical use. 667opv. 0/0.3/1.5/7.5/30/60/150/300/600/900V DC & 75mV. 0/0.3/1.5/7.5/30/60/150/300/600/900V AC. 0/300uA/1.5/6/15/150/60/600mA/1/1.5/6A DC. 0/1.5/6/15/60/150/600mA/1.5/6A AC. 0/200/3k/30k ohms. DC accuracy 1%. AC 1.5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions.
OUR PRICE £11.60 P/P & Ins 60p

TMK MODEL TW50K

46 ranges, mirror scale. 50k/V DC 50k/V AC. DC Volts: 0.125/0.25/1.25/2.5/5/10/25/50/125/250/500/1000. AC Volts 1.5/3/5/10/25/50/125/250/500/1000. DC current 25/50uA/2.5/5/25/50/250/500mA/5/10A. Resistance: 10k/100k/1 Meg/10 Meg ohms. −20 to +81.5dB.
OUR PRICE £13.50 P/P & Ins 60p

U4313 MULTIMETER

High sensitivity (20,000 opv on DC and 2,000 opv on AC) and accuracy of 1.5% on DC and 2.5% on AC. Ranges: DC and AC current; 0.6 mA/3/15/60/300/1.5A; DC and AC Voltage: 1.5V/3/7.5/15/30/60/150/300/600; DC resistance 1kohm/10/100/1,000, −10 to +12dB, etc. Complete with steel carrying case and leads, manual.
OUR PRICE £14.90 p/p & Ins. 60p

U4317 MULTIMETER

High sensitivity instrument for field and laboratory work. Knife edge pointer, 86mm. mirror scale. Overload protection. Ranges: 100mV/0.5/2.5/10/25/50/100/250/500/1000 V DC. 0.5/2.5/10/25/50/100/250/500/1000V AC. Current: 50uA/0.5/1/5/10/50/250mA/1/5A DC. 0.25/0.5/1/5/10/50/250mA/1/5A AC. Resistance: 0.5/10/100/200 ohms/1/3/30/300k ohms. Decibels: −5 to +10dB. Battery operated. Size: 210 x 115 x 90mm. Supplied in carrying case complete with leads.
OUR PRICE £18.35 P/P & Ins 60p

U81 Clamp VOLT AMMETER

For measuring AC voltage and current without breaking circuit. Ranges: 300/600V AC. Current: 10/25/100/250/500A. Accuracy 4%. Size 263 x 94 x 36mm. Complete with carrying case, leads and fuses.
OUR PRICE £15.10 P/P & Ins 60p

MODEL 500

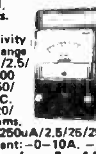
30,000 opv with overload protection. Mirror scale. 0/0.5/2.5/10/25/100/250/500/1000V DC. 0/2.5/10/25/100/250/500/1000V AC. 0/50uA/5/50/500mA. 12A DC. 0/60k/6 meg/60 megohms.
OUR PRICE £15.05 P/P & Ins 60p

SWR METER Model SWR3

Handy SWR meter for transmitter antenna alignment, with built-in field strength meter. Accuracy 5%, Impedance 52' Indicator 100uA DC. Full scale 5 section collapsible antenna. Size 145 x 50 x 60mm.
OUR PRICE £4.55 P/P & Ins 60p

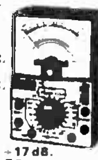
KAMODEN 360 MULTIMETER

High sensitivity. DC 100kohm/V AC 10kohm/V 5" mirror scale, overload protected. Ranges: 0.5/2.5/10/50/250/1000V DC. 5/10/50/250/1000V AC. Current: 0.01mA/0.5/5/50/500mA/10A. Resistance: 0.1/1/10/100 ohms/1/10/10k ohms/10/100M ohms. Decibels −20 to +62dB. Battery operated. Size: 180 x 140 x 80mm. Supplied complete with test leads etc.
OUR PRICE £18.90 P/P & Ins 60p

Model HT100B4 MULTIMETER

Overload protected, shock proof circuits. 9.5uA Meter with mirror scale. Sensitivity 100kV. Polarity change switch. Ranges: 0.5/2.5/1-50/250/500/1,000 Volts DC. 2.5/10/50/250/1,000 Volts AC. DC resistance 0–20/200k/2/20 Meg. ohms. DC current:– 10/250uA/2.5/25/250 mA/10A. AC current: −0–10A. −20 to +62dB. Operates from 2 x 1.5V batteries. Size: 180 x 134 x 79mm.
OUR PRICE £21.50 P/P & Ins 60p

KAMODEN HM720B FET VOM

Input impedence 10 Megohms. Ranges:– 0/.25/1/2.5/10/50/1000V DC. 0/2.5/10/50/250/1000V AC. 0/25uA/2.5/25/250 mA DC. 0/5k/50k/500k/5 M 500 Megohms
OUR PRICE £24.30 P/P & Ins 60p

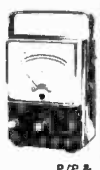
MODEL AF.105 VOM

50,000 opv. Mirror scale. Meter protection. 0/·3/3/12/60/120/300/600/1200V DC. 0/6/30/120/300/600/1200V DC. 0/30μA/6/60/300 mA/12 Amp. 0/10K/1m/10m/100 Meg Ohms. −20 to +17 dB.
OUR PRICE £13.50 P/P & Ins 60p

MODEL AS.1000 VOM

100,000 opv. Mirror scale. Built-in meter protection. 0/3/12/60/120/300/600/1200V DC. 0/6/30/120/300/600V AC. 0/10μA/6/60/300mA/12 Amp. 0/2K/200K/2M/200 Meg Ohm. −20 to +17dB.
OUR PRICE £18.90 P/P & Ins 60p

U4341 Multimeter & Transistor Tester

27 ranges. 16,700opv. Overload protected. Ranges: 0.3/1.5/6/30/60/150/300/900V DC. 1.5/7.5/30/150/300/750V AC. Current: 0.06/0.6/6/60/600mA DC. 0.3/3/30/300mA AC. Resistance: 0.08/0.6/2/6/20/60/200k ohms/2 Mohms. Battery operated. Supplied complete with probes, leads and steel carrying case. Size: 115 x 215 x 90mm.
OUR PRICE £11.85 P/P & Ins 60p

KAMODEN TT35 TRANSISTOR TESTER

High quality instrument to test reverse leak current and DC current. Amplification factor of NPN, PNP, diodes, transistors, SCR's etc. 4" square clear scale meter. Operates from internal batteries. Complete with instructions, leads carrying handle.
OUR PRICE £18.90 P/P & Ins 60p

S100TR MULTIMETER TRANSISTOR TESTER

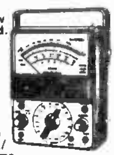
100,000opv. Mirror scale. Overload protection. 0/0.12/0.6/3/12/30/120/600V DC. 0/6/30/120/600V AC. 0/12/600uA/12/300mA/6/12A DC 0/10k/1 Meg/100 Meg. −20 to +50dB. 0.01–0.2 MFD
Transistor tester measures Alpha, Beta and ICO. Complete with instructions, batteries and leads.
OUR PRICE £22.65 P/P & Ins 60p

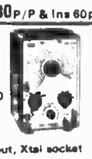
CI5 PULSE OSCILLOSCOPE

For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth: 10MHz. Sensitivity at 100kHz VRMS/mm: 0.1–25; HOR. AMP. Bandwidth: 500kHz. Sensitivity ay 100kHz VRMS/mm: 0.3–25 Preset triggered sweep 1–3000usec. Free running 20–200 kHz in nine ranges. Calibrator pips. 220 x 360 x 430mm. 115–230V AC.
OUR PRICE £47.50 P/P & Ins £1.50

370WTR MULTIMETER

Features AC current ranges. 20,000opv. 0/0.5/2.5/10/50/250/500/1000V DC. 0/2.5/10/50/250/500/1000V AC. 0/50uA/1/10/100 mA/1/10A DC. 0/100mA/1/10A AC. 0/5k/50k/500k/5 Meg/50 Meg. Decibels: −20 to +62dB.
OUR PRICE £21.50 P/P & Ins 60p

KAMODEN 72.200 Multitester

High sensitivity tester. 200,000 opv Overload protected. Mirror scale. Ranges: −0/.06/.3/3/30/120/600/1200V DC. 0/3/12/60/300/11200 V AC. 0/6uA/1.2mA/120mA/600mA/12A DC 0/12A AC. −20 to +63dB. 0/2k/200k/2 Meg/200 Megohms.
OUR PRICE £24.30 P/P & Ins 60p

TE-200 RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 kHz-500 MHz on 6 bands. Directly calibrated. Variable R.F. attenuator audio output, Xtal socket for calibration. 220/240V a.c. Brand new with instructions. Size 140mm x 215mm x 170mm.
OUR PRICE £24.30 P/P & Ins 60p

ARF 300 AF/RF SIGNAL GENERATOR

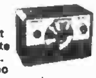
All transistorised compact fully portable. AF sine-wave 18Hz to 220 kHz. AF square wave 18Hz to 100k Hz. Output Square/Sine wave 10V. P-P RF 100kHz to 200MHz. Output 1V maximum. 220/240V AC operation. Complete with instructions and leads.
OUR PRICE £40.50 P/P & Ins 60p

TRANSISTORISED L.C.R. A.C. BR/8 MEASURING BRIDGE

A new portable bridge offering excellent range and accuracy at low cost. Resistance: 6 ranges: 0.1 ohm-11.1 megohm ± 1% Inductance: 6 ranges: 1 microhenry-111 henries ± 2% Capacity: 6 ranges: 10pf-1110 mfd ± 2% Turns Ratio: 6 ranges: 1:1/1000-1:11100 ± 1% Bridge Voltage at 1,000cps. Operated from 9-volt battery. 100 microamp meter indication. Size 7½" x 5" x 2"
OUR PRICE £29.70 P/P & Ins 60p

TE22 SINE SQUARE WAVE AUDIO GENERATOR

Sine 20cps to 200kHz on 4 bands. Square 20 cps to 30 kHz. Output impedence 5000 Ohms. 200/250V AC operation. Supplied brand new guaranteed, with instruction manual and leads.
OUR PRICE £26.90 P/P & Ins 60p

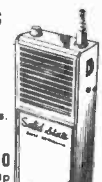
MODEL TE20 RF SIGNAL GENERATOR

Six bands. 120kHz–260MHz. Dual output RF terminals. Separate variable audio output. Accuracy ± 2%. Audio output to 8V. Power requirements: 105–125V, 220–240V AC. Size: 193 x 265 x 150mm. Complete with test leads etc.
OUR PRICE £20.45 P/P & Ins 60p

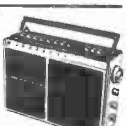
NEW GOLDRING CK 2 KIT

Belt-drive 2-speed turntable in kit form complete with pick up arm and head shell.
OUR PRICE £21.15 P/P & Ins £1.35

INCREDIBLE FERGUSON CASSETTE DECK BARGAIN

THE FERGUSON 3429
Stereo Cassette Deck is being offered by LASKYS at an incredible price, and this is what you get a beautiful teak/aluminium stereo cassette deck with 3-digit tape counter, manual or automatic level controls, DIN input/output, slider controls, level meter, monitor earphone output, and a stereo microphone with deck stand!
OUR PRICE £37.50 P/P & Ins. £1.65

WALKIE TALKIES

SKYFON NV7
Super low cost transmitter/receivers. 100MW with call buzzer and on/off volume control. 7 transistors. Telescopic rod antenna.
OUR PRICE £43.60 per PAIR P/P & Ins 50p
NOT LICENSABLE IN THE U.K.

NATIONAL PORTABLE MULTI-BAND RADIOS

Two magnificent multi-band portable (DC) radios from National Panasonic – one of the world's largest manufacturers of fine radio equipment. The RF-905 (not illustrated) is an AM/FM 5-band (FM/LW/MW/SW1/2) 15-transistor 19-diode unit with station presets, slider level controls, fine tuning, and a full, smooth sound! And the RF-1700 is an *8-band* (FM/AIR/PSB high/PSB low/AM/Marine/SW1/SW2) radio with band indicator, dial light, loudness control, AFC, fine tuning, tone, and squelch – a real enthusiast's radio!

RF-905 **OUR PRICE £34.95** P/P & Ins. £1.35
RF-1700 **OUR PRICE £62.50** P/P & Ins. £1.35

LOUDSPEAKERS AT LASKYS
Hundreds of incredible loudspeaker bargains at LASKYS – Famous names like TANNOY, WHARFEDALE, and GOODMANS, and all offered at astoundingly low prices! Hurry while stocks last!

SINCLAIR SPECIALS AT LASKYS
These Sinclair Project 80 modules are famous world wide for the ease with which they make up into high-quality, reliable Hi-Fi components. Thanks to special purchases, LASKYS have slashed prices to the bone! Compare these prices . . . you'll be amazed!

SINCLAIR Project 80 Modules

Z40 Power Amp.	£3.75	P/P & Ins. 15p
Z60 Power Amp.	£6.95	P/P & Ins. 15p
Stereo 80 Pre-Amp	£7.50	P/P & Ins. 15p
Active Filter Unit	£4.50	P/P & Ins. 15p
FM Tuner	£7.50	P/P & Ins. 15p
Stereo Decoder	£4.95	P/P & Ins. 15p
PZ5 Power Supply	£2.75	P/P & Ins. 30p
PZ6 Power Supply	£4.50	P/P & Ins. 30p
PZ8 Power Supply	£7.90	P/P & Ins. 30p
Transformer for PZ8	£5.05	P/P & Ins. 30p

SINCLAIR PROJECT 805

Now available at special low LASKYS prices – the famous project 805 no-solder amplifier kit. Included are all necessary wires, push-on connectors, P80 pre-amp, two Z40 power boards giving 12w rms, PZ5 power supply, and a comprehensive manual.
List Price £49.93
OUR PRICE £17.50 P/P & Ins. £1.65

SINCLAIR PROJECT 80 RECEIVER

World-famous Sinclair modules in sophisticated black-metal Scandinavian livery – delivers 20 watts rms per channel into 8 ohms, with FM stereo tuner – all slider controls on the tuner section are neatly recessed into the top of the unit. Fine performance and truly remarkable value for money.
OUR PRICE £56.25 P/P & Ins. £1.65

SINCLAIR PROJECT 80 AMPLIFIER
Lower-powered than its receiver brother, but still a solid 6½ w rms per channel, with the same superb performance standard. Here at last is a budget amplifier without the "budget look".
OUR PRICE £28.10 P/P & Ins. £1.65

SINCLAIR DM2 DIGITAL MULTIMETER

Will measure AC and DC volts, AC and DC current, and resistance in a total of 20 ranges. The large light emitting diode display will read up to 1999 and automatically indicate polarity. Indication of positive and negative overload is also provided. The instrument is fitted with a combined carrying handle and bench stand and sockets are provided for the connection of an external power supply.
RANGES:
DC VOLTS: .1v, 10, 100v, 1000v.
AC VOLTS: 1v, 10v, 100v, 1000v.
DC CURRENT: 1mA, 10mA, 100mA, 1000mA.
AC CURRENT: 1mA, 10mA, 100mA, 1000mA.
RESISTANCE: 1k, 10k, 100k, 1000k.
OUR PRICE £63.70 P/P & Ins 50p

SPECIAL OFFER! SINCLAIR 4000 AMPLIFIER AND FM TUNER
Slimline elegance and great performance from SINCLAIR – the 4000 amplifier gives 17W RMS per channel (both driven) into 8 ohms, phones jack, active switchable scratch filter, low noise and distortion, and much more.
List Price £74.95
OUR PRICE £33.95 p/p & Ins. £1.65
A perfect match for the 4000 amplifier is the 4000 FM tuner, which boasts a capture ratio of 3dB, sensitivity of 3μV for 30dB quieting, stereo beacon, etc.
List Price £62.43
OUR PRICE £29.95 p/p & Ins. £1.65

ALL PRICES INCLUDE VAT

BI-PRE-PAK
The people for component bargains

Makers of **Stirling Sound** audio equipment

ORIGINATORS OF PRE-PACKED COMPONENTS IN BRITAIN—AND STILL LEADING!

XMAS OFFER!

A Bi-Pre-Pak Super Special!

- ★ PRICES INCLUDE V.A.T. AND POSTAGE AND PACKING IN U.K.
- ★ TOTAL VALUE £30 —YOU PAY £18·00
- ★ SATISFACTION GUARANTEED
- ★ ORDER NOW—DELIVERY BY RETURN

BATT/MAINS STEREO F.M. TUNER/AMP
TO SHOW YOU A SAVING OF £12

if you buy all 4 units together. Bought singly you save 33⅓% off regular price of each unit

1 F.M. TUNER FRONT-END
Ganged tuning; A.F.C. facility. Reduction-geared drive, 88-108 MHZ. Usual price inc. VAT £8·01 **£5.34**

2 I.F. BOARD
Using I.C. Designed for use with above front-end. Usual price inc. VAT £6·76 **£4.50**

3 STEREO DECODER, using I.C.
Designed for use with the above modules, can also be used with other mono F.M. tuners. Ready aligned. (L.E.D. for stereo beacon available at 20p) usual price inc. VAT £7·22 **£4.82**

4 5+5 WATT MUSIC POWER I.C. AMP
Useful stereo power amplifier with good performance, at economy price. Usual price inc. VAT £8·01 **£5.34**

TOTAL VALUE AT REGULAR ADVERTISED PRICE £30.00

3 SPECIAL OFFERS

LM 380 AUDIO IC (Marked SL60745). Brand new and to spec. 3 watts R.M.S. out. With data. **£1·00**

Three **SN7490**. Brand new I.C. to spec. decode counters only **£1·20***

Five **SN7400** Quad 2 input Nan gate ICs. Only **60p***

NEW RANGE TRANSISTOR & COMPONENT PACKS

TP SELECTION

- **TP5** 20 Transistors, PNP Germanium, Red Spot A.F.
- **TP6** 20 Transistors, PNP Germanium, White spot RF.
- **TP7** 1 2N174 150w 80Vce Power Transistor, with mounting assembly.
- **TP19** 100 diodes, mixed Germanium, Gold-bonded, etc. Marked/Unmarked.
- **TP23** Twenty NPN Silicon uncoded T05. Similiar to BFY50/2, 2N696, 2N1613, etc. Complementary to TP24.
- **TP24** Twenty PNP Silicon, uncoded T05. Similar to BFY64, 2N2904/5
- **TP29** 8 power diodes 400V, 1·25A Silicon FST 3/4.

UT SELECTION

- **UT1** 50 PNP's Germanium, AF & RF.
- **UT2** 150 Germanium diodes, min. glass.
- **UT4** 100 Silicon diodes, min. glass, similar to IN914, IN916.
- **UT5** 40 250mW Zener diodes OAZ24 range; average 50% good.
- **UT7** 30 Silicon rectifiers 750mA, mixed voltages, Top Hats, etc.
- **UT9** 40 NPN Silicon planers. Similar to 2N3707-11 range. Low noise amps.
- **UT12** 25 2N3702/3 Transistors, PNP Silicon, Plastic to 92.

CP SELECTION

- **CP1** Mixed bag of capacitors—Electrolytic, Paper, Silver Mica (Approx. 150—sold by weight).
- **CP2** 200 (approx.) Resistors, various types, values, watts. (Sold by weight.)
- **CP3** 40 Wire wound resistors, mixed.
- **CP4** 12 pots—pre-set, w/wound, carbon, dual, with/without switches—all mixed.
- **CP7** Heat sinks, assorted. To fit SO-Z (OC72) TO-1 (AC128), etc.

ALL ABOVE PACKS—60p EACH. TP Tested & Guaranteed; UT Untested, unmarked; CP Components.

SUNDRY

P.I PAK—Approx. 170 short-lead semiconductors and components, PNP, NPN, diodes, rectifiers, etc. on PCBs. At least 30% factory marked. Some data supplied. **50p***
UHF 625 line tuner, rotary. **£2·50**
Rev Counter (for cars) (8%). **£1·00***
Books by Bernard's Publications, Newnes-Butterworth's etc. No VAT.

THE FREE CATALOGUE
New edition better than ever. It's your's for free and well worth getting—only please send large S.A.E. with 10p stamp if we have to post it to you.

CAPACITOR DISCHARGE IGNITION KIT
Simple to assemble and fit. Improves car performance, saves on fuel. P&P 30p. **£7·50***

BI-PRE-PAK X-HATCH GENERATOR Mk.2

Four-pattern selector switch 3" x 5½" x 3"
Ready-built and tested *£9·93
In kit form *£7·93
Please add 35p for postage and packing

Is invaluable to industrial and home user alike. Improved circuitry assures reliability and still better accuracy. Very compact, self-contained. Robustly built. Widely used by TV rental and other engineers. With reinforced fibreglass case, instructions, but less batteries. (Three U2 type required.)

TV SIGNAL STRENGTH METER
Complete kit as described in "Television" £19·50 plus 40p* for P&P

SS300 POWER SUPPLY STABILISER
Add this to your unstabilised supply to obtain a steady working voltage from 15 to 50V for your audio system, workbench etc. Meters can be easily added. **£3·25***

PLASTIC POWER TRANSISTORS

40 WATT SILICON*

Type	Polarity	Gain	VCE	Price
40N1	NPN	15	15	20p
40N2	NPN	40	40	30p
40P1	PNP	15	15	20p
40P2	PNP	40	40	30p

90 WATT SILICON*

Type	Polarity	Gain	VCE	Price
90N1	NPN	15	15	25p
90N2	NPN	40	40	35p
90P1	PNP	15	15	25p
90P2	PNP	40	40	35p

If you prefer not to cut coupon out, please mention PW12 when writing

TERMS OF BUSINESS:
VAT at 25% must be added to total value of order except for items marked * or (8%), when VAT is to be added at 8%. No VAT on overseas orders. **POST & PACKING** add 25p for UK orders unless marked otherwise. Minimum mail order acceptable—£1. Overseas orders, add £1 for postage. Any difference will be credited or charged. **PRICES** subject to alteration without notice. **AVAILABILITY** All items available at time of going to press when every effort is made to ensure correctness of information.

★ PHONE · WRITE · CALL
GIVE US YOUR ACCESS NO. and we will do the rest!

To BI-PRE-PAK, 224-226 WEST RD., WESTCLIFF-ON-SEA, ESSEX

Please send ....

for which I enclose .... inc. V.A.T.

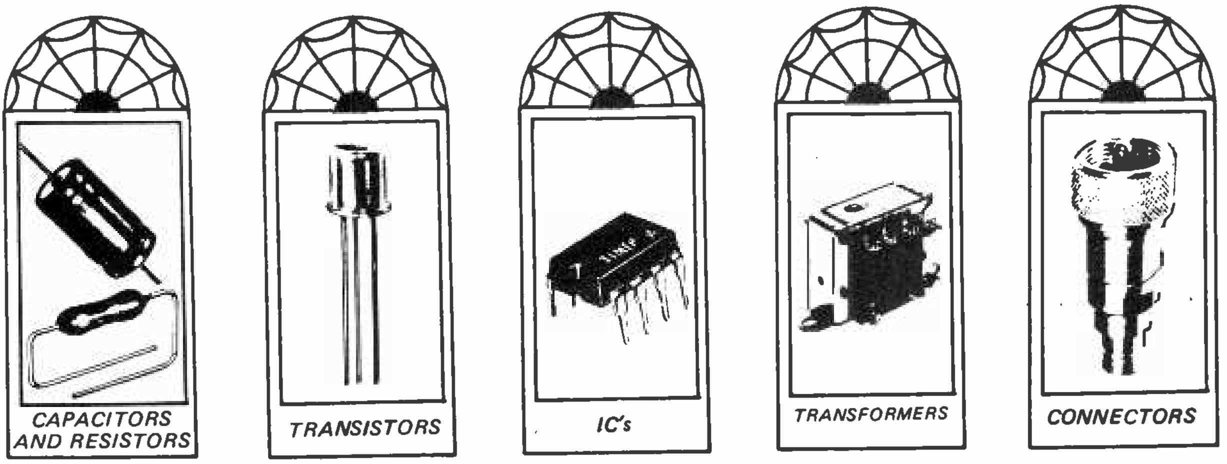
Name ....

Address ....

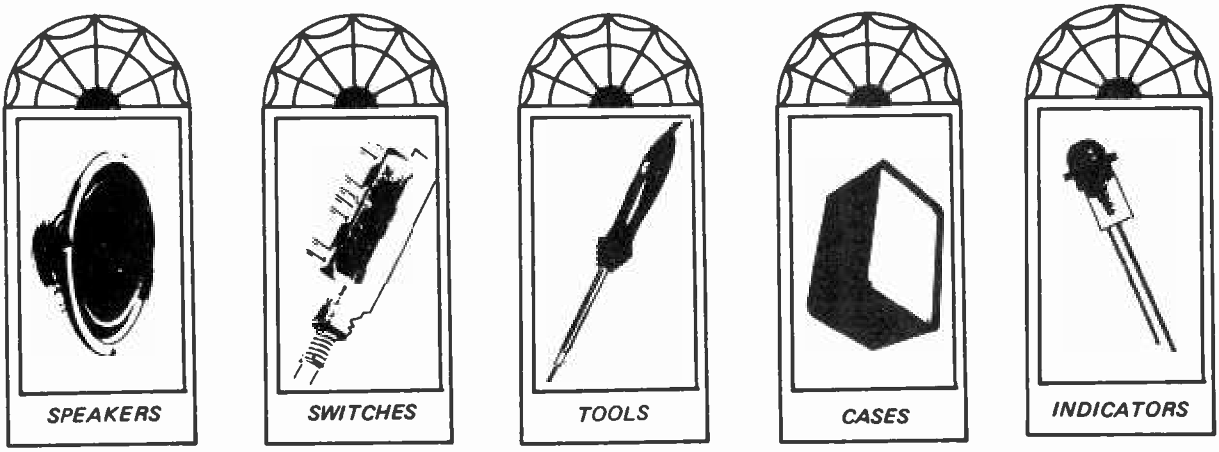
.... PW13

BI-PRE-PAK LTD
Co Reg No 820919
222 224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SS0 9DF.
TELEPHONE: SOUTHEND (0702) 46344.

WRITE ORDER SEPARATELY AND ATTACH COUPON IF REQUIRED



Use DORAM components for your project



The doorway to Amateur Electronics

- DORAM'S NEW CATALOGUE OFFERS THOUSANDS UPON THOUSANDS OF QUALITY ELECTRONIC COMPONENTS AND AUDIO ACCESSORIES FROM TRUSTED BIG NAME MANUFACTURERS.
- ALL COMPONENTS ARE INDIVIDUALLY CODED AND PRICED - MANY NEW COMPONENTS ADDED FROM CUSTOMER REQUESTS.
- 16 EXTRA PAGE DATA SECTION.
- UNIQUE FREE UP-DATE PRODUCT INFORMATION SERVICE DURING LIFE SPAN OF CATALOGUE.
- ALL COMPONENTS SENT BY RETURN OF POST.
- POST AND PACKING FREE (only applies for Great Britain, N. Ireland and B.F.P.O. Nos. - overseas orders F.O.B.)
- NO QUIBBLE REPLACEMENT PART SERVICE

The doorway to amateur electronics

DORAM

DORAM ELECTRONICS LIMITED
P. O. Box TR8
Leeds LS12 2UF

I enclose 60p. Please send me by return my new Doram Catalogue. (Overseas orders except for B.F.P.O., please add 30p for post and packing surface only).

PLEASE PRINT BLOCK CAPITALS PW1/76

NAME ____________

ADDRESS ____________

____

____

____________ Post Code ____________

BI-PAK SEMICONDUCTORS

TRANSISTORS

BRAND NEW FULLY GUARANTEED

Type	Price
AC107	0·20
AC113	0·19
AC115	0·20
AC117K	0·30
AC122	0·12
AC125	0·18
AC126	0·18
AC127	0·19
AC128	0·19
AC132	0·15
AC134	0·15
AC137	0·15
AC141	0·19
AC141K	0·30
AC142	0·19
AC142K	0·26
AC151	0·16
AC154	0·20
AC155	0·20
AC156	0·20
AC157	0·25
AC165	0·20
AC166	0·20
AC167	0·20
AC168	0·25
AC169	0·15
AC176	0·20
AC177	0·25
AC178	0·29
AC179	0·29
AC180	0·20
AC180K	0·30
AC181	0·20
AC181K	0·30
AC187	0·22
AC187K	0·23
AC188	0·22
AC188K	0·23
ACY17	0·26
ACY18	0·20
ACY19	0·20
ACY20	0·20
ACY21	0·20
ACY22	0·17
ACY27	0·19
ACY28	0·19
ACY29	0·36
ACY30	0·29
ACY31	0·29
ACY34	0·21
BC173	0·15
BC174	0·15
BC175	0·22
BC177	0·19
BC178	0·19
BC179	0·19
BC180	0·25
BC181	0·25
BC182	0·15
BC182L	0·15
BC183	0·15
BC183L	0·15
BC184	0·20
BC184L	0·20
BC186	0·29
BC187	0·29
BC207	0·11
BC208	0·11
BC209	0·12
BC212L	0·13
BC213L	0·13
BC214L	0·17
BC225	0·26
BC226	0·36
BC301	0·28
BC302	0·25
BC303	0·31
BC304	0·37
BC440	0·31
BC460	0·37
BCY30	0·25
BCY31	0·27
BCY32	0·31
BCY33	0·22
BCY34	0·26
BCY70	0·15
BCY71	0·20
BCY72	0·15
BCZ10	0·20
BCZ11	0·26
BCZ12	0·26
BD115	0·63
BD116	0·81
BD121	0·61
BD123	0·67
BD124	0·70
BD131	0·51
BD132	0·61
BD133	0·67
BD135	0·41
BFY53	0·18
BSX19	0·16
BSX20	0·16
BSY25	0·16
BSY26	0·16
BSY27	0·16
BSY28	0·16
BSY29	0·16
BSY38	0·19
BSY39	0·19

Type	Price
BSY40	0·29
BSY41	0·29
BSY95	0·13
BSY95A	0·13
BU105	£2·04
C111E	0·51
C400	0·31
C407	0·26
C424	0·26
C425	0·51
C426	0·36
C428	0·20
C441	0·31
C442	0·31
C444	0·36
C450	0·22
MAT100	0·19
MAT101	0·20
MAT120	0·19
MAT121	0·20
MJE521	0·56
MJE2955	0·88
MJE3055	0·57
MJE3440	0·51
MPF102	0·43
MPF104	0·38
MPF105	0·38
OC19	0·36
OC20	0·65
OC22	0·47
OC23	0·49
OC24	0·57
OC25	0·39
OC26	0·30
OC28	0·51
OC29	0·51
OC35	0·43
OC36	0·51
OC41	0·20
OC42	0·25
2N918	0·31
2N929	0·21
2N930	0·21
2N1131	0·20
2N1132	0·22
2N1302	0·15
2N1303	0·15
2N1304	0·18
2N1305	0·18
2N1306	0·21
2N1307	0·21
2N1308	0·24
2N1309	0·24
2N1613	0·20
2N1711	0·20
2N1889	0·32
2N1890	0·46
2N1893	0·38
2N2147	0·73
2N2148	0·58
2N2192	0·36
2N2193	0·36
2N2194	0·36
2N2217	0·22
2N2218	0·20
2N2219	0·20
2N2220	0·22
2N2221	0·20
2N2222	0·20
2N2368	0·18
2N2369	0·15
2N2369A	0·15
2N2411	0·25
2N2412	0·25
2N2646	0·48
2N2711	0·21
2N2712	0·21
2N2714	0·21
2N2904	0·18
2N2904A	0·21
2N2905	0·21
2N2905A	0·21
2N2906	0·16
2N2906A	0·19
2N2907	0·20
2N2907A	0·22
2N2923	0·15
2N2924	0·15
2N2925	0·15
ACY35	0·21
ACY36	0·29
ACY40	0·18
ACY41	0·19
ACY44	0·36
AD130	0·39
AD140	0·49
AD142	0·49
AD143	0·39
AD149	0·51
AD161	0·36
AD162	0·36
AD161 & AD162(MP)	0·69
ADT140	0·51
AF114	0·25
AF115	0·25
AF116	0·25
AF117	0·25

Type	Price
AF118	0·36
AF124	0·31
AF125	0·31
AF126	0·29
AF127	0·29
AF139	0·31
AF178	0·51
AF179	0·51
AF180	0·51
AF181	0·51
AF186	0·51
AF239	0·38
AL102	0·68
AL103	0·68
ASY26	0·26
ASY27	0·31
ASY28	0·26
ASY29	0·26
ASY50	0·26
ASY51	0·26
ASY52	0·26
ASY54	0·26
ASY55	0·26
ASY56	0·26
ASY57	0·26
ASY58	0·26
ASY73	0·26
ASZ21	0·41
BC107	0·08
BC108	0·08
BC109	0·08
BD136	0·41
BD137	0·46
BD138	0·51
BD139	0·56
BD140	0·61
BD155	0·81
BD175	0·61
BD176	0·61
BD177	0·67
BD178	0·67
BD179	0·71
BD180	0·71
BD185	0·67
BD186	0·67
BD187	0·71
BD188	0·71
BD189	0·77
BD190	0·77
BD195	0·87
BD196	0·87
BD197	0·92
BD198	0·92
BD199	0·98
BD200	0·98
BD205	0·81
BD206	0·81
BD207	0·98
BD208	0·98
BDY20	£1·02
BF115	0·25
BF117	0·46
BF118	0·71
BF119	0·71
BF121	0·46
BF123	0·51
BF125	0·46
BF127	0·51
BF152	0·56
BF153	0·46
BF154	0·46
BF155	0·71
BF156	0·49
BF157	0·56
BF158	0·56
BF159	0·61
BF160	0·41
BF162	0·41
BF163	0·41
BF164	0·41
BF165	0·41
OC44	0·16
OC45	0·13
OC70	0·10
OC71	0·10
OC72	0·15
OC74	0·15
OC75	0·16
OC76	0·16
OC77	0·26
OC81	0·16
OC81D	0·16
OC82	0·16
OC82D	0·16
OC83	0·20
OC139	0·20
OC140	0·20
OC169	0·26
OC170	0·26
OC171	0·26
OC200	0·26
OC201	0·29
OC202	0·29
OC203	0·26
OC204	0·26
OC205	0·36
OC309	0·41
OCP71	0·44*
ORP12	0·44*
ORP60	0·41*

Type	Price
ORP61	0·41*
P20	0·51*
P346A	0·20
P397	0·43
ST140	0·13
ST141	0·18
TIP29	0·44
TIP30	0·52
TIP31A	0·56
TIP32A	0·68
TIP41A	0·68
TIP42A	0·81
TIS43	0·31*
UT46	0·28*
ZN414	1·11
2G301	0·19
2G302	0·19
2G303	0·19
2G304	0·25
2G306	0·41
2G308	0·36
2N2926 G	0·13
2N2926 Y	0·11
2N2926 O	0·10
2N2926 R	0·10
2N2926 B	0·10
2N3010	0·71
2N3011	0·15
2N3053	0·18
2N3054	0·47
2N3055	0·42
2N3319	0·15
2N3391 A	0·17
2N3392	0·15
2N3393	0·15
2N3394	0·15
2N3395	0·18
2N3402	0·21
2N3403	0·21
2N3404	0·29
2N3405	0·43
2N3414	0·16
2N3415	0·16
2N3416	0·29
2N3417	0·29
2N3525	0·77*
2N3614	0·69
2N3615	0·76
2N3616	0·76
2N3646	0·09
2N3702	0·12
2N3703	0·12
2N3704	0·13
2N3705	0·12
2N3706	0·12
2N3707	0·13
2N3708	0·08
2N3709	0·09
2N3710	0·09
2N3711	0·09
2N3819	0·29
2N3820	0·51
2N3821	0·36
2N3823	0·29
2N3903	0·29
2N3904	0·31
2N3905	0·29
2N3906	0·28
2N4058	0·12
2N4059	0·10
2N4060	0·12
BC113	0·10
BC114	0·16
BC115	0·16
BC116	0·16
BC117	0·19
BC118	0·10
BC119	0·31
BC120	0·81
BC125	0·12
BC126	0·19
BC132	0·12
BC134	0·19
BC135	0·12
BC136	0·16
BC137	0·16
BC139	0·41
BC140	0·31
BC141	0·31
BC142	0·31
BC143	0·31
BC145	0·46
BC147	0·10
BC148	0·10
BC149	0·12
BC150	0·19
BC151	0·20
BC152	0·18
BC153	0·29
BC154	0·31
BC157	0·19
BC158	0·12
BC159	0·12
BC160	0·46
BC161	0·51
BC167	0·12
BC168	0·12
BC169	0·12
BC170	0·12
BC171	0·15

Type	Price
BC172	0·15
BF167	0·22
BF173	0·22
BF176	0·36
BF177	0·36
BF178	0·31
BF179	0·31
BF180	0·31
BF181	0·31
BF182	0·41
BF183	0·41
BF184	0·26
BF185	0·31
BF187	0·28
BF188	0·41
BF194	0·12
BF195	0·12
BF196	0·15
BF197	0·15
BF200	0·46
BF222	0·98
BF257	0·46
BF258	0·61
BF259	0·87
BF262	0·56
BF263	0·56
BF270	0·36
BF271	0·31
BF272	0·81
BF273	0·36
BF274	0·36
BFW20	0·61
BFX29	0·28
BFX84	0·22
BFX85	0·31
BFX86	0·22
BFX87	0·25
BFX88	0·22
BFY50	0·20
BFY51	0·20
BFY52	0·20
2G309	0·37
2G339	0·20
2G339A	0·17
2G344	0·19
2G345	0·17
2G371	0·17
2G371B	0·12
2G373	0·18
2G374	0·18
2G377	0·31
2G378	0·17
2G381	0·17
2G382	0·17
2G401	0·31
2G414	0·31
2G417	0·26
2N388	0·36
2N388A	0·56
2N404	0·20
2N404A	0·29
2N524	0·43
2N527	0·50
2N598	0·43
2N599	0·46
2N696	0·13
2N697	0·14
2N698	0·25
2N699	0·36
2N706	0·08
2N706A	0·09
2N708	0·12
2N711	0·31
2N717	0·36
2N718	0·25
2N718A	0·51
2N726	0·29
2N727	0·29
2N743	0·20
2N744	0·20
2N914	0·15
2N4061	0·12
2N4062	0·12
2N4284	0·18
2N4285	0·18
2N4286	0·18
2N4287	0·18
2N4288	0·18
2N4289	0·18
2N4290	0·18
2N4291	0·18
2N4292	0·18
2N4293	0·18
2N5172	0·12
2N5194	0·56
2N5294	0·56
2N5296	0·56
2N5457	0·32
2N5458	0·32
2N5459	0·41
2N6122	0·69
2S301	0·51
2S302A	0·43
2S302	0·43
2S303	0·56
2S304	0·71
2S305	0·80
2S306	0·80
2S307	0·80
2S321	0·75

* 74 SERIES T.T.L. I.C's

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

Type	1	25	100+	Type	1	25	100+	Type	1	25	100+
7400	0·14	0·13	0·12	7448	£1·02	0·99	0·97	74122	0·65	0·63	0·60
7401	0·14	0·13	0·12	7450	0·14	0·13	0·12	74123	0·69	0·68	0·65
7402	0·14	0·13	0·12	7451	0·14	0·13	0·12	74141	0·79	0·76	0·73
7403	0·14	0·13	0·12	7453	0·14	0·13	0·12	74145	£1·20	£1·16	£1·11
7404	0·14	0·13	0·12	7454	0·14	0·13	0·12	74150	£1·39	£1·30	£1·20
7405	0·14	0·13	0·12	7460	0·14	0·13	0·12	74151	£1·02	0·97	0·93
7406	0·36	0·31	0·29	7470	0·30	0·27	0·25	74153	0·93	0·88	0·83
7407	0·36	0·31	0·29	7472	0·30	0·27	0·25	74154	£1·57	£1·48	£1·48
7408	0·23	0·22	0·21	7473	0·38	0·36	0·32	74155	£1·11	£1·06	£1·02
7409	0·23	0·22	0·21	7474	0·38	0·36	0·32	74156	£1·11	£1·06	£1·02
7410	0·14	0·13	0·12	7475	0·56	0·54	0·52	74157	0·93	0·88	0·83
7411	0·23	0·22	0·21	7476	0·41	0·40	0·39	74160	£1·30	£1·25	£1·20
7412	0·26	0·25	0·24	7480	0·56	0·54	0·51	74161	£1·30	£1·25	£1·20
7413	0·30	0·29	0·28	7481	1·02	0·97	0·93	74162	£1·30	£1·25	£1·20
7416	0·28	0·27	0·26	7482	0·83	0·79	0·74	74163	£1·30	£1·25	£1·20
7417	0·28	0·27	0·26	7483	£1·11	£1·06	0·97	74164	£1·67	£1·62	£1·55
7420	0·14	0·13	0·12	7484	0·93	0·90	0·88	74165	£1·67	£1·62	£1·55
7422	0·28	0·27	0·26	7485	£1·48	£1·44	£1·39	74166	£1·48	£1·44	£1·39
7423	0·37	0·36	0·35	7486	0·32	0·31	0·30	74174	£1·48	£1·44	£1·39
7425	0·37	0·36	0·35	7489	£3·70	£3·47	£3·24	74175	£1·02	0·97	0·93
7426	0·37	0·35	0·33	7490	0·60	0·58	0·56	74176	£1·16	£1·11	£1·06
7427	0·37	0·35	0·33	7491	£1·02	0·97	0·93	74177	£1·16	£1·11	£1·06
7428	0·42	0·39	0·37	7492	0·69	0·66	0·59	74180	£1·16	£1·11	£1·06
7430	0·14	0·13	0·12	7493	0·69	0·66	0·59	74181	£3·66	£3·56	£3·47
7432	0·37	0·35	0·33	7494	0·79	0·76	0·69	74182	£1·16	£1·11	£1·06
7433	0·39	0·37	0·35	7495	0·79	0·76	0·69	74184	£1·67	£1·62	£1·55
7437	0·32	0·30	0·28	7496	0·89	0·86	0·80	74190	£1·81	£1·76	£1·71
7438	0·32	0·30	0·28	74100	£1·39	£1·34	£1·30	74191	£1·81	£1·76	£1·71
7440	0·14	0·13	0·12	74104	0·56	0·54	0·51	74192	£1·81	£1·76	£1·71
7441	0·69	0·66	0·59	74105	0·56	0·54	0·51	74193	£1·81	£1·76	£1·71
7442	0·69	0·66	0·59	74107	0·41	0·39	0·37	74194	£1·20	£1·16	£1·11
7443	£1·11	£1·06	£1·02	74110	0·56	0·51	0·46	74195	£1·02	0·97	0·93
7444	£1·11	£1·06	£1·02	74111	0·83	0·81	0·78	74196	£1·11	£1·06	£1·02
7445	£1·48	£1·44	£1·39	74118	0·93	0·88	0·83	74197	£1·11	£1·06	£1·02
7446	£1·11	£1·06	£1·02	74119	£1·39	£1·30	£1·20	74190	£2·55	£2·50	£2·45
7447	£1·02	0·99	0·97	74121	0·46	0·44	0·41	74199	£2·31	£2·21	£2·11

Devices may be mixed to qualify for quantity price. (TTL 74 series only) data is available for the above series of I.C's in booklet form. PRICE 35p.

* D.T.L. 930 SERIES

Type	1	25	100+	Type	1	25	100+	Type	1	25	100+
BP930	0·14	0·13	0·12	BP944	0·15	0·14	0·13	BP962	0·14	0·13	0·12
BP932	0·15	0·14	0·13	BP945	0·28	0·26	0·23	BP9093	0·42	0·40	0·38
BP933	0·15	0·14	0·13	BP946	0·14	0·13	0·12	BP9094	0·42	0·40	0·38
BP935	0·15	0·14	0·13	BP948	0·28	0·26	0·23	BP9097	0·42	0·40	0·38
BP936	0·15	0·14	0·13	BP951	0·65	0·60	0·56	BP9099	0·42	0·40	0·38

* TRIACS

	Case	100V	200V	400V
2 Amp	TO5	0·31	0·51	0·71
6 Amp	TO66	0·51	0·61	0·77
10 Amp	TO48	0·77	0·92	£1·12

ALL PRICES
PLEASE ADD VA
ITEMS EXCEPT
GIRO NUMBER
388-7006
Postage & Packin
Add extra for airma

* D.I.L. SOCKETS

		1	25	100+
TSO14	14 pin type	0·31	0·28	0·25
TSO16	16 pin type	0·35	0·32	0·30
TSO24	24 pin type	0·69	0·64	0·62
BPS 8	8 pin type (low cost)	0·14	0·12	0·10
BPS14	14 pin type (low cost)	0·15	0·13	0·11
BPS16	16 pin type (low cost)	0·16	0·14	0·12

LINEAR I.C's

Type	1	25	100+
72702	0·46	0·44	0·42
72709	0·23	0·21	0·19
72709P	0·19	0·18	0·17
72710	0·33	0·31	0·28
72741	0·28	0·27	0·26
72741C	0·26	0·25	0·24
72741P	0·28	0·27	0·26
72747	0·79	0·74	0·61
72748P	0·35	0·33	0·31
SL201C	0·46	0·42	0·37

Type	1	25	100+
SL701C	0·46	0·42	0·37
SL702C	0·46	0·42	0·37
TAA263	0·74	0·65	0·56
TAA293	0·93	0·88	0·83
TAA350A	£1·71	£1·67	£1·57
uA703C	0·28	0·24	0·22
uA709C	0·19	0·18	0·17
uA711C	0·32	0·31	0·28
uA712C	0·32	0·31	0·28

Type	1	25	100+
uA723C	0·45	0·43	0·40
76003	£1·39	£1·34	£1·30
76023	£1·39	£1·34	£1·30
76660	0·88	0·86	0·83
LM380	0·93	0·90	0·88
NE555	0·45	0·43	0·40
NE556	0·88	0·86	0·83
TBA800	£1·39	£1·34	£1·30
ZN414	£1·11	—	—

SILICON RECTIFIERS

PIV	300mA (DO 7)	750mA (SO 16)	1 Amp Plastic		1·5Amp (SO 16)	3Amp (SO 10)	10Amp (SO 10)	30Amp (TO 48)
50	0·05	0·06	1N4001	0·05	0·07	0·14	0·19*	0·56*
100	0·05	0·07	1N4002	0·06	0·09	0·16	0·21*	0·69*
200	0·06	0·09	1N4003	0·07	0·12	0·20	0·23*	0·93*
400	0·07	0·14	1N4004	0·08	0·14	0·28	0·35*	£1·25*
600	0·08	0·16	1N4005	0·09	0·16	0·33	0·42*	£1·76*
800	0·11	0·18	1N4006	0·10	0·18	0·35	0·51*	£1·94*
1000	0·13	0·28	1N4007	0·11	0·23	0·44	0·60*	£2·31*
1200	—	0·32			0·28	0·54	0·69*	£2·88*

PO BOX 6 WARE HERTS

SUPER UNTESTED PAKS

Pak No.	Description	Price £p
U 1	120 Glass Sub-min. General purpose Germ. diodes	0·60
U 2	50 Mixed Germanium transistors AF/RF	0·60
U 3	75 Germanium gold bonded sub-min. like OA5, OA47	0·60
U 4	30 Germanium transistors like OC81, AC128	0·60
U 5	60 200mA sub-min. silicon diodes	0·60
U 6	30 Sil. Planar trans. NPN like BSY95A, 2N706	0·60
U 7	16 Sil. rect. TOP-HAT 750mA VLTG. RANGE up to 100	0·60
U 8	50 Sil. planar diodes DO-7 glass 250mA like OA200/202	0·60
U 9	20 Mixed voltages, 1 Watt Zener Diodes	0·60
U10	20 BAY50 charge storage diodes DO-7 glass	0·60
U11	20 PNP Sil. planar trans. TO-5 like 2N1132, 2N2904	0·60
U13	30 PNP-NPN Sil. transistors OC200 & 2S104	0·60
U14	150 Mixed silicon and germanium diodes	0·60
U15	20 NPN Sil. planar trans. TO-5 like 2N696, 2N697	0·60
U16	10 3Amp sil. rectifiers stud type up to 1000 PIV	0·60
U17	30 Germanium PNP AF transistors TO-5 like ACY 17-22	0·60
U18	8 6 Amp sil. rectifiers BYZ13 type up to 600 PIV	0·60
U19	20 Silicon NPN transistors like BC 108	0·60
U20	12 1·5 Amp sil. rectifiers top hat up to 1000 PIV	0·60
U21	30 AF. Germ. alloy transistors 2G300 series & OC71	0·60
U23	25 MADT's like MHz series PNP transistors	0·60
U24	20 Germ. 1 Amp rectifiers GJM series up to 300 PIV	0·60
U25	25 300 MHz NPN silicon transistors 2N708, BSY27	0·60
U26	30 Fast switching silicon diodes like IN914 Micro-Min	0·60
U29	10 1 Amp SCR's TO-5 can. up to 600 PIV CRS1/25-600	£1·20*
U32	25 Zener diodes 400 mW DO-7 case 3-33 volts mixed	0·60
U33	15 Plastic case 1 Amp sil. rectifiers IN4000 series	0·60
U34	30 Silicon PNP alloy trans. TO-5 BCY26 2S302/4	0·60
U35	25 Silicon planar transistors PNP TO-18 2N2906	0·60
U36	20 Silicon planar NPN transistors TO-5 BFY50/51/52	0·60
U37	30 Silicon alloy transistors SO-2 PNP OC200, 2S322	0·60
U38	20 Fast switching silicon trans. NPN 400 MHz 2N3011	0·60
U39	30 RF. Ger. PNP transistors 2N1303/5 TO-5	0·60
U40	10 Dual transistors 6 lead TO-5 2N2060	0·60
U43	25 Silicon trans. plastic TO-18 A.F. BC113/114	0·60
U44	20 Silicon trans. plastic TO-5 BC115	0·60
U45	7 3A SCR. TO66 up to 600 PIV	£1·20*
U46	20 Unijunction transistors similar to TIS43	0·60*
U47	10 TO220AB plastic triacs 50V 6A	£1·20*
U48	9 NPN Sil. power transistors like 2N3055	£1·20
U49	12 NPN Sil. plastic power trans. 60W like 2n5294/5296	£1·20

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

CLUDE VAT
T 25% TO ALL
ADD 8%
NO VAT
d 20p overseas
nimum order 75p

VOLTAGE REGULATORS

*

TO.3 Plastic Encapsulation

uA.7805/L129 5V (Equiv. to MVR5V) £1·25p

uA.7812/L130 12V (Equiv. to MVR12V) £1·25p

uA.7815/L131 15V (Equiv. to MVR15V) £1·25p

uA.7818 18V (Equiv. to MVR18V) £1·25p

* THYRISTORS

PIV	0·6A TO18	0·8A TO92	1A TO5	3A TO66	5A TO66	5A TO64	7A TO48	10A TO48	16A TO48	30A TO48
10	0·13	0·15	—	—	—	—	—	—	—	—
20	0·15	0·18	—	—	—	—	—	—	—	—
30	0·19	0·22	—	—	—	—	—	—	—	—
50	0·22	0·28	0 20	0·25	0·36	0·36	0·48	0·51	0·54	£1·18
100	0·25	0·30	0·25	0·25	0·48	0·48	0·51	0·57	0·58	£1·48
150	0·31	0·38	—	—	—	—	—	—	—	—
200	0·38	0·44	0·25	0·30	0·50	0·50	0·57	0·62	0·62	£1·63
400	—	—	0·30	0·39	0·55	0·57	0·62	0·71	0·77	£1·79
600	—	—	0·39	0·48	0·69	0·69	0·78	0·99	0·90	—
800	—	—	0·58	0·65	0·81	0·81	0·92	£1·22	£1·39	£4·07

DIODES

Type	*Price*	*Type*	*Price*	*Type*	*Price*	*Type*	*Price*
AA119	0·08	BY101	0·12	BYZ16	0·41	OA85	0·09
AA120	0·08	BY105	0·18	BYZ17	0·36	OA90	0·07
AA129	0·08	BY114	0·12	BYZ18	0·36	OA91	0·07
AAY30	0·09	BY124	0·12	BYZ19	0·28	OA95	0·07
AAZ13	0·10	BY126	0·15	CG62		OA200	0·07
BA100	0·10	BY127	0·16	(OA91Eq)	0·06	OA202	0·07
BA116	0·21	BY128	0·16	CG651 (OA70-		SD10	0·06
BA126	0·22	BY130	0·17	OA79)	0·07	SD19	0·06
BA148	0·15	BY133	0·21	OA5 Short		1N34	0·07
BA154	0·12	BY164	0·51	Leads	0·21	1N34A	0·07
BA155	0·15	BYX38/300	0·48	OA10	0·14	1N914	0·06
BA156	0·14	BYZ10	0·36	OA47	0·07	1N916	0·06
BA173	0·15	BYZ11	0·31	OA70	0·07	1N4148	0·06
BB104	0·15	BYZ12	0·31	OA79	0·07	1S021	0·10
BY100	0·16	BYZ13	0·26	OA81	0·07	1S951	0·70

QUALITY TESTED PAKS

Pak No.	Quality Tested Paks	Price
Q 1	20 Red spot transistors PNP	0·60
Q 2	16 White spot R.F. transistors PNP	0·60
Q 3	4 OC 77 type transistors	0·60
Q 4	6 Matched transistors OC44/45/81/81D	0·60
Q 5	4 OC 75 transistors	0·60
Q 6	5 OC 72 transistors	0·60
Q 7	4 AC 128 transistors PNP high gain	0·60
Q 8	4 AC 126 transistors PNP	0·60
Q 9	7 OC 81 type transistors	0·60
Q10	7 OC 71 type transistors	0·60
Q11	2 AC 127/128 Complementary pairs PNP/NPN	0·60
Q12	3 AF 116 type transistors	0·60
Q13	3 AF 117 type transistors	0·60
Q14	3 OC 171 H.F. type transistors	0·60
Q15	7 2N2926 Sil. Epoxy transistors mixed colours	0·60
Q17	5 NPN 2 × ST.141. & 3 × ST.140	0·60
Q18	4 MADT'S 2 × MAT 100 & 2 × MAT 120	0·60
Q19	3 MADT'S 2 × MAT 101 & 1 × MAT 121	0·60
Q20	4 OC 44 Germanium transistors A.F.	0·60
Q21	4 AC 127 NPN Germanium transistors	0·60
Q22	20 NKT transistors A.F. R.F. coded	0·60
Q23	10 OA 202 Silicon diodes sub-min	0·60
Q24	8 OA 81 diodes	0·60
Q25	15 IN 914 Silicon diodes 75PIV 75mA	0·60
Q26	8 OA95 Germanium diodes sub-min-IN69	0·60
Q27	2 10A 600 PIV Silicon rectifiers IS425B	0·60*
Q28	2 Silicon power rectifiers BYZ 13	0·60
Q29	4 Sil. transistors 2×2N696, 1×2N697, 1×2N698	0·60
Q30	7 Silicon switch transistors 2N706 NPN	0·60
Q31	6 Silicon switch transistors 2N708 NPN	0·60
Q32	3 PNP Sil. trans. 2×2N1131, 1×2N1132	0·60
Q33	3 Silicon NPN transistors 2N1711	0·60
Q34	7 Sil. NPN trans. 2N2369, 500MHz (code P397)	0·60
Q35	3 Silicon PNP TO-5 2×2N2904 & 1×2N2095	0·60
Q36	7 2N3646 TO-18 plastic 300 MHz NPN	0·60
Q37	3 2N3053 NPN Silicon transistors	0·60
Q38	5 PNP transistors 3×2N3703, 2×2N3702	0·60
Q39	5 NPN transistors 3×2N3704, 2×2N3705	0·60
Q40	5 NPN transistors 3×2N3707, 2×2N3708	0·60
Q41	3 Plastic NPN TO18 2N3904	0·60
Q43	5 BC 107 NPN transistors	0·60
Q44	5 NPN transistors 3×BC 108, 2×BC 109	0·60
Q45	3 BC 113 NPN TO-18 transistors	0·60
Q46	3 BC 115 NPN TO-5 transistors	0·60
Q47	4 NPN high gain transistors 2×BC 167, 2×BC 168	0·60
Q48	3 BCY 70 PNP transistors TO-18	0·60
Q49	3 NPN transistors 2×BFY 51, 1×BFY 52	0·60
Q50	7 BSY 28 NPN switch transistors TO-18	0·60
Q51	7 BSY 95A NPN transistors 300MHz	0·60
Q52	8 BY 100 type silicon rectifiers	£1·20
Q53	25 Sil. & Germ. trans. mixed all marked new	£1·50
Q54	6 TIL 209 Red LED	£1·20*

* UNTESTED T.T.L. PAKS

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

Pak No.	Contents	Price	Pak No.	Contents	Price
UIC00 =	12 × 7400	0·60	UIC72 =	8 × 7472	0·60
UIC01 =	12 × 7401	0·60	UIC73 =	8 × 7473	0·60
UIC02 =	12 × 7402	0·60	UIC74 =	8 × 7474	0·60
UIC03 =	12 × 7403	0·60	UIC75 =	8 × 7475	0·60
UIC04 =	12 × 7404	0·60	UIC76 =	8 × 7476	0·60
UIC05 =	12 × 7405	0·60	UIC80 =	5 × 7480	0·60
UIC06 =	8 × 7406	0·60	UIC81 =	5 × 7481	0·60
UIC07 =	8 × 7407	0·60	UIC82 =	5 × 7482	0·60
UIC10 =	12 × 7410	0·60	UIC83 =	5 × 7483	0·60
UIC13 =	8 × 7413	0·60	UIC86 =	5 × 7486	0·60
UIC20 =	12 × 7420	0·60	UIC90 =	5 × 7490	0·60
UIC30 =	12 × 7430	0·60	UIC91 =	5 × 7491	0·60
UIC40 =	12 × 7440	0·60	UIC92 =	5 × 7492	0·60
UIC41 =	5 × 7441	0·60	UIC93 =	5 × 7493	0·60
UIC42 =	5 × 7442	0·60	UIC94 =	5 × 7494	0·60
UIC43 =	5 × 7443	0·60	UIC95 =	5 × 7495	0·60
UIC44 ×	5 × 7444	0·60	UIC96 =	5 × 7496	0·60
UIC45 =	5 × 7445	0·60	UIC100 =	5 × 74100	0·60
UIC46 =	5 × 7446	0·60	UIC121 =	5 × 74121	0·60
UIC47 =	5 × 7447	0·60	UIC141 =	5 × 74141	0·60
UIC48 =	5 × 7448	0·60	UIC151 =	5 × 74151	0·60
UIC50 =	12 × 7450	0·60	UIC154 =	5 × 74154	0·60
UIC51 =	12 × 7451	0·60	UIC193 =	5 × 74193	0·60
UIC53 =	12 × 7453	0·60	UIC199 =	5 × 74199	0·60
UIC54 =	12 × 7454	0·60	UIC X1	25 Assorted 74's	£1·50
UIC60 =	12 × 7460	0·60			
UIC70 =	8 × 7470	0·60			

MAMMOTH I.C. PAK

*

APPROX. 200 PIECES

Assorted fall-out integrated circuits, including: Logic, 74 series, Linear, Audio and D.T.L. Many coded devices but some unmarked—you to identify.

OUR SPECIAL PRICE £1.20p

WORLD SCOOP

JUMBO SEMICONDUCTOR PAK

Transistors—Germ. and Silicon. Rectifiers—Diodes—Triacs—Thyristors—I.C.'s and Zeners. ALL NEW AND CODED

APPROX 100 PIECES

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

ONLY £1.85p

UNTESTED LIN PAKS

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

Pak No.	Contents	Price
ULIC709 =	10 × 709	0·60
ULIC710 =	7 × 710	0·60
ULIC741 =	7 × 741	0·60
ULIC747 =	5 × 747	0·60
ULIC748 =	7 × 748	0·60

C280 CAPACITOR PAK

Containing 75 of the C280 range of capacitors assorted in values ranging from ·01uF to 2·2uF. Complete with identification chart.

FANTASTIC VALUE
ONLY £1·20p.

SIL. G.P. DIODES

300 mW 40 PIV (min) SUB-MIN FULLY TESTED
Ideal for Organ builders

30 for 50p, 100 for £1.50, 500 for £5, 1000 for £9.

G.P. SWITCHING TRANS

TO18 SIM. TO 2N706/8 BSY27/28/95A
All usable devices. No open and shorts. ALSO AVAILABLE IN PNP similar to 2N2906, BCY 70
20 for 50p, 50 for £1, 100 for £1.80, 500 for £8, 1000 for £14.

When ordering please state NPN or PNP

G.P. 100

30 WATT GERMANIUM TO3 METAL CASE
Vcbo 80V, Vceo 50V, IC 10A, Hfe 30-170 replaces the majority of Germanium power Transistors in the OC, AD NKT range.

1-24	25-99	100+
44p	41p	37p

G.P. 300

115 WATT SILICON TO3 METAL CASE
Vcbo 100V, Vceo 60V, IC 15A, Hfe, 20-100 suitable replacement for 2N3055, BDY11 or BDY20

1-24	25-99	100+
50p	48p	46p

INDICATORS

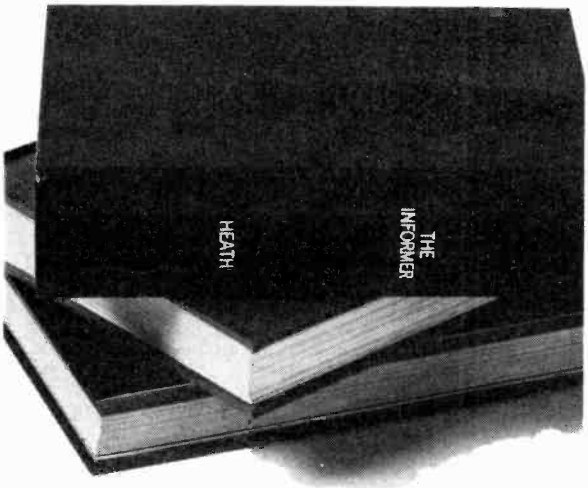
3015F Minitron 7 Segment Indicator £1.11p*
MAN 3M L.E.D. 7 SEGMENT DISPLAY 0.127" High Characters £1·76p*

ZENER DIODES

FULL RANGE IN STOCK
VOLTAGE RANGE 2-33V

400 mw	1·5 w	10 w*
8p	17p	30p

Enough books are written about crime, this one stops it.



Outside it's a book. Inside it's an ingenious ultrasonic burglar alarm from Heathkit. The GD-39.

A complete kit that can be assembled in only a few enjoyable hours, with the help of a very easy to follow instruction manual.

The GD-39 works by transmitting a silent, ultrasonic signal throughout the room. And continuously monitoring it. Any movement made by an intruder in the room will then automatically produce a change in the signal. Which triggers off a lamp and, thirty seconds later, a remote buzzer, that just you hear, or a loud bell.

Enough to scare the living daylights out of a burglar.

For more details, and a bookful of other ideas, just post the coupon now for your Heathkit catalogue.

Or, if you're in London or Gloucester, call in and see us. The London Heathkit Centre is at 233 Tottenham Court Road. The Gloucester showroom is next to our factory in Bristol Road.

Heath (Gloucester) Limited,
Dept. PW-16 Bristol Road,
Gloucester GL2 6EE.
Tel: (0452) 29451.

The GD-39
Ultrasonic Burglar Alarm

To: Heath (Gloucester) Limited, Dept. PW-16, Gloucester GL2 6EE. Please send me a Heathkit catalogue. I enclose a 10p stamp for postage.

HEATH
Schlumberger

Name

Address

Postcode

Monthly budget plan available

Marshall's

A. Marshall (London) Ltd Dept: PW
42 Cricklewood Broadway London NW2 3ET Tel: 01-452 0161/2
Telex: 21492
& 85 West Regent St Glasgow G2 2QD Tel: 041-332 4133
& 1 Straits Parade Fishponds Bristol BS16 2LX
Tel: 0272 654201/2
& 27 Rue Danton Issy Les Moulineaux Paris 92 Tel: 644 2356

Catalogue price 25p Trade and export enquiries welcome

Our range covers over 7,000 items. The largest selection in Britain

Top 200 IC's TTL, CMOS & Linears

								SN74151	85p
CA3020A	£1·80	CD4050	66p	NE555V	70p	SN7442	65p	SN74153	85p
CA3028A	79p	CD3130	88	NE556	£1·30	SN7446	95p	SN74154	£1·50
CA3035	£1·37	CD4510	£1·25	NE560	£4·48	SN7447	95p	SN74157	95p
CA3046	70p	CD4511	£1·94	NE565	£4·48	SN7448	90p	SN74160	£1·10
CA3048	£2·11	CD4516	£1·25	SL414	£1·80	SN7450	16p	SN74161	£1·10
CA3052	£1·62	CD4518	£1·87	SL610C	£1·70	SN7451	16p	SN74162	£1·10
CA3089E	£1·96	CD4520	£1·87	SL611C	£1·70	SN7453	16p	SN74163	£1·10
CA3090Q	£4·23	LM301A	48p	SL612C	£1·70	SN7454	16p	SN74164	£2·01
CD4000	36p	LM308	£2·50	SK620C	£2·60	SN7460	16p	SN74165	£2·01
CD4001	36p	L005TL	£1·50	SL621C	£2·60	SN7470	33p	SN74167	£4·10
CD4002	36p	LM380	£1·10	SL623C	£4·59	SN7472	26p	SN74174	£1·25
CD4006	£1·58	LM381	£2·20	SL640C	£3·10	SN7473	36p	SN74175	90p
CD4007	36p	LM702C	75p	SN7400	16p	SN7474	36p	SN74176	£1·44
CD4008	£1·63	LM709	38p	SN7401	16p	SN7475	50p	SN74180	£1·40
CD4009	£1·18	TO99	38p	SN7401AN	38p	SN7476	35p	SN74181	£1·95
CD4010	£1·18	8DIL	45p	SN7402	16p	SN7480	50p	SN74190	£2·30
CD4011	36p	14DIL	38p	SN7403	16p	SN7481	£1·25	SN74191	£2·30
CD4012	36p	LM710	47p	SN7404	19p	SN7482	75p	SN74192	£1·15
CD4013	66p	LM723C	90p	SN7405	19p	SN7483	95p	SN74193	£1·15
CD4014	£1·72	LM741C	40p	SN7406	45p	SN7484	95p	SN74196	£1·60
CD4015	£1·72	TO99	40p	SN7407	45p	SN7485	£1·25	SN74197	£1·58
CD4016	66p	8DIL	40p	SN7408	19p	SN7486	32p	SN74198	£2·25
CD4017	£1·72	14DIL	38p	SN7409	22p	SN7490	45p	SN74199	£2·25
CD4018	£2·55	LM747	£1·05	SN7410	16p	SN7491	85p	SN76003N	£2.92
CD4019	86p	LM748	60p	SN7411	25p	SN7492	45p	SN76013N	£1.95
CD4020	£1·91	8DIL	60p	SN7412	28p	SN7493	45p	SN76023N	£1.60
CD4021	£1·72	14DIL	73p	SN7413	35p	SN7494	82p	SN76033N	£2.92
CD4022	£1·66	LM3900	70p	SN7416	35p	SN7495	72p	TAA263	£1·10
CD4023	36p	LM7805	£2·00	SN7417	35p	SN7496	75p	TAA300	£1·80
CD4024	£1·24	LM7812	£2·50	SN7420	16p	SN74100	£1·25	TAA350A	£2·10
CD4025	32p	LM7815	£2·50	SN7423	29p	SN74107	36p	TAA550	60p
CD4027	43p	LM7824	£2·50	SN7425	29p	SN74118	£1·00	TAA611C	£2·18
CD4028	£1·50	MC1303L	£1·50	SN7427	29p	SN74119	£1·92	TAA621	£2·03
CD4029	£3·50	MC1310P	£2·50	SN7430	16p	SN74121	37p	TAA661B	£1·32
CD4030	87p	MC1330P	90p	SN7432	28p	SN74122	50p	TBA641B	£2·25
CD4031	£5·19	MC1351P	80p	SN7437	35p	SN74123	60p	TBA651	£1·69
CD4037	£1·93	MC14553	£4·07	SN7438	35p	SN74141	85p	TBA800	£1·40
CD4041	£1·86	MC1466L	£3·50	SN7440	16p	SN74145	90p	TBA810	£1·40
CD4049	81p	MC1469R	£2·75	SN7441AN	85p	SN74150	£1·50	TBA820	£1·15

London, Glasgow, Paris and now BRISTOL It's our service that makes us grow

POPULAR SEMICONDUCTORS

2N696	22p	2N3906	27p	AF139	65p	BD139	71p	MPSA56	31p
2N697	16p	2N4037	42p	AF239	65p	BD140	87p	OC28	76½p
2N698	82p	2N4036	67p	AF240	90p	BF115	36p	OC35	60p
2N699	59p	2N4058	18p	AF279	70p	BF117	55p	OC42	50p
2N706	14p	2N4062	15p	AF280	79p	BF154	20p	OC45	32p
2N708	17p	2N4289	34p	AL102	£1·00	BF159	27p	TIP29A	49p
2N916	28p	2N4920	£1·10	BC107	14p	BF180	35p	TIP29C	58p
2N918	32p	2N4921	83p	BC108	14p	BF181	36p	TIP31A	62p
2N1302	18½p	2N4923	£1·00	BC109	14p	BF184	30p	TIP32A	74p
2N1304	26p	2N5245	47p	BC147B	14p	BF194	12p	TIP33A	£1·01
2N1306	31p	2N5294	48p	BC148B	15p	BF195	12p	TIP34A	£1·51
2N1308	47p	2N5296	48p	BC149B	15p	BF196	13p	TIP35A	£2·90
2N1711	45p	2N5457	49p	BC157A	16p	BF197	15p	TIP36A	£3·70
2N2102	60p	2N5458	46p	BC158A	16p	BF198	18p	TIP41A	74p
2N2147	78p	2N5459	49p	BC167B	15p	BF244	21p	TIP42A	£0·90
2N2148	94p	2N6027	45p	BC168B	15p	BF257	47p	TIP2955	98p
2N2218A	22p	3N128	73p	BC169B	15p	BF258	53p	TIP3055	50p
2N2219A	26p	3N140	£1·00	BC182	12p	BF259	55p	TIS43	28p
2N2220	25p	3N141	81p	BC182L	12p	BF561	27p	ZTX300	13p
2N2221	18p	3N200	£2·49	BC183	12p	BF598	25p	ZTX301	13p
2N2222	20p	40361	40p	BC183L	12p	BFR39	24p	ZTX500	15p
2N2369	20p	40362	45p	BC184	13p	BFR79	24p	ZTX501	13p
2N2646	55p	40406	44p	BC184L	13p	BFX29	30p	ZTX502	18p
2N2904	22p	40407	35p	BC212A	16p	BFX30	27p	IN914	7p
2N2905	25p	40408	50p	BC212LA	16p	BFX84	24p	IN3754	15p
2N2906	19p	40409	52p	BC213LA	15p	BFX85	30p	IN4007	10p
2N2907	22p	40410	52p	BC214LB	18p	BFX88	25p	IN4148	7p
2N2924	20p	40411	£2·00	BC237B	16p	BFY50	22½p	IN5404	22p
2N2926G	12p	40594	74p	BC238C	15p	BFY51	23p	IN5408	30p
2N3053	25p	40595	84p	BC239C	15p	BFY52	20½p	AA119	8p
2N3054	60p	40636	£1·10	BC257A	16p	BRY39	48p	BA102	25p
2N3055	75p	40673	73p	BC258B	16p	ME0402	20p	BA145	18p
2N3391	28p	AC162	20p	BC259B	17p	ME0412	18p	BA154	12p
2N3392	15p	AC127	20p	BC301	34p	ME4102	11p	BA155	12p
2N3393	15p	AC128	20p	BC307B	17p	MJ480	95p	BB103B	23p
2N3440	59p	AC151	27p	BC308A	15p	MJ481	£1·20	BB104B	45p
2N3442	£1·40	AC152	49p	BC309C	20p	MJ490	£1·05	BY126	12p
2N3638	15p	AC153	35p	BC327	23p	MJ491	1·45	BY127	15p
2N3702	12p	AC176	30p	BC328	22p	MJ2955	£1·00	BYZ11	51p
2N3703	13p	AC187K	35p	BCY70	17p	MJE340	48p	BYZ12	51p
2N3704	15p	AC188K	40p	BCY71	22p	MJE370	65p	OA47	6p
2N3706	15p	AD143	68p	BCY72	15p	MJE371	75p	OA81	18p
2N3708	14p	AD161	50p	BD121	£1·00	MJE520	60p	OA90	6p
2N3714	£1·38	AD162	50p	BD123	82p	MJE521	70p	OA91	6p
2N3716	£1·80	AF106	40p	BD124	67p	MJE2955	£1·20	OA200	8p
2M3771	£2·20	AF109	40p	BD131	40p	MJE3055	75p	BY164	57p
2N3773	£2·65	AF115	35p	BD132	50p	MP8113	47p	ST2diac	20p
2N3789	£2·06	AF116	35p	BD135	43p	MPF102	39p	40669	£1·00
2N3819	37p	AF117	35p	BD136	47p	MPSA05	25p	TIC44	29p
2N3820	64p	AF118	35p	BD137	55p	MPSA06	31p	C106D	65p
2N3904	27p	AF124	30p	BD138	63p	MPSA55	31p	ORP12	60p

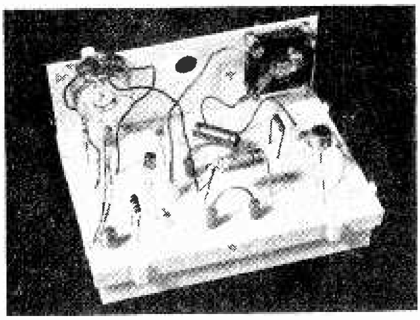
Prices correct at December 1975, but all exclusive of VAT. P.&P. 25p

P.B. ELECTRONICS LTD.
SCOTLAND

ELECTRONIC – SCIENTIFIC – INSTRUMENTS

Sales Office: 57 High Street, Saffron Walden, Essex. Tel: Saffron Walden (0799) 22876.
Factory: 62 Largo Road, St. Andrews, Fife, Scotland. Tel: St. Andrews 2641.

S–DEC Solderless Breadboard 25p Off.



The world proved S–DEC can now be yours with 25P off list price take this coupon to your local dealer or send direct to us for immediate delivery.

S–DEC just plug components directly in, no soldering, use components over and over again.

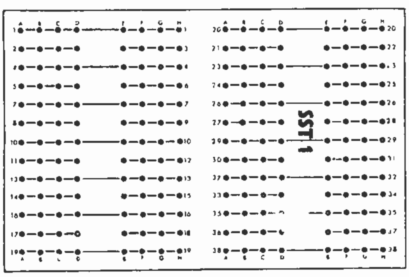
With your S–DEC you receive FREE a booklet which gives a range of circuits which can be quickly assembled on the S–DEC including Radio-Receiver, VHF Radio-Microphone, 3 Stage Amplifier and many others, also FREE control panel for mounting switches, lamps etc.

S–DEC normally £1.98 with this advertisement £1.73
(When ordering direct send £2.08 to cover Post & VAT)

T–DEC normally £3.63 with this advertisement £3.38
(When ordering direct send £3.87 to cover Post & VAT)

U–DEC–A for discrete and use with I.C. send £4.31
(Mr. Trader for every coupon received PB will refund 25p)

NEW NEW PB DEC Super–Solder Boards. Low Cost.



Matched to the world famous range of DEC breadboard layouts PB introduce a new concept into printed circuit board assembly. Now you can buy off the shelf professional circuit boards which have the following features.

DEC SUPER–SOLDER BOARD SSU. Roller Tinned for super soldering.

Carefully engineered layout for maximum assembly efficiency bus-bars for power supplies. No cutting and drilling of contact rails required.

The 208 contacts are identified by a letter number system.

SIZE OF BOARDS 5" x 3" APPROX; fibreglass, drilled, roller tinned.

Lay the prototype out on DEC-breadboards and then for small or large production runs use SUPER–SOLDER Boards.

Super-Solder Boards are available in packs of 1 or 3 off.

SUPER SOLDER BOARD SSS-1 for use with S DEC circuits only 1 off £0.39, 3off £1.00

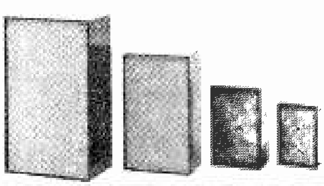
SUPER SOLDER BOARD SST1 for discrete circuits 1 off £0.59, 3 off £1.60.

SUPER SOLDER BOARD SSU1 for discrete and dil circuits 1 of £0.59, 3 off £1.60

SUPER SOLDER BOARD SSN1 for discrete and dil circuits up to 40 lead .6" DIL and for direct insertion of TO5 .1" lead out sockets and packages 1 off £0.69, 3 off £2.00

When ordering please £0.40 for Post and VAT.

Zippy Cabinets. Ideal For All Assembly Cabinets.



Robust ABS plastic assembly boxes, front panel designed to be cut and drilled, slots inside for mounting circuit boards attractive colouring and styling.

TP1 80 x 50 x 30mm £0.72 1 OFF
TP2 115 x 65 x 40mm £1.27 1 OFF
TP3 155 x 90 x 50mm £1.62 1 OFF
TP4 210 x 125 x 70mm £2.27 1 OFF

Discount for quantity prices include Post & VAT.

Resist Coated Circuit Board Lowest price in U.K.
12" x 12" Glass Fibre 1/16 coated with resist £1.50 each.

Circuit Board Manufacture, Fast delivery, Low Price, any circuit board made in days.

S DEC – T DEC – U DEC Accessories.

16 DIL ADAPTOR	£0.99
16 DIL with socket	£1.92
Single ended leads (packs of ten)	£0.90
Double ended leads (packs of ten)	£0.90

EXPERIMENT GUIDES used by all to teach electronics with DEC breadboards.

GUIDE A	8 Projects	£1.50
GUIDE B	10 Projects	£1.77
GUIDE C	3 ADVANCED	£0.90
GUIDE D	10 Projects	£2.40
GUIDE E	23 Projects	£4.20

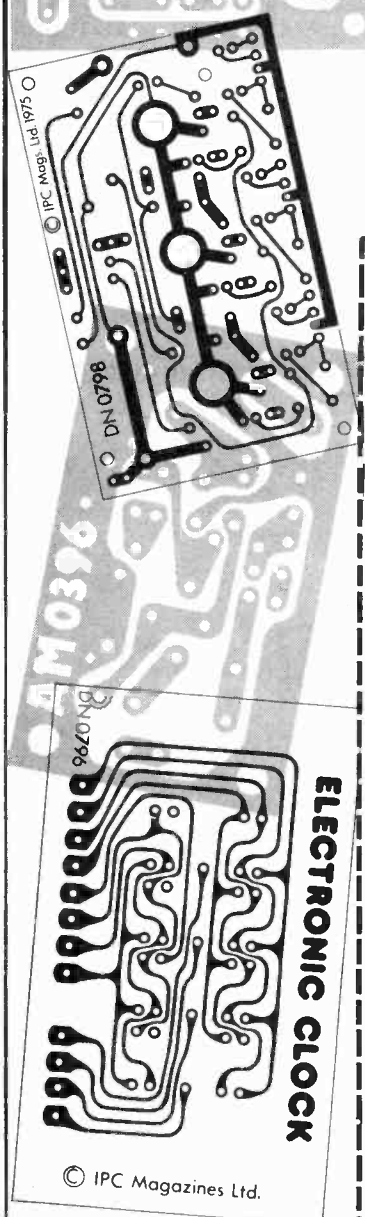
NIGHT GUARD.
Dimmer with a difference, Guards your home from theft, SET, darkness comes, lights come on, dawn, lights go off. Dims room lights up to 500 watts. £5.95 + £1.05 VAT & POST

PB Electronics (Scotland) Ltd
57 High Street, Saffron Walden, Essex, CB10 1AA.
Tel: 0799 22876

All stockists of DEC Breadboards please note PB are the manufacturers and suppliers, please send all orders, communications direct.

EDITORIAL ANNOUNCEMENT

NEW! PRACTICAL WIRELESS PCB SERVICE FOR READERS



As a result of continued requests from readers we are happy to announce the start of a printed circuit board service for projects published in Practical Wireless. A list of PCBs now available, plus ordering coupon, will be found below. The list will be extended as new PCBs are made available. Generally the boards will be of epoxy glassfibre, drilled and roller-tinned. For the time being PCBs for projects published in PW before December 1975 are not available through this new service

To:- READERS PCB SERVICES, PO BOX 11, WORKSOP, NOTTS

Please supply PCB/s as indicated by tick/s in box/es

Issue	Project		Ref	Price	
Dec 75	Radio-Pickup Link		DN0792	0·98 + 10 p/p	☐
Dec 75	Random Number Selector		DN0793A	0·98 + 10	☐
Dec 75	Sound-To-Light Display		DN0798	1·15 + 10	☐
Dec 75	12V PA System		DN2/JM	0·98 + 10	☐
Dec 75	Disco System, Amplifier				
	(2 required)	SRBP each	AM0421	3·40 + 18	☐
		glassfibre each	AM0421	4·10 + 18	☐
Dec 75	Disco System, Light Modulator		AM0423	2·70 + 18	☐
Jan 76	Music Box	SRBP	DN1/JM	2·25 + 18	☐
		glassfibre	DN1/JM	3·00 + 18	☐
Jan 76	Emergency Light Unit		AM0419	3·50 + 18	☐

Post and packing is for one board. For each additional board add 4p to the 10p or 18p rate as applicable. Prices include VAT.

I enclose Postal Order/Cheque No.......................... for £................ made payable to READERS PCB SERVICES.

NAME..

ADDRESS ....

....

.... Post Code ....

Any correspondence concerning this service must be addressed to READERS PCB SERVICES and not to the Editorial offices.

NEWS... NEWS... NEWS...

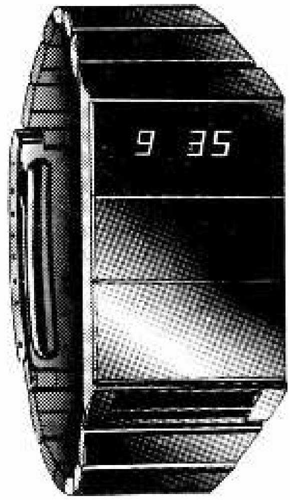
Sinclair digital watch

THE watch is controlled by a quartz crystal and on command displays either hours and minutes or minutes and seconds, depending on the switch that is operated. The display is internally timed for one second or will stay on as long as the switch is closed. The two operating switches are located on the watch front beneath the LED display. There is a third switch on the rear which permits setting of the watch and holding of the time to which it has been set. Closing the read hours and minutes switch and then depressing the set switch will clock hours round at the rate of one per second and similarly depressing the minutes and seconds switch followed by the set switch will clock minutes round at one per second. Seconds are automatically reset to zero. Depressing the set switch only will stop the watch and hold the set time.

Sinclair guarantee an accuracy of better than one second per day and typically several times better than that will be obtained. The accuracy is fundamentally determined by the quartz crystal and the precision to which this is trimmed. The watch is powered by two small mercury cells and will give a life of typically one year dependent on the frequency with which the display is used.

The electronic circuitry to control the watch is all contained on a single integrated circuit which Sinclair Radionics have designed using injection logic technology. The chip requires only a quartz crystal, a trimmer capacitor, an LED display and batteries to complete the electrical line-up.

Three years ago, having spent a considerable time reviewing and analysing various technologies appropriate to electronic watches, Sinclair realised that the process which was gradually emerging from the research laboratories of Philips and IBM had both electrical parameters and cost potentials well-suited to a watch. The process is now known as I^2L and is capable of very low power consumption, having a speed power product of less than 1pJ, combined with an ability to supply



high peak currents without using excessively large output devices. The process is intrinsically capable of low voltage operation without needing tight parameter control.

A study carried out by the company showed that without recourse to fine geometries a chip area saving of 1·5:1 could be achieved compared with ion implanted CMOS devices and at the same time both segment and digit drive components could be incorporated on the chip. With one exception presently available CMOS chips require separate bipolar digit drivers. The process required careful development with an able semiconductor company, but it had a good start as it was based on a well-established bipolar process with a considerable amount of knowledge already to hand. The development lay in optimising a different range of parameters.

Close analysis of chip size, slice processing cost and yield showed that the balance should weigh considerably in favour of the bipolar technology and therefore a major design programme was undertaken.

The whole design was carried out by Sinclair engineers to the extent of producing an actual circuit layout, which was diffused and refined in conjunction with ITT in England. During all stages of both circuit and process development, close contact was maintained between the two companies to ensure that circuit parameters married up to process requirements and vice versa.

Part Exchange Scheme

HENRY'S-LINDAIR hi-fi and audio retail group is operating a new Part Exchange Department.

The firm states that customers who bring their old equipment into any Henry's-Lindair store will be given a reasonable 'trade-in' allowance which they may then use against the purchase of new equipment from that particular store. The trade-in equipment will then be passed to the Service Department, if necessary, where it will be tested and overhauled. It will then be sold through one of the group's newly established Bargain Centres in Edgeware Road and Tottenham Court Road, London, with a three month guarantee.

MORE NEWS . . . ON PAGE 758

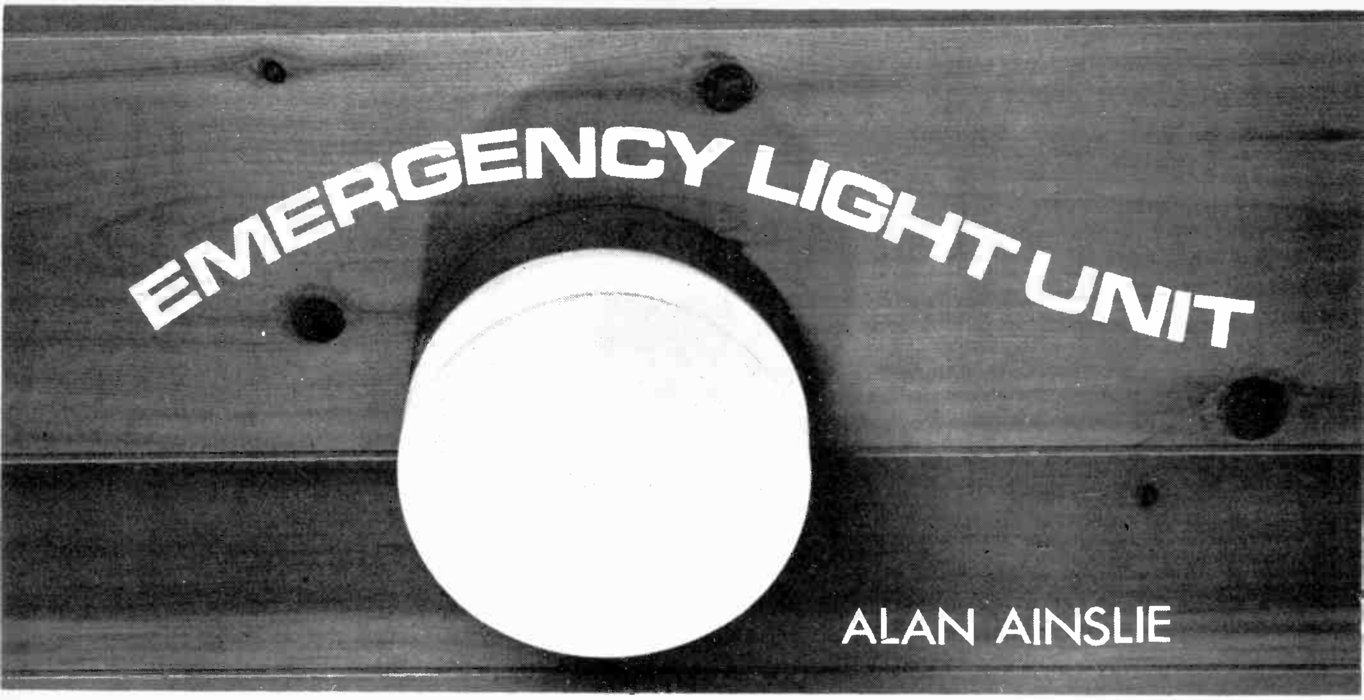
Arrow Stock Sheet

ARROW Electronics Ltd., recently sent us a copy of their latest stock sheet and price list. Included in it are their special low price specialities of COS-MOS logic devices and items ranging from a metal detector and S-Dec products to opto-electronic devices and jack plugs. A very useful list of available components and prices to have by the workbench.

If you would like a free copy of the Arrow list, send a stamped, self-addressed envelope to *Arrow Electronics Ltd., Mail Order Dept., P. W., 7 Coptfold Road, Brentwood, Essex, CM14 4BW.*

Aerialite

AERIALITE Aerials have transferred their sales, production and technical departments from Congleton in Cheshire, to Whitegate, Broadway, Chadderton, Oldham, Lancs, OL9 9QC. Telephone: 061-652 1111.



EMERGENCY LIGHT UNIT

ALAN AINSLIE

WITH another season of possible power failures approaching interest must again be centred on ways of lighting the home when the mains fail. This article describes an Emergency Light Unit which will automatically illuminate a central position in a home during a power cut. The light output is sufficient to illuminate a hall or landing and stairs to prevent accidents in the dark. By using an inexpensive moulded commercial case the unit can be made to look very presentable, becoming a permanent part of the decor.

This unit is the type of 'luminaire' known as "non-sustained" as it lights up only under mains failure conditions. It belongs to the general class of '3-hour luminaires' although the rechargeable cells used allow a discharge period of over 4 hours. The 3-hour rating applies to a cycle period of 24 hours, i.e. one mains failure or less per day.

Circuit

A 6-0-6V transformer, Fig. 1, is permanently connected across the mains to provide both a charging current for the cells and a 'mains-on' reference voltage, which ceases when a mains failure occurs. Diodes D1 and D3 are connected as a full wave rectifier to charge the cells through the current limiting resistor, R1. The unit uses three nickel cadmium cells B1/3 giving a total terminal voltage of 3·75V to power three 3·5V 0·3A bulbs in parallel.

The specification for this class of Emergency Light Unit requires that it should be capable of operating on a 24 hour charge/discharge cycle. The lamps fitted to the unit consume almost 1A and for the specified 3-hour discharge period this represents 75% of the capacity of the 4Ah cells. In a 24 hour cycle therefore, a charging period of 21 hours is available to replace 75% of the cell capacity or 3Ah.

The value of R1 has been chosen to give approximately 250mA charging current recommended by the cell manufacturers as not giving rise to damage through overcharging, and which, in fact, replenishes the cells, after a 3 hour discharge at 1A, in 17 or 18 hours, safely exceeding the requirements of the specification.

A proposal to the British Standards Institute recommends that it shall be mandatory to have a warning should the cells fail to charge. This is to take the form of a long-life red indicator lamp monitoring the actual charging current, rather than the presence of a mains input to the 'luminaire.' In this design an LED is used with its limiting resistor

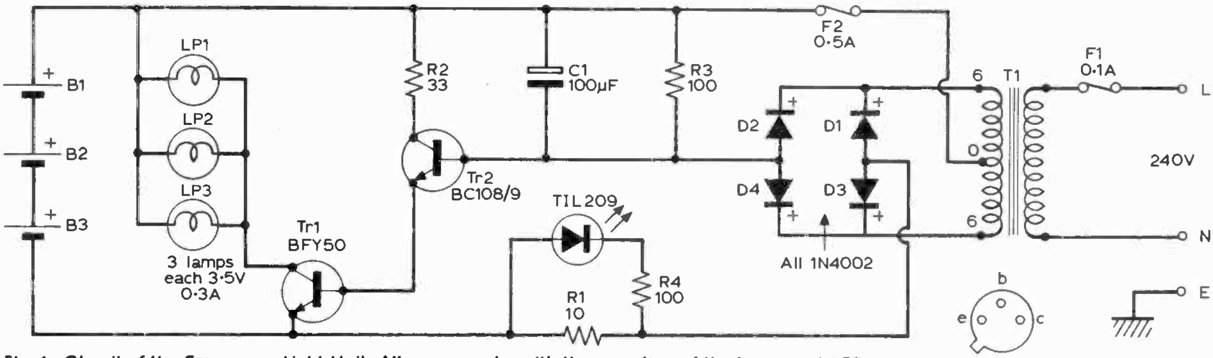


Fig. 1: Circuit of the Emergency Light Unit. All components, with the exception of the lamps and LED, are mounted on a single PCB.

to sense the voltage drop across R1, which is about 2·5V when the cells are charging normally. Should a cell become open circuit or a fault develop in the charger circuit then the voltage drop across R1 will fall to zero and the LED will go out, as proposed in the above recommendation. In practice the LED must be arranged so as to be visible at all times, easily arranged by placing the LED behind, but close to, the diffuser giving a patch of red light during normal charging.

The 'mains-on' reference voltage is produced by D2 and D4 which give −6V from the transformer relative to the positive side of the battery when the mains is applied. The reference voltage is smoothed by C1, to prevent 100Hz triggering of the lamp, and fed to Tr2 base which biases this transistor off by making its base more negative than its emitter. However, when the mains fail C1 discharges into R3 and Tr2 is no longer cut off. Base current through R3 turns on the transistor which in turn turns on Tr1 by effectively connecting R2 between its base and the positive supply.

Transistor Tr1 is supplied with such heavy base current through R2 and Tr2 that it saturates and behaves as a simple diode of low voltage drop in series with the cells and the bulbs. In practice a saturation voltage of 650mV is typical, corresponding to a power dissipation in Tr1 of only 600mW. With Tr1 saturated the bulbs receive about 3·3V and pass a little under 1A if three 0·3A bulbs are used. Higher current bulbs should **not** be used in an effort to increase the light output as Tr1 will fail to saturate and will overheat. It is possible to use a lower current load (3×0·15A bulbs, for instance) which will lengthen the maximum discharge time for the unit.

The Emergency Light Unit is equipped with two fuses, one of 0·1A on the primary side of the mains transformer and one of 0·5A on the secondary, designed to offer protection against a fire hazard in the event of any components failing. Only the specified types should be used otherwise the unit may be dangerous under fault conditions.

Construction

There are two possible ways of constructing the Emergency Light Unit; either as a self-contained lamp or as a 'control box' driving a separate decorative lamp. In the latter case the PCB is constructed as will be described and housed in a suitable cabinet, with any metalwork connected to mains earth. The LED to indicate cell charging should be mounted on the front of the control box and a small socket provided for connection to the bulb(s), which can be concealed in an ornamental oil lamp or something similar.

Self-contained 'luminaires' are most popular commercially and this unit was primarily designed to be both self-contained and attractive in appearance. A rather pleasing case for the unit is available in a choice of colours from British Home Stores as an interior light fitting. It is a simple matter to remove the reflector and lampholder fitted in the bottom of the case, as well as all metal attachments, to leave an empty shell into which the PCB and lampholder board can be fitted.

To ensure long term reliability a PCB, Fig. 2, has been designed to accommodate all the electronics. The board is octagonal as it has to fit in the bottom of the round case. It is convenient to mount the transformer first. The specified one is for PCB mounting.

★ components list

Resistors
R1 10Ω 2W, R2 33Ω, R3 100Ω, R4 100Ω
(R2/3/4 are ½W 5 or 10%)

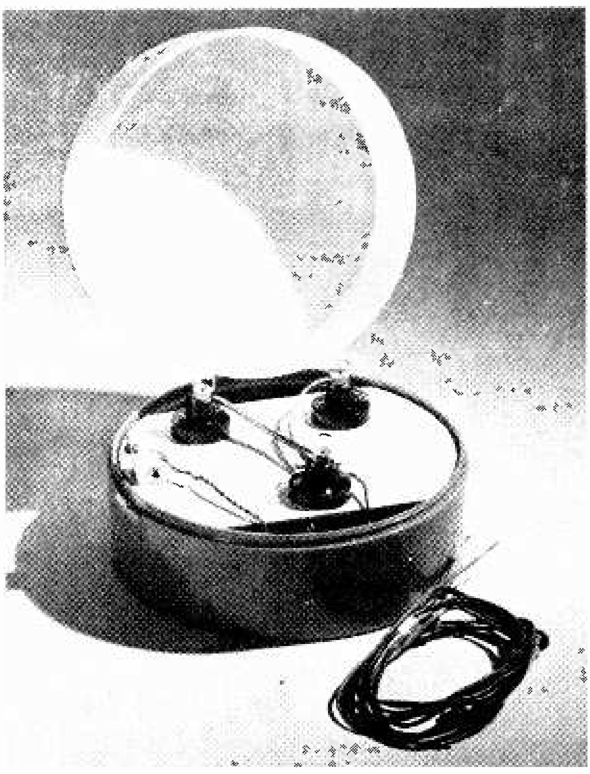
Semiconductors

Tr1	BFY50	Tr2	BC108 or 109
D1/4	1N4002	LED	TIL209

Miscellaneous
C1, 100μF 10V. T1, 240V primary, 6-0-6V 250mA secondary (B.B. Electronics, 1 Windsor Walk, South Anston, Nr. Sheffield, Yorks. Type EL3/6A £1·86 + 25p P/P). B1/3, Ever Ready NCC400 Style HB, or similar, 3 off. F1, 100mA 20mm fuse. F2, 500mA 20mm fuse. Fuse holders, for PCB, 2 off. Lamps, 3·5V 0·3A with holders, 3 off. Case, British Home Stores type 1914. TO5 heatsink for Tr1.

Alternatives can be used but mounting holes will have to be drilled in the board and the transformer connected with flexible leads.

All the other components, except the cells, can then be mounted as in the PCB layout drawing Fig. 3. The fuse holders are easier to mount if they are clipped on to a fuse before insertion into the board. Tr1 is fitted with a TO5 finned heatsink to keep it cool during discharge. Solder tags are inserted for the six external connections to the board. **The cells are inserted last** because, as received, they are partially charged and could damage partially completed



The completed 'luminaire'. The PCB is mounted in the bottom of the case, the lamp board resting on a rim inside the case. Both boards should be a tight fit in the case.

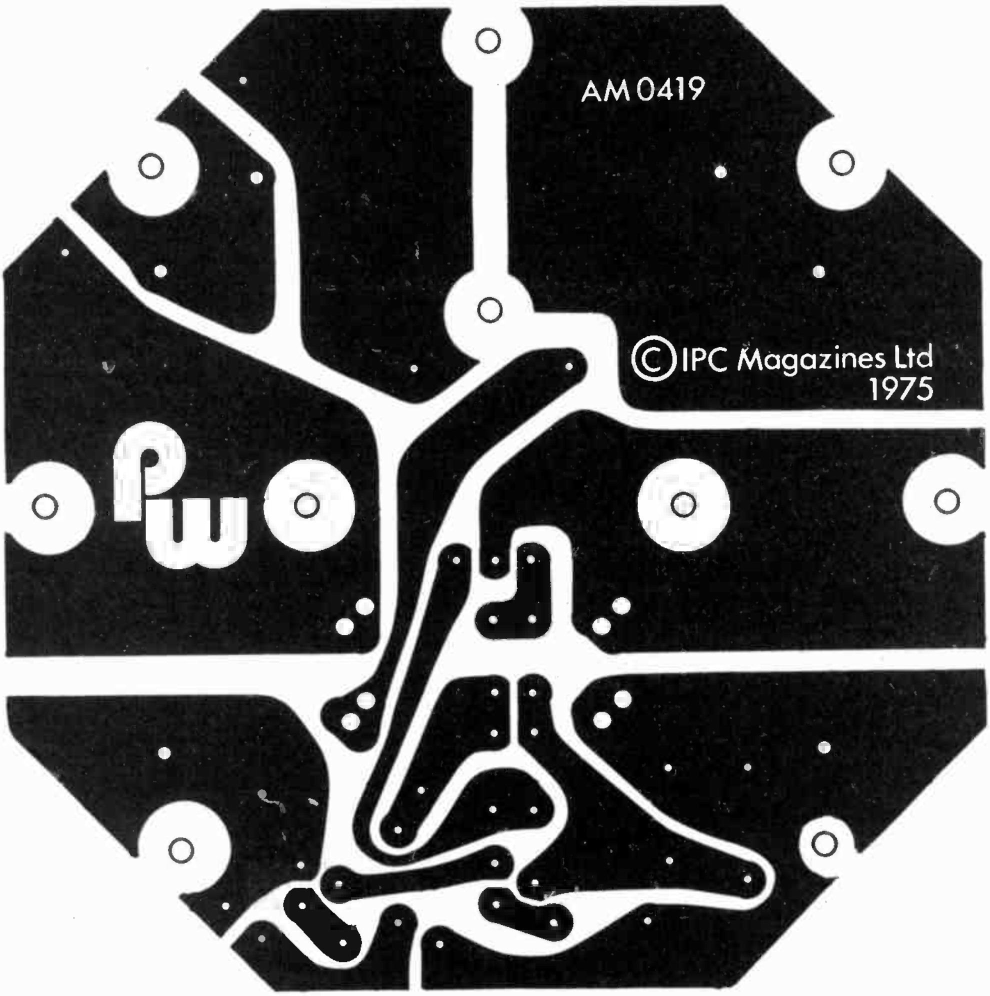


Fig. 2: Full-size layout of the PCB. Fig. 3: next page, shows the component layout. The cell retaining straps have been removed in this view.

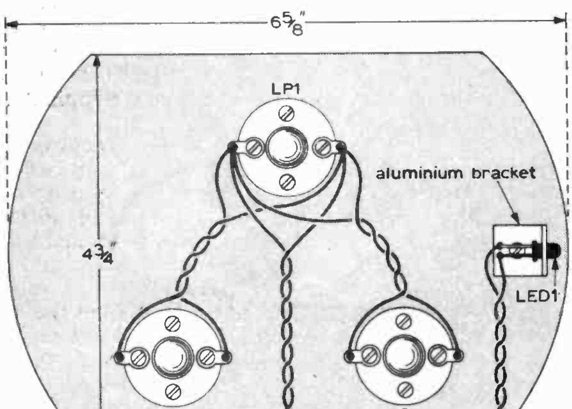


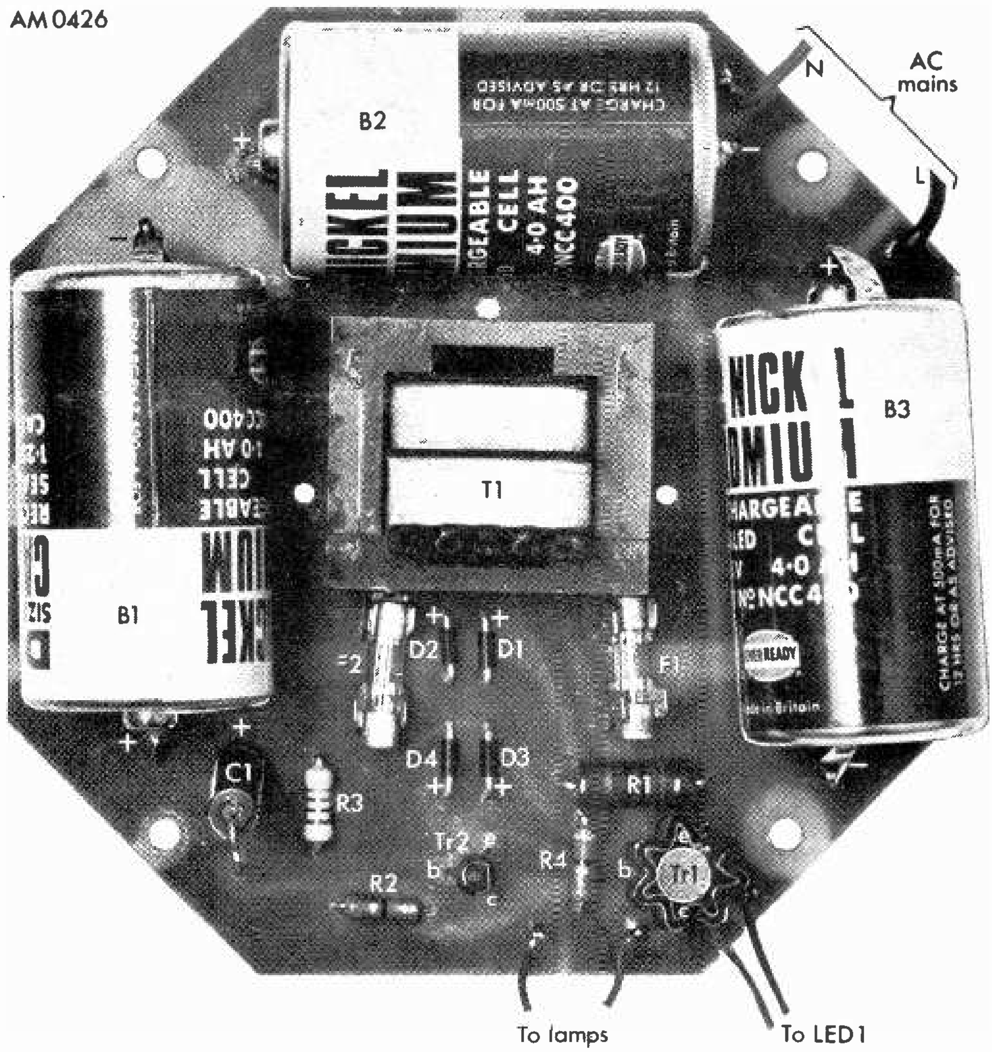
Fig. 4: The lamp board also carries the LED which should be bright enough to be visible through the translucent part of the case when the cells are charging normally. Diameter of the board will depend upon the actual case used by the constructor.

circuitry. Short lengths of tinned copper wire are used to connect the cells to the board and give some support. Small straps are then made from sheet tinplate, one for each cell held down on either side using the 6BA holes in the PCB. Alternatively, simple straps can be formed from thick copper wire passed through the holes, twisted and soldered under the board.

Three bulbs are used in the prototype and the three MES lampholders are mounted on a piece of perspex, fixed to the top of the bottom half of the case, and painted white to act as a reflector. The perspex is a tight push fit in the case and needs no mounting screws. A small bracket is made from aluminium to hold the LED against the translucent dome. All three lampholders are wired in parallel with a short length of flex left for connection to the PCB. Similarly a length of flex is soldered to the LED, Fig. 4.

(N.B. On no account should wood be used to make the lampholder board or any other part of the luminaire as this would present a fire hazard.)

The PCB is placed in the bottom of the case and a felt pen used to mark the position of the four mounting bolts. The base is then drilled to accept 4BA bolts which are held captive with nuts. This is necessary because the PCB has to be removed prior to installation to reveal the holes for the wall screws.



When the board has been mounted, the wires to the lampholder panel are soldered to the tags and the panel fixed in place.

After thoroughly checking all connections the mains can be connected to the input of the unit. The LED should glow indicating that the cells are being charged. A voltmeter across R1 should indicate a voltage drop of about 2·5V showing that the charging current is of the right order. After a period of ten minutes or so the cells should be sufficiently charged to run the lamps for a couple of minutes when the mains is switched off.

Installation

The unit can be mounted in any position as the cells are held by their straps. Should the unit be mounted on a ceiling it is important to check that the lampholder panel is a tight fit.

There are three mounting holes for woodscrews, in the bottom of the case, together with a central hole for the mains cable. With the PCB removed the bottom of the case is screwed to the wall or ceiling with a short length of mains cable left floating. The PCB is replaced and the mains input soldered in. Alternatively a short fly-lead with a terminal block can be used to save soldering at the installation stage. The lampholder board is pushed into position and the three bulbs tightened. At this stage, if the cells are charged, the bulbs will light because there is no mains input. With mains on the bulbs should extinguish and the LED will come on. Snapping the dome on completes the installation.

In use the Emergency Light Unit requires no maintenance other than a regular check, by switching the mains off, to ensure that it is operating correctly. The cells have an operating life of several years and providing that no extremes of temperature are encountered the need for replacement would be unlikely. Should the unit be used outside or where the temperature could drop below 10°C then the cell manufacturers recommend that precautions be taken to prevent damaging the cells by over-voltage during charging. Protection can be provided by connecting a 4·7V 2W zener diode across the cells, the cathode to the positive end of C1 and the anode to the emitter of Tr1.

Finally, a warning about the nickel cadmium cells used in this project. This type of sintered plate cell has an internal resistance of only a few milliohms which means that dangerously high currents will flow if a cell is accidentally short-circuited. They should therefore be treated with respect and kept in their packing until needed. PW

IC REV COUNTER

J. B. DANCE M.Sc

IN this article it will be shown how an integrated circuit especially designed for use in the automobile field can be employed as the heart of a simple engine 'rev counter'. These are much used in sports cars for rally driving to enable maximum performance to be obtained. They show the driver the optimum moment at which to change gear in order to obtain the best possible performance without the risk of damaging the engine by 'over-reving'. Rev counters can also be most instructive to the learner driver, whilst some car owners feel that they confer a prestige value on their vehicle.

The SAK115

The integrated circuit used in this project is the SAK115 which is manufactured by ITT Semiconductors. The device is encapsulated in a plastic dual-in-line case which has a metal tab on each side of the device and eight connecting pins.

The device has been designed for vehicles having negative earth since almost all modern cars are of this type. However, it will be shown that the same device can also be used with an extra transistor in a slightly more complex circuit for vehicles which have positive earth systems.

Negative earth

The use of the SAK115 in the simpler negative earth circuit of Fig. 1 will be considered first. Each time the contact breaker points on the car open, a voltage pulse is developed across them. Each pulse occurs at the same time as a spark in the engine. The number of pulses per minute (ppm) is thus proportional (but not equal) to the engine revolution rate. The pulses can therefore be used to drive the rev counter provided that each pulse causes a constant amount of charge to flow through the meter.

The input to the circuit of Fig. 1 is fed by the fairly high voltage pulses from the contact breaker which are then fed to the potential divider R1 and R2. Consequently, only about one-tenth of the original pulse amplitude is fed to pin 1 of the IC. The SAK115 is monostable and of the flip-flop type. Each pulse fed to pin 1 switches the circuit, so that the output voltage at pin 6 changes for a short time, during which time a current flows through the meter M1. At the end of the timed period the circuit automatically returns to its former stable state. The circuit remains in the latter state until the next pulse arrives.

The duration of the current pulse to the meter is determined by the product of C1, R3 and VR1. If the value of VR1 is increased, the length of the current pulse increases and so does the deflection of the meter. The trimmer VR1 can thus be employed to calibrate the circuit so that the correct readings are provided by the instrument. If the meter is to indicate the correct rpm under all conditions, the current which passes through the meter during any pulse must always have the same value. It must not, for example, vary with the battery supply voltage or the readings of the meter would depend on the charge/discharge battery current and on the state of charge of the battery.

In order to keep the amplitude of the current pulses through the meter fairly constant, a zener diode is incorporated to provide a relatively constant voltage supply to the IC. As the car battery voltage

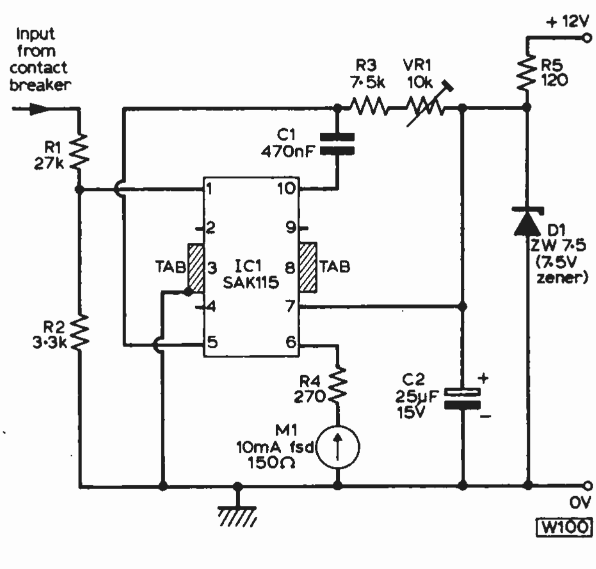


Fig. 1: Basic circuit of the rev counter utilising the SAK115 integrated circuit. The above circuit is only suitable for vehicles having a negative earth system.

changes, the voltage across the zener diode D1 remains virtually constant and the whole of the change of voltage appears across R5. The capacitor C2 smooths the supply to the IC and removes any stray pulses.

The duration and amplitude of each current pulse is fixed by the circuit component values, so each pulse from the contact breaker causes the same amount of charge to flow through the meter. The meter deflection is therefore proportional to the rate of revolution of the engine. Although the current through the meter actually consists of individual short pulses (each of a few thousandths of a second in duration), the mechanical inertia of the meter smooths out these pulses to give a virtually steady reading.

Noise pulses

The electrical system of a vehicle is notoriously noisy, consisting of transient changes in voltages at various points in the circuit, which would normally trigger a conventional monostable circuit and cause a high reading to be obtained. However, the SAK115 has been specifically designed for use in such noisy environments and cannot be triggered by pulses which have an amplitude of less than about 8V at pin 1.

The potential divider resistors R1 and R2 reduce any spurious input pulses still further and the circuit is therefore insensitive to pulses of less than about 80V at the contact breaker itself. In negative earth cars, a positive pulse considerably greater than this value is developed at the contact which is not earthed, each time the current ceases to flow through the ignition coil when the contacts open. It is the inductance of the coil which is responsible for the generation of these pulses.

The SAK115, being specifically designed for negative earth vehicles, is insensitive to negative-going pulses. This again greatly reduces the likelihood of incorrect readings being obtained due to triggering of the circuit by spurious pulses. Any negative pulses which reach pin 1 are shorted to earth by a diode inside the IC connected between pins 1 and 3.

A further advantage of the use of a purpose built IC is that the internal push-pull output stage of the device is specially designed to drive a moving-coil meter. It provides adequate drive even when the meter coil has a relatively high inductance and when the revolution rate is high.

★ components list

Resistors

R1	27kΩ	R5	120Ω
R2	3·3kΩ	R6	270Ω
R3	7·5kΩ	VR1	10kΩ vert preset, miniature
R4	270Ω (see text)		

All resistors 10% ¼W

Capacitors

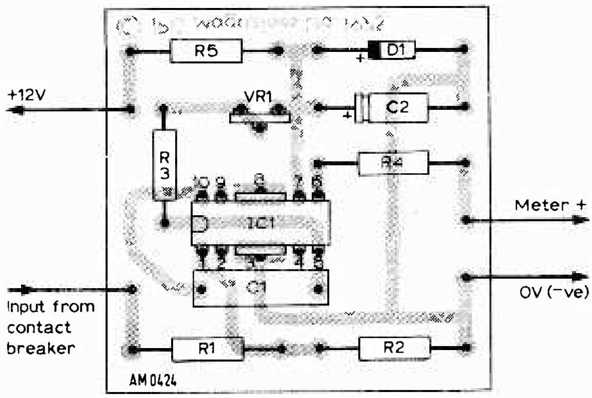
C1	470nF 25V	C2	25μF 15V

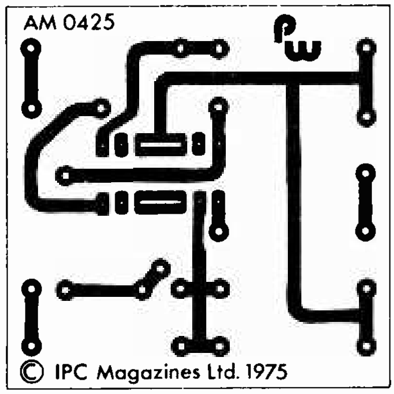
Semiconductors

IC1 SAK115—Available from Phoenix Electronics (Portsmouth) Ltd., 139-141 Havant Rd., Drayton, Portsmouth, Hants. PO6 2AA. Priced £1·14 each plus 48p VAT and p&p.
D1 ZW7·5 zener diode
Tr1 2N2904 or similar pnp transistor

Miscellaneous

M1, 0–10mA fsd moving coil meter. 50 x 50mm piece of veroboard, or pcb. T1, mains transformer with secondary 80 to 200V RMS. Br1, bridge rectifier or 4 rectifier diodes.





The suggested printed circuit board and component layout are shown actual size, and for negative earth systems only. It is also suggested that the board be suitably drilled, and mounted directly on the back of the meter.

The meter

The meter should be calibrated over the range required. For a small car, 6,000 rpm is about the maximum one should ever use, but in some sports-cars a value up to about 8,000 rpm is permissible. One therefore requires a meter scaled from zero up to about seven or eight for a typical small car, or possibly up to ten for a sports car. This allows an adequate margin at the top end of the scale. Unfortunately meters calibrated from zero up to about eight are not normally available.

The simplest solution is to employ a 10mA fsd meter, where each milliamp of the scale can be made to correspond to 1000 rpm. The uppermost part of the scale will not then be used. Constructors who are good at artwork will be able to make a scale marked

0-8,000 rpm from transfers (such as 'Letraset'). The top part of the scale could then be marked with a red band to show that the engine should not be taken to such a high rpm.

The current which flows through the meter under any conditions is inversely proportional to the sum of R4 and the meter resistance. The circuits shown are suitable for use with meters which have an fsd of about 10mA and a resistance of about 150Ω. If the meter resistance is much less than 150Ω, the value of R4 should be increased to make up the difference. Similarly, if a more sensitive meter is used, the total resistance of the meter circuit must be increased to reduce the current which flows under any specified pulse rate. The total resistance of the meter circuit of Fig. 1 is about 420Ω. If a meter with an fsd of 2mA is used, one-fifth of the current is required to obtain a given deflection, and therefore the total resistance in the meter circuit should be about 1·6kΩ.

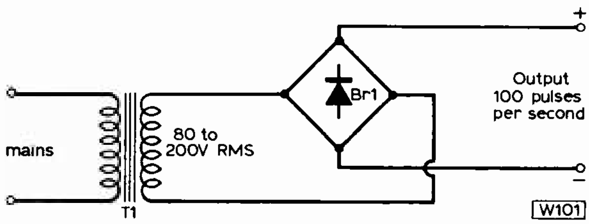


Fig. 2: The circuit shown here provides a simple method for obtaining an output of 6,000 pulses per minute. This is for the calibration of the circuits shown in Figs. 1 & 3.

Calibration

One can, of course, calibrate the circuit by driving the car at a known speed in a specified gear and getting a colleague to adjust VR1 so that the meter indicates the correct rpm for the speed and gear concerned, calculated from the vehicle manufacturer's data. This procedure is somewhat tedious and requires a constant speed to be kept up for at least a minute or so; in addition, it relies on the accuracy of the speedometer. It is more accurate however to make at least a preliminary bench adjustment of VR1 by feeding pulses at a known frequency into the circuit. The 50Hz mains supply is the obvious source, since it is easy to obtain 3,000 or 6,000 ppm by half-wave or full-wave rectification of the supply.

Most small cars are four cylinder, four stroke types, whose camshaft rotates at half the engine revolution rate, giving four sparks per revolution of this shaft. Thus the contact breaker provides two pulses to the rev-counter circuit per revolution of the engine. If 6,000 ppm are fed to the circuit, the trimmer VR1 must be adjusted so that the meter indicates 3,000 rpm.

The very simple circuit of Fig. 2 can be employed as a source of 6,000 ppm.

An AC output from the transformer of not less than about 80V is fed to the bridge rectifier circuit shown. This circuit inverts each alternative half cycle of the 50Hz mains voltage and thus produces 100Hz output of 6,000 ppm. The output from Fig. 2 must be connected with the correct polarity to the input of Fig. 1 or no meter reading will be obtained. The negative output line from Fig. 2 is connected to the OV line of Fig. 1, whilst the positive output is connected to the upper end of R1 of Fig. 1.

Although it is possible to feed the mains directly to the bridge rectifier of Fig. 2, this can be very dangerous in the hands of the inexperienced experimenter. It is far safer to use a transformer.

If a transformer with a secondary winding providing 80 to 200V RMS output is not available, a transformer providing a somewhat lower voltage may be used for the calibration, but R1 of Fig. 1 must be reduced during the calibration only, so that an adequate pulse reaches the IC.

6/8 cylinder vehicles

In the case of a six cylinder, four stroke vehicle, the cam shaft again rotates at half engine speed, but there will be six pulses per rotation of the cam shaft instead of four. The contacts therefore provide three pulses per engine revolution. Thus when the bridge circuit of Fig. 2 is used to provide 6,000 ppm VR1 should be adjusted so that the meter indicates 2,000 rpm.

In the case of an eight cylinder, four stroke vehicle, each engine revolution produces four pulses from the contact breaker. When the circuit of Fig. 2 is used, VR1 should be adjusted so that the meter shows 1,500 rpm. In the case of six and eight cylinder vehicles, it may be necessary to increase R4 somewhat in order to achieve correct readings. A value of 390Ω for six cylinder cars and 560Ω for eight cylinder cars should be suitable, but these values are not critical and it is only necessary to ensure that VR1 can be adjusted to give the correct reading.

Once the circuit has been calibrated using the mains frequency it can be fitted into the vehicle and should require no further attention. However, recalibration will be necessary if a meter of different internal resistance is employed or the zener diode is changed.

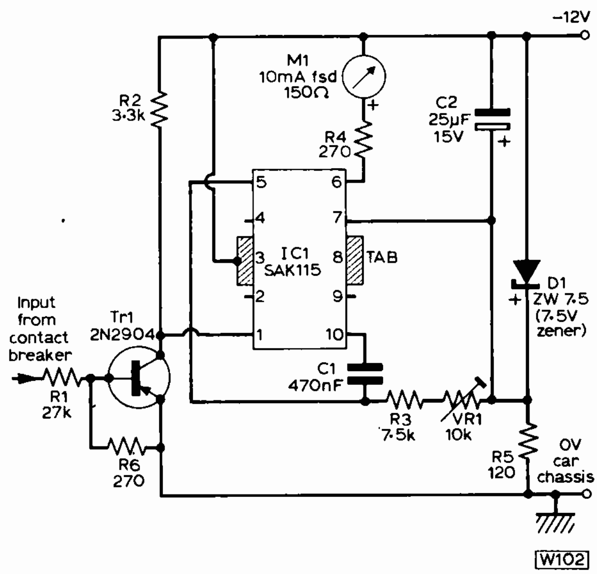


Fig. 3: The above circuit is similar in design to that shown in Fig. 1, but is only suitable for vehicles having a positive earth. The purpose of the transistor is to amplify and reverse the polarity of the pulses.

continued on page 765.

I can just imagine the old chap bawling at Rudolph "Here's another nice mess you've landed us in!" And there's Rudolph smirking all over his face, fondly imagining he's another Biggles. They've certainly a lot of ground to cover to deliver all those toys, not to mention all those gorgeous Home Radio Components Catalogues!

Don't worry . . . they'll soon carry out some make-shift repairs and your catalogue will arrive on time. That is, assuming you have ordered one! You *have* ordered one . . . haven't you? If not, please order right away. It certainly is the most useful present you could give the electronics enthusiast. So, if you have a son, grandson or nephew who's been bitten by the electronics bug, just send them one, and then every time they use it (which will be often) they'll think "what a clever feller you are!"

Of course, you already own one yourself? No? Then treat yourself right away . . . you deserve it! The catalogue has 240 pages listing about 6,000 items, of which nearly 2,000 are illustrated. The cost for that little lot is 85p plus 45p postage and packing, but the catalogue has 14 vouchers, which when used as directed enable you to claim back 70 pence. Send the coupon below, with your cheque or P.O. for £1·30 today.

I showed this advert to my grand-daughter and she asked "Is a victory roll something you eat?" It therefore occurred to me that the point of the cartoon might escape our younger readers, so here is the explanation. During World War Two, if one of our fighter pilots shot down an enemy aircraft, when he returned to base he did a slow roll over the aerodrome before landing; hence the term "Victory Roll."

A Happy Christmas to all our readers.

Please write your Name and Address in block capitals

NAME ....

ADDRESS ....

....

....

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

(Regn. No. London 912966)

HOME RADIO (Components) LTD. Dept. PW, 234-240 London Road, Mitcham, CR4 3HD Phone 01-648 8422

AIRCRAFT H.F. Rx type R4187 & Control box these are a crystal controlled Rx intended for remote control and will provide up to 24 channels in the range 2·8 to 18Mc/s the Rx is a dual conversion type with I.F's of 2·15Mc/s & 100Kc, 2 RF stages, RT & CW IF filters BFO, N.L. O/P stage etc. uses 16 B7g type valves, normal power I/P 24v & 19v DC (or 200v HT & 19v) uses type Hc6/u crystals not supplied. Supplied with control box & manual **£16·20. SIGNAL GENERATOR** Marconi type TF144G 85Kc to 25Mc/s in 8 bands, fine & coarse Atten, O/P meter for use on 240v mains tested with Inst book & circ. **£26. V.H.F. RADIO** Control box fitted with fine & coarse freq selector turrets these contain a total of 54 Hc18 type crystals (these are miniature wire ended type) covering the freq range 13·51 to 19·87Mc/s the crystals can be removed or unit can be used as it is (reqs 19v & 200v) a full list of crystal freq available on request **£7. SONAR IND UNITS** modern style unit with 5″ sq flat face electrostatic tube with dual beam & Blue/Yell phosfor, module construction with approx 40 min & sub min valves, as Int RF type EHT unit 2·7Kv, 17Kc crystal, A.F. O/P channel, 3 counter dials linked to CRT cursors. In their original application the CRT gives dual beams sweeping from bottom to top of CRT at low speed (CRT as two separate deflection & gun systems) these units req ext HT & 24v supplies, no circ but some data supplied. New boxed **£14·50** S/H **£12·50. DISH AE** 18″ dia 4″ deep at centre very rigid in plain Ali new boxed **£3·70. PYE VANGUARD** R.T. units for 12v DC set up for 70/85Mc/s range, RF O/P 20 watts, double conversion Rx, with x transis I.F. & O/P section, supplied less Tx & Rx crystal (2nd L.O. crystal supplied) supplied with circ & crystal data, less accs. **£10·60** R1155B Rx unit few of these well known Rx cover Long & Med wave plus 2 S.W. 3 to 18Mc/s fitted N type drive, tuning Ind, complete with DF section, as BFO etc 7 valves in Rx plus 3 in DF reqs ext supplies of 220v 60Ma & 6·3v supplied tested with copy of manual **£30** also a few N L & N models these have 1·5 to 3Mc/s band at **£36. YAXLEY SWTS** all new unused larger type Inst swts 8p 12w 8b & 2p 23w 2b **£1·40** ea, 7p 23w 7b **£1·70** & 6p 12w 6b **£1·20. T.V. FILTER UNITS** made to fit in Ae lead fully Ali box 4½ x 1½ x 1½″ fitted standard coax plug & sk new 4 for **£1·20.**

MANUALS & CIRCS. R1155A to N, 62 Set, CT38, 13A Scope, AR88D or LF, HRO, 1049 scope, R4187 & C/Bx R1475 all **£2·60** ea. R1392 A & B, 31 set, CT52/84, Cont Meter No. 1, Sig Gen 1632 all **£1·60** ea. R107 **£2·70**, R209 Mk 1, 2 **£1·80**, CR100 (B28) **£4·10.** 19 set **£2·65**, 88 set **£1·45**, TF144 **£1·40**, CT316 **£2·40.** 52 Rx **£1·35.** 730/4 **£2·30.** S640 **£1·40.**

CIRCS ONLY. 1035 Mk 1, 2 or 3, 1049 Mk 3, B44, CRT26, R220, R3673, PCR, 2 & 3, B40B, C or D, 38 set AFV, CT54, BC624/5 TF801 ARR-2, APN-9, all **£1** ea. PYE Vang or Ranger **£1·40** ea.

Above prices include Carriage/Postage & V.A.T. S.A.E. for list 14 or enquiry. Goods are ex equipment unless stated otherwise.

A. H. SUPPLIES

122 HANDSWORTH ROAD

SHEFFIELD, S9 4AA

Phone 444278 (0742)

TRANSFORMERS

ALL EX-STOCK—SAME DAY DESPATCH

MAINS ISOLATING
PRI. 120/240V. SEC. 120/240.
CENTRE TAP WITH SCREEN
115V or 240V Sec. only

Ref. No.	VA (Watts)	£	p & p £
07	20	3·77	0·58
149	60	4·69	0·72
150	100	5·33	0·85
151	200	8·54	1·12
152	250	10·32	1·41
153	350	12·47	1·41
154	500	14·33	1·61
155	750	21·94	BRS
156	1000	30·57	BRS
157	1500	34·89	BRS
158	2000	38·92	BRS

12 and or 24 Volt
PRIMARY 240-250 VOLTS

Ref. No.	Amps 12v	Amps 24v	£	p & p £
111	0·5	0·25	1·54	0·28
213	1·0	0·5	1·86	0·58
71	2	1	2·41	0·58
18	4	2	2·97	0·72
70	6	3	4·43	0·72
108	8	4	5·09	0·85
72	10	5	5·50	0·85
116	12	6	5·80	0·97
17	16	8	7·48	0·97
115	20	10	10·91	1·61
187	30	15	14·20	1·41
226	60	30	17·67	BRS

30 VOLT RANGE
Prim. 200-240V
Sec. 0-12-15-20-24-30V

Ref No.	Amps	£	p & p £
112	0·5	1·90	0·58
79	1·0	2·52	0·72
3	2·0	3·77	0·72
20	3·0	4·70	0·85
21	4·0	5·56	0·85
51	5·0	6·73	0·97
117	6·0	7·52	1·12
88	8·0	10·20	1·25
89	10·0	10·36	1·41

50 VOLT RANGE
Prim. 200-240V
Sec. 0-19-25-33-40-50V

Ref No.	Amps	£	p & p £
102	0·5	2·71	0·58
103	1·0	3·55	0·72
104	2·0	4·95	0·85
105	3·0	6·10	0·97
106	4·0	7·98	1·12
107	6·0	12·71	1·25
118	8·0	13·63	1·61
119	10·0	17·75	BRS

60 VOLT RANGE
Prim. 200-240V
Sec. 0-24-30-40-48-60V

Ref. No.	Amps	£	p & p £
124	0·5	2·48	0·72
126	1·0	3·68	0·72
127	2·0	5·33	0·85
125	3·0	7·90	0·97
123	4·0	9·19	1·41
40	5·0	10·24	1·25
120	6·0	12·07	1·41
121	8·0	15·75	BRS
122	10·0	19·40	BRS
189	12·0	20·25	BRS

AUTO TRANSFORMERS

Ref No	VA (Watts)	Auto Taps	£	p & p £
113	20	0-115-210-240	1·75	0·51
64	75	" "	3·05	0·72
4	150	0-115-200-220-240	4·33	0·72
66	300	" "	6·11	0·85
67	500	" "	9·36	1·25
84	1000	" "	14·36	1·61
93	1500	" "	19·02	BRS
95	2000	" "	25·41	BRS
73	3000	" "	36·84	BRS

CASED AUTO TRANSFORMERS
240V mains lead input & USA 2 pin outlets

20VA	£3·29	P&P £0·72	Ref 113W
150VA	£6·37	P&P £0·85	Ref 4W
500VA	£10·97	P&P £1·25	Ref 67W
1000VA	£18·39	P&P BRS	Ref 84W

SCREENED MINIATURES

Ref	mA	Volts	£	p&p p
238	200	3-0-3	1·62	39
212	1A, 1A	0-6, 0-6	1·93	46
13	100	9-0-9	1·56	25
235	330, 330	0-9, 0-9	1·64	25
207	500, 500	0-8-9, 0-8-9	2·02	51
208	1A, 1A	0-8-9, 0-8-9	3·07	58
236	200, 200	0-15, 0-15	1·56	25
214	300, 300	0-20, 0-20	2·01	58
221	700(DC)	20-12-0-12-20	2·38	58
206	1A, 1A	0-15-20, 0-15-20	3·61	72
203	500, 500	0-15-27, 0-15-27	3·15	72
204	1A, 1A	0-15-27, 0-15-27	4·14	72
S112	500	12, 15, 20, 24, 30	1·97	58

HIGH VOLTAGE
Mains Isolating
Prim. 200/220 or 400/440
Sec. 100/120 or 200/240

VA	Ref	£	p & p £
60	243	4·37	0·97
350	247	10·93	1·41
1000	250	26·31	BRS
2000	252	44·12	BRS

PLUS

BRIDGE RECTIFIERS

50V	2A	35p
100V	2A	40p
200V	1A	45p
400V	4A	65p
600V	2A	50p
500V	10A(PM 7A6)	£2·35

P & P 15p

TEST METERS

AVO 8 MK5	£55·88
AVO 72	£21·72
U4313*	£13·85
U4315*	£11·80

*(USSR) inc. steel carrying case
P & P £1·10

ANTEX SOLDERING IRONS
15W **£2·68** 18W **£2·45** 25W **£2·26**
SOLDERING IRON KIT **£3·61**
STAND FOR ABOVE **£1·13**
P & P 25p

MAGNETIC TO CERAMIC CARTRIDGE CONVERTOR
OPERATING VOLTAGE 20-45V
ONLY **£2·65** *P & P* 18p

INSTRUMENT CASES
(in two sections, black vinyl covered top and sides and bezel)
P & P 25p

Length	Width	Height	Price
8″ x	5¼″ x	2″	£1·25
11″ x	6″ x	3″	£1·62
6″ x	4¾″ x	1½″	£0·92
9″ x	5¼″ x	2½″	£1·39

POWER UNIT
CC12-05 Output Switched
3-4-5-6-7·5 5-9-12V at 500mA
£4·08. *P & P* 48p

HIGH QUALITY MODULES

3 Watt RMS AMPLIFIER	£2·30
5 Watt RMS AMPLIFIER	£2·65
10 Watt RMS AMPLIFIER	£2·95
25 Watt RMS AMPLIFIER	£3·95
PRE-AMP for 3-5-10W	£4·03
PRE-AMP for 3-5-25W	£13·20
POWER SUPPLIES 3-5-10W	88p
POWER SUPPLIES 25W	£3·00
TRANSFORMER 3W	£1·48
TRANSFORMER 5-10W	£2·13
TRANSFORMER 25W	£2·60
P & P Amps/Pre-Amps/Power Supplies	18p
P & P Transformers	37p

BSR MINI-DECK
4 SPEED AUTO CHANGER **£6·00**
P & P 72p

CAR STEREO SPEAKERS
8ohm ANGLED **£3·56** pr *P & P* 51p

CARBON POTENTIOMETERS
LOG and LIN *P & P 12p each*
4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M

Single Less Switch	14p
Single D.P. Switch	26p
Tandem Less Switch	43p
1K LIN Less Switch	14p

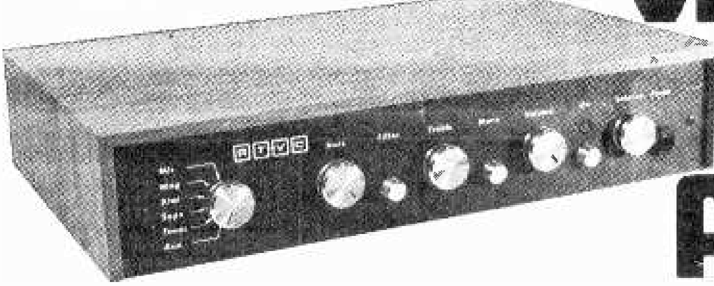
PLEASE ADD 8% VAT AFTER P. & P.
AUDIO ACCESSORIES & BARGAIN COMPONENT PAKS
ELECTROSIL & SEMICONDUCTOR STOCKIST
Callers Welcome (Mon.-Fri.) or send stamp for lists.

Barrie Electronics Ltd.

3, THE MINORIES, LONDON EC3N 1BJ
TELEPHONE: 01-488 331/8
NEAREST TUBE STATIONS: ALDGATE & LIVERPOOL ST

SPECIAL PRODUCT REPORT

RT-VC VISCOUNT IV STEREO AMPLIFIER



YOU may have noticed in the sparkling advertisements for sparkling amplification gear that when it comes to output wattage there is usually more sparkle than watts-per-pound sterling. For some time RT-VC have specialized in offering concrete value-for-money in their range of products. From my expereince of the range one can find very useful equipment performance without the fancy treatment that characterises goods offered by the 'Big Boys'. This does not mean that looks are placed second; indeed the result a happy compromise of both appearance and performance. For those of us on a restricted budget it is surely good that such firms can still hold their head above water. Quite obviously there is a strong market for watts without frills.

FIRST LOOK

I have just been living with the new Viscount IV stereo amplifier and find the unit most suitable for inclusion within a stereo system where that difficult combination of power and price seem to get out of balance.

The quoted specifications are given below and were borne out in practice. Laboratory data does not always check out with practical realisation (theory into practice and all that) thus more time was spent in the subjective appraisal of this unit. However, under lab conditions I am glad to report that the unit was able to provide 20W RMS of true-blue power from each channel at 1kHz! With both channels driven simultaneously nigh-on 16W was throbbing into each load resistor.

Frankly, I do not know of any other equipment available that is completely built, ready for connection to the mains, looks good and offering this solid output power at the price. The Viscount IV is compact and features a slimline appearance within its real teak veneered case. No plastic 'simulation'!

FACILITIES

The front panel incorporates the bright aluminium and matt black of more costly units. No less than six varieties of input signal can be selected by the switch seen at the left side of the fascia. Next along are two rotary wide-range tone controls affording adjustment of the bass and treble ends of the audio spectrum. Between these is a pushbutton activating the low-pass filter so attenuating HF scratch from carelessly kept records.

A stereo-mono pushbutton offers useful flexibility and some devious minds may even care to indulge in a little mono-mixing or perhaps have different sounds in different rooms. The volume control is conventional in that both channels are affected equally while the balance control enables either channel to be reduced to zero level without disturbing its partner.

Two remaining features at the front are the on-off push-button with flush mounted indicator lamp and a ¼in. diameter stereo headphone socket. Clear labelling is a feature of both front and rear, right down to the pinning of the DIN input sockets. Certainly this avoids the confusion in referring to drawings where the artist has forgotten to mention whether the diagram refers to a plug or a socket!

Four such sockets are provided on the rear panel to allow signals from magnetic cartridge, crystal cartridge, microphone, tuner, tape machine and one other auxiliary source to be coupled in to the audio system. The tape facility has in-out pinning to permit the single cord connection that eases the lot of the tape enthusiast. Outputs to speakers sees use of DIN sockets again for convenience. Also of sure convenience is the provision of two mains outlets in the US twin flatpin configuration that has been common on much imported audio apparatus. These outputs are activated with the amplifier itself. Unit protection is by a single 'slo-blo' fuse accessible from outside the case.

Well, that's the unit. Simple, yet incorporating many features not found on amplifiers costing more. Back in the lab for a second I'm glad to report that no sign of crossover distortion was evident at any output level. Traces seen on the scope screen were always clean, right up to the unit's clipping point where evidence of the latter was observed to be symmetrical.

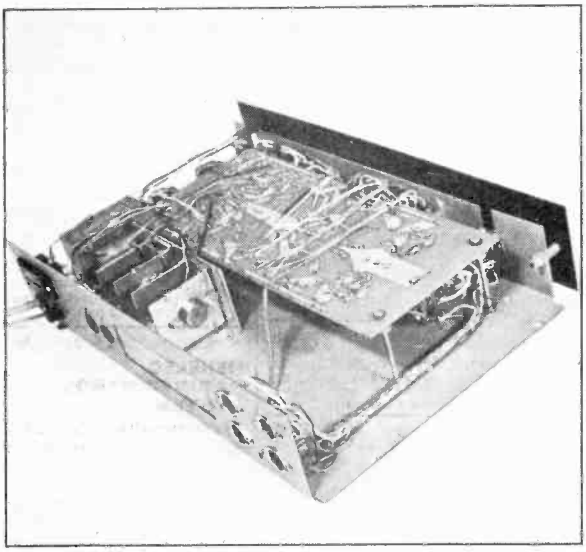
SPECIFICATION

Power Output	20+20W RMS into 8Ω
Speakers	8 to 15Ω
Total Distortion	Better than 0·2% @ 10W
Six Switched Inputs	1. Mag PU 3mV @ 47kΩ 2. Crystal/Ceramic PU 50mV @ 50kΩ 3. Tape 140mV @ 50kΩ 4. Tuner as 3. 5. Microphone 3mV @ 50kΩ 6. Auxilary as 3.
Frequency Response	25Hz to 25kHz @ full rated output
Signal/Noise Ratio	Better than −50dB at all inputs
Tone Control	Bass ± 15dB @ 50Hz Treble ± 12dB @ 10kHz
Supply	200/250VAC 60W
Dimensions	15¼" wide, 3" high, 10" deep (388 x 77 x 254mm)

CONCLUSIONS

Wired up to the normal components of my audio system the amplifier certainly gave a good account of itself. Amazingly so in view of the price, especially compared to the price of my normal amplifier! I tried many types of signal source and all were processed by the Viscount IV in a very satisfactory manner. Using a pair of inelegant and not very expensive loudspeakers I found that the wide range of tone control available from the unit was able to replace what was obviously lacking in the speakers. Coupled with a significantly more expensive pair of speakers the range of control available from those controls marked 'bass' and 'treble' was very marked. Some 'disco-bass' sounds were recreated right in my living room! With more natural settings of these controls and in conjunction with a broad range of listening material, extending from rock to the classics, I was able to enjoy a pleasingly smooth performance. Distortion, especially that ugly crossover type, was indiscernible.

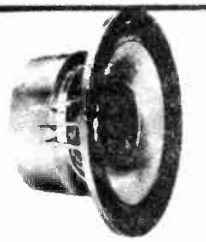
The range of output powers employed in the listening tests extended from the 'normal' background levels used when guests are present right up to fruity power levels I sometimes like to indulge in when alone (I think my neighbours have either become used to me or fled the district).



Plenty of room inside, with the output transistors well clear of the rest of the circuitry.

I found myself constantly referring back to the price of the amplifier the more it seemed to please me in sheer performance. The only peculiarity that bothered me, and I must say that I did become used to it, was the unorthodox positions of the knob datum lines. These appear to have a middle position at five o'clock and while unnatural at first it could even be a fresh novelty in these days of style-oneupmanship by the manufacturers. In all then a very versatile amplifier with power enough for most domestic installations. I would recommend it highly where funds are particularly tight, where kit-building is 'out', and where upgrading of an existing installation is called for without breaking the bank. Altogether extremely good value for money.

The RT-VC Viscount IV Stereo Amplifier retails at £27·50 including VAT and is available separately or as part of a complete Hi-Fi system. Many permutations are available for the Hi-Fi enthusiast with an eye on cost and good performance. For further information on the complete RT-VC Viscount IV Stereo System, please refer to their advertisement in this issue. **RT-VC 21C High Street, Acton, London, W3,** and **323 Edgware Road, London, W2.**



WILMSLOW AUDIO

THE Firm for speakers!

SPEAKERS

Baker Group 25 3, 8 or 15 ohm	£8·64
Baker Group 35 3, 8 or 15 ohm	£10·25
Baker Group 50 12 8 or 15 ohm	£14·00
Baker Deluxe 12" d/cone	£13·75
Baker Major	£11·67
Baker Regent	£10·00
Baker Superb	£18·12
Baker Auditorium 12	£16·25
Celestion MH1000 horn, 8 or 15 ohm	£13·50
Celestion PS8 for Unilex	£3·75
Celestion G12M 8 or 15 ohm	£12·95
Celestion G12H 8 or 15 ohm	£15·95
Celestion G15C 8 or 15 ohm	£28·95
Celestion G18C 8 or 15 ohm	£34·50
EMI 13 x 8" 150 d/c 8 ohm	£2·94
EMI 13 x 8" type 350 8 or 15 ohm	£9·56
EMI 13 x 8" 25 watt base	£9·00
EMI 6½" 93850 4 or 8 ohm	£4·37
EMI 8 x 5 d/cone, roll surr 10 watt	£3·95
EMI 14 x 9" Bass 8 ohm	£13·25
Eagle DT33 30 watt tweeter	£6·31
Eagle HT15 horn tweeter	£4·40
Eagle CT5 cone tweeter	£2·08
Eagle CT10 tweeter 8 or 16 ohm	£3·00
Eagle MHT10 horn tweeter	£4·44
Eagle crossover CN23, CN28, CN216	£1·75
Eagle FR4	£6·12
Eagle FR65	£9·62
Eagle FR8	£12·31
Elac 9 x 5, 59RM109 15 ohm, 59RM114 8 ohm	£3·44
Elac 6½" 6RM171 d/c roll surr.	£4·06
Elac 6½" 6RM220 d/cone	£3·12
Elac 4" tweeter TW4	£1·75
Elac 8" 8CS175 3 ohm	£2·87
Fane Pop 15 watt 12"	£5·25
Fane Pop 25/2 25 watt 12"	£7·50
Fane Pop 50 watt 12"	£12·00
Fane Pop 55 60 watt 12"	£13·95
Fane Pop 60 watt 15"	£17·25
Fane Pop 100 watt 18"	£25·95
Fane Crescendo 12A 100 watt 12"	£34·50
Fane Crescendo 12B bass	£36·50
Fane Crescendo 100 watt 15"	£47·50
Fane Crescendo 150 watt 18"	£62·95
Fane 801T 8" d/c roll surr.	£9·95
Fane 807T 8" d/c roll surr.	£5·75
Fane 808T 8" d/c	£3·95
Fane 910 horn	£14·95
Fane 920 horn	£33·95
Goodmans 8P 8" or 15 ohm	£5·50
Goodmans 10P 8 or 15 ohm	£5·80
Goodmans 12P 8 or 15 ohm	£13·95
Goodmans 12P-D 8 or 15 ohm	£16·95
Goodmans 12P-G 8 or 15 ohm	£15·95
Goodmans Audiomax 12AX 100 watt	£36·50
Goodmans Audiomax 15AX	£40·25
Goodmans 15P 8 or 15 ohm	£21·00
Goodmans 18P 8 or 15 ohm	£36·00
Goodmans Hifax 750	£16·00
Goodmans Axent 100 tweeter	£8·44
Goodmans Audiom 100 12"	£13·90
Goodmans Axiom 402 12"	£20·00
Goodmans Twinaxiom 8	£10·14
Goodmans Twinaxiom 10	£10·75
Kef T27	£6·06
Kef T15	£6·94
Kef B110	£8·37
Kef B200	£9·50
Kef B139	£16·95
Kef DN8	£2·31
Kef DN12	£5·99
Kef DN13	£4·50
STC4001G super tweeter	£6·56
Richard Allan CG8T 8" d/c r/surr.	£7·50
2½" 64 ohm, 70mm 80 ohm, 70mm 8 ohm	·77
2½" 75 ohm	·55
7" x 4" 3 or 8 ohm	£1·65
8" x 5" 3 or 8 ohm	£1·75
10" x 6" 3, 8 or 15 ohm	£2·69

Prices correct at 3.10.75.

SPEAKER KITS

Baker Major Module	each £13·44
Goodmans Mezzo Twinkit	pair £47·19
Goodmans DIN 20	each £14·75
Helme XLK 30	pair £19·00
Helme XLK 35	pair £24·00
Helme XLK 40	pair £35·00
Helme XLK 50	pair £56·00
Keffit 1	pair £53·00
Keffit 3	each £48·00
Richard Allan Twinkit	each £10·95
Richard Allan Triple 8	each £16·50
Richard Allan Triple 12	each £23·95
Richard Allan Super Triple	each £28·75
Richard Allan RA8 Kit	pair £42·00
Richard Allan RA8Z Kit	pair £63·00
Wharfedale Linton 2 kit	pair £23·12
Wharfedale Glendale 3 kit	pair £40·62
Wharfedale Dovedale 3 kit	pair £63·12

PA/DISCO AMPLIFIERS

(carr. and ins. £1)

Baker Major 100 watt	£57·25
Linear 30/40	£30·00
Linear 40/60	£35·00
Linear 80/100	£58·95
Linear 100 watt slave	£44·00

Eagle PA range in stock—ask for catalogue

Free with speaker orders over £7—

"Hi-Fi Loudspeaker Enclosures" book. All units guaranteed new and perfect. Prompt despatch. Carriage and packing: speakers 50p each, 12" and up 75p each. Speaker kits 80p each (£1·60 pair) tweeters and crossovers 30p.

Including V.A.T. 25% on Hi Fi, 8% on PRO and PA

WILMSLOW AUDIO (Dept. PW)

Loudspeakers: Swan Works, Bank Square, Wilmslow, Cheshire. SK9 1HF
Discount Radio, PA, Hi-Fi: 10 Swan Street, Wilmslow

Send stamp for free booklet "Choosing a Speaker"

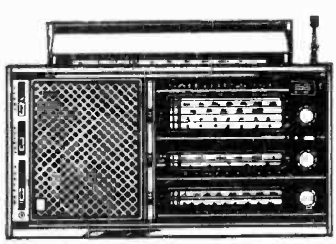
The Ultimate Radio!

GRUNDIG SATELLIT 2000

You've got your yacht, private aircraft, Rolls Corniche?—then all you need for a full set of status symbols is this latest model Grundig Satellit, Germany's top radio! Radio performance, appearance and sound quality are all superb. VHF FM, MW, LW, 10 SW bands plus band-spread, 27 transistors and 22 diodes, Battery/Mains (110/240v) 2 speakers, 57" telescopic aerial.

Our price **£161·45** inc. carr., ins. and VAT.

Big discounts on Grundig, ITT, Koyo, etc. Send stamp for list.



WILMSLOW AUDIO
DEPT. (PW),
10 Swan Street,
Wilmslow, Cheshire.

Wire Wound Resistors. Our selection of mixed values. 30 for **£1·40**. 100 for **£3·50**.

Audio Amplifier Module. Mullard LP1173, output power, nominal 10 watt, supply voltage +24 volt, with data and circuit, **£2·30** + post.

Ferguson Stereogram chassis Model 3357, all transistor, medium long, VHF/FM. 3 watts per channel S/M. with connection data, less tuning scale, **£18·00.** Post paid.

Crystals HC6U: 52·03333 MHz: 52·02500: 52·01667: 51·56667: 51·58330: 37·76250: 37·75000: 12·895·8: 12·891·6: 12·700·0: 9·456·25: 9·455·55: 9·533·33: 9·531·94: 9·520·55: 9·090·62: 9·087·5. **50p** each.

Electrolytics. 32/32/32μF, 325v. 2"× 1¼" 35p: 80μF 150v 1¼" x 1" 20p: 2000μF 30v, 2½"×1" 25p: 2000μF 35v 3"×1" 30p: 470μF 100v 3"×1¼" 25p: 2000/2000μF 25v 2" x 1½" 35p: 700μF 200v 3½" x 1¼" 30p: 16/16μF 275v 1¼" x 1" 20p: 40/40/20μF 275v 3" x 1" 20p: 4500/900/900μF 30v 2½" x 1½" 50p: 2500μF 40v 2½" x 1½" 40p: 470μF 25v 1¼" x ½" 15p: 4,000μF 25v 3" x 1¼" 40p. 32μF 450v 1½" x 1" 30p: 8μF/16μF 450v 1¼" x ¾" 30p: 1000μF 12v 1¼" x ½" 15p. 5000μF 50v 2" x 1¾" 50p: 150/200/200μF 300v 3" x 1¾" 50p: 4500μF 35v 2½ × 1½" 50p.

Try our parcel of small capacitors 20 mixed valves £1·50 + post.

Matched pair of bookshelf speakers. Teak finish, size 12"×8"×5". 8×5 8" ohms ceramic, 5 watts RMS. Complete with din leads. **£10·00** pair + post.

Thorn TV IF chassis, 950 series (less valves). **£1·60** + post.

UHF 625 transistor push button tuner (NSF Telefunken) as used on Decca MS2400. Brand new and boxed, circuit diagram supplied **£3·00** + post.

P-C Boards (not computer panels) 1 off 6 transistor single wave band. 1 off 4 transistor audio. 1 off 3 transistor **£1·40** + post, three boards.

Repanco Transformers AF1, AF2, TT45, 46, 47, 49, 53. **20p** each + post.

L/M, M/W, VHF Tuner 5 transistor in kit form, complete with full assembly instructions. 9vt supply, positive earth. O/put 100mw. Built-in A.M. aerial. 88-108 Mcs. **£5·25** + post.

Mains Droppers, 10 mixed values, **£1·00** + post.

Edgewise Level meters, 200μA, size ¾" overall. **50p** + post.

Chrome Plastic knobs, 3 types, 4 off each with spring clip, **£1·25** + post.

Aluminium Chassis, 7½"×5½"×2½" **65p** + post: 10" x 7½" x 2¾" **75p** + post. 11" x 7½" x 2¼" **85p** + post.

Push Button Selector for varicap tuner—4 way £1·50 6 way £2·00 + post.

Portable Radio AFC/FM MB/SW/LW/MW. Battery only 12vt. £17·50 + post.

Ferguson Stereogram Chassis. MW/LW/VHF with tuning scale (5+5 watts sine wave) 15 ohms £26·25. Post paid

15 ASSORTED SWITCHES £1·90 + post. **50—3 way to 7 way TAG STRIPS,** £1·15 + post, **ALMA REPANCO & DENCO COILS. NEW/BOXED OUR SELECTION—5 FOR £1·15** + post.

Please add 10% post and packing. Add 25% VAT to total order. Gram Chassis free postage. No goods despatched outside U.K.

SURPLECTRONICS

216 LEAGRAVE ROAD, LUTON, LU3 1JD, BEDS.

TAKE 20

DAVID ANDREWS

No. 73 TOUCH SWITCH

A series of simple transistor projects, using not more than twenty components.

IN an increasing number of applications ordinary mechanical switches are being superseded by touch activated switches. These are operated by body resistance between two electrodes, rather than by mechanical pressure or movement. Apart from the obvious novelty value, these have the practical advantage of having no moving parts to wear out. giving them the reliability of the main electronic part that they are switching.

This article describes a simple touch switch which provides the ON/OFF switching of any small piece of battery-powered equipment which has a current consumption of between a few micro-amps and 100mA, such as portable receivers, signal generators and other test equipment.

★ components list

Resistors

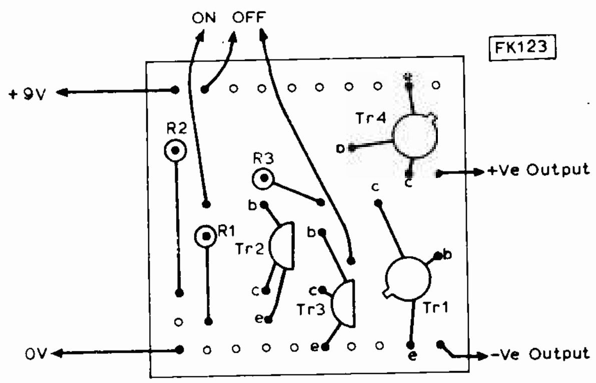
R1	680Ω	R3	8·2MΩ
R2	4·7kΩ	All ¼W 5% or 10% tolerance	

Semiconductors

Tr1	BC108	Tr3	2N2926G
Tr2	2N2926G	Tr4	BC178

Miscellaneous

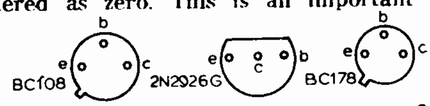
Veroboard 35 x 35mm, 0·1in. matrix. 9V Battery and clips. Piece of copperclad board for touch plate.

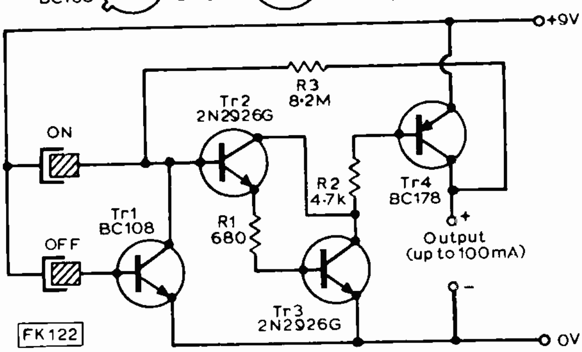


The circuit is constructed on 0·1in matrix Veroboard, with flying leads to the touch plates.

The Circuit

The device uses only four transistors, three resistors, and when initially connected to the supply is in the off state; no current flowing except for leakage currents. As the transistors are all silicon types, the total leakage current is only a fraction of 1μA and for all practical purposes can be considered as zero. This is an important feature as





Circuit diagram of touch switch. Current consumption of the unit is 1·3mA when in the ON state, and less than 1μA when in the OFF state.

otherwise the unit would be drawing power even when the main equipment was turned off.

When the ON plate is touched a small bias current flows from the positive supply into the base of Tr2. This is wired as the first transistor of a Darlington pair, Tr3 being the second transistor. This bias current will begin to turn on Tr2 and Tr3 and cause a base current to be supplied to Tr4 via Tr3 and R2.

As Tr4 turns on, the voltage at its oscillator will begin to rise, and this will cause further base current to flow into Tr2. This is supplied from Tr4 collector via R3. This extra base current will cause Tr2, Tr3 and Tr4 to conduct more heavily, which in turn causes an even greater current flow through R3. This regenerative action results in Tr4 being switched quickly to saturation. The equipment connected in its collector circuit will thus be turned on, and as the circuit is self latching, it will remain on, even when the operator's finger is removed from the touch plate.

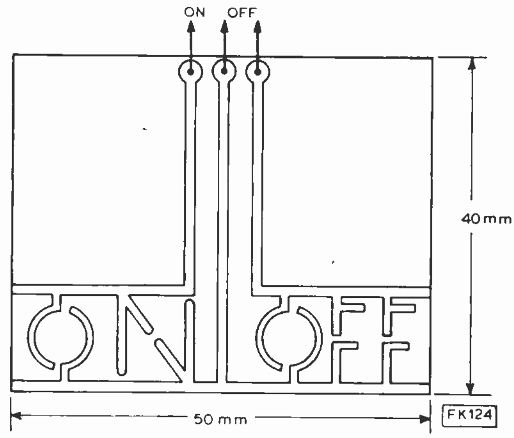
When the OFF plate is touched, Tr1 receives a base current from the positive supply, turning it on. In doing so, it shunts the base current of Tr2 to earth, and so turns Tr2, Tr3 and Tr4 off. The circuit is thus returned to its original condition. R1 and R2 are current limiting resistors included to prevent Tr3 and Tr4 from passing an excessive current. The current consumption of the unit when it is in the ON state is about 1·3mA, and it is a secondary function of R1 and R2 to limit this current to an economic level.

Construction

Construction of the unit is very straightforward being built on a piece of 0·1in Veroboard. The touch plate can be made to conventional designs from PCB or Veroboard, or the novel printed circuit design employed by the author can be copied.

This is perhaps a little less sensitive than conventional designs, but it still provides adequate sensitivity when used with this circuit.

For practical use on a piece of equipment an aperture should be cut in the front panel of the equipment, or any other convenient point, then the touch plate glued or bolted in place behind the cutout. In use it should be found that the touch plates only need to be touched momentarily to initiate the switching action. The only exception to this will be if the controlled equipment has a fairly high value decoupling capacitor connected across the supply lines (such as in a transistor radio). In this case it will be necessary to touch the OFF plate fractionally longer than normal, so that the decoupling capacitor has a chance to discharge. Otherwise the unit may turn on again as the finger of the operator is removed from the plate.



Although any shape can be used for the touch plates the above design was used by the author.

NEWS... NEWS... NEWS...

Greenweld Meter Catalogue

GREENWELD Electronics tell us that they have now compiled a catalogue detailing the various types of multimeter that they have in stock.

If anyone would like a free copy, together with price list, they can get one by sending a 9in x 4in stamped addressed envelope to: *Peter Green, Greenweld Electronics, 51 Shirley Park Road, Southampton.*

Sound & Vision '76

SOUND & Vision '76 will be the title of next year's TV and audio show to be held at the National Exhibition Centre, Birmingham (May 28th to 31st).

The show follows on from HEDA—the first International Home Electronics and Domestic Appliances Exhibition—a five day trade show sponsored by the Association of Manufacturers of Domestic Electrical Appliances (AMDEA) and the British Radio Equipment Manufacturers' Association (BREMA) which opens on May 23rd.

With the exception of the first day of the public show, when the doors will open at noon, the TV and audio show will be open from 10 a.m. to 10 p.m. daily including the Spring Bank Holiday Monday.

GB2RS News Broadcasts

THE R.S.G.B. has operated these broadcasts on 80m and 2m for many years now and the service for Region 1 has been improved by the addition of two more news readers.

They would appreciate any information on the coverage obtained and the number of readers listening on each of the two bands. It would also interest the R.S.G.B. to know how many non-members are listeners to these broadcasts. Also, if you have any suggestions for material to be included in these weekly bulletins, the R.S.G.B would be pleased to hear from you.

VHF-UHF Manual (3rd edition)

THIS completely revised and enlarged edition is also available from the R.S.G.B All the existing chapters have been up-dated and expanded. In addition, chapters on Space Communication and Microwaves have been included for the first time.

The volume, which has an increased page size and a lot more pages, is case-bound to overcome the binding problems that existed with earlier editions. Price had not been decided at the time of our going to press.

Woollies own

IT'S the Wonder of Good Old Woollies — that's what the adverts tell us—and the latest wonder may well be Winfield-brand audio equipment.

Woolworths are setting up audio centres in 170 of their larger stores. Initially, the departments will concentrate on branded goods (HMV, Ultra, Ferguson, Pye, Philips, Fidelity, etc.) with prices ranging from £40 to £400, but if these items go down well with the public, the Winfield brand may soon be available.

Each department is headed by a manager who has been given training organised by various manufacturers and Woolworths will set up their own network of manufacturer-approved service agents.

1976 Amateur Radio Callbook

THE new edition of the R.S.G.B. Callbook is available from the *Radio Society of Great Britain, 35 Doughty Street, London, WC1N 2AE.*

The price of £1·47, although higher than for the 1975 edition includes the cost of postage and packing.

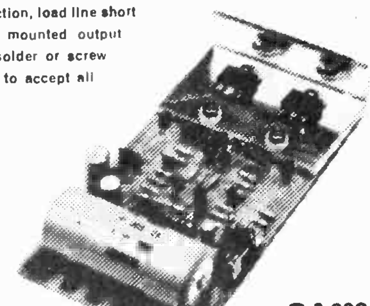
MORE NEWS ON PAGE 743

SAXON
ENTERTAINMENTS LTD

SYSTEM 7000
professional standards · realistic prices

THE NEW POWER AMPLIFIERS

Three brilliant new power modules employing the same circuitry, using 10 transistors, three diodes and one zener diode with electronic over temperature cutout as well as normal thermal protection, load line short circuit and incorrect load protection, integrally mounted output capacitor. Fused D.C. supply terminal. May be solder or screw connected. The input impedance is high enough to accept all types of mixer having an output of 250 mV.



New features—new performance standards

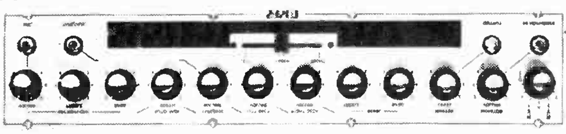
★ New 90°C overtemperature cutout (electronic not mechanical).
★ New integral output capacitor, no external components required for normal operation.
★ Short circuit load line type protection with twin summing amplifiers.
★ Inherently open circuit proof.
★ Input sensitivity −10 dBm (240 mV into 50k) ie suitable for most mixers. Response 30Hz 40KHz ±1dB.
★ Typical distortion 0·4% Noise −80 dB.
★ Suitable for all public address, discotheque, and group applications.
★ Fused supply and o/p terminal.
★ Single supply line (split supply not required.)
★ Compatible with all other Saxon units

SA608
60 w.r.m.s. into 8Ω 30 w.r.m.s. into 15Ω. Texas 15A output transistors.
£11·50

SA308
30 w.r.m.s. into 8Ω 15 w.r.m.s. into 15Ω basic circuit identical to SA 1208 10A Plastic D/P transistors
£9·00

SA1208
120 W.R.M.S. INTO 8Ω
60 w.r.m.s. into 15Ω Glass fibre printed circuit board. 15A output transistors
£16·00

SYSTEM 7000 DISCO CONTROL UNIT



★ Mono or stereo.
★ 2 Deck and one tape inputs, individually controlled plus L/R deck fader (ineffective at central).
★ Wide range bass and treble controls plus separate MIC volume bass and treble controls. Overall master control.
★ Continuously variable autofade depth and threshold.
★ Five position monitoring switch with two mute positions—ample headphone power.
★ Complete, cased with all terminations by plug/socket etc.
★ Noise −80 dB Response 20Hz-50 kHz ± 1dB.
★ Stainless steel escutcheon, boldly designed.

Mono **£28·50**
Stereo **£45·00**

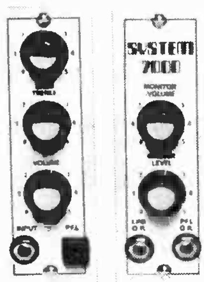
Send for full descriptive leaflet.

IN MODULAR FORM
Assembled in P.C.B. Similar characteristics to above. Ideal for constructors.
Mono **£18·50** Stereo **£27·50**

SYSTEM 7000 MODULAR MIXING—UP TO 20 CHANNELS

Complete versions of the IM7001 and IM7200 modules shown in our advertisement make a professional quality versatile mixer to *your* requirements using these modules mono and stereo inputs may be combined.

★ **The mixing modules split mono signals.**
★ **Each input module has own monitor switch.**
★ **Stainless steel panel on 15cm × 5cm matrix (approx.).**
★ **Input equalisation for all types of signal inc. magnetic cartridge.**
★ **Complete system may comprise twenty channels, mono or stereo with ample monitoring power.**
★ **May be patched in with disco mixers or minotaur amplifier.**



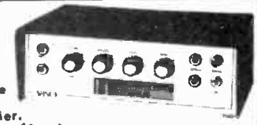
Mono Input Module **£8·50** Stereo Input Module **£12·00**
Mono Mixer Module **£8·50** Stereo Mixer Module **£12·00**
Power Supply Unit for up to 20 Modules **£7·50**

THE NEW POWER SUPPLIES

★ One piece, ready to wire assembly with integral glassfibre pcb.
★ Grain oriented laminated transformers for compactness.
★ Facilities for preamp supply.
★ Fully fused.
★ Size of all models 10 x 8 x 13cm. (PM1202 16cm)

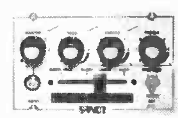
PM1201	95 V for one SA1208	£11·00
PM1202	95 V for two SA1208	£14·00
PM602	65 V for one or two SA 608	£9·00
PM302	45 V for one or two SA 308	£7·50

MINOTAUR AMPLIFIER



100 w.r.m.s. into 8Ω
★ Two mixed inputs, wide range bass & treble controls
★ May be operated as a slave amplifier.
★ Extremely compact (27cm × 16cm × 10cm).
★ Fully protected against all incorrect* loads and short circuits.
**Except minotaur (anodised aluminium).*
£47·50

SYSTEM 7000 LIGHTING CONTROL UNIT



★ 1000 WATTS PER CHANNEL SOUND LIGHT *AND* SEQUENTIAL *AND* OVERRIDE.
★ Individual control of bass, middle and treble.
★ Master control for easy adjustment.
★ Plug/socket terminations throughout.
★ Slider control for function, allows sound/light, sequencing or combination of both.
★ Stainless steel front panel to match disco control unit.
★ Electronic override eliminates clicks.
£35·00

SAXON SUPERFECT LIGHT UNIT
The Modular version of ST7000 Light Control Unit.
Sequential display with variable speed. Continuously variable function display with no signal. Carries 1000 watts per channel. Separate bass, middle, treble and master audio controls, etc., etc.
£19·75

SAXON SOUNDLITE
Our outstandingly successful 3000 watt unit in modular form.
£13·50

GUARANTEE
All Saxon Entertainments' modules and units are guaranteed for 12 months from date of purchase.

TERMS OF BUSINESS
Phone orders to 01-684 6385 for C.O.D. payment or by Access or Barclaycard.
Ordering by post, make cheques, postal orders payable to Saxon Entertainments Ltd., crossed, or send Access or Barclaycard No.
Shop hours—Monday to Saturday 9.0 a.m. to 5.00 p.m.
Prices subject to alteration without notice.

TRADE ENQUIRIES TO
Norman Rose Electrical Ltd.
London—phone 01-837 9111 Birmingham 021-236 4710
Manchester—phone 061-273 1498 Bradford 0274 24008

PRICES INCLUDE CARRIAGE & PACKING, BUT V.A.T. AT 8% MUST BE ADDED TO VALUE OF ALL ORDERS

SAXON ENTERTAINMENTS LTD.
327 WHITEHORSE ROAD, W. CROYDON, SURREY CRO 2HS
Telephone: Sales 01-684 0098; Service 01-684 6385

I.C. OF THE MONTH

Number 55 — SGS-ATES AUDIO POWER AMPLIFIERS

A NUMBER of medium power IC audio amplifiers are produced by SGS-ATES Ltd. in quad-in-line packages. Here we consider the TBA810 and TCA830 which incorporate thermal shut-down circuits and the TCA940 which has output short-circuit protection in addition to the thermal shut-down circuit.

If any of these devices become so hot (about 130°C) that a further rise in temperature might damage them, the drive currents to the bases of the output transistors are automatically diverted. The current in the output stages is thus greatly reduced so that the internal power dissipation remains small until the device becomes cool. It is therefore most unlikely that the experimenter will accidentally destroy any of these devices provided that the maximum permissible power supply voltage is not exceeded. Thermal runaway cannot occur.

TYPES

The TBA810S can provide 7W into a 4Ω loudspeaker when fed from a 16V line or 6W into 4Ω from a 14V supply. Thus it is very suitable for use in car radio receivers. This device is encapsulated in the 'Findip' package which has two cooling fins fitted to the sides of the device. The TBA810AS is electrically identical with the TBA810S but has two short horizontal cooling tabs with a hole for attaching a heatsink to each tab.

The TCA830S has the Findip encapsulation of the TBA810S but provides up to 4·2W into a 4Ω speaker when fed from a 14V supply line or 3·7W into 8Ω from a 16V supply.

The TCA940 is supplied in the same package as the TBA810AS and it can provide up to 10W into a 4Ω speaker when a 20V supply is used or 6·5W into 8Ω with the same supply voltage. The TCA940E has the same internal circuit as the TCA940, but the package of the TBA810S is used. It is wise to limit the maximum continuous power delivered by this device to about 7W into a 4Ω speaker or it will get very warm. However, it can supply up to 10W for a moment. The protective circuits will prevent it from overheating to the point of damage. The pin connections of all the devices are identical, shown in Fig. 1.

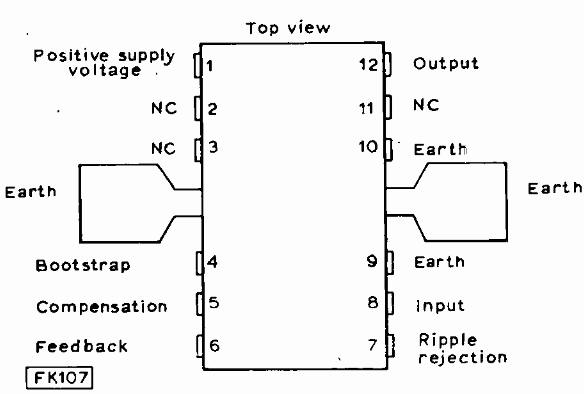


Fig. 1: Connections of all the devices discussed.

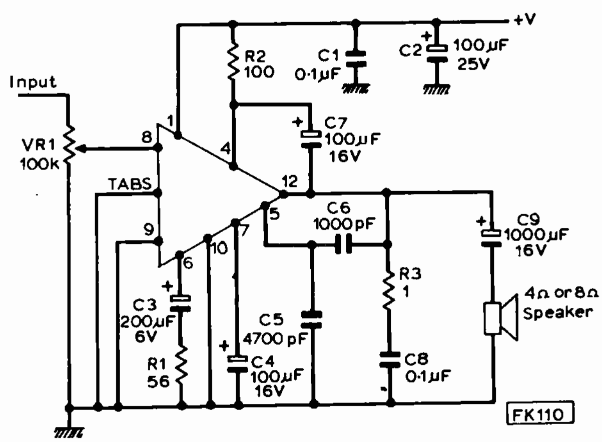


Fig. 2: A typical circuit.

TYPICAL CIRCUIT

A typical circuit for any of the devices under discussion is shown in Fig. 2. Volume control VR1 may be replaced by a 100kΩ resistor.

Capacitor C1 should be soldered close to pin 1 of the device to prevent the possibility of high frequency oscillations, but C2 may be in the power unit. Feedback for the bootstrap circuit at pin 4 is provided by C7 and R2, whilst C9 prevents a steady current from flowing through the loudspeaker speech coil. If the value of C9 is reduced, the bass response will be affected, since this capaictor sets the low frequency cut off.

GAIN

The gain of Fig. 2 is equal to the ratio of the value of an internal 4kΩ feedback resistor divided by the value of R1, and is between 34 and 40dB. This corresponds to a voltage gain of between 50 and 100 times.

If the value of R1 is reduced, the fraction of the voltage fed back through the internal 4kΩ resistor

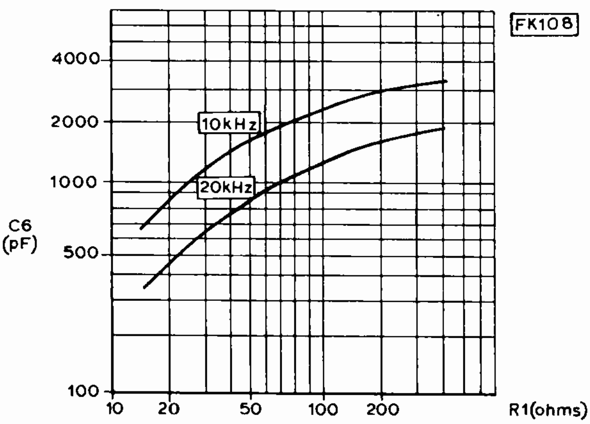


Fig. 3: The values of C6 for various values of R1 for the upper cut-off frequencies of 10kHz and 20kHz.

to pin 6 will be reduced and the gain will be increased. For example, if R1 is 15Ω, the voltage gain will be about 270, whilst if R1 is 150Ω the gain will be about 27. It is recommended that R1 should have a value between these limits, although R1 can have a value of up to 220Ω with a 12V supply before saturation occurs in the input stage.

The variation of gain in these devices arises from the tolerance of the internal feedback resistor (±30%) and from the tolerance in the value of R1. This variation can be reduced by connecting a resistor of less than 4kΩ and 5% tolerance from the lower end of C9 in Fig. 2 to the upper end of R1.

Capacitors C5 and C6 control the frequency response but the values required are also affected by the value of the gain controlling resistor R1, so Fig. 3 shows the value of C6 required with various values of R1 for upper cut-off frequencies (3dB down) of 10kHz and 20kHz. A value of C5 about five times that of C6 produces optimum stability. The values shown in Fig. 2 provide an upper cut off frequency of about 17kHz.

In the case of the TCA830S, C5 may be omitted and the value of C6 can be 390pF. This gives a response to 10kHz with a 56Ω resistor for R1, but the value of C6 should be selected in proportion to the value of R1.

The components R3 and C8 form a 'Boucherot cell' or 'Zobel' network. These components, in parallel with the speaker inductance and capacitance, present a load to the output of the amplifier which approximates to a pure resistance (without any inductive or capacitive components) at all frequencies. This greatly reduces any tendency to instability at high frequencies.

SUPPLY VOLTAGE

The absolute maximum supply voltage to the TCA940 is 24V. However, it is wise to regard 20V as the maximum voltage to leave a reasonable margin of safety. The TBA810 devices and the TCA830S have the lower absolute maximum voltage rating of 20V so the maximum working voltage should be regarded as being about 16V. The TBA810 devices can deliver more current than the TCA830S.

The minimum recommended supply voltage for the TBA810 and the TCA830S is 4V, but the power output at this voltage is only a fraction of a watt. The minimum recommended operating voltage for the TCA940 is 6V, at which the device will deliver about 1W into a 4Ω speaker or ½W into 8Ω.

DISTORTION

The maximum output power levels quoted are for 10% total harmonic distortion. In actual practice such a peak distortion level is reached only occasionally. The typical distortion is about 0·3% for power levels of up to 2W (TCA830S), up to 3W (TBA810 devices) and up to 5W (TCA940 devices).

However, the distortion rises very rapidly indeed with the onset of waveform clipping, as shown in Fig. 4 for the TCA940 with an 18V supply. The capacitor C4 of Fig. 2 attenuates any hum on the power supply line by about 45dB, but the attenuation falls to about 40dB if R1 is reduced to 20Ω.

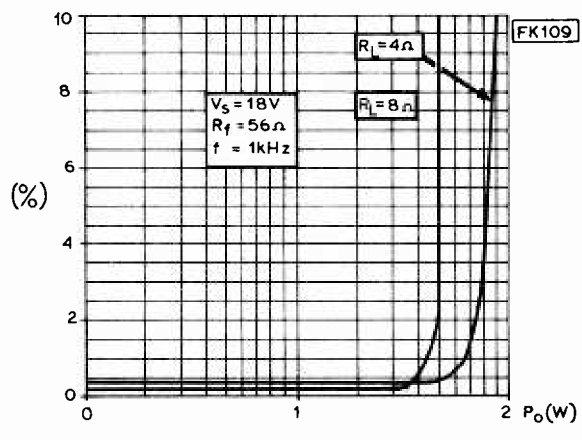


Fig. 4: Distortion plotted against output power for a typical TCA940 device for an 18V supply.

SIMPLER CIRCUIT

An alternative circuit which is somewhat simpler than that of Fig. 2 is shown in Fig. 5. Neither side of the speaker can be connected to the negative (earth) line, but the capacitor C6 of Fig. 5 replaces both C7 and C9 of Fig. 2.

The remainder of Fig. 5 is similar to Fig. 2, except

continued on page 765

IC OF THE MONTH—continued from page 762

that the hum attenuating capacitor on pin 7 has been omitted, since Fig. 5 is often used in portable receivers. If desired, tone control circuits can be incorporated in the input circuit of an amplifier or in an external feedback loop.

MOUNTING

The Findip package of the TBA810S type may be mounted on a printed circuit board, the cooling tabs each being soldered to copper foil of about 20 to 30mm square depending on the maximum power output required. Mounting of the TBA810AS package should present few problems since the device can be soldered into a printed circuit board with small metal heat sinks bolted to each of the tabs of the device.

AVAILABILITY

The devices are available from Chromasonic Electronics, 56 Fortis Green Road, Muswell Hill, London N10 3HN and from The Radio Shop, 16 Cherry Lane, Bristol BS1 3NG. The prices are in the region of £1 to £2.

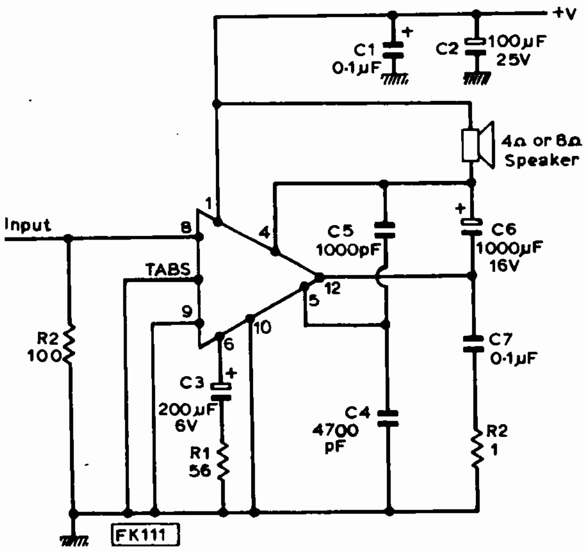


Fig. 5: A simple circuit in which neither side of the loudspeaker can be earthed.

I.C. REV COUNTER—continued from page 750

Positive earth cars

The circuit of Fig. 3 may be employed with vehicles having positive earth, where the input pulses from the contact breaker have a negative polarity. They are fed into the potential divider consisting of R1 and R6. Where only about one hundredth of the initial pulse amplitude is fed to the base of Tr1. It has been found experimentally that, with the values of R1 and R6 shown in this circuit, the input pulse amplitude required to just trigger this circuit is about the same as that required to trigger the circuit of Fig. 1.

Smaller pulses are obtained from the junction of the potential divider resistors in Fig. 3 than in Fig. 1, but the transistor amplifies the pulses. The amplification provided by various transistors differs somewhat, but is in no way critical. The amplified pulses appear across the resistors R2 and are positive going, since the transistor circuit changes the pulse polarity. These pulses are used to drive the IC connected in the same type of circuit as in Fig. 1.

Positive earth calibration

The positive earth circuit of Fig. 3 may be calibrated in exactly the same way as the circuit of Fig. 1, but requires negative pulses to trigger it. The negative output line from Fig. 2 is therefore connected to R1 in Fig. 3, whilst the positive line from Fig. 2 may be connected to either of the power supply lines in Fig. 3. No meter reading will be obtained if these connections are made the wrong way around.

Power supply

The power supply to the IC should be obtained in the following way so that no current will be drawn when the car's ignition is switched off. In addition, protection is then provided by the car's ignition fuse. The negative power supply line in Fig. 1 or the positive supply line in Fig. 3 should be connected to a good chassis earth on the vehicle, such as the one on the control box. The other power supply line should be connected to the output from the fuse controlled by the ignition switch. Constructors will probably find it most convenient to clamp the meter to the steering column by means of a bracket and a suitable clip. The circuit board itself can be placed in any convenient place, for example, behind the meter.

IC information

The following information is included for those readers who wish to have more information on the SAK115 itself. The power supply (that is, the zener voltage in Figs. 1 and 3) must not exceed 9V or the device may be damaged. It is therefore recommended that the actual supply should lie between 7·5V and 8V at pin 7. The power supply current required is about 12 to 22mA.

The input frequency from the contact breaker should not exceed 10kHz, but this is well above that obtainable from any vehicle. It is also recommended that the resistance between pins 7 and 10 should be between 5k and 20kΩ.

GOING BACK...

1970 60 50 40 30 20

COLIN RICHES

THIS month we do not go back quite so far in time with a piece of equipment kindly loaned to us by Mr. **T. C. McCulley**, 31 Cleveland Road, New Malden, Surrey. As far as we know, it is of about 1947 vintage and was an American development made under licence in this country.

Basically the machine is a very sophisticated version of the disc record used by BBC correspondents in the last war to make recordings at the front line so that the people back home could hear the real sounds of war.

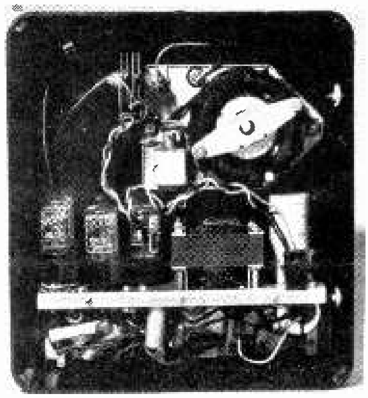
Our machine is called a "Recordon" and was to be used on a.c. only 200/250V or 100/130V. To make a recording, one had to turn the volume control-power supply switch clockwise and turn the 'record' switch to the 'on' position. The recording disc was then placed on the turntable lining it up with positioning pins so that it would not slip round. A grooved disc or 'scroll' was then placed on the recording disc and the tonearm placed against the knob in the centre of the scroll. All that remained was then to speak into the microphone.

Top view showing disc in position.

To hear the recording, the 'play' switch was operated and the tonearm placed against the knob in the centre of the scroll. The volume was adjusted to suit and if the playback became muffled, one could rotate the tuner knob to restore clarity.

This machine was used as some form of office dictating device and it had amongst its features, a button for the erasing of dictation errors, a footswitch control and a push-button 'executive' type microphone.

The accessories that go with Mr. McCulley's recorder.



Rear view showing valves and motor.

An inscription on the case tells us that the suppliers were Thermionic Products Ltd., of London, S.E.11 and the machine was manufactured under agreement with the Brush Development Co., the Brush Crystal Co., Magnetone Inc. and Thermionic Products Ltd. Patent Nos. 454595 and 599751 applied.

If anyone has further information on the Recordon, please would they contact Mr. McCulley direct.

Vintage vision

SOUND is closely allied to vision and this brings us to an interesting note to make for your diaries if you are keen on vintage sound projectors and audio equipment. It's the first ever British Film Collectors' Convention and it will be held on Saturday 24th January 1976 at the Holborn Central Library Theatre, High Holborn, London, WC2.

There will be an exhibition of vintage cine equipment, some of which will actually be working, plus displays of photographs of the old times. There will also be continuous shows of the latest package films released on Super 8mm and some interesting sound projectors in use.

Anyone interested in attending, please send a stamped, addressed envelope to *Paul Van Someren, 145 New Kings Road, London, SW6 4SL.*

Vintage News-sheet

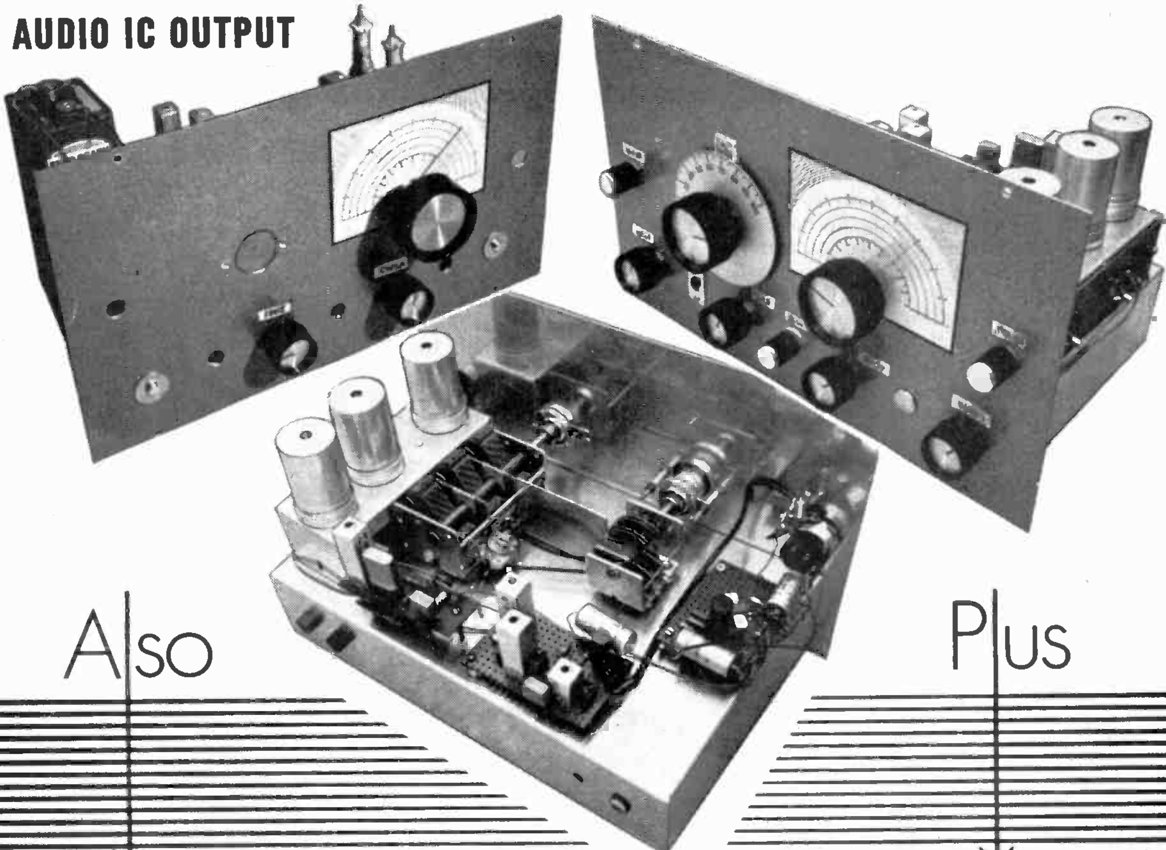
If anyone would like a free copy of the Antique Wireless News-sheet, send a stamped, self-addressed envelope to *Tudor Rees (Vintage Services), 64 Broad St., Staple Hill, Bristol, BS16 5NL.*

GENERAL COVERAGE STEP BY STEP RECEIVER

IN NEXT MONTH'S PRACTICAL WIRELESS

- **COVERS MEDIUM WAVES & 3 SHORT WAVE BANDS 1·7 to 30 MHz**
- **DUAL-GATE FETs in RF and MIXER STAGES**
- **AUDIO IC OUTPUT**

The multi-stage receiver is an ideal subject for step-by-step construction. The basic set can be built, tested and operated before further stages are added. These optional extras include an RF amplifier stage, IF stage with crystal filter, beat frequency oscillator permitting reception of Morse and single sideband telephony, and an extra audio stage.



Also

STEREO MIXER UNIT

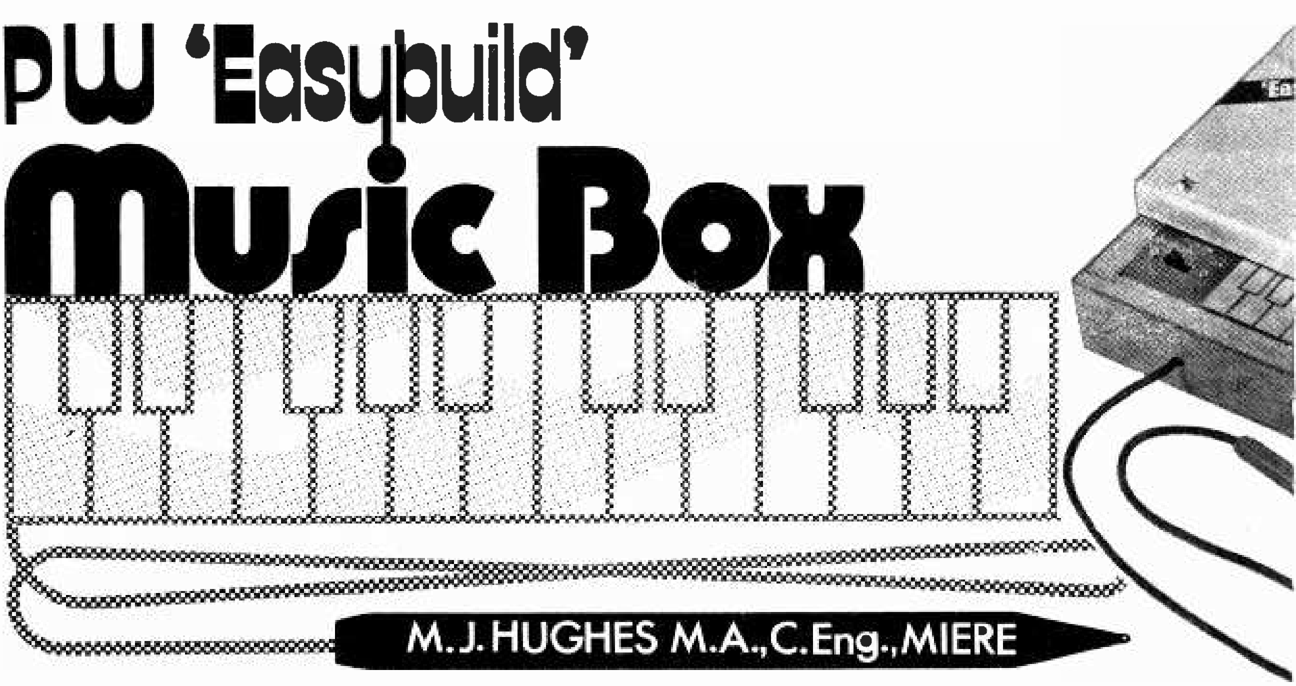
Mix your microphones output with music from the radio or tapedeck to make your own stereo recordings. Mains powered thus eliminating expensive batteries. Simple construction on plain veroboard.

Plus

ALL THE REGULAR FEATURES

ON SALE IN JANUARY

PW 'Easybuild' Music Box



M. J. HUGHES M.A., C.Eng., MIERE

THIS is a comparatively simple project which most beginners could easily undertake. It is a monophonic organ (i.e. only one note can be played at a time) in which the note is selected by touching a key-shaped electrical contact on the printed circuit board with a probe. In that respect it does not differ greatly from other designs already published but a few features have been added which make the project novel in some respects. It was a temptation to add a number of other refinements but it was felt that one of the big attractions of this project would be its absolute simplicity.

PERFORMANCE

A 25 note keyboard spanning two octaves (from C to C) is used and each note is individually tuned with its own preset potentiometer. A master preset allows the pitch of the organ to be shifted over several octaves without altering any other component values. The individual notes will need a slight amount of retuning after this operation because the voltage control effect of the master preset is not linear. In practice this is no hardship, because once having made the instrument and decided whether to have bass, tenor, alto or soprano pitch simply adjust the presets and leave them.

The advantage of being able to set the pitch of the organ is useful if the project were to be used in school because there need be no variance from one organ to another and later an "Ensemble" of several of the organs could be used to form the basis of a band, similar to a recorder group.

A switch allows vibrato to be selected and a preset control determines the depth of the vibrato. There is no tone control nor volume control; they could be fitted but were left out, with a very good motive. Because a printed circuit board is used there is virtually no free wiring, which sometimes causes problems for beginners and certainly, in this case, would detract from the neat mechanical assembly. The only free wires are those to the battery and probe.

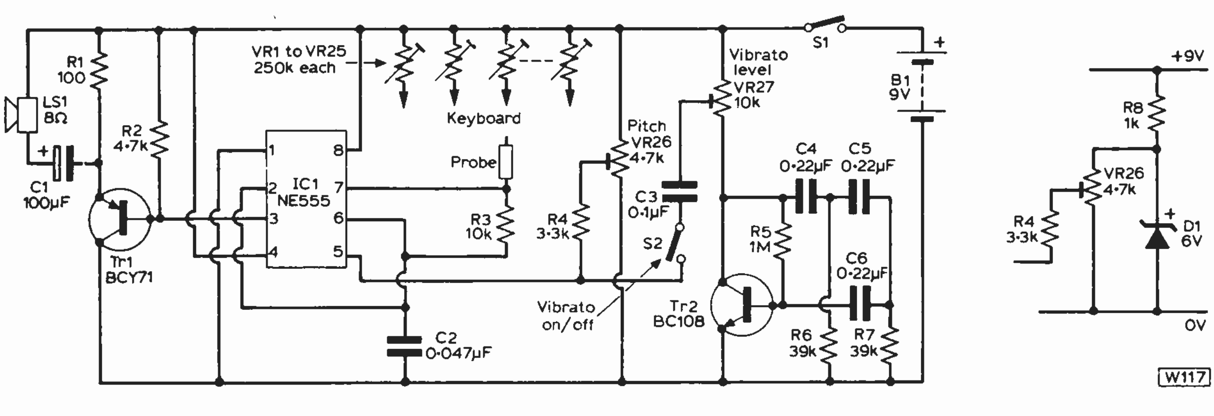
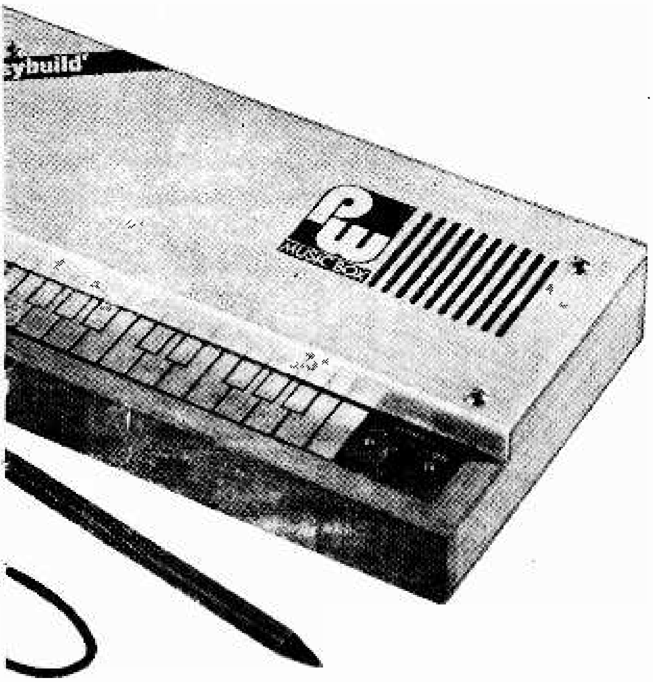


Fig. 1: Full circuit of the Music Box with, inset right, optional circuit for improved stability of the tuning voltage.



★ components list

Resistors

R1	100Ω	R4	3·3kΩ	R7	39kΩ
R2	4·7kΩ	R5	1MΩ	R8	1kΩ
R3	10kΩ	R6	39kΩ		

All 10% ½ or ¼W
VR1-25 250kΩ (25 off) vertical sub-miniature pre-set pots.
VR26 4·7kΩ ditto
VR27 10kΩ ditto

Capacitors

C1	100μF 12V	C3	0·1μF	C5	0·22μF
C2	0·047μF	C4	0·22μF	C6	0·22μF

All polyester except C1.

Semiconductors

Tr1	BCY71	Tr2	BC108
IC1	NE555	D1	6V 400mW zener

Miscellaneous
Miniature slide switch, on-off, 2 off. Speaker, 8 to 35Ω, not more than 2¼in. overall diameter. PCB (see page 742). PPS battery and press-stud connector. Cabinet, probe and material for cover.

A solid mahogany cabinet with plywood base can be obtained from Birch & Ridley, Watson Road, Worksop, Notts. for £3·50 plus 40p p/p. An aluminium top plate with circular speaker hole can be obtained from H. L. Smith Ltd., 287 Edgware Road, London W2 for 33p plus 17p p/p.

CIRCUIT

The circuit is shown in Fig. 1 and the heart of it is an NE555 IC timer operating in astable mode. The frequency of oscillation is set by the value of C2 together with R3 and the selected preset potentiometer from VR1 to VR25. It is the probe, connected to the top end of R3 which is used to select the potentiometer and, hence, the note. The output of IC1 is a square wave which has an amplitude of several volts and it is only necessary to take this from pin 3 and provide a degree of current amplification with the emitter follower Tr1 before it is used to drive a small loudspeaker.

A PNP emitter-follower stage is used so that when no note is being played Tr1 is not conducting, reducing battery consumption. By using an NE555 one can make use of its voltage control capability. A DC voltage at pin 5 will shift the frequency of operation altering the pitch of the instrument over a wide range without changing C2 or any of the other potentiometers. The control voltage is produced by VR26. As the battery voltage falls this control voltage will change slightly affecting the tuning of the instrument but in the majority of cases where the instrument is used as a toy this is not likely to present problems.

If very stable tuning is required this control voltage can be obtained using a zener diode and an extra resistor as shown in the inset to Fig. 1. This modification would require a slight change to the PCB but it is felt that few would want to do this, keeping to the simpler version.

A low frequency signal on top of the DC control voltage will frequency modulate the signal from IC1 which provides perfect vibrato. Tr2 and its associated components form a simple phase shift oscillator which produces a pure 6Hz sinewave output. A controllable portion of this is selected by VR27 and fed via C3 and the vibrato switch to the voltage control input of the main oscillator. Adjustment of VR27 sets the depth of vibrato. It is important that a branded BC108 is used for Tr2 as some general purpose NPN transistors will not have sufficient gain to get the vibrato circuit oscillating. For the same reason use good quality polyester capacitors for C4, C5 and C6 and avoid ceramic types.

The circuit will work with just about any speaker having an impedance of 8Ω or greater but the crucial factor is its diameter so that it will fit on the printed circuit board. An 8Ω speaker will give the largest output but a 35Ω one still gives quite an appreciable output.

CONSTRUCTION

For assembly of the printed circuit board refer to Fig. 2/3. Start by inserting and soldering in all the preset potentiometers. This is a bit monotonous but it gives plenty of practice at soldering before coming to the semiconductors! Next glue the loudspeaker into position with a fast-setting epoxy resin, and avoid getting the resin on the cone of the speaker. Before going on to the rest of the components fix the two slide switches S1 and S2 into position. These switches and the loudspeaker should be mounted on the plain side of the board.

Go on to solder in all the fixed resistors and then the capacitors. The only polarised component so far is C1 so make sure this is inserted the right way round, the positive end of the capacitor should go into the hole nearer to the loudspeaker connection. Insert and solder the two transistors into their correct position and the leads the right way round. The emitter is the wire nearest the spigot on the can, the collector is the wire diametrically opposite the emitter and the base lead is midway between the two but offset to one side. Finally insert the integrated circuit making sure that its orientation mark is in the position shown on the layout drawing.

The only wiring left goes to the battery switch, the loudspeaker and the vibrato switch. A single wire goes to the probe.

TESTING

Before testing, set all the potentiometers to the middle of their range. Connect the battery, switch on and try touching the end of the flying lead on any of the keys, when a strong note should come from the loudspeaker but the tuning will be meaningless at this point. While touching a single key check the vibrato by switching it on and altering the depth by adjustment of VR27. Check, also that adjustment of VR26 will change the note you are holding.

Now decide how you wish to pitch the instrument. Holding the probe lead on the central "C" of the keyboard, adjust VR26 until the note heard corresponds to the middle "C" of the two octave span required. (A piano is a great help here). From there on it is only necessary to touch each note in turn and adjust the corresponding potentiometer until the instrument is accurately tuned over the entire two octaves in question. It is much easier to tune if the vibrato is switched off.

FINISHING OFF

Make the wooden cabinet and the bent aluminium lid as shown in the drawings. If it is not possible to use aluminium then make the lid out of thin plywood or plastic. In fact some readers might prefer to make the whole box from plastic. The printed circuit board should just be a snug fit inside the case.

Place the printed circuit board inside the box and put some temporary packing under the front edge to keep the board level. Mark the holes for mounting the board to the underside of the lid, one in each corner. Make sure that the holes are clear of the printed wiring.

Use long 4BA screws with nuts to bolt the PCB to the underside of the lid and make sure that it stands off sufficiently to leave a small gap between the bottom edge of the front drop and the keys, otherwise a short circuit might occur.

Before completing assembly glue a card strap inside the front edge of the box to hold the battery. Position the battery and thread the probe lead through the hole in the front. A knot in this lead will take the

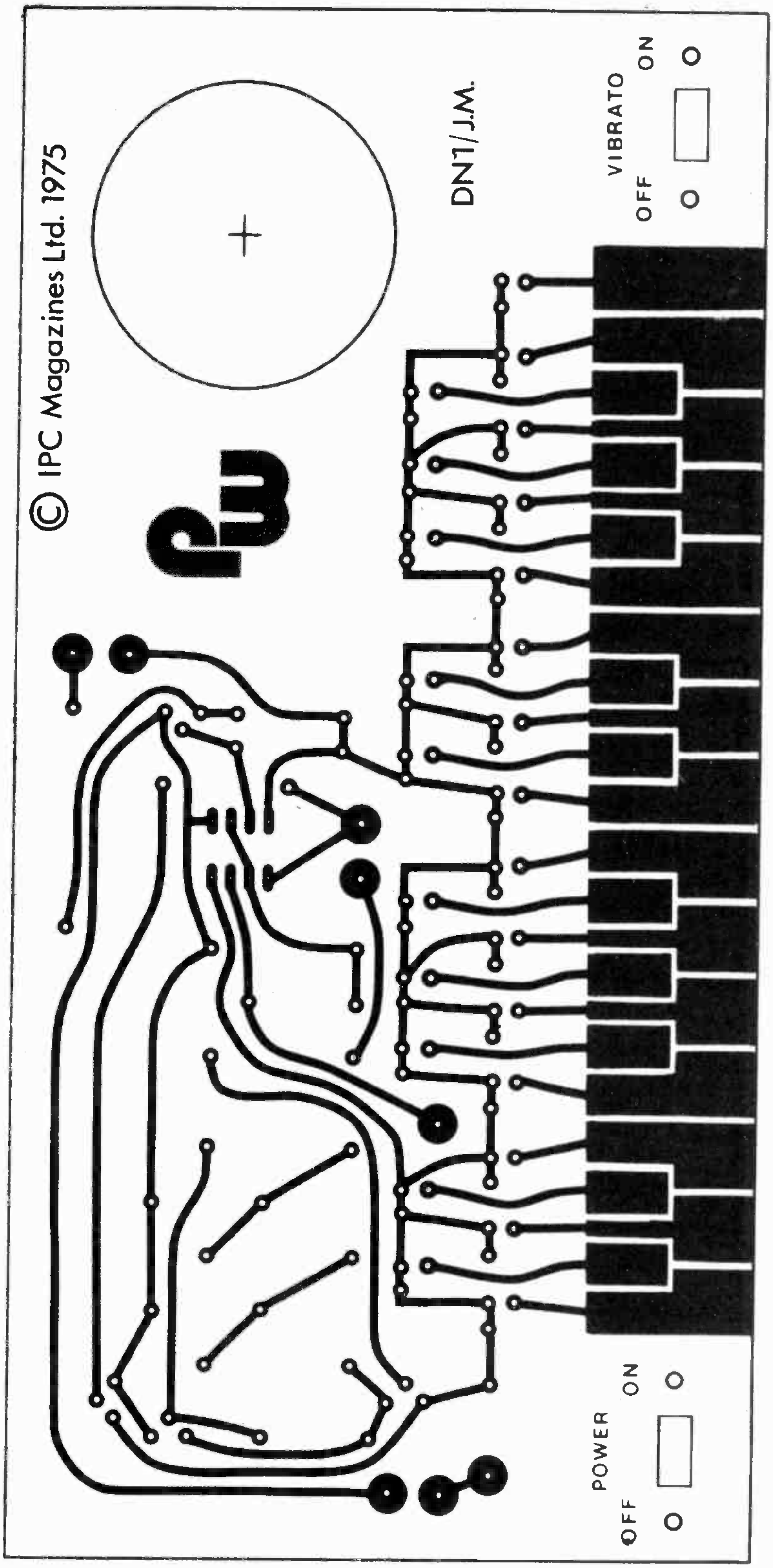
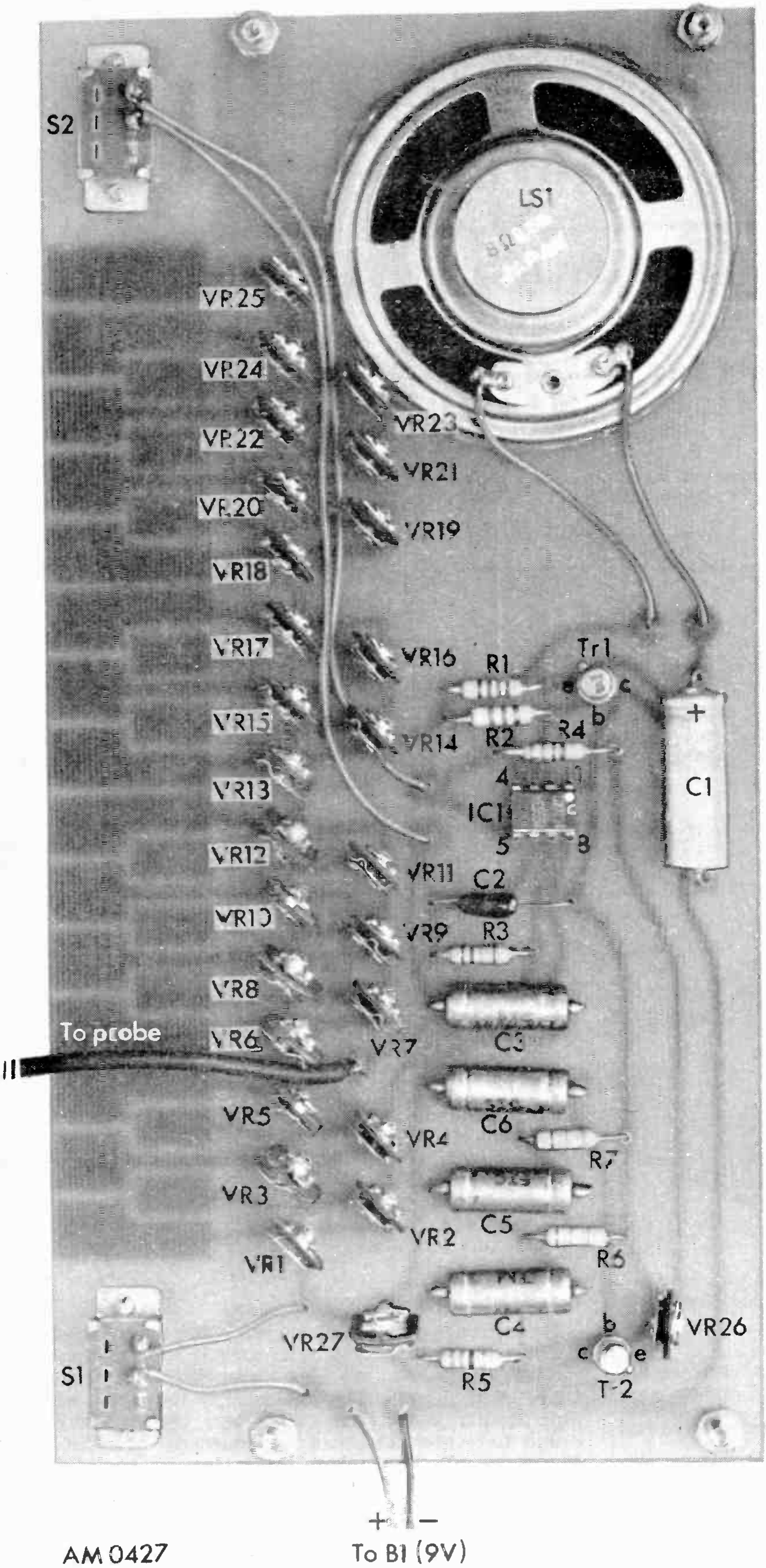


Fig. 2: above, shows the PCB for the Music Box, drawn actual size. Fig. 3: next page, is a guide to the layout of the components on the PCB. The voltage stabilising circuit shown in Fig. 1 is not included on this board. The two switches and the speaker are glued to the plain side of the PCB.



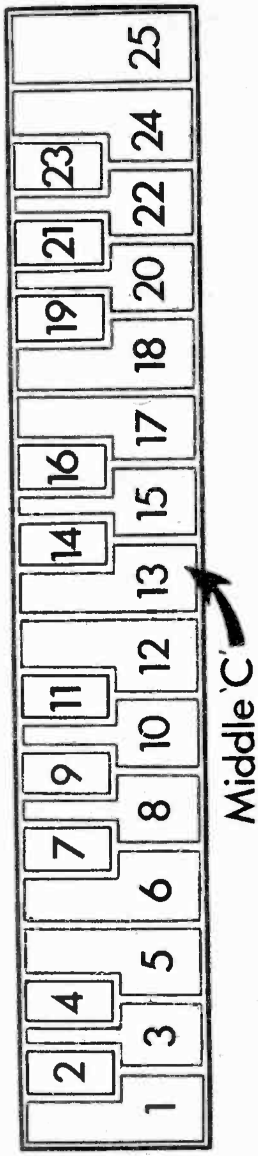


Fig. 4: 'Keyboard' layout with the 'keys' numbered to enable tunes to be played using the notation shown on the next page.

strain and prevent pulling of the lead from its solder pad. Make a final check on the tuning and then screw the PCB into position in the box.

To make the probe use the body of a felt-tipped pen having first removed the tip and the internals. The flying lead should be threaded through the body, if necessary drill out the back end and through the tip. Strip off a bit of insulation and fold the wire back on itself and apply a smooth blob of solder.

'COME ALL YE FAITHFUL'

8 8 — 3 8 10 — 3 — 12 10 12 13 12 10 — 8 8 — 7 5 7 8 10 12 7 5 — 3 3.

'CAMPTOWN RACES'

11 11 11 8 11 13 11 8 — 8 6 — 8 6 11 11 11 8 11 13 11 8 — 8 6 — 8 6 — 4.

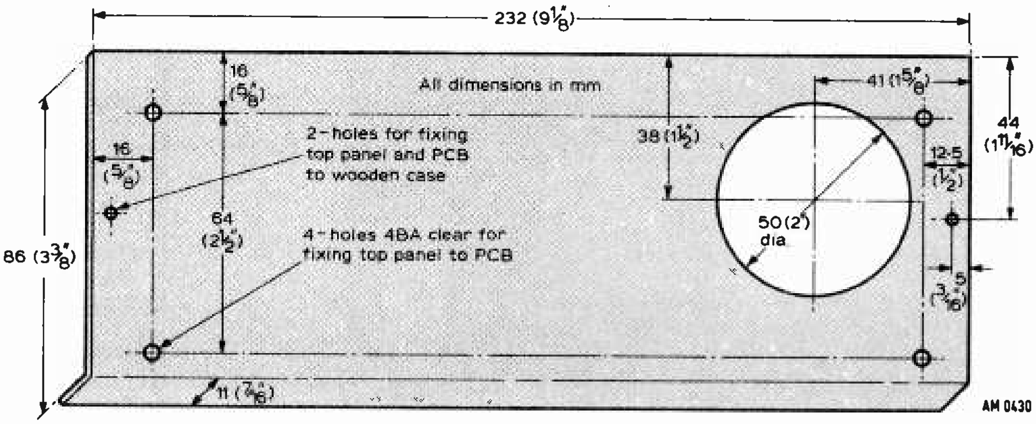
'COCKLES AND MUSSELS'

1 6 — 6 6 6 10 — 6 8 8 8 8 11 8 8 10 13 11 10 13 11 10 6 8 — 6.

'JINGLE BELLS'

13 13 13 — 13 13 13 — 13 16 9 11 13 — 14 14 14 — 14 14 13 13 13 13 13 11 13 11 16 — 13 13 13 — 13 13 13 — 13 16 9 11 13 — 14 14 14 — 14 14 — 13 13 — 13 13 16 14 13 11 9.

To assist the non-musical the notes of some well-known tunes are numbered as shown here to correspond with the 'keyboard' of Fig. 4.



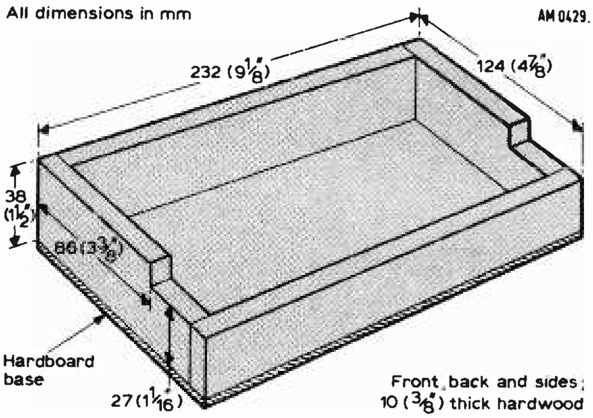
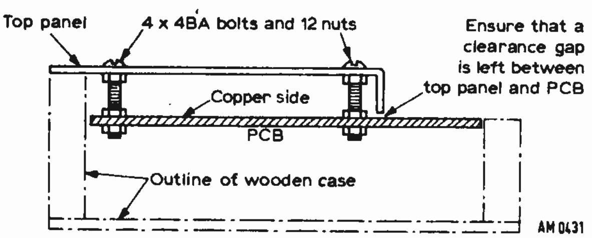


Fig. 5: Dimensions of the top cover of the Music Box. The speaker aperture can be backed with a small piece of cloth or the cutout can be made ornamental as in the author's model.
Fig 6: left, shows the simple case for the Music Box.
Fig 7: below left, illustrates the way in which the PCB is fitted to the top cover. It is very important to see that the gap shown is adequate to prevent the top cover shorting the 'keys'.



Finally, carefully glue the wire and the tip into place with epoxy resin.

An overlay, Fig. 4, can be cut out and stuck on the lid to match up with the keys. This is for the benefit of those who cannot read music but would like to practice playing music such as the selection of seasonal tunes shown.

MAKING MUSIC

Having built and tested the Music Box the natural desire will be to play a tune on it! For the non-musical constructor we have reproduced the 'keyboard' with numbers, together with the notes of four popular ditties given as numbers, thus enabling a tune to be played without any knowledge of music. The dash indicates a short pause.

To carry the idea further and to make the playing of a tune even easier by this method, the 'keys' can be marked with the numbers by means of small sticky labels or even with a felt-tipped pen.

want some lolly?

££££££££££££££££££££££££££££££££££

Eric Dowdeswell Asst. Editor

IT has occurred to us that considering something around 110,000 copies of PW are sold every month, the number of articles received from readers for publication is remarkably small! Apart from articles commissioned from established authors, and those written by our own staff, we rely upon material received from readers.

We believe that PW pays authors reasonably well for their efforts so we came to the conclusion that among the many constructors there are plenty who think that they are not capable of putting their practical experience into words and diagrams. We believe they are wrong, so let us see what is wanted by us from you and how we can help you to help us to help you to a little lolly. Phew!

One of the most important aids for the electronics constructor, whether he works on the kitchen table or in a well-equipped workshop, should be a notebook in which he can record circuits used, values of components, lead-out connections of IC's and transistors, circuit changes and modifications and a host of other information that will prove invaluable when it comes to writing an article.

Don't be afraid of large circuit diagrams. In my own case, my favourite field in design and construction is receivers and transceivers yet I have never drawn a complete circuit diagram of one in my life! Of each separate stage, yes, with precise details of any home-made components, such as coils, as they were actually made. It is our Technical Illustrator who will put it all together, if necessary. So, if your circuit is at all complicated split it into separate logical stages, taking care to identify various inputs, outputs and power supply lines. Use ruled or graph paper to assist in the preparation of a drawing.

The drawings should be clear, naturally, but masterpieces of artwork are not wanted and will not be used as such, anyway. Accuracy is the watchword and if you make any last minute modifications to the actual model then do not forget to alter the diagrams where relevant and the copy, if affected. This is where the notebook really comes in useful.

Put all diagrams, graphs, tables and suchlike on separate sheets of paper and mark them with figure numbers to agree with the text. Under no circumstances must such material be included in the main copy.

We like to have your manuscript with wide margins at the top, bottom and both sides and typed double spaced. Even if your copy is perfect we still have to mark it with instructions for the compositors. Of course, the copy can be handwritten but it must be clear and easy to read or the Editor will not be very impressed! I should perhaps point out that all articles received are first seen by the Editor and then passed round the technical staff for their comments before being accepted or rejected by the Editor. It doesn't take very long to do this, so don't worry!

As for general style of writing, look at any articles in PW and follow that. A short introduction, the general thinking leading to the final design, brief description of how the circuit works plus general notes on construction and alignment where called for. As for symbols in the text, again look at PW.

When typing try to keep to about 48 characters a line and then it is an easy matter to assess the total number of words, which should be shown on a cover sheet to the manuscript.

One item often omitted by an author is a components list and the source and price of any parts which may be difficult to obtain or not generally available. If you have been a constructor for a while you will have accumulated a lot of spare components so, in a project intended for publication, make sure that you quote the correct specification for say, a resistor, for the particular circuit and not the value and wattage that you happened to use from your junk box! Don't quote several different values of bypass capacitor, just because they were available, where a common value would be much more helpful to the reader.

Check that the components list agrees with the circuit diagram for values and don't forget the items that do not show on circuit diagrams or physical layouts, such as battery clips, transistor holders if used, knobs, dials etc.

Photographs of a treasured project are a rather sensitive point with some authors! Unless good photography happens to be another achievement of the author the results are generally grim if the shots are made at home. Out-of-focus blobs on rumpled patterned tablecloths leave a lot to be desired! Initially they do give us an idea of what the thing looks like but if the article is accepted we will probably ask you to send the prototype to us for photographing in our own studios. DO NOT SEND IT UNTIL ASKED!

If you think you can manage to wield the camera successfully we want clear black and white half-plate pictures but the size is not so important. Identify pictures by writing on the back with a very soft pencil, never a biro pen, or preferably by writing on a small label and sticking that on the back of the picture.

Now that you are getting close to the stage of sending the lot to us, there are a couple of points more. When the copy is right, number the pages consecutively. Read it through as if you were a reader seeing it for the first time, referring to your circuit diagrams etc. which will crosscheck your figure numbering. Small alterations may be made by hand in the text but if extensive should be typed on a separate sheet of paper with instructions to insert where indicated.

It will be a nuisance I know, but before you part with all your bumph do get it photocopied, diagrams and all. We may need to refer to you on some point or other which is pretty pointless if you haven't got a copy of your article!

When we get your masterpiece we will acknowledge its receipt at once followed by a letter later on to advise acceptance or otherwise. Payment is usually on publication of the article but the Editor may, in certain circumstances, decide to pay on acceptance but this would be exceptional. Obviously a project should appeal to our readers and it does not have to go to six pages or several parts, a couple of pages can be just as interesting and equally welcome.

We do not expect our authors to invent new circuits but if you know that your design is based upon a circuit already published then we would expect you to acknowledge the fact in the text, as is frequently done. Our editorial staff read an awful lot of technical magazines in the course of a month and a couple of us have pretty long memories (and a lot of years!) so don't bother to submit a direct 'pinch' from another magazine. If we don't spot it, our eagle-eyed readers will!

SUMMARY

Diagrams, circuits, graphs and the like must be on pages separate from the copy and numbered to correspond with the copy.

The copy should be typed with double line spacing and with ample margins at the top, bottom and sides of the pages and on one side only of each sheet. Try to type to about 48 characters a line.

Photographs should be clear and in black and white, preferably half plate size. Identify each photograph on the back, see text.

Look at any copy of PW for guidance as to symbols and style to be used.

WHY NOT CONTACT THE EDITOR NOW WITH BRIEF DETAILS OF THAT PROJECT YOU WOULD LIKE TO WRITE ABOUT?

The Black Watch – using the unique Sinclair-designed state-of-the-art IC.

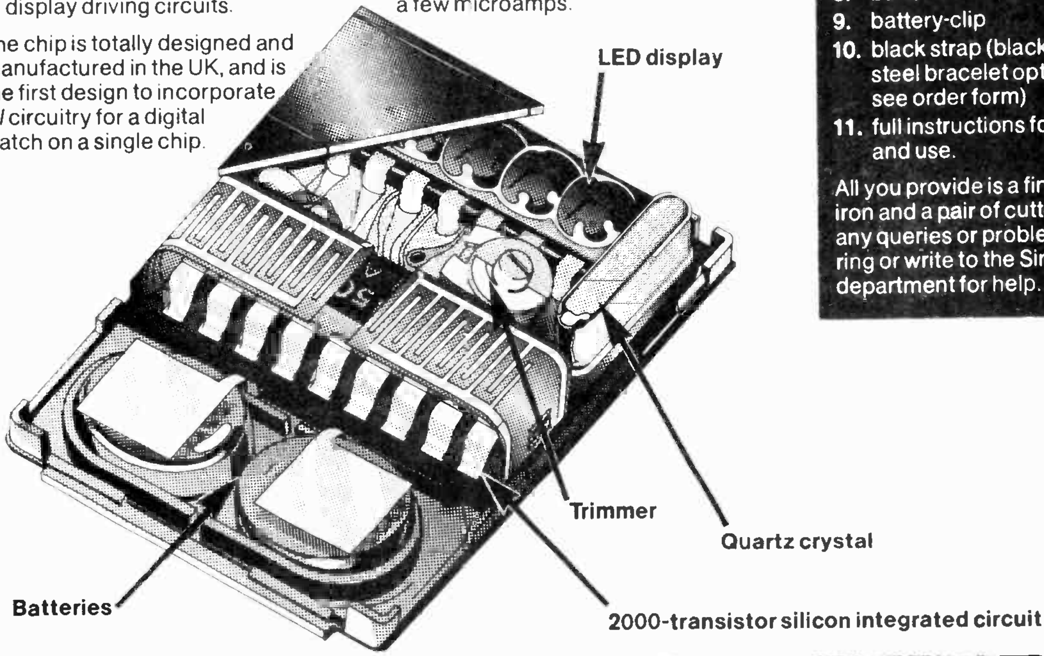
The chip...
The heart of the Black Watch is a unique IC designed by Sinclair and custom-built for them using state-of-the-art technology – integrated injection logic.

This chip of silicon measures only 3 mm x 3 mm and contains over 2000 transistors. The circuit includes

a) reference oscillator
b) divider chain
c) decoder circuits
d) display inhibit circuits
e) display driving circuits.

The chip is totally designed and manufactured in the UK, and is the first design to incorporate *all* circuitry for a digital watch on a single chip.

...and how it works
A crystal-controlled reference is used to drive a chain of 15 binary dividers which reduce the frequency from 32,768 Hz to 1 Hz. This accurate signal is then counted into units of seconds, minutes, and hours, and on request the stored information is processed by the decoders and display drivers to feed the four 7-segment LED displays. When the display is not in operation, special power-saving circuits on the chip reduce current consumption to only a few microamps.



Complete kit £17.95!

The kit contains
1. printed circuit board
2. unique Sinclair-designed IC
3. encapsulated quartz crystal
4. trimmer
5. capacitor
6. LED display
7. 2-part case with window in position
8. batteries
9. battery-clip
10. black strap (black stainless-steel bracelet optional extra – see order form)
11. full instructions for building and use.

All you provide is a fine soldering iron and a pair of cutters. If you've any queries or problems in building, ring or write to the Sinclair service department for help.

Take advantage of this no-risks, money-back offer today!

The Sinclair Black Watch is fully guaranteed. Return your kit within 10 days and we'll refund your money without question. All parts are tested and checked before despatch – and correctly-assembled watches are guaranteed for one year. Simply fill in the FREEPOST order form and post it – today!

Price in kit form: £17.95 (inc. black strap, VAT, p&p).

sinclair

Sinclair Radionics Ltd,
London Road, St Ives,
Huntingdon, Cambs., PE17 4HJ.
Tel: St Ives (0480) 64646.
Reg. no: 699483 England. VAT Reg. no: 213 8170 88.

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

Please send me Total £

.... (qty) Sinclair Black Watch kit(s) at £17.95 (inc. black strap, VAT, p&p). ....

.... (qty) black stainless-steel bracelet(s) at £2.00 (inc. VAT, p&p). ....

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

* Please debit my *Barclaycard/Access/American Express account number

....

Name ____________________

Address ____________________

____

____________________ PW1

Please print. FREEPOST – no stamp required. *Delete as required

GENERAL SERVICING

An occasional series by LES LAWRY-JOHNS chatting this time on—

1-UNIT AUDIO EQUIPMENT

THE units referred to in this article are mainly those of the cheaper variety costing, say, under £100. Such a unit could have an auto-changer of the cheaper BSR type with a simple amplifier system using a single audio chip for each channel or perhaps an audio pair, a driver and a preamplifier for each channel. Several examples of such units have been produced by various firms, some with radio, some without, and they all tend to follow a similar pattern of a basic design with limited output and few frills.

Auto-changers

We shall start by taking a quick look at the auto-changer which does tend to give one or two troubles which occur so often that they can be predicted, within reason. The most common trouble which we have experienced of late is due to lack of lubrication on the centre post, the friction sometimes becoming so great that it is difficult to spin the turntable by hand. Normally things do not get to this stage as the user is concerned by the slow and varying speed of the turntable and either does something about it or gets something done.

A variation on the same theme is noisy rotation, causing the pick-up arm to vibrate. The answer is to remove the centre trim and circlip, ease off the turntable and oil the centre post. Check for any roughness and do the same with the turntable centre bearing. Whilst doing this it is worthwhile checking the motor and idler. Whilst the bottom bearing of the motor rarely needs attention, although it does happen, the top bearing loses its lubrication, understandably enough, much earlier. So a few drops in the top bearing do not come amiss. The screeching of a dry bearing is not an uncommon noise to issue from the average type of motor.

Another cause of speed variation is lack of friction between the motor spindle and the rubber of the idler wheel. The rubber tends to become shiny and requires roughening with a piece of fine sandpaper or the like. Make sure that no oil gets on this rubber and that it spins easily on its post. It is often thought that wear on this rubber idler will cause the speed to vary, due to its smaller diameter. This is not so. The size of the idler wheel has no influence on the speed of the turntable at all, unless of course it has an irregularity on its surface when it will produce a bumping effect. The speed is controlled by the motor and its drive spindle and the size of the turntable driven surface.

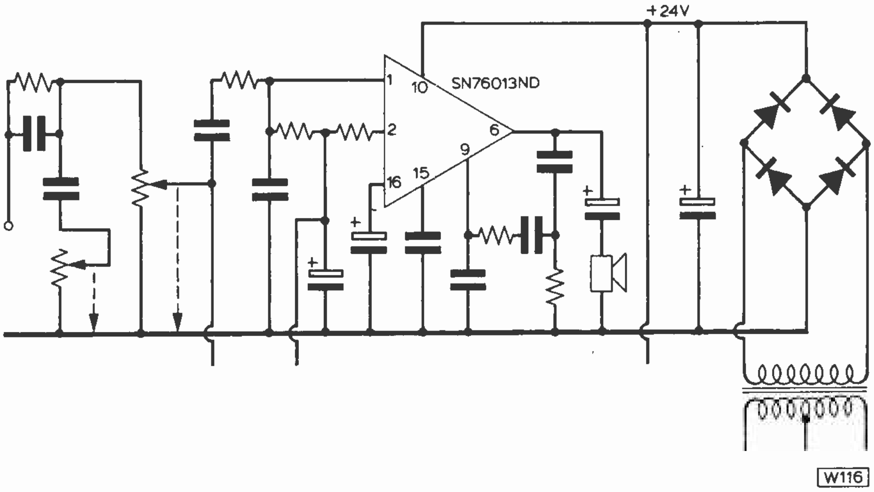
Having got that off our chest we should now have a smoothly running motor, an evenly spinning idler driving a turntable which is freely rotating about the centre pillar. Belt driven and direct drive turntables need not concern us here as they are found only in more expensive assemblies.

The Amplifier

Before considering any specific faults we should first consider external factors which can cause them. The most common fault is failure of the output transistors or ICs (chips). Such failure can be caused by the use of unsuitable loudspeakers or a fault in the cable to them, including the possibility of the leads in the plug touching. It pays to check the plug and lead, plus any joins in it, and the loudspeaker itself. If the amplifier output is specified for 8Ω working, ensure that the loudspeaker is an 8Ω one and that no other loudspeaker has been wired across it.

A good number of loudspeakers clearly marked 8Ω have been found to be 3Ω, and usually of unknown origin, and this has meant that the equipment to which they have been fitted has been overrun, dissipating excessive current and thereby excess heat. This has meant the early demise of the ICs

—with suspicion of the driver—



This is the basic circuit of many stereo amplifiers found in domestic audio equipment and serves to illustrate the text.

or output transistors operated beyond their rated power. Quite often the loudspeakers are fixed in a position, together with their wiring, which makes removal inconvenient so that when the amplifier fails it is only this which is taken for repair. With new components fitted and tested upon correct speakers, the equipment is once more coupled up and the overruning is repeated.

A permutation of this state of affairs is often that one speaker is incorrect, one correct. One channel fails due to overrunning and the owner changes over the speaker plugs to "check the speakers". This means that the wrong speaker is now connected to the good channel and the correct speaker to the failed one. The equipment can be operated like this for some time on the basis that "some sound is better than none" with the resultant destruction of the good channel.

Another consideration here; if one channel fails and the supply is not regulated, the remaining channel will operate at a higher supply voltage and thus may fail due to this factor. The only moral which can be drawn is that if one channel fails, for whatever reason, the equipment should not be used until the fault(s) is rectified and the system checked.

—leave no whiskers which can rotate—

Before leaving the subject of loudspeakers let us make one or two points, probably elementary to most, quite clear. If loudspeakers are to be added to an existing system and there is no provision for this on the amplifier, add them in series (cut one wire and insert the speaker), never loop off in parallel. Parallel working decreases the impedance and thus increases the load on the amplifier. Series working increases the impedance and decreases the load; not so much power but the amplifier will last longer! If an amplifier is designed to work into 8Ω, use an 8Ω load, or more, but not less. If leads have to be joined, make sure they cannot touch accidentally. If plugs are to be soldered, bring the insulation right up to the tags and leave no whiskers which can rotate and touch if the leads are twisted. These simple precautions can avoid annoying and costly repairs. If space permits, put a short length of insulating sleeving over the insulation of the wire and slide it over the joint when it has been soldered.

Servicing Amplifiers

The rather simple stereo amplifier which is likely to be fitted in our unit under discussion, will have a pair of audio chips or two pairs of output transistors with driver(s) and a preamplifier. An example of one channel a unit, with the bare necessities, is shown in the circuit.

Undoubtedly the most common fault in these units is the failure of one or both of the ICs, usually SN76013ND or SN76013N. The main difference is that the ND lies flat on the panel with two pieces of metal soldered to the print earth as a heat sink. The N series differs by having these pieces of metal bent up to form a larger finned heat sink.

If one is lucky, and things have not gone too far, the unit can be connected to the speakers and switched on to produce sound from one speaker and nothing (or a hum) from the other. If there is no sound at all from one channel this chip will be quite cold and a voltage check will show a reading on pin 10 only. If there is a hum from one side the chip will be overheating and again is easily identified.

Replacement of a defective chip is not at all difficult provided one has an efficient means of removing the solder to leave the chip loose in the holes so that it can be lifted out and the new one popped in, soldered on all active pins, and any flux removed from between the joints. Removing the solder in the first place is the major part of the battle. A soldering bit which fits over all pins at once and sucks up the solder in one go is a luxury which not everyone has available. Most are content to use a simple vacuum pump or perhaps the more efficient desoldering braid. On occasions this is all that is required but, more often than not, things are not that simple.

—many engineers are climbing Mount Everest—

For example, both channels may be inoperative but only one chip need be at fault (check voltages for this one) because one chip can turn the other off. Again, one channel may be working when tested and the other is defective. When the latter is replaced the unit may work fine for a time and then one channel fails, quickly followed by the other. Investigation may show that the new chip has failed but the other is now functioning just to add to the confusion. The answer is that one has been intermittent causing the voltage to rise, in turn causing the otherwise good one to short internally. The answer is to replace both chips when there is the slightest hint of "one channel went first, and then the other". Such hanky panky can also cause trouble elsewhere. For example, a shorted chip (or output pair of transistors) can cause a heavy flow of current sufficient to cause the bridge rectifier to short out before the fuse fails. Hence one can be faced with a blown fuse, apparently caused by a defective rectifier. Replacement of these parts should be followed by a careful check on the supply line to ascertain whether there is still a contributory short.

It is alarming just how much time, money and patience can be expended on a seemingly simple job if one is not aware of the pitfalls that await the unwary or unwarned.

This is one of the reasons why audio unit repairs are not exactly sought after by workshops, often engaged in the usually more straightforward servicing of TV receivers. The fact that these latter devices are being served up with ever-increasing numbers of chips probably explains why many engineers are leaving the trade and taking up the less arduous pursuit of climbing Mount Everest or deep-sea diving. Those remaining hope that replacement panels will save them in the field whilst the faulty panel can be put on a test rig under test for diagnosis by someone else during the day or by himself in the wee small hours!

In all cases the rule is to know what the voltages should be at various points or at least be able to compare a working stage with a non-working one, and to take these voltages without damaging the item under test. An ordinary voltmeter test prod is a pretty clumsy affair and can easily slip between adjacent pins of a chip. Either sharpen the probe or bind a needle to it. If there is doubt, check all relevant components. A leaky capacitor or a faulty resistor is often found after a chip has been needlessly replaced.

AC or DC Coupling

Whilst most up-to-date inexpensive amplifiers use chips, some modern and all older ones use a balanced pair in the output stage of each channel with their drivers and pre-amplifiers. The very early amplifiers used transformer coupling from the driver to the output pair and this made fault diagnosis very easy as the output stage was, from a supply point of view, bias, etc., independent of the earlier stages. Thus if one transistor's voltages were high it was a comparatively easy matter to cold test each transistor and associated resistors to ascertain where the short or open circuit was occurring.

It hasn't been that easy for some considerable time now, as transformers are a thing of the past; stages are DC coupled and thus interdependent. A fault in an early stage can easily switch off all succeeding stages so that wildly wrong voltages in the output stage need not denote a fault here, or in the driver stage(s). The rule is therefore to regard the amplifier as a whole and start from the beginning, say from where the preamplifier is isolated from the preceding stage by a capacitor. The snag, once again, is that the pre-amplifier may depend for its bias on the output stage, then where are you?

Quite often the job is less tedious than it could be by virtue of the fact that certain types of transistor are more prone to fail than others. For example, if we know that AC128 transistors are used, these are tested first, together with the associated emitter resistors. This has saved time, again and again. The method of cold testing transistors with an ohmmeter has been described on many occasions and will not be repeated here. Quite apart from this, if the emitter resistors appear scorched or otherwise distressed, these usually being about $2 \cdot 2\Omega$, it is a pretty safe bet that the output pair need replacement together with suspicion of the driver.

If in doubt it is far better to replace all suspects in one go rather than try to pinpoint one particular transistor. Low and medium power audio transistors are cheap and easy to replace (as a rule, but there are always exceptions) but it is not always easy to gain access. So once the panel or unit is out for repair, do what is necessary plus anything else remotely suspect before reassembling.

—the answer is to replace both chips—

Noise

We have so far considered the causes of inoperative stages, but, all too often, the fault is the annoying one of excessive background noise. Usually the suspect items are capacitors or transistors, the latter being the main culprits, with electrolytic capacitors following close behind. Sometimes the responsible component is heat conscious and can be identified by a judicious squirt of cooling solution (Freezit) but more often the trouble is due to an internal defect which no amount of freezing or disturbing will alter. Operation of the volume control will immediately identify the rough position in the circuit (before or after the control, always assuming the control itself is not responsible) and this is a starting point.

Bearing in mind the fact that the whole circuit is probably DC coupled and that shorting the base to emitter of an early stage would probably shut down the whole circuit and thus do very little to identify the actual culprit, a fairly high value capacitor can be used (depending upon the circuit values) to short out the signal and eventually the noise when the faulty stage is reached.

Distortion

Distortion is usually due to transistors working under improper conditions, sometimes caused by leaky capacitors, sometimes by faulty transistors, very occasionally by incorrect value resistors. The action taken depends very much upon the experience of the repairer. Very often a short-cut can be taken if the type of capacitors fitted are those which are well-known to be likely to break down. If, for example, some small electrolytic capacitors are fitted which are coloured black with silver writing denoting their value, etc., it is prudent to check the voltages of the associated stages and if these are suspect, remove the capacitor and test again. If the voltages are now right, and a meter check reveals heavy leakage through the capacitor, the short cut is well justified. Quite often the output transistors are unmatched or one is defective, this showing in a voltage check followed by a cold resistance test. If the voltages are wrong but the cold test appears about right, check the driver stages where a high reading may be found both ways, base to emitter or base to collector, or perhaps a low reading in the reverse (when it should be high, taking into consideration the circuit values) direction.

Dry Joints, and the like

It is often the case that incorrect working is not due to component failure at all and it is always worthwhile spending a little time gently rocking various components to ensure that they are properly soldered to the panel. It is surprising how long a piece of equipment will function with a component not being soldered at all in the first place! It doesn't usually show up until, as a rule, the equipment is disturbed. Since this is usually due to a fault developing in another section, the repairer is faced with two faults instead of one although he probably only realises this when the more obvious fault has been located and cleared. This is irritating, to put it as mildly as possible.

A variation of this is a crack in a copper track which may not show up until the panel is flexed. This again is a great time waster and a combination of signal injection, voltage reading and continuity testing may be required to locate the break if it cannot be seen.

Checking the Cartridge

One of the more common faults is that the output of one channel is normal but the output of the other is low or absent. It is prudent to check the cartridge on the pick-up head before taking any other action. This is done quite easily by disconnecting the leads from the cartridge, with the amplifier on and the balance control at centre, when hum, equal from each channel, should be obtained, picked up by the active lead to each channel, usually the red for one channel and white for the other, the black and green leads being earthed and common. If the red clip provides a reasonable hum when touched as does the green for the other channel, the amplifier is likely to be in order and the cartridge at fault. A replacement cartridge is probably the only attention required. If there is hum from one side but not the other, follow the leads underneath to the tag strip and repeat the hum test. If equal hum is obained, the continuity of the relevant lead to the pick-up head should be checked. If no hum is received on one side follow through to the amplifier and check the input to this with the lead connected and with it off; to check for the rather unlikely possibility of a short in the cable, from inner to screening.

Having said this we hasten to add that if phono plugs are used for the connection to the amplifier or to the tag strip the possibility of such a short becomes a probability and will be found where the screening is soldered to the plug body, the heat used having melted the insulation between the inner and the outer. If this is so, cut back the cable and make the connection with a longer pigtail on the screen. It may not look so nice but a short is less likely.

TO BE CONTINUED

PRODUCTION LINES

colin riches

THE LOCKABINET

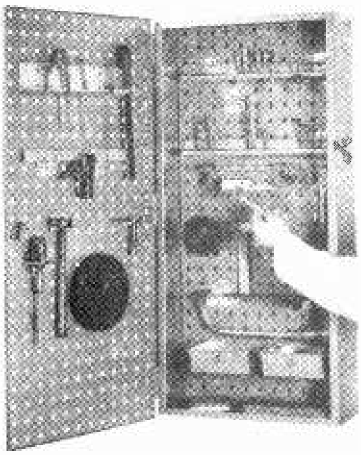
As tools of all types become increasingly expensive Lockpanel Ltd. have introduced a "Lockabinet".

The photograph illustrates the all British-made cabinet which is ruggedly constructed from 1·25mm (18G) metal panels. The cabinet has overall dimensions of 1000 mm (39″) x 460 mm (18⅛″) x 200 mm (8″). The back panel and door are perforated with a regular pattern of square holes into which can be hooked a wide range of tool holding accessories suitable for storing virtually any type of hand tool, engineers or electrician's tools.

The Lockabinet is wall mounted, with access to the fixing brackets from inside the cabinet. Thus, when locked it offers security for its contents whilst providing an orderly and visually effective storage method—each tool being easily located when required.

Finished in anti-chip epoxy stove enamel of light green colour the Lockabinet is provided with a chromium plated integral lock.

All the accessories can be purchased separately from the cabinet



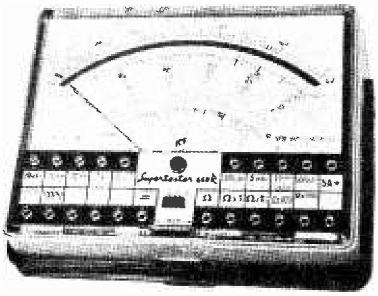
but the firm offers a complete kit which includes a cabinet plus a selection of the most generally useful accessories at £37·48. The price includes packing, carriage and VAT.

Lockpanel would be pleased to send full details of the Lockabinet to any readers on application. *The Lockpanel Company Limited, Marjorie Street, Leicester, LE4 5GZ.*

THE SUPERTESTER

The Supertester 680R is an 80-range test meter with a 20,000 ohm/V sensitivity.

Technical data—Volts A.C. 11 ranges: 2-10-50-250-1000-2500 Volts and **4-20-100-500 and 2000 Volts.** Volts D.C. 13 ranges: 100mV-2V-10-50-200-500-1000 Volts **200mV-4V-20-100-400 and 2000 Volts.** Amp. D.C. 12 ranges: 50 µA-500 µA-5 mA-50 mA-500mA-5 Amp and **100 µA-1 mA-10mA-100mA-1 Amp and 10 Amp.** Amp. A.C. 10 ranges: 250 µA-2·5mA-25mA-250mA-2·5A and **500µA-5mA-50mA-500mA-5A.** Ohms 6 ranges: **x1-x10-x100-x1000-x10,000 and Low Ohms.** Detector Reactance 1 range: from 0 to 10 Megohms. Frequency Output 2 ranges: from 0 to 500 and from 0 to 5000Hz. Voltage Output 9 ranges: 10-50-250-1000-2500V and **20-100-500-2000 Volts.** Decibels 10 ranges from −24 to +70dB. Capacity 6 ranges: from 0 to 50,000 and from 0 to 500,000pF using the mains and from 0 to 20, from 0 to 200, from 0 to 2,000 and from 0 to 20,000 microfarad using the incorporated 3 Volts battery. **Bold figures indicate A — V x 2.** Price complete with case and probes is around £18·50. Further information on the 680R and other instruments from: *Electronic Brokers Ltd., 49-53 Pancras Road, London, NW1.*



KNOBS, ETC.

A broad range of collet knobs and accessories is now available from Roxburgh Electronics Ltd.

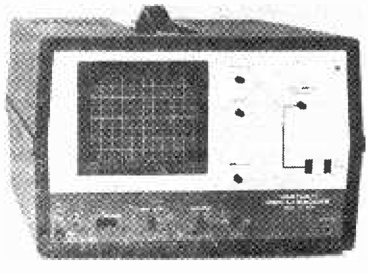
Designed for ease of handling and simplicity of assembly, they are produced to fit shaft diameters of 3mm., 4mm. or 6mm., and ⅛ in. or ¼ in. The diameters of the knobs, at 10, 11, 15, 21 and 29mm., are such that they will fit into the cap recess of the next largest size, enabling double knobs to be formed.

The knobs and nut covers are available in winged and plain styles, with or without line, in matt finished black, red or grey nylon; the caps and pointers, which are also of matt finished nylon, are additionally available in green, blue or yellow. The captioned dials, which can be supplied with a variety of standard legends and symbols, are of polycarbonate. *Roxburgh Electronics Ltd., 22 Winchelsea Road, Rye, Sussex. Telephone: Rye 3777.*

DC-5MHz, 100mV SCOPE

The new Heathkit IO-4560 'scope's sweep speed is continuously adjustable from 20 ms/cm to 200 ns/cm. Maximum vertical sensitivity is 100mV with a front panel switch for X1, X10 and X100 attenuation, AC or DC. Vertical input impedance is 1 megohm for low circuit loading. Up to 400 VDC can be applied directly without circuit damage, making it a great 'scope for students' use. For phase and frequency measurements, an external horizontal input can be applied directly through the front panel input jack. It has 250mV sensitivity with DC to 100kHz bandwidth. Display stability is excellent because the low voltage supplies for the amplifiers and sweep circuit are zener regulated. The primary circuit of the power transformer is fused for protection from over-load.

Kit K/IO-4560 costs £69·90 including VAT and delivery within the United Kingdom. Full details available upon request from: *Heath (Gloucester) Ltd., Bristol Road, Gloucester GL2 6EE or The London Heathkit Centre, 233 Tottenham Court Road, London W1P 9AE.*



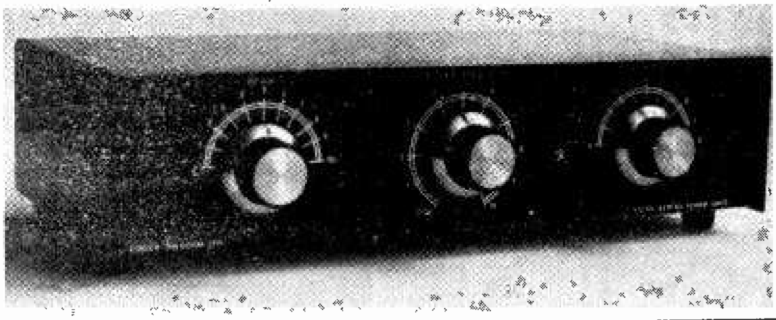
AERIAL TUNER UNIT

The Codar RQ-80 A.T.U. has been designed to match the random lengths of single wire often employed as aerials on short wave receivers, and to provide an efficient coupling to the receiver input with appreciable increase in signal level. It is particularly effective where short or indoor aerials have to be used because of space limitations.

The RQ-80 employs an air spaced Hi-Q low-loss "Codarcoil" inductor in a tuned input/output PI-network with a very wide range of matching obtainable with 10 switch positions of inductance taps. An additional switch position transfers the aerial direct to the receiver.

The nominal range covered is 1·5–30MHz continuous, the L.F. end limit being dependent on the type and length of aerial in use, and can be lower than quoted.

It is fully screened in a metal cabinet 23cm x 12cm x 5cm (9" x 4¾" x 2") and finished in charcoal grey and black with white legends. Co-ax output socket to receiver is provided. 12 months guarantee. Price is £12·50 posted. *Codar, Valcon Works, Burrell Buildings, Churchill Industrial Estate, Lancing, Sussex, BN15 8TZ. Tel. Lancing 61901.*



CAPACITANCE METER

Electronic Services & Products Limited, have introduced a new linear capacitance meter to meet a requirement for fast accurate measurement of a wide range of capacitors.

The instrument incorporates integrated circuits with a reliable linear scale meter producing accuracies usually reserved for manually balanced instruments.

Measurements as low as 1pF and up to 10μF are easily obtained by the simple selection of the appropriate range and NO balancing is required at any stage of the operation. The correct value is simply read direct from the meter.

Power is provided by two 9 volt (PP3) batteries whose condition is continuously monitored by a Light Emmitting Diode. Should the batteries fall below the voltage required for accurate measurement then the LED will not light. Price £35·00. *Electronic Services & Products Ltd., Braunston, Daventry, Northants. NN11 7HH. Tel. Rugby 890672.*

VEROBOXES

Vero Electronics Limited announce the introduction of a new range of Plastic Veroboxes® which have been designed to house the smaller type of instrument or control unit.

The boxes are constructed of two mouldings in light grey high impact A.B.S. and contain built-in guide slots for vertical mounting of P.C. boards or metal plates. The base panel is also fitted with threaded inserts for the attachment of a horizontal P.C. board or chassis. The boxes include, anodized aluminium front and rear panels for the mounting of switches, knobs, meters or plugs and sockets. These panels are held in position by the mouldings so that no panel fixing screws are required. The two mouldings themselves are screwed together by four screws which enter through the base moulding and are hidden from view by the plastic feet used with the boxes.

The illustration shows the various sizes of Verobox® which are available together with examples of the fixing of P.C. boards. A new full colour brochure is now available describing these latest additions to the Vero range of small enclosures. *Vero Electronics Limited, Industrial Estate, Chandlers Ford, Eastleigh, Hants.*

SINCLAIR'S DIGITAL WATCH

Sinclair recently announced their new digital watch (see News . . .) The electronic circuitry which controls the watch is all contained on a Sinclair-designed IC measuring 117 x 123 thou.—developed using injection logic technology—I^2L.

Sinclair believes that this original watch chip design, containing over 2,000 active devices is the sole production watch chip, using injection logic, available in the world today. The chip requires only a quartz crystal, trimmer capacitor, a LED display and mercury cells to complete the watch circuit.

The three-function watch employs a 32·768kHz flexural bar crystal as the frequency control element for the oscillator and this is trimmed in production to a precise frequency.

PW 'Easybuild' STEREO DISCO SYSTEM

PART 2 — A.C. AINSLIE* & C. TOMS†

Continued from last month

Heavy feedback around the power amplifiers has produced a design very tolerant of supply voltage fluctuations. This has saved the expense of a stabilised power supply and allows a reserve of power in the smoothing capacitors to give a transient music power output exceeding 100W.

Current consumption for one channel at full power is in the order of 2A. Ample safety margins are therefore provided by specifying a 6·6A bridge rectifier to power a stereo console. Smoothing is provided by two separate 1000μF capacitors since a single 2000μF capacitor to handle the necessary ripple current and high voltage is not generally available.

THE LIGHT MODULATOR

As there is sufficient audio signal voltage available from powerful amplifiers, a passive selective network is used for channel separation. The crossover frequencies are 3kHz and 7kHz giving better results than the more usual low frequency crossover networks. Fig. 5 shows the circuit diagram.

The level of each channel is controlled by VR16 (HF) VR15 (MID) and VR14 (LF). Overall display brightness is controlled by VR13 with R53 as a limiting resistor. Trigger transformers T2, T3 and T4 drive the gates of the thyristors and isolate the input circuitry from the mains. To reduce any mains borne interference, a capacitive suppression filter is provided (C33-39).

CONSTRUCTION

Ease of assembly and repeatability of results are ensured by assembling all the electronics on printed circuit boards with the exception of the mixer which is so simple that a p.c.b. is not needed.

Each sub-assembly is completed and preferably bench tested before being mounted into the console. The power supply is assembled in the console as it acts as a structural support and would need to be built before the other units could be tested.

STEREO/MONO OPTIONS

A mono disco console comprises a single pre-amp/power amp board, mono mixer and a power supply. Mono cartridges would be used in the turntables or stereo cartridges wired for mono (both channels paralleled).

LIGHT MODULATOR (OPTIONAL)

Resistors

R52	39Ω 5W wirewound
VR13	250Ω 1W wirewound
VR14	100Ω } horiz. skeleton presets
VR15	100Ω } horiz. skeleton presets
VR16	100Ω } horiz. skeleton presets

Capacitors

C30	0·47μF 100V working
C31, C32	8μF bipolar (B. B. Atkin) (2 off)
C33-C39	0·1μF 1000VDC (7 off)

Inductors

L1	1mH Type WK05/3K } (B. B. Atkin)
L2	0·5mH Type WK1/B3K } (B. B. Atkin)
T2-T4	High frequency pulse transformer (ITT) (3 off) (B. B. Atkin)

Thyristors

SCR1-SCR3	BTY79-400R (for 1kW per channel) or BT106 for console lights only (3 off)

Bulbs

LP2-LP4	100W spot bulbs (B. B. Atkin) (3 off)

Miscellaneous

Brass/ceramic bulb holders (3 off) (B. B. Atkin)
S4-S6 S.P.S.T. miniature toggle switches (3 off)
S7 S.P.S.T. illuminated rocker switch
F3 2A 20mm fuse and panel mounting holder
Terminal pins (10 off), printed circuit board (1 off)

*Consultant †W.K.F. Electronics

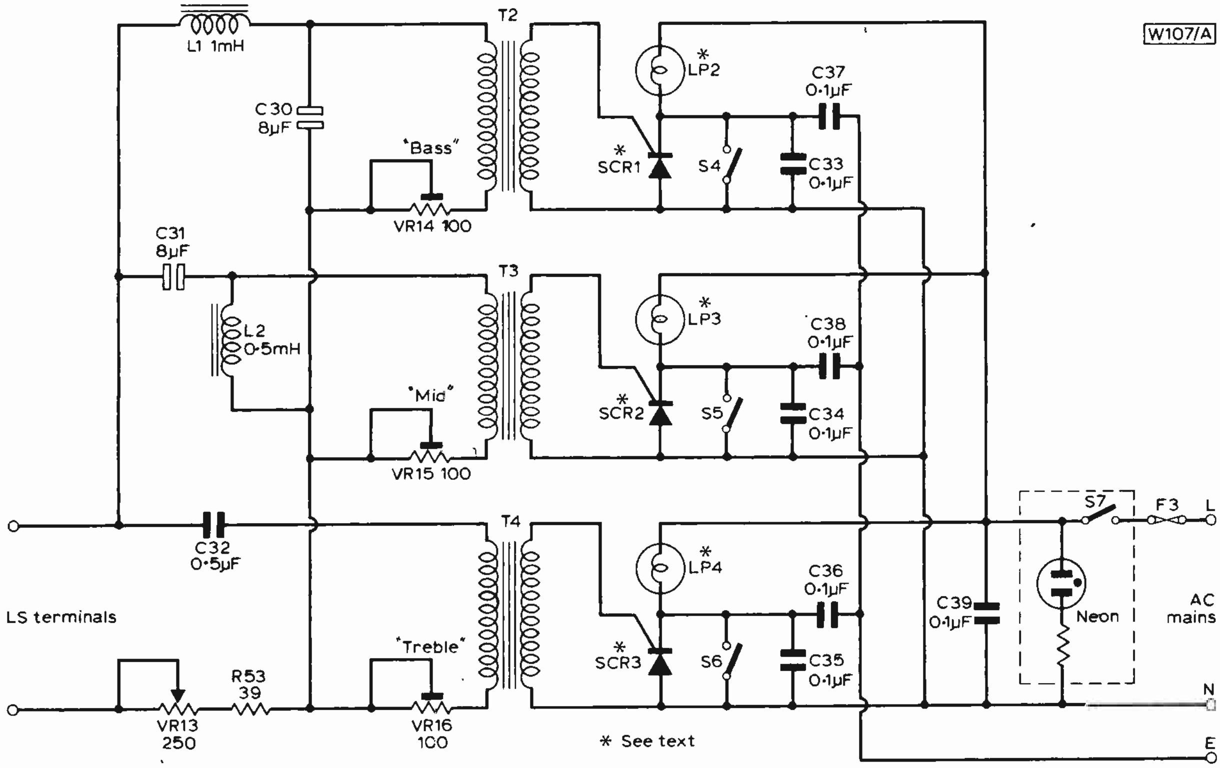


Fig. 5: Circuit diagram of the Light Modulator for use with the Disco system. The thyristors may be either BT106 for console lights only or BTY79-400R for up to 1000W of external lighting.

A stereo console would have a pair of pre-amp/power amp boards (one for each channel), as well as a stereo mixer using tandem controls and incorporating a balance control. A single power supply of adequate current rating is used, this being the same as for the mono version.

To allow for future conversion to stereo, a mono system could be built using a single pre-amp/power amp board but with a stereo mixer. To convert to stereo all that would be involved would be the construction of a second amplifier board and the removal of the cross-channel shorting link on the pick-up cartridges.

AMPLIFIER BOARDS

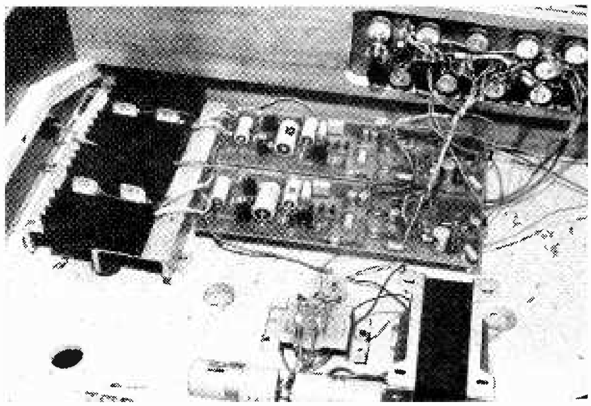
The p.c.b. design and component layout are shown in Figs. 6 and 7. Component mounting is quite straightforward and should follow normal practice. Attention should be paid particularly to capacitor and transistor polarities. Some of the transistor numbers are rather similar and particular care has to be taken not to confuse them. Close tolerance resistors have been specified to ensure consistent performance and all capacitor voltages have been chosen to allow a wide safety margin. C23 must be a low leakage component of adequate voltage rating. Polyester or tantalum capacitors are satisfactory but an electrolytic should not be used as the leakage currents upset the amplifier balance.

Small terminal pins (Veropins) are soldered to the board to take external connections.

All three driver transistors in the power amplifier dissipate quite high powers and need heatsinks. Simple black anodised clip-ons are perfectly satisfactory giving a thermal resistance of 50°C/W in free air.

The output transistors Tr15 and Tr16 are TO3-cased devices which require an insulating mounting kit on account of their "live" cases. A 150mm (6in) length of black anodised extruded heatsink which gives a thermal resistance of little more than 1°C/W and is adequate for both output transistors.

Silicone grease or special heatsink compound should be lightly smeared over the insulating washers prior to mounting the transistors. Shakeproof washers should be used on the mounting nuts and a solder tag placed under one nut of each transistor as the collector connection. A simple ohmmeter check should be made to ensure that none of the transistor connections is shorting to the heatsink. Two bundles of three colour coded wires connect the output transistors to the p.c.b. terminal pins.



Layout of the amplifier boards, power transistors on heatsinks and power supply components on the wooden cabinet described in detail next month.

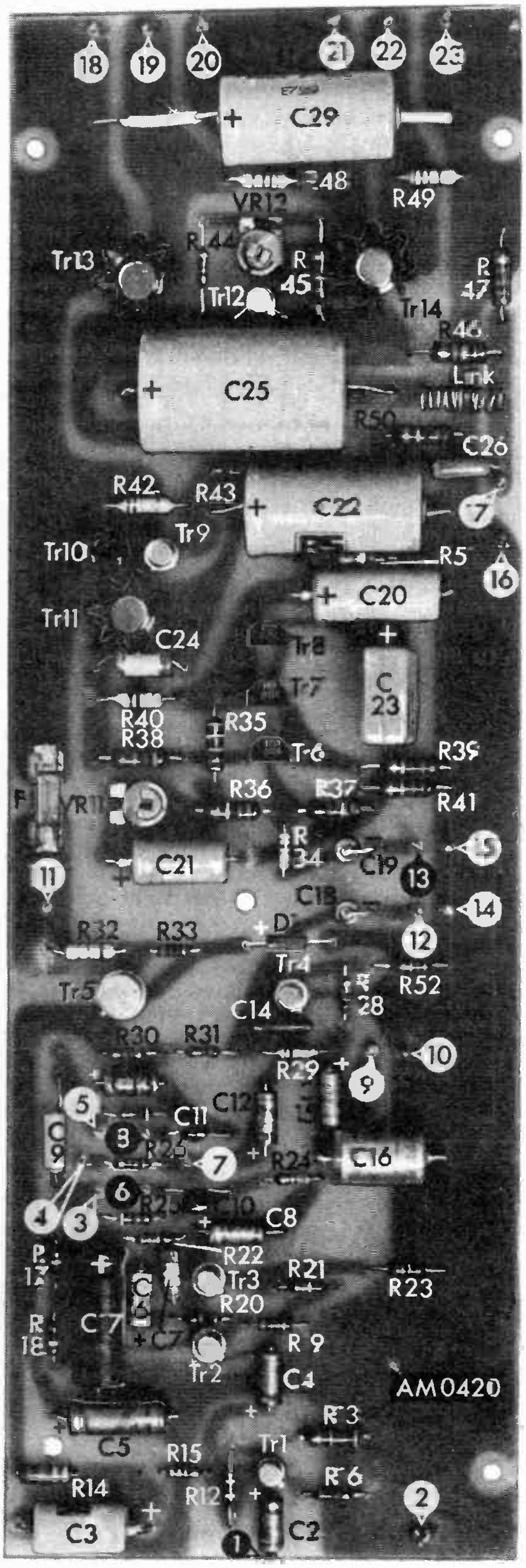


Fig. 6 and 7: Layout of the components on the amplifier board p.c.b. and printed circuit design (not to scale). The link to the right of C25 is coiled to aid high frequency stability (about ten turns).

Front view of the completed Disco Unit

POWER SUPPLY

The power supply transformer is mounted centrally on the bottom of the console. In this way it offers some support to the centre of the deck board which rests directly on top. If the recommended transformer is not used additional packing may be required to bring the overall height to 123mm. A transformer of low leakage flux should be used to reduce the possibility of hum pickup.

The bridge rectifier is mounted on a small heatsink which, together with a clip for the smoothing capacitor is screwed directly on to the wooden baseboard (see photo).

A terminal block is fixed to the bottom of the console to supply mains from the on/off switch to the transformer. When the decks are installed they will also draw their mains from this terminal block.

SETTING UP THE POWER AMPLIFIER

Before power is applied to the board, VR12 (quiescent current preset) must be set fully clockwise and VR11 (common mode voltage) set to midway to avoid damaging the pre-amplifier on switch on. No connections need be made to the pre-amp and the power amp input (negative end of C19) is temporarily shorted to earth.

With 80V applied to the power amplifier, VR12 is adjusted to bring the positive end of C25 to exactly 40V.

Should an oscilloscope and signal generator be available, VR11 can be adjusted for symmetrical clipping of a 1kHz sine wave applied to the power amplifier input. There is no need to have a load connected for this adjustment which is just as well as few loudspeakers would safely handle a 100W plus sine wave.

In the event of no equipment being available, VR11 should be replaced with a two per cent 60kΩ resistor which would give near to optimum performance.

Adjustment of the quiescent current preset VR12 is made with amplifier at operating temperature preferably installed in the plinth. Before VR12 is moved from its fully clockwise position, the amplifier is used to deliver a medium power (20 or 30W) into a load for a quarter of an hour or so to give sufficient time for the temperature to stabilise. With the input short circuit removed, the power amplifier will accept the output signal from most radio tuners or tape recorders and will drive a loudspeaker or dummy load (four 15Ω 10W resistors in parallel). The input signal is connected between earth and the negative end of C19, a suitable amplitude being 100mV or so.

When the temperature has stabilised the supply should be switched off, the input short circuit replaced and the supply fuse on the p.c.b. removed. The collector connection to Tr15 (pin 18 on the p.c.b.) is then removed and a 50mA meter placed in series. The load is removed from the output as the surge of current charging the output capacitor would damage the meter.

Having checked that the meter connections are secure the fuse is replaced and power applied. VR12 is adjusted carefully for a reading of 8 to 10mA, this quiescent current being sufficient to virtually eliminate crossover effects.

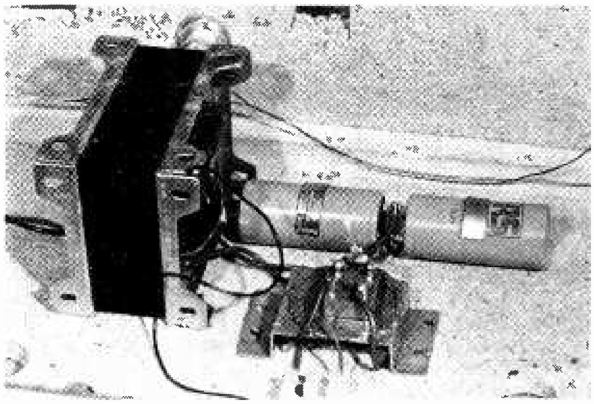
It is necessary to carry out this adjustment fairly rapidly so that the transistors do not cool down significantly from their operating temperature. When the complete Disco system has been assembled in the console, it is as well to reset the quiescent current after an evening's use. Readers without the equipment necessary for this setting-up procedure should turn the preset 20° from the fully clockwise position. This will result in a low but adequate standing current.

Under no circumstances should power be applied to the amplifier without the milliammeter or Tr15 collector connected otherwise most of the transistors will be destroyed.

LIGHT MODULATOR CONSTRUCTION

The three-channel light modulator is assembled completely on a single p.c.b. (see Figs. 8 and 9).

Three amp stud-mounting thyristors are specified which are capable of driving up to about 300W of lighting for each channel. The devices need to be considerably over-rated because of the low resistance of filament lamps when cold, i.e. on switch-on. The 3A devices are simply cooled by an excess of copper on the p.c.b. but additional heatsinks would be advisable should higher current devices be employed to drive larger light columns. Such heatsinks could take the form of a simple aluminium "U"



View of the power supply components which are mounted on the base board. The power supply can be built temporarily in order to test the amplifier boards.

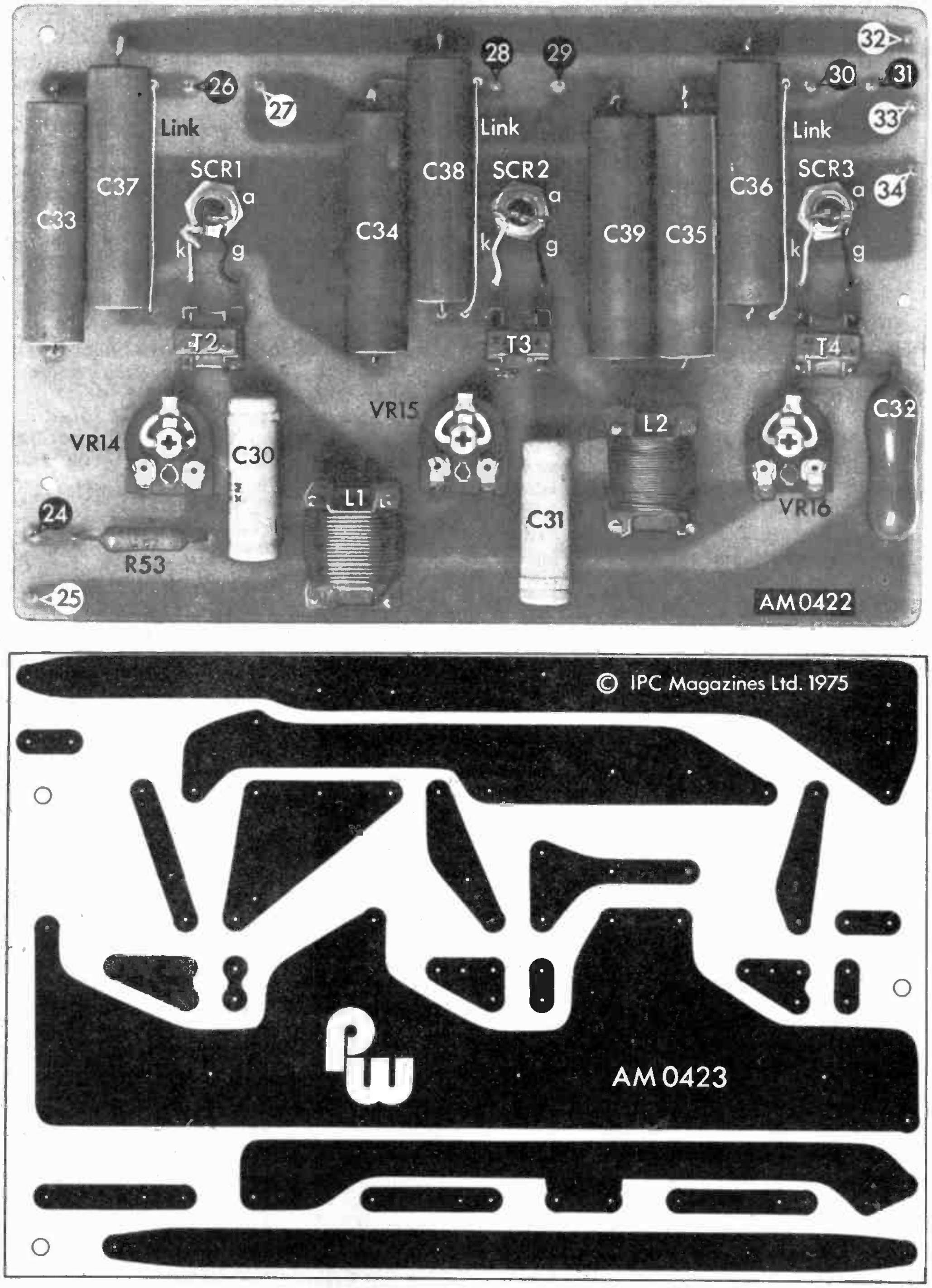


Fig. 8 and 9: Construction of the Light Modulator board showing layout of components and printed circuit layout.

sandwiched between the device and the board of two or three inches area or a commercial stud package cooler could be used.

The trigger transformers must be of good quality as the safety of the whole Disco system depends on the interwinding insulation of these components. The amplifier side of the electronics and the turntable metalwork should be properly earthed through the three-core mains lead to ensure operator safety even in the event of a breakdown of these transformers.

VR13 adjusts the overall sensitivity of the modulator and is set to produce a satisfactory display after installation.

In Part 3 cabinet construction and interwiring of the complete unit will be described.

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

A REMINDER of the winter comes with the No. 1 edition of the 160m DX Bulletin from "Stew" Perry W1BB for the 75/76 season. If you once listened to Top Band in the daytime and found nothing, you could not be blamed if you wrote-off the band for good! However, you would be very pleasantly surprised if you tried again after dark! Last season was the best yet for Stew, working 62 countries and all the signs are that he will do even better this season. Prefixes already active include VK, KH6, ZL, JA, VS6, PY and many others, with promise of activity from KC4, VR1, VP2 and HB0.

Once again W1BB has organised Transatlantic Tests especially for Europeans who have not so far been able to work a W station, and vice versa. Dates are December 21, January 11 and February 8 from 0500 to 0730 GMT. Even if you are only listening it is still a thrill to realise that your local G station with his 10W is probably making it across the "pond" for the first time! Remember, the W/VE's can be found between 1800 and 1807kHz and the Europeans around the so-called "DX window" 1825 to 1830kHz. Considering the chaos on some other bands this gentleman's agreement works very well indeed. Any European calling W's on their own frequency soon gets told the facts of life!

W. C. Johnson, 72 Estcourt Street, Newbridge Road, Hull is a newcomer to the short wave bands and after refurbishing an old CR45 with new valves etc has been pleasantly surprised at its performance. However he would be very glad to get hold of a manual for this set and naturally will be only too pleased to reimburse anyone who can help.

Dennis Anderson (London SE11) kindly relieved my ignorance of his Realistic DX150 receiver by sending in the handbook, duly statted for reference. Made in Japan and handled by the Radio Shack Co. in the States it is general coverage with bandspread and resembles a solid-state 9R59DS! But I imagine its performance is rather better especially at the higher frequencies. For £30 Dennis certainly got a bargain!

Tim Charles (Colchester) finds that 15 and 20m are beginning to die down for the winter but he is compensated by the ZL's on 80m nowadays. He says 'not to be worried' if you hear ZL4ZLV, permitted to use the amateur bands but normally the commercial station at the works of ZL4AV, producing marine radio equipment. Home one morning after visiting his dentist Tim found YJ8CS on 20m for a new one, in the New Hebrides. **Martin Kessel** A9016 (Stoke-on-Trent) reports getting cards from KS6ET and KS6FF, proof of the efficiency of his HMV 5-valver or at least his handling of it! **Neil Whiteside** A8859 (Hitchin) got his Microwaves Module working on 2m with a longwire as a start but found things much better with a proper yagi for the band.

Seems my note on the Pioneer Radio Club in Edinburgh, in the September issue, produced a few new faces. Co-founder **Bob Henderson** GM4DTJ reports that they now have a room of their very own, a basic requirement of any successful club, and a programme of equipment construction is already under way, with the club transmitter active on the HF bands and on 2m. **Paul Barker** BRS34898 (Sunderland) was very happy to 'see' 9K2DO, on his SSTV setup on 20m. Paul discovered that XJ6UM was really VE6UM in a different hat! Won't be long before we are allowed to pick our own prefixes in celebration of a birthday or something equally daft!

Stephen Budd A8713 (Worthing) seems to have been on the 'A' prefix hunt copying A2CJP, A4XGC, A6XB and A9XBB from Botswana, Oman, United Arab Emirates and Bahrein respectively. Those envious of the KS6's mentioned previously might like to know, via Stephen, that several KS6's hang around 14284kHz on SSB. **Andrew Swiffin** A8603 (Cheadle) may have to mortgage his receiver, he says, to be able to pay the postage for his reports to this column! He too, found the two KS6's, around 0845 GMT.

Back to **Tim Charles** again, reporting some of the repeaters he has been hearing on 2m, including OZ3REI on channel R5. According to Tim, a North Essex Raynet (RSGB's emergency network) group exercise was being repeated all over Denmark by an unidentified repeater on R8 recently! Being an anti-repeater man myself I think the day is not far off when the amateur community will be sorry that it ever went in for repeaters. The behaviour of many operators on these frequencies has to be heard to be believed!

Mike Green A8088 (Northwich) found seven LU's, six PY's and three ZP's on 10m which can't be bad on a band often accused of being dead.

Although this is being compiled in October for the January issue which will be out on 5 December it is appropriate to wish you all a VERY HAPPY CHRISTMAS and to hope that Father Christmas will bring along all that nice new gear that we have all been waiting for!

ON THE AIR

NOTE:— Please ensure logs are posted in time to reach me by 25th of each month.

Log extracts

M. Kessel:— 80m EA6BG VU2GDG **20m** DU6EG KL7BJW M1D VK5WD VK9KK ZL1AH

J. Hinton:— 20m FC9UK YS1AE 8P6CC **15m** HZ1KE 7Q7RM 9G1LZ 9J2BO

M. Bennett:— 80m 4W1AF 9K6OG **20m** HB0AIC HL9UF KG6JES ZS1AMB (Queen Maud Land ITU Zone 67) **15m** CM6AI FL8AC VK9XX 9N1MM **10m** DU3ON HK3LT ZP5JN 7Q7RM

D. Anderson:— 20m KL7HFQ PZ1DR **15m** 9J2BO PY1AZ

P. Barker:— 20m EA9EX JY9JM ZL4PD **20m SSTV** EA3AUM I2PET OH5RM OK2OI 9K2DO **15m** ZS1E 9L1JM (QSL W4BAA)

T. Charles:— 160m OE5NT OH2BO OH3VV 80m JY3ZH W6CXQ ZL1JX ZL4ZLV 5V7WT **40m HV3SJ WA0KXJ/OY 20m** YJ8CS ZL1BN ZL1TY **15m JE3NB KZ5EK LU7EY ZS6BR 9H1EN 2m DM3WCB** OZ3REI (repeater, FM)

A. Swiffin:— 80m CX9BT **20m** KS6ET KS6FF YB0PG **15m** TU2FH 5L2FM

S. Budd:— 20m AP2KS A2CJP A4XGC A6XB A9XBB C5AN WA6LRG/KB6 KJ6CF KM6EB KS6DV KS6ET KS6FF P29CW VP8NP VS5DB XP1AA (Greenland) 3B9DA (Rodriguez Is) 4S7BR 5T5CJ 5V7WT 7P8AC (Lesotho)

M. Green:— 40m TR8SS **20m** C5AN HI8REL YN8GTG **15m** CX3VR VU2DK 5L7F 9J2AB HP7XJS (DXpedition) **10m** LU4DSZ PY4KL ZP5RS **2m via Oscar 7 from 10m** VP9GE

All SSB except those in bold which are CW.

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

MR. R. CORBETT of Kettering recently picked up a copy of PW during his teabreak at work, and upon reading this column became converted to DXing, and, pausing only to finish his sandwiches, dashed out to trade his portable for one with short wave coverage. "I am amazed at the results obtained" says Mr. Corbett, and I am flattered at the results of this column, says I! Our friend then asks several questions on how to get the best from his new purchase which I will do my best to answer.

The first one is that, setting aside ex-service sets, there are not many sets under £50 that have complete short wave coverage. The Codar CR70A is within your price range and adding on the PR40 pre-selector will improve reception. Otherwise you will have to have the medium wave plus the SW coverage. I must say that I have heard of some strange shacks but under the stairs is a new one on me! I would think that this situation is prone to all the interference that comes from domestic appliances.

The second question posed was the one that puzzles a lot of DXers. If, in the SINPO code, 5 is the strongest then how does one estimate the propagation? The simple answer is that for a 5 rating one looks for perfect propagation, free from all fading, in fact, of local radio quality. In propagation measurement all sorts of factors must be taken into consideration, notably, fading, audio quality and the noise that accompanies the signal. There is an alternative system that uses only the letters SIO, Strength Interference and Overall readability, lumping noise and propagation under the one heading.

From Long Eaton, Notts, **H. A. Mead** writes about a map that Radio Prague has sent him showing the ITU zones. He comments that the zone numbers on the map are different from those on the map in the Radio Amateurs Handbook. I would suspect that the ITU number were drawn up by the International Telecommunications Union for the use and benefit of the broadcasters while amateurs have a zoning system of their own making. (*And in use many years before the ITU one was thought of. Again, change for changes sake. Eric G4AR.*)

An information-packed letter arrived chez Bell recently from **John McLeod** of Inverness. Firstly, he tells us that Radio Kiev has announced a new English service on 7390, 6045, 6020 at 1930 to 2000 Mondays, Thursdays and Saturdays. Further on the DX scene a fault in one of Radio Sweden's aerials has resulted in the closedown of some of the services from the Horby and Karlsborg transmitters. John then goes on to nominate RBI as producing the most boring QSL card! It has a decibel table overprinted RBI in red. There are also a few harsh words from John on the way some secretaries address cards to him using "England" or, in one case, "Scotland, England, GB!"

Station address lists seem to be popular for the avid QSLer so here are a few that have been requested:—

Radio Kuwait, PO Box 397, Kuwait.
Radio Cairo, PO Box 795, Cairo, Egypt.
Radio Finland, PO Box 528, Helsinki, Finland.

A rarely reported station comes from **Robert Hill** at school in Colwyn Bay, Wales This is Radio Athens on 7250 at 1915. The set in use is an Invicta 8027 with an internal aerial and on the high ground of that part of the country pulled in the skywaves from the following:—

9755 AWR Malta relay, 2030 Saturdays only, in English.

11940 Radio Kuwait, at 1730.

11642 Radio Israel, at 2050, sign off time.

Robert then asks for details of the Malta relay since he logged not only AWR but IBRA at 2100 to 2115. The transmitters in question are run by Deutche Welle and leased to other broadcasters. They comprise one 600kW for MW and three 250kW on the short waves. They also own the transmitter in Portugal used by AWR.

Recently this column featured a vintage SW receiver, so **C. H. Wood**, of Sunbury-on-Thames, comes along with a 1936 Murphy A36, this set is certainly pre-April 1937 since that is the month it was

ON THE AIR

reviewed in (dare we mention it?) Wireless World! The set has had little done to it except for a new valve and transformer and a couple of switches, C.H. mentions that he has had to paint some of the insulation to protect it and some of the stations printed on the dial have long since vanished!

Congratulations are in order for the American folk music show "Grand old 'opry" heard on the AFRTS air waves. The show is fifty years old this year and was the subject of a "happy birthday" piece on BBC recently. Another BBC curiosity is a recently issued record in praise of radio, by an outfit calling themselves "The Medium Wave Band", friends of Charles Molloy?

Finally, an official statement from Radio Canada has reached me regarding the sad demise of the RCI Short Wave Club. The reason for this is said to be "the need for stringent budgetry controls". It is stated that they need listeners cooperation in giving their views on programme content rather than just QSLing, and in this area what they describe as an "unsatisfactory result" came out of their recent QSL policy. Therefore they have decided that no more QSLs will be issued until Spring 1976. When the new schedules are issued for the 1976 short wave season then listeners on the mailing list will get a QSL. If the collector wishes to make it an "official" QSL he must return it to RCI having filled in the details in order that it may be stamped. The new card will have an Olympic Games motif and it seems that RCI are set fair to continue this policy since they say that a card will be sent automatically each year.

Well, that seems to wind things up for this month so I will wish you and yours a Very Happy Christmas and, although we are coming up to the sunspot minimum, the best of DX for 1976.

MEDIUM WAVE DX

by CHARLES MOLLOY

MEDIUM wave transmitters in Europe operate on channels which, over the greater part of the band, are spaced 9kHz apart. In other parts of the world, channels are multiples of 10kHz and occasionally 5kHz and the two systems coincide at intervals of 90kHz, for example 620, 710 and 800. DXing on those frequencies can be difficult for the listener in Europe. Fortunately there are other parts of the band where the DX channels are 4kHz away from the nearest European broadcast and the DXer who hunts in these areas is often well rewarded.

During the evening search for Baghdad on 760kHz; Isfahan in Iran on 1100kHz; Kabul in Afghanistan on 1280kHz; Kuwait on 1345kHz; Ahwaz, Iran on 1390kHz; Dubai, United Arab Emirates on 1480kHz and Sharjah on 1575kHz. After midnight listen for Surinam on 725kHz; Georgetown, Guyana on 760kHz; CJON St John's, Newfoundland on 930kHz; Hofei, China on 940kHz; Hyderbad, Pakistan on 1010kHz; St John's Antigua on 1100kHz; Radio Globo, Rio de Janeiro on 1180kHz and Radio Tupi, also in Rio, on 1280kHz. All of these stations have been logged recently in the UK by DXers using communications type receivers and a MW loop or longwire aerial.

Alfred Johnson, of Barnet, has been active on the band between 0200 and 0300 GMT. The highlights of his North American log include the following from the USA; WOR in New York City on 710kHz; WABC also in NYC on 770kHz; WGY in Schenectady, NY on 810kHz; WHAS Louisville, Kentucky on 840kHz; WCFL Chicago on 1000kHz; KDKA Pittsburg on 1020kHz and WHN in NYC on 1050kHz.

Harold Emblem writes again from Mirfield in Yorkshire to report a good bag of North American outlets using his Eddystone 730 and MW loop. Canadians heard include four from Newfoundland; CBNA in St Anthony on 600kHz; CBN in St John's on 640kHz; CKVO in Clareville on 710kHz and CJON St John's on 930kHz plus a couple from Nova Scotia; CHER in Sydney on 960kHz and CKEC in New Glasgow on 1320kHz.

DX from the USA includes WINS in NYC on 1010kHz; WTIC Hartford on 1080kHz; WNEW in NYC on 1130kHz; WLOB Portland, Maine on 1310kHz and WOKO in Albany, NY on 1460kHz. Harold reports reception of Nouakchott in the African republic of Mauritania on 1349kHz at 2230 GMT, the time when the French stations on this channel usually sign off. A very good catch. Another to look for is Enugu in Nigeria on 1320kHz which can be heard with news in English at 2300 before signing-off for the night five minutes later.

Radio St Pierre which transmits with a power of 4kW on 1375kHz is the sole broadcasting station in the French islands of St Pierre and Miquelon which are located a few miles off the south coast of Newfoundland. Radio St Pierre is often heard in the UK during the winter. Listen after Lille on 1367kHz has closed down for the night, usually at 2300. Radio St Pierre is on the air until 0100, its local time is three hours behind GMT and the station will answer a correct reception report with a verification letter. Write to Radio St Pierre, BP7, St Pierre et Miquelon if you want to add this North American "country" to your list of countries verified.

BROADCAST BANDS
Short Wave reports by the 15th of the month to Derek Bell c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.
Medium Wave Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.
AMATEUR BANDS
Logs covering any amateur band/s in band/alphabetical order by the 25th of the month to Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey, KT21 2TW.

HOTLINES

ON RECENT DEVELOPMENTS

HOT POT

It seems that component technology never stands still, and while the semiconductor manufacturers often hit the headlines with new devices, there are times when the more mundane components come to the forefront. Take the humble potentiometer as an example. Basically it might be thought of as a length of resistive material along which a small metallic wiper is moved. Thus by moving the finger along the material, the resistance between wiper and one end can be varied.

Two differing approaches have come to light and the first obvious difference is that there is no finger nor any wiper and thus no actual frictional contact of any sort!

The first approach employs two small ferrite cylinders with wire wound round them to form inductors. A permanent magnet also features and is used to vary the saturation of the ferrite as it is rotated. Of course, left to their own devices, the inductances across the ferrites are constant. But by passing a magnet over them a strange effect occurs; the inductance of the other decreases. A signal between the two ferrite cylinders thus provides an output which is proportional to the angular position of the magnet. Note that there is no actual physical contact between the elements. It is claimed that these potentiometers, which are no larger than conventional pots, can survive and operate happily at temperatures of 200°C which would seem to indicate applications in engine control and the like.

The second approach to potentiometer design is quite ingenious and delves into the realms of semiconductor resistors. The resultant devices are called field plate potentiometers and operate as follows.

Certain materials exhibit a marked change in resistance under the influence of a magnetic field. This is called the magneto-resistive phenomenon. The effect has been known for many decades but new advances in semiconductor materials have led to new crystaline structures, considerably increasing the range over which the resistance can be varied.

The technique employed is to embed minute needles of a conducting substance in a semiconductor material. In the absence of a magnetic field the current passing through the structure passes through these regions via the shortest possible route. By applying a magnetic field, the current paths between the tiny needles become deflected causing the current to travel further and thus there is an increase in resistance due to this longer path effect.

TEMPERATURE

Perhaps one of the most popular and recurring circuit ideas in electronics construction journals is some form of temperature measurement and/or control. A common approach is to use an op amp (operational amplifier) since the two inputs offer a means of comparing one thing with another. The voltage on one input can be held constant and the variation in voltage applied to the other input (usually caused to vary by the sensor) gives a difference which shows up at the output.

Temperature tyros will be pleased to hear that a semiconductor manufacturer has brought out a chip (measuring 50 x 50mil) which has temperature sensor, zener diode stabilized voltage reference, and op amp all included. Designed for use in the range −25°C to 85°C it comes in an uncalibrated form to within ±10°C. However, the user can calibrate it to within ±0·5°C with the simple addition of an external potentiometer. Price is not easy to guess but in the US the quoted cost for quantities of 100 to 999 are just a dollar each.

NEW DDM

Each time a new instrument is launched onto the market, it seems to have better and better specifications. A DMM (digital multimeter) marketed recently offered a capability of measuring resistance up to 2GΩ (that's two million million Ohms). Not satisfied with this, the manufacturers built in the ability to resolve currents down to 100pA (picoamps—a million millionth of an Amp) and dc voltages down to 100μV. It can also measure AC voltages up to 700MHz. Price in the US is under $1,700 and it's the product of a Dutch company. My £3·50p Lisle Street special will never seem the same again.

FOOD FOR THOUGHT

If you want food for thought, how about the new induction heating for cookers. Not to be confused with microwave ovens, the approach is to employ fast turnoff thyristors operating at some 30kHz. The idea is to cause eddy currents in the base of a cooking utensil. This is done by a coil just beneath the cooker surface. Estimated to halve electricity useage, the system doesn't work until a utensil is placed above it since, with nothing there, there will be nothing in which to induce the eddy currents.

FAST-RECOVERY DIODE

A new fast-recovery diode (BD277) from RCA Solid State—Europe is available in a low-cost TO-220 Versawatt plastic package, giving excellent heat-sink capability and making the device particularly suitable for use in the deflection systems for 110° large-screen television tubes. Two of the diodes, used in conjunction with two thyristors, form the complete deflection circuitry, controlling the horizontal yoke current during the beam trace interval and acting as the commutating switch to initiate trace/retrace switching and controlling yoke current during retrace.

The diode is designed for operation from supply voltages between 150 and 270V (nominal), and can handle a maximum reverse voltage of 800V and an average current between 2A and 7A, depending on the heat sinking of the device. The diode can handle surges of more than 100A, and a low, 'soft' (low in harmonics) recovery characteristic.

Other applications in television sets include clamp and booster diodes, diode modulators and switching power supplies, and the diode can also be used in hammer drivers, invertors and convertors for induction heating systems, electronic ignition circuits, or speed controls for domestic appliances such as washing machines. Ban those washday blues with a BD277!

Ginsberg

RADIO EXCHANGE LTD.

ALL PRICES INCLUDE VAT
We regret we cannot for the time being accept Overseas Orders. Open to U.K. and Ireland residents only.

NEW EDU-KIT MAJOR

Completely Solderless Electronic Construction Kit. Build these projects without soldering iron or solder

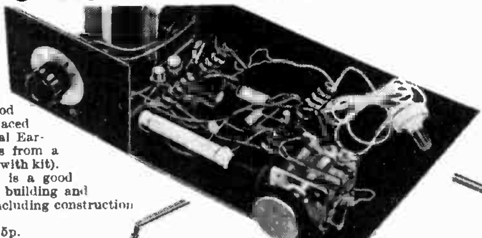
- ★ 4 Transistor Earpiece Radio.
- ★ Signal Tracer.
- ★ Signal Injector.
- ★ Transistor Tester NPN-PNP.
- ★ 4 Transistor Push Pull Amplifier.
- ★ 5 Transistor Push Pull Amplifier.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ 5 Transistor Short Wave Radio.
- ★ Electronic Metronome.
- ★ Electronic Noise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

Components Include: 24 Resistors ● 21 Capacitors ● 10 Transistors ● 3½" Loudspeaker ● Earpiece ● Mica Baseboard ● 3 12-way connectors ● 2 Volume controls ● 2 Slider Switches ● 1 Tuning Condenser ● 3 Knobs ● Ready Wound MW/LW/SW Coils ● Ferrite Rod ● 6½ yards of wire ● 1 yard of sleeving etc. ● Complete kit of parts including construction plans.

Total Building Costs £10·30 P & P 65p

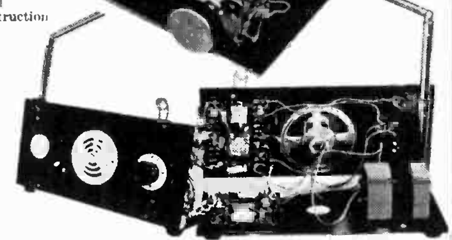
ELECTRONIC CONSTRUCTION KITS

ECK 1



3 Transistor Easy Stage Earpiece Receiver Kit. Full Medium Wave Coverage. Complete with Ready Wound Ferrite Rod Aerial, High Efficiency Air Spaced Tuning Capacitor. Sensitive Crystal Earpiece and Gain Control. Operates from a 9 Volt P.P. 7 Battery (not supplied with kit). This Electronic Construction Kit is a good starter for those interested in kit building and soldering. Complete kit of Parts including construction plans **£4·50** P.P. and ins. 45p.

ECK 2

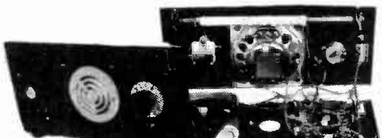


Self Contained Multi-Band V.H.F. Receiver Kit. 8 Transistors and 3 Diodes. Push/Pull Output. 3" Loudspeaker, Gain Control, Superb 9 section swivel ratchet and retractable chrome plated telescopic aerial, V.H.F. Tuning Capacitor, Resistors, Capacitors, Transistors, etc. Will receive (subject to local reception Conditions) T.V. Sound, Public Service Band, Aircraft, V.H.F. Local Stations, etc. Operates from a 9 Volt P.P.7 Battery (not supplied with kit)

Complete kit of parts including construction plans **£7·95** P.P. and Ins. 55p.

ECK 3

5 Transistor Medium Wave Receiver Kit. Class "A" Output with 3½" Loudspeaker. Simple to operate with full Medium Wave Coverage. Ready Wound 8" Ferrite Rod Aerial. No external Aerial required. 7 stages, 5 Transistors and 2 Diodes, Tuning Capacitor, Gain Control, etc. Operates from a 4½ Volt Battery (not supplied. Complete kit of parts including construction plans



£5·40 P.P. and Ins. 43p.

ECK 4

7 Transistors, 6 tuneable wavebands, MW, LW, Trawler Band, 3 Short Wave Bands, Receiver Kit. With 5" × 3" Loudspeaker. Push/Pull output stage, Gain Control, and Rotary Switch. 7 Transistors and 4 Diodes. 6 section chrome plated telescopic aerial. 8" Sensitive Ready Wound Ferrite Rod Aerial, Tuning Capacitor Resistors, Capacitors, etc. Operates from a 9 Volt P.P.7 Battery (not supplied with kit). Complete kit of parts including construction plans

£7·25 P.P. and Ins. 55p.

VHF AIR CONVERTER KIT

Build this Converter Kit and Receive the Aircraft Band by placing it by the side of a radio tuned to Medium Wave or the Long Wave Band and operating as shown in the instructions supplied free with all parts. Uses a Retractable Chrome plated Telescopic Aerial. Gain Control, V. H. F. Tuning Capacitor, Transistor, etc.

All Parts including Case and Plans. **£4·35** P.P. and Ins. 40p.

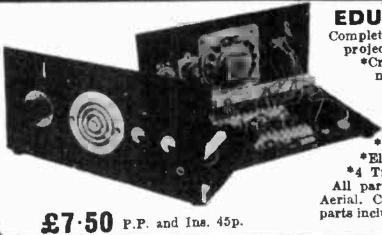
ROAMER TEN MARK 2

With VHF including aircraft

Now with free earpiece and switched socket. 10 Transistors. Latest 4" 2 watt Ferrite Magnet Loudspeaker. 9 Tuneable Wavebands, MW1, MW2, LW, SW1, SW2, SW3, Trawler Band, VHF and Local Stations also Aircraft Band. Built in Ferrite Rod Aerial for MW/LW. Chrome plated 6 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. 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 9" × 7" × 4". Easy to follow instructions and diagrams. Parts price list and plans 50p free with parts.

Total building costs £11·87 P.P. and Ins. 65p.

EDU-KIT JUNIOR



Completely Solderless Electronic Construction Kit. Build these projects without Soldering Iron or Solder.

- *Crystal Radio Medium Wave Coverage:—No Battery necessary.
- *One Transistor Radio.
- *2 Transistor Regenerative Radio.
- *3 Transistor Earpiece Radio Medium Wave Coverage.
- *4 Transistor Medium Wave Loudspeaker Radio.
- *Electronic Noise Generator.
- *Electronic Metronome.
- *4 Transistor Push/Pull Amplifier.

All parts including Loudspeaker, Earpiece, MW Ferrite Rod Aerial. Capacitors, Resistors, Transistors, etc. Complete kit of parts including construction plans.

£7·50 P.P. and Ins. 45p.

RADIO EXCHANGE LTD.

TO RADIO EXCHANGE LTD., 61A HIGH STREET, BEDFORD MK40 1SA. Tel: 0234 52367, REG NO. 788372

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

I enclose £..................... for ....

Name ....

Address ....

....

PW 1

CQ!CQ!CQ!CQ!

EQUIPMENT FOR DISPOSAL

..crystals. 12·925, 12·958333, 13·008333MHz. Hardly used and in HC6/U holders. G8JBH, 63 The Drive, Edgware, Middlesex, HA8 8PS.

ISSUES FOR DISPOSAL

..P.W. for April, May, August 1970 and June 1971.—D. Horrill, Mark House, Lindale, Grange-on-Sands, Cumbria.

..Television for Jan. 1972 to October 1974 excluding August 1972 to December 1972 inclusive.—B. C. Jackson, 28 High Street, Frodsham, Cheshire, WA6 7HE.

..P.W. 1970 to 1974.—M. Pedersen, 19 Belgrave Street, Brighton, BN2 2NS.

CORRESPONDENTS WANTED

..someone of my own age (14) who is interested in Amateur radio in general and electronics.—Andrew Sharpe, Hazel Dene, High Horse Close, Rowlands Gill, Tyne and Wear, NE39 1AW.

..anyone who has built the Galleon VHF kit advertised in P.W. I have found this kit extremely satisfying.—F. Ward, 2 Brookdown Terrace, Saltash, Cornwall, PL12 6HU.

..I am 17 and would like to correspond with readers, especially hams about my own age. Very interested in satellites.—G. Selvakumaran, 16 Jalan Batu Pahat (opp. Ban Ho Lee Shell), Kluang, Johore, West Malaysia.

BOOKS WANTED

..I want to collect older Mullard Data Book publications.—John B. Millin Jnr., 39 Dalgleish Avenue, Cumnock, Ayrshire, KA18 1QG.

..a copy of Practical Television Circuits. 1968 edition by Street.—S. H. Biggs, Bell Cottage, Bonfire Lane, Horsted Keynes, Sussex, RH17 7AJ.

EQUIPMENT WANTED

..active filter unit and stereo FM tuner for Sinclair Project 60.—M. Stanley, 9 Ormiston Gardens, Knock, Belfast, BT5 6JD.

..microphone transformer, ratio 100-1 or 150-1.—W. L. Brunson, 28 Meadfoot Road, Moreton, Merseyside.

..Telefunken radio valve type 199 for a c1938 TRF set made by Dr. Georg Seibt A.G. model VE 301 DYN. Also any gen on this equipment.—Sgt. J. Irvire REME, 1 Cheshire Regiment, Weeton, Lancs.

..Cossor valves 63 SPT and 61BT for 1035 oscilloscope.—Ian Ropper, 29 Wakefield Avenue, Edinburgh, EH7 6TN.

..receiver wanted for a 13-year old SWL.—P. Jeffries, 29 Walworth Grove, Acklam, Middlesborough, Teeside, TS5 8NN.

..the type of transistor used in Two Tone Door Bell (P.W. May 1973).—A. Fanzeres, P.O. Box 2483-ZC-00, Rio, Brazil.

..Sinclair Project 60 FM tuner.—C. Parkins, P.O. Box 10, Stanmore, Middlesex.

..an R107 receiver in working order.—J. King, 2 Delacherois Avenue, Lisburn, Co. Antrim, N. Ireland.

..power leads and headphones belonging to R209 receiver.—I. Simpson, 107 Derryhale Road, Portadown, Craigavon, Co. Armagh, N. Ireland, BT62 3SR.

..loan of CL33 valve required for old Bush receiver to see if any other faults present apart from this missing valve.—K. G. Bailey, 29 Anstruther Road, Norfolk Park, Edgbaston, Birmingham, B15 3NN.

..a balanced armature speaker unit.—J. Claxton, 6 Lloyd Park House, Forest Road, Walthamstow, London, E.17.

INFORMATION WANTED

..design for bias oscillator working at approximately 100kHz. Erase head must not be used and supply voltage must be around 6-12V.—R. Hill, 30 Queens Road, Bradford, West Yorks., BD8 7BT.

..manuals, circuit diagrams or any info. on Cossor 1052 D.B. scope, also C. F. Lord, FM3-3 frequency meter and Jason EM-10 valve voltmeter.—M. Roebuck, 16 Elizabeth Street, Newsome, Huddersfield, West Yorkshire.

..Schaub Lorenz Weekend T50L circuit diagram wanted. Will stat and return.—R. F. Nicholls, 11 Rue Dufrexou, 44 St. Nazaire, France.

..good condition DX Data Chart (P.W. March '73 issue). Also issue of P.W. containing A.T.U.—R. Rooney, Rolestown, Kilsallaghan, Co. Dublin, Ireland.

..instruction manual/handbooks for the Trio JR310 and Trio 9R59DS communications receivers.—K. Arasu, School House, Brighton College, Brighton, BN2 2AL, Sussex.

..details, circuit, manual, etc. for STC B46 receiver, oscillator tuned, roller coaster coil, manufactured 1948 (STC No. 406).—T. D. Jackson, 60 Industrial Street, Todmorden, Lancs., OL14 5BT.

..instruction handbook and/or circuit diagram for a ex-WD scope 'Indicator CTR type 103'. Ref. 10Q/16208, part of 'Monitor type 101' and its associated power pack.—P. V. Hill, 25 Southern Crescent, Bramhill, Stockport, Cheshire, SK7 3AQ.

..borrow or buy circuit for Philips car radio N4G40T serial L21600. Version only has two windings on L6. Collector T2 goes to L4 via 350 ohms.—J. Palmer, 70 Westbury Road, Northwood, Middlesex, HA6 3BY.

..Schaub Lorenz T50L. Information on how to receive BBC MW with external aerials. Circuit and alignment details also required.—R. Nicholls, 85 Avenue de Plaisance, 44 St. Nazaire, France.

..manual or circuit diagram for the TR1143 serial 11041 ex-WD Transceiver.—B. Bridges, 22 Bell Avenue, Harrow Crescent, Romford, Essex.

..circuit diagram for Ferranti 194 mains receiver.—J. Carver, 112 Merthyr Mawr Road, Bridgend, Glamorgan, CF31 3NY.

STILL AVAILABLE!

REPRINTS OF PW's

TEXAN 20 + 20W IC STEREO AMPLIFIER

May-August 72

**Send 30p + 10p (post and packing) to:
Chief Cashier (PW Texan), IPC Magazines,
Tower House, Southampton Street,
London, WC2E 9QX**

OUR "CQ" COLUMN

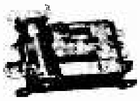
On page 793 of this issue, we have some CQ requests for back-numbers. **Please help us to help you,** if you want a "CQ" published, and you can do that by following the style on page 793 when you write to us. Please keep CQ's as short as possible.

CQ's should be sent to THE "CQ" COLUMN, Practical Wireless Editorial, Fleetway House, Farringdon Street, London, EC4A 4AD.

HIGH POWER BATTERY MOTOR

12v operated strong enough to power a motor mower go-cart or similar. Speed easily variable. These motors can also be used as a brake for any rotating machine simply by coupling the spin die to the machine and short-circuiting the windings by a variable resistance. price £2·50 + post and V.A.T. 74p. *DITTO* but 6/12v even more powerful as it's larger and is series wound £3·50 + 85p post and V.A.T.

PERMEABILITY TUNERS



M.W. two stage ideal for use with ZN414 or similar circuit. Price 15p each + post and VAT 15p.

MAINS TRANSISTOR PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1. PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: main transformer rectifier. smoothing and load resistor, condensers and instructions. Real snip at only **£1·50.** VAT & postage 60p.

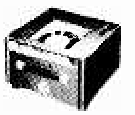
NUMICATOR TUBES

For digital instruments, counters. timers, clocks, etc. Hi-vac XNII Price **90p** each, 20p Post and VAT.

DC HIGH CURRENT PANEL METERS

3½" wound wide angle 240 movement meters, flush mounting fitted with external shunts, made by Crompton Parkinson, brand new, still in maker's cartons. These are a real bargain at **£5·50** each. Reasonable quantities available in the following ranges 0-10 amps, 0-20 amps, 0-30 amps, 0-40 amps, 0-50 amps. Post and VAT 80p each.

TAPE DECK



In metal case with carrying handle, heavy flywheel and capstan drive. Tape speed 3¾. Mains operated on metal platform with tape head and guide. Not new but guaranteed good working order. Price **£1·50** plus VAT and Postage £1·50.

SOUND TO LIGHT UNIT

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450w). Unit in box all ready to work. **£7·95** plus 95 VAT and postage.

OVEN THERMOSTAT

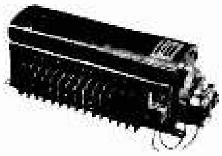
Made by the famous Diamond H Company, this has a sensor joined by a capilliary to a variable control and when fitted with a knob is ideal for many ovens or processes, 50p each + post and VAT 15p

MAINS TRANSFORMERS

All standard 230-250 volt primaries		£ p
1v	1 amp (special)	1·76
2·4v	5 amp	·85
6·3v	2 amp	1·25
6·3v	3 amp	1·75
9v	1 amp	·95
9v	3·5 amp	2·50
12v	1½ amp	1·50
12v	1 amp	1·00
6·5v-0·8·5v	1 amp	1·50
18v	1 amp	1·50
24v	2 amp	2·25
24v	3 amp	3·60
12·0·12v	50mA	1·20
6·0-6v	50mA	1·20
8·0-8v	½ amp	1·50
18·0-18v	2 amp	3·50
25v	1½ amp	1·95
50v 2 amp & 6·3v	1 amp	4·50
60v 5 amp & 5v	1 amp	7·50
27v	8 amp	4·50
30v	37 amp	22·00
80v tapped 75v & 70v	4 amp	5·50
230v-60mA & 6·3v	1·5 amp	1·75
275-0·275v at 90mA & 604v	3 amp	2·25
EHT Transformer 5000v 23mA	(intermittent)	5·60
Charger Transformers		
6v and 12v	2 amp	1·50
6v and 12v	3 amp	2·25
6v and 12v	5 amp	3·50

Add 30p per piece to cover postage and VAT 25%

HONEYWELL PROGRAMMER



This is a drum timing device, the drum being calibrated to equal divisions for switch-setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips, thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control. Boiler firing. Dispensing and Vending machines. Display lighting animated and signs. Signalling, etc. Price from makers probably over £20 each. Special snip price **£9·96.** £1·00 Post and VAT. Don't miss this terrific bargain.

BREAK-DOWN UNIT

Contains hundreds of useful parts some of which are as follows—66 silicon diodes equivalent OA91, 68 resistors, mostly ½ watt 5 % covering a wide range of values 4 x ·1 mfd 400v mfd condensers, 15 x ·01 mfd 100v condensers, 2 RF chokes 8 x B9 valve holders, 1 x 4H choke, 1 x 115v transformer, 1 boxed unit containing 4 delay lines also tag panels, trimmer condensers, suppressors, etc., on a useful chassis sized approx 9" x 5" x 7". Only **75p** (the 66 diodes would cost at least 10 times this amount). This is a snip not to be missed. Post and VAT 75p.

HORSTMANN 24-HOUR TIME SWITCH

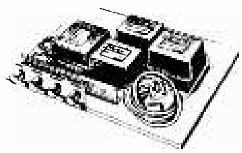
With 6 position programmer. When fitted to hot water systems this could programme as follows:

Programme	Hot Water	Central Heating
0	Off	Off
1	Twice Daily	Off
2	All Day	Off
3	Twice Daily	Twice Daily
4	All Day	All Day
5	Continuously	Continuously

Suitable. of course, to programme other than central heating and hot water, for instance, programme upstairs and downstairs electric heating or heating and cooling or taped music and radio. In fact, there is no limit to the versatility of this Programmer. Mains operated. Size 3in × 3in × 2in deep. Price **£5·50.** 80p Post and VAT. as illustrated but less case.

THIS MONTH'S SNIP

MULLARD UNILEX



A mains operated 4 + 4 stereo system. Rated one of the finest performers in the stereo field this would make a wonderful gift for almost anyone In easy-to-assemble modular form and complete with a pair of Goodmans speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only **£15·50** including VAT and postage.

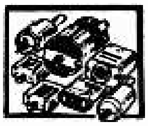
GPO PUSH BUTTON DIALLING UNIT

Will take the place of the normal rotating dial has 10 numbered keys, so suitable for other digital systems. A desk mounting unit with rubber feet, this is a very intricate and expensive piece of apparatus. New and unused—our price only **£9** each + £1·36 post and VAT.

24V POWER PACK

Normal mains input with a thermal safety device. 800 mA output, 4000 mfd of smoothing and full wave rectification. complete enclosed in plastic box and with flex for mains and terminal block for output. Price **£1·75** + £1 post and VAT.

ONLY £1·50 FOR SEVEN ELECTRIC MOTORS

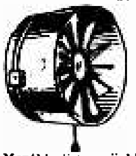


7 powerful batt. motors as used in racing cars and power models. Output and types vary for use in hundreds of projects—Tools, toys, models, etc. All brand new reversible and for 1½-12v batts. Wiring diag. inc. VAT P Post 40p. FREE plan for min. power station.

BLACK LIGHT

As used in discotheques and for stage effects etc. Virtually no white light appears until the rays impinge on luminous paint or white shirts, etc. We offer 9" 6w tubes complete with starter, choke, lamp holders and starter-holder. Price **£2·75** + 30p post. Tubes only **£2.** Post & VAT 50p.
175 Watt model **£6·50** + 92p Post and VAT.

EXTRACTOR FAN



Cleans the air at the rate of 10,000 cubic feet per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc. It's so quiet it can hardly be heard. Compact, 5½" casing comprises motor, fan blades sheet steel casing, pull switch, mains connector and fixing brackets **£4·25** VAT & Postage £1·50.

Monthly list available free; send long stamped envelope.

TERMS: Where order is under £5 please add 30p surcharge to offset packing expenses.

J. BULL (ELECTRICAL) LTD.

(Dept. P.W.), 103 TAMWORTH ROAD, CROYDON CRO IXX.

NEW ITEMS THIS MONTH

NOTE: PLUS SIGN AFTER THE PRICES INDICATES VAT.

Ferrite pot core (Vinkor) made by Mullard, maker's ref. No. LA 14107402K, circular, size approx. 1¾" x ⁵⁄₁₆", a size which is the same as the one specified for the Scropio car ignition system. Price only **50p** + 4p per pair. Post 15p + 1p.

12v DC motor made by Smiths, powerful, ideal for car blower; motor size 4" long x 3" diameter, ¼" spindle; 1½" long.**£2** + 16p. Post 40p + 3p.

Plinth and cover for BSR plinth is teak colour and cover is smoky, Special offer **£4** + £1. Post £1 + 25p. Covers available separately price £2 + 50p. Post £1 + 25p.

Plinth and cover for SP25. This is a deeper, rather nicer plinth, unfortunately more expensive. Price **£5·50** + £1·37. Post £1 + 25p.

Central heating controller, the Randall Mark 3, as fitted to Trianco and many other central heating systems. Has a two on/off per 24 hour clock switch and a 7 position selector switch. Price **£6·50** + 52p. Postage 50p + 4p.

Light for growing. Putting back the clock makes us realise how short daylight is during the months of November, December, January and February. As plants cannot grow without light, short days represent a loss of growing time which can be supplemented by using fluorescent lighting, especially important now that heating represents such an expensive item. We can offer a very cheap form of fluorescent lighting, (we do not think any other firm can beat our price), 50' of fluorescent light **£10** + 80p if you can collect, or **£13** + £1·04 if we have to despatch by British Road Services. For this you get 10 x 5' tubes, 20 tube ends. 10 chokes, 10 starters and holders and 20 terry clips for mounting the tubes. You only have to supply the wooden battens and wiring up wire. Do not miss this offer—only 50 parcels now remain.

Connecting wire. Suitable for joining up these fluorescent lights is available, price **£5** + **40p** per 100 metres. This is a good quality flat, twin with heavy duty insulation. Post £1 + 8p per reel.

70 stranded very heavy duty wire rated at 15 amps but will carry considerably more than this. 500 metre drums only £10 + 80p per drum. Carriage £2 + 16p.

Multi-range test meter. 11 ranges all selected by central switch. first-class two jewel movement, Japanese made. The right size to put in your pocket. always carry one with you to save your legs and earn your money. Ranges as follows:
AC 10, 50, 250, 1,000; DC 10, 50, 250, 1,000. Resistance 0-150,000 ohms. Current 0-1 0-100. A big purchase of these enables us to offer at **£4·55** + 36p (post 40p + 3p), which is very little more than we originally sold these for 6 years ago.

9v Battery operated record player motors, on plate with turntable and mat. Price **£4** + £1. Post 50p + 13p.

Instrument motor, mains operated, makes 1 rev in 4 hours, made by the famous Smiths Company. Price **£1·50** + 12p. Post 10p + 1p.

BARGAINS FOR CALLERS. We always have bargains for callers and now that the post charges are so high it is even more worthwhile for you to call. One item which we are offering at a very silly price this month is a *wooden cabinet* intended originally to be used for a music centre and offered at only a fraction of the cost of the wood alone, namely **50p** each.
We have other cabinets including **large stereogram** types from **£2** upwards, depending on condition, cabinets for **portable players** and **radios** from **50p** upwards.

Key chain radio (microsonic) Whilst clearing out our Park Street store we came across a box of these, brand new, just as they left the factory, some had suffered in transit and storage but we tested them all and quite a lot are in working order. You might know someone who would like one for Christmas. We have not got many but are offering at **£2** each. Post 40p + 10p. Please note this is just for the radio in its zipped around carrying case. The re-chargeable batteries have depreciated beyong reclaiming and so we are not including these.

Thermostat with capilliary with sensor joined by approx. 1 metre of capilliary covering the temperature range 0-170°C capable of switching 16 amps at 250v. Made by the famous Ranco Company with screwed thread and spindle rather like a volume control—has dozens of applications. Offered at only **75p** + 6p. Post 12p + 1p.

Aerials. For medium and long wave, wound and fitted on ferrite rod, 6" long by ⅜" diameter. Price **60p** + 15p Post 10p + 5p.

Smoke, fire and gas alarm (SAGA Mark II) Winter is the worst time for fires because more heaters are used. Even all electric homes are now becoming an increasing fire risk. Colour television, blower heaters, electric blankets have all been the cause of tragic and disastrous fires, so the need for protection in the home becomes greater every day. Do not leave it until it is too late! The money invested in our SAGA Mark II spread over its useful life is negligible compared to the life of one of your dear ones. The SAGA will trigger off when the level of smoke, gas or heat exceeds normal Price **£15** + £1·20. Post 75p + 6p.

Blower/fan by Smiths, maker's ref FFB 0701-022. This is a mains operated blower. the special feature being that the motor is mounted inside the impeller, so making this very compact. Fan housing size approx, 7½" x 8½", outlet size 3" x 3½". Price **£5·75** + 46p. Post 80p + 6p.

Dial thermometer by Rototherm, indicates from 50F to 250F, dial size 3½", chrome and glass front. **75p** + 6p. Post 10p + 1p.

Rocker switch 13 amp 250v, white, small snaplin fixing into oblong hole, size approx 1¼" x ⅝" engraved "on/off". **25p** + 2p Post 1p.

ENTER THE BI-PAK GREAT CHRISTMAS COMPETITION!

WIN A 22" COLOUR T.V. FREE!

2nd Prize: A complete Hi-Fi outfit comprising a Legionaire Amplifier, Record Deck and EMI Speaker Kits.

3rd Prize: Black and White mains/battery Television.

4th Prize: An Electronic Calculator.

Plus: 49 runner-up prizes of Electronic Slide Rules.

1. Unijunction Transistor
2. Electrolytic Capacitor
3. Thermistor
4. Hexode Valve
5. DIAC
6. Light Dependent Resistors
7. Gas Filled Discharge Tube
8. Field Effect Transistors
9. NPN Transistor
10. Capacitor
11. L.F. Choke
12. Microphone
13. Thermo-couple
14. Aerial (General)
15. Earth
16. Neon
17. Zener Diode
18. Tetrode Valve
19. PNP Transistor
20. Resistor (Variable)
21. Selenium Cell
22. Aerial (Transmitine)
23. Preset Resistor
24. Electro Magnet
25. Plug and Socket
26. Fuse
27. Silicon Controlled Rectifier
28. Rectifier
29. Spark Gap
30. Coaxial Plug & Socket

HOW TO ENTER

You are allowed one line for every £1·00 spent with Bi-Pak. Facing you will find illustrated, 20 electronic symbols. Just choose the correct descriptions for these from the 30 alternatives shown and enter the numbers of the descriptions in the entry coupon alongside the letter indicating the symbol—should you need more columns you will find a coupon in every electronic publication. Then write a slogan of not more than 10 words but including the name BI-PAK.

RULES

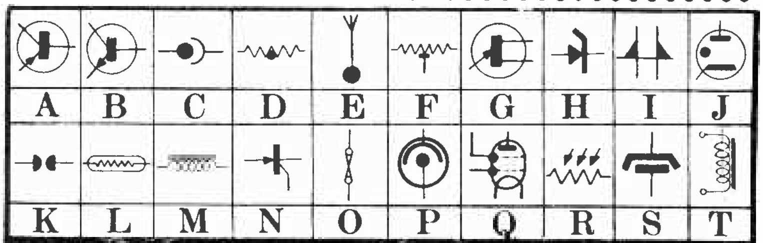
There is no entry fee but one line is allowed for every £1·00 spent with BI-PAK (SEE OUR ADVERTISEMENT ON PAGE 734). Every entry must be made on a proper entry coupon and must bear the entrant's full name and address.

All accepted entries will be examined and the Adjudicating Committee will award the FIRST PRIZE of a COLOUR TELEVISION to the competitor they consider to show the correct answers and who submits the best slogan. The remaining prizes will be awarded for the next best entries in order of merit.

Closing date February 29th. Entries arriving after the closing date will be disqualified, as will any received incomplete, illegible, mutilated or altered or not complying with the instructions and rules exactly. No responsibility can be taken for entries lost or delayed in the post or otherwise. Proof of posting will not be accepted as proof of receipt. All decisions of the adjudicating Committee will be final and legally binding. No correspondence will be entered into. Winners will be notified and the result published in the earliest possible issues of this magazine.

The competition is open to all except employees (and their families) of Bi-Pak Semiconductors. We regret that this competition is restricted to U.K. residents only. Entrants must agree to abide by the rules of the competition.

All entries become the property of Bi-Pak Semiconductors and any slogan submitted mav be used at the discretion of he company.



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T

SLOGAN ....

....

Name ....

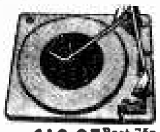
Address .... PW

....

Send to: BI-PAK, P.O. BOX 6, WARE, HERTS.

RETURN OF POST MAIL ORDER SERVICE

NEW BRS HI-FI CHANGER



STEREO AND 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 13¼ × 11¼in. Above motor board 3¼in. Below motor board 2¼in. With STEREO/MONO CARTRIDGE **£10·95** Post 75p.

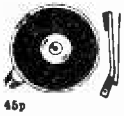
PORTABLE PLAYER CABINET

Modern design. Size 16" x 15" x 7" rexine covered. Large front grille. Hinged Lid. Chrome fittings. Motor board cut for Garrard deck. Few only, in red and black. **£4·95** Post 45p.

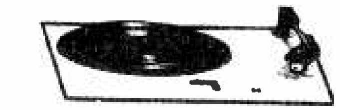
HEAVY METAL PLINTH

With P.V.C. Cover. Cut out for most B.S.R. or Garrard decks. Size 12¼ × 14¼ × 7¼in. Silver or Black **£5·95** Post 75p

BSR JUNIOR SINGLE PLAYER



Heavy duty 4-speed motor with separate pick-up arm fitted LP/78 turnover mono compatible cartridge. **£4.95** Post 45p



R.C.S. DISCO DECK SINGLE RECORD PLAYER

Fitted with auto stop, stereo/compat. cartridge. Base-plate. Size 11in × 8¼in. Turntable. Size 7in diameter. A/C mains. 220/250V motor has a separate winding 14 volt to power a small amplifier. 3 speeds plays all size records. Two for £13 **£6·95** Post 45p

COMPLETE STEREO SYSTEM

Two full size loudspeakers 13¼ × 10 × 3¼in. Player unit clips to loudspeakers making it extremely compact. Overall size only 13¼ × 10 × 8¼in. 3 watts per channel, plays all records 33 rpm 45 rpm. Separate volume & tone controls 240v AC mains

Attractive Teak finish Weight 13lbs. Bargain Price **£25** 85p carriage

SPECIAL OFFER! SMITH'S CLOCKWORK 15 AMP TIME SWITCH 0-60 MINUTES

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. Fully insulated. Makers last list price £4·50. Brand new and fully guaranteed. OUR PRICE **£2·50** Post 35p.

CASSETTE RECORDER MOTOR ONLY. 6 Volt. Will replace many types. Ideal for models. £1·25.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in sides 6 × 4in 55p; 8 × 6in 68p; 10 × 7in 75p; 12 × 8in £1; 14 × 9in £1·20; 16 × 6in £1·26; 12 × 3in 65p; 16 × 10in £1·40.

ALUMINIUM PANELS 18 s.w.g. 6 × 4in 15p; 8 × 6in 25p; 14 × 3in 25p; 10 × 7in 30p; 12 × 5in 30p; 12 × 8in 40p; 16 × 6in 45p; 14 × 9in 50p; 12 × 12in 55p; 16 × 10in 75p.

ALUMINIUM BOXES. 18 SWG with lid. 3 × 3 × 3in. = 75p. 4 × 4 × 4in. = 90p. 6 × 4 × 4in = £1·10. 9 × 4 × 4in. = £1·30. 12 × 4 × 4in. = £1·50.

1½inch DIAMETER WAVECHANGE SWITCHES 45p. EA. 2 p. 2-way, or 2 p. 6-way, or 3 p. 4-way,. 1 p.1 2-way, or 4 p. 2-way, or 4 p. 3-way.

TOGGLE SWITCHES, sp. 20p; dp. 25p; dp. dt. 30p.

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

Ideal for Mike, Tape P.U., Guitar, etc. Can be used with Battery 9-12v. or H.T. line 200-300V. D.C. operation. Size 1¾" × 1½" × ¾". Response 25 c.p.s. to 25 Kc/s, 26 db gain. For use with valve or transistor equipment. Full instructions supplied. Details S.A.E. **£1·45** Post 30p

NEW TUBULAR ELECTROLYTICS				CAN TYPES	
2/350V	20p	250/25V	14p	16+16+16/275v	45p
4/350V	20p	500/25V	20p	50+50/300V	50p
8/350V	22p	100+100/275v	65p	32+32/450V	75p
16/350V	30p	150+200/275v	70p	100+50+50/350V	85p
32/500V	50p	8+8/450V	50p	32+32+32/350	75p
25/25V	10p	8+16/450V	50p	900MFD/350V	95p
50/50V	10p	16+16/450V	50p	4700/63V	95p
100/25V	10p	32+32/350V	50p		

LOW VOLTAGE ELECTROLYTICS.
22, 25, 50, 68, 150, 470, 500, 680, 1500, 2200, 3300, mfd all 6 volt 10p. ea.
22, 25, 68, 100, 150, 200, 220, 330, 470, 680, 1000, 1500, 2200, mfd all 10 volt 10p ea.
220, 330, 1000, 4700, mfd all 4v. 10p ea.
1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 10p.
500mF 12V 15p; 25V 20p; 50V 30p.
1000mF 12V 20p; 25V 35p; 50V 47p; 100V 70p.
2000mF 6V 25p; 25V 42p; 50V 57p; 4700/63V 95p.
2500mF 50V 62p; 3000mF 25V 47p; 50V 65p.
5000mF 6V 25p; 12V 42p 25V 75p; 35V 85p; 50V 95p.
500V-0·001 to 0·05 4p; 0·1 10p; 0·25 12p; 0·47 25p.
CERAMIC 1pF to 0·01mF, 5p. Silver Mica 2 to 5000pF, 5p.
PAPER 350V-0·1 7p; 0·5 18p; 1mF or 2mF 150V 15p.
MICRO SWITCH single pole changeover 20p
MICRO SWITCH sub min 25p.
TWIN GANG. "0-0" 208pF+176pF, £1·10.
Slow motion drive 365pF+365pF with 25pF+25pF, 50p; 500pF standard twin gang 75p. 120 PF twin gang 50p.

ELAC 9 × 5in. HI-FI SPEAKER. TYPE 59RM. THIS FAMOUS AND WIDELY USED UNIT NOW AVAILABLE AT BARGAIN PRICE 10 WATT, 8 OHM. CERAMIC MAGNET. **£3·45**

NEON PANEL INDICATORS. 250V AC/DC Amber, 30p
RESISTORS. ¼ w., ½ w., 1 w., 20%, 2p; 2 w. 8p. 10 Ω to 10M.
HIGH STABILITY. ½ w. 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, 12p each; 2w 0·5 ohm to 8·2 ohms 15p.
TAPE OSCILLATOR COIL. Valve type, 35p.
FERRITE ROD 8" × ⅜" 20p; 6 × ¼" 20p; 3 × ⅜" 10p.

MAINS TRANSFORMERS

ALL POST 40p each

250–0–250V 80MA. 6·3.2A £2·95.
250-0-250 80 mA. 6·3 v. 3·5 a. 6·3 v. 1 a. or 5 v. 2 a. £4·60
350-0-350 80 mA. 6·3 v 3·5 a, 6·3 v. 1a. or 5 v. 2 a. £5·80
300-0-300 v. 120 mA., 6·3 v. 4 a. C.T.; 6·3 v. 2 a. £7·00
MINIATURE 200 v. 20 mA., 6·3 v. 1 a. 2½ × 2½ × 2in. 95p
MIDGET 220 v. 45 mA., 6·3 v. 2 a. 2¾ × 2½ × 2in... £1·20
HEATER TRANS. 6·3 v. 3 amps. £1·45 ½ amp. 95p
GENERAL PURPOSE LOW VOLTAGE. Tapped outputs at 2 amp., 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. £4·60
1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £4·80
2 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £7·00
3 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £8·70
5 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £11·25
5, 8, 10, 16 v. ½ A £2. 6-0-6 v. 500 mA 90p. 9 v. 1 amp. £1. 12 v. 300 mA £1. 12 v. 500 mA £1. 12 v. 750 mA £1. 40 v. 2 amp. tapped 10 v. or 30 v. £2·50. 20V 3 amp. £2. 40V 3 a. £2·50. 22V-0-22V 4A D.C. £3·45
AUTO TRANSFORMERS. 115v to 230v or 230v to 115v. 150w. £5; 250w. £6; 400w. £7; 500w. £8.
CHARGER TRANSFORMERS. Input 200/250v. for 6 or 12v., 1½ amp. £2·75; 4 amp. £4·80.
FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12v. outputs. 1½ amp. 40p; 2 amp. 55p; 4 amp. 85p.

MAINS ISOLATING TRANSFORMER

Primary 0-110-240v. Secondary 0-240v. 3 amps. 720 watts. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. Famous make. (Value £19) OUR PRICE **£13·50** Carr. 95p. Suitable for outside use.

R.C.S. 3 WAY CROSSOVER

Complete with 12 ft. twin lead fitted with din speaker plug. Ready assembled with leads for speakers, bass, mid and tweeter. Crossover frequencies—950 cps and 3,000 cps. For systems up to 25 watts. **£2·20**

VOLUME CONTROLS

5 K. ohms to 2 Meg. LOG or LIN. L/S 20p. D.P. 35p. STEREO L/S 55p. D.P. 75p. Edge 5K. S.P. Transistor 25p

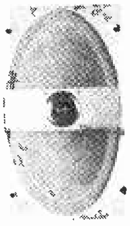
80 Ohm Coax 5p yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £2; 60 yd. £3.
FRINGE LOW LOSS Ideal 625 and colour. **10p** per yd

Wirewound controls 1½in. diam. 3 watts. 10 ohms to 100K British made with long spindles ¼in. dia 85p ea.

DUAL CONCENTRIC POT 500k LOG + 500k LIN D.P. switch. Inner spindle 3¼in; outer spindle 2¼in. 75p.

E.M.I. 13½ × 8 in. SPEAKER SALE!



With tweeter. And crossover. 10 watt. State 3 or 8 or 15 ohm. As illustrated. **£5·25** Post 45p

With flared tweeter cone and ceramic magnet. 10 watt. 8 ohm. Bass res. 45-60 cps. Flux 10,000 gauss. **£3·45** 15 watts model £5. Post 45p

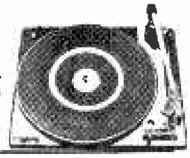
Bookshelf Cabinet

£6·95 Fluted wood front 16 × 10 × 7in. Teak Veneer Post 45p

GOODMANS 6½in. HI-FI SPEAKER

8 ohm, 10 watt. Large ceramic magnet Special Rubber cone surround. Frequency response 30-15,000 cps. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. **£4·60** Suitable Tweeter £2·30.

B.S.R. SINGLE PLAYER DECK



3 speeds, cueing device, counter-balanced arm. Ideal disco deck Stereo cartridge fitted. **£17·50** post 75p.

GOODMANS 8 in. WOOFER

8 ohm 15 watt. Deep cone. Heavy ceramic magnet. Bass resonance 35 cps. Frequency response 30-8,000 cps. Ideal bass unit for Hi-Fi systems **£5·75**

LOUDSPEAKERS P.M. 3 OHMS. 7 × 4in. £1·25; 6½in. £1·50; 8 × 5in. £1·60; 8in. £1·75; 10 × 6in. £1·90; 10in. £2·00.
SPECIAL OFFER LOUDSPEAKERS! All Brand New. 3 ohm, 2½in; 2¾in; 3½in; 5in. 8 ohm, 2¼in; 2¾in; 5in × 3in; 5in. 15 ohm, 3½in; 6in; 6 × 4in; 5in × 3in; 7 × 4in; 8 × 5in. 25 ohm, 2¼in; 3in; 3in; 5 × 3in; 5in. 35 ohm; 3in; 5in. 80 ohm, 2¼in; 2¾in. 120 ohm, 3in. **£1·25** EACH

LOUDSPEAKER VOLUME CONTROL 15 ohm 10 watt with 1in long threaded bush for wood panel mounting 75p.

RICHARD ALLAN TWIN CONE LOUDSPEAKERS, 8in. diameter 4W £2·50, 10in. diameter 5W £2·95; Post 25p. 12in. diameter, 6W, £3·50; 3 or 8 or 15 ohm models.
SPEAKER COVERING MATERIALS. Samples Large S.A.E.
Horn Tweeters 2-16Kc/s. 10W 8 ohm or 16 ohm £2·60.
De Luxe Horn Tweeters 2-18 Kc/s, 15W, 8 ohm £4·00.
TWO-WAY 3,000 c.p.s. CROSS OVERS 3, 8 or 15 ohm £1·60.
3-WAY CROSSOVER 850 cps and 3000 cps (25 watt) £2·20.

GOODMANS CONE TWEETER

18,000 cps. 25 watts. 8 ohm. Price **£3·60.**

ELECTRO MAGNETIC PENDULUM MECHANISM

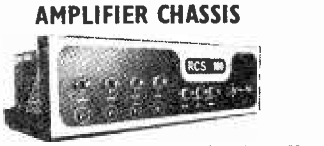
1·5v d.c. operation over 250 hrs. continuous on SP2 battery. fully adjustable swing and speed. Ideal displays teaching electro magnetism or for metronome; strobe etc. 95p. Post 20p

WEYRAD TYPE COILS

P50/1AC-60p.	RA2W 85p.	Twin Gang £1·20.
P50/2CC-40p.	OPT1 65p.	Printed Circuit 85p.
P50/3CC-40p.	LFDT4. 65p.	

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p OUTLET BOXES, SURFACE MOUNTING 25p.
BALANCED TWIN RIBBON FEEDER 300 ohms, 7p yd.
JACK SOCKET Std. open-circuit 15p, closed circuit 23p; Chrome Lead Socket 45p. Phono Plugs 10p. Phono Socket 8p JACK PLUGS Std. Chrome 20p; 3·5mm Chrome 15p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 15p. DIN PLUGS 3-pin 18p; 5-pin 25p. VALVE HOLDERS 5p; CERAMIC 10p; CANS 5p.

R.C.S. 100 WATT VALVE AMPLIFIER CHASSIS



Professional model. Four inputs. Treble, Bass, Master Volume Controls. Ideal disco P.A. or groups. Guitars, organs Suitable carrying case £10 **£85** plus £1·50 carr.

CASH PRICES INCLUDE VAT   MINIMUM POST AND PACKING 30p.   CALLERS WELCOME

RADIO COMPONENT

Illustrated Radio Books & Component Lists 10p. Written guarantee.

RETURN OF POST MAIL ORDER SERVICE

R.C.S. 10 WATT AMPLIFIER KIT

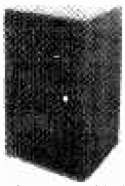
This kit is suitable for record players, tape play back, guitars, electronic instruments or small P.A. systems. Two versions are available. A mono kit or a stereo kit. The mono kit uses 13 semiconductors. The stereo kit uses 22 semiconductors with printed front panel and volume, bass and treble controls. Spec. = 10 watts output into 8 ohm, 7 watts into 15 ohms. Response 20 CPS to 30 K/CS. input 100 M.V. high imp. Size 9½in. × 3in. × 2in.

Mono kit **£12·50** Stereo kit **£20** post 45p.

ELAC 8in. or 10 x 6in. HI-FI SPEAKER

Dual cone plasticised roll surround. Large ceramic magnet. 50–16,000 cps. Bass resonance 55 cps. 8 ohm impedance. 8in. 10 watts **£4·35**

TEAK VENEER HI-FI SPEAKER CABINETS
Fluted Wood Fronts



MODEL "A". 20 × 18 × 12in. For 12in. dia. 10in. speaker. **£12·50** Post 75p

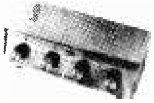
MODEL "B". 16 × 10 × 7in. For 13 × 8in. or 8in. speaker. **£6·95** Post 45p

LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft.

BAKER RECOMMENDED 12 inch Enclosure 4 cubic ft. HI-FI CABINET £21·50. Carr. £2 each. Few only. Size 30 × 20 × 12in. Teak Finished Fluted Front.

TEAKWOOD LOUDSPEAKER FRONT GRILLS Modernise your cabinets with the Grooved look. Sizes—18¼" × 10¼"—75p. 10¼" × 7¼"—45p.

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt battery operated. **£5·20**



STEREO VERSION OF ABOVE £6·85.

R.C.S. STEREO FM TUNER BRITISH MADE

This completely cased mains powered Hi-Fi Tuner with brushed aluminium facia is British made using the latest circuitry. Bargain **£30** Post 45p.

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated. **£3·95**

WAFER THIN HEATING ELEMENTS

OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10¼ × 8¼ × $\frac{1}{16}$in. Operating voltage 200/250V. a.c. 250 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopiers and print drying equipment.
Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails—ideal for airing cupboards. Ideal for anti-frost device for the garage —preventing frozen radiators or acting as oil sump heater. Use in the greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

ONLY **40p** EACH (FOUR FOR £1·50)

ALL POST PAID—Discounts for quantity.

BAKER MAJOR 12" £11·50

Post 50p

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 25 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£14·50**

Please state 3 or 8 or 15 ohms. Post 80p

"BIG SOUND" BAKER SPEAKERS

Robustly constructed to stand up to long periods of electronic power. As used by leading groups and discos

Useful response 30-13,000 cps. Bass Resonance 55 cps.

GROUP "25" 12in. 30 watt 3, 8 or 15 ohms. **£8·95** Post 40p

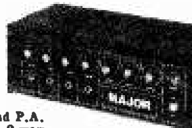
GROUP "35" 12in. 40 watt 3, 8 or 15 ohms. **£10·50** Post 40p

GROUP "50" 15in. 75 watt 8 or 15 ohms. **£19·50** Post 80p

GROUP 50/12in. 60 watt 8 or 15 ohms **£14·50** Post 80p

Group + PA Cabinets in stock Send for Leaflet.

BAKER 50 WATT ALL PURPOSE TRANSISTOR AMPLIFIER



All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 2 way mixing. Output 8/15 ohm. a.c. Mains. Separate treble and bass controls. Guaranteed. **£49** Carr. £1·00

Deluxe 100 watt model as illustrated £65. also available in Heavy Wooden case £75.

NEW DISCO 100 WATT £59

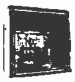
ALL PURPOSE AMPLIFIER CHASSIS Carr. £1.
2 inputs. 4 outputs separate volume treble and bass controls. Ideal disco amplifier chassis

R.C.S. SOUND TO LIGHT KIT

1000 watts per channel. Full instructions supplied. Kit price **£12·50**

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER. Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/250V. Leaflet S.A.E. **£4·35** Post 30p

QUALITY LOUDSPEAKER ENCLOSURE



Teak veneered ½in thick wood cabinet. Size 18½in × 18½in × 8½in. Weight 22lbs. This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for 6½inch Woofer. £8·50 Carr. 85p. Rosewood Version £9·50 Carr. 85p. Baffle could be cut to take larger speaker.

SPECIAL OFFERS

100 Ohm 20 watt Rheostat 2½in diam. Ceramic Former. Screw Terminals ¼in. diam. spindle. 95p. Post 25p. AC mains relay 3 pole change over 75p.

E.M.I. GRAM MOTOR **£1·25**
120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2¼ × 2¼ × 2¼ in. Post 30p.

E.M.I. TAPE MOTOR **£2·00**
4 pole, 240 v. 135 mA. Size 3¼ × 2½ × 2½in. 1200 rpm. Spindle $\frac{3}{16}$ in diameter. 120v version £1. Post 30p

BAKER HI-FI SPEAKERS
HIGH QUALITY — BRITISH MADE

REGENT
12in. 20 watts

An inexpensive unit for the beginner in high fidelity and for general purposes. May be used to improve any Radio, Amplifier, Hi-Fi or Television receiver.
Bass Resonance 45cps
Flux Density 12,000gauss
Useful response 45-13,000cps
3 or 8 or 15 ohm models.

£10·50 Post 40p

DE-LUXE Mk II
12in 15 watts

Especially designed to provide full range reproduction at an economical cost. Suitable for use with any high fidelity system. Built-in concentric tweeter cone.
Bass Resonance 30cps
Flux Density 14,000gauss
Useful response 25-16,000cps
8 or 15 ohms models.

£13·50 Post 40p

SUPERB
12in. 25 watts

A high quality loudspeaker, its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.
Bass Resonance 25cps
Flux Density 16,500gauss
Useful response 20-17,000cps
8 or 15 ohms models.

£17·00 Post 80p

AUDITORIUM
12in. 35 watts

A full range reproducer for high power, Electric Guitars, public address, multi-speaker systems, electric organs. Ideal for Hi-Fi and Discotheques.
Bass Resonance 35cps
Flux Density 15,000gauss
Useful response 25-16,000cps
8 or 15 ohms models.

£15·50 Post 80p

AUDITORIUM
15in. 45 watts

A high wattage loudspeaker of exceptional quality with a level response to above 8,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home HI-FI.
Bass Resonance 35cps
Flux Density 15,000gauss
Useful response 20-14,000cps
8 or 15 ohms models.

£19·50 Post 80p

Hi-Fi Enclosure Manual containing plans, designs, crossover data and cubic tables. 60p. Post 8p.

CUSTOMERS FREE CAR PARK

OPEN 9-6. WEDNESDAY 9-1. SATURDAY 9-5. Closed for lunch 1-15—2-30

SPECIALISTS 337 WHITEHORSE ROAD . CROYDON

(Exports Remit cash and extra postage.)

Buses 50, 68, 159. Rail Selhurst

Telephone 01-684-1665

GIRO NO. 331 7056. Access and Barclay card accepted. C.W.O. only. P.&P. 25p
Discount: £15–10%, (except net items)
Export Order enquiries welcome (min. £5)
Official Orders accepted from Educational & Government Departments
ALL PRICES INCLUDE VAT AT 8%
E. & O. E.

PLEASE ADD AN EXTRA 15% VAT EXCEPT ON TEST METERS, AND VEROBOARD please total 8% & 25% items separately   ALL STOCK SUBJECT TO AVAILABILITY

SPECIAL RESISTOR KITS
10E12 ¼W KIT: 10 of each E12 value, 22 ohms—1M, a total of 570 (CARBON FILM 5%), **£4·60 net**
25E12 ¼W KIT: 25 of each E12 value, 22 ohms—1M, a total of 1425 (CARBON FILM 5%), **£10·99 net**
10E12 ½W KIT: 10 of each E12 value, 22 ohms—1M, a total of 570 (CARBON FILM 5%), **£4·60 net**
25E12 ½W KIT: 25 of each E12 value. 22 ohms—1M, a total of 1425 (CARBON FILM 5%), **£10·99 net**

MULLARD POLYESTER CAPACITORS C280 SERIES
250V P.C. Mounting: 0·01μF, 0·015μF, 0·022μF, **3½p.** 0·033μF, 0·047μF, **4p.** 0·068μF, 0·1μF, **4½p.** 0·15μF, **5p.** 0·22μF, **6p.** 0·33μF, **8p.** 0·47μF, **10p.** 0·68μF, **13p** 1μF, **17p.** 1·5μF, **26p.** 2·2μF, **28p.**

MULLARD POLYESTER CAPACITORS C296 SERIES
400V: 0·001μF, 0·0015μF, 0·0022μF, 0·0033μF, 0·0047μF, 0·0068μF, 0·01μF, 0·015μF, 0·022μF, 0·033μF, **4p.** 0·047μF, 0·068μF, 0·1μF, **5p.** 0·15μF, **8p** 0·22μF, **10p.** 0·33μF, **15p.** 0·47μF, **18p.**
160V: 0·01μF, 0·15μF, 0·022μF 0·047μF, 0·068μF, **4p.** 0·1μF, **5p.** 0·15μF, **6p.** 0·22μF. **7p.** 0·33μF, **8p.** 0·47μF, **10p.** 0·68μF, **14p.** 1μF, **17p.**

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, (μF) 0·01, 0·015, 0·022, 0·033, 0·047, **2½p.** each. 0·1, 30V, **5p.**

POLYSTYRENE CAPACITORS 160V 5%
(pF) 10, 15, 22, 33, 47, 68, 100, 150, 220, 330, 470, 680, 1000, 1500, 2200, 3300 4700, 6800, 10,000, **4½p.**

RESISTORS
CF—High Stab Carbon Film, 5%   MF—High Stab Metal Film, 5%.

W.	Type	Range	1–99	100–499	500–999	1000+	Size mm
⅛	CF	22–1M	1	0·90	0·85	0·80	2·4x7·5
¼	CF	22–2M2	1	0·90	0·85	0·80	3·9x10·5
¼	MF	10–2M7	2	1·7	1·4	1·2	3x7
½	MF	10–2M2	2	1·6	1·3	1·1	4·2x10·8
1	MF	10–10M	3	1·98	1·81	1·65	6·6x13
2	MF	10–10M	4·5	3·52	3·08	2·75	8x17·5

(Price in pence each).
VALUES AVAILABLE—E12 Series only. (Net prices above 100.)

PRESET SKELETON POTENTIOMETERS
MINIATURE 0·25W Vertical or horizontal **7p** each 1K, 2K2, 4K7, 10K, etc. up to 1M Ω
SUB-MIN 0·05W Vertical, 100 Ω to 220K Ω **7p** each.

Buy it with Access

B. H. COMPONENT FACTORS LTD.

(P.W.) LEIGHTON ELECTRONICS CENTRE, 59 NORTH ST., LEIGHTON BUZZARD, BEDS.
Tel.: LEIGHTON BUZZARD 2316 (STD. Code 05253)

Miniature Mullard Electrolytics

1·0μF	63V	7p	100μF	25V	7p
1·5μF	63V	7p	100μF	63V	17p
2·2μF	63V	7p	150μF	16V	7p
3·3μF	63V	7p	150μF	63V	17p
4·0μF	40V	7p	220μF	6·4V	7p
4·7μF	63V	7p	220μF	10V	7p
6·8μF	63V	7p	220μF	16V	8p
10μF	25V	7p	220μF	63V	25p
10μF	63V	7p	330μF	16V	14p
15μF	16V	7p	330μF	63V	28p
15μF	63V	7p	470μF	6·4	8p
16μF	40V	7p	470μF	40V	25p
22μF	25V	7p	680μF	16V	17p
22μF	63V	7p	680μF	40V	28p
32μF	10V	7p	1000μF	16V	25p
33μF	16V	7p	1000μF	25V	28p
33μF	40V	7p	1500μF	6·4V	17p
47μF	10V	7p	1500μF	16V	28p
47μF	25V	7p	2200μF	10V	28p
47μF	63V	8p	3300μF	6·4V	28p
68μF	16V	7p			
68μF	63V	14p			
100μF	10V	7p			

VEROBOARD

	0·1	0·15
2½ × 5″	45p	45p
2½ × 3¾″	41p	30p
3¾ × 5″	51p	53p
3¾ × 3¾″	45p	45p
2½ × 1″	11p	10p
2½ × 5″ (Plain)	—	22p
2½ × 3¾″ (Plain)	—	20p
5 × 3¾″ (Plain)	—	37p
Insertion tool	87p	87p
Track Cutter	68p	68p
Pins, Pkt. 50	25p	25p

TRANSISTORS

AC127	21p	BC212L	13p
AC128	22p	BC213L	13p
BC107	12p	BC214L	18p
BC108	12p	OC44	19p
BC109	13p	OC71	13p
BC148	13p	OC81	17p
BC149	13p	OC170	29p
BC182L	13p	2N2926	13p
BC183L	13p	2N3702	14p
BC184L	14p	T1543	45p

POTENTIOMETERS
Carbon Track 5K Ω to 2M Ω, log or lin (and 1K lin). Single, **17½p** Dual Gang **48p.** Log single with switch **28p,** Slider Pots. 5K—500k, 60mm Log or Lin **45p.** Dual **55p.** Knob **10p.**

DIODES

IN4001	6½p
IN4002	7½p
IN4003	9p
IN4004	90p
IN4005	12p
IN4006	14p
IN914	7p
IN916	7p
BA100	10p
OA5	42p
OA47	9p
OA81	11p
OA200	8p

PLUGS

DIN 2 Pin	12p
3 Pin	13p
5 Pin 180°	16p
Std. Jack	20p
2.5mm jack	13p
Phono	7p

SOCKETS

DIN 2 Pin	10p
3 Pin	10p
5 Pin 180°	12p
Std. Jack	18p
2.5mm Jack	13p
Phono	7p

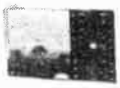
ELECTROLYTIC CAPACITORS. Tubular & Large Cans (uF/V): 1/25, 2/25, 4/25, 4·7/10, 5/25, 8/25, 10/10, 10/50, 16/25, 22/63, 25/25, 25/50, 32/25, 50/25, 100/10, 100/25, **7p.** 50/50, **8p.** 100/50, 200/25, **10p.** 250/50, **18p.** 500/10. **8p.** 500/25, **17p.** 500/50, **25p.** 1000/10, **17p.** 1000/25, **25p.** 1000/50, **40p.** 2000/10, **20p.** 1000/100, **£1·10.** 2000/25, **35p.** 2000/100, **£1·20.** 2500/25, **38p.** 2500/50, **68p.** 5000/25, **69p.** 5000/50, **£1·20.**

HI-VOLT: 4/350, **20p.** 8/350, **23p.** 100/100 **27p.** 16/350, **35p.** 100/100, **27p.** 100/250, **40p.**

METALLISED PAPER CAPACITORS
250V: 0·05μF, 0·1μF, **6p.** 0·25, **6p.** 0·5μF, **7½p.** 1μF, **9p.** 500V: 0·025, 0·05, **6p.** 0·1, **6p.** 0·25, **7½p.** 0·5, **9p.** 1000V: 0·01, **12p.** 0·022, **13p.** 0·047, 0·1, **19p.** 0·22, **28p.** 0·47, **36p.**

LEIGHTON ELECTRONICS CENTRE
Our new Electronics Centre is now open in Leighton Buzzard and all callers are welcome. As well as our normal stock of over 3000 product lines, we have a large range of surplus equipment, Bargains, Calculators, etc. OPEN 6 DAYS 9 to 5 (shut 12.30 to 1.30).

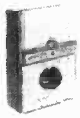
MULTIMETER U4323
22 Ranges plus AF/IF Oscillator 20,000Ω/Volt.
Vdc—0·5—1000V in 7 ranges
Vac—2·5—1000V in 6 ranges
Idc—0·05—500mA in 5 ranges
Resistance—5Ω—1MΩ in 4 ranges.
Accuracy—5% of F.S.D.
OSCILLATOR—1 KHz and 465 KHz (A, M.) at approx. 1 Volt.
Size—160 x 97 x 40mm.
Supplied complete with carrying case, test leads and battery.
PRICE £8·64 net p & p 75p.


U4323

MULTIMETER U4341
27 Ranges plus Transistor Tester.
16,700Ω/Volt. Overload protected.
Vdc—0·3—900V in 8 ranges.
Vac—1·5—750V in 6 ranges.
Idc—0·06—600mA in 5 ranges.
Iac—0·3—300mA in 4 ranges.
Resistance—2KΩ—2MΩ in 4 ranges.
Accuracy—dc—2½%. ac—4% of F.S.D.
hfe—10—350 in 2 ranges.
Size—115 x 215 x 90mm.
Complete with steel carrying case, test leads, and battery.
PRICE £11·88 net p & p 75p.


U4341

MULTIMETER U4324
34 Ranges. High sensitivity.
20,000Ω/Volt. Overload protected.
Vdc—0·6—1200V in 9 ranges.
Vac—3—900V in 8 ranges.
Idc—0·06—3A in 6 ranges.
Iac—0·3—3A in 5 ranges.
Resistance—25Ω—5MΩ in 5 ranges.
Accuracy—dc and R—2½% of F.S.D.
ac and db—4% of F.S.D.
Size—167 x 98 x 63mm.
Supplied complete with storage case, test leads, spare diode, and battery.
PRICE £10·64 net p & p 75p.


U4324

MULTIMETER U4313
33 ranges. Knife edge with mirror scale.
20,000Ω/Volt. High accuracy. mVdc—75mV.
Vdc—1·5—600V in 9 ranges.
Vac—1·5—600V in 9 ranges.
Idc—60—120 microamps in 2
Idc—0·6—1500mA in 6 ranges.
Iac—0·6—1500mA in 6 ranges.
Resistance—1KΩ—1MΩ in 4 ranges.
db scale—-10 to + 12db.
Accuracy—dc—1½%, ac—2½%
Size—115 x 215 x 90mm.
Complete with steel carrying case, test leads, and battery.
PRICE £14·90 net p & p 75p.

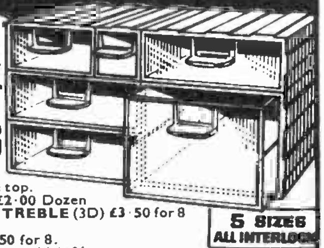

U4313

PAYS FOR ITSELF WITH DISCOUNT VOUCHERS WORTH **20p**

HAVE YOU GOT YOURS
CATALOGUE NO. 4A NEW CONVENIENT SIZE, AND FULLY ILLUSTRATED.
CONTAINS MANY HARD TO GET ITEMS
★ DISCOUNTS
★ ALL NEW STOCK
★ SATISFACTION GUARANTEE
★ DEPENDABLE SERVICE
POST FREE
Please send S.A.E. for Supplement No. 1

I-N-T-E-R-L-O-C-K-I-N-G PLASTIC STORAGE DRAWERS

Newest, neatest 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. ID have space dividers. Build up any size cabinet for wall, bench or table top.



DISCOUNT PRICES

SINGLE UNITS (5″×2¼″×2¼″) £2·00 Dozen
DOUBLE UNITS £3·50 Dozen. **TREBLE** (3D) £3·50 for 8
DOUBLE TREBLE £4·90 for 8.
EXTRA LARGE SIZE (6D1) £4·50 for 8.
Carriage 50p. Orders over £10 please add 10% carr.
QUANTITY DISCOUNTS! 5% in £1 for orders over £20 7½% for orders over £60. Quotations for large quantities.
PLEASE ADD 8% VAT TO TOTAL REMITTANCE.
FLAIRLINE SUPPLIES (Dept. PW1), 124 CRICKLEWOOD BROADWAY LONDON N.W.2 01-450 4844

PROFESSIONAL AUDIO MODULES

We invite the serious constructor of quality PA, disco and mixer systems to consider the merits of our modular audio circuits which feature

VERSATILITY QUALITY ECONOMY

MS12X POWER MODULE: A double amplifier conservatively rated at 50 + 50W stereo, or 100W mono (bridge connected). Price **£12·50** (+ 8% VAT).

MODULO MIX. A series of pre-amp modules which may be combined to meet most mixer requirements.

For full details, send sae to:

PETER STYLES ELECTRONICS
48 Thorncliffe Road, Oxford

Crescent Quality Components

BARGAIN CAPACITOR 2,000MFD at 50v. DC wkg. Size — 2" × 1½" diameter. Tag ended. All new and unused. Our price **35p.** + 25%.

BARGAIN PROJECT BOX
A plastic box with moulded extrusion rails for PC or Chassis panels with metal front plate fitted with four screws (all supplied).
An ideal box to give a small project a professional finish.
SIZE (internal) 81mm × 51mm × 28mm.
OUR PRICE **40p.** +8%

JB11D STEREO JUNCTION BOX
The most popular stereo junction box. Facility for two pairs of headphones and two speakers. 3 position switch selects headphones, loudspeakers or both. A bargain at **£2·50** +25%

LIGHT EMITTING DIODES +8%

	RED	GREEN	YELLOW	AMBER
0·2 inch	17p	27p	29p	27p
0·16 inch	24p	29p	30p	29p
0·125 inch	15p	25p	30p	25p

For orders of 10 and more LEDs 10% discount. (All LEDs supplied with free plastic mounting clip).

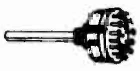
LOW COST SEVEN SEGMENT DISPLAYS ·3 INCH +8%

CR72R	Red	Com. Anode	Left Dec.	£1·35
CR52G	Green	Com. Anode.	Left Dec.	£1·35
CR82Y	Yellow	Com. Anode	Left Dec.	£1·35
CR74R	Red	Com. Cathode	Right Dec.	£1·35
CR54G	Green	Com. Cathode	Right Dec.	£1·35
CR84Y	Yellow	Com. Cathode	Right Dec.	£1·35

For full information on low cost displays please send 15p.

Clock Chip +8%
CT7001 MOS/LSI Digital Clock/Calendar Chip Plus full Circuits and Information leaflet **£5·95**
Circuits and Information Sheet **25p**
Lit 704 Led Display for above **£1·10**
Or 4 for **£4·20**

WAFER SWITCHES
1 Pole 12 Way
2 Pole 2 Way
2 Pole 3 Way
2 Pole 4 Way
2 Pole 6 Way
3 Pole 4 Way
4 Pole 3 Way
37p each +8%



POTENTIOMETERS
All types 1" and less diameter

Singles		Dual	
5K	Log or	5K	
10K	Lin Less	10K	
25K	Switch	25K	Less
50K	17p each	50K	Switch
100K		100K	53p each
250K	Double	250K	+25%
500K	Pole	500K	
1M	Switch	1M	
2M	37p each	2M	

FERRIC CHLORIDE
Anhydrous ferric chloride in double sealed one pound poly packs.
Our Price **65p** + P/P + VAT @8% per lb.

MAINS TRANSFORMERS
Open Type Double Wound Continuously Rated, two hole fixing clamp with colour coded flying leads, varnish impregnated. Approx. size: 1¾" × 1½" × 1½" high
Fixing centres: $2^5/_{32}$".
TR1 20–0–20v 100 m/a
TR2 12–0–12 v 100 m/a — All
TR3 9–0–9 v 100 m/a — 240 Volt
TR4 6–0–6 v 100 m/a — Primary
TR5 3–0–3 v 100 m/a
Our Price **£1·23 each** +8%

ANTEX SOLDERING IRONS AND SPARES
X25 25 watt = **£2·45**
X25 Spare Element = **£1·20**
X25 Spare Bits No. 50, 51, 52 = **44p each**
C240/2 15 watt = **£2·45**
C240/2 Spare Element = **£1·10**
C240/2 Spare Bits No. 2, 3, 6 = **32p each**
ST3. Soldering Iron Stand Suitable for all models = **£1·10**
+ 8% VAT

LOW PRICE TRANSISTORS
BF203B = **15p** TIP42A = **75p**
AC142K = **25p** OC75 = **22p**
BC149B = **15p** AA129 = **6p**
+ 25% VAT

POWER SUPPLY UNITS +8%
PP1 switched 3, 4½, 6, 7½, 9 and 12 volts at 500 m/a, with on/off switch and pilot light. Size: 130mm × 55mm × 75mm.
ONLY 24·00

PP2 Switched 6 – 7½ – 9 volt Battery Eliminator. Approx. size 2¾" × 2½" × 3½". Ideal for cassette recorders **£3·25**
PP3 Car converter. From 12v Pos. or Neg. to = 6 – 7½ – 9 volt. Easy to fit and transistor regulated **£3·90**

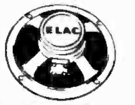
VEROBOARD +8%

	·1	·15	Plain ·15
2½ × 3¾	38p	28p	18p
2½ × 5	41p	41p	20p
3¾ × 3¾	41p	41p	
3¾ × 5	47p	49p	34p
17 × 2½	1·24p	93p	69p
17 × 3¾	1·69p	1·32p	97p
17 × 5	2·16p		1·87p

Pin insertion tool **81p**
Spot face cutter **59p**
Pkt 36 pins (state ·1 or ·15) **30p**

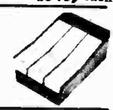
LOUDSPEAKERS +25%
2½" 8 ohm **60p**
2½" 40 ohm **60p**
2½" 80 ohm **60p**
5" 8 ohm ceramic **£1·25**
6½" 8 ohm dual cone ceramic **£2·50**
10" 8 ohm dual cone ceramic **£3·75**
8" × 5" 8 ohm Perman't Magnet **£1·60**

BARGAIN BOARDS
Components galore for the experimenter. Ex-Computer boards with resistors, capacitors and useful transistors—at least 4 transistors per board. Five boards **£1** + 8%.



10-INCH 8 OHM DUAL CONE
Manufactured by "ELAC" to a very high standard these loudspeakers are a real bargain
SPEC:—Size = 10" Dual Cone.
Power = 10 Watts
Frequency = 40-12000Hz
+25% Our Price = **£3·75p each**

MAINS KEYNECTOR
Keynector connects any Electrical Equipment to the mains supply in seconds. Ideal for bench, garage demonstrations, etc. Multi connections can be made (max. load 13A fused).
£3·25p. +8%



ALUMINIUM BOXES +8%
Metal project boxes give your work a professional finish

	L	W	H	
AB7	2¾	5¼	1½	54p
AB8	4	4	1½	63p
AB9	4	2¾	1½	54p
AB10	4	5¼	1½	63p
AB11	4	2½	2	54p
AB12	3	2	1	45p
AB13	6	4	2	69p
AB14	7	5	2½	84p
AB15	8	6	3	99p
AB16	10	7	3	£1·35
AB17	10	4½	3	£1·03
AB18	12	5	3	£1·20
AB19	12	8	3	£1·50

ABS PLASTIC BOXES +8%
Handy boxes for construction projects. Moulded extrusion rails for P.C. or chassis panels. Fitted with 1mm front panels.
1005 = 105mm × 73mm × 45mm = **55p**
1006 = 150mm × 75mm × 47mm = **72p**
1007 = 184mm × 124mm × 60mm = **£1·28**
1021 = 106mm × 74mm × 45mm (sloping front) = **55p**

TELESCOPIC AERIAL
Nine section fully swivelling telescopic aerial with 4BA single bolt fixing or two hole fixing bracket.
Fully extended = 43" Fully closed = 7"
Our Price 50p + P/P + VAT @ 25%

LOW NOISE LOW PRICE CASSETTES +8%
Good quality tape in well made screw type cassettes. Presented in single plastic cases.
C60 = **31p** C90 = **42p** C120 = **53p**
10% Discount on ten or more cassettes of one type

CLEAR PLASTIC PANEL METERS
Size 59mm × 46mm × 35mm these meters require a 38mm hole for mounting.
ME6 = 0 to 50 micro amp Full Scale
ME7 = 0 to 100 micro amp Full Scale
ME8 = 0 to 500 micro amp Full Scale
ME9 = 0 to 1 m/a Full Scale
ME10 = 0 to 5 m/a Full Scale
ME11 = 0 to 10 m/a FullScale
ME12 = 0 to 50 m/a Full Scale
ME13 = 0 to 100 m/a Full Scale
ME14 = 0 to 500 m/a Full Scale
ME15 = 0 to 1 amp Full Scale
ME16 = 0 to 50 volts
ME17 = 0 to 300 volts A.C. Full Scale
ME18 = "S" Meter
ME19 = "VU" Meter

OUR PRICE **£3·00** +8%

SCOOP PURCHASE
MW—LW—FM STEREO TUNER
We supply a MW—LW—FM—Stereo Tuner fully wired and aligned on a 6" × 4" × 1½" printed board, plus the Ferrite Aerial and switch which you connect following our complete instructions.
Now you only need a 9-12 volt D.C. supply and you can feed this tuner into any Stereo Amplifier.
FANTASTIC VALUE AT £7·00 + 25% VAT

MINIATURE RELAYS
Brand new range of British made Relays. Size 1½" × 1" × ¾". All two changeovers with 250v 1·5A contacts and suitable for fitting on ·1m Veroboard.

Type	Volts	Current	Ohms
27/A	12v	17M/A	700
21/A	12v	28M/A	430
12/A	6v	33M/A	185

All **£1·30** each –

IC EXTRACTION TOOL
Saves damage to Valuable IC's
ONLY 40p + 8% VAT

TWO WAY STEREO ADAPTOR
Stereo jack plug to two stereo line sockets complete with 110 mm of cable. For plugging two stereo inputs into one. A Bargain at **65p.** + 25%

CABLE LESS SOLDERING IRON
WAHL "ISO—TIP"
★ Completely Portable
★ Heats in 5 seconds
★ Solders up to 150 joints or more per charge
★ Recharges automatically in its own stand
★ No AC leakage or induced current to damage delicate components
★ Heats to 700 deg. F
★ Fine Tip for delicate and general purpose soldering
★ Only 8" long and weighs just 6 ozs.
OUR PRICE **£9·75** +8% (spare bits are available)

3 KILOWATTS 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 1000W lamps to the output terminals of the unit, and you produce a fascinating sound-light display. (All guaranteed).

£18·50 plus 75p P. & P. + 8%

BARGAIN TRANSFORMERS
12-0-12 volt 500m/a
240 volt primary transformer bargain.
approx size = 60mm x 40mm x 50mm
fixing centres = 75mm
Our Price = £1·20 +8%

P.C. ETCHING KIT
This kit contains all that the constructor will need to etch the circuits of his own design
Contents = Plastic etching dish.
Sample copper clad board.
Laminate Cutter.
1 lb Ferric Chloride.
Large Plastic Spoon.
Etch Resist Pen.
Full Etching Instructions.
Complete and Big Kit Value at **£3·75p** +8%

U.K. POSTAGE 50p UNLESS OTHERWISE STATED

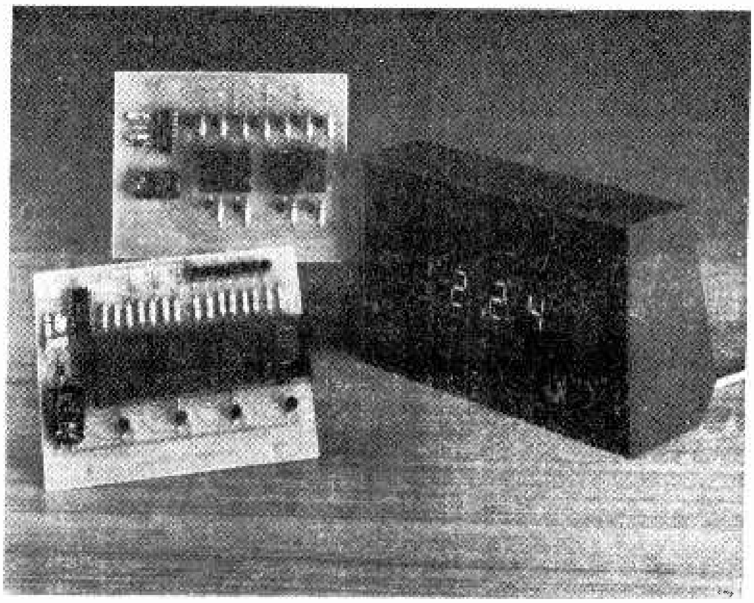
VAT—All prices are excluding VAT. Please add to each item the VAT rate indicated.

CRESCENT RADIO LTD. P.W.
All mail to No. 1 ST. MICHAELS TERRACE
WOOD GREEN, LONDON N22 4SJ.
Phone: 01-888 4474
Callers Welcome at
15 Mayes Road & 13 South Mall, Edmonton N9.

If you construct You should own one.

CRESCENT CATALOGUE
Price 30p.

Greenbank Electronics Established 1970



The illustration shows the two P.C.B. kits already assembled, one has 8mm high digits, the other has 16mm high digits. Also shown is an example of a completed clock.
Free on request: Data on AY-5-1224 and MK50253 clock chips, 4 and 6 digit alarm clock suggested circuits, quartz crystal timebase, and L.E.D. displays, (If you can send an S.A.E., it makes things a little easier for us).

DIGITAL CLOCK
P.C.B. KITS FROM
£9·95 (plus 10p post and VAT @ 8%)

Features:—

★ High quality fibreglass P.C.B. 112 × 89mm (both types), a suitable case is available as illustrated, or you can make your own.

★ All components mount on one side of the board for neatness and simple construction.

★ AY-5-1224 chip and L.E.D.s 'plug-in' for easy assembly and servicing.

★ Uses L.E.D. display (believed to have the longest life time of all electronic display types known at present)

★ A single 12V, 500mA, 50 Hz supply is the only input required (e.g. our 2 × 6V Min. Tr., see below).

★ Full eight page instructions provided, and back up assistance if you need it—success guaranteed! Suitable for even the absolute beginner.

★ Easily converted to give additional 4 range 'stop-watch' facility, for e.g. darkroom timer.

★ All parts available individually at no increase in price—buy only what you need.

★ An excellent idea for a most acceptable gift.

CLOCK/'STOPWATCH' P.C.B.s
Type 1224-704E/PCB for 8mm high display 95p. Type 1224-747E/PCB for 16mm high display 95p.

COMPONENT KITS
Include: P.C.B., AY-5-1224 Chip, 4 L.E.D. digits, transistors, diodes, resistors, capacitors, mounting socket pins, full instructions. Ref: 1224-704E/Kit (8mm high digits) £9·95
Also, as above but using 16mm high digits (P.C.B. is same size). Ref: 1224-747E/Kit £3·44 extra.
(Either P.C.B. kit can be supplied assembled and tested for an additional 75p)

CLOCK CHIPS
AY-5-1224 4 digit £3·66 MK 50253 4/6 digit alarm £5·50
(CT 7001 discontinued)

L.E.D.s (Please check availability)
DL-Series 7 seg. displays, common anode and common cathode types: 0·3" single digits, 'Economy' 85p, 'Prime' £1·70; 0·5" double digits, 'Economy' £3·05, 'Prime' £4·40; 0·6" single digits, 'Economy' £1·70: 'Prime' £2·45, 0·2" single red L.E.D. dinicator 12p

MINIATURE TRANSFORMERS
6VA Types with 240V primary, approximate dimensions W.45mm H.38mm D.40mm, fixing centres 53·5. Secondary voltages available: 2 x 4½V, 2 x 6V, 2 x 12V, 2 x 15V, 2 x 20V, all same price £1·52.

CMOS
Popular types 4001, 4011 gates 15p (Range is being extended—send for list.) New CA 3130 R.C.A. COS/MOS op-amp 75p.

ANTEX SOLDERING IRONS
C.240 15 watt miniature type £2·45. X.25/240 25 watt £2·45.

Terms: C.W.O. Add VAT to all prices at 8%. Post etc., U.K. 10p per order, export 75p (no VAT). All orders processed on day of receipt

GREENBANK ELECTRONICS (Dept. W1P)
94 New Chester Road, New Ferry, Wirral, Merseyside, L62 5AG, England. Tel:—051-645 3391

FIRST GRADE TRANSISTORS ALL BRANDED

BC107, BC108, BC109 9p each or 100 for £7·50
also
BC147, BC148, BC149, BC157, BC158, BC159, BF194, BF195, BF196, BF197 8p Each or 100 for £6·50
Type numbers may be mixed for quantity discounts
BD124 55p; AD149 matched pair 65p
8 pin DIL 741's
10+26p, 25+23p, 100+21p, 250+20p
Popular diodes IN4148 50 for only £1·25
IN4001, IN4002, IN4003, IN4004, IN4005, IN4006 6p each 30 for £1·50
Mullard Ferrite Cores LA3 54p, LA4 81p, LA7 81p
All prices include post and VAT at appropriate rates
MAIL ORDER ONLY
XEROZA RADIO
1 East Street, Bishop's Tawton, Devon

PLEASE MENTION PRACTICAL WIRELESS WHEN REPLYING TO ADVERTISEMENTS

Practical Wireless Classified Advertisements

The pre-paid rate for classified advertisements is 14p per word (minimum 12 words), box number 35p extra. Semi-displayed setting £12·00 per single column inch. All cheques, postal orders, etc., to be made payable to PRACTICAL WIRELESS and crossed "Lloyds Bank Ltd." Treasury notes should always be sent *registered post*. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, PRACTICAL WIRELESS, IPC Magazines Ltd. Fleetway House, Farringdon Street, London, EC4A 4AD for insertion in the next available issue. (01-634 4451).

Receivers and Components

BRAND NEW COMPONENTS BY RETURN: Electrolytics—16V, 25V, 50V—0·47, 1·0, 2·2, 4·7, 10 mfds.—5p. 22, 47—5½p. (50V—6p) 100—7p. (50V—8p), 220—8p. (50V—10p), 500—11p. (50V—16p), 1000/25V—18p. Subminiature bead-type tantalums—0·1/35V, 0·22/35V, 0·47/35V, 1·0/35V, 2·2/35V, 4·7/35V, 10/20V, 22/16V, 47/6V, 100/3V.—11p. Mylar Film 100V.—0·001, 0·002, 0·005, 0·01, 0·02.—3p. 0·04, 0·05—3½p. Mullard tubular polyester 400V E6 series 0·001-0·022—3½p. 0·033-0·1—4½p. Mullard miniature C333 ceramics 63V E12 series 2%, 1·8 pf.-47 pf.—3p. 56 pf.-330 pf.—3½p. Polystyrene 63V E12 series 10 pf.-1000 pf.—3p. 1200 pf.-10,000 pf—4p. Miniature Highstab. carbon film resistors ⅓W E12 series 5% 1Ω-10MΩ. (10% over 1MΩ) 1·2p. Postage 10p. Prices VAT Inclusive. The C.R. Supply Co., 127, Chesterfield Road, Sheffield S8.

BULK OFFERS

1N4001	£2·50	BC149	£6·00	BFX88	£14·00
1N4002	£2·80	BC157	£6·00	BFY64	£12·50
1N4003	£3·20	BC158	£6·00	BSX20	£9·00
1N4004	£3·50	BC159	£8·00	BSY95A	£6·00
1N4005	£3·90	BC161	£10·00	OC36	£36·00
1N4006	£4·30	BC172	£6·00	OC81D	£4·00
1N4007	£4·70	BC267	£6·00	OC200	£28·00
1N4148	£2·20	BC328	£10·00	PBC108	£5·00
AC128	£10·00	BC548	£6·00	2N2646	£34·00
AC176	£12·00	BD131	£16·00	2N3055	£28·00
BC107	£7·00	BF173	£14·00	2N3442	£75·00
BC108	£7·00	BF181	£20·00	2N5294	£21·00
BC109	£7·00	BF244B	£13·00	NE555V	£38·00
BC119	£12·00	BF194	£6·00	709C	£16·00
BC126	£12·00	BF195	£6·00	741C	£19·00
BC139	£14·00	BF197	£6·00	7440	£6·00
BC147	£8·00	BF458	£30·00	SN76660	
BC148	£5·00	BFW43	£12·00		£22·00

All prices per minimum quantity of 100
All full spec. marked devices
Ferric Chloride £30 per 100 1lb bags.
Miniature mains transformers. 100mA sec: 6-0-6V £5·80/10; 9-09V £6·30/10; 12-0-12V £6·80/10.
Min. cer. plate caps 33pF 2% £7/1000
100pF 2% £7·50/1000
Siemens polystyrene 470pF 5% £8·00/1000.
100μF 40V £4/100, 470μF 25V £6/100, 47μF 63V £3/100.
PP3 Batt. snap connector £4/100.
Crystal mic. inserts, 1¼" Dia. £20/100.
90V neons £3/100.
Coax back to back connectors £4·20/100.
Coax. plugs £4·70/100
H61 Texas Light Sensor £32/100.
Minimum Order £5; Carr. Free. Add VAT at the appropriate rate S.A.E. enquiries, List.
10μH chokes, £3/100.
Honeywell V3 microswitches £9/100.
400mW Zeners, 6V8 8V2 9V1 10 11 12 13 13V5 15 16 20 22 24 27 & 30V, All £5/100.
Lamps: 10V ·2A MES £3/100; 18V 70mA min. flange £4/100.

JUNIPER ELECTRONICS (PW1)
PO Box 61, Southampton SO9 7EE

TRIACS (plastic) 10A/400V 67p (3+64p), DIAC 19p, NE555 44p, 13×BC148 80p*, 10×BC158 80p*, LEDs 9·2in dia, red 20p, yellow, amber, green 25p. 300W dimmer kit £1·95. P&P 15p, add 8% VAT (*25%). TK Electronics, 106 Studley Grange Road, London W7 2LX.

TRANSISTOR BONANZA. Branded devices equivalent 50 popular semiconductors BC108, BC147, BC148, BC212LA, BC309, BF196, BC159, BF258, BF371. Any 10 or multiple of 10, £1 inc. VAT. P&P 15p. Teleservice, 13 Worcester Street, Wolverhampton. 772293.

ENTHUSIASTS OF RADIO 1920 to 1945! For, components, valves, service sheets & complete receivers, contact us. Monthly newsheet available upon receipt of S.A.E. Tudor Rees, 64, Broad St., Staple Hill, Bristol, BS16 5NL. 0272 565472.

Precision Polycarbonate Capacitors

All High Stability – xtremely Low Leakage

440V AC RANGE Value (μF)	Dimensions (mm) L	D	Price each	63DC RANGE Value μF	×1%	×2%
				0·01μF & 0·1μF	66p	49p
				0·22μF; 0·33μF;		
0·1μF	27	12·7	51p	0·47μF	67p	50p
0·15μF	27	12·7	59p	0·68μF	74p	53p
0·22μF	33	16	64p	1·0μF	82p	62p
0·25μF	33	16	67p	1·5μF	89p	71p
0·33μF	33	16	75p	2·2μF	96p	75p
0.47μF	33	19	80p	3·3μF	£1·15	82p
0·5μF	33	19	87p	4·7μF	£1·62	£1·13
0·68μF	50·8	19	93p	6·8μF	£1·96	£1·38
1·0μF	50·8	19	£1·03	10μF	£2·40	£1·95
1·5μF	50·8	25·4	£1·21	15μF	£3·22	£2·79
2·0μF	50·8	25·4	£1·44	22μF	£4·28	£3·68

TANTALUM BEAD CAPACITORS—Value available: 0·1, 0·22, 0·47, 1·0, 2·2, 4·7, 6·8μF at 15V/25V or 35V; 10·0μF at 16V/20V or 25V; 22·0μF at 6V/10V or 16V; 33·0μF at 6V or 10V; 47·0μF at 3V or 6V; 100·0μF at 3V. ALL at 10p* each, 10 for 95p*, 50 for £4*.

TRANSISTORS V I.C.'s

BC107/8/9	9p	*BC212/212L	14p	2N3702/4	11p
*BC114	12p	*BC213/213L	11p	2N3055	50p
*BC147/8/9	10p	*BC214/214L	11p	OC71	12p
*BC153/154	12p	*BF194/5	12p	NE555Timer	61p
*BC157/8/9	12p	BFY50/1/2	20p	741C 8pin DIL	32p
*BC182/182L	11p	AF178	30p	ZN414	£1·15
*BC183/183L	11p	AF234	38p		
*BC184/184L	12p				

POPULAR DIODES—1N914 6p, 8 for 45p, 18 for 90p; 1N916 8p, 6 for 45p, 14 for 90p; 1S44 5p, 11 for 50p, 24 for £1·00. 1N4148 5p, 6 for 27p, 12 for 48p; 1N4001 5½p; 002 6p; 003 6½p; 004 7p; 005 7½p; 006 8p; 007 8½p.

LOW PRICE ZENER DIODES—400mW, Tol. ±5% at 5mA. 3V; 3V3; 3V6; 4V7; 5V1; 5V6; 6V2; 6V8; 7V5; 8V2; 9V1; 10V; 11V; 12V; 13V; 13·5V; 15V; 16V; 18V; 20V; 22V; 24V; 27V; 30V; 33V. All at 7p each. 5 for 33p, 10 for 65p. SPECIAL OFFER: 100 Zeners (may be mixed) for £6·00.

RESISTORS—High stability, low noise carbon dim 5%, ¼W at 40°C, ⅛W at 70°C. E12 series only—from 2·2 Ω to 2·2M Ω. ALL at 1p* each, 8p* for 10 of any one value, 70p* for 100 of any one value. SPECIAL PACK: 10 of each value 2·2 Ω to 2·2M Ω (730 resistors) £5*.

SILICON PLASTIC RECTIFIERS—1·5 amp, wire-ended DO27: 100 P.I.V. 7p (4 for 26p); 400 P.I.V. 8p (4 for 30p).

BRIDGE RECTIFIERS—2½ amp: 200V 40p; 350V 45p; 600V 55p.

SUBMINIATURE VERTICAL PRESETS—0 1W only: All at 5p* each: w; 100w; 220w; 470w; 680w; 1K; 2K2; 4K7; 6K8; 10K; 15K; 22K; 47K; 100K; 250K; 680K; 1M; 2M5; 5M.

PLEASE ADD 15p POST AND PACKING ON ALL ORDERS BELOW £5. ALL EXPORT ORDERS ADD COST OF SEA/AIRMAIL.

Add 8% VAT to all items except those marked with * which are 25%
Send S.A.E. for additional stock lists.
Wholesale price lists available to bona fide companies.

MARCO TRADING (Dept. W1),
The Old School, Edstaston, Nr. Wem, Shropshire.
Tel: Whixall 464/465 (STD 094 872)
(Proprs. Minicost Trading Ltd.)

VALVES

Radio-TV Industrial Transmitting
2200 Types. 1930 to 1975, many obsolete. List 20p. S.A.E. for quotation. Postal export service. We wish to purchase all types of new and boxed valves. Wholesaler's, Dealer's, etc., stocks purchased.

COX RADIO (SUSSEX) LTD., The Parade, East Wittering, Sussex. West Wittering 2023

MULTIBAND RADIOS. Grundig Satellit, 13 band, £158. BF8 Unit, £15. Koyo marine, aircraft, PSB, FM, SW1/2, MW, LW, £55. Multi 5 (MW, FM, SW, aircraft, PSB), £17. Sharp (MW/aircraft), £13. Langtons, High Street, Rocester, Staffs. Sae lists.

BETA DEVICES

MANUFACTURERS BRANDED PRODUCTS

TRANSISTORS		DIODES & RECT		BRIDGE RECT.	
AC187/8 PR	0·40	IN914	0·04	1A 100v W01	0·20
BC107/8/9	0·09	IN4148	0·04	1A 200v W02	0·22
BC109C	0·11	BY127	0·14	1A 600v W06	0·30
BC147/8/9	0·10	IN4001/2	0·05	25A 200v	£2·00
BCY70/71/72	0·18	IN4003/4/5	0·06	ZENERS	
BFX86/7/8	0·20	IN4006/7	0·08	BZY88c 3·3-33v 5%	0·09
BFY50	0·18	IN5401	0·11	1 watt 6·8-200v 5%	0·15
BFY51/52	0·12				
2N1132	0·25	3015F	1·00	L.E.D.	
2N1711	0·25	DL747	2·45	209-RED	0·17
2N2646	0·30	TBA800	0·90	LED CLIP	0·02
2N2905A	0·21	555 Timer	0·50	OP. AMP. IC's	
2N3053	0·14			709C TO99	0·30
2N3055	0·38	D.I.L. SOCKETS		709C D.I.L.	0·30
OC28	0·45	8 Pin	0·12	741C TO99	0·36
OC35	0·35	14 Pin	0·12	741C D.I.L.	0·36
OC26	0·45	16 Pin	0·14	723C D.I.L.	0·80
OC36	0·35			747C D.I.L.	0·85
TIP41A	0·74	ADD 17% V.A.T.		748C D.I.L.	0·36
TIP42A	0·90				

NEW CAP-PAC 1 **NEW**
CONTENTS:—AL ELECTROLYTIC CAPACITORS

10mf	16V	6 pcs	
22mf	16V	3 pcs	Value £1·65
47mf	16V	3 pcs	
100mf	16V	6 pcs	Now **£1.00** (inc. VAT)
25mf	25V	3 pcs	

C.W.O. PLUS P.P. 15p TO
BETA DEVICES,
4, Highbridge Street,
Waltham Abbey, Essex.

COMPONENTS GALORE, pack of 500 assorted Radio, TV and Electronic components, a real bargain at a realistic price. Send only £1·50 c.w.o. This applies only to United Kingdom and Ireland. Overseas prices by arrangement. Caledonian Components. PO Box 3, Glenrothes, Fife, Scotland.

GIEGER COUNTER TUBES CV2247, ex-equipment (unused) complete with socket **£1·65,** 50μA Moving Coil meter scaled ·1-10 milli-Rontgens per hour, complete with mounting clip, ex-equipment, **£1·10** (or one tube and one meter for **£2·20**), Smiths Motaysyn Position Indicator and Transmitter, with or without modification will work as an aerial or wind direction monitor **£2·00**, 240° ex-aircraft moving coil meter, 1mA FSD, scaled 0-110% with coloured sectors, 3 in. dia. (would make ideal wind speed indicator) **£3·00**. Prices include P. & P. Mail Order only. **ELDUN ELECTRONICS**
16 RAVEN ROAD, TIMPERLEY, CHESHIRE

Ladders

LADDERS. Varnished. 25½ ft extended, £24·05, carriage £1·40. Leaflet, aluminium ladders and loft stairways. Tel: Telford 586644.

Service Sheets

G. T. TECHNICAL INFORMATION SERVICE
10 DRYDEN CHAMBERS, 119 OXFORD ST., LONDON W1R 1PA
MAIL ORDER ONLY
SERVICE SHEETS SERVICE
For Black and White TV, Radios, Record Players and Tape Recorders 50p
Please send large Stamped Addressed Envelope.
COLOUR MANUALS
We can supply manuals for most makes of Colour Television Receivers
B.R.C. PYE EKCO PHILIPS ITT/KB SONY G.E.C. HITACHI BAIRD ULTRA INVICTA etc.
Please send a Stamped Addressed Envelope for a prompt reply.

SERVICE SHEETS for Radio, TV, Tape Recorders, Stereo, etc., with free fault-finding guide, 50p and SAE, Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex.

BELL'S TELEVISION SERVICES for service sheets, manuals & books on radio/TV etc. Service sheets 50p plus SAE. Service sheet catalogue 25p. Back issues of magazines from April '74 onwards cover price plus 12p post. Free booklists on request. SAE with enquiries please to B.T.S., 190 Kings Road, Harrogate, Yorkshire. Telephone Harrogate (code 0423) 55885.

SERVICE SHEETS, radio, TV etc. 10,000 models. Catalogue 24p, plus SAE with orders, enquiries. Telray, 154 Brook Street, Preston PR1 7HP.

Books and Publications

UFO CHARTS: Wave Prediction 56p; Daily Flight Pattern 50p; TV Doppler Detection, 66p; Propulsion Theory 57p; "Anti-Gravity" 57p; Map 52p. Numerous circuits: Detection, Radiometers, Multidigit Testers, Clocks, SAE Lists + 10p. R & E, Highlands, Needham Market, Suffolk.

T.V. REPAIRS MADE EASY
Send your make/model/chassis no. & £3·50; by return you receive the repair manual containing simple to follow instructions including your set (no circuit diagrams included). British sets covered in 4 mono manuals & 3 colour manuals (some foreign). Write/phone now for trade terms.
Instructions to make a signal injector for £1·20. Ask about the giant Circuit Diagram Manuals.
TV TECHNIC (PW2),
76 CHURCH STREET, LARKHALL, LANARKS, ML9 1HE. (0698 883334).

For Sale

MICROPHONES: AKG D202EI, £45·00; AKG D190C or E, £20·00; AKG D224, £60·00; Sennheiser MD211N, £45·00. All brand new and boxed. Please add 25% for VAT. All other AKG and Sennheiser mikes, SAE for quote. J. J. Francis (Wood Green), Ltd., Manwood House, Matching Green, Harlow, Essex. Tel: Matching 476.

COPPER CLAD LAMINATE
FOR
PRINTED CIRCUITS
Single sided 1/16" paper base—1·5p/sq. inch.
Single sided 1/16" glass-epoxy—2·0p/sq. inch.
Any rectangular sizes cut to your requirements.
Please send cash with order.
Price includes postage and packing.
From: **SIMTECH ENGINEERING LTD**
Dedham Road, Ardleigh, Colchester, Essex, C07 7QA
Telephone 0206 230133

DISCOLIGHTS. Best! Cheapest! Reliable! Bumper catalogue: Aarvak Electronics, 12a(P) Bruce Grove, N17 6RA. 01-808 8923.

Wanted

WE BUY New Valves, Transistors and clean new components, large or small quantities, all details, quotation by return. WALTON'S, 55 Worcester Street, Wolverhampton.

TOP PRICES PAID for NEW VALVES and TRANSISTORS
popular T.V. and Radio types.
KENSINGTON SUPPLIES (C),
367 Kensington Street, Bradford 8, Yorkshire.

RADIO & TELEVISION SERVICING books wanted from 1963-64 edition onwards. £2·00 paid per copy by return of post. Bell's Television Services, 190 Kings Road, Harrogate, N. Yorks. Tel: Harrogate 55885.

SERVICE SHEET circuit diagram and other info relative to Bendix RA-1B RX (Ex AM). Fair price paid. Clews, Penkridge Road, Acton Trussell, Near Stafford. Penkridge (078 571) 2630. Reverse charge.

ELSTONE MR15 output transformer. New or good secondhand. Box No 128.

Situations Vacant

MEN!
£90p.w.
can be yours

Tens of thousands of new computer personnel needed over the next few years alone. Now for the first time anybody (no special qualifications are needed) can train outside the computer industry for an exciting career as a computer operator in only 4 weeks. It can pay around £35 p.w. as a starter and can reach over £90 p.w. We subscribe to the code of practice for Computer schools of the National Computing Centre—a non-profit organisation which was set up and sponsored by the British Government. Write without obligation for FREE details TODAY.

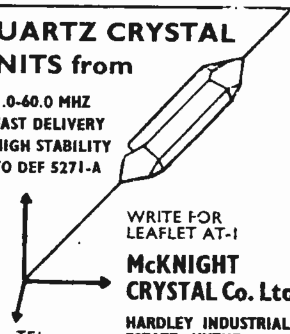
London Computer Operators Training Centre
C25, Oxford Hse.,
9-15 Oxford St. W1. Tel: 01-734 2874

Educational

GO TO SEA as a Radio Officer. Write: Principal, Nautical College, Broadwater, Fleetwood FY7 8JZ.

Miscellaneous

QUARTZ CRYSTAL UNITS from



- 1.0-60.0 MHZ
- FAST DELIVERY
- HIGH STABILITY
- TO DEF 5271-A

WRITE FOR LEAFLET AT-1
McKNIGHT CRYSTAL Co. Ltd.
HARDLEY INDUSTRIAL ESTATE, HYTHE, SOUTHAMPTON SO4 6ZY
TEL. HYTHE 848961
STD CODE 0703

50 MIXED TUNING DRIVE CORD PULLEYS, 8mm to 12·7mm diameters, easily fitted to panels by any 6BA screw and nut. Suitable for large tuners to miniature radios. £1 post free. 100 selected plated 2-4 and 6BA screws, comprising of csk/head, R/H, C/H and grub screws, etc., in lengths from 3·2mm to 35mm, an excellent assortment. 85p post free. 100 assorted 4 and 6BA spacers, round and hexagon, threaded and clearance types, all popular lengths 6·5mm to 12·7mm. £1 post free. One each of the above packs for £2·50 post free. All the above components are brand new items. Electro-Mech Products, 7 Chantry Avenue, Bideford, Devon. Manufacturers of precision turned components to the electronics industry.

FELSTEAD ELECTRONICS (PW95)
Longley Lane, Gatley, Cheadle, Ches. SK8 4EE
Our new complete list with illus. stylus chart and best values in cartridges, cassettes, tape, audio leads, microphones, meters and multi-testers, phones, plugs, sockets and many useful accessories for radio, recording and hi-fi. Yours FREE for S.A.E. Usual trustworthy service.
Most items available to callers in Manchester.
at Trionix, 177 School Lane, Kingsway Cnr. 19

P.C.B. SUPPLIED FOR P.W. PROJECTS. A soldering varnish finish which is a superb soldering agent. 6p sq in. Positive master films for photo copying 30p (13in x 8in max). (P&P 20p). R. Darlison, 1 Valentine Drive, Oadby, Leicester (0533-716273).

ALUMINIUM PROJECT BOXES
lids and screws included

Box No.	Length "	Width "	Height "	Price
7	5¼	2¾	1½	47p
8	4	4	1½	46p
9	4	2¾	1½	46p
10	5¼	4	1½	49p
11	4	2½	2	46p
12	3	2	1	38p
13	6	4	2	58p
14	7	5	2½	75p
15	8	6	3	93p
16	10	7	3	£1·14

Prices include VAT (at 8%) but 18p should be added to the total order value for postage and packing.
8 WATT 12 VOLT FLUORESCENT LIGHT KIT
Complete Kit including all components, heatsink, channel, tube, etc.
ONLY £3·49 inc. VAT p & p
Ready Built £4·10 inc. VAT, p & p
Diffuser 59p extra inc VAT, p & p
Send Cheque or P.O's with your order direct to:—
ELECTRONICS DESIGN ASSOCIATES
(Dept. PW12), 82 Bath Street, Walsall WS1 3DE
Phone: Walsall 33652

PRINTED CIRCUIT BOARDS, ready drilled for immediate assembly. Prices inclusive of P&P etc: No extras. Practical Wireless PCB's: Disco Amplifier £3·60 each. Disco Light Modulator £2·90. TELE-TENNIS (6 PCB's) £3·70—Sound Effects £1·10—Ball Speed Control £1·10. Ferret Locator 85p. Derby £1·00. Electronic Clock £2·07. Easybuild Organ (2 PCB's) £5·80. Telephone Exchange £1·64. PRACTICAL ELECTRONICS PCB's: Joanna £1·25 each, all 14 £15·00. C.C.T.V. (2 PCB's) £2·18. Orion £2·26. I.C. Pulse Generator £1·37. Time Lapse Photography £1·40. Many Others Available: S.A.E. for lists.
PRODUCTION SPACE AVAILABLE for: P.C.B. Production, Silk-screen Printing, Tinning, P.C.B. Design and Modifications, Electroplating. Full Art/Graphic, Photographic and Design facilities. Production Estimates: By return upon submission of 'Rough's', Full Masters, Existing units or Circuit Diagram to: W.K.F. Electronics, Welbeck Street, Whitwell, Worksop, Notts. S80 4TW. Callers by appointment to 1-3, Station Road, Whitwell. Tel: Whitwell (Derbys) 695 or 544, STD Code 090974.

PRINTED CIRCUITS and HARDWARE

Readily available supplies of Constructors' hardware, Aluminium sheet and sections. Printed circuit boards, top quality for individual or published designs. Prompt service. Send 15p for catalogue.

Ramar Constructor Services, Masons Road, Stratford on Avon, Warwicks. Tel. 4879

1lb PACKS OF ASSORTED SIZES OF COPPER LAMINATES. (Average 10 x 5) for 80p. Min. order 1lb. Cash with order to:—F.E.S. Norton Springs, Norton Canes, Cannock, West Midlands.

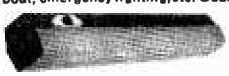
THE SCIENTIFIC WIRE CO

Copper - Nickel Chrome - Eureka - Manganin Wires.
Enamelled - Silk - Cotton - Tinned Coverings.
No minimum charges or quantities.
Trade and Export enquiries welcome.
S.A.E. Brings List.
P.O. BOX 30, LONDON, E4 9BW

AERIAL WIRE. High quality PVC-covered multi-strand copper, 50ft, 75p (12p); 75ft, £1·12 (15p); 100ft, £1·48 (18p); 150ft, £2·25 (28p); 200ft, £2·88 (30p); 250ft, £3·60 (33p); 300ft, £4·30 (36p). P&P in brackets. Longer lengths available. SAE all enquiries. Al Radio Components, 14 The Borough, Canterbury, Kent CT1 2DR.

---

12 VOLT 21" 13 Watt Fluorescent Lighting (by Thorn/AEI) with diffuser & on/off switch. Ideal caravan, boat, emergency lighting, etc. Guaranteed.



£5·50 Inc. VAT & Post. List price £7·02 Inc. VAT
SALOP ELECTRONICS 23 Wyle Cop, Shrewsbury, Shropshire Tel. 53206

ENAMELLED COPPER WIRE

S.W.G.	1 lb reel	½ lb reel
10 to 19	2·40	1·35
20 to 29	2·45	1·40
30 to 34	2·60	1·50
35 to 40	2·85	1·60

All the above prices are inclusive of postage and packing in U.K.

COPPER SUPPLIES
102 Parrswood Road, Withington, Manchester 20 Tel: 061-445 8753

SUPERB INSTRUMENT CASES by Bazelli, manufactured from heavy duty PVC faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range, competitive prices start at a low 75p. Examples: width, depth, height, 8in x 5in x 3in, £1·55; 10in x 6in x 3in, £2·20; 10in x 8in x 3in, £2·75; 12in x 10in x 3in, £3·60; 8in x 4in x 4in, £1·80; 10in x 6in x 4in, £2·70; 12in x 8in x 4in, £3·60; 7in x 7in x 5in, £2·65; 8in x 10in x 6in, £3·60; 12in x 8in x 7in, £4; 12in x 12in x 7in, £4·40. Plus 8% VAT & 50p postage. Over 200 models to choose from. Prompt despatch. Free literature (stamp would be appreciated), Bazelli, Dept. No. 25, St. Wilfrid's, Foundry Lane, Halton, Lancaster LA2 6LT.

TEXAN AMPLIFIER 20 + 20 Watt
Complete Kit £32·00 (Tax extra)

Pack 1. Res. 80p. Pack 2/3. Capacitors £3·65. Pack 5. Switches £1·50. Pack 6. Pots. Pack 7. Semi Cond. £8·25. Pack 9 P.C.B. £3·00. Pack 10. Chassis £3·00 Case £3·50.
Toroidal Transf. £6·00 P.P. + Tax extra £2. (Toroidal Transf. for 28W £8·10 + tax & post £2)

TELERADIO ELECTRONICS
325 Fore St., Edmonton, London N9

OVAL DIGITAL CLOCK CASES

Attractive stoneware pottery cases; 'oatmeal' glazed; suitable for most digital clock circuits that use 4 or 6 digit L.E.D. displays.
ONLY £3·60 inclusive
Send S.A.E. for full details of above and many others, to:
J. BARRIE-SMITH
56 Conifer Rd., Coxford, Southampton, Hants.

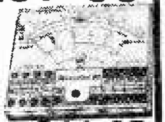
NICKEL CADMIUM cylindrical accumulators for dry battery replacement. Buy no more dry cells. F/Scp. S.A.E. brings full details by return. Sandwell Plant Ltd. 1 Denholm Road, Sutton Coldfield, West Midlands. 021-354 9764.

Synthesiser "Sounds Supreme"
by Dewtron (25% VAT extra.)

Famous kits, e.g. waa-waa complete kit £4·50; Fuzz kit £6·50 P&P 25p under £10. Ring Modulator modules £11. "Mister Bassman" Bass Pedal Units and whole range of synthesiser modules, musical novelties, etc. Catalogue 20p from D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset.

FANTASTIC NEW MICROTEST 80

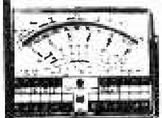
MEASURES ONLY 90×70×18 mm
ELECTRONIC ZERO Ω



Amazing Value at £11·95
8 fields of measurement and 40 ranges

PRINTED CIRCUIT BOARD IS REMOVABLE WITHOUT SOLDERING

Volts D.C. 6 ranges: 100mV - 2V. - 10V. - 50V. - 200V.-1000V. (20k Ω/V) 2% precision on DC and AC
Volts A.C. 5 ranges: 1·5V. - 10V. - 50V. - 250V. - 1000V. (4k Ω/V)
Amp. D.C. 6 ranges: 50µA - 500µA - 5mA - 50mA - 500mA - 5A
Amp. A.C. 5 ranges: 250µA - 2·5mA - 25mA - 250mA - 2·5A
Ohms 4 ranges: Low Ω - Ω x 1 - Ω x 10 - Ω x 100 from 1/10 di Ω until 5 Mega Ω;
V Output 5 ranges: 1·5V. - 10V. - 50V. - 250V. - 1000V.
Decibels 5 ranges: + 6dB, +22dB, +36dB, +50dB, +62dB
Capacity 4 ranges: 25µF - 250µF - 2500µF - 25,000µF

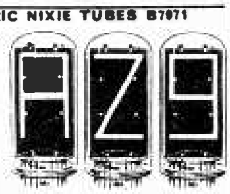


SUPERTESTER 680R ICE
20,000 Ohm per Volt/sensitivity ● Fully screened against external magnetic fields ● Scale width and small case dimensions (128 x 95 x 32mm) ● Accuracy and stability (1% in D.C., 2% in A.C.) of indicated reading ● Simplicity and ease of use and readibility ● Full ranges of accessories ● 1000 times overload ● Printed circuit board is removable without de-soldering ● More ranges than any other meter. Ask for free catalogue **£18·50**
Accessories (extra) available to convert Microtest 80 & Supertester 680R into following: LIGHT-METER GAUSS METER, ELECTRONIC VOLTMETER, AMPERCLAMP, TRANSISTOR TESTER, TEMPERATURE PROBE, PHASE SEQUENCE INDICATOR, Ω x 100K Multiplier, SIGNAL INJECTOR—Send for details.

MORE RANGES FOR LESS MONEY!

AC/DC Multimeter type U4324
A-DC 0·06-3A - 6 Ranges.
A-AC 0·3-3A - 5 Ranges.
V-DC 0·6-1200 V - 9 Ranges.
V-AC 3-900 V - 8 Ranges.
Freq.: In the range of 45 to 20kHz.
Resistance: 500 Ohm to 5 MOhm- 5 Ranges. Decibel: —10 to + 12dB
Accuracy: ± 2·5% DC. ± 4% AC
Dimensions: 167 x 98 x 63 mm.
Only £9·25

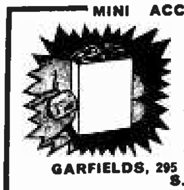
ALPHANUMERIC NIXIE TUBES B7971



The Alphanumeric NIXIE tube has the ability to display all the letters of the alphabet, numerals 0 thru 9 and special characters in a single tube. From the standpoint of both readability and electrical characteristics, the Alphanumeric NIXIE tube provides many unique benefits including ★ 170v-21mA ★ All d.c. operation ★ Uniform, continuous line characters of equal height ★ Memory with simple solid state drive circuits ★ Readability in high ambient light . . . 200 footlamberts brightness ★ Long life with no loss of brightness ★ Character height 2½in.
Price only **99p** each plus 16p P/P.
Bases for above 60p each.

JUST ARRIVED!!
NUMERIC INDICATOR TUBES
Ultra-long life, high quality, 0-9 and 2 independent decimal points. Supply voltage 200V D.C. Current 14mA, Pulse duration 100µs. Character height 0·51, overall size 1·4.
Brand new, guaranteed. Surplus to manufacturers requirements. Type B5853st
1-25 £1 25+ 90p 100+ 80p
1000+ price on application
8% VAT to all items + 35p P & P
ELECTRONIC BROKERS LTD.
49-53 Pancras Road, London NW1 2QB
Tel: 01-837 7781

MINI ACCUMULATORS



2 volt MULTI-USE Sealed Lead Acid Re-chargeable Cells. Size L450—1·4" x 1·1" x ·44". 3 for £2·15 inc. P. & P. Size GA2—1·7" x 1·3" x ·5". 3 for £2·65 inc. P. & P. Suits Fi-Cord

GARFIELDS, 295 Rye Lane, London, S.E.15

BARGAIN PACK Electrolytic Capacitors. Unused and marked, good mixed selection. Price: 100 £1; P&P 15p (our choice). Etch your own circuit board. Printed circuit board, 10in x 5in, complete with etching compound and instructions, 85p. P&P 15p. Ferric chloride etching compound in 1lb packs net, complete with instructions, 40p. P&P 30p. Lancashire Mail Order, 6 William Street, Stubbins Ramsbottom, Bury, Lancs.

JAYBEE FOR KITS

AMTRON, JOSTYKIT, ETC.

Send S.A.E. for full information

JAYBEE ELECTRONICS, Sarum Farm Est. SARUM ROAD, WINCHESTER, HANTS
Telephone 0962-61806

DO-IT-YOURSELF loudspeakers for hi-fi are our speciality. Full range of components and accessories including chassis speakers, crossovers, sound absorbent, grille fabrics etc. always available. We stock the fabulous value Helme speaker kits complete with full and easy instructions) also Peerless and Wharfedale kits. Just about the lowest prices anywhere! Send 8½p stamp for bargain list to: Audioscan, Dept. PW1, 4 Princes Square, Harrogate, North Yorkshire.

BUILD YOUR OWN

You are invited to send S.A.E. for lists of our very extensive range of high quality amplifier, pre-amps, F.M. tuners, instruments, Radiocontrol ignition units and many other kits. Please state requirements.

TELERADIO ELECTRONICS, 325 FORE STREET, EDMONTON, LONDON N9

ELECTRO SPARES

ARE STILL SUPPLYING BOTH THE

P.E. VARICAP STEREO PUSH BUTTON F.M. TUNER KIT

Easy to construct, highest quality reproduction. £33·50 INC. VAT & POSTAGE. SAE for FREE BROCHURE.

AND

P.E. 'GEMINI' STEREO AMP.

all components available. Send 55p+9p. p. & p. for full constructional Booklet containing performance details, specification assembly instruction and fault finding guide ETC. ETC.

CAR OWNERS! DON'T FORGET THE 'MANTA' ELECTRONIC IGNITION SYSTEM

for reduced petrol consumption and smoother running. Kit £15·50 incl VAT. P & P. Assembled £17·15.

ELECTROSPARES DEPT. PW2.
288, ECCLESHALL ROAD, SHEFFIELD S11 8PE.

TRANSMIT!

★ Unique **TRANSMITTER/RECEIVER** Kit. No licence examinations or tests required to operate this transistorised equipment. Easy to build. Get transmitting. Send **£7·95** for yours now!

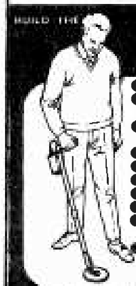
★ Psychedelic **MINI-STROBE** Kit. Take a pocket-sized lightning storm to Disco's & parties. 'Brain-freeze' 'em with vari-speed stop-motion flashes. Includes super case too. Send £3·50 now!
(all prices include V.A.T., packing & postage.)

Send remittance to:
BOFFIN PROJECTS, 4 CUNLIFFE ROAD, STONELEIGH, EWELL, SURREY
(Mail order U.K. only)
Or for more details, send 20p for lists

2·7½kg parcels surplus electronic components resistors, capacitors, switches, pots, etc. £1·20 p & p 75p.
Wirewound resistors 2W and upwards mixed values 120 for £1, p & p 42p.
Light bulbs mixed voltage and wattage eg. 2·5v, 6v, 12v etc. from 0·5 watt upwards, including panel lights and vehicle bulbs 30 for £1, p. & p. 30.
R. A. STOBBS, 933 Manchester Road, Cowlersley, Huddersfield, Yorks HD4 5TA

LOW-COST IC MOUNTING for any size DIL package. 100 pin sockets, 50p. 7 and 8 hole plastic supports, 5p/pair. Quantity rates. SAE details and sample. Trial pack, 50p (P&P 10p/order.) PKG Electronics, Oak Lodge, Tansley, Derbyshire DE4 5FE.

BUILD THE **TREASURE TRACER MK III** Metal Locator



- Varicap tuning
- Britain's best selling metal locator kit
- Weighs only 22oz. Fitted with Faraday shield.
- Speaker and earphone operation
- Knocks down to only 17in.
- Prebuilt search coil assembly
- Thoroughly professional finish
- As seen on BBC1 and BBC2 TV
- You only need soldering iron, screwdriver, pliers and snips
- Five transistor circuit

Send stamped, addressed envelope for leaflet

Complete Kit **£10·90** Post 60p + 92p VAT(8%) — Built & tested **£15·25** Post 60p £1·27 VAT(8%)

MINIKITS ELECTRONICS, 6a CLEVELAND ROAD, LONDON, E18 2AH (Mail order only)

60KHz MSF RUGBY RADIO RECEIVER. Available in kit form or assembled unit. Details from Toolex, Bristol Road, Sherborne, Dorset.

GLASS FIBRE P.C.B.'s. Send 1:1 master and 30p per board plus 7p per square inch tinned or plus 9p per square inch drilled and tinned. Discount for quantity. PROTO DESIGN, 4, Highcliffe Way, Wickford, Essex. SS11 8LA.

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Practical Wireless for ....

insertions. I enclose Cheque/P.O. for £.......................
(Cheques and Postal Orders should be crossed Lloyds Bank Ltd. and made payable to Practical Wireless).

NAME ....

ADDRESS ....

....

Send to: Classified Advertisement Manager
PRACTICAL WIRELESS, Fleetway House, Farringdon Street, London EC4A 4AD
Telephone 01-634 4451
Rate
14p per word, minimum 12 words. Box No. 35p extra.

Company registered in England. Registered No. 53626. Registered office: Tower House, 8/14 Southampton Street, London WC2E 9QX.

INDEX TO ADVERTISERS

Published on approximately the 7th of each month by IPC Magazines Limited, Fleetway House, Farringdon Street, London EC4A 4AD. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon and Gotch (Asia) Ltd.; South Africa—Central News Agency Ltd. PRACTICAL WIRELESS is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been 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, excluding Eire where the selling price is subject to V.A.T., and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.