

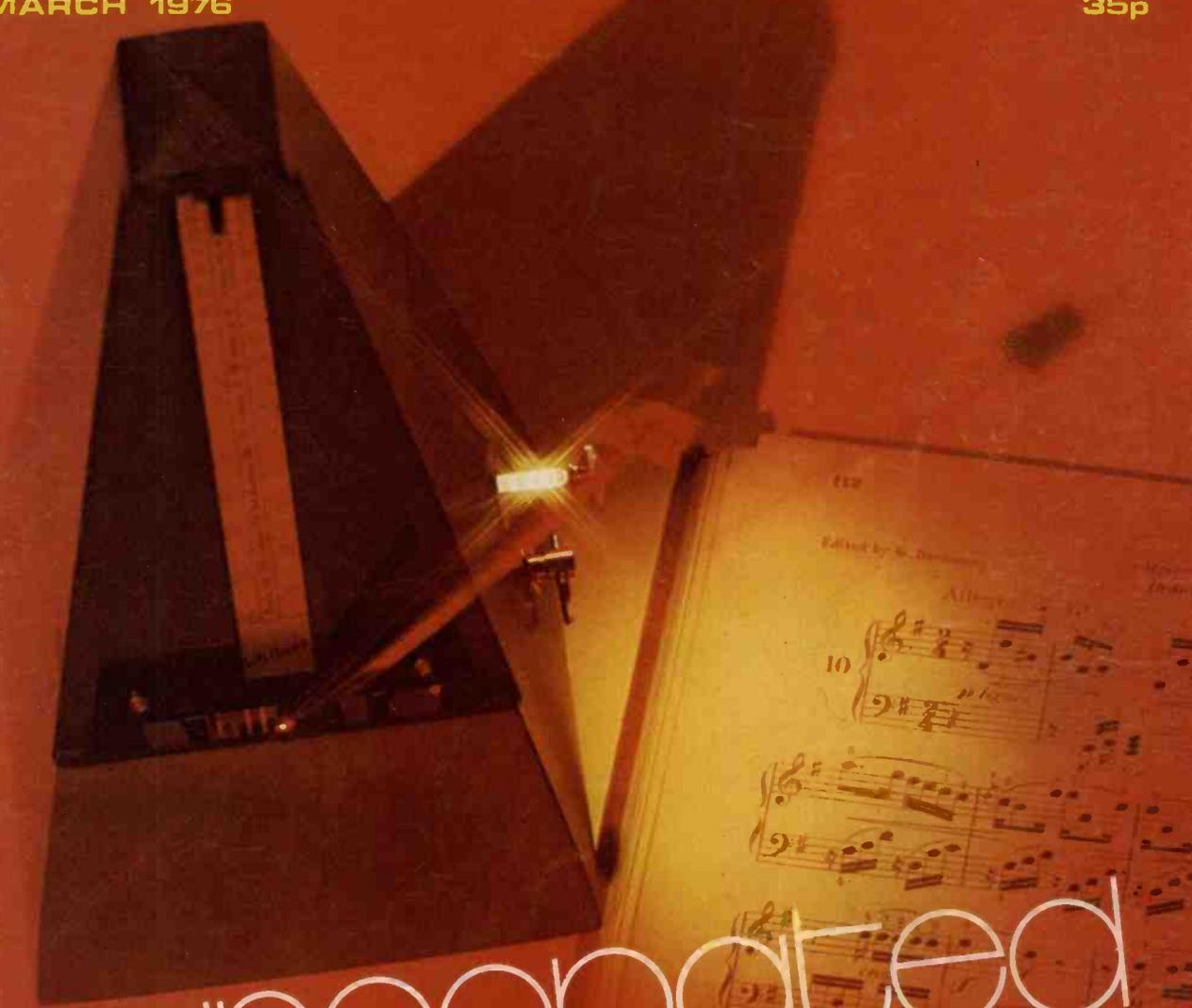
KmL

PRACTICAL

# ELECTRONICS

MARCH 1976

35p



## syncopated rhythm

**This month... the accent is on MUSIC!**  
SYNCHRONOME • PEAK LEVEL INDICATOR • DISTORTION FILTER

# CHROMASONIC electronics

Dept. 2, 56, Fortis Green Road,  
Muswell Hill, London, N10 3HN.  
telephone: 01-883 3705

## C - MOS

	1-24	25-99	100+
CD4000AE	19p	17p	14p
CD4001AE	19p	17p	14p
CD4002AE	19p	17p	14p
CD4006AE	£1.59	£1.33	£1.00
CD4007AE	23p	19p	15p
CD4008AE	£1.75	£1.46	£1.17
CD4009AE	Use	CD4049*	
CD4010AE	Use	CD4050*	
CD4011AE	19p	17p	14p
CD4012AE	19p	17p	14p
CD4013AE	59p	50p	46p
CD4014AE	£1.75	£1.46	£1.17
CD4015AE	£1.75	£1.46	£1.17
CD4016AE	55p	48p	44p
CD4017AE	£1.29	£1.07	93p
CD4018AE	£1.89	£1.56	£1.25
CD4019AE	80p	64p	53p
CD4020AE	£1.97	£1.64	£1.31
CD4021AE	£1.75	£1.46	£1.17p
CD4023AE	19p	17p	14p
CD4023AE	£1.83	£1.53	£1.27
CD4024AE	£1.26	£1.05	84p
CD4025AE	19p	17p	14p
CD4026AE	£2.79	£2.33	£1.86
CD4027AE	98p	82p	65p
CD4028AE	£1.53	£1.28	£1.02
CD4029AE	£1.89	£1.56	£1.15
CD4030AE	71p	59p	47p
CD4035AE	£1.75	£1.46	£1.17
CD4040AE	£2.01	£1.69	£1.34
CD4042AE	£1.49	£1.24	99p
CD4044AE	£2.15	£1.79	£1.44
CD4049AE	69p	58p	46p
CD4050AE	69p	58p	46p
CD4051AE	£2.78	£2.32	£1.85
CD4052AE	£2.78	£2.32	£1.85
CD4056AE	£2.12	£1.76	£1.41
CD4060AE	£2.39	£1.99	£1.55
CD4066AE	£1.13	94p	75p
CD4068AE	28p	24p	19p
CD4069AE	28p	24p	19p
CD4070AE	28p	24p	19p
CD4071AE	28p	24p	19p
CD4077AE	71p	59p	47p
CD4081AE	28p	24p	19p
CD4082AE	28p	24p	19p
CD4085AE	£1.78	£1.06	85p
CD4095AE	£1.28	£1.06	85p
CD4099AE	£1.56	£1.20	£1.04
CD4099AE	£2.95	£2.46	£1.96
CD4511AE	£2.36	£1.79	£1.44
CD4528AE	£1.30	£1.08	87p

## I.C. SOCKETS

Pin Sockets, pins in strips of 100. Just strip off what you need. 65p per strip

Dual in line  
8 pin 13p; 24 pin 26p; 10S 14 pin 15p; 28 pin 30p; 8 pin 31p; 16 pin 15p; 36 pin 39p; 8 pin 35p.

## FREE CIRCUITS

Our 8 Page A4 Audio I.C. Booklet is supplied FREE with purchases of Linear I.C.'s worth £1. or more (35p. if sold alone) Contains circuits and pin connections

5 Audio Pre-Amplifiers  
1 Tape Pre-Amplifier  
1 Power Driver  
1 Instrument Amplifier (Bifer)  
1 General Purpose Mixer Amplifier  
1 D.C. Controlled Gain Control  
1 Micro-mini radio (2 I.C.'s)

## PHOTO-DARLINGTON

Vceo 25v 2N5777  
Vcbo 8v  
I<sub>D</sub> 250 mA  
P<sub>D</sub> 200 mW  
Hfe 2500

## LINE-O-LIGHT

NEW LED Linear Cursors each device contains 10 light emitting diodes in a 20 pin light in-line package. Ideal for solid state analogue meters or dials

Type 101 RED £2.75. \* Complete with leaflet.

## 74 TTL

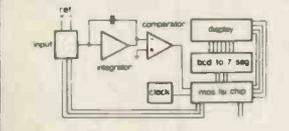
	1-24	25-99	100+
7400	14p	12p	10p
7401	14p	12p	10p
7402	14p	12p	10p
7403	14p	12p	10p
7404	14p	12p	10p
7406	16p	13p	11p
7408	16p	13p	11p
7409	16p	13p	11p
7410	16p	13p	11p
7413	29p	24p	20p
7417	27p	22p	20p
7420	16p	13p	11p
7427	27p	22p	18p
7430	16p	13p	11p
7432	27p	22p	18p
7437	27p	22p	18p
7441	75p	62p	50p
7442	65p	55p	43p
7445	85p	71p	57p
7447	81p	75p	65p
7448	75p	62p	50p
7447A	95p	83p	67p
7470	30p	25p	20p
7472	25p	21p	17p
7473	30p	25p	20p
7474	32p	26p	21p
7475	47p	39p	31p
7476	33p	26p	21p
7482	75p	62p	50p
7485	£1.30	£1.09	87p
7486	22p	22p	21p
7489	£2.92	£2.80	£2.10
7489	49p	40p	32p
7491	65p	55p	45p
7492	57p	46p	36p
7493	45p	40p	32p
7495	67p	55p	45p
74100	£1.08	89p	72p
74107	35p	28p	22p
74121	34p	28p	22p
74122	47p	39p	31p
74141	78p	63p	53p
74145	68p	58p	48p
74154	£1.67	£1.48	86p
74174	£1.00	83p	67p
74180	£1.06	88p	71p
74181	£3.20	£2.50	£1.90
74192	£1.35	£1.14	90p
74193	£1.35	£1.14	90p
74196	£1.64	£1.34	97p

## LINEAR I.C.'s

555 (8 pin dip) IV	55p
555 (50-99T)	£1.29
556 (14 pin dip)	81p
703 (RF/IF Amp)	68p
707 (8 pin dip)	38p
709 (TO-99)	45p
709 (14 pin dip)	38p
710 (8 pin dip)	39p
710 (TO-99)	45p
710 (14 pin dip)	44p
711 (TO-99)	51p
711 (14 pin dip)	44p
720 (A.M. Radio)	£1.76
723 (TO-99)	£1.09
723 (14 pin dip)	55p
741 (8 pin dip)	30p
741 (14 pin dip)	38p
747 (14 pin dip)	£1.04
748 (8 pin dip)	42p
748 (TO-99)	46p
748 (14 pin dip)	49p
753 (F.M. 1st. I.F.)	£1.08
75491	88p
75492	81p
Regulators 100mA	
78L05WC (TO-92)	60p
78L12WC (TO-92)	40p
78L15WC (TO-92)	60p
Regulators 100mA	
78L05AWC (TBA625A)	90p
78L12AWC (TBA625B)	90p
78L15AWC (TBA625C)	90p
Regulators 500mA	
78M05HC	£1.35
78M12HC	£1.35
78M15HC	£1.35
78M18HC	£1.35
78M24HC	£1.35
Regulators 1A	
7805KC (TO-3)	£2.09
7812KC (TO-3)	£2.09
7815KC (TO-3)	£2.09
7818KC (TO-3)	£2.09
7824KC (TO-3)	£2.09
Regulators 1A	
7805UC (TO-220)	£1.72
7812UC (TO-220)	£1.72
7815UC (TO-220)	£1.72
7818UC (TO-220)	£1.72
7824UC (TO-220)	£1.72
ICL8030	£3.52

AY-1-0212	£6.93
AY-1-5051	£1.44
AY-1-5124	£3.95
AY-1-5360	£6.59
AY-5-3507	£6.59
AY-5-4507	£7.94
BHA0002	£3.01
CA2111	£1.19
CA3045	£1.69
CA3046	88p
CA3053	59p
CA3065	£1.60
CA3075	£1.64
CA3078	£1.26
CA3080	59p
CA3081	£1.86
CA3082	£1.86
CA3089E (TDA1200)	£2.43
CA3092E	£1.67
CA3122E	£1.76
CA3130	64p
CA3401E (LM3900)	68p
CA3600E	£1.44
LM2111	£1.12
LM3900	69p
LM3909	66p
MC1303L	£1.94
MC1306P	85p
MC1310P	£2.10
MC1312P	£2.52
MC1314P	£4.34
MC1315P	£4.85
MC1327P	£1.48
MC1330P	89p
MC1339P	£1.60
MC1350	68p
MC1351	92p
MC1352	92p
MC1357	£1.60
MC1358 (CA3065)	£1.23
MC1375	£1.56
MC1455 (555T)	£1.57
MC1456CG	65p
MC1458CP1	89p
MC1468G	£2.30
MC1495L	£4.48
MC1496G	£1.01
MC3002P	£1.65
MC3401P	81p
MFC4000B	87p
MFC4006A	85p
MFC6030A	85p
MFC6040	£1.01
MMS314	£4.80
MMS316	£9.99
MVRSV (TO-3)	£1.45
MVR12V (TO-3)	£1.45
MVR15V (TO-3)	£1.45
NE540L	£1.25
NE546L	£1.16
NE555V	69p
NE556	£1.29
NE580B	£5.06
NE581B	£5.06
NE582B	£5.06
NE583	£2.96
NE565N	£2.63
NE566V	£1.87
NE567V	£2.63
SD6000	£1.22
SL414A	£2.09
SL415A	£2.75
SL437D	£7.05
SL440	£2.84
SN75491N	88p
SN75492N	£1.10
SN76001N (TAA611)	£1.82
SN76003N	£3.30
SN76013N	£1.98
SN76023N	£1.98
SN76227N (MC1327)	£1.89
SN76532N	£1.86
SN76544N	£1.81
SN76550-2 (TAA550)	89p
SN76552-2	81p
SN76660N (TBA120)	75p
SN76666N (CA3065)	£1.12
TAA263	£1.50
TAA300	£2.16
TAA310A	£1.87
TAA320	£1.44
TAA350	£2.43
TAA370	£3.45
TAA500	75
TAA570	£2.75
TAA700	£5.03
TBA1205	£1.25
TBA21	£1.02
TBA781 (733)	£2.59
TBA5000	£3.16
TBA5200	£3.85
TBA5300	£3.27
TBA5400	£3.72
TBA5500	£5.29
TBA5600Q	£5.29
TBA625A	£1.03
TBA625B	£1.03
TBA625C	£1.03
TBA651	£1.87
TBA720Q	£2.79
TBA7500	£2.79
TBA800	£1.11
TBA810A	£1.24
TBA820	84p
TBA920Q	£4.71
TBA990Q	£4.71
TCA270Q	£5.24
TCA760	£2.16
TCA800Q	£7.24
TCA8305	£1.04
TCA940	£2.25
TDA1054	£1.50
TDA1200	£2.43
TDA1405	80p
TDA1412	80p
TDA1415	80p
TDA2010	80p
TDA2020	£3.75
ULN2111A	£1.52
ZN414	£1.26

## 3 1/2 DECADE DVM I.C.



This state-of-the-art MOS LSI chip contains all the logic necessary for a 3 decade, dual slope integrating, automatic polarity detecting DVM. Supplied with free data and circuit booklet. AY-5-3507

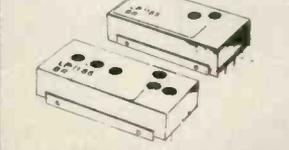
OUR PRICE ONLY £6.59. \* (Data and Circuit Booklets alone 20p.)

## The AY-5-1224 tick-tock

Another marvel from G.I. A 16 pin 12-24 hr. Clock I.C. with 25 pin capability and low external parts count. Supplied with manufacturers detailed leaflet £3.95p\* (inc. VAT) (Leaflet alone 20p.) Full Kit (excluding case) available towards end of 1975. Please Clive for details.

## MULLARD MODULES

Still make the simplest, highly reliable F.M. tuner



LP1186 Vario front end £8.60  
LP1185 F. Strip £8.95  
LP1400 Multiplex decoder £9.02

## LED DISPLAYS DIGITAL SWITCH

Litronic Double Digit Displays  
0.5" Common Anode; 2 R/H  
Decimal Points  
DL721 ± 1.9  
DL727 0.0 to 9.9  
Suitable for Clocks, Meters, Instruments, Channel Indicators  
Our price £4.75 \* each

BCD encoded digital switch  
Reading 0 to 9. Suitable for digital clock alarm setting  
DVM input Scaling etc.

1 to 9. £1.49 each \*

Low cost Red GaAsP  
Matsuda MLED 500  
in a TO92 package

0.33" Litronic DL 707 Series  
0.33" Monsanto MAN 50/70/BQ/3600  
0.33" Xciton XAN 70 Series  
0.63" Litronic DL747 'Jumbo' Series

15p.\*

all £1.82\* each (Red only)  
all £1.82\* Each (Red, Green, Yellow, Orange)  
all £1.49\* Each (Red, Green, Yellow)  
all £2.32\* Each (Red, Green, Yellow, Orange)  
all £2.42\* Each (Red only)

Common Cathode as Common Anode (Red only)

NOTE: MAN 4000 Series pin outs are 14 pin dit the same as MAN 50/70 and 80 series.

## LIGHT EMITTING DIODES

Free snap-on plastic retainer

0.125" dia. lens (TIL 209)	0.16" dia. lens (MLED 650)
1+ 10* 100*	1+ 10* 100*
Red 16p 15p 13p	27p 24p 22p
Green 27p 24p 22p	33p 30p 27p
Orange 27p 24p 22p	33p 30p 27p
Yellow 34p 31p 29p	35p 32p 30p

## MAINS TRANSFORMERS

Secondaries	1A	2A	4A
6-0-6V 100 mA	97p.	0-9-17 V	£1.95 * £2.27
9-0-9V 100 mA	97p.	0-12-15-20-24-30 V	£2.48 * £4.15
12-0-12V 100 mA	97p.	0-24-30-40-48-60 V	£5.18 * £7.02
20-0-20V 1 A	£4.55	0-19-25-33-40-50 V	£2.70 * £4.53
24-0-24V 500 mA	£2.48		
28-0-28V 1 A	£6.18		

p.p. on transformers 10% of price min. 20p

## VAT INC

Items followed by \* inc. VAT at 8% all others include 25%

Overseas Customers deduct 2/7% from \* items, 1/5 from others

postage &

# PRACTICAL ELECTRONICS

VOLUME 12 No. 3 MARCH 1976

---

## CONSTRUCTIONAL PROJECTS

- SYNCHRONOME** *by A. Briar*  
An accented-beat metronome for duple, triple and quadruple rhythms 198
- PEAK LEVEL INDICATOR** *by J. T. Tiernan*  
A useful recording accessory which gives a fast-acting indication of overload 203
- TOTAL HARMONIC DISTORTION FILTER** *by R. A. Penfold*  
Allows measurement of t.h.d. at 100Hz and 1kHz 216
- CAR/CARAVAN CLOCK** *by M. Fischer*  
Mains conversion and circuits for controller and latch 225

## GENERAL FEATURES

- USING CMOS DIGITAL I.C.s—3** *by D. B. Johnson-Davies & A. M. Marshall*  
Gate packages, driving circuits and latches 206
- SEMICONDUCTOR UPDATE** *by D. W. Coles*  
A look at some recently released devices 224
- INGENUITY UNLIMITED**  
TV Sound Adaptor—B.F.O.—Touch Switch—Stereo Preamplifier—Light Switch and Motor Driver—Low Voltage Regulator—Car Fuse Monitor—Combination Lock—Autotone Mk 2 234

## NEWS AND COMMENT

- EDITORIAL**—The Old Order Changeth 197
- SPACEWATCH** *by Frank W. Hyde*  
To Mars by Viking 212
- KIT REPORT**  
Construction and assessment of the Sinclair "Black Watch" 220
- INDUSTRY NOTEBOOK** *by Nexus*  
What's happening inside industry 222
- PRODUCT REVIEW**  
A review of the recently released Hewlett Packard 3476A/B Digital Multimeter 243
- READOUT**  
A selection of readers' letters 244

## SPECIAL P.E. PUBLICATION

**SOUND DESIGN**—Coming soon, details on page 215

Our April issue will be published on Friday, March 12, 1976  
(for details of contents see page 223)

---

© IPC Magazines Limited 1976. Copyright in all drawings, photographs and articles published in PRACTICAL ELECTRONICS is fully protected, and reproduction or imitations in whole or part are expressly forbidden. All reasonable precautions are taken by PRACTICAL ELECTRONICS to ensure that the advice and data given to readers are reliable. We cannot, however, guarantee it, and we cannot accept legal responsibility for it. Prices quoted are those current as we go to press.



# CHINAGLIA

INTRODUCES THE

## DOLOMITI

A NEW HIGH SENSITIVITY MULTIMETER  
WITH ALL THE FEATURES YOU WILL EVER NEED



**Sensitivity 20k $\Omega$ /V d.c. and a.c.**  
Accuracy  $\pm 2\%$  d.c., 2-5% a.c. and  $\Omega$ .  
39 ranges: d.c. V, 0-150mV, 500mV, 1-5V, 5V, 15V, 50V, 150V, 500V, 1-5kV; d.c. 1, 0-50 $\mu$ A, 500 $\mu$ A, 5mA, 50mA, 0-5A, 5A; a.c. V, 5V, 15V, 50V, 150V, 500V, 1-5kV; a.c. 1, 5mA, 50mA, 0-5A, 5A; dB -10 to +65 in 6 ranges;  $\Omega$  0-0.5k $\Omega$ , 5k $\Omega$ , 50k $\Omega$ , 500k $\Omega$ , 5M $\Omega$ , 50M $\Omega$ ; pF 50kpF, 500kpF.  
Scale mirror and fine line pointer for accuracy.  
Single knob main range switching and all panel controls.  
C.E.I. Class 1 movement with sprung jewel bearings.  
Extended 92mm scale length for extra clarity of reading.  
Compact ABS case 125 x 131 x 37mm. Weight 650g with batteries.  
Supplied complete with carrying case, leads, handbook and full 12-month guarantee.  
Optional 30kV d.c. probe available.

Meter £25.40 inc. VAT (80p P.P.)  
30kV Probe £9.50 inc. VAT

For details of this and the many other exciting instruments in the Chinaglia range, including multimeters, component measuring, automotive and electronic instruments please write or telephone:

**CHINAGLIA (U.K.) LTD.**

19 Mulberry Walk, London SW3 6DZ  
Tel: 01-352 1897

ALSO AVAILABLE FROM: ARTHUR SALLIS, 28 GARDENER STREET, BRIGHTON 1

## P.E. ORION

Complete Kit of semiconductors £10.95  
High quality printed circuit £3.40

THIS GLASS FIBRE P.C.B. IS ROLLER TINNED AND  
SCREEN PRINTED WITH COMPONENT LOCATIONS.

### FERRANTI semiconductors

BF559	17p	ZTX301	16p	ZTX502	20p	ZS174	29p
BF560	18p	ZTX302	19p	ZTX503	21p	ZS176	38p
BF561	19p	ZTX303	21p	ZTX504	25p	ZS178	65p
BF596	18p	ZTX304	24p	ZTX530	22p	ZS270	16p
BF597	19p	ZTX320	20p	ZTX531	23p	ZS271	25p
BF598	20p	ZTX330	21p	ZTX550	20p	ZS272	28p
ZTX107	14p	ZTX331	23p	ZTX551	21p	ZS274	33p
ZTX108	12p	ZTX382	20p	2N3055	76p	ZS276	43p
ZTX109	14p	ZTX383	19p			ZS278	69p
ZTX212	19p	ZTX384	21p	* DIODES *			
ZTX213	18p	ZTX450	20p	ZS142	44p	* ZENERS * KS030A to KS180A 41p BZV19 series 18p	
ZTX214	22p	ZTX451	20p	ZS170	14p		
ZTX239	13p	ZTX500	18p	ZS171	19p		
ZTX300	15p	ZTX501	17p	ZS172	25p		

ZN414 radio microcircuit, with circuits and data £1.25  
ZN424E low noise audio i.c., with circuits and data £1.50  
ZN1034E precision timer i.c., with data £3.23  
ZN1040E universal count/display i.c., with data £12.96

### PE TV SOUND SEPARATOR

Complete kit of semiconductors £2.40  
High quality printed circuit board £1.25  
Murata filters—SFE6-OMA 38p; CDA6-OMC 38p.  
MOTOROLA BD699 £1.27; BD700 £1.41; MJE2955 £1.50; MJE3055 87p; MC1357PQ £1.60; MJ4032 £4.88; MJ4035 £4.86.

Ferranti MS4A PhotoCells £1.65 each.  
POSTAGE AND PACKING 15p per order. Orders over £5 post free.  
All devices top grade, brand new, and to full manufacturers spec. We do not sell seconds or rejects. Send SAE for our data sheet and price list. We can supply any Ferranti device to order. SAE for quotation.

ALL PRICES INCLUDE VAT AT THE APPROPRIATE RATE

**DAVIAN ELECTRONICS**

PO BOX 38, OLDHAM, LANCs, OL2 6XJ

## The 'MISTRAL' Digital Clock

\* A Complete Kit or fully built \*



Kit £12.50 (Incl)

Built £18.00

- Pleasant green display ● 24 Hour readout
- Silent Synchronous Accuracy ● Fully electronic
- Pulsating colon ● Push button setting ● Building time 1hr ● Attractive acrylic case ● Easy to follow instructions ● Size 10.5 x 5.7 x 8cm
- Ready drilled PCB to accept components

Exetron Time Ltd. offer this unique transformerless design at a substantial saving on retail price. The kit is complete less mains lead—all you require is a soldering iron, solder, and screwdriver to assemble your own digital clock.

Also available from:  
HENRY'S RADIO, 231 Tottenham Court Rd., London W1.  
HENRY'S RADIO, 404 Edgware Rd., London W2.  
CROFTON ELECTRONICS LTD., 124 Colne Rd., Twickenham, Middx  
INTECH PRODUCTS LTD., Imp House, Ashford Rd., Ashford, Middx.  
BYWOOD ELECTRONICS, 68 Ebbwens Rd., Hemel Hempstead, Herts.

### EXETRON (DEPT. P.E.)

Regal House, Penhill Road, LANCING, Sussex

Payment: CWO, Cheque, Access, Barclaycard (Quote Number)

# DORAM

## A PROFESSIONAL DEAL FOR AMATEURS

\*ORDERS BY RETURN OF POST \*NO QUIBBLE REPLACEMENT PART SERVICE  
\*QUALITY BRANDED PRODUCTS \*FREE UP-DATE INFORMATION SERVICE

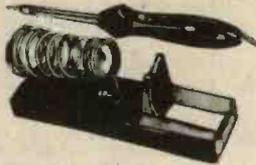
### TOOLS

The handy EXPO 12V d.c. drill is supplied complete with drill kit containing 4 small drills, two spare collets, two cutters, wire brush, soft buffer, grindstone and 9 various milling and reaming tools.

Drill & kit £9.50 + s  
Kit only £4.75 + s



### ORYX 60W SOLDERING IRON



Temperature can be altered between 200-400°C.

Iron 240V £6.00 + s  
Stand £2.20 + s

### ISO-TIP CORDLESS IRON

Mains and 12V d.c. versions available  
£11.50 + s



### DE-SOLDER TOOLS

Three high-suction models available

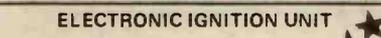
SR2 £6.20 + s  
SR3 £5.20 + s  
SR3AS £4.80 + s

Spare nozzle 60p ea. + s  
Please state type



### NICKEL - CADMIUM RECHARGEABLE CELLS

	Sim. to dry cell	nom. capacity	charge cur. (mA)	£
HP7	0.5Ah	50	1.10	s
SR3	1.2Ah	100	1.24	s
HP11	2.0Ah	200	1.80	s
HP2	4.0Ah	400	2.70	s



### ELECTRONIC IGNITION UNIT

- \* High performance
- \* For 2 & 4 stroke engines
- \* Improved start/running
- \* 'Crisper' throttle response
- \* Reduce battery drain

Neg. earth or pos. earth

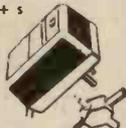
£15.00 + s

Please state type required



### BATTERY ELIMINATOR

Switched output 6, 7.5 or 9V at 250mA.  
D.C. pos. or neg. earth  
£3.15 + s



### SEMI-CONDUCTOR DEVICES

#### RECTIFIERS

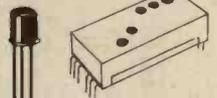
IN 4001 - 8p ea.)  
IN 4002 - 9p ea.) + s  
IN 4003 - 9p ea.)



1-0A bridge (400V) - 36p + H  
1-6A " (200V) - 48p + H  
1-6A " (800V) - 70p + H  
2-0A " (200V) - 72p + H  
2-0A " (600V) - 90p + H

### MULLARD MODULES

LP 1173 - £6.75 + H  
LP 1184/2 - £7.20 + H  
LP 1185 - £5.60 + H  
LP 1186 - £6.90 + H  
LP 1400 - £7.25 + H



### TRANSISTORS

BC 107 - 18p s  
BC 108 - 17p s  
BC 109 - 18p s  
BFY 50 - 24p s  
BFY 51 - 24p s  
BFY 52 - 24p s  
2N 3055 - 80p s  
2N 2646 - 94p s  
TIP 2955 £1.14 s  
TIP 3055 - 61p s  
BC 237B - 13p H  
BC 238C - 12p H  
BC 239C - 14p H  
ZTX 107 - 12p H  
ZTX 108 - 11p H  
ZTX 109 - 13p H  
ZTX 300 - 15p H  
ZTX 500 - 16p H  
MJE 340 - 62p H  
TIP 31A - 36p H  
TIP 32A - 40p H  
2N 3819 - 32p H  
3N 141 - 65p s  
CS 715 - 18p H  
(Similar to MC1310P)  
BF 180 - 40p s  
BRY39 - 72p s

### I.C.'s

T05 Reg - £1.10 s  
MVR 5 - £1.55 s  
MVR 12 - £1.55 s  
MVR 15 - £1.55 s  
LM 309K - £2.12 s  
7805 - £1.50 s  
7812 - £1.50 s  
7815 - £1.50 s  
7824 - £1.50 s  
±15V D.I.L. - £2.82 s  
TBA 231 - £1.75 H  
TBA 800 - £1.60 H  
TBA 810S - £1.80 H  
TBA 820 - £1.20 H  
ZN 414 - £1.30 H  
ZN 424 - £1.25 H  
741 Op-amp - 54p s  
747 Op-amp (Dual 741) - 95p s  
748 Op-amp - 48p s  
555 TIMER - 84p s  
556 (dual 555) - £1.44 s  
HA 1156 - £1.60 H (similar to MC1310P)  
ORP12 - 72p s  
8A Triac - £1.18 s  
ZN 1034E - £4.70 s

**'INTERNATIONAL 25'**  
Build yourself a **BIG SOUND amp** at a budget price



As featured in 'ET' Oct. 75 edition

#### FEATURES

- \* Triple Op-amp pre-amplifier
- \* Power 'Darlington's'
- \* Modern styling
- \* 25W per channel into 8 ohms.

Complete kit with assembly instructions  
Overseas orders £34.50  
S.A.E. for full spec.

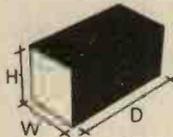
**£29-95**  
+£4-05 VAT

### BOOKS (Z)

Hi-fi hints and tips 38p ea.  
Towers international transistor selector £2.95 ea.  
Electronic circuit design handbook - a must for electronic enthusiasts £4.50 ea.

### 'SAMOS' CASES

Low-cost blue cover and white base PVC steel cases



S1 50W x 50H x 100D £1.03 + s  
S2 100W x 50H x 100D £1.17 + s  
S3 150W x 50H x 100D £1.31 + s  
S4 50W x 75H x 125D £1.47 + s  
S5 100W x 75H x 125D £1.68 + s  
S6 150W x 75H x 125D £1.97 + s  
S7 200W x 75H x 125D £2.19 + s

#### SPECIAL OFFER!!

If catalogue ordered simultaneously with order for SAMOS cases - case price less 25%

### CONDITIONS OF SALE

All prices are ex-VAT  
If affixed with s add 8%  
If affixed with H add 25%  
Z = Zero rated  
Package & posting free for orders over £3.00  
Overseas orders add 15%  
Cash with order. Cheques/Postal Orders to Doram Electronics Limited, P.O. Box TR8, Leeds, LS12 2UF  
Small order handling charge of 40p for orders under £3.00

### DORAM'S NEW CATALOGUE - THE AMATEURS GOOD COMPANION



**ONLY 60p**

inc. post & packing.

Free up-date service until Aug. 1976.

**DORAM** "The Doorway to Amateur Electronics"  
An Electrocomponents Group Company

NAME .....

ADDRESS .....

POST CODE .....

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

PE3/76

# RST VALVE MAIL ORDER CO.

16a WELLFIELD ROAD, LONDON SW16 2BS

**SPECIAL EXPRESS MAIL ORDER SERVICE**

2p	5p	5p	5p	5p	5p
1N21	0-17	AFZ11	1-15	BY213	0-25
1N23	0-35	AFZ12	2-00	BY210	0-45
1N25	0-58	AFZ26	0-25	BY211	0-40
1N253	0-50	AFZ27	0-33	BY212	0-40
1N256	0-50	AFZ28	0-25	BY213	0-42
1N245	0-18	AFZ36	0-25	BY215	1-25
1N725A	0-20	AFZ90	0-20	BY216	0-60
1N914	0-06	AFY51	0-40	BY288	0-10
1N4007	0-12	AFY53	0-20	C111	0-55
1S113	0-25	AFY55	0-20	CR81/05	0-35
1S902	0-23	AFY62	0-25	CR81/40	0-50
2G371	0-75	AFY66	0-33	CS4B	1-90
2G381	0-22	ASZ21	1-00	CS10B	3-50
2G414	0-30	AU104	1-00	DU000	0-15
2G417	0-25	AU101	1-50	DU005	0-25
2N404	0-22	BC107	0-14	DU007	0-40
2N487	0-22	BC108	0-13	DU008	0-38
2N498	0-30	BC109	0-14	DU3	0-33
2N706	0-12	BC113	0-15	DU4	0-10
2N706A	0-12	BC116	0-20	DU5	0-30
2N708	0-15	BC116A	0-23	DU8	0-25
2N709	0-40	BC118	0-20	DU12	0-10
2N1091	0-25	BC121	0-20	GET102	0-50
2N1131	0-25	BC122	0-20	GET103	0-40
2N1132	0-24	BC122	0-20	GET113	0-35
2N1302	0-18	BC125	0-68	GET114	0-30
2N1303	0-18	BC126	0-68	GET115	0-30
2N1304	0-22	BC140	0-55	GET118	0-35
2N1305	0-22	BC147	0-10	GET120	0-50
2N1306	0-22	BC148	0-08	GET872	0-30
2N1307	0-28	BC149	0-10	GET875	0-40
2N1308	0-28	BC157	0-14	GET880	0-60
2N1309	0-28	BC158	0-12	GET881	0-25
2N147	0-78	BC159	0-32	GET882	0-35
2N2148	0-60	BC169	0-14	GET885	0-45
2N2160	0-78	BCY31	0-45	GEX44	0-08
2N2218	0-23	BCY32	0-85	GEX45/1	0-45
2N2219	0-25	BCY33	0-38	GEX941	0-45
2N2369A	0-18	BCY34	0-45	GJ3M	0-50
2N2444	1-99	BCY38	0-55	GJ4M	0-50
2N2413	0-75	BCY39	0-50	GJ5M	0-25
2N2445	0-50	BCY40	0-80	GJ7M	0-45
2N2904	0-20	BCY42	0-30	HS1005	0-50
2N2904A	0-25	BCY70	0-18	HS100A	0-20
2N2906	0-20	BCY71	0-22	MAT100	0-20
2N2907	0-20	BCZ10	0-60	MAT101	0-25
2N2924	0-13	BCZ11	0-65	MAT120	0-20
2N2925	0-15	BD121	1-00	MAT121	0-25
2N2926	0-12	BD122	1-00	MKT210	0-45
2N3054	0-48	BD124	0-65	MKT220	0-63
2N3055	0-45	BDY11	1-45	MJE2955	1-27
2N3702	0-11	BF115	0-20	MJE3055	0-77
2N3703	0-15	BF167	0-25	MPF102	0-40
2N3706	0-11	BF173	0-28	MPF103	0-36
2N3707	0-13	BF181	0-35	MPF104	0-35
2N3709	0-10	BF184	0-25	MPF105	0-38
2N3710	0-11	BF185	0-22	NKT128	0-45
2N3711	0-11	BF184	0-10	NKT129	0-30
2N3819	0-38	BF195	0-13	NKT211	0-35
2N4289	0-20	BF196	0-15	NKT213	0-35
2N5027	0-35	BF197	0-15	NKT214	0-34
2N5085	0-33	BF861	0-25	NKT216	0-40
2S301	0-59	BF862	0-25	NKT217	0-45
2S304	1-15	BFX12	0-20	NKT218	0-45
2S501	0-75	BFX13	0-28	NKT219	0-33
2S703	1-00	BFX20	0-28	NKT222	0-30
AA199	0-20	BFX30	0-28	NKT224	0-25
AAZ12	0-75	BFX35	0-98	NKT251	0-24
AAZ13	0-61	BFX63	0-50	NKT271	0-20
AC126	0-25	BFX84	0-28	NKT272	0-20
AC127	0-25	BFX85	0-28	NKT273	0-20
AC128	0-15	BFX86	0-25	NKT274	0-20
AC129	0-25	BFX87	0-25	NKT275	0-25
AC187	0-21	BFX88	0-24	NKT277	0-20
AC188	0-25	BFY10	0-50	NKT278	0-25
ACY17	0-75	BFY11	0-40	NKT301	1-00
ACY18	0-27	BFY17	0-40	NKT304	1-00
ACY19	0-27	BFY18	0-45	NKT403	1-00
ACY20	0-35	BFY19	0-55	NKT404	1-00
ACY21	0-35	BFY24	0-45	NKT678	0-30
ACY22	0-35	BFY44	1-00	NKT713	0-30
ACY27	0-25	BFY50	0-21	NKT777	0-38
ACY28	0-25	BFY51	0-20	OA7	0-75
ACY39	0-78	BFY52	0-20	OA7	0-75
ACY40	0-22	BFY53	0-17	OA8	0-12
ACY41	0-22	BFY64	0-38	OA7	0-18
ACY44	0-32	BFY90	0-81	OA70	1-10
AD140	0-50	BR100	0-40	OA71	0-20
AD149	0-50	BR100	0-40	OA72	0-10
AD161	0-44	BXK27	0-50	OA73	0-15
AD162	0-44	BXK60	0-93	OA74	0-15
AF106	0-30	BY74	0-15	OA79	0-10
AF114	0-25	BY76	0-17	OA81	0-18
AF115	0-25	BY77	0-20	OA81	0-18
AF116	0-25	BY8Y1	0-50	OA85	0-15
AF117	0-24	BY8Y5A	0-12	OA96	0-16
AF118	0-27	BY8Y5	0-12	OA90	0-07
AF119	0-50	BT102/500R	0-00	OA91	0-07
AF124	0-30	BTY13	0-38	OA95	0-07
AF125	0-30	BTY42	0-92	OA200	0-08
AF126	0-30	BTY79/100R	0-00	OA202	0-06
AF127	0-30	BTY79/400R	0-00	OA210	0-20
AF139	0-41	BY179	1-50	OA211	0-35
AF175	0-55	BY182	0-85	OA2200	0-50
AF179	0-65	BY182	0-85	OA2201	0-45
AF180	0-53	BY182	0-85	OA2202	0-45
AF181	0-50	BY182	0-85	OA2203	0-45
AF186	0-48	BY182	0-85	OA2204	0-45

Open daily to callers: Mon.-Fri. 9 a.m.-5 p.m.  
 Valves, Tubes and Transistors • Closed Sat. 1 p.m.-3 p.m.  
 Terms C.W.O. only • Tel. 01-677 2424-7  
 Post and Packing 12p per order.  
 V.A.T. Transistors 25%. Integrated Circuits 8%.

12in LONG PERSISTENCE CRT. Full spec. Price £8-50 to include V.A.T. and Carriage.

**MAKE YOUR SINGLE BEAM SCOPE INTO A DOUBLE WITH OUR NEW LOW PRICED SOLID STATE SWITCH.** 2Hz to 8MHz. Hook up to a 9 volt battery and connect to your scope and have two traces for ONLY £8-25, P. & P. 25p. (Not cased, not calibrated.)

**WIDE RANGE WOBBLER.** 5MHz to 150MHz up to 15MHz sweep width. Only 3 controls. preset RF level, sweep width and frequency. Ideal for 10-7 or 1F IF alignment, filters, receivers. Can be used with any general purpose scope. Full instructions supplied. Connect 6-3V a.c. and use within minutes of receiving. All this for ONLY £8-75, P. & P. 35p. (Not cased, not calibrated.)

**20Hz to 200kHz WB, SINE and SQUARE GENERATOR.** Four ranges. Independent amplitude controls, thermistor stabilised. Ready to use. 9V supply required. £8-85 each. SINE WAVE only £8-85 each. P. & P. 35p. (Not cased, not calibrated.)

**GRATICULES** 12cm x 14cm high quality plastic 15p each, P. & P. 8p.

\*Large quantity of good quality components—NO PASSING TRADE—so we offer 3lb of ELECTRONIC GOODIES for £1-70. Post paid.

\*METER PACK—3 different meters for £2. P. & P. 55p.

\*MIN TRANSFORMER. 240V input. 3V 1A output. Brand new 65p each. P. & P. 20p.

P.C.B. PACKS. S & D. Quantity 2 sq. ft.—no tiny pieces. 50p, P. & P. 37p.

\*CAPACITOR PACK—50 brand new components, only 50p, P. & P. 37p.

SOME OSCILLOSCOPES ALWAYS AVAILABLE. S.A.E. stating specification and price range.

VAT NOT INCLUDED IN PRICE  
 Goods marked \* 25% V.A.T., otherwise 8%  
 OPEN 9 a.m. to 6 p.m. ANY DAY

**CHILTMead LTD**  
 7/9 ARTHUR ROAD, READING, BERKS.  
 (near Tech. College) Tel. Reading 582605

\*TRIMMER PACK. 2 twin 50/200pF ceramic, 2 twin 10/60pF ceramic; 2 min strip with 4 preset 5/20pF on each; 3 air spaced preset 30/100pF on ceramic base. ALL BRAND NEW. 25p the lot, P. & P. 15p.

\*PHOTOCELL equ. OCP71, 13p each.

\*MULLARD OCP70, 10p each.

DELIVERED TO YOUR DOOR. 1cwt of Electronic Scrap chassis, boards, etc. No rubbish. FOR ONLY £4-50.

\*MODERN TELEPHONES. Type 706: two tone grey or black, £3-75 each. Type 7006: two-tone grey or green, £3-75 each. Style similar to Type 746: grey, or black, £3 each. As above but discoloured, grey only, £2 each. P. & P. all types 45p each.

\*HANDSETS. Complete with 2 inserts and lead, £1-25 each, P. & P. 37p.

\*DIALS. ONLY 50p each, P. & P. 25p.

\*HIGH VALUE—PRINTED BOARD PACK. Hundreds of components, transistors, etc.—No 2 boards the same. No short leaded transistor computer boards. £1-75, post paid.

\*CRYSTALS. 4-43MHz. Brand new, £1-25 each, P. & P. 15p.

RESETTABLE COUNTERS—4 digit by Sodeco/Stonebridge. 1.000 ohm coil, £2 each, P. & P. 35p.

\*BEEHIVE TRIMMER 3/30pF. Brand new. Qty 1-9 13p each, P. & P. 15p; 10-99 10p each, P. & P. 25p; 100-999 7p each, P. & P. free.

HE CRYSTAL DRIVE UNIT. 19in rack mount. Standard 240V input with superb crystal oven by Labgear (no crystals) £5 each, Carr. £2.

\*1,000pF FEE THRU CAPACITORS. Only sold in packs of 10, 30p, P. & P. 15p.

# ELECTROVALUE

*The good components service*

In relatively few years, Electrovalue has risen to a position of pre-eminence as mail-order (and industrial) suppliers of semi-conductors, components, accessories, etc. There are wide ranges and large stocks to choose from as well as many worthwhile advantages to enjoy when you order from Electrovalue.

## CATALOGUE 8 AWAITS YOU!

Enlarged to 144 pages. New items. Opto-electronics. Diagram of components, applications, I.C. circuits, etc. Better than even No. 7. Post free 40p, including voucher for 40p for use on order over £5-00 list value.

## DISCOUNTS

On all C.W.O. mail orders, except for some items marked NETT. on orders list value

5% £5 or more      10% £15 or more

## FREE POST AND PACKING

On all C.W.O. mail orders in U.K. over £2 list value. If under, add 15p handling charge.

## PRICE STABILIZATION POLICY

Prices are held and then reviewed over minimum periods of 3 months with effect from 1 January 1976

## QUALITY GUARANTEE

On everything in our Catalogue—No manufacturers rejects, seconds or sub-standards merchandise.

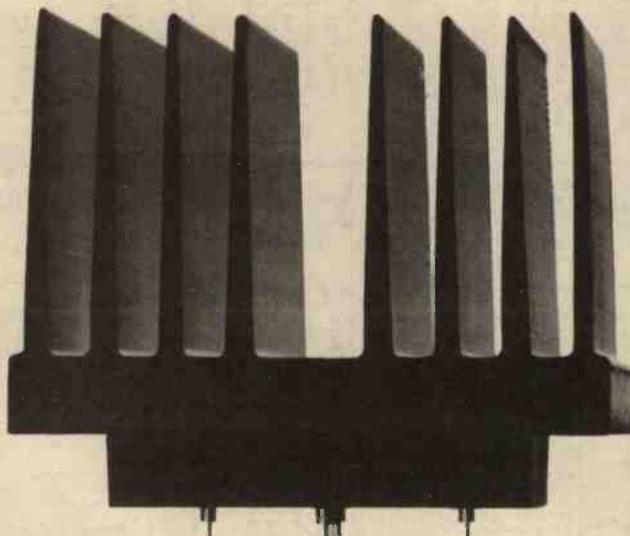
## ELECTROVALUE LTD

All communications to Dept. 2/2, 28 St. JUDAS ROAD, ENGLEFIELD GREEN, EGHAM, SURREY TW20 0HB. Telephone Egham 3603, Telex 284475. Shop hours 9-5.30 daily, 9-1 pm Sat.

NORTHERN BRANCH: 640 Burnage Lane, Burnage, Manchester M19 1NA. Telephone (081) 432 4945. Shop hours Daily 9-5.30 pm; 9-1 pm Sat.

# 100 WATTS!

## HY200



The HY200 is a 100 watt amplifier of hybrid construction with an integral heatsink. Internally the HY200 features open and short circuit protection with the added feature of thermal shutdown when the heatsink rises above a predetermined temperature, with these features the HY200 can be installed into any equipment with the confidence that it is virtually indestructible under any operating conditions. The low distortion and high signal to noise ratio together with wide band width makes the HY200 an amplifier of true Hi-Fi performance and these factors coupled with its robustness make it suitable for Hi-Fi, Group, Disco, PA, etc.

#### Specification

Output power 100 watts into 8Ω. Input sensitivity 500mV R.M.S. Input impedance 100kΩ. Signal/noise ratio 96dB at 100 watts. Power bandwidth 10Hz-45kHz -3dB. Distortion 0.05% typical. Weight 1kg (2.2lb).

**£21.20**

plus £5.30 VAT. P. & P. free

Power supply PSU90 for one HY200 output 45-0-45V d.c. at 2 amps.

**£10.56**

plus £2.64 VAT. P. & P. free

**TWO YEARS' GUARANTEE ON ALL OUR PRODUCTS**

**I.L.P. Electronics Ltd.**  
**Crossland House,**  
**Nackington, Canterbury**  
**Kent CT4 7AD**  
**Tel (0227) 63218**

Please supply .....

Total Purchase price .....

Enclose: Cheque  Postal Orders  Money Order

Please debit my Access account  Barclaycard account

Account number .....

Name and Address .....

.....

Signature .....

# SEMICONDUCTORS

## Linear IC's

Type	Quantities	Type	Quantities
	1 25 100+		1 25 100+
72702	0-46 0-44 0-42	SL701C	0-46 0-42 0-37
72709	0-23 0-21 0-19	SL702C	0-46 0-42 0-37
72709P	0-19 0-18 0-17	TAA263	0-74 0-65 0-56
72710	0-32 0-31 0-28	TAA293	0-93 0-88 0-83
72741	0-28 0-27 0-26	TAA350	£1-71 £1-87 £1-57
72741C	0-26 0-25 0-24	UA703C	0-26 0-24 0-22
72741P	0-28 0-27 0-26	UA709C	0-19 0-18 0-17
72747	0-79 0-74 0-61	UA711C	0-32 0-31 0-28
72748P	0-35 0-33 0-31	UA712C	0-32 0-31 0-28
SL201C	0-46 0-42 0-37	UA723C	0-45 0-43 0-40

Type	Quantities
	1 25 100+
76003	£1-39 £1-34 £1-30
76023	£1-39 £1-34 £1-30
76660	0-88 0-88 0-83
LM380	0-83 0-90 0-88
*NE555	0-45 0-43 0-40
*NE556	0-88 0-86 0-83
TBA500	£1-39 £1-34 £1-30
ZN414	£1-11

## Untested LIN Paks

Manufacturers "Fail Outs" which include Functional and part Functional Units. These are classified 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 x 709	0-60
ULIC710	7 x 710	0-60
ULIC741	7 x 741	0-60
ULIC747	5 x 747	0-60
ULIC748	7 x 748	0-60

## ★ 74 Series TTL IC's

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

Type	Quantities	Type	Quantities	Type	Quantities
	1 25 100+		1 25 100+		1 25 100+
7400	0-10 0-09 0-08	7448	0-87 0-86 0-85	74122	0-52 0-51 0-50
7401	0-13 0-12 0-11	7450	0-13 0-12 0-11	74141	0-78 0-77 0-75
7402	0-12 0-12 0-11	7451	0-13 0-12 0-11	74145	0-86 0-84 0-81
7403	0-13 0-12 0-11	7453	0-13 0-12 0-11	74150	£1-37 £1-30 £1-20
7404	0-12 0-12 0-11	7454	0-13 0-12 0-11	74151	0-82 0-78 0-75
7405	0-12 0-12 0-11	7460	0-13 0-12 0-11	74153	0-82 0-78 0-75
7406	0-31 0-29 0-27	7470	0-30 0-27 0-25	74154	£1-57 £1-43 £1-48
7407	0-31 0-29 0-27	7472	0-30 0-27 0-25	74155	0-82 0-78 0-75
7408	0-17 0-15 0-13	7473	0-32 0-30 0-28	74156	0-82 0-78 0-75
7409	0-17 0-15 0-13	7474	0-34 0-31 0-29	74157	0-93 0-88 0-83
7410	0-10 0-09 0-08	7475	0-52 0-50 0-48	74160	£1-19 £1-12 £1-06
7411	0-23 0-22 0-21	7476	0-35 0-33 0-31	74161	£1-19 £1-12 £1-06
7412	0-25 0-24 0-23	7480	0-50 0-47 0-44	74162	£1-19 £1-12 £1-06
7413	0-30 0-29 0-28	7481	£1-02 0-97 0-93	74163	£1-19 £1-12 £1-06
7415	0-28 0-27 0-26	7482	0-83 0-79 0-74	74164	£1-37 £1-25 £1-19
7417	0-28 0-27 0-26	7483	£1-00 0-92 0-85	74165	£1-37 £1-25 £1-19
7420	0-12 0-12 0-11	7484	0-93 0-90 0-88	74166	£1-48 £1-37 £1-25
7422	0-28 0-27 0-26	7485	£1-25 £1-19 £1-12	74174	£1-25 £1-49 £1-12
7423	0-32 0-31 0-30	7486	0-32 0-31 0-30	74175	£1-02 0-97 0-83
7425	0-32 0-31 0-30	7489	£3-12 £2-81 £2-50	74176	£1-16 £1-11 £1-06
7426	0-32 0-31 0-30	7490	0-48 0-44 0-40	74177	£1-17 £1-11 £1-06
7427	0-32 0-31 0-30	7491	0-75 0-69 0-62	74180	£1-16 £1-11 £1-06
7428	0-42 0-39 0-37	7492	0-54 0-49 0-44	74181	£2-50 £2-38 £2-25
7430	0-13 0-12 0-11	7493	0-48 0-44 0-40	74182	£1-00 0-94 0-88
7432	0-31 0-30 0-29	7494	0-56 0-53 0-50	74184	£1-67 £1-62 £1-55
7433	0-39 0-37 0-35	7495	0-72 0-67 0-62	74190	£1-75 £1-63 £1-50
7437	0-31 0-30 0-29	7496	0-85 0-81 0-78	74191	£1-75 £1-63 £1-50
7438	0-31 0-30 0-29	74100	£1-25 £1-19 £1-13	74192	£1-37 £1-31 £1-25
7440	0-13 0-12 0-11	74104	0-38 0-34 0-31	74193	£1-37 £1-31 £1-25
7441	0-69 0-66 0-59	74105	0-38 0-34 0-31	74194	£1-20 £1-16 £1-11
7442	0-69 0-66 0-59	74107	0-38 0-34 0-31	74195	0-94 0-91 0-88
7443	£1-11 £1-06 £1-02	74108	0-56 0-51 0-46	74196	£1-11 £1-06 £1-02
7444	£1-11 £1-06 £1-02	74111	0-83 0-81 0-78	74197	£1-11 £1-06 £1-02
7445	0-94 0-89 0-89	74118	0-93 0-88 0-83	74198	£2-37 £2-31 £2-25
7446	£1-06 £1-03 £1-00	74119	£1-38 £1-30 £1-20	74199	£2-25 £2-18 £2-11
7447	0-85 0-84 0-82	74121	0-34 0-33 0-31	74123	0-89 0-68 0-65

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.

## ★ DTL 930 Series

Type	Quantities	Type	Quantities
	1 25 100+		1 25 100+
BP930	0-14 0-13 0-13	BP944	0-15 0-14 0-13
BP932	0-15 0-14 0-13	BP945	0-28 0-26 0-23
BP933	0-15 0-14 0-13	BP946	0-14 0-13 0-12
BP935	0-15 0-14 0-13	BP948	0-28 0-26 0-23
BP936	0-15 0-14 0-13	BP951	0-85 0-60 0-56

## ★ Voltage Regulators

TO-3 Plastic Encapsulation  
 UA.7805/L129 5V  
 (equiv. to MVR5V) £1-25  
 UA.7812/L130 12V  
 (equiv. to MVR12V) £1-25  
 UA.7815/L131 15V  
 (equiv. to MVR15V) £1-25  
 UA.7818 18V  
 (equiv. to MVR18V) £1-25

## ★ DIL Sockets

TSO14 14 pin type  
 TSO16 16 pin type  
 TSO24 24 pin type  
 BPS 8 8 pin type (low cost)  
 BPS14 14 pin type (low cost)  
 BPS16 16 pin type (low cost)

**VAT**  
 PLEASE ADD 8%  
 TO ITEMS  
 MARKED ★  
 REMAINDER  
 ADD 25%

## Mammoth IC Pak

APPROX. 200 PIECES  
 Assorted fail-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 £1-20\***

# P&P

Postage and Packing add 25p unless otherwise shown. Add extra for airmail. Minimum order £1.

## ★ Indicator

3015F Minitor 7 Segment Indicator £1-11

## ★ Untested TTL Paks

Pak No.	Contents	Price	Pak No.	Contents	Price
UIC20	12 x 7400	0-60	UIC70	8 x 7470	0-80
UIC21	12 x 7401	0-60	UIC72	8 x 7472	0-60
UIC22	12 x 7402	0-60	UIC73	8 x 7473	0-60
UIC23	12 x 7403	0-60	UIC74	8 x 7474	0-60
UIC24	12 x 7404	0-60	UIC75	8 x 7475	0-60
UIC25	12 x 7405	0-60	UIC76	8 x 7476	0-60
UIC26	8 x 7406	0-60	UIC80	5 x 7480	0-80
UIC27	8 x 7407	0-60	UIC81	5 x 7481	0-60
UIC28	5 x 7408	0-60	UIC82	5 x 7482	0-60
UIC13	8 x 7413	0-60	UIC83	5 x 7483	0-60
UIC29	12 x 7420	0-60	UIC86	5 x 7486	0-60
UIC30	12 x 7430	0-60	UIC90	5 x 7490	0-60
UIC40	12 x 7440	0-60	UIC91	5 x 7491	0-60
UIC41	5 x 7441	0-60	UIC92	5 x 7492	0-60
UIC42	5 x 7442	0-60	UIC93	5 x 7493	0-60
UIC43	5 x 7443	0-60	UIC94	5 x 7494	0-60
UIC44	5 x 7444	0-60	UIC95	5 x 7495	0-60
UIC45	5 x 7445	0-60	UIC96	5 x 7496	0-60
UIC46	5 x 7446	0-60	UIC100	5 x 74100	0-60
UIC47	5 x 7447	0-60	UIC121	5 x 74121	0-60
UIC48	5 x 7448	0-60	UIC141	5 x 74141	0-60
UIC50	12 x 7450	0-60	UIC151	5 x 74151	0-60
UIC51	12 x 7451	0-60	UIC154	5 x 74154	0-60
UIC53	12 x 7453	0-60	UIC183	5 x 74183	0-60
UIC54	12 x 7454	0-60	UIC189	5 x 74189	0-60
UIC60	12 x 7460	0-60	UIC199	5 x 74199	0-60
			UIC XI 25 Assorted		£1-50

# BI-PAK

P.O. BOX 6, WARE · HERTS

# SEMI-CONDUCTORS

## TRANSISTORS

BRAND NEW FULLY GUARANTEED

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price		
AC107	*0.20	ADT140	*0.51	BC151	*0.20	BC303	*0.31	BDY20	*1.02	BSY39	*0.19	OC82	*0.16	2N1131	*0.20	2N2906	*0.16	2N3705	0.12
AC113	*0.19	AF114	*0.25	BC152	*0.18	BC304	*0.37	BF115	*0.25	BSY40	*0.29	OC92D	*0.16	2N1132	*0.22	2N2906A	*0.19	2N3706	0.12
AC115	*0.20	AF115	*0.25	BC153	*0.29	BC440	*0.31	BF117	*0.46	BSY41	*0.29	OC83	*0.20	2N1302	*0.15	2N2907	*0.20	2N3707	*0.13
AC117K	*0.30	AF116	*0.25	BC154	0.21	BC460	*0.37	BF118	*0.71	BSY95	*0.13	OC39	*0.20	2N1303	*0.15	2N2907A	*0.22	2N3706	0.08
AC122	*0.12	AF117	*0.25	BC157	0.19	BD115	*0.63	BF119	*0.71	BSY95A	*0.13	OC140	*0.20	2N1304	*0.18	2N2923	0.15	2N3709	0.09
AC125	*0.18	AF118	*0.36	BC158	0.12	BD116	*0.81	BF121	0.45	BU105	*2.04	OC169	*0.26	2N1305	*0.18	2N2924	0.15	2N3710	0.09
AC126	*0.18	AF124	*0.31	BC159	0.12	BD121	*0.61	BF123	0.51	MJE521	*0.56	OC170	*0.26	2N1306	*0.21	2N2925	0.15	2N3711	0.09
AC127	*0.19	AF125	*0.31	BC160	*0.46	BD123	*0.67	BF125	0.46	MJE2955	*0.88	OC171	*0.26	2N1307	*0.21	2N2926G	0.13	2N3819	*0.59
AC128	*0.19	AF126	*0.29	BC161	*0.51	BD124	*0.79	BF127	0.51	MJE3055	*0.57	OC200	*0.26	2N1308	*0.24	2N2926Y	0.11	2N3820	*0.21
AC132	*0.15	AF127	*0.29	BC167	0.12	BD131	*0.51	BF129	0.51	MJE3440	*0.51	OC201	*0.29	2N1309	*0.24	2N2926O	0.10	2N3823	*0.29
AC134	*0.15	AF139	*0.31	BC168	0.12	BD132	*0.61	BF152	0.56	MPF102	*0.43	OC202	*0.29	2N1613	*0.20	2N2926R	0.10	2N3903	0.29
AC137	*0.15	AF178	*0.51	BC169	0.12	BD133	*0.87	BF153	0.46	MPF104	*0.38	OC203	*0.26	2N1711	*0.20	2N2926B	0.10	2N3904	0.31
AC141	*0.19	AF179	*0.51	BC170	0.10	BD135	0.41	BF154	0.46	MPF105	*0.38	OC204	*0.26	2N2147	*0.73	2N3053	*0.18	2N3905	0.29
AC141K	*0.30	AF180	*0.51	BC171	0.10	BD136	0.41	BF155	*0.71	MPF106	*0.38	OC205	*0.36	2N2148	*0.58	2N3054	*0.47	2N3906	0.28
AC142	*0.19	AF181	*0.51	BC172	0.10	BD137	0.46	BF156	*0.49	OC19	*0.65	OC206	*0.36	2N2218	*0.20	2N3055	*0.47	2N4287	0.18
AC142K	*0.26	AF182	*0.51	BC173	0.10	BD138	0.51	BF157	*0.56	OC20	*0.65	OC309	*0.41	2N2219	*0.20	2N3056	*0.42	2N4288	0.18
AC176	*0.20	AF239	*0.38	BC174	0.15	BD139	0.56	BF158	0.56	OC22	*0.47	OCPT1	*0.40	2N2220	*0.22	2N3402	*0.29	2N4289	0.18
AC180	*0.20	AL102	*0.68	BC175	*0.35	BD140	0.61	BF159	0.61	OC23	*0.49	ORP12	*0.60	2N2221	*0.20	2N3403	*0.29	2N4290	0.18
AC180K	*0.20	AL103	*0.68	BC177	*0.19	BD155	*0.81	BF173	*0.22	OC24	*0.57	ORP60	*0.60	2N2222	*0.20	2N3404	*0.43	2N4291	0.18
AC181	*0.20	BC107	*0.08	BC178	*0.19	BD175	*0.61	BF173	*0.22	OC25	*0.39	ORP61	*0.60	2N2356	*0.18	2N3525	*0.77	2N4292	0.18
AC181K	*0.30	BC108	*0.08	BC179	*0.19	BD176	*0.61	BF176	0.36	OC26	*0.39	ORP61	*0.60	2N2359	*0.15	2N3614	*0.69	2N4293	0.18
AC187	*0.22	BC109	*0.08	BC180	*0.25	BD177	*0.67	BF179	0.31	OC28	*0.30	TIP29	*0.44	2N2369A	*0.15	2N3615	*0.76	2N5172	0.12
AC187K	*0.22	BC109	*0.08	BC181	0.20	BD178	*0.71	BF180	*0.31	OC29	*0.51	TIP30	*0.52	2N2369B	*0.15	2N3616	*0.76	2N5172	0.12
AC188	*0.22	BC114	0.16	BC182	0.15	BD179	*0.71	BF181	*0.31	OC29	*0.51	TIP31A	*0.56	2N2369C	*0.15	2N3617	*0.76	2N5172	0.12
AC188K	*0.23	BC115	0.16	BC182L	0.15	BD180	*0.71	BF194	0.12	OC35	*0.43	TIP32A	*0.68	2N2369D	*0.15	2N3618	*0.76	2N5172	0.12
ACV17	*0.26	BC116	0.16	BC183	0.15	BD185	*0.87	BF195	0.12	OC36	*0.51	TIP41A	*0.68	2N2904	*0.18	2N3646	*0.09	2N5458	*0.32
ACV18	*0.24	BC117	0.19	BC183L	0.15	BD186	*0.87	BF196	0.15	OC41	*0.20	TIP42A	*0.81	2N2905A	*0.21	2N3702	0.12	2N5459	*0.41
ACV19	*0.24	BC118	0.10	BC184	0.20	BD187	*0.71	BF197	0.15	OC42	*0.25	TIS43	*0.31	2N2905	*0.21	2N3703	0.12	40361	*0.41
ACV20	*0.24	BC119	*0.31	BC184L	0.20	BD188	*0.71	BF257	*0.46	OC44	*0.16	UT46	*0.28	2N2905A	*0.21	2N3704	0.13	40362	*0.51
ACV21	*0.24	BC120	*0.31	BC186	*0.29	BD189	*0.77	BF258	*0.61	OC45	*0.13	ZN414	*1.11						
ACV22	*0.24	BC137	0.16	BC187	*0.29	BD190	*0.77	BFY53	*0.18	OC70	*0.15	ZN696	*0.13						
AD140	*0.49	BC139	*0.41	BC207	0.11	BD195	*0.87	BSX19	*0.16	OC71	*0.15	ZN697	*0.14						
AD140	*0.49	BC140	*0.31	BC208	0.11	BD196	*0.87	BSX20	*0.16	OC72	*0.15	ZN698	*0.25						
AD142	*0.48	BC141	*0.31	BC209	0.12	BD197	*0.92	BSY25	*0.16	OC74	*0.15	ZN699	*0.36						
AD143	*0.39	BC142	*0.31	BC212L	0.13	BD198	*0.92	BSY26	*0.16	OC75	*0.16	ZN706	*0.11						
AD149	*0.39	BC143	*0.31	BC213L	0.13	BD199	*0.98	BSY27	*0.16	OC76	*0.16	ZN706A	*0.12						
AD161	*0.36	BC145	*0.46	BC214L	0.17	BD200	*0.98	BSY28	*0.16	OC77	*0.26	ZN708	*0.14						
AD162	*0.36	BC147	0.10	BC225	0.26	BD205	*0.81	BSY29	*0.16	OC81	*0.16	ZN914	*0.15						
AD161 & AD162 (MP)	*0.69	BC148	0.10	BC226	0.36	BD206	*0.81	BSY38	*0.19	OC81D	*0.18	ZN918	*0.31						
		BC149	0.12	BC201	*0.28	BD207	*0.98												
		BC150	0.19	BC302	*0.25	BD208	*0.98												

## VAT CHAT

Please add 8% to prices marked \*.  
Remainder add 25%. Do not add VAT to prices marked †.

## SUPER UNTESTED PAKS

Pak No.	Description	Price
U 1	120 Glass Sub-min. General purpose Germ. diodes	0.60
U 4	30 Germanium transistors like OC81, AC128	*0.60
U 5	60 200mA sub-min. silicon diodes	*0.60
U11	20 PNP Sil. planar trans. TO-5 like 2N1132, 2N2904	*0.60
U15	20 NPN Sil. planar trans. TO-5 like 2N696, 2N697	*0.60
U19	20 Silicon NPN transistors like BC108	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 CRS/5-600	*£1.20
U32	25 Zener diodes 400mV DO-7 case 3-36 volts mixed	0.60
U36	20 Silicon planar NPN transistors TO-5 BFY50/51/52	*0.60
U45	7 3A SCR TO66 up to 600 PIV	*£1.20
U46	20 Unijunction transistors similar to TIS43	*0.60
U48	9 NPN Sil. power transistors like 2N3055	*£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.

## DIODES

Type	Price	Type	Price	Type	Price	Type	Price
BA100	*0.10	BB104	*0.15	OA10	*0.14	OA51	*0.07
BA116	*0.21	BY100	*0.18	OA47	*0.07	OA55	*0.07
BA126	*0.22	BY126	*0.15	OA70	*0.07	OA200	*0.07
BA148	*0.15	BY127	*0.16	OA79	*0.07	OA202	*0.07
BA154	*0.12	BY128	*0.16	OA81	*0.07	IN914	*0.06
BA156	*0.14	BY164	*0.51	OA85	*0.09	IN916	*0.06
BA173	*0.15	BYX38/30	*0.43	OA90	*0.07	IN4148	*0.06

## THYRISTORS

PIV	0.5A	0.8A	1A	3A	5A	5A	7A	10A	18A	30A
	TO18	TO92	TO5	TO66	TO66	TO64	TO48	TO48	TO48	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	*1.43
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	*0.85	*0.81	*0.81	*0.92	*1.22	*1.39	*4.07

## SILICON RECTIFIERS

PIV	300mA (DO 7)	750mA (SO 16)	1 Amp Plastic	1.5 Amp (SO 16)	3 Amp (SO 10)	10 Amp (SO 10)	30 Amp (TO 48)	
50	0.05	0.06	IN4001	0.05	0.07	0.14	0.19*	0.56*
100	0.05	0.07	IN4002	0.06	0.09	0.16	0.21*	0.69*
200	0.06	0.09	IN4003	0.07	0.12	0.20	0.23*	0.93*
400	0.07	0.14	IN4004	0.08	0.14	0.28	0.35*	1.25*
600	0.08	0.16	IN4005	0.09	0.16	0.33	0.42*	1.78*
800	0.11	0.18	IN4006	0.10	0.18	0.35	0.51*	1.94*
1000	0.13	0.28	IN4007	0.11	0.23	0.44	0.60*	2.31*
1200	—	0.32	—	—	0.28	0.54	0.69*	2.88*

## SIL. G.P. DIODES

300mW 400 PIV (min) SUB-MIN FULLY TESTED  
Ideal for Organ Builders

30 for 50p, 100 for £1.50, 500 for £5, 1,000 for £9.

## TRIACS

Case	100V	200V	400V
2 Amp TO5	*0.31	*0.51	*0.71
6 Amp TO65	*0.51	*0.61	*0.77
10 Amp TO48	*0.77	*0.92	*1.12

## GP300

115 WATT SILICON TO3 METAL CASE  
V<sub>ceo</sub> 100V, V<sub>ceo</sub> 60V, IC 15A, Hfe. 20-100 suitable replacement for 2N3055, BDY11 or BDY20.

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

## GP Switching Trans

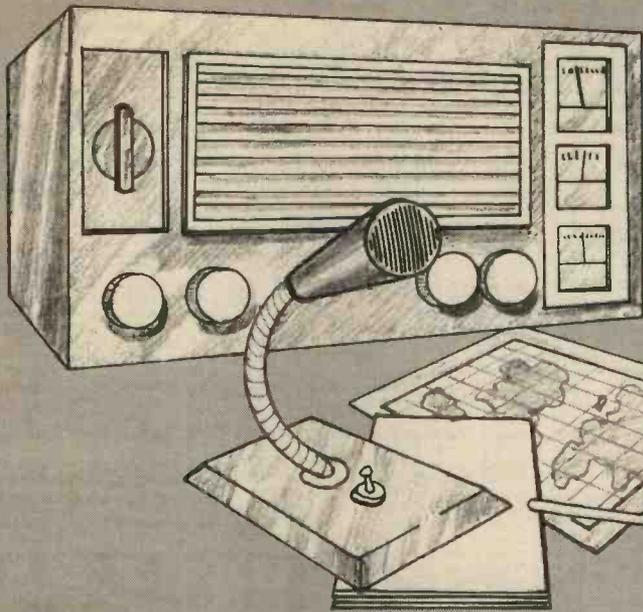
TO18 SIM. TO 2N706/8 BSY27/28/95A  
All usable devices. No open and shorts. ALSO AVAILABLE IN PNP similar to 2N2906, BCY70.

20 for \*50p, 50 for \*£1, 100 for \*£1.80, 500 for \*£8, 1,000 for \*£14.  
When ordering please state NPN or PNP

## 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 only \*£1.85p

## ZENER DIODES



# Become a radio amateur.

Learn how to become a radio-amateur in contact with the whole world. We give skilled preparation for the G.P.O. licence.

**Free!**

Brochure, without obligation to:  
**BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL, Dept. EB36**  
 P.O. Box 156, Jersey, Channel Islands.

NAME \_\_\_\_\_  
 ADDRESS \_\_\_\_\_

Block caps please

## Don't miss your copy of HENRY'S NEW CATALOGUE

only 50p Plus 20p P&P



- ★ OVER 5,000 ITEMS – largest UK range of electronic components for home constructors.
- ★ 200 PAGES – every aspect of electronics and components for amateurs and hobbyists – kits, projects, test gear.
- ★ DOZENS of new lines and new ranges.
- ★ MANY price reductions throughout the new Catalogue.
- ★ A Discount Voucher with every copy, worth 50p.

**FREE** TO EDUCATIONAL ESTABLISHMENTS when ordered on official notepaper.

Write now for your copy, enclosing 70p remittance

ALL PRICES INCLUSIVE OF VAT

**Henry's RADIO**

### ELECTRONIC FOOTBALL AND TENNIS WITH THE FABULOUS VIDEO SPORT ON YOUR OWN TV

Play three exciting electronic ball games. FOOTBALL, TENNIS, HOLE IN THE WALL on your own TV! Just plug Video Sport into the aerial socket of your TV and away you go. Completely safe for you, your children and your TV. Mains operated.



#### OUR INCREDIBLE PRICE

**£29.50** incl. VAT + 50p P/C

Demonstrations now in all CENTRES!

#### AM/FM MODULES

LP1179 LP1181

Combined AM/FM tuner modules, together with a small number of R's and C's and Ferrite Aerial, make up a sensitive FM/MW/LW tuner. 6 Volts supply, supplied with data and circuit sheets.

LP1173 combined IF strip £4.50.  
 LP1179. FM front end and AM gang £4.50.

£8.52 the pair.  
 Suitable Ferrite aerial 87p.  
 Carriage and packing 30p



#### UHF TV TUNERS

625 line receiver UHF transistorised tuners U.K. operation. Brand new. (Post/packing 25p each).

TYPE B 4-button push button (adjustable) £4.60.  
 TYPE C variable tuning £2.90.  
 TYPE D 6-button UHF/VHF tuner £5.20

#### YOUR NEAREST STORE

LONDON, EDGWARE ROAD LONDON W2  
 466 Electronic Centre & Supermarket 01-402 6341  
 303 Brixton Centre  
 309 Electronics Supermarket  
 TOTTENHAM COURT ROAD W1  
 231 Electronic Centre & Supermarket 01-380 3459

OUT OF TOWN NOTTINGHAM  
 94/9 Electronic Centre Nottingham 42668  
 ALL MAIL ORDERS TO 303 EDGWARE ROAD W2  
 Please contact at time of preparation  
 Subject to change without notice. © R OE

### BUILD THE TEXAN + FM TUNER TEXAN 20 + 20W STEREO AMP

Features glass fibre PC board, Gardners low field transformer, 6-I.C.s, 10-transistors plus diodes, etc. Designed by Texas Instruments engineers for Henry's and P.W. 1972. Overall size 15 1/2 x 2 1/2 x 6 1/2in. Mains operated. Free leak sleeve with every kit.



**£35** (carriage £1)

(also built and tested £45).

### HENELEC STEREO FM TUNER

Features capacity diode tuning, lead and tuning meter indicators, mains operated. High performance and sensitivity. Overall size in leak sleeve 8 x 2 1/2 x 6 1/2in. Complete kit with leak sleeve.

**£26.25** (carriage £1)

(also built and tested £31.20).

### JOIN THE LARGE BAND OF CONSTRUCTORS!

#### AM/FM and Decoder Board

Containing Mullard Modules LP1185, LP1186 and LP1181 with MC1310 decoder IC on compact printed circuit board. Ready aligned, requires only Ferrite Aerial Tuning Gang and AM Oscillator Coil, Tuning Pot and Zener. 15V supply, output 300mV, 75 ohms aerial input. Input circuit and instructions supplied.



**£16.50** incl. VAT, postage 30p

NOW OPEN  
**ELECTRONIC SUPERMARKET**  
 309 EDGWARE ROAD W.2

Barclaycard & Access welcome  
 ALL PRICES INCLUDE VAT



PATENT PENDING

# Sparkrite mk2

The tried, tested, proven, reliable, complete, professional, capacitive discharge,

## Electronic Ignition Kit

"Sparkrite" was voted best of 8 systems tested by Popular Motoring Magazine



### ORDER NOW

TO ELECTRONICS DESIGN ASSOCIATES DEPT. PE3, 82 Bath Street, Walsall, WS1 3DE. Phone 33652

FROM Name \_\_\_\_\_

Address \_\_\_\_\_

Qty. \_\_\_\_\_

SPARKRITE MK 2 DIY Assembly kit @ £10.93

SPARKRITE MK 2 Ready Built Negative earth @ £13.86

SPARKRITE MK 2 Ready Built Positive earth @ £13.86

Ignition changeover switches @ £2.98

R.P.M. Limit systems in the above units @ £2.42

I enclose cheque/P.O.s for £ \_\_\_\_\_

Cheque No. \_\_\_\_\_

(Send SAE if brochure only required)

Sparkrite MK2 is a high performance, high quality, capacitive discharge, electronic ignition system.

Because of the superb design of the Sparkrite circuit it completely eliminates problems of the contact breaker. There is no misfire because contact breaker bounce is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R.P.M. Contact breaker burn is eliminated by reducing the current to about 1/50th of the norm. It will perform equally well with new, old, or even badly pitted points and is not dependent upon the dwell time of the contact breakers for recharging the system. Sparkrite incorporates a short circuit protected inverter which eliminates the problems of SCR lock on and therefore eliminates the possibility of blowing the transistor or the SCR. (Many capacitive discharge ignitions are not completely foolproof in this respect.)

Sparkrite can therefore give you:-

up to 20% better fuel consumption, instant all weather starting, cleaner plugs - they last up to 5 times longer without attention, faster acceleration, higher top speeds, longer coil and battery life, efficient fuel burning and less air pollution, smoother running, continual peak performance.

**THE KIT COMPRISES EVERYTHING NEEDED**

Ready drilled pressed steel case coated in matt black epoxy resin, ready drilled base and heatsink, top quality 5 year

guaranteed transformer and components, cables, coil connectors, printed circuit board, nuts, bolts, silicon grease, full instructions to make the kit negative or positive earth, and 10 page installation instructions.

#### OPTIONAL EXTRAS

Electronic R.P.M. limitation.

This can be included in the unit to prevent over revving, an advantage to most companies, hire firms, high performance drivers etc.

Electronic/conventional ignition switch.

Gives instant changeover from "Sparkrite" ignition to conventional ignition for performance comparisons, static timing etc., and will also switch the ignition off completely as a security device. Includes: switch, connectors, mounting bracket and instructions. Cables excluded.

#### PRICES

DI.Y. assembly kit £10.93 incl. V.A.T. post and packing. Ready built unit £13.86 incl. V.A.T. post and packing (Both to fit all vehicles with coil/distributor ignition up to 8 cylinders.)

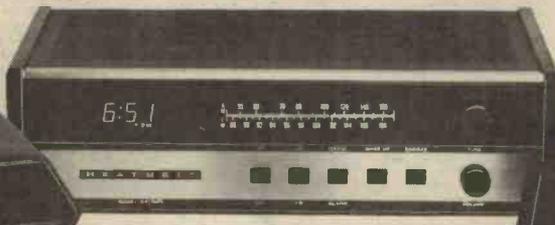
Switch for instant changeover from "Sparkrite" ignition to conventional ignition £2.98 incl. V.A.T. post and packing. R.P.M. limiting control £2.42 incl. V.A.T. post and packing (Fitted in case on ready built unit, dashboard mounting on kit.)

CALLERS WELCOME

# There's more than one way to make your time more enjoyable.



GC-1092AE Deluxe Alarm Clock



GC-1093 Car Clock/Timer



GC-1094 Digital Alarm Clock

GR-1075 AM/FM Alarm Clock-Radio

Instead of just offering you one digital clock kit, Heathkit offer you four. Two alarms, a car model and a superb AM/FM clock-radio.

And, being Heathkit, they all come in easy to build kit form. Complete with a step-by-step instruction manual. So you should enjoy every second.

Post the coupon, enclosing a 10p stamp, and we'll send you a Heathkit catalogue with full details.

Heath (Gloucester) Ltd., Dept. PE-125, Bristol Road, Gloucester, GL2 6EE. Tel: (0452) 29451.

To: Heath (Gloucester) Limited, Dept. PE/36, Gloucester GL2 6EE.

Please send me a Heathkit catalogue. I enclose 10p for postage.

Name \_\_\_\_\_

Address \_\_\_\_\_

Postcode \_\_\_\_\_

HEATH  
Schlumberger

Monthly budget plan available

# BI-PRE-PAK

Bargains in Semi-Conductors, components, modules & equipment.

## B-P-P Packs

Originated in 1959 by the company's managing director, his were the first semi-conductor and component packs to be marketed in this country, and indeed, the company's name grew out of "British Industrial Pre-Pack Components". Today, Bi-Pre-Pak continues to occupy a position of pre-eminence in the supply of packs as well as a vastly extended range of products detailed in our latest 24 page A4 size free catalogue. Send 10p stamped large self-addressed envelope for your copy by return.

IT'S ALL IN OUR FREE CATALOGUE

## Component Packs

CP1 150 Capacitors, mixed bag of paper, silver mica, electrolytics, etc. Approx quantity, counted by weight. (post & packing) ..... 60p  
 CP2 200 Resistors, mixed bag of different types, values, wattages, etc. Approx quantity, counted by weight..... 60p  
 CP3 40 Wirewound resistors, mixed types, values and wattages ..... 60p  
 CP4 12 Potentiometers, pre-sets, w/wound, carbon, etc. Mixed types and values..... 60p  
 CP5 5 Earphones, single low impedance for transistor radio, cassettes, etc. Less plugs, for suitable plugs see PAKs CP9 and CP10..... 60p  
 CP6 50 TO-5 mounting pads, fits between transistor and board, for that pro. finish..... 60p  
 CP8 500 Cable clips for G.P.O. pin dia. cable. Nylon with hardened steel pin (probably tungsten) per sealed box of 500 ..... 60p  
 CP9 5 3-5mm plugs, miniature jack, to fit earphones in PAK CP5 ..... 60p  
 CP10 5 2-5mm sub miniature jack, to fit earphones in PAK CP5 ..... 60p  
 CP11 6 Screwdrivers, 1 x mains neon tester, 5 x grub screwdrivers ..... 60p  
 CP12 10 Reed relay inserts, 1in long pin dia. These will operate from an external magnet or coil. For Magnets see PAK CP13 ..... 60p  
 CP13 10 magnets of various sizes for operating reed-switches in PAK CP12. Ideal for burglar alarms on doors and windows, etc ..... 60p  
 CP14 40 Potentiometers, pre-sets, carbons, dualgangs, with and without switches, etc. Mixed values and wattages £1-20 ..... 60p  
 CP15 12 Standard crocodile clips, screw fixing, good quality ..... 60p  
 CP16 5 P.C. boards each containing a BF180 UHF amplifier transistor. A good basis for building a TV serial pre-amp as various parts inc..... 60p  
 CP17 25 Electrolytic Capacitors, various values and voltages, many useful types, from TV to transistor radio and Hi-Fi (post and packing 23p)..... 60p  
 CP18 1 Light activated SCR.50 volts 1.6 amps type L9F. Ready mounted on PC board with gate resistor and leads fitted. Full data and circuit diagrams for 14 projects, including slave photo flash unit, burglar alarm, etc..... 60p  
 CP19 3 Micro switches 1 pole change over, standard model 1 1/2 x 1/2 in ..... 60p  
 CP20 10 Relays, assorted types, ex-GPO and others, mixed voltages ..... £1-20  
 CP21 200 Square inches of copper laminate P.C. board, in approx. 8 pieces ..... 60p  
 CP22 3 Fibreglass plain printed circuit boards, approx 2 1/2 x 1 1/2 in ..... 60p  
 CP23 4 Switches, miniature push to make single pole ..... 60p

## Semi-Conductors

TESTED AND GUARANTEED

TP4 3 SN7490 integrated circuits, 14 pin dual in line TTL type. Decade counter. Get one FREE these are 60p each in singles ..... £1-20\*

All the following are at 60p each pack

TP5\* 5 SN7400 integrated circuits, 14 pin dual in line TTL type. Quad 2-input NAND gate. Get one FREE, these are 15p each.  
 TP10 2 Light dependant resistors. 400 ohms light 1 megohm dark. pin dia.  
 TP11 10 Transistors XB102 and XB112 equiv. to AC126, AC156, OC81/2, OC72, etc.  
 TP12\* 4 127 Silicon rectifiers 1000 piv 1 amp. Plastic TV rectifier.  
 TP13\* 5 OCP71 Light sensitive transistors.  
 TP14 20 OC71 germanium PNP audio pre-amp transistor, black glass type.  
 TP15 20 OC81 germanium PNP audio output transistor, white glass type.  
 TP16 20 OC200 1/2/3 transistors. PNP silicon TO-5, unmarked.  
 TP17 20 1 watt Zener diodes, mixed voltages, 6.8 to 43 volts.  
 TP18 20 2N3707/8/9/10 transistors. NPN silicon plastic, unmarked.  
 TP19 100 Diodes, mixture of germanium, gold bonded, silicon, etc., a useful selection of many types, marked and unmarked.  
 TP20 10 Mullard OC45 transistors, I.F. amp PNP germanium.  
 TP23 20 BFY50/1/2, 2N696/7, 2N1613, etc. NPN silicon TO-5 uncod. Complementary to PAK TP24.  
 TP24 20 BFY64, 2N2904/5, etc., PNP silicon TO-5 uncod. Complementary to PAK TP23.  
 TP29 20 NPN silicon planar transistors, TO-18 similar to BC108 etc, uncod.  
 TP31 20 PNP silicon planar transistors, TO-18 similar to BC178 etc, uncod.  
 TP32 20 2N2926 Silicon Plastic transistors, uncod and ungraded for colour.

UNTESTED PACKS—60p EACH  
Specially for keen bargain hunters

UT1 50 PNP germanium transistors, AF and RF. Very good yield.  
 UT2 150 Germanium diodes, miniature glass type.  
 UT5 40 Zener diodes, 250mW OAZ240 range, average 50% good.  
 SINGLES  
 Bridge Rectifiers, Plastic encapsulated  
 PIV = 50V ..... 100V ..... 400V  
 1 amp ..... 25p\* ..... 35p\* ..... 45p\*  
 2 amp ..... 35p\* ..... 45p\* ..... 55p\*  
 4 amp ..... 45p\* ..... 50p\* ..... 60p\*  
 6 amp ..... 50p\* ..... 60p\* ..... 70p\*  
 BY164 equiv. SKB2/02 400V 1.5 amp..... 45p\*

F.E.T.e:  
 2N3919 18p; ..... 2N4418 20p  
 Mos F.E.T.e:  
 3N141/MEM616 ..... 50p  
 Uni-Junction Transistors:  
 2N2160 65p ..... 2N2646 48p\*  
 P.T.U.e: TIS 43 31p\* ..... 50p  
 P.U.T.e: 2N2602 ..... 18p\*  
 L.E.D.s: TL209, Red ..... 33p\*  
 YL211, Green ..... 33p\*

Also:  
 POWER DIODES,  
 THYRISTORS,  
 TRIACS,  
 DIAC,  
 ZENER DIODES,  
 OPTO-ELECTRONICS,  
 Etc.

EXCITING NEW  
 STIRLING SOUND  
 AUDIO MODULES  
 SEE NEXT  
 MONTH'S ISSUE

## POWER TRANSISTORS

	Vce	Watts	1c Amps	Price
40P1	15	20	3	20p*
40P2	40	40	4	30p*
40P2	40	40	4	30p*
90N1	15	45	4	25p*
90P1	15	45	4	25p*
90N2	40	90	8	35p*
90P2	40	90	8	35p*

Many other types available from 3 to T15 watts

Integrated Circuits: MM5314 Dual in line clock chips £3-00\*  
 LMS 380/SL 60745 Dual in line 2W audio amp, with data, etc ..... £4-25  
 Dual in line IC sockets 8-pin-14p; 14-pin-15p\*; 16-pin-16p\*

## Sundry

Signal Generator: For MW and IF covers 550kHz to 1.6 MHz for MW and 400 to 550kHz for IF. Fully portable (p & p 40p)  
 Pocket Signal Injector Fountain-pen type. Invaluable for finding fault ..... £2-00\*  
 Ex-GPO Sin Sliccutters: Not new, but in perfect order, per pair ..... 50p\*  
 Ex-GPO Sin Long Nose Pliers: Not new, but in perfect order, per pair ..... 60p\*  
 Mains Transformers:  
 MT6 6V 0.6V 100mA ..... £1-22\*  
 MT12 12V 0.12V 50mA ..... £1-22\*  
 SST9/1 9V 1amp ..... £1-67\*  
 SST12/1 12V 1amp ..... £2-05\*  
 SST18/1 18V 1amp ..... £2-50\*  
 SST25/2 25V 2amp ..... £3-00\*  
 SST30/2 30V 2amp ..... £4-25\*  
 SST35/4 35V 4amp ..... £5-50\*

## PC EDGE CONNECTORS

Type	Size	Pitch	Price
SSEC 6 way	1 1/2in	0-156in	32p
SSEC 10 way	1 1/2in	0-156in	50p
SSEC 12 way	2in	0-156in	60p
SSEC 16 way	2 1/2in	0-156in	75p
SSEC 18 way	3in	0-156in	85p
SSEC 22 way	3 1/2in	0-156in	100p

## OTHER UNTESTED PACKS

UT10 15 power transistors, PNP germanium and NPN silicon, mostly TO-3 but some plastic and some marked.  
 UT13 15 integrated circuits, experimenters pak, dual in line, TO-5, TTL, DTL, marked and unmarked, some definitely good but old types.

For full ranges—See Catalogue

## BOOKS

All free of VAT—We carry very large stocks of technical books by Babani & Bernard Publishers, by Newnes and Butterworth as well as reference books from the Common Market in English/German/Italian. All detailed in our catalogue.

## B-P-P SECURITY CHECK POINT

- Write your own name and address clearly in block capital letters.
- Check that your order is correct for description, quantity and price.
- Don't forget VAT at 25% of total value of order unless otherwise stated.
- MAKE SURE YOU GET OUR NAME AND ADDRESS RIGHT WHEN ORDERING
- Cash (cheque, money or postal order) with your order, please
- Mention this journal when ordering if you don't want to cut out the coupon.

TERMS OF BUSINESS:  
 VAT at 25% must be added to total value of orders except for items marked \* or (%). when VAT is to be added at 8%. No VAT on overseas orders. POST and 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.

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

Please send .....  
 for which I enclose ..... inc VAT  
 Name .....  
 Address .....  
 PE3A



## BI-PRE-PAK LTD

Co Reg. No B20119

222 224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SSO 9DF.

TELEPHONE: SOUTHEM (0702) 46344.

WRITE ORDER SEPARATELY AND ATTACH COUPON IF REQUIRED

# SAXON

ENTERTAINMENTS LTD.

# SYSTEM 7000

professional standards · realistic prices

## NEW! NEW! NEW!

### 120 WATT RMS POWER AMPLIFIER MODULE USES 150W 16A RCA DEVICES

Compare these features...

- 10 transistors, 4 diodes—fibre glass P.C.B.
- Typical distortion: 0.4%; noise: -80dB
- Short, open circuit proof—load line limiting
- Compact—6 × 3 × 1½ in (15 × 8 × 4cm)
- Only FOUR connections—Simplicity!
- High sensitivity (240mV) suits most mixers
- Frequency response—30Hz-40Hz ± 1dB
- Single supply line—no output capacitor needed (95V)
- Standard 8Ω output—will operate on other impedances

ALSO AVAILABLE—60W RMS AND 30W RMS VERSIONS  
WITH ALL THE ABOVE FEATURES

SA608 60W RMS into 8Ω (65V) £12.50

SA308 30W RMS into 8Ω (48V) £9.50



It's  
the new  
SA1208D  
£19.50



■ **POWER SUPPLIES** with glass fibre P.C.B. high grade transformer, fully fused and ready to wire: ■ PM120/1 for one SA1208 £11.60; PM120/2 for two SA1208D £15.30; PM601/2 for one or two SA608 £10.50; PM301/2 for one or two SA308 £8.60

## SYSTEM 7000 DISCOTHEQUE CONTROL UNIT *Design and performance to professional standards*

- Complete and ready to plug in
- Totally encased—no soldering at all
- Tough, bold, two tone stainless panel—for panel mounting or freestanding
- Mono or Stereo versions
- Front and rear output terminations to suit style of usage
- Inputs for 2 ceramic cartridges/tape/microphone
- Autofade with depth and threshold controls
- Wide range treble and bass controls on both channels
- Individual deck controls and left/right fader
- Low noise (-80dB) 20Hz-50kHz ± 1dB
- Suits all Saxon amplifiers and most other makes
- ½ watt headphone monitor—five-position switch with mute positions



■ **CONTROLS**—Left to right: mic vol treble/bass, autofade depth, L/deck vol, R/deck volume, tape volume, treble, bass, master, monitor volume, monitor selector on/off

■ **VARIABLE AUTOFADE STAINLESS STEEL PANEL**

Mono £34.50

Stereo £49.00

## MODULAR DISCO MIXERS *Mono and Stereo*

Printed circuit sub-assembly version of the above mixers—ideal for those wishing to incorporate Saxon's superb specifications into their own systems—all the electronics are provided.

You require only plugs and sockets plus one switch to complete the wiring. All other controls are already mounted on the P.C.B.

Comprehensive wiring instructions are supplied with circuit and diagrams.



Mono £18.50  
Stereo £27.50

## MULTI-PURPOSE MODULAR MIXERS

A SYSTEM 7000 BREAKTHROUGH—UP TO 20 CHANNELS MONO/STEREO

### ■ P.C.B. MODULES:

- Ready assembled with all controls
- Simple terminations—solder or edge connector
- Consumption 10mA at 18V



INPUT MODULES  
(up to 20 may be used)  
MIXING MODULE  
(only 1 required)

Mono 1M7001M  
Stereo 1M7001S  
Mono 1M7002M  
Stereo 1M7002S

£5.50  
£9.00  
£5.50  
£9.00

### ■ COMPLETELY WIRED WITH STAINLESS PANEL:

Both modular and complete types offer:

- Inputs for all sources *inc.* mag. cartridge
- Wide range bass and treble controls
- Only one mixing module required
- Up to twenty channels
- ½W monitor power
- Mono and stereo modules may be used together
- Feeds most amplifiers
- Modern low noise circuitry
- 20Hz-30kHz ± 1dB
- Echo send/return facility
- Complete—ready to plug in or solder
- 5cm matrix—bold panel
- Individual monitor buttons
- Send for details



Provides headphone output and mixes all inputs to output level  
SUITS ALL MIXING REQUIREMENTS FOR GROUPS—CLUBS, DISCOS, ETC.

Mono input module £8.50  
Stereo input module £12.00

Mono mixer module £8.50  
Stereo mixer module £12.00

# ... the complete answer!

SEE SYSTEM 7000 AT OUR SHOWROOMS OR SEND FOR LOCAL STOCKIST LIST

## New! TWO STROBES TO MEET ALL REQUIREMENTS

### SUPERSTROBE

- Built in Saxon reliability
- 1 flash/2 sec up to 20 flashes/sec
- Compact black Bondene case
- Appearance matches other Saxon units
- Ideal for the mobile disco or smaller club

### PRO-STROBE

- Giant 80 watt tube
- Discharge energy up to 6 Joules
- External trigger—audio up to 240V
- May be used with Soundlite to obtain rainbow strobe effect
- Smart, tough Bondene case
- 8in x 8in x 5in approx. (20cm x 20cm x 13cm)



SUPERSTROBE £24.75  
PRO-STROBE £38.50

## New! 150 WATT LIQUID WHEEL PROJECTOR

- Complete with wheel
- 150 watt tungsten lamp
- Wide range of extra effects may be attached
- Sturdy construction
- Adjustable feet



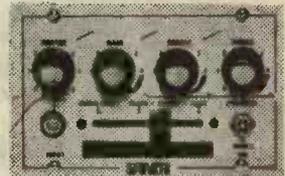
£29.00 Spare wheels £4.90

## TOTAL CONTROL WITH THE SYSTEM 7000 LIGHTING CONTROL UNIT AND SUPERFECT MODULE

- Full control of 3kW of lights (1kW/channel)
- Audio control *plus* sequence *plus* override
- Variable speed sequence with slider function control
- Stainless steel two tone panel—matches mixer
- 13 transistors 8 diodes—advanced control circuitry
- High audio sensitivity—operates from any amplifier
- Attractive Bondene case—free standing or panel mounting
- Individual tone controls *plus* master audio control

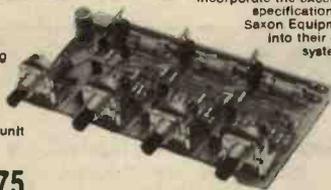
This unit offers the performance of units offered at nearly twice the price

£38.00 inc. case and plug—ready to use.



## SUPERFECT MODULE

- All features as the system 7000 lighting control unit
- Requires only panel and plug socket, etc.
- Slider control supplied
- Glass fibre P.C.B.
- 8 amp RCA triacs
- Complete light show in one unit



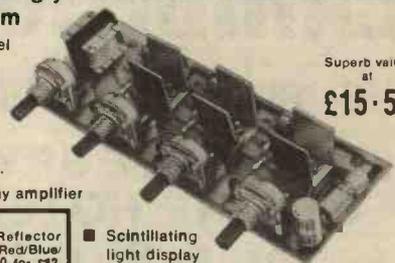
With instructions £24.75

This P.C.B. sub-assembly of the system 7000 lighting control unit is recommended for those wishing to incorporate the excellent specifications of Saxon Equipment into their own systems.

## SAXON SOUND-LITE

Our outstandingly successful 3kW converter in module form

- Up to 1kW/channel
- Individual tone controls
- Master control
- RCA 8A triacs
- Glass fibre P.C.B.
- Operates from any amplifier



Superb value at £15.50

## REFLECTORPOD

3-way light banks with twin plug/socket complete with reflector lamps—attractive Bondene case with white front.

£15 each

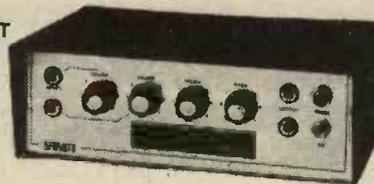
SPECIAL OFFER—Reflector lamps (spots) 100W Red/Blue Green £1.40 each or 10 for £12.

- Scintillating light display

## SYSTEM 7000 MINOTAUR

THE LITTLE AMPLIFIER WITH THE BIG HEART  
100W INTO 8Ω

- Twin mixed inputs
- Wide range bass and treble controls
- May be used as a slave amplifier
- Twin output sockets
- Two tone anodised front panel
- Fully protected against incorrect loads



With Bondene cover £49.00

£53.00 With Vynide covered wooden case

CHASSIS LOUDSPEAKERS 12in 50 watt high-grade Saxon units with 14,000 gauss magnet *plus* presence dome. ONLY £14.50 EACH Full range professional quality

Ask for a quotation for a complete system to your specification—Systems from £280; Consoles from £180

Bona-fide trade enquiries to:  
NORMAN ROSE ELECTRICAL LTD.—  
LONDON (01-837 8111); MANCHESTER (061-273 1498); BIRMINGHAM (021-238 4710); BRADFORD (0274 26104).

We have a fine selection of consoles, loudspeaker cabinets, etc., on demonstration at our Croydon showroom.



Access or Barclaycard?



Send or Telephone your number for prompt attention.

After 5p.m. ring 01-684 6385 for our Answerphone service

PRICES include carr. and packing but VAT at 8% must be added to all orders. C.O.D. 65p extra—S.A.E. all enquiries please. CALLERS are welcome at our showrooms at

327-333 Whitehorse Road, Croydon, Surrey CR0 2HS

Orders by post to the same address—Please make cheques or crossed P.O.'s payable to

# SAXON ENTERTAINMENTS LTD.

Telephone: 01-684 6385/0098

Shop Hours 9am-5pm (Lunch 12.30-1.30); Sat. 9.30am-5pm. Prices and specifications subject to alteration without notice

Mail Order desk 10am-4pm Mon.-Fri. VAT No. 218 6921 49 RGD ENGLAND 1091983

# COME AND SEE

*the latest in*

SOUND and VISUAL  
COMMUNICATIONS  
EQUIPMENT

*at the*

# SOUND 76

INTERNATIONAL  
EXHIBITION

16-18 MARCH 1976

BLOOMSBURY  
CENTRE HOTEL  
Coram Street  
Russell Square  
London WC1

10.00-18.00hrs daily

Admission Free

Organisers

THE ASSOCIATION  
OF PUBLIC ADDRESS  
ENGINEERS

47 Windsor Road, Slough, Berks.

Telephone: Slough 39455

## ELECTROLYTIC CAPACITOR OFFER

10000/63 £1-88	2200/40 30p	220/63 18p
10000/50 £1-50	1000/180 63p	180/25 9p
5000/70 78p	1000/40 25p	100/40 13p
5000/50 75p	1000/30 25p	100/12 7p
5000/35 50p	1000/25 25p	8/450 18p
5000/12 25p	470/63 23p	16/450 25p
3000/25 30p	470/35 20p	50/450 30p
2500/70 63p	330/100 30p	32+32/450 38p
2200/6.3 20p	250/64 20p	50/50 6p

Micro Switches (make or break) 33p  
Cable Ties 3p  
TOS Heat Sinks 13p  
Pot cores (14mm or 18mm), complete 40p  
180° Plastic Din Sockets 13p

DIGITAL I.C.s  
Large range of 7400 series in stock. Prices from 18p.

INTEGRATED AUDIO POWER AMPS.  
.20W RMS. 1 off £8-38, Stereo pair £11-95.  
.30W RMS 1 off £7-95, Stereo pair £14-80.  
.50W RMS 1 off £12-38, Stereo pair £22-78.  
50W RMS (40) amp. kits complete with building and application details. Suitable for instruments, disco, hi-fi, etc. £8-95.  
S.A.E. FOR DETAILS

ZN414 IC Radio, £1-20, 741 56p.  
IC sockets DIL, all 26p.  
Complete range of components held in stock.  
Resistors C.F. 0.5W and 0.25W, all 2p.  
Metal Oxide 0.5W, 5p.  
MYLAR Caps.:  
1nF, 2nF, 5nF, 6p; 10nF, 20nF, 30nF, 40nF, 47nF, 8p; 0.1µF, 0.2µF, 12p.  
C280, Polyester 250V:  
10nF, 22nF, 4p; 33nF, 47nF, 4p; 68nF, 5p; 0.1µF, 0.15µF, 5p; 0.22µF, 6p; 0.33µF, 9p; 0.47µF, 10p; 0.68µF, 14p; 1.0µF, 17p; 1.5µF, 25p; 2.2µF, 29p.  
1N4002 6p  
1N4003 6p  
1N4004 7p  
1N4005 8p  
1N4006 8p  
1N4007 9p  
1N4148 5p  
OA90 8p  
OA91 8p  
CRS1/40 89p  
CRS3/40 £1-08  
CRS7/40 £1-38  
CRS1/60 £1-25  
CRS7/60 £1-80  
40669 £1-18  
ZENER DIODES  
400mW 18p  
1 watt 18p

## SEMICONDUCTORS

AC141 57p	BC167 14p	BD124 97p	MJ3001 £2-80	2N3053 25p
AC142 42p	BC168 14p	BD131 52p	MJ4200 £5-88	2N3054 66p
AD161 62p	BC169 15p	BD132 64p	MJE2955 £1-48	2N3055 59p
AD162 62p	BC182 13p	BD135 56p	MJE3055 75p	2N3702-2N3711 14p
BC107 13p	BC212 16p	BD136 63p	TIP29A 69p	40361 55p
BC108 12p	BC301 32p	BFY50 23p	TIP30A 95p	40362 60p
BC109 18p	BC302 56p	BFY51 22p	TIP31A 87p	40406 55p
BC147 14p	BC303 37p	BFY52 24p	TIP32A 99p	40407 60p
BC148 12p	BCY70 18p	MJ481 £1-36	TIP42A £1-27	40408 43p
BC149 14p	BCY71 50p	MJ491 £1-52	TIP2955 £1-38	40409-40410 65p
BC157 14p	BCY72 16p	MJ2500 £2-75	TIP3055 75p	
BC158 12p	BD115 67p	MJ2501 £2-85		
BC159 12p	BD121 £1-48	MJ3000 £2-68		

ALL PRICES INCLUDE VAT  
P. & P. 25p on all orders. Hundreds of other types of semiconductors held in stock. S.A.E. with all inquiries.

# E B A

Elliott Blunt Audio Ltd

40 YORK STREET, TWICKENHAM, MIDDX.

Tel. 01-891 1692

Opening hours 9.30 a.m. to 6 p.m. Monday to Saturday

## Dimmit

range of light  
dimmers and lighting  
control systems

Illustrated is the popular PMSD1000 module. A 1kW slider control dimmer, interference suppressed, 60mm slider range size  $4\frac{1}{2} \times 2 \times 1\frac{1}{2}$ in. Ideal for low cost stage and disco lighting. Used by schools, theatres, studios, etc. Complete with scale plate, fixing screws and full instructions. £8-60 inc. VAT and postage and packing.

Complete compact light dimmer systems for stage, club and disco lighting, etc.

DD61M (illustrated). Six 1kW channels, six outlet sockets, master control, mains on/off switch, size  $23 \times 8\frac{1}{2} \times 5$ in. Price £108-00 inc. VAT.

DD61. As DD61M but without master control. Price £86-40 inc. VAT.

DD61-B. Six 1kW channels, using module PMSD1000, lowest cost system. Size  $16\frac{1}{2} \times 8 \times 5$ in. Price £54-00 inc. VAT.

DD62M. As DD61M but with six 2kW channels, size  $25 \times 10\frac{1}{2} \times 6$ in. Price £156-60 inc. VAT.

DD62. As DD62M but without master control. Price £129-60 inc. VAT.

Add £2-20 postage and packing for all systems.

The Dimmit range includes rotary and slider control dimmers and sound to light converters for home, entertainment and professional applications. Ratings 1kW, 2kW, 3kW.

All products are guaranteed and are supplied with full instructions and applications. Full after-sales service. Technical advice given.

For full information on all modules and lighting control systems send 15p for our illustrated catalogue and price list. Callers welcome, visit our showroom for a demonstration of any of the modules or systems. Mon.-Fri. 9.30 to 6.0 p.m. Sat. by arrangement.

**YOUNG ELECTRONICS LTD.**  
184 Royal College Street, London NW1 9NN Tel. 01-267 0201



# RADIO EXCHANGE LTD.

ALL PRICES INCLUDE VAT

## 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 Loud-speaker 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.
- 24 Resistors ● 21 Capacitors ● 10 Transistors ● 3 1/2" Loudspeaker ● Earpiece ● Mica Baseboard
- 3 1/2" Connectors ● 2 Volume Controls ● 2 Slider Switches ● 1 Tuning Condenser ● 3 Knobs
- Ready Wound MW/LW/SW Coils ● Ferrite Rod ● 6 1/2 yards of wire ● 1 yard of sleeving, etc

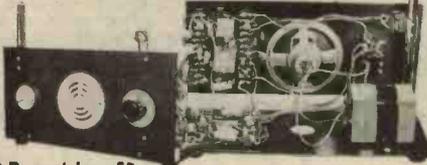
Complete kit of parts including construction plans

Total building costs **£9.99**  
P.P. and Ins. 65p

## ELECTRONIC CONSTRUCTION KITS

### E.C.K. 2 Self Contained Multi-Band V.H.F. Receiver Kit.

8 transistors and 3 diodes. Push pull output. 3in 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 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).

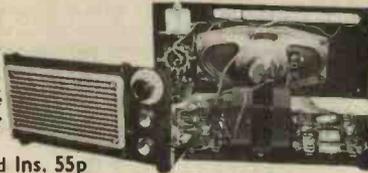


Complete kit of parts **£7.95** P.P. and Ins. 55p

INCLUDING CONSTRUCTION PLANS

### E.C.K. 4

7 transistors, 6 tuneable wavebands, MW, LW, Trawler Band, 3 Short Wave Bands. Receiver Kit. With 5in x 3in loudspeaker. Push pull output stage, gain control, and rotary switch. 7 transistors and 4 diodes. 6 section chrome-plated telescopic aerial. 8 in sensitive ready wound ferrite rod aerial, tuning capacitor, resistors, capacitors, etc. Operates from a 9 volt P.P. 7 battery (not supplied with kit).

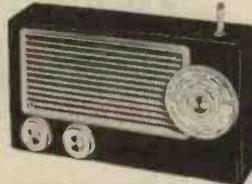


Complete kit of parts **£7.25** P.P. and Ins. 55p

INCLUDING CONSTRUCTION PLANS

## TRANS EIGHT

8 Transistors and 3 Diodes  
6 Tuneable wavebands: MW, LW, SW1, SW2, SW3 and trawler band. Sensitive ferrite rod aerial for MW and LW. Telescopic aerial for short waves. 3in speaker, 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts Size 9in x 5 1/2in x 2 1/2in approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker.



Complete kit of parts including construction plans.

Total building costs **£6.99** P.P. and Ins. 55p

(Overseas Seamail P. & P. £2.50)



## EDU-KIT

Build Radios, Amplifiers, etc.

Components include:  
Tuning condenser, 2 volume controls, 2 slider switches, fine tone 3in moving coil speaker, terminal strip, ferrite rod aerial, battery clips, 4 tag boards, 10 transistors, 4 diodes, resistors, capacitors, 3 1/2in knobs. Units once constructed are detachable from master unit, enabling them to be stored for future use. Ideal for schools, educational authorities and all those interested in radio construction.

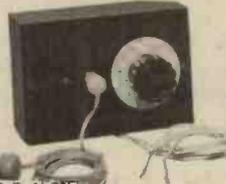
Five units to construct

Complete kit of parts including construction plans.  
Total building **£6.99** P.P. and Ins. 55p  
costs (Overseas Seamail P. & P. £3.40)

## NEW JIFFY TESTER

Easy to build and operate, fits in the pocket. A quick checker for continuity of resistors, chokes, diodes, transistors, circuit wiring (not mains) and loudspeakers.

Complete with earpiece, jack plug and socket resistors, capacitors, components, etc. Complete kit of parts including construction plans.  
Total building **£3.15**



P.P. and Ins. 30p  
(Overseas Seamail P. & P. £1.70)

## POCKET FIVE

3 tuneable wavebands. MW, LW and trawler band. 7 stages, 5 transistors and 2 diodes, super-sensitive ferrite rod aerial, attractive black and gold case. Size 5 1/2in x 1 1/2in x 3/4in approx.

Complete kit of parts including construction plans.  
Total building **£3.99** P.P. and Ins. 45p  
costs (Overseas Seamail P. & P. £2.30)



## V.H.F. 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.



Use 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. & Ins. 40p

## ROAMER TEN MARK 2

WITH VHF INCLUDING AIRCRAFT  
Now with free earpiece and switched socket. 10 transistors. Latest 5in x 3in 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 socket. 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 rich chestnut shade with gold blocking. Size 9in x 7 1/2in x 4in. Easy to follow instructions and diagrams.



Complete kit of parts including construction plans.

Total building **£11.87** P.P. & Ins. 65p

## RADIO EXCHANGE LTD.

To: RADIO EXCHANGE LTD.  
61A High Street  
Bedford MK40 1SA

Tel: 0234 52367, REG NO. 788372

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

I enclose £..... for

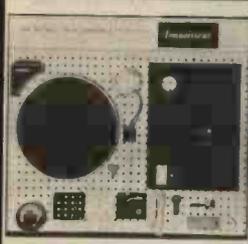
Name .....

Address .....

PE3



New from Connoisseur - BD3 Transcription Unit  
 With a studio style rising turntable giving accurate cueing. Run up time is only a fraction of a second.  
 Other important features include an external power source and consequently no hum field. A belt driven turntable with neon illuminated stroboscopic disc with 3 speeds, 33, 45 and 78 - all featuring variable control.  
 The BD3 arm is lightweight and incorporates a unique method of magnetic stabilisation with an interchangeable head shell tracking cartridges down to 0.6 grams.



*Connoisseur  
 Sound  
 Design*



The unit features brushed aluminium trim and is mounted on a matched wooden plinth complete with acrylic dust cover.  
**BD2 Turntable Assembly**  
 The famous BD2 belt drive turntable features push button speed change, an SAU2 pick up arm with damped lowering device, brushed aluminium trim, and specially designed turntable mat.  
 It is available in chassis form, or as illustrated mounted on a slimline wooden plinth, with acrylic cover which features an easy hinged on hinged off movement.



**BD1 Turntable Kit**  
 The BD1, well known for its excellent performance and superb quality is available in kit form, which allows greater freedom of choice for the practical enthusiast with regard to mounting, selection of arm etc. Construction is simplicity itself with no soldering required. Now it's easy to own the best.

**SAU2 Pick Up Arm**  
 Recognised as one of today's most advanced pick up arms. Among its star features is an Auto Bias compensator, hydraulic lowering device, precision balance and an adjustable head shell which can be matched to a wide variety of decks and pick up cartridges, ideal for the demanding practical audiophile.

For further details of all Connoisseur products, the BD3 or BD2, the BD1 kit or SAU2 arm, to the still popular SCU1 cartridge and our precision stylus balance, please contact your dealer or send a stamp for brochure.

Top left: The BD1 Turntable Kit.  
 Top: The SAU2 pick up arm.  
 Top right: The BD2 Turntable Assembly.  
 Right: The BD3 Transcription Unit.

**Connoisseur**

Manufactured by:-

A. R. Sugden & CO. (Engineers) Ltd, Atlas Mill Rd, Brighouse, Yorks, HD6 1ES  
 Tel: Brighouse (04847) 2142. Telegrams & Cables: Connoisseur, Brighouse.

**INVERTORS**



240v-50Hz from your 12v car battery.  
 25 watt—£4.20                      150 watt—£19.10  
 40 watt—£7.35                      300 watt (12v)—£29.85  
 75 watt—£10.71                      300 watt (24v)—£23.75

All above invertors are in kit form but may be purchased built up in metal case & ready for use. Price list sent on receipt of s.a.e. Prices include post & packing.

**P.W. AUTOMATIC EMERGENCY SUPPLY**

240v-50Hz-150 watt inverter with built in battery charger. In event of power failure switches over automatically from battery charging to inverter operation. Cct. as appeared in Dec. 72 P.W. Complete kit of parts (excluding meter) £22.50 + £1.10 p. & p.

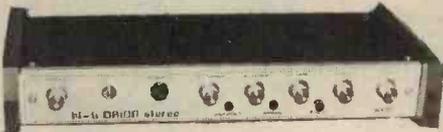
**FLOURESCENT LIGHT INVERTOR KIT**  
 8 watt-12v-Flourescent light, suitable for tents, caravans, houses, boats & secondary lighting for factories, hotels, etc.

12" - 8 watt—£2.90 + 25p p. & p. Built up—£4 + 25p.  
 21" - 13 watt—£3.30 + 30p p. & p. Built up—£4.50 + 30p.

**TRANSFORMERS & COILS**

Both high volume & small order capacity available.  
 Special offer. Miniature mains transformer 12-0-12v-6V.A.—85p plus 10p p. & p.  
 TRADE & EXPORT ENQUIRIES WELCOMED

**P.E. ORION STEREO AMPLIFIER**



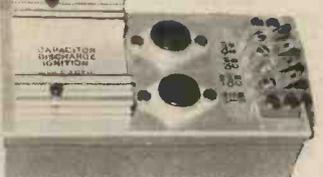
20 + 20 Watts r.m.s. into 8 ohm load. Distortion less than 0.01% 100Hz-10kHz. Frequency response ± 1dB 20 Hz to 20 kHz. Hum level virtually nil with vol. full on.

This is a power amplifier of superb quality incorporating the very latest design features. Professional hi-fi enthusiasts have classed it as fantastic and real value for money. The CCT incorporates a low flux transformer and inputs for disc, tape, tuner, etc.

Complete kit of parts including slim line bookend case, silk screened front panel & knobs. £43 incl. VAT & p. & p.

The bookend case, I.C.s & semiconductors, P.C. board, Transformer, etc. may be purchased separately if desired. Send S.A.E. for further information

**ASTRO IGNITION**



**ASTRO IGNITION SYSTEM**

Complete kit of parts for this proven and tested system £9.50 incl. VAT. Ready built with only two connections to alter £12.50 incl. VAT. Thousands have used this system both home and abroad. Consider these advantages more power, faster acceleration, fuel economy, excellent cold starting, smoother running, no contact breaker burning. Also because of the high energy spark, the fuel mixture can be made weaker giving further economy and fewer plug problems. Fitting time when built 5 minutes approx. Please state whether positive or negative earth. Trade and export enquiries welcomed.

**ASTRO ELECTRONICS**

Spring Bank road, West Park Chesterfield.

# Marshall's

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

Call in and see us 9-5.30 Mon-Fri 9-5.00 Sat

Trade and export enquiries welcome

Catalogue price 25p

## Top 500 Semiconductors from the Largest Range in the U.K.

2N456	0-80	Orange	0-12	2N5192	1-24	AF106	0-40	BC186	0-25	BF159	0-27	LOO5T1	1-50	OC35	0-60	
2N456A	0-85		2N5053	0-25	2N5195	1-46	AF109R	0-40	BC187	0-27	BF160	0-25	LM380	1-10	OC42	0-50
2N457A	1-00		2N5054	0-60	2N5245	0-47	AF114	0-35	BC207	0-12	BF163	0-32	LM381	2-20	OC45	0-32
2N480	4-20		2N5055	0-75	2N5294	0-48	AF115	0-35	BC208	0-11	BF166	0-40	LM702C	0-75	OC71	0-17
2N491	4-38		2N5390	0-45	2N5295	0-48	AF116	0-35	BC212K	0-16	BF167	0-25	LM709	0-90	OC72	0-25
2N492	5-00		2N5391	0-28	2N5296	0-48	AF117	0-35	BC212L	0-16	BF173	0-27	TO99	0-48	OC81	0-25
2N493	5-20		2N5391A	0-28	2N5298	0-50	AF118	0-35	BC214	0-18	BF177	0-29	8D1L	0-38	OC83	0-24
2N696	0-22		2N5392	0-15	2N5457	0-49	AF124	0-30	BC237	0-18	BF178	0-35	14D1L	0-40	ORP12	0-55
2N697	0-18		2N5393	0-15	2N5458	0-48	AF125	0-30	BC238	0-15	BF179	0-43	LM710	0-47	R53	1-80
2N698	0-82		2N5394	0-15	2N5459	0-49	AF126	0-28	BC239	0-15	BF180	0-35	LM723C	0-90	SL414A	1-60
2N699	0-58		2N5402	0-18	2N5492	0-58	AF127	0-28	BC251	0-25	BF181	0-38	LM741	0-38	SL610C	1-70
2N706	0-14		2N5403	0-19	2N5494	0-58	AF139	0-65	BC253	0-25	BF182	0-35	TO99	0-40	SL611C	1-70
2N706A	0-16		2N5414	0-20	2N5496	0-61	AF186	0-46	BC257	0-16	BF183	0-55	8D1L	0-40	SL612C	1-70
2N708	0-17		2N5415	0-21	2N5777	0-45	AF200	0-65	BC258	0-18	BF184	0-30	14D1L	0-38	SL620C	2-60
2N709	0-42		2N5415	0-24	2N6027	0-45	AF239	0-65	BC259	0-17	BF185	0-30	LM747	0-30	SL621C	2-60
2N711	0-50		2N5417	0-29	3N128	0-73	AF240	0-65	BC262	0-17	BF189	0-23	LM748	0-38	SL623	3-18
2N718	0-23		2N5440	0-59	3N139	1-42	AF279	0-70	BC262	0-23	BF195	0-12	8D1L	0-60	SL631	4-18
2N718A	0-28		2N5441	0-97	3N140	1-40	AF279	0-70	BC263	0-25	BF196	0-13	14D1L	0-73	SL641C	3-10
2N720	0-57		2N5442	1-40	3N141	0-81	AL102	1-00	BC300	0-38	BF197	0-15	LM3900	0-70	SN76003N	2-82
2N914	0-39		2N5638	0-15	3N200	2-49	AL103	1-00	BC301	0-34	BF198	0-18	LM7805	2-00	SN76013N	1-95
2N916	0-28		2N5638A	0-15	40361	0-40	BC107	0-14	BC302	0-29	BF200	0-40	LM7812	2-50	SN76023N	1-60
2N918	0-32		2N5639	0-27	40362	0-45	BC108	0-14	BC303	0-54	BF225J	0-23	LM7815	2-50	SN76033N	2-82
2N929	0-37		2N5641	0-17	40363	0-68	BC109	0-17	BC307	0-17	BF244	0-21	LM7824	2-50	ST2	0-20
2N930	0-21		2N5642	0-17	40364	0-68	BC110	0-15	BC308	0-15	BF245	0-45	TA28B3	1-10	TA28C3	1-10
2N1302	0-19		2N5703	0-13	40394	0-56	BC115	0-17	BC309C	0-20	BF246	0-58	MC1310	2-50	TA3300	1-80
2N1303	0-19		2N5704	0-15	40395	0-65	BC116	0-17	BC317	0-12	BF247	0-65	MC1330P	0-90	TA3350	1-80
2N1304	0-26		2N5705	0-16	40406	0-44	BC116A	0-38	BC318	0-12	BF254	0-19	MC1351P	0-60	TA5500	0-60
2N1305	0-24		2N5706	0-15	40407	0-35	BC117	0-21	BC327	0-20	BF255	0-19	MC1352P	0-80	TA6611C	2-10
2N1306	0-31		2N5707	0-18	40408	0-35	BC118	0-14	BC338	0-20	BF257	0-47	MC1466	3-50	TA6621	2-03
2N1307	0-30		2N5708	0-14	40409	0-52	BC119	0-29	BCY30	0-80	BF258	0-53	MC1489	2-75	TA6611B	1-32
2N1308	0-47		2N5709	0-15	40410	0-52	BC121	0-35	BCY31	0-85	BF259	0-55	ME0402	0-20	TA6641B	2-25
2N1309	0-47		2N5710	0-15	40411	2-00	BC125	0-16	BCY32	1-15	BF259	0-55	ME0404	0-13	TA6651	1-68
2N1671	1-54		2N5711	1-15	40594	0-74	BC126	0-23	BCY33	0-85	BF279	0-24	ME0412	0-18	TA8800	1-40
2N1671A	1-67		2N5712	1-20	40595	0-64	BC132	0-30	BCY34	0-79	BFS21A	2-30	ME4102	0-11	TA8810	1-40
2N1671B	1-85		2N5713	1-20	40601	0-67	BC134	0-13	BCY38	1-00	BFS28	1-36	ME4104	0-11	TA8820	1-15
2N1711	0-45		2N5714	1-38	40602	0-61	BC135	0-13	BCY39	1-50	BF581	0-27	MJ480	0-95	TA920	2-30
2N1907	5-50		2N5715	1-50	40603	0-17	BC136	0-17	BCY40	0-97	BF589	0-25	MJ481	1-20	TIL209	0-30
2N1202	0-60		2N5716	1-80	40604	0-56	BC137	0-17	BCY42	0-75	BF590	0-23	MJ482	1-45	TIP29A	0-48
2N1447	0-78		2N5717	2-20	40636	1-10	BC140	0-68	BCY58	0-30	BFX30	0-27	MJ491	1-25	TIP29C	0-80
2N1248	0-84		2N5772	1-60	40669	1-00	BC141	0-68	BCY59	0-32	BFX84	0-24	MJ2355	1-00	TIP30A	0-58
2N1260	0-90		2N5773	2-65	40673	0-73	BC142	0-23	BCY70	0-17	BFX85	0-30	MJ2360	0-48	TIP30C	0-85
2N2218A	0-22		2N5789	2-06	4C126	0-20	BC143	0-25	BCY71	0-22	BFX87	0-28	MJ2955	1-20	TIP31A	0-62
2N219	0-24		2N5790	2-40	4C127	0-20	BC147	0-14	BCY72	0-15	BFX88	0-25	MJ3055	0-75	TIP31C	1-00
2N219A	0-26		2N5791	2-35	4C128	0-20	BC148	0-18	BD115	0-75	BFX89	0-90	MJ3070	0-65	TIP32A	0-74
2N220	0-25		2N5792	2-60	4C129	0-27	BC149	0-15	BD116	0-75	BFY50	0-43	MJ3071	0-75	TIP32C	1-25
2N221	0-18		2N5794	0-24	4C152V	0-48	BC153	0-18	BD121	1-00	BFY51	0-23	MJ520	0-60	TIP33A	1-01
2N221A	0-21		2N5819	0-37	4C153	0-35	BC154	0-18	BD123	0-82	BFY52	0-21	MJ521	0-70	TIP33C	1-45
2N222	0-20		2N5820	0-64	4C153K	0-40	BC157	0-16	BD124	0-67	BFY53	0-18	MP811	0-32	TIP34A	1-51
2N222A	0-25		2N5823	0-78	4C154	0-25	BC158	0-18	BD131	0-40	BFY90	0-75	MP812	0-40	TIP34C	2-60
2N2366	0-25		2N5904	0-27	4C176	0-30	BC160	0-60	BD132	0-50	BRY39	0-38	MP813	0-47	TIP35A	2-90
2N2369	0-20		2N5906	0-27	4C176K	0-40	BC167B	0-15	BD135	0-45	BSX20	0-21	MPF102	0-39	TIP36A	3-70
2N2369A	0-22		2N5906	0-67	4C187K	0-35	BC168B	0-15	BD136	0-45	BSX21	0-28	MPSA05	0-58	TIP41A	0-78
2N2646	0-55		2N4037	0-42	4C188K	0-40	BC169C	0-15	BD137	0-55	BU104	2-00	MPSA06	0-31	TIP41C	1-40
2N2647	0-98		2N4058	0-18	4CY18	0-24	BC169B	0-15	BD138	0-63	BU105	2-25	MPSA12	0-35	TIP42A	0-90
2N2904	0-22		2N4059	0-15	4CY19	0-27	BC169C	0-15	BD139	0-71	C106D	0-65	MPSA55	0-28	TIP42C	1-60
2N2904A	0-24		2N4060	0-15	4CY20	0-22	BC170A	0-15	BD140	0-87	CA3018A	0-65	MPSA56	0-31	TIP49C	0-70
2N2905	0-25		2N4061	0-15	4CY21	0-26	BC171	0-16	BD529	0-60	CA3020A	1-80	MP5U05	0-65	TIP53	1-70
2N2905A	0-28		2N4062	0-15	4CY21	0-26	BC172	0-17	BD530	0-80	CA3028A	1-79	MPSU06	0-58	TIP2955	0-98
2N2906	0-19		2N4126	0-21	4CY30	0-58	BC177	0-26	BDY20	1-05	CA3035	1-37	MPSU55	0-63	TIP3055	0-50
2N2906A	0-21		2N4289	0-34	AD142	0-57	BC178	0-27	BF115	0-36	CA3046	0-70	MPSU56	0-60	TIV43	0-28
2N2907	0-22		2N4919	0-95	AD143	0-58	BC179	0-30	BF117	0-55	CA3048	2-11	NE555V	1-70	ZTX300	0-13
2N2907A	0-24		2N4920	1-10	AD149V	1-20	BC182	0-12	BF121	0-35	CA3052	1-62	NE556	1-30	ZTX301	0-13
2N2924	0-20		2N4921	0-35	AD150	1-15	BY182L	0-12	BF123	0-35	CA3089E	1-96	NE560	4-48	ZTX302	0-20
2N2925	0-20		2N4922	1-00	AD161	0-50	BC183	0-12	BF125	0-35	CA3090Q	4-23	NE561	4-48	ZTX303	0-15
2N2926	0-26		2N4923	1-00	AD162	0-50	BC183L	0-12	BF152	0-20	LM301A	0-88	NE565A	4-48	ZTX301	0-13
Green	0-12		2N5190	0-92	AD161	PR	BC184	0-13	BF153	0-25	LM308	2-50	OC23	1-35	ZTX502	0-18
Yellow	0-12		2N5191	0-96	AD162	PR	BC184L	0-13	BF154	0-20	LM309K	1-88	OC28	0-78	ZTX503	0-23

## MULLARD RADIO MODULES

RF/IF AMPLIFIER	
LP1173	£6-68
LP1181	£3-94
STEREO PREAMPLIFIER	
LP1183/2	£4-32
LP1184/2	£7-18
FM/IF AMPLIFIER	
LP1185	£5-56
FM TUNER	
LP1186	£6-88
LP1400	£7-22

## P.C. MARKER PEN DALO 33PC, 47p.

ZENER DIODES 400MW 11p, 1W 17p, 2.5W 35p.  
IC SOCKETS 8 DIL 10p, 14 DIL 14p, 16 DIL 13p.  
RESISTORS 1W 2p (100 per value 0-013p); 1/2W 3p (100 per value 0-10p).  
JUMBO 7 SEGMENT DISPLAYS £2-50.  
SCORPIO CAR IGNITION KIT £12-50.  
DL 707 £1-75.  
MINITRON £1-55.  
LEDs Red, Yellow, Green, 16 dia. 31p, 20 dia. 33p.

## SEE MARSHALLS FOR CMOS

CD4000 0-18	CD4018 0-88	CD4042 0-70
CD4001 0-18	CD4019 0-52	CD4043 0-83
CD4002 0-18	CD4020 0-80	CD4044 0-77
CD4006 0-89	CD4021 0-88	CD4045 1-30
CD4007 0-18	CD4022 0-85	CD4046 1-20
CD4008 0-82	CD4023 0-18	

# RTVC

# FOR SPEAKERS AT FANTASTIC REDUCTIONS

## ELIZABETHAN STEREO TUNER AMPLIFIER

This compact Tuner Amplifier gives you full medium wave and V.H.F. coverage and FM stereo. With inputs for your turntable and tape recorder. It has rotary tuning, Volume, Balance, Bass and Treble controls and push button selection switches for Phono/tape FM Stereo, FM mono, Medium wave and A.F.C. has built-in stereo beacon and switched headphone socket.

### Technical Specifications

15 transistors, 11

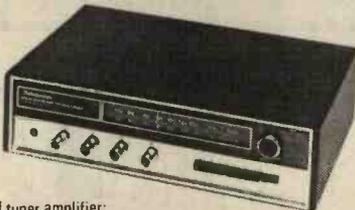
diodes, integrated circuit.

Power output 8 watts. Size of tuner amplifier:

4" x 10" x 15½" approx. Finished in selected rosewood

veneer with brushed aluminium front panel and matching controls. **£29.00**

+p & p £1.50



## SPECIAL OFFER

As above but with a BSR C123 Turntable in matching teak veneered plinth and a pair of 'Compact' easy to build speakers (see opposite panel).

**£39.00**

+p & p £3.00

## BSR DECKS WITH PLINTHS AT FANTASTIC REDUCTIONS



**MP60 TYPE (illustrated). £16.00**  
Leas Cartridge p & p £1.50

**C141 (not illustrated). Auto. £12.00**  
with cue fitted stereo cartridge p & p £1.50

**C123 (not illustrated). Auto. £10.00**  
with stereo crystal cartridge p & p £1.50

All Plinths finished in matching Teak veneer

# RTVC\*

## VISCOUNT IV STEREO SYSTEM

### System 1a. £69.00

The new 20+20 watt Stereo Amplifier incorporating the latest silicon transistor solid state circuitry, the RT-VC VISCOUNT IV gives you a powerful 20 watts RMS per channel into 8 ohms. Superb teak-finished cabinet, with anodised fascia to harmonise with any decor. Polished trim and knobs.

The VISCOUNT IV has a comprehensive range of controls - volume, bass, treble, balance, mono/stereo, mode selector, and scratch filter.

Front panel socket for stereo headphones. And a host of sockets at the rear - for left and right speakers, tape recorder, auxiliary, tuner, disc and microphone.

**SPECIFICATION:** 20 watts RMS per channel 40 watts peak. Suitable 8-15 ohms speakers. Total distortion @ 10 watts better than 0.2%. Six switched inputs: 1. Magnetic P.U. - 3 millivolts @ 47 K ohms (R.I.A.A.); 2. Crystal/ceramic P.U. - 50 millivolts @ 50 K ohms (R.I.A.A.); 3. 4. 6. Tape Tuner/Aux. - 140 millivolts @ 50 K ohms (flat frequency response); 5. Microphone - 3 millivolts @ 50 K ohms (flat frequency response).

**CONTROLS:** Push button ON/OFF, stereo/mono, scratch filter, 6 position rotary selector. Individual rotary controls for treble, bass, balance and volume. Headphone socket, tape out socket. Aux. mains output. Frequency response: 25 Hz to 25 KHz @ full rated output. Signal to noise ratio: better than -50 dB on all inputs. Tone control range: Bass ±15 dB @ 50 Hz; Treble ±12 dB @ 10 KHz. Power requirements: 200-250V A.C. mains @ 60 watts. Approx. size: 15½" x 3" x 10".

MP60 type deck with magnetic cartridge, de luxe plinth and cover.

Two Duo Type IIa matched speakers - enclosure size approx. 19½" x 10½" x 7½" in simulated teak. Drive unit 13" x 8" with 3" tweeter, 15 watts handling, 30 watts peak.

Complete System with these speakers **£69.00** + £6.50 p & p.

### System 2. £85.00

Viscount IV amplifier (As System 1a)  
MP60 type deck (As System 1a)

Two Duo Type III matched speakers

- Enclosure size approx. 27" x 13"

x 11½". Finished in teak simulate.

Drive units 13" x 8" bass driver, and

two 3" (approx.) tweeters, 20 watts

RMS, 8 ohms frequency range -

20 Hz to 18,000 Hz.

Complete System with these

speakers **£85.00** + £7.60 p & p.

### PRICES: SYSTEM 1a

Viscount IV R103

amplifier £27.50 + £1.90 p & p.

2 Duo Type IIa

speakers £30.00 + £6.50 p & p.

MP60 type deck with Mag. cartridge

de luxe plinth

and cover £22.00 + £3.30 p & p.

Total if purchased

separately: £79.50

Available complete for only: **£69.00**

+ £8.50 p & p.

### PRICES: SYSTEM 2

Viscount IV R103

amplifier £27.50 + £1.90 p & p.

2 Duo Type III

speakers £46.00 + £7.50 p & p.

MP60 type deck with Mag. cartridge

de luxe plinth

and cover £22.00 + £3.30 p & p.

Total if purchased

separately: £95.50

Available complete for only: **£85.00**

+ £7.60 p & p.



**20x20 SYSTEM**

Scotland and the Orkneys P & P Surcharge  
System 1a £1.75 System 2 £3.50



## THE 'COMPACT'

### EASY BUILD SPEAKER KIT

A compact bookshelf speaker system giving a high electro acoustic efficiency for the low powered amplifier.

The professional finish can be obtained with the minimum of tools, the infinite baffle type enclosures come ready mired and professionally finished, simply apply glue, fold up around baffle board, and fix together with masking tape till glue dries.

The cabinet measures 12"x9"x5" deep approx finished in simulated teak, incorporating a quality 7"x4" elliptical speaker, power handling 4 watts, flux density 30,000 maxwells, impedance 8-15 ohms nominal, voice coil dia ¾" magnet size 2½" approx.



**£6.00**

pair inclusive, P & P £1.70

## EASY TO BUILD SPEAKER KITS

These superb simulated teak-finished speaker kits have been specially designed by RT-VC for the cost-conscious hi-fi enthusiast who wants top quality speakers but

doesn't want to spend the earth. Built to EMI's exacting specification, these new RT-VC speaker kits (350 type kit) incorporate 13" x 8" woofer, 3½" tweeter and matching crossover.

Easily put together with just a few basic tools.

**Specification (each speaker):** Impedance 8 ohms.

Power handling 15 watts RMS (30 watts peak).

Response 20-20,000 Hz. Size 20" x 11" x 9½"

approx. Comparable built units (EMI LE3) sold else-

where for over £45 pair.

**£22.00 pair complete** + £5.20 p & p.

Complete with crossover Components and circuit diagram



## EMI 350 KIT

**£7.25** + £1.20 p & p.

Complete with crossover

Components and circuit

diagram

System consists of a 13" x 8" approx. woofer with a 3" tweeter, crossover components and circuit diagram. Frequency response: 20 Hz to 20 KHz. Power handling 15 watts RMS into 8 ohms. (Peak 30 watts.)

## PUSH BUTTON CAR RADIO KIT- THE TOURIST TT\*



**NO SOLDERING REQUIRED**

**NOW BUILD YOUR OWN PUSH BUTTON CAR RADIO** +£1.05 p & p.  
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 4½" deep approx.

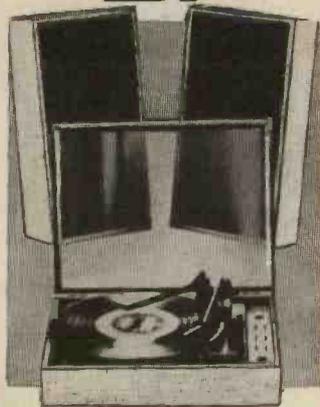
Speaker including baffle and fixing strip £2.00 +45p p & p. Car Aerial Recommended - fully retractable £1.80+40p p & p.  
The Tourist 1 Kit For the experienced constructor. If you can solder on a printed circuit board you can build this model. Same technical specification as Tourist TT. **Price £8.20+£1.05 p & p.**

## SPECIAL OFFER

The Tourist 1 Kit, same specification as Tourist TT complete with speakers, fixing kit and fully retractable aerial.

**£10.50** + p & p £1.50

## \*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" x 8" x 4". Complete deck and cover in closed position approx. 15½" x 12" x 6".

**Complete only £23.20** +£3.00 p & p.

Extras if required. Optional Diamond Stylus £1.80. 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" x 8" x 3½".

**£20.00** +£1.35 p & p.

## 8 TRACK HOME CARTRIDGE PLAYER



Yours for only

**£16.20** +£1.70 p & p.

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

## SPECIAL OFFER

As above but complete with build yourself Unisound Amplifier Kit (see opposite panel) + 2 'Compact' easy to build speaker kits (see opposite page).

**£25.00** + p & p £2.00

## BUILD YOUR OWN STEREO AMPLIFIER\*

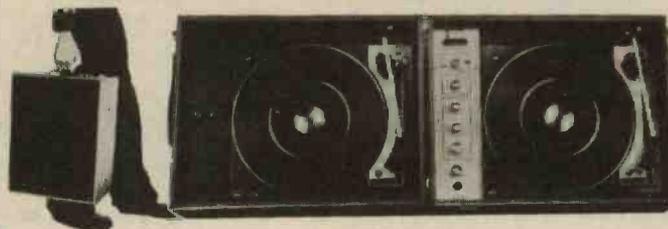


For the man who wants to design his own stereo - here's your chance to start, with Unisound - pre-amp, power amplifier and control panel. No soldering - just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic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

**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. MP80 type single play professional series decks, fitted with crystal cartridges.

## PORTABLE DISCO CONSOLE\*



### 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 keeley 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 - 17½" x 13½" x 8½" (app.)  
Unit Open - 35½" x 13½" x 4½" (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

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 Jan. 1976 and subject to change without notice.

\* Minimum order on ACCESS/BARCLAYCARD-£11.



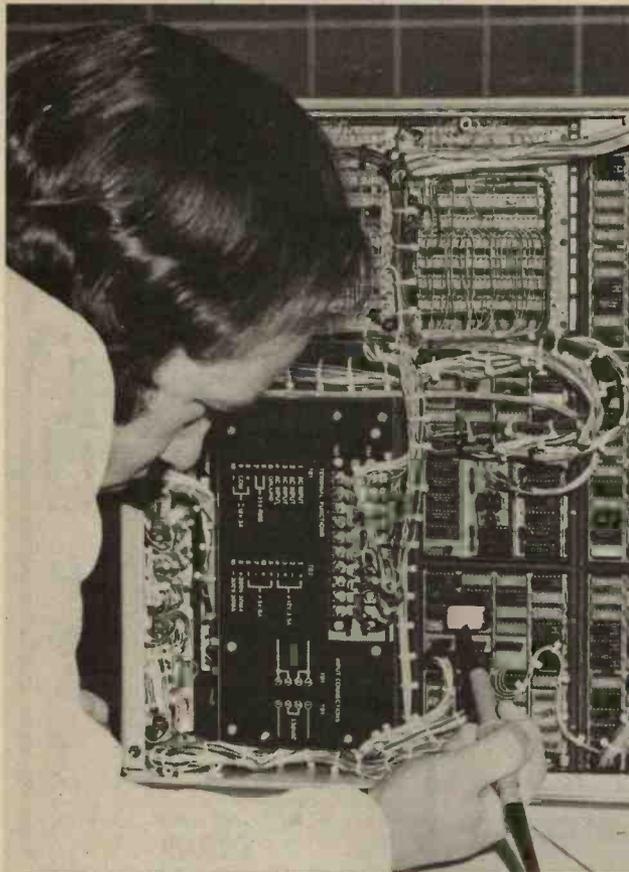
**DO NOT SEND CARD**

Just write your order giving your credit card number



21D 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.



# This hobby brings big rewards.

A soldering iron and a screwdriver. If you know how to use them, or at least know one end from the other, you know enough to enrol in our unique home electronics course.

This new style course will enable anyone to have a real understanding of electronics by a modern, practical and visual method. No previous knowledge is required, no maths, and an absolute minimum of theory.

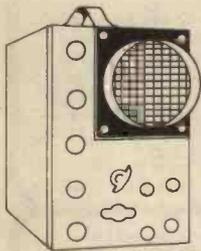
You build, see and learn as, step by step, we take you through all the fundamentals of electronics and show you how easily the subject can be mastered and add a new dimension not only to your hobby but also to your earning capacity.

All the training can be carried out in the comfort of your own home and at your own pace. A tutor is available to whom you can write, at any time, for advice or help during your work. A Certificate is given at the end of every course.

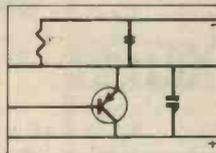
## 1

### Build an oscilloscope.

As the first stage of your training, you actually build your own Cathode ray oscilloscope! This is no toy, but a test instrument that you will need not only for the course's practical experiments, but also later if you decide to develop your knowledge and enter the profession. It remains your property and represents a very large saving over buying a similar piece of essential equipment.



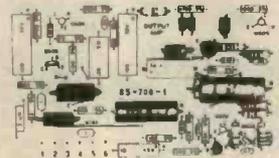
## 2



### Read, draw and understand circuit diagrams.

In a short time you will be able to read and draw circuit diagrams, understand the very fundamentals of television, radio, computers and countless other electronic devices and their servicing procedures.

## 3



### Carry out over 40 experiments on basic circuits.

We show you how to conduct experiments on a wide variety of different circuits and turn the information gained into a working knowledge of testing, servicing and maintaining all types of electronic equipment, radio, t.v. etc.

To find out more about how to learn electronics in a new, exciting and absorbing way, just clip the coupon for a free colour brochure and full details of enrolment.

## PLUS FREE GIFT!



ALL STUDENTS ENROLLING IN OUR COURSES RECEIVE A FREE CIRCUIT BOARD ORIGINATING FROM A COMPUTER AND CONTAINING MANY DIFFERENT COMPONENTS THAT CAN BE USED IN EXPERIMENTS AND PROVIDE AN EXCELLENT EXAMPLE OF CURRENT ELECTRONIC PRACTICE

Brochure without obligation to:  
**BRITISH NATIONAL RADIO  
 & ELECTRONICS SCHOOL**, Dept. EL26  
 P.O. Box 156, Jersey, Channel Islands

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

(Block caps please)

## THE OLD ORDER CHANGETH

IT IS the nature of some changes to hurt a bit and strike at established traditions; even so in electronics. In the good old days an electronic circuit was a circuit, and was seen to be so! It could be analysed quite easily, from input to output, every part recognizable and its function readily determined. Now we frequently have to content ourselves with the knowledge of the overall function of some circuit or portion thereof, and remain in ignorance of the precise manner by which particular functions are achieved.

Anyone returning to electronics after a few years abstinence must be considerably shaken when they first encounter some of today's circuit diagrams, with those frequent blank and anonymous areas bearing little more than the legend "IC1" *et seq.* Yet there is nothing that really need alarm the more traditionally minded enthusiast and constructor—or for that matter, the beginner.

Electronics is a changing world, that it would be idle to deny. The home constructor certainly has to be more selective in the kind of projects he tackles, that is one major change which has come about in this field. It is patent that some projects are no longer truly viable in home constructor terms—for practical or economic reasons. The pocket calculator gave the first example of the great commercial possibilities of large scale circuit integration when applied to mass production of a piece of equipment for the consumer market. Very quickly it became obvious that the home constructor had little to gain from attempting to build a calculator for himself; in any event the nature of things decreed that, in nine out of ten cases, a manufacturer's kit would have to be resorted to. Thereupon, it became an assembly job rather than a bonafide constructor job. No technical knowledge was necessary nor was it likely to be acquired during the process of assembling such a kit. On the credit side, the skill of the constructor in handling microscopic devices and in performing extremely delicate soldering operations was put to the test. If he came through this with flying colours, the completed instrument was living proof of his competence which could be overtly paraded before wondering and admiring friends.

Today, the foregoing could be said to apply to the digital wristwatch—but even more so. With this latest example of microelectronics in the consumer market, the scale of operations is further reduced and the degree of dexterity demanded of the assembler must therefore be correspondingly greater.

One thing that never changes is the fascination generated by the new and novel. That first digital wristwatch, like that very first radio of old, simply *has* to be built: for the experience, for the fun, for the very sense of personal achievement. For some it is an irresistible challenge. Often it is a form of baptism, since for some, assembling a kit could be their first real practical involvement with electronics. But they must not confuse kit assembly with normal constructing activities which embrace an infinite variety of projects—with or without the use of i.c.s. They should realise that many typical constructor projects have no commercial counterpart and that remains, in spite of other changes, one of the great advantages and rewards of this hobby.

F.E.B.

### Editor

F. E. BENNETT

### Editorial

D. BARRINGTON *Production Editor*  
G. GODBOLD *Technical Editor*  
R. W. LAWRENCE, B.Sc.

### Art Dept.

J. D. POUNTNEY *Art Editor*  
D. J. GOODING  
R. J. GOODMAN  
K. A. WOODRUFF

### Editorial Offices:

Fleetway House, Farringdon St.  
London EC4A 4AD  
Phone: 01-634 4452

### Advertisement Manager

D. W. B. TILLEARD  
Phone: 01-261 5148

### P. J. MEW

Phone: 01-261 5190

### C. R. BROWN *Classified*

Phone: 01-261 5000

### Advertising Offices:

King's Reach Tower, Stamford St.  
London SE1 9LS  
Phone: 01-261 5000

**T**HE Synchronome is an accented beat metronome which can provide duple, triple and quadruple times at the turn of a switch. It utilises six TTL integrated circuits plus a few discrete components. The unit is completely self contained and may be driven by battery or mains.

### MAELZEL'S METRONOME

The mechanical metronome has been in existence virtually unchanged since the eighteenth century. The original design was the brainchild of Maelzel (1772-1828) and to this day such indications at the head of a piece of music as M.M. = 100 mean that the crotchet beat should be taken as the speed of Maelzel's metronome set to 100 beats/minute.

Whilst there is no dispute with the ability of the metronome to perform its function reliably there is still, however, room for improvement.

The basic metronome provides only beats. A more expensive refinement is the one that provides accented timing so that a bell operates on every second, third or fourth beat.

Whilst the purist or traditionalist may scorn the use of an electronic device to do the job the mechanical metronome has done since the time of Beethoven, the Synchronome offers an advanced design to bring musical tempo into the twentieth century.

### OPERATION

The complete block diagram is shown in Fig. 1. The timing source is an oscillator running at one hundred times its required speed so that a degree of stability can be maintained. The square wave output is divided by the necessary factor of one hundred and fed at its correct rate to a monostable

We would like to thank Chappel's of New Bond St for the use of the metronome shown on this and the front cover pages

# synchronome

By A. BRIAR



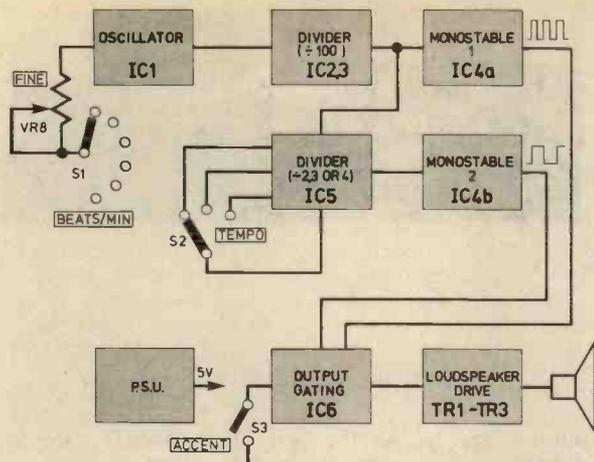


Fig. 1. Block circuit of Synchronome

circuit (Monostable 1). This will give an output pulse of predetermined duration every time it is triggered by a positive transition. The output is fed to the loudspeaker drive circuit via a gating arrangement (which will have no effect on the pulse until accented timing is selected).

The output of the main divider circuit is also fed to a further divider chain. This circuit will divide the signal by a further factor of two or three or four in conjunction with a gate dependent upon the position of the "Tempo" selection switch. The

reset output of the gate to the divider is also fed to a second mono (Monostable 2) which has a much wider pulse width than the first. Now, if "Accent" is selected, then this wider pulse (when present) inhibits the narrow pulse from the first mono and routes itself instead to the loudspeaker drive circuit.

The loudspeaker drive circuit converts the square wave inputs to it to current pulses which pass through the speaker itself.

### CIRCUIT

The full circuit is shown in Fig. 2. 74 series TTL has been used for all the integrated circuits in the Synchronome for simplicity.

The oscillator uses a 7413 Schmitt trigger with six switched ranges which are all independently variable; in addition, there is a fine frequency adjustable resistor which can vary the speed incrementally on any range. The frequency of oscillation is dictated by capacity and the total feedback resistance.

The oscillator output is fed to two conventional 7490 divider circuits to obtain the final division by one hundred. The reset inputs to the 7490s are held to the logical low state to ensure that the correct sequence is obtained.

A single chip, the 74123 dual retriggerable monostable is used for generating both the narrow and wide pulses. The output pulse width is a function of the timing capacitor and resistor for each stage. Ideally, the timing resistor should be in the range 5-50 kilohms though these values are not over critical in this application.

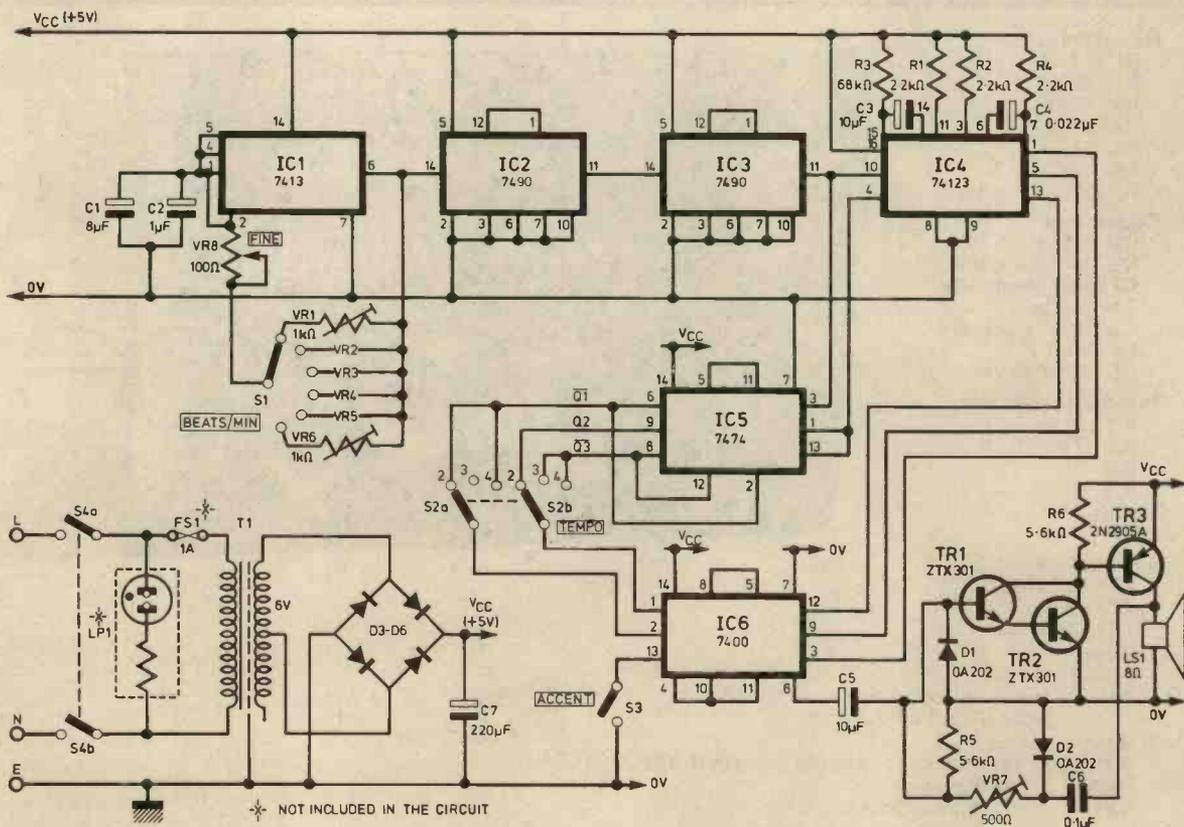
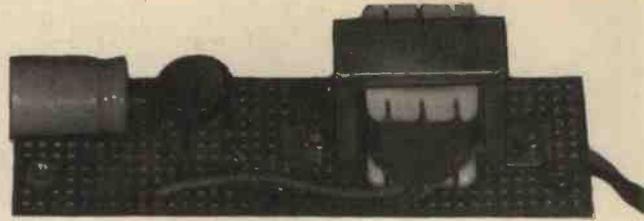


Fig. 2. Complete circuit



## ACCENT SELECTION

The chip used here is the 7474 dual D type flip flop; however, the configuration may seem slightly strange to some readers. Since it is required to use these flip-flops as a divider circuit rather than as a conventional latch (which would be their normal function) each of the flip-flops needs to be "back primed" by feeding the NOT Q output back to the D input. In so doing, the 7474 will act as a counter provided that the input is fed in as the clock pulse. The Q and NOT Q outputs of each stage are fed to the "Accent" selection switch so that duple, triple or quadruple time may be selected. The selected

outputs are fed to the two input NAND gate to provide the reset pulse for both flip flops.

The negative reset pulse is also fed to the 74123 to generate the wider accent pulse.

## OUTPUT GATING

If "Accent" is switched off then the 7400 enables the narrow pulse from the 74123 to reach the loudspeaker driver stage and also inhibits the wide pulse from getting through. When "Accent" is selected then the 7400 will inhibit the narrow pulse and substitutes the wide pulse to the loudspeaker drive circuit.

## COMPONENTS ...

### Resistors

- R1 2.2k $\Omega$
- R2 2.2k $\Omega$
- R3 68k $\Omega$
- R4 2.2k $\Omega$
- R5 5.6k $\Omega$
- R6 5.6k $\Omega$
- All  $\frac{1}{4}$ W carbon

### Capacitors

- C1 8 $\mu$ F elect. 10V
- C2 1 $\mu$ F elect. 10V
- C3 10 $\mu$ F elect. 10V
- C4 0.022 $\mu$ F
- C5 10 $\mu$ F elect. 25V
- C6 0.1 $\mu$ F
- C7 220 $\mu$ F 25V

### Integrated circuits

- IC1 7413
- IC2 7490
- IC3 7490
- IC4 74123
- IC5 7474
- IC6 7400

### Transistors

- TR1 ZTX301
- TR2 ZTX301
- TR3 2N2905A

### Diodes

- D1-D2 OA202
- D3-D6 Mains silicon bridge rectifier (1A p.c type) (R.S. Components)

### Potentiometers

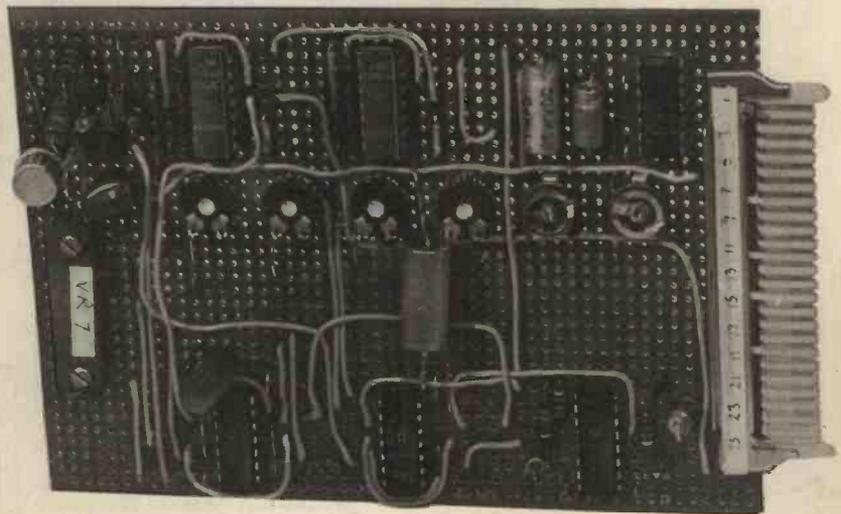
- VR1-VR6 1k $\Omega$  miniature skeleton presets (6 off)
- VR7 500 $\Omega$  trimpot
- VR8 100 $\Omega$  linear potentiometer

### Loudspeaker

- LS1 8 $\Omega$ , 2in miniature loudspeaker

### Switches

- S1
- S2 4-pole 3-way
- S3



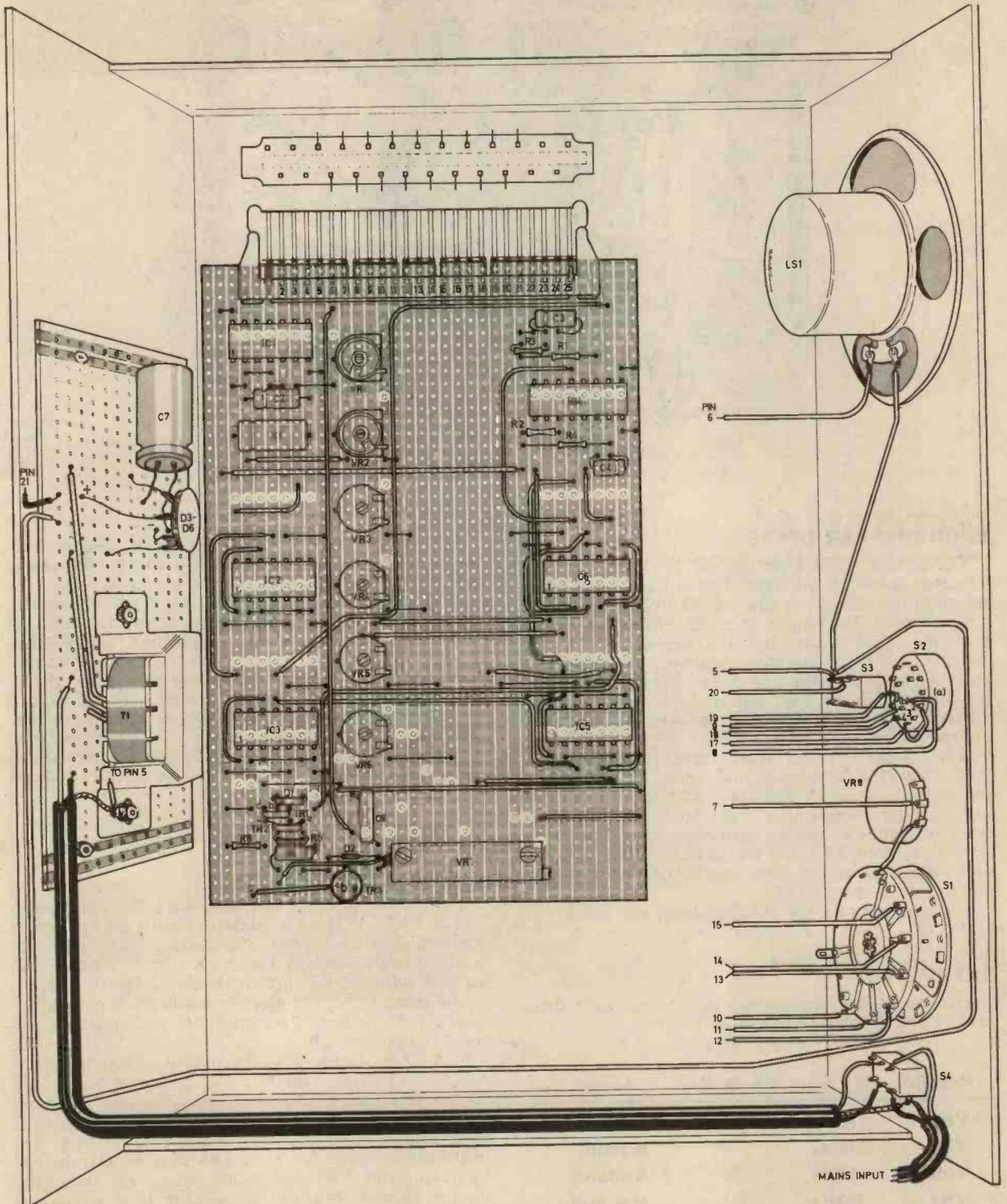
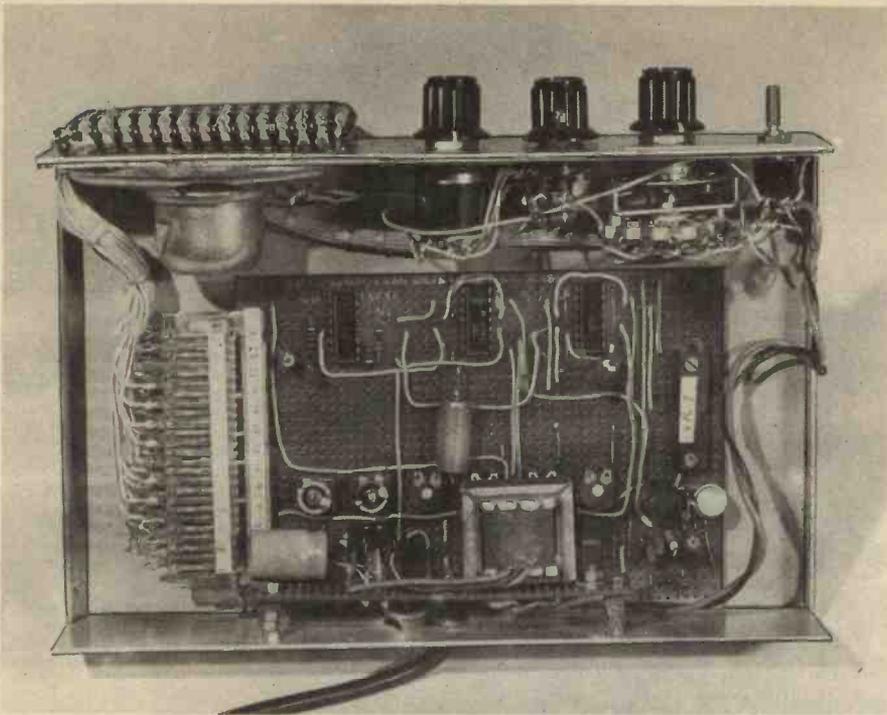


Fig. 3. Wiring details of Synchronome



## LOUDSPEAKER DRIVE

The square wave input to the loudspeaker drive circuit is fed via a differentiating circuit to TR1 and the negative transitions are cut off by D1. TR1 and TR2 form a Darlington pair to drive the output transistor TR3 which has the loudspeaker as its collector load. In addition, feedback is introduced via VR7 and the setting of this is given in the initial adjustment but its function is to enable sufficient current drive to reach the speaker to give the desired sound.

If a speaker greater than about three inches is used then the complete unit may be run quite successfully by a 6V battery. The prototype ran for six hours continually from four HP7 batteries but, by using a smaller speaker, more current is needed through TR3 and the speaker to achieve the same effect. It is for these applications that a 5V power supply is required.

Assembly details for the Synchromome are given in Fig. 3.

## SETTING UP

The six ranges can be set up to suit individual needs but a suggested set is given below:

Resistor	Osc Freq	Beats Min	Name
VR1	83Hz	50	Largo
VR2	117Hz	70	Adagio
VR3	150Hz	90	Andante
VR4	192Hz	115	Moderato
VR5	240Hz	144	Allegro
VR6	313Hz	188	Presto

These ranges are flexible to a certain degree but by operation of the fine frequency control the exact rate for the individual user can be obtained.

It is important to note that when the individual ranges are being set up, the fine frequency control VR8 should be set at its mid-position. Ideally the oscillator should be set up using a frequency counter or an oscilloscope but, should neither of these be available, then the output circuit may be set up first and then the individual ranges adjusted using a watch with a second hand. If this latter method is adopted then it is advisable to finally check each range over a period of about two minutes to ensure a degree of accuracy.

## OUTPUT CIRCUIT

For setting up the output circuit the only control is VR7. With the "Accent" switch on the "off" position adjust VR7 until the correct clicking sound is heard in the loudspeaker. Now switch "Accent" to on and adjust VR7 until a distinctly lower, longer sound is heard on the appropriate beat. When satisfied, check the sound on the other two positions of the "Tempo" switch.

If VR7 is set too low, the output circuit will self oscillate on every input pulse giving a series of loud whines, so ensure that VR7 is set to its mid-position initially. When using a loudspeaker greater than about three inches a double click may be heard on the accented beat. This may be eliminated by taking out VR7 altogether but to get sufficient output current through the speaker it is advisable to keep some positive feedback so that a fixed resistor of about 1.5 kilohms should be inserted in place of VR7. ★



# PEAK LEVEL INDICATOR

By J. T. TIERNAN

*A stereo add-on unit for better tape recording*

**T**O THE inveterate hi-fi hobbyist the steady flow of circuit designs in the many hi-fi and electronics magazines is a source of constant pleasure and interest, but, by the very nature of such things, it is unlikely that the design fits your requirements to a tee. More often than not you find yourself wanting to combine specific sections of different designs into a single unit, and whilst the modular nature of many recent designs makes this none too difficult, there can, obviously, be problems.

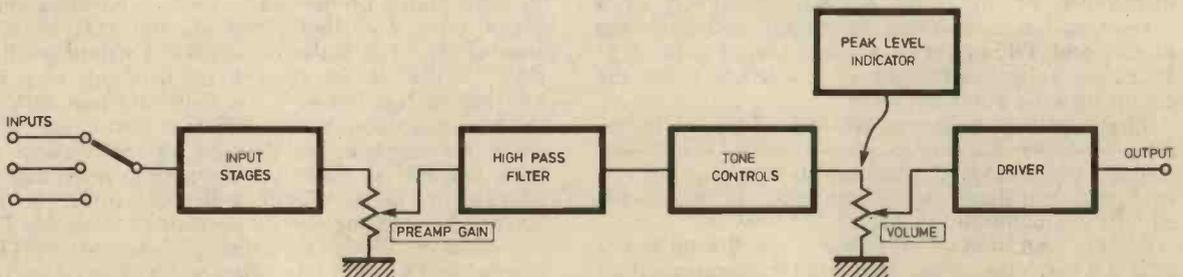
One particular source of concern relates to the matching of signal input and output levels between different circuits or complete equipments. Problems of this nature are often more apparent than real, but the dynamic conditions of designs which involve frequency conscious networks: pick-up preamplifiers, tone controls, and, particularly, steep cut filters,

can be difficult to determine, and their characteristics can change beyond recognition when driven at, or near, overload level.

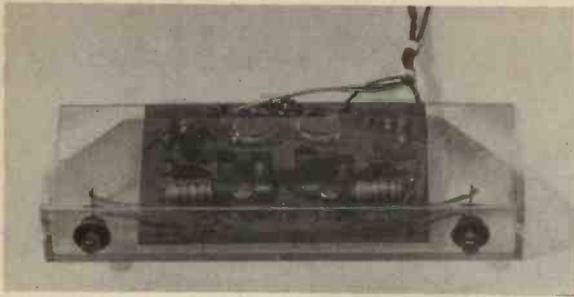
It was with such worries in mind that this simple, but effective, peak level indicator was designed. In its original form it is incorporated in an audio pre-amplifier, set to indicate signal levels 6dB below output clipping, and it has given sterling service for several months. The overall arrangement of the preamp functions and the position of the indicator is shown in Fig. 1.

The design has an obvious application in tape recorders, as a recording level indicator; and, with a calibrated input attenuator, it could give service as a compact a.c. voltmeter or signal detector.

For the purpose of this article a stereo indicator has been made up as a separate unit.



**Fig. 1. Block diagram of a typical audio preamplifier showing the suggested connection point for peak level indicator**



## PERFORMANCE

The unit has a fast attack/slow decay response and will activate an l.e.d. indicator when the input threshold level is exceeded. With the component values specified its performance is as follows:

Input Sensitivity (max) 500mV  
 Threshold Discrimination < 1% (5mV @ 400mV RMS 1kHz sine wave input)

LED Active Period 20mS (10μs transient input)

Fig. 2 illustrates the test conditions.

The 10μs input pulse represents a 50kHz audio transient, demonstrating a bandwidth capability well in excess of that needed for audio applications; and a 20ms l.e.d. output pulse has excellent visual impact.

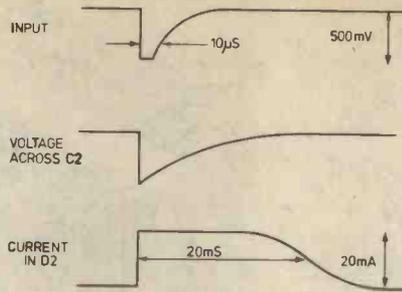


Fig. 2(a). Diagram illustrating threshold discrimination

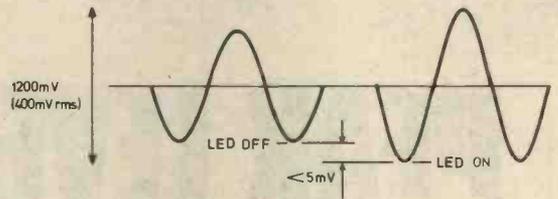


Fig. 2(b). Diagram showing transient response of the peak level indicator

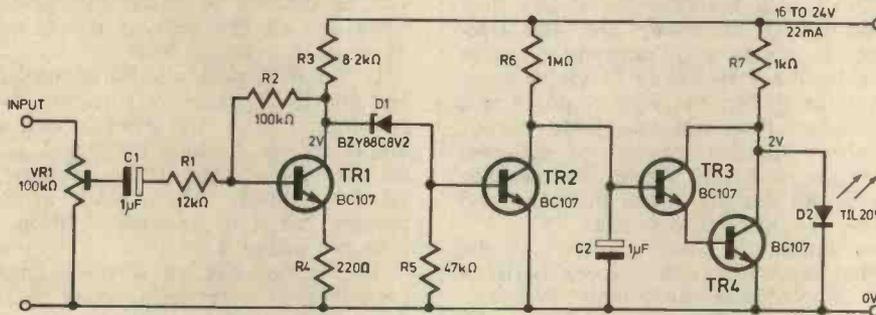


Fig. 3. Circuit diagram of the mono version of the peak level indicator

## CIRCUIT DESCRIPTION

The circuit of a single channel peak level meter is shown in Fig. 3. TR1 is a conventional amplifier stage, biased near to saturation, with gain largely determined by the ratio R2/R1. TR2 acts as a current switch, controlling the charge and discharge of C2; and TR3/4 forms a high current gain stage acting as a bypass for the l.e.d. current when the circuit is in the quiescent state.

The bypass arrangement has been adopted to ensure a steady current is drawn from the power supply, whatever the circuit's state, and thus no switching transients are transferred to associated circuits via (common) power supply lines.

Circuit operation is as follows: In the quiescent state TR1 is fully conducting with its collector sitting at about 2V, and, because of the Zener diode (D1) coupling, TR2's base is effectively grounded. TR2 is passing no current and C2 (1μF tantalum) will

have acquired a positive charge via the 1MΩ collector load of TR2.

The Darlington connected transistors TR3/4 are forward biased by the charge on C2 and draw about 20mA from the supply rail via the 1kΩ collector resistor R7. The collector of TR4 is sitting at about 0.5V, which is insufficient to forward bias D2, and the voltage across C2 is held at about 1.1V by the base-emitter voltages of TR3/4.

On the negative portion of an input cycle the base current in TR1 will fall, and, provided the subsequent rise of TR1's collector voltage is sufficient to overcome the Zener diode threshold, TR2 will conduct. C2 is very quickly discharged by TR2; current in TR3/4 is immediately cut off; and current through R7 is diverted to D2 which lights up.

continued on page 240

# PEAK LEVEL INDICATOR

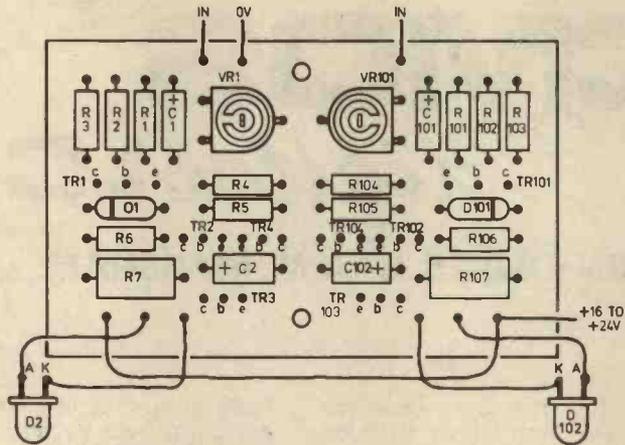


Fig. 4(a). Layout of the components of the printed circuit board. For a mono version the board can be split down the middle and only half used

## COMPONENTS...

### Resistors

R1 12k $\Omega$	R5 47k $\Omega$
R2 100k $\Omega$	R6 1M $\Omega$
R3 8.2k $\Omega$	R7 1k $\Omega$ $\frac{1}{2}$ W $\pm$ 10% carbon
R4 220 $\Omega$	
All $\frac{1}{4}$ W $\pm$ 5% carbon film except R7	

### Potentiometer

VR1 100k $\Omega$  sub miniature horizontal preset

### Capacitors

C1 1 $\mu$ F 16V tantalum  
C2 1 $\mu$ F 35V tantalum

### Semiconductors

TR1-TR4 BC107C (4 off)  
D1 BZY88C 8V2 8.2V 400mW Zener  
D2 TIL209 light emitting diode

For a stereo version twice the number of components specified above are required

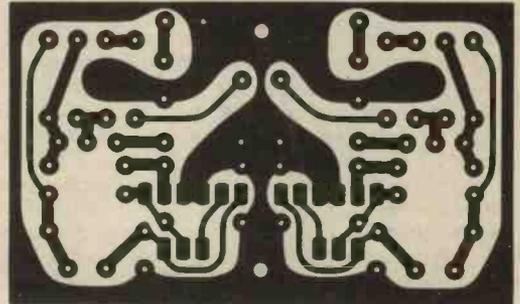
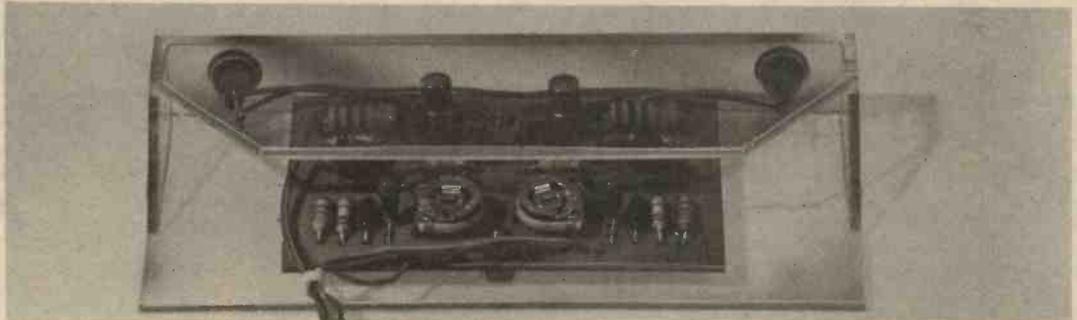


Fig. 4(b). Full size printed circuit master of the peak level indicator

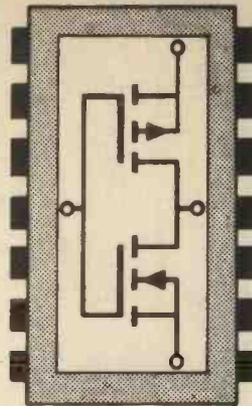


The completed stereo peak level indicator mounted on a piece of cassette tape case

# Using

# CMOS

## digital I.C.s



By **D.B. JOHNSON-DAVIES & A.M. MARSHALL** B.A.

### PART 3

**T**HE previous parts in this series have described the basic building-blocks from which all CMOS devices are constructed—the complementary MOSFET pair and the transmission gate.

This part will cover the range of gate packages available in CMOS.

#### LOGIC GATES

The two basic types of gate in the CMOS family are the NOR and NAND, and these two functions have the added advantage that spare gates can be used as inverters in linear applications. However, it is often the case that the design of a circuit will be greatly simplified by resorting to other functions, and so a full list of the types available is given in Table 3.1, with the pin diagrams in Fig. 3.1. Note that the supply pins are always conveniently placed at opposite corners of the package.

Worthy of mention are the two special gate packages shown in Fig. 3.1(e) and (f). The 4501 contains two 4-input NAND gates and a 2-input NOR gate with true/complement output. By making the connections shown dotted in Fig. 3.1(e) the gate will

work as an 8-input NAND or AND gate with the output taken from pin 15 or 14 respectively. Note that pin 14 should not be used as an input to the inverter. The 4572 contains 4 inverters, a 2-input NOR gate and a 2-input NAND gate, making it possible to construct any 2<sup>n</sup> or 3-input function.

#### INVERTERS AND BUFFERS

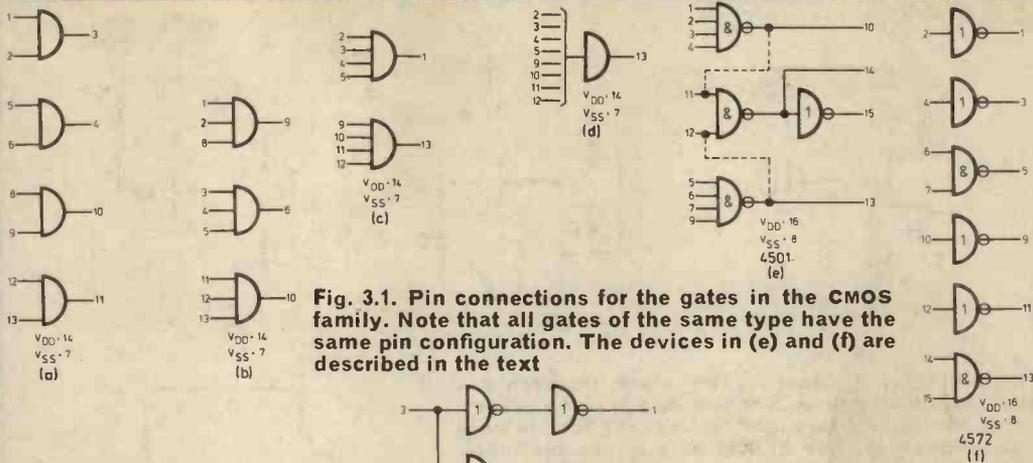
The various types of inverter and buffer packages available are shown in Fig. 3.2. The 4069 is a standard unbuffered hex-inverter for use where buffering is not needed, or where it would lead to excessive power dissipation in some linear applications. The other types shown all have high-current buffered outputs, and are useful for driving displays or other logic families.

The two basic buffers are the 4049 hex inverting type and the 4050 hex non-inverting type. On these devices the V<sub>CC</sub> terminal can be at any voltage up to V<sub>DD</sub>, enabling them to be used for logic level conversion.

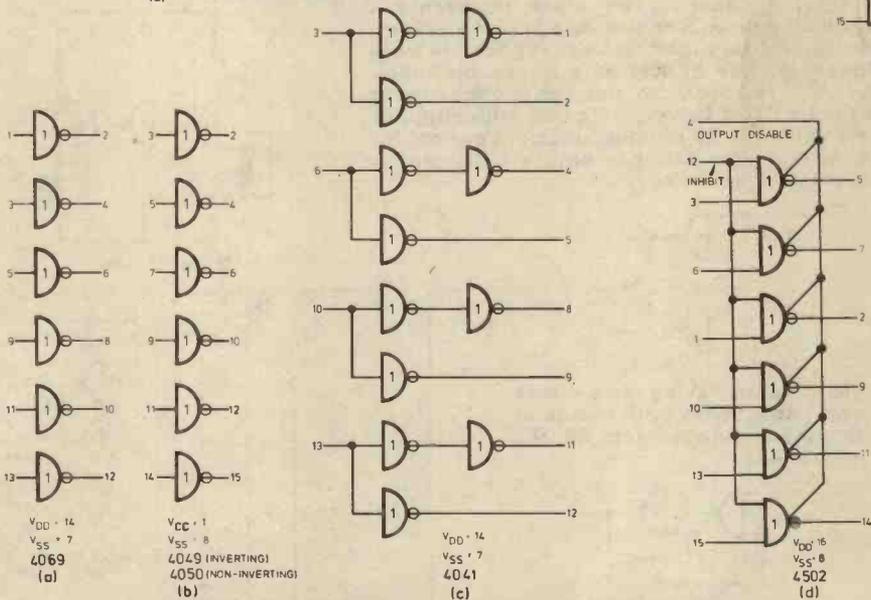
The 4049 and 4050 have replaced the earlier 4009 and 4010 which needed two supply connections.

Table 3.1. Full range of CMOS logic gates

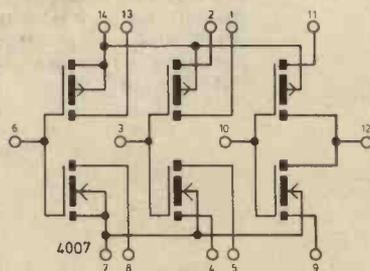
	FIGURE	NOR	NAND	OR	AND	EXCLUSIVE OR	EXCLUSIVE NOR
QUAD 2-INPUT	Fig. 3.1 (a)	4001	4011	4071	4081	4070 4030 4507	4077
TRIPLE 3-INPUT	Fig. 3.1 (b)	4025	4023	4075	4073	—	—
DUAL 4-INPUT	Fig. 3.1 (c)	4002	4012 4501	4072	4082	—	—
8-INPUT	Fig. 3.1 (d)	4078	4068 4501		4501	—	—



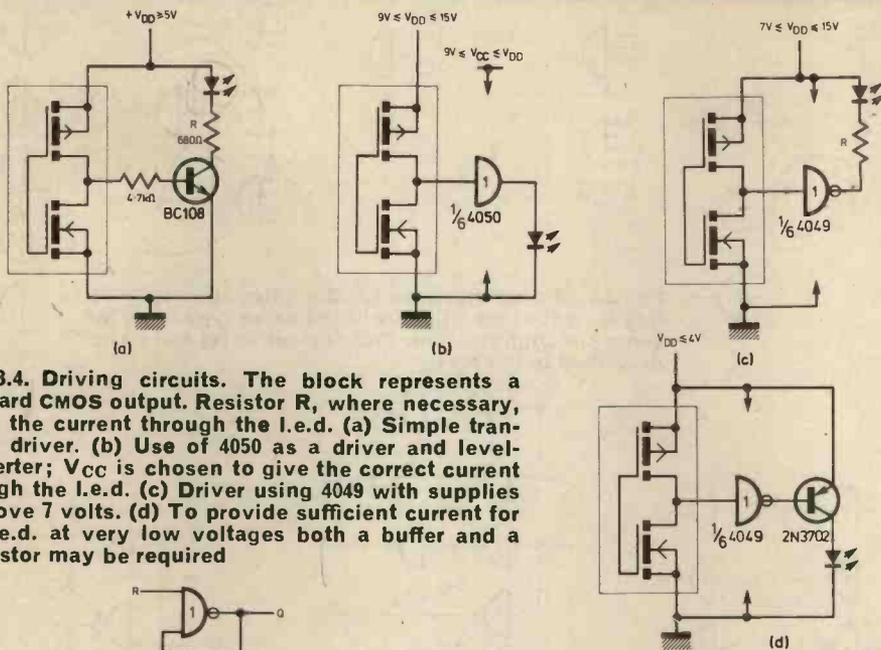
**Fig. 3.1. Pin connections for the gates in the CMOS family. Note that all gates of the same type have the same pin configuration. The devices in (e) and (f) are described in the text**



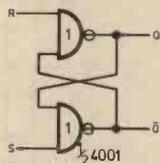
**Fig. 3.2. Pin connections for the inverter and buffer packages. (a) Hex inverter. (b) Hex inverting and non-inverting buffers or level converters. (c) Quad true/complement buffer. (d) Strobed hex inverter buffer. Pin 4 is the three-state output disable, and pin 12 is the output inhibit**



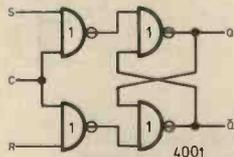
**Fig. 3.3. Connection diagram for the 4007 dual complementary pair and inverter. The diode protection networks are not shown**



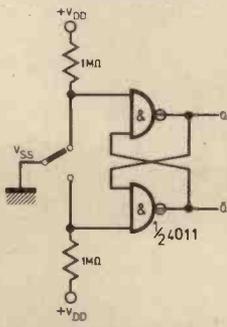
**Fig. 3.4. Driving circuits.** The block represents a standard CMOS output. Resistor R, where necessary, limits the current through the l.e.d. (a) Simple transistor driver. (b) Use of 4050 as a driver and level-converter;  $V_{CC}$  is chosen to give the correct current through the l.e.d. (c) Driver using 4049 with supplies of above 7 volts. (d) To provide sufficient current for the l.e.d. at very low voltages both a buffer and a transistor may be required



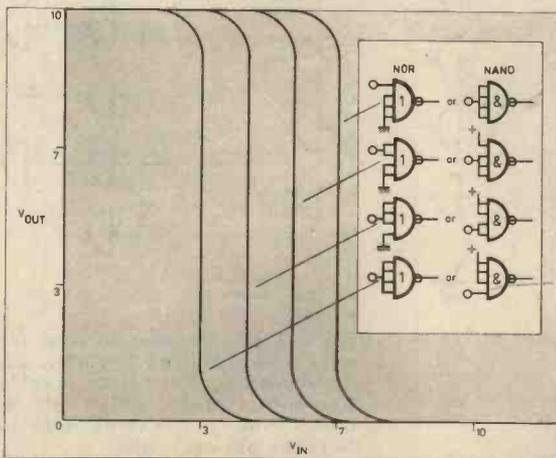
**Fig. 3.5. R-S latch using two cross coupled NOR gates.** With both inputs at logical "0" the previous state at the inputs is memorised



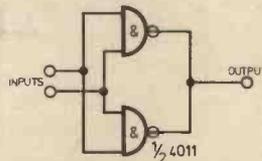
**Fig. 3.6. Gated R-S latch uses one 4001 package.** A logical "1" on the control input disables the R and S inputs



**Fig. 3.7. Switch debouncer using an R-S latch.** The resistors may be any large value. Alternatively NOR gates may be used, with the resistors going to  $V_{SS}$  and the switch to  $V_{DD}$



**Fig. 3.8. The effect of paralleling inputs.** Increasing the number in a NOR gate causes a decrease in the input 'low' noise margin and an increase in the input high noise margin. The reverse holds for a NAND gate



**Fig. 3.9. Both source and sink current may be increased by paralleling whole gates or inverters from the same package.** The speed performance will also be improved

# MAPLIN ELECTRONIC SUPPLIES

P.O. BOX 3, RAYLEIGH, ESSEX

Tel: Southend-on-Sea (0702) 44101

ALL PRICES INCLUDE VAT & POSTAGE & PACKING

(U.K. only)

(20p handling charge if order under £2)

PRICES: Regrettably this advertisement had to be prepared before prices current during Feb./March 1976 were known. For details send a.s.e. for our Feb./March newsletter giving current guaranteed prices (see back cover). Overseas customers deduct VAT, details in

Visit our shop 284 London Road Westcliff-on-Sea Essex

## MAINS TRANSFORMERS

Conform to BS415. Split bobbin construction.  
0-8V, 500mA + 0-6V, 500mA MIN TR 9V £1.55  
0-8V, 500mA + 0-9V, 500mA MIN TR 9V £1.87  
0-12V, 250mA + 0-12V, 250mA MIN TR 12V £1.55 (1)  
0-20V, 150mA + 0-20V, 150mA MIN TR 20V £1.55  
0-36V, 83mA + 0-36V, 83mA MIN TR 36V £1.87  
0-8-9V, 1A + 0-12V, 1A TR 12V 1A £1.99

0-28V, 1A + 0-28V, 1A TR 9V 1A £2.99  
0-15-20V, 1A + 0-15-20V, 1A TR 20V 1A £3.99

for quantities over 25 special discounts are available

Uncovered boards  
149 x 114 58 x 42 (0.1") SRBP 0.1in.  
127 x 95 33 x 24 (0.15") SRBP 0.35in.  
Vero Spot Face Cutter TOOL 2022

Terminal Pins (Packs of 36 pins)

For 0.1" Veroboards Single sided PIN 2145 13p

Double sided PIN 2144 13p

For 0.15" Veroboards and both uncovered

boards Single sided PIN 2141 20½p

Double sided PIN 2140 20½p

## VEROBOARD

Size (mm)	No. of holes (matrix)	Order code
127 x 63	50 x 24 (0.1")	VERO 10345
127 x 63	37 x 24 (0.1")	VERO 10346
95 x 63	50 x 36 (0.15")	VERO 10347
95 x 63	37 x 34 (0.1")	VERO 10348
95 x 63	25 x 16 (0.15")	VERO 43P16
127 x 95	33 x 24 (0.15")	VERO 45P16

## JACKS

2.5mm Plastic Plug 35p  
2.5mm Screened Line Socket 35p  
3.5mm Plastic Plug 11p  
3.5mm Screened Line Socket 11p  
3.5mm Screened Plug 11p  
3.5mm Open-type Chassis Socket 9½p  
3.5mm Plastic Line Socket 11p

## PHONO

Plug Plastic Top 7p  
Plug Screened 15p  
Chassis Socket Single 10p  
Chassis Socket Twin 10p  
Line Socket Screened 15p

## PLUGS and SOCKETS

CO-AX Co-ax Plug 14p  
Aluminum Plastic barrel 10p  
Co-ax Socket 11p  
Panel fixing Flush fixing 20p

## SWITCHES

Slide sub-min DPDT ... 13p  
Slide 16 DPDT ... 14p  
Push to make non-locking SPST ... 15p  
Push to break non-locking SPST ... 15p  
Microswitch SA 250V AC ... 16p  
Push-on, Push-off Locking DPST 250V 4A ... 20p  
Rocker DPST 250V 10A White ... 45½p  
Toggle Sub-miniature 2A 250V (Type A) SPDT ... 65p  
Toggle Sub-miniature 2A 250V (Type B) DPDT ... 87p  
Toggle DPDT 250V 15A with ON/OFF Plate ... 27p  
10 position BCD output slide switch ... £1.61

## POTS

Rotary miniature carbon track ¼in. spindle.  
Values available: 5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M, 2M, 5M  
Lin single-gang (+ 1k) ... 23½p  
Log single-gang ... 23½p  
Lin or Log single with switch ... 36½p  
Lin or Log dual-gang ... 72½p

## OMNIVUM GATHERUM

12-way 5 Amp Terminal Block 17p  
PVC Insulation Tape (11mm x 10m), Black, Red, Blue, Green, Brown, White ... 19½p  
Duo PCB Pen 85p  
Printed Circuit Kit, contains polishing powder, etch resist, etching liquid, resist remover, flux, copper clad board, stencil knife, spatula and etching tray ... £3.99  
Copper clad FR4 board (200 x 100mm) 46p  
Copper clad fibreglass board ... £1.84  
Probe Clips (1 red, 1 black) 42p  
Solder 10m of 22swg ... 79p

## INTEGRATED CIRCUITS

AY-10212	ES-94	MVRIS (TO3)	E1-73	uA7805 (TO 3) 81
AY-31224	ES-100	M252	E1-10	uA7815 (TO 3) 81
CA3064 (14-pin DIL)	E1-65	NE555 (8-pin DIL)	E1-50	ZN414 (TO 18) E1 50
LM002C (TO 9)	E1-73	SG1495 (14-pin DIL)	E4-99	CD4021AE 73p
LM301A (8-pin DIL)	SG3402 (14-pin DIL)	E1-17	CD4007AE 73p	66p
LM309 (8-pin DIL)	FB48105	E1-25	CD4011AE 73p	66p
LM390 (14-pin DIL)	E1-13	uA790C (TO 9)	CD20A016AE 54p	66p
LM381 (14-pin DIL)	E1-65	uA723C (TO 9)	59p	7413 71p
LM3900 (14-pin DIL)	SG50	uA723C (14-pin DIL)	28p	7417 71p
MC130P (14-pin DIL)	SG50	uA741C (8-pin DIL)	39p	7473 39p
MC190 (14-pin DIL)	SG50	uA741C (14-pin DIL)	84p	7474 39p
MC132P (16-pin DIL)	SG50	uA747C (14-pin DIL)	29p	7490 55p
MFC6008	SG50	uA748C (8-pin DIL)	14p	7493 55p
MFC6040	E1-84	uA78L5 (TO 9)	45p	7493 55p
MM5314 (24-pin DIL)	E1-73	uA78L5 (TO 9)	45p	7421 47p
MVRIS (TO 3)	E1-73	uA7805 (Plastic)	E1-13	
MVRIS (TO 3)	E1-73	uA7815 (Plastic)	E1-13	

# SUPERSONIC SAME-DAY SERVICE

## QUALITY COMPONENTS - FAST!

Fane POP 50

8n 50W 12 inch Bass Speaker  
Frequency Response 50Hz-8KHz  
Flux Density 13,000 Gauss  
£12.45

Please note: No discount vouchers given on this item.

## PLUGS and SOCKETS

CO-AX Co-ax Plug 14p  
Aluminum Plastic barrel 10p  
Co-ax Socket 11p  
Panel fixing Flush fixing 20p

## SWITCHES

Slide sub-min DPDT ... 13p  
Slide 16 DPDT ... 14p  
Push to make non-locking SPST ... 15p  
Push to break non-locking SPST ... 15p  
Microswitch SA 250V AC ... 16p  
Push-on, Push-off Locking DPST 250V 4A ... 20p  
Rocker DPST 250V 10A White ... 45½p  
Toggle Sub-miniature 2A 250V (Type A) SPDT ... 65p  
Toggle Sub-miniature 2A 250V (Type B) DPDT ... 87p  
Toggle DPDT 250V 15A with ON/OFF Plate ... 27p  
10 position BCD output slide switch ... £1.61

## POTS

Rotary miniature carbon track ¼in. spindle.  
Values available: 5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M, 2M, 5M  
Lin single-gang (+ 1k) ... 23½p  
Log single-gang ... 23½p  
Lin or Log single with switch ... 36½p  
Lin or Log dual-gang ... 72½p

## OMNIVUM GATHERUM

12-way 5 Amp Terminal Block 17p  
PVC Insulation Tape (11mm x 10m), Black, Red, Blue, Green, Brown, White ... 19½p  
Duo PCB Pen 85p  
Printed Circuit Kit, contains polishing powder, etch resist, etching liquid, resist remover, flux, copper clad board, stencil knife, spatula and etching tray ... £3.99  
Copper clad FR4 board (200 x 100mm) 46p  
Copper clad fibreglass board ... £1.84  
Probe Clips (1 red, 1 black) 42p  
Solder 10m of 22swg ... 79p

## INTEGRATED CIRCUITS

AY-10212	ES-94	MVRIS (TO3)	E1-73	uA7805 (TO 3) 81
AY-31224	ES-100	M252	E1-10	uA7815 (TO 3) 81
CA3064 (14-pin DIL)	E1-65	NE555 (8-pin DIL)	E1-50	ZN414 (TO 18) E1 50
LM002C (TO 9)	E1-73	SG1495 (14-pin DIL)	E4-99	CD4021AE 73p
LM301A (8-pin DIL)	SG3402 (14-pin DIL)	E1-17	CD4007AE 73p	66p
LM309 (8-pin DIL)	FB48105	E1-25	CD4011AE 73p	66p
LM390 (14-pin DIL)	E1-13	uA790C (TO 9)	CD20A016AE 54p	66p
LM381 (14-pin DIL)	E1-65	uA723C (TO 9)	59p	7413 71p
LM3900 (14-pin DIL)	SG50	uA723C (14-pin DIL)	28p	7417 71p
MC130P (14-pin DIL)	SG50	uA741C (8-pin DIL)	39p	7473 39p
MC190 (14-pin DIL)	SG50	uA741C (14-pin DIL)	84p	7474 39p
MC132P (16-pin DIL)	SG50	uA747C (14-pin DIL)	29p	7490 55p
MFC6008	SG50	uA748C (8-pin DIL)	14p	7493 55p
MFC6040	E1-84	uA78L5 (TO 9)	45p	7493 55p
MM5314 (24-pin DIL)	E1-73	uA78L5 (TO 9)	45p	7421 47p
MVRIS (TO 3)	E1-73	uA7805 (Plastic)	E1-13	
MVRIS (TO 3)	E1-73	uA7815 (Plastic)	E1-13	

## ORGAN COMPONENTS

Keyboards Morellis — as used by the professionals.  
#9-note C to C £29.40  
#1-note C to C £25.90  
Swit pedal with 10k log pot £8.40  
Pedalboard 13-note C to C £30.00  
— with changeover contacts fitted £28.00  
Spring Line Unit (Short) £4.10  
Spring Line Unit (Long) £6.90  
Reverberation Driver Module £8.67  
S.a.e. please for full details: Leaflet MES 24  
Gold-clad phosphor bronze wire 22p per metre  
Palladium earth bar per octave length 11p  
Contact Blocks changeover single pole (GJ) 25½p  
two pole make (GB) 29p  
three pole make (GC) 25p  
four pole make (GE) 46p  
five pole make (GH) 87p  
Switches unengraved (black, grey, red or white) with DPDT switch rocker type 74p

## RESISTORS

CARBON FILM  
¼W (MIN RES) 1 ohm to 1M: 5%; 1M2 to 10M: 10% E12 ... 2p each  
¼W (STD RES) 1 ohm to 10 ohms: 5%; 1M2 to 10M: 10% E12 — 11 ohm to 1M: 5% E12 and E24 ... 2p each  
1W (OXIDE) 10 ohm to 1M: 2% E12 and E24 ... 5p each  
WIREWOUND  
¼W (MIN RES) 0.22, 0.27, 0.33, 0.47 ohms, 1 ohm 5% ... 11p  
1.2 ohm to 270 ohms: 5% E12 ... 15p  
Also 1% Oxide, 1W Carbon Film, 5W and 10W Wirewound types stocked.  
E24: 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and decads.

## TRANSISTORS & DIODES

AC127	101p	BC213L	10p	BFY51	17p	2A 4001V Bridge	55p
AC128 <td>101p <td>BC214L</td> <td>22p</td> <td>BFY52</td> <td>17p</td> <td>2N2219</td> <td>33½p</td> </td>	101p <td>BC214L</td> <td>22p</td> <td>BFY52</td> <td>17p</td> <td>2N2219</td> <td>33½p</td>	BC214L	22p	BFY52	17p	2N2219	33½p
AC176 <td>101p <td>BC327</td> <td>27½p</td> <td>BY164</td> <td>81p</td> <td>2N2646</td> <td>48½p</td> </td>	101p <td>BC327</td> <td>27½p</td> <td>BY164</td> <td>81p</td> <td>2N2646</td> <td>48½p</td>	BC327	27½p	BY164	81p	2N2646	48½p
AD161ZMP	E1-67	BC328	26p	BC261 series	21p	2N2905	35½p
AF117	27p	BC337	27p	BCY8 series	21p	2N2920 Or. Ye	15p
BAX13	8p	BC338	25p	C106D1	58½p	and G	10p
BC107	12p	BCY71	24p	CMR102	36p	30K53	18½p
BC108	11p	BD131	49p	MJ255	82p	2N3054	60p
BC109	14p	BC132	57p	MJE955	E1-21	2N3055	53p
BC142	10p	BD131 2M	E1-10	MJE3055	81p	2N3070	19p
BC143	10p	BD135	51½p	MPF102	45p	2N3703	15p
BC147	12½p	BD139	61p	OC71	25p	2N3704	17p
BC148	12½p	BC140	80p	SC460C	35p	2N3705	16p
BC149	15p	BF258	20p	ST2	95½p	2N3706	17p
BC168C	8p	BF259	27p	T1543	35p	2N3707	17p
BC169C	8p	BFX29	32½p	WOODS	37p	2N3708	16p
BC176	15p	BFX30	32½p	W04	17p	2N3709	27½p
BC179	15p	BFX84	35p	Z1J	30p	2N3819	27½p
BC182L	12½p	BFX85	35p	Z1X108	11p	2N3903	25p
BC183L	15p	BFX87	32½p	IN74	5p	2N3904	25p
BC184L	15p	BFX88	34½p	IN4148	5p	2N5245	56p
BC210L	17½p	BFY50	17p	2A 5001V Bridge	48½p	2N5559	64p

## THE AMAZING DMO2

A ready-built, tested and guaranteed digital master oscillator. Accurately generates the top 13 notes for your organ system and reduces the complete tuning of your organ to ONE SIMPLE adjustment. New design gives selectable C to C output ranges of (approx.) 4k to 8k (highest) or 2k to 4k or 1k to 2k, etc. Right down to 16Hz to 32Hz! And this new compatible design is even smaller. Only 3.5in. x 3.7in., including gold-plated edge connexion.  
DMO2T Includes built-in variable depth and note frequency shift remutant.

## RESISTORS

CARBON FILM  
¼W (MIN RES) 1 ohm to 1M: 5%; 1M2 to 10M: 10% E12 ... 2p each  
¼W (STD RES) 1 ohm to 10 ohms: 5%; 1M2 to 10M: 10% E12 — 11 ohm to 1M: 5% E12 and E24 ... 2p each  
1W (OXIDE) 10 ohm to 1M: 2% E12 and E24 ... 5p each  
WIREWOUND  
¼W (MIN RES) 0.22, 0.27, 0.33, 0.47 ohms, 1 ohm 5% ... 11p  
1.2 ohm to 270 ohms: 5% E12 ... 15p  
Also 1% Oxide, 1W Carbon Film, 5W and 10W Wirewound types stocked.  
E24: 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and decads.

## TRANSISTORS & DIODES

AC127	101p	BC213L	10p	BFY51	17p	2A 4001V Bridge	55p
AC128	101p <td>BC214L</td> <td>22p</td> <td>BFY52</td> <td>17p</td> <td>2N2219</td> <td>33½p</td>	BC214L	22p	BFY52	17p	2N2219	33½p
AC176	101p <td>BC327</td> <td>27½p</td> <td>BY164</td> <td>81p</td> <td>2N2646</td> <td>48½p</td>	BC327	27½p	BY164	81p	2N2646	48½p
AD161ZMP	E1-67	BC328	26p	BC261 series	21p	2N2905	35½p
AF117	27p	BC337	27p	BCY8 series	21p	2N2920 Or. Ye	15p
BAX13	8p	BC338	25p	C106D1	58½p	and G	10p
BC107	12p	BCY71	24p	CMR102	36p	30K53	18½p
BC108	11p	BD131	49p	MJ255	82p	2N3054	60p
BC109	14p	BC132	57p	MJE955	E1-21	2N3055	53p
BC142	10p	BD131 2M	E1-10	MJE3055	81p	2N3070	19p
BC143	10p	BD135	51½p	MPF102	45p	2N3703	15p
BC147	12½p	BD139	61p	OC71	25p	2N3704	17p
BC148	12½p	BC140	80p	SC460C	35p	2N3705	16p
BC149	15p	BF258	20p	ST2	95½p	2N3706	17p
BC168C	8p	BF259	27p	T1543	35p	2N3707	17p
BC169C	8p	BFX29	32½p	WOODS	37p	2N3708	16p
BC176	15p	BFX30	32½p	W04	17p	2N3709	27½p
BC179	15p	BFX84	35p	Z1J	30p	2N3819	27½p
BC182L	12½p	BFX85	35p	Z1X108	11p	2N3903	25p
BC183L	15p	BFX87	32½p	IN74	5p	2N3904	25p
BC184L	15p	BFX88	34½p	IN4148	5p	2N5245	56p
BC210L	17½p	BFY50	17p	2A 5001V Bridge	48½p	2N5559	64p

## ELECTROLYTIC CAPACITORS

Cap. (µF)	Voltage (V)	Case Size	Cap. (µF)	Voltage (V)	Case Size
1.5	6.3	3	330	16	00
1.5	6.3	3	330	6.3	03
2.2	6.3	3	68	16	00
3.3					

# ALBEN LIGHTING

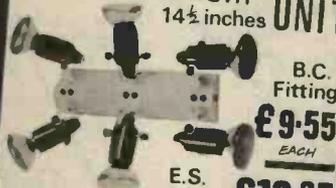
**Random FLASHER UNIT**  
 IDEAL FOR DISCOS · HOMES · JUKE BOXES · PUBS ETC.



Wired ready for use  
 Complete with three  
 100 watt coloured lamps  
 that flash independently  
 at random.

**£18-95**

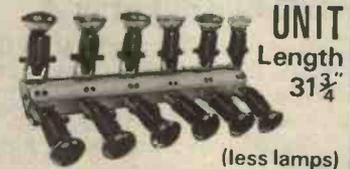
**TWIN BANK 6 LIGHT UNIT**  
 (less lamps) LENGTH 14½ inches



B.C. Fitting **£9-55**  
 EACH

E.S. Fitting **£10-35**  
 EACH

**TWIN BANK 12 LIGHT UNIT**  
 Length 31¾"



(less lamps)

B.C. Fitting **£15-60** | E.S. Fitting **£17-00**  
 EACH EACH

**Sound to Light MASTER UNIT** 600 WATTS PER CHANNEL



**£30-95**

INCLUDING CHANNEL OUTPUT PLUGS AND MAINS INPUT SOCKET.

Connects to your loudspeaker or loud speaker socket. The unit can be connected to your existing spotlight fittings or to any of our fittings

**TYPE A SPOT**  
 (less lamp)



B.C. Fitting **£1-95** EACH | E.S. Fitting **£2-12** EACH

**TYPE B 3 BANK UNIT**  
 (Less Lamps)



B.C. Fitting **£6-90** | E.S. Fitting **£7-26**  
 EACH EACH

ALL PRICES INCLUDE V.A.T. and POST & PACKING  
 (These prices apply to the United Kingdom only)

**100 WATT SPOT LAMPS** Minimum 3 lamps

RED, YELLOW, GREEN **£1-18** each **£3-54**  
 BLUE, CLEAR B.C. or E.S. Fitting

Send 20p for illustrated leaflet & price list.

**ALBEN ENGINEERING CO. LTD.**

**DEPT. PE, THE CRESCENT, WORSTHORNE, BURNLEY, LANCS. Tel: Burnley 20940**

**CJL**

CJL LTD. P.O. BOX 34, CANTERBURY, CT1 1YT  
 ALL PRICES INCLUDE P&P AND V.A.T.

**ANTEX SOLDERING IRONS**

(with slide on & off bits)	
15W 'C' miniature irons	£2.30
3/32" 1/8" 3/16" bits—each	£0.45
'C' Elements	£1.10
18W 'G' miniature irons	£2.50
3/32" 1/8" 3/16" bits—each	£0.45
'G' Elements	£1.35
15W 'CCN' Low leakage irons	£2.70
3/32" 1/8" 3/16" bits—each	£0.45
'CCN' Elements	£1.50
25W 'X25' Low leakage irons	£2.30
3/32" 1/8" 3/16" bits—each	£0.47
'X25' Elements	£1.15
'SK1', 'SK2', Soldering Kits	£3.85
ST3 Stands—for all models	£1.10
<b>SOLDER</b> in Bib dispenser	£0.45

**WIRE STRIPPER & CUTTER** £0.85

**HAND DRILLS** Leytool precision, compact, 5/16" chuck **£3.99**

**AERIALS** Extend 15-120cm **£1.50**

**CASSETTE** 'Head Demagnetisers' Shaped pole—saves time **£3.65**

**EARPHONES** Stethoscope **£1.25**

**Crystal earphone, lead & plug** **£0.65**

**Headphone**, 2,000 Ω **£3.20**

**INTERCOMS** 2-station **£6.35**

**MICROPHONES** Dynamic **£2.15**

**PRINTED CIRCUIT KITS** -All items for producing p.c.'s **£3.99**

**SIGNAL INJECTOR** -Audio through video signals, self contained **£4.25**

**STEREO HEADPHONES** 8Ω **£4.85**

**SPEAKERS** -75mm dia. 8Ω **£1.00**

## SPECIAL OFFER

ZN1034E NEW FERRANTI PRECISION TIMER I.C., £2-80, Data 10p.  
 R. M. Marstons Book "110 Operational Amplifier Projects", PLUS FREE 741 I.C. £1-80. Only a few left.  
 ZN414 Radio I.C. £1-10. Ferranti Applications Booklet for ZN414 25p.  
 ZN424E Gated Linear Amplifier I.C. £1-20, Data 10p. which includes excellent magnetic cartridge preamplifier circuit.  
 ZMX141 Photo Transistor 60p. Ferranti Booklet for opto-devices 25p.  
 Engineers, Students and Amateurs! New Ferranti E-Line Transistor 83 Page Application Report 50p.

**RADNAGE RADIO & ELECTRONICS**  
 2 Bottom Road, Radnage  
 High Wycombe, Bucks.

Prices Inclusive—Add 20p post and packing U.K., 60p exports  
 Mail Order Only

The 4041 is a quad true/complement buffer which provides both inverted and non-inverted outputs. Finally the 4502 strobed hex inverter buffer consists of six inverters with three-state outputs. Applying a logical "1" to pin 4 puts all six outputs at high impedance (greater than  $10M\Omega$ ) making it possible for many packages to share the same output lines. More than 50 three-state outputs can be "common bussed" in this way. Pin 12 is an output inhibit; a logical "1" switches the six outputs to "0".

One part does not really fit into any of the above categories; the 4007 dual complementary pair and inverter shown in Fig. 3.3. This part provides access to the individual transistor elements making it possible to construct circuits not catered for in the standard range. Furthermore, their device will replace discrete MOSFETS in many circuits, at a fraction of the cost.

### OUTPUT DRIVE CURRENT

As mentioned earlier, CMOS gates have a d.c. fan-out of more than 100 since CMOS inputs present a negligible resistive load. However, the driving capabilities of CMOS are not very great by other standards, most outputs only being able to sink one low-power TTL input load at 5 volts, and so some sort of interface will often be needed between the output and the external circuit.

For every device two drive currents are given; these are the "sink" current which flows through the  $n$ -type MOSFETS when the output is at logical "0", and the "source" current through the  $p$ -types when the output is at logical "1".

The source and sink currents will be equal only in devices which have symmetrical outputs, such as inverters and all parts in the B-series (which have two inverters before the outputs). The currents for other devices will depend on the arrangement of the MOSFETS at the output. These values represent limits, and the output of a gate can be shorted to  $V_{DD}$  or  $V_{SS}$  or to another output without causing any damage. This is because of the relatively high output impedance of a CMOS gate (typically in the region of 500 to 1 kilohms) and this limits the current to a safe level. High current buffers such as the 4049 can, however, suffer from supplies of more than circuits if operating from supplies of more than about 7 volts, as the overall package power dissipation will exceed the recommended 200mW, and so these types should be treated with greater care.

### DRIVING CIRCUITS

Due to the complementary arrangement of CMOS outputs, the load may be connected between the output and either supply rail. Fig. 3.4 gives four circuits for driving light emitting diodes from a standard output, and these can easily be extended to other applications.

The output currents are very dependent on the supply voltage, and choice of driving circuit will often be dictated by this. With supplies of less than about 4 volts the base current of a driver transistor can exceed the standard output current of the CMOS device, and an intermediate buffer will be needed as in Fig. 3.4(d).

### UNUSED INPUTS

In some logic families unused inputs will look after themselves. For example, in TTL any inputs left floating will be pulled up to a logical "1" level. This is not the case with CMOS due to the near infinite input impedance of a gate. A floating gate is at an undefined level and can give rise to erratic operation, and the input capacitance may charge up to the switching point causing high power consumption. The simple cure is to hold unused inputs at some defined logic level, either by joining them to a used input, or by connecting them to the non-significant logic level for that function.

Paralleling inputs results in a slight increase in speed due to the lower "on" resistance of the paralleled devices, although this is minimised by a compensating speed decrease due to the added capacitance. More important is that the output source or sink current of the device is increased in proportion to the number of inputs tied together; in NAND gates the source current is increased, whereas in NOR gates the sink current increases, so that a gate from a 4002 package with all inputs paralleled will sink 3.2mA at 5 volts, sufficient to drive one TTL load.

### GATES AS LATCHES

A one-bit memory or R-S latch may be constructed from two NOR gates as in Fig. 3.5. Alternatively NAND gates can be used in a similar configuration. The information remains memorised when the R (reset) and S (set) inputs are both at the non-significant logic level, this being  $R = S = 0$  for NOR gates. The control input in the circuit of Fig. 3.6 performs this function by holding the R and S inputs low. One common application of the R-S latch is the switch debouncer shown in Fig. 3.7, this time using NAND gates. The pull-up resistors, which can have any value up to several megohms, hold the inputs at logical "1" when not taken to "0" by the switch contact. This ensures that a noisy contact does not change the state of the output.

Next month: Linear use of CMOS with practical amplifiers and oscillators.

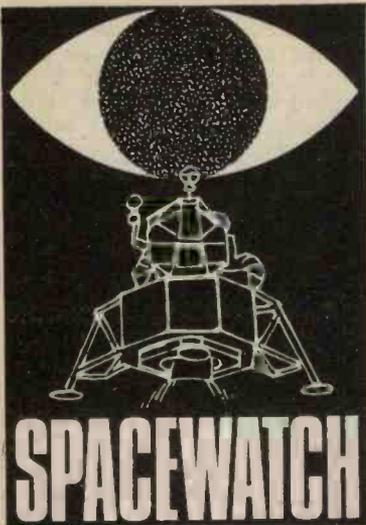
Visit  
**PRACTICAL ELECTRONICS**  
at the  
**SOUND '76**  
INTERNATIONAL

The Public Address Engineers  
Exhibition,  
Bloomsbury Centre Hotel,  
Coram Street,  
Russell Square, London, WC1

16-18 March

10.00-18.00 hrs daily—Admission FREE

On show will be the  
"New" P.E. MINISONIC Mk 2



# SPACEWATCH

BY FRANK W. HYDE

## TO MARS BY VIKING

The *Viking* missions to Mars is the highlight for 1976 and especially for America it marks a new milestone in Space History. These vehicles consist of two parts, the orbiter and the lander and represent the latest of the sophisticated techniques available. The lander part of the spacecraft will touch down on July 4. The whole operation will be repeated a few days later with the second spacecraft.

As a combined operation it will be unique for there will be four units at work at the same time, enabling a vast area of the red planet's surface to be observed from the orbiters and the local terrain investigated by the landers.

The two composite vehicles were dispatched into a minimum energy orbital trajectory and will be at their destinations when the planet is on the opposite side of the Sun from the Earth. Thus they will represent the unusual situation of being in operation but out of direct communication with Earth for about a month.

The orbiter is a very much enlarged version of *Mariner* spacecraft weighing about 2,300 kilograms compared with the *Mariner* which is about 1,000 kilograms. The lander is contained within the structure. The *Viking* composite unit contains larger propellant tanks and more powerful aids such as the computers.

The camera system is also an improved one in order that the pictures may be relayed more rapidly back to Earth than in the previous missions. This is an important point because the decision to make the actual landing will be determined by the terrain and this can only be made if mission control can see what is happening. With a communication time for the round trip of around 40 minutes per bit,

the extent of the improved technique can be appreciated.

Three basic programmes are planned. The orbiters will carry on the detailed photography of the planet begun by *Mariner 9* at the 1971 opposition. Second, the spacecraft will study the physical conditions of the planet which will include the atmosphere and the geology and internal structure. Thirdly, the landers will look for life and/or biological processes.

## EXPERIMENTS AND OBSERVATIONS

The radio and radar measurements will be directed to the size of the planet, the electromagnetic properties, atmospheric disturbance, density of the atmosphere, gravitational conditions, density of the planet and surface density.

The orbiters will observe the formation of clouds and their movements and the possible changes of the concentrations of water vapour. The landers will also record their local weather at the two points on the surface where they land.

Both orbiters and landers will photograph the geology giving details of structure, faults, stratification, types of rock and debris erosion and other conditions. The landers will sample the soil examining it for details such as minerals and the general composition by means of the scoops and subsequent processing within the lander craft.

The seismic measurements will afford data as to the structure of the planet and whether in fact it has a core, mantle and a crust like the Earth.

## LANDING SITES

Four sites have been chosen for the landers and they have a primary and secondary importance. They are designated Prime A1 located at the area known as Chrise. In this area there are sand dunes of the order of hundreds of metres across with ripples. There are dust deposits with material washed down from the canyons to the south. This is also a possible area for fossil water.

The alternative or back up site is the area of Tritos Lacus which is similar to the Prime area but where the material is likely to have been carried north from the equatorial highlands.

Prime B1 is at Cydonia. This is a flat stretch of plains where it is possible that water may be present during the summer for a few weeks. The area is smooth, possibly basalt, covered with dust and sediment. The back up site is Alba which is close to a major volcanic region.

The orbiters carry advanced television cameras. At closest approach of the spacecraft to the planet on each orbit these cameras will have a resolution of 50 metres per television line at an altitude of 1,500

kilometres. Each picture from the lander cameras will take 20 minutes to complete. It will not be possible to resolve a moving object therefore from the landers. However, the optical system enables close-ups of the far horizon pictures to be sharp.

The landing sites will be selected from the orbiter pictures which will watch for any onset of dust storms that might endanger the landing sequence.

The twin cameras will survey the landscape and near to the site to determine where to dig for samples. The scoop will collect a load and transfer this to a funnel on the top of the vehicle. From here it will fall into various processing sections where the analysis will be performed and the data relayed via the orbiters to Earth.

The cameras can be used for black and white pictures, colour and infra-red over three spectral bands. Also, the two cameras can provide a stereo effect. They are extremely versatile and can look at parts of the spacecraft, nearby objects as well as the panoramic scene.

Perhaps this conveys some of the excitement of this mission, that machines controlled from a distance of some 230 million miles and a time lag of more than 20 minutes between order and execution is now a normal part of modern technology.

## SOVIET ACTIVITY

In the excitement of the *Viking* programme it must not be forgotten that the USSR have two vehicles orbiting Mars and continuing to furnish data of the conditions. There will be expected an interchange of information from both projects.

A visit to the *Salyut 4* orbiting station was made on two manned occasions during its year in orbit and also one visit by an unmanned *Soyuz 20* which was automatically linked up with *Salyut 4*. The complex is continuing to study near Earth space.

Another aspect of Soviet space spin-off concerns the material used for space suits. The USA were worried as to the suitability of the material used by the USSR for space suits and called for samples. The material is known as "Lola" and has a high heat resistance able to withstand temperatures up to 1,000 degrees C.

When the Americans made their tests it was found that the material was superior to the American material (which they insisted should be used on the combined task because of fire risk) in many ways not least the claim for Lola that it is stronger, has a good electrical insulator property and the almost casual claim that it is "only slightly affected" by a concentrated solution of 96% of sulphuric acid.

## RELAYS

SIEMENS, PLESSEY, Etc.  
MINIATURE RELAYS

Col. (1) Coil ohms	1	2	3	4
Col. (2)	52	4-8	2 c/o	75p*
Working	58	5-9	6 c/o	85p*
c.o. volts	185	8-12	6M	65p*
Col. 3	230	9-18	2 c/o HD	85p*
Contacts	430	15-24	4 c/o	85p*
Col. (4)	700	12-24	2 c/o	65p*
Price	700	16-24	2 c/o	85p*
	1,250	18-36	2 c/o	65p*
HD =	2,500	31-43	2 c/o HD	65p*
Heavy duty	2,500	36-45	6M	65p*
	15k	85-110	6M	65p*

\*Incl. Base. All prices incl. P. & P.

### OPEN TYPE RELAYS

6 VOLT D.C. 1 make contacts 35p. Post 15p.  
9 VOLT D.C. RELAY  
3 c/o 5 amp contacts. 70 ohm coil. 75p. Post 15p.  
12 VOLT D.C. RELAY  
3 c/o 5 amp contacts. 120 ohm coil. 75p. Post 15p.  
100 VOLT A.C. 2 c/o 65p. 3 c/o 75p. Post 15p.

### ENCLOSED TYPE RELAYS

24 VOLT D.C. 3 c/o 75p. Post 20p. Base 15p extra.  
24 VOLT A.C. Mfg. by I.T.T. 3 h.d. c/o contacts.  
55p. Post 20p. Base 15p.  
55 VOLT A.C. RELAY  
3 h.d. c/o contacts. Price 55p. Post 20p. Base 15p.  
230 VOLT RELAY  
3 h.d. c/o contacts. Price 75p. Post 20p. Octal  
plug in base 15p extra.

230/240 VOLT A.C. RELAY. Mfg. by Arrow 2 h.d.  
15 amp c/o contacts. Amp connectors. Price £1.  
Post 20p.

### 230/240 VOLT A.C. RELAY

3 c/o 5 amp contacts. Sealed. Mfg. ISKRA.  
£1.25. Post 20p. Base 15p extra.  
CLARE-ELLIOTT TYPE RP7641 G8  
Miniature relay. 675 ohm coil. 24 Volt D.C. 2 c/o.  
70p post paid.

110V. 2 c/o, 20 amp contacts. £1.25. Post 10p.  
Many other forms from stock—phone for details.

### LATCHING RELAY

Twin latching relay, "flip-flop" 2 c/o  
each relay. Mains contacts. 115V  
A.C. or 50V D.C. operation. 240V  
A.C. with 2.5K resistor. 85p. Post 20p.



### C/O MICRO SWITCH

VERY SPECIAL OFFER. Mfg. by  
C.E.M. 3 amp 250 volt. 10 amp 125  
volt. 50 for £3. Post 36p. 100 for £3.  
Post 50p. 1,000 for £45. Post paid.  
Bulk purchase means LOW! LOW! prices.  
DOUBLE POLE C/O or 2 make/2 break micro  
switch. 10 amp 250v a.c. With detachable roller  
assembly. 10 for £2.50. Post 50p (min. order 10).



### 230/250 VOLT A.C. SOLENOID

Approximately 1 1/2 lb pull. Size of feet 1 1/4" x 1 1/4".  
Price £1.00. Post 20p.  
HEAVY DUTY TYPE. 10 lb. (approx.) pull. £2.50.  
Post 50p.

### 24 VOLT DC SOLENOIDS

UNIT containing 1 heavy duty solenoid approx. 25lb  
pull 1 inch travel. Two x approx. 1lb pull 1/2 inch  
travel. 6 x approx. 4oz. pull 1/2 inch travel. One  
24 volt d.c., 1 heavy duty single make relay. Price  
£2.50. Post £1. ABSOLUTE BARGAIN.



600 WATT DIMMER SWITCH  
Easily fitted. Fully guaranteed by makers.  
Will control up to 600W of lighting  
except fluorescent at mains voltage.  
Complete with simple instructions.  
£2.75. Post 25p.  
2,000 watt model, £8. Post 40p.

### CENTRIFUGAL BLOWER

Mfg by Smiths Industries. 230/240V  
a.c. Miniature Model. Series SE/200.  
Size 95mm x 82mm x 82mm.  
Aperture 38mm x 31mm. 12  
c.f.m., £2.75. Post 50p.



Mfg. by Airflow Developments Ltd.  
Precision made. Continuously rated, smooth running.  
230/240V a.c. motor. 80 c.f.m. As illustrated but  
with round aperture. £6.50. Post 75p.

Mfg. by Woods.  
Extremely powerful. 220/250V a.c. 0.3A 2,700 r.p.m.  
continuously rated. Capacitor start. Cast construction.  
Aperture 66mm x 50mm, O/A 200mm. £12.  
Post £1.

### INSULATION TESTERS NEW!

Test to I.E.E. Spec. Rugged metal  
construction, suitable for bench or  
field work, constant speed clutch.  
Size L.8in, W.4in, H.6in, weight 6lb.  
500V, 500 megohms, £30. Post 80p.  
1,000V, 1,000 MΩ, £36. Post 80p.



All Mail Orders—Callers—Ample Parking  
Dept. PE3, 57 BRIDGMAN ROAD  
CHISWICK, LONDON W4 5BB  
Phone 01-995 1560  
Showroom open Mon.-Fri.

## VARIABLE VOLTAGE TRANSFORMERS

INPUT 230/240V a.c. 50/60 OUTPUT  
VARIABLE 0-260V All Types  
SHROUDED TYPE  
200 watt (1 amp) £10.00  
0.5 KVA (2 1/2 amp) (MAX) £11-50  
1 KVA (5 amp) (MAX) £16-50  
2 KVA (10 amp) (MAX) £30-00  
3 KVA (15 amp) (MAX) £33-00  
4 KVA (20 amp) (MAX) £60-00  
37.5 amp (MAX) £102-50  
CARRIAGE AND PACKING EXTRA



### L.T. TRANSFORMERS

0, 6, 12 Volt at 10 amp. £5-60. Post 70p.  
0, 10, 17, 18 Volt at 10 amp. £7-90. Post £1-00  
0, 4, 6, 24, 32 Volt at 12 amp. £9-90. Post £1-00  
0, 6, 12 Volt at 20 amp. £9. Post £1-00  
0, 12, 24 Volt at 10 amp. £9-20. Post £1-00  
0, 6, 12, 17, 18, 20 Volt at 20 amp. £10-40. Post £1-00  
Other types to order at short notice—Phone your  
enquiries.

### STROBE! STROBE! STROBE!

#### HY-LIGHT STROBE MK IV

Build a Strobe Unit, using the latest type Xenon  
white light flash tube. Solid state timing and  
triggering circuit. 230/250V a.c. operation.  
For use in large rooms, halls and utilises a silica  
tube, printed circuit. Speed adjustable 0-20 f.p.s.  
Light output greater than many (so called 4  
Joule) strobes £15-40. Post 75p.

#### ULTRA VIOLET BULB BIG BLACK LIGHT

400 Watt. Mercury vapour ultra violet lamp.  
Powerful source of u.v. P.F. ballast is essential.  
Price of matched ballast and bulb £21.  
Post £1-50. Spare bulb £8. Post 65p.

#### ULTRA VIOLET BLACK LIGHT FLUORESCENT TUBES

4ft 40 watt, £5-50 (callers only).  
2ft 20 watt, £4-25. Post 60p. (For use in  
standard bi-pin), MINI. 12in 8 watt, £1-60.  
Post 25p. 9in 6 watt, £1-30. Post 25p.  
Complete ballast unit and holders for 9in and  
12in tube, £1-70. Post 30p. (9in and 12in  
measures approx.)

### SQUAD LIGHT

A new conception in  
light control. Four  
channels each capable  
of handling 750 watts  
of spot lights, flood lights or dozens of small  
mains lamps. Seven programs all speed  
controlled plus flash modulation, effectively  
giving 14 different displays. Makes sound-  
to-light obsolete. Completely electrically and  
mechanically noise free. Can be used on same  
circuit as radio mixes or sensitive amplifiers.  
A whole new range of lighting effects possible  
with astounding results. Already in use in  
London's foremost theatres, night clubs and  
discos. Conforms to all R.F.I. tests, including  
Common Market regulations. Supplied in  
tough, well designed case with embossed  
front panel. Price only £60. Post 75p. S.A.E.  
(Footscap) for further details.



### WIDE RANGE OF DISCO LIGHTING EQUIPMENT

6" colour wheels, 3 1/2" cassettes. S.A.E. (Footscap)  
for details.

### TIME SWITCH

"Horstmann" Type V Mk. II Time  
switch. 200/250 volt A.C. Two on/two  
off every 24 hours, at any manually pre-  
set time. 30 amp contacts. 36 hour  
spring reserve in case of power failure.  
Day omitting device. Fitted in heavy  
high impact case, with glass observa-  
tion window. Built to highest Electricity  
Board Spec. individually tested. Price  
£7-75. Post 50p. (Total incl. VAT £8-91)



### WHY PAY MORE?

MULTI RANGE METER, A.C. volts  
2.5-500, D.C. volts 2.5-500 (Sensitivity  
2000 Ω/V d.c. and a.c.). D.c. current  
0/1/10/100 mA, Ohms range. Sturdy  
compact moving coil instrument with  
21 ranges. Dimensions 120 x 80 x  
44mm. Weight 0.32kg.  
SERVICE TRADING CO. Price £5-00. Post 50p.  
(Total price incl. VAT and post £5-94). Incl. leads and  
battery.



### VAT

VAT at 8% MUST BE ADDED TO  
ALL ORDERS FOR THE TOTAL VALUE  
OF GOODS INCLUDING POSTAGE  
UNLESS OTHERWISE STATED

**SERVICE  
TRADING CO.**

## ROTARY VACUUM AIR PUMP AND COMPRESSOR

Carbon vane oilless, 100/115V a.c.,  
1 1/2 h.p. motor, 50/60 cycle, 2875/3450  
r.p.m., 20 in vacuum, comp. 1-25  
c.f.m., 10 p.s.i. (approx. figures).  
New unused surplus stock. Supplied  
with electrical connection data. FRACTION OF  
MAKER'S PRICE £12. Post £1-00. Suitable 110/240V,  
150 watt auto transformer £3-50. Post 50p. (Both  
items together Post £1-25).



## GEARED MOTORS

36 R.P.M. Reversible  
230/240V a.c. 60lb. in. torque. Continuously rated.  
Size: L 235mm, W 120mm, H 125mm. Spindle dia.  
13mm x 60mm long. Fitted mounted feet, M.f.g.  
Croydon. Brand New. £15. Post £1.

220/240V a.c. Small, powerful, continuously rated,  
reversible motor. M.f.g. Berger (Germany). Size  
80mm x 65mm x 65mm. Spindle dia. 6mm x 15mm  
long. Weight 725g. £5-50. Post 50p.

## BODINE TYPE N.C.I.

(Type J) 71 r.p.m. torque 10 lb. in.  
Reversible 1/70th h.p. 50Hz. (Type  
2) 28 r.p.m. torque 20 lb. in.  
Reversible 1/80th h.p. 50Hz.  
The above two precision made U.S.A. motors are  
offered in 'as new' condition. Input voltage of motor  
115V a.c. Supplied complete with transformer for  
230/240V A.C. input.  
Price, either type £6-25. Post 75p or less trans-  
former £3-75. Post 65p.



## TYPE SD48

80 lb. in. Input 100/200 volt A.C. Length incl. gear-  
box 270 mm. Height 135 mm. Width 150 mm. drive  
shaft 16 mm. Weight 8.5 Kilos. BRAND NEW.  
Price £10. Carr. £1.  
Suitable transformer for use on 220/240 volt A.C.  
£3-85. Post 50p.

230/240 VOLT A.C. MINIATURE MOTOR.  
20 R.P.M. Price £1. Post 20p.

## REVERSIBLE MOTOR

General Electric, 230V a.c. 1,600  
r.p.m. 0.25A. Complete with anti-  
vibration mounting bracket and  
capacitor. O/A size 110mm x 95mm.  
Spindle 4in. dia. 20mm long. Ex.  
equipment tested. £3. Post 50p.



## PROGRAMME TIMERS

230/240V a.c. 15 r.p.m. Motors.  
Each cam operates a c/o micro  
switch. Ideal for lighting effects,  
animated displays, etc. Ex equipment  
tested.  
2 cam model. 15 r.p.m. £2-00 post 35p.  
8 cam model. 20 r.p.m. £4-75 post 60p.



## TRIAC

Raytheon Tag symmetrical Triac. Type TAG.  
2500V0V, 10 amp, 500 p.i.v. Glass passivated plastic  
triac. Swiss precision product for long term  
reliability £1-00. Post 10p. (Inclusive of Data and  
application sheet.) Suitable Disc 18p.

## A.C. MAINS TIMER UNIT

Based on an electric clock, with  
25 amp. single pole switch,  
which can be preset for any  
period up to 12 hrs. ahead  
to switch on for any length  
of time, from 10 mins. to  
6 hrs. then switch off. An  
additional 60 min. audible  
timer is also incorporated. Ideal  
for Tape Recorders, Lights,  
Electric Blankets, etc. Attractive satin copper finish.  
Size 135mm x 130mm x 60mm. Price £2-25. Post  
40p. (Total incl. VAT and Post £2-87).



## POWER RHEOSTATS !!!

Superior Quality Precision Made  
NEW POWER RHEOSTATS

New ceramic construction, vitreous  
enamel embedded winding, heavy  
duty brush assembly, continuously  
rated.

25 WATT 10/25/50/100/150/250/500/1k/1-5k ohm.  
£1-70. Post 20p.  
50 WATT 1/5/10/25/50/100/250/500/1k ohm  
£2-10. Post 25p.  
100 WATT 1/5/10/25/50/100/250/500/1k/1-5k/2-5k/  
3-5k/5k ohm £3-30. Post 35p.  
Black Silver, Skirted knob calibrated in Nos. 1-9  
1/4in. dia. brass bush. Ideal for above 22p each.



Personal callers only. Open Sat.  
9 LITTLE NEWPORT STREET  
LONDON WC2H 7JJ  
Phone 01-437 0576

**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 easy to follow GUIDE TO SUCCESS should be read by every ambitious engineer. Send for this helpful 76-page free book NOW! No obligation, nobody will call on you. It could be the best thing you ever did.

**CHOOSE A BRAND NEW FUTURE HERE**

**CUT OUT THIS COUPON**

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

- |   |                          |  |                          |
|---|--------------------------|--|--------------------------|
| <b>ELECTRICAL &amp; ELECTRONICS</b>         |                          | Air Registration Board Certs.          | <input type="checkbox"/> |
| Practical Radio & Electronics (with kit)    | <input type="checkbox"/> | MAA/IMI Dip.                           | <input type="checkbox"/> |
| Electronic Engineering Certificate          | <input type="checkbox"/> | <b>CONSTRUCTIONAL</b>                  |                          |
| General Elect. Eng. Certificate             | <input type="checkbox"/> | Heating Ventilating & Air Conditioning | <input type="checkbox"/> |
| C. & G. Elect. Installations                | <input type="checkbox"/> | Architectural Draughtsmanship & Design | <input type="checkbox"/> |
| Elect. Install. & Work                      | <input type="checkbox"/> | L.I.O.B.                               | <input type="checkbox"/> |
| C. & G. Elect. Technicians                  | <input type="checkbox"/> | Carpentry & Joinery                    | <input type="checkbox"/> |
|   |                          | Plumbing Technology                    | <input type="checkbox"/> |
|   |                          | General Building                       | <input type="checkbox"/> |
|   |                          | Painting & Decorating                  | <input type="checkbox"/> |
| <b>RADIO &amp; TELE-COMMUNICATIONS</b>      |                          | <b>MECHANICAL</b>                      |                          |
| Colour TV Servicing                         | <input type="checkbox"/> | A.M.S.E. (Mech.)                       | <input type="checkbox"/> |
| C. & G. Telecoms. Technician's Cert.        | <input type="checkbox"/> | General Mech. Eng.                     | <input type="checkbox"/> |
| C. & G. Radio, TV & Electronics Mech. Cert. | <input type="checkbox"/> | Inst. Engineers & Technicians          | <input type="checkbox"/> |
| Radio & TV Engineering Course               | <input type="checkbox"/> | Maintenance Engineering                | <input type="checkbox"/> |
| Radio, Servicing & Repairs                  | <input type="checkbox"/> | Welding                                | <input type="checkbox"/> |
| Radio Amateur's Exam                        | <input type="checkbox"/> | <b>MANAGEMENT &amp; PRODUCTION</b>     |                          |
|   |                          | Computer Programming                   | <input type="checkbox"/> |
|   |                          | Inst. of Cost & Managements Accts.     | <input type="checkbox"/> |
| <b>AUTO &amp; AERO</b>                      |                          | <b>DRAUGHTSMANSHIP &amp; DESIGN</b>    |                          |
| Motor Mechanics                             | <input type="checkbox"/> | General Draughtsmanship                | <input type="checkbox"/> |
| C. & G. Motor V. Mechanics                  | <input type="checkbox"/> | A.M.I.E.D.                             | <input type="checkbox"/> |
| General Auto Engineering                    | <input type="checkbox"/> | Electrical Draughtsmanship             | <input type="checkbox"/> |
| A.M.I.M.I.                                  | <input type="checkbox"/> |  |                          |

**POST NOW**

**G.C.E.**  
—58 'O' & 'A' Level Subjects  
—over 10,000 Group Passes!

**Aldermaston College**

Dept. TPE15, Reading RG7 4PF

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

NAME (Block Capitals) .....

ADDRESS .....

Postcode .....

Other subjects of interest..... Age.....

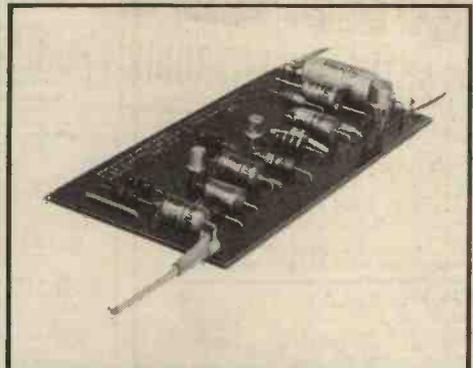
Accredited by C.A.C.C. Member of A.B.C.C.

**HOME OF BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY**

Still the simplest, fastest way of constructing your electronic circuits. Vero Electronics Ltd manufacture boards to suit most of your requirements, including, Verostrip, Dual in line I.C. boards, Plain Boards, etc. A new catalogue is available (price 10p + S.A.E. at least 7" x 9")

**VERO**

**VERO BOARD**



Vero Electronics Limited, Retail Dept., Industrial Estate, Chandler's Ford, Hants., SO5 3ZR Telephone: Chandler's Ford 2956 (STD 04125)

**P.E. CAR CLOCK with Journey Timer**

6-digit clock for use in any car with 12V battery, with an independent journey timer incorporated. Bright Jumbo LED display comes on with ignition—automatic intensity control. Complete kit of all parts needed to build this clock, including case, PCBs and all components. Full instructions, £77.77.

Easy to Build DIGITAL CLOCK (as in Jan E.E.). Kit of all components, including case, etc., for this attractive 4-digit clock with 12mm green display. Full instructions, £16.20.

A complete kit of parts to build this month's P.E. Mains Alarm Clock will also be available—send large s.a.e. for details and prices or phone for immediate dispatch.

50HZ CRYSTAL TIMEBASE KIT for clocks: all parts incl. PCB £6.28.

<b>RCA—MOT only</b>	CD4000	0-17	CD4033	1-14	CD4066	0-58	CD4527	1-30	SN75492	1-02
	CD4001	0-17	CD4034	1-56	CD4067	2-95	CD4532	1-16	7447	1-05
	CD4002	0-17	CD4035	0-97	CD4068	0-18	CD4555	0-74	7448	0-85
	CD4006	0-97	CD4036	1-82	CD4069	0-18	CD4556	0-74		
	CD4007	0-17	CD4037	0-78	CD4070	0-18	MC14508	2-37		
	CD4008	0-79	CD4038	0-88	CD4071	0-18	MC14528	0-86	20WAY1M	1-00
	CD4009	0-46	CD4039	2-86	CD4072	0-18	MC14534	6-04	10M for	8-50
	CD4010	0-46	CD4040	0-86	CD4073	0-18	MC14553	4-07	10WAY1M	0-60
	CD4011	0-17	CD4041	0-89	CD4075	0-18	MC14566	1-21	10M for	4-80
	CD4012	0-17	CD4042	0-63	CD4076	1-27	MCM14552	8-05		
	CD4013	0-46	CD4043	0-83	CD4077	0-18				
	CD4014	0-83	CD4044	1-77	CD4078	0-18	Clock Chips		IC Socket	
	CD4015	0-83	CD4045	1-15	CD4081	0-18	MK50253	5-60	Pins	
	CD4016	0-48	CD4046	1-10	CD4082	0-18	MMS314	4-44	100	0-50
	CD4017	0-83	CD4047	0-74	CD4085	0-59	AY51224	3-66	1000	4-00
	CD4018	0-83	CD4048	0-48	CD4086	0-59	AY51202	4-76	3000	10-50
	CD4019	0-46	CD4049	0-46	CD4089	1-27	MKS0250	5-00		
	CD4020	0-92	CD4050	0-46	CD4093	0-66			<b>LSI Sockets</b>	
	CD4021	0-83	CD4051	0-77	CD4094	1-53			Pins +	
	CD4022	0-79	CD4052	0-77	CD4095	0-86			Supports	
	CD4023	0-17	CD4053	0-77	CD4096	0-86	No VAT or		24 PIN	0-30
	CD4024	0-64	CD4054	0-95	CD4099	1-50	P. & P.		28 PIN	0-30
	CD4025	0-17	CD4055	1-08	CD4502	0-98	RC41975	2-67	40 PIN	0-30
	CD4026	1-42	CD4056	1-08	CD4510	1-12	MCM05	2-77		
	CD4027	0-46	CD4057	20-35	CD4511	1-28	Displays		<b>Verocases</b>	
	CD4028	0-76	CD4059	10-64	CD4514	2-56	SLT-0	5-80	751-10J	2-84
	CD4029	0-94	CD4060	0-92	CD4515	2-56	DL704E	0-85	751411D	3-04
	CD4030	0-46	CD4061	16-43	CD4518	1-12	FND500	1-50	751412K	4-00

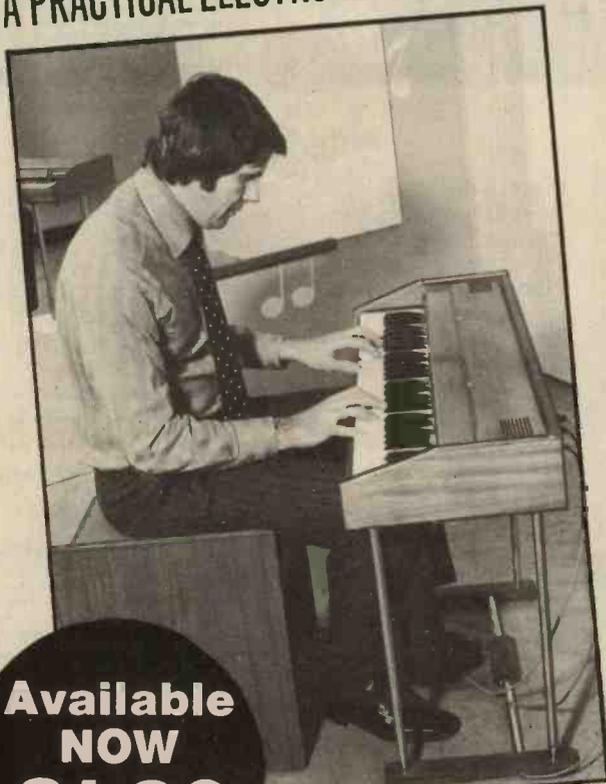
ADD VAT at 8% (higher rate does not apply to any of above). 15p P. & P. on orders under £3 (despatch by 1st Class Post). Price list and data sent FREE with an order, or on request (an S.A.E. helps). Official orders welcomed (written or phoned). Universities, Polytechnics, Government, Companies, etc. Export orders (no VAT): add 35p (Europe), £1 (overseas) for airmail P. & P.

**SINTEL** 53b ASTON STREET, OXFORD  
TEL. 0865 49791

# SOUND DESIGN

A PRACTICAL ELECTRONICS PUBLICATION

A SPECIAL SELECTION OF MUSICAL PROJECTS FROM PE



Available  
NOW  
**£1.20**

by post only

(Please allow at least 2 weeks for delivery)

## THE JOANNA ELECTRONIC PIANO

has realistic piano effect with touch-sensitive keyboard and additional choice of harpsichord or honky-tonk voicing.

## THE ORION STEREO AMPLIFIER

A hi-fi amplifier with output of over 20+20 watts. Compact and complete in one unit, it measures only 14" x 6" x 2".

## THE MINISONIC MK2 SOUND SYNTHESIZER

An up-dated version of the published Mk 1, the Mk 2 has an integral keyboard, two 250 mW monitoring channels and loudspeakers, and facilities for amplitude, frequency and harmonic modulation.

**PLUS** Some great sound effects units for guitars, keyboard instruments and general recording.

If you do not wish to mutilate your copy of the magazine, please send your order on a separate sheet.

To: Practical Electronics,  
IPC Magazines Ltd., Fleetway House,  
Farrington Street, London EC4A 4AD.

Please send me .....copy (ies)  
of "Sound Design". I enclose a Postal  
Order/Cheque for £1.20 (£1 + 20p post.  
& pack.) or (state amount for more than  
one copy .....  
(p&p 35p for 2 copies).

PLEASE WRITE IN BLOCK LETTERS

Name .....

Address .....

.....Post code.....

Remittances with overseas orders must be sufficient to cover despatch by sea or air mail as required.

Company registered in England. Regd. No. 53626. A subsidiary of Reed International Limited

# TOTAL HARMONIC DISTORTION FILTER

By R.A. PENFOLD

ONE of the most important parameters of an amplifier, perhaps the most important, is its level of distortion. It is therefore somewhat paradoxical that very few amateur electronic workshops are equipped to measure distortion.

The reason for this is almost certainly due to the high cost of a distortion meter, which is rather expensive even if home constructed. However, there must be many amateur workshops which are equipped with a high quality audio signal generator, and an oscilloscope and/or an a.c. millivoltmeter. These form the basis of distortion measuring gear, and few other items of equipment are required to enable distortion to be measured. In fact the only other major item of test gear that is required is a notch filter, and this article describes a very simple and inexpensive filter for use in measuring total harmonic distortion at 100Hz and 1kHz.

The unit is quite small and neat, and is completely self contained, power being supplied by an internal 9 volt (PP3) battery. As the current consumption is less than 2mA, the running costs are negligible, and even with extensive use the battery will have virtually its shelf life. The filter has been designed to be as simple to operate as possible, but prospective constructors should bear in mind that measuring distortion in amplifiers is necessarily a fairly complex process.

## TYPES OF DISTORTION

There are two types of distortion for which figures are normally quoted in amplifier specifications: intermodulation distortion (i.m.d.), and total harmonic distortion (t.h.d.).

### I.M.D.

I.m.d. is the more involved of the two and occurs when two or more signals are presented to a non-linear amplifier (any practical amplifier is non-linear to some degree). The distortion results in two main new frequencies being produced by the amplifier. If we take a simple example with only two input frequencies  $f_1$  and  $f_2$ , the new signals

are equal to  $f_1 + f_2$  and  $f_1 - f_2$ , where  $f_1$  is the higher of the two frequencies. The situation is little more complicated than this would suggest as the new frequencies interact with one another, and with the original two signals, and more new signals are produced. These then interact with one another, and so on, with a multitude of new frequencies being produced by the amplifier.

Measuring this form of distortion is, not surprisingly, very involved and probably beyond the scope of most amateurs.

### T.H.D.

Total harmonic distortion is more straightforward and is the result of a single tone being processed by a non-linear amplifier. Here the distortion of the fundamental frequency produces harmonics at the output of  $2f$ ,  $3f$ ,  $4f$ ,  $5f$ , etc. If, for example, a 1kHz tone is applied to an amplifier, signals at 2kHz, 3kHz, 4kHz, and so on, will be produced as a result of the t.h.d.

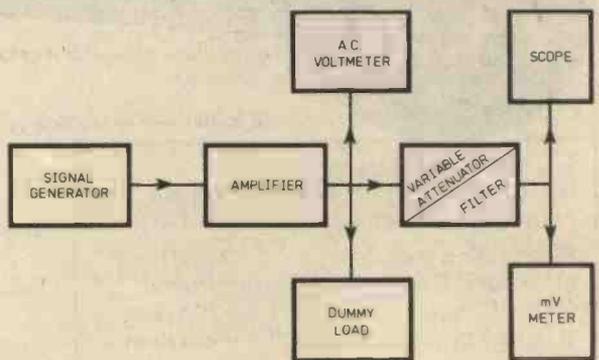


Fig. 1. Arrangement used by the author to measure t.h.d. The filter removes the fundamental enabling the distortion products (including noise) to be measured

## MEASUREMENT OF T.H.D.

This type of distortion is much easier to measure, and the basic arrangement used here is illustrated in Fig. 1.

A high purity sinewave is fed to the input of the amplifier from the signal generator. It is inevitable that the signal generator will have a certain amount of distortion on the output, and this distortion should be measured beforehand.

A dummy load resistor simulates the normal load impedance of the amplifier, and the voltmeter allows the output of the signal generator to be adjusted to give the appropriate power output level from the amplifier. The filter gives a narrow rejection notch at its operating frequency (we will assume this to be 1kHz in this example), and the signal generator is adjusted to this notch frequency.

The filter described here has two operating frequencies, and at the outset this is set to the one at which the distortion is not being measured so that the signal can pass unhindered. The attenuator is then adjusted to give a convenient reference level on the millivolt meter. 100mV or 1V r.m.s. will probably be the most convenient. 1V r.m.s. is about the maximum the filter can handle without clipping the signal and giving misleading results.

If the filter is now switched back to 1kHz it can be critically adjusted to give the lowest possible reading on the millivoltmeter. The signal generator frequency control will probably need some small adjustment as well, and the scope is very helpful in obtaining the correct settings. This procedure will be described in greater detail later.

## CALCULATIONS

When these adjustments have been carried out properly the fundamental frequency will have been virtually eliminated, and only the distortion and noise will remain. From the reading on the meter the distortion factor can be calculated and is equal to:

$$\left( \frac{\text{Millivoltmeter reading}}{\text{Reference level}} \times 100 \right) - D$$

(Where D is the percentage distortion of the signal generator.)

This gives the distortion factor as a percentage. The distortion factor is equal to the t.h.d. plus the noise present. The percentage of t.h.d. can be found by calculating the distortion factor, and the noise level as a percentage of the output level at which the measurement was made:

$$\left( \frac{\text{Output noise}}{\text{Voltage measured across dummy load earlier}} \right) \times 100$$

The percentage of t.h.d. is equal to the distortion factor minus the noise level.

## EXAMPLE OF A T.H.D. CALCULATION

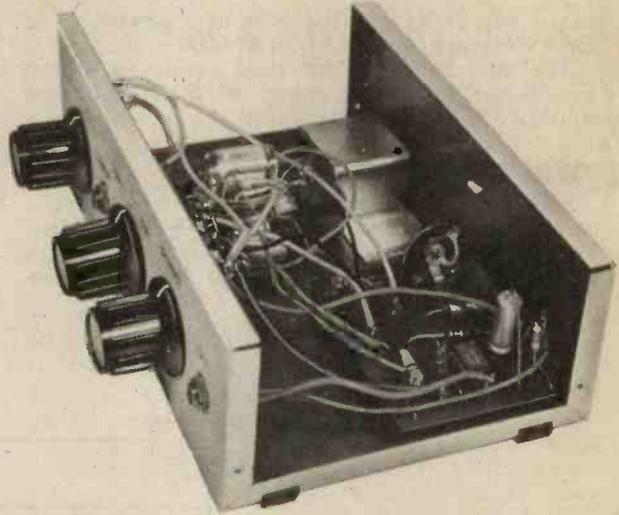
The following example may help to make this a little clearer. Assume that we wish to measure the t.h.d. level of an amplifier delivering 2 watts r.m.s. into an 8 ohm load at 1kHz.

First the signal generator is set to 1kHz and adjusted to give a reading of 4 volts r.m.s. on the voltmeter. An 8 ohm (8.2 ohms will do) resistor is used as the dummy load. The filter is switched to the 100Hz position and the attenuator is adjusted to

give a convenient reading on the millivoltmeter, say 1 volt r.m.s. The filter is then switched to the 1kHz position, and then both it and the signal generator are adjusted for the minimum fundamental output.

If, for instance, this leaves a reading of 15mV on the millivoltmeter and the signal generator has a distortion level of 0.2%, then the distortion factor equals  $(15 \times 100/1,000) - 0.2 = 1.5 - 0.2 = 1.3\%$ .

The signal generator is then switched off and the millivoltmeter is used to measure the output noise of the amplifier directly at its output terminals. If



## COMPONENTS ...

### Resistors

R1	22kΩ	R5	47kΩ
R2	150kΩ 5% or better	R6	4.7kΩ
R3	150kΩ 5% or better	R7	4.7kΩ
R4	100kΩ	R8	1.2MΩ

All resistors 10% carbon ¼W unless otherwise stated

### Potentiometers

VR1	100kΩ lin carbon pot
VR2	100kΩ standard vertical preset
VR3	10kΩ lin carbon pot

### Capacitors

C1	10μF 10V elect
C2	1nF polystyrene or mica, 5% or better
C3	10nF polystyrene or mica, 5% or better
C4	10nF polystyrene or mica, 5% or better
C5	1nF polystyrene or mica, 5% or better
C6	20nF polystyrene or mica, 5% or better
C7	2nF polystyrene or mica, 5% or better
C8	16μF 10V elect

### Integrated circuit

741C operational amplifier in 8-pin DIL package

### Miscellaneous

Metal instrument case, Samos S3 (Doram)  
3-way 4-pole rotary switch. Aluminium for battery bracket  
Three control knobs. PP3 battery and battery clips to suit  
Two 3.5mm jack sockets  
0.1in matrix Veroboard

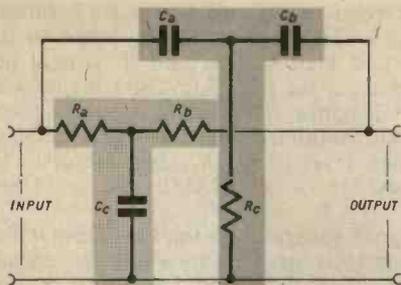


Fig 2. The basic "Twin-Tee" notch filter

this is, say 8mV, then the noise as a percentage of the 4 volt output level is  $8 \times 100/4,000 = 0.2\%$ .

The total harmonic distortion equals the distortion factor minus the noise, which in this case equals  $1.3\% - 0.2\% = 1.1\%$  t.h.d.

### TWIN-T NOTCH FILTER

Probably the most simple filter that will give a narrow rejection notch is the twin-T notch filter. The circuit of a twin-T notch filter is shown in Fig. 2, and it should be apparent from this how the filter derives its name.

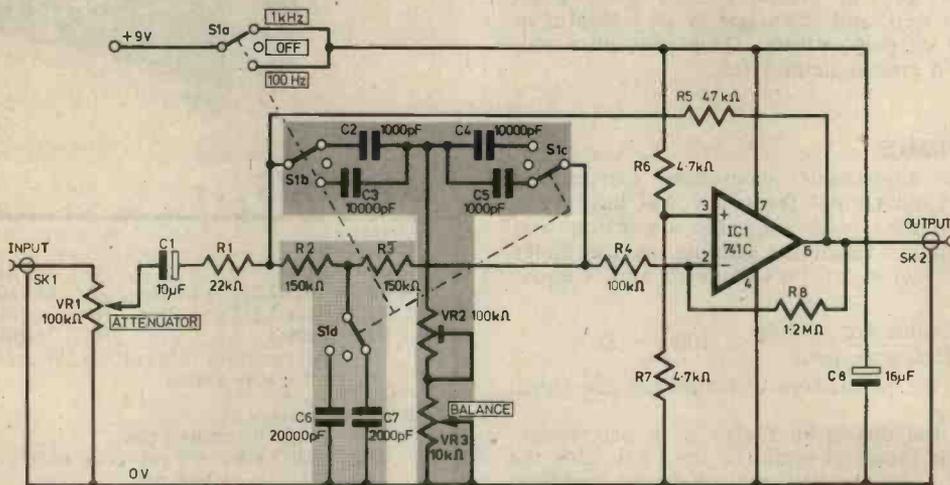


Fig. 3. Full circuit diagram of the filter

In order to give a good performance the components used in the filter should have a tolerance of 5% or better.

One drawback of this filter is that it attenuates the second harmonic by almost 6dB, and would also significantly reduce the noise from the amplifier. This would give rather an optimistic assessment of an amplifier's performance.

### PRACTICAL FILTER

It is possible to improve the performance of a filter by including it in either a positive or negative feedback loop of an amplifier, depending upon

which aspect of performance one wishes to improve. Here we wish to obtain a flatter response near to the resonant frequency of the filter, and this is achieved by the use of negative feedback. The circuit diagram of a practical filter employing this technique is shown in Fig. 3.

VR1 is the variable attenuator, and from here the input signal is fed to the input of the twin-T filter via C1 and R1. There are two sets of capacitors in the filter, and these can be switched by S1 to give a notch at either 100Hz or 1kHz. S1 also operates as the on/off switch. The lower value resistor of the network is made variable so that the circuit can be adjusted for optimum results.

The output of the filter is fed to an amplifier using a type 741 i.c. operational amplifier. As a single supply rail is used, a potential divider formed by R6 and R7 is necessary to act as a centre tap on the supply to bias the non-inverting input of the i.c. The circuit operates as an inverting amplifier with R4 and R8 setting the gain at 12.

### SECOND FEEDBACK LOOP

There is, however, another feedback loop via R5. Thus as the attenuation of the filter increases towards

its resonant frequency, the negative feedback is reduced and the gain of the circuit is increased. This counteracts the losses in the filter and gives a flatter response.

At, and very close to, the resonant frequency of the filter, the losses in the filter are extremely large, and the feedback is unable to significantly compensate for these with the maximum closed loop gain of the 741 circuitry set at only 12 by the first feedback loop.

The overall response of the circuit is therefore exactly what is required. It is flat over (and beyond) the audio frequency spectrum, except for a narrow notch of extremely high attenuation at resonance. The overall gain of the circuit is a little more than unity.

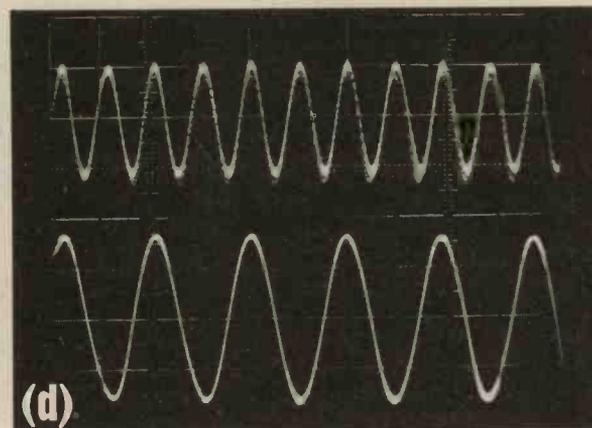
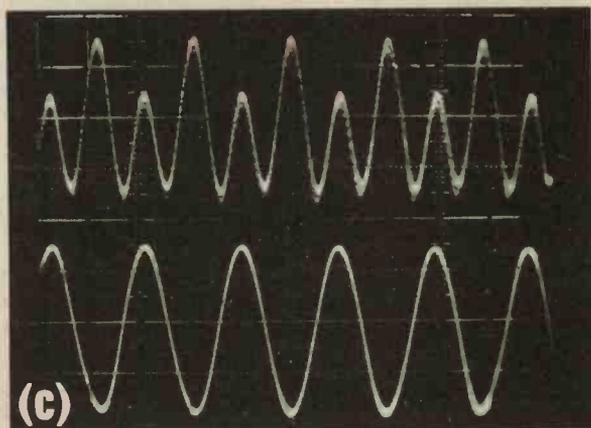
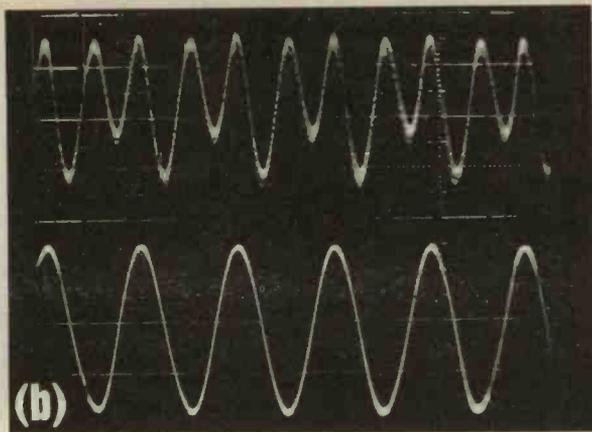
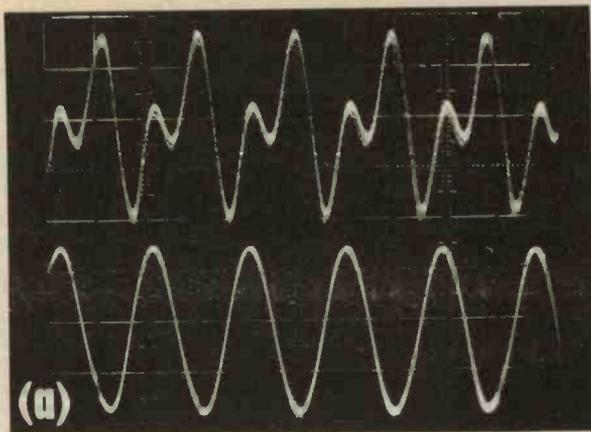


Fig. 5. Typical oscilloscope traces obtained using the filter: (a) balance control set roughly correct; (b) balance control adjusted to align tops of waveforms; (c) signal generator frequency then adjusted to align bottoms of waveforms; (d) distortion (predominantly second harmonic) and residual noise with fundamental notched out. The sinewave input is at 1kHz and the measured level of distortion is 1%

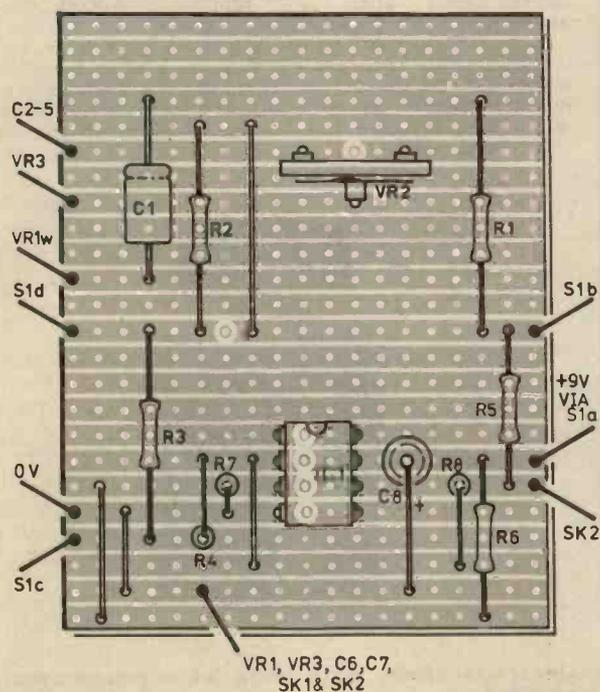


Fig. 4. Veroboard details and component layout

### CONSTRUCTION

A ready made steel instrument case having outside dimensions of 150 × 100 × 50mm provides a suitable housing for the unit.

Most of the small components are mounted on a piece of 0.1in Veroboard having 24 strips by 19 holes. Full constructional details of this panel are shown in Fig. 4. No socket is required for the i.c. Veropins are used where connections are taken to the controls, sockets, etc. C2 to C7 were mounted on S1 on the prototype.

The general layout of the interior of the case is straightforward but make sure that the Veroboard panel is mounted in a position which enables easy access to the adjustment of VR2. A small mounting bracket for the battery is easily fabricated from a scrap of aluminium and glued in position.

### ADJUSTMENT

Before the completed unit is ready for use, VR2 must be given the correct setting. To do this, connect a signal generator tuned to 1kHz to the input of the filter, and set the function switch of the filter to the 1kHz position. Set the slider of VR2



at the position which gives the lowest indication on an oscilloscope or millivolt meter connected to the output of the filter. VR3 should be set at its midway setting during this operation.

Now adjust the signal generator frequency control slightly either side of its initial setting in an attempt to obtain a still lower reading from the output indicator. Then readjust VR2 for the lowest possible output. Continue this procedure until no further improvement can be obtained. VR2 then has the correct setting.

**USING THE FILTER**

The rejection notch of the filter is very narrow and the adjustment of the input frequency and the balance control of the filter is quite critical. If the filter's output is being monitored by an oscilloscope, the following procedure can be adopted in order to quickly arrive at the correct settings of these controls.

With the controls set at roughly the right settings a waveform something like that of Fig. 5a should be obtained. The balance control is then adjusted so that the tops of the waveforms of the fundamental and first harmonic are aligned, as shown in Fig. 5b. The input frequency is then adjusted to align the bottoms of the waveforms (Fig. 5c). The balance control is then once again used to align the tops of the waveforms, as this whole sequence is repeated several times until the fundamental is almost completely suppressed, leaving only the noise and distortion (Fig. 5d).

**NECESSARY EQUIPMENT**

It is not absolutely essential to have an oscilloscope to monitor the output, but obviously this greatly simplifies and speeds adjustment of the equipment, and is the only way of being completely sure that the fundamental has been adequately suppressed. Also, it is not absolutely essential to have a millivoltmeter to measure the output, as most oscilloscopes will be capable of measuring the filter output level. If the distortion includes a large amount of second harmonic distortion, however, it may be difficult to gauge the r.m.s. output level as it will not be a definite fraction of the peak to peak level, as is the case with a sinewave signal.

The signal generator needs to be a good quality type and should really have a distortion level less than 0.2% if accurate measurements are to be possible. The generator's distortion factor is measured using the set-up of Fig. 1, but of course with no amplifier intervening between the filter and the signal generator. ★

**PE KIT REPORT**

INTEGRATED injection logic (i<sup>2</sup>L) is a fairly recent technology which many might have heard of in relation to the microprocessor.

In the beginning the areas of application envisaged embraced many of the products now made in CMOS, MOS and some low power TTL. Wristwatches were an obvious area of involvement since two of the advantages of i<sup>2</sup>L are low power and low voltage requirements such as provided by small Mallory cells.

The recently announced Sinclair "Black Watch" kit utilises an i<sup>2</sup>L i.c. and lays at once that bane to all MOS users—static electricity! There are actually no handling precautions necessary so it was with a gay heart and a nylon shirt that I got to constructing this.

**ASSEMBLY INSTRUCTIONS**

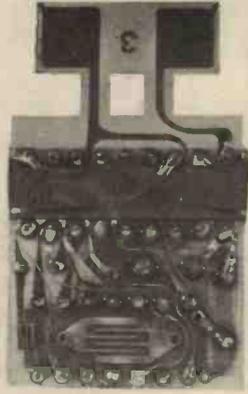
At £17.95 it's obvious that an awful lot of people will have a go at this kit so simplicity in assembly instruction is paramount.

A component list allows you to first check the kit contents and to familiarise yourself with their shapes and identities. Tool requirements are next; soldering iron (suitably earthed), small wire cutter, fine-nosed pliers and non-metallic trimming tool.

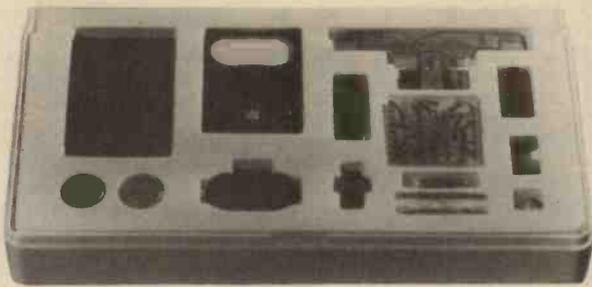
It should go without saying that anyone attempting an assembly of watch dimensions should have a steady hand and reasonable eyesight. An extension lamp and watchmaker's eyepiece is an ideal aid to this.

Of course, the iron is the most important tool. The bit should be small, 3/16 in is the best size. Recommended types are the Weller Marksman, Adcola Adam or Antex CN. These should be earthed.

It is at this point, when you have piece-parts and tools, to really read the instructions. Besides those on assembly there are some on using the watch which have important figures and there is also a separate addendum on bending details for a copper shield which can be easily overlooked.



Underside of the p.c.b. with all components assembled



# sinclair BLACK WATCH

## PUTTING IT TOGETHER

Since there is no circuit diagram, the only concern is relating, with the correct orientation, the component parts to the p.c.b. provided. This little square is your work area and familiarisation with its copper geometry is to advantage. After preparation with varnish (solder and grease are also provided) the trimmer and capacitor are added. There is no need to pre-tin anything as the copper, leads and solder all showed a great affinity. When soldering in the quartz crystal an urgent iron is needed as overheating can be detrimental.

## DISPLAY AND I.C.

The display has 14 pins and it is important to get the orientation right and this means picking out pin 1. An arrowed scale-of-two enlargement parades this in the instructions. All subsequent handling of the p.c.b. should be with care as the plastics lens can easily be scratched.

And so on to the 18 pin d.i.p. i.c. The massive indent solves the orientation problem. Again a quick iron is needed. Part of the assembly time on this is spent in wrapping around a flexible p.c.b. which mates with one line of pins and provides contact pads for the batteries and touch pads for hours/minutes and minutes/seconds displays. This can be seen in the photograph.

It remains to check whether the electronics are "go". A bulldog clip is needed to make connection to the Mallory cells. You can't confuse the polarities as the clip, cells and p.c.b. are all shown in graphic perspective union in the literature. It remains to make metallic contact with the touch pads.

My watch worked first time which is an endorsement to the excellence of the parts and the instructions. Obviously there will be people who will be disappointed at this point either through faulty components or an excess of zeal. Whatever—Sinclair provide a service guarantee for a charge of £3.50; this does not cover the cost of replacement parts, refundable if their components are at fault. The completed watch is covered by a one year guarantee.

## ADJUSTMENT

After a 24-hour "burn-in" the copper shield is box-fashioned and slid over the module. The watch can now be accurately adjusted against a time signal (TIM or radio). At the trimmer, approximately 10 degrees of rotation will produce a change of one second a day.

The module is now ready for case assembly which is simple and adequately described in the literature.

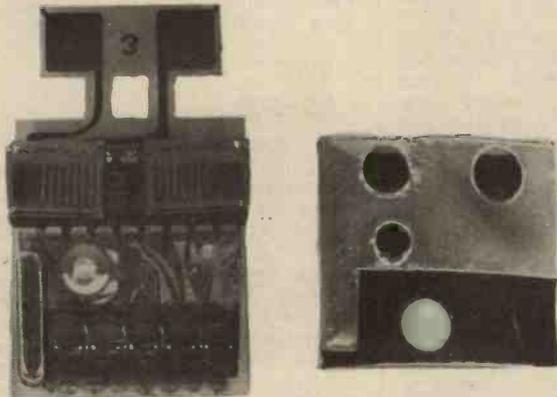
## SIZE

In common with most digital watches, the "Black Watch" does cover a large area of the wrist. This with its box styling and plastic structure would seem to make it liable for easy damage.

The conventional analogue watch is reassuring with its protective shockproofing and waterproofing and the habit of assessing a watch by these criteria dies hard.

However—accuracy is what timekeeping is all about and Sinclair does guarantee this to within a second a day with the possibility of improvement with adroit twiddling of the trimmer.

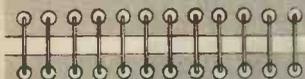
G. G.



The assembled watch module and copper surround. It is essential that all components are closely seated on the p.c.b. and all lead ends cropped short or the copper screen will not fit. It is expected that the screen will be omitted from future kits with circuit modification.



£17.95  
Inc VAT



# INDUSTRY NOTEBOOK

*By Nexus*



## COMMUNICATIONS

This year's Communications '76 Exhibition and Conference at the Metropole Convention Centre, Brighton, will be the shop window for what the British do best in electronics—communications. And so they should, having been first in the field.

The event is in June and already there are more exhibitors than for the last show in 1974 and they have booked more than double the floor space so that an additional hall in the Centre has been taken to accommodate the latecomers.

Ninety-nine learned papers are to be read. This, unhappily, means parallel sessions with up to three papers being presented simultaneously in different locations, leading to a measure of frustration. There are to be four incoming trade missions consisting of senior communications executives from 40 different countries and they will tour British industry as well as attend the exhibition.

Among the social events is a reception by Brighton Corporation's Mayor and Mayoress in the historic Royal Pavilion. Will it all lead to substantial new business? There will be well over 100 exhibitors and all expect to do well.

## QUICK TUNING

With so much emphasis these days on satellite and microwave link communications, high-frequency radio tends to take a back seat but I am pleased to report that h.f., on which so many of us cut our teeth, still has plenty of life, not only operationally in the congested h.f. bands but also in new business. Marconi Communications has recently announced a

new h.f. amplifier to be known as the H1140. It is a further development of the Marconi Self Tuning (MST) range and gives a mean or p.e.p. output of 10kW over the range of 1.6MHz to 30MHz. Input requirement may be any frequency within the range at any level between 50mW and 150mW.

The key feature, however, is that it tunes itself to any frequency in typically three seconds with no knob twiddling. Of course, Marconi is not alone in providing this type of feature which enables quick band changing either to overcome propagation variations or for security reasons.

Ten of the new h.f. amplifiers have been sold through NATO for installation at the Crimond Naval station to the north of Aberdeen. Due for delivery early in 1977, they will be used in a five-pair configuration to beef up NATO communications for Allied navies in Northern Waters. A subsequent NATO order, announced only a week later, is for low frequency drivers and amplifiers for Crimond. The first order was worth £400,000, the second £200,000.

Nice business for starters, and the NATO endorsement is excellent for future business of which Marconi expects plenty.

## TV SAT-HOME LINK

The European Space Agency is pressing on with feasibility studies on direct colour-TV reception in the home from satellites. At present TV via satellite comes in to big receiving complexes like Goochilly, then relayed to your local TV station and re-transmitted from there. The idea is that individual viewers should be able to receive the TV transmission direct from the satellite.

Well, there's nothing really to stop you doing that now if you are prepared to invest a million pounds or so in building a steerable 85ft diameter dish antenna in your garden, together with cooled parametric amplifiers and all the rest of the paraphernalia associated with space communications.

The reason why the big dishes are necessary is because of the comparative feebleness of the power transmitted from space, dictated by the type of payload put in orbit and the available power supplies. It follows that if you reduce the size of the earth dish to something that could be mounted on the roof or outside a window, the collecting area for the signal is so much reduced that, for the same results, the satellite must generate much more power.

So the drive is now on to get more powerful transmission from space, the target being 2kW of prime power and this brings its

own problems. In the space environment, of thermal dissipation and equipment protection. Marconi Space and Defence Systems, who have a study contract from the European Space Agency, report that European development of high power travelling wave tubes is well advanced with 1kW already achieved in the allocated band of 11.7 to 12.5GHz.

The home receiver will have a mass-produced dish some 2½ft in diameter, expected to be plastic with a metallized reflective coating on the business side. There will, of course, also have to be an amplifier and frequency conversion equipment to feed a standard TV set.

## POLICEMAN'S LOT

The policeman's lot is not a happy one. With terrorism added to rising figures for what we might call conventional crime, the workload is escalating and the need for quick response greater than ever. It is no wonder that police forces are investing in computerised command and control systems of a complexity approaching that used in military defence headquarters. The problems are the same in kind, differing only in detail.

Among the new installations now being fitted are one for the Suffolk Police and one for the Metropolitan Police. Suffolk is to use a system based on a GEC 4080 computer and the Metropolitan force one based on Data General hardware. Contractors, respectively, are Marconi Space and Defence Systems and International Aeradio Ltd.

Both systems make extensive use of visual display units as the interface with the computer and the IAL system, called RADIAL, also projects a map of the incident area for instant and accurate location data on which to base action.

## LASERS

A recent building exhibition in London showed a remarkable penetration of laser technology into what is normally regarded as an industry conservative in outlook. There were laser plumb-lines, lasers for pipe-laying and trench digging, for distance measuring and for floor and ceiling alignment.

Another popular application is in meteorology and, in the electronics industry itself, Teradyne reports that there are now more than 30 automated laser trimmer systems, for hybrid microcircuitry, of their manufacture installed in Europe. Biggest users, however, are still the defence forces for range-finding, target-marking and weapon guidance.

# Next Month...

Don't miss the variety of interests covered in this **BUMPER ISSUE**— including **Special 8 PAGE SUPPLEMENT**

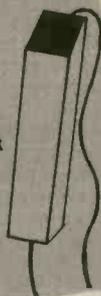
## SOUNDS EXTRAORDINARY

Surveys the various sound effects units currently in use. Defines terms, explains operation and outlines the circuit arrangements used to create these amusing, amazing, and sometimes quite startling, effects

**PLUS**

### PE DIGI-PROBE

A most useful and easy to use instrument invaluable to all who work with logic circuits. Seven segment i.e.d. gives precise indication of steady state logic, and pulse decimal point indicates high speed switching



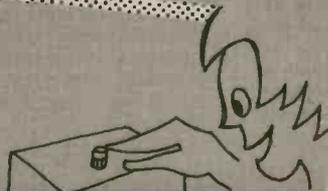
### A.D.S.R ENVELOPE SHAPER

An add-on unit for electronic musical instruments such as organs and synthesizers to give a wide range of interesting effects. Four controls give a multitude of different envelope shapes which will greatly enhance the range of sounds within your capability



### SHOOT

Fun for all the family with this fascinating game to test your speed of reaction. All you have to do is to "hit" a moving light as it moves along a row of light emitting diodes, but each time you "miss" the game gets harder



# PRACTICAL ELECTRONICS

APRIL ISSUE ON SALE MARCH 12, 1976

**PLEASE NOTE:**

It is in your interest to place a firm order with your newsagent—in advance. Back numbers are not available, so make sure of your copy now!

# SEMICONDUCTOR UPDATE

By R.W. COLES

1720R  
1723R  
MC14419  
8038

## THE BIG RED "ONE"

Ever since i.e.d. displays of the seven-segment variety first saw the light of day, they have suffered from one serious drawback—size—or rather, lack of it! The usual size range for early devices was about 2.5mm to 7.5mm character height, which meant that a good pair of eyes and/or a magnifying lens were required for easy reading.

Of course, there are applications which require this diminutive sort of display, but manufacturers have been constantly aware of their inadequacies in this department and have been striving to compete with the larger Minitrans and Nixie tubes for the lucrative slice of the market which includes all those of us whose vision is not quite what it used to be!

The first step in the right direction came in the form of the 15mm "Jumbo" devices which use the light-pipe technology to channel the light from single-point source i.e.d. chips into fair sized segments. This light-pipe success has now been followed by an even bigger 25mm display which is easily visible over a 20m viewing distance.

This new "King-size" device is made in the U.S.A. by a firm called Industrial Electronic Engineers Incorporated but is available in the United Kingdom from the rather more familiar "Perdix Components Ltd." It is produced as a common anode type (1720R) or a common cathode type (1723R) and comes in a 14-pin package with 15mm row spacing so that it can go into a standard 24-pin d.i.l. socket. Each segment is lit from not one but two i.e.d. chips in series so that the forward voltage per segment is about 3.3V at 20mA.

## KEY CODER

It is the modern trend to replace conventional knobs and switches with a calculator style keyboard. This approach can cut out a lot of hardware for the extra cost of a handful of logic and analogue chips, and lends itself well to the all-powerful l.s.i. technology with its promise of extremely low prices for large quantities.

Signal generators, even power supplies, can now be obtained with an i.e.d. display and a functional key-pad as the only external sign of

the "goodies" within. To select, say, a frequency and output level on a signal generator of this type, one would simply punch in an appropriate string of digits to get an instant response, with no necessity for knob twiddling at all!

This is all very well for the larger manufacturer, but the sad fact is that the nuts, bolts, and dial-cord approach has still been the only solution for us amateurs, or has at any rate, until now. The range of c.m.o.s. logic systems produced by Motorola has been mentioned before in this column, and a new addition to this range, the MC14419, looks like being the start of a breakthrough which will result in keyboards sprouting in the most unlikely places.

The MC14419 is the answer to the keyboard-fancier's dreams, since it combines in one easy-to-use 16-pin d.i.l. package:

- A 16 key-to-binary encoder.
- A rollover protection circuit.
- A delay circuit for key de-bouncing.
- A strobe pulse generator.

The key switches required are of the simple "push-to-make" type arranged as a 4 × 4 matrix, and with a full sixteen keys to play with, there is plenty of scope for control functions, decimal points, and arithmetic operators in addition to the ten numeric keys normally employed.

## VERY FUNCTIONAL

My next offering is an integrated circuit which has been around for about a year now, but, surprisingly, has not had the coverage it deserves.

I am referring to the 8038 function generator introduced by Intersil, and even if you have heard of it before

I am sure that you will agree that it is worth a second look (Fig. 1).

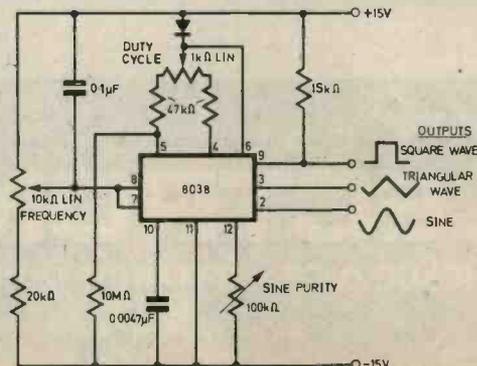
The 8038 is a chip with universal appeal for electronics enthusiasts, because whether you are a "Logic person" or an "Audio person" you will find it hard to resist a single integrated circuit which gives simultaneous sine, square, and triangular wave outputs over the frequency range 0.001Hz to 1MHz. If those features are not enough to make you an instant fan, then perhaps the fact that a voltage controlled input is provided to facilitate frequency modulation or frequency sweeping, will do the trick. For the sacrifice of the sine output you can also generate a sawtooth from the triangular output and a pulse waveform from the squarewave output, simply by varying the duty cycle, and all this is available for a mere £3.00 from amateur suppliers.

Before everybody starts reaching for their piggy-banks perhaps I had better be scrupulously fair and point out a couple of snags!

The biggest flaw in the operation of the 8038 is undoubtedly the fact that the sine output is *not* distortion free, and this is not really surprising when the method of sine generation is examined. The sine waveform is produced by "whittling away" the triangular wave in the right places to give an approximation of a sine curve, with the possibility of minimising distortion with an external pot. Performance can be improved with an external filter if required.

The outputs of the 8038 are of the high impedance type and should not be connected to a load of less than 10k ohms, which in practice means that an Op-Amp buffer may be required in certain applications.

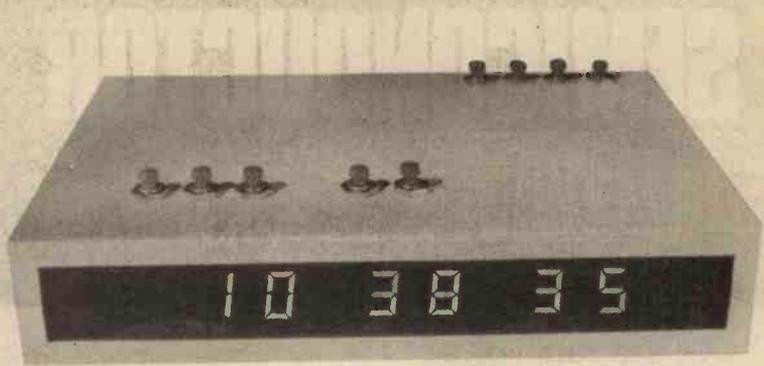
Fig. 1



# CAR/ CARAVAN CLOCK

PART  
TWO

## ADDITIONS TO THE BASIC DESIGN



★ Mains operation plus Latch and Controller facilities

By M. Fischer\*

A simple and attractive mains only digital alarm clock can be constructed using the clock PCB (PCB2) and the display PCB (PCB3) included in last month's car clock. The changes in design involve the addition of three rectifier diodes and a 50Hz diode to PCB2 changing the value of segment current limiting resistors (R29-R35), and of course adding a mains transformer.

### POWER SUPPLY DESIGN

Two supply lines are required providing 14V at 20mA and 6V at 500mA as seen in Fig. 12. The capacitors are needed in both versions.

For the V + (4) supply, when pin A of T1 nears its maximum positive voltage with respect to pin C, diodes D3 and D1 conduct to charge C1, providing a half-wave rectified and smoothed 14V for the MK50253 positive supply.

For the V + (2) supply, D1 and D2 cause a full wave rectified voltage at V + (2) with respect to 0V, with a peak voltage of approximately 7V. The

current flowing between V + (2) and 0V is so large that C2 provides little smoothing and the ripple voltage is about 5V. This causes a 100Hz ripple in the display brightness, which is, however, invisible to the human eye.

If V + (2) and V + (4) had been obtained from, say, a single full wave rectified and smoothed supply, as has been the case in most other clock designs, four rectifier diodes would have been required instead of three, and C1 would have had to be increased to 2,500 $\mu$ F. This would have changed the peak current through T1 from 0.5A to about 5A, which would have required a transformer with a rating of about 12VA rather than 6VA.

### CHOICE OF TRANSFORMER

There are several 6V-0-6V, 6VA miniature transformers on the market but constructors are warned that those tried got fairly hot in mid-summer, even with no load. The various manufacturers told us that, in order to build a miniature transformer with

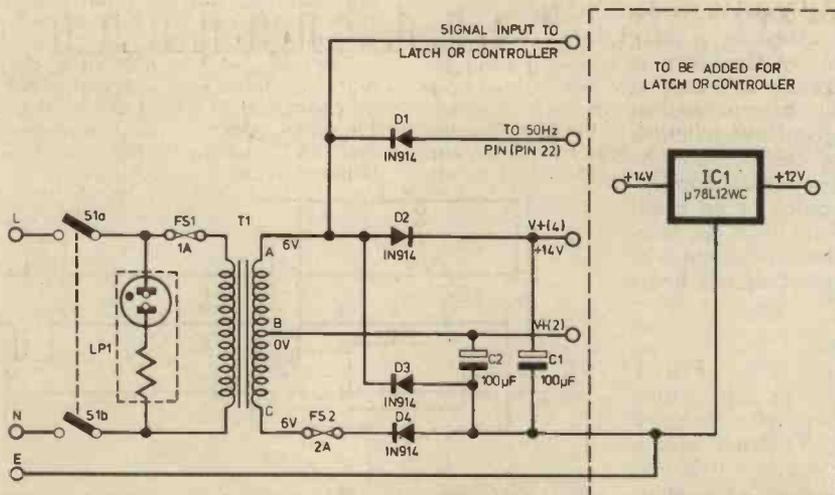


Fig. 12. Mains p.s.u. and added regulator for Latch and Controller circuits

### COMPONENTS . . .

#### POWER SUPPLY

##### Capacitors

C1-C2 100 $\mu$ F elect. 25V (2 off)

##### Semiconductors

IC1  $\mu$ A 78L12WC (if required)  
D1-D4 1N914 (4 off)

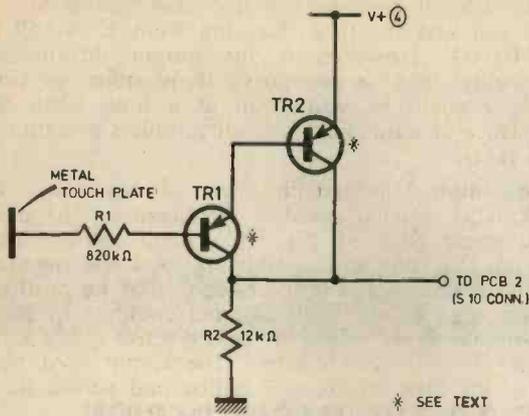
##### Transformer

T1 6-0-6V, 6VA miniature mains transformer (Sintel, 53b Aston St., Oxford)

##### Switches

S1—Double pole mains on/off.

\*Sintel



**Fig. 13. Touch switch snooze control**

a low variation in output voltage with load, the transformer has to be made "loosely", and hence runs hot. As this application can tolerate large percentage changes in transformer voltage, we have had some wound on a high-efficiency core, with low loss windings. This transformer runs remarkably cool, and we do not recommend that constructors use any other if building the clock in the case specified.

### TOUCH SWITCH SNOOZE

Those who want the magic of a touch switch snooze control can mount the components shown in the circuit diagram in Fig. 13 on a small piece of Veroboard.

When the touch plate is touched with a finger, the 50Hz signal picked up by the body causes the Darlington pair TR1 and TR2 to switch on and off at 50Hz, providing positive pulses for the snooze control. The touch plate can be any metal object such as a screw, etc. When the snooze is activated, the alarm tone disappears for about ten minutes.

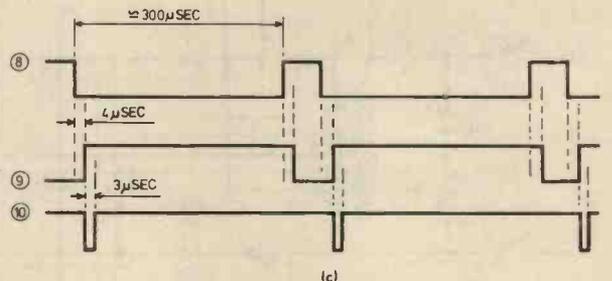
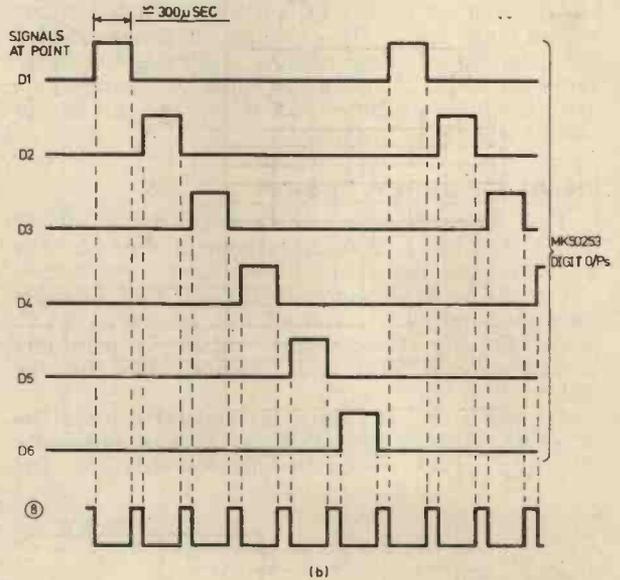
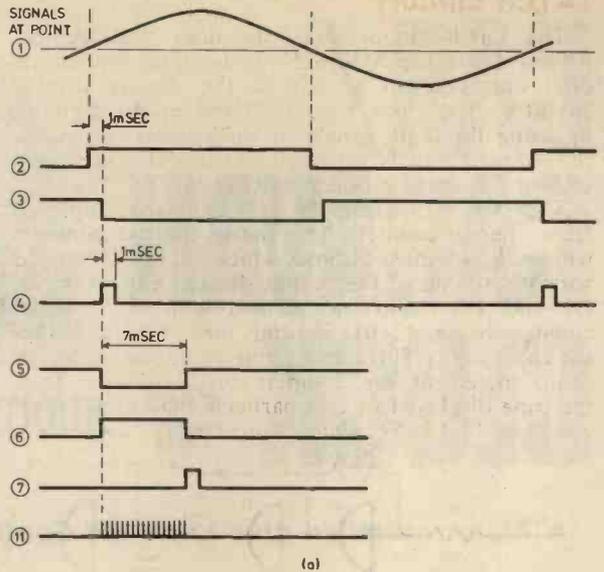
These are two functions which allow the mains clock to be used as more than a simple clock.

### DISPLAY LATCH

The Display Latch adds a digital memory to the clock so that, when a button is pushed or a relay contact is closed, the time shown by the clock is stored in a memory, without affecting the normal operation of the clock. Switching is provided so that at any time, either the time given by the clock chip or the time contained in the memory can be displayed. So far we have used this in two applications. In the first, the unit was needed as an event timer to record the exact time of faults in an electrical sub-station. In the second the instrument was needed to record the finishing time of sailing boats in a boat race.

### CONTROLLER

The Controller turns the digital clock into a time switch. Typical applications in mind were to use a dual unit to control a Video Tape Recorder with a facility for a warm-up period, and an alarm to sound three times a day to remind personnel at a mail-order components company to get the mail to the local Post Office in time for the various collections.



**Fig. 14(a). Signals at points marked on Latch circuit (b) Signals at IC5/6 and (c) enlarged view of these at (8), (9), (10)**

## LATCH CIRCUIT

The Latch circuit takes the digit and segment drivers from the MK50253 and supplies alternate digit and segment signals to the display driving circuitry. The clock time is stored in the memory by using the digit signals to write seven bit words, the segment signals, into two CD4039AE's used as a six word  $\times$  seven bit memory (Fig 14).

The MK50253 outputs are signals multiplexed from internal counters. This means that the counters will be incremented at times which are not correlated with the timing of the output signals. For example, D1 and D2 might be scanned with the internal counter being 12:01:59 and then before D3 is switched on, a 50Hz transition could occur which could increment the counters to 12:02:00. Thus the time displayed in this particular D1 to D6 scan would be 12:02:59, which is incorrect.

In normal practice this does not matter as the eye just sees the time changing from 12:01:59 to 12:02:00. However, if the output information is being held in memory, it is quite possible that it could be written in at a time when the sequence of outputs is misleading, unless precautions are taken.

A little experimenting has shown that the MK50253 internal counters increment on the positive going edge of the 50Hz input signal. This means that one can confidently load the memory if the loading starts long enough after the positive-going edge to allow the internal counters to settle down and finish before the next positive going 50Hz edge, 20 milliseconds later. The circuit used here loads the memory for a 7 millisecond period starting 1 millisecond after the edge in question.

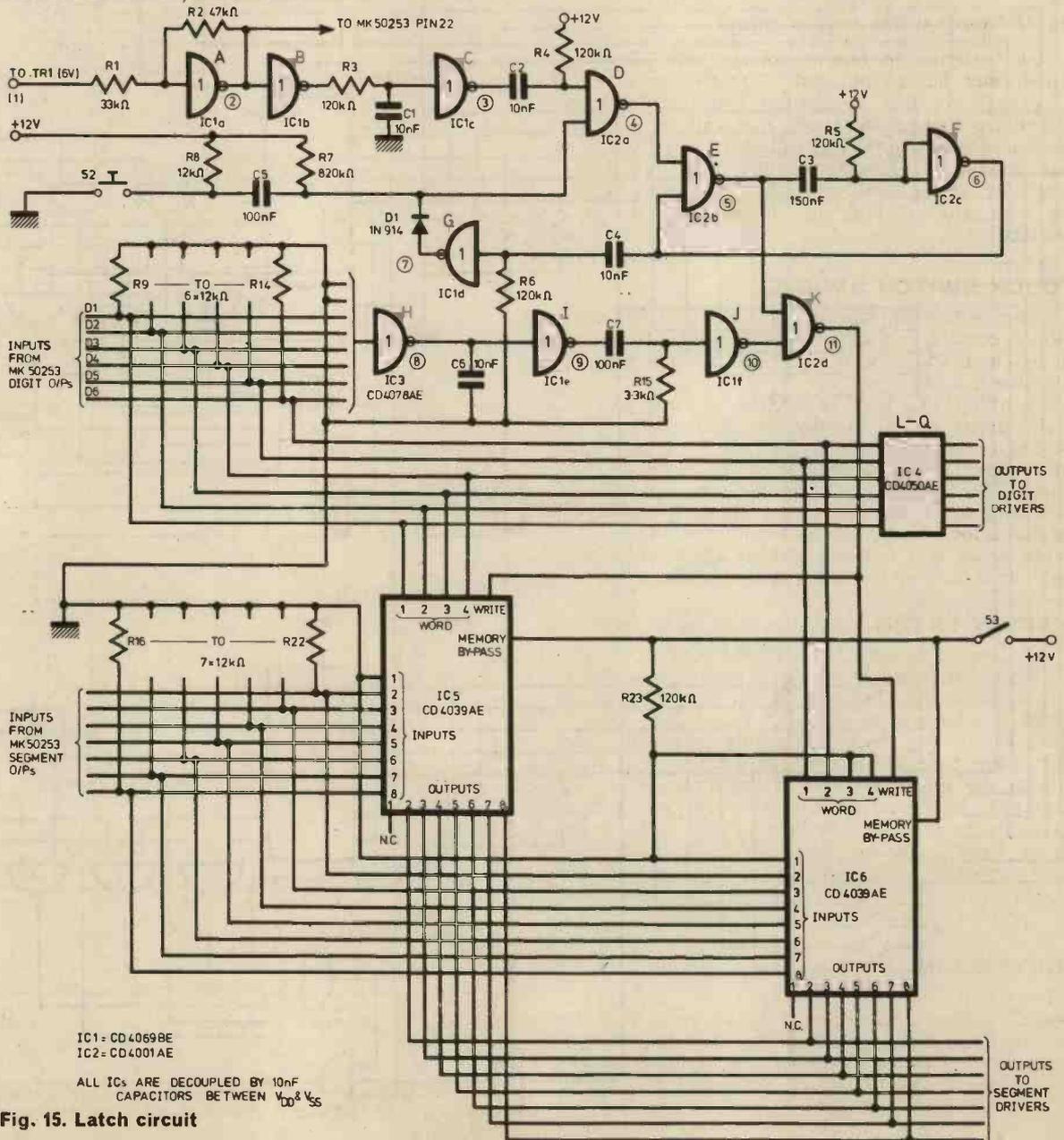
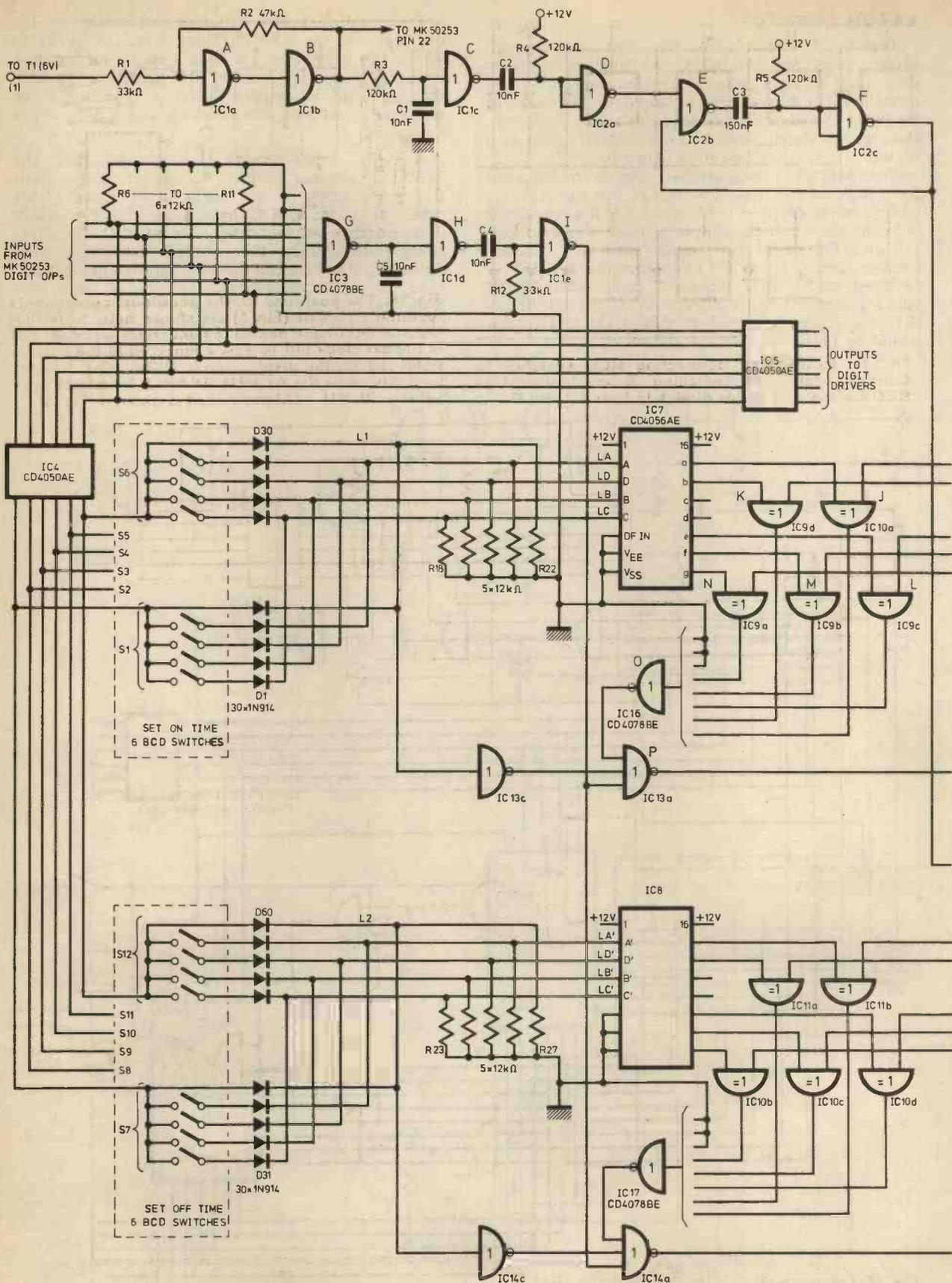
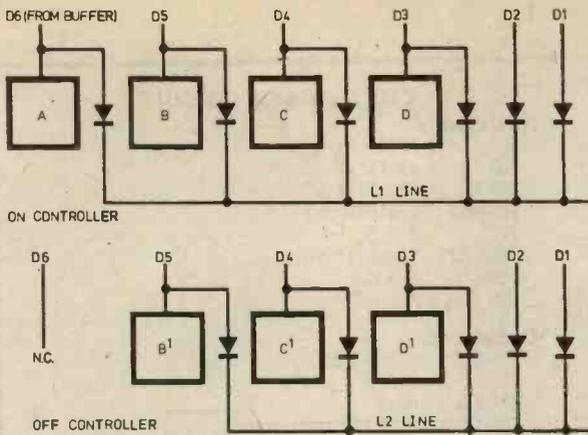
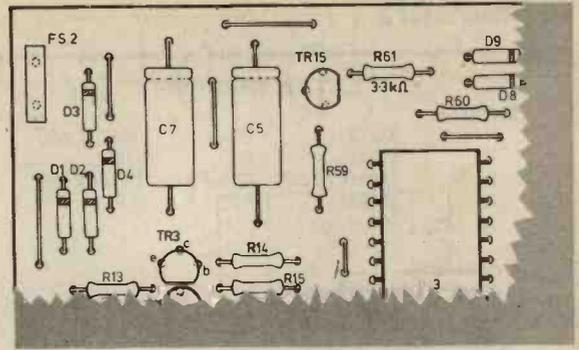


Fig. 15. Latch circuit

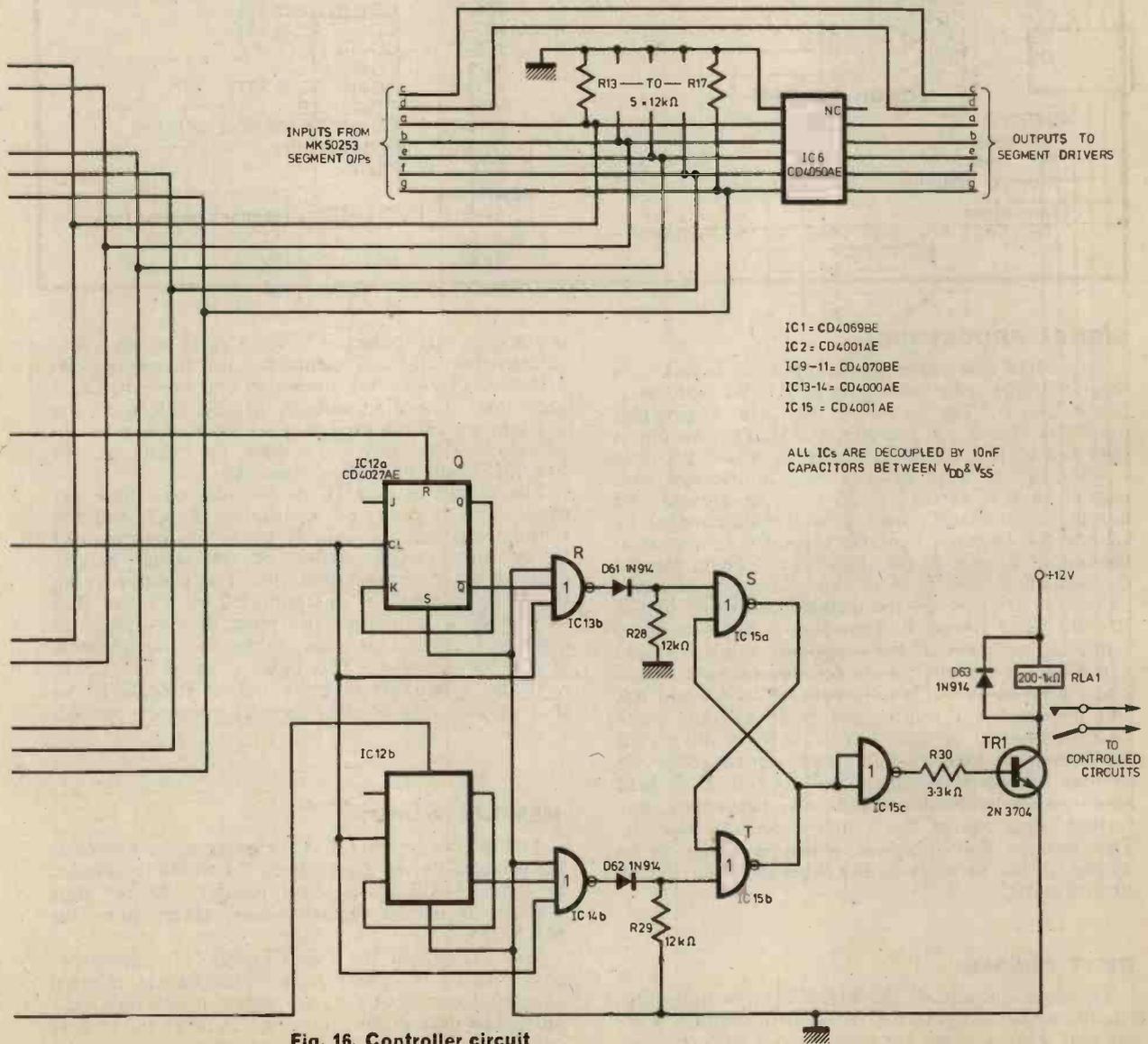




**Fig. 17. Example of connecting BCD switches to Controller for on/off switching. A box indicates as BCD switch with series diodes to lines LA to LD**



**Fig. 18. The positions for the additional components required on PCB2 (Fig. 5) are shown here. Note that the rear right-hand pad on the underside was not used in the car clock but is now connected to the outside right pad on the display p.c.b. PCB4. The START i.e.d. becomes the ALARM ENABLE i.e.d. R61 is in series with S11. (Alarm circuit is given in Fig. 3)**



**Fig. 16. Controller circuit**

# COMPONENTS . . .

## LATCH CIRCUIT

### Resistors

R1	33k $\Omega$	R8-R14	12k $\Omega$ (7 off)
R2	47k $\Omega$	R15	3.3k $\Omega$
R3-R6	120k $\Omega$ (4 off)	R16-R22	12k $\Omega$ (6 off)
R7	820k $\Omega$	R23	120k $\Omega$

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

### Capacitors

C1-C2	10nF (2 off)
C3	150nF $\pm$ 10%
C4	10nF
C5	100nF
C6	10nF
C7	100nF
C8-C13	10nF (6 off) decoupling for i.c.s.

### Semiconductors

IC1	CD4069 BE
IC2	CD4001 AE
IC3	CD4078 AE
IC4	CD4050 AE
IC5-IC6	CD4039 AE (2 off)
D1	IN914

## TOUCH SWITCH

### Resistors

R1	820k $\Omega$
R2	12k $\Omega$

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

### Transistors

TR1-TR2	Any <i>pnp</i> small signal transistor—BC212 etc.
---------	---

## CONTROLLER CIRCUIT

### Resistors

R1	33k $\Omega$
R2	47k $\Omega$
R3-R5	120k $\Omega$ (5 off)
R6-R11	12k $\Omega$ (6 off)
R12	3.3k $\Omega$
R13-R29	12k $\Omega$ (17 off)
R30	3.3k $\Omega$

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

### Capacitors

C1-C2	10nF (2 off)
C3	150nF $\pm$ 10%
C4-C5	10nF
C6-C22	10nF (17 off)

### Semiconductors

IC1	CD4069 BE
IC2	CD4001 AE
IC3	CD4078 BE
IC4-6	CD4050 AE (3 off)
IC7-8	CD4056 AE (2 off)
IC9-11	CD4070 BE (3 off)
IC12	CD4027 AE
IC13-14	CD4000 AE (2 off)
IC15	CD4001 AE
IC16-17	CD4078 BE (2 off)
D1-D63	IN914 (63 off)
TR1	2N3704

### Switches

S1-S12	BCD switches (as many as required)
--------	------------------------------------

### Relay

RLA1	200 $\Omega$ -1k 6-12V
------	------------------------

## SIGNAL PROCESSING

The 50Hz sine wave signal input (1) is fed to a Schmitt trigger gate consisting of R1, R2 and inverters A and B. The output of this gate (2) provides the 50Hz signal for the MK50253. This output is then fed to R3, C1 and inverter C, which provides a 50Hz square wave delayed by 1 millisecond with respect to that at (2). If S1 is being pressed, the output of inverter C, having been differentiated by C2 and R4, causes a 1 millisecond pulse to appear at the output of gate D (4). If S1 is not being pressed the output of gate D stays low. The 1 millisecond pulse then triggers the monostable consisting of C3, R5 and gates E and F, providing a negative going 7 millisecond pulse at the output of gate E (5) and a positive going one at the output of gate F (6). The output of gate F is differentiated by C4 and R6, and produces a 1 millisecond positive going pulse at the output of inverter G (7). If S1 is still closed the output of inverter G charges up capacitor C5 so that the corresponding input to gate D is held high, which holds its output low, preventing any further triggering of the 7 millisecond monostable. This ensures that the time which is going to be written in the memory is the time at which the S1 closure starts.

## DIGIT PULSES

The digit outputs of the MK50253 are non-overlapping sequential pulses. The segment outputs' leading and trailing edges are synchronous with the cor-

responding digit pulses. The write pulse which writes information into the memory must therefore start after a digit pulse has gone high and finish before it goes low. The digit outputs of the MK50253 are fed into a CD4048 used as a six input NOR gate. Six 12 kilohm pull-down resistors are used as the MK50253 only pulls the outputs up.

The output of gate H (8) provides one pulse per digit. This is then fed to inverter I. C6 and the output resistance of gate H cause the output of I to be an inverted version of the signal at (8), delayed by 4 microseconds (9). The positive going edge of this signal is differentiated by C7 and R15 to provide a 3 microsecond pulse at the output of inverter J (10). This pulse fulfils the requirements of the "write pulse". This pulse is gated by gate K with the 7 millisecond pulse output of gate E, so that writing only occurs when S1 has been pushed.

## MEMORY WORDS

The memory words that are going to be written in are selected by the digit signals D1 to D6 (connected to the CD4039 word select inputs), and the data written in is the segment data, taken from the MK50253.

With S2 closed the two CD4039's "memory bypass" inputs are held high. This causes internal switches to connect the data inputs to the data outputs. The data outputs are used to drive the display segment drivers (those of an ordinary mains clock).

Thus with S2 closed the display shows the ordinary time. With S2 open, the memory outputs will be the information selected by the word select inputs in the same way as during writing. Thus the display will now show the time stored in the memory.

A hex buffer (buffers L, M, N, O, P, Q) is used to buffer the signal to the clock digit drivers. No buffer is required on the CD4039 outputs as these have a high current sourcing capability. When no word of a CD4039 is being selected, its data outputs are left floating, which allows the two i.c. outputs to be wired in parallel as shown.

A plastic transistor-sized three terminal regulator  $\mu$ A78L12WC is used to provide 12V for the CMOS and also the  $V_{SS}$  supply to the MK50253.

## CONSTRUCTION

Full constructional details are not given but the following notes should assist.

The units may be built on Veroboard, d.i.p. board, etc. All i.c.s should be decoupled between the  $V_{DD}$  and  $V_{SS}$  pins with a 10nF capacitor.

As the segment and digit drivers, and the MK50253 connections other than digit and segment outputs are identical to those of an ordinary mains clock, the Latch may be built as an addition to the latter. The 3.3 kilohm resistors in series with each segment and digit output can be mounted on the Veroboard rather than p.c.b. to provide input and output connections to the Latch.

As described the instrument has one display which displays either the time or the contents of the memory. If separate displays are wanted, display driving circuitry will have to be duplicated, and the original segment and digit information will have to be tapped off at the appropriate points and buffered before going to the drivers.

More than one Latch can be added to one clock, although separate displays or complex display switching will be required.

## CONTROLLER CIRCUIT

The aspect of the Controller circuit which is common to the Latch circuit is the need to use only the outputs of the MK50253 when they are stable. For this reason gates A to I of the controller circuit perform the same functions as the corresponding gates in the Latch. The only difference is that the monostable consisting of gates E and F is fired every 50Hz cycle rather than only when a button has been pressed (Fig. 16).

The output at (1) consists of 7 millisecond pulses which define periods during which the MK50253 count will not change. The pulses at (2) are high at times when the segment and digit outputs of the MK50253 have settled down. During a particular digit time, say D1, the information present on lines LA, LB, LC and LD will correspond to the value selected by the BCD switch S1. This binary information is converted to seven segment information by the CD4056 BCD-to-seven-segment decoder. Five of these segments are then compared with the corresponding MK50253 segment outputs by EXCLUSIVE-OR gates. The comparison only needs to be made using the five segments shown as these uniquely determine the digit value.

The EXCLUSIVE-OR gates truth table is such that their output is a "1" when their inputs differ.

The outputs of the EXCLUSIVE-OR gates are combined by the NOR-gate "0". The output of this gate is low whenever the BCD switch value and the MK50253 value of a digit differ. This output is then gated by gate P by two signals. One is the inverted value of line 1 and serves to blank any "digits not equal" signal which occurs during a digit time for which no comparison is required. The other blanking signal is that at (2) which only allows a "digits-not-equal" signal to be passed once per digit time, after the MK50253 outputs, etc. have settled down.

At the beginning of a 7 millisecond pulse from (1), J-K flip-flop Q is clocked, and its Q output is set to "1". If the time indicated by the MK50253 is different to the time set by the BCD switches, during the following 7 milliseconds one or more "not-equal" pulses will appear at the output of gate P, resetting the flip-flop Q to "0". This will ensure that the output of gate R remains "0", as for it to be a "1", the "Q" output of flip-flop Q still has to be a "1" at the end of the 7 millisecond period, when (2) goes to a "0." If the two times are equal flip-flop Q's output "Q" will still be high when (2) goes low, and the output of gate R will set the alarm R-S flip-flop consisting of gates S and T, turning the controller output relay on. An identical system is used to clear this R-S flip-flop and turn the controller output off.

## CONTROLLER NOTES

Some additional notes as for the Latch are in order. For example, more than one on-off Controller can be added to one MK50253 clock. That part of the circuit shown in dotted lines need not be repeated—the signal produced by it can be fed to several controllers in parallel.

The L1 and L2 lines and the diodes going to them tell the circuit which digits will be looked at to set or clear the output. This enables one to economise on BCD switches. For example, the following arrangement will switch on at an exact time defined in hours and minutes, and off up to several hours later, using a total of seven BCD switches (Fig. 17).

This controller will switch on at AB:CD:00 hrs, and switch off at the next XB':C'D':00 hrs, where X can be any value.

Where, in a given digit position, there is only a diode to the L1 or L2 lines, but no BCD switch, this circuit behaves as if there is a BCD switch with its value set to "0". Where no L1 or L2 diode is connected, that digit will be ignored by the controller. Substitutes can be used for the BCD switches shown. In some applications the BCD values can be hard-wired; in others d.i.l. pin headers and sockets can be used to set the times by "plugging" values in.

As shown, a single controller has two switching times, which sequentially switch an R-S flip-flop on and off. The controllers could be built with only one switching time, or with both switching times connected as switching on times, with a manual off.

*NOTE: The toned area in Fig. 6 (last month) should be traced out and dropped in the centre cut-out in Fig. 7 (PCB2). The black lines from PCB1 to the tone area are the interconnecting wires to PCB2.*

*In Fig. 1, the V + (5) line to IC2 should be V + (3).*



# Now...the most exciting Sinclair kit ever

## The Black Watch kit

### At £14.95, it's

★ **practical** – easily built by anyone in an evening's straightforward assembly.

★ **complete** – right down to strap and batteries.

★ **guaranteed.** A correctly-assembled watch is guaranteed for a year. It works as soon as you put the batteries in. On a built watch we guarantee an accuracy within a second a day – but building it yourself you may be able to adjust the trimmer to achieve an accuracy within a second a week.



The Black Watch by Sinclair is unique. Controlled by a quartz crystal... powered by two hearing aid batteries... using bright red LEDs to show hours and minutes and minutes and seconds... it's also styled in the cool prestige Sinclair fashion: no knobs, no buttons, no flash.

The Black Watch kit is unique, too. It's rational – Sinclair have reduced the separate components to just four.

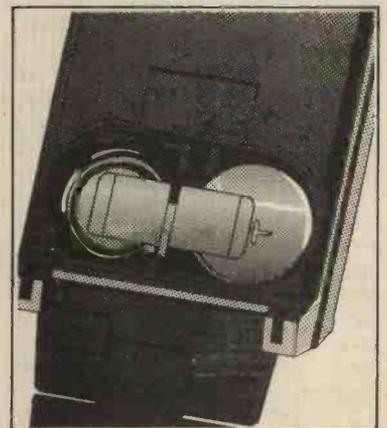
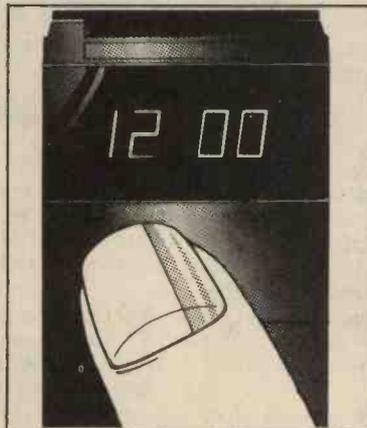
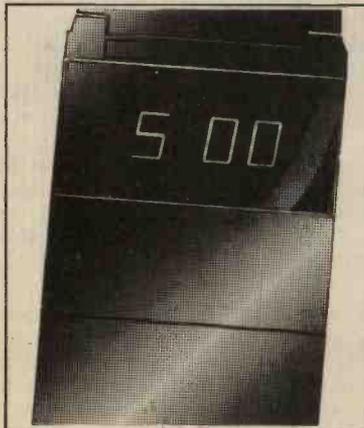
It's simple – anybody who can use a soldering iron can assemble a Black Watch without difficulty. From opening the kit to wearing the watch is a couple of hours' work.

### The special features of The Black Watch

Smooth, chunky, matt-black case, with black strap. (Black stainless-steel bracelet available as extra – see order form.)

Large, bright, red display – easily read at night.  
Touch-and-see case – no unprofessional buttons.

Runs on two hearing-aid batteries (supplied). Change your batteries yourself – no expensive jeweller's service.



## 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

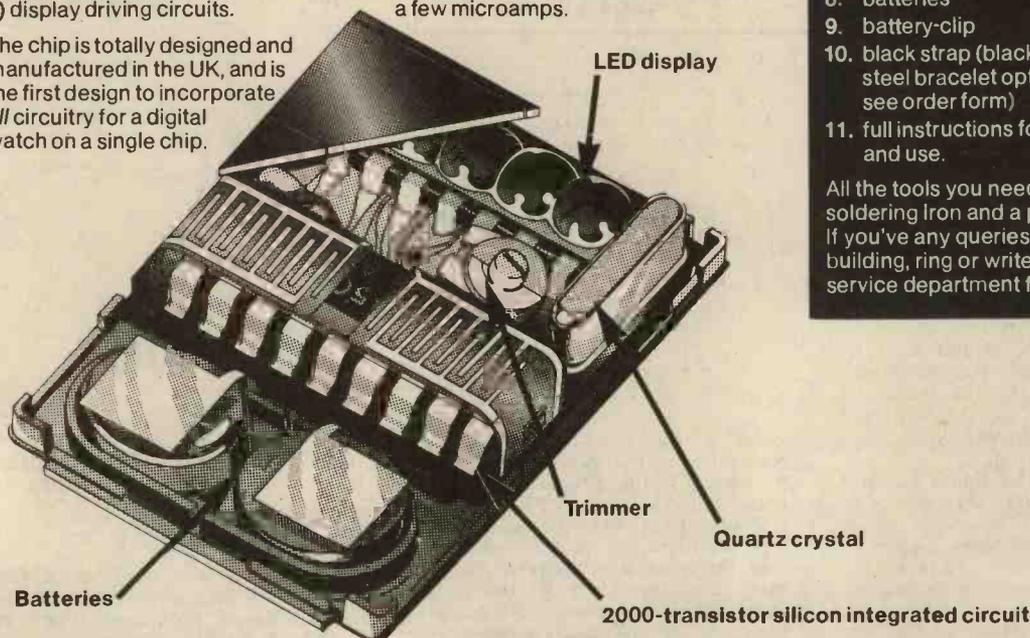
A crystal-controlled reference is used to drive a chain of 15 binary dividers which reduce the frequency from 32,768 Hz to 1 Hz. This accurate signal is then counted into units of seconds, minutes, and hours, and on request the stored information is processed by the decoders and display drivers to feed 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 £14.95!

### 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 the tools you need are a fine soldering Iron and a pair of cutters. If you've any queries or problems in building, ring or write to 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 in original condition 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: £14.95 (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 £14.95 (inc. black strap, VAT, p&p).

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

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

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

Name \_\_\_\_\_

Address \_\_\_\_\_

PE/3

Please print. FREEPOST – no stamp required.

\*Delete as required

# INGENUITY UNLIMITED



A selection of readers suggested circuits. It should be emphasized that these designs have not been proven by us. They will at any rate stimulate further thought. Any idea published will be awarded payment according to its merits. Why not submit YOUR IDEA?

### Please Note

Articles submitted for publication should conform to the usual practices of this journal, e.g. with regard to abbreviations and circuit symbols. Diagrams should be on separate sheets, not inserted in the text.

## TV SOUND ADAPTOR

MOST television sets do not employ a mains transformer and may not be connected directly to external amplifiers. There are some sophisticated commercial units which deal with television sound, but these are rather expensive. The circuit in Fig. 1 overcomes this problem economically and maintains the required electrical isolation of the television.

The input to the circuit is taken from the top of the television volume control. In this way, the signal presented to the external amplifier is independent of the television volume setting.

At this point, the signal has not been processed by the television audio circuitry, it does not suffer from the distortion associated with such circuits, and is suitable for reproduction through high quality audio systems.

The input impedance of this circuit is around 500kΩ, so it will not load the television audio circuits.

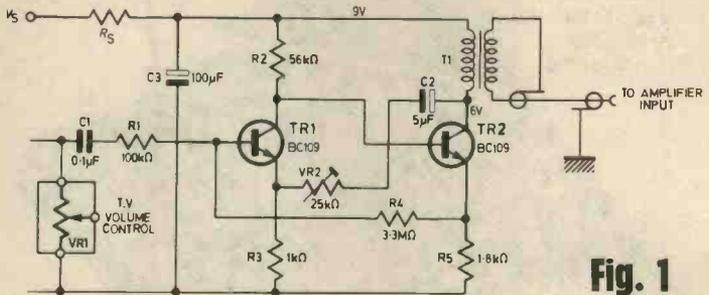


Fig. 1

After amplification, the signal is presented to the external amplifier through T1, the primary of which is the collector load of TR2.

Transformer T1 must be a mains type so that one may be confident that the insulation between the primary and secondary windings can stand accidental mains voltage, and provide the necessary degree of safety. The transformer can be any miniature mains type, the

off the television audio board or tuner. The value of the resistor  $R_x$  should be chosen according to the formula:

$$R_s = \frac{V_s - 9}{1.5} \text{ k}$$

The circuit was tried on a few different TV sets, and was proved to be capable of producing sound of truly high quality.

M. Greenfield.  
Leeds

## B.F.O.

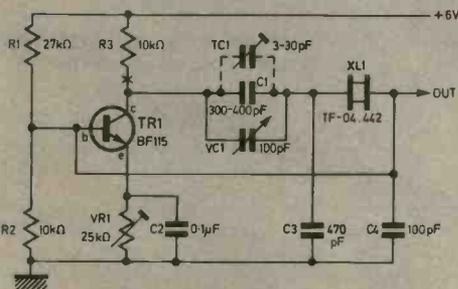


Fig. 1

READERS interested in short wave reception who at present use a b.f.o. with the normal coil arrangement may like this circuit which will enable them to achieve a higher stability oscillator.

The circuit shown in Fig. 1 is an oscillator based on the Pierce arrangement. The series resonant frequency of the crystal is 442kHz but it can be raised by adding series capacitance. About 500pF is required to achieve the popular working frequency of 455kHz. This is made up with a 350pF fixed capacitor and a 100pF trimmer in parallel for fine adjustment.

E. Vaughan,  
High Wycombe.

## RECIPROCATING TOUCH SWITCH

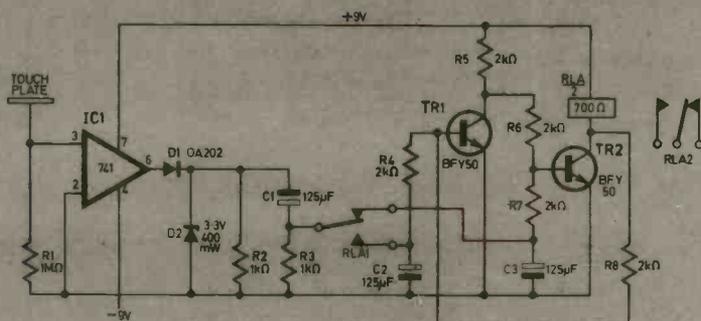


Fig. 1

DESIGNED to operate a bedside lamp (using the remaining contacts RLA2), the circuit shown in Fig. 1 uses an interesting form of bistable, which unlike conventional types, does not need a steep rising edge to trigger it. Despite its limitations (it will not operate at more than 0.8Hz), it does away with the need for a Schmitt trigger.

The Zener diode was found to be necessary to limit the input to three volts otherwise when a signal is applied to the touch plate the bistable becomes free-running.

Miss V. Mouricio,  
Lingfield.

## HIGH QUALITY STEREO PRE-AMPLIFIER

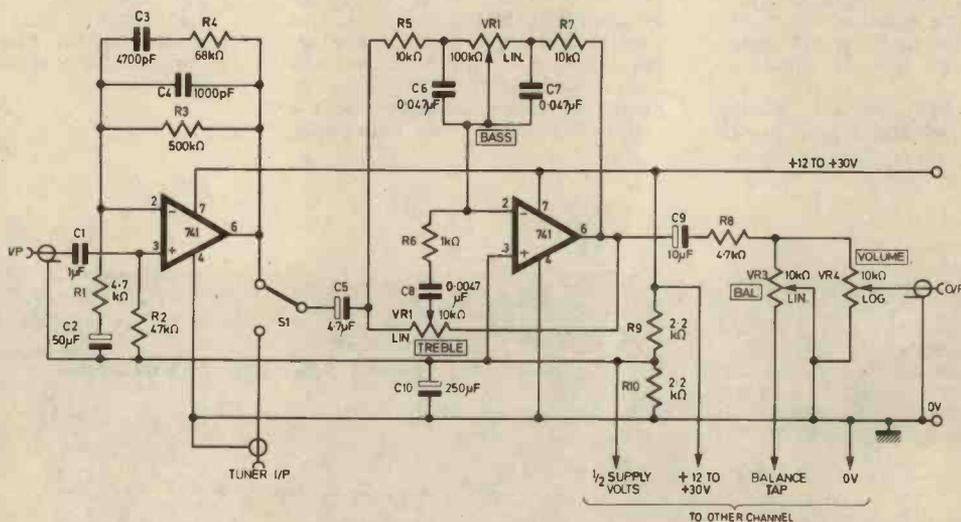


Fig. 1

MOST i.c. pre-amp circuits specify the use of specialised, and sometimes hard to obtain, integrated circuits. There is no reason, however, why the ubiquitous (and cheap!) 741 should not be employed in this application. Fig. 1 shows a circuit using these which does not require the normal dual power supply and will in fact operate satisfactorily on any single unregulated supply in the range 12 to 30V.

The circuit shown is for use with a magnetic cartridge. IC1 provides most of the overall gain and the

network C3, R4, C4, R3 provides RIAA equalisation to within 1dB between 20Hz and 20kHz. IC2 is the active element of the tone control which provides  $\pm 10$ dB of control of bass and treble. An input level of 4mV gives an output of around 500mV at 1kHz with the tone controls flat. For use with cartridges other than magnetic, R2 should be adjusted to suit the manufacturer's loading recommendations, and R1 should be selected to give the required a.c. gain. A second switched input is provided for con-

nection to a tuner, etc. and has a sensitivity of approximately 500mV.

The layout of the preamplifier is not critical provided that normal screening precautions are observed on all signal leads longer than 2 or 3 inches.

The prototype was built on Veroboard and gave excellent results with negligible hum, noise and distortion, even with 3 volts of ripple on the power supply.

M. W. Clarke,  
Princes Risborough.

## LIGHT OPERATED SWITCH AND MOTOR DRIVER

THE purpose of this unit is to operate a motor when light stops falling upon the light dependent resistor. When light is falling upon the ORP12, it conducts and the gate is at "0" in positive logic. One of the gates is kept permanently at "1" by R1 and therefore since it is a NAND gate, the output is "1". The second NAND gate acts as an INVERT gate by having one of the inputs kept at "1" permanently, therefore the output is at "0".

The i.c. is a DTL 930 which needs a supply of 5V and this is achieved by using a Zener diode of 5.1V with a rating of 400mW, in conjunction with a 22 ohm resistor. This output is fed into the base of TR1. The base emitter voltage is kept at 0.6V by R4 and the base emitter voltage of TR2 is kept at 0.6V by R5. This resistor also drops the voltage for TR3 and provides base current.

TR3 supplies the current to drive the motor and lamp. R6 keeps the current to below the Ic max. of TR3. VR1 adjusts the speed of the motor and also the brightness of the lamp which is inversely proportional to the speed of the motor. In this case the motor is not turned on because of the "0" input to TR1.

With no light present on the ORP12 one of the inputs to the

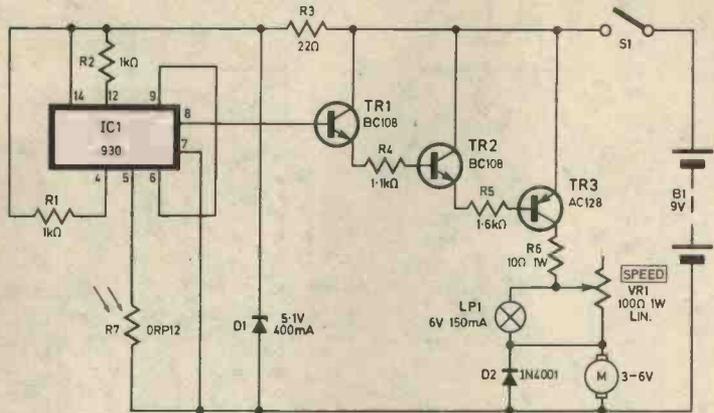


Fig. 1

first NAND gate is at "1" and the other input automatically becomes "1". An output of "0" is produced and this is fed into the second NAND gate producing an output of "1" which is fed into the base of TR1. This transistor switches TR2 to the logic level and then TR3 starts to conduct, producing a current which drives the motor and lamp LP1. Due to greater current consumption of the motor the more the bulb light

diminishes the faster the motor goes. Any motor of 3-6V can be used.

The lamp indicates if the circuit is working since sometimes the motor will not work until VR1 is set for high speed.

The operation may be reversed by connecting the base of TR1 to the output of the first NAND gate.

P. V. Saduikis,  
Leeds, Yorks.

THE circuit in Fig. 1 shows a simple regulator suitable for feeding the ZN414 radio receiver i.c. The ZN414 is very voltage conscious and both the diode and transistor drive circuits recommended by Ferranti do not stabilise the supply well enough to compensate for falling battery voltage with a consequent loss in gain. Also it is useful to be able to adjust the supply voltage to the i.c. in order to obtain the optimum gain/selectivity conditions.

TR1 operates in the emitter follower mode. When the voltage at the base of TR2 rises to 0.7V, TR2's base drive via R1 is reduced, holding the output to a value preset by VR1. Capacitor C2 is present to maintain stability.

M. J. Meaken,  
Gatley.

## SIMPLE LOW VOLTAGE REGULATOR

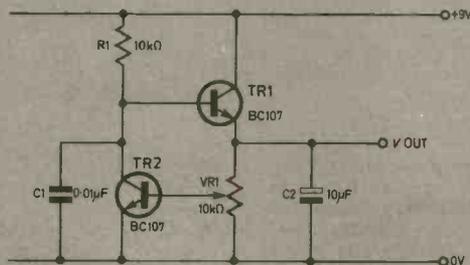
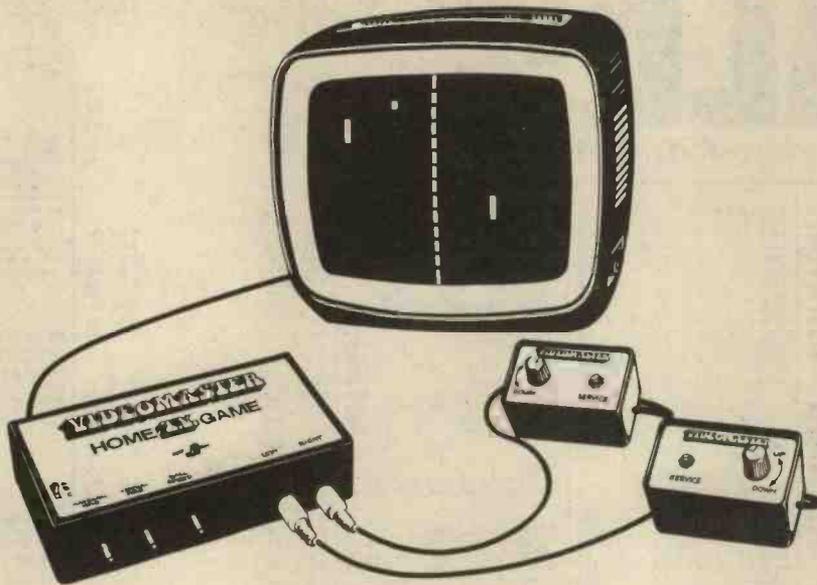


Fig. 1



# Videomaster urge all good electronics enthusiasts to play the game

The best thing about the Videomaster Home T.V. Game Mk. III is that the sheer pleasure of building it is immediately followed by the excitement of playing three fascinating games.

The famous Videomaster is now available for you to make. It plugs into any standard UHF 625 line TV set, and it shouldn't take you longer than a few hours to build.

In detail . . . The Videomaster Mk. III has eleven integrated circuits . . . four transistors . . . eleven diodes . . . is easy to build . . . with no alignment necessary because with ready-built and tested transistorized UHF modulator, is complete with all parts . . . including fully drilled and prepared p.c.b. . . . handsome plastic box . . . control leads . . . complete step by step assembly instructions . . . Runs on a PP7 9 volt battery . . . and has logic and analogue "state of the art" circuitry all with National Semiconductors CMOS devices . . . with full specification.

POST TODAY TO:

The cost? Only **£19.95** (+ VAT)

## Videomaster Ltd

119/120 Chancery Lane, London WC2A 1QU

Please send me . . . . . (insert no.) Videomaster Mk. III kits at £21.55 ea. inc. VAT. P & P

I enclose my cheque/money order for £. . . . .

Tick if VHF Modulator required  -£1 extra

NAME

ADDRESS



ALLOW 14 DAYS FOR DELIVERY

PE5

Reg. No. 1115532

# SALE

FANTASTIC OPPORTUNITY to stock up with quality components at slashing price reductions. Available at these prices for ONE MONTH only—

orders received after 15 MARCH may be refused.

<b>DISCRETE</b> BC182 10p BC184 10p BC213 12p ZN2219 23p ZN2484 32p ZN2905 27p ZN5459 33p MPLS101 20p MPLS151 20p MPLS157 42p ZTX300 13p ZTX501 14p  <b>LINEAR</b> CA3046 60p FET-MOPA £2.30 LM318 £2.00 MC1306P 53p MFC4000B 60p ZN424E £1.00 709 31p 710 38p 741 20p 741SCP £1.10 748 42p 555 44p  <b>ZENERS</b> All voltages (400mW) 8p	<b>T.T.L. I.C.s</b> 7402 10p 7404 10p 7410 12p 7420 23p 7430 32p 7473 27p 7475 33p 7476 20p 7489 20p 7493 42p 74121 13p 74122 40p 74123 50p 74150 £2.00  <b>CMOS I.C.s</b> MC14011 18p MC14018 45p  <b>DIODES</b> IN194 3 for 10p IGP7 9p ISJ50 10p IN4001 5p IN4007 10p IN5401 12p BA148 20p	<b>TRANSFORMERS</b> 25-0-25V at 4A £8.00 MT102AT £3.20 MT123AT £10.15 MT206AT £4.20 All Transformers post free!  <b>PLUGS AND SOCKETS</b> Cannon LNE-11C £2.38 Cannon LNE-32 £1.84 Cannon 3-11C £.51 Cannon 3-14 90p Cannon 5-11C £3.32 Cannon 5-32 £1.78 1/4 Jack Skt. Stereo 20p 1/4 Jack Plug Stereo (Metal) 50p 3.5mm Jack Skt. 8p McMurdo RS 20p  <b>MISC.</b> V.U. Meter8 (Minimix-8) £1.20 Minimix-8 Complete Kit £40.00  <b>PANELS AND PCBs</b> PE Minibonics EA008 £2.80 Minisonic PSU, EA011 £1.80 Minimix-8 composite 10p Minimix-8 front panels, ready anodized & printed £4.18	<b>CAPACITORS</b> <b>CERAMIC</b> 880pF, 30/50V 5 for 12p 1000pF, 30/50V 5 for 12p 2000pF, 30/50V 5 for 12p 0.047pF, 30/50V 5 for 12p 0.047pF, 30/50V 5 for 12p 0.1uF, 30/50V each 9p  <b>ELECTROLYTIC—P.C.</b> 1000u, 16V 25p 330u, 35V 22p 220u, 25V 12p 47u, 50V 10p 10u, 50V 8p 10u, 25V 7p 4.7u, 25V 5p  <b>ELECTROLYTIC—AXIAL</b> 2200u, 10V 2 for 25p 1500u, 16V 2 for 25p 150u, 63V 2 for 12p 100u, 63V 2 for 12p 100u, 25V 2 for 12p 100u, 10V 2 for 10p 50u, 15V 2 for 8p 47u, 25V 2 for 8p 22u, 10V 2 for 8p  <b>POLYESTER (C280, C281, etc.)</b> 0.022u (C281), 250V 5 for 10p 0.033u (C281), 250V 5 for 10p 0.33u, 250V 5 for 25p 0.47u, 250V 5 for 25p 0.68u, 250V 5 for 25p 0.015u, 250V 5 for 20p 0.022u (C280), 250V 5 for 20p 0.033u (C280), 250V 5 for 20p 0.047u, 250V 5 for 20p 0.068u, 250V 5 for 20p 0.1u, 250V 5 for 20p 0.15u, 250V 5 for 20p 0.220-22u, 250V 5 for 35p 0.33u, 250V 5 for 35p 0.47u, 250V 2 for 25p 0.68u, 250V 2 for 25p 1.0u, tubular each 34p	<b>TANTALUM BEAD</b> 0.1u, 35V 11p 0.22u, 35V 11p 0.47u, 35V 11p 1.0u, 35V 11p 2.2u, 35V 11p 4.7u, 35V 15p 10u, 16V 15p 10u, 25V 15p 22u, 16V 15p 47u, 6.3V 15p 100u, 3.0V 15p  <b>VERO CARDFRAME SYSTEM</b> Case KMVIF £11.50 End angles (PR), HWVIF 55p 8in Module, KMVIF £2.40 4in Module, KMVIF £1.80 2in Panel, F2VIF 65p 1in Panel, F1VIF 60p Plug, 19124/SS31 80p Skt., 19125/SF31 70p Card Handles 10 for 60p Veroboard (panel) E100 75p Veroboard (module) M28/19012 70p  <b>RESISTORS</b> Single, 100k Lin 22p Tandem, 100k Log (2 dB) 70p Fixed, Metal Oxide 1/4W 21p Fixed, Carbon Film 1/4W 1p Multiturn Cermet Presets 75p Single Turn Cermet Presets 35p Single Turn Carbon Presets 20p  <b>WIRES AND CABLES</b> UR 202 Coax. (White) 8p 7/0.2 small screened cable 8p <b>HOOK-UP WIRE:</b> 25 PAIRS, 24 S.W.G. solid, with P.V.C. insulation 20p 36 x 7/0.2 all colours different (stranded) 35p (Prices per metre) 70p
---	--	--	--	--

## EATON AUDIO

DEPT. PE, P.O. BOX 3  
ST. NEOTS, CAMBS  
PE19 3JB

TERMS: MAIL ORDER ONLY C.W.O. MINIMUM ORDER £1. VAT Please add 25% to value of order inc P & P unless otherwise stated. Cheques or P.O.s payable to Eaton Audio. Orders over £5 free of P & P, otherwise please add 10p in the £1.

### FREE Brochure on New KITS

Whether professional, student, teacher or amateur, the field of electronics can open up a new world for you. Send 15p to cover postage



CROFTON don't just sell kits, we offer you a technical back up service to ensure your success

The following is a selection of some of the more popular kits -

- ★ Mullard CCTV Camera
- ★ PE CCTV Camera
- ★ Mistral Digital Clock (Kit £12.50 Inclusive)
- ★ Electronic Ignition
- ★ Sound Operated Flash
- ★ P.W. Tele-Tennis Game
- ★ UHF Modulator
- ★ Bench Power Supply
- ★ Wobblulator
- ★ All ETI Top Projects
- ★ Many of the Elektor Projects

NOTE PCBs for most published projects available to order

### CROFTON ELECTRONICS LTD

Dept. E 124 Colne Road, Twickenham, Middx O1 898 1569



4 1/2 in x 3 1/2 in METER. 30µA, 50µA or 100µA, £3.85. 16p P. & P.

**TAPE RECORDER LEVEL METER**

500µA, 80p. 10p P. & P.

**CARDIODYNAMIC MICROPHONE**

Model UD-130. Frequency response 50-15,000c/s. Impedance Dual 50K and 600 ohms, £7.50. 26p P. & P.

42 x 42mm meters 1mA, 10mA, 100mA, 500mA, £2.76. 16p P. & P.

60 x 45mm meters 50µA, 100µA, 500µA and 1mA VU meter, £2.92. 11p P. & P.

Edgewise meters 90mm x 34mm 1mA, £3.40. 16p P. & P.

**MULTI-METER**

Model ITI-2  
20,000 ohm/volt, £6.90.  
26p P. & P.

**3 WATT STEREO (1 + 1) PER CHANNEL AMPLIFIER**  
£4.30. 16p P. & P.

All above prices include V.A.T. LARGE S.A.E. for List No. 12. Special prices for quantity quoted on request.

### M. DZIUBAS

158 Bradshawgate • Bolton • Lancs. BL2 1BA

## FUSE MONITOR FOR CARS

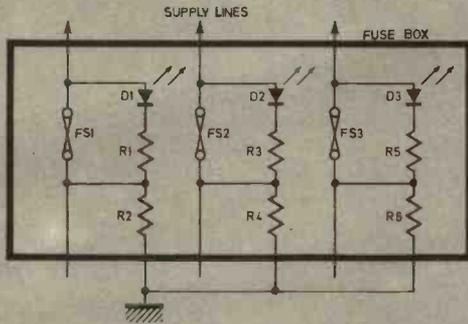


Fig. 1

FUSES have a nasty habit of blowing at very inconvenient times, such as when its dark, cold or wet. This simple arrangement can provide an easy-to-see monitor as to the state of the fuses and thus can save a lot of bother.

The circuit is very straightforward; light emitting diodes are used in series with 2.7kΩ resistors across the various fuses. A further 1kΩ resistor is connected from the chassis to R1. When the fuse is good the l.e.d. and R1 are shorted out and the l.e.d. remains off. However, when the fuse is open circuit, current flows through the l.e.d. and a fault is indicated. For positive earth operation the l.e.d. must be reversed.

A. Foster,  
Germany.

## DIGITAL COMBINATION LOCK

THE flip-flops (Fig. 1) have their outputs connected to the clear inputs of the next stage and the J and K inputs are left free. When flip-flop 1 (IC1a) is reset its Q output goes to logic 0. This resets the next stage and so on to flip-flop 4 (IC2b). With the Q output of IC2b at logic 0, the output is inactivated. This means that each flip-flop has to change state in turn (enabling the next stage) for the output to be activated.

To enter a chosen number, the number is set on the 1-pole 12-way switch and S3 is pressed. The two NAND gates eliminate switch bounce so that the flip-flops do not fire twice. If a number is entered twice its corresponding flip-flop will set all the flip-flops after it. If an unallocated number is entered then the alarm will sound, and can only be stopped by pressing the reset button, which also clears all the flip-flops.

N. M. de Smith,  
London.

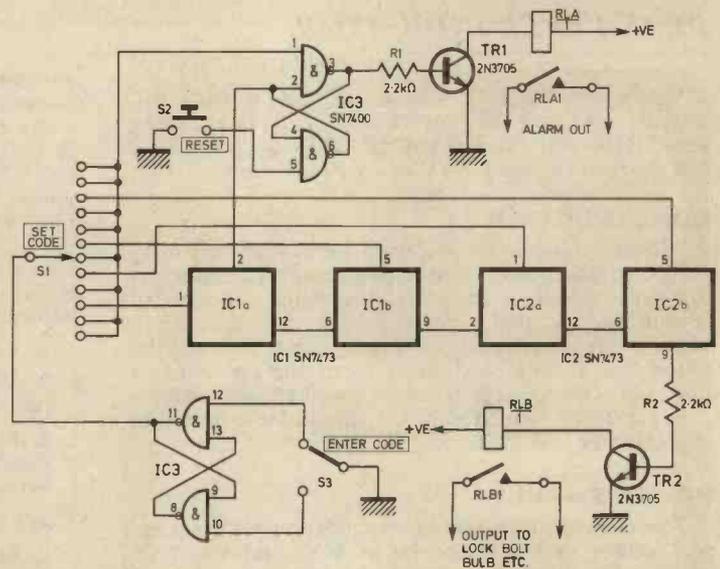


Fig. 1

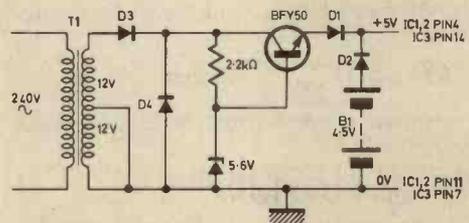
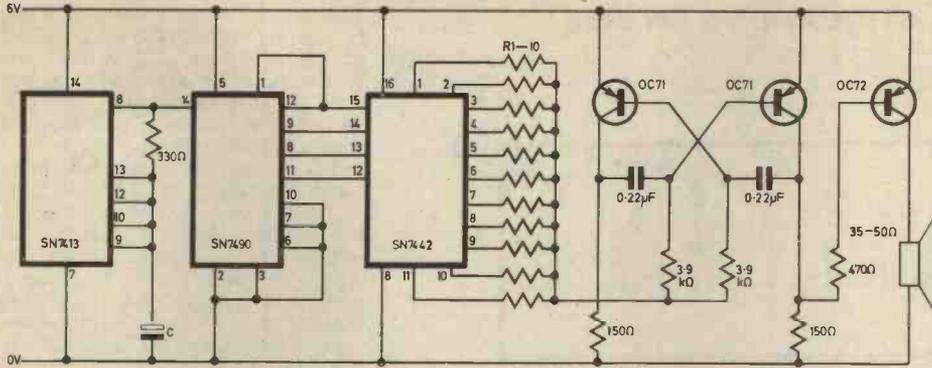


Fig. 2

## AUTOTONE MK 2



**Fig. 1**

THE circuit in Fig. 1 is similar to the Autotone published in P.E. about a year and a half ago. The ring counter has been replaced by a triple i.c. system. An SN7413, R1 and C1 forms an oscillator which then drives a 7490 decade counter. This then feeds a 7442 decoder which sequentially pulls resistors R1-10 to earth. The

frequency of operation of the astable (TR1 and TR2) is therefore determined by which resistor is grounded. The resistor values to provide reasonable operating frequencies of the astable were found to lie in the range zero to about 10kΩ. An absence of one of the resistors provides a break in the sequence.

TR3 provides an output suitable for driving a loudspeaker. It must be borne in mind that the sequence of notes will repeat themselves as the 7490 resets to zero after a count of nine, but interesting tunes can nevertheless be composed.

C. R. Batchellor,  
Brentwood.

## PEAK LEVEL INDICATOR

*continued from page 204*

When the negative voltage at TR1's base disappears TR1 and TR2 revert to their quiescent state; but TR3/4 will remain cut off (D2 "on") until C2 has charged to about +1V via the 1MΩ resistor.

### CONSTRUCTION

All components are standard items and they may be accommodated on a printed circuit board measuring only 6.5 × 4cm (stereo version). The board layout and printed circuit pattern for the stereo version are illustrated in Fig. 4, and it must be noted that it will be difficult to fit the components unless the low wattage types, as specified, are used.

For long term reliability C2 should be a tantalum capacitor as specified.

### POWER SUPPLY

The circuit will work to specification with a supply voltage in the range 16 to 24V, and this falls within the supply range of the majority of pre-amplifier designs. Sensitivity outside these limits may not be according to the specification, but a range of 12 to 30V can be accommodated by changing the value of R7:

$$R7 = \frac{\text{Supply volts}}{20} \text{ kilohm}$$

The current required is approximately 22mA (44mA for stereo version).

### SENSITIVITY IMPROVEMENT

At 500mV the sensitivity will be adequate for most monitoring applications, but it can be im-

proved upon, if required, by modification of component values around TR1.

As mentioned earlier, the gain of the first stage is determined by the ratio R2/R1, and the value of R2 has been specified very conservatively to ensure that the stated sensitivity figure will be met, even with a relatively low gain transistor at TR1. But a decent BC107 will allow for a considerable increase in the value of R2, with a commensurate increase in overall sensitivity. To determine the optimum value:

1. Replace R2 with a 1MΩ variable resistor.
2. Vary R2 to set the voltage at TR2 collector to (no more than) +3V.
3. Measure the resultant value of the variable resistor and replace with the nearest preferred value fixed resistor below that measured.

There are two other methods:

1. Reduce the value of R1 (lower limit 470 ohms): this will give a significant increase in gain, at the expense of a lowering of the unit's input impedance, and it may need to be driven from a low source.
2. Replace the 8.2V Zener diode with a lower voltage type (minimum value equal to the voltage at TR1 collector plus 1.5V): at best this will only allow the gain to be doubled, and the threshold discrimination will be widened with consequent diminishing of the visual impact of the l.e.d. output.

The maximum sensitivities achieved with the original units were in the range 25 to 40mV. ★

## SUPERSOUND 13 HI-FI MONO AMPLIFIER

A superb solid state audio amplifier. Brand new components throughout. 3 Silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz-30KHz  $\pm 3$ db. Fully integrated pre-amplifier stage with separate Volume, Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3 1/2" high x 6" wide x 7 1/2" deep. AC 200/240V. PRICE £15.00. P. & P. 85p.

## DE LUXE STEREO AMPLIFIER

AC mains 200-240 v. U n i g heavy duty fully isolated mains transformer with full wave rectifier giving adequate smoothing with negligible hum. Valve line-up:- 2 x ECL86 Triode Pentodes. 1 x E230 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance, channel and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11" w x 4" d. Overall height including valves 6". Ready built and tested to a high standard. £12-50. P. & P. 95p.

**ALL PURPOSE POWER SUPPLY UNIT 200/240v.** A.C. input. Four switched fully smoothed D.C. outputs giving 6v, 7.5v, and 9v, and 12v, at 1 amp on load. Fitted insulated output terminals and pilot-lamp indicator. Hammer finish metal case overall size 6" x 3 1/2" x 2 1/2". Ready built and tested. Price £6-35. P. & P. 85p.

**VYNALE & BEXINE SPEAKERS & CABINET FABRICS** per yd. 54 in. wide. Our price £1-30 yd. length. P. & P. 35p per yd. (min. 1 yd.). B.A.E. for samples.

### HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 8.5 watts. Volume and tone controls. Chassis size only 7in. wide x 3in. deep x 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer. Price £5-00. P. & P. 85p. BARGAIN PRICE

**BRAND NEW MULTI-RATIO MAINS TRANSFORMERS.** Giving 13 alternatives. Primary: 0-210-240v. Secondary combinations 0-5-10-15-20-26-30-36-40-50v. half wave at 1 amp. 10-15-20-26-30-36-40-50v. at 2 amp full wave. Size 3in. long x 3 1/2in. wide x 3in. deep. Price £2-75. P. & P. 75p.

**MAINS TRANSFORMER.** For power supplies. Pri. 200/240v. Sec. 0-0-9 at 500 mA. £1-35. P. & P. 35p. Pri. 200/240v. Sec. 12-0-12 at 1 amp. £1-50. P. & P. 55p. Pri. 200/240v. Sec. 10-0-10 at 2 amp. £2-20. P. & P. 70p.

### GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER

For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz-25KHz. Gain 26dB. Solid encapsulation size 1 1/2" x 1 1/2" x 1". Brand new complete with instructions. Price £1-50. P. & P. 15p.

### STEREO-DECODER SIZE 2" x 3" x 1 1/2"

Ready built. Pre-aligned and tested. Sens. 20-50mV for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of blanks and tips) supplied. £2-25 plus 20p P. & P. Stereo beacon light if required 45p extra.

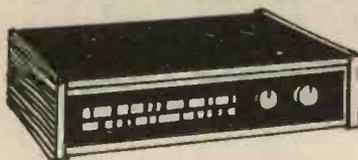


**QUALITY RECORD PLAYER AMPLIFIER MK. II** A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in wide x 3in deep x 6in high. Ready built and tested. PRICE £8-50. P. & P. 90p.

**ALSO AVAILABLE** mounted on board with output transformer and speaker. PRICE £7-75. P. & P. £1-00.

Open 9.30-5.30 Monday to Friday. 9.30-5 Saturday. Closed Wednesday. Prices and specifications correct at time of press. Subject to alteration without notice

## HARVERSONIC MAINS OPERATED SOLID STATE STEREO FM TUNER



### Enjoy Fabulous Stereo Radio at this Low Introductory Price!

Designed and styled to match our 10 + 10 amplifier but will suit any other standard stereo amplifier. The design incorporates the very latest circuitry techniques with high-grain, low noise IF stages. Automatic frequency control to 'lock on' station and prevent drift. IC stereo decoder for maximum stereo separation. L.E.D. for stereo beacon indicator. Nominal output of tuner 100mV. Approximate size 12 1/2in wide x 8in deep by 2 1/2in high. Supplied ready built, fully tested and fully guaranteed. AC mains 200/240V (not available in kit form).

**Special Offer for 1 month only £25-00 + £1-20. P. & P.**

**LATEST AGOS GP81/18C mono compatible cartridge** with T/O stylus for LP/EP/78. Universal mounting bracket. £1-75. P. & P. 18p.

**CERAMIC STEREO CARTRIDGE.** Universal mounting brackets and turnover stylus. 70mV per channel output. ONLY £2-06. P. & P. 18p.

**SONOTONE STEREO COMPATIBLE STEREO CARTRIDGE** T/O stylus Diamond Stereo LP and Sapphire 78. ONLY £2-62. P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £3-18. P. & P. 18p.

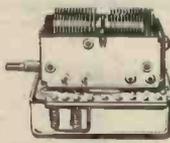
**LATEST ORGYAL T/O STEREO/COMPATIBLE CARTRIDGE** for EP/LP/Stereo 78. £1-98. P. & P. 18p.

**LATEST T/O MONO COMPATIBLE CARTRIDGE** for playing EP/LP/78 mono or stereo records on mono equipment. Only £1-78. P. & P. 18p.

### SPECIAL OFFERS

Mullard LP1159 RF-IF Double Tuned Amplifier Module for nominal 470KHz. Size approx. 2 1/2" x 1 1/2" x 1 1/2" 7-6V + earth. Brand new pre-aligned. Full specification and connection details supplied. £2-50 + P. & P. 12p.

**Pye VHF/FM Tuner Head** covering 88-103MHz/Hz. 107MHz IF output 7-8V + earth. Supplied pre-aligned, with (gang) full circuit diagram and connection details supplied. Beautifully made with precision-gear PM and 323 P1 + 323 P1 AM Tuning only £3-50 + P. & P. 35p.



**PRECISION MADE** Push Button Switch bank. 8 Buttons giving 16 S/P C/O interlocked switches plus 1 Cancel Button Plus 3 d/p c/o. Overall size 5" x 2 1/2" x 1". Supplied complete with chrome finished switch buttons 2 for £1-50 + 10p. P. & P.

### HI-FI LOUDSPEAKER SYSTEM MK II

Beautifully made simulated teak finish enclosure box with most attractive etched front. Size 16 1/2" high x 10 1/2" wide x 9" deep (approx.). Fitted with E.M.I. Ceramic Magnet 13" x 8" bass unit, H.F. tweeter unit and crossover. AVAILABLE IN NOMINAL 4 ohm, 8 ohm or 16 ohm impedance (state which).

### OUR PRICE £12-50 each. Carr. £1-60

Cabinet Available Separately 27-50. Carr. £1-20. Also available in 8 ohms with EMI 13" x 8" bass speaker with parasitic tweeter £11-00. Carr. £1-60

### LOUDSPEAKER BARGAINS

3in. 3 ohm £1-45. P. & P. 35p. 7" x 4in. 3 ohm £1-69. P. & P. 45p. 10" x 6in. 3 or 15 ohm. £2-50. P. & P. 75p. E.M.I. 8" x 3in. 3 ohm with high flux magnet. £2-06. P. & P. 50p. E.M.I. 13 1/2" x 8in. with high flux ceramic magnet with parasitic tweeter 3, 8 or 15 ohm £4-12. P. & P. 85p. E.M.I. 13" x 8in. 3, 8 or 15 ohm with inbuilt tweeter and crossover network £5-50. P. & P. 85p. E.M.I. tweeter. Approx. 3". Available 3 or 8 or 15 ohms. £2-00 + 25p. P. & P.

### "POLY PLANAR" WAFER-TYPE. WIDE RANGE ELECTRO-DYNAMIC SPEAKER

Size 11 1/2" x 14 1/2" x 1 1/2" deep. Weight 10oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Resonance 40Hz-20KHz. Can be mounted on ceilings, walls. Send S.A.E. for details. Only £7-68 each. P. & P. 70p.

Now also available 8", 10 watts r.m.s. 20 watt peak 40 Hz-20,000 Hz. Overall depth 1". Ideal for Hi-Fi or for use in cars. £5-18 + 40p P. & P.

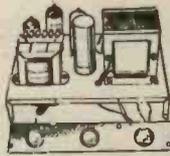
## HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistor in the first 4 stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 8 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled printed circuit board with component identification clearly marked, anodised brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specifications: Power output: 14 watts r.m.s. per channel into 8 ohms. Frequency response  $\pm 3$ dB 12-30,000 Hz Sensitivity: better than 80mV into 1M $\Omega$ . Full power bandwidth:  $\pm 3$ dB 12-15,000 Hz. Bass, boost approx. to  $\pm 12$ dB. Treble cut approx. to  $-16$ dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp. Overall size 12" w x 8" d x 2 1/2" h. Fully detailed 7 page construction manual and parts list free with kit or send 25p plus postage S.A.E. **AMPLIFIER KIT** £15-00. P. & P. 55p (Magnetic input components 33p extra) **POWER PACK KIT** £5-35. P. & P. 85p **CABINET** £5-35. P. & P. 75p

**Special offer — only £24 if all 3 units ordered at one time including P. & P.**

Full after sales service. Also available ready built and tested £32-50. P. & P. £1-00. Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi-Fi Discosque use, etc.



### 3-VALVE AUDIO AMPLIFIER HA34 MK II

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on metal chassis with heavy gauge metal chassis, size 7 1/2" x 4" d x 4 1/2" h. Incorporates ECC83, EL84, E280 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4 1/2 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £7-75. P. & P. 85p.

**ESL "FOUR" AMPLIFIER KIT.** Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. £6-80. P. & P. 85p.

### 10/14 WATT HI-FI AMPLIFIER KIT

A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15  $\Omega$  speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EP86 and E280 rectifier. Simple instruction booklet £2.50 x S.A.E. (Free with parts). All parts sold separately. ONLY £12-00. P. & P. £1-25. Also available ready built and tested £16-50. P. & P. £1-20.

### SPECIAL OFFER

Limited number of the latest BBR C141R1 Auto/Manual changer de-luxe. Lightweight tubular arm cue-ing lever bias compensator £14-00 + £1-10. P. & P.

### OUR PRICES INCLUDE VAT AT CURRENT RATES

(Please write clearly)

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

## HARVERSON SURPLUS CO. LTD.

(Dept. P.E.) 170 HIGH ST., MERTON, LONDON, S.W.19 Tel.: 01-540 3985

A few minutes from South Wimbledon Tube Station  
SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES



# TRAMPUS

ELECTRONICS LTD. WINDSOR

58-60 GROVE RD.  
WINDSOR, BERKS, SL4 1HS.  
ADD 8% VAT TO PRICES MARKED \*  
ADD 25% VAT TO ALL OTHER PRICES  
SEND C.H.O. (EXCEPT GOVT'DEMPTS)  
POST & PACKING 20% FOR THE UK

NEW FAST SERVICE, LOW PRICES.  
MONEY BACK IF NOT SATISFIED.  
ALL BRAND NEW TOP GRADE FULL  
SPEC DEVICES, CALLERS WELCOME  
NEW CATALOGUE LIST FREE SAE.  
BARCLAYCARD & ACCESS BY POST.  
SORRY NO SALES TELEPHONE.

## FAST SERVICE



DL707 COM. ANODE &  
DL704 COM. CATH.  
0.3" 0-9pd 85p\*ea.  
747 JUMBO 0.8" C.A.  
LED DISPLAY £1.89\*  
3015F 0-9pd £1.20\*  
DL33 MINI 3 DIGIT  
& MAGNIFIER £1.25\*  
STROBE TUBE £5\*

## LEDS red 12P.

209 STYLE OR 0.2" NO CLIP 12p\*  
TIL209 or 0.2" RED & CLIP 14p\*  
GREEN LARGE/S'MALL & CLIP 19p\*  
ORANGE LARGE/S'MALL & CLIP 19p\*  
ORP12 57p\* 2N5777 33p\* TEC12 50p\*  
DIGITAL CLOCKS MM5316 £5\*  
MM5314 £3.39\* MM5311 £5\*  
AY51224 £3.49\* PCB £1\*

### CAPACITORS

CERAMIC 22pF-0.1uf 50v 5p.  
ELECTROLYTIC: 10/50/100 uf in  
25V 7P. 50V 9P. 2uf/10V 6P.  
1000uf 25V 18P. 200/500uf 9P.  
POTENTIOMETERS LIN/LOG 14P.  
PRESETS 6P. RESISTORS 11P ea

HEATSINKS: T05 & T018 5P\* TV4 15P\*  
TV3/T03 15P\* EXTRUDED 4" 4Y1 29P\*

SWITCHES: SPST 19P. DPDT 25P.  
DIN PLUGS ALL 12P. SOCKETS ALL 9P

ALI CASES AB5/AB7 50P. AB13 65P\*  
TRANSFORMERS 1/1A 6 or 12V £1.50\*

TRAMPUS FULL SPEC PAKS ALL £1 ea

PAK A 10 RED LEDS our choice £1\*  
PAK B 5 741C OP AMP 8 PIN £1\*  
PAK C 4 2N3055 £1. D 12 BC109P £1\*  
PAK E 10 BC182 £1. F 11 2N3704 £1  
PAK G 8 BFY51 £1. H 9 2N3819 £1  
PAK J 9 2N3953 £1. K 40 1N914 £1  
NEW PAK M 4 PLASTIC 3055 90W £1\*

## IC's LOW PRICES

703 RF/IF	26p	MC1303	£1.50
709 T099	22p*	MC1310	£2.20
709 DIL 14	28p*	MC1312 SQ	£2.50
710 DIL 14	31p*	MC1318	£2.50
723 Regul'r	45p*	MC1330	75p
741 DIL 8	21p*	MC1339	£1.40
741 DIL 14	31p*	MC1350 1/2	75p
741 T099	31p*	MC1466 /9	£3
747 2x741	67p*	MFC4000 1W	49p
748 DIL 8	27p*	NE536 PETOPA	£2
7805 5V	£1.25*	NE540	£1.10*
7812 12V	£1.25*	NE550 2vr	£1*
7815 15V	£1.25*	NE555 TIMER	42p*
7900 Series	£2*	NE556 2x	88p*
76013 6W AF	75p	NE560 PLL	£4.00
CA3046	54p	NE561 PLL	£4.00
CA3048	£2	NE562 PLL	£4.00
CA3054	£1.50	NE563	£2.25
ICL8038 SGEN	£3*	NE565	£2.50
LN300	£1.50*	NE566	£1.55
LN301 OPA	41p*	NE567	£2.20
LN304 0-40V	£3*	SN72741 741	21p*
LN308 H1 Bo	95p*	SN7660 IF	75p
LN309K 5V	£1.75*	SN7661 IF	£1
LN372 IF	£2.00	TAD100 RIF	£2
LN377 2x2W	£3	TBA800	89p
LN380 R0745	89p	TBA810 7WAF	99p
LN381	£1.50	TBA820	75p
LN3900 4OPA	63p*	ZN414 RX	98p



## 740 TTL

7400	11p*	7474	29p*
7401	13p*	7476	29p*
7402	13p*	7490	39p*
7404	15p*	7491	73p*
7410	13p*	7492	43p*
7413	29p*	7493	39p*
7420	13p*	7494	46p*
7430	13p*	7496	74p*
7440	13p*	74100	£1*
7441	84p*	74121	27p*
7447	89p*	74129	65p*
7470	26p*	74141	64p*
7472	24p*	74173	£2*
7473	29p*	74174	£1*
		74175	85p*

## TRANSISTORS ALL FULL SPEC

PRICE EACH:-	MATCHING	20p*
AC127 & 128	INS. BUSH SET	6p*
AC176	TIP29 & 30	43p*
AC187 & 188	TIP31 & 32	54p*
AD149	TIP41	68p*
AD161 & 162	TIP42	74p*
BC107	TIP2955	99p*
BC107B	TIP3055	67p*
BC108	T1343 UJCT	32p
BC108B	ZTX107/8/9	11p
BC109	ZTX300 & 304	20p
BC109C	ZTX500 & 504	42p
BC147/8/9	2N706 & 708	11p*
BC157/8/9	2N2646 UJT	38p*
BC167/8/9	2N2904 & 5	20p*
BC177/8/9	2N2926 broyg	9p*
BC182/3/4A&L10p	2N3053	16p*
BC212/3/4A&L12p	2N3054	42p*
9CY70/1/2	2N3055 115W	37p*
BD131 & 132	2N3055 RCA	60p*
BFR88 250V	2N3072/3/4/5	9p
BFY51	2N3706/7/8/9	9p
BFY52	2N3710 & 11	10p
BFY52 & 53	2N3819E PGT	14p
BS119/20/21	2N3820 PGT	40p
4J2955 T03	2N3822E PGT	16p
4J2955	2N3904/5/6	15p
4J2955	2N4289 mnt	31p
4J2955	2N5457 PGT	49p

## CMOS LOGIC

NEW MOTOROLA	CD14533	£2.35*	
CD4000	15p*	CD4028	73p*
CD4001	16p*	CD4046	£1*
CD4002	16p*	CD4047	73p*
CD4009	45p*	CD4049	45p*
CD4011	17p*	CD4054	94p*
CD4013	45p*	CD4055	£1*
CD4016	45p*	CD4059	90p*
CD4017	82p*	CD4071	17p*
CD4018	82p*	CD4081	17p*
CD4022	82p*	CD4510	£1.19*
CD4023	77p*	CD4511	£1.90*
CD4024	63p*	CD4528	£1.10*
CD4027	45p*	CD4558	£2.35*

## DIODES

0A81 & 0A91 GERMANIUM 5p.  
1N4001 1A50V & 1N4002 5p\*  
1N4004 6p\* 1N4007 9p\*  
1N4148 & 1N914 SILICON 4p.  
ZENERS BZY88 400mV 9p.  
ZENERS 11W 17P. Z1J mnt 11p  
BRIDGE RECTIFIER 1A50 18P  
1A400V 25p. 4A100V 45p

## SCR'S TRIACS

SCR'S TAG1/400 1A400V 50p\*  
1A50V 38p\* 1A 600V 70p\*  
C108D 4A400V SCR ONLY 47p\*  
TRIAC SC146B 10A400V £1\*  
TRIAC DISCO 16A400V £1.75\*  
DIACS: ST2 20p. BR100 25p

## vero

36PINS 28P\* FACE CUTTER 49p\*  
COPPERCLAD 0.1 PITCH VERO  
21"x5" 32p\* 21"x3 1/2" 29p\*  
31"x5" 37p\* 31"x3 1/2" 32p\*  
31"x17" £1.70\*  
31"x17" PLAIN 0.1" £1.06\*  
DIL BREADBOARD 6x4" £2\*

## DALO pen 69P

DALO ETCH RESIST PEN 69p\*  
FEC ETCH PAK 500gm 89p\*  
6x4" COPPER BOARD 50p\*  
PCB KIT 3 ITEMS £2\*  
CASSETTE MECHANISM £9 & AS1 £2  
TGS GAS DETECTORS 308etc £2\*

## Oil sockets

TOP QUALITY NYLON  
SOCKETS SPIN 12p\*  
14PIN 13p. 16PIN 14p  
SOLDERCON PINS:  
100 65p\* 1000 £3.50\*

# FREE



## YOURSELF FOR A BETTER JOB WITH MORE PAY!

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

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

### CUT OUT THIS COUPON

#### CHOOSE A BRAND NEW FUTURE HERE!

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

- |  |                          |  |                          |   |                          |
|--|--------------------------|--|--------------------------|---|--------------------------|
| Practical Radio and Electronics (Technician) | <input type="checkbox"/> | C. & G. Radio, TV & Electronics, Mechanics | <input type="checkbox"/> | C. & G. LI Installations and Wiring           | <input type="checkbox"/> |
| Electronic Engineering                       | <input type="checkbox"/> | Radio Amateurs                             | <input type="checkbox"/> | General Electrical                            | <input type="checkbox"/> |
| Television Maintenance and Servicing         | <input type="checkbox"/> | Practical TV                               | <input type="checkbox"/> | Engineering                                   | <input type="checkbox"/> |
| General Radio and TV Engineering             | <input type="checkbox"/> | Colour Television                          | <input type="checkbox"/> | Society of Engineers (Electrical Engineering) | <input type="checkbox"/> |
| Radio Servicing, Maintenance and Repairs     | <input type="checkbox"/> | Servicing                                  | <input type="checkbox"/> | Electrical Installations and Wiring           | <input type="checkbox"/> |
|  |                          | Computer Electronics                       | <input type="checkbox"/> | C. & G. Electrical Technicians (Primary)      | <input type="checkbox"/> |
|  |                          | C. & G. LI Radio TV Servicing cert.        | <input type="checkbox"/> | C. & G. Telecomunications                     | <input type="checkbox"/> |
|  |                          | Post Master General 1st & 2nd class certs. | <input type="checkbox"/> |   |                          |
|  |                          | C. & G. Electrical Engineering Practise    | <input type="checkbox"/> |   |                          |

# Test Equipment



## Multimeters

The Eagle range of multimeters covers every possible need of the electrical or electronic engineer. They cost from about £6 to £58 (inc V.A.T.). There's at least one which suits your job precisely.

We have a lot of other test equipment too. Send the coupon and we'll send you our complete catalogue.

Please send me details of all your test equipment

NAME .....

ADDRESS .....



Eagle International Ltd., Precision Centre, Heather Park Drive, Wembley HA0 1SU  
Tel (01)-902 8832

# Eagle

To ALDERMASTON COLLEGE Dept. EPE15 Reading RG7 4FP  
Also at our London Advisory Office, 4 Fore St Avenue, Moorgate, London EC2Y 5EJ. Tel: 01-428 2721.  
NAME (Block Capitals Please) .....

ADDRESS .....

Other subjects Accredited by C.A.C.C. POSTCODE .....

Age .....

Member of A.B.C.C.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

# HEWLETT PACKARD

## THE 3476A/B DIGITAL MULTIMETER

A new, competitively priced,  $3\frac{1}{2}$  digit, autoranging digital multimeter has been introduced by Hewlett Packard. The instrument is priced at £144 with built in mains unit or £175 with rechargeable batteries and charging facilities.

Capable of resolving 0.1mV d.c., 0.3mV a.c., the multimeter provides an order of magnitude of resolution greater than standard  $3\frac{1}{2}$  digit types. This is achieved by allowing the half digit to have three possible states: off altogether, 1 or 0. The first state is used when reading values such as 2.31, 23.1, 231 etc., the second when reading 0.1017, 1.017, 10.17, 101.7 etc., and the third when reading 0.0004, 0.0114 etc., the  $\frac{1}{2}$  digit therefore effectively being used as a fourth digit.

The multimeter can also measure resistance from  $1\Omega$  to  $11M\Omega$  and has a.c. and d.c. current ranges from 0.3mA to 1.1A and 0.1mA to 11A respectively. In order to prevent inadvertent switching into the current mode, a separate input socket is provided for current measurement. All the current ranges are fuse protected.

Access to the fuse is via a sliding panel on the side of the multimeter. The test leads are first removed, then, on sliding the panel to the side, both the active fuse and a spare pop out.

The principle of operation of the multimeter is based on the well known dual slope integration technique, all logic functions and analogue switching being contained in an N-MOS i.c. High accuracy and low temperature coefficient are achieved by the use of a thin film Tantalum Nitride resistor pack which is in fact mounted in the same package as the N-MOS chip. This contains most of the precision resistors required in the multimeter.

The 3476A/B in use



There is no "set-zero" control on the front panel as the control logic incorporated in the main i.c. automatically performs this itself, so it is claimed. Zero stability was indeed found to be good on the sample tested.

The autoranging feature is a great asset in a multimeter, the 3476A possesses this and also a facility for range holding to allow rapid readings of similar values to be taken.

Typical accuracy of the device on d.c. voltage is 0.5%; d.c. current 1%; resistance 0.6% (open circuit voltage less than 4 volts). The a.c. voltage and current accuracies were 1.5% and 2% respectively from 45Hz to 2kHz but the frequency response was rather disappointing at  $\pm 8\%$  of reading +1% of range when the bandwidth is increased to 10kHz.

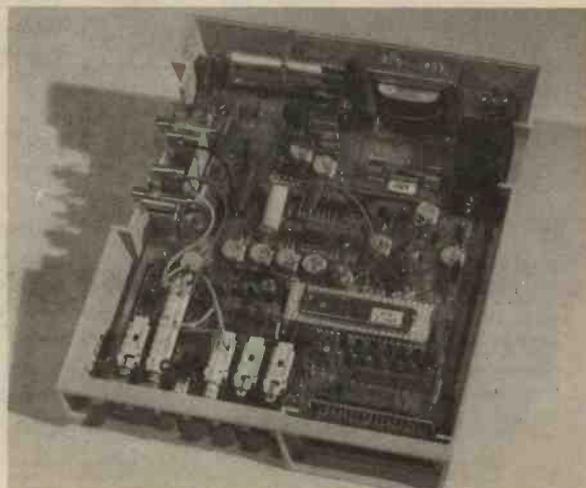
The multimeter lives up to the traditional Hewlett Packard reliability expectations. The sort of tests performed on the meter to check reliability include a 1,000V square wave applied directly to the input terminals to test ability to handle transients; 220V a.c. applied to any terminals with all combinations of push buttons, and also a test involving 10kV being discharged to all exposed metal to simulate static discharges.

The multimeter is obviously aimed at the upper bracket of the amateur market but provides good value for money, the autoranging feature and high resolution giving it distinct advantages over many in this area of the market.

R.W.L.

The 3476A and B (the 3476B includes rechargeable batteries) are available from Hewlett-Packard Limited, King Street Lane, Winnersh, Wokingham, Berkshire RG11 5AR.

Internal view showing i.c. containing both control logic and tantalum nitride precision resistor array



# Readout —

## A SELECTION FROM OUR POSTBAG

Readers requiring a reply to any letter must include a stamped addressed envelope. We regret that we cannot answer any technical queries on the telephone.

### It's An Advantage

Sir, — Mr Timson has largely missed the point in his letter "A Protest" (Readout, February issue). He will see from my article, "Christmas Lights Flasher" (December '75) in paras. 2 and 3, that the electronic flasher has many advantages over the bi-metal strip. These are much more reliable operation (bi-metal strips tend to stick closed), ability to control a wide range of load wattages at rates set by the user, and very important, it causes absolutely no interference to radio and TV.

All these extra features are typical of the type of improvements that electronics can offer over more traditional processes in so many fields—in much the same way that the typewriter that Mr. Timson used for his letter is an advance over the pen.

What would he say to a criticism of his machine for using so many cranks, levers and springs to replace the usually reliable and inexpensive ball point pen? It's because it's better Mr. Timson, that's what!

J. N. Watt,  
Camberley,  
Surrey.

### Engine Analyser

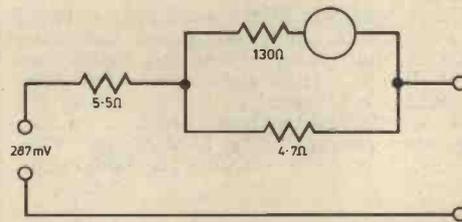
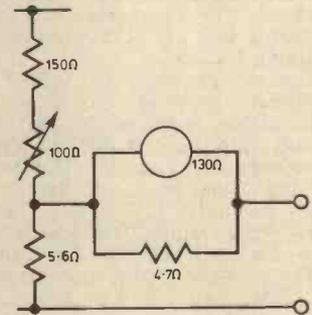
Sir.—I found Mr Biggs's comments (Readout, February issue) on my article "P.E. Engine Analyser" very interesting. As regards increasing the tachometer range this is quite possible for engines of less than eight cylinders. For instance the timing resistor values given for an eight cylinder engine would, if used on a four cylinder engine, allow the r.p.m. scale to be multiplied by two, giving a maximum of 5,000 r.p.m. Similarly the resistors for engines of less than four cylinders could be halved to bring these into line.

If each cylinder of a multi-cylinder engine has its own separate contact assembly then each cylinder must be treated as a single cylinder

engine. Also for two stroke engines the factor of  $\frac{1}{2}$  should be removed from the r.p.m. formulae in the second article and timing resistors will be half those for a four stroke engine to give the same meter calibration.

To reduce the resistance range of the continuity meter, the source impedance of the ohmmeter circuit must be reduced by shunting the meter. A circuit is enclosed which should give a reading of 10 ohms at half scale. This will result in an extra 40mA load on the 10V regulated supply but this should not cause any problems.

D. G. Haley,  
Hemel Hempstead.



### TOWNSEND COATES LIMITED

MULLARD INTEGRATED CIRCUITS

Telephone: 0533 769191. Telex: 34321

DTL

FCH121/RC224. FCH181/RC246 40p each

TTL

FJH141/7440N, FJH151/7450N, FJH161/7451N, FJH171/7453N, 12p each

FJH181/7454N, FJY101/7460N 23p each

FJJ111/7472N 32p each

FJJ101/7470N, FJJ131/7474N, FJJ191/7476N 34p each

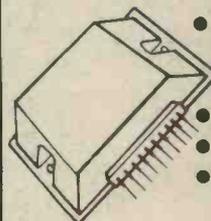
FJJ121/7473N 40p each

FJJ251/7492N 40p each

FJL101/7441N 80p each

ALL ORDERS PLUS 45p P. & P. PLUS VAT AT 8%  
REMITTANCE WITH ORDER PLEASE

### 35 WATT AUDIO HYBRID POWER IC



- Only 8 external comp's (6 capacitors + 2 resistors) required.
- Dual or single power rails.
- 4 - 16 ohm load.
- Send s.a.e. for details. (supplied free with IC)

£6.50. each, including postage etc.

R.L.Automation, 11 Fossil Rd., SE13.7DE.



# WILMSLOW AUDIO

## THE Firm for speakers!

### SPEAKERS

Baker Group 25, 3, 8 or 15 ohm  
 Baker Group 35, 3, 8 or 15 ohm  
 Baker Group 50/12 8 or 15 ohm  
 Baker Group 50/15 8 or 15 ohm  
 Baker Deluxe 124 8 or 15 ohm  
 Baker Major 3, 8 or 15 ohm  
 Baker Superb 8 or 15 ohm  
 Baker Regent 12in 8 or 15 ohm  
 Baker Auditorium 12in 8 or 15 ohm  
 Baker Auditorium 15in 8 or 15 ohm  
 Celestion G12M 8 or 15 ohm  
 Celestion G12H 8 or 15 ohm  
 Celestion G12/50 8 or 15 ohm  
 Celestion G12/50TC 8 or 15 ohm  
 Celestion G15C 8 or 15 ohm  
 Celestion G18C 8 or 15 ohm  
 Celestion HF1300 8 or 15 ohm  
 Celestion HF2000 8 ohm  
 Celestion MH1000 8 or 15 ohm  
 Celestion C03K  
 Decca London ribbon horn  
 Decca London CO/1000/8 crossover  
 Decca DK30 ribbon horn  
 Decca CO/1/8 crossover (DK30)  
 EMI 150 13 x 8in d/cone 8 ohm  
 EMI 13 x 8in 20W bass 8 ohm  
 EMI 14 x 9in bass 8 ohms, 14A770  
 EMI 8 x 5in, 10W, d/cone, roll surr.  
 EMI 6 1/2in d/cone, roll surr., 8 ohm  
 EMI 8in roll surr. bass  
 EMI 5in mid range  
 Elac 59RM109 (15 ohm), 59RM114 (8 ohm)  
 Elac 6 1/2in d/cone, roll surr., 8 ohm  
 Elac 10in 10RM239, 8 ohm  
 Eagle Crossover 3000Hz 3, 8 or 15 ohm  
 Eagle FR4  
 Eagle FR65  
 Eagle FR8  
 Eagle FR10  
 Eagle HT15  
 Eagle HT21  
 Eagle MHT10  
 Eagle FF28 Multicell, horn  
 Fane Pop 15, 8 or 16 ohm  
 Fane Pop 25T, 8 or 16 ohm  
 Fane Pop 33T, 8 or 16 ohm  
 Fane Pop 50, 8 or 16 ohm  
 Fane Pop 55, 8 or 16 ohm  
 Fane Pop 60, 8 or 16 ohm  
 Fane Pop 70, 8 or 16 ohm  
 Fane Pop 100, 8 or 16 ohm  
 Fane Crescendo 12A, 8 or 16 ohm  
 Fane Crescendo 12BL, 8 or 16 ohm  
 Fane Crescendo 15/100A, 8 or 16 ohm  
 Fane Crescendo 15/125, 8 or 16 ohm

£8-64  
 £10-25  
 £14-00  
 £18-62  
 £13-75  
 £11-87  
 £18-12  
 £10-00  
 £16-25  
 £21-56  
 £12-95  
 £15-95  
 £16-50  
 £18-00  
 £26-95  
 £34-50  
 £7-75  
 £5-80  
 £9-50  
 £13-50  
 £4-95  
 £32-00  
 £7-50  
 £18-06  
 £5-00  
 £2-94  
 £8-00  
 £13-25  
 £3-95  
 £4-37  
 £8-37  
 £3-50  
 £3-44  
 £4-06  
 £3-95  
 £1-75  
 £6-12  
 £9-62  
 £12-31  
 £15-62  
 £4-40  
 £6-81  
 £4-44  
 £9-00  
 £5-25  
 £7-50  
 £8-75  
 £12-00  
 £13-95  
 £17-25  
 £18-75  
 £25-95  
 £34-50  
 £36-50  
 £47-50  
 £57-95

### SPEAKERS

Fane Crescendo 18, 8 or 16 ohm  
 Fane 910 Mk II horn  
 Fane 920 Mk II horn  
 Fane HPX1 crossover 200W  
 Fane 13 x 8in, 15W dual cone  
 Fane 801T 8in d/c, roll surr.  
 Gauss 12in 200W  
 Gauss 15in 200W  
 Gauss 18in 200W  
 Goodmans Axent 100  
 Goodmans Audiom 100 15 ohm  
 Goodmans Audiom 200 8 ohm  
 Goodmans Axiom 402 8 or 15 ohm  
 Goodmans Twinaxiom 8, 8 or 15 ohm  
 Goodmans Twinaxiom 10, 8 or 15 ohm  
 Goodmans 8P 8 or 15 ohm  
 Goodmans 10P 8 or 15 ohm  
 Goodmans 12P 8 or 15 ohm  
 Goodmans 12PG 8 or 15 ohm  
 Goodmans 12PD 8 or 15 ohm  
 Goodmans 12AX 8 or 15 ohm  
 Goodmans 15AX 8 or 15 ohm  
 Goodmans 15P 8 or 15 ohm  
 Goodmans 18P 8 or 15 ohm  
 Goodmans Hifax 750P  
 Goodmans 5in midrange 8 ohm  
 Jordan Watts Module, 4, 8 or 15 ohm  
 Kef T27  
 Kef T15  
 Kef B110  
 Kef B200  
 Kef B139  
 Kef DN8  
 Kef DN12  
 Kef DN13 SP1015 or SP1017  
 Lowther PM6  
 Lowther PM6 Mk I  
 Lowther PM7  
 Peerless KO10DT 4 or 8 ohm  
 Peerless DT10HFC 8 ohm  
 Peerless KO40MRF 8 ohm  
 Peerless MT25HFC 8 ohm  
 Richard Allan CA12 12in bass  
 Richard Allan HP8B  
 Richard Allan LP8B  
 Richard Allan DT20  
 Richard Allan CN8280  
 Richard Allan CN820  
 Richard Allan Super Disco 60W 12in  
 Richard Allan CG15 15in bass  
 Richard Allan Super Disco 12in 60 watt  
 Richard Allan Super Disco 10in 50 watt  
 Richard Allan Super Disco 8in 50 watt  
 Radford BD25  
 Radford MD9

£62-95  
 £14-95  
 £33-95  
 £2-50  
 £5-50  
 £9-95  
 £73-00  
 £83-00  
 £110-00  
 £8-44  
 £13-90  
 £13-90  
 £20-00  
 £10-14  
 £10-75  
 £5-50  
 £5-80  
 £13-95  
 £15-95  
 £16-95  
 £36-50  
 £40-25  
 £21-00  
 £36-00  
 £16-00  
 £4-50  
 £17-06  
 £6-06  
 £8-94  
 £8-37  
 £9-50  
 £16-95  
 £2-31  
 £5-99  
 £4-50  
 £27-50  
 £29-95  
 £48-00  
 £8-06  
 £9-18  
 £10-31  
 £3-12  
 £22-00  
 £13-25  
 £9-25  
 £6-75  
 £15-00  
 £4-00  
 £15-95  
 £27-95  
 £15-95  
 £9-95  
 £11-95  
 £18-44  
 £11-50

Radford MD6  
 Radford TD3  
 Radford FN11  
 Radford FN12a or FN12b  
 STC 4001G  
 Tannoy 10in HPD  
 Tannoy 12in HPD  
 Tannoy 15in HPD  
 Wharfedale Super 10 RS/DD 8 ohm

### SPEAKER KITS

Baker Major Module 3, 8 or 15 ohm each  
 Goodmans DIN 20 4 or 8 ohm each  
 Goodmans Mezzo Twin kit pair  
 Helme XLK 30 pair  
 Helme XLK 35 pair  
 Helme XLK 40 pair  
 Helme XLK 50 pair  
 Kefkit 1 pair  
 Kefkit III each  
 Peerless 20-2 each  
 Peerless 20-28 each  
 Peerless 20-3 pair  
 Peerless 50-4 each  
 Peerless 3-15 each  
 Peerless 1060 pair  
 Peerless 1070 each  
 Peerless 1120 each  
 Richard Allan Twin assembly each  
 Richard Allan Triple 8 each  
 Richard Allan Triple 12 each  
 Richard Allan Super Triple each  
 Richard Allan RA8 Kit pair  
 Richard Allan RA82 Kit pair  
 Richard Allan RA82L Kit pair  
 Wharfedale Linton II kit pair  
 Wharfedale Giendale III kit pair  
 Wharfedale Giendale 3XP kit pair  
 Wharfedale Dovedale III kit pair

## HI-FI ON DEMONSTRATION in our showrooms:

Akai, Armstrong, Bowers & Wilkins, Castle, Celestion, Dual, Goodmans, Kef, Leak, Pioneer, Radford, Richard Allan, Rotel, Tandberg, Trio, Videotone, Wharfedale, etc.—ask for our Hi-Fi price list!

Complete RADFORD range in stock: amplifiers, preamps, power amps, low distortion oscillator, distortion measuring set, etc.

All items guaranteed new and perfect

Prompt despatch

PRICES INCLUDE VAT AND ARE CORRECT AT

8/12/75

Carriage: 50p per speaker (12in and over 75p each), Tweeters, crossovers 30p each, Kits 80p each (£1-60 pair).

Send stamp for free booklet "Choosing a Speaker"

# WILMSLOW AUDIO

Dept P.E.

Loudspeakers: Swan Works, Bank Square, Wilmslow, Cheshire.

P.A., Hi-Fi, etc.: 10 Swan Street, Wilmslow. Hi-Fi, Radio, etc.: Swift of Wilmslow, 5 Swan Street, Wilmslow.

Telephone Wilmslow 29599 (speakers); 26213 (hi-fi, etc.).

Complete kits in stock for Radford Studio 90, Monitor 180, Studio 270, Studio 360, Hi-Fi Answers Monitor, Hi-Fi News No-compromise, Wireless World Transmission Line, Practical Hi-Fi and Audio (Giles) Monitor, etc.

Construction leaflets for Radford, Kef, Jordan Watts, Tannoy, etc., free on request.

P.A. amplifiers, microphones, etc., by Linear, Shure, Eagle, Beyer, AKG, etc.

FREE with orders over £10—"Hi-Fi Loudspeakers Enclosures" book.

# CRESCENT RADIO LTD.

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

MAIL ORDER DEPT.  
1 ST. MICHAELS TERRACE, WOOD GREEN  
LONDON N22 4SJ Phone 888-4774

## 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 x 61mm x 28mm.

OUR PRICE 40p. + 8%.



## 10in 8ohm DUAL CONE L/S

Manufactured by "ELAC" to a very high standard these loudspeakers are a real bargain.  
SPEC—Size—10in. Dual Cone Power—10 Watts. Frequency—40-12000Hz. + 25%. Our price £3.75 ea.



## I.C. SOCKETS + 8%

D.I.L.  
8 pin—13p 24 pin—24p  
14 pin—14p 28 pin—28p  
16 pin—14p 36 pin—36p

## FERRIC CHLORIDE

Anhydrous ferric chloride in double sealed one pound poly packs.  
Our Price 65p per lb. + P/P + VAT @ 8%.

## MINIATURE RELAYS

Brand new range of British made relays, size: 1 1/4in x 1 1/4in x 1in. All two changeovers with 250V 1.5A contacts and suitable for fitting on 0.1m veroboard.

Type Volts Current Ohms  
27/A 12V 17mA 700 All  
21/A 12V 28mA 430 £1.30  
12/A 6V 33mA 185 each + 8%.

## MINI LOUSPEAKERS

2 1/2" 80 ohm 60p  
2 1/2" 40 ohm 60p  
2 1/2" 8 ohm 60p + 25%.

## LOW PRICE TRANSISTORS

BF803B 15p TIP42A 75p  
AO142B 25p OC75 25p  
BC149B 15p AA129 8p

## I.C.

**EXTRACTION TOOL**  
Saves damage to valuable I.C.s  
ONLY 40p + 8% VAT

## 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%.

## CABLE LESS SOLDERING IRON WAHL "ISO-TIP"

★ Completely portable.  
★ Solders up to 150 joints per charge.  
★ Recharges in its own stand.  
★ Fine tip for all types of soldering.  
★ Only 8in long and weighs just 6 ozs.  
OUR PRICE £9.75 + 8%.  
(Spare bits are available)

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

We supply the three modules for you to build this Disco-Group-P.A. amplifier into the cabinet of your choice.

★ **THE POWER AMP MODULE**  
170W R.M.S. sq. wave 300W instantaneous peak into 8 ohm (60W into 16 ohm).

★ **THE PRE-AMP MODULE**

Four control pre-amp, Vol. Bass, Treble, Middle controls. Designed to drive most amplifiers using F.E.T. first stage.

★ **THE POWER SUPPLY**

Is supplied complete with the mains transformer. Complete fixing instructions are supplied and no technical knowledge is required to connect the three ready wired modules. A fantastic bargain. £27.50, carr. £1.20. Send S.A.E. for further details on this or our ready built amplifiers. + 8%.

## 12-0-12V 500M/A

240V 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 copperclad board. Laminated Cutter. 1 lb Ferric Chloride. Large Plastic Spoon. Etch Resist Pen. Full Etching Instructions. Complete and Big Kit Value at £3.75 + 8% VAT.

## 2in. PANEL METERS

Size 69mm x 40mm  
0-50uA —ME3 0-100mA—ME13  
0-100uA—ME7 0-500mA—ME14  
0-500uA—ME8 0-1A —ME15  
0-1mA —ME9 0-60V —ME16  
0-5mA —ME10 0-300V a.c.—ME17  
0-10mA—ME11 8 meter —ME18  
0-50mA—ME12 V.U. meter—ME19

£3 each. + 8%.

## POWER PACKS

PP1 Switched 3.4-0.7-0 and 12V at 500M/A with on/off switch and pilot light. Size 130M/M x 55M/M x 75M/M. only £4.

PP2 Switched 6.7-0.9V Battery Eliminator. Approx. size 2 1/2in x 2 1/2in x 3 1/2in. Ideal for cassette recorders, £3.25.

PP3 Car converter. From 12V Pos. or Neg. to = 6.7-0.9V. Easy to fit and transistor regulated, £3.90. + 8%.

## 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%.

## DENCO TRANSISTOR TUNING COILS

Coils for transistor Superhets and converters suitable for chassis or B9A base mounting.

T coils  
Blue: Aerial coil with base input winding.

Yellow: Interstage R.F. coil with outcouplings

Red: Oscillator coil for 465Kc/s IF

White: Oscillator coil for 1.6M/c IF

Range	1T	2T	3T	4T	5T
Mcs	0.15-0.4	0.515-1.545	1.67-5.3	5-15	10.5-31.5
Metres	2,000-750	580-194	180-57	60-20	28-9.5

Price. Blue: Range 1 = 86p. Ranges 2-5 = 74p  
Yellow: Range 1 = 86p. Ranges 2-5 = 74p.  
Red: Ranges 1-5 = 74p. White: Ranges 1-5 = 74p. + 25% VAT.

## Low Voltage Stereo Amplifier

8 transistor stereo amplifier with volume, bass, balance and tone controls. Approx. 3W into 8 ohm per channel. Needs a 9/12V d.c. supply and is complete on a 2 1/2in x 7 1/2in P.C. board. Ideal for domestic record players, etc.

A BARGAIN AT £5 + 25% VAT

## U.K. CARRIAGE 50p UNLESS OTHERWISE STATED

VAT—All prices are excluding VAT. Please add to each item the VAT rate indicated.

## ★ ELECTRONIC PIANO KIT ★ SYNTHESISER KIT ★ ELECTRONIC ORGAN KITS



There are five superb Electronic Organ kits specially designed for the D-I-Y enthusiast. With the extreme flexibility allowed in design, you can build an organ to your requirements, which will compare with an organ commercially built costing double the price.

★ Portable organ with 4 octave keyboard, £145.29. ★ Console organ with 5 octave keyboard, £250.93. ★ Console organ with 2 x 4 octave keyboards and 13 note pedal board, £470.65. ★ Console organ with 2 x 5 octave keyboards and 32 note pedal board, £680. ★ Console organ with 3 x 5 octave keyboards and 32 note pedal board, £960. ★ W/W Sound Synthesiser Part Kit, £149. ★ W/W Touch Sensitive Electronic Piano Part Kit, £110. ★ 2 speed rotating speaker units, Bass unit £68, Mid-Range £75, Hi Fi Twin Horns £89.

All components can be purchased separately, i.e., semiconductor devices, M.O.S. master oscillators, coils, keyboards, pedal boards, stop tabs, draw bars, key-contacts, etc.

Send 60p for catalogue which includes 5 x 10p vouchers or send your own parts list, enclosing S.A.E. for quotation.

## Elvins Electronic Musical Instruments

Showroom and Head Office, 12 Brett Road, Hackney, London E8 1JP (Tel. 01-986 8455); 8 Putney Bridge Road, London SW18 1HU (Tel. 01-870 4949); 40m/42a Dalston Lane, Dalston Junction, London E8 (Tel. 01-249 5624).

Business hours: Open 9 a.m. to 6 p.m. Monday to Saturday. Closed all day Thursday. Open 10 a.m. to 1 p.m. Sunday by appointment.  
Vacancy for shop assistant with electronic knowledge

## INDUSTRIAL PRICES FOR THE HOBBYIST

ALL 'BIG NAME' BRANDED GOODS

SAME DAY SERVICE

MONEY BACK GUARANTEE

I/C's	£	CD4015AE	£	CD4043AE	£
CA3028A	0.64	CD4016AE	0.37	CD4044AE	0.62
CA3035	1.10	CD4017AE	0.70	CD4045AE	0.93
CA3046	0.57	CD4018AE	0.70	CD4046AE	0.88
CA3048	1.40	CD4019AE	0.37	CD4047AE	0.60
CA3052	1.00	CD4020AE	0.74	CD4048AE	0.37
CA3088E	1.60	CD4021AE	0.70	CD4049AE	0.37
CA3090Q	1.50	CD4022AE	0.65	CD4050AE	0.37
CD4000AE	0.14	CD4023AE	0.14	LO05T1	1.17
CD4001AE	0.14	CD4024AE	0.15	LO36T1	1.17
CD4006AE	0.80	CD4025AE	0.14	LM3091C	1.25
CD4009AE	0.37	CD4026AE	1.14	TA6A21	1.76
CD4010AE	0.37	CD4027AE	0.37	TA6A61B	1.14
CD4011AE	0.14	CD4028AE	0.60	TA6A51	1.03
CD4012AE	0.14	CD4029AE	0.75	TBA800	0.89
CD4013AE	0.37	CD4030AE	0.37	TBA810	1.00
CD4014AE	0.70	CD4037AE	0.63	TBA820	0.60
		CD4041AE	0.56	741c(Minidip)	0.18

TRANSISTORS	£	2N4036	£	40636	£
2N696	0.15	2N4037	0.35	40673	0.45
2N705	0.10	2N5296	0.30	BC107	0.06
2N1711	0.18	3N128	0.61	BC108	0.06
2N2102	0.56	3N140	0.76	BC109	0.06
2N2369	0.10	3N141	0.68	BC237	0.05
2N2905	0.27	40306	0.33	BCY70	0.09
2N3053A	0.17	40362	0.33	BCY71	0.18
2N3054	0.30	40406	0.31	BCY72	0.09
2N3055	0.35	40407	0.28	BFX29	0.26
2N3440	0.24	40408	0.41	BFX30	0.29
2N3442	1.32	40409	0.43	BFX84	0.21
2N3702	0.12	40410	0.43	BFX85	0.26
2N3703	0.12	40411	1.82	BFX88	0.22
2N3704	0.15	40594	0.53	BFY50	0.18
2N3705	0.14	40595	0.69	BFY51	1.14
2N3708	0.12			BFY52	0.18
				OC35	0.35

DIODES/ZENERS	£	IN4005/6/7	£	BZY88 400mW.	£
IN14001/2/3/4	0.03	IN4148	0.15	All voltages	0.06
				OA47	0.05

Terms: C.W.O. Add 10p P/P 8% VAT Cos/Mos 25% VAT OTHER

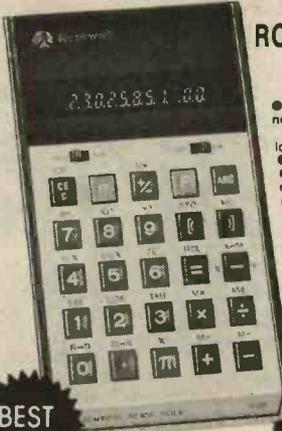
Send SAE for comprehensive Cos/Mos List.

## ROWNSGEM LTD.

Rosebank Parade, Plough Road, Yateley, Camberley, Surrey.  
Phone No. 0252 871388

THE PROFESSIONAL ORGANISATION FOR THE 'HOBBYIST'

### ELECTRONICS



#### ROCKWELL 63R—Rechargeable

EXTRA LARGE 12-POSITION DISPLAY WITH SCIENTIFIC NOTATION

- 8-digit mantissa, 2-digit exponent and 2 positions for negative mantissa and exponent sign ● 4 functions (+, -, ×, ÷) ● Fully addressable memory ● Algebraic logic (enter 5-3 =, display answer, 2) ● Floating decimal ● Enter exponent key for working in scientific notation ● Two levels of parenthetical operations ● Degree/radian conversion ● Trig functions in either degrees or radians ● Inverse functions in either degrees or radians ● Logarithmic functions (common and natural) ● Antilogs ( $e^x$  and  $10^x$ ) ●  $y^x$  for raising positive numbers to power ● Factorial ● Square root ● Reciprocal ● Register exchange ● Sign change ● Constant pi ● Automatic constant for all four functions ● Indicator for improper operations ● Indicator for non-zero memory ● Automatic overflow/underflow ● Operates on rechargeable batteries or A.C. ● Deluxe carrying wallet

**ONLY £32.50 + 8% VAT**  
INCLUDING RECHARGER

#### SPECIAL OFFERS

#### CASIO fx-101

with INDEPENDENT MEMORY AND SCIENTIFIC NOTATION



The NEW CASIO fx-101 has the 18 important math functions most commonly used in scientific and technical fields. Easy to operate, independent function keys. The constant for  $\pi$  smoothly handles repetitive figure work and conversions. ● Entry/basic functions ● 10-digit mantissa or 8-digit mantissa plus 2 digit exp. (powers of ten from  $10^0$  to  $10^9$ ) ● Full floating mode with underflow ● Overflow indicated by an "E" sign, locking the calculator ● Green digitron tube and zero suppression ● 34mm high, 96mm wide, 160mm deep.

**ONLY £26.90**

Normal functions—4 basic functions, chain and mixed operation, constants for  $\pi$  and  $e$ , automatic accumulation in 4 functions, true credit balance and calculations involving decimal places. Scientific functions—Trigonometric and inverse trigonometric functions by degree or radian, common and natural logarithmic functions, exponentiations with base  $e^x$  (exponentials, squares and powers), Square roots, reciprocals, sexagesimal/decimal conversion, Pi entry and scientific notation.

A.C. mains adaptor, if required please add £2.75

#### NOVOUS 4515

100 Step Programmable The New 100 Step Programmable Scientific Calculator. Saves time and effort with complicated problems.

This is truly an unbeatable machine

- 8 Digit ● Common and natural logs and anti log ● Sine, Cos, Tan and their inverse ● Reciprocals ●  $y^x$  ●  $x^2$  ● 3 level stack ●  $\pi$  ● Register exchange ● Sign change ● Memory ● Memory +  $x^2$  ● Degree/radian conversion ● Rechargeable (Recharger included in price) ● Vinyl case (full instruction manual).

If you need scientific notation, then the NOVOUS 4525 is your answer. 8 digit + 2 exponent 100 step programmable + 4 roll stack and everything else the 4515 has.

**ONLY £59.90 + 8% VAT**  
Full one year manufacturer's guarantee  
OUR PRICE

Please add 8% VAT to all prices except Clock/Radio



OUR PRICE  
**£43.50**  
+ 8% VAT  
including recharger

#### SCIENTIFIC

ALGEBRAIC	£
CBM SR4148 12 digit + 2 exp.	39.95
CBM SR6120 10-digit + 2 exp.	31.95
TEXAS SR18 8-digit + 2 exp.	31.50
TEXAS 50A 10-digit + 2 exp.	43.50
TEXAS 51A 10-digit + 2 exp.	63.50
ROCKWELL 51R 8-digit conversion	23.95
ROCKWELL 63R 8-digit + 2 exp.	29.95
ROCKWELL 61R 8-digit	27.50
SINCLAIR OXFORD 300 5-digit + 2 exp.	21.95
CASIO FX101 8-digit + 2 exp.	26.90
CASIO FX15 8-digit + 2 exp.	24.03
CASIO FX10 8-digit + 2 exp.	19.95
The New Green VATMAN SCIENTIFIC 8-digit + 2 exp.	27.90

#### REVERSE POLISH LOGIC

SINCLAIR SCIENTIFIC 5-digit + 2 exp.	11.50
NOVOUS 4510 8-digit mathematic	19.50
NOVOUS 4515 8-digit mathematic, 100 step programmable	39.50
NOVOUS 4520 8-digit 2 exp. 4 roll stack	45.50
NOVOUS 4525 8-digit 2 exp. 4 roll stack 100 step programmable	59.90
NOVOUS 6310 8-digit conversion	21.50
NOVOUS 6320 8-digit financial	33.50
NOVOUS 6025 8-digit financial, 100 step programmable	59.90
NOVOUS 6030 8-digit statistical	38.00
NOVOUS 6035 8-digit statistical, 100 step programmable	59.90

#### CBM SR7919D

- 8 digit or 5 digit + 2 exponent ● Sine, Tan, Cos and their inverse ● Natural Logs, Common Logs, Antl Logs ● Square Root ● Reciprocals ●  $y^x$  ●  $x^2$  ●  $\pi$  ● Register Exchange ● Memory plus ● Store Recall ● Sign Change ● Algebraic Logic



**ONLY £12.50 + 8% VAT**

1 year Manufacturer's Guarantee  
CBM mains adaptor. Please add £2.50 to total



**NEW!**

#### DECIMO DIGITAL CLOCK RADIO AS ON TV

Recommended Price £50  
**OUR PRICE**  
**£35.50** incl VAT plus £1. p & o

What is unique about this beautiful Clock/Radio? Besides being a first class AM/FM radio, is its unique 1 1/2" computer type display. You don't have to fret about the irritating blip or pulsating glare of other types of clock radios—this has a soft, restful and silent orange glow with a dimmer to adjust its brightness to suit your taste.

#### JUST LOOK AT THESE SUPERB FEATURES

- Unique light emitting 1 1/2" computer-type orange numerals are large, clear and easy to read from across the room and can be seen from any angle.
- Time setting can be done clockwise or anti-clockwise. Wake-to-music or Wake-to-alarm system.
- Touch N' dimmer—to give you extra minutes to sleep without re-setting the buzzer alarm.
- Sleep switch shuts off radio automatically. Adjustable up to 90 mins. Lets you go to sleep to music.
- Electronic 12-hour alarm that can be set at 10 minute intervals.
- Dimmer switch for time display brightness control.
- Radio features highest quality components. Solid state circuitry and advanced engineering for crisp, clean sound in full tonal range. Convenient top-mounted push-button controls.
- Side mounted tuning control knob. Front mounted volume and tone slide controls.
- Precision vernier tuning slide rule dial with black-out green-lighted log type tone control for adjusting tone and bass response.
- Switchable automatic frequency control (A.F.C.) On F.M. Switch in for drift-free listening. Switch-out for precision tuning. Automatic gain control (A.G.C.) on M.W. stabilises signal.
- Three-inch top-mounted speaker to float sound around the room.
- Dual built-in F.M. antennas. One on line cord and an indoor line-wire tube for hard-to-get F.M. stations. Built-in ferrite rod antenna for M.W. speaker.
- Output jack to accommodate optional earphone: Pillow or auxiliary silver front.
- Charcoal Grey high-impact resistant styrene cabinet with Teak finish and silver front.
- Dimensions 4" H. 12 1/2" W. 6 1/2" D. Power source A.C. 240 volts, 50Hz.

#### U.S.A. 5-FUNCTION

#### DIGITAL WATCHES FROM £29.50



Presentation-packed, one of the finest digital watches available at this low, low price. Full 5-functions showing hours, mins, secs and date. Limited supplies. Only £28.50 + VAT

**ARNEX QUARTZ** As above but with Gold plated, fully flexible interwoven type bracelet and case. Water resistant. Large round face. 2-button operation. Also available in steel. 5 functions. £35.50 + VAT

**MICROSONIC** Full 5-functions. Attractive oblong face with body-matching flexible bar-bracelet. Gold plated or available in stainless steel. Our price only £43.50 + VAT

**TELON** One of the finest and slimmest watches we have yet offered. FULL 7-FUNCTIONS. Beautifully styled flexible bracelet and case in satin stainless steel. Bright L.E.D. display with 3 sec. hold and fade-out—hours, mins, secs (secs displayed with mins!) month and date. Single-button operation. Illustrated. Our price £45.70 + VAT

All these watches have automatic computerisation for 28, 30 and 31 day months and arrive in beautiful presentation boxes

## ORDER FORM

To: **BARCLAY ELECTRONICS** Dept 4PE  
STANLEY HOUSE, 1115, FINCHLEY ROAD, LONDON N.W.11.  
All goods fully guaranteed. If not satisfied—money refunded if returned undamaged within 7 days.  
PHONE CALLS AND PERSONAL CALLERS WELCOME MON-THURS BETWEEN 2 and 5 pm. 01-458 4755

Please send me .....

with/without optional mains adaptor. I enclose cheque/money order total value

£ ..... including 55p to cover packing.

NAME .....

ADDRESS .....

# RETURN OF POST MAIL ORDER SERVICE

## NEW BSR HI-FI AUTOCHANGER

### 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 13 1/2" x 11 in.  
Above motor board 3 1/2 in.  
With STEREO/MONO CARTRIDGE  
Tubular Arm & Cueixx device



£10.95 Post 75p.

## PORTABLE PLAYER CABINET £4.95

Modern design. Size 16" x 15" x 7" resinie top 45p.  
covered. Large front grille. Hinged lid. Chrome  
fitting. Motor board cut for Garrard or BSR  
deck. Few only, in red and black

## HEAVY METAL PLINTHS

With P.V.C. Cover. Cut out for most  
B.S.R. or Garrard decks. Silver grey  
Anish. Model "A". Size 12 1/2" x 14 1/2" x 7 1/2 in.  
Model "B". Size 16 x 13 1/2" x 7 in. £8.50

£5.95 Post 75p

## FLARED HORN TWEETER

### Multi Cellular Horn Tweeter

8 ohm, 30W rating, 3 Kc/s to  
18 Kc/s. Improve your loud-  
speaker systems with £7.50  
this remarkable unit.



## R.C.S. DISCO DECK SINGLE RECORD PLAYER

Fitted with auto stop, stereo/comp. cartridge. Base-  
plate. Size 11 in. x 8 in. Turnable. Size 7 in diameter. A/C  
main. 220/250V motor has a separate winding 14 volt to  
power a small amplifier.

3 speeds plays all size records.  
Two for £13. Post 75p

£6.95 Post 45p

## COMPLETE STEREO SYSTEM

Two full size loudspeakers 13 1/2" x 10" x 3 1/2 in. Player  
unit clips to loudspeakers making it extremely compact.  
Overall size only 13 1/2" x 10" x 8 1/2 in. 3 watts per



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.



Also available 0-6 hours

CASSETTE RECORDER MOTOR ONLY. 6 Volt.  
Will replace many types. Ideal for models. £1.25.

BLANK ALUMINIUM CHASSIS 18 s.w.g. 2 1/2 in sides  
6 x 4 in 70p; 8 x 6 in 80p; 10 x 7 in £1.15; 12 x 8 in £1.35;  
14 x 9 in £1.60; 16 x 9 in £1.45; 12 x 13 in 75p; 16 x 10 in  
£1.70.

ALUMINIUM PANELS 18 s.w.g. 8 x 4 in 150p; 8 x 6 in 25p;  
14 x 8 in 25p; 10 x 7 in 30p; 12 x 6 in 30p; 12 x 8 in 40p;  
16 x 6 in 45p; 14 x 9 in 50p; 12 x 12 in 55p; 16 x 10 in 75p.

1 1/2 inch DIAMETER WAVECHANGE SWITCHES 45p. EA.  
2 p. 2-way, or 2 p. 6-way, or 3 p. 4-way.  
1 p. 1 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  
1 1/2" x 1 1/2" x 1". Response 25 c.p.s. to 25 Kc/s, 26 db gain.  
For use with valve or transistor equipment. £1.45 Post  
Full instructions supplied. Details S.A.E. 30p

NEW TUBULAR ELECTROLYTICS			GAN TYPES	
2/380V	20p	250/25V	18p	16 + 16 + 16/276V46p
4/380V	20p	500/25V	30p	50 + 50/300V 50p
8/380V	22p	100 + 100/275V 65p		82 + 32/450V 75p
16/350V	30p	150 + 200/275V 70p		100 + 50 + 50/350V86p
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		4700/83V 95p
100/25V	10p	32 + 32/350V 50p		

LOW VOLTAGE ELECTROLYTICS.  
22, 25, 50, 88, 150, 470, 500, 680, 1500, 2200, 3800, mfd  
all 8 volt 10p ea.  
22, 25, 50, 88, 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, 6, 10, 25, 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; 4700/33V 95p.  
2500mF 50V 62p; 3000mF 25V 47p; 50V 45p.  
5000mF 6V 25p; 12V 42p; 25V 75p; 35V 85p; 50V 95p.  
500V-0.001 to 0.05 4v; 0.1 10p; 0.5 12p; 0.47 25p.  
CERAMIC 1pF to 0.01mF, sp. Silver Mica 2 to 5000pF, 5p.  
PAPER 850V-0.1 7p; 0.5 18p; 1mF or 2mF 150V 15p.  
MICRO SWITCH single pole changeover 20p  
MICRO SWITCH sub min 25p.  
TWIN GANG. "0-02" 208pF + 170pF, £1.20.  
Slow motion drive 365pF + 365pF w/25pF + 25pF, 50p;  
500pF standard twin gang 75p. 120 pF twin gang 50p.

ELAC 8 x 5 in. HI-FI SPEAKER. TYPE 59RM. THIS  
FAMOUS AND WIDELY USED UNIT NOW  
AVAILABLE AT BARGAIN PRICE £3.45  
10 WATT, 8 OHM. CERAMIC MAGNET.

NEON PANEL INDICATORS. 250V AC/DC Amber, 30p  
RESISTORS. 1/4 w., 1/2 w., 1 w., 20p, 2p; 2 w., 8p, 10p to 10M.  
HIGH STABILITY. 1/4 w., 2c; 10 ohms to 5 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, 85p.  
FERRITE ROD 8" x 1/2" 20p; 6" x 1" 20p; 3" x 1" 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. 5-3 v. 1 a. or 5 v. 2 a. £4.60  
350-0-350 80 mA. 6-3 v. 3-5 a. 5-3 v. 1 a. or 5 v. 2 a. £5.80  
800-0-800 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. 2 1/2 x 2 1/2 in. 95p  
MIDGET 220 v. 45 mA. 6-3 v. 2 a. 2 1/2 x 2 1/2 in. £1.45.  
HEATER TR. 100 W. 6-3 v. 3 amps. £1.45 4 amp. 90p  
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, 18, 18, 20, 24, 30, 36, 40, 48, 60 £4.60  
2 amp., 6, 8, 10, 12, 18, 18, 20, 24, 30, 36, 40, 48, 60 £7.00  
3 amp., 6, 8, 10, 12, 18, 18, 20, 24, 30, 36, 40, 48, 60 £8.70  
5 amp., 6, 8, 10, 12, 18, 18, 20, 24, 30, 36, 40, 48, 60 £11.25  
6, 8, 10, 18 v. 1 a. £2. 6-0-6 v. 500 mA £1. 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. £8; 400w. £7; 500w. £8.  
CHARGER TRANSFORMERS. Input 230/250v.  
for 6 or 12v. 1 1/2 amp. £2.75; 4 amp. £4.60.  
FULL WAVE BRIDGE CHARGER RECTIFIERS:  
8 or 12v. outputs. 1 1/2 amp. 40p; 2 amp. 55p; 4 amp. 85p.

## R.C.S. STABILISED POWER PACK KIT

All parts including printed circuit and instructions to  
build this unit. Voltages available: 6V, £2.95 Post  
7-5V, 9V, 12V. Up to 100 mA output.  
Please state voltage required.

## 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 - 50 cps and £2.20  
3,000 cps. For systems up to 25 watts.

## VOLUME CONTROLS 80 Ohm Coax 8p per yd.

5 K. ohms to 2 Meg. LOG or  
LIN. L/S 20p. D.P. 35p.  
STEREO L/S 55p. D.P. 75p.  
Edre 5K. S.P. Transistor 25p

## BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £3. 80 yd. £4.50. FRINGE LOW LOSS 15p per yd. Ideal 825 and colour

Wirewound controls 1 1/2 in. diam. 3 watts, 10 ohms to 100K  
British made with long spindles jin. dia 85p ea.

DUAL CONCENTRIC POT 500K LOG + 500K LIN D.P.  
switch. Inner spindle 3 1/2 in; outer spindle 2 1/2 in. 75p.

## CASH PRICES INCLUDE VAT MINIMUM POST AND PACKING 30p. CALLERS WELCOME

# RADIO COMPONENT

Illustrated Radio Books & Component Lists 10p. Written guarantee.

## E.M.I. 13 1/2" x 8 in. SPEAKER SALE!

With tweeter. £5.25  
And crossover, 10 Post  
watt. State 3 or 8ohm  
As illustrated Post 35p



With flared tweeter cone and ceramic  
magnet. 10 watt. 8ohm.  
Bass res. 45-80 cps. £3.45  
Flux 10,000 gauss. Post 45p.

15 watts single cone model £8.60.

## Bookshelf Cabinet £6.95

Fluted wood front 16x10x8in. Teak Veneer Post 45p

## GOODMANS 6 1/2 in. HI-FI SPEAKER £4.60

4 or 8 ohm. 10 watt. Large ceramic magnet.  
Special cone surround. Frequency response 30-15,000  
cps. Ideal P.A. Columns, HI-FI Enclosure Systems, etc.  
Suitable Tweeter £2.30.



## B.S.R. SINGLE PLAYER DECK £17.50 post 75p.

3 speeds, cueing device, balanced  
arm. Ideal disco deck. Stereo  
cartridge fitted.



## GOODMANS 8 in. WOOFER £1.25 EACH

Rubber cone surround.  
8 ohm 15 watt. Deep cone.  
Heavy ceramic magnet. Bass  
resonance 35 cps. Frequency  
response 30-8,000 cps.  
Ideal bass unit for £6.75  
HI-FI systems



LOUDSPEAKERS P.M. 3 OHMS. 7 x 4 in. £1.25; 6 1/2 in. £1.50;  
9 x 5 in. £1.60; 8 in. £1.75; 10 x 6 in. £1.90; 10 in. £2.00.  
SPECIAL OFFER LOUDSPEAKERS: All Brand New.  
3 ohm, 2 1/2 in; 3 1/2 in; 5 in. 8 ohm, 2 1/2 in; 2 1/2 in; 5 in x 8 in;  
5 in. 15 ohm, 3 1/2 in; 5 in; 6 x 4 in; 5 in x 3 in; 7 x 4 in; 8 x 5 in.  
25 ohm, 2 1/2 in; 3 in; 3 in; 5 x 3 in; 5 in. 35 ohm; 3 in; 5 in.  
80 ohm, 2 1/2 in; 2 1/2 in. 120 ohm, 3 in. £1.25 EACH

LOUDSPEAKER VOLUME CONTROL 15 ohm 10 watt  
with lin lock threaded bush for wood panel mounting 75p.

RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 5 in.  
diameter 4W £2.50. 10 in. diameter 5W £2.95; Post 25p.  
12 in. diameter 4W, £3.60; 3 or 8 or 15 ohm models.  
SPEAKER COVERING MATERIALS. Samples Large 8 A.M.  
Horn Tweeters 2-16Kc/s. 10W 8 ohm or 15 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 £4.00.  
8-WAY CROSSOVER 850 cps and 3000 cps (25 watt) £2.20.

## GOODMANS CONE TWEETER £3.60

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 metromons; diorobe etc. 95p. Post 20p

WEYRAD TYPE COILS		
P50/1AC-60p.	RA2W 85p.	Twin Gang £1.20.
P50/3CC-40p.	OPT1 85p.	Printed Circuit 85p.
P50/8CC-40p.	LFD74. 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 25p;  
Chrome Lead Socket 45p. Phono Plugs 10p. Phono Socket 5p  
JACK PLUGS 8p. Chrome 20p; 3.5mm Chrome 15p. DIN  
SOCKETS Chassis 3-pin 15p; 5-pin 10p. DIN SOCKETS  
Lead 3-pin 15p; 5-pin 15p. DIN PLUGS 3-pin 15p; 5-pin 25p.  
VALVE HOLDERS 5p; CERAMIC 10p; GANS 5p.

## R.C.S. 100 WATT VALVE AMPLIFIER CHASSIS



Professional model. Four inputs. Treble, Bass, Master,  
Volume Controls. Ideal disco, P.A. or groups.  
S.A.E. for details. 5 speaker £85 plus £1.50 carr.  
outputs, very robust job. Suitable carrying case £16.50

# 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/C.S. Input 100 M.V. high imp. Size 9 1/2in. x 3in. x 2in.

Mono kit **£12-50** Stereo kit **£20** <sup>post</sup> 45p.  
Easy to build. Full instructions supplied.



## ELAC 10 inch

Dual cone plasticised roll surround. Large ceramic magnet. 50-18,000 cps. Bass resonance 55 cps. 8 ohm impedance. 10 watts **£5-50**

## TEAK VENEER HI-FI SPEAKER CABINETS Fluted Wood Fronts

MODEL "A". 20 x 13 x 12in. For 12in. dia. **£12-50** <sup>post</sup> 75p

MODEL "B". 16 x 10 x 9in. For 13 x 8in. or **£6-95** <sup>post</sup> 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 x 20 x 12in. Teak Finished Fluted Front.

TEAKWOOD LOUDSPEAKER FRONT GRILLS  
Modernise your cabinets with the Grooved look. Sizes—18 1/2" x 10 1/2" — 78p, 10 1/2" x 7 1/2" — 48p.

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER  
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



This completely cased mains powered Hi-Fi Tuner with brushed aluminium fascia is British made using the latest circuitry. Bargain **£27-50** <sup>post</sup> 45p.

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated. **£3-95**

## WAFFER HEATING ELEMENTS THIN

OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10 1/2" x 8 1/2" x 1/4in. Operating voltage 200/250V. a.c. 350 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopyers 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 driers, towel rails—ideal for airing cupboards. Ideal for anti-frost device for the garage—preventing frozen radiators or acting as oil pump 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 Maxwell. Bass resonance 40 c/s Rated 25 watts. NOTE: 8 or 8 or 16 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, haffle and instructions. **£14-50**  
As illustrated.

Please state 8 or 8 or 16 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" £8-95**

12in. 30 watt 3, 8 or 15 ohms. Post 40p

**GROUP "35" £10-50**

12in. 40 watt 3, 8 or 15 ohms. Post 40p

**GROUP 50/12in. £14-50**

80 watt 8 or 15 ohms. Post 80p

**GROUP "50" £19-50**

15in. 75 watt 8 or 16 ohms. Post 80p

Group + PA Cabinets in stock Send for Leaflet.

BAKER 50 WATT ALL PURPOSE TRANSISTOR AMPLIFIER **£49** Carr. £1-00

NEW 'DISCO 100 WATT' ALL PURPOSE AMPLIFIER CHASSIS **£55** Carr. £1-00

2 inputs. 4 outputs separate volume treble and bass controls. Ideal disco or slave amplifier chassis.

PW SOUND TO LIGHT DISPLAY Complete kit of parts with R.G.S. printed circuit. Three 1000 watt channels. As featured in December Practical Wireless. **£12-50** CABINET extra £3.

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 1in thick wood cabinet. Size 16 1/2in x 16 1/2in x 8 1/2in. Weight 28lbs. 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 out out for 6 1/2in Woofer. £8 50 Carr. 85p. Rosewood Version £9-50 Carr. 85p. Baffle could be out to take larger speaker.

E.M.I. GRAM MOTOR 120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2 1/2" x 2 1/2" in. **£1-25** Post 30p.

E.M.I. TAPE MOTOR 4 pole, 240 v. 185 mA. 1400 rpm. Spindle 1/4in diameter. 120v version £1. (Illustrated) **£2-00** Post 30p

Post 30p

Post 30p

Post 30p

Post 30p

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 16 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 25-18,000cps  
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 Discos-theques.

Bass Resonance 35cps  
Flux Density 15,000gauss  
Useful response 25-16,000cps  
8 or 16 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, Discos-theques. 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, cross-over data and cubic tables. 50p. Post 8p.

CUSTOMERS FREE CAR PARK

# SPECIALISTS

(Exports Remit cash and extra postage.)

OPEN 9-6. WEDNESDAY 9-1. SATURDAY 9-5. Closed for lunch 1-15-2-30

337 WHITEHORSE ROAD . CROYDON

Buses 50, 68, 159. Rail Selhurst

Telephone 01-684-1665

# THE POWER HOUSES



Real Tone SC60

## SC60 ADVANCED SCIENTIFIC

The SC60 is the most advanced scientific and statistical calculator in its price range.

- 3 memories
- 50 functions
- 66 keyboard commands

The SC60 will solve your complex problems at a price that isn't a problem.

### BASIC FUNCTIONS

There are so many we can list only some of them 10 digits, 2 exponents, algebraic logic, with two parenthesis

levels. Sin, Cos, Tan (plus inverse), Inx, Log 10<sup>x</sup>, e<sup>x</sup>, pl. xy, √x, x<sup>2</sup>, 1/x, x<sup>-y</sup> and x<sup>-m</sup> exchange, sign change, factorial, Charges in 5 hours and cuts off to prevent overcharging.

### ADVANCED FUNCTIONS

Combinatorial functions and binomial coefficients, combinations, permutations, normal probability functions, Pr(Z), Gamma function (r), normal distribution function, statistical functions, arithmetic mean, standard deviation, variance sq. rt. of sum of squares 11 x 11.

MEMORY three addressable memories which can also be used automatically for statistical functions, with sum memory, sum of squares memory and index memory plus index register. Weight 330 grams. Size 17 x 9 x 3cm

ACCESSORIES as for SC44 SCIENTIFIC

**£54** Inc. Vat & p.p.

## SC44 SCIENTIFIC

- 8 DIGIT MANTISSA plus sign and 2 digit exponent plus sign
- Algebraic logic and exponential functions
- 2 Parenthesis levels (( ))
- Trig functions (Sin, Cos, Tan) inverse
- Log, Inx Log<sup>x</sup>, Antilog e<sup>x</sup>, 10<sup>x</sup>
- Exchange operation (xy)
- Factorial n!, Pl. 1/x, x<sup>2</sup>, √x
- Trig and inverse trig in either radians or degrees
- Exponentiation (y<sup>x</sup>)
- Automatic error detection and display clearing operations (CA, CE)
- 22 Functions
- 40 Keys
- Plus much more



Real Tone SC44

Works to 10 digits, Rounds to 8. Full chain calculation with any function sequence. 1 Addressable memory with sum to memory key. Takes only 3 seconds on long calculations.

1 YEAR WARRANTY

### ACCESSORIES INCLUDE:

NiCd rechargeable batteries, a.c. adaptor/charger, leatherette carry case, instructions, 1 year guarantee. S.A.E. Re: T.J. SR52 at £2.50 (inc. VAT) plus for H.P. prices.

**£34.56** Inc. Vat & p.p.

Please send me SC60-£54 inc. VAT, & p.p. or SC44-£34.56 inc. VAT, & p.p.

NAME

ADDRESS

Orders to: KRAMER & CO., 9 October Place, Holders Hill Road, London NW4 1EJ. Tel: 01-203 2473. Telex 888941 attention KRAMER. Registered No. 1797716. Export orders invited.

## SC60. 10 MEMORY

Also available is the SC60.10—which has 10 operator accessible memories with protected group memory which includes sum-memory, sum of squares memory, and index memory.

We repair most makes of calculator. Send for quotation.

**£64.95** Inc. VAT & p.p.

# P.E. JOANNA

Electronic Piano



ALL PARTS CAN BE SUPPLIED

Keyboard, Keyswitch, P.C.B.s, Hardware, Semiconductors, Resistors, Capacitors, Cabinets Complete kits or easy stages

Constructed Planos to order Send S.A.E. for details

## Clef Products

31 Mountfield Road, Bramhall Stockport, Cheshire SK7 1LY

## THE RADIO SHOP

16 CHERRY LANE BRISTOL BS1 3NG TELEPHONE 0272-421196

### TRIACS

1-6AMP PLASTIC*	6AMP ISOLATED TAB
NAS 0161W 100V 0-28	NAS 0651W 100V 0-65
NAS 0161X 100V 0-28	NAS 0651X 100V 0-65
NAS 0162W 200V 0-30	NAS 0652W 200V 0-61
NAS 0162X 200V 0-29	NAS 0652X 200V 0-61
NAS 0164W 400V 0-40	NAS 0654W 400V 0-70
NAS 0164X 400V 0-38	NAS 0654X 400V 0-70
NAS 0166W 600V 0-50	NAS 0656W 600V 0-81
NAS 0166X 600V 0-48	NAS 0656X 600V 0-76
10AMP ISOLATED TAB	3-5AMP CLIPPED TAB
NAS 1001W 100V 0-72	NAS 0351W 100V 0-52
NAS 1001X 100V 0-72	NAS 0351X 100V 0-52
NAS 1002W 200V 0-76	NAS 0352W 200V 0-56
NAS 1002X 200V 0-76	NAS 0352X 200V 0-56
NAS 1004W 400V 1-09	NAS 0354W 400V 0-88
NAS 1004X 400V 1-04	NAS 0354X 400V 0-87
NAS 1006W 600V 1-36	NAS 0356W 600V 0-85
NAS 1006X 600V 1-36	NAS 0356X 600V 0-84
8-3AMP ISOLATED TAB	15AMP ISOLATED TAB
NAS 0851W 100V 0-68	NAS 1501W 100V 1-05
NAS 0851X 100V 0-68	NAS 1501X 100V 0-95
NAS 0852W 200V 0-78	NAS 1502W 200V 1-02
NAS 0852X 200V 0-78	NAS 1502X 200V 1-02
NAS 0854W 400V 0-88	NAS 1504W 400V 1-81
NAS 0854X 400V 0-85	NAS 1504X 400V 1-68
NAS 0856W 600V 1-10	NAS 1506W 600V 1-89
NAS 0856X 600V 1-06	NAS 1506X 600V 1-84

Devices with internal trigger have 'W' suffix. 'X' denotes standard triac.

### THYRISTORS

1-6AMP TO6*	4AMP ISOLATED TAB
NAS 006P 50PIV 0-28	NAS 106P 50PIV 0-28
NAS 006Q 100PIV 0-28	NAS 106Q 100PIV 0-30
NAS 006R 200PIV 0-39	NAS 106R 200PIV 0-30
NAS 006S 400PIV 0-40	NAS 106S 400PIV 0-87
NAS 006T 600PIV 0-52	NAS 106T 600PIV 0-90
6AMP ISOLATED TAB	8AMP ISOLATED TAB
NAS 206P 50PIV 0-37	NAS 306P 50PIV 0-41
NAS 206Q 100PIV 0-42	NAS 306Q 100PIV 0-47
NAS 206R 200PIV 0-50	NAS 306R 200PIV 0-59
NAS 206S 400PIV 0-77	NAS 306S 400PIV 0-85

### CLOCK CHIPS

CT 7001 28 pin 4-85	AV-5-1224 18 pin 3-78
28 pin skt 0-55	18 pin skt 0-18
Data 0-15	Data 0-15

707 LED 0-3" Common Anode Display	1-00
704 LED 0-3" Common Cathode Display	0-80
747 LED 0-6" Common Anode Display	1-65

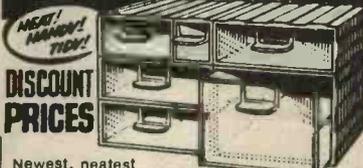
Thyristors C106 Series 4Amp 50V 0-32 100V 0-37 200V 0-48 400V 0-56 600V 0-70

### INTEGRATED CIRCUITS

TAA 550 TO18 0-54	*709 14 pin 0-37
TAA 263 TO18 0-82	*741 8 pin 0-35
555 8 pin 0-40	*748 14 pin 0-50
556 8 pin 1-05	*723 14 pin 0-87

\* Please add 25% VAT. Remainder 8%. Postage and packing 20p per order. Phone in your Access and Barclaycard order.

## INTERLOCKING PLASTIC STORAGE DRAWERS



DISCOUNT PRICES

Neatest, 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. 1D and 2D have space dividers. Build up any size cabinet for wall, bench or table top.

As supplied to Post Office, Industry and Government Dept.

- SINGLE UNITS (1D) (5in x 2½in x 2½in). £2 DOZEN.
- DOUBLE UNITS (2D) (5in x 4½in x 2½in). £3-50 DOZEN.
- TREBLE (3D) £3-50 for 8.
- DOUBLE TREBLE 2 drawers, in one outer case (6D2), £4-90 for 8.
- EXTRA LARGE SIZE (6D1) £4-50 for 8.

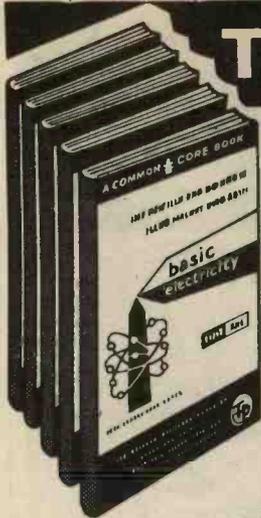
PLUS QUANTITY DISCOUNTS  
Orders over £20, less 5%.  
Orders over £60, less 7½%.

PACKING/POSTAGE/CARRIAGE: Add 75p to all orders under £10. Orders £10 and over, please add 10% carriage.

QUOTATIONS FOR LARGER QUANTITIES  
Please add 8% V.A.T. to total remittance

## FLAIRLINE SUPPLIES

(Dept. PE3)  
24 Cricklewood Broadway, London NW2  
Tel. 01-450 4844



# The Pictorial Method

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

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

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

### WHAT READERS SAY

- I have made great use of the Basic Manuals. *B.C., Hendon*
- I have found the Electronics volumes so interesting: please rush me Electricity. *C.A., Folkestone*
- I would like to say I am completely satisfied with the wonderful manuals. *A.L.P., Buckingham*
- I find these books are exactly what I have been looking for: they explain everything in perfect detail. *H.W.R., Postfract*
- These books make all other publications out of date with their simplicity and interest. *J.W.R., Newbury*
- You can add my blessings to your already long list of praises about your Basic publications. *P.J.J., Rustington*

### YOUR 100% GUARANTEE

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

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

Please find enclosed P.O./Cheque value £.....

- BASIC ELECTRICITY 5 parts £8.00   
 BASIC ELECTRONICS 6 parts £9.50   
 BASIC TELEVISION 3 parts £5.00

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

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

**POST NOW FOR THIS OFFER!**

ERSIN

# Multicore

5 CORE SOLDER

## for fast easy reliable soldering EASY TO USE DISPENSERS AND REELS IDEAL FOR HOME CONSTRUCTORS

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

### SAVBIT handy solder dispenser



A coil of Ersin Multicore Savbit Solder in a dispenser 7ft 6 in of 18 s.w.g. (2.2 metres of 1.22mm). The Solder that reduces the wear of soldering iron bits.

Size 5  
32p

### SAVBIT solder for general purpose work

A handy plastic reel of SAVBIT alloy. 63ft of 18 s.w.g. (19.2 metres of 1.22mm)

Size 12 £1.80



### ALU-SOL for soldering aluminium

New Multicore Alu-sol flux-cored solder in 16 s.w.g. No extra flux needed. Plastic reel holds 36ft. Supplied with full instructions. Also available in solder dispenser.

Size 4 £2.32



### Fine gauge solder for soldering small components

Fine gauge solder for soldering small components 138ft of 22 s.w.g. (42.0 metres of 0.71mm) Ersin Multicore 5 core solder wound on a plastic reel. Suitable for intricate work and small components.

Size 10 £1.44



### For soldering fine joints

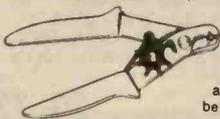
Dispensers of Ersin Multicore Solder make those small jobs easier. 21ft of 22 s.w.g. (5.4 metres of 0.71mm) solder, specially suitable for soldering fine wires, small components and for repairing printed circuits.

Size 15 40p

Or size 19A for kit wiring or Radio and T.V. repairs 7ft (2.1 metres) of 18 s.w.g. (1.22mm) Ersin Multicore Solder.

Size 19A 34p

### NEW BIB WIRE STRIPPER & CUTTER



Fitted with unique 8 gauge selector with handle locking device and easy grip handles. Spring incorporated for automatic opening. Strips insulation from flex and cables in seconds and can also be used as a cutter. Model 8B. 80p

### NEW SOLDER WICK



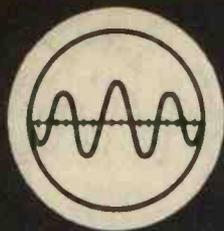
Absorbs solder instantly, from tags and printed circuits. Only needs 40 to 50 Watt soldering iron. Quick and easy to use. Does not need flux and is non-corrosive.

Size 18 90p

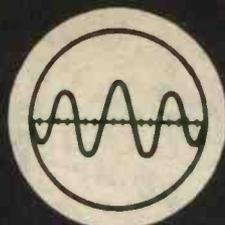
### Bib Hi-Fi Accessories Limited,

Sole U.K. Sales Concessionaires P.O. Box 78 Hemel Hempstead, Herts HP2 4RH

Prices shown are recommended retail excluding VAT. From Electrical and Hardware Shops. If unobtainable, send 20p P & P plus VAT at 8p in the £1. Prices and specifications subject to change without notice.



# TUAC



TRANSISTOR UNIVERSAL AMPLIFICATION CO. LTD  
163 MITCHAM RD. LONDON SW17 9PG 01-672 3137 9080

## MONO DISCOTHEQUE MIXER WITH AUTO FADE



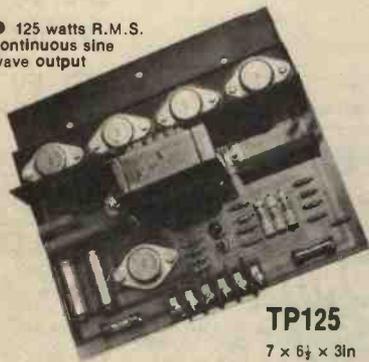
Designed for the discerning D.J. of professional standard. Offering a vast variety of functions. Controls: Mic Vol; Tone, over-ride depth; auto/Manual Sw; Tape Vol; L & R Deck Faders; Deck Volume; Treble and Bass; H. Phon Vol Selector; Master Vol On/Off Sw. Max output 1V RMS.

Specification: Deck Inputs—50mV into 1M $\Omega$ ; Deck Tone Controls—treble +20 -10dB at 12kHz, Bass +22 -15dB at 40Hz; Mic Input—200 ohms upwards, 2mV into 10k $\Omega$ ; Mic Tone Control—Total Variation Treble 15dB, Total Variation Bass 10dB; Tape Input—30mV into 47k $\Omega$ ; Power Requirements—30-50 volts at 50mA.

**£31.50**  
PANEL SIZE  
18 x 4½ in  
DEPTH 3 in

## ★ TUAC AMPLIFIER MODULES ★ POWER AND QUALITY ★

● 125 watts R.M.S. continuous sine wave output



**TP125**

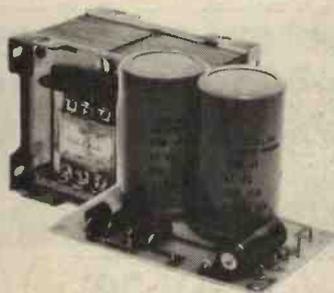
7 x 6½ x 3 in

**£19.50**

● 4 R.C.A. 150 watt 15 amp output transistors

- Rugged layer wound driver transformer
- Short—Open—and Thermal overload protection
- Only 6 connections

Power supplies vacuum impregnated. Transformers with supply board incorporating pre-amp supply:



PS 250 for supplying 2 TP125s

£22.00

PS 60/60 for supplying 2 TL60s

£19.50

PS 125  $\pm$  45 volts for TP125

£13.75

PS 100  $\pm$  43 volts for TL100

£12.00

PS 60  $\pm$  38 volts for TL60

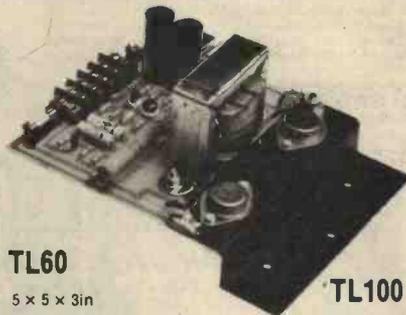
£11.50

PS 30  $\pm$  25 volts for TL30

£7.50

PSU 2 for supplying disco mixer

£5.50



**TL60**

5 x 5 x 3 in

- 60 watts R.M.S. continuous sine wave output
- 2 R.C.A. 110 watt 15 amp transistors

**£13.50**

**TL100**

5 x 5 x 3 in

- 100 watts R.M.S. continuous sine wave output
- 2 R.C.A. 150 watt 15 amp transistors

**£16.25**

Specification on all power modules: All output power ratings  $\pm$  0.5dB; Output impedance 8-15 ohms; THD at full power 2% typically 1%; Input sensitivity 60mV into 10k $\Omega$ ; Frequency response 20Hz-20kHz  $\pm$  2dB; Hum and noise better than -70dB.

### STOCKISTS—CALLERS ONLY

Geo Mathews. 85.87 Hurst Street. Birmingham (Tel. 021-622 1941)

Arthur Sallis Ltd. 28 Gardner Street (Tel. Brighton 65806)

Bristol Disco Centre. 26 The Promenade. Gloucester Road (Tel. Bristol 41666)

Socodi. 9 The Friars (Tel. Canterbury 60948)

Cookies. 132 West Street (Tel. Crewe 4739)

A1 Music Centre. 88 Oxford Street. Manchester (Tel. 061-236 0340)

Oamon Electronics. 99 Carrington Street (Tel. Nottingham 53880)

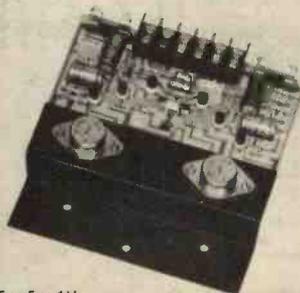
Electra Centre. 58 Lancaster Road (Tel. Preston 58488)

Mitchell Electronics. 64 Winchester Street (Tel. Salisbury 23689)

Mitchell Electronics for Southampton area

### TL30

NEW FROM TUAC TL30 D.C. COUPLED POWER AMPLIFIER MODULE.



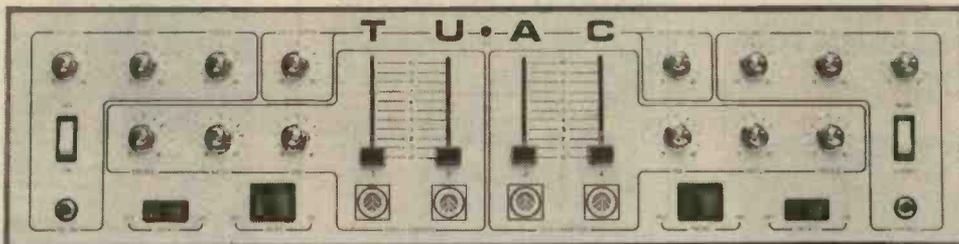
5 x 5 x 1½ in

- Output power 30 watts R.M.S. continuous sine wave
- Output impedance 8-15 ohms
- T.H.D. at full power 0.5%
- Signal to noise ratio -85dB
- Input sensitivity 60mV into 50k ohms
- Frequency response 25Hz-50kHz
- 8 transistors
- 4 diodes
- Only six connections

**£9.75**

Send large stamped addressed envelope with all enquiries or send £1 (refundable against purchase) for fully illustrated 20 page catalogue.

## TUAC STEREO DISCO MIXER



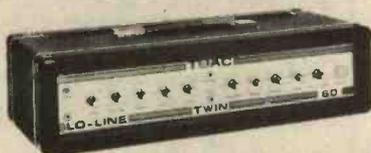
**INPUTS:** Four identical stereo inputs available with any equalisation. Two magnetic and two flat supplied as standard. High quality slider control on each channel. Volume, treble, and bass controls for each pair of sliders. Sensitivity mag., 3mV (R.I.A.A. comp.). Flat 50mV at 1kHz. Bass controls  $\pm 18\text{dB}$  at 60Hz. Treble controls  $\pm 18\text{dB}$  at 15kHz. **OUTPUT:** Up to 3 volts (+12dB) available. Attenuated output for TUAC Power Modules. Rotary master and balance controls. Band width 15Hz-25kHz  $\pm 1\text{dB}$ .

**P.F.L.:** Output 250mW into 8 ohms. Rotary volume control. Monitoring facility for all 4 channels. Selection via touch sensitive illuminated switches. Switched visual cue indicator.

**Miscellaneous Facilities:** Two illuminated deck on/off switches. Mains illuminated on/off switch. Auto fade illuminated on/off switch. Mains powered with integral screen and back cover. Complete with full instructions.

**£75.00**

Size: 25in long x 6in high x 5in deep



**TWIN  
60**

- ★ Lo-Line Twin 125 (125 watts version) **£98.00**
- ★ Lo-Line 60 (single pre-amp version) **£65.00**
- ★ Lo-line 125 (single pre-amp version) **£81.00**
- ★ Lo-line 125 slave output power 125 watts R.M.S. **£70.00**

**£80.00**

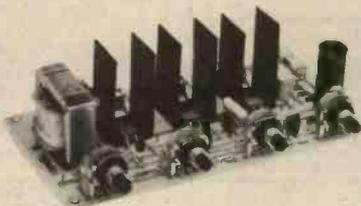
Output power 60 watts R.M.S. Four inputs, two channels each with volume, treble, middle and bass controls. Variable wave form control.

▲▼ All Lo-Line Amplifiers are 25½in long x 11½in high x 6½in deep ▼▲

### NEW TUAC LO-LINE STEREO 250 125 WATTS PER CHANNEL—£130

#### 3 CHANNEL LIGHT MODULATOR

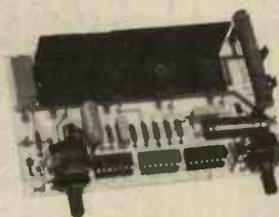
- RCA 8A Triacs
- 1000W per channel
- Each channel fully suppressed and fused
- Master control to operate from 1W to 100W
- Full wave control
- 12 easy connections



**£15.50** (Single Channel Version 1500 Watts £7.25)

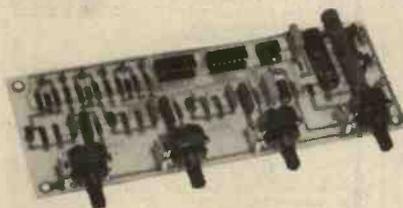
#### 4 CHANNEL SOUND TO LIGHT SEQUENCE CHASER—4LSMI

- RCA 8A Triacs
- 1000W per channel
- Fully suppressed and fused
- Switched master control for sound operation from ½W to 125W
- Speed control for fixed rate sequence from 8 per minute to 50 per second
- Full logic integrated circuitry with optical isolation for amplifier protection
- Full wave control
- 13 easy connections



Patents applied for **£17.25**

#### ADD SEQUENCE CHASING AND DIMMING EFFECTS TO YOUR TUAC 3 CHANNEL LIGHT MODULATOR



- Speed Control 3 per min. to 10 per sec.
- Full logic integrated circuitry
- Dimmer control to each channel
- 9 easy connections

**SEQUENCE DIMMER MODULE—3SDMI**

**£11.75**

#### HOW TO ORDER BY POST

Make cheques P O's payable to  
TUAC LTD (PE3)  
or quote Access Barclaycard No.  
and post to TUAC LTD (PE3)  
163 Mitcham Road, London, SW17 9PG  
We accept phone orders against  
Access Barclaycard holders  
Phone 01-672 3137 9080

**ALL PRICES INCLUDE V.A.T. (8%) AND POSTAGE AND PACKING**

ACCESS AND BARCLAYCARD ACCEPTED—JUST SEND OR PHONE US YOUR NUMBER

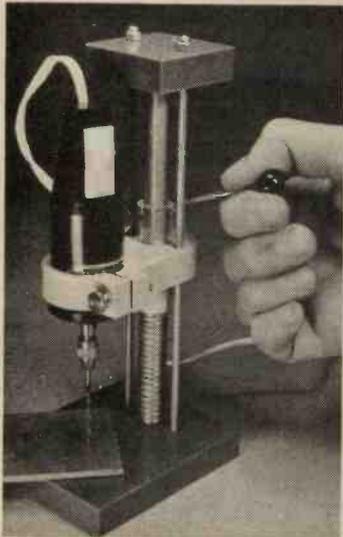
HP ENQUIRIES INVITED

# PRECISION PETITE LTD.

119A HIGH STREET,  
TEDDINGTON TW11 8HG

Tel. 01-977 0878

**INTRODUCING A  
MINIATURE  
PRECISION 12V. D.C.  
DRILL DESIGNED FOR  
THE ELECTRONIC  
ENGINEER**

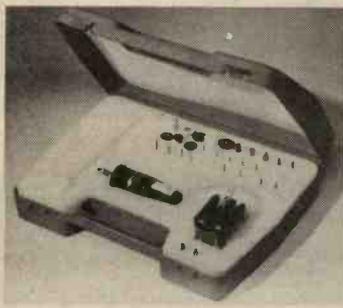


**Mk. II Drill only**

£8.00 p.p. 35p

**Stand**

£3.76 p.p. 58p



Complete kit as illustrated (less batts.) with a variety of 30 tools. Space for Stand and Transformer.

**KIT 30 TOOLS** £16.00 p.p. 75p

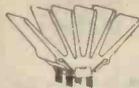
**STAND** £3.76 p.p. 35p

**TRANSFORMER** £5.50 p.p. 75p

**S.A.E. FOR  
DETAILS**

## JC12 AMPLIFIER

6W IC audio amp with free data and printed circuit £2.80. Special offer only £2.45 if bought with deluxe kit.



## DELUXE KIT FOR THE JC12

Includes all parts for the printed circuit and volume, bass and treble controls needed to complete the mono version £2.29. Stereo model with balance control £4.95.

## JC12 POWER KIT

Supplies 28V 0.5A kits £2.95.

## PREAMP KITS FOR THE JC12

Type 1 for magnetic pickups, mics and tuners. Mono model £1.75. Stereo model £3.25. Type 2 for ceramic or crystal pickups. Mono 95p. Stereo £1.90. SEND S.A.E. FOR FREE LEAFLET ON KITS

## SINCLAIR

# IC20 AMPLIFIER

IC20 10 + 10W stereo amp kit with free booklet and printed circuit £8.58. PS20 power supply kit for above £4.95.

VP20 volume, tone control and preamp kit with printed circuits £7.95.

SP20 10W 4Ω loud-speaker £2.95.

SEND S.A.E. FOR FREE DATA LEAFLET

## BATTERY Eliminator Bargains

### 6-WAY SPECIAL

Switched output of 3/4/6/7/4/9/12V at 500mA with unique 4-way multi-jack connector and free matching socket £4.95.

### 3-WAY MODEL

Switched outputs of 6, 7½ and 9V at 250mA with unique 4-way multi-jack connector and free matching socket £2.95.

### RADIO MODELS

50mA output with poppet battery connectors for transistor radios etc. 6V £2.95, 9V £2.95.

Double 4½ + 4½V. N/A 6 + 6V £3.95. 9 + 9V £3.95.

**TAPE RECORDER MAINS UNITS**  
7½V output complete with 5 pin DIN plug to run cassette tape recorders from the a.c. mains £3.45.

## SINCLAIR CALCULATORS

Cambridge Scientific	£8.95	<b>MAINS UNITS</b>	
Oxford 100	£12.95	For Oxford Series	
Cam. Mem.	£8.95	For Cambridge, Cam.	£3.19
Oxford 300	£14.95	Mem. and Scientific	
Programmable P.O.A.	£22.98		£3.15

## CBM CALCULATORS

\*776MD 7 digits/1% memory £7.16.  
\*887D 8 digits/1% memory/constant £9.95.  
\*385R 8 digits/constant/1% rechargeable £10.85.  
\*GL976MD £9.50. GL976MR £13.60.  
\*GL997D £11.95. GL997R £15.30.  
\*SR7919D 8 digits/memory/scientific notation/π/trig/log/power/roots £13.95.  
SR4148R £39.95. Mains unit for \* machines £2.95. All others include mains charger unit.

## FERRANTI ZN414

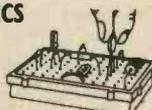
IC radio chip with data £1.69. Printed circuit and extra parts for radio £3.60. Case £1 extra. Send S.A.E. for free leaflet.

## SINCLAIR PROJECT 80

AFU £7.55. FM tuner £13.25. Decoder £8.55. Z40 £5.75. Z60 £8.95. PZ8 £8.20. Trans. for PZ8 £5.40. Stereo 80 £7.50. PZ5 £3.95. Project 805 £18.95. PZ6 £8.70.

## S-DECS and T-DECS

S-DeC £2.24.  
T-DeC £4.05.  
µ-DeC A £4.45.  
µ-DeC B £7.85.  
IC carriers: 16 dil: plain £1.18; with socket £2.21. 10 TO5: plain £1.09; with socket £2.08; SST1 3 for £2; SSU1 3 for £2; SSN1 3 for £2.40. 25p off any order accompanied by PB electronics coupon.



## SWANLEY ELECTRONICS

Dept. PE, P.O. Box 68, Swanley, Kent  
Prices include post and VAT. Official orders from schools, etc. welcome. Overseas customers please deduct VAT (8% on calculators and S-DeC and T-DeC range, otherwise 25%).

GIRO NO 331 7056. Access and Barclay card accepted.  
C.W.O. only. Terms of business as in our Catalogue.  
Export Order enquiries welcome (€5 min.)  
Official Orders accepted from Educational and Government Departments  
ALL PRICES INCLUDE VAT and P. & P.  
SHOP HOURS 9-12.30. 1.30-5.00 6 days

**CF**  
E. & O.E.

**20p plus 10p postage**

**86 PAGES—3,000 ITEMS FULLY ILLUSTRATED**

**\*20p CREDIT VOUCHERS**

**\*ALL NEW STOCK**

**\*SATISFACTION GUARANTEED**

**\*DISCOUNTS**

**\*NEW PRICE LIST No. 1—S.A.E.**

**Boxes — Cases —**  
Kits — PC Materials —  
Tools — Resistors — Test Meters — Capacitors — Hardware — Semiconductors — Books — Pots — Coils — Audio Accessories — Screws — Connectors — Audio — Modules — Transformers — Transistors — Knobs — Calculators — Audio Leads — Batteries — S dec Storage Units — Heatinks, etc., etc.

**Electronic Components Catalogue 4a**

**CF**  
**ORS LTD**

**SPECIAL CAPACITOR KITS**  
C280 Kit—PC Mounting polyester 250V 5 of each value: 0.01, 0.022, 0.047, 0.1, 0.22µF, 2 of 0.47, 1µF. £1.98 net.  
C286 Kit—Tubular polyester, 400V, 5 of each value: 0.01, 0.022, 0.047, 0.1, 0.22µF, 2 of 0.47µF, £2.67 net.  
Ceramic Kit—square plaque, 50V 5 of each value, 22, 33, 47, 100, 220, 330, 470, 1000pF, 220, 4700pF, 0.01µF. £1.88 net.

**SPECIAL RESISTOR KITS (CARBON FILM 5%)** (Prices include post & packing) 10E12 ½W or ¼W KIT: 10 of each E12 value, 22 ohms—1M, a total of 570 £5.28 net  
25E12 ¼W or ½W KIT: 25 of each E12 value, 22ohms—1M, a total of 1425 £12.64 net

## B. H. COMPONENT FACTORS LTD.

**MULTIMETER U4323**  
22 Ranges plus AF/IF Oscillator 20,000Ω/Volt.  
Vdc—0.5—1000V in 7 ranges  
Vac—2.5—100V in 8 ranges  
Idc—0.05—500mA in 5 ranges  
Resistance—5Ω—1MΩ in 4 ranges.  
Accuracy—5% of F.S.D.  
OSCILLATOR—1KHz and 465KHz (A.M.) at approx. 1 Volt.  
Size—180 x 97 x 40mm.  
Supplied complete with carrying case, test leads and battery.  
PRICE £8.64 net P. & P. 75p

U4323

**MULTIMETER U4324**  
34 Ranges. High sensitivity. 20,000Ω/Volt.  
Vdc—0.6—1200V in 9 ranges.  
Vac—3—900V in 8 ranges.  
Idc—0.06—3A in 8 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 U4341**  
27 Ranges plus Transistor Tester. 16,700Ω/Volt.  
Vdc—0.3—900V in 8 ranges.  
Vac—1.5—750V in 8 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.  
Ite—10—350 in 2 ranges.  
Size—115 x 215 x 90mm.  
Complete with carrying case, test leads, and battery.  
PRICE £11.88 net P. & P. 75p

U4341

**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. Iac—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 carrying case, test leads, and battery.  
PRICE £14.90 net P. & P. 75p.

U4313

(P.E.), LEIGHTON ELECTRONICS CENTRE,  
59 NORTH STREET, LEIGHTON BUZZARD, LU7 7EG.  
Tel.: Leighton Buzzard 2316 (St. Code 0523)

1000µf 40v.w. ELECTROLYTIC CAPACITORS, size 1½in x ½in, 3 for 35p.  
 6 SILICON NPN PHOTO TRANSISTORS for 57p.  
 TAPE RECORDER MECHANICAL DIGITAL COUNTERS at 20p.  
 18 VOLT 1 Amp TRANSFORMERS, 250 Volt AC Input at 85p.  
 200 ASSORTED TUBULAR CERAMICS for 57p.  
 TUNING CAPACITORS, Direct Drive. 365 + 150pf at 38p, 200 + 200 + 25 + 25pf at 38p, 500 + 500pf at 45p.  
 TRANSISTOR RF CHOKES 2.5 MH at 12p, 10 MH Tapped at 5 MH at 15p.  
 6 BANK PUSH BUTTON UNIT 6 Pole Change Over Per Button at 40p.  
 60 WIRE WOUND RESISTORS assorted 1 to 10 Watts at 57p.  
 COMPRESSION TRIMMERS, 10pf, 30pf, 50pf, 150pf, 1,000pf, all at 6p each.  
 MULLARD COLOUR TV TRANSUCERS at 15p each.  
 MULLARD COLOUR TV DELAY LINE, Type DL1E1695 at 40p.  
 CABINET SWITCHES, stays on while door open. 3 for 50p.  
 ARDENTI SUB-MINIATURE ROTARY SWITCHES, small spindle. 1 Pole 6 Way at 15p, 4 Pole 5 Way at 25p.  
 UNMARKED GOOD 2N 706 TRANSISTORS 12 for 57p.  
 20 BRANDED ITT ASSORTED ZENERS for 15p.  
 20 BRANDED ASSORTED STC SILICON DIODES at 50p.  
 OCTAL PLUG-IN MODULES with 2 300 PIV 1 Amp Diodes at 12p each.  
 35 ASSORTED PRE-SETS and SLIDERS at 57p.  
 FET's similar to 2N 3819 6 for £1.  
 UHF TRANSISTOR TV TUNER brand new at £1-10.  
 400 PIV 1 Amp TRIACS, 3 for 57p.  
 NEONS FOR TRIGGERING TRIACS 6 for 50p.  
 200 ASSORTED DISCS CERAMICS at 57p.  
 PLASTIC POWER TRANSISTORS, 30 Watt NPN, 22p each. PNP 25p each or 38p pair.  
 6 OP-AMPS 8 Lead to 5 Can Untested with Data at 57p.  
 50 TRANSISTOR TYPE ELECTROLYTICS, assorted at 57p.  
 7 JAPANESE and CONTINENTAL VOLUME CONTROLS for £1.  
 100 ASSORTED SILVER MICA CAPACITORS at 57p.  
 500yd. REEL OF PVC CABLE, 14 strand 0-0048 at £3 reel.  
 SMALL SILICON SOLAR CELLS, no information. 4 for £1.  
 20 TUNING VARACTOR DIODES, assorted unmarked for 45p.  
 X BAND GUNN DIODES with data at £1-65.  
 X BAND DETECTOR DIODES Like SIM 2 at 15p or 1N 23 at 25p.  
 2N 3375 VHF POWER TRANSISTORS at £2-16 each.

Please add 15p for post and packing on orders under £1-50.

## J. BIRKETT

### RAID COMPONENT SUPPLIERS

25 The Stralt, Lincoln, LN2 1JF

Tel: 20767

## TECHNICAL TRAINING IN ELECTRONICS AND TELECOMMUNICATIONS

ICS can provide the technical knowledge that is so essential to your success; knowledge that will enable you to take advantage of the many opportunities open to trained people. You study in your own home, in your own time and at your own pace and if you are studying for an examination ICS guarantee coaching until you are successful.

**City & Guilds Certificates:**  
**Telecommunications Technicians**  
**Radio, TV, Electronics Technicians**  
**Technical Communications**  
**Radio Servicing Theory**  
**Radio Amateurs**  
**Electrical Installation Work**  
**MPT Radio Communications Certificate**

**Diploma Courses:**  
**Colour TV Servicing**  
**Electronic Engineering and Maintenance**  
**Computer Engineering and Programming**  
**Radio, TV, Audio Engineering and Servicing**  
**Electrical Engineering, Installation and Contracting**

**POST OR PHONE TODAY FOR FREE BOOKLET.**

**To: International Correspondence Schools**

**ICS** Dept. 771Q Intertext House, London SW8 4UJ or telephone 622 9911

Subject of Interest.....

Name .....

Address .....

Tel: .....

# TRANSFORMERS

## ALL EX-STOCK - SAME DAY DESPATCH. VAT 8%

MAINS ISOLATING				12 AND OR 24 VOLT			
Prim. 120/240V, Sec. 120/240V				PRIMARY 240-250 VOLTS			
Ref. No.	VA (Watts)	£	P & P	Ref. No.	12V	24V	£
07*	20	3-77	58	111	0-5	0-25	1-54
149	60	4-69	72	213	1-0	0-5	1-86
150	100	5-33	85	71	2	1	2-41
151	200	8-54	1-12	18	4	2	2-97
152	250	10-32	1-41	70	6	3	4-43
153	350	12-47	1-41	102	8	4	5-09
154	500	14-33	1-61	72	10	5	5-50
155	750	21-94	BRS	116	12	6	5-80
156	1000	30-57	BRS	17	16	8	7-48
157	1500	34-89	BRS	115	20	10	10-91
158	2000	38-92	BRS	187	30	15	14-20
159	3000	61-48	BRS	226	60	30	17-87

30 VOLT RANGE				50 VOLT RANGE			
Prim. 200/240V, Sec. 0-12-15-20-24-30V				Prim. 200/240V, Sec. 0-19-25-33-40-50V			
Ref. No.	VA (Watts)	£	P & P	Ref. No.	10V	15V	£
112	0-5	1-90	58	102	0-5	2-71	58
79	1-0	2-52	72	103	1-0	3-55	72
3	2-0	3-77	72	104	2-0	4-95	85
20	3-0	4-70	85	105	3-0	6-10	97
21	4-0	5-56	85	106	4-0	7-88	1-12
51	5-0	6-75	97	107	6-0	12-71	1-25
117	6-0	7-52	1-12	119	10-0	17-75	BRS
88	8-0	10-20	1-25				
89	10-0	10-36	1-41				

60 VOLT RANGE				AUTO TRANSFORMERS			
Prim. 200/240V, Sec. 0-24-30-40-48-60V				Ref. VA (Watts)			
Ref. No.	VA (Watts)	£	P & P	Ref. No.	VA (Watts)	£	P & P
124	0-5	2-48	72	113	20	0-115-210-240	1-75
126	1-0	3-68	72	64	75	0-115-210-240	3-05
127	2-0	5-33	85	4	150	0-115-200-220-240	4-13
125	3-0	7-90	97	66	300	0-115-200-220-240	6-11
123	4-0	9-19	1-41	67	500	0-115-200-220-240	9-36
40	5-0	10-24	1-25	64	1000	0-115-200-220-240	14-36
120	6-0	12-07	1-41	93	1500	0-115-200-220-240	19-02
121	8-0	15-75	BRS	95	2000	0-115-200-220-240	25-41
122	10-0	19-40	BRS	73	3000	0-115-200-220-240	38-84
189	12-0	20-25	BRS				

CASED AUTO TRANSFORMERS			
240V mains lead input and U.S.A. 2-PIN outlets:			
Ref. No.	VA (Watts)	£	P & P
20VA	£3-20	P. & P. 72p	113W
150VA	£8-37	P. & P. 85p	4W
500VA	£10-87	P. & P. £1-25	87W
1000VA	£18-39	P. & P. BRS	84W
2000VA	£28-71	P. & P. BRS	95W

HIGH VOLTAGE MAINS ISOLATING			
Prim. 200/240V, Sec. 0-100/120V or 200/240V			
VA	Ref.	£	P & P
60	243	4-37	97
350	247	10-93	1-41
1000	250	28-31	BRS
2000	252	44-12	BRS

BRIDGE RECTIFIERS			
VA	Ref.	£	P & P
50V	2A	35p	
100V	2A	40p	
200V	1A	45p	
400V	4A	65p	
500V	2A	50p	
500V	10A (PM 7A6)	£2-35	

TEST METERS			
Ref.	VA	£	P & P
AVO 8 MKS		£55-88	
AVO 72		£21-72	
U4313*		£13-85	
U4315*		£11-80	

ANTEX SOLDERING IRONS			
Ref.	VA	£	P & P
15W	£2-68, 18W	£2-45, 25W	£2-28

MAGNETIC TO CERAMIC CARTRIDGE CONVERTOR			
Ref.	VA	£	P & P
		only £2-65	P. & P. 18p, VAT 25%

BSR MINI-DECK			
Ref.	VA	£	P & P
		4 Speed Autochanger	£8-00
			P. & P. 72p, VAT 25%*

NEW STEREO 30			
Ref.	VA	£	P & P
		COMPLETE STEREO CHASSIS INC:	
		7 + 7W RMS AMP, Pre-amp, power supply, front panel, knobs (needs mains trans.), Stereo 30, £15-75. Mains trans. £2-45. Teak veneered cab. £3-65. P. & P. 85p, VAT 25%.	

ELECTROFIL METAL OXIDE RESISTORS			
Style	TOL	Omic Range	Price/per 100
TR4	2%	10Ω-300kΩ	£10-50
	5%	10Ω-300kΩ	£8-00
TR5	2%	10Ω-470kΩ	£2-50
	2%	510kΩ-1MΩ	£2-60
TR6	2%	10Ω-47Ω	£18-50
	2%	51Ω-510kΩ	£7-50
	2%	560kΩ-2MΩ	£18-50
TR8	2%	10Ω-91Ω	£18-50
	2%	100Ω-100kΩ	£10-50
	2%	110kΩ-1MΩ	£17-50

PLEASE ADD VAT AFTER P & P  
 Audio Accessories and Bargain Component Paks.  
 Semi-Conductor stockists.  
 Callers welcome (Mon-Fri) or send stamp for lists

**Barrie Electronics Ltd.**  
 3, THE MINORIES, LONDON EC3N 1BJ  
 TELEPHONE: 01-488 3316/8  
 NEAREST TUBE STATIONS: ALDGATE & LIVERPOOL ST.



## P.E. SYNTHESISER

(P.E. Feb. 1973 to Feb. 1974)

The well acclaimed and highly versatile large-scale mains-operated Sound Synthesiser complete with keyboard circuits. All function circuits may be used independently, or interconnected. The greater the number of circuits, the greater the versatility. Other circuits in our lists may be used with the Synthesiser to good advantage.

### THE MAIN SYNTHESISER

Stabilised Power Supply	£12.05
Two Linear Voltage Controlled Oscillators and one Inverter—all 3 circuits:	£16.38
PCB (2 are required)—each	£1.48
Two Ramp Generators and Two Input Amplifiers—all 4 circuits	£5.62
PCB (holds all 4 circuits)	£1.38
Sample-and-Hold and Noise Generator—PCB (holds both circuits)	£6.64
PCB (holds both circuits)	£1.70
Tone Control, £2.43; PCB, 80p	
Reverberation Amplifier	£6.36
Sprine Line unit for Reverb Amp	£4.95
Ring Modulator	£3.75
Peak Level Meter Circuit	£1.50
100µA Panel Meter	£3.75
PCB for Rev., R-Mod. & Meter Ccts.,	£1.94
Envelope Shaper, £5.35; PCB, £1.46	
Voltage Controlled Amp. and Diff. Amp.	£6.86
PCB (holds both circuits)	£1.32
<b>THE SYNTHESISER KEYBOARD CIRCUITS</b>	
Can be used without the Main Synthesiser to make an independent musical instrument	
2 Log. Voltage Controlled Oscillators	£14.55
PCB for both log VCO's	£2.60
Divider, 2 Hold Circuits, 2 Modulation Amplifiers, Mixer and 2 Envelope Shapers	£19.64
PCB (Holds the first 6 circuits)	£1.80
PCB for both Envelope Shapers	£1.55
Keyboard Stabilised Power Supply	£7.30
Printed Circuit Board	94p

# SYNTHESISERS AND KEYBOARDS

## P.E. JOANNA

(P.E. May to Aug. 1975)

The new electronic piano that has switchable alternative voicing of Piano Honky-Tonk and Harpsichord. All PCB's are "as published".

Power Supply	£7.96
Tone Generator and Top C Envelope Shaper	£9.25
PCB for above	£1.30
Envelope Shapers	
12 sets (full requirement)	£32.16
Set of 12 PCB's (full requirement)	£15.00
Voicing and Pre-Amplifier Circuits	£8.37
PCB for above circuits	£1.84
Power Amplifier	£14.50
PCB for power amp	95p



## P.E. MINISONIC

(P.E. Nov. 1974 to March 1975)

A portable, battery or mains operated, miniature sound synthesiser, with keyboard circuits. Although having slightly fewer facilities than the large P.E. Synthesiser, the functions offered by this design give it great scope and versatility.

Two Voltage Controlled Oscillators	£5.22
Voltage Controlled Filter and Voltage Reference Circuit	£3.41
Two Envelope Shapers and Two Voltage Controlled Amplifiers	£7.25
Keyboard Controller and Hold Circuits	£2.66
Keyboard Divider Resistors (select type to suit keyboard used, all are 2% tolerance). 2 Octave, £1; 3 Oct., £1.48; 4 Oct., £1.96; 5 Oct., £2.44.	
H.F. Oscillator and Detector	£1.66
Ring Mod., Noise Gen. & Env. Inverter	£5.27
Two Power Amplifiers and Two Mixers	£3.55
Battery Eliminator	£5.88
Temperature Stabiliser	£1.47
PCB to hold 2 VCOs, VCF and V-Ref	£2.02
PCB to hold 2 ES, 2 VCAs, 2 Mixers, Ring Mod, Keyboard Control and Hold	£2.20
PCB to hold 2 Power Amps, Noise Gen, Envelope Inverter, HF Osc. and Detector	£1.45
PCB for Battery Elim. & Temp. Stab.	£1.35

## KEYBOARDS

Kimber-Allen Keyboards as required for many published circuits, including the P.E. Joanna, P.E. Minisonic and P.E. Synthesiser. The manufacturers claim that these are the finest moulded plastic keyboards made.

3 Octave Keyboard (37 notes C to C)	£20.50
4 Octave Keyboard (49 notes C to C)	£23.50
5 Octave Keyboard (61 notes C to C)	£27.00

Contact Assemblies for use with above keyboards: Single-pole change-over (SP) as for P.E. Joanna and P.E. Minisonic. Two-pole normally-open make-break (2P) as for P.E. Synthesiser. Special contact assembly (4PS) having 4 poles, 3 of which are normally-open make-break contacts and the fourth is a change-over contact—this special assembly enables the same keyboard to be used with the P.E. Synthesiser, P.E. Minisonic, and P.E. Synthesiser simultaneously thus avoiding the cost of more than one keyboard.

3 Octave	4 Octave	5 Octave
Contact Each Set	Set	Set
20p	£7.40	£9.80
2P	24p	£6.88
4PS	48p	£17.76
		£23.52

Printed Circuit Boards for use with the above contacts and thus eliminating most of the interwiring required, are available—details in our lists.

## PHONOSONICS

FOR ADDRESS, INFORMATION REGARDING POST AND PACKING, VAT, LISTS, AND EXPORT TERMS SEE OUR OTHER ADVERTISEMENT ON OPPOSITE PAGE

Photos: 2 of our units containing some of the P.E. projects built from our kits and PCBs. (The cases were built by ourselves and are not for sale.)

# TRANSISTOR ELECTRONIC ORGANS FOR THE AMATEUR

Third, revised edition

by A. Douglas Price £4.70

ELECTRONIC TEST EQUIPMENT by H. T. Kitchen. Price £4.90.

FOUNDATIONS OF WIRELESS AND ELECTRONICS by M. G. Scroggie. Price £4.25.

HOW TO BUILD ELECTRONIC KITS by V. Capel. Price £1.95.

SERVICING TRANSISTOR RADIOS by L. D'Airo. Price £2.20.

ELECTRONIC CIRCUITS AND SYSTEMS by R. King. Price £5.40.

HI-FI YEAR BOOK 1976 by K. Ellmore. Price £2.45.

ELECTRONIC CIRCUIT DESIGN HANDBOOK by EEE Magazine. Price £5.10.

RSGB AMATEUR RADIO CALL BOOK 1976 by R.S.G.B. Price £1.45.

RADIO VALVE AND SEMICONDUCTOR DATA by A. M. Ball. Price £2.40.

★ TOTAL PRICE INCLUDES POSTAGE ★

## THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKIST of British and American Technical Books

19-21 PRAED STREET LONDON W2 1NP

Phone 01-723 4185

Closed Saturday 1 p.m.

## OSMABET LTD

We make transformers amongst other things

**LOW VOLTAGE TRANSFORMERS**  
Prim. 200/240V a.c., 5V 1A 50p; 6.3V 1.5A £1.65; 3A £2.10; 6A CT £3.75; 12V 1.5A £2.10; 3A £3.75; 6A CT £5.25; 18V 1.5A CT £3.45; 24V 1.5A CT £3.75; 3A CT £5.25; 5A £8; 8A £11.25; 12A £16.50; 40V 3A CT £7.50; 50V 6A CT £18.75; 25V 2A + 25V 2A £7; 12V 4A + 12V 4A £7.

**LT TRANSFORMERS TAPPED SEC.** Prim 200/240V 0-10-12-14-18-18V 2A £4; 4A £9.25. 0-12-15-20-24-30V 2A £4.50; 4A £8.75. 0-5-20-30-40-60V 1A £4.85; 2A £8.75. 0-40-50-60-80-100-110V 1A £7.

**MIDGET RECTIFIER TRANSFORMERS**  
For FW rect. 200/240V a.c., 6-0-8V 1.5A or 9-0-9V 1A £1.80 each; 12-0-12V 1A, or 20-0-20V 0.75A, or 9-0-9V 0.5A, or 12-0-12V 0.25A, or 20-0-20V 0.15A, or 3V 0.5A + 6V 0.5A, or 9V 0.35A + 9V 0.35A, or 12V 0.25A + 12V 0.25A, or 20V 0.15A + 20V 0.15A, all at £2 each.

**LOUDSPEAKERS**  
2 1/2in 8 or 75Ω, 2 1/2in 8 or 25Ω, 3in 3, 8 or 35Ω, 3 1/2in 8, 15 or 80Ω, 85p each; 8 x 3in 3, 8, 15 or 25Ω, £1.75; Goodman speakers; 5in full throw 8Ω 10W, £4.25; 8 1/2in double cone 4Ω, £3; 12in 25W 4 or 15Ω, £8.

**"INSTANT" BULK TAPE/CASSETTE ERASER**  
Instant erasure any diameter tape spool or cassette, demagnetises tape heads, 200/240V a.c., £3.75.

**TAPE RECORDER MOTORS**  
New, blowers, fans, etc., 110V a.c., 50p (75p pair).

**SYNCHRONOUS GEARED MOTORS** 200/240V a.c. Brand new Smiths, built in gearbox, 2 r.p.h., 75p each.

**PAPER TUBULAR CONDENSERS**  
4-7mF, 160V, 30 x 20mm, 20p (100 for £10).

**SPEAKER MATCHING AUTO TRANSFORMER**  
12W, 3 to 8 or 15Ω, up or down, £1.65.

**CABLES — CABLES — CABLES**  
**MICROPHONE TWIN M/DUTY, BRAIDED SCREEN**  
Professional cable for stage, studio, outdoor. PVC covered, grey, 20p per metre. Grey: Single cable, black, 10p per metre.

**MULTI WAY SCREENED, PVC COVERED**  
36 way £1; 25 way 75p; 14 way 50p; 6 way 20p; 4 way 14p; 2 way 10p; 1 way 8p per metre.

**LOW LOSS CO-AXIAL CABLE 75Ω**  
Standard UHF 12p and VHF 9p per metre.

**3 CORE MAINS CABLE**  
13A 25p; 6A 15p; 2.5A 8p Per metre. 1A mini cable £3 per 100 metres; speaker twin cable, £2.50 per 100 metres; loudspeaker twin cable, 75p per 20 metres.

ALL TYPES DOMESTIC AND COMMERCIAL CABLES, ALL SIZES AND COLOURS AND COLOUR CHANGING WIRES. MULTI SCREENED AND UNSCREENED CABLE. TRADE ENQUIRIES INVITED

Carriage and VAT extra on all orders  
S.A.E. ENQUIRIES. LISTS. MAIL ORDER ONLY  
46 Kenilworth Road, Edgware, Middx. HA8 8YQ  
Tel. 01-958 9344



A NEW booklet from VERO ELECTRONICS LIMITED describing products for the Home Constructor is now available from:— Vero Electronics Ltd., Retail Dept., Industrial Estate, Chandler's Ford, Eastleigh, Hants, SO5 3ZR. Tel: Chandlers Ford 2956

Write to: Mr. J. Bowden, Retail Sales Manager, for your copy.

# PHONOSONICS

**SUPPLIERS OF QUALITY PRINTED  
CIRCUIT BOARDS, KITS AND  
COMPONENTS TO A WORLD-WIDE MARKET**

## SOUND-TO-LIGHT (P.E. Apr./Aug. 71)

The ever-popular AURORA—4 or 8 channels each responding to a different sound frequency and controlling its own light. Can be used with most audio systems and lamp intensities. A MUST for any Disco, and a fascinating visual display for the home.

4 channel component set (excl. thyristors) £13-05  
8 channel component set (excl. thyristors) £22-56  
Power supply component set £4-96  
PCB for 4 frequency channels £1-32  
PCB for power supply and 8 lamp drivers £1-56  
1 Amp 400V thyristors (1 per chan. requ.) each 75p  
Panel meter (1µA) (optional) £3-75

## VOICE OPERATED FADER (P.E. Dec. 73)

For automatically reducing music volume during "talk-over" particularly useful for Disco work or for home-movie shows.

Component set incl. PCB £3-05

## TAPE-NOISE LIMITER

Very effective circuit for reducing the hiss found in most tape recordings.

Component set (incl. PCB) £2-60  
Regulated power supply (incl. PCB) £3-98

## P.E. MINIMIX 6

DETAILS IN LIST

## GUITAR EFFECTS PEDAL (P.E. July 75)

Will modify an audio signal not only from a guitar but from any audio source, producing 8 different switchable effects that can be further modified by manual controls. Possibly the most interesting of all the low-priced sound effects units in our range.

Component set with special foot operated switches £6-25

Alternative component set with panel mounting switches £4-60  
Printed Circuit Board £1-30

## HI-FI TAPE-LINK (P.E. Mar./Apr. 73)

Designed for use with reasonable quality tape-decks, this high performance pre-amp includes record, playback and metering circuits. While stocks last.

Stereo component set (excl. panel meter) £24-25  
Mono component set (excl. panel meter) £14-70  
Power supply component set £5-93  
Stereo main PCB £2-80  
Stereo sub-assembly PCB 98p

## VOLTAGE CONTROLLED FILTER (P.E. Oct. 74)

An independently designed VCF that can be used with the P.E. Synthesiser.

Component set £3-41  
Printed circuit board £1-25

## ENVELOPE SHAPER

The new ADSR Envelope Shaper published in P.E. October 1975 and having manual control of its Attack, Release and Sustain functions.

Component set incl. PCB £4-16

Component sets include all necessary resistors, capacitors, semiconductor, potentiometers and transformers. Fuller details are in our lists.

Transistors	BFY51	22p	2N3055	48p	
AC128	20p	BFY52	24p	2N3702	12p
AC176	20p	BSY95A	22p	2N3703	12p
BC107	13p	MJE2955	110p	2N3704	12p
BC108	13p	OC28	60p	2N3819	35p
BC109	13p	OC71	14p	2N4060	39p
BC147	13p	OC71	14p	2N4060	39p
BC148	12p	OC72	14p	2N4871	36p
BC149	12p	OC84	25p	2N5245	51p
BC157	13p	ORP12	66p	2N5777	45p
BC158	13p	ZTX107	12p		
BC159	13p	ZTX108	73p	Diodes	
BC182L	13p	ZTX501	13p	IN914	4p
BC184	13p	ZTX503	15p	IN4001	6p
BC187	25p	ZTX531	23p	IN4002	7p
BC204	14p	2N706	13p	IN4004	8p
BC209C	14p	2N914	22p	IN4006	9p
BC212L	15p	2N1304	22p	IN4007	10p
BC213	15p	2N2905	27p	OA91	7p
BC478	29p	2N2907	22p	OA200	8p
BCY71	22p	2N3053	18p	OA202	8p
BFY50	22p	2N3054	66p	ZS1	75p
				ZS171	16p

## LIST

Send S.A.E. with all U.K. requests for free list giving fuller details of PCBs, kits, and other components.  
Overseas enquiries for list:  
Europe—send 20p.  
Other countries—send 30p.

## POST AND HANDLING

U.K. orders under £15 add 22p.  
over £15 add 40p.  
Optional: Fee for compensation against loss or damage in post (U.K., Eire & C.I. only): 35p.

## VAT

Add 25% (or current rate if different) to full total of goods, post and handling.  
Overseas—VAT does not currently apply.

Overseas—will be charged extra. minimum charge 74p. Details of kit weights, and postage rates will be sent with list.  
Eire and Channel Isles classify as overseas for posting purposes.

## RHYTHM GENERATOR

(P.E. Mar./Apr. 74)

Programmable for 64,000 rhythm patterns from 8 effects circuits (high and low bongs, bass and snare drums, long and short brushes, blocks and soft cymbal), and with variable time signatures and rhythm rates. Really fascinating and useful.  
Tempo, Timing and Logic circuits £12-59  
PCB for above circuits (double-sided) £2-94  
Component set for all 8 effects circuits £10-49  
Set of 4 PCB's to hold all 8 effects £4-74  
Simple mixer (no PCB available) £2-76  
Alternative mixer with external volume controls and adjustable gain (independently designed), including PCB £9-93  
Power Supply, including PCB £6-42

## SOUND BENDER (P.E. May 74)

A multi-purpose sound controller, the functions of which include envelope shaper, tremolo, voice operated fader, automatic fader and frequency-doubler.

Component set for above functions (excl. SWs) £6-58  
Printed circuit board £1-58  
Optional extra—additional Audio Modulator, the use of which, in conjunction with the above component set, can produce "jungle-drum" rhythms.

Component set (incl. PCB) £2-55

## PHASING UNIT (P.E. Sept. 73)

A simple but effective manually controlled unit for introducing the "phasing" sound into live or recorded music.

Component set (incl. PCB) £2-50

## PHASING CONTROL UNIT (P.E. Oct. 74)

For use with the above Phasing Unit to automatically control the rate of phasing.

Component set (incl. PCB) £3-75

## ULTRASONIC TRANSMITTER-RECEIVER

(P.E. May 1972). A highly sensitive, tight-beam, long-range, "invisible beam" detection circuit with numerous applications. While stocks last.  
Component set with PCBs but excluding transducers £4-60

## WIND AND RAIN UNIT

A manually controlled unit for producing the above-named sounds.

Component set incl. PCB £2-83

## POWER SUPPLIES

Sophisticated low-noise highly-stabilised power supply kits complete with PCB's and detailed information are now available. Details in list.

Other PCBs (all "as published") While stocks last  
Bench Power Supply (P.E. Sept. 1974) 70p  
CCTV:

Master Logic, Video Amp., Sync Mixer and Cathode Switch PCB (P.E. Oct. 1974) £2-20  
PCB for Remaining Circuits (P.E. Oct. 1974) £2-20  
Digital Power Supply (P.E. Aug. 1972) 50p

## Electronic Piano:

Pre-amp PCB (P.E. Oct. 1972) 85p  
Power Supply PCB (P.E. Oct. 1972) 60p

Power Slaves: Power Supply PCB (P.E. Aug. 1974) 55p  
Rondo:  
Pre-Amp PCB (P.E. Oct. 1973) 60p  
Tone, Balance and Volume Control PCB (P.E. Oct.) £1-40

Integrated Circuits	Zeners	Electrolytic Capacitors (µF/V)
709 TOS	40p	3-3V 400mW 15p
709 8-pin DIL	40p	3-9V 400mW 15p
723 TOS	95p	4-7 1W 25p
741 8-pin DIL	32p	5-1V 1W 25p
748 TOS	63p	5-1V 400mW 15p
748 8-pin DIL	63p	5-6V 400mW 15p
µA7805 TO220	165p	5-6V 13W 20p
µA7815 TO220	165p	6-2V 400mW 15p
		6-2V 400mW 15p
		6-8V 400mW 15p
		9-1V 400mW 15p
		10V 400mW 15p
		11V 1W 25p
		12V 400mW 15p
		12V 1W 25p
		13V 400mW 15p
		33/50 6p
		68/100 10p
		18V 400mW 15p
		47/25 6p
		18V 1W 25p
		47/63 7p
		100/10 6p
		20V 400mW 15p
		20V 1W 25p
		100/10 6p
		27V 400mW 15p
		100/25 6p

## BIOLOGICAL AMPLIFIER (P.E. Jan./Feb. 73)

Multi-function circuits that, with the use of other external equipment, can serve as lie detector, alphaphone, cardiophone, etc.

Pre-Amplifier Module  
Component set and PCB £3-71

## Basic Output Circuits

Combined component set with PCBs, for alphaphone cardiophone, frequency meter and visual feedback lamp driver circuits £5-39

## Audio Amplifier Module

Type PC7 £5-50

## SINE AND SQUARE WAVE GENERATOR (P.E. July 75)

Suitable for audio, digital, or general purpose. Controllable through 4 decade ranges 10Hz to 100kHz. Switched attenuation through 10 ranges from 10V to 1mV peak-to-peak.

Component set £8-88  
PCB for above components £1-60  
Power Supply £5-70  
PCB for Power Supply 96p

## P.E. TUNING FORK

(P.E. NOVEMBER, 1975)

Main component set incl. PCB £13-50  
Power supply set incl. PCB £6-57

## REVERBERATION UNIT (P.W. Nov./Dec. 72)

A high quality unit having microphone and line input pre-amps, and providing full control over reverberation level.

Component set (excl. spring unit) £7-55  
Printed circuit board £1-76  
9 inch spring unit £4-95  
Panel meter (50µA) (optional) £3-75

## SEMI-CONDUCTOR TESTER (P.E. Oct. 73)

Essential test equipment for the enterprising home constructor. While stocks last.

Set of resistors, capacitors, semiconductors, potentiometers, makaswitches and PCB £8-44  
Panel meter (500µA) £3-75

## PHOTOPRINT PROCESS CONTROL (P.E. Jan./Feb. 72)

For colour and B & W, an indispensable dark-room unit for finding exposure, controlling enlarger timing, and stabilising mains voltage.

Component set (excl. meter) £10-72  
Printed Circuit Board £1-74  
Panel meter (1mA) £3-75

## SYNCHROME

AND  
PEAK LEVEL INDICATOR

DETAILS IN LIST

## PHOTOCOPIES

of P.E. texts for most of our kits are available. Prices in our lists.

## SEE OUR

LIST  
FOR  
OTHER  
GOODS  
STOCKED

Polyester (µF)	Tantalum (µF/V)
0-01 31p	0-1/35 13p
0-015 31p	0-22/35 13p
0-022 31p	0-47/35 13p
0-033 4p	1-0/35 13p
0-047 4p	1-5/35 13p
0-068 4p	2-2/35 13p
0-1 4p	4-7/35 16p
0-15 51p	10/16 16p
0-22 6p	10/25 18p
0-33 8p	15/6-3 16p
0-47 10p	22/16 18p
0-68 12p	47/6-3 18p
1-0 15p	47/16V 30p
2-2 26p	100/3 18p

Prices are correct at time of press. E. & O.E. deliveries subject to availability.

PHONOSONICS, DEPT. PE43, 22 HIGH STREET, SIDCUP, KENT DA14 6EH

MAIL ORDER AND C.W.O. ONLY  
DON'T FORGET VAT!

# B. BAMBER ELECTRONICS

Dept PE, 5 STATION ROAD, LITTLEPORT, CAMBS., CB6 1QE  
Telephone: ELY (0353) 860185 (2 lines) Tuesday to Saturday

PLEASE ADD 8% VAT (unless otherwise stated)

**MINIATURE 2 PIN PLUGS AND SOCKETS** (fit into tin hole, pins enclosed, with covers for chassis mounting, or can be used for in-line connectors). Bargain pack of 3 plugs + 3 sockets + covers, 50p.

**PROGRAMMERS** (magnetic devices). Contain 9 microswitches (suitable for mains operation) with 9 rotating cams, all individually adjustable, ideal for switching disco lights, displays, etc. or industrial machine programming. (Need slow motion motor to drive cams, not supplied) 9 switch version £1.50, or 15 switch version £2.10 **WAY PUSH-BUTTON UNITS**,  $\frac{1}{2}$ in square buttons, marked 0-9, cancelling type, mounted on one PCB for easy fixing, ex-equip, 50p. **HEAVY DUTY HEATSINK BLOCKS**, undrilled, base area  $2\frac{1}{2}$ in x 2in, with 6 fins, total height  $2\frac{1}{2}$ in 50p each.

**RV RELAYS**, Continental type, 2 pole change over, 35p

**RUBBER MAGNETS**  $\frac{1}{2}$ in square, with mounting hole, 20 for 30p.

**SPERRY 7-SEGMENT P.G.D. DISPLAYS**, digit height 0.3in red, with decimal points, 150V to 200V (nominal 180V) operation. These are high-volt industrial type and therefore brighter than normal displays. All brand new. AT THE BARGAIN PRICE OF 50p PER DIGIT. TYPE 332 (two digits in one mount) £1 each. TYPE 333 (three digits on one mount) £1.50. (Sorry, no single digit available.) Data Supplied.

**BSX20 Transistors**, 3 for 50p.  
**BC108 (metal can)**, 4 for 50p.  
**BC108 (plastic BC108)**, 5 for 50p.  
**OC200 Transistors**, 6 for 50p.  
**BSY95A Transistors**, 6 for 50p.  
**BFY51 Transistors**, 4 for 50p.  
**BCY27 Transistors**, 4 for 50p.  
**PNP audio type TOS Transistors**, 12 for 25p.

**Rotary switches**, min. 4 pole 2-way, 2 for 50p.  
**Telephone Type earpiece insert**, 50p.  
 **$\frac{1}{2}$ in polythene chassis mounting fuseholders**, 6 for 30p.

**LES Lamps**, 24V 1-2W, 10 for 40p.  
**Mullard Tubular ceramic trimmers**, 1-18pF, 6 for 50p.  
**I.C. a. some coded**, 14 DIL type, untested, mixed, 20 for 25p.  
**Miniature slider switches**, 2 pole 2-way, 5 for 50p.

**TRANSISTOR HEATSINKS**, to take 2 x TO18 transistors, screw in clamps, block size  $1\frac{1}{2}$  x  $\frac{1}{2}$ in, with holes for mounting, 3 for 50p.

**HIGH QUALITY SPEAKERS**,  $\frac{1}{2}$ in x  $\frac{1}{2}$ in allpurpose, only 2in deep, inverse magnet, 4 ohms, rated up to 10W, £1.50 each, or 2 for £2.75 (qty. discount available). + 25% VAT.

**Coils on  $\frac{1}{2}$ in dia.  $\frac{1}{2}$ in long paxolin formers**, 5 for 20p.  
**Valveholders**, mixed bag of 10 for 50p.

**Springs**, 1in long x  $\frac{1}{4}$ in dia. per pack 25p.  
**LF chokes on  $\frac{1}{2}$ in x 2in cores**, 5 for 20p.  
**2-8pF. 10mm circular ceramic trimmers (for VHF/UHF work)** 3 pin mounting, 5 for 20p.

**TOS transistor insulator sets**, 10 for 50p.  
**PC Board Withdrawal handles**, mixed coils, 8 for 50p.

**Solder**, 20 SWG, 80/40 alloy, approx 8 yds for 25p.  
**Multiturn Pots**, 10 turn,  $\frac{1}{2}$ in spindle (ex-equip), following values available, 2kohm, 5kohm, 400kohm, £1 each.  
**Lead suppressors (10kohm)** for mobile plug leads, 4 for 50p.

**1mA Meters**, 2 in square, plastic fronts (these have a paper scale stuck over the original marked 0-1mA which is easily peeled off and an internal 18K resistor which is easily removed), £1.75 each or 2 for £3.

**Sifam 100uA Meters**. Black rectangular type 24,  $2\frac{1}{2}$ in x  $2\frac{1}{2}$ in (modern Pys type) marked 0-50, 0-100, 0-150, 0-750, all on one scale (supplied separately) with scale, £2.75.

**RS Midget 3 pole 4 way, rotary switches**, 40p each.

**SPECIAL OFFER.**  
Miniature 50ohm Coax, high quality, PTFE insulation and blue PTFE cover, solid silver plated inner, and silver plated braid, approx 3m. overall diameter (ideal for unit wiring of RF stages up to 23cms, etc.), 4 metres for 50p.

**PLUGS & SOCKETS.**  
**BNC Socket** (Single-hole mounting type) Ex-equipment (special offer) 3 for 50p.  
**N-Type Plugs** 50 ohm, 80p each, 3 for £1.50.  
**N-Type Sockets** (4-hole chassis mounting, 50 ohms (a small coax lead type), 50p each.

**Greenpar (GE30015) Chassis Lead Terminations** (these are the units which bolt on to the chassis, the lead is secured by screw cap, and the inner of the coax passes through the chassis), 30p each, 4 for £1.

**PL259 Plugs (PTFE)**, brand new, packed with reducers, 85p or 5 for £3.  
**SO239 Sockets (PTFE)**, brand new (4-hole fixing type), 50p each or 5 for £2.25.

**20-way ISEP Plugs and Sockets**, 40p set (1 plug + 1 socket).

**Plugs and sockets sold separately at 25p each.**  
**Bulgain Round Free Scks**, 3 pin, for mains input on test equipment, etc., 25p each.

**BNC Insulated Sockets** (single hole type), 65p each.  
**Bulgain Flat 2-pin Flex Connectors non-reversible** 40p each.

**Mobile Converters**, 24V DC input 13-8V at approx 3-4A DC output, fully stabilised, £3.50 each (ideal for running 12V car radio from 24V lorry battery).

**Pkts. of 2BA Nuts** (the self-locking ones with the nylon insert) 100 for 50p.

We now stock **Spiralux Tools** for the electronic enthusiast. Screwdrivers, Nut Spanners, BA and Metric sizes, pop rivet guns, etc. S.A.E. for list.

**I.F. Cans**,  $\frac{1}{2}$ in square, suitable for rawind, 6 for 30p.  
**Miniature earphones** with min. jack plug, 2 for 50p.

**Dubilier Electrolytics**, 50uF, 450V, 2 for 50p.  
**Dubilier Electrolytics**, 100uF, 275V, 2 for 50p.  
**Plessey Electrolytics**, 470uF, 63V, 3 for 50p.

**TCC Electrolytics**, 1000uF, 30V, 3 for 60p.  
**Plessey Electrolytics**, 1000uF, 180V, 40p each (3 for £1).

**Dubilier Electrolytics**, 5000uF, 35V, 50p each.  
**Dubilier Electrolytics**, 5000uF, 50V, 80p each.  
**Dubilier Electrolytics**, 5000uF, 70V, 85p each.

**ITT Electrolytics**, 6800uF, 25V, high grade, screw terminals, with mounting clips, 50p each.  
**Plessey Electrolytics**, 10,000uF at 63V, 75p each.  
**Plessey Cathodray Capacitors**, 0-0.4uF at 12-5kV DC. Screw terminals, £1.50 each.

**PLEASE ADD 25% VAT TO ALL CAPACITORS**  
**A LARGE RANGE OF CAPACITORS AVAILABLE AT BARGAIN PRICES, S.A.E. FOR LIST.**

PLEASE ADD 8% VAT (unless otherwise stated)

**SPECIAL OFFER!**  
**MAINS TRANSFORMER**, TYPE 14/4, 14V at 4A, £2.50.

**DIECAST BOXES** (approx size in inches)

4.3 x 2.3 x 1.2	85p
4.8 x 2.3 x 1.5	75p
4.8 x 3.8 x 1	85p
4.8 x 3.8 x 2	£1.00
6.8 x 4.8 x 2	£1.45
4.8 x 3.8 x 3	£1.55
6.8 x 4.8 x 4	£2.25
8.6 x 5.8 x 2	£1.85
10.8 x 6.8 x 2	£2.25

Please add 8% VAT

**WELLER SOLDERING IRONS.**  
**EXPERT.** Built-in-spotlight illuminate work. Pistol grip with fingertip trigger. High efficiency copper soldering tip.

**EXPERT SOLDER GUN**, £6.80 + VAT (54p)  
**EXPERT SOLDER GUN KIT** (spare bit case, etc.), £8.80 + VAT (78p)

**SPARE BITS, PAIR**, 20p + VAT (2p)  
**MARKSMAN SOLDERING IRONS**  
**SP15D 15W** £2.52 + VAT (20p)  
**SP25D 25W** £2.52 + VAT (20p)

**SP25D 25W + bits**, etc. kit £3.12 + VAT (25p)  
**BENCH STAND** with spring for Marksmen Irons, £1.80 + VAT (14p)

**SPARE BITS**  
**MT8 for 15W, 42p + VAT (3p).**  
**MT4 for 25W, 35p + VAT (3p).**

**TCPI TEMPERATURE CONTROLLED IRON.**  
Temperature controlled iron & PSU, £10.43 + VAT (£1.47).

**SPARE TIPS**  
Type CC single flat. Type K double flat fine tip. 80p each + VAT (8p).

**ALL SPARES AVAILABLE**

**MULTICORE SOLDER**  
Size 5 Savbit 18 s.w.g. in alloy dispenser, 32p + VAT (3p).  
Size C15AV18 Savbit 18s.w.g. 50p + VAT (4p).  
Size 12 SAVBIT 18s.w.g. on plastic reel £1.80 + VAT (15p)

**MINIATURE PLIERS** High quality "Crescent", made in USA, £4.35 + VAT (35p).  
**SIDE CUTTERS**, high quality "Crescent", made in USA, £5.45 + VAT (44p).

Terms of Business: CASH WITH ORDER. MINIMUM ORDER £1. ALL PRICES INCLUDE POST & PACKING (UK ONLY). SAE WITH ALL ENQUIRIES Please. PLEASE ADD VAT AS SHOWN. ALL GOODS IN STOCK DESPATCHED BY RETURN.

## SENSATIONAL — WORLDBEATING DIGITAL ALARM KIT

- BUILT IN ALARM
- PHOTOCCELL CONTROLLED BRIGHTNESS
- AM/PM INDICATOR
- GIANT 0.63in LED DISPLAY



£16

ONLY

INC. VAT & P & P etc.

NB. STANDARD NON-ALARM STILL ONLY £14 IN KIT FORM

CLOCK READY BUILT £22-50

## BARGAIN BITS

ALL ITEMS CARRY FULL MFG GUARANTEE. VAT INCLUSIVE ORDERS UNDER £2 ADD 25p FOR HANDLING CHARGE

MM5314 Clock Chip 4-6 Digit	£2.95	12V Relays min. IP c/o 330Ω coil	£1.80
GI. AY51202 Clock Chip 4 Digit	£4.76	LM3900 quad op amp	£0.60
NSN61L 0.63in LED. Price each	£1.65	LM309H 200mA 5V reg.	£1.15
DS8865N Seg. Driver Chip	£0.50	741 mini DIP 8 pin	£0.31
Futaba 4 Digit Display plus AM/PM	£6.36	IN4001 50V 1A diode	£0.04
Resistors $\frac{1}{4}$ W 5% carbon film, most values.	£0.10	IN4148 Small signal diode	£0.03
Packs of 10 only	per pack	Fuse holders 20 x 5mm	£0.20
Resistors $\frac{1}{4}$ W 5% carbon film, most values.	£0.10	Slide Switch 4 pos.	£0.20
Packs of 10 only	per pack	Mains Transformer 110/240V IN	£2.00
Resistors 1W 5% carbon film, most values.	£0.15	0-16.5 at 100mA OUT	
Packs of 5 only	per pack	Slide Pot 5K ohm LIN 45mm	£0.55
Triac 400V 15A isolated tab TO220	£1.98	5-pin DIN plug	£0.14
Transistors Plastic BC183/213/307	£0.10	5-pin DIN Socket Chassis Mount	£0.08
		CAPACITORS	
		Pack of 5	
		0-001 400V	20p
		0-01 400V	20p
		0-022 100V	20p
		0-033 100V	20p
		0-022 250V	35p
		0-01 630V	55p
		0-1 250V	30p
		0-22 250V	£1.10
		1uF 250AC	
		Mains	£0.41 each

## CWO PULSE ELECTRONICS

Dept. P10, 202 SHEFFORD ROAD, CLIFTON, SHEFFORD, S.A.E. for complete list. BEDS. HITCHIN (0462) 814477

**Unbeatable**

**VALUE**

**Genuine GOLDRING Stylus P. & P. 25p**

G800	£2.35	G850	£1.95
G800/H	£2.35	G800/E	£4.42

**MICROPHONES P. & P. 25p**

UD130—Cardioid dynamic dual impedance 600 and 50kΩ	£6.58
ECM81—Cardioid condenser omni-directional 600 and 50kΩ impedance	£11.99
RX201—Cardioid dynamic 600Ω echo mike, 4 transistors, 1.5sec reverberation time, with volume control and on-off switch	£9.93
Phillips type cassette mike	£1.65
Cassette stick mike with remote control	£1.30
Gem 2 station Intercom (baby alarm)	£3.85

**CASSETTES (Low Noise) P. & P. 25p**

	1-5	over 6
C60	35p	32p
C90	43p	40p
C120	55p	52p

**SOLDERING IRONS P. & P. 25p**

12V d.c. 15 watt	£1.24	250V a.c. 40 watt	£1.40
------------------	-------	-------------------	-------

**CABINET KITS P. & P. 85p per pair**

12" x 8" x 4 1/2" (8" x 5" or 7" x 4" cutout)	£2.90 each
12" x 12" x 7 1/2" (10", 8" or 8" x 5" cutout)	£4.05 each
18" x 11" x 7 1/2" (8" and 3", 8" x 5" or 8" cutout)	£5.10 each
22" x 14" x 7 1/2" (13" x 8" or 12" and 3" cutout)	£8.15 each

**ALL PRICES INCLUDE VAT**  
Items subject to availability and manufacturers' increase. U.K. only.

**Riversdale Electronics**

Mail Order Department **PE5**

P.O. Box 470, Manchester M60 4BU

**SYNTHESISER**  
Modules by **Dewtron®**



The synthesiser illustrated was built using Dewtron modules, as sold to constructors for some years now. With over 10 years' experience in mail-order, we have supplied many famous people and groups. Over 30 types of synthesis modules, some of extremely precision design, e.g. VCO-2 log-law oscillator; 3-wave o/p/s; sample/hold/envelope module; 3-octave keyboards, contacts, special tuning-ladder resistors, etc. Famous "Modumatrix" patching system makes other patching a thing of the past! Send just 20p for full catalogue to:

**D.E.W. LTD.**

254 Ringwood Road, Ferndown  
Dorset BH22 9AR

**GREENWELD**

**HAVE MOVED TO LARGER PREMISES AT:  
443 MILLBROOK ROAD  
SOUTHAMPTON SO1 0HX**

Tel. (0703) 772501

All mail order and callers to this address please—callers only to 21 Deptford Broadway, SE8 (Tel. 01-692 2009) and 38 Lower Addiscombe Road, Croydon (Tel. 01-688 2950)

**741s**

8 pin DIL full spec., 10 + 26p, 25 + 3p, 100 + 21p.

**BARGAIN PACKS**

12 BC107	£1.20	25 1N4001	£1.20
12 BC108	£1.20	22 1N4002	£1.20
12 BC109	£1.20	20 1N4003	£1.20
15 BC148	£1.20	18 1N4004	£1.20
12 BC149	£1.20	16 1N4005	£1.20
12 BC157	£1.20	14 1N4006	£1.20
12 BC158	£1.20	12 1N4007	£1.20
12 BC159	£1.20	40 1N4148	£1.20
2 2N2646	£1.20	3 2N3055	£1.20
10 BC328	£1.20	1 SN76660	£1.20
12 BF194	£1.20	1 SN76013	£1.20
7 BF173	£1.20	4 741C	£1.20
5 BF181	£1.20	2 555	£1.20
12 BF195	£1.20	6 BY103	£1.20
12 BC548	£1.20	16BC348B	£1.20

All full-spec. marked devices.

**PC ETCHING KIT Mk II**

Contains 1lb ferric chloride, 100 sq. in copper clad board, DALO Quick Dri etch resist pen, abrasive cleaner, 2 miniature drill bits, etching dish and instructions. £3.85.

**71b BARGAIN PARCELS**

Hundreds of new components—pots, resistors, capacitors, switches, PC Boards with transistors, diodes and zeners, loads of odds and ends. Only £3.25.

**TRANSISTOR PACKS**

200 assorted mainly out of spec transistors, mostly unmarked—NPN, PNP plastic, TO5, TO18, RF, AF, small signal and TO3 power devices. About 75% usable devices. Only £1.60.

1,000 unmarked 1N4148 diodes, 95% OK. Only £4.  
100 unmarked BC108, untested £2.10.  
10 out-of-spec. 2N3055 (no opens or shorts) £1.10.

**RE-SETTABLE COUNTERS**

4 digit 24V operation, 68mA. Speed up to 10 Impulses/sec. £1.50.

**CALCULATOR KEYBOARDS**

4 different types—all have 0-9 and DP keys plus the following:

Type A has 10 function keys and 5 position slide switch, size 200 x 135mm. Price £1.50.

Type B has 13 function keys and 5 position slide switch, size 200 x 135mm. Price £1.65.

Type C has 14 function keys and 7 position slide switch and a 3 position slide switch, size 185 x 115mm. Price £1.80.

Type D has 19 function keys and 8 position slide switch. Size 220 x 125mm. Price £2.10.

**HEAT SINKS**

Large (155 x 135 x 60mm) with 2 x OC29. Weight 31b. £1.30.

**ODDS AND ENDS**

80V 10A rectifiers—4 mounted on heat sink, ideal for battery charger. £1.20.

Screw mixture—approx. 500 assorted screws 2BA to 8BA plus some self-tapping, few nuts and washers, etc., £1.

Telephone handsets, brand new, but old type so only £1.20 pair.  
115V 65W soldering irons, £1.20.  
230V 700W immersion heater, 75p.  
VHF power transistor by Texas, type 2N3375, £1.20.

Free with every order—base connection data sheet on over 50 popular digital/linear ICs, voltage regs., etc.

All prices quoted include VAT and UK/BFPO postage. Most orders despatched on day of receipt. SAE with enquiries or for List please. Send 10p for Multimeter catalogue—free on request on orders over £3. Official Orders accepted from Schools, etc. Export/Wholesale enquiries welcome. Surplus components always wanted.

**555s**

8 pin DIL full spec., 3 + 52p, 10 + 44p, 25 + 41p.

**RESISTOR AND CAPACITOR PACKS**

400 assorted carbon resistors	£1.50
250 hi-stabs, 1, 2, 5% ±1W	£1.40
100 wirewounds 2-15W	£2.00
200 miniature resistors, 1/4, 1/2 and 1/2W, mostly carbon film	£1.10
200 poly, mica, ceramic caps	£1.10
100 polyester, 0.01-2.2uF	£1.30
200 miniature electrolytics, but many unmarked so only	£1.10
15 airspaced and compression trimmers	£1.10

**JUMBO PACK:** 1 each of the above 8 packs, £10.90 value for only £8.50!

**TRANSFORMERS**

All have mains primaries: 6-0-6V 100mA 90p; 9-0-9V 100mA 95p; 12-0-12V 50mA 80p; 12-0-12V 100mA £1; 24-0-24V 500mA £2.05. Multi-tapped transformer to give 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 or 30V, or 12-0-12V, or 15-0-15V—1A version £3.15; 2A version £4.45; 30-0-30V 1A £3.25; 6-0-6V 1/2A £1.95; 12-0-12V 1A £2.15; 25V 1.75A £2; 17V 1A £2.10.

**COMPUTER PANELS**

Large quantity always available; 11b assorted £1.75; 71b £3.65; 561b £16. Pack with about 500 components inc. at least 50 transistors £1.

Pack with 12 high quality panels, inc. ICs, power transistors, multi-turn trim pots, hundreds of small signal transistors, resistors, zeners, capacitors, etc., only £2.75.

**FERRIC CHLORIDE**

Anhydrous technical quality in 11b double sealed packs: 11b 85p; 31b 1.90; 101b £4.80; 1001b £36.

**VEROBOARD**

100 sq. in assorted sizes and pitches, about 8 pieces (all 0.1in if requested), £1.20.

**RELAYS**

Lots of different types available to callers. Miniature plug-in types, 430 + 430 ohm coil, 4 c/o contacts, 60p. PC 3000 type 500 ohm coil (operates on 6V), 1 heavy duty make contact, 60p. Omron 11 pin plug-in type, mains coil, 3 c/o contacts rated 10A, £1.20. PE Gas Igniter Kit, as featured in July 1975 edition. Still only £3.

**VEROBXES**

Professional quality, two-tone grey polystyrene boxes with threaded inserts for mounting PC boards: 120 x 65 x 40mm £1.52; 150 x 80 x 50mm £1.75; 188 x 110 x 60mm £2.40. Sloping front type: 220 x 174 x 100/52mm £4.20.

**DEVELOPMENT PACKS**

50V ceramic plate capacitors, 5%: 10 of each value 22pF to 1,000pF, total 210 caps., £3.

CR25 carbon film 1/2W resistors, 5%: 10 of each value 10 ohms to 1MΩ, total 610 resistors, £7.50.

Electrolytics, wire ended 25V working, 10 each of: 1, 2, 2, 4, 7, 10, 22, 47 and 100mF, 70 capacitors for £3.60.

400mW zeners 5%, 10 each 3V to 30V, 260 in all. Only £14.

# Practical Electronics Classified Advertisements

RATES: 13p per word (minimum 12 words). Box No. 35p extra. Semi-Display £10.00 per single column inch. Advertisements must be prepaid and addressed to Classified Advertisement Manager, "Practical Electronics" IPC MAGAZINES LTD., Fleetway House, Farringdon Street, London EC4A 4AD. Tel. 01-634 4451.

## RECEIVERS AND COMPONENTS

Bank of 20 Neons 74p (16p). 5 Figure Resettable Counter 18/22V works on 12, £2.50 (50p). Box with 20 x LA2 Pot Core + 20 x 1% Caps £1.75 (75p). Copper Clad Pax Panels 5 1/2 x 5 1/2 in. 6-75p; 12 x 12 in. 75p; 17 1/2 x 9 1/2 in. 85p; 8 1/2 x 9 1/2 in. 3-£1.25; Fibre Glass Ditto 12 1/2 x 7 in. 90p; 18 x 4 in. 85p; 7 x 8 in. 60p; 1 1/2 x 1 1/2 in. £1.75. All C.P. 74 Series ICs on Panel(s), 10-85p (10p). Three Transistor Audio Amp. Transistors Equiv. to AC128, OC72 40p (10p). 3-£1, c.p. T.V. Convergence Panels 2 x AC128, 3 slugged coils, 3 slide switches, 11 W. W. pots, 3 carbon presets, 2 ferrite chokes, etc. £1.30, c.p. Talking Page Panel 2 pots, 12 silicon transistors and 5 C.R. 8 nice electrolytics 80p (15p). Valupaka P2, 8 silicon diodes 650V. 1 1/4 on tagboard 50p (10p). P9 100 5/Mica Caps 55p (10p). P11 100 Polystyrene Caps 80p (10p). Lists 15p Refund on purchase.

7lb assorted components £2.50  
3lb assorted computer panels £1.70

### J.W.B. RADIO

2 Barnfield Crescent, Sale, Cheshire M33 1NL  
Postage in brackets Mail order only

8000P1 10mF/12V 10/20p, 100/£1; 10mF/70V, 22mF/50V 10/25p, 100/£1.25; 100mF/16V, 100mF/6V 10/30p, 100/£1.50. 1N4002, 4p, 1N4004 5p, 1N4007 6p, 1N914 4p, 1N4148 4p. Bridges 1A/200V 2/50p, 2A/200V 2/65p. Transistors, plastic BC107/8/9 10p, ZTX300/500 14p, ZTX304/504 22p, TIP3055 45p, TIP2955 64p. Metal can BC107/8/9 12p, 2N3055 73p. Leads w/clips TIL2009/red 16p, green, orange, yellow, 21p. I.C.s 8 pin/741 25p, 555 49p. P. & P. 20p. AUDIO-OPTICS, 19 Middleway, Chinnor, Oxon.

### TTL LOWER PRICES!

(Fast delivery. All prices include VAT)  
SPECIAL OFFER OF 7400, 7410, 7420, 7430 and 7440 at 11p each, ZTX108 at 8p each.  
Above offer ends 31 March, 1976, and is regardless of quantity ordered.

Type	1/24	25/99	Type	1/24	25/99
7400	0.13	0.12	7480	0.47	0.42
7401	0.4	0.12	7482	2.80	0.75
7402	0.14	0.12	7484	0.92	0.89
7403	0.14	0.12	7485	1.30	1.09
7404	0.16	0.13	7486	3.00	2.66
7405	0.16	0.15	7489	2.90	2.80
7406	0.36	0.31	7490	4.20	0.40
7408	0.16	0.15	7491	0.65	0.55
7409	0.14	0.12	7492	0.46	0.42
7411	0.23	0.20	7493	0.42	0.40
7412	0.16	0.15	7495	0.59	0.55
7413	0.32	0.31	7496	0.77	0.69
7414	0.65	0.60	74100	1.08	0.89
7417	0.30	0.29	74107	0.33	0.28
7420	0.14	0.13	74109	0.54	0.48
7422	0.20	0.23	74121	0.30	0.28
7423	0.27	0.25	74122	0.47	0.39
7427	0.27	0.25	74123	0.65	0.61
7430	0.14	0.13	74141	0.69	0.63
7432	0.27	0.25	74145	0.68	0.58
7437	0.27	0.25	74150	1.05	0.95
7440	0.14	0.13	74151	0.78	0.75
7441	0.69	0.62	74153	0.76	0.72
7442	0.65	0.55	74154	1.60	1.45
7445	0.85	0.71	74155	0.82	0.80
7447A	0.75	0.72	74157	0.83	0.79
7448	0.76	0.73	74160	1.05	0.95
7450	0.14	0.13	74164	1.25	1.05
7451	0.14	0.13	74174	0.99	0.83
7453	0.14	0.13	74175	0.92	0.83
7454	0.14	0.13	74177	0.89	0.83
7460	0.14	0.13	74190	1.25	1.15
7472	0.25	0.21	74191	1.25	1.15
7473	0.30	0.25	74192	1.30	1.14
7474	0.31	0.26	74193	1.30	1.14
7475	0.45	0.39	74195	0.81	0.79
7476	0.32	0.26	74196	1.64	1.34

TTL (except special offers) may be mixed for quantity prices.  
All devices full spec. by famous manufacturers. S.A.E. for full lists. All orders sent by 1st class post. 12p P. & P. on all goods below £2 (12p P. & P. on all orders for special offers).

J. C. JONES

(Dept. PE15) 46 BURSTELLARS,  
ST. IVES, HUNTINGDON PE17 4XX  
(Mail Order only)

MINIATURE CARBON FILM RESISTORS, 5%, 1W, 1/2W, 1/4W, E12 Series, 22 ohm to 1 Mohm, 10 for 10p, 50 for 45p, 100 for 80p. P. & P. 10p. Mixed values and wattages to your choice. CANDAR, Freeport, Reading, RG1 1BR.

## BETA DEVICES

### MANUFACTURERS' BRANDED PRODUCTS

TRANSISTORS	I.C.'s	DIODES & RECT			
AS929	0.25	709C TO99	0.30	1N914	0.04
AF125	0.20	709C D.I.L.	0.30	1N4148	0.04
BC107		741C TO99	0.38	0A91	0.05
BC108	0.08	741C D.I.L.	0.38	1N4001/2	0.05
BC109C	0.11	723C D.I.L.	0.80	1N4003/4/5	0.08
BC147/8/9	0.10	747C D.I.L.	0.85	1N4000	0.08
BCY70/71/72/13		748C D.I.L.	0.38	BRIDGES	
BC441	0.20	1N5401	0.11	50V 1A	0.18
BC461	0.25	555	0.60	100V 1A	0.20
BFY50	0.18	TBA810	0.90	600V 1A	0.30
BFY51/52	0.18	2N3055	0.38	200V 26A	2.00
OC28		D.I.L. SOCKETS		ZENERS	
OC33	0.35	8-Pin	0.12	BZY38 3-3-	
2N2644	0.30	14-Pin	0.12	33V 5%	0.09
2N3053	0.44	16-Pin	0.12	1 Watt 6-8-	
OC28	0.45	16-Pin	0.14	200V 5%	0.15
OC36	0.35			L.E.D.	
TIP31A	0.50			17V-Red	0.17
TIP32A	0.60			17V-V.A.T.	L.E.D. Clip 0.62

### C.W.O. PLUS P.P. 15p TO BETA DEVICES

4 High Bridge Street, Waltham Abbey, Essex

VALVES, RADIO, TV, TRANSMITTING, INDUSTRIAL. 1930 to 1975. 2,200 types in stock, many obsolete. List 20p. Quotation S.A.B. Postal export service. We wish to purchase new and boxed valves. Dealers, wholesalers, etc., stocks purchased. COX RADIO (SUSSEX) LTD., The Parade, East Wittering, Sussex. Tel. West Wittering 2023.

## Precision Polycarbonate Capacitors

All High Stability—extremely Low Leakage  
440 V A.C. RANGE 63V D.C. RANGE

Value (µF)	Dimen- sions (mm)	Price each	Value (µF)	±1%	±2%
0.1µF	27 12.7 51p	0.01µF; 0.1µF	68p	48p	
0.15µF	27 12.7 51p	0.2µF; 0.33µF	67p	50p	
0.22µF	33 16 83p	0.47µF	67p	50p	
0.25µF	33 16 83p	0.68µF	74p	53p	
0.33µF	33 16 75p	1.0µF	82p	62p	
0.47µF	33 19 80p	1.5µF	89p	71p	
0.5µF	33 19 87p	2.2µF	98p	75p	
0.68µF	50.8 19 93p	3.3µF	£1.15	82p	
1.0µF	50.8 19 £1.03	4.7µF	£1.62	£1.13	
1.5µF	50.8 25.4 £1.21	10µF	£2.40	£1.95	
2.0µF	50.8 25.4 £1.44	15µF	£3.22	£2.79	
		22µF	£4.28	£3.68	

TANTALUM BEAD CAPACITORS—Value available: 0.1, 0.22, 0.33, 0.47, 0.68, 1.0, 2.2, 3.3, 4.7, 6.8µF at 18V/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 12p\* each, 10 for £1.10\*, 50 for 25\*, 100 for 20p\*.

TRANSISTORS V.L.O.'s  
\*BC107/8/9 9p \*BC212/212L 14p 2N3055 50p  
\*BC111 12p \*OC212 11p OC712 12p  
\*BC147/8/9 10p \*BC214/214L 11p NE555Timer 61p  
\*BC153/154 12p \*BF194/5 12p 74C1 Bipin DIL  
\*BC157/8/9 12p BF750/1/2 20p 32p  
\*BC182/182L 11p AF178 30p ZN414 £1.15  
\*BC183/183L 11p AF234 38p 8N76013ND  
\*BC184/184L 12p 2N3702/4 11p £1.50

POPULAR DIODES—1N914 6p, 8 for 45p, 18 for 90p; 1N916 8p, 6 for 45p, 14 for 90p; 1844 5p, 11 for 50p; 24 for £1.00, 1N4148 5p, 6 for 27p, 12 for 48p; 1N4001 51p; 002 6p; 003 6p; 004 7p; 005 71p; 006 8p; 007 81p.  
LOW PRICE ZENER DIODES—400mW, Tol. ±0.5% 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 55p, 50 for 23-£2. SPECIAL OFFER: 100 Zeners (may be mixed) for 28-00p.

RESISTORS—High stability, low noise carbon film 5% 1W at 40°C, 1W at 70°C. E12 series only—from 2-2Ω 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 2-2Ω to 2-2M Ω (730 resistors) 25\*.

SELENIUM PLASTIC RECTIFIERS—1.5 amp, wire-ended 1027; 100 P.I.V. 7p (4 for 28p); 400 P.I.V. 8p (4 for 30p). BRIDGE RECTIFIERS—2 1/2 amp; 200V 40p; 350V 45p; 600V 55p.

SUBMINIATURE VERTICAL PRESETS—0-1W only: All at 5p each; 50; 100; 220; 470; 680 ohm; 1K; 2K9; 4K7; 6K8; 10K; 15K; 22K; 47K; 100K; 250K; 500K; 1M; 2M; 5M.

PLEASE ADD 20p POST AND PACKING ON ALL ORDERS. EXPORT—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. PE3)

The Old School, Edgaston, Nr. Wem, Shropshire.  
Tel: Whixall 484/485 (STD 094 872)  
(Proprs. Minicost Trading Ltd.)

## R.T. SERVICES

### (MAIL ORDER ONLY)

77 Hayfield Rd., Salford 6, Lancs.

Tapped Auto Transformer, 240V-110V, 80 watts, £2 P.P. New.  
Heat Sinks 5 x 4in, drilled for 2 TO3 transistors. New 65p.

Transformer 240V primary 25 volts at 1 1/2 amps. New £2 P.P.  
FM Tuner with R.F. Stage and A.G.C., 3 transistors, neg. earth, 2 1/2 x 2 x 1 1/2 in with circuit, £1.75 P.P.

Crouzet Geared Motors 240V. 5/6/15/20 r.p.m. New £1.75 P.P.

Panel with 3 1 amp F/W bridge rect. 6 transistors, 5 pre set pots, etc., etc. Price 3 for £1.75 P.P. NEW.

Electrolytic Capacitors, 2,500 at 40V. Size 3 x 1 1/2 in. for £1 P.P. NEW.

3E1 Scope Tubes with base and connections £4 P.P.

UHF TV Tuners. Transistorised, £2.10 P.P. Transformers. 12.0-12V, 100mA, £1.25 inc. P.P. 9.0-9V, 100mA, £1.25 inc. P.P. 29V 50mA, 95p inc. P.P. 6.0-6V, 100mA, £1.25 inc. P.P.

Transformer. 24 volt, approx. 1 amp + 6.3V CT approx. 500mA, £1.60 inc. P.P.

Transformer. 22 volt, 100mA, £1.25 P.P. Transformer. 45 volt, 2 amp, £3.38 P.P.

P.C. Board. S/S, 5 1/2 x 5 1/2 in, 10 for £1.10 P.P.

Power Unit Components Transformer. 18 volt 1 amp F/W bridge rectifier, 2 1250 mfd capacitors, all new £1.60 per kit. P.P.

Mixed Pack of C280 series Mullard capacitors. 100 for £1.30 inc. P.P.

Tel. 061-236 1541

All prices include VAT and P.P.

50 COMPONENTS. Resistors, capacitors, diodes, transistors, pots, coils, etc. Identified, formed leads, fall-out and surplus. Good value at £1.60. All inclusive (U.K. postal rates only). C.W.O. please to: L. PENNESEY (PE), Bankhead Farm, South Queensferry, West Lothian.

## BULK OFFERS

1N4001	£2.50	*BC157	£8.00	BFY38	£14.00
1N4002	£2.40	*BC158	£8.00	BFY51	£10.00
1N4003	£3.20	*BC159	£8.00	BFY64	£12.50
1N4004	£3.50	BC161	£10.00	BSX20	£9.00
1N4005	£3.90	*BC184C	£8.00	BSY95A	£6.00
1N4006	£4.30	*BC328	£10.00	OC81D	£4.00
1N4007	£4.70	*OC347	£8.00	*PBC108	£5.00
1N4148	£2.30	*BC348	£5.00	2G302	£8.00
BC107	£7.00	*BC548	£8.00	2N3055	£28.00
BC108	£6.50	BD131	£16.00	2N3442	£75.00
BC109	£7.00	*BF152	£10.00	*2N4062	£7.50
*BC118	£5.50	BF173	£14.00	*2N4418	£8.00
BC119	£32.00	BF181	£20.00	2N524	£21.00
BC139	£14.00	*BF194	£8.00	SN7440	£8.00
*BC147	£8.00	*BF195	£8.00	SN7490	£29.00
*BC148	£5.00	BFW43	£12.00	SN7660	£22.00
		*BC208	£8.00	741	£19.00

SPECIAL: AD161/2 matched pairs, £40.  
All prices per minimum quantity of 100. All devices full spec. and marked.

\*Electrolytics, wire ended small size. Television 1.00µF 10V £8.100; 470µF £5.100; 4.7µF 25V £3.100; 47µF 25V £3.50-100; Kappo 2,200µF 10V £3.100; Plesey 100µF 40V £4.100; ITT 47µF 63V £4.100; Impco 10µF 25V PC £2.50-100.  
\*Non-Polarized: 470pF 160V polystyrene £4.500; 33pF ceramic plate £3.50-500; 100pF EP-50/100; Lemco 1.00µF Tub. Cap. Type 318K £1-50/100.  
\*Ferric Chloride, Anhydrous. 100 x 1lb bags £3.00.  
\*Miniature Mains Transformers: 6.0-6V 100mA £5-80. 10. 9.0-9V 100mA £6-30/10. 12.0-12V 50mA £5-40/10. 12.0-12V 100mA £8-80/10. 12V 100mA £5/10.  
\*Plugs and Sockets: Co-Ax back to back conn. £4-20/100. 5-pin 180 Din plugs £8/100. Sockets £5-50/100.  
\*Computer Panels, good quality, 5 1/2 x 5 in boards reworking 20p-50p each. £12/100; £25/300; £65/1,000. Veroboard offers: £2-85/1lb; 10lb or more £2-60/1lb.  
\*PP3 Battery connectors £4/100; £16/500.

## JUNIPER ELECTRONICS (PE3)

PO Box 61, Southampton, SO9 7EJ

\*Add 25% VAT, rest is 8% VAT. Minimum Order £5, excl. VAT. Carriage free on all goods. S.A.E. inst enquiries.

### RESISTOR BARGAINS

Brand New mixed value packs of 1 watt 5% carbon film resistors in the range of 10 ohms-1 Meg.

No large quantities of high values.

Pack of 250 £2.00  
500 £3.50  
1000 £5.00

These prices include Post and Packing and VAT  
Electrical Digital Clocks, 43a Chipstead Valley Road, Coulsdon, Surrey  
Tel. 01-668 8693

### BRAND NEW COMPONENTS BY RETURN

Electrolytics 16V, 25V, 50V, 0.47, 1.0, 2.2, 4.7, 10mfd, 5p; 22, 47, 81p (50V, 8p); 100, 7p (50V, 8p); 220, 8p (50V, 10p); 500, 11p (50V, 10p); 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, 22/18V, 47/8V, 100/3V, 11p. Mylar Film 100V, 0.001, 0.002, 0.005, 0.01, 0.02, 3p; 0.04, 0.05, 3p. Mullard tubular polyester 400V E8 series, 0.001-0.022, 3p; 0.033-0.1, 4p. Mullard polyester 100V tubular or 250V miniature for vertical mounting E8 series, 0.01-0.047, 3p; 0.008, 0.1, 4p; 0.15, 0.22, 8p; 0.33, 7p; 0.47, 8p; 0.88, 11p; 1.0, 14p; 1.5/250V, 18p; 2.2/250V, 22p. Mullard miniature C333 ceramics 63V E12 series 2% 1.8pF-47pF, 3p; 50pF-330pF, 3p. Plate ceramics 50V E8 series 470pF-47,000pF, 2p. Polystyrene 63V, E12 series 10pF-1,000pF, 3p; 1,200pF-10,000pF, 4p. Miniature highstab carbon film resistors 1W E12 series 5% (10% over 1M $\Omega$ ) 1 $\Omega$ -10M $\Omega$ , 1-2p; 1N4002, 8p; 1N4008, 8p; 1N4148, 4p. Postage 10p. Prices VAT inclusive. THE O.R. SUPPLY CO., 127 Chesterfield Road, Sheffield, S8 0RN.

LED panel clip tip	S	0-125	0-2	INFRA RED 550uW
	RED	15p	19p	Axial lead 48p
	G/Y	27p	33p	1.5mW E1-10
	OR	27p	33p	8mW E1-55

OPTO-ISOLATORS	SCR's	50V	100V	400V
IL74 1.5KV, 150kHz E1	T05 1A	25p	27p	46p
4350 2.5KV, 5MHz E2-25	T08 3A	27p	35p	50p
Data free with all OPTO	TRIAC T05	2A	400V	60p

AC125.5/7.8 15p	2N2926(G) 12p	VOLTAGE REGS
AD151/162 40p	2N3053 15p	5V 7805 Plastic
AF117 20p	2N3054 45p	12V 7812 1 Amp
AF124.5/6.7 34p	2N3055 41p	15V 7815 all
BC107/8/9 9p	2N3702/3/4 12p	18V 7818 E1-50
BC109C 12p	2N3903/4/5/6 16p	723 DIP14 50p
BC147/8/9 10p	2N2646 35p	BRIDGE RECTS
BC157/8/9 11p	MPPF102 40p	2A 50V 30p
BC187/8/9 11p	2N3819 25p	2A 100V 36p
BC169C 12p	2N3823 30p	2A 200V 41p
BC177/8/9 17p	BR100 Diac 21p	2A 400V 46p
BC182/3/4/1 11p	IN914 3p	ZENERS BZV88
BC186/7 30p	IN4001 5p	2.7-33V 9p
BC212/3/4/12p	IN4002/3 6p	NE555V 60p
BCY70/71/72 12p	IN4004/5 7p	NE556 E1-10
BF194/5 13p	IN4008/7 8p	LM380 E1-00
BF196/7 14p	IN4148 4p	ZN414 E1-10
BFY50/51 16p	OA47 6p	7400 1p
BFX29 30p	OA70 OA79 8p	D.I.L. SOCKETS
BFX84 24p	OA81 OA90 7p	8-pin 12p
BSX19/20 18p	OA91 OA95 6p	14-pin 13p
OC71 10p	OA200 6p	16-pin 14p
2N706 10p	OA202 7p	Mica + bushes
2N1711 20p	OP. AMPS	709 all 25p
2N2219 20p	IN4001 5p	741 8-pin 28p
2N2904 5/6/7 16p	IN4002/3 6p	TO3 TO66 5p
2N2904/5/6A 18p	IN4004/5 7p	748 D.I.L. 36p
2N2926(R) 7p	IN4008/7 8p	Delco Pen 70p

PRICES INCLUSIVE + 15p P. & P. (1st class)  
ISLAND DEVICES, P.O. Box 11, Margate, Kent

TURN YOUR SURPLUS capacitors, transistors, etc., into cash. Contact COLES-HARDING & CO., P.O. Box 5, Frome, Somerset. Immediate cash settlement.

### CFJ LIMITED

Guaranteed New Branded Products Only  
Resistors 1 watt CR25 1p. 1 watt 3p.  
Capacitors 0.01 $\mu$ F C280 polyester 4p.  
10 $\mu$ F 16V 7p. 100 $\mu$ F 10V 9p.  
IN914 5p. BC109 15p. 741TC 42p.  
Sifam collet knobs 28p.

Large S.A.E. for comprehensive lists  
VAT 25%. P. & P. 15p

McKennis Buildings, Dock Road  
Birkenhead, Merseyside L41 0DG

HEDDON VALLEY ELECTRONICS. Free catalogue and order forms now available. Many popular semiconductors, resistors, condensers, etc., all at competitive prices. Prompt attention on all orders regardless of sizes. All components guaranteed. A must for the home constructor, for the price of a S.A.E. Bumpsley Mill, Parracombe, N. Devon.

## EDUCATIONAL

### CITY & GUILDS EXAMS.

Study for success with ICS. An ICS homestudy course will ensure that you pass your C. & G. exams. Special courses for: Telecoms. Technicians, Electrical Installations, Radio, TV & Electronics Technicians. Radio Amateurs. Full details from: ICS SCHOOL OF ELECTRONICS, Dept.

772Q, Intertext House, London, SW8 4UJ.  
Tel. 01-622 9911 (all hours).

## TELEVISION TRAINING

16 MONTHS' full-time practical and theoretical training course in Radio and TV Servicing (Mono and Colour) for beginners, with GCE (or equivalent) in Maths & English.

13 WEEKS' full-time Colour TV Servicing course. Includes 100 hours practical training. Mono revision if necessary. Good electronics background essential.

NEXT SESSION commences on April 20th.

Prospectus from London Electronics College, Dept. A3, 20 Penywern Road, London SW5 9SU. Tel. 01-373 8721.

### COLOUR TV SERVICING.

Learn the techniques of servicing Colour TV sets through new homestudy course approved by leading manufacturers. Covers principles, practice and alignment with numerous illustrations and diagrams. Other courses for radio and audio servicing. Full details from: ICS SCHOOL OF ELECTRONICS, Dept.

772Q, Intertext House, London, SW8 4UJ.  
Tel. 01-622 9911 (all hours).

### TAPETALKS are the CLEVER way to LEARN

THIS MONTHS SPECIAL OFFER:  
TWO C60 Cassettes entitled  
INTRODUCING ELECTRONICS  
will be sent to you by return of post for only £5.42 plus 55p VAT/P. & P.

TAPETALK, P.O. Box 99 (PE)  
Milton Keynes MK3 5BR  
Tel.: Milton Keynes (0908) 77710

### TECHNICAL TRAINING.

Get the training you need to move up into a higher paid job. Take the first step now—write or phone ICS for details of ICS specialist homestudy courses on Radio, TV, Audio Eng. and Servicing, Electronics, Computers; also self-build radio kits. Full details from: ICS SCHOOL OF ELECTRONICS, Dept.

772Q, Intertext House, London, SW8 4UJ.  
Tel. 01-622 9911 (all hours).

### LADDERS

LADDERS, varnished 20' 9" extd. £19.82. Carr. £1.40. Leaflet. Also aluminium ext. and loft ladders. Tel. Telford 586644.

## MISCELLANEOUS

DO-IT-YOURSELF LOUDSPEAKERS for hi-fi our speciality. Full range of components and accessories including chassis speakers, cross-overs, 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 8p stamp for bargain list to: AUDIOSCAN, Dept. PE378, 4 Princes Square, Harrogate, North Yorkshire.

### LIQUIDATION SALE

LIMITED QUANTITY 12 OR 24 VOLT GAS AND SMOKE DETECTORS COMPLETE WITH AUDIBLE AND VISUAL ALARMS, GIMBAL MOUNTING, SENSOR HEAD CABLE AND FITTING INSTALLATION DIAGRAM.

Previously sold at £38.50 Ex. VAT. £25 including postage to clear. No offers.

Apply: Liquidator, Dermot Fitzgerald, F.C.A., Metcalfe, Lilburn & Enright, 11 The Crescent, Limerick, Ireland.

## BUILD THE TREASURE TRACER



MK III Metal Locator

- Vertical tuning
- Britain's best selling metal locator kit
- Fitted with Faraday shield
- Speaker and earphone operation
- 0.000 already acid
- Practical search coil assembly
- Five transistor circuit
- Thoroughly professional finish
- You only need soldering iron, screw-driver, pliers and snips
- As seen on BBC-1 and BBC-2 TV

Send stamped, addressed envelope for leaflet

Complete Kit £12.50 Post 85p + £1.00 VAT (8%)  
Built and tested £17.50 Post 85p + £1.40 VAT (8%)  
MINIKITS ELECTRONICS, 6g CLEVELAND ROAD  
LONDON E18 2AN (Mail Order Only)

### SUPERB INSTRUMENT CASES by Bazell,

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, 8" x 5" x 3" £1-65; 10" x 6" x 3" £2-20; 10" x 8" x 3" £2-75; 12" x 10" x 3" £3-60; 8" x 4" x 4" £1-80; 10" x 6" x 4" £2-70; 12" x 8" x 4" £3-60; 7" x 7" x 5" £2-65; 8" x 10" x 6" £3-60; 12" x 8" x 7" £4-12; 12" x 12" x 7" £4-40. Plus 62p postage + 8% VAT. Over 400 models to choose from. Prompt despatch. Free literature (stamp would be appreciated). BAZELLI, Dept. No. 23, St. Wilfrid's, Foundry Lane, Halton, Lancaster LA2 6LT.

### PHOTOTECH (EUROPE)

New Optoelectronic Detectors  
Type 1: Photodiode, 2 pin Configuration: Photo-sensitive area 0.85 x 10<sup>-3</sup> square inches.  
Type 2: Photoswitch, 4 pin Configuration, 20V-30V supply. Switching threshold set by external R.C.  
Type 3: Photoswitch with automatic threshold adjustment. 6 pin Configuration 20V-30V supply.  
LED: Gallium Arsenide Phosphide red emitting diode.  
Data and operating notes sent with each order. Prices: (including VAT, packaging and carriage)  
Type 1: 75p each Type 2: £1.00 each Type 3: £1.50 each  
LED: 17p each, or free with each optoelectronic detector ordered.  
Please send C.V.O. or S.A.E. for data only to: Phototech (Europe), 23a Upper Elmers End Road, Beckenham, Kent

DIGITAL CLOCK COMPONENTS. AY-51224 clock chip, £3.66. 0.3in high economy type LED displays, DL-704E, 85p; 0.6in high ditto, DL-747E £1.70. P.C.B. to suit chip and displays, etc. (two types), 95p each. MK 50253 alarm clock chip, £5.50. Full details of both chips, circuit diagrams, data, etc., free on request. Add 10p per order and VAT at 8%. GREENBANK ELECTRONICS (Dept. ECF), 94 New Chester Road, New Ferry, Wirral, Merseyside, L62 5AG.

# AIRFIELD NAVAIDS

## Training course starting April 26

IAL is a world leader in communications and aviation services and we will be running a series of UK training courses this year to meet our expanding overseas commitments. Successful completion will lead to interesting, highly-paid postings abroad and opportunities to expand with the company.

To qualify for a place on the course, you should have several years' experience in the maintenance and operation of ILS, VOR and DME, together with a knowledge of associated ground-to-

air communications systems.

We offer attractive tax-free salaries overseas and additional benefits include: free furnished accommodation; an excellent pension scheme; opportunities for accompanied postings; education/child allowance.

The next course starts April 26th, 1976. Secure your place by contacting the Senior Recruitment Engineer, International Aeradio Limited, Aeradio House, Hayes Road,

Southall,  
Middlesex.  
Telephone:  
01-571 1808 or  
01-571 0678.



## FIRST CLASS VIDEO ENGINEER

Experienced in VCRs, U-matics, 2" machines  
and colour monitors. Bench work.

For initial interview phone  
01-580 2283

### FOR SALE

**DIGITAL VOLTMETERS.** Schneider VT50. 0 to 1.99V. Excellent condition. Mains operated. Data supplied. Ideal basis for multimeter. £20. Box 63.

**RUSSIAN C1-5 (C157) Oscilloscope.** Unused, new, £35. Wireless World, Dolby Stereo Unit incompletely built, £30. (Urgently need funds). Potters Bar 55463.

**SHACK LEFTOVERS,** complete items and components, ICs, etc. S.A.E. for latest list. W. H. JARVIS, Dall, Rannoch Station, Perth.

### SERVICE SHEETS

**BELL'S TELEVISION SERVICES** for service sheets, manuals and books on Radio/TV, etc. Service sheets 50p plus S.A.E. Service sheet catalogue 25p. Back issues of magazines from April, '74 onwards. Cover price plus 12p post. Free booklists on request. S.A.E. with enquiries please to: B.T.S. 190 Kings Road, Harrogate, Yorkshire. Tel. Harrogate (0423) 55885.

**SERVICE SHEETS** for radio, TV, tape recorders, stereo, etc., with free fault-finding guide, 50p and S.A.E. HAMILTON RADIO, 47 Bohemia Road, St. Leonards, Sussex

**SERVICE SHEETS,** radio, TV, etc. 10,000 models. Catalogue 24p plus S.A.E. with orders-enquiries. TELRAY, 154 Brook Street, Preston, PR1 7HP.

## MEN! £90 p.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 C39

Oxford House, 9-15 Oxford Street, W.1  
Tel. 01-734 2874

### WANTED

**TOP PRICES PAID**  
NEW VALVES AND TRANSISTORS  
Popular T.V. and Radio types  
**KENSINGTON SUPPLIES (B)**  
367 Kensington Street  
Bradford 8, Yorks.

### MISCELLANEOUS

(continued)

### BUILD YOUR OWN

YOU ARE INVITED TO SEND S.A.E. FOR LISTS ON OUR VERY EXTENSIVE RANGE OF HIGH QUALITY AMPLIFIERS, PRE-AMPS, F.M. TUNERS, INSTRUMENTS, RADIO CONTROL, IGNITION UNITS AND MANY OTHER KITS. STATE REQUIREMENTS.

**TELERADIO ELECTRONICS**  
325 Fore St., Edmonton, London N9

### 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 and 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 and 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

### THE SCIENTIFIC WIRE CO.

Copper—Nickel Chrome—Eureka—  
Manganin Wires.  
Enamelled—Silk—Cotton—Tinned  
Coverings.

No minimum charges or quantities.  
S.A.E. Brings List.

Trade and export enquiries welcome.

P.O. BOX 30, LONDON E4 9BW

## ENAMELLED COPPER WIRE

S.W.G.	1lb reel	1/2 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 the U.K.

## COPPER SUPPLIES

102 Farslow Road, Withington,  
Manchester 20  
Telephone 061-445 8753

## 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 £3.80 inclusive

Send S.A.E. for full details of above and many others to:



**J. BARRIE-SMITH**

56 Conifer Rd., Coxford, Southampton, Hants.

**CLEARING LABORATORY**, scopes, recorders, testmeters, bridges, audio, R.F. generators, turntables, tapeheads, stabilised P.S.U.s, sweep generators, test equipment, etc. Lower Beeding 236.

## CABINET FITTINGS

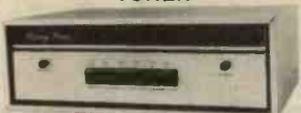
FOR

Stage Loudspeakers and Amplifier Cabs  
Fretcloths, Coverings, Recess Handles, Strap Handles, Feet, Castors, Locks and Hinges, Corners, Trim, Speaker Bolts, etc., etc.  
Send 2 X 8p Stamps for samples and list.

**ADAM HALL (P.E. SUPPLIES)**

Unit G, Starline Works, Grainger Road  
Southend-on-Sea, Essex.

## THE P.E. "VARICAP" STEREO PUSH BUTTON TUNER



Using the latest Mullard modules for R.F. and I.F. circuits—pre-aligned for ease of construction—this KIT has an F.M. tuner with stereo decoder, push button tuning, self regulated power supply, etc., etc., for highest quality reproduction.

Price £34.50 inc. VAT, P. & P.  
S.A.E. for FREE brochure

We also still supply ALL components for the P.E. "GEMINI" STEREO AMPLIFIER. Send 55p + 2p P. & P. for a full constructional booklet containing performance details, specification assembly instruction and fault finding guide.

## ELECTRO SPARES

Dept. P.E. 288 Ecclesall Road,  
Sheffield, S11 8PE

## BREAK INTO I.C.s THIS WINTER

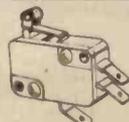
Using our I.C. Experimental/Educational Kits, you can learn all about the modern digital logic techniques. These step-by-step kits contain specially selected I.C.s, Holders, Veroboard, L.E.D.s, instructions and data. Kit one: Gates. Kit Two: Flip-Flops. Kit Three: Shift Registers. Kit Four: Counters. Kit Five: Displays. Each kit is £3.50 (including P. & P.).

S.A.E. for further details to:

### AUTOMATED HOMES

69 High Street, Ryton, Coventry, CV8 3FJ.  
(Mail Order only)

**DRY TRANSFER LETTERING** for that one-off panel. "BEC" cabinets. Orion case still available. Send for leaflets 15p (refundable): H.M. ELECTRONICS, 275a Fulwood Road, Sheffield, S10 3BD.



## ROLLER OPERATED MICRO SWITCHES

New, full maker's spec.,  
10A 250V a.c., 20p each  
plus VAT, P. & P. 10p.

## R.X. PRODUCTS

Welland Buildings, Caerphilly, Mid-Glamorgan

## 4-STATION INTERCOM



£15.95  
+ VAT £1.28

Solve your communication problems with this 4-Station Transistor Intercom system (1 master and 3 Subs), in robust plastic cabinets for desk or wall mounting. Call/talk/listen from Master to Subs and Subs to Master. Ideally suitable for Business, Surgery, Schools, Hospitals, Office and Home. Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft and other accessories. P. & P. 76p.

**MAINS INTERCOM NEW MODEL**  
No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On off switch and volume control. Price £31.24 per pair. P. & P. 76p.

## NEW! AMERICAN TYPE CRADLE TELEPHONE AMPLIFIER



ONLY  
£12.95  
+ VAT £1.04

Latest transistorised Telephone Amplifier with detached plug-in speaker. Placing the receiver on to the cradle activates on/off switch for immediate two-way conversation without holding the handset. Many people can listen at a time. Increase efficiency in office, shop, workshop. Perfect for "conference" calls: leaves the user's hands free to make notes, consult files. No long waiting, saves time with long-distance calls. Volume. Direct tape recording mode at £13.95 + VAT £1.12. P. & P. 70p. 10-day price refund guarantee.

WEST LONDON DIRECT SUPPLIES (PE3)  
169 KENSINGTON HIGH STREET, LONDON, W.8

## BRIDGE ELECTRONICS COMPONENTS

AC126	£ 0.13	BD1938	£ 0.28	2N2218A	£ 0.18
AC127 <td>0.13</td> <td>BD1939 <td>0.29</td> <td>2N2219 <td>0.17</td> </td></td>	0.13	BD1939 <td>0.29</td> <td>2N2219 <td>0.17</td> </td>	0.29	2N2219 <td>0.17</td>	0.17
AC128 <td>0.11</td> <td>BD140</td> <td>0.32</td> <td>2N2219A</td> <td>0.18</td>	0.11	BD140	0.32	2N2219A	0.18
AC151 <td>0.18</td> <td>BDY56</td> <td>1.00</td> <td>2N2221</td> <td>0.17</td>	0.18	BDY56	1.00	2N2221	0.17
AC152 <td>0.25</td> <td>BF115</td> <td>0.20</td> <td>2N2221A</td> <td>0.18</td>	0.25	BF115	0.20	2N2221A	0.18
AC183 <td>0.27</td> <td>BF200</td> <td>0.25</td> <td>2N2222</td> <td>0.17</td>	0.27	BF200	0.25	2N2222	0.17
AC176 <td>0.14</td> <td>BF194</td> <td>0.09</td> <td>2N2646</td> <td>0.30</td>	0.14	BF194	0.09	2N2646	0.30
AC187K <td>0.27</td> <td>BF195</td> <td>0.09</td> <td>2N2904</td> <td>0.18</td>	0.27	BF195	0.09	2N2904	0.18
AC188K <td>0.27</td> <td>BF198</td> <td>0.12</td> <td>2N2905</td> <td>0.18</td>	0.27	BF198	0.12	2N2905	0.18
AD181 <td>0.35</td> <td>BF199</td> <td>0.12</td> <td>2N2906</td> <td>0.18</td>	0.35	BF199	0.12	2N2906	0.18
AD162 <td>0.35</td> <td>BF257</td> <td>0.24</td> <td>2N2907</td> <td>0.18</td>	0.35	BF257	0.24	2N2907	0.18
BA102 <td>0.10</td> <td>BF258</td> <td>0.24</td> <td>2N2926G</td> <td>0.09</td>	0.10	BF258	0.24	2N2926G	0.09
BAX13 <td>0.03</td> <td>BF259</td> <td>0.24</td> <td>2N3053</td> <td>0.20</td>	0.03	BF259	0.24	2N3053	0.20
BAK16 <td>0.04</td> <td>BFX28</td> <td>0.22</td> <td>2N3054</td> <td>0.40</td>	0.04	BFX28	0.22	2N3054	0.40
BC107 <td>0.08</td> <td>BFX30</td> <td>0.22</td> <td>2N3055</td> <td>0.45</td>	0.08	BFX30	0.22	2N3055	0.45
BC108 <td>0.06</td> <td>BFX84</td> <td>0.20</td> <td>2N3393</td> <td>0.12</td>	0.06	BFX84	0.20	2N3393	0.12
BC109 <td>0.06</td> <td>BFX85</td> <td>0.27</td> <td>2N3441</td> <td>0.58</td>	0.06	BFX85	0.27	2N3441	0.58
BC147 <td>0.09</td> <td>BFY30</td> <td>0.19</td> <td>2N3442</td> <td>0.96</td>	0.09	BFY30	0.19	2N3442	0.96
BC146 <td>0.09</td> <td>BFY51</td> <td>0.19</td> <td>2N3638</td> <td>0.10</td>	0.09	BFY51	0.19	2N3638	0.10
BC149 <td>0.09</td> <td>BFY52</td> <td>0.19</td> <td>2N3638A</td> <td>0.10</td>	0.09	BFY52	0.19	2N3638A	0.10
BC187 <td>0.10</td> <td>BY128</td> <td>0.11</td> <td>2N3702</td> <td>0.10</td>	0.10	BY128	0.11	2N3702	0.10
BC188 <td>0.10</td> <td>BY127</td> <td>0.11</td> <td>2N3704</td> <td>0.10</td>	0.10	BY127	0.11	2N3704	0.10
BC189 <td>0.10</td> <td>DA47</td> <td>0.06</td> <td>2N3706</td> <td>0.10</td>	0.10	DA47	0.06	2N3706	0.10
BC182 <td>0.09</td> <td>DA200</td> <td>0.04</td> <td>2N3708</td> <td>0.10</td>	0.09	DA200	0.04	2N3708	0.10
BC183 <td>0.09</td> <td>DA91</td> <td>0.04</td> <td>2N3771</td> <td>1.25</td>	0.09	DA91	0.04	2N3771	1.25
BC184 <td>0.09</td> <td>DA200</td> <td>0.05</td> <td>2N3772</td> <td>1.35</td>	0.09	DA200	0.05	2N3772	1.35
BC212 <td>0.09</td> <td>DA202</td> <td>0.06</td> <td>2N3773</td> <td>2.00</td>	0.09	DA202	0.06	2N3773	2.00
BC213 <td>0.09</td> <td>IN614</td> <td>0.04</td> <td>2N3804</td> <td>0.11</td>	0.09	IN614	0.04	2N3804	0.11
BC214 <td>0.09</td> <td>IN4008</td> <td>0.05</td> <td>2N3906</td> <td>0.12</td>	0.09	IN4008	0.05	2N3906	0.12
BC237 <td>0.08</td> <td>IN4007</td> <td>0.06</td> <td>2N5294</td> <td>0.35</td>	0.08	IN4007	0.06	2N5294	0.35
BC238 <td>0.08</td> <td>IN4148</td> <td>0.03</td> <td>2N5296</td> <td>0.35</td>	0.08	IN4148	0.03	2N5296	0.35
BC239 <td>0.08</td> <td>IS920</td> <td>0.05</td> <td>2N5298</td> <td>0.20</td>	0.08	IS920	0.05	2N5298	0.20
BC307 <td>0.09</td> <td>2N697</td> <td>0.15</td> <td>2N5319</td> <td>0.30</td>	0.09	2N697	0.15	2N5319	0.30
BC308 <td>0.09</td> <td>2N698</td> <td>0.14</td> <td>2N4036</td> <td>0.55</td>	0.09	2N698	0.14	2N4036	0.55
BC309 <td>0.09</td> <td>2N706</td> <td>0.10</td> <td>2N4037</td> <td>0.40</td>	0.09	2N706	0.10	2N4037	0.40
BC327 <td>0.12</td> <td>2N708</td> <td>0.10</td> <td>2N4921</td> <td>0.80</td>	0.12	2N708	0.10	2N4921	0.80
BC328 <td>0.12</td> <td>2N816</td> <td>0.22</td> <td>2N5080</td> <td>0.25</td>	0.12	2N816	0.22	2N5080	0.25
BCY70 <td>0.13</td> <td>2N1305</td> <td>0.25</td> <td>2N4289</td> <td>0.25</td>	0.13	2N1305	0.25	2N4289	0.25
BCY71 <td>0.13</td> <td>2N1307</td> <td>0.25</td> <td>2N5447</td> <td>0.12</td>	0.13	2N1307	0.25	2N5447	0.12
BCY72 <td>0.12</td> <td>2N1308</td> <td>0.25</td> <td>2N5449</td> <td>0.12</td>	0.12	2N1308	0.25	2N5449	0.12
BD135 <td>0.28</td> <td>2N1613</td> <td>0.15</td> <td>2N5457</td> <td>0.30</td>	0.28	2N1613	0.15	2N5457	0.30
BD136 <td>0.28</td> <td>2N1711</td> <td>0.15</td> <td>2N5458</td> <td>0.27</td>	0.28	2N1711	0.15	2N5458	0.27
BD137 <td>0.27</td> <td>2N2218</td> <td>0.17</td> <td>2N6027</td> <td>0.40</td>	0.27	2N2218	0.17	2N6027	0.40

## FULLY GUARANTEED

Mail order only VAT extra p&p 20p  
Bridge Electronics  
PO Box No. 10 Fishponds Bristol BS16 2LX

## HELME

**DO-IT-YOURSELF  
HI-FI STEREO  
SPEAKER KITS**  
The best value around!  
Send for details  
**HELME AUDIO  
PRODUCTS LTD.**  
Dept. P.E.  
SUMMERBRIDGE  
HARROGATE YORKS  
Tel. Darley 279 (Std Code 0423 72)

**LOW COST I.C. MOUNTING** for any size DIL package. 100 Soldercon sockets 60p. 7 and 8 hole plastic supports 5p pair. Quantity rates. S.A.E. details and sample. Trial pack 60p. (P. & P. 10p order). P.K.G. ELECTRONICS, Oak Lodge, Tansley, Derbyshire, DE4 5FE.

## 12 VOLT

21in 13 watt FLUORESCENT LIGHTING (by THORN/AEI) with diffuser and on/off switch. Ideal, caravan, boat, emergency lighting, etc.

£5.50  
inc. VAT and post.  
List price £7.02 inc. VAT.

SALOP ELECTRONICS Tel. 53296  
23 Wyle Cop, Shrewsbury, Shropshire

**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 Highcliff Way, Wickford, Essex, SS11 5LA.

## 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

Please mention

## PRACTICAL ELECTRONICS

when replying to  
ADVERTISEMENTS



ALL MAIL ORDER BY RETURN. C.O.D. SERVICE WELCOME

# C.T. ELECTRONICS

V.A.T.  
Unless otherwise stated all prices are exclusive of V.A.T. Please check whether the goods you are ordering are 25% or 8%. Carriage orders under £10 please add 33p. Order over £10 post free in U.K. only. This to be at our discretion.

All mail order and enquiries to 270 Acton Lane, Chiswick W4 5DG. Tel. 01-994 6275

## SEMICONDUCTORS

AAZ12 25p	BC238 15p	MJ2901 £1-95	TIP36B £3-50	2N2907 25p
AC107 35p	BC239 15p	MJE340 50p	TIP41B 70p	2N2925 13p
AC125 25p	BC240 30p	MJE370 75p	TIP42B 95p	2N3053 25p
AC126 25p	BC301 30p	MJE371 90p	TIP29C 60p	2N3055 60p
AC127 25p	BC302 30p	MJE520 65p	TIP30C 72p	2N3232 £1-35
AC128 25p	BC303 35p	MJ2955 £1-20	TIP31C 80p	2N3525 £1-10
AC176 25p	BCY31 35p	MJE3055 75p	TIP32C £1-20	2N3553 £1-40
AC187 27p	BCY32 95p	MM1613 80p	TIP33C £1-20	2N3643 30p
AC188 27p	BCY34 65p	MM1712 85p	TIP34C £1-20	2N3702 12p
AC197 40p	BCY38 65p	MPP102 45p	TIP35C £3-00	2N3703 12p
AC198 29p	BCY38 65p	MPP103 45p	TIP36C £3-74	2N3704 12p
AC199 25p	BCY39 85p	(2N5457) 35p	TIP41C 90p	2N3705 12p
AC200 25p	BCY55 £1-50	MPP104 45p	TIP42C £1-00	2N3706 12p
AC201 25p	BCY70 20p	(2N5458) 35p	TIS50 40p	2N3707 12p
AD140 80p	CCY71 20p	MPP105 45p	ZTX107 15p	2N3708 14p
AD142 80p	CCY72 25p	(2N5459) 40p	ZTX300 15p	2N3709 14p
AD161 45p	BD121 75p	OA47 10p	ZTX500 16p	2N3771 £1-50
AD162 45p	BD123 85p	OA70 10p	ZTX501 20p	2N3772 £1-60
AF114 25p	BD124 70p	OA79 10p	ZTX504 50p	2N3792 £1-00
AF115 25p	BD131 40p	OA81 10p	ZTX531 30p	2N3794 30p
AF116 25p	BD132 50p	OA90 10p	ZTX550 25p	2N3819 35p
AF117 25p	BD136 50p	OA91 10p	IN659 85p	2N3820 55p
AF118 50p	BD137 50p	OA92 10p	IN681 40p	2N3823 70p
AF124 30p	BD139 75p	OA202 10p	IN816 8p	2N3866 35p
AF239 60p	BD140 87p	OA210 35p	IN4001 8p	2N3904 22p
BA102 30p	BD153 80p	OA211 35p	IN4002 9p	2N3905 25p
BA112 50p	BD156 80p	OC16 90p	IN4003 9p	2N3906 25p
BA114 15p	BDY17 £1-50	OC19 85p	IN4004 10p	2N4014 30p
BA155 15p	BDY19 £1-90	OC22 85p	IN4005 12p	2N4036 62p
BC115 15p	BDY20 £1-20	OC26 65p	IN4006 14p	2N4037 44p
BC107 13p	BF152 20p	OC28 60p	IN4007 15p	2N4058 14p
BC108 12p	BF166 30p	OC35 60p	IN4148 7p	2N4059 14p
BC109 14p	BF173 35p	OC40 40p	2N686 25p	2N4060 12p
BC109c 16p	BF180 35p	OC42 40p	2N687 25p	2N4061 12p
BC113 13p	BF194 16p	OC44 20p	2N688 25p	2N4062 12p
BC114 13p	BF195 16p	OC70 25p	2N706 12p	2N4126 10p
BC115 15p	BF196 16p	OC75 25p	2N706A 14p	2N4280 25p
BC116 15p	BF197 16p	OC77 40p	2N708 15p	2N4287 25p
BC117 20p	BF200 35p	OC78 20p	2N929 22p	2N4288 27p
BC118 15p	BF224 15p	OC79 25p	2N930 22p	2N4289 30p
BC119 30p	BF24J 15p	OC82 25p	2N1302 20p	2N4290 25p
BC143 25p	BF245 45p	OC83 25p	2N1303 20p	2N4291 30p
BC147 12p	BF259 55p	OC85 25p	2N1304 30p	2N4302 45p
BC148 12p	BFX29 30p	OC87 25p	2N1305 30p	2N4444 £1-90
BC149 12p	BFX34 30p	OC139 30p	2N1306 30p	2N4871 35p
BC149c 14p	BFX85 30p	OC170 25p	2N1307 30p	2N4903 £1-30
BC157 14p	BFX86 30p	OC171 30p	2N1308 30p	2N4919 90p
BC158 14p	BFY44 59p	OC201 60p	2N1309 30p	2N5069 £1-30
BC159 14p	BFY50 25p	OC202 75p	2N1611 30p	2N5191 95p
BC167 14p	BFY51 25p	TIP29A 45p	2N1613 30p	2N5192 £1-20
BC168 14p	BFY52 25p	TIP30 55p	2N1890 60p	2N5195 £1-40
BC169 14p	BFY53 25p	TIP31A 57p	2N2145 15p	2N5245 45p
BC172 13p	BFY54 25p	TIP32A 69p	2N2147 90p	2N5296 55p
BC182 12p	BSV69 65p	TIP33A £1-00	2N2217 25p	2N5298 50p
BC182L 12p	BSV68 70p	TIP34A £1-40	2N2218 25p	2N5457 35p
BC183 12p	BSW63 65p	TIP35A £3-28	2N2219 25p	2N5458 35p
BC184 12p	BSW68 80p	TIP35A £3-56	2N2222 20p	2N5459 40p
BC184L 12p	BSX18 15p	TIP41A 70p	2N2222A 25p	2N5485 55p
BC185 35p	BSX20 15p	TIP42A 85p	2N2306 70p	2N5490 55p
BC186 27p	BY127 20p	TIP29B 54p	2N2369A 50p	2N5555 85p
BC212 12p	BY164 65p	TIP30B 60p	2N2474 30p	2N5777 40p
BC212L 12p	IS100 15p	TIP31B 85p	2N2846 50p	100 PINS SS 30p
BC213 12p	IS103 15p	OC201 60p	2N2846 £1-50	100 PINS DS 30p
BC213L 12p	MJ340 50p	TIP33B £1-00	2N4904 25p	500 PINS SS £1-55
BC214 14p	MJ481 95p	TIP34B £1-62	2N2905 30p	500 PINS DS £1-55
BC214L 15p	MJ2801 £1-25	TIP35B £2-71	2N2906 25p	

TTL (full stocks available)

Miniature Aerospace Synchros, Servos, Stepping Motors by Mullrad, Rank, etc.	553—4mm Stackable Socket Plug
Mullrad Type D885-BC Synchronous Receiver	554—4mm in Line Socket
Servo Motor Type 11 M10 A6	561—3mm Socket
(Both in sealed containers) + 8% V.A.T.	562—Spade Terminal
AGC, Telefunken High Performance Oscilloscope Tube, Type D14/131 125mm x 107mm face plus accessories, £25 each + 8% V.A.T. Data available	561—Phono Line Plug
	562—Phono Lite Socket
	443—Phono Chassis Socket
	301—3in Miniature Croc. Clip
	303—Standard Croc. Clip
	311—Bulldog Clip
550—4mm Plug	364—Pin Clip
551—4mm Socket	444—Probe Clip
552—4mm Terminal	Standard choice of colours.

## S.C.R.s

CRS1/05 40p	CRS1/10 50p	CRS1/20 60p	CRS1/40 65p	CRS1/60 60p	CRS2/10 60p	CRS2/20 62p	CRS2/40 62p	CRS2/400 £1-00
CRS16/100 85p	CRS16/200 90p	CRS16/500 £1-80	C106D 45p	C106E 70p	40669 90p	TiC44 35p	2N4444 £1-90	BT10/500A 90p

## BRIDGE RECTIFIERS

W02 1A 20V 50p	BY164 1-4A 87p	MDS952.2 6A 50p	100V 80p
----------------	----------------	-----------------	----------

## ZENER DIODES

BZV88 Series 400mW	3-V-33V, 5% 11p	1.5W range 25p	10W range 45p
--------------------	-----------------	----------------	---------------

## L.E.D.

TIL209 20p	HP5082 28p	MA2082R 20p
------------	------------	-------------

## L.D.R.

ORP12 75p	NE555 Timer 55p
-----------	-----------------

## TO3 VOLTAGE REGULATORS

L005 5V 650mA	L036 12V 500mA	L037 15V 450mA
---------------	----------------	----------------

## VERO BOARD

2 1/2 x 3 1/2 32p	2 1/2 x 5 32p	3 1/2 x 3 1/2 35p	3 1/2 x 5 40p	1 7/8 x 2 1/2 £1-05	1 7/8 x 3 £1-43	1 7/8 x 5 £1-84	PIN INS. TOOL 72p	S.P.F. CUTTER 52p	100 PINS SS 30p	100 PINS DS 30p	500 PINS SS £1-55	500 PINS DS £1-55
-------------------	---------------	-------------------	---------------	---------------------	-----------------	-----------------	-------------------	-------------------	-----------------	-----------------	-------------------	-------------------

## PERSONAL CALLERS ALWAYS WELCOME

## TRIACS

TXL228B 8A 400V 85p	SC40D £1-40	SC40E £1-65	SC45D £1-70	SC45E £2-10	SC50D £2-42	SC50E £2-70	DIAC 25p
---------------------	-------------	-------------	-------------	-------------	-------------	-------------	----------

## LINEAR I.C.s

LM304 Reg. £1-80	LM309K 5V 1A Voltage Reg. £2-10	LM723C 2.37V 150mA Voltage Reg. £1-05	MFC4000 250mW Audio 75p	TBA800 5 watt Audio 93p	709C Op Amp D.I.L./TO99 45p	741C Op Amp 8/14 D.I.L./TO99 25p	748C Op Amp D.I.L. 75p	747C Dual Op Amp £1-20	ZN414 Radio I.C. £1-25	TAD100 Radio I.C. Inc. Filter £1-90	CA3014 £1-55	CA3018 £1-00	CA3028 £1-20	CA3036 £1-00	CA3046 80p	CA3048 £2-35	CA3075 £1-80	CA3090C £4-95	MC1303L £2-20	MC1310P £2-80
------------------	---------------------------------	---------------------------------------	-------------------------	-------------------------	-----------------------------	----------------------------------	------------------------	------------------------	------------------------	-------------------------------------	--------------	--------------	--------------	--------------	------------	--------------	--------------	---------------	---------------	---------------

## NECESSARY TOOLS

100 PINS SS 30p	100 PINS DS 30p	500 PINS SS £1-55	500 PINS DS £1-55
-----------------	-----------------	-------------------	-------------------

## ALSO STOCKED

BNC PLUGS at 35p each  
UHF (N) PLUGS at 50p each.  
Industrial, R.F., Military, Multitway too numerous to list. Also a large stock of Multitway cable to suit.  
All the above are new in original packets. Please add 8% VAT P & 3p.

## Potentiometers

Linear or Log	Single	Double
Rotary Pots	20p	45p
Rotary Switched	30p	—

## ★★ SPECIAL OFFERS ★★

MINIATURE MAINS TRANSFORMER. PRI 240V SEC. 12V 100mA Manuf.: Hinchley. Size: 36 x 45 x 40mm F.C. 53mm. Price 1—65p, 100—80p ea. 1,000—50p ea. 10,000—40p ea. 8% VAT.

## MINIATURE MAINS TRANSFORMER.

Primary 115/240V Sec. 18V/250mA at 80p ea. + VAT and postage 33p, 8% VAT.

## MULLARD POT CORE TYPE FX2241 at 60p ea. + 33p p.p. 8% VAT.

## 24V D.C. SOLENOID by MAGNETIC DEVICES

6069 each. 2 1/2in long x 1/2in x 1/2in + 8% VAT.

## 240V A.C. SOLENOID. Reversible operation: twin coil. Size approx. 2 1/2 x 1 1/2 x 1 1/2in 90p.

30 unmarked OC71 transistors 75p

A million plus Metal Oxides always in stock.

TR4/TR5 3p each; TR6 4p each; TR8 7p each.

Manufacturers phone for quantity discounts. Please state voltage required.

50 GE Diode OA47 equivalent £1-00

8µF 600V WKG PAPER CAPACITORS. Ideal for Strobe Constructors £1-50 each + 8% VAT + 33p post.

Many other values of PAPER CAPACITORS in stock. Phone for details.

PLESSEY AIRSPACED CAPACITORS to suit 1in spindle:

100pF Two Gang at 55p + 25% VAT

500pF Two Gang at 75p + 25% VAT.

## MULLARD TUBULAR CERAMIC UHF TRIMMERS (PROFESSIONAL)

Type 082 0.8-2.2pF

801 0.8-2.2pF Price 10p ea.

991 0.5-1.5pF

## QUANTITY DISCOUNTS PLEASE TELEPHONE 1,000pF Feedthrough capacitor 5p ea.

Miniature tubular P.C. trimmers

3-5-13pF 10p ea.

Wire wounds from 1/2 watt to 100 watts. Please phone for prices, etc.

Gold Flashed professional TRANSISTOR SOCKETS. To suit small signal TO18, etc. 30 for £1-00 + 8% VAT.

W. WOUND POTS 1Ω-100KΩ at 30p each

Colvern or Reliance styles + 25% VAT.

VERO EDGE CONNECTOR 2 1/2 way 0-1in pitch 30p each + 8% VAT. All the other sizes in stock.

SIEMENS VARLEY RELAY 4P C/O 700Ω 24V 50p each.

PLESSEY RELAY 2P C/O 6V operation 40p each.

MODERN DISC CERAMICS £1-00 a hundred, £8-00 a thousand + 25% VAT. Phone or write for list.

## ACCESSORIES

DIL SOCKETS, 8 pin 14p, 14 pin 14p, 16 pin 14p. Mica Washers + 2 Bushes (TO3 or TO6) 4p.

## METAL BOXES

ALUMINIUM BOXES IDEAL FOR VERO BOARD WITH BASE AND P.K. screws

Length	Width	Height	Price
AB7 2 1/2in	5 1/2in	1 1/2in	60p
AB8 4in	4in	1 1/2in	60p
AB9 4in	2 1/2in	1 1/2in	80p
AB10 4in	5 1/2in	1 1/2in	80p
AB11 4in	2in	2in	85p
AB12 3in	2in	1in	50p
AB13 6in	4in	2in	77p
AB14 7in	5in	2 1/2in	90p
AB15 8in	6in	3in	£1-16
AB16 10in	7in	3in	£1-32
AB17 10in	4in	3in	£1-10
AB18 12in	5in	3in	£1-32
AB19 12in	8in	3in	£1-80

## ALUMINIUM BOXES WITH SLOPING TOP PANEL—IDEAL FOR PRE-AMPS, ETC., USING SLIDER CONTROLS

AB20 8in Long 9in Wide 3 1/2in High at back

2in High at front 6in Slope to front

With P.K. Screws

AB21 As above but 10in long £2-20

AB22 As above but 12in long £2-50

## ★★ SPECIAL OFFERS ★★

MULTICORE CABLE. 20 way 7/0076 plus Screen at 70p per yard plus postage by weight.

MULTICORE CABLE. 25-way, individually screened, 14/0076. £1-00 per yard plus V.A.T. Postage by weight

# More than just a catalogue

## Projects for you to build

4-digit clock, 6-digit clock, 10W high quality power amp., High quality stereo pre-amp., Stereo Tuner, F.M. Stereo decoder, etc., etc. ....

CIRCUITS ... Frequency Doublers, Oscillators, Timers, Voltmeters, Power Supplies, Amplifiers, Capacitance Multiplier, etc., etc. ....

Full details and pictures of our wide range of components, e.g. capacitors, cases, knobs, veroboards, edge connectors, plugs and sockets, lamps and lampholders, audio leads, adaptor plugs, rotary and slide potentiometers, presets, relays, resistors (even 1% types!), switches, interlocking pushbutton switches, pot cores, transformers, cable and wire, panel meters, nuts and bolts, tools, organ components, keyboards, L.E.D.'s, 7-segment displays, heatsinks, transistors, diodes, integrated circuits, etc., etc., etc. ....



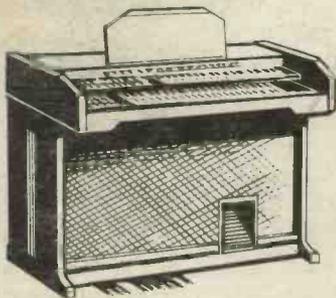
132 pages!

**MAPLIN  
ELECTRONIC  
SUPPLIES**  
SUPERSONIC  
SAME-DAY-SERVICE  
QUALITY COMPONENTS  
-FAST!

REALLY GOOD VALUE FOR MONEY AT JUST 40p.

NOW TURN TO PAGE 209  
FOR A SELECTION OF  
THE COMPONENTS  
WE STOCK

## ELECTRONIC ORGAN



Build yourself an exciting Electronic Organ. Our leaflet MESS1, price 15p, deals with the basic theory of electronic organs and describes the construction of a simple 49-note instrument with a single keyboard and a limited number of stops.

Leaflet MESS2, price 15p, describes the extension of the organ to two keyboards each with five voices and the extension by an octave of the organ's range.

Solid-state switching and new footages along with a pedal board and a further extension of the organ's range are shown in leaflet MESS3, priced at 35p. (Pre-publication price 15p.)

## No more doubts about prices

Now our prices are GUARANTEED (changes in VAT excluded) for two month periods—and we'll tell you about price changes in advance for just 30p a year (refunded on purchases). If you already have our catalogue send us an S.A.E. and we'll send you our latest list of GUARANTEED prices. Send us 30p and we'll put you on our mailing list—you'll receive immediately our latest price list then every two months from the starting date shown on that list you'll receive details of our prices for the next GUARANTEED period before the prices are implemented!—plus details of any new lines, special offers, interesting projects—and clip-off coupons to spend on components to repay your 30p when used as directed.

NOTE: The price list is based on the Order Codes shown in our catalogue so an investment in our super catalogue is an essential first step.

Call in at our shop, 284 London Road, Westcliff-on-Sea, Essex. Please address all mail to P.O. Box 3, Rayleigh, Essex, SS6 8LR.

## SYNTHESISER



A reprint of the complete article giving full construction details published by 'Electronics Today International' between January-

September '74 of the International Voltage Controlled Synthesiser, developed as a 'state of the art', now available, price £1.50. S.A.E. please for detailed price list.

## GRAPHIC EQUALISER



A really superior high quality stereo graphic equaliser as described in the January edition of 'Electronics Today International'.

We stock all the parts (except woodwork) including the metalwork drilled and printed. 15p brings you a reprint of the article.

**MAPLIN  
ELECTRONIC  
SUPPLIES**

P.O. Box 3 Rayleigh Essex SS6 8LR.  
Telephone: Southend-on-Sea (0702) 44101