

ADD 2003
PRACTICAL

ELECTRONICS

JULY 1976

35p

PE DIGISCOPE...



**ALSO IN
THIS ISSUE...**

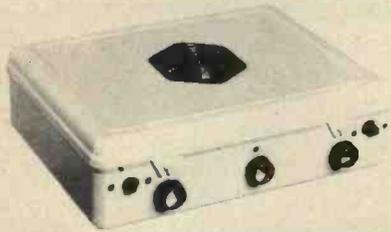
- **FLUORESCENT
LIGHT INVERTER**
- **AUTOSTOP for
Model Railways**
- **RADIO CONTROL
SYSTEM 2...
Receiver and Decoder**

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 Loudspeaker Radio MW/LW.
- 5 Transistor Short Wave Radio
- Electronic Metronome
- Electronic Noise Generator
- 24 Resistors
- 21 Capacitors
- 10 Transistors
- 31 Loudspeaker
- 2 Batteryless Crystal Radio
- One Transistor Radio
- 2 Transistor Regenerative Radio
- 3 Transistor Regenerative Radio
- Audible Tester
- Sensitive Pre-Amplifier.
- Earpiece
- Mica Baseboard
- 3 Knobs
- 1 Tuning Condenser
- 3 Knobs
- Ready Wound MW/LW/SW Coils
- Ferrite Rod
- 63 yards of wire
- 1 yard of sleeving, etc.

Complete kit of parts including construction plans

Total building costs £9.00 (Overseas Seamail P. & P. £3.50)
P.P. and Ins. 65p

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.

Uses a retractable chrome plated telescopic aerial, gain control, V.H.F. tuning capacitor, transistor, etc.

All parts including case and plans

£3.95 P.P. & Ins. 40p

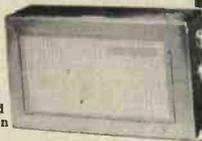


POCKET FIVE

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

Complete kit of parts including construction plans.

Total Building Costs: £3.60 P.P. and Ins. 50p



NEW Everyday Series

Build this exciting new series of designs.

E.V.5. 5 Transistors and 2 diodes. MW/LW. Powered by 4 1/2 V battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3in loudspeaker. Attractive case with red speaker grille. Size 9in. x 5 1/2in. x 2 1/2in. approx. All parts including Case and Plans.

Total Building costs £4.30 P. & P + Ins. 50p

E.V.6. Case and looks as above. 6 Transistors 3 diodes. Powered by 9V battery. Ferrite rod aerial, 3in. loudspeaker, etc. MW/LW coverage. Push/Pull output.

All parts including Case and Plans.

Total Building costs £4.95 P. & P. + Ins. 50p

E.V.7. Case and looks as above, 7 Transistors and 3 diodes. Six wavebands, MW/LW, Trawler Band SW1, SW2, SW3, powered by 9V battery. Push pull output. Telescopic aerial for short waves. 3in. Loudspeaker. All parts including Case and Plans.

Total Building Costs £6.35 P. & P. + Ins. 50p

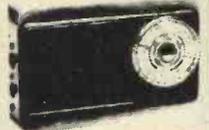


TRANSONA FIVE

NOW WITH 3" LOUDSPEAKER

Wavebands, transistors and speaker as Pocket Five. Larger Case with Red Speaker Grille and Tuning Dial. Plans and Parts Price List free with parts.

Total Building Costs £4.05 P.P. and Ins. 50p



EDU-KIT

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



Five unit including master unit to construct

Components include: Tuning condenser, 2 volume controls, 2 slider switches, fine tune 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.

All parts including case and plans. **£6.30** P.P. and Ins. 55p

ELECTRONIC CONSTRUCTION KITS

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

8 transistors and 2 diodes. Push pull output. 3in loudspeaker, gain control, superb 9 section 5in/12v ratchet and retractable chrome plated telescopic aerial, V.H.F. tuning capacitor, resistors, capacitors, transistors, etc. Will receive T.V. sound, public services 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 **£7.15** P.P. and Ins. 55p

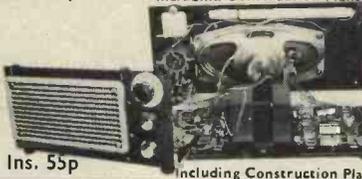


Including Construction Plans

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 **£6.55** P.P. and Ins. 55p



Including Construction Plans

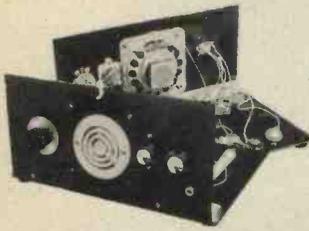
EDU-KIT JUNIOR

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

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

All parts including loudspeaker, earpiece, MW ferrite rod aerial, capacitors, resistors, transistors, etc.

Complete kit of parts **£6.55** P. & P. + Ins. 55p



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. SPECIAL APPLICATION—Can also be used as a versatile signal injector. Complete with earpiece, jack plug and socket resistors, capacitors, components, etc.

Complete kit of parts **£2.85** P. & P. including construction plans + Ins. 30p



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

Tel.: 0234 52367, REG NO. 788372

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

I enclose £..... for

Name

Address

PE776

PRACTICAL ELECTRONICS

VOLUME 12 No. 7 JULY 1976

CONSTRUCTIONAL PROJECTS

- CAR INTRUDER ALARM** *by J. Haggis*
Sounds the horn intermittently if doors, boot or bonnet are opened 548
- P.E. DIGISCOPE** *by R. W. Coles & B. Cullen*
A hand held, 1MHz low voltage oscilloscope with an i.e.d. display 553
- PROPORTIONAL RADIO CONTROL—2** *by J. D. Whiteley*
A 9-channel 27MHz system with options of proportional or switched control on each channel. This month the Receiver, Interface and Decoder 568
- FLUORESCENT LIGHT INVERTER** *by A. J. Bassett*
Allows large fluorescent tubes to be driven from a car battery without the need for a choke or starter 576
- AUTO-STOP FOR MODEL RAILWAYS** *by E. A. Parr*
A design to halt a model train at stations for a predetermined time 580

GENERAL FEATURES

- SEMICONDUCTOR UPDATE** *by R. W. Coles*
A look at some recently released devices 558
- USING CMOS DIGITAL I.C.s—7** *by D. B. Johnson-Davies & A. M. Marshall*
The last in this series of basic CMOS digital devices 584
- INGENUITY UNLIMITED**
Tacho Slave—Sound to Light System—Quiz Buzzer—Fuse Failure Warning—Electronic Dice—Digital Model Control—Novel Memory 589

NEWS AND COMMENT

- EDITORIAL—A Powerful Combination** 547
- NEWS BRIEFS**
- Cable Ship—Microprocessor Tutor 559
- SPACEWATCH** *by Frank W. Hyde*
Solar Energy—Satcom Launches 560
- PARIS COMPONENTS SHOW** *by D. Gibson*
News from the Continent 563
- ALL ELECTRONICS SHOW** *by G. Godbold*
A look at one of the new London Spring collections 567
- INDUSTRY NOTEBOOK** *by Nexus*
What's happening inside industry 579
- PATENTS REVIEW**
Extending patents—Why not a trademark?—Improved bass 583
- POINTS ARISING**
P.E. Digi-Probe—Digital Frequency Meter 594

Our August issue will be published on Friday, July 9, 1976
(for details of contents, see page 573)

© 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.

It's here!

The Minisonic Mk. 2 has arrived—available NOW for the first time in kit form, the Minisonic 2 probably represents the best value for money in electronic music today.

Kits are available for complete instruments or individual sections, or for the conversion of Mk. 1 Minisonics to Mk. 2 specification. (Conversion details apply to Eaton Audio P.C.B.s, but may be adapted to suit others.)

In order to ensure that the appearance of the complete instrument enhances its performance, a complete cabinet kit is available, incorporating a fully finished black enamelled, silk-screened front panel, with matching back and base, and solid Afromosia end-cheeks. This kit also includes all switches, knobs, sockets, screws and panel indicators. Suitable keyboards and contact assemblies are also in stock.

READY-MADE INSTRUMENTS AVAILABLE



SEPARATE KITS

Cabinet Kit (inc. Keyboard, etc.) MS/2-1 & 2	192.84
Keyboard Controller MS/2-3	8.87
Voltage Controlled Oscillator MS/2-4 (Note—2 off MS/2-4 required)	16.96
Sync. Kit MS/2-4sync	
Envelope Shaper/VCA MS/2-5 (Note—2 off MS/2-5 required)	6.68
H.F. Oscillator/Detector MS/2-6	1.94
Hold Isolator MS/2-7	3.24
Voltage Controlled Filter MS/2-8	7.54

Ring Modulator MS/2-9	3.75
Noise Generator MS/2-10	2.00
Output Amplifier MS/2-11	8.93
Control Envelope Inverter MS/2-12	0.91
Stabilised Power Supply MS/2-13	9.00

CONVERSION KITS

Ancillary Functions Kit MS/2-14C	11.57
Oscillator Conversion Kit MS/2-15C (Note—2 off MS/2-15C required)	11.04

SEPARATE ITEMS

P.C. Boards—Main PCB EAO14	3.80
Power Supply EAO15	1.80
Dual Transistor MD8001	1.20
Operational Amplifier LM318N	2.00
Field Effect transistor 2N5459	0.48
Multi-Turn Preset Pots 1K, 10K, 20K	0.96

Send large S.A.E. for further details and contents of kits

SOME SALE ITEMS STILL AVAILABLE. HURRY, WHILST STOCKS LAST

LINEARS

CA3046	0.60
MC1306P	0.53
MFC4000B	0.45
2N424E	3.00
741	0.22
741 SCP	1.10

PANELS & PCBs

PE Minisonic EA008	2.50
--------------------	------

Minisonic PSU EA011	1.60
Minimix—6 Composite	2.00
Minimix—8 front panel	4.18

CAPACITORS

Axial Lead—Electrolytic	
22µF 10V	2 for 25p
1500µ 18V	2 for 25p
150µF 50V	2 for 10p
100µF 10V	2 for 10p
50µF 15V	2 for 6p
22µF 10V	2 for 6p

VERO CARDFRAME SYSTEM

Case KMVIF	11.50
End Angles (PR) HWV1F	0.55
8in. Module KRV1F	2.40
4in. Module K4V1F	1.80
2in. Panel F2V1F	0.65
1in. Panel F1V1F	0.60
Plug 19124/SS31	0.80
Socket 19125/SF31	0.70
Card Handles (10 off)	0.60
Veroboard Panel E100	0.75
Module MGB/19012	0.70

Send S.A.E. for further details

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 on the £1.

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 44 page FREE book now. No obligation and nobody will call on you. It could be the best thing you ever did.

This 44 page FREE book shows how!

CUT OUT THIS COUPON
CHOOSE A BRAND NEW FUTURE HERE!

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

- | | | |
|---|---|---|
| <input type="checkbox"/> Practical Radio and Electronics (Technetron)
<input type="checkbox"/> Electronic Engineering
<input type="checkbox"/> Television Maintenance and Servicing
<input type="checkbox"/> General Radio and TV Engineering
<input type="checkbox"/> Radio Servicing, Maintenance and Repairs | <input type="checkbox"/> C. & G. Radio, TV & Electronics, Mechanics
<input type="checkbox"/> Radio Amateurs
<input type="checkbox"/> Practical TV
<input type="checkbox"/> Colour Television
<input type="checkbox"/> Servicing
<input type="checkbox"/> Computer Electronics
<input type="checkbox"/> C. & G. LI Radio TV Servicing cert.
<input type="checkbox"/> Post Master General 1st & 2nd class certs.
<input type="checkbox"/> C. & G. Electrical Engineering Practise | <input type="checkbox"/> C. & G. LI Installations and Wiring
<input type="checkbox"/> General Electrical Engineering
<input type="checkbox"/> Society of Engineers (Electrical Engineering)
<input type="checkbox"/> Electrical Installations and Wiring
<input type="checkbox"/> C. & G. Electrical Technicians (Primary)
<input type="checkbox"/> C. & G. Telecommunications |
|---|---|---|

To **ALDERMASTON COLLEGE** Dept. EPE 19 Reading RG7 4PF

Also at our London Advisory Office, 4 Fore St. Avenue, Moorgate, London EC2Y 5EJ. Tel: 01-428 2721.

NAME (Block Capitals Please)

ADDRESS

POSTCODE

Age

Other subjects

Accredited by C.A.C.C.

Member of A.B.C.C.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

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 4½ x 2 x 1½in. Ideal for low cost stage and disco lighting. Used by schools, theatres, studios, etc. Complete with scale plate, fixing screws and full instructions. £9.06 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 x 8½ x 5in. Price £140.40 inc. VAT.

DD61-B. Six 1kW channels, using module PMSD1000, lowest cost system. Size 16½ x 8 x 5in. Price £64.50 inc. VAT.

DD62M. As DD61M but with six 2kW channels, size 25 x 10½ x 6in. Price £205.20 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



Get a great deal from

Marshall's

A Marshall (London) Ltd Dept: PE
40/42 Cricklewood Broadway London NW2 3ET
Tel: 01-452 0161/2 Telex: 21492
& 85 West Regent St Glasgow G2 2QD
Tel: 041-332 4133
& 1 Straits Parade Fishponds Bristol BS16 2LX
Tel: 0272-654201/2
& 27 Rue Danton Issy Les Moulineaux
Paris 92

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

Trade and export enquiries welcome

Catalogue price 35p (30p for callers)

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

2N456	0-80	Yellow	0-12	2N5190	0-92	AF106R	0-40	BC207	0-12	BF160	0-23	LOO5T1	1-50	OC42	0-50
2N456A	0-85	Orange	0-12	2N5191	0-96	AF114	0-35	BC208	0-11	BF163	0-32	LM380	0-98	OC35	0-32
2N457A	1-20	2N3053	0-25	2N5192	1-24	AF115	0-35	BC212	0-16	BF166	0-40	LM381	2-07	OC71	0-17
2N490	4-00	2N3054	0-60	2N5195	1-48	AF116	0-35	BC212L	0-16	BF167	0-25	LM709	0-97	OC72	0-25
2N491	4-00	2N3055	0-65	2N5245	0-29	AF117	0-35	BC214L	0-16	BF173	0-27	TO99	0-38	OC81	0-25
2N492	5-00	2N3390	0-45	2N5246	0-48	AF118	0-35	BC237	0-16	BF177	0-20	8D1L	0-45	OC83	0-24
2N493	5-22	2N3391	0-28	2N5294	0-48	AF124	0-30	BC238	0-15	BF178	0-35	8D1L	0-40	OC84	0-25
2N696	0-22	2N3391A	0-29	2N5296	0-48	AF125	0-30	BC239	0-15	BF179	0-43	LM714	0-60	OC85	0-24
2N697	0-16	2N3392	0-15	2N5298	0-50	AF126	0-28	BC251	0-25	BF180	0-35	LM723C	0-66	OC86	0-24
2N698	0-82	2N3393	0-15	2N5457	0-29	AF127	0-28	BC253	0-25	BF181	0-36	LM741	0-60	OC87	0-24
2N699	0-59	2N3394	0-15	2N5458	0-28	AF139	0-65	BC257	0-18	BF182	0-35	TO99	0-40	OC88	0-24
2N706	0-14	2N3402	0-18	2N5459	0-28	AF188	0-46	BC258	0-18	BF183	0-35	8D1L	0-40	OC89	0-24
2N706A	0-16	2N3403	0-19	2N5492	0-58	AF200	0-65	BC259	0-17	BF184	0-30	14D1L	0-38	OC90	0-24
2N708	0-17	2N3414	0-20	2N5494	0-58	AF239	0-65	BC281	0-25	BF185	0-30	LM747	1-05	OC91	0-24
2N709	0-42	2N3415	0-21	2N5496	0-61	AF240	0-90	BC282	0-22	BF194	0-12	LM748	0-60	OC92	0-24
2N711	0-20	2N3416	0-24	2N5777	0-45	AF279	0-70	BC263	0-25	BF195	0-12	8D1L	0-44	OC93	0-24
2N718	0-53	2N3417	0-29	2N6027	0-45	AF280	0-79	BC300	0-38	BF196	0-13	14D1L	0-41	OC94	0-24
2N718A	0-28	2N3440	0-58	2N6128	0-45	AL103	1-00	BC301	0-34	BF197	0-15	LM3900	0-61	OC95	0-24
2N720	0-57	2N3441	0-57	2N6139	1-42	AL103	1-00	BC302	0-28	BF198	0-18	LM7805P	1-60	OC96	0-24
2N720A	0-22	2N3442	1-40	2N6140	1-00	BC107	0-14	BC303	0-54	BF200	0-40	LM7812P	1-60	OC97	0-24
2N738	0-28	2N3638	0-15	2N6141	0-81	BC108	0-14	BC307	0-17	BF225J	0-23	LM7815P	1-60	OC98	0-24
2N738A	0-28	2N3638A	0-15	2N6200	2-49	BC109	0-15	BC308A	0-15	BF244	0-21	LM7824P	1-60	OC99	0-24
2N929	0-25	2N3639	0-27	40361	0-40	BC113	0-15	BC309C	0-20	BF245	0-45	MC1303	1-50	OC100	0-24
2N930	0-26	2N3641	0-17	40362	0-45	BC115	0-17	BC317	0-12	BF246	0-58	MC1310	2-50	OC101	0-24
2N1302	0-19	2N3702	0-12	40363	0-88	BC116	0-17	BC318	0-12	BF247	0-65	MC1330P	0-90	OC102	0-24
2N1303	0-19	2N3703	0-13	40389	0-46	BC116A	0-18	BC337	0-20	BF254	0-19	MC1351P	0-80	OC103	0-24
2N1304	0-26	2N3704	0-15	40394	0-56	BC117	0-21	BC338	0-20	BF255	0-19	MC1352P	0-80	OC104	0-24
2N1305	0-24	2N3705	0-15	40395	0-65	BC118	0-14	BCY30	1-03	BF257	0-47	MC1466	3-50	OC105	0-24
2N1306	0-21	2N3706	0-15	40406	0-65	BC119	0-29	BCY31	1-06	BF258	0-53	MC1469	2-75	OC106	0-24
2N1307	0-30	2N3707	0-18	40407	0-35	BC121	0-35	BCY32	1-18	BF259	0-55	ME0402	0-20	OC107	0-24
2N1308	0-47	2N3708	0-14	40408	0-50	BC125	0-16	BCY33	0-56	BF259	0-24	ME0404	0-13	OC108	0-24
2N1309	0-47	2N3709	0-15	40409	0-52	BC126	0-23	BCY34	0-50	BF259	0-24	ME0412	0-18	OC109	0-24
2N1671	1-54	2N3710	0-15	40410	0-52	BC132	0-30	BCY38	1-00	BF521A	2-30	ME4102	0-11	OC110	0-24
2N1671A	1-67	2N3711	0-15	40411	2-00	BC134	0-13	BCY39	1-00	BF528	1-36	ME4104	0-11	OC111	0-24
2N1671B	1-85	2N3712	1-20	40534	0-74	BC135	0-13	BCY40	0-87	BF561	0-27	ML480	0-95	OC112	0-24
2N1711	0-27	2N3713	1-20	40535	0-84	BC136	0-17	BCY42	0-28	BF568	0-25	ML481	1-20	OC113	0-24
2N1907	5-50	2N3722	0-12	40601	0-61	BC137	0-17	BCY48	0-30	BFX23	0-35	ML490	1-05	OC114	0-24
2N1908	0-50	2N3715	1-50	40602	0-61	BC140	0-68	BCY51	0-30	BFX29	0-30	ML2955	1-00	OC115	0-24
2N2147	0-78	2N3716	1-80	40603	0-58	BC141	0-68	BCY70	0-17	BFX87	0-28	MLJ2955	1-20	OC116	0-24
2N2148	0-94	2N3717	2-20	40604	0-56	BC142	0-23	BCY71	0-22	BFX85	0-35	MLJ340	0-48	OC117	0-24
2N2160	0-30	2N3772	1-80	40636	1-10	BC143	0-25	BCY72	0-18	BFX87	0-28	MLJ2955	1-20	OC118	0-24
2N2218A	0-47	2N3773	2-65	40673	0-73	BC147	0-10	BD115	0-75	BFX88	0-30	MLJ3055	0-75	OC119	0-24
2N2219	0-42	2N3789	2-06	40673	0-73	BC148	0-09	BD116	0-75	BFX89	0-30	MLJ3070	0-65	OC120	0-24
2N2219A	0-52	2N3790	2-40	AC126	0-20	BC125	0-13	BD121	1-00	BFY50	0-30	MLJ371	0-75	OC121	0-24
2N2220	0-25	2N3791	2-35	AC127	0-40	BC153	0-18	BD123	0-82	FFY51	0-28	MLJ520	0-60	OC122	0-24
2N2221	0-18	2N3792	2-60	AC128	0-35	BC154	0-18	BD124	0-82	FFY52	0-30	MLJ521	0-70	OC123	0-24
2N2221A	0-21	2N3794	2-24	AC151V	0-27	BC157	0-16	BD131	0-40	BFY53	0-26	MP8111	0-32	OC124	0-24
2N2222	0-20	2N3819	0-37	AC152V	0-35	BC158	0-18	BD132	0-50	BFY90	1-27	MP8112	0-40	OC125	0-24
2N2222A	0-25	2N3820	0-29	CI153	0-49	BC160	0-78	BD135	0-21	BRV39	0-48	MP8113	0-47	OC126	0-24
2N2366	0-17	2N3923	0-58	AC153K	0-40	BC167B	0-15	BD136	0-28	BSX20	0-28	MPF102	0-39	OC127	0-24
2N2369	0-20	2N3904	0-19	AC154	0-25	BC168B	0-15	BD137	0-24	BSX21	0-30	MPSA05	0-25	OC128	0-24
2N2369A	0-22	2N3906	0-19	AC176	0-41	BC168C	0-15	BD138	0-26	BU105	2-50	MPSA06	0-31	OC129	0-24
2N2646	0-55	2N4036	0-67	AC176K	0-35	BC169B	0-15	BD139	0-71	BU205	2-50	MPSA12	0-35	OC130	0-24
2N2647	0-98	2N4037	0-42	AC178K	0-40	BC189C	0-15	BD140	0-87	CI06D	0-85	MPSA55	0-25	OC131	0-24
2N2904	0-48	2N4058	0-18	AC188K	0-40	BC170A	0-15	BD141	0-87	CA3029A	1-80	MPSA56	0-31	OC132	0-24
2N2904A	0-45	2N4059	0-15	AC187	PR	BC171	0-16	BD142	0-87	CA3028A	0-78	MPSU05	0-65	OC133	0-24
2N2905	0-47	2N4060	0-15	AC188	0-95	BC172	0-12	BDY20	1-05	CA3035	1-37	MPSU06	0-68	OC134	0-24
2N2905A	0-50	2N4061	0-15	AD142	0-57	BC177	0-19	BF115	0-29	CA3046	0-70	MPSU55	0-63	OC135	0-24
2N2906	0-33	2N4062	0-15	AD143	0-74	BC178	0-18	BF121	0-35	CA3048	2-11	MPSU56	0-80	OC136	0-24
2N2906A	0-42	2N4063	0-28	AD149V	1-15	BC179	0-21	BF121	0-35	CA3052	1-82	NE555V	0-70	OC137	0-24
2N2907	0-22	2N4299	0-34	AD150	0-75	BC182	0-12	BF123	0-35	CA3080A	1-08	NE566	1-30	OC138	0-24
2N2907A	0-24	2N4919	0-95	AD161	0-69	BY182L	0-12	BF125	0-25	CA3090C	0-23	NE561	4-40	OC139	0-24
2N2924	0-20	2N4920	1-10	AD162	0-69	BC183L	0-12	BF152	0-20	LM301A	0-48	NE565A	4-48	OC140	0-24
2N2925	0-20	2N4921	0-83	AD161	PR	BC184	0-13	BF154	0-25	LM308	1-17	OC28	1-48	OC141	0-24
2N2926	0-18	2N4922	1-00	AD162	1-58	BC184	0-13	BF154	0-20	LM308A	1-17	OC28	1-48	OC142	0-24
Green	0-12	2N4923	1-00	AF106	0-40	BC184L	0-13	BF159	0-27	LM309K	1-88	OC35	1-16	OC143	0-24

NEW RANGE TOOLS—HIGH QUALITY

MINIATURE ELECTRONIC PLIERS

INSULATED HANDLES

Round nose box joint 4in £2-50

long

Diagonal cutters box joint £2-80

4in long

Flat nose box joint 4in long £2-40

Snipe nose box joint 4in long £2-40

P.C. MARKER PEN DALO 33PC, 87p.

ZENER DIODES 400MW 11p, 1W 17p, 2-5W 35p.

IC SOCKETS 8 DIL 12p, 14 DIL 14p, 16 DIL 16p.

RESISTORS ½w 2p (100 per value 0-013p); ¼w 3p (100 per value 0-02p)

SCORPIO CAR IGNITION KIT £12-75.

JUMBO 7 SEGMENT DISPLAYS £2.

DIL 707 £1-75.

MINITRON £1-50.

LEDs Red, green and yellow, 20 dia, 32p.

SEE MARSHALL'S FOR CMOS

CD4000	0-18	CD4018	0-88	CD4042	0-70
CD4001	0-18	CD4019	0-52	CD4043	0-83
CD4002	0-18	CD4020	0-88	CD4044	0-77
CD4003	0-98	CD4021	0-88	CD4045	1-30
CD4007	0-18	CD4022	0-85	CD4046	1-20
CD4008	0-82	CD4023	0-18	CD4047	0-85
CD4009	0-52	CD4024	0-72	CD4048	0-45

RST VALVE MAIL ORDER CO.

Climax House
159 Fallsbrook Road, London SW16 6ED
SPECIAL EXPRESS MAIL ORDER SERVICE

	£p		£p		£p		£p		£p
1N21	0-17	AF181	0-50	BY213	0-25	OAZ205	0-45	ZS170	0-12
1N23	0-35	AF186	0-48	BY210	0-45	OAZ206	0-45	ZS271	0-20
1N85	0-88	AFZ11	1-15	BY211	0-40	OAZ207	0-45	ZT21	0-25
1N203	0-50	AFZ12	2-00	BY212	0-40	OAZ208	0-40	ZT43	0-25
1N256	0-50	ASY29	0-45	BY213	0-42	OAZ209	0-40	ZTX107	0-12
1N645	0-16	ASY36	0-25	BY215	1-25	OAZ210	0-40	ZTX108	0-10
1N725A	0-20	ASY50	0-20	BY216	0-60	OAZ211	0-40	ZTX300	0-13
1N914	0-06	ASY51	0-40	BZY88	0-10	OAZ222	0-45	ZTX304	0-24
1N4007	0-12	ASY53	0-20	C111	0-55	OAZ223	0-45	ZTX500	0-13
18113	0-25	ASY55	0-20	CRS1/05	0-45	OAZ224	0-45	ZTX503	0-18
18202	0-23	ASY62	0-25	CRS1/40	0-65	OAZ241	0-25	ZTX531	0-25
2G371	0-75	ASZ21	1-00	C84B	1-80	OAZ242	0-15		
2G381	0-22	ASZ23	0-75	CS10B	3-50	OAZ244	0-25		
2G414	0-30	AU104	1-00	DD000	0-15	OAZ246	0-15		
2G417	0-25	AUY10	1-50	DD003	0-15	OC16	1-38		
2N404	0-22	BC107	0-14	DD008	0-25	OC16T	1-00		
2N697	0-18	BC108	0-13	DD007	0-40	OC22	1-00		
2N698	0-30	BC109	0-14	DD008	0-35	OC23	1-25		
2N706	0-12	BC113	0-15	GD3	0-33	OC24	1-10		
2N706A	0-12	BC115	0-20	GD4	0-10	OC25	0-40		
2N708	0-15	BC116	0-20	GD5	0-33	OC26	0-40		
2N709	0-40	BC116A	0-23	GD8	0-25	OC28	0-75		
2N1091	0-55	BC118	0-20	GD12	0-10	OC29	0-65		
2N1131	0-25	BC121	0-20	GET102	0-50	OC30	0-40		
2N1132	0-24	BC122	0-20	GET103	0-40	OC35	0-75		
2N1302	0-18	BC125	0-68	GET113	0-35	OC36	0-80		
2N1303	0-18	BC126	0-65	GET114	0-30	OC41	0-35		
2N1304	0-28	BC140	0-55	GET115	0-90	OC42	0-40		
2N1305	0-22	BC147	0-10	GET116	0-85	OC43	0-70		
2N1306	0-28	BC148	0-08	GET120	0-50	OC44	0-20		
2N1307	0-28	BC149	0-10	GET122	0-30	OC44M	0-17		
2N1308	0-28	BC157	0-14	GET175	0-40	OC45	0-20		
2N2147	1-25	BC166	0-12	GET880	0-60	OC49M	0-18		
2N2148	0-20	BC160	0-63	GET881	0-25	OC46	0-27		
2N2160	0-78	BC169	0-14	GET882	0-35	OC57	0-60		
2N2218	0-23	BCY31	0-45	GET885	0-40	OC58	0-80		
2N2219	0-25	BCY32	0-85	GEX44	0-08	OC59	0-80		
2N2369A	0-16	BCY33	0-88	GEX45/1	0-45	OC66	0-50		
2N2444	1-99	BCY34	0-45	GJ3M	0-50	OC71	2-85		
2N2413	0-75	BCY38	1-00	GJ4M	0-50	OC72	0-28		
2N2446	0-50	BCY39	1-50	GJ5M	0-25	OC73	0-50		
2N2904	0-20	BOY40	0-80	GJ7M	0-50	OC74	0-30		
2N2906	0-20	BCY42	0-45	HG1005	0-50	OC75	0-80		
2N2907	0-23	BCY70	0-18	HS100A	0-20	OC76	0-30		
2N2924	0-13	BCY71	0-22	MAT100	0-20	OC77	0-54		
2N2925	0-15	BCZ10	0-60	MAT101	0-25	OC78	0-25		
2N2926	0-12	BD121	1-00	MAT120	0-20	OC79	0-30		
2N3055	0-65	BD123	1-00	MAT121	0-25	OC81	0-29		
2N3702	0-11	BF185	0-65	MEJ340	0-47	OC81M	0-20		
2N3705	0-15	BF186	0-25	MEJ341	1-45	OC82	0-18		
2N3706	0-11	BF187	0-25	MEJ355	0-77	OC82	0-28		
2N3707	0-13	BF173	0-28	MFP102	0-40	OC82D	0-25		
2N3709	0-10	BF181	0-35	MFP103	0-38	OC83	0-80		
2N3710	0-11	BF184	0-22	MFP104	0-35	OC84	0-30		
2N3819	0-88	BF194	0-82	MFP105	0-38	OC114	0-88		
2N4289	0-30	BF195	0-13	NKT128	0-45	OC122	1-00		
2N5027	0-53	BF196	0-15	NKT129	0-30	OC123	1-10		
2N5098	0-33	BF197	0-15	NKT211	0-25	OC139	1-00		
28301	0-89	BF197	0-15	NKT212	0-25	OC140	1-14		
28304	1-15	BF861	0-25	NKT214	0-24	OC141	0-80		
28501	0-75	BF898	0-25	NKT216	0-40	OC169	0-20		
28703	1-00	BFX12	0-20	NKT217	0-45	OC170	0-80		
40250	0-54	BFX29	0-28	NKT218	0-45	OC171	0-30		
40251	0-83	BFX30	0-28	NKT219	0-33	OC200	1-00		
A1129	0-20	BFX30	0-28	NKT222	0-30	OC201	1-50		
AAZ12	0-75	BFX35	0-88	NKT224	0-25	OC202	1-50		
AAZ13	0-12	BFX63	0-50	NKT251	0-24	OC203	1-25		
AAZ17	0-13	BFX85	0-25	NKT271	0-20	OC204	1-75		
AC107	0-51	BFX86	0-25	NKT272	0-20	OC205	1-50		
AC126	0-25	BFX87	0-25	NKT275	0-25	OC206	1-10		
AC127	0-25	BFX88	0-24	NKT277	0-20	OC207	1-00		
AC187	0-21	BFY10	0-50	NKT278	0-25	OC460	0-20		
AC188	0-20	BFY17	0-40	NKT301	1-00	OC470	0-80		
AC177	0-75	BFY18	0-45	NKT403	1-00	OC771	1-20		
ACY18	0-35	BFY19	0-55	NKT404	1-00	ORP12	0-80		
ACY20	0-35	BFY24	0-45	NKT773	0-25	ORP60	0-55		
ACY21	0-35	BFY44	1-00	NKT773	0-25	ORP61	0-48		
ACY22	0-85	BFY51	0-20	NK1777	0-38	8X68	0-28		
ACY27	0-25	BFY52	0-20	OA3	0-72	8X635	0-55		
ACY28	0-25	BFY53	0-17	OA6	0-12	8X640	0-75		
ACY39	0-78	BFY64	0-38	OA7	0-08	8X641	0-75		
ACY40	0-22	BFY90	0-81	OA70	0-10	8X642	0-60		
ACY44	0-32	BHX27	0-50	OA71	0-20	8X644	0-85		
AD140	0-50	BHX60	0-93	OA73	0-15	8X645	0-85		
AD149	0-75	BHX78	0-18	OA74	0-15	TIC44	0-29		
AD181	0-44	BSY26	0-17	OA81	0-18	V15/30P	0-75		
AD182	0-44	BSY27	0-20	OA85	0-15	V30/201P	0-75		
AF114	0-25	BSY51	0-50	OA86	0-15	V60/201	0-50		
AF115	0-25	BSY95A	0-12	OA90	0-07	V60/201E	0-75		
AF116	0-25	BT102/500R	0-75	OA95	0-07	XA101	0-18		
AF117	0-24	BT102/500R	0-75	OA95	0-07	XA102	0-18		
AF118	0-57	BTY42	0-92	OA200	0-08	XA151	0-15		
AF119	0-20	BTY79/100R	0-75	OA202	0-08	XA152	0-15		
AF124	0-30	BTY79/400R	0-75	OA210	0-20	XA161	0-25		
AF125	0-30			OA211	0-35	XA162	0-25		
AF126	0-30			OA220	0-50	XB101	0-45		
AF127	0-30			OAZ201	0-45	XB102	0-30		
AF130	0-41			OAZ202	0-45	XB103	0-30		
AF178	0-55			OAZ203	0-45	XB103	0-30		
AF179	0-65			OAZ204	0-45	XB113	0-80		
AF180	0-55					XB121	0-45		

Open daily to callers: Mon.-Fri. 9 a.m.-5 p.m.
Valves, Tubes and Transistors - Closed Saturday
Terms C.W.O. only - Tel. 01-677 2424-7
Quotations for any types not listed.
Post and Packing 15p per order.
V.A.T. Plastic Transistors 12½%. Metal Can Transistors 8%. Integrated Circuits 8%.

Sparkrite mk2

Capacitive discharge electronic ignition

VOTED BEST OF 8 SYSTEMS TESTED BY 'POPULAR MOTORING' MAGAZINE



- * Smoother running
- * Instant all-weather starting
- * Continual peak performance
- * Longer coil/battery/plug life
- * Improved acceleration/top speeds
- * Up to 20% better fuel consumption

Sparkrite Mk. 2 is a high performance, high quality capacitive discharge, electronic ignition system in kit form. Tried, tested, proven, reliable and complete. It can be assembled in two or three hours and fitted in 15/30 mins.

Because of the superb design of the Sparkrite circuit it completely eliminates problems of the contact breaker. There is no misfire due to contact breaker bounce which 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 transistors or the SCR. (Most capacitive discharge ignitions are not completely foolproof in this respect). All kits fit vehicles with coil/distributor ignition up to 8 cylinders.

THE KIT COMPRISES EVERYTHING NEEDED
Ready drilled pressed steel case coated in matt black epoxy resin, ready drilled base and heat-sink, 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/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.
Also available RPM limiting control for dashboard mounting (fitted in case on ready built unit).

CALLERS WELCOME. For Crypton tuning and fitting service - phone (0922) 33008.

PRICES INCLUDE VAT, POST AND PACKING.

Improve performance & economy NOW

POST TODAY!

Quick installation
No engine modification required

Electronics Design Associates, Dept. PE6,
82 Bath Street, Walsall, WS1 3DE. Phone: (0922) 33652

Name

Address

16 pin DIL 0-15

16 pin DIL 0-17

Plug in sockets - low profile

	QUANTITY REQD.	
Mk. 2 DIY Ass. Kit @ £11.80		I enclose cheque/PO's for £
Mk. 2 Ready Built Negative Earth @ £14.97		Cheque No.
Mk. 2 Ready Built Positive Earth @ £14.97		
Ignition Changeover switches @ £4.30		
R.P.M. Limit systems in above units @ £2.42		Send SAE if brochure only required.

Prices correct when going to press.

DECIMO

VATMAN SCIENTIFIC (illus.)—Large green display, 8-digits, 2 exponents, 4 trig log functions 10^{10} radian degrees, exchange, memory, π , reciprocal, X^2 , etc. Single function keyboard. 20 hr battery life. £25.00*



MINI-VATMAN—Green display, smaller and slimmer than Vatman. 8-digits, % key, $\sqrt{\quad}$. £8.90*

MINI-VATMAN M—As above but with % and full-function memory. £11.50*

VATMAN (illus.)—8-digit, % key, green display. £9.75*



SUPER-VATMAN—Similar to above but with full-function memory, X^2 , reciprocal, π , $\sqrt{\quad}$. £12.75*

ROCKWELL

63R (illus.)—8-digit, 2 exponent, 10^{10} memory, 2-level parentheses, all trig and log functions, degree radian, factorial, reciprocal, π , $\sqrt{\quad}$, etc. Rechargeable. £25.86(R)



44RD—9-digit or 5-digit + 2 exp. Green display. Store. Similar to 63R less factorial. £18.95*

64RD—12-digit or 8-digit + 2 exp. Additional to 44RD: Polar rec. co-ordinates. Log, rad, or grad. £23.97*

51R—8-digits, metric and currency converter. £21.95(R)

8R—8-digits, % key. £8.75*



20R (illus.)—8-digits, % key, full-function memory. £10.95*

24RD—Green display, $\sqrt{\quad}$, 8-digit. £13.75*

24K (illus.)—Stainless-steel slimline, green display, beautiful leatherette wallet to hold pen, note-pad (all included) and credit cards. Full memory, $\sqrt{\quad}$, click-buttons. Rechargeable. £21.95(R)



NOVUS

4520—8-digit, 10^{10} exponent, RPN logic, full trig and log functions, 4-roll stack, memory, memory exchange, $\sqrt{\quad}$, degree and radian. Rechargeable. £22.90(R)



4525—Rechargeable. Programmable version of 4520. £45.90(R)

4510—8-digits, 3 level stack, all trig and log function, $\sqrt{\quad}$, π , reciprocal, memory, etc. £14.90*

4515—100-step programmable version. £37.90(R)

6020—Financier. £17.95*

6025—Financier 100-step programmable. Rechargeable. £45.90(R)

2030—Statistician. £17.80*

6035—100-step programmable Statistician. Rechargeable. (Inc. recharger) £45.90(R)

TEXAS

SR50A (illus.)—10-digit, 2 exponent, all trig and log functions, hyperbolic, X to the root of Y , radian and degree, factorial, memory, etc. Rechargeable. £34.29(R)



SR51A—As above but with 3 independent memories, linear regression, mean, variance, standard deviation, permutation, random number generation plus 20 basic conversions and their inverse. Rechargeable. £49.90(R)

NEW SR52—244 programme steps. 20 inde. memories, 9 level parentheses. Card programmable. Supplied with 20 blank magnetic cards and programme manual. FREE manual on any one of the following: 1 Statistics. 2 Electrical Engineering. 3 Mathematics. 4 Finance. £249.99(R)

sinclair

NEW SCIENTIFIC—only 4½in x 2½in x ½in yet has 8-digits or 5+2 exponents. Using the NEW chip, it has full algebraic logic and many more functions. Algebraic logic is constant on all four arithmetic functions.



Functions: C & CE key • sin • cos • tan • arcsin • arccos and tan • reciprocal • E to the X • natural log • antilog • $\sqrt{\quad}$ • memory + • memory - • memory exchange • memory cancel • EE exponent • change notation • PLUS a degree radian switch! ONLY £14.60

OXFORD 300—Larger version of above. £17.95*

CAMBRIDGE £8*

CAMBRIDGE MEMORY £10.75*

OXFORD 150 £8.95

CBM

4190(R)—10 digits, 2 exponents, 90 Programme scientific. Statistical and metric conversions. £44.93(R)

£1800—Similar to the 4148R. Green display. Battery operated. £24.50*

7919D—Students Scientific. Full trig and logs, 8-digit or 5 + 2 exponents. Reciprocal, π , $\sqrt{\quad}$ memory. £13.90

796D—8-digits, % and store. £6.75*

997R—Rechargeable % and full memory. £12.50(R)

4148R (illus.)—10-digits, 2 exponents. Full log and trig functions. X^2 Reciprocal, π , X root of Y , Polar rectangular co-ordinates. 2-store memory. Rechargeable. Mean and Standard deviation. £32.50(R)



ALL PRICES INCLUDE VAT. Please add 55p P. & P.

CASIO

FX-20 (illus.)—Full trig and log functions: 8-digit mantissa or 6-digit mantissa and 2-digit exponents; 10^{10} to 10^{-99} ; bright green display; full sin, cos, tan, inverse sin, inverse cos, inverse tan; log X and ln x, e^x , X^y , $\sqrt{\quad}$, reciprocal degree radian conversion; memory and exponent key. ONLY £16.00*



FX-15—As above but larger and including a larger display, X^2 key, π key, reciprocal key. ONLY £20.00*

FX-101—De Luxe model with similar functions to the FX-15 but 8-digits + 2 exponents 10^{10} to 10^{-99} . OUR PRICE £25.00*

8R—Memory, % key. £8.95*

POCKET 8s—% key. £7.95*

POCKET MINI-MEMORY—% key, bright green display. £9.95*

ALL ITEMS CARRY A FULL YEAR'S GUARANTEE

* Free B.S.I. adaptor. (R) Free re-charger.

JUST ARRIVED—THE NEW TEXAS SR56

100-step programmable—10-digit, 2 exponents, 10 independent memories, 2 loop control instructions, 4 additional and 3 unconditional branch instructions, plus 4 levels of subroutines, all log, trig and statistical functions! £79.90(R)

Digital Watches

EXELAR

5-Function digital watch in stainless-steel finish with matching bracelet. Shows hours, minutes, seconds date. Plus a.m. Indicator and hold and fade out. £21.90



Gold finish £23.90

ASTRA

3-Functions Shows hrs, mins and secs. Single button operation. Limited supplies at this low price. ONLY £13.95 with strap. Gold finish £15.95



THE SUPERB 10-function PULSTRONIC

Shows date and month in correct order! Single button control. Display visible in pitch dark. Hrs, Mins, Secs, Date • Month in letters. Day of Week in letters. Self-adjusting calendar. Auto hold and fade-out. A.M. setting Indicator. P.M. setting Indicator. Undoubtedly one of the most sophisticated watches available at this unbeatable price! Styled in finest solid Stainless-steel, satin finished with polished bevelled edges. Complete with adjustable matching stainless-steel bracelet AND a FREE presentation box. Extra batteries £1.15 per pair



LIMITED STOCKS ONLY £37.40

ORDER FORM

PHONE CALLS AND PERSONAL CALLERS WELCOME MONS-THURS BETWEEN 2 and 5 p.m., SUNDAY 10 a.m. to 1 p.m. 01-458 4755.

To: BARCLAY ELECTRONICS Dept. PE8B, TEMPLE FORTUNE, 1115 FINCHLEY ROAD, LONDON N.W.11

Please Send me with/without optional mains adaptor. I enclose cheque/money order total value £..... including 55p to cover P. & P.

NAME ADDRESS

barclay

BI-PAK

High quality audio



STEREO FM TUNER

Fitted with Phase Lock-loop Decoder

- ★ FET Input Stage
- ★ VARI-CAP diode tuning
- ★ Switched AFC
- ★ Multi turn pre-sets
- ★ LED Stereo Indicator

Typical Specification:
Sensitivity 3µ volts
Stereo separation 30dB
Supply required 20-30V
at 90 Ma max.

OUR PRICE ONLY

£19.95

The 450 Tuner provides instant programme selection at the touch of a button ensuring accurate tuning of 4 pre-selected stations, any of which may be altered as often as you choose, by simply changing the settings of the pre-set controls.
Used with your existing audio equipment or with the BI-KITS STEREO 30 or the MK60 Kit etc. Alternatively the PS12 can be used if no suitable supply is available, together with the Transformer T461. The S450 is supplied fully built, tested and aligned. The unit is easily installed using the simple instructions supplied.



AL 60

VAT
ADD
12 1/2 %

25 Watts
(RMS)

- Max Heat Sink temp. 90°C.
- Frequency response 20Hz.
- Distortion better than 0.1 at 1kHz.
- Supply voltage 15-50V.
- Thermal Feedback.
- Latest Design Improvements.
- Load—3, 4, 5 or 16 ohms.
- Signal to noise ratio 80dB.
- Overall size 63 x 13mm.

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

ONLY **£3.95**

Stabilised Power Supply Type SPM80

SPM80 is especially designed to power 2 of the AL60 Amplifiers, up to 15 watts (r.m.s.) per channel simultaneously. With the addition of the Mains Transformer BMT80, the unit will provide outputs of up to 1.5A at 35V. Size: 63 x 105 x 30mm. Incorporating short circuit protection.

INPUT VOLTAGE
OUTPUT VOLTAGE
OUTPUT CURRENT
OVERLOAD CURRENT
DIMENSIONS
TRANSFORMER BMT80

33-40V A.C.
33V D.C. Nominal
10mA-1.5 amps
1.7 amps approx.
105 x 63 x 30mm
£2.60 + 62p postage

£3.00

STEREO PRE-AMPLIFIER PA 100



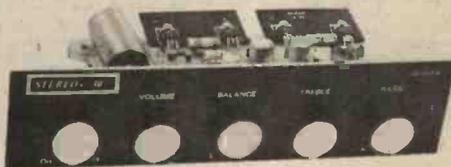
A top quality stereo pre-amplifier and tone control unit. The six push-button selector switch provides a choice of inputs together with two really effective filters for high and low frequencies, plus tape output.

Frequency Response +1dB 20Hz-20kHz.
Sensitivity of inputs:
1. Tape input 100mV into 100k ohms
2. Radio Tuner 100mV into 100k ohms
3. Magnetic P.U. 3mV into 50k ohms
P.U. input equalises to R1AA curve within 1dB from 20Hz to 20kHz.
Supply 20-35V at 20mA. Dimensions —298 x 89 x 35mm.

£13.50 P. & P. 45p

MK60 AUDIO KIT:
Comprising: 2 x AL60's, 1 x SPM80, 1 x BMT80, 1 x PA100, 1 front panel and knobs, 1 kit of parts to include on/off switch, neon indicator, stereo headphone sockets plus instruction booklet. COMPLETE PRICE £27.55 plus 62p postage.
TEAK 60 AUDIO KIT:
Comprising: Teak veneered cabinet size 168 x 114 x 31in. other parts include aluminium chassis, heatsink and front panel bracket plus back panel and appropriate sockets etc. KIT PRICE £9.20 plus 62p postage.

STEREO 30 COMPLETE AUDIO CHASSIS



7 + 7 WATTS R.M.S.
The Stereo 30 comprises a complete stereo pre-amplifier, power amplifiers and power supply. This, with only the addition of a transformer or overwind will produce a high quality audio unit suitable for use with a wide range of inputs i.e. high quality ceramic pick-up, stereo tuner, stereo tape deck etc. Simple to install, tons, black front panel, knobs, mains switch, fuse and fuse holder and universal mounting brackets enabling it to be installed in a record plinth, cabinets of your own construction or the cabinet available. Ideal for the beginner or the advanced constructor who requires HI-FI performance with a minimum of installation difficulty (can be installed in 30 mins.).

TRANSFORMER **£2.45** plus 62p P. & P.
TEAK CASE **£3.65** plus 62p P. & P.

£15.75 P. & P. 45p

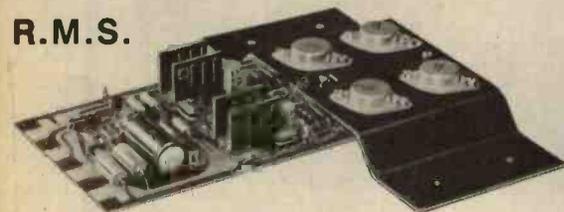
equipment mono and other modules for Stereo

IT'S NEW!

IT'S POWERFUL

IT'S THE AL250

**125 watts
R.M.S.**



POWER AMPLIFIER

Specially designed for use in—
Disco Units, P.A. Systems, high power
Hi-Fi, Sound reinforcement systems

The module has a sensitivity of 450mV and a frequency response extending from 25Hz to 20kHz whilst distortion levels are typically below 0.1%. The use of 4, 115W transistors in the output stage makes the unit extremely rugged while damage resulting from incorrect or short-circuit loads is prevented by a four transistor protection circuit.

The unit is intended for use in many applications such as disco units, sound reinforcement systems, background music players, etc.

SPECIFICATION:

Output Power: 125 watt RMS
Continuous
Operating voltage: 50-80
Loads: 4-16 ohms
Frequency response: 25Hz-20kHz
Measured at 100 watts
Sensitivity for 100 watts output at
1kHz: 450mV
Input impedance: 33k ohms

Total harmonic distortion
50 watts into 4 ohms: 0.1%
50 watts into 8 ohms: 0.06%
S/N ratio: better than 80dBs
Damping factor, 8 ohms: 65
Semiconductor complement: 13
transistors 5 diodes
Overall size: Heatsink width
190mm, length 205mm, height
40mm

ONLY £15.95 + 8% VAT

**MPA
30**



Enjoy the quality of a magnetic cartridge with your existing ceramic equipment using the new Bi-Pak M.P.A. 30 which is a high quality pre-amplifier enabling magnetic cartridges to be used where facilities exist for the use of ceramic cartridges only. Used in conjunction are 4 low noise, high gain silicon transistors. It is provided with a standard DIN input socket for ease of connection. Supplied with full, easy-to-follow instructions.

£2.65

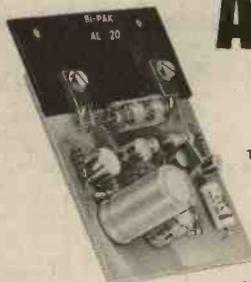
**VAT
ADD
12½%**

**POSTAGE &
PACKING**

Postage & Packing add 25p unless otherwise shown. Add extra for airmail. Min. £1-00

AL10-20-30

**AUDIO AMPLIFIER
MODULES**



The AL10, AL20 and AL30 units are similar in their appearance and in their general specification. However, careful selection of the plastic power devices has resulted in a range of output powers from 3 to 10 watts R.M.S. The versatility of their design makes them ideal for use in record players, tape recorders, stereo amplifiers and cassette and cartridge tape players in the home. Harmonic Distortion $P_o = 3$ watts $f = 0.25\%$ Load Impedance 8-16 ohm

Frequency response $\pm 3dB$ $P_o = 2$ watts 50Hz-25kHz
Sensitivity for Rated O/P— $V_s = 25V$, $R_L = 80$ ohm
 $f = 1kHz$ 75mV. RMS. Size: 75 x 63 x 25mm.

AL10 3W
R.M.S.

£2.30

AL2 5W
R.M.S.

£2.65

AL30 10W
R.M.S.

£2.95

NEW

**PA 12
£6.50**

NEW PA12 Stereo Pre-Amplifier completely redesigned for use with AL10 20 30 Amplifier Modules. Features include on/off volume, Balance, Bass and Treble controls. Complete with tape output. Frequency Response 20Hz-20kHz (±3dB)
Bass and Treble range $\pm 12dB$
input Impedance 1 meg ohm
Input Sensitivity 300mV
Supply requirements 24V, 5mA
Size 152 x 64 x 33mm

PS 12

Power supply for AL10/20/30, PA12, S450 etc. Input voltage 15-20V a.c. Output voltage 22-30V d.c. Output Current 800mA Max. Size 60 x 43 x 26mm.

Transformer T538 £2-30

£1-20

BI-PAK

P.O. BOX 6, WARE, HERTS

united electronics

A complete range of Disco Mixers, Power Amps and Electronic Modules

Distributed by mail only; write to:

PARBOLD ELECTRONICS

17 Chorley Road, Hilldale, Parbold, Lancs. WN8 7AN

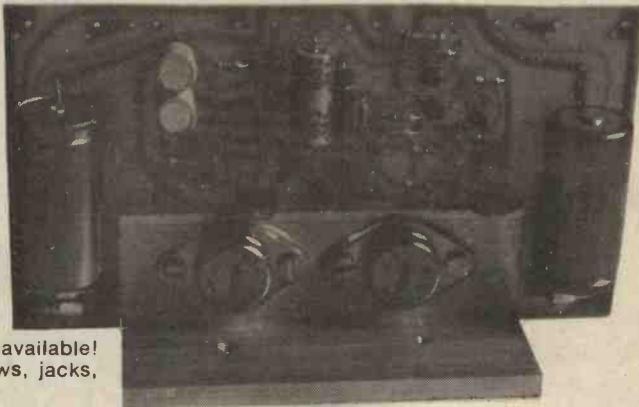
ALL PRICES INCLUDE VAT AND P. & P.

PA110 (as illustrated): 110W 4 Ω with 45-0-45V d.c. 3A P.S.U. All you need is Amp Card and Transformer! Hi-power, hi-fidelity and low noise! Hundreds of satisfied users! Kit £19.50; Built £24.50; Trans. £9.90

PA50: 50W 4 Ω with 45V d.c. 2A P.S.U. 150W output transistors and 5 diode protection circuit. Fuses and capacitors on P.S.U. Built £7.95; P.S.U. Card Built £5.95; Transformer £4.95

IC2/4: Input Microchip Pre-amp to suit either amp unit. Factory set at 14mV 50K Ω . Linear adjustable to 3mV 47k Ω . R1a mag. equalised or any magnetic crystal or ceramic device. High or low Imp.! Up to 2.5V output available! Cadmium-plated chassis kit with knobs, screws, jacks, etc., £9.95 (screen printed and drilled). Package deal PA110 £61.95; PA50 £49.95.

Chunky 3in thick metal-cornered Wooden Cabinet with heavy-duty feet and handles, really professional finish, £8.95. Mono Disco Pre-amp: Kit £49; Built £69. Stereo Discomix: Kit £79; Built £119. Fuzz Lights: red, blue, amber, green, £19.50. Super Teak Cabinets: 7 x 4in £3.90; 8 x 5in £4.90; 8in £5.90; 10in £7.90; 12in £8.90; TW £9.90. Heavy Duty Black Cabinets: 12in £12.90; 2 x 12in £16.90; 15in £19.90; 15in Bin £36.90; 4 x 12in Tall £24.90.



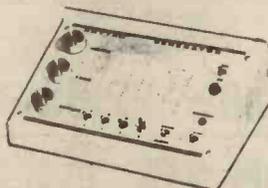
ANNOUNCEMENT

P.W. RHYTHM GENERATOR.

SWING, WALTZ, ROCK, TANGO, CHA CHA, MARCH, MAMBA, FOX TROT, SHUFFLE.

ALL COMPONENT PARTS ARE AVAILABLE SEPARATELY S.A.E. FOR LISTS, OR FOR PRICING.

Tel. 0246-31475



FULL KIT: £37.50 + £1.00 (includes V.A.T.)

KIT INCLUDES NEW UPDATED P.C.B.'s

With Printed layout for easy assembly, all components "nice" switches and knobs, case, in fact everything you need to complete this very exciting Project.

P.C.B.'s ARE AVAILABLE SEPARATELY

Set of NEW UPDATED P.C.B.'s with a printed layout, made in first class quality fibre-glass, by a well known national company.

Price on application to:

ASTRO/WKF INC.
1 QUEEN STREET NORTH
WHITTINGTON MOOR,
CHESTERFIELD,
DERBYSHIRE
Tel: 0246-31475



SPECIAL OFFER

ALWAYS SHELVES FULL OF ODD UNITS, CHASSIS, etc. Many bargains for callers. Lists also available S.A.E.

12in LONG PERSISTENCE CRT. New, boxed. Last few 100 to clear at £1 each, or Carr. at £2.50 each.

MIN. TRANSFORMER. 240V input, 3V 1A output. Brand new. Now only 25p each, P. & P. 50p.

WIDE RANGE WOBBULATOR 5MHz to 150MHz up to 15MHz sweep width. Only 3 controls, preset RF level, sweep width and frequency. Ideal for 10.7 or TV 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.

NEW—UPGRADED CONTENTS—FOR LESS MONEY. * 3lb electronic goodies, £1.60 post paid. * High value printed board pack—hundreds of components, transistors, etc.—no flat to the board transistors, £1.65 post paid.

GRATICULES 12 x 14cm high quality plastic 15p each, P. & P. 10p. * 1000pF feed thru capacitors 10 for 30p, P. & P. 15p. * CAPACITOR pack 50 brand new components only 50p, P. & P. 48p.

FIBREGLASS BOARD PACK. More board—less money. Larger pieces. Not less than 2.5 sq. ft for 95p, P. & P. 65p. Double or single sided cut to any size. New lower price 1p per sq.in, P. & P. extra.

* METER PACKS—3 different meters £2, P. & P. £1.

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

* TRIMMER PACK. 2 twin 50/200pF ceramic, 2 twin 10/80pF 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.

* TELEPHONES. Post Office Style 746. Black or two tone grey £8.50 each. Modern Style 706 Black or two tone grey £4.50 each. Modern Standard Style in grey or black with a place to put your fingers like the 746, £3 each. As above but discoloured grey only £2 each. All telephones complete with standard dial and bells. P. & P. all styles 75p each.

HANDSETS complete with 2 inserts and lead £1.75 each, P. & P. 65p.

* CRYSTALS. 4-43MHz. Brand new, Now at 25p each, P. & P. 15p.

* BEEHIVE TRIMMERS 3/30pF. Brand new, 10 off 40p, P. & P. 15p; 100 off £3.50, P. & P. 75p; 500 off £15, P. & P. £1.25; 1,000 off £25, P. & P. 1.50.

MUFFIN FANS. 115V, size 5 x 5 x 1 1/2in. Superly quiet and reliable. Ex. eq. but tested. £1.50 each, P. & P. 75p.

* POT PACK. All brand new modern. Single and ganged. Our choice. 7 for 25p, P. & P. 48p.

BNC PLUG TO BNC PLUG LEAD. Assembled ready to use 75p each, P. & P. 20p. Ex-eq. BNC socket 15p, BNC plug 20p. BNC Plug and Socket 30p, pair, P. & P. 15p.

Minimum Mail Order £2... excess postage refunded. VAT NOT INCLUDED IN PRICE

Goods marked * 12% VAT, otherwise 8%

OPEN 9 a.m. to 5-30 p.m. ANY DAY



CHILTHAM LTD

7/9 ARTHUR ROAD, READING, BERKS.
(rear Tech. College) Tel. Reading 582605



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 1/2 in. x 3 in. x 2 in.

Mono kit **£11-25** Stereo kit **£18** post 45p.
Easy to build. Full instructions supplied.



ELAC 10 inch

Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps. Bass resonance 55 cps. 8 ohm impedance, 10 watts

£4-95

TEAK VENEER HI-FI SPEAKER CABINETS

MODEL "A". 20 x 13 x 12in. For 12in. dia. **£11-25** Post 75p

MODEL "B". 16 x 10 x 9in. For 13 x 8in. **£6-95** Post 45p

LOUDSPEAKER CABINET WADDING 18in. wide. 25p ft.

BAKER RECOMMENDED 12 inch Enclosure 4 cubic ft. HI-FI CABINET £19-35 Carr. £2 each. Few only. Size 30 x 20 x 12in. Teak. Finish Fluted Front.

TEAKWOOD LOUDSPEAKER FRONT GRILL Modernise your cabinets with the Grooved look. 10 1/2" x 7 1/2" 45p.

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 £6-25.

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** Post 45p.

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated. **£3-95**

WAFER HEATING ELEMENTS

THIN Size 10 1/2 x 8 1/2 x 1/4 in. Operating voltage 200/250V a.c. 250 watts approx. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos.

ONLY 40p EACH (FOUR FOR £1-50) ALL POST PAID—Discounts for quantity.

E.M.I. 13 1/2 x 8 in. SPEAKER SALE!

With flared tweeter cone and ceramic magnet. 10 watt, 8 ohm. **£3-45** Bass res. 45-60 cps. Flux 10,000 gauss. Post 45p

With tweeter. And crossover. 10 watt. State 3 or 8 ohm. As illustrated. **£5-25** Post 45p

15 watt model 8 or 15 ohm £8.

BAKER MAJOR 12" £10-35



Post 50p
30-14,500 c/s. 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s. Rated 25 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit. 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£13**

Please state 8 or 8 or 15 ohms. Post 80p

"BIG SOUND" BAKER SPEAKERS

Robustly constructed to stand up to long periods of electronic power. As used by leading groups and discos

Useful response 30-13,000 cps. Bass Resonance 55 cps.

GROUP "25" **£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**
60 watt 8 or 15 ohms. Post 80p

GROUP "50" **£19-50**
15in. 75 watt
8 or 15 ohms. Post 80p

Group + PA Cabinets in stock Send for Leaflet.

BAKER 50 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 2 way mixing. Output 8/15 ohm. A.C. Mains. Separate treble and bass controls.

NEW 150 WATT MODEL 4 way mixing £88. NEW "DISCO 100 WATT" **£52**

ALL PURPOSE AMPLIFIER CHASSIS **£1** Carr. £1
2 inputs. 4 outputs separate volume treble and bass controls. Ideal disco or slave amplifier chassis. WOOD CABINET. AVAILABLE £9.

PW SOUND TO LIGHT DISPLAY

Complete kit of parts with R.C.S. printed circuit. Three 1000 watt channels. As featured in December Practical Wireless. **£12-50** CABINET extra £3.

GOODMANS CONE TWEETER

18,000 cps. 25 watts 8 ohm. Price **£3-25**

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 outputs. 3 or 8 or 15 ohm 100V line. To order. Suitable carrying case **£16-50** **£85** plus £2-50 carr.

E.M.I. GRAM MOTOR 120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2 1/2 x 2 1/2 x 1 in. **£1-25** Post 30p.

E.M.I. TAPE MOTOR 4 pole, 240v. 185 mA. 1400 rpm Spindle 3/4 in. diameter. 120v version £1. (Illustrated). Size 3 1/2 x 2 1/2 x 2 1/2 in. **£2-00** Post 30p

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 month guarantee. AC 200/250v. Size 13 1/2 x 11 1/2 in. Above motor board 3 1/2 in. Below motor board 2 1/2 in. With STEREO/MONO CARTRIDGE **£10-25**

Post 75p

PORTABLE PLAYER CABINET £4-50

Modern design. Size 18" x 14" x 7" recess Post 50p. Covered. Large front grille. Hinged Lid. Chrome fittings. Motor board cut for Garrard or BSR deck. Few only, in red and black.



R.C.S. DISCO DECK SINGLE RECORD PLAYER

Fitted with auto stop, stereo/compost. cartridge. Base-plate. Size 11in. x 8 1/2 in. Turntable. Size 7in. diameter A/C mains. 220/250V.

3 speeds plays all size records. **£6-25** Post 45p
Two for £12. Post 75p

HEAVY METAL PLINTHS

With P.V.C. Cover. Cut out for most B.S.R. or Garrard decks. Silver grey finish. 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. **£5-95** £6-50 Post 75p

TINTED PLASTIC COVERS ONLY

Sizes: 'A'—14 1/2" x 12 1/2" x 4 1/2", £2-50. 'B'—20 1/2" x 12 1/2" x 4 1/2", £3. 'C'—17 1/2" x 13 1/2" x 4 1/2", £3-25. 'D'—18 1/2" x 14" x 4 1/2", £3-50. Ideal for record decks, tape decks, etc. Post 75p.

BAKER HI-FI SPEAKERS HIGH QUALITY — BRITISH MADE SUPERB

12in. 25 watts

A high quality loudspeaker, its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special capacitor drive and concentric tweeter cone resultant in full range reproduction with remarkable efficiency in the upper register. Bass Resonance 25cps Flux Density 15,000 gauss Useful response 20-17,000cps 8 or 15 ohms models.

£15-50 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. Bass Resonance 35cps Flux Density 16,000 gauss Useful response 25-16,000cps 8 or 15 ohms models.

£15-50 Post 80p

AUDITORIUM

15in. 45 watts

Bass Resonance 35cps Flux Density 15,000 gauss Useful response 20-14,000 cps 8 or 15 ohms models.

£19-50 Post 80p

RADIO COMPONENT SPECIALISTS

Minimum post 30p.

Access and Barclaycard Welcome.

Radio Books & Components Lists 10p.

337 WHITEHORSE ROAD, CROYDON

Open 9-6 Wed. 9-1 Sat. 9-5 (Closed for lunch 1.15-2.30) Rail Selhurst. Tel. 01-684 1665

Random Flasher Unit



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 14 1/2 inches



B.C. Fitting **£9.55**
E.S. Fitting **£10.35**
EACH

Sound to Light MASTER UNIT 600 WATTS PER CHANNEL



£30.95

INCLUDING CHANNEL OUTPUT PLUGS AND MAINS INLET SOCKET

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** EACH | E.S. Fitting **£7.26** EACH

TWIN BANK 12 LIGHT UNIT Length 31 1/2 (less lamps)



B.C. Fitting **£15.60** EACH | E.S. Fitting **£17.00** EACH

100 WATT SPOT LAMPS
RED, YELLOW, GREEN
BLUE, CLEAR **£1.18** each
B.C. or E.S. Fitting **£3.54**

ALL PRICES INCLUDE V.A.T. (and POST & PACKING where necessary to the United Kingdom only)

Send 20p for illustrated leaflet & price list.

ALBEN ENGINEERING CO. LTD.
DEPT. PE THE CRESCENT, WORSTHORNE,
BURNLEY, LANCs. Tel. Burnley 20940

TRANSISTORS AND RECTIFIERS

BC RANGE	187	9p	177	45p*	183	27p
107	9p*	168	9p	178	45p*	27p*
108	9p*	169	9p	185	30p*	200
109C	9p*	170	8p	186	30p*	222
113	9p*	171	8p	187	38p*	BFX 67
114	9p	172	8p	199	38p*	BFX 88
115	9p	173	8p			20p
116	9p	174	15p			
117	12p	177	12p*	BF RANGE		
118	8p	178	12p*	117	27p*	
119	20p*	179	12p*	137	27p*	TIP RANGE
120	20p*	182	8p	177	24p	29
125	9p	183	8p	178	24p	30p
126	9p	184	8p	179	24p*	31A
132	8p	185	18p	180	27p*	32A
134	8p	186	13p*	181	27p*	41A
135	8p	187	14p*	182	27p*	42A
136	9p	212	8p*			48p*
137	9p*	301	18p*	RECTIFIERS		
139	15p*	302	18p*	1N4001 1A 50V PIV		41p
140	15p*	303	18p*	1N4002 1A 100V PIV		41p
141	18p*	304	18p*	1N4003 1A 200V PIV		41p
142	15p*			1N4004 1A 400V PIV		5p
143	15p*			1N4005 1A 600V PIV		5p
145	15p			1N4006 1A 800V PIV		51p
147	9p*			1N4007 1A 1kV PIV		51p
148	8p	115	27p*	1N5400 3A 50V PIV		30
149	8p	131	30p*	1N5401 3A 100V PIV		71p
153	9p	132	32p*	1N5402 3A 200V PIV		8p
154	9p	137	27p	1N5403 3A 300V PIV		81p
157	8p	139	38p	1N5404 3A 400V PIV		9p
158	8p	140	38p	1N5405 3A 500V PIV		9p
159	8p	155	38p	1N5406 3A 600V PIV		81p
160	15p*	175	38p*	1N5407 3A 800V PIV		10p
161	15p*	176	38p*	1N5408 3A 1kV PIV		101p

Transistor mounting kit (Mica washer and 2 bushes) 5p
Other transistors and rectifiers available on request
Items marked * carry 8% VAT. Unmarked items carry 12 1/2% VAT. Please add 20p for packing and postage with each order
Goods advertised in previous Nos. of this Magazine still available. S.A.E. for latest list

M. DZIUBAS

158 Bradshawgate • BOLTON • Lancs.

Tel. Bolton 29324

ELECTROTIME

SPECIALISTS IN ELECTRONIC TIMEKEEPING

ELECTRONIC DIGITAL ALARM CLOCK MODEL EC3



★ LARGE 4 DIGIT DISPLAY ★ 24 HOUR ALARM ★ A.M./P.M. INDICATOR ★ BRIGHTNESS CONTROL ★ FLASHING SECONDS INDICATOR ★ ATTRACTIVE WHITE CASE ★ 5 MINUTE REPEATING SNOOZE ALARM

Complete Built Clock

£14 inc. VAT

THE "MISTRAL" 1 DIGITAL CLOCK



★ PLEASANT GREEN DISPLAY ★ PULSATING COLON ★ 12/24 HOUR READOUT ★ PUSH BUTTON SETTING ★ FULLY ELECTRONIC ★ BUILDING TIME 1 HOUR

Complete Kit

£11.07 inc. VAT

Built Clock

£14.95 inc. VAT

LCD MODEL TLC4



Continuous Readout utilising Liquid Crystal Display with Backlight for night reading

Features:
★ HOURS
★ MINUTES
★ SECONDS
★ DATE

Rhodium

£39.95 inc. VAT

Gold

£41.50 inc. VAT

LED MODEL TLE5



Features:

★ HOURS
★ MINUTES
★ SECONDS
★ DATE
★ DAY OF WEEK

£29.50 inc. VAT

Gold or Rhodium plated

We are proud to announce the opening of our new showroom in which you will find one of the largest ranges of digital electronic clocks and watches available in the U.K. So why not call and see us? One year's guarantee with all models. Electronic accuracy to within seconds per week.

ELECTROTIME, Dept. 3/7, 11 Shepley's Yard, Shopping Precinct, Town Centre, Chesterfield, Derbyshire. Tel. (0246) 35804

Please supply
I enclose cheque/postal order

NAME

ADDRESS

PACKAGE OF TEN — DEDUCT 15%

PACKAGE OF ONE HUNDRED — DEDUCT 25%

TTL					
7400	12p	7451	15p	74153	69p
7401	13p	7453	15p	74154	1-19p
7402	13p	7454	16p	74155	79p
7403	13p	7468	13p	74156	82p
7404	15p	7464	24p	74157	79p
7405	15p	7465	24p	74161	97p
7406	25p	7472	25p	74163	98p
7407	25p	7473	30p	74164	1-29p
7408	16p	7474	30p	74165	1-39p
7409	16p	7475	47p	74166	1-33p
7410	13p	7476	30p	74173	1-09p
7411	18p	7483	80p	74175	79p
7413	33p	7485	92p	74176	1-09p
7414	55p	7486	27p	74177	97p
7416	25p	7489	1-79p	74180	97p
7417	25p	7490	42p	74181	95p
7420	13p	7491	79p	74182	92p
7422	25p	7492	49p	74184	1-79p
7423	25p	7493	49p	74185	1-49p
7425	25p	7494	56p	74187	4-00p
7426	26p	7495	56p	74190	1-29p
7427	25p	7496	63p	74191	1-29p
7430	14p	74100	95p	74192	1-09p
7432	25p	74105	69p	74193	98p
7437	29p	74107	29p	74194	1-19p
7438	24p	74121	29p	74195	83p
7440	13p	74122	49p	74196	1-29p
7441	69p	74123	59p	74197	1-29p
7442	63p	74125	57p	74198	1-49p
7443	63p	74126	57p	74199	1-89p
7444	65p	74132	59p	74200	6-39p
7445	86p	74141	74p	74279	75p
7446	89p	74145	79p		
7447	96p	74150	89p		
7448	89p	74151	69p		
7450	14p				

LOW POWER

74100	18p	74L51	18p	74L90	1-07p
74102	18p	74L55	21p	74L91	92p
74L03	18p	74L57	21p	74L93	97p
74L04	21p	74L72	31p	74L95	97p
74L06	21p	74L73	44p	74L96	1-09p
74L10	18p	74L74	44p	74L164	1-69p
74L20	18p	74L78	49p	74L165	1-69p
74L30	18p	74L85	96p		
74L42	97p	74L86	44p		

LOW POWER SCHOTTKY

74LS00	26p	74LS32	29p	74LS95	1-38p
74LS02	26p	74LS40	35p	74LS100	40p
74LS04	26p	74LS42	32p	74LS164	1-38p
74LS08	29p	74LS74	42p	74LS193	1-50p
74LS10	26p	74LS90	26p	74LS197	1-38p
74LS20	26p	74LS93	92p		

HIGH SPEED

74H100	18p	74H22	21p	74H61	29p
74H01	18p	74H30	21p	74H62	23p
74H04	18p	74H40	18p	74H74	37p
74H08	18p	74H50	18p	74H101	40p
74H10	18p	74H52	21p	74H102	40p
74H11	18p	74H53	23p	74H103	46p
74H20	18p	74H55	23p	74H106	46p
74H21	18p	74H60	24p	74H108	46p

SCHOTTKY

74S00	26p	74S08	35p	74S22	26p
74S02	35p	74S10	26p	74S32	40p
74S03	26p	74S20	26p	74S74	26p
74S04	35p				

8000 (NATIONAL)

8091	38p	8220	95p	8811	39p
8092	38p	8230	1-45p	8812	65p
8095	87p	8288	89p	8822	1-49p
8121	56p	8520	75p	8830	1-49p
8123	97p	8551	1-39p	8831	1-49p
8130	1-38p	8563	32p	8836	29p
8200	1-43p	8810	45p	8880	79p
8214					

8000 (SIGNETICS)

8263	3-79	8267	1-79		
------	------	------	------	--	--

8000

9002	24	9309	56	9601	62
9301	72	9312	56	9602	56

DTL

930	12	937	12	949	12
932	12	944	12	962	12
936	12	946	17	963	12

CLOCK CHIPS

MM5311	6 digit multiplexed BCD, 7 seg 12-24 Hr, 50-60 Hz 28 pin	£3-07
MM5312	4 digit multiplexed BCD, 7 seg 1 pps 12-23 Hr, 50-60 Hz 24 pin	2-23
MM5313	6 digit multiplexed BCD, 7 seg 1 pps 12-24 Hr, 50-60 Hz 28 pin	3-07
MM5314	6 digit multiplexed 12-24 Hr, 50-60Hz 24 pin	3-07
MM5316	4 digit 12-24 Hr, 50-60 Hz, alarm 40 pin	2-78
CT7001	6 digit, 12-24 Hr, 50-60 Hz, alarm, timer and date circuits 28 pin	4-80

IC SOCKETS

Solder Tail - low profile

8 pin	13p	24 pin	29p
14 pin	14p	28 pin	41p
16 pin	15p	40 pin	48p
18 pin	22p		

WIRE WRAP - gold plate

14 pin	34p
--------	-----

CMOS

4000A	21	4018A	89	4066A	72
4001A	21	4020A	1-22	4068A	2-05
4002A	21	4021A	1-13	4069A	3-6
4006A	1-10	4022A	90	4071A	32
4007A	22	4023A	21	4072A	29
4008A	1-46	4024A	72	4073A	29
4009A	47	4025A	21	4075A	32
4010A	44	4027A	48	4078A	32
4011A	22	4028A	81	4082A	29
4012A	21	4030A	37	4510A	1-69
4013A	37	4035A	1-04	4528A	1-31
4014A	1-22	4040A	99	4545A	1-71
4015A	1-22	4042A	1-21	4901A	31
4016A	46	4049A	48		
4017A	98	4056A	48		

74C00	24	74C74	72	74C162	2-05
74C02	35	74C76	1-07	74C163	2-05
74C04	47	74C107	94	74C164	2-21
74C08	47	74C151	1-83	74C173	1-83
74C10	41	74C154	2-21	74C195	1-90
74C20	41	74C157	1-38	80C95	9-4
74C42	1-36	74C160	2-05	80C97	9-4
74C73	98	74C161	2-05		

CALCULATOR CHIPS

CTS002	12 digit, 4 function fixed decimal - battery operation 40 pin	£1-99
CTS00	12 digit, 4 function plus memory, fixed decimal 28 pin	2-06

MM5525	8 digit, 4 function, floating decimal 28 pin	1-37
MM5536	6 digit, 4 function, 9V battery operation 18 pin	2-78
MM5538	8 digit, 5 function plus memory and constant floating decimal, 9V battery operation 22 pin	2-78
MM5539	9 digit, 4 function, 9V battery operation 22 pin	2-78

MEMORIES

1101	256 bit RAM MOS 16 pin	£1-09
1103	1024 bit RAM MOS 18 pin	1-97
1702A	2048 bit static PROM elect. prog. - UV eras. 24 pin	10-50
2102	1024 bit static RAM DTL/TTL comp. 1 ms 16 pin	2-00
2103-8	Same as 2101 except 500ns	2-25
5203	2048 bit static PROM elect. prog. - UV eras. 24 pin	7-55
5260	1024 bit dynamic RAM MOS 16 pin	1-35
5261	1024 bit dynamic RAM MOS 16 pin	1-35
5262	2048 bit dynamic RAM MOS 22 pin	1-55
7489	64 bit ROM TTL 16 pin	1-79
82523	256 bit PROM SCHOTTKY 16 pin	2-75
F93410	256 bit RAM bi-polar 16 pin	1-50
74187	1024 bit ROM TTL 16 pin	4-00
74200	256 bit RAM tri-state 16 pin	4-39

TANTALUM CAPACITORS SOLID-DIPPED ± 20%

1 mld 35V	15p	10 mld 16V	21p
.33 mld 35V	15p	10 mld 25V	22p
1 mld 35V	15p	15 mld 10V	22p
2.2 mld 20V	15p	22 mld 16V	22p
2.2 mld 35V	15p	33 mld 10V	25p
4.7 mld 16V	18p	47 mld 6V	25p
6.8 mld 16V	18p	56 mld 6V	25p
6.8 mld 50V	21p		

SHIFT REGISTERS

MM5013	1024 bit accum. dyn. 8 pin	£11-20
MM5016	500/512 bit dyn. 8 pin	1-10
SE5-4025	Quad 25 bit 2504 1024 bit multiplexed dyn 8 pin	3-40

BANKAMER CARD MASTERCHARGE ACCESS BARCLAYCARD EUROCARD CHARGEX CARTESBLUES

Date sheets on request. Add 20p ea. if item is priced below 50p each.

JULY SPECIALS

1103	Memory	10/£6-90	100/£61
5260	"	10/ 8-20	100/ 72
5261	"	10/ 8-20	100/ 72
5262	"	10/ 9-59	100/ 84
5002	Calc Chip	10/ 8-20	100/ 72
5005	" "	10/ 9-59	100/ 84
5738	" "	10/ 13-80	100/ 121
309K	5V Reg	10/ 6-90	100/ 61
741	Op Amp mDIP	10/ 1-45	100/ 13
3900	Quad Amp DIP	10/ 1-76	100/ 17
MAN 1	Display	10/ 8-20	100/ 72
74123	Dual Monostable multivibrator	10/ 3-86	100/ 34

MISC DEVICES

ULN 2208	FM gain block 34dB mDIP	£1-03
ULN2209	FM gain block 48dB mDIP	1-03
2513	64 s 8 s character generator	7-00
CA 3046	Transistor array 14 pin DIP	55

LINEAR CIRCUITS

3001	Pos V Reg (super 723) IO-5	£ 49
3001	Hi Perf Op Amp mDIP TO-5	21
3002	Volt follower TO-5	45
3004	Neg V Reg IO-5	56
3005	Pos V Reg IO-5	56
3007	Op AMP (super 741) mDIP TO-5	44
3008	Micro Pow Op Amp mDIP TO-5	69
3009K	5V IA regulator TO-3	1-25
310	V follower Op Amp mDIP	75
311	Hi perf V Comp mDIP TO-5	67
319	Hi Speed Dual Comp DIP	82
3201	Neg Reg 5, 12, 15 TO-3/20	1-12
320K	Neg Reg 5.2, 12 TO-3	1-32
322	Precision Timer DIP	69
324	Quad Op Amp DIP	1-23
329	Quad Comparator DIP	1-06
340K	Pos V reg (5V, 6V, 8V, 12V, 15V, 18V, 24V) TO-3	1-48
3401	Pos V reg (5V, 6V, 8V, 12V, 15V, 18V, 24V) TO-20	1-23
370	AGC/Squelch AMPL DIP	92
372	AF-IF Strip detector DIP	51
373	AM/FM/SSB Strip IO-5	35
376	Pos V Reg mDIP	38
380	2w Audio Amp DIP	93
380-8	6w Audio Amp mDIP	1-02
381	Lo Noise Dual preamp DIP	1-13
382	Lo Noise Dual preamp DIP	1-13
531	High Slew rate Op Amp	2-07
540	Power driver TO-5	62
550	Free V Reg DIP	62
555	Timer mDIP	44
556A	Dual 555 Timer DIP	1-02
560	Phase Locked Loop DIP	2-23
562	Phase Locked Loop DIP	2-23
565	Phase Locked Loop DIP TO-5	1-38
566	Function Gen mDIP TO-5	1-38
567	Tone Decoder mDIP	1-38
569	Operational AMP TO-5 or DIP	31
710	Hi Speed Volt Comp DIP	24
711	Dual Difference Compar DIP	51
723	V Reg DIP	44
733	Diff. video AMPL TO-5	63
735	Dual Hi Perf Op Amp DIP	75
741	Comp Op Amp mDIP TO-5	29
747	741 Dual Op Amp DIP or TO-5	51
748	Freq Adj 741 mDIP	31
1304	FS Multis Stereo Demod DIP	75
1307	FM Multis Stereo Demod DIP	92
1456	Op Amp mDIP	51
1458	Dual Comp Op Amp mDIP	44
1800	Stereo multiplexer DIP	1-73
3900	Quad Amplifier DIP	38
7524	Dual core memory sense Amp	1-20
7525	Dual core memory sense Amp	92
8038	Voltage contr. osc. DIP	3-60
8864	9 DIG led Cath. Exp. DIP	1-58
75150	Dual Line Driver DIP	1-27
75451	Dual Peripheral Driver mDIP	24
75452	Dual Peripheral Driver mDIP	24
75453	(351) Dual Periph Driver mDIP	24
75491	Quad Seg Driver for LED DIP	58
75492	Hex Digit Driver DIP	63

METAL FILM RESISTORS ± 1% WATT

QTY	PRICE EACH	PRICE MINIMUM 10 PER VALUE	PRICE PER VALUE 100 PER VALUE
0-10	£-12		
10-100	£-08		
100-1000	06	£-85	
1000-		04	

RESISTANCE (OHMS)

22.6	71.5	182	887	11.8K	40.2K
23.7	78.7	187	1.15K	13.0K	45.3K
25.5	84.5	191	1.5 K	15.0K	48.7K
30.9	105	205	2.49K	18.2K	54.9K
34.8	110	232	3.57K	19.1K	60.4K

TRANSFORMERS

ALL EX-STOCK—SAME DAY DESPATCH

NO HIDDEN EXTRAS— Prices include VAT and P. & P. EXCEPT * WHERE CARRIAGE WILL BE ACCORDING TO WEIGHT & DISTANCE—BRS.

Electroval Audio accessories, semiconductors, panel meters and multi-meters.

MAINS ISOLATING
P.R.I. 120/240V
SEC. 120/240V

CENTRE TAP WITH SCREEN	Ref.	VA	(Watts)	£
07*	20		£3.97	
149	60		5.84	
150	100		6.67	
151	200		10.43	
152	250		12.97	
153	350		14.99	
154	500		17.21	
155	750		23.69†	
156	1000		33.01†	
157	1500		37.68†	
158	2000		42.03†	
159	3000		56.40†	

*115V or 240V Sec. only.

12 and or 24 Volt PRIMARY 240-250 VOLTS
Ref. Amps £

12v	24v	£	
111	0.5	1.97	
213	1.0	0.5	2.84
71	2	1	3.23
68	3	-	4.60
85	5	-	4.91
18	4	2	3.98
70	8	3	5.56
108	8	4	8.41
72	10	5	8.66
116	12	6	7.42
17	16	8	9.13
115	20	10	13.52
187	30	15	18.86
226	60	30	19.08†

50 VOLT RANGE
Prim. 200-240V
Sec. 0.19-25-33-40-50V
Ref. Amps £

102	0.5	£3.46
103	1.0	4.51
104	2.0	6.26
105	3.0	7.83
106	4.0	9.83
107	6.0	15.08
118	8.0	18.46
119	10.0	19.17†

SWITCHES

SPST	TOGGLE	3 FOR	0-97
DPDT	TOGGLE	3 FOR	£1.16
DPDT	SLIDE	6 FOR	0.97

ANTEX SOLDERING IRONS
15W £3.40 18W £3.19 25W £2.92
SOLDERING IRON KIT £4.48
STAND FOR ABOVE £1.49

MAGNETIC TO CERAMIC CARTRIDGE CONVERTOR
OPERATING VOLTAGE 20-45V only
£3-17.

CALLERS WELCOME (MON.-FRI.)
OR SEND STAMP FOR LISTS.

COMPONENT PAKS
200 Mixed v.c. resistors (count by weight)
150 Mixed value capacitors (count by weight)
30 Mixed value precision resistors ±2%
15 Assorted pots & pre-sets
10 Resistor switches
3 Micro switches
20 Assorted tag strips
PLEASE STATE PAK REQUIRED
87p PER PAK

30 VOLT RANGE
Prim. 200-240V
Sec. 0.12-15-20-24-30V
Ref. Amps £

112	0.5	2.58
79	1.0	3.38
3	2.0	4.85
20	3.0	5.99
21	4.0	6.92
51	5.0	8.32
117	6.0	9.33
88	8.0	12.38
89	10.0	12.71

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

VA	Ref.	£
24	50	5.77
350	247	13.33
1000	250	26.41†
2000	252	47.65†

SCREENED MINATURES
Ref. mA Volts £

238	200	3-0-3	£
212	1A, 1A	0-6, 0-6	2.71
13	100	9-0-9	1.96
235	300, 330	0-9, 0-9	2.04
207	500, 500	0-9, 0-9	3.94
208	1A, 1A	0-9, 0-9	3.94
236	200, 200	0-15, 0-15	1.95
214	300, 300	0-20, 0-20	2.82
221	700 (DC)	20-12-0-12-20	4.28
208	1A, 1A	0-15-20, 0-15-20	4.70
203	500, 500	0-15-27, 0-15-27	4.16
204	1A, 1A	0-15-27, 0-15-27	5.14
5112	500	12, 15, 20, 24, 30	2.68

BRIDGE RECTIFIERS

50V	2A	0.55
100V	2A	0.61
100V	5A	0.95
200V	1A	0.55
200V	2A	0.67
400V	2A	0.72
400V	4A	0.89
600V	2A	0.78
1000V	2A	0.89
500V 10APM TA6		2.70

HIGH QUALITY MODULES

3 Watt RMS AMPLIFIER	£2.78
5 Watt RMS AMPLIFIER	£3.17
10 Watt RMS AMPLIFIER	£3.51
25 Watt RMS AMPLIFIER	£4.63
125W RMS AMPLIFIER	£17.42
PRE-AMP for 3-5-10W	£7.50
PRE-AMP for 25W	£15.38
POWER SUPPLIES 3.5-10W	£1.54
POWER SUPPLIES 25W	£3.57
TRANSFORMER 3W	£2.54
TRANSFORMER 5-10W	£2.99
TRANSFORMER 25W	£3.38

BSR MINI-OECK
4 Speed Auto Changer £7.53
BSR P12BR
Single and Auto (Chassis) £19.06
Garrard SP25 (Chassis) £20.13

NEW STEREO 30
Complete Stereo Chassis Inc.:
7 + 7w RMS. Amp. Pre-amp. Power Supply, Front Panel, Knobs (only needs Mains Trans.). Stereo 30 £18.67
Mains Trans £3.15. Teak veneered cab. £4.51.

AUDIO KIT 25W

- 2 + 25W Amplifiers
- 1 + Per-Amp
- 1 + Power supply
- 1 + Transformer
- 1 + Front Panel
- 1 + Kit of parts to include on/off switch, neon ind. Stereo head-phone socket. Plus instructions book £32.07.

CARTRIDGES

Magnetic Sonotone 100	£5.31
Ceramic E.E.I. CS 2000	£2.67

TEAK AUDIO KIT 25W
Teak veneered cabinet
16½" + 11½" + 3½" aluminium chassis.
heat sink and front panel brackets plus back panel and sockets etc. £11.00

60 VOLT RANGE
Prim. 200-240V
Sec. 0.24-30-40-48-60V
Ref. Amps £

124	0.5	3.46
126	1.0	4.75
127	2.0	6.87
125	3.0	9.54
123	4.0	11.45
40	5.0	12.41
120	6.0	14.56
121	8.0	17.01†
122	10.0	20.85†
189	12.0	21.87†

AUTO TRANSFORMERS
Ref. VA Auto Taps (Watts) £

113	20	0-115-210-240	2.44
64	75	0-115-210-240	4.07
4	150	0-115-200-220-240	5.45
66	300	0-115-200-220-240	7.51
67	500	0-115-200-220-240	11.46
84	1000	0-115-200-220-240	17.25
93	1500	0-115-200-220-240	20.54†
95	2000	0-115-200-220-240	27.44†
73	3000	0-115-200-220-240	39.46†

TEST METERS

AVO 8 MK5	£67.17
AVO 72	£26.78
AVO TT 169	£27.26
AVO MMS	£23.40

Cases and Accessories.

POWER UNIT
CC12-05 Output Switched
3-4.5-6-7.5-9-12V
at 500mA. £5.03

STEREO FM TUNER WITH PHASE-LOCK LOOP
4 Pre-selected stations supply 20-35V. 90mA Max. £22.71

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

20VA	£4.33	Ref 133W
150VA	£7.80	Ref 4W
500VA	£13.37	Ref 87W
1000VA	£19.86*	Ref 84W
2000VA	£31.01*	Ref 95W

ON SITE TOOL ISOLATORS
240 to 110V 500VA to 2KVA
(to BS5353) Send for details

Barrie Electronics Ltd.

3, THE MINORIES, LONDON EC3N 1BJ
TELEPHONE: 01-488 3316 7/8

NEAREST TUBE STATIONS ALDGATE & LIVERPOOL ST

Express component service same day turn round

QUALITY—SERVICE
RELIABILITY—CARE
FULL SPEC DEVICES
NO RUBBISH
COMPETITIVE PRICES

S.A.E. brings Stock
List and Freepost
Order Service plus
Special Offers of the month



orchard electronics

Filint House, High Street
Wallingford, Oxon

Tel: (0491) 35529. Telex: 4SP WALFRD 849349

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 ISSUE 2 READY NOW!

Second printing (Green cover) with up-dated information, 144 pages. New items. Opto-electronics. Diagram of components, applications, I.C. circuits, etc. Post free 40p, including voucher for 40p for use on order over £5.00 list value. A must for careful buyers.

DISCOUNTS

On all C.W.O. mail orders, except for some items marked NETT.
5% on orders list value
10% on orders list value
£5 or more £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. Next review period effective from July 1st.

QUALITY GUARANTEE

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

ELECTROVALUE LTD

All communications to Dept. 7/2, 78 ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY TW20 0HB. Telephone Egham 3603. Telex: 284475. Shop hours 9-5.30 daily, 9-1 pm Sat.

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

BRITAIN'S FASTEST SERVICE!

NEW 74 SERIES TTL PRICES

	1-24	25-99	100+
7400	11p	10p	10p
7401	14p	12p	10p
7402	11p	10p	10p
7403	16p	14p	10p
7404	16p	13p	11p
7405	16p	13p	11p
7408	16p	13p	11p
7409	16p	13p	11p
7410	11p	10p	10p
7413	27p	24p	20p
7420	16p	13p	11p
7425	23p	22p	22p
7430	16p	13p	11p
7440	18p	16p	15p
7441	75p	62p	50p
7442	65p	55p	43p
7445	85p	71p	57p
7447	80p	75p	65p
7450	16p	13p	11p
7451	16p	13p	11p
7453	16p	13p	11p
7454	16p	13p	11p
7460	16p	13p	11p
7472	25p	21p	17p
7473	30p	25p	20p
7474	32p	26p	21p
7475	47p	39p	31p
7476	32p	26p	21p
7480	60p	56p	42p
7482	75p	62p	50p
7483	70p	65p	62p
7485	1.25p	1.08p	85p
7486	32p	26p	21p
7490	44p	39p	30p
7491A	65p	55p	45p
7492	57p	46p	36p
7493	45p	40p	32p
7494	73p	65p	58p
7495	70p	60p	54p
7496	70p	60p	54p
74100	1.08p	89p	78p
74107	35p	28p	22p
74121	34p	28p	22p
74141	75p	62p	52p
74150	1.05p	95p	87p
74151	65p	58p	56p
74153	62p	58p	54p
74154	1.00p	92p	85p
74155	70p	63p	58p
74156	70p	63p	58p
74174	1.00p	83p	67p
74180	1.00p	83p	67p
74181	2.31p	2.05p	1.82p
74190	1.15p	1.00p	95p
74191	1.15p	1.00p	95p
74192	1.00p	83p	67p
74193	1.05p	95p	87p
74196	1.28p	1.05p	95p
74197	1.29p	1.05p	95p

Pricing on this series is calculated on the total pieces ordered regardless of mix.

NEW EXTENDED COSMOS RANGE

	1-24	25-99	100+
CD4000AE	19p	17p	14p
CD4001AE	19p	17p	14p
CD4002AE	19p	17p	14p
CD4006AE	1.06p	86p	70p
CD4007AE	19p	17p	14p
CD4008AE	87p	70p	58p
CD4009AE	50p	40p	34p
CD4010AE	50p	40p	34p
CD4011AE	19p	17p	14p
CD4012AE	19p	17p	14p
CD4013AE	50p	40p	34p
CD4014AE	94p	74p	61p
CD4015AE	94p	74p	61p
CD4016AE	50p	40p	34p
CD4017AE	94p	74p	61p
CD4018AE	94p	74p	61p
CD4019AE	50p	40p	34p
CD4020AE	1.06p	86p	70p
CD4021AE	94p	74p	61p
CD4022AE	87p	70p	58p
CD4023AE	10p	17p	14p
CD4024AE	72p	56p	46p
CD4025AE	19p	17p	14p
CD4026AE	1.60p	1.25p	1.03p
CD4027AE	50p	40p	34p
CD4028AE	87p	70p	58p
CD4029AE	1.06p	86p	70p
CD4030AE	50p	40p	34p
CD4035AE	1.06p	86p	70p
CD4040AE	94p	74p	61p
CD4042AE	78p	60p	50p
CD4043AE	94p	74p	61p
CD4044AE	87p	70p	58p
CD4046AE	1.24p	99p	80p
CD4049AE	50p	40p	34p
CD4050AE	50p	40p	34p
CD4052AE	87p	70p	58p
CD4056AE	1.24p	99p	80p
CD4060AE	1.24p	99p	80p
CD4066AE	87p	70p	58p
CD4068BE	20p	18p	16p
CD4069BE	20p	18p	16p
CD4070BE	20p	18p	16p
CD4071BE	20p	18p	16p
CD4073BE	20p	18p	16p
CD4077BE	20p	18p	16p
CD4081BE	20p	18p	16p
CD4082BE	20p	18p	16p
CD4085BE	65p	52p	42p
CD4086BE	65p	52p	42p
CD4093BE	75p	65p	60p
CD4099BE	1.65p	1.35p	1.10p
CD4511BE	1.65p	1.35p	1.10p
CD4528BE	1.30p	1.08p	87p

Pricing on this series is calculated on the total pieces ordered regardless of mix.

DIL SOCKETS—NEW ULTRA LOW PROFILE

8 DIL/UP	12p
14 DIL/UP	15p
16 DIL/UP	16p
24 DIL/UP	26p
DIL PINS	
100 FOR	65p

SOLDERING EQUIPMENT & TOOLS

DST Mk. 1.	"Solder Sucker" a truly indispensable tool	£4.30p
DST Mk. 1.	Spare Nozzle	46p
CCN-15W	Miniature Iron 240V	£2.95p
X25-240	25 Watt Iron 240V	£2.95p
X50-TC	Temperature Controlled Iron	£9.75p
MLX12	12V Battery Iron	£3.50p
ST3	Soldering Iron Stand	
S167	For all models	£1.25p
S167	Thermal shunt for delicate components	40p
BIT2	Spare bit Nickel clad for iron 3/32"	36p
BIT3	Spare bit Nickel clad for iron 5/32"	36p
BIT4	Spare bit Nickel clad for iron 3/16"	36p
BIT1100	Iron coated for CCN 3/32"	46p
BIT50	Spare bit for X25 and MLX12 irons—iron coated 3/32"	46p
BIT51	Spare bit for X25 and MLX12 irons—iron coated 1/8"	46p
BIT52	Spare bit for X25 and MLX12 irons—iron coated 3/16"	46p

TRANSDUCERS

40kHz Ultrasonic transducers as used in many Mag. articles complete with suggested circuits: Order type: RL400PP £4.20 pair

IC TEST CLIP

New low price £1.95 each. Clips on to 14/16 lead IC's under test. Can be used as a removal tool.

TIMER CHIP NE555V

New Low Prices:	
1-24	25
55	49

LM380
3 Watt IC
98p

741 OP-AMP MINIDIP

New bulk prices and SPECIAL! YOU CAN INCLUDE YOUR 741 WITH YOUR TOTAL TTL 74 SERIES MIX to get best price:

	1-24	25+	100+
	30	25	22

3-2mm LEDs

Extended range plus ARROW bulk prices: All prices include free bushes.

	1-24	25+	100+
Red	14	12	10
Green	27	24	22
Amber	27	24	22

(All are TIL209 size)

THE GREEN GIANT

Jumbo sized Green LED—jump while they last:

	1-12	13-24	25+	100+
	25	22	20	18

3 WATT ZENERS

Axial lead, miniature plastic case full 3 Watt Disc. Following voltages only: 6.8, 8.2, 10, 11, 12, 15, 16, 18, 22, 24, 27, 32, 33, 62, 68, 91, 100.

ALL ONE PRICE 40p

MM5314 CLOCK CHIP

With hold/advance count, output strobe, 7 Seg. output. With data

£4.00*

7 WATT AUDIO CHIP

TBA810S with data

£1.40

SENSATIONAL STOCK CLEARANCE

PAK: AA1 Twenty assorted transistors our choice £1.00

PAK: AA2 Ten TAA243 Op. Amps (high gain 702) £1.00

PAK: AA3 Ten BCW54 300mW 300mHz 64v Transistor NPN £1.00

PAK: AA4 Three 2N3055 £1.00

PAK: AA5 Twenty Diodes & Rectifiers/Bridges our choice £1.00

PAK: AA6 Five BD187 (pre-formed) Plastic Power Transistor £1.00

PAK: AA7 Ten assorted Zeners our choice £1.00

SUPERPAK Our Guaranteed Value pack of clearance lines. Semic's Resistors, Caps, Pots, etc., etc. £1.00

GREAT TRIAC CLEARANCE

SC35A	3A 100V	50p
SC35B	3A 200V	60p
SC40B	6A 200V	65p
SC40D	6A 400V	80p
SC40E	6A 500V	85p
SC45A	10A 100V	70p
SC45B	10A 200V	75p
SC45E	10A 500V	90p
SC50D	15A 400V	£1.00p
SC50E	15A 500V	£1.10p

All stud mounted, fixing nuts supplied.

4-TRACK TAPE HEADS

Record/pb £3.00 each
Stereo heads rec./pb. + erase £1.80 pair*

SEMICONDUCTORS & IC'S

Our huge availability of transistors, diodes, Triacs SCR's Zeners, etc., is too large to list. See previous catalogues and advertisements for price and availability or Telephone Alan Green on 0277 219435 for a quick price.

Our 1976/7 catalogue is well under way and will be bigger and better than ever.

Our Retail shop (5 mins. from Brentwood mainline station) is being enlarged with many new lines. Pay us a visit.

VAT Prices are exclusive of VAT. Add VAT at 8% except for items marked * when 12½% should be added.

POSTAGE Still no-charge.

ARROW ELECTRONICS LTD.

COPTFOLD ROAD
BRENTWOOD ESSEX

RETAIL SHOP

Our shop is open six days per week—many more items stocked than we could ever list. (Thurs. early closing).

SYNTHESISERS, SOUND EFFECTS AND PHONOSONICS



COMPONENTS SETS include all necessary resistors, capacitors, semi-conductors, potentiometers and transformers. Hardware such as cases, sockets, knobs, etc. are not included but most of these may be bought separately. Fuller details of kits, PCBs and parts are shown in our lists.

CIRCUIT AND LAYOUT DIAGRAMS are supplied free with all PCBs designed by Phonosonics.

PHOTOCOPIES of the P.E. texts for most of the kits are available—prices in our lists.

MAIL ORDER SUPPLIERS OF QUALITY PRINTED CIRCUIT BOARDS, KITS AND COMPONENTS TO A WORLD-WIDE MARKET.

P.E. SYNTHESISER

(P.E. Feb. 73 to Feb. 74)

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 (notably P.E. Minisonic, Phasing Unit, Wind and Rain, Rhythm Generator, Sound Bender, Voltage Controlled Filter, Guitar Effects Pedal).

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 £6.64
PCB (holds both circuits) £1.70
Tone Control £2.43
PCB £0.80
Reverberation Amplifier £6.36
Spring Line unit for Reverb. Amp. £4.95
Ring Modulator £3.93
Peak Level Meter Circuit £1.50
100µA Panel Meter £3.75
PCB to hold Reverb, Ring Mod and Meter Circuits £1.94
Envelope Shaper £5.35
PCB £1.46
Voltage Controlled Amplifier and Differential Amplifier £6.86
PCB (holds both circuits) £1.32

THE SYNTHESISER KEYBOARD CIRCUITS

(Can be used without the Main Synthesiser to make an independent musical instrument)
Two Logarithmic Voltage Controlled Oscillators £14.55
Component set £2.60
PCB (holds both circuits) £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

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

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. 5W's) £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. £2.55
Component Set (incl. PCB)

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

WAH-WAH UNIT (P.E. Apr. 76)

The Wah-wah effect produced by this unit can be controlled manually or by the integral automatic controller.
Component Set incl. PCB £2.99

POST AND HANDLING

U.K. orders—under £15 add 25p plus VAT, over £15 add 50p plus VAT.
Optional Insurance for compensation against loss or damage in post, add 35p in addition to above post and handling.
Ire, C.I., B.F.P.O., and other countries are subject to Export postage rates.

P.E. JOANNA (P.E. May/Sept. 75)

A five-octave electronic piano that has switchable alternative voicing of Honky-Tonk piano, ordinary piano, harpsichord, or a mixture of any of the three, together with facilities including fast and slow tremolo, loud and soft pedal switching, and sustain pedal switching. The power amplifier typically delivers 24 watts into 8 ohms. The PCBs have been redesigned by ourselves making improved use of the space available.

Main Power Supply £9.41
Tone Generator and Top C Envelope Shaper £9.97
PCB for Main PSU, Tone Gen & Top C.E.S. £2.10
Envelope Shapers for all notes (except Top C) £32.16
Set of PCBs for Envelope Shapers (except Top C) £10.40
Voicing and Pre-Amp Circuits £8.37
PCB for Voicing and Pre-amp £2.64
Power Amplifier (incl. separate Power Supply) £14.50
PCB for Power Amp and PSU 95p

RHYTHM GENERATOR (P.E. Mar./Apr. 74)

Programmable for 64,000 rhythm patterns from 8 effects circuits (high and low bonzos, 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 £12.57
PCB for above circuits (double-sided) £2.84
Component set for all 8 effects circuits £10.49
PCB for all 8 effects £3.60
Simple mixer (our design) incl. PCB £3.70
Alternative mixer with external volume controls, incl. PCB £9.93
Power Supply for T, T and L, and Effects, incl. PCB £6.42
(See our list for Power Supplies for Mixers)

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 in. Spring Unit £4.95
Panel Meter (50µA) (optional) £3.75

WIND AND RAIN UNIT

A manually controlled unit for producing the above-named sounds.
Component set incl. PCB £2.83

P.E. MINIMIX 6 (P.E. Nov./Dec. 75)

Each of the 6 input channels has its own gain, volume and panning controls. The volume of the twin channel outputs are fully manually controllable, as are the headphone and pre-fade monitoring facilities. Twin VU meters provide visual display of channel audio levels. Ideal for use with effects and synthesiser kits.
For details see our list.

8-INPUT MIXER

A simple mixer having 8 inputs each of which has a preset level control and which are combined into one output channel having a preset over-all level control and a master output volume control. Designed for inter-coupling our various sound effects and synthesiser kits.
Component set incl. PCB £3.70

25 WATT MONO AMPLIFIER (P.E. Sept. 75)

A good general purpose integrated circuit power amplifier typically delivering 25 watts into 8 ohms. Power bandwidth 20Hz to 20kHz, 3dB, Input impedance 20k m. Distortion 0.2%. Suitable for use with any of our sound producing kits.
Component Set incl. power supply £14.50
Printed Circuit Board 95p
For stereo use two sets and PCBs are required.

TREBLE BOOST UNIT (P.E. Apr. 76)

Gives a much shriller quality to audio signals fed through it. The depth of boost is manually adjustable.
Component Set incl. PCB £2.15

VAT

Add 12½% (or current rate if changed) to full total of goods, post and handlink. (Does not apply to export orders).

P.E. MINISONIC MK I

(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. Like the large Synthesiser it too may be advantageously used with other circuits in our lists.

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 Octave £1.48; 4 Octave £1.96; 5 Octave £2.44. £1.66
H.F. Oscillator and Detector
Ring Modulator, Noise Generator and Envelope Inverter £5.45
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 ESs, 2 VCAs, 2 Mixers, Ring Mod, Keyboard Control and Hold £2.20
PCB to hold 2 Power Amps., Noise Gen., Envelope-Inverter, H.F. Osc and Detector £1.45
PCB to hold Battery Eliminator and Temperature Stabiliser £1.35

P.E. MINISONIC MK 2

Conversion kits and PCBs for updating the MK I version are now available. Details in our list.

ENVELOPE SHAPERS

Both of the kits below have manual control over their Attack, Decay, Sustain and Release functions. Both kits include PCB (VCA means Voltage Controlled Amplifier)
Envelope Shaper and VCA (P.E. Apr. 76) £5.43
Envelope Shaper (without VCA) (P.E. Oct. 75) £4.16

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

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

P.E. TUNING FORK (P.E. Nov. 75)

Produces 84 switch-selected frequency-accurate tones. An LED monitor clearly displays all beat note adjustments. Ideal for tuning acoustic and electronic musical instruments alike.
Main Component Set incl. PCB £14.22
Power Supply set incl. PCB £6.57

P.E. SYNCHRONOME (P.E. Mar. 76)

An accented-beat electronic metronome, providing duple, triple and quadruple times with full control over the beat rate. Can also be used as a simple drum-beat rhythm generator. Includes power supply.
Component Set incl. loudspeaker £10.20
Printed Circuit Board £1.70

PEAK LEVEL INDICATOR (P.E. Mar. 76)

A twin-channel visual display unit for monitoring the peak level of audio signals. Well suited for use when inter-coupling our many sound producing kits to help avoid signal over-loading.
Component Set incl. PCB (as published) £3.26

EXPORT ORDERS are welcome, though we advise that a current copy of our list should be obtained before ordering as it also shows Export postage rates. All payments must be cash-with-order, in Sterling and preferably by International Money Order or through an English Bank. To obtain list for Europe send 20p, for other countries send 40p.

OTHER PROJECTS

PHOTOGRAPHS in this advertisement show two 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, though a small selection of other cases is available.



LIST—Send Stamped Addressed Envelope 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 40p.

KEYBOARDS AND CONTACTS

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 available. All octaves are C to C. The keys are plastic, spring-loaded and mounted on a robust aluminium frame.

3 Octave (37 notes) £20.50. 4 Oct (49 notes) £23.50. 5 Oct (61 notes) £27.

Contact Assemblies for use with above keyboards: Single-pole change-over (type SP) as for P.E. Joanna and P.E. Minisonic. Two-pole normally open-make-break (type DP) as for P.E. Synthesiser. Special contact assembly (type 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 the P.E. Joanna simultaneously thus avoiding the cost of more than one keyboard.

Contact	Each	3 Octave Set	4 Octave Set	5 Octave Set
SP	20p	£7.40	£9.80	£12.20
2P	24p	£8.88	£11.76	£14.64
4PS	48p	£17.76	£23.52	£29.28

PRINTED CIRCUIT BOARDS for use with the above contacts and thus eliminating most of the inter-wiring required, are available. Details in our lists.

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 lights. 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	£3.32
PCB for power supply and 8 lamp drivers	£1.56
1A 400V thyristors (1 per chan. req.) each	75p
Panel meter (1µA) (optional)	£3.75

3-CHANNEL SOUND-TO-LIGHT (P.E. Apr. 76)

A simple but effective sound-to-light controller capable of operating 3 lamps each of approximately 700 watts. Includes power supply, thyristors, and by-pass switches.

Component Set incl. PCB	£11.36
-------------------------	--------

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-Amp Module Component Set incl. PCB	£3.71
Basic Output Circuits—combined component set with PCBs, for alphaphone, cardiophone, frequency meter and visual feedback lamp-driver circuits	£5.38
Audio Amplifier Module Type PC7	£6.75

TAPE NOISE LIMITER

Very effective circuit for reducing the hiss found in most tape recordings. All kits include PCBs.

Standard Tolerance Set of Components	£2.60
Superior Tolerance Set of Components	£3.22
Regulated Power Supply (will drive 2 sets)	£3.98

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

HARMONIC DISTORTION FILTER (P.E. Mar. 76)

A simple to operate filter for use in measuring the total harmonic distortion in amplifiers.

Component set incl. PCB	£2.45
-------------------------	-------

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, and indispensable dark-room unit for finding exposure, controlling enlarger timings, and stabilising mains voltage. While stocks last.

Component Set (excl. meter)	£10.72
Printed Circuit Board	£1.74
Panel Meter (1mA)	£3.75

CAMELO inc. P.C.B.

Fuzz unit inc. P.C.B.	£2.85
	£1.80

PRICES ARE CORRECT AT TIME OF PRESS. E. & O.E. DELIVERY SUBJECT TO AVAILABILITY.

TRANSISTORS

AC128	20p
AC176	20p
BC107	13p
BC108	13p
BC109	13p
BC147	12p
BC148	12p
BC149	12p
BC157	13p
BC158	13p
BC159	13p
BC182L	12p
BC184	12p
BC187	25p
BC204	14p
BC209C	14p
BC212L	15p
BC213	15p
BC478	28p
BCY71	22p
BD131	44p
BD132	55p
BFY50	22p
BFY51	22p
BFY52	24p
BSY95A	22p
MJE2955	110p
OC78	60p
OC79	14p
OC72	14p
OC84	25p
ORP12	66p
ZTX107	12p
ZTX108	71p
ZTX501	15p
ZTX503	15p
ZTX531	23p
2N706	13p
2N914	22p
2N1304	22p
2N219	27p
2N2905	27p
2N2905A	28p
2N2907	22p
2N3053	18p
2N3054	66p
2N3055	48p
2N3702	12p
2N3703	12p
2N3704	12p
2N3819	35p
2N3820	64p
2N3823E	39p
2N4060	12p
2N4871	36p
2N5245	51p
2N5777	45p

INTEGRATED CIRTS.

709 T05	40p
709 8-pin DIL	40p
723 T05	95p
741 8-pin DIL	32p
748 T05	63p
748 8-pin DIL	63p
µA7805 TO220	165p
µA7808 TO220	165p
µA7812 TO220	165p
µA7815 TO220	165p
µA7818 TO220	165p
AV-1.0212	622p
AV-1.6711/6	188p
CA3046	71p
MFC4000B	73p
MFC6040	83p
SG3402N	220p

PHONONICS

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 44 page FREE book shows how!

This easy to follow GUIDE TO SUCCESS should be read by every ambitious engineer. Send for this help 44 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.

ELECTRICAL & ELECTRONICS

- Practical Radio & Electronics (with kit)
- Electronic Engineering Certificate
- General Elect. Eng. Certificate
- C. & G. Elect. Installations
- Elect. Install. & Work
- C. & G. Elect. Technicians

Air Registration Board Certs.

- MAA/IMI Dip.
- CONSTRUCTIONAL Heating Ventilating & Air Conditioning
- Architectural Draughtsmanship & Design
- L.I.O.B.
- Carpentry & Joinery
- Plumbing Technology
- General Building
- Painting & Decorating

RADIO & TELE-COMMUNICATIONS

- Colour TV Servicing
- C. & G. Telecoms. Technician's Cert.
- C. & G. Radio, TV & Electronics Mech. Cert.
- Radio & TV Engineering Course
- Radio, Servicing & Repairs
- Radio Amateur's Exam

MECHANICAL

- A.M.S.E. (Mech.)
- General Mech. Eng.
- Inst. Engineers & Technicians
- Maintenance Engineering
- Welding

MANAGEMENT & PRODUCTION

- Computer Programming
- Inst. of Cost & Managements Accts.

AUTO & AERO

- Motor Mechanics
- C. & G. Motor V. Mechanics
- General Auto Engineering
- A.M.I.M.I.

DRAUGHTSMANSHIP & DESIGN

- General Draughtsmanship
- A.M.I.E.D.
- Electrical Draughtsmanship



G.C.E.

—58 'O' & 'A' Level Subjects
—over 10,000 Group Passes!

Aldermaston College

Dept. TPE 19, 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

TAMBA ELECTRONICS

QUALITY PRODUCTS
FOR HI-FI, DISCO,
P.A. GROUP AND CLUB USE

A BRAND NEW RANGE OF AMPLIFIER MODULES 5 to 100 WATT/RMS

Choose the power you need from these five pure complementary amplifiers
Two-year guarantee

All amplifiers feature a pure complementary symmetry output stage for low distortion and high reliability—the highest grade components (by Mullard—Texas, Plessey—RCA etc.) used throughout

- Suits loads 4–16 ohms (optimum load 8 ohms, TAM50/100/250, 4 ohms TAM500/1000)
- Low distortion (0–1%)
- 20–20,000 Hz \pm 1dB
- Silicon circuitry throughout
- Inherently open circuit proof
- Four simple connections



TAM50 5W RMS 25V supply	£3.20
TAM100 10W RMS 35V supply	£3.75
TAM250 25W RMS 45V supply	£4.25
TAM500 50W RMS 45V supply	£6.95
TAM1000 100W RMS 65V supply	£9.80
(all modules carriage free)	

- High sensitivity—100mV
- Low profile (1in high 3½in x 3in)
- 75% efficient
- Glass fibre printed circuit board
- Accepts most mixers/pre-amplifiers

POWER SUPPLIES

For 1 or 2 TAM50/100	£4.25 (carr 50p)
For 1 or 2 TAM250/500	£6.95 (carr 50p)
For 1 or 2 TAM1000	£9.80 (carr 50p)

You may order as follows: C.W.O. (crossed cheques, P.O.s, M.O.s etc) C.O.D. (50p extra). We accept Access and Barclaycard—send or telephone your number—do not send your card. Add VAT at 8% to orders for 50–100W units and at 12½% for 5–25W units

Hours, 9.30a.m.–5p.m.
Mon.–Sat. Callers welcome.
Tel: (01) 684 0098

TAMBA ELECTRONICS

Bensham Manor Road Passage, Bensham Manor Road, Thornton Heath, Surrey.

SINCLAIR IC20

IC20 10W+10W stereo IC amplifier kit with free booklet and printed circuit, £4.95.
PZ20 Power supply kit for the above, £3.95.
VP20 Volume, tone control and preamp kit, £7.50.
SP² 10W 4 ohm speaker for IC20, £2.70
CS20 11 x 6 x 3in attractive case for IC20 £2.95.

Send S.A.E. for free leaflet.

JC12 AMPLIFIER

6W IC audio amp. with free data and printed circuit, £1.95*.

DELUXE KIT FOR JC12

Includes extra parts for the pcb and vol., bass and treble controls for mono version, £2.06. Stereo model with balance control, £4.46.

JC12 POWER KIT

Supplies 25V 1A, £3.25.

JC12 PREAMP KITS

Type 1 for magnetic pickups, mics and tuners. Mono £1.40 Stereo £2.80. Type 2 for ceramic or crystal pickups. Mono 78p, Stereo £1.56.

LOUDSPEAKERS FOR JC12

8in. x 5in. 8 ohms 5W £2.28.
Send S.A.E. for free leaflet on kits.

FERRANTI ZN414

IC radio chip with data £1.34. Printed circuit and extra parts for radio £3.25. Case 80p extra. Send S.A.E. for free leaflet.

SINCLAIR PROJECT 80

FM tuner £13.25, O18 £9.50, PZ5 £3.95, PZ6 £3.70, PZ8 £3.10, Trans for PZ8 £5.60, Z40 £5.75, Stereo 80 £11.95, Project 8050 £18.95, Quad decoder £14.95, Z80 no longer available, but we stock a similar 30W equivalent amp, £10.30, Stereo 80 £11.95, Project 8050 £18.95, Quad decoder £14.95.

PRINTED CIRCUIT KIT £3.95*

Make your own printed circuits. Contains etching dish, 100 sq. in. of copper clad board, 1lb ferric chloride, etch resist pen, small drill bit, laminate cutter and instructions.

MAINS TRANSFORMERS

6–0 6V 100mA 86p, 9–0 9V 100mA 86p, 18V 1A £1.85*, 0, 12, 15, 20, 24, 30V 1A £2.95*, 12–0 12V 1A £1.95*, 0, 12, 15, 20, 24, 30V 2A £4.20*, 20V 2½A £2.00.
6V and 9V trans are d.c. rated, others are a.c. volts.

SINCLAIR BLACK WATCH

Fully assembled with black strap, £20.95*.
With bracelet, £22.95*.



SINCLAIR CALCULATORS*

Cambridge £4.95, Cambridge % £7.35, Scientific £3.95, Cam. Scientific £11.45, Oxford 100 £4.95, Oxford 300 £13.30, Programmable scientific £25.95, Mains adaptors for programmable and Oxfords £3.18; for Cambridge and Scientific £3.15.

CBM CALCULATORS*

776MD 7 digit, %, memory £5.95, 796MD 8 digit, %, memory £3.45, 897D 8 digit, %, 4 function memory £7.80, SR7919D 8 digit, memory, trig, log, pi, powers, scientific notation £13.20, SR1800 10 digit scientific £23.25, SR4148R 14 digit rechargeable scientific with charger £29.95, Mains adaptor for other machines £2.95.

CASIO CALCULATORS*

Pocket 8S 8 digits, %, const, £6.95, Memory 8R 8 digit, %, memory, const, £8.95, Pocket Mini P-810 8 digits, %, memory, const, miniature fits into your shirt pocket £8.95, FX20 8 digit, memory, trig, log, powers, scientific notation £16.95, Mains adaptors for all models £3.95.

NOVUS CALCULATORS*

760 8 digit £5.45, 835 8 digit, %, const, sq. root, 4 function memory £7.48, 4525 10 digit programmable scientific calculator £45.80, 4510 £13.20, 4515 £37.85, 4520 £22.65, Mains adaptor £4.20.

24-HR. DIGITAL CLOCK KIT*

Includes pcb, mains power supply, attractive case, 0–5in. jumbo green display, clock chip, and all other parts. Displays hours and minutes separated by a pulsating colon. Kit £10.95, Built £12.90, Send S.A.E. for free leaflet. Built with alarm £13.95.

S-DECS AND T-DECS*

S-DeC £2.24

T-DeC £4.05

µ-DeC A £4.45

µ-DeC B £7.85

N-DeC £10.45

IC carriers—

16 dill. plain £1.07, with socket £2.21, 10 TO5: plain 99p, with socket £1.95, SST1 60p, SSU1 60p, SSN1 80p.



Battery Eliminator Bargains

55 WAY SUPER

New switched model, 3 to 30V in ½V steps. Fully stabilized. 1A output. Kit £8.95, Assembled £11.95, 2A model, Kit £10.95, Built £13.95.

6-WAY SPECIAL

Switched output of 3/4V/6/7½/9/12V at 500mA with 4-way multi-jack plug and free matching socket, £5.20.



6-WAY DOUBLE RADIO MODEL £6.20

Similar to above, but with press-stud battery connectors. 3+ 3/4+ 4½/6+ 6/7½+ 7½/9+ 9/12+ 12V at 250mA. Also gives 15/18/24V single.

3-WAY MODEL

Switched output of 6/7½/9V at 250mA with 4-way multi-jack plug and free matching socket, £2.95*.

RADIO MODELS

50mA with press-stud battery connectors for radios etc. 9V £3.25, 6V £3.45, 9+9V £4.45, 6+6V £4.45, 4½+ 4½V £4.45, Also 9V 300mA £3.95.

CASSETTE MAINS UNITS

7½V output to run cassette recorders from the mains. Complete with 5 pin DIN plug, 50 mA model £3.45, 300mA model £3.95.

CAR CONVERTORS

Input 12V d.c. Output 6/7½/9V d.c. 1A regulated, £4.75*.

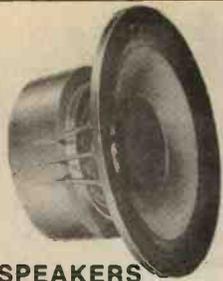
BATTERY ELIMINATOR KITS

Send S.A.E. for free leaflet on range.
100mA radio type with press stud battery terminals, 4½V £1.80, 6V £1.80, 9V £1.80
50mA double radio type with press stud terminals, 4½V + 4½V £2.50, 6V + 6V £2.50, 9V + 9V £2.50.
100mA cassette type with 5 pin DIN plug, 7½V £1.80.
Stabilized 6-way type with voltage stabilizer to give low hum, 3/4V/6/7½/9/12/15/18V 50mA, £3.15.
Heavy duty 12-way types 4½/6/7½/11/13/14/17/21/28/34/42V, 1 amp £4.10, 2 amp £8.80.

Post 30p on orders under £2, otherwise free. Prices include VAT (Overseas customers deduct 7% on items marked *, otherwise 11%). Official orders from schools, government labs., etc., welcome.

SWANLEY ELECTRONICS

Dept. PE, PO Box 68, Swanley, Kent



WILMSLOW AUDIO

THE Firm for speakers!

SPEAKERS

Baker Group 25, 3, 8 or 15 ohm	£8-64
Baker Group 35, 3, 8 or 15 ohm	£10-25
Baker Group 50/12 8 or 15 ohm	£14-00
Baker Group 50/15 8 or 15 ohm	£18-62
Baker Deluxe 124, 8 or 15 ohm	£12-38
Baker Major 3, 8 or 15 ohm	£10-96
Baker Superb 8 or 15 ohm	£16-31
Baker Regent 12in 8 or 15 ohm	£9-00
Baker Auditorium 12in 8 or 15 ohm	£14-65
Baker Auditorium 15in 8 or 15 ohm	£19-41
Castle 8RS/DD 4 or 8 ohm	£9-28
Celestion G12M 8 or 15 ohm	£12-95
Celestion G12H 8 or 15 ohm	£15-95
Celestion G12/50 8 or 15 ohm	£16-50
Celestion G12/50TC 8 or 15 ohm	£18-00
Celestion G12/50 2236 s/cone	£16-50
Celestion G12/50 2239 s/cone, alum. dome	£17-00
Celestion G15C 8 or 15 ohm	£26-95
Celestion G18C 8 or 15 ohm	£34-50
Celestion HF1300 8 or 15 ohm	£7-75
Celestion HF2000 8 ohm	£9-50
Celestion MH1000 8 or 15 ohm	£13-50
Celestion CO3K	£4-46
Decca London ribbon horn	£28-80
Decca London CO/1000/8 crossover	£6-75
Decca DK30 ribbon horn	£17-25
Decca CO/1/8 crossover (DK30)	£4-50
EMI 150 13 x 8in d/cone 8 ohm	£2-94
EMI 13 x 8in 20W bass 8 ohm	£9-00
EMI 14 x 9in bass 8 ohms, 14A770	£11-92
EMI 8 x 5in, 10W, d/cone, roll surr.	£3-56
EMI 6 1/2in d/cone, roll surr., 8 ohm	£3-93
EMI 8in roll surr. bass	£5-73
EMI 5in mid range	£3-50
Elac 59RM 109 (15 ohm), 59RM114 (8 ohm)	£3-38
Elac 6 1/2in d/cone, roll surr., 8 ohm	£3-83
Elac 10in 10RM239, 8 ohm	£3-83
Eagle Crossover 3000Hz 3, 8 or 15 ohm	£1-57
Eagle FR4	£5-81
Eagle FR65	£8-66
Eagle FR8	£11-08
Eagle FR10	£14-06
Eagle HT15	£3-96
Eagle HT21	£8-13
Eagle MHT10	£4-00
Eagle FF28 Multicell, horn	£9-10
Fane Pop 15, 8 or 16 ohm	£5-25
Fane Pop 33T, 8 or 16 ohm	£9-25
Fane Pop 50, 8 or 16 ohm	£12-50
Fane Pop 55, 8 or 16 ohm	£15-50
Fane Pop 60, 8 or 16 ohm	£17-95
Fane Pop 70, 8 or 16 ohm	£18-75
Fane Pop 100, 8 or 16 ohm	£27-95
Fane Crescendo 12A, 8 or 16 ohm	£37-95
Fane Crescendo 12BL, 8 or 16 ohm	£39-95
Fane Crescendo 15/100A, 8 or 16 ohm	£49-95
Fane Crescendo 15/125, 8 or 16 ohm	£59-95
Fane Crescendo 18, 8 or 16 ohm	£67-95
Fane 910 Mk II horn	£15-75

SPEAKERS

Fane 920 Mk II horn	£36-95
Fane HPX1 crossover 200W	£2-50
Fane 13 x 8in, 15W dual cone	£5-50
Fane 801T 8in d/c, roll surr.	£8-96
Gauss 12in 200W	£84-00
Gauss 15in 200W	£96-00
Gauss 18in 200W	£129-00
Goodmans Axent 100	£7-60
Goodmans Audiom 200 8 ohm	£13-46
Goodmans Axiom 402 8 or 15 ohm	£19-80
Goodmans Twinaxiom 8, 8 or 15 ohm	£9-50
Goodmans Twinaxiom 10, 8 or 15 ohm	£9-86
Goodmans 8P 8 or 15 ohm	£5-95
Goodmans 10P 8 or 15 ohm	£6-25
Goodmans 12P 8 or 15 ohm	£14-95
Goodmans 12PG 8 or 15 ohm	£16-50
Goodmans 12PD 8 or 15 ohm	£16-95
Goodmans 12AX 8 or 15 ohm	£39-00
Goodmans 15AX 8 or 15 ohm	£45-00
Goodmans 15P 8 or 15 ohm	£22-50
Goodmans 18P 8 or 15 ohm	£39-00
Goodmans Hifax 750P	£16-00
Goodmans 5in midrange 8 ohm	£4-05
Jordan Watts Module, 4, 8 or 15 ohm	£15-36
Kef T27	£5-18
Kef T15	£6-25
Kef B110	£6-75
Kef B200	£7-85
Kef B139	£15-08
Kef DN8	£2-08
Kef DN12	£5-39
Kef DN13 SP1015 or SP1017	£4-05
Lowther PM6	£30-60
Lowther PM6 Mk 1	£32-85
Lowther PM7	£48-60
Peerless K010DT 4 or 8 ohm	£7-25
Peerless DT10HFC 8 ohm	£8-26
Peerless KQ40MRF 8 ohm	£9-50
Peerless MT225HCF 8 ohm	£2-95
Richard Allan CA12 12in bass	£19-80
Richard Allan HP8B	£11-93
Richard Allan LP8B	£8-33
Richard Allan DT20	£6-08
Richard Allan CN8280	£16-20
Richard Allan CN820	£3-15
Richard Allan Super Disco 60W 12in	£16-95
Richard Allan CG15 15in bass	£27-45
Richard Allan Super Disco 12in 60 watt	£16-95
Richard Allan Super Disco 10in 50 watt	£13-25
Richard Allan Super Disco 8in 50 watt	£12-95
Radford BD25	£22-00
Radford MD9	£10-50
Radford MD6	£12-50
Radford TD3	£7-25
Radford Cross Over Network	£13-00
STC 4001G	£5-90
Tannoy 10in HPD	£67-50
Tannoy 12in HPD	£73-75

Tannoy 15in HPD

Wharfedale Super 10 RS/DD 8 ohm

£88-15

£13-50

SPEAKER KITS

Baker Major Module 3, 8 or 15 ohm	each	£13-28
Fane Mode One Mk II 15W	each	£10-35
Fane D40 Disco Kit	each	£19-95
Goodmans DIN 20 4 or 8 ohm	each	£13-28
Goodmans Mezzo Twin kit	pair	£46-50
Helme XLK 30	pair	£17-10
Helme XLK 35	pair	£21-60
Helme XLK 40	pair	£31-50
Helme XLK 50	pair	£50-40
Kefkit 1	pair	£44-10
Kefkit III	each	£39-38
Peerless 20-2	each	£15-70
Peerless 30-28	each	£21-95
Peerless 20-3	each	£23-90
Peerless 50-4	each	£38-45
Peerless 1060	each	£50-40
Peerless 1070	each	£41-40
Peerless 1120	each	£45-00
Richard Allan Twin assembly	each	£13-46
Richard Allan Triple 8	each	£20-25
Richard Allan Triple 12	each	£25-16
Richard Allan Super Triple	each	£28-25
Richard Allan RA8 Kit	pair	£37-80
Richard Allan RA82 Kit	pair	£59-40
Richard Allan RA82L Kit	pair	£65-70
Wharfedale Linton II kit	pair	£20-81
Wharfedale Glendale 3XP kit	pair	£47-70
Wharfedale Dovedale III kit	pair	£59-40

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 discount price list.

THIS MONTH'S SPECIALS!

Pioneer PL12D	£43-00
Pioneer PL15R	£53-00
Pioneer SX434	£98-95
Rotel RX202	£80-80
Videotone Minimax II	£39-00

We stock the complete Radford range of amplifiers, preamplifiers, power amplifiers, tuners, etc., and also Radford Audio Laboratory equipment, low distortion oscillator, distortion measuring set, audio noise meter, etc.

ALL PRICES INCLUDE VAT (PRICES CORRECT AT 12-5-76)

Send stamp for free 32 page booklet "Choosing a Speaker"

ALL UNITS GUARANTEED NEW AND PERFECT
Carriage and Insurance: Speakers 50p each (12in and up 75p each); Kits 80p each (£1-60 per pair); Tweeters and Crossovers 30p each.

WILMSLOW AUDIO

Dept PE

Loudspeakers, mail order and export:
Swan Works, Bank Square, Wilmslow.

Hi-Fi, Radio and TV: Swift of Wilmslow,
5 Swan Street, Wilmslow, Cheshire.

PA, Hi-Fi and Accessories: Wilmslow
Audio, 10 Swan Street, Wilmslow,
Cheshire.

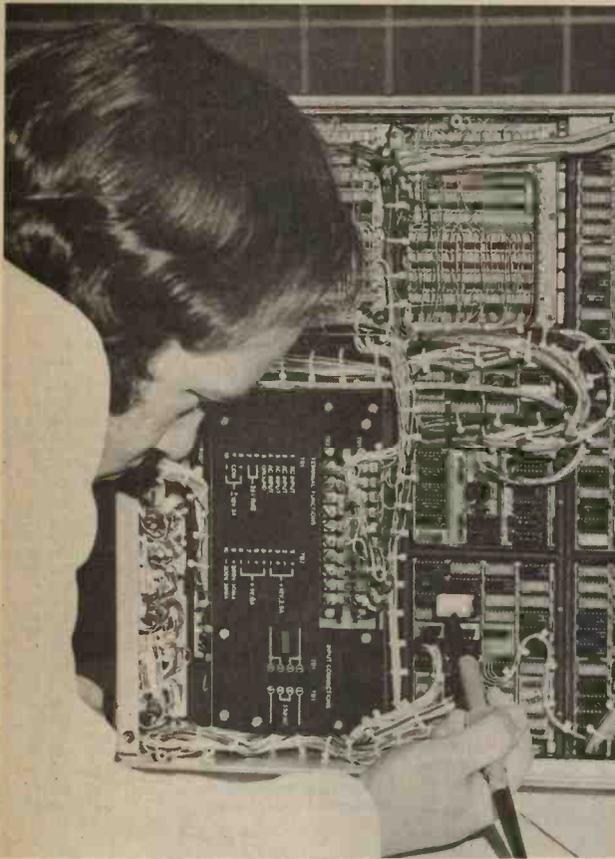
Telephone: Loudspeakers, mail order and
export—Wilmslow 29599; Hi-Fi, Radio,
etc.—Wilmslow 26213.

Complete kits in stock for Radford Studio 90, Radford Monitor 180, Radford Studio 270, Radford Studio 360, Hi-Fi Answers Monitor (Rogers), Hi-Fi News No Compromise (Frisby), Hi-Fi News State of the Art, Wireless World Transmission Line (Bailey), Practical Hi-Fi and Audio Monitor (Giles), Practical Hi-Fi and Audio Triangle (Giles), Popular Hi-Fi (Colloms), etc.

Construction leaflets for Radford, Kef, Jordan Watts, Tannoy, Hi-Fi Answers Monitor, free on request.

P.A. amplifiers, microphones, etc., by Shure, Linear, Eagle, Beyer, AKG, etc.

FREE with orders over £10—"Hi-Fi Loudspeaker Enclosures" book.



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.

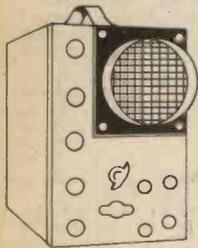
You build, see and learn as, step by step, we take you through all the fundamentals of electronics and show you how easily the subject can be mastered and add a new dimension not only to your hobby but also to your earning capacity.

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.

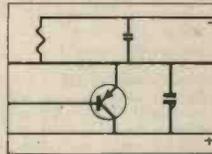
1

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.



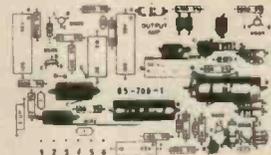
2



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.

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

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.

Brochure without obligation to:
**BRITISH NATIONAL RADIO
 & ELECTRONICS SCHOOL**, Dept. EL78
 P.O. Box 156, Jersey, Channel Islands

NAME _____

ADDRESS _____

(Block caps please)

A POWERFUL COMBINATION

B RITAIN'S new National Exhibition Centre at Birmingham was the setting for this year's International Electrical, Electronic and Instrument Exhibition. This new and spacious venue was most appropriate for the marriage of the IEA and Electrex, appearing together for the first time in one combined exhibition. A report will appear next month. Meanwhile the significance of the event deserves comment.

The close relationship between electronics and electrical engineering is self-evident. But as technologies advance this relationship grows ever closer and today the electricity supply services rely upon electronic instruments and circuits for control and monitoring purposes at all stages, from the power generating station through the varied distribution networks to the ultimate consumer. Conversely, electronic equipment requires electrical power to operate, though electronics is not entirely dependent upon the normal electricity supply. A real measure of independence is enjoyed by electronics because so much equipment can operate from other sources of electrical energy. But since battery manufacture, like all industry, is finally dependent upon mains supplies it would be unwise to make too much of such an argument. Devolution may be fashionable in political circles, but that's not the road for the electronics and electrical industries. Future needs and circumstances can only bring the two even closer together. In such an amalgamation of forces much of our future prosperity, if not existence, depends.

Energy resources has become a commonplace topic, and with very good reason. Indigenous fossil fuels will not last for ever, and there is an undeniable need to start looking for alternative sources of energy from which to produce electricity. For electricity remains the most convenient and flexible form of power, although not the most economical to generate using traditional methods and fuels.

Much work is currently being performed in exploring possible ways of harnessing and using solar radiated energy. But the self-sufficient home is still a dream, despite valiant efforts being made by various individuals and groups. One interesting idea recently mooted is for a two-way system whereby houses could feed current collected from roof top batteries of solar cells into the national grid in times of low domestic demand. Energy so contributed by countless homes could be used to pump water to high level reservoirs where it would be stored for eventual use to drive generators at time of heavy demand. The ambitious scheme envisaged poses mammoth problems, and clearly electronic control would play a vital role in any practical realisation of such a two-way exchange scheme.

No Government is likely to allocate millions of pounds to finance this or any other revolutionary scheme—however ideal and desirable—so long as it is not immediately imperative to do so. Thanks to North Sea oil, the present day fuel situation seems good and adequate. But we may be living in a fool's paradise. The situation will be very different in 25 years time.

Common sense cries out for a National Energy Policy and a bold plan to organise research and engineering resources to concentrate on new alternative methods for electricity generation. May the coming together at Birmingham of the electronic and electrical industries be an augury of some determined and positive efforts in this direction.

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



CAR INTRUDER ALARM

By J. HAGGIS

THIS article describes the design and construction of a circuit that can be made to give warning of an intruder opening any of your car doors, boot or bonnet. The circuit is made to operate a relay which repeatedly switches on for three seconds and off for one second. This relay can in turn be made to operate the vehicle horn or any other audible warning device.

The circuit is arranged such that the horn will silence after a chosen interval only if the car door, boot or bonnet are properly closed again. If, however, the door, etc. are not closed the horn will continue to sound.

It was thought that if the horn was made to sound intermittently it would attract more attention and save the battery and horn. With this interrupted sound, an intruder could not claim he had his horn stuck on.

DOOR SWITCHES

The first requirement is to fit the vehicle doors, boot and bonnet with switches. These switches should be installed such that when the door, etc. is closed the contacts are open, and closed when the door is open. Reed relays and magnets could be usefully employed if desired, instead of push-buttons.

CIRCUIT DESCRIPTION

The circuit is required to operate a relay if any of the door switch contacts are made, and to operate that relay at approximately a three second on, one second off ratio. It must also keep doing this for approximately one minute 15 seconds after the door switch has been made, even if the door is closed immediately.

If, however, the door remains open, the circuit must ensure that the relay will continue to operate at the above on/off ratio indefinitely.

To achieve these two requirements, two of the now well-known 555 timers are used. Timer IC1 (Fig. 1) is wired in the monostable mode and provides a positive supply to timer IC2 for approximately one minute 15 seconds.

Timer IC2 is wired in the astable mode and provides the on/off pulse to drive the relay RLA.

It is worth noting at this stage that the diode across the relay coil *must* be a germanium gold bonded type. Other types were tried but did not fully suppress the back e.m.f., causing the timer to be re-triggered.

The values of R5 and C2 determine the length of time the circuit remains operative. With the values shown it will operate for approximately 75 seconds. This is a long time for a car horn to be blowing,

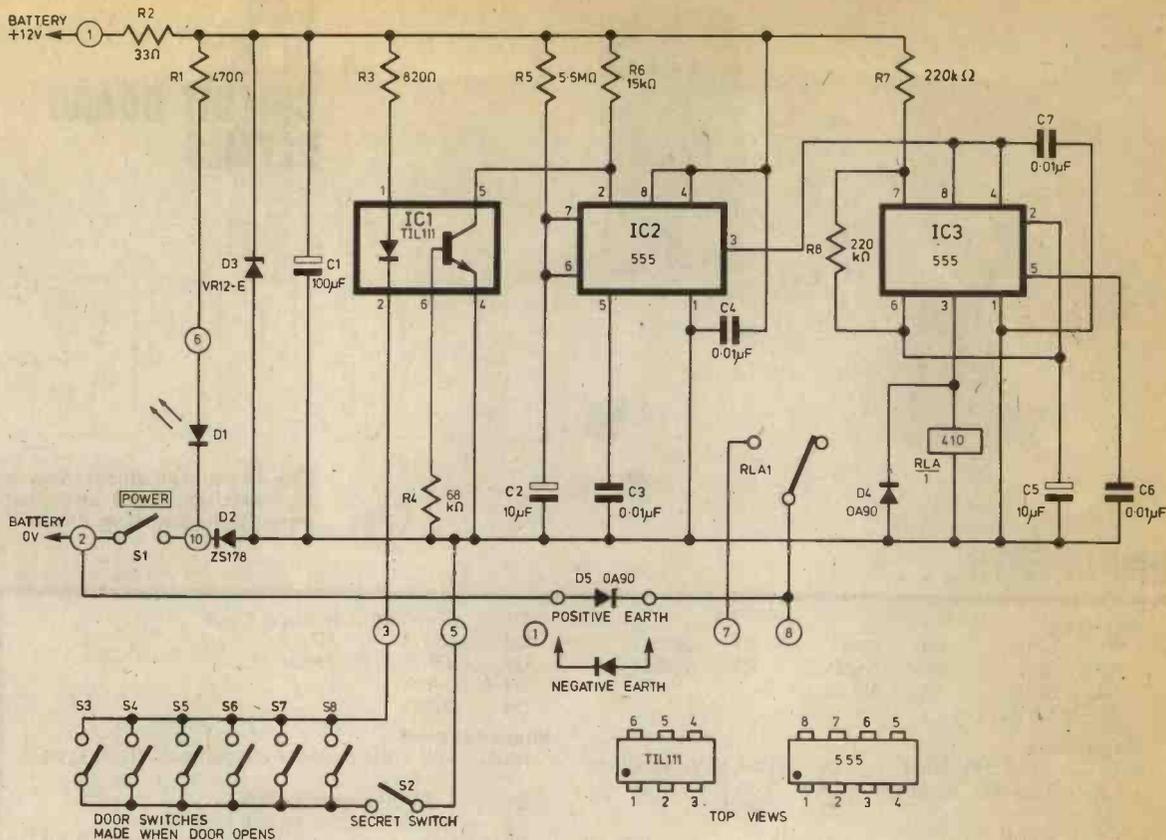


Fig. 1. Complete circuit diagram of the Car Intruder Alarm

but if any constructor thinks it should be longer, he can increase the time by increasing the value of R5 or C2. The data sheet for the timer states that the maximum value of R5 for reliable operation is determined by the value of the threshold current (I_T) into pin 6 which is $0.25\mu\text{A}$ (max).

$$R5 (\text{max}) < \frac{V_{CC}}{3 \times 0.25} \text{ M}\Omega$$

$$R5 (\text{min}) = 1\text{k}\Omega$$

i.e. for 12V operation $R5 (\text{max}) = 16\text{M}\Omega$.

Ideally R5 should be kept as small as possible. C2 is determined from the formula for the time delay. For $t = 3$ mins with a value of $R5 = 8\text{M}\Omega$

$$C2 = \frac{180}{1.1 \times 8 \times 10^6} \text{ farads} = 20\mu\text{F}.$$

It is worth noting that individual tolerances of capacitors can make a mockery of calculations. Allow plenty of time for the capacitor to cool before its timing is checked.

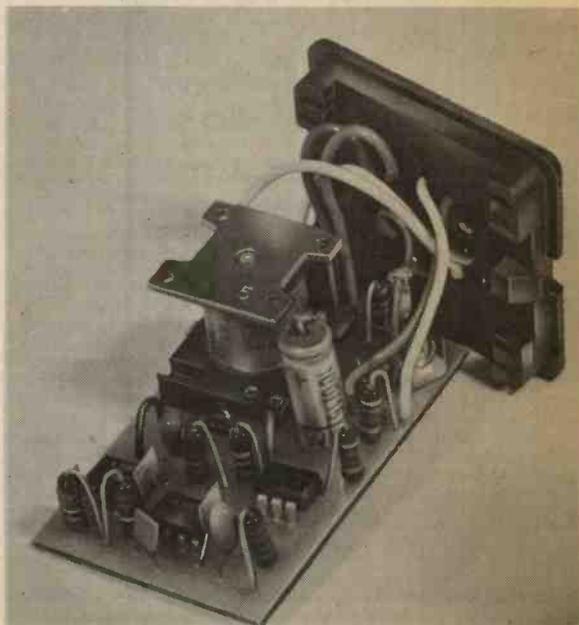
Again, if desired, timer IC2 on/off ratio can be altered.

$$t_{ON} = 0.685 (R7 + R8) \times C5$$

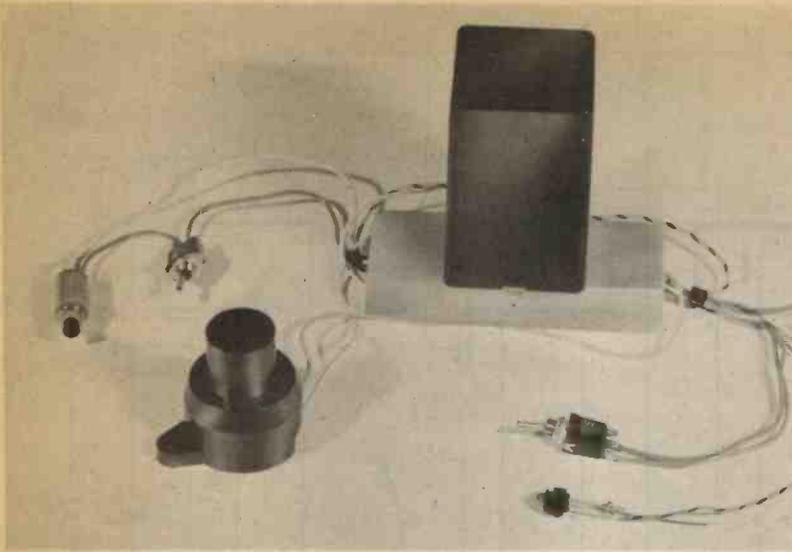
$$t_{OFF} = 0.685 R8 \times C5$$

where t_{ON} and t_{OFF} are in seconds when R7 and R8 are in ohms and C5 is in farads. Total period $t = t_{ON} + t_{OFF}$. The same constraints on the choice of values of R7, R8 and C5 apply as given for the monostable mode.

The intruder alarm circuit wired to the 11-pin base



CAR ALARM CIRCUIT BOARD DETAILS



The completed alarm showing all switches, siren and dash-board light emitting diode

COMPONENTS . . .

Resistors

R1	470 Ω	R4	68k Ω	R7	220k Ω
R2	33 Ω	R5	5.6M Ω	R8	220k Ω
R3	820 Ω	R6	15k Ω		

All $\pm 5\%$ $\frac{1}{2}$ W

Capacitors

C1	100 μ F 15V elect	C5	10 μ F 35V tantalum
C2	10 μ F 35V tantalum	C6	0.01 μ F
C3	0.01 μ F	C7	0.01 μ F
C4	0.01 μ F		

Semiconductors

IC1	TIL111 optically coupled isolator
IC2	555 timer i.c.
IC3	555 timer i.c.

D1 Green light emitting diode

D2 ZS178

D3 VR12-E 12V Zener

D4 OA90

D5 OA90

Miscellaneous

RLA 6V 410 Ω changeover contacts (R.S. Type 912)

S1 On/off toggle switch

S2 On/off toggle switch (see text)

S3-S8 Miniature push-to-break switches (R.S.) or reed switches and magnets (see text)

11-pin module case, 11-pin screw base, screw base cover (all R.S.)

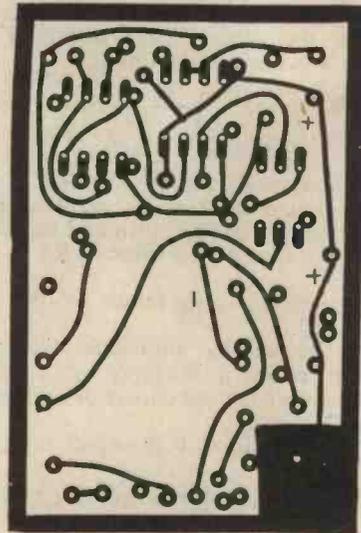
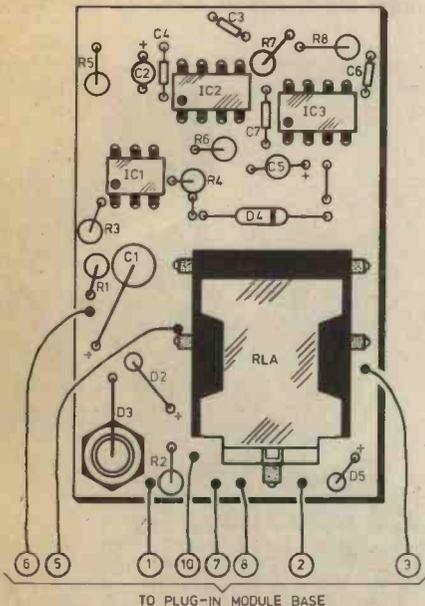


Fig. 2. Layout of the components on the printed circuit board (left) and printed circuit master shown full size (right). Note that diode D5 is connected to pin 1 or 2 according to earth system, see Fig 1

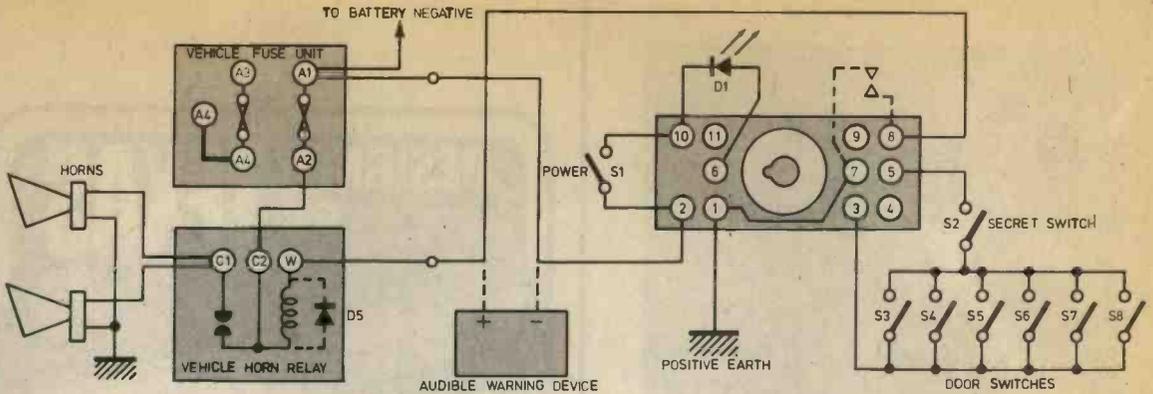


Fig. 3. Wiring the unit into a car with a positive earth system. The green l.e.d. (D1) can be mounted inside the car to show that the system is in operation. The audible warning device can be used if it is preferred not to use the car horns

The trigger input, pin 2, of the 555 is very sensitive and it was found that even the shortest length of wire on this point gave trouble, the main difficulty being that the timer would be re-triggered after the time interval.

To avoid any trouble from the long length of wire required to reach the door switches, it was decided to isolate them from the timer by using a TIL111. This is an optically coupled isolator which consists of a light emitting diode (l.e.d.) and photo-transistor in one 6-pin dual-in-line package.

The current through the l.e.d. must be limited to 60mA maximum. The transistor is an *npn* type. The base resistor (R4) is chosen to ensure that the transistor is turned fully on when full light is emitted from the l.e.d.

It is arranged that when any door is opened 0V is applied to the l.e.d. cathode causing it to illuminate, turning on the phototransistor.

The negative going edge at the collector triggers the timer IC1. Once triggered, the output (pin 3) goes to +9V.

If the door is then closed timer IC1 will remain in that state, providing supply voltage to IC2, until its time interval is ended, pin 3 then falling to 0V.

If the door were to remain open, holding the door contact closed, the l.e.d. would remain illuminated, the phototransistor collector and pin 2 remaining at 0V. In this condition (pin 2 at 0V) the time interval does not terminate, i.e. the output pin 3 remains at +9 volts until such time as pin 2 is returned to its high state.

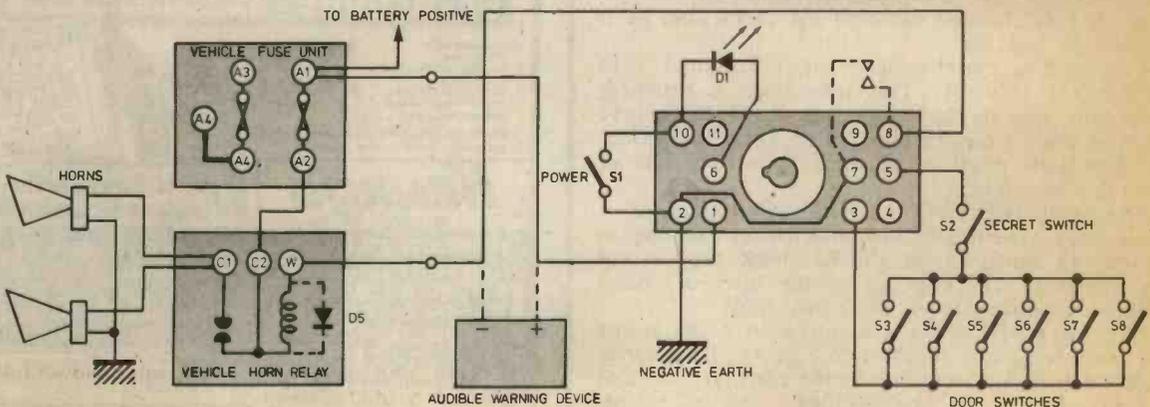
The voltage from a car 12V battery can rise to as much as 15 volts so a 12V Zener D3 has been used to stabilise the voltage.

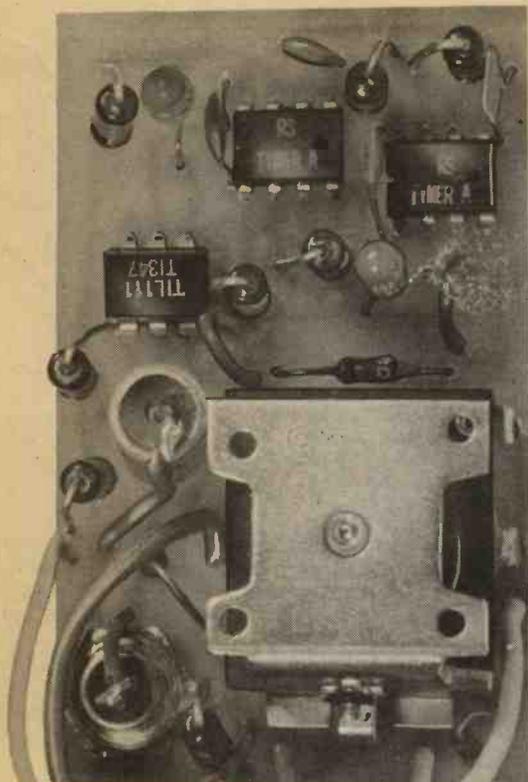
The switch to provide power to the circuit is best situated well out of sight and reach. To indicate that the circuit is on a green l.e.d. (D1) is used. This gives very long life.

ARMING THE SYSTEM

In order that the owner can set the system and get out of his car the secret switch (S2) must be installed. This is a switch that has to be actuated once the owner is out of his car with all doors closed. It is not much use going into detail in this article about this switch. There is plenty of scope here for the ingenious.

Fig. 4. Wiring the unit into a car with a negative earth system





Completed printed circuit board showing component layout

CONSTRUCTION

The circuit board is housed in an 11-pin plug-in module case, which can then be used with a screw terminal, 11-pin relay base and cover.

The circuit board measures 6.5cm x 4.1cm and the layout is not critical. A full size layout is given in Fig. 2.

The system can be used with either positive or negative earth systems. Some cars employ a horn relay and others switch the horn directly. In either case, whether it be a positive or negative earth system, all cars checked switched the earth side, be it positive or negative.

For positive earth systems strap Terminal 7 to Terminal 1 (Fig. 3). This puts positive (earthed) volts onto one of the relay contacts. For negative earth systems strap Terminal 7 to Terminal 2 (Fig. 4). This puts negative (earthed) volts onto one of the relay contacts.

The system described has only been used on a horn relay system and any constructor wishing to switch the horns direct should check the current requirements. The contacts of the relay described in this article are rated at five amps, 150W.

It is essential to have a suppression diode across the horn relay coil (diode D5, Fig. 1). Its polarity must be changed according to the earth system, and again must be of the type specified. ★

DESIGNED BY TEXAS



30,000 ALREADY SOLD
Texan Amplifier as featured by PRACTICAL WIRELESS
SOLE U.K. DISTRIBUTORS - HENRY'S

Build it yourself for only

£32 KIT PRICE INC. VAT + £1.00 p&p.
 Built and tested £42.00 inc. VAT + £1.00 p&p.

Build the Texan stereo amplifier, then you can be doubly proud! For a start, you'll own a superb home entertainment unit. And have had all the pleasure of doing it yourself, with the Henry's kit.

Look at the Texan specification

Incorporating fully integrated stereo preamp and power amp, with 6 IC's, 10 transistors, 6 rectifiers and zener diodes. Plus stabilised, protected circuitry, glass fibre pcb; Gardners low-field low-line mains transformer; all facilities and controls. Slim design, chassis 14 1/2" x 6 1/2" x 2" overall. 20 watts per channel RMS, less than 0.1% distortion at 1 kHz.

- ★ Can be built Stage by stage
- ★ Ask for leaflet 5.
- ★ Everything necessary supplied. Full after sales service and guarantees.

TEXAN FM TUNER KIT **£23.50**
 inc. VAT + 50p p&p

Built and tested £28.50 inc. VAT + 50p p&p.

Build the matching Texan stereo tuner! Features advanced varicap tuning. Phase lock loop decoder. Professionally designed circuit. Everything you need is in the kit. From the glass fibre pcb to the cabinet itself. Excellent spec: 2.5 uV aerial sensitivity. 500 mV output (adjustable). Tuning range 87-102 MHz. Mains powered.

THE NATURAL FOLLOW-ON

VIDEO SPORT



An up-to-the-minute game. Plugs into your own TV aerial socket. Switch on. And you're away! Choose your game - football, tennis or hole-in-the-wall. Absolutely safe. For you. Your children. And your TV. Mains powered. List Price £42.50

HENRY'S PRICE **£25.00**
 inc. VAT + 50p p&p

★ OVER 10,000 ALREADY SOLD
 ★ IDEAL GIFT

For this latest edition, we have made hundreds of changes and additions. Features now include:

- ★ over 5000 items - many new
- ★ free 50p voucher inside every copy
- ★ virtually everything needed by amateurs and professionals
- ★ over 200 pages
- ★ easy-to-use, complete alphabetical index
- ★ section index
- ★ everything at competitive prices

ONLY 50p

FREE to Educational Establishments when ordered on official headed notepaper

+20p cart./pack.

TRANSISTOR & VALVE DISCOUNT PRICE LIST
 over 2000 types
 SEND FOR YOUR FREE COPY

HENRY'S RADIO

All mail to: Henry's Radio
 303 Edgware Rd. London W2

LONDON W2: 404/6 Edgware Road. Tel: 01-402 8381

LONDON W1: 231 Tottenham Ct Rd. ^{lower} sales floor. Tel: 01-636 6681

★ NOTTINGHAM: 94/96 Upper Parliament St. Tel: (0602) 40403

★ READING, BERKS: 130/131 Friar Street. Tel: (0734) 583230

★ HARROW: 190/4 Station Road. Tel: 01-863 7788

★ CROYDON: 110 North End.

Tel: 01-681 3310

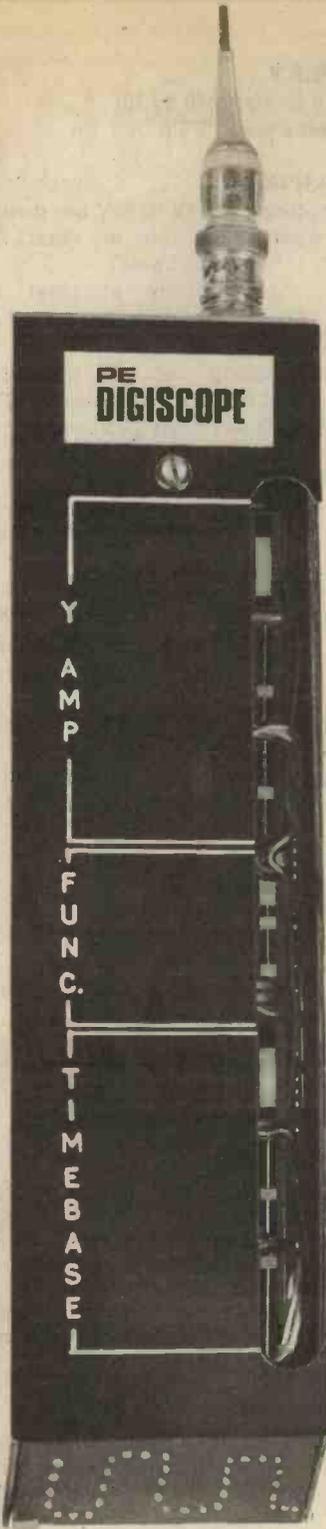
★ NEW STORES

Please Note: Mail Order Customers
VAT DOWN HENRY'S WILL CREDIT ANY
 VAT OVERPAYMENTS

PE

DIGISCOPE

By R. W. Coles and B. Cullen



THIS is the first of a series of articles describing an experimental oscilloscope not much bigger in size than a logic probe with an l.e.d. display substituting for the c.r.t. Although it lacks the capability of the conventional instrument in both bandwidth and resolution of waveshapes, it presents a different approach in design by replacing the usual high voltage analogue circuitry with TTL logic and interfacing with an 8×10 l.e.d. matrix.

Of course, with an X and Y scan of a matrix of this density it can sometimes be difficult to identify the shape of wave, this applies particularly to those with a slow rate of change. However, familiarity with the instrument in handling the controls can do much to lessen this problem. Pulses, step functions, etc. are relatively easy to identify and measure. An excellent triggered time-base generator contributes a great deal in really positive locking.

FRESH APPROACH

It occurred to the writers that with modern l.e.d. and integrated circuit techniques, it might be possible to design an entirely new breed of scope which would be small and handy for portable use, but which would operate from low voltages, even batteries.

The display device itself was the crucial factor, and it was recognised from the start that it would not be possible to match the high definition of a c.r.t. Nevertheless, by using an l.e.d. matrix it seemed possible that one would be able to see the shape of waveforms, and be able to measure their amplitude and frequency to a reasonable degree of accuracy.

Furthermore, since a matrix display consists of a series of discrete points, it seemed that low cost TTL logic could be used extensively to replace the expensive high voltage analogue circuitry used in conventional scopes.

NEW GROUND

As finally defined, Digiscope breaks new ground in the oscilloscope hierarchy since it is not much bigger than a logic-probe, and is suitable for hand-held operation and the more traditional bench use with a probe attached. The major compromise made when choosing an i.e.d. display was in the definition possible with only 80 data points against the several thousand equivalent points on a similar sized c.r.t. Once this compromise has been accepted, however, the rest of the circuitry becomes much simpler than that of a conventional scope, and the performance in most other areas is equal to or better than that of its predecessors. Most important of all, the eradication of high voltages from the design makes the circuit easy to build using the minimum of hardware.

CIRCUIT

A block diagram of Digiscope is shown in Fig. 1.1. and it can be seen that at this level there are more boxes in this design than in a traditional instrument! This is not as bad as it at first appears, since most of the boxes can be easily produced with cheap integrated circuits.

The display is built up from a matrix of i.e.d.s wired as eight rows by ten columns, so the drive circuits are required to produce eight separate Y drives, and ten separate X drives. When the scope is triggered the timebase circuitry causes each column to be enabled in turn from left to right, the duration of each "column enable" being determined by the timebase speed setting. At the end of a sweep the display is blanked and the timebase rests to await another trigger pulse.

The output of the Y Amplifier is compared with a series of reference thresholds and the result of this comparison decides which of the eight rows should be enabled at any given time. The interaction of this X and Y scan results in a waveshape trace being plotted on the screen. At slow speeds, individual points of the plot can be observed, but at higher timebase rates the eye integrates the display and observes what appears to be a static plot of the waveform.

Y AMPLIFIER

The Y Amplifier itself is of traditional form, being simply a linear amplifier with variable gain and a high input impedance, preceded by a switched attenuator.

The output from the Y Amplifier is fed in parallel to nine comparator circuits which have as their other inputs, one of a series of nine reference voltages from the Reference Generator circuit. The Reference Generator is simply a chain of forward biased diodes so that each reference voltage differs from its neighbours by about 700mV.

A typical voltage output from the Y Amplifier will be above some comparator thresholds, and below others, so that some comparators will give a logic 1 out, others a 0. The display requires a single row drive whose position in the column can be interpolated from the transition between 1s and 0s in the nine comparator outputs, and this interpolation is achieved by a bank of eight EXCLUSIVE-OR gates, forming the Row Decoder.

• • SPECIFICATION • • •

DISPLAY

80 i.e.d. matrix (8 by 10)
Display area 1.5in by 1.1in

AMPLIFIER

Sensitivity 10mV to 80V per division
Bandwidth d.c. to at least 1MHz (d.c. coupled)
5Hz to at least 1MHz (a.c. coupled)
Input impedance 1 Megohm
Input coupling d.c., a.c., ground
Maximum input voltage (see text)
Y Shift 8 switched positions

TIMEBASE

Time/division 100ns to 10s per division in
25 calibrated steps

TRIGGERING

Trigger modes *AUTO* or *NORM* (*AUTO* provides a reference trace in the absence of a trigger)
Trigger slope positive or negative selectable
Trigger level seven switched steps
External trigger requires TTL type square edge

POWER SUPPLIES

+12 volts at 60 milliamps
-12 volts at 60 milliamps
+5 volts at 350 milliamps
from external mains power unit or batteries
(3.5W maximum consumption)

ROW DRIVERS

The appropriate row is driven by one of eight Row Drivers which consist of open collector gates and *pnp* transistors which take the required row line up to plus 5V. The second inputs to each of eight open collector gates are commoned together and used as an overriding blanking input so that the display can be disabled between each sweep.

TRIGGER CIRCUIT

The sharp transition generated when a particular comparator switches, is ideal as a triggering signal for the timebase, and since each comparator switches at a different threshold voltage it is a simple matter to choose a single comparator output as a trigger by means of a switch.

The chosen trigger signal is buffered by the Trigger Amplifier and then used to trigger a monostable

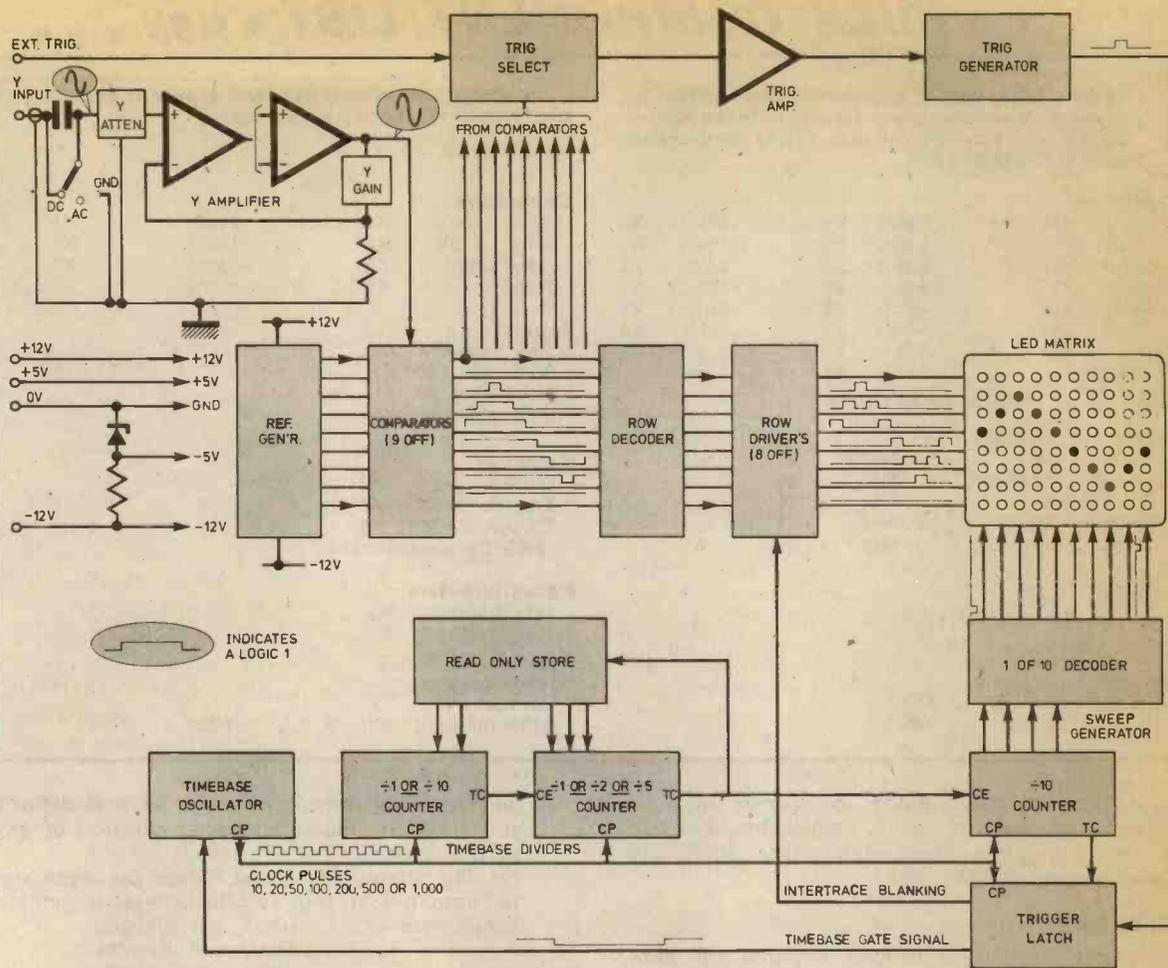


Fig. 1.1. Block diagram of the Digiscope

in the Trigger Generator circuit. If the Trigger Latch is primed then the pulse from the monostable will reset it. The output of the Trigger Latch is used to enable the Timebase Oscillator which then starts to generate pulses at the selected rate.

TIMEBASE

In all, there are 24 possible timebase speeds, and to select all these directly, at the Timebase Oscillator would require the switching of lots of bulky C/R networks. To overcome this problem, the Timebase Oscillator itself is restricted to only four switched speeds, and thus four C/R networks. Each of these basic frequencies is then divided down in a ROM programmed, two decade, BCD counter to arrive at one of four switch selectable rates. This Timebase Divider circuit divides the selected Timebase Oscillator frequency by 1, 2, 5, 10, 20, 50, or 100, to give a total range of speeds which are more than adequate for the job.

The final timebase frequency is fed to a further BCD counter which forms part of the Sweep Generator to step the matrix columns in sequence. The outputs of this counter drive a four-line-to-ten-line decoder the purpose of which is to connect each of

the column lines to ground in turn as the counter counts from 0 to 9. At the end of a single count from 0 to 9 the Sweep Generator sets the Trigger Latch which in turn shuts off the Timebase Oscillator and blanks the display while awaiting a further trigger.

POWER SUPPLIES

The power supplies required by Digiscope are plus 5V at 350mA, plus 12V at 60mA, and minus 12V at 60mA, a total of about 3.25W. The prototype is at present operating with a small mains power unit which will be described later, but there is no reason why existing supplies or batteries should not be used if desired, providing adequate regulation is maintained.

CONSTRUCTION

From the outset Digiscope was planned as a miniature instrument and a probe like shape was considered essential to the design. The main circuitry is mounted on two strip board decks, one above the other, each measuring 7½in by 2in and spaced only ¼in apart. Because of this dense constructional layout any intending constructors should

•• BULK COMPONENT LIST •••

To take advantage of any concessions offered by retailers for bulk purchases we include the following list which covers the majority of components used in the Digiscope.

Individual component lists will appear as usual with circuit diagrams as they occur.

Resistors

100Ω	X10	1.8kΩ	X1	10kΩ	X3
150Ω	X1	2.2kΩ	X2	15kΩ	X1
330Ω	X1	2.7kΩ	X1	39kΩ	X1
560Ω	X2	3.9kΩ	X2	100kΩ	X1
620Ω	X18	4.7kΩ	X3	910kΩ	X1
820Ω	X8	5.6kΩ	X1	1MΩ	X3
1kΩ	X17	6.8kΩ	X1		
1.5kΩ	X1	9.1kΩ	X1		

All $\frac{1}{8}$ W 5% metal oxide miniature

Integrated Circuits

CA3100	X1	74145	X1
μ A710C	X9 (8 pin)	7486	X2
DTL935	X1	7474	X1
74123	X2	7410	X1
74160	X3	7401	X2

Transistors

2N3819	X2
Any silicon npn	X11
Any silicon pnp	X8

Diodes

Silicon small signal	X23
RL50-01 (l.e.d.s)	X80

Capacitors

0.1 μ F	400V	X1	24pF	X1
0.1 μ F	250V	X1	100pF	X1
0.1 μ F	\geq 20V	X8	330pF	X1
6.8pF		X1		

Zeners

5.6V	400mW	X2
3.3V	400mW	X1
9.1V	400mW	X1
5.1V	400mW	X1

Switches

DS16A	2-4	X2
DS16A	1-8	X4
DS16A	VAR24	X1

(ERG Components Ltd.)

Potentiometers

1kΩ (helical)	X1
10kΩ (helical)	X1

Miscellaneous

Formica	
0.15in matrix Veroboard, b.n.c. socket	

be confident of their ability to operate in such miniature environments, and of course should ensure that their soldering irons and other tools are "mouse" enough for the job!

CONTROLS

The large number of selector switches and controls required on any practical scope raised serious problems which were solved by using d.i.l. switches made by ERG Components. These clever little switches are the same size as a 16 pin d.i.l. integrated circuit, and since they can be soldered directly onto a printed circuit they avoid the bulk and tangle of panel mounted rotary switches.

In all, 23 integrated circuits are used in the design, 13 logic types, and 10 analogue types, all except the op. amp being in dual-in-line packs.

MATRIX

The display matrix is built up with the cheapest kind of discrete l.e.d.s on a piece of specially modified 0.15in matrix Veroboard, and when constructed it forms a compact and durable sub-assembly. The display matrix is mounted at the rear of the case and viewed through a red filter.

The case is built up from Formica sheet joined with Araldite, and this material proved ideal because of its strength combined with a thinness which made it possible to build a "tight" protective cladding.

Y-AMPLIFIER EXAMINED

The basic circuit of the Y Amplifier is shown in Fig. 1.2. There are three parts to the circuit, an input attenuator, a source follower, and a high gain operational amplifier. The performance conditions required from this circuit are as follows.

(a) The input impedance must be well defined at 1 megohm, regardless of the position of any of the controls.

(b) The attenuator should reduce the input signal amplitude in four switched ranges to achieve sensitivities of:

10mV per division
100mV per division
1V per division
10V per division

with other controls in the CAL position.

(c) The output of the amplifier must produce a 5.6V peak-to-peak swing in order to completely fill the screen vertically. (The figure of 5.6V is arrived at by multiplying the threshold difference, 800mV, by the number of thresholds to cover a column, 7.)

(d) The gain of the amplifier must be variable in eight switched steps of 1:2:3:4:5:6:7:8 to provide a fine sensitivity control over the total range of 10mV to 80V/division.

(e) The amplifier must have a good d.c. performance and a negligible output offset voltage so that output signals are accurately referred to 0V.

(f) The a.c. performance of the amplifier should be as good as possible, i.e. the bandwidth should extend to at least 1MHz at all gain settings.

(g) The inputs to the active devices must be protected against accidental application of over-voltages.

ATTENUATOR

The attenuator is basically a switched potential divider giving a constant 1 megohm resistance to ground at the Y input, but a variable resistance to ground as far as the amplifier itself is concerned.

SEMICONDUCTOR UPDATE

By R.W. COLES

LM399

LM1812

DI-445

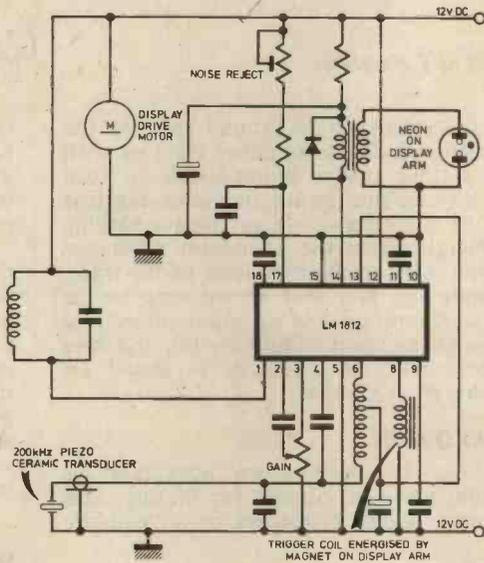
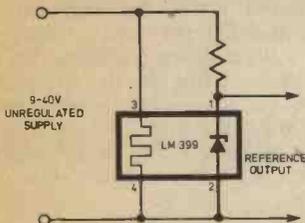
REFERENCE ONLY

If you need to develop a stable reference voltage, then a Zener diode is the simple solution, but unfortunately not always a completely satisfactory one, because a standard Zener suffers from several problems which often require the use of extra components before the required reference can be relied upon.

The most obvious characteristic of a Zener is its slope resistance (i.e. how much does the voltage change with change in current?) and it's true that modern silicon devices have fairly low slope resistances, but where large line and load variations are encountered it is often still necessary to add an external Op-Amp voltage follower to the reference circuit.

Zeners are noisy too... making them useful as "white-noise" generators but doubtful candidates for use in precision voltage regulators where output noise can be an unwanted embarrassment. These problems are, however, small beer compared to their fundamental vice which is their shift of reference voltage with change in temperature. There isn't a lot you can do about this one other than putting the reference circuit in a temperature controlled oven, and of course we couldn't normally contemplate that, or could we?

Well, yes, now we can, because of a clever new "Zener" integrated circuit from National, the LM399. The LM399 contains a single monolithic chip incorporating a Zener, an



amplifier, and a temperature stabilised oven circuit all in a tiddly four lead TO46 can. Although on a single chip, the circuit breaks logically into two sections, the reference section and the temperature stabiliser, each with two leads, Fig. 1.

The reference section behaves just like a conventional Zener (only better!) and can be substituted into any circuit in which a Zener is normally used. The temperature stabiliser will operate from any supply between 9 and 40V and keeps the chip temperature at a very stable 90°C, regardless of ambient temperature fluctuations, giving the reference section a temperature co-efficient of 0.002%/°C maximum!

This "Super-Zener" also has a low slope resistance of 0.5 ohms, a wide operating current range, and a very low noise figure into the bargain. What more could you ask?

FISH WITH CHIPS?

Summer is with us again, and no doubt many readers will be turning their thoughts away from electronics and towards some nautical pursuit such as sea-fishing or cruising. If these readers have any pangs of remorse about neglecting their soldering irons for the season, perhaps the National LM1812 integrated circuit might persuade them to share those summer evenings between their two hobbies without conflict!

The LM1812 looks good even to a land-lubber like me because it contains in a single 18-pin d.i.l. all the necessary electronics to build an ultrasonic sonar transceiver with a 12W transmitter output and a versatile display drive facility. An ultrasonic system like this can be used in a boat as a fish-finding sonar or as a depth echo-sounder, but with

a few extra components the LM1812 can also be used for amplitude modulated diver communications links, and can even be used in air at lower frequencies in, for example, intruder or burglar alarms.

In a typical role, as an echosounder (Fig. 2), the chip generates a single transmit pulse as the display driver motor passes a zero reference point, the display then indicates any return signals received during the ensuing 360° rotation, showing the depth to the sea-bottom or any obstruction.

The output from the transmitter drives a piezo-ceramic transducer (which is also used for reception) via a simple auto transformer, the resonant frequency of the transducer and the transformer being chosen to suit the application, 150 to 200kHz being typical for echo sounding work. A single parallel tuned circuit sets the exact frequency of operation of the acoustic receiver and transmitter, keeping external components to a minimum.

The display driver stage would traditionally operate a "peanut-neon" on the end of the motor driven display arm, via a step up transformer, but alternative displays such as l.e.d.s or even c.r.t.s can be catered for if desired.

Applications for the LM1812 are almost endless; this is a thoroughly useful and intriguing new device, with a versatile collection of control and signal inputs too numerous to mention, a terrible temptation to all those who intend to give up chips while they fish!

DRIVE POWER

If a t.t.l. or MOS logic circuit has to talk to the outside world, it often finds the conditions a bit overpowering out there. Nasty big mains-switching relays and thirsty filament bulbs make your average logic gate tremble at the knees at the thought of those high collector voltages, inductive spikes, and all those *dreadful* milliamps. It is necessary under these conditions to use a discrete component circuit to carry out the dirty business, leaving the delicate and well brought up logic gate at a proper distance from the distasteful conditions which BFY50s and hairy-chested 2N3055s can easily take in their stride!

If it were just a case of slapping a power transistor on the gate output, then this type of interface wouldn't be too much of a headache, but of course power driver circuits tend to grow like "Topsy", requiring resistors,

diodes, capacitors and perhaps even a second transistor for level shifting and extra current gain.

With problems like these, wouldn't it be nice if someone were to produce a gate-compatible power driver integrated circuit which tackled these difficult loads and didn't need a bevy of other components in support? Well, someone has, a firm called Dionics Inc. has taken a long look at the problem and has produced a device called the **DI-445** which offers milled-fist performance in a velvet-glove 8-pin mini-d.i.p. package.

Dionics really did their homework well, because the DI-445 will switch up to 125mA at 80V and can be driven from a wide range of logic levels including the CMOS and t.t.l. variety. Not only that but it isn't even necessary to get the "load-ON" logic level right because the DI-445 will operate from *either* positive or negative true input levels. A fully isolated power diode is provided in the package for use as a "catching diode" when driving inductive loads such as solenoids or relays, making it unlikely that any ancillary components would be required even with the most unfriendly of loads. In short, the new Dionics device could take a load off your mind!

NEWS BRIEFS

Sea Call

WITH more than half of all 'phone calls into and out of Britain handled by undersea cable the speedy repair of cable breakdowns becomes even more important as even bigger complexes are brought into service every year.

To help tackle this problem the first of two specially designed cable ships commissioned by the Post Office has just started service. Claimed as the World's most advanced cable repair ship, the Post Office cable ship *Monarch* is now fully operational and its sister ship, *CS Iris*, will be operational in the Autumn.

As part of an exercise to gain further sea experience, a Royal Navy Wasp helicopter was, for the first time, landed on her helicopter deck whilst on the move. This manoeuvre was to test and calibrate *Monarch's* glide path indicator equipment, a device used to give the helicopter pilots a correct approach reading.

Microprocessor Tutor

TO help fill the need for a form of microprocessor "teach-in", RCA have introduced a COSMAC Micro-tutor kit which is based on the CDP18000 series of microprocessors with 256 bytes of random access memory. Outputs are registered on a 2-digit hexadecimal display and a set of eight switches is provided for manual inputs.

The Microtutor is intended as an experimental/educational system and is accompanied by a manual written in a language designed for people with only a basic electronics background.

Microcomputer concepts are demonstrated by sample programmes, which are claimed to be simple to load and run on the tutor. All system signals can be directly observed, and an external option socket allows users to add their own circuits, typical examples being suggested in the manual.

The tutor may also be used for prototyping COSMAC systems in applications which do not justify the use of more sophisticated programming aids.

Further information on the CDP COSMAC Micro-tutor and further systems can be obtained from RCA Solid State—Europe, Dept P.E. Sunbury-on-Thames, Middlesex, TW16 7HW.





BY FRANK W. HYDE

SOLAR ENERGY

The United States are as ambitious in their harnessing of the energy of the Sun as they were with other space programmes. The project known as *Powersat* has a programme to launch up to thirty stations in orbit. The source of the scheme as reported earlier in *Spacewatch* is the Boeing Company. Each of the Powersats will give 10,000 MW at ground level, about equal to two of the present maximum output stations. The ground aerial would be about 8km in diameter.

With these plans go the methods of launching the materials for the giant structures that need to be built in space to provide the microwave energy. The heavy lift vehicle needed for the task is provisionally scaled to be some 158ft in diameter and 189ft high. The power required for this vehicle would be provided by 22 oxygen-hydrogen engines.

SATCOM LAUNCHES

The RCA *Satcom* system began in 1973 and has been a highly beneficial and successful system. This was the first of the United States own domestic systems and used capacity leased from Canada using the *Anik* satellites. Since then there have been cost improvements and tariffs have been reduced so that voice grade circuits can now be rented for rather less than the normal terrestrial links.

The second RCA *Satcom 2* was launched on March 26th and was to be finally in its appointed place at the end of June. This will be a geostationary position at 135 degrees west and will complement *Satcom 1* which is at 119 degrees west.

Together the satellites will provide 48 channels, each one capable of one colour transmission, 1,000 two way voice circuits or 64 million bits of data per second. *Satcom 2* will provide facilities to Alaska, Hawaii and the 48 states. Each of the four dish aerials will be oriented to cover a particular section of the territory.

The satellite weighs 2,000lb and when the solar panels are open the span is 37ft. The main body measures 5ft 4in x 4ft 2in x 4ft 3in. It is a three axis stabilised vehicle and has the power for a life of eight years with all operations continuous.

The satellite was launched by a three stage *Delta* launch vehicle. The first stage was a modified Douglas *Thor* booster using nine strap on solid fuel motors. The booster itself utilised liquid oxygen and liquid hydrocarbon propellant. The second stage was powered by a liquid fuel engine which was gimbal mounted to suit control during the second stage burn. The third stage was spin stabilised. The satellite first went to 140 miles height and then three days later with the aid of an "apogee kick" motor was transferred to its geostationary position.

FEED HORNS

The fixed assembly of four reflector aerials are offset for direction by the use of feed horns. This system makes for stable operation. There are a number of special RCA products employed. One of these is the graphite fibre epoxy material for the microwave filters, the waveguide sections and the antenna feeds.

Frequency and polarisation interleaving is achieved with the separate channels, 24 of them, by use of the transponder and the four antennas. Each channel has a 34MHz usable bandwidth within a 500MHz allocation. The dielectric reflectors use embedded wires in conducting grids to provide cross polarisation isolation. This is how the 24 channels are achieved.

CONTROL SYSTEM

The satellite control system is very comprehensive. The attitude section employs a sealed high speed wheel at 4,000 rpm, with a separate earth sensor and closed loop magnetic roll control. The RCA stabilised attitude control system provides three axis control by virtue of its gyroscopic rigidity provided by the wheel and the servo exchange of angular momentum with the craft main body. The inertial stability permits attitude determination by a single roll/pitch sensor of the earth's horizon. Magnetic torque is used and there is no need for moving parts. The system maintains orientation during the normal orbital operation, adjustment of

orbit and the injection of manoeuvres. The pointing capability is ± 0.21 degrees about roll ± 0.30 degrees about yaw and ± 0.19 degrees about pitch.

For orientation the satellite uses 12 hydrazine thrusters in a closed loop for north/south, east/west rotation keeping. During a period of 7 minutes every three weeks this loop with its rate gyro will be energised to modulate the north/south station keeping thrusters and compensate for residual thruster misalignment or mismatch to maintain attitude control.

For thermal control of heat absorption and heat rejection in order that the components and equipment stay within their operating limits (10 to 30 degrees Centigrade), space type mirrors and thermal insulation is employed to give passive control.

POWER AND PROPULSION

The power system consists of two folded solar array panels and three nickel cadmium batteries. The maximum output of the power supplies is 740 watts regulated at 35 volts. This falls to 550 watts at 35 volts after eight years. The batteries supply the power during the two eclipse periods each year. The Sun oriented solar arrays and direct arrays balance the efficiency and weight ratio. With the main body of the spacecraft always aligned vertically, a single axis clock controlled drive shaft maintains the array toward the Sun. The area of the solar cells is 71.5 square feet. The use of distributed converters through the system guards against power supply failure in toto. There is one in each of the 24 travelling wave tube amplifiers.

The propulsion system of the satellite is designed for the operational life of eight years. It carries 216lb of hydrazine propellant in four tanks. The thrusters can be controlled directly from the ground control station. Thrusters can be selectively fired to cover spin/axis control in the transfer orbit as well as velocity control in synchronous orbit. The hydrazine reacts with a catalyst to provide the energy thrust from 12 engine assemblies. Maintenance of the longitude position and equatorial orbit inclination of 0.1 degrees needs 21 minutes of thrusting every three weeks. The apogee kick motor has a solid propellant fuel and 2,000lb orbit transfer thrust.

The command and telemetry system uses two omni antennas and controls all functions. The frequencies for these are 6.424GHz, and for the beacons 3.701 to 4.199MHz. Logic level commands are distributed to the spacecraft by a demodulator.

15-240 WATTS!

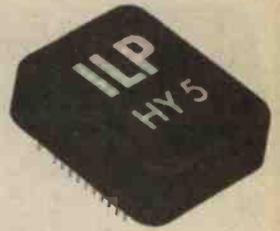
HY5 Preamplifier

The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag Cartridge, tuner, etc.) are catered for internally, the desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.

FEATURES: complete pre-amplifier in single pack; multi-function equalisation; low noise; low distortion; high overload; two simply combined for stereo.

APPLICATIONS: hi-fi; mixers; disco; guitar and organ; public address.
SPECIFICATION: Inputs—magnetic pick-up 3mV; ceramic pick-up 30mV; tuner 100mV; microphone 10mV; auxiliary 3-100mV; Input Impedance 47k Ω at 1kHz. Outputs—tape 100mV, main output 500mV R.M.S. Active Tone Controls—treble \pm 12dB at 10kHz; bass \pm 12dB at 100Hz. Distortion—0.1% at 1kHz; signal/noise ratio 68dB. Overload—38dB on magnetic pick-up. Supply Voltage— \pm 16-50V.

Price \pounds 4.75 + 59p VAT. P. & P. free
HY5 mounting board B.1. 48p + 6p VAT. P. & P. free



HY30 15W into 8 Ω

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of: I.C., heatsink, P.C. board, 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating Instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up to date technology available.

FEATURES: complete kit; low distortion; short, open and thermal protection; easy to build.
APPLICATIONS: updating audio equipment; guitar practice amplifier; test amplifier; audio oscillator.
SPECIFICATION: Output Power—15W R.M.S. into 8 Ω . Distortion—0.1% at 15W. Input Sensitivity—500mV. Frequency Response—10Hz-16kHz -3dB.

Price \pounds 4.75 + 59p VAT. P. & P. free

**AVAILABLE
JUNE 1976**

HY50 25W into 8 Ω

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.

FEATURES: low distortion; integral heatsink; only five connections; 7 amp output transistors; no external components.
APPLICATIONS: medium power hi-fi systems; low power disco; guitar amplifier.
SPECIFICATION: Input Sensitivity—500mV. Output Power—25W R.M.S. into 8 Ω . Load Impedance—4-16 Ω . Distortion—0.04% at 25W at 1kHz. Signal/Noise Ratio—75dB. Frequency Response—10Hz-45kHz -3dB. Supply Voltage— \pm 25V. Size—105 x 50 x 25mm.

Price \pounds 6.20 + 77p VAT. P. & P. free



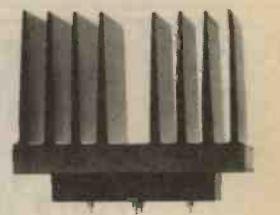
HY120 60W into 8 Ω

The HY120 is the baby of I.L.P.'s new high power range, designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

FEATURES: very low distortion; integral heatsink; load line protection; thermal protection; five connections; no external components.

APPLICATIONS: hi-fi; high quality disco; public address; monitor amplifier; guitar and organ.
SPECIFICATION: Input Sensitivity—500mV. Output Power—60W R.M.S. into 8 Ω . Load Impedance—4-16 Ω . Distortion—0.04% at 60W at 1kHz. Signal/Noise Ratio—90dB. Frequency Response—10Hz-45kHz -3dB. Supply Voltage— \pm 35V. Size—114 x 50 x 85mm.

Price \pounds 14.40 + \pounds 1.16 VAT. P. & P. free



HY200 120W into 8 Ω

The HY200 (now improved to give an output of 120 watts) has been designed to stand the most rugged conditions such as disco or group while still retaining true hi-fi performance.

FEATURES: thermal shutdown; very low distortion; load line protection; integral heatsink; no external components.

APPLICATIONS: hi-fi; disco; monitor; power slave; industrial; public address.
SPECIFICATION: Input Sensitivity—500mV. Output Power—120W R.M.S. into 8 Ω . Load Impedance—4-16 Ω . Distortion—0.05% at 100W at 1kHz. Signal/Noise Ratio—96dB. Frequency Response—10Hz-45kHz -3dB. Supply Voltage— \pm 45V. Size—114 x 100 x 85mm

Price \pounds 21.20 + \pounds 1.70 VAT. P. & P. free

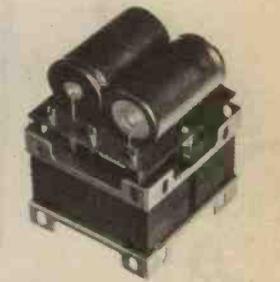
HY400 240W into 4 Ω

The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4 Ω ! It has been designed for high power disco or public address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.

FEATURES: thermal shutdown; very low distortion; load line protection; no external components.

APPLICATIONS: public address; disco; power slave; industrial.
SPECIFICATION: Input Sensitivity—500mV. Output Power—240W R.M.S. into 4 Ω . Load Impedance—4-16 Ω . Distortion—0.1% at 240W at 1kHz. Signal/Noise Ratio—94dB. Frequency Response—10Hz-45kHz -3dB. Supply Voltage— \pm 45V. Input Sensitivity—500mV. Size—114 x 100 x 85mm.

Price \pounds 29.25 + \pounds 2.34 VAT. P. & P. free



POWER SUPPLIES: PSU38—suitable for two HY30s \pounds 4.75 + 59p VAT. P. & P. free. PSU50—suitable for two HY50s \pounds 6.20 + 77p VAT. P. & P. free. PSU70—suitable for two HY120s \pounds 12.50 + \pounds 1.00 VAT. P. & P. free. PSU90—suitable for one HY200 \pounds 11.50 + 92p VAT. P. & P. free. PSU180—suitable for two HY200s or one HY400 \pounds 21 + \pounds 1.68 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

I Enclose: Cheque Postal Orders Money Order

Please debit my Access account Barclaycard account

Account number

Name and Address

Signature

Registered office No. 1032630



TRAMPUS

ELECTRONICS LTD. WINDSOR

58-60 GROVE RD. WINDSOR, BERKS. SL4 1HS.
 ADD 8% VAT TO PRICES MARKED *
 ADD 12% VAT TO ALL OTHER PRICES
 SEND C.W.O. (EXCEPT GOVT. DEPTS)
 POST & PACKING 20p 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 3AR.
 BARGAINCLAY & ACCESS BY POST
 OR TELEPHONE ON 45 NINTHAM

FAST SERVICE



ALL FULL SPEC.
 DL707 COM. ANODE &
 DL704 COM. CATHODE
 0.3" 0-9DP 89p. ea.
 747 JUMBO 0.6" CA
 LED DISPLAY £1.75.
 3015F 0-9DP £1.25.
 DISCO ETC STROBE
 ZENON TUBE £5 ea.

LEDS red 12p.

209 STYLE OR 0.2" NO CLIP 11p
 TIL209 or 0.2" RED & CLIP 13p
 GREEN LARGE/SMALL & CLIP 22p
 ORANGE LARGE/SMALL & CLIP 22p
 ORP12 57p* 2N5777 33p* TEC12 50p*
 DIGITAL CLOCKS MM5316 £5
 MM5314 £3.39* MM5311 £5
 AT51224 £3.49* PCB £1*

CAPACITORS

CERAMIC 22p/0.1uf 50v 5p.
 ELECTROLYTIC: 10/50/100 uf 10 or
 25V 7P. 50V 9P. 2uf/10V 6p.
 1000uf 25V 18p. 200/500uf 9p.
 POTENTIOMETERS LIN/LOG 16p ea
 PRESETS 6p. RESISTORS 1 P ea

HEATSINKS T05/LB 7p. T03 15p.
 SWITCHES: SPST 19p. DPDT 24p.
 DIN PLUGS ALL 12p. SOCKETS 9p.
 ALL CASES: A95/A87 50p AB13 65p
 TRANSFORMERS 100mA 89p ea.
 1A/1A 6/12 or 12/24 £2 each.

NEW ADDIBLE WARNING BLEEPER £1

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 BC108 £1*
 PAK E 10 HC182 £1. F 11 2N3704 £1
 PAK G 8 BFY51 £1*. H 9 2N3819 £1*
 PAK J 9 2N3053 £1*. K 40 1N914 £1
 NEW PAK M 4 PLASTIC 3055 90W £1*

IC's LOW PRICES

703 RP/IF	26p	MC1303	£1.47
709 T099	22p*	MC1310	£2.09
709 DIL 14	28p*	MC1312 SQ	£1.50
710 DIL 14	31p*	MC1318	£2.50
723 Regul'r	45p*	MC1330	75p
741 DIL 8	20p*	MC1339	£1.49
741 DIL 14	31p*	MC1350/1/2	75p
741 T099	31p*	MC1466 1/4	£3
747 2x741	67p*	MFC4000 1/4	59p
748 DIL 8	27p*	NE536 FETOPA £2*	
7805 5V	£1.39*	NE540	£1.10*
7812 12V	£1.39*	NE550 2vr	£1*
7815 15V	£1.39*	NE555 TIMER	41p*
7900 Series	£3*	NE556 2x	84p*
76013 6W AF	75p	NE560 PLL	£4.00
CA3046	59p	NE561 PLL	£4.00
CA3048	£2.20	NE562 PLL	£4.00
CA3054	£2	NE563	£2.25
IC18038	£2.89*	NE565	£2.50
LM300	£1.50*	NE566	£1.55
LM301 OPA	41p*	NE567	£2.20
LM304 0-40V	£3*	SN72741 741	20p*
LM308 H 80	85p*	SN76660 IF	75p
LM309K 5V	£1.75*	SN76611 IF	£1
LM372 IF	£2.00	TAD100 AIF	£2
LM377 2x2W	£3	TB8000	89p
LM380 6074s	89p	TB810 7WAF	89p
LM381	£2	TB820	£1.49
LM3900 4DPA	63p*	ZN414 RX	99p

749 TTL

FULL SPEC. 5% off 100MIX

7400	9p*	7474	27p*
7401	10p*	7476	27p*
7402/3	11p*	7490	37p*
7404	13p*	7491	60p*
7405/6/7	25p*	7492/93	43p*
7408/9/10	8p*	7494	43p*
7413	26p*	7496	68p*
7420/30	12p*	74100	£1
7440	12p*	74121	26p*
7441	64p*	74123	58p*
7447	67p*	74141	64p*
7470	25p*	74174	£1*
7472	22p*	74175	95p*
7473	26p*	74196	£1*

TRANSISTORS

PRICE EACH:-		WATCHING	20p*
AC127 & 128	10p*	INS. BUSH SET	6p*
AC176	15p*	TIP29 & 30	43p*
AC187 & 188	18p*	TIP31 & 32	54p*
AD149	45p*	TIP41	63p*
AD161 & 162	33p*	TIP42	67p*
BC107	8p*	TIP2955	99p*
BC107B	12p*	TIP3055	67p*
BC108	7p*	T1S4 UJCT	26p*
BC108B	12p*	ZTX107/18/9	11p
BC109	8p*	ZTX300 & 304	20p
BC109C	12p*	ZTX500 & 504	42p
BC147/8/9	9p	2N706 & 708	11p*
BC157/8/9	12p	2N2646 UJT	38p*
BC167/8/9	12p	2N2904 & 5	28p*
BC177/8/9	18p	2N2928 broog	9p*
BC182/3/4A&L10p		2N3053	16p*
BC210/1/2	18p*	2N3054	42p*
BD131 & 132	39p*	2N3055 115V	37p*
BFR88	250V 35p	2N3055 RCA	60p*
BFY50	14p*	2N3702/3/4/5	8p
BFY51	14p*	2N3706/7/8/9	8p
BFY52 & 53	14p*	2N3819E PET	12p
BSX19/20/21	16p*	2N3820 PET	40p
MJ2955 T03	75p*	2N3823E PET	16p
MJE2955	89p*	2N3904/5/6	15p
MJE3055	64p*	2N4289 minif	31p
MPL131 PUT	49p*	2N5457 PET	45p

TELEPHONE 54525

DIODES
 OAS1 & OAS1 GERMANIUM 5p.
 1N4001 1A50V & 1N4002 5p*
 1N4004 6p* 1N4007 9p*
 1N4148 & 1N914 SILICON 4p.
 ZENERS BZY88 400mW 9p.
 ZENERS 1W 17P. Z1J noise £1
 BRIDGE RECTIFIER 1A50 18p
 1A400V 25p. 4A100V 45p

SCR'S TRIACS
 SCR: A TAG1/400 1A400V 50p*
 1A50V 38p* 1A 600V 70p*
 C106D 4A400V SCR ONLY 47p*
 TRIAC SC146D 10A400V £1*
 TRIAC DISCO 16A400V £1.75*
 DIACS: ST2 20p. BR100 25p

vero
 36PINS 28P FACE CUTTER 49p*
 COPPERCLAD 0.1 PITCH VERO
 24"x5" 32p* 24"x3" 29p*
 31"x5" 37p* 31"x3" 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 500mg 89p*
 6x4" COPPER BOARD 50p*
 PCB KIT 3 ITEMS
 CASSETTE MECHANISM £9 & Ast12
 TGS GAS DETECTORS 30etc £2*

Oil sockets
 TOP QUALITY NYLON
 SOCKETS 8PIN 12p*
 14PIN 12p/16PIN 12p*
 SOLDERCON PINS:
 100 65p/1000 £3.50*

BURNEZE

Cools soothes and heals minor burns

Burneze - unique aerosol first aid - cools instantly, contains a fast-acting local anaesthetic plus antihistamine to control swelling. It deals with the lingering pain of a minor burn or scald and reduces the chance of a blister. Keeps nimble fingers working. From Boots and other chemists. No first-aid box is complete without Burneze.

G SPRING MADNESS BARGAIN SALE! RD

F.M. Tuners, 8-transistor chassis with stereo decoder and L.E.D. Indicator £16-80 SALE PRICE £10-90

Aircraft-band Receiver. Just place near any radio. £5-97 SALE PRICE £3-90

Echo-chamber (endless tape). Variable delay. £2-09 SALE PRICE £3-50

Field-strength indicators. 1-250MHz. £5-00 SALE PRICE £2-75

Stereo Amplifiers complete. 3-watt. 8-ohm. £4-00 SALE PRICE £3-90

10-watt Amplifiers. 12 volt d.c. 3/8/15-ohm. £5-00 SALE PRICE £3-90

Cartridges. Acos GP104. Ceramic/diamond £2-02 SALE PRICE £1-50

Cartridges. Acos GP101. Crystal/sapphire/compatible £1-00 SALE PRICE £0-50

Speakers. 2in. 8 ohm £0-50 SALE PRICE £0-35

Speakers. Car Stereo. 8 ohm. 5 watt. In cabinets £2-90 SALE PRICE £2-50

Dynamic Tape Mikes with remote-control facility. £1-90 SALE PRICE £0-80

Crystal Tape Recorder Mikes £0-40 SALE PRICE £0-20

Crystal Mike inserts with bracket £0-30 SALE PRICE £0-20

Indicators. 12 volt L.E.D. in chrome bezel £0-44 SALE PRICE £0-35

"Bargain Bags" 4lb caps/resistors/transistors/diodes £5-00 SALE PRICE £4-00

ALL ABOVE ITEMS PLUS 12% VAT

Prices in this advertisement relate to existing stocks only. Send stamped addressed envelope plus 10p in stamps for full details of all these items, plus our complete stock list.

Fluorescent 12-volt Camping Lights:		
21in. 13 watt	£8 00	£4-90
12in. 8 watt	£7 00	£3-90
"Disco" Type 3-Channel Flashing Light Units. Built-in mike. No connection needed to amp	£19 95	£17-50
Multimeters—a.c. 0-1000V. d.c. 0-1000V. 0-100mA. 0-150kΩ	£3-90	£3-50
Multimeters:		
a.c. 0-500V (10 ranges), d.c. 0-500V (12 ranges)		
d.c. current 0-25uA to 0-10 amps (10 ranges)		
Resistance 0-100 ohms to 0-16MΩ (4 ranges)	£11 95	£11-30
Panel Meters. 0-50uA. 2 1/2 in x 1 1/2 in	£3-90	£2-50
Soldering irons. 15 watt. Pencil bit	£1 95	£1-20
Servisol Switch Cleaner (with snorkel)	£0-84	£0-50
Copper-clad Fibre Glass Board:		
Single-sided. Square foot		£1-00
Double-sided. Square foot		£1-25
"Fotoluk" Light Sensitive Spray for printed circuit making		£1-30
Developer for same		£0-30
Ferric Chloride for etching		£9 49

ALL ABOVE ITEMS PLUS 8% VAT

G. F. MILWARD, 369 Alum Rock Road, Tel. 021-327 2339 Birmingham B8 3DR. Postage: Below £10—50p Above £10—Free



Paris Components Show '76

By D. Gibson

PARTICIPATION by exhibitors from 28 countries and well over 1,000 stands made this year's "Paris Components Show" a must for most people in the industry. Officially designated the Salon International des Composants Électroniques, it drew over 72,200 visitors.

POWER TRENDS

From such a galaxy of products displayed it is difficult to single out individual items. However, a number of the more interesting components and equipments do give useful food for thought. For example, the transistor sounding the death knell for valves did not sound so convincing a statement when examining a millimeter tube capable of delivering 1,000W at 40GHz. That power is for the c.w. mode; if pulsed, the tube gives 10,000W at 95GHz! It also has a life of many thousands of hours.

It would, of course, be foolish to "knock" transistors in terms of power since they have become established in many applications of lower dissipation. One such component shown, was housed in an innocent TO83 package and was rated at 350W at up to 50kHz. Not in the gigahertz range but still quite good enough to convert many a treasured hi fi speaker into an audio fuse.

Doubtless such devices will be a useful addition to the armoury of pop groups where such specifications will be loudly acclaimed—very loudly.



The TDA2002 8 watt amplifier

LACK OF SUPPORT

In the lower power audio range interest was aroused in the TDA2002. Basically a class-B audio amplifier it has been specifically designed for car radios and gives 8W into a 2Ω load. Perhaps the most striking thing about it is the marked lack of discrete supporting components required to form the complete amplifier; four capacitors and two resistors.

It would appear to be a useful component for simple record player amplifiers, modulators for amateur uses and many other applications.

SPOTLIGHT

Transistors with impressive power ratings were not the only items of interest. Indeed, a device described as an electro-optic timing switch proved to be positively intriguing.

It incorporates an elapsed time indicator in which a drop of clear liquid moves through a mercury-filled capillary tube at a constant rate established by a fixed electric current through the tube.

This clear liquid "dot" is used as a lens to focus light from a built-in illuminator on to one or other of a pair of photo-sensitive sensors. The light is initially directed on one of the sensors, which is conductive, closing its associated load circuit. At the end of the cycle the control "dot" shifts the light to the other sensor, causing it to become conductive, and the first sensor to switch "open". Clearly a design which required a spot of pure genius.

FRENCH CONNECTION

With over 575 foreign exhibitors there was no shortage of ideas from overseas. But the French, too, offered a fair share of interesting exhibits. One such company showed a 24-position slide switch rated at 250V 0.1A 50Hz. They are suitable for direct insertion into p.c.bs and other switch combinations are also available.

Perhaps a switch-tuned radio offering instant selection of up to 24 stations without the need to fiddle about tuning would be a good application?

A switch with a difference describes a new relay system which really amounted to a do-it-yourself kit. The armature module is the basic element and this plugs into its allotted place in a rack. Around this one can add various time, contact and memory modules.

Each additional module is a snap-on unit and all modules butt together offering immediate automatic mechanical operation without any need for linkage assembly. Thus one starts with the basic armature assembly module and then adds such modules as are required for the system desired.

TRANSFORMATION

A transformer designed for television sets hardly seems an item to cause much interest, and yet one company from Belgium described

Jean Renaud multiway slide switches



just such an item as innovative. It has been designed for switched-mode power supplies and has the useful advantage of offering regulated secondary voltages. This means that many of the regulated voltages which were previously taken from the line scanning stage can now be derived from the switched-mode supply circuit.

An added benefit is that scanning stage power requirements are reduced and circuit reliability is improved. Apart from meeting scanning stage power requirements, this transformer also provides supplies to the set's h.f. and i.f. stages as well as for the picture tube's heater voltage.

This could be the start of a trend (certainly in Europe) to use switched-mode power supplies in entertainment-type equipment.

In this kind of supply, the mains is taken directly to rectifier(s) and used to power switching semiconductor devices which feed a smaller, usually ferrite transformer. The a.c. voltage, now at very much higher frequency, is rectified and smoothed and fed out as a source of d.c. voltage. The smoothing components can be very much smaller since the frequency is very much higher. A dramatic decrease in size is possible using this technique.

MULTI-HEAD

This year's show covered 28,000 square metres and would have been even bigger if the section dealing with measuring instruments had been included. However, this was left out because another exhibition in Paris was mainly devoted to this specific area. This did not mean that no instruments were present and many of these were included in the electronics production area.

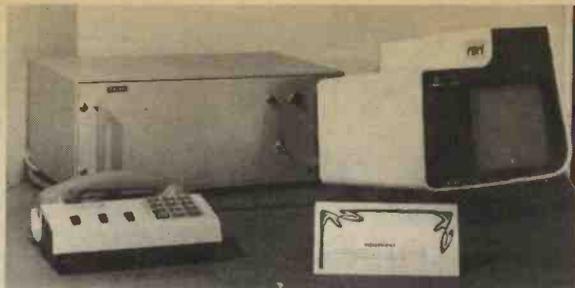
Here, such items as multi-head p.c.b. drilling machines were displayed. These were controlled by a paper tape which dictated where each head should drill a hole in the x and y axis. Many thousands of holes can be automatically drilled in this way with an accuracy of typically $\pm 0.01\text{mm}$. Some of these multi-head equipments also allow for an automatic change of drill.

A GOOD START

Very few areas of application escaped attention at this exhibition. The automotive market is one example where electronics manufacturers and designers are cultivating an increasing interest.

For one German exhibitor it was the contact breaker which was the focus of attention. The idea is to do away with nasty physical metal switching contacts which get dirty, pit and wear. This company is trying opto electronics as a possible solution. The second objective is to tie this in with transistorised ignition.

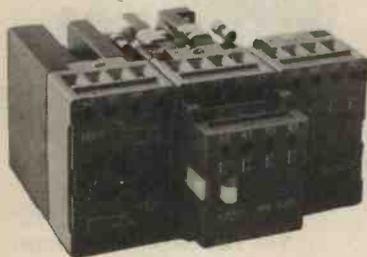
Some vision-phone (Visiophone) equipment on show. Quite clearly a Tele-phone!



The latter approach permits currents exceeding 8A which, together with reverse voltages of over 400V are superior to conventional systems.

The total system concept features a light barrier installed in the distributor comprising a l.e.d. functioning as a transmitter and a photosensitive transistor as a receiver. In the 3mm long infra red optical path a slotted cap rotates on the distributor shaft and allows a light beam to pass at the firing point. The make/break ratio determining the cut-in period of the primary circuit depends upon the slot width. The light from the phototransistor is amplified and directly acts upon the firing transistor (a power darlington type) into whose emitter-collector circuit the primary winding of the ignition coil is collected.

While development is still going on, figures and results to date show that this company is off to a good start!



"Do-it-yourself" relay system modules

REDS IN CONTROL

With ultrasonics making some headway in remote control for things like television receivers it would seem that such a system would develop from strength to strength. But no—there's a rival, and a serious one, too. It's our old friend infra red coming up fast off the rails with a challenge which just cannot be taken lightly.

Ultrasonic waves have a disadvantage that harmonics of the line time-base may lead to acoustic disturbances. The new remote control system offers up to 31 control functions and employs binary coding to keep peripheral outlay to a minimum.

Transmitted commands are selected by an 8 x 4 button matrix arranged on the transmitter. The

receiver contains the interpreting circuit and three storages for analogue functions such as sound, colour saturation, brightness, with the associated analogue-to-digital converters.

ON THE LIGHT SIDE

An impressive sight on one stand was a lone battery. It has a shelf life of ten years and during that time can be relied upon to provide a minimum of 30 hours power. Useful for applications such as battery-powered burglar alarms or emergency torches it also featured elsewhere in a complete flashlight which was claimed to function happily from -53°C to $+75^{\circ}\text{C}$.

Low level light tubes are always impressive but when one enters a completely dark room and still finds that the tube can resolve the scene there is something unnerving about it all—makes undressing in the dark a bit silly.

A French company displayed one such tube which has a sensitivity comparable to that of photographic film rated at 100,000 ASA. For the non-photographic reader this means that scenes with an illumination as low as one hundred thousandth of a lux can be televised at 25 images per second (a normal broadcast standard) with a resolution of over 700 t.v. lines per image.

Remember the early projection television tubes? Well, the military for one still uses them, or rather more sophisticated versions. One such beastly gives a very bright (10,000 foot candles), fine trace—2,000 t.v. lines.

It is employed to project dynamic images on to a screen of several metres square. Multi-coloured images are produced by superimposing the images from a number of tubes each with its own particular colour phosphor.

These are just a handful of the many items shown at the Paris show. Space available allows but brief mention of midget power supplies, valves which give 500,000W and tiny variable capacitors which measure only 1.9mm in diameter.

Perhaps the most staggering thought is that all these new things will be old by next year when, of course, there will be the 1977 Salon International des Composants Électroniques.



FROM BI-PRE-PAK

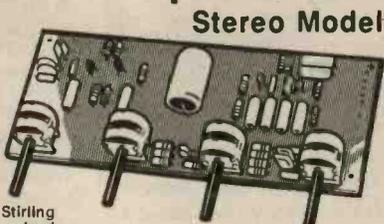
Stirling Sound Products

UNIT 1—Pre-Amp/Control

SUPERB VALUE
AT **£7.80**

With active tone control circuitry

UNIT 1, latest addition in the Stirling Sound range of realistically priced constructional modules is going to assure many many more constructors of obtaining quality where price has prevented it before. UNIT 1 offers full stereo facilities, is guaranteed and easy to connect up.

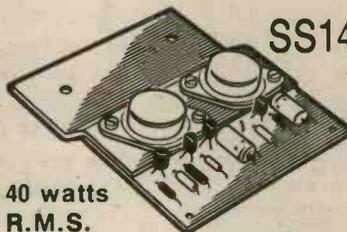


Stereo Model

- Input sensitivity—50mV, adjustable
- Bass control—200mV for 50mV in
- Bass control—± 15dB at 30kHz
- Treble control—± 15dB at 10kHz
- Balance control; volume control; ½in spindles
- Operating voltage—10-15V

Made in our own factory in Essex and sold direct

More Power—Less VAT!



SS140 Mk. 3

Power Amp now with built-in output capacitor **Built for hard work**

40 watts R.M.S. into 4Ω

£3.95

+ 8% VAT

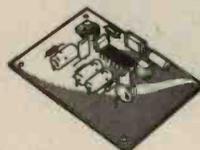
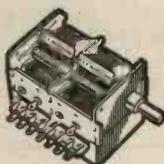
Resulting from research and development, the Mk. 3 version of this most popular power amp, now includes built-in output capacitor with improved stability under severest working conditions. Greatly used for P.A., disco and similar work, SS140 offers fantastic value for the price.

Build and save with Stirling Sound

Basic modules for building up to a Stereo Tuner-Amp

POWER AMPS

- | | | |
|---------|---|-------|
| SS103 | Simple I.C. module, 3W R.M.S. with current short-circuit and thermal protection. | £1.75 |
| SS103-3 | Stereo version of SS103 using two SL80745 I.C.s with data. | £3.25 |
| SS105 | 5 watt amplifier to run from 12V. | £2.25 |
| SS110 | Similar to SS105 but more powerful giving 10W into 4ohms. 24V operation | £2.75 |
| Mk. 3 | | |
| SS120 | 20 watt module when used with 34V into 4ohms (SS105, SS110, SS120, all 3½ x 2 x ½in.) | £3.25 |
| Mk. 3 | | |
| SS125 | Deluxe high fidelity amp. with only 0.05% distortion at all levels. For 50V operation. 25W R.M.S. out | £5.00 |



TUNING

- | | | |
|-------|---|-------|
| SS201 | Tuner front end. Geared variable tuning, 88-108MHz. A.F.C. facility | £5.00 |
| SS202 | I.F. amp A meter and/or A.F.C. can be connected (size 3in x 2in) | £2.65 |
| SS203 | Stereo decoder for use with SS201 and SS202 or any good F.M. tuner. A L.E.D. beacon may be attached (3in x 2in) | £3.85 |

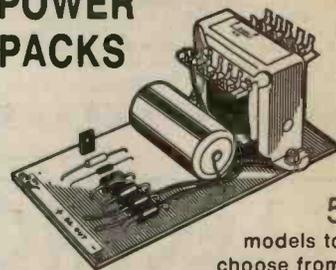
CONTROL UNITS

- | | | |
|-------|--|-------|
| SS100 | Active tone control, stereo, ± 15dB cut and boost with suitable network | £1.60 |
| SS101 | Pre-amp for ceramic p.u., radio and tape with passive tone control details | £1.60 |
| SS102 | Stereo pre-amp with R.I.A.A. equalisation, mag., p.u., tape and radio in | £2.25 |

POWER STABILISER

- | | | |
|-------|---|--------|
| SS300 | Add this to your un stabilised supply to obtain a steady working voltage from 12 to 50V for your audio system, workbench, etc. Money saving and very reliable | £3.25* |
|-------|---|--------|

Stirling Sound POWER PACKS



5 models to choose from

Not only do these excellent power packs stand up unflinchingly to hard work—inclusion of a take off point at around 13-15V adds to their usefulness and once again price and value are outstanding.

Made to serve for years

- | | | |
|-------|--------|--------|
| SS312 | 12V/1A | £3.75* |
| SS318 | 18V/1A | £4.15* |
| SS324 | 24V/1A | £4.60* |
| SS334 | 34V/2A | £5.20* |
| SS345 | 45V/3A | £6.25* |

Add 50p for P. & P. any model

Direct from the makers and obtainable only from Bi-Pre-Pak Ltd.

Stirling Sound products are designed by professional experts and made in our own factory. They are distributed exclusively through Bi-Pre-Pak Ltd.

NEW SHOWROOM

We have extended and added exciting new stocks at our West Road premises for demos, etc. All welcome

BI-PRE-PAK CATALOGUE plus Summer Special Offer list for component users. Send large 10p S.A.E. for free copy.

TERMS OF BUSINESS:

VAT at 12½% must be added to total value of order except for items marked * or (8%) when VAT is to be added at 8%. No VAT on overseas orders. POST & PACKING add 30p 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 STIRLING SOUND (BI-PRE-PAK LTD) 220/222 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SSO 0DF

Please send

..... for which I enclose £

Inc. V.A.T.

NAME

ADDRESS

PE7C

Order your Stirling Sound products from

BI-PRE-PAK LTD

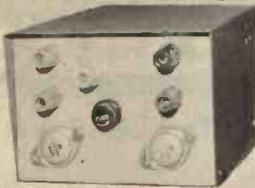
Co Reg No 820919

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

TELEPHONE: SOUTHEND (0702) 46344

Make cheques/money orders payable to Bi-Pre-Pak Ltd

INVERTORS



240v-50Hz from your 12v car battery.

25 watt—£4.75 300 watt (24v)—£28.45
 40 watt—£8.27 400 watt (12v)—£39.05
 75 watt—£12.03 500 watt (24v)—£48.18
 150 watt—£21.27 1kW (50v)—£127.00
 300 watt (12v)—£33.03 1.5kW (110v)—£140.00

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) £24.50 + £1.70p. & p.

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

12"-8 watt—£3.90 + 35p p. & p. Built up—£4.90 + 35p p. & p.
 21"-13 watt—£4.20 + 52p p. & p. Built up—£5.80 + 52p p. & p.

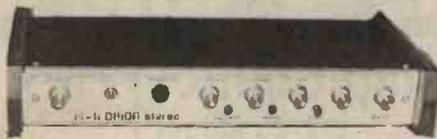
TRANSFORMERS & COILS

Both high volume & small order capacity available.

Special offer. Miniature mains transformer 6-0-6v-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 ± 1 dB 20 Hz to 20 kHz. Hum level virtually nil with volume 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.

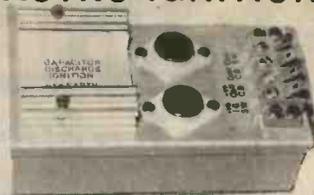
Complete kit of parts including slim line bookend case, silk screened front panel & knobs. £47.30 incl. VAT & p. & p.

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

INSTRUMENT CASES

Bookend Amplifier and attractive styled Instrument Cases available. Send S. and A. envelope for Price List.

ASTRO IGNITION



ASTRO IGNITION SYSTEM

Complete kit of parts for this proven and tested system £10.45 incl. VAT. Ready built with only two connections to alter £13.75 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.

ELECTRONIC DIGITAL CLOCK

with alarm and snooze features



SPECIAL OFFER

£12.48

Plus 99p VAT

Features: ● 0.7 inch High Digits ● Variable Intensity ● 24-hour Alarm ● 5-minute Repeating, Snooze Alarm ● Alarm Set Indicator ● Snooze Indicator ● Pulsing Second Indicator ● Power Interrupt Indicator ● Alarm Cancel Features—Tilt Operation ● Alarm Tone Output ● A.M.—P.M. Indicator

Size: 130mm x 90mm x 95mm. Weight: 10oz. Power supply: 110V a.c. $\pm 10\%$ 60Hz; 230V a.c. $\pm 10\%$ 50Hz.

Manufactured to high standards by a major American electronics corporation, this superbly styled solid-state timepiece is made available to all readers fully guaranteed.

Free trial in your home—Try out the clock in your home. If digital time is not for you return it in original condition within 10 days and we'll refund your money without question.

TIME MICROELECTRONICS

TM Brighton Hill Parade, Basingstoke, Hants
 RG22 11EH.

Please send electronic clocks as illustrated. I enclose cheque postal order money order for £14.02 which includes P. & P.

Name

Address

Signature

The All-Electronics Show

By G. Godbold

IT seems as if we can add another trade show to the Spring "walkabout" on the evidence of attendance at Park Lane's Grosvenor House where more than 160 companies had stands for the All-Electronics Show during the three days—13th to 15th April.

In the grand surroundings of the Great Room and Ballroom there was plenty to attract and interest particularly in the way of new items.

INSTRUMENTS

Not least in today's increasingly bewildering world of electronics is the mass of test and measuring equipment available. In this area, synonymous with technical excellence, but at a price, is Tektronix who also market under the Telequipment name.

On display was a couple of portable diagnostic aids to the TV serviceman; the Telequipment D32, a dual-trace 10MHz oscilloscope and the S22, a single trace 5MHz model. Both of these are extremely compact, weighing just 10lb with a relatively large screen area in relation to control fascia. Operation can be from mains or rechargeable batteries.

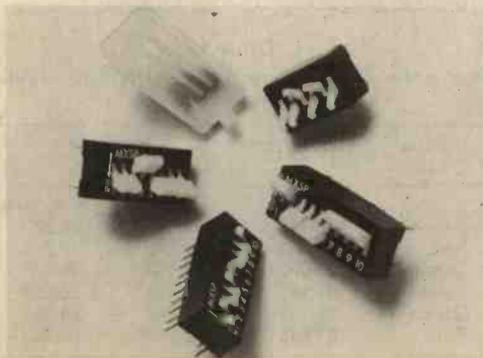
Prominently figured was the Tektronix TMS 500 series of test and measurement modules. These represent single function instruments which readily combine to form a console sharing a common power rail. Over 30 of these plug-in modules make up the series.

Other new scopes seen were the Dynamco 7500, a dual-trace portable instrument with a vertical sensitivity of 10mV/division over a 40MHz bandwidth and the OS4000 digital oscilloscope, the star of the Gould Advance range which combines a conventional 10MHz scope performance with a digital memory system capable of storing signals up to 450kHz. An output module is incorporated which processes the contents of the digital memory to provide a hard copy output for use with a chart recorder.

Other new Gould Advance products were the SG200 seven range signal generator covering 160kHz to 230MHz and the DMM7A, a 3½ digit d.v.m. with a 10A measuring capability on both a.c. and d.c.

Claiming a world scoop B & K Labs showed their 2131 Digital Frequency Analyser designed to measure and display octave and third octave spectra in real time with outputs available to analogue or digital peripherals.

The Molex 4130 series of d.i.l. switches



SEMICONDUCTORS

Last year the Philips giant absorbed Signetics and as a result of this it seemed rather strange to see the names Mullard and Signetics sharing stands.

Amongst the broad range of i.c.s and f.e.t.s on display was the MOSPOWER VMP-1. This rather remarkable f.e.t. has a power rating of 35W with maximum allowable current of 2A. The breakdown is 60V and the drive current is nanoamps. This growth area will represent a serious challenge to traditional bipolar devices particularly in high speed power switching. Signetics also displayed a 150µW triple op amp which draws only 50µA from a 1½V supply.

Among the Mullard items were the new range of Locmos i.c.s, which now total 70, microprocessors and the recently introduced field programmable logic arrays.

Making its UK debut for Plessey was the SP750B high speed comparator which is claimed to be the world's fastest. Also on show by Plessey Traffic and Instrumentation was their VISTA scanning system designed to check p.c.b.s for defects after screen printing and plating.

CASES

About a decade ago lunch-boxes were a modish container for constructors' projects. With the enormous variety of metal and plastic cases both in colour and geometry there is no excuse for tatty containerisation. Lektrokit, a name familiar to all constructors, made a new contribution with their range of "Transistek" modular instrument cases. Totalling 25 models in eight different styles, colours and sizes, they are of low cost and professional standard. Support trays and aluminium are available for components and p.c.b.s.

The Imhof-Bedco display also included a new range of plastic boxes, called IMboxes, all of which had integral slots for accepting p.c.b.s.

PASSIVE COMPONENTS

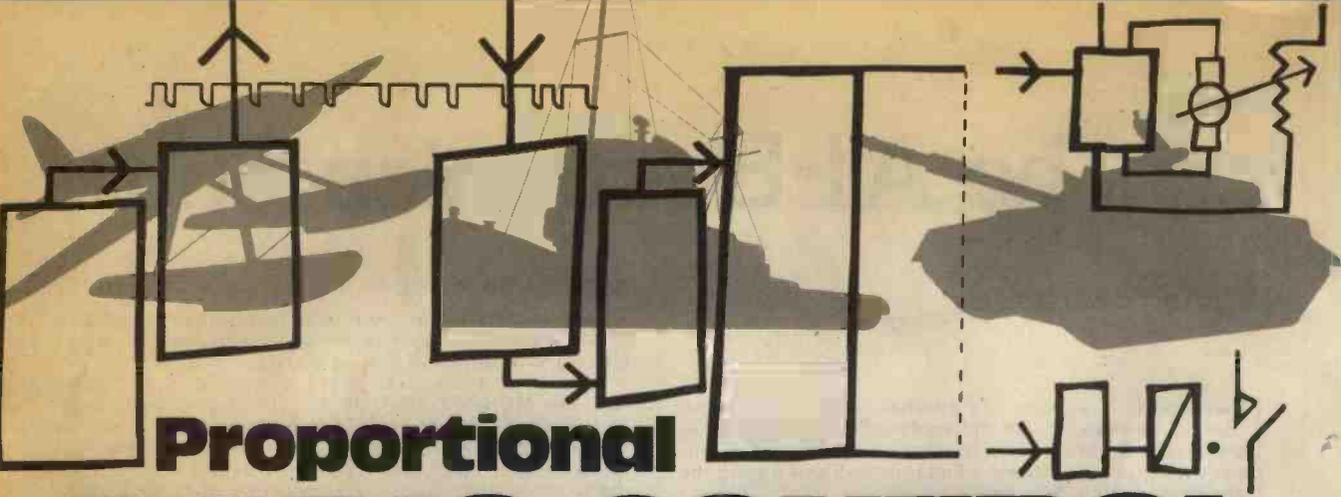
Departing from the traditional toroid shape and showing a significant cost-saving, Reading Windings introduced a "square toroid" range of transformers. Aimed at the audio and instrumentation market, the output power range extends through 5-120VA offering high efficiency with low radiation.

New from Molex Electronics was the 4130 series of multi-position d.i.l. binary option selection switches. Designed for mounting onto a p.c.b. they feature single and ganged lever action with up to ten discrete channels.

Practical Electronics also had a static display of projects past, present and future.

Telequipment D32 dual-trace 10MHz battery mains 'scope





Proportional RADIO CONTROL SYSTEM

By J. D. WHITELEY

PART 2 Receiver, Interface & Decoder

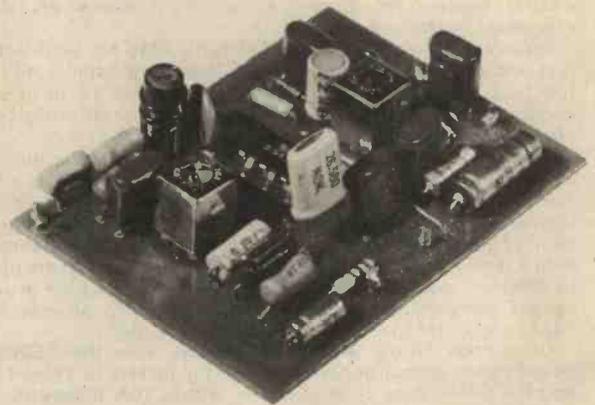
THE receiver section of the system is both sensitive and selective and has been designed for use with the transmitter described last month, which operates at around 27MHz (dependent on crystal; see later).

It is a very stable crystal controlled superhet based on the TBA651 integrated circuit which is a complete radio including r.f. amplifier, oscillator, and i.f. amplifier. The package of the TBA651 is unusual since it is a 16-pin quad-in-line, sockets being difficult to obtain.

The manufacturer's data gives a maximum operating frequency of the oscillator of 30MHz and the receiver can be operated from a supply of 4.5-16V, although the author has found the best performance to be at 9V, using the crystal oscillator circuit as shown in Fig. 7.

CIRCUIT DESCRIPTION

From the circuit shown in Fig. 7, it will be seen that L1, C3 are a tuned circuit to the received r.f. signal, L2, C4 coupling the r.f. amp to pin 1. R1 is the untuned load of the r.f. amplifier with C5 coupling to the mixer stage at pin 4. The external components of the oscillator L3, L4, C7 and the crystal are connected to pins 6 and 7. The mixer output is coupled to the i.f. input pin 13 by C8 and T1. The second and final i.f.t. T2 connected to pin 10, has the detector D1, i.f. filter R3, C12, C13, and detector load R6, connected to the i.f. secondary. The a.g.c. reference voltage is connected to pin 15 by R4 whilst C14, C15 are a further i.f. filter. The delayed a.g.c. is controlled by R5, C11, both values being adjustable to suit the delay required. It is important that C16 is included, since R6 is above ground potential. An 'S meter' can be connected across R6 if required; for this purpose, pins have been included on the board.



CRYSTAL OSCILLATOR

For those not familiar with the channels used for radio control in the 27MHz band, a table has been included which may be of some use (Table 1).

The Toko transformers T1 and T2 are for an intermediate frequency of 455/470kHz.

Table 1
The colour codes used for different crystal frequencies

Channel Colour	Transmitter		Receiver	
	MHz	I.F. 455kHz	I.F. 465kHz	
Brown	26-995	26-540	26-530	
Red	27-045	26-590	26-580	
Orange	27-095	26-640	26-630	
Yellow	27-145	26-690	26-680	
Green	27-195	26-740	26-730	
Blue	27-245	26-790	26-780	

RECEIVER

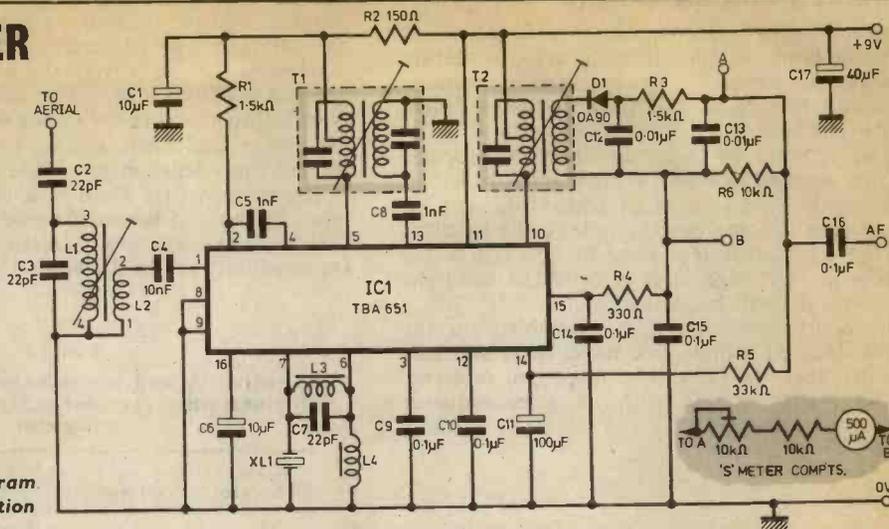


Fig. 7. Circuit diagram of the receiver section

COMPONENTS...

Resistors

R1 1.5k Ω	R3 1.5k Ω	R5 33k Ω
R2 150 Ω	R4 330 Ω	R6 10k Ω

All resistors $\frac{1}{8}$ W 5% carbon

Capacitors

C1 10 μ F 25V elect.
C2 22pF ceramic
C3 22pF ceramic
C4 10nF ceramic
C5 1nF ceramic
C6 10 μ F 3V elect.
C7 47pF ceramic
C8 1nF ceramic
C9 0.1 μ F plastic or paper
C10 0.1 μ F plastic or paper
C11 100 μ F 6V elect.
C12 0.01 μ F plastic or paper
C13 0.01 μ F plastic or paper
C14 0.1 μ F plastic or paper
C15 0.1 μ F plastic or paper
C16 0.1 μ F plastic or paper
C17 40 μ F 25V elect.

Semiconductors

*IC1 TBA651 D1 OA 90

Inductors, transformers

- L1 13 turns 5mm dia. former 28 s.w.g.
- L2 4 turns 5mm dia. former 28 s.w.g.
- L3 1.5 μ H r.f. choke
- L4 80 μ H r.f. choke
- *T1 Toko YRCS 11098 AC2 455kHz (1st i.f.)
- *T2 Toko YHCS 11100 AC2 455kHz (3rd i.f.)

Miscellaneous

- XL1 27MHz R/C band, selected to suit transmitter XL1
- Aladdin 5 mm coil former
- Printed circuit board (60 \times 80mm) and p.c.b. pins
- *The i.f. transformers and i.c. may be obtained from Ambit International, 37 High Street, Brentwood, Essex CM14 4RH

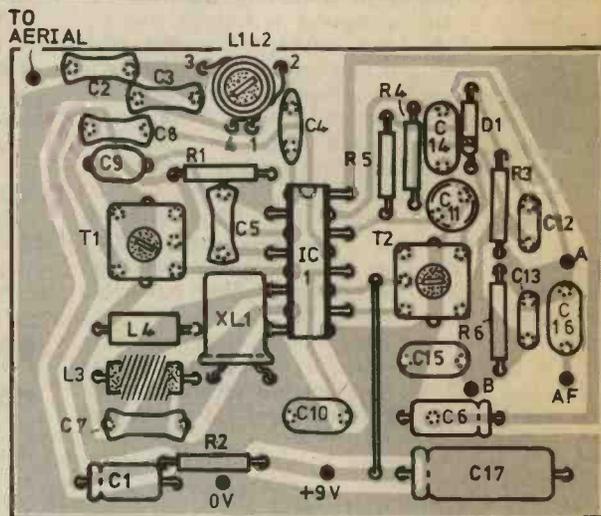
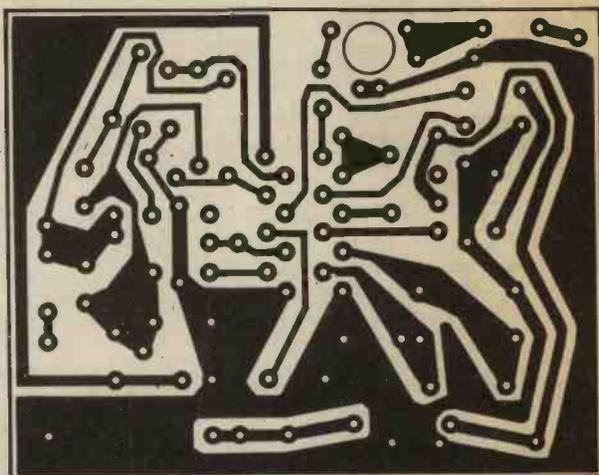


Fig. 8. P.C.B. master and component layout of the receiver

THE PRINTED CIRCUIT BOARD

The circuit is first drawn on a piece of single sided p.c.b. (60mm × 80mm) using a p.c.b. marker pen. The surplus copper is then removed by immersing the board in etchant and then the holes drilled using a No. 59 drill.

The base is removed from the 5mm coil former using a fine toothed saw and a 5mm hole drilled in the p.c.b. as in Fig. 8, a small round file will be found useful in opening out the hole to the required size so that the former is a good fit. Do not fit the coil former at this stage as it is better to wind the coils first—details will be shown later.

All the components are next assembled on the board and soldered using a fine tipped iron and thin gauge solder, then the i.c. can be fitted and soldered, taking the usual care as with all semiconductor devices.

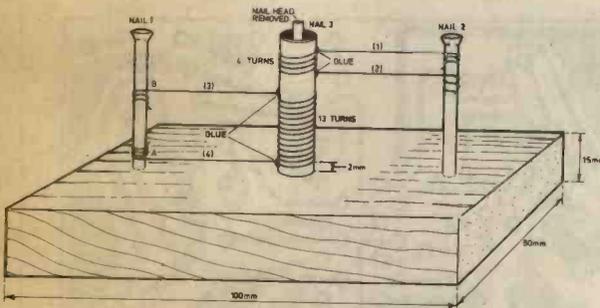


Fig. 9. Winding jig for L1 and L2

COIL WINDING DETAILS

If difficulty is found in obtaining the two r.f. chokes then they can be wound as follows: for L3 wind 30 turns of 40 s.w.g. enamelled copper wire on to a $\frac{1}{4}$ W 100 Ω resistor and for L4 wind 250 turns of the same gauge on to another 100 Ω resistor.

The coil winding details for L1 and L2 are shown in Fig. 9. A piece of wood 15mm × 50mm × 100mm and three 50mm nails are assembled as shown.

The bottom coil L1 is first wound by putting a few turns of wire around nail 1 at A, then winding 13 turns on to the former in a clockwise direction, but leaving a space at the bottom of 2mm to enable the former to fit in the hole in the p.c.b.

When 13 turns have been wound, finish the wire on nail 1 at B. The other winding is done in a similar way, then the ends on the coil are secured with a suitable glue and when dry the wires cut at the nail ends.

TESTING AND ALIGNMENT

First examine the p.c.b. for any poor soldered connections and short circuits between the copper. Next connect a 9V battery via a multimeter and measure the current taken by the receiver; this

should be about 10mA. Remove the multimeter and connect it to points A-B on the receiver with a low d.c. voltage range selected.

Remove the aerial from the transmitter and switch it on at a distance of a few feet from the receiver. Now adjust the core of T2 for maximum reading on the meter and then adjust T1 in a similar way. Repeat the operation to ensure maximum output.

The core in L1/L2 can now be adjusted for maximum reading on the multimeter.

If a signal generator is used, then typical figures for sensitivity are as shown in Table 2.

Table 2
Sensitivities and meter/scope measurements obtained when receiver is tested with a signal generator

Signal Generator	Voltmeter	L.F. on 'scope
μ V	V	(Modulation 80%) mV
10	0.2	65
18	0.5	
20	0.8	1,000
50	1.0	1,500
70	1.5	
carrier off	0.1	15 (noise)

TTL INTERFACE

The interface unit is necessary for two reasons: first it reshapes the pulses that have been distorted in the receiver due to L/C circuits and bandwidth limitation and secondly it presents to the TTL circuitry a pulse of the correct polarity and amplitude—both these features being important with any TTL equipment as it requires a fast rise time pulse for correct operation.

CIRCUIT DESCRIPTION

The circuit diagram is given in Fig. 10.

The signal from the receiver is fed to the base of TR1 which is unbiased and is held cut off by R7. A positive going pulse switches on TR1 which unlatches TR2 (being half a Schmitt trigger) while TR3 (the other half) switches on.

The emitter follower TR4 switches off due to TR3 collector falling to a low positive potential. When the signal pulse goes negative and the cut off point of TR1 is passed, the Schmitt resets quickly and TR4 is again switched on.

The net result of this fast switching is to produce an output very similar to that of the transmitted pulse train.

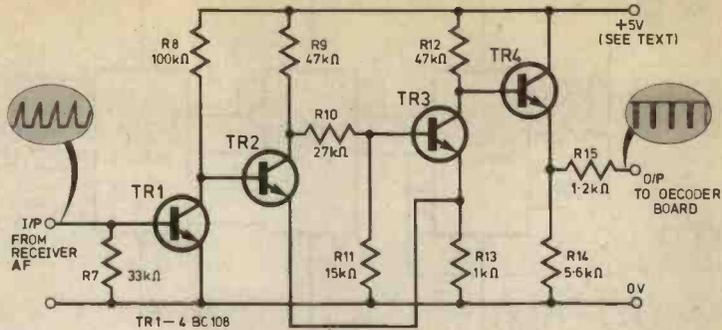
CONSTRUCTION

The p.c.b. design for the circuit described above requires a piece of board measuring 44mm × 42mm with all resistors $\frac{1}{4}$ watt and BC108 transistors for TR1-TR4. Pins were used for wire take off points as soldering to the copper board with wire is seldom satisfactory.

The component layout and p.c.b. master are given in Fig. 11.

continued on pages 572 and 582

INTERFACE



COMPONENTS...

TTL INTERFACE

Resistors

- R7 33k Ω
 - R8 100k Ω
 - R9 47k Ω
 - R10 27k Ω
 - R11 15k Ω
 - R12 47k Ω
 - R13 1k Ω
 - R14 5.6k Ω
 - R15 1.2k Ω
- All resistors $\frac{1}{8}$ W 5% carbon

Transistors

- TR1-4 (4 off) BC108

Miscellaneous

- Printed circuit board (44 \times 42mm)
- and p.c.b. pins

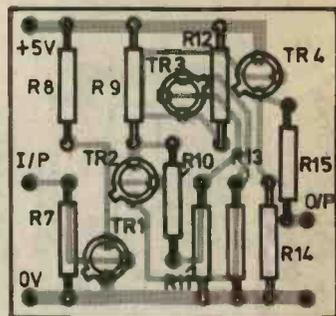
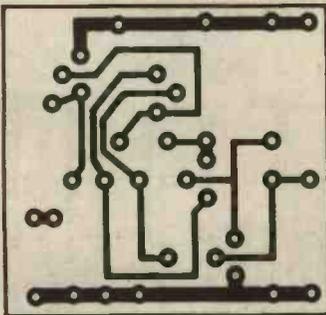
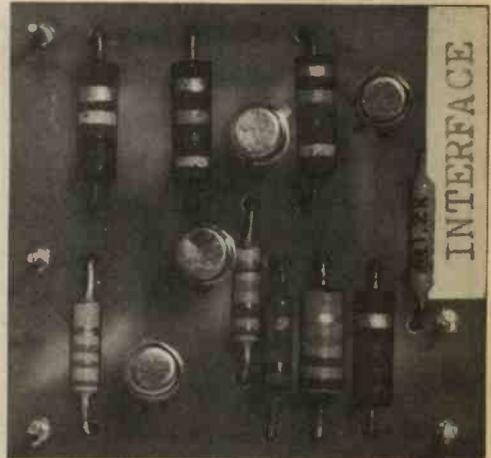


Fig. 11. Component layout and p.c.b. master for the interface section

DECODER

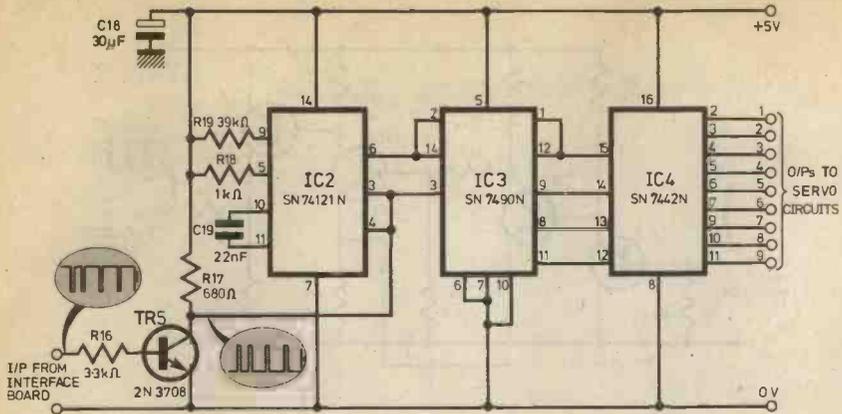


Fig. 12. Circuit diagram of the decoder

COMPONENTS ...

DECODER

Resistors

- R16 3.3kΩ
- R17 680Ω
- R18 1kΩ
- R19 39kΩ
- All resistors 1/8W 5%

Capacitors

- C18 30μF 10V tantalum
- C19 0.022μF plastic or paper

Semiconductors

- TR5 2N3708
- IC2 74121
- IC3 7490
- IC4 7442

Miscellaneous

- Printed circuit board (70×55mm) and p.c.b. pins

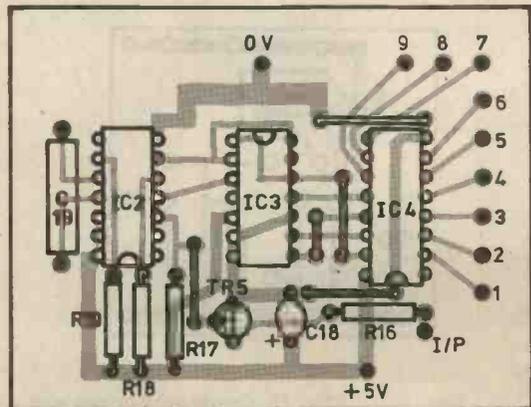
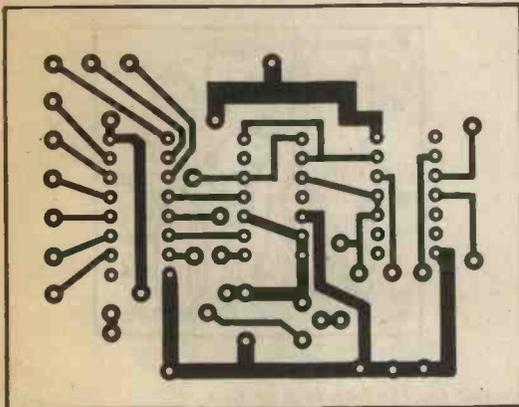
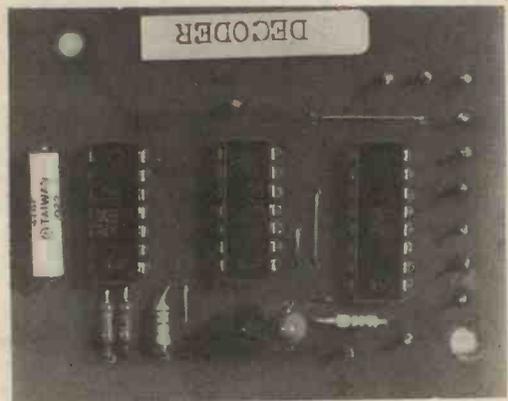


Fig. 14. Component layout and p.c.b. master for the decoder

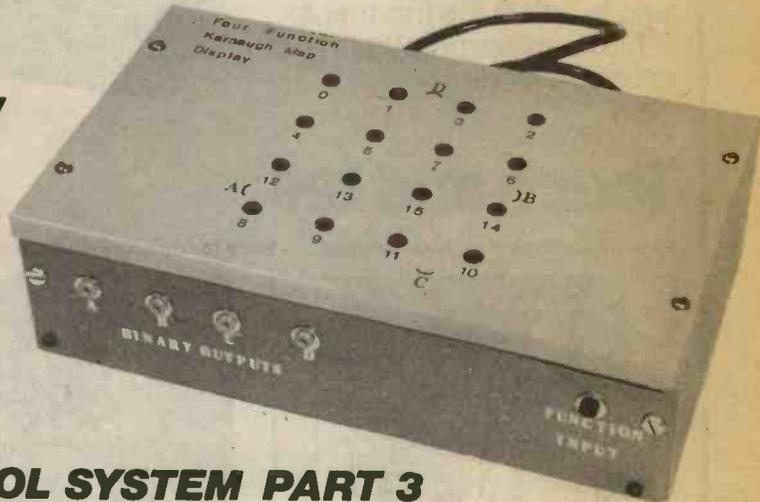
GUITAR EFFECTS UNIT

Most Fuzz units tend to give a very harsh output, the original envelope of the guitar signal being completely lost due to the sustain effect which usually accompanies fuzz. The Guitar Overdrive Unit allows the user to produce many degrees of distortion, from the typical overdriven amplifier sound, through round 'shifting' tones, to the more common hard, spiky fuzz, the attack/decay characteristics in the first two cases being retained.



KARNAUGH MAP DISPLAY

A Karnaugh map is a simple visual representation of a number of two-state functions, and may be used to obtain a simplified Boolean expression from a truth table. The mapping is usually done with pencil and paper—this unit uses 16 l.e.d.s to portray the output function of a logic circuit having four input variables.



Plus...

**RADIO CONTROL SYSTEM PART 3
DIGISCOPE...PART 2**

PRACTICAL ELECTRONICS

OUR AUGUST ISSUE WILL BE PUBLISHED ON FRIDAY, JULY 9, 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!

The Black Watch kit

£14.95!

★ **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.



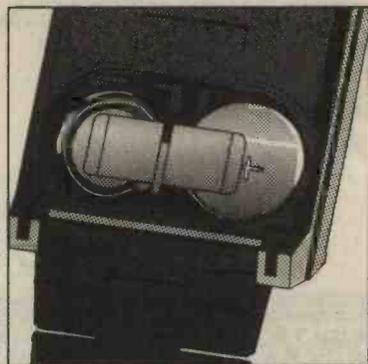
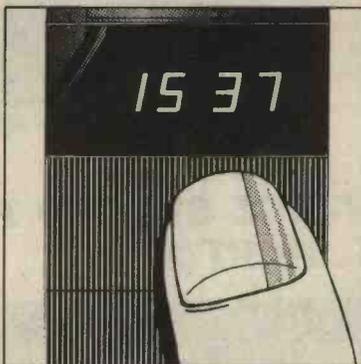
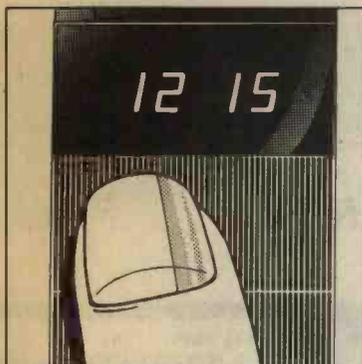
The Black Watch by Sinclair is unique. Controlled by a quartz crystal, and powered by two hearing aid batteries, it uses bright red LEDs to show hours and minutes, and minutes and seconds. And it's styled in the cool prestige Sinclair fashion: no knobs, no buttons, no flash.

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

Touch and tell

Press here for hours and minutes... here for minutes and seconds.

Batteries easily replaced at home.



The specialist 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). Easily re-set using special button—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.

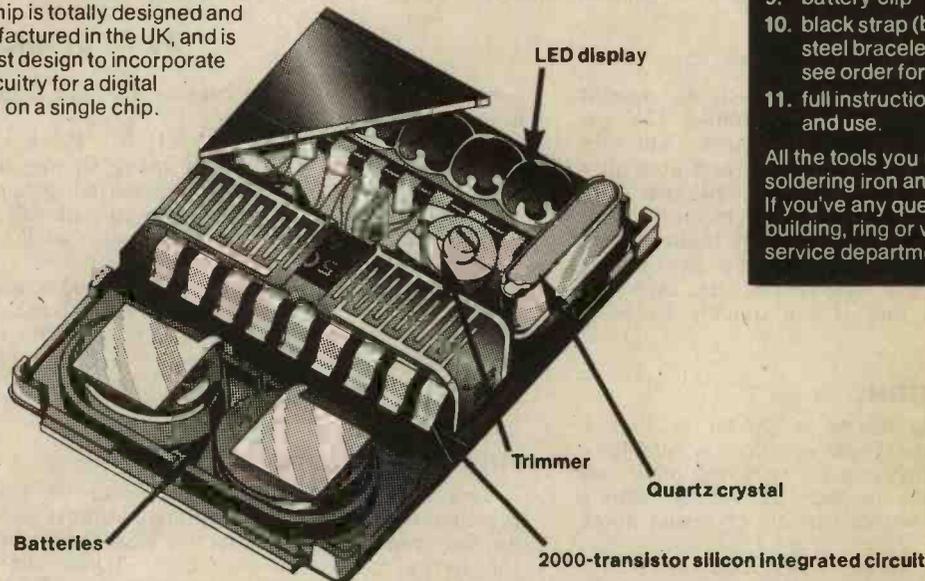
This chip of silicon measures only 3 mm x 3 mm and contains over 2000 transistors. The circuit includes

- 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).

Price in built form: £24.95 (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) Sinclair Black Watch(es) built at £24.95 (inc. black strap, VAT, p&p).	* Please debit my *Barclaycard/Access/ American Express account number
..... (qty) black stainless-steel bracelet(s) at £2.00 (inc. VAT, p&p).

Name (please print) _____

Address _____

Signature _____ PE/7

FREEPOST – no stamp required.

* Delete as required

FLUORESCENT LIGHT INVERTER

Get new life out of your old tubes with this fluorescent tube economiser

By A. J. Bassett

THIS article describes a device which will readily light a large fluorescent tube from a 12V car battery without need of a choke or starter. The tube will start instantly without flickering, and may glow even more brightly than if it were used with 240V mains power. It is even possible to light an old tube which will no longer function at all on mains power, and when used for this purpose the device may truly be described as a tube-economiser, especially when one considers that it can quickly be built, mainly from scrap!

CIRCUIT OPERATION

The circuit of the device is shown in Fig. 1.

For the non-technical person this is simply a fluorescent lamp which can be switched on or off by means of a switch in the 12V supply from a car battery or other source capable of giving about 5 amps.

Technically it is a simple power oscillator which forms a push-pull inverter supplying power to the fluorescent lamp tube by way of a high voltage winding on the transformer.

The power transistors operate in a switching mode. Although in theory they should dissipate only a little heat, this is not realised in practice due to various sources of inefficiency in the circuit.

The more astute constructor will observe that there is no apparent bias on the transistor bases to cause them to conduct and initiate oscillations. The circuit in fact relies on the leakage present in the germanium transistors to generate a small impulse in the primary winding which "kicks" the circuit into oscillation at switch-on. If silicon devices were used, a bias arrangement would have to be incorporated due to their much lower leakage. After trying various germanium transistors, OC35s were finally chosen as they provided consistently high performance in this arrangement.

BASE DRIVE

The numbers of turns on the base drive windings (nominally only three turns each) may be easily altered if it is required to increase or decrease the base drive to the power transistors, and this may be

done individually to compensate for one running hotter than the other.

By changing the values of R1, R2, the currents flowing in TR1, TR2 may be made to match yet more closely, and this results in greater efficiency.

By raising the value of R1, less current will flow in TR1 and likewise by raising the value of R2, less current will flow in TR2.

If the values of R1, R2 are lowered, a greater current will be taken and the fluorescent tube will glow more brightly. However, care must be taken not to exceed the maximum current rating of the transistors, which is 6 amps. A 7 amp fuse is used in the circuit.

FREQUENCY OF OSCILLATION

This is dependent upon a number of factors, principal ones being supply voltage, number of turns on the primary, and the nature and dimensions of the ferrite material of the core. If an annoying whistle is produced, the frequency may be raised by reducing the number of turns on the primary until it becomes inaudible. However, this results in an increase in current consumption, and this should be allowed for as described under the "Base Drive".

TUBE OPERATION

The tube operates in a somewhat different manner to that when 240-volt mains is used.

Because it is started by the action of high-voltage pulses from the oscillator on the gas in the tube, there is no need of heaters, choke or a starter and the tube will start from cold.

Although in theory this means that the cathodes will have a shorter life, the author has found that in practice tubes which will no longer operate from 240V mains will run quite happily from the oscillator for many extra months. So in these days of ecology-consciousness and material re-cycling, it makes a lot of sense to squeeze extra life out of your old fluorescent tubes by using such a tube economiser!

Because the frequency of operation is so much higher, the tube provides, when adjusted for ultra-

COMPONENTS . . .

Resistors

R1, 2 8.2Ω 2.5W

Transistors

TR1, 2 OC35

Transformer

Line output transformer obtained from a scrap t.v. and associated hardware

Miscellaneous

Silicone grease, 500sq.cm. of 16 s.w.g. aluminium sheet, 18 s.w.g. insulated copper wire, 30 s.w.g. insulated copper wire. FS1 7A

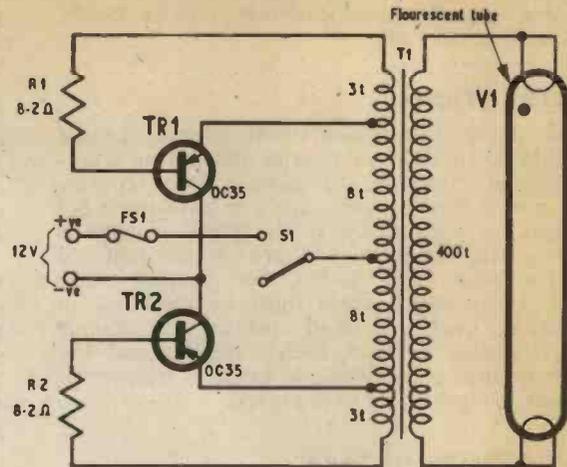


Fig. 1. The circuit diagram of the inverter

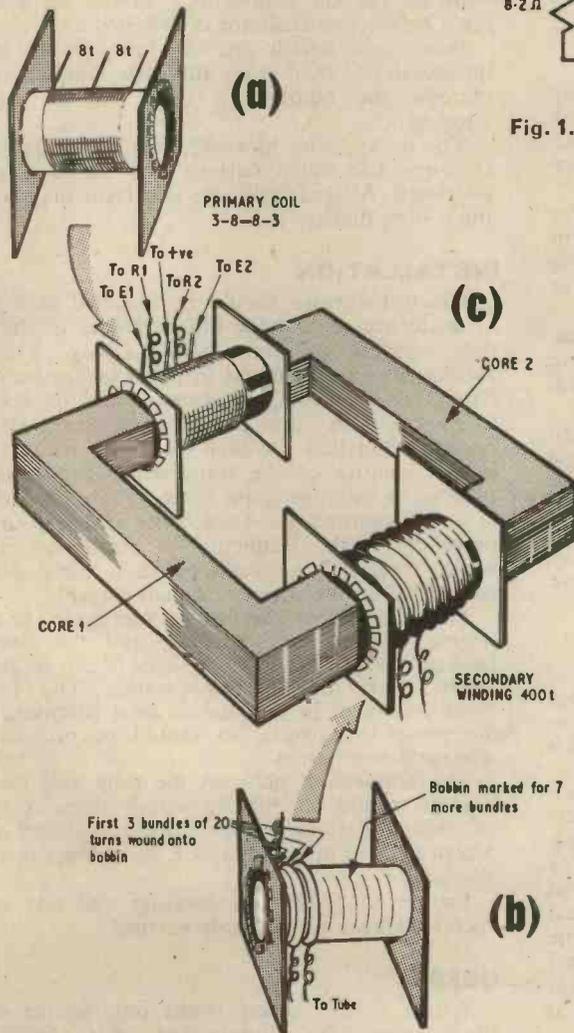


Fig. 3. Transformer winding details. (a) The primary winding. (b) The secondary winding shown during construction. (c) The completed windings assembled on the C-cores

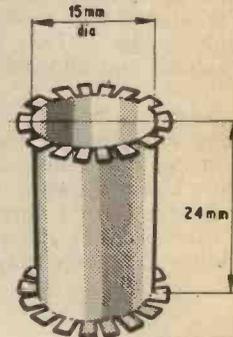


Fig. 2. Dimensions of a suitable bobbin. This size will fit most line-output transformers

sonic operation, about 40,000 pulses of light each second compared with only 100 pulses per second from 50Hz mains. This relies much less on our persistence of vision, and provides a more steady source of illumination.

CONSTRUCTION

Mount the OC35 transistors onto a piece of sheet aluminium of 16 s.w.g. or heavier and having a surface area of 500sq.cm. or more. (Two separate smaller pieces may be used, one per transistor.) No insulators are needed, as, if the power supply is negative earth, the metal will provide the required earth connection to chassis. For positive earth systems the transistor cases must be insulated, or *npn* devices used. A small quantity of silicone grease is placed between each transistor and the aluminium sheet or heat-sink to assist in transfer of heat from the transistors to the metal.

TRANSFORMER DETAILS

Obtain the line output transformer from a scrap t.v. set, and dismantle it, being careful not to break the ferrite core. Retain the ferrite core, which usually comes apart in two C-shaped parts. Keep also the core mounting components.

The next stage is to prepare new windings for the transformer. The primary consists of 16 turns of 18 s.w.g. insulated copper wire, centre tapped. At each end of the primary a further three turns of thinner wire are wound in the same direction.

Make two bobbins of thin cardboard or cartridge-paper according to Fig. 2. They may be dipped in quick-drying varnish and allowed to set in a warm dry place.

When the bobbins are dry, wind the 16-turn primary winding onto the stoutest one in a single even layer, bringing out a loop a few centimetres long at the centre tap as shown in Fig. 3a. Over each half of this winding, wind three more turns of thinner wire, which may be the same gauge as the secondary winding. The wire may be held in place with tape.

SECONDARY WINDING

The secondary is wound using a much thinner insulated wire, 30 s.w.g. being suitable. It is pile-wound in two layers. A method of winding which the author recommends is shown in Fig. 3b.

Leaving a few centimetres of wire at the beginning for connecting purposes, pile wind ten successive bundles of 20 turns each along the length of the bobbin. Obviously each bundle must occupy less than 2.4mm of the length of the bobbin, so it is a good idea to mark the bobbin into ten equal intervals before you start winding. This gives the first 200 turns. Cover with insulation, and repeat the winding back along the bobbin to give another 200 turns. Secure this with tape. After testing, it may be dipped in varnish.

Fit the C-cores into the windings so that the transformer has the appearance of Fig. 3c, and clamp firmly together. The clamps are not shown in the diagram as different transformers use clamps of a variety of shapes. When tightening the clamps be sure not to crack the C-cores as they are brittle, so only moderate pressure should be used.

TESTING

Connect the primary winding of the transformer to the two power transistors as shown in Figs. 1 and 3, by way of resistors R1, R2. If the 12V power is connected now, a high-pitched whine should be heard, and the unit should consume a current of about 3 amps. Whenever the unit is switched on, be careful that the secondary wires are kept out of contact with anything they should not touch, as a high voltage appears across them.

When the fluorescent tube is connected, the pitch should rise, and may become inaudible as it reaches the ultrasonic range of frequency.

Switch off the unit and disconnect the 12V supply. Now connect one end of the secondary winding to the two pins at one end of a fluorescent lighting tube. Similarly connect the other end of the secondary winding to both pins at the other end of the tube. As a high voltage will be present, this winding and all connections should be well insulated before the oscillator is switched on.

When you switch on, the tube should light up immediately. If it does not, try another tube, or increase the number of turns on the secondary winding.

Too many turns, however, may cause the device to consume too much current and the transistors to overheat. Alternatively, the oscillator may stall, giving a dim, flickery light.

INSTALLATION

The transformer should be installed in a cabinet or enclosure so that the high voltages of the secondary winding are out of harm's way. The transformer may be mounted in place using the original fixing arrangements, but care should be taken not to mount it in close proximity to sheet steel; the reason being that the high-frequency magnetic field in the vicinity of the transformer can cause steel objects to heat up quite considerably at a distance of a few centimetres. Indeed the author found that, especially if the frequency of oscillation is ultrasonic, temperature produced in a piece of metal placed within the core could melt solder!

Fortunately this effect is only apparent to a large degree with magnetic metals, and the aluminium heat-sink with the power transistors can be mounted fairly close to the transformer. The heat-sink becomes warm in use due to heat produced within the power transistors, so should be provided with adequate ventilation.

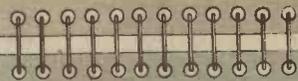
The connection between the tube and the transformer should be directly wired—there is no need of chokes, starters or capacitors, and if any of these are present in the lampholder, disconnect them from the tube.

Ensure that the tube housing and any exposed metal surfaces are correctly earthed.

USES

Where a 12V battery is the only source of electrical power for illumination, this steady light, coupled with the reduction of shadows when a long tube is used, make the tube economiser far preferable to the use of incandescent bulbs.

Obviously the same advantages hold for use in power-cuts together with the advantage that the economiser is cheap to build, and can be put together quite quickly. ★



INDUSTRY NOTEBOOK

By Nexus



TURBULENCE

Nobody would welcome, say, five years of absolute stability more than the semiconductor industry. Alas, the overall situation is as turbulent as usual but while the agony of the manufacturers is as intense as ever, the savage competition and struggle for market shares is, as I pointed out a couple of issues ago, beneficial to the consumer.

The two latest casualties are both Canadian-based. The brave hopes of Microsystems International Ltd., which started up in 1969 were never realised. The company, a subsidiary of Northern Electric, never became profitable and in 1974 is said to have lost £20 million.

Another Canadian company, Siltek, also in the CMOS trade and founded in 1972, might have put in a bid for MIL's assets but is now in receivership following the price-cutting battle between market leaders like RCA and Motorola.

Siltek couldn't stand the heat despite being largely funded by the Canadian government. So hopes of a rescue from Siltek have foundered and the latest news is that MIL's huge investment in the paraphernalia of semiconductor manufacturing, estimated at some £6 million, was scheduled for public auction in the first week of June.

Motorola has run into difficulties in fabricating ^{12}L microprocessors and is reported to be withdrawing from the technology and concentrating on n -channel MOS which has been outstandingly successful. Texas Instruments appears to be pressing on with ^{12}L but with a delayed launch date. The ^{12}L technology, if it can be realised successfully, gives a large increase

in operating speed but pays a penalty in noise immunity and packaging density.

Meantime, the battle for supremacy in the market place continues and according to recent forecasts the market for micro-processors in Western Europe will top £300 million by 1984. Motorola claims to hold 15 per cent of the total world market this year and 35 per cent of the 8-bit market and, as I write, is threatening to slash prices for the small user (i.e. in quantities up to 100) by another 50 per cent. Mullard in the U.K. has already cut the small-quantity price of its Signetics 8-bit NMOS from £38 to £18 in 1-24 quantities. In 100-999 quantities the price drops dramatically to £12.

A speaker at the recent Seminex exhibition and conference in London suggested that the current commodity life for semiconductor devices was now only two years before obsolescence set in.

INSTRUMENT NEWS

After years of flat trading, electronic test and measuring instruments are perking up. Bright news is that the MRCA Tornado automatic test equipment (ATE) contract has now been finally firmed up in a European consortium led by Marconi-Elliott Avionic Systems as prime contractors and product managers.

The amount of the contract is not revealed either in test stations to be built or in cash, but it seems likely, taking into account the number of aircraft involved and the way they are expected to be deployed by Britain, Germany and Italy, that there won't be much change out of £50 million. MEAS's partners are Siemens in Germany and Selenia in Italy with British Aircraft Corporation and Rohde & Schwarz as sub-contractors.

Good progress was reported by Malden Electronics. This new company is virtually the old and well-established Venner Electronics, formerly a part of the multinational AMF Corporation. Former director of AMF, David Ollington, bought the electronics interests at the turn of the year and although the new company has a different name it is carrying on where Venner left off and is still making established products of the old firm like timer-counters, sine and square wave generators and test instruments for the Post Office, and will continue to support existing Venner instrument users with spares and service.

The new company reports six months work in hand and some potentially substantial orders in the pipeline. New instruments are also in development and these will be announced later in the year.

An export boost, through a marketing agreement with the Data Tech Division of the Perin Corporation located in Santa Ana, California, is expected by Rcal Instruments. American engineers have already been to England to receive technical instruction on the Rcal 99 Series of counter-timers and frequency meters, introduced last autumn, and on a number of communications test instruments.

The 99 Series of instruments are a complete family all built round a single LSI chip of considerable complexity designed by Rcal and manufactured in the c.d.i. process by Ferranti. The instruments are said to have sold well in Europe since the original launch. In the United States they are to bear the Data Tech label but will all be custom-built by Rcal for the U.S. market.

The largest of the wholly British instrument companies, Marconi Instruments, has just launched a new range of low-cost digital frequency meters using a custom built MOS-LSI chip. Large scale integration cuts down assembly costs and improves reliability. The TF2432 going up to 560MHz is priced at £380 but for the "low-frequency" engineer (how low is low?) who is content with 10Hz to 80MHz, the TF2430 comes at a bargain price of £165 with a standard crystal with a stability of 1.3 parts in 10^7 per deg C.

For long the slumbering giant in test gear, Philips has just introduced two new oscilloscopes, part of a programme to double the company's market share in the test gear market from its present five per cent during the next two or three years.

HAPPY RETIREMENT

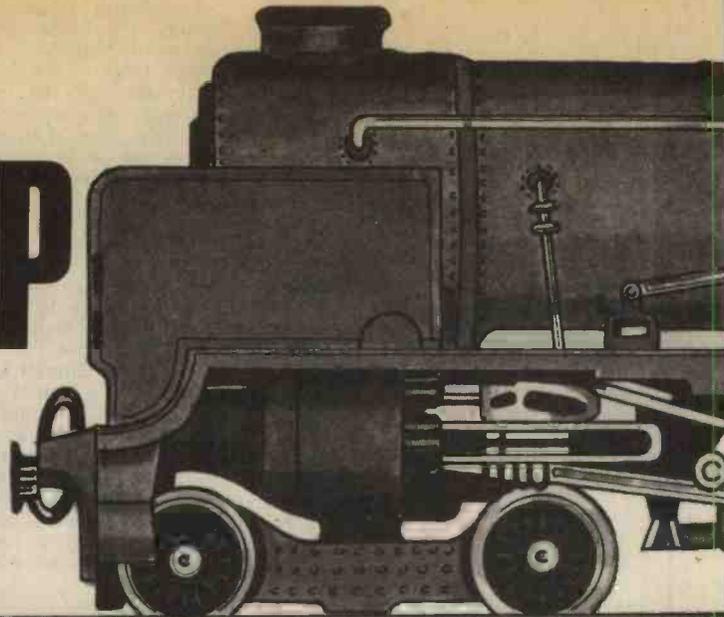
After more than thirty years of service with the Radio & Electronic Component Manufacturers' Federation (RECMF), Arnold C. Bentley retired as Director on May 6.

Affectionately known throughout the industry as Ben, he joined the RECMF as Assistant Secretary in 1945 when he retired from the Royal Air Force. In his later years, in addition to his other duties, Ben was deeply involved in the problems of component standardisation and international harmonisation. He was a founder-member of the Committee of European Passive Electronic Component Manufacturers' Associations (CEPEC) in 1965 and was President for the year 1969/70.

While wishing Ben a happy retirement we also extend a welcome to the new Director, William Barrett, who joins RECMF after five years as Director of the Scientific Instrument Manufacturers' Association (SIMA).

AUTO STOP for Model Railways

By E.A. PARR



THIS automatic stop circuit was designed to stop a model railway train for a pre-determined time at a station. It requires only two connections to the track and needs no external supplies.

The trains can approach the section from either direction and the delay will still operate.

CIRCUIT DESCRIPTION

The circuit diagram and track connections are shown on Fig. 1. As can be seen, there are only two connections to the track; these can be connected either way round.

With no engine on the track, all the voltages in the circuit will be zero, hence the transistors and the thyristor will not be conducting.

Suppose a train now appears. When it enters the station section it will stop as there is no current path by the bridge circuit.

The positive output from the bridge will now rise to the locomotive supply, and C1 will commence to charge via VR1. At this point in time TR1 base is negative with respect to its emitter, hence TR1, TR2 and the thyristor are still turned off.

When C1 charges to half the locomotive supply, TR1 will turn on, turning TR2 on, which in turn fires the thyristor.

There is now a through path via the bridge for the locomotive current and the train will start again.

DELAY TIME

The delay time that the train spends in the section is determined by VR1 and C1. R1 is included to prevent C1 being shorted to the positive output of the bridge.

Because the emitter of TR1 is held at half the locomotive supply, and C1 is being charged by the locomotive supply, the time at which TR1 turns on,

and hence the delay time, is largely independent of the locomotive supply. The train can approach the section at speed or at a crawl and it will stop for the same time.

Diode D5 discharges C1 when the thyristor fires. This ensures that C1 starts charging from the same point each time, giving a consistent delay time.

COMPONENTS . . .

Resistors

R1-R3 1k Ω (3 off)
R4 10k Ω
R5 1k Ω
R6* 820 Ω see text
All $\frac{1}{2}$ W 10% carbon

Capacitors

C1 250 μ F elect. 25V
C2 4,700 μ F see text
C3 250 μ F elect. 25V

Potentiometer

VR1 100k Ω miniature

Semiconductors

D1-D4 Silicon Bridge Rectifier REC 63 (R.S.)
D5, D6 1N4001
TR1 2N3704
TR2 2N3703
CSR1 Any 1A 50V thyristor (see text regarding holding current)

Miscellaneous

0.1in Veroboard 3.3in \times 1.8in

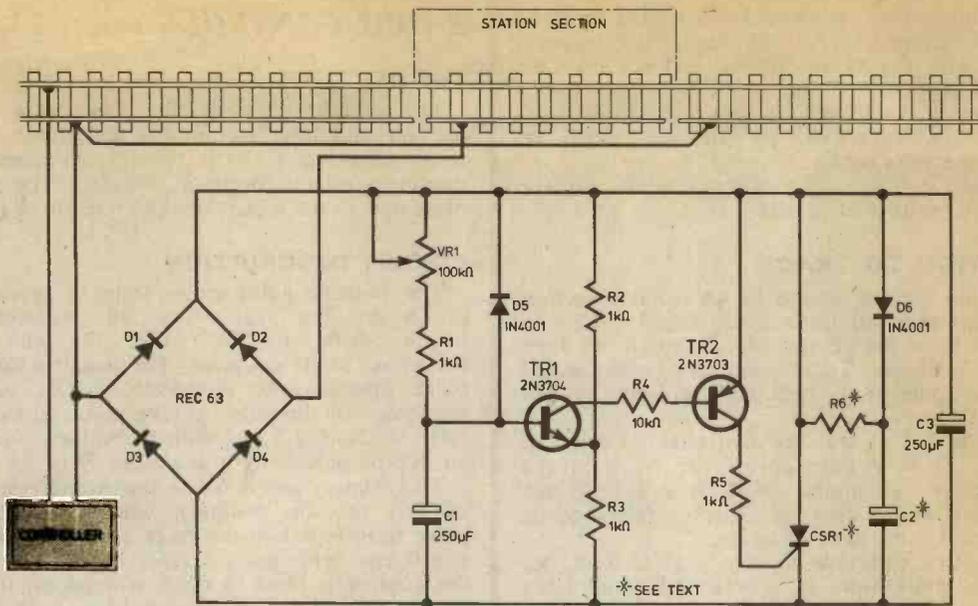


Fig. 1 Circuit of the Auto-stop unit

Once fired, a thyristor stays on as long as it is passing current. Unfortunately, a locomotive motor and the track itself causes the current to be intermittent. The circuit was built originally without R6, D6, C2 and it was found that the locomotive proceeded in short bursts. This could be caused with dirt on the commutator or the track breaking the locomotive supply. Here the thyristor would turn off, and the locomotive would have to wait for C1 to charge again.

TIME CONSTANT

C2 and R6 provide current for the thyristor to keep a small current flowing through the thyristor during the intermittent breaks in the locomotive current. The thyristor will stay on for a time determined by the time constant C2 and R6.

R6 is determined by the holding current of the thyristor (usually about 5mA) and the time required (and hence C2) by the length of the station section.

The author found 820 ohms and 4,700μF for R6 and C2 gave good results with the thyristor used and a section length of six inches.

If the time constant is made too long, the train following will not stop at the station as the thyristor will still be conducting.

Capacitor C2 is charged by the locomotive via D6, and this charging action softens the stop of the train, giving a somewhat fast ramp.

The start is unramped, but the circuit was designed for simplicity of design and connections rather than sophistication.

CONSTRUCTION

The circuit was built on standard 0.1in pitch Vero-board as shown in Fig. 2.

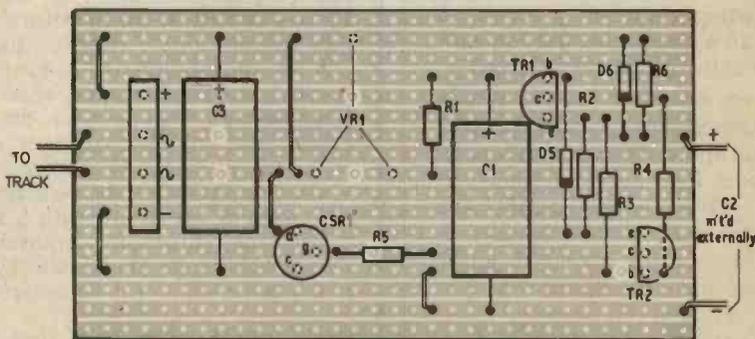


Fig. 2 Vero cutting details and component layout

The circuit is very uncritical with regard to transistors and thyristor types although some experimentation with the values of R6 and C2 may be required as explained above.

The value of VR1 and C1 give a delay time of up to 10 seconds. This can be increased further by increasing the value of C1.

Note that C2 is mounted external to the printed circuit board because of its size.

CONNECTION TO TRACK

The station section should be an isolated section with one common rail as shown in Fig. 1. The two track wires from the printed circuit board are then connected as shown. These wires can be connected either way round and the track polarity is not important.

To test the circuit, put the controller on full and connect a 12V 1W bulb across the track in the station section. It should shine at full brilliance then dim out as C2 charges. After a few seconds delay it should come back on again.

A locomotive can now be tried. If it does not restart or it pulls away in a series of small jerks the values of C2 and R6 probably require adjusting.

If it is required to have the auto-stop facility switchable, simply connect a switch across the a.c. inputs of the bridge to short the circuit out. The train will proceed through the section without stopping. ★

MAIL BAG

The on-going increase in postal and telephone charges does not seem to have made any difference to our post bag or our telephone bell. Enquiries continue to flood in.

We find that there are two points we are constantly mentioning. In the first place we just cannot afford to reply to any *readers' letters*, particularly those not associated with projects we have published, unless they are accompanied by a *stamped addressed envelope*. Were we to undertake to do so our post bill would become astronomic.

We cannot deal with *technical enquiries by telephone*. Readers should write in, giving details of symptoms and perhaps some test point readings, when requesting technical help so that we can at least give the relevant author some idea of the problems involved.

Finally, whilst we normally supply details as to source of components in each project we do assume that the constructor refers to advertisements and has an awareness of general sources. Thus, where goods are generally available we do not specify a source. You could save the cost of a letter by reading the advertisement pages first.

We regret that we are unable to supply any back copies of Practical Electronics

THE DECODER

The decoder receives the pulse train from the receiver and interface boards and detects the sync pulse allowing a b.c.d. count to commence for decoding in the decimal decoder. The output is presented to the inputs of the servo drive boards.

CIRCUIT DESCRIPTION

The positive going pulse train (a typical one is shown in Fig. 13) from the receiver is fed to the base of TR5 (Fig. 12) which inverts the pulses at its collector. The negative edge of the pulse operates the monostable (IC2) causing an expansion of the pulse to take place set by $t = C19 (R19 + 2k) \log_2 2$ and with the values selected gives an output pulse length at output Q of 0.6ms.

This 0.6ms pulse is fed to the A and reset 1 inputs of IC3 (decade counter), whilst the unexpanded pulse train is fed to the reset 2 input of IC3. When the 0.5ms sync pulse arrives at the reset 2 input the counter is reset to 0000, whereupon it proceeds to count until the counter reaches 1001, when the internal 'b.c.d.' resets will occur.

The reset pulse is 0.1ms (this being the difference between the 0.6ms monostable output and the 0.5ms sync pulse). The b.c.d. output of IC3 is connected to the b.c.d. input to the decimal decoder IC4, which provides a decimal output of 1-9.

These are negative going outputs and each is repeated every 20ms or so, and offset from each other by 0.25ms, which is the pulse spacing in the train.

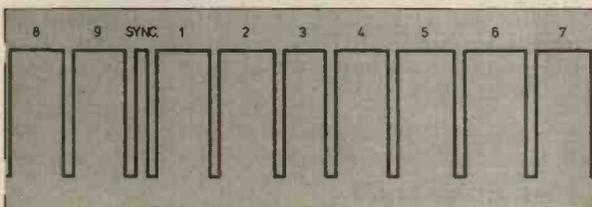


Fig. 13. Typical input waveform to TR5 with channel 3 operated

CONSTRUCTION

The layout of the printed circuit is shown in Fig. 14 and measures 70 x 55mm. The location of all i.c.s should be noted before they are soldered as they are difficult to remove afterwards if wrong.

A fine tipped soldering iron with small gauge solder prevents solder runs and short circuits. There are few discrete components on the board, but note the connections of TR5 which is of the form TO92a with the collector in the centre.

On completion of the soldering, the author found that washing the board with a small stiff brush and a drop of Turpentine removed all flux deposited during soldering. The result then, is a clean board that can be examined before connecting the supply.

Next month: The final part of this series will describe the servo amplifier, servo drive and relay drive sections.

PATENTS REVIEW . . .

EXTENDING PATENTS

It is interesting to note that patents are only very occasionally, and under very special circumstances, extended. The record for extension is held by BP 524 443, in the name of Georges Valensi. This patent, which dates back to January, 1939, expired, not after the normal 16 years' maximum life span of a British patent, but in June, 1971, after 32 years, having been extended several times.

The patent covered the original idea for using differential circuits to produce a series of comparisons of the various colour voltages in a colour TV system, thereby to produce a representative colour signal voltage which could be transmitted with relatively reduced band width. The extensions were granted to Valensi (and EMI) because the invention was obviously of dramatic significance and its exploitation was delayed first by the War and second by the late involvement of this country in colour TV.

Now that the patent has finally expired, its contents are, of course, free for any colour set manufacturer to use.

IMPROVED BASS

In BP 1 406 427, the Ferrograph Company of Slough, Bucks., suggests that the bass response of a reflex cabinet can be extended with less risk of undesirable resonance effects by extending the reflex aperture into the cabinet.

The conventional form of a bass reflex port is shown dotted in Fig. 1. The new idea is to make a port of much larger diameter and much greater length. To accommodate this greater length, the port is formed as an L-shaped pipe that extends first back into the cabinet and then upwards at right angles to behind the drive unit, Fig. 1.

The whole cabinet, including the L-shaped pipe, is filled with sound absorbent material such as long fibre wool or plastics fibre. In practice it is found that, with an enclosure of 2ft x 1ft 3ins x 1ft 6ins, the pipe should be between 1ft and 3ft long with an optimum length of 2ft.

WHY NOT A TRADEMARK ?

We have previously reported on the continuing rise in official patent fees.

Individuals and firms active in the electronics field should not forget the other valuable source of commercial protection—Registered Trademarks. Many of the household names in electronics are registered trademarks, and although trademark fees are also continually rising, the cost of securing and maintaining a trademark may prove insignificant in comparison with the commercial benefits which accrue.

Anyone doubting the commercial benefit of a trademark need only recall the last time they asked for a branded electrical product by name and in consequence legally obliged the salesman to sell them only goods from the firm of origin denoted by the brand name.

Individuals or firms launching a new electronic product and seeking to establish whether the name of their choice is already owned by a competitor must currently either search for themselves in the Public Search Room of the Trademarks Registry or employ a searcher or trademark agent to do the job for them. Failure to carry out such a check before launching or importing and advertising a new product can prove to be an extremely expensive mistake if the chosen name subsequently proves to be someone else's property. It is, however, a common occurrence.

The Trademarks Registry (in the same building as the Patent Office, Southampton Buildings, Chancery Lane, London WC2) has on file a quarter of a million registered trademarks, but somewhat surprisingly a search through these marks must still be conducted by hand.

Although the simplicity of unambiguously classifying a trademark name or logo (as opposed to the difficulty of classifying the content of a lengthy patent document) should make trademarks ideal subjects for automated data storage and retrieval techniques, there is still no positive move in this country towards automation. This is partly because trademarks can give perpetual protection (Trademark No. 1, "Bass for Beer" is now 100 years old) and still in force, for there are now two quite different classification systems running alongside each other.

Although legislation dating back to 1938 provides for elimination of the older, obsolete classification, this has never been implemented, and there is currently even talk of attempting to devise a system for automating concurrent searches through both classifications. As this would, in some cases, involve searching through more than 20 separate classes for different filings of a single word used in a single situation (there are in all 50 classes in one classification and 34 in the other), the idea must surely be a non-starter.

IN BRIEF

BP 1 426 962—Granada TV Rentals Ltd.: *Stereo Signal Generator*. A full circuit diagram, complete with values, is given for a clever system of locally producing multiplex stereo transmission signals (for instance for shop demonstration of a receiver) using a colour television chrominance chip.

BP 1 427 133—Smiths Industries Ltd.: *Vehicle Monitoring and/or Controlling Apparatus*. A very complex digital system for automatically monitoring virtually every performance parameter of a motor car, converting sensor signals into pulse trains and providing automatic control when necessary.

BP 1 406 427

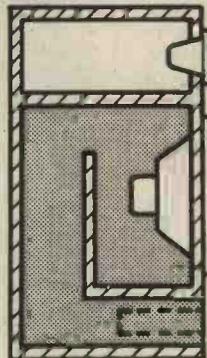


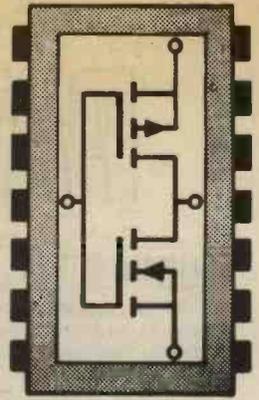
Fig. 1

Copies of Patents can be obtained from the Patent Office Sales, St. Mary Cray, Orpington, Kent Price 75p each

Using

CMOS

digital I.C.s



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

PART 7

THIS series has, so far, been restricted to a consideration of complementary MOS devices at the small-scale integration level. That is to say to the level of gate packages, monostables and Schmitt triggers. Many of the devices and circuits have been fairly routine conversions of popular TTL configurations into CMOS logic. The fact that it has been possible to do this in a comprehensive way with a new technology possessing very special properties of its own, is important. These special properties of CMOS logic—high noise immunity, low power dissipation and wide operating voltage range—achieve a greater relevance and clarity when presented in a setting already made familiar by the widespread use of TTL.

MSI CMOS

TTL gained its ascendancy over previous logic families more for its ability to provide a wide range of medium-scale integrated MSI functions than for its speed. This wide variety of MSI functions made it the standard choice even for users who did not require its speed but, nevertheless, had to pay the penalties that go with it.

Similarly what is really attracting users to CMOS is its ability to pack a much greater density of functions on to a chip. CMOS provides an even bigger range of MSI and LSI devices, some of which have the unique property of embracing both the digital and analogue worlds.

Table 7.1 gives a list of standard CMOS devices, above the gate level of complexity, for which there are no equivalent devices in any other logic family. These are, of course, additional to the dozens of other functions that go to make CMOS a comprehensive logic family.

What immediately becomes apparent from looking at the list is the number of high-density, complex sequential logic functions that CMOS technology has made possible. These are the MSI and LSI flip-flops, shift registers and counters that considerably simplify sequential logic design. They have, as will be shown, created new areas of application.

When the ability of CMOS to switch or multiplex analogue as well as digital signals is also taken into consideration, we find that CMOS provides the designer with entirely new and powerful methods of solving familiar problems.

D TYPE FLIP-FLOP

Before discussing these devices and associated circuits, it is worth taking a brief look at how CMOS technology achieves this high packing density in sequential logic functions.

The basic cell from which CMOS shift registers and counters are constructed is known as the "D" type latch flip-flop (Fig. 7.1). This consists simply of two inverters and two transmission gates. The transmission gate, described earlier in this series (Fig. 2.2)

Table 7.1—Standard CMOS devices

Part No.	Description
4006	18-stage static shift register
4016	Quad bilateral analogue switch
4066	
4017	
4020	Decade counter/divider
4022	14-stage binary counter/divider
4024	Divide-by-8 counter/divider
4031	7-stage binary counter/divider
4033	64-stage static shift register
4034	Decade counter/divider with 7-segment outputs
4040	8-stage static shift register
4045	12-stage binary counter/divider
4046	21-stage counter
4051, 2, 3	Digital phase-locked loop
4055, 56	Bidirectional analogue multiplexers
4059	Liquid crystal display drivers
4060	Programmable divide-by-"N" counter
4062	14-stage binary counter/divider and oscillator
4067	200-stage dynamic shift register
4511	16-channel multiplexer/demultiplexer
4517	BCD to 7-segment latch decoder driver
4521	Dual 64-bit static shift register
4534	24-stage binary frequency divider
4536	5-decade counter
4549	24-stage programmable timer
4553	Successive approximation A/D register
4557	3-digit counter
4562	Variable length (1 to 64 bit) shift register
4566	128-bit static shift register
	Time-base generator

is formed by connecting a *p*-channel and an *n*-channel MOS transistor in parallel. The result is an excellent single-pole, single-throw switch with no offset voltage.

The simplicity of the CMOS flip-flop comes from the fact that the two transmission gates literally switch the inverters into one of two states at each transition of the clock. To operate the transmission gates the clock (*C*) and its complement (\bar{C}) are required. When the clock is low, TG1 is on and TG2 is off. So *Q* follows the complement of the input *D*. When the clock is high, TG1 is off and TG2 is on. In this condition the data is memorised in the closed loop latch formed by the two inverters and TG2.

Cascading two of the flip-flops of Fig. 7.1 and using NOR gates instead of inverters to give SET and RESET facilities forms the standard CMOS master-slave "D" type flip-flop (Fig. 7.2). In operation the

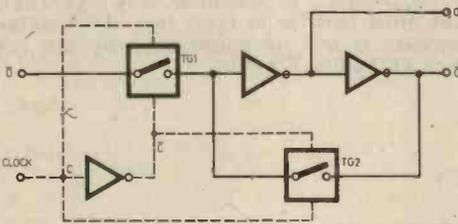


Fig. 7.1. Basic CMOS "D" flip-flop. The transmission gates switch in opposition at each clock transition. When TG1 is on, TG2 is off and the complement of the *D* input appears at the *Q* output. At the next clock transition, TG1 is off and TG2 is on and the data is memorised in the closed-loop latch formed by the two inverters and TG2.

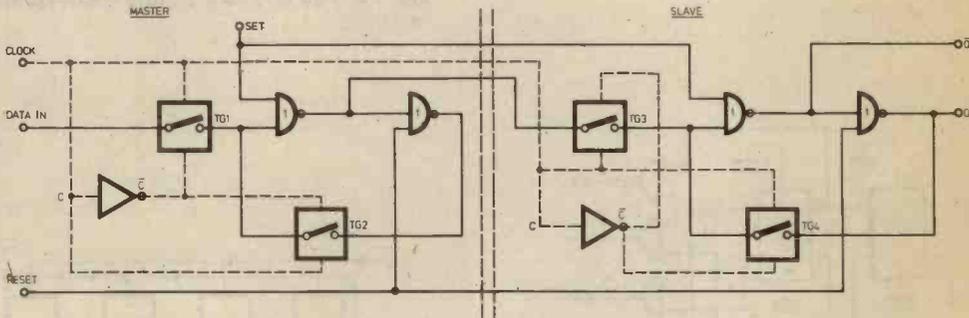


Fig. 7.2. The "D" type master/slave flip-flop. With SET and RESET at "0", the NOR gates are alternately cross-coupled to form latches by TG2 and TG4. When the clock is low, TG1 and TG4 are on and TG2 and TG3 are off. Thus the "Slave" is latched and the data is entered into the "Master". When the clock goes high, the transmission gates reverse their states. The "Master" latches the data which is directly applied, through TG3, to the output of the "Slave" (*Q*)

logic level at the input "D" is delayed before appearing at the *Q* output by half a clock cycle (hence the "D" meaning delayed).

The CMOS part number is 4013 and it consists of two "D" type flip-flops. The pin connections and truth table are shown in Fig. 7.3. A modified version of the "D" type flip-flop is formed by additional gating at the input to form two inputs, called *J* and *K*. This is the dual J-K flip-flop, 4027 (Fig. 7.4). The extra inputs make the 4027 especially useful in control logic, as well as in sequential counting.

DIVIDERS AND CLOCKS

The 4013 and 4027 are useful in simple dividers, where it is required to divide by two, three or four. For higher numbers it is more economical to use CMOS dividers from Table 7.1 such as the 4017 or 4022 which will be described later.

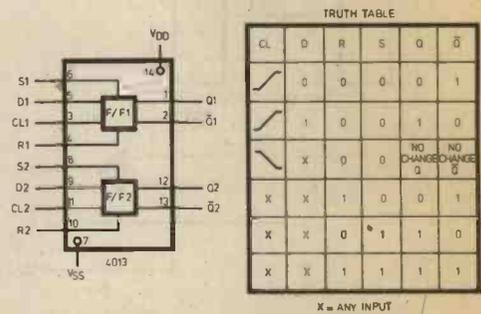


Fig. 7.3. Truth table and package diagram of the 4013 dual "D" type flip-flop

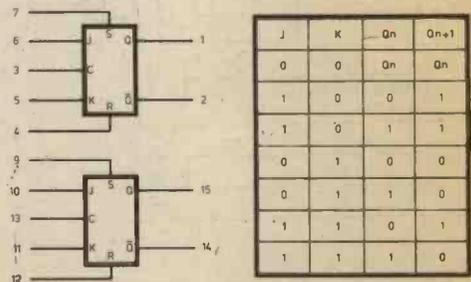


Fig. 7.4. Truth table and package diagram of the 4027 dual J-K flip-flop

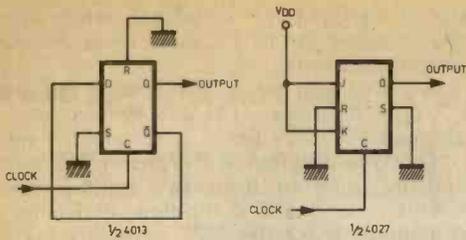


Fig. 7.5. Divide-by-2 circuits using the 4013 "D" type flip-flop and the 4027 J-K flip-flop

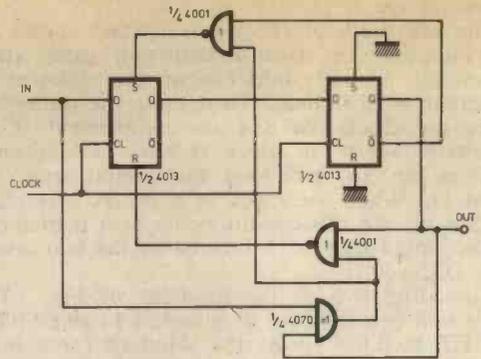


Fig. 7.8. Digital low-pass filter. Any signal at the input must last for at least two clock pulses, otherwise it will be suppressed by the reset action of the first flip-flop

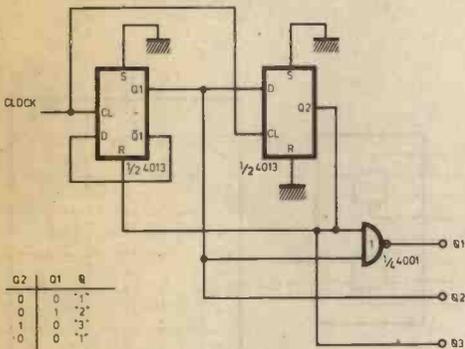


Fig. 7.6. Three-phase clock circuit using the 4013. The 4013 is connected to form a divide-by-3 circuit and the addition of a NOR gate provides three outputs of sequential non-overlapping pulses

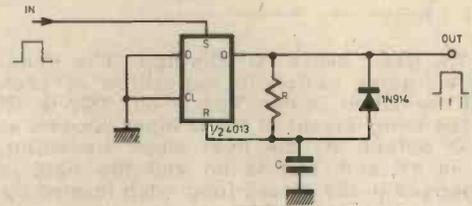


Fig. 7.9. The 4013 as a simple monostable

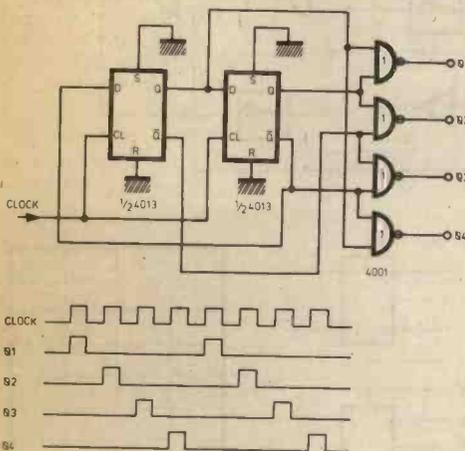


Fig. 7.7. Four-phase clock circuit. The divide-by-4 arrangement is decoded by a quad NOR gate to provide four sequential outputs

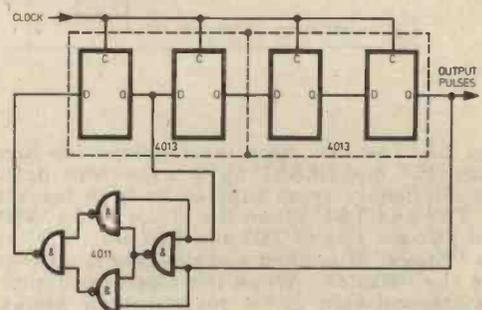


Fig. 7.10. Maximal-length pulse sequence generator. All possible combinations of 0s and 1s in the shift register (except the all-zero state) will appear at the output before repeating

Fig. 7.5 shows divide-by-2 arrangements using the 4013 or the 4027. Fig. 7.6 is a divide-by-3 circuit using 4013 dual "D" type flip-flop. The addition of a 2-input NOR gate ($\frac{1}{2}$ 4001) provides simple decoding to convert the divider into a 3-phase clock. The three outputs give sequential non-overlapping pulses.

Similarly in Fig. 7.7, a quad 2-input NOR gate (4001) decodes a divide-by-4 circuit to produce a four-phase clock. An application of these last two circuits would be to commutate the 4016 bilateral analogue switch, and thus produce a simple electronic equivalent of the electromechanical uni-selector.

LOW-PASS FILTER

The S and R inputs, which are provided for asynchronous setting and resetting, can be used to convert the divide-by-4 circuit of Fig. 7.7 into a digital low-pass filter (Fig. 7.8).

This circuit is very useful for the suppression of spurious signals of high amplitude and long duration. It requires a simple adjustable oscillator connected to the CLOCK input to control the filter characteristics. The action of the filter is such that the input signal must endure for at least two clock pulses before it is transmitted to the output. Otherwise it is suppressed by reset action of the first flip-flop.

MONOSTABLE

Because of the very high input impedance and the high threshold voltage of CMOS, the 4013 flip-flop is useful in a variety of timing applications involving large time constants. Fig. 7.9 shows the 4013 connected to operate as a monostable or one-shot. The output pulse width (t) is approximately $0.66RC$.

Because of the very high input impedance R can be as high as 10 megohms. Its minimum value is restricted to around 20 kilohms by the limited output current available from CMOS. However, this gives a ratio of 500:1 for the output pulse width by varying R alone.

The capacitor C discharges when its voltage reaches the threshold of the reset input of the flip-flop. The diode ensures that it discharges quickly. However, a lower limit of its value is determined by the flip-flop's requirement of a minimum reset pulse width of 125 nanoseconds. The minimum value of C would typically be $0.003\mu F$.

With C and R both variable it is possible to adjust the output pulse width in the ratio of 10,000:1.

M-SEQUENCE GENERATOR

An economical noise generator can be constructed by cascading two 4013 flip-flops as a four-stage shift register, Fig. 7.10. When the outputs of the register are fed back to the input, as shown, via an EXCLUSIVE-OR gate and the clock is started, the output will cycle through all possible combinations of 0s and 1s in the register, except the all zero condition, before repeating. The all zero condition has to be avoided since it would latch-up the register.

In the circuit shown, the sequence will repeat after $(2^4 - 1)$ bits i.e. 15 bits have been generated. This is the maximal-length pulse sequence (m-sequence) for a four-stage shift register. One application is the generation of noise where the harmonic spectrum is related to the clock frequency. ★

Join the Digital Revolution

Understand the latest developments in calculators, computers, watches, telephones, television, automotive instrumentation. . .

Each of the 6 volumes of this self-instruction course measures 11 $\frac{1}{2}$ " x 8 $\frac{1}{2}$ " and contains 60 pages packed with information, diagrams and questions designed to lead you step-by-step through number systems and Boolean algebra, to memories, counters and simple arithmetic circuits, and on to a complete understanding of the design and operation of calculators and computers. Design of Digital Systems.



£6 · 20

plus 80p packing and surface post anywhere in the world.

Payments may be made in foreign currencies.

Quantity discounts available on request.

VAT zero rated.

Also available—a more elementary course assuming no prior knowledge except simple arithmetic. Digital Computer Logic and Electronics

In 4 volumes:

1. Basic Computer Logic
2. Logical Circuit Elements
3. Designing Circuits to Carry Out Logical Functions
4. Flipflops and Registers

£4 · 20

plus 80p P. & P.

Offer Order both courses for the bargain price £9·70, plus 80p P. & P.

**Designer
Manager
Enthusiast
Scientist
Engineer
Student**

These courses were written so that you could teach yourself the theory and application of digital logic. Learning by self instruction has the advantages of being quicker and more thorough than classroom learning. You work at your own speed and must respond by answering questions on each new piece of information before proceeding to the next.

Guarantee—no risk to you

If you are not entirely satisfied with Design of Digital Systems or Digital Computer Logic and Electronics, you may return them to us and your money will be refunded in full, no questions asked.

To: Cambridge Learning Enterprises (Dept. ENG)
FREEPOST, St. Ives, Huntingdon, Cambs. PE17 4BR

*Please send me . . . set(s) of Design of Digital Systems at £7·00 each, p & p included

*or . . . set(s) of Digital Computer Logic and Electronics at £5·00 each, p & p included

*or . . . combined set(s) at £10·50 each, p & p included

Name

Address

*delete as applicable

No need to use a stamp—just print FREEPOST on the envelope. PE7

GREENWELD

443 Millbrook Road Southampton
SO1 0HX Tel: (0703) 772501

All mail orders and callers to this address please—callers only to 21 Deptford Broadway, SE8 (Tel. 01-692 2009) and 38 Lower Addiscombe Road, Croydon

NEW LOW PRICES— VAT INCLUSIVE !!!

All full spec. marked * devices by famous manufacturers

DIGITAL I.C.s

7400 10p	7450 13p	7495 62p
7401 12p	7451 12p	7496 72p
7402 12p	7452 12p	74107 32p
7404 15p	7454 12p	74121 30p
7405 20p	7460 12p	74122 45p
7406 25p	7472 24p	74123 54p
7408 12p	7473 24p	74132 48p
7410 11p	7474 24p	74150 148p
7413 25p	7475 46p	74154 120p
7414 54p	7476 24p	74155 62p
7420 12p	7483 74p	74157 56p
7430 12p	7486 35p	74159 168p
7432 16p	7490 40p	74174 82p
7437 16p	7491 64p	74179 100p
7440 13p	7492 45p	74180 100p
7447 72p	7493 45p	74367 100p

LINEAR I.C.s

741 25p; 555 40p; 723 (TO99) 50p
Plastic Voltage Regulators:
TO128 case 5V 600mA 80p, 12V 500mA 80p

TRANSISTORS

AC127 15p	BD131 38p
AC128 15p	BD132 40p
AC176 16p	BFY50 15p
AC187 16p	BFY52 15p
AC188 18p	TIP41A
AD167 35p	TIP42A
AD182 35p	TIP2955 96p
BC107 10p	TIP3055 42p
BC108 10p	2N2219 26p
BC109 10p	2N2369 22p
BC109C 15p	2N2646 42p
BC147 10p	2N2926G 12p
BC148 10p	2N3053 18p
BC149 10p	2N3054 49p
BC157 10p	2N3055 38p
BC158 10p	2N3440 54p
BC159 10p	2N3442 £1.20
BC161 18p	2N3702 10p
BC182 12p	2N3703 10p
BC183 12p	2N3704 10p
BC184 12p	2N3705 10p
BC212 14p	2N3708 10p
BC213 14p	2N3819 22p
BC214 14p	2N4059 10p
BCV70 15p	2N4418 10p
BCV71 15p	2N5204 30p
BCV72 15p	40673 50p

DIODES AND LEDs

500V 5A SCR 45p; 400V 2A Triac 80p;
Diac BR100 25p; 400V 15A Triac £1.50;
CRP12 45p; MRO450 40p; TL209 Red
LED 15p; 0.2in LED Red 22p; green,
Yellow or amber 24p
1N4002 5p; 1N4004 8p; 1N4007 9p;
1N4148 4p; BY127 12p; 100V3A 12p;
400V3A 15p; OA81 5p; OA51 5p
50V 1A bridge 22p; 800V 1A 40p;
250V 2A 40p
50V 30A rect. + or - stud 40p
Zeners—400mW BZY88. All voltages
from 3V to 30V 10p
1.3W plastic from 3V to 200V 20p

RESISTORS

Carbon film 5% 1/4W miniature. All values
in E12 series from 1Ω to 10MΩ (over
1MΩ 10%) 11p each.
Metal Film 5% 1W. All values in E12
series from 27Ω to 10MΩ 24p. 1% and
better—S.A.E. for lists of over 250
values

Wirewound 2 1/2W 0.25, 0.33, 0.47 1Ω 8p;
Wirewound 5W all values from 1Ω to
47k 10p each.

TRANSFORMERS

0-0-6V 100mA 90p; 0-0-9V 100mA 95p;
12-0-12V 50mA 90p; 12-0-12V 100mA
£1; 12-0-12V 1A £2.60; 20V 55mA 90p;
22V 100mA £1; 29V 50mA 85p; 6-3V
1A £1.95; 6-0-6V 1 1/2A £2.30; 12V
150mA 80p; 17V 1A £1.80; 25V 1 1/2A
£2.30; 0-0-30V 1A £3.70.
Multitapped type to give 3, 4, 5, 6, 8,
10, 12, 15, 18, 20, 24 or 30V, or
12-0-12 or 15-0-15V, 1A version
£3.20, 2A version £4.50; 16V 20A
£6.50. Bell transformer in white
case, gives 4, 8 or 12V 1A £2.55-0.55V
5A £8.50.

WIRE

Enamelled copper wire on 2oz reels
SWG/price: 16/32p, 18/34p, 20/36p,
22/38p, 24/40p, 26/42p, 28/44p, 30/46p,
32/48p, 34/50p, 36/52p, 38/54p, 40/56p.

RF CHOKES

0.75, 6-8, 10, 27, 47, 68μH, all 10p
each. 1.5, 2.5, 5.0, 7.5, 10mH, all
30p each.

CAPACITORS

Ceramic plate, 22pF to 1.000pF 2p;
polyester 1.000 to 6.800pF 5p; 0.01,
0.015, 0.022, 0.033, 0.047, 0.068, 0.1mF
4p; 0.15, 0.22mF 5p; 0.33 6p; 0.47 8p;
0.68 10p; 1mF 12p; 2.2mF 16p; 3.3mF
24p.
Polystyrene 10pF to 1.000pF 4p; 1.200pF
to 10.000pF 6p. All 2 1/2%.
Electrolytic:
All 25V: 0.47, 1, 2.2, 4.7, 10, 22, 47mF
8p; 100mF 7p; 220mF 9p; 470mF 11p;
1.000mF 13p; 2.200mF 27p; 40V: 47mF
7p; 100mF 8p; 220mF 10p; 470mF 13p;
1.000mF 32p; 2.200mF 48p.
Tantalum bead. mF/V: 0.1/35; 0.2/25;
0.33/35; 0.47/35; 1/35; 2.2/18; 2.2/35;
3.3/35; 4.7/35; 6.8/35; 10/16; 10/25; 15/10;
22/8; 22/10; 22/16; 33/10; 47/6; 3; 100/3.
11p each.

VEROBORD

100 sq.in. good size offcuts. Mixed, or
all 0.1 £1.30.

ALUMINIUM BOXES

Complete with base and PK Screws.
AB7 133 x 70 x 38mm 50p
AB8 102 x 102 x 38mm 50p
AB9 102 x 70 x 38mm 47p
AB10 102 x 133 x 38mm 50p
AB11 102 x 64 x 51mm 47p
AB12 76 x 51 x 25mm 44p
AB13 132 x 102 x 51mm 85p
AB14 178 x 127 x 64mm 85p
AB15 203 x 152 x 76mm £1.50
AB16 254 x 178 x 76mm £1.80
AB17 254 x 114 x 76mm £1.50
AB18 307 x 128 x 76mm £1.75
AB19 307 x 203 x 76mm £2.00
AB20 102 x 102 x 64mm 80p
AB21 133 x 102 x 64mm 90p
AB22 132 x 102 x 64mm 90p
AB23 102 x 102 x 64mm 80p
AB24 133 x 102 x 64mm 90p
AB25 152 x 102 x 76mm £1.00

VEROBXES AND CASES

Professional 2 part boxes made of dark
and light grey high impact polystyrene.
2518 120 x 85 x 40mm £1.52
2520 150 x 80 x 50mm £1.75
2522 188 x 110 x 60mm £2.40
Sloping front version, ideal for mixers
2523 220 x 174 x 100/52mm £4.20
Cases, white plastic top and bottom,
front and back aluminium panels that
slit in. Type:
A10 105 x 140 x 40mm £2.90
1411 205 x 140 x 75mm £3.25
1412 205 x 140 x 110mm £4.20
1237 154 x 85 x 40mm £1.80
1238 154 x 85 x 60mm £2.25
1239 154 x 85 x 80mm £2.75
Small general purpose plastic boxes:
1413 7 1/2 x 40 x 24mm 32p
PB1 115 x 75 x 36mm 42p

DEVELOPMENT PACKS

Save £££'s by buying a full range of
components at one go! All full spec.
marked devices, no rejects or odd stock.
50V ceramic plate capacitors 5% 10 of
each value 22p to 1.000pF. Total 210
capacitors £2.70.
CR25 carbon film resistors, 1 watt 5%
10 of each value 10Ω to 1MΩ, total
610 £8.00.
Extended range, 1 ohm to 10M 850
resistors £8.30.
Electrolytics, wire ended 25V working
10 each of: 1, 2.2, 4.7, 10, 22, 47 and
100mF 70 capacitors for £3.20.
C280 polyesters, 10 of each value: 0.01,
0.015, 0.022, 0.033, 0.047, 0.068,
0.1, 0.15, 0.22, 0.33, 0.47mF, 110 caps
£4.00.
Zeners, 400mW 5% BZY88, 10 each
3V to 30V total 260 £14.00.
1 pack, 5 of each value £8.20.
Tantalum Bead caps, 14 values from
0.1/35 to 100/3. 10 of each total 140
caps £11.00.



Electronic Organ with 4 footages and sustain



Electronic Piano with touch-sensitive and special effects

SEND LARGE S.A.E. FOR DETAILS

Fantastic Reduction on all stock items—Bargains not to be missed. Hurry—while stocks last!

Keyboards: 4-octave £15.50; 5-octave £20. GU500 Top Octave Generator £12.55. GD500/5 Top Octave Generator and Dividers £35.20. Organ I.C.s: AY-1-0212 £6.23; AY-1-5051 £1.34; AY-1-6721/5 £1.45; AY-1-6721/6 £1.62; AY-1-5050 £1.96. Rhythm Generator AY-5-1315 £5.06. Chord Generator AY-5-1317A £6.18. Priority Latching AY-1-1313 £6.18. All prices include VAT. Callers only. Construction manual for portable organ £2.25. Catalogue 60p available by post.



Electronic Musical Instruments

Organ Centre: 12 Brett Road, Hackney, London E8 1JP (01-986 8455). New Component Shop; 40/42a Dalston Lane, London E8 2AZ (01-249 5624)—1 minute walk from Dalston Junction Station.

1,000pF 40 VV ELECTROLYTICS. Size 1 1/2 x 1/4 in at 3 for 35p.
60 ASSORTED WIRE WOUND RESISTORS. 1 to 10W at 57p.
NPN TO 39 POWER DARLINGTON TRANSISTORS at 20p each.
SILICON SOLAR CELLS 0.5V 15mA at 35p, 0.5V 50 mA at 50p, 0.5V 100mA at 60p, 0.5V 200mA at £1.
100 SUB-MINIATURE DISC CERAMICS ASSORTED from 3.3pF to 0.01μF at 57p.
VHF NPN TRANSISTORS TYPE BF 224 at 6 for 57p.
TAG ENDED ELECTROLYTICS 3.300μF 64VV at 50p, 4.700μF 40VV at 45p. Sizes 2 1/2 in x 1 1/2 in.
FM IC'S LIKE TA A570. Untested with data at 5 for 57p.
FERRANTI ZTX108 NPN TRANSISTORS at 6 for 57p.
50 ASSORTED RADIO and TV KNOBS for 75p.
DUAL GATE MOS FET's similar to 40673 at 33p, 4 for £1.10.
20 PHOTO TRANSISTORS NPN. Untested for £1.
500 yard REEL of PVC CABLE, 14 Strand 0.0048 at £3.
BD187 4A PLASTIC POWER TRANSISTORS at 40p each, 4 for £1.35.
100 ASSORTED 1/4 W RESISTORS. 17 different values at 57p.
MULTI-TRANSISTOR I.C. LIKE CA3045. Untested with data at 5 for 57p.
UNMARKED GOOD 2N3866 TRANSISTORS at 40p each, 3 for £1.
25 UNMARKED UNTESTED BC107-8-9 TRANSISTORS at 57p
PLASTIC TRIACS 400 PIV 6A at 60p each.
50 ASSORTED TRANSISTOR ELECTROLYTIC CAPACITORS at 57p.
20 ITT BRANDED 250 mW ZENERS ASSORTED for 75p.
20 STC 750mA SILICON DIODES ASSORTED for 50p.
GERMANIUM TRANSISTORS AC141K, AC142K, AC153K, AC176K, AC187K, AC188K. All at 20p each.
TV TRANSISTORS R2008 at 75p, R2010B at £1.25.
FETs MPF102 at 30p, MPF103 at 25p, BFW10 at 30p, BFW11 at 30p, BF256 at 25p, 2N3819 at 20p, 40673 equiv. at 33p.
TUNING VARIATOR DIODES. Untested 200 to 330pF at 6 for 50p.
POWER TRANSISTORS. MP8112 npn at 15p, MP8512 pnp at 15p.
POSTAGE STAMP TRIMMERS 10pF, 30pF, 50pF, 150pF, 750pF, 1.000pF at 6p.
NEW BOOK "CONSTRUCTING SIMPLE SHORT WAVE RECEIVERS", by G. Dobbs at 60p.
20 VHF TUNING VARIATOR DIODES 85% good, 45p.
PLASTIC 6A SCR's 50 PIV at 15p, 300 PIV at 25p, 400 PIV at 40p.
30 TO 500 ASSORTED POLYESTER CAPACITORS for £1.
35 ASSORTED PRE-SETS and SLIDERS at 57p
STACKPOLE ROCKER SWITCHES 5A 240V at 18p each, 4 for 50p.
TAPE RECORDER DIGITAL MECHANICAL COUNTERS for 20p.
Please add 20p post and packing on orders under £2

J. BIRKETT

RADIO COMPONENT SUPPLIERS
25 The Strait, Lincoln, LN2 1JF

Tel: 20767

See Practical Wireless for details of packs of components, surplus goods, etc. All prices quoted include VAT. Add 15p postage on orders under £2. 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.

INGENUITY UNLIMITED



A selection of readers suggested circuits. It should be emphasised 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.

The wire which used to feed the ignition coil (via the tacho loop) is now connected to the emitter of TR1. This is turned on by TR2. TR2 is modulated by the contact breaker, R3 making the load minimal. TR2 thus modulates TR1 and causes current pulses to reach the tacho.

The coil lead on the original was of the resistance type (part of the car's ignition boost system). If the car to which the system is to be fitted does not have a resistance lead, some adjustments of R1 may be necessary. This may also be the case for tachos of different sensitivity.

The unit is so small that it can fit in the case of the C.D. ignition system.

F. C. Dunford.
London.

TACHO SLAVE

THIS circuit is designed to enable current impulse tachos to be used on cars fitted with electronic ignition.

Sometimes the pulsed coil lead can be looped through the tacho pickup coil, but in my case this was not possible because the loop is internal and the impulse lead permanently connected to the ignition feed. In any case this unit avoids very drastic rewiring.

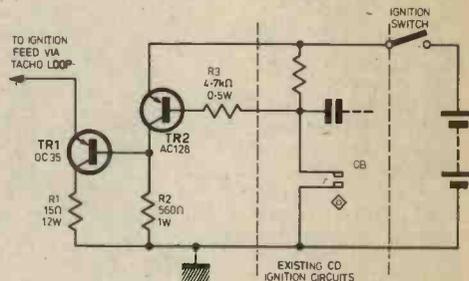


Fig. 1

SOUND TO LIGHT SYSTEM

THE circuit operates on a nine volt supply, the gate of the s.c.r. or triac being connected to the positive rail via a 330 ohm resistor in parallel with a 100 microfarad capacitor. The cathode or MT1 in the case of a triac is taken to mains neutral.

This arrangement means that the s.c.r. or triac is normally turned on. The input from the sound source is put through an isolating transformer and the secondary is connected to the base and emitter of the transistor TR1. Thus when a sufficiently strong signal causes the transistor TR1 to turn on, an alternative current path is provided and this causes the s.c.r. or triac to turn off. The 50k Ω resistor VR1 is used to bias the transistor TR1 to alter the light/dark periods.

The circuit has been found to perform well in a Disco and if fairly low wattage lighting in suitable colours is used, can produce quite pleasing effects between

records where the standard lighting is normally ultra-violet.

K. P. White.
Brighton.
Sussex.

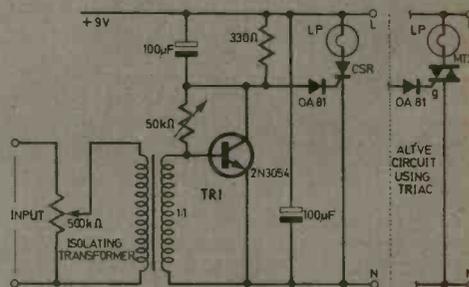


Fig. 1

A SIMPLE QUIZ BUZZER FOR TWO OR MORE CONTESTANTS

AFTER surveying the various designs for quiz buzzers, I did not find one that was simple enough to warrant construction of a buzzer system catering for six or more contestants. This prompted the development of the circuit shown below, Fig. 1.

The action of the lighting is simple. R2 holds CSR1 gate at ground potential until S1 is depressed. This connects R5 to the gate via R1, the gate "ON" voltage is gained and CSR1 switches on, lighting the lamp LP1. Resistor R1 limits the gate current when the gate is shorted to the anode by the switch S1.

If thyristors with particularly sensitive gates are used, then small capacitors, 10nF, may have to be connected across the gate resistor R2. This is to prevent the CSR from switching on due to noise, which can be picked up by the long cable connecting the contestant's push-button to the control box.

The inhibition circuit action is more complex, but only uses one steering diode per lamp circuit instead of several. When CSR1 is switched on, the p.d. across R2 (600mV with the resistance values as shown) is sufficient to switch the CSR on. As the gate currents and p.d.s required to turn the CSRs on varies from device to device, then R2 may have to be changed to suit.

Once CSR1 is switched on and lamp LP1 lit, point B is pulled down to near ground potential; it will be, approximately 0.7V above 0 volts due to the p.d. across the current conducting CSR. Likewise point A will be at near ground potential, at 1.0 to 1.4 volts depending upon the diode D1. Thus if S2 is pushed the potential difference at point C will be the same (Fig. 2). So the p.d. across R4 will be 0.3V giving insufficient drive to the CSR gate to turn it on.

This circuit may be wired up to cater for any number of contestants just by adding more switching modules. Although TIC45s and IS120s were used in the prototype there is no reason why other types of thyristor and diode should not be used, bearing in mind that the correct functioning of the circuit is dependent upon the gate currents of the CSRs, and the diodes should be chosen for minimum voltage drop across their junctions. The resistances of R1 and R2 are determined by the current requirements of the CSR gates, and should be chosen to allow just enough current through to the gate to turn it on.

To give an audible indication as well as visual, a buzzer may be incorporated into the circuit. The circuit shown below in Fig. 3 is a

Fig. 1

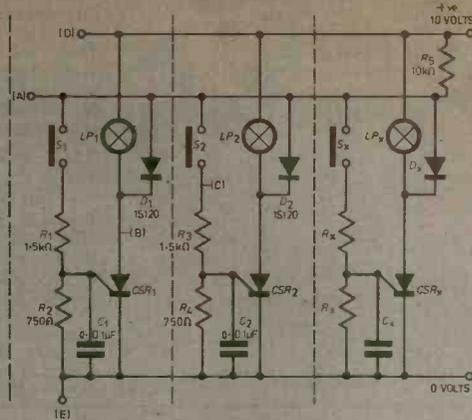


Fig. 2

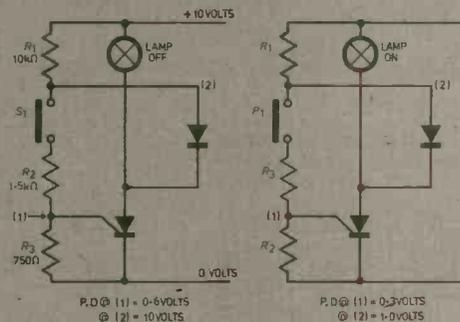
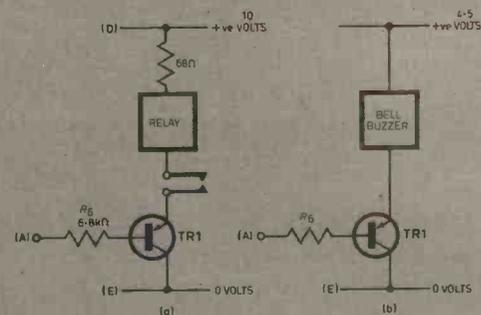


Fig. 3



simple transistor switch. When all the lights are out, then point A will be at the supply rail voltage, 10V; and the transistor base will be reverse biased, cutting TR1 off. Once a lamp has been lit, point A will be brought down to 1V above ground potential switching TR1 and the buzzer on.

Once the buzzer has been activated it will operate until the unit has been reset, thus indicating to the quiz master that the buzzer requires resetting before the next question is set.

The buzzer can be a 6V or 9V relay wired to buzz; these are more economical on current than bell

buzzers, which may require a separate battery from the rest of the buzzer unit as they operate at different voltages, usually 4.5V (Fig. 3b).

All the cables used to wire up the contestants' switch buttons should be the same length (to ensure equal cable resistance), and if very long cable is used then the value of R5 may have to be reduced to compensate for the resistance of the wire.

Diodes D1-Dx should be germanium devices, as the voltage drop across the junction will be at a minimum.

P. Culverhouse,
Stevenage, Herts.

DORAM

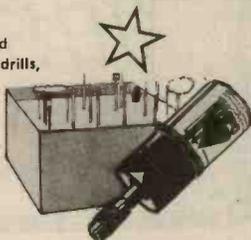
A PROFESSIONAL DEAL FOR AMATEURS

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

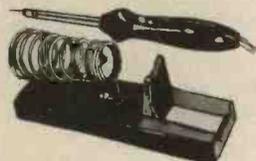
TOOLS

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 50W SOLDERING IRON



Temperature can be altered between 200-400°C.

Iron 240V £6.90 + s
Stand £2.80 + 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
	—	1.2Ah	100	£1.24 s
	HP11	2.0Ah	200	£1.80 s
	HP2	4.0Ah	400	£2.70 s

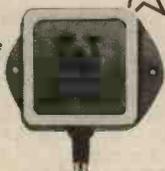
ELECTRONIC IGNITION UNIT

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

Neg. earth or pos. earth

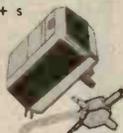
£15.00 + s

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

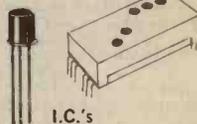
IN 4001 - 5p ea.)
IN 4002 - 6p ea.) + s
IN 4003 - 6p ea.)



1-0A bridge (400V) - 32p + 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 - £6.10 + H
LP 1184/2 - £6.58 + H
LP 1185 - £4.50 + H
LP 1186 - £6.32 + H
LP 1400 - £5.15 + H



TRANSISTORS

BC 107 - 12p s
BC 108 - 11p s
BC 109 - 12p s
BFY 50 - 20p s
BFY 51 - 19p s
BFY 52 - 20p s
2N 3055 - 80p s
2N 2646 - 94p s
TIP 2955 £1.14 s
TIP 3055 - 61p s
BC 237B - 11p H
BC 238C - 10p H
BC 239C - 12p H
ZTX 107 - 10p H
ZTX 108 - 9p H
ZTX 109 - 12p H
ZTX 300 - 13p H
ZTX 500 - 14p 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 2N 3819)
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 - £2.10 s
7805 - £1.55 s
7812 - £1.55 s
7815 - £1.55 s
7824 - £1.55 s
±15V D.I.L. - £2.82 s
TBA 231 - £1.75 H
TBA 800 - £1.20 H
TBA 810S - £1.31 H
TBA 820 - £1.00 H
ZN 414 - £1.30 H
ZN 424 - £1.25 H
741 Op-amp - 36p s
747 Op-amp (Dual 741) - 95p s
748 Op-amp - 48p s
555 TIMER - 56p s
555 (dual 555) - £1.10 H
HA 1156 - £1.60 H
(similar to MC1310P)
ORP12 - 72p s
8A Triac - £1.18 s
ZN 1034E - £4.70 s

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.
Electronic components (Newnes) - £1.80 ea.
P.C.B. assembly (Newnes) - £1.80 ea.
Electronic diagrams (newnes) - £1.80 ea.

'INTERNATIONAL 25'

Build yourself a BIG SOUND amp at a budget price



As featured in 'ETI' Oct. 75 edition

FEATURES

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

Complete kit with assembly instructions

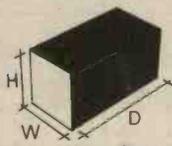
Overseas orders £34.50
S.A.E. for full spec.

£29-95
+ £3.74 VAT

'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 60p 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 12 1/2%
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

NEW RADIO MODULE RANGE



144 MHz Converters
28-30 MHz £15.25 + H
2-4 MHz £15.25 + H

70cm - 432 MHz Converters
144-146 MHz £18-25 + H
28-30 MHz £18-25 + H

144 MHz Dual Output Pre-Amp
£9.25 + H

ALL AVAILABLE EX-STOCK

432 MHz Varactor Tripler
£17.65 + H

M252AA Rhythm Generator
£7.99 + H

New to the UK from PRONTO

Battery operated LCD read out
CALENDAR CLOCK KIT - crystal accuracy -
 Bold Digits - runs on two Penlight Cells.

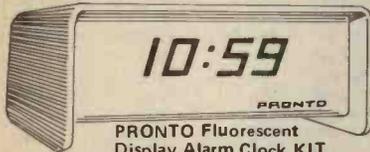


Now is the time for the hobbyist to move into Advanced Technology with Pronto!
PRONTO MODEL 301 - The first completely portable liquid crystal display, digital CALENDAR CLOCK KIT offered in the United Kingdom.

- * Battery operation - two small alkaline cells give a minimum life of 12 months.
- * Superb accuracy through crystal control - of 3 minutes a year
- * Wide angle display with 1/2 inch digits
- * Push Buttons give choice of 3 display modes - hours minutes on 12 hour display with flashing colon, nr seconds, or date.
- * PRONTO 301 comes complete with easy to follow

instructions AT £29.50 including V.A.T. You save Pounds off the recommended retail price of a comparable made up clock.

TERMS: Cash with order - make a cheque and/or postal order payable to PRONTO ELECTRONIC SYSTEMS LIMITED.
 (P & P - U.K. £0.45 Overseas £1.50)



PRONTO Fluorescent Display Alarm Clock KIT

Wake up to the electronic age with the new PRONTO 304 Alarm Clock

- * Large Bright Green Display
- * Alarm with 10 minute 'snooze' feature
- * AM/PM indication and simple setting
- * Automatic brightness control on digits governed by room lighting

* Ingenious gravity alarm - time setting mode switch * Full assembly instructions

AT £15.50 including V.A.T.
 With all PRONTO products - enquiries from the Trade, as well as the Hobbyist, are welcome, and you can also buy individual components!
PRONTO CONSTRUCTOR'S CLUB
 When you buy your first Pronto kit you're automatically a Member of the PRONTO CONSTRUCTOR'S CLUB. It will not only keep you in the picture on new ideas and kits... but gives you **FREE a £2 Voucher** against the purchase of your next kit!
 Isn't it time you joined the Club?

Please send me -

PRONTO 301 KIT/S AT £29.50 EACH (Plus P & P)

PRONTO 304 KIT/S AT £15.50 EACH (Plus P & P)

My cheque/P.O. for _____ is enclosed

NAME _____

ADDRESS _____

Pronto Electronic Systems Ltd.
 645/647 High Rd., Seven Kings, Essex IG3 8RA. 01-599 3041
 Reg. office No 1081707

ELECTROLYTIC CAPACITOR OFFER			
10000/63 £1-88	2200/40	30p	220/63 18p
10000/50 £1-50	1000/180	63p	160/25 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 16p
5000/12 25p	470/63	23p	18/450 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 8p
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 28p.			
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 £22-76.			
50W RMS (4/1) amp. kits complete with building and application details. Suitable for instruments, disco, hi-fi, etc. £8-95.			
S.A.E. FOR DETAILS			
Z414 IC Radio, £1-20, 741 56p.		IC sockets DIL, all 24p.	
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, 0-1uF, 0-2uF, 12p.			
C280, Polyester 250V: 10nF, 22nF, 4p; 33nF, 47nF, 4p; 68nF, 5p; 0-1uF, 0-15uF, 5p; 0-22uF, 6p; 0-33uF, 9p; 0-47uF, 10p; 0-68uF, 14p; 1-0uF, 17p; 1-5uF, 25p; 2-2uF, 29p.			
1N4004 7p	CRS7/40 £1-38		
1N4007 9p	CRS1/60 £1-25		
1N4148 5p	CRS7/60 £1-80		
	40669 £1-18		
OA90 8p			
OA91 9p			
ZENER DIODES			
CRS1/40 68p	400mW 10p		
CRS3/40 £1-08	1'watt 18p		

SEMICONDUCTORS			
AC141 57p	BC157 14p	BD115 67p	MJ3000 £2-68
AC142 42p	BC158 12p	BD121 £1-48	MJ3003 26p
AC187 30p	BC159 12p	BD124 97p	2N3054 66p
AC188 30p	BC167 14p	BD131 52p	2N3055 59p
AC187K 41p	BC168 14p	BD132 64p	2N3702- 2N3711 14p
AC188K 41p	BC169 15p	BD135 56p	
AD161 62p	BC182 13p	BD136 63p	TIP29A 89p
AD162 62p	BC212 18p	BFY50 23p	TIP30A 95p
BC107 13p	BC301 32p	BFY51 22p	TIP31A 87p
BC108 12p	BC302 56p	BFY52 24p	TIP32A 98p
BC109 18p	BC303 37p	MJ481 £1-36	TIP41A 72p
BC147 14p	BCY70 16p	MJ491 £1-52	TIP42A £1-27
BC148 12p	BCY71 56p	MJ2500 £2-75	TIP285 £1-38
BC149 14p	BCY72 16p	MJ2501 £2-85	TIP3085 75p

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.

EBA

Elliott Blunt Audio Ltd
 40 YORK STREET, TWICKENHAM, MIDDX.
 Tel. 01-891 1692

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



You can rely on a CROFTON KIT

Whether professional, student, teacher or amateur, the field of electronics can open up a new world for you.

Send 15p S.A.E. (10ln x 12ln) to cover postage

PLEASE NOTE OUR NEW ADDRESS



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 (inc. VAT + 50p P. & P.); Built £18 + 50p P. & P.
- ★ Electronic Ignition
- ★ Sound Operated Flash
- ★ PW Tele-Tennis Game
- ★ UHF Modulator
- ★ Bench Power Supply
- ★ Wobbulator
- ★ All ETI Top Projects
- ★ Many of the Elektor Projects

NOTE PCBs for most published projects available to order

CROFTON ELECTRONICS LTD

Dept. E, 35 Grosvenor Road, Twickenham, Middx. 01-891 1923

DIGITAL MODEL CONTROL



In this circuit an SN7493 four bit binary counter i.c. is used to switch motors on either side of a model boat so giving directional control by bringing about an imbalance in the forces propelling the boat and so turning it. Two motors are used, one on either side of the main propulsion unit (as far from it as possible).

Motor M_1 moves the boat to starboard; M_2 to port.

A pulse is received by the RC receiver in the boat and transmitted to TR1 base triggering the i.c. which counts one.

Only two outputs of the i.c. are used so the output codes obtainable are 00, used for half ahead, 01 to turn one way, 10 to turn the other and 11 for full ahead. The outputs of the i.c. are taken to TR2 and TR3 which operate relays controlling M_1 and M_2 so that they operate in sequence.

D. Osborne,
Carlisle.

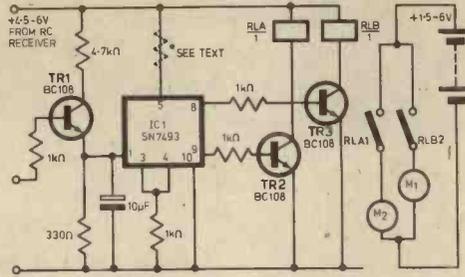


Fig. 2

NOVEL MEMORY

The circuit in Fig. 1 will be recognised by most of your readers as being a memory element. The usual method of operation is to have the inputs A and B at logic 1. The output Q_1 is $\overline{Q_2}$. If A goes to logic 0, Q_1 is set to logic 1 and Q_2 to logic 0. This state continues even when A returns to logic 1. Similarly, if B goes to logic 1, Q_2 is set at logic 1 and Q_1 at logic 0.

A novel method of operating this circuit is as follows. The input B is normally kept at logic 1. The

output Q_1 is kept at logic 1 (assuming that A has been at logic 0 after B last returned to logic 1), no matter what input is seen at A. If a negative going pulse appears at the input B, the output Q_1 will be A. If A is at logic 0, no change in the state of Q_1 is observed. If, however, A is at logic 1, the output Q_1 goes to logic 0 and will remain in this state until A goes to logic 0 and resets Q_1 to logic 1, irrespective of the condition of B. Typical waveforms are shown in Fig. 2.

P. N. Hobson,
Sheffield.

Fig. 1.

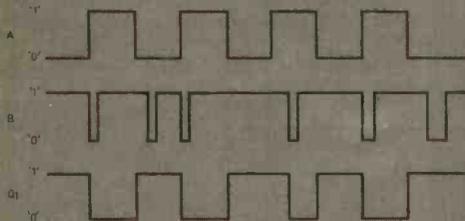
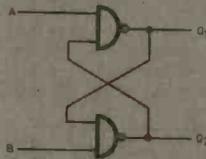


Fig. 2

POINTS ARISING

P.E. DIGI-PROBE (April 1976)
It has been brought to our attention that **DIGIPROBE** is the registered trade mark of Kane-May Ltd., of Welwyn Garden City, Herts. The instrument described in our April issue and entitled "PE Digi-Probe" has no connection with the above Firm nor its products. We apologise for any inconvenience that may have been caused because of the entirely coincidental choice of this almost identical name by our contributors for their own original design.

DIGITAL FREQUENCY METER

(June 1976)
On page 505, the circuit diagram for the high impedance buffer (Fig. 13a) shows the base of TR14 connected to the gate of TR15 and also to "ground". This is, of course, incorrect and the base should only be connected to the "ground" line.

TIME AND TEMPERATURE...

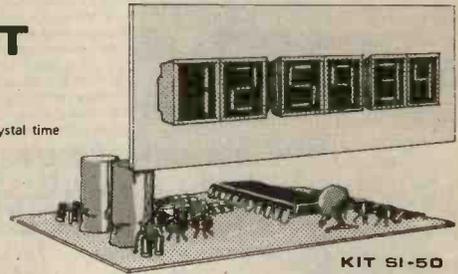
exciting new digital electronic kits from sabtronics

Now you can build a digital alarm clock that displays the time of day as well as the temperature, or a digital alarm clock only, or a digital thermometer only. These exciting new kits from Sabtronics utilize the most up-to-date digital electronic techniques and offer features found only in more expensive instruments.

6-DIGIT LED ALARM CLOCK KIT

FEATURES:

- 6 Bright red LED displays, 0.5 inch character height.
- 12 hour 60 Hz or 24 hour 50 Hz operation. (Optional 12 hour operation with our crystal time base kit).
- AM-PM and power failure indicators.
- 10 minute snooze alarm.
- Time sharing capability for displaying temperature (when used with optional thermometer kit.)
- 3-way manual or optional automatic control for display intensity.
- Single power supply and minimum interface components.
- Kit includes all components, PC Boards, switches, alarm speaker and complete assembly instructions. You provide a 12V transformer.



KIT SI-50

£9.75
Airmail P&P £1.20

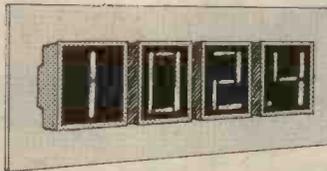
DIGITAL THERMOMETER KIT

Here's another exclusive from Sabtronics — the first low cost digital thermometer with high-quality features.

Two versions available: Kit SI-40 for interfacing with our six-digit alarm clock, and Kit SI-41, a complete unit for independent operation.

KIT SI-40

£11.50
Airmail P&P 90p.



FEATURES:

- 4-digit temperature display.
- Fahrenheit, Celsius or Kelvin.
- Displays time 20 seconds; Temperature 10 seconds.
- Range: 0° to 200°F or 0° to 100°C.
- Accuracy: ±1° from 0° to 160° and ±2° from 160° to 200° with proper adjustment.
- Temperature change sensitivity: ±0.1°

NOTE: This kit is designed to interface with our specially designed alarm clock kit only. It will not interface with other digital clocks.

KIT SI-41

£16.95
Airmail P&P £1.25

KIT SI-41 Same specs. as SI-40 except that this is a complete unit with its own display LED's and power supply components (minus 12V transformer) for temperature measurement only.

0.5 inch LED's

CRYSTAL TIME BASE KIT

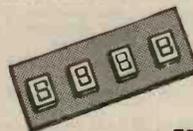
Here's an excellent unit for converting your mains operated clock to DC operation. Features a 60Hz output but is ideal for use with our SI-50 clock kit, MM5314, MM5316, CT7001, MK50250 and many other clock chips which have 50 and 60Hz inputs.

FEATURES:

- Super small size of only 1 in. x 1.5 in.
- Low power consumption - 2.5mA typical.
- Operates from 5-16 VDC.
- Perfect for cars, boats, campers or portable clocks.
- Kit includes all components, PCB, crystal and instructions.

KIT SI-62

£4.95
Airmail Ppd.



4-DIGIT DECADE COUNTER

operates off a 5v supply (not included)

FEATURES:

- On-chip internal oscillator for scanning speed.
- Overflow and count-extend outputs.
- Transfer, reset, count, blanking and true complement control inputs.
- Circuit board can be cascaded to 8-12-16 etc. digits.
- Kit includes all components, PCB's, LED displays and full assembly instructions.

KIT SI-12a **£13.75** Airmail
(with 0.25" displays) ppd.

KIT SI-12b **£15.95**
(with 0.50" displays)

ordering information

U.K. AND EIRE CUSTOMERS (including N. Ireland).

All prices are listed in British pounds and pence. Remittance by bank cheque or international postal money order in sterling or an equivalent amount in U.S. funds. We regret that personal cheques are not acceptable nor can goods be sent C.O.D. The prices do not include any taxes leviable by a purchasers country of residence.

CUSTOMERS IN OTHER COUNTRIES: Please write us for price and shipping information.

sabtronics
INTERNATIONAL

P.O. BOX 64683, DALLAS, TEXAS 75206, U.S.A.

TEL. (214) 369-7309 • TWX. 910 861 4422 WUI

RTVC

Now the VISCOUNT IV 30 x 30 Stereo Amp IN KIT FORM



£24.75
+£1.50 p&p

For the experienced constructor the Viscount IV amplifier comes complete with teak finished cabinet, front trim panel, knobs and all necessary metalwork. The specification for the NEW 30 x 30 is similar to the complete system offered below, but of course with the bigger output

STEREO 21



COMPLETE ONLY

£23.00

+ p&p £4.00 controls and padded earpieces to give optimum performance **£5.25**

INCORPORATING A GARRARD DECK

Garrard 3 speed Deck automatic, manual facilities together with stereo cartridge and cueing device.

Stereo 21, easy to assemble audio system kit. No soldering required. The unit is finished in SimiTeak, and the acrylic top presents an unusually interesting variation on the modern deck plinth.

Includes - 3 speed deck, automatic manual facilities together with stereo cartridge and cueing device.

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 12" x 9" x 5". Complete deck and cover in closed position approx 15 1/2" x 12" x 6".

Extras if required. Optional Diamond Stylus **£1.50**

Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance **£5.25**

BSR DECKS WITH PLINTHS AT FANTASTIC REDUCTIONS



MP 60 Type (illustrated) £14.40
Less Cartridge p&p £2.00

C141 (not illustrated) £10.80
Auto. with Cue Fitted Stereo Cartridge p&p £1.50

All plinths finished in matching Teak veneer.

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, 3 1/2" 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 9 1/2" approx. Comparable built units (EMI LE3) sold elsewhere for over £45.00.

£19.80 pair complete

Complete with crossover Components and circuit diagram.



EASY-BUILD SPEAKER KIT

THE NEW 'COMPACT'

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 mitered and professionally finished, and fix together with masking tape till glue dries.

The cabinet measures 12" x 9" x 5" deep approx. finished in simulated teak, incorporating a quality 8" speaker, maximum power handling 7 watts, impedance 8 ohms nominal, magnet size 2 3/8" approx., with 1 1/2" parasitic tweeter.



£7.50
PAIR INCLUSIVE
+ p&p £1.70

EMI 350 KIT

£6.55 + £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.)

VISCOUNT IV STEREO AMP

COMPLETE 20 x 20 SYSTEMS

SYSTEM 1b £65.00

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 at 10 watts better than 0.2%. Six switched inputs: 1. Magnetic PU - 3 millivolts at 47 K ohms (R.I.A.A.); 2. Crystal/ceramic PU. - 50 millivolts at 50 K ohms (R.I.A.A.); 3, 4, 6. Tape Tuner/Aux. - 140 millivolts at 50 K ohms (flat frequency response); 5. Microphone - 3 millivolts at 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 at full rated output. Signal to noise ratio: better than -50 dB on all inputs. Tone control range: Bass ± 15 dB at 50 Hz; Treble ± 12 dB at 10 KHz. Power requirements: 250V A.C. mains at 60 watts.

Approx size: 15 1/2" x 3" x 10". MP60 type deck with magnetic cartridge, de luxe plinth and cover. Two Duo Type II8 matched speakers - Enclosure size 18 1/2" x 13 1/2" x 7 1/4" approx. in veneer teak. Drive unit 10" with 2 1/2" tweeter. 12 watts handling 24 watts peak.

Complete System with these speakers £65.00
+ £8.50 p&p.



SYSTEM 2 £80.00

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 11 1/2". 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 **£80.00** + £7.60 p & p.

PRICES: SYSTEM 1a

Viscount IV amplifier £24.75 + £1.90 p & p.

2 Duo Type II8 speakers £27.00 + £8.50 p & p.

MP60 type deck with Mag. cartridge de luxe plinth and cover £19.80 + £3.30 p & p.

Total if purchased separately: £71.55

Available complete for only: **£65.00**

+ £8.50 p & p.

PRICES: SYSTEM 2

Viscount IV amplifier £24.75 + £1.90 p & p.

2 Duo Type III speakers £41.40 + £7.50 p & p.

MP60 type deck with Mag. cartridge de luxe plinth and cover £19.80 + £3.30 p & p.

Total if purchased separately: £85.95

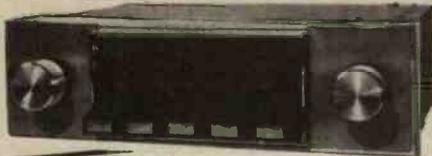
Available complete for only: **£80.00**

+ £7.60 p & p.

Scotland P & P Surcharge System 1a £1.75 System 2 £3.50

Note: 30x30 kit available only as a separate item.

PUSH BUTTON CAR RADIO KIT—FOR THE EX-CONSTRUCTOR



IF YOU CAN SOLDER CORRECTLY ON A PRINTED CIRCUIT BOARD YOU CAN BUILD THIS KIT CORRECTLY

NOW YOU CAN BUILD YOUR OWN PUSH BUTTON CAR RADIO!

This construction kit comprises a fully built and aligned R.F.I.F. module; Printed circuit board, with ready mounted integrated circuit output stage and all other components. The push button tuning mechanism is fully built and tested ready to mate with the printed circuit board. (once it is assembled). **NOTE:** No test equipment is required for alignment, but remember you must have the ability to solder on a 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 4 1/2" deep approx. Speaker including baffle and fixing strip **£1.80+45p.** p.&p. Car Aerial Recommended — fully retractable **£1.45+40p.** p.&p. **£7.40** +£1.05 p&p.

STEREO CASSETTE TAPE DECK KIT

Kit comprises of ready built cassette tape transport mechanism. Featuring pause control, solenoid assisted auto-stop, 3 digit tape counter, belt-driven balanced fly wheel, DC motor with electronic speed control, ready built and mounted record/replay PC board, and two VU meters, power supply, PC board, mains transformer. Input and output sockets and two level controls. Specification power source 240 AC 50Hz. Output more than 0.5v input mike —65dB. 10KΩ DIN —47dB. 100KΩ. Track system 2 channel stereo record play-back. Tape speed, 4.8CM/SEC. Frequency response 50-12000 Hz signal to noise ratio —42dB. Recording system AC Bias. Erasing system AC erase. Bias frequency 57KHz. Size of mechanism 8" x 5" x 3 1/2" approx. unit easy to mount into your cabinet 3" required to clear base of mechanism approx.

* This is an advanced kit not suitable for those without electrical know'edge and those unable to solder.



£29.25
+ p&p £1.50
or send SAE for complete details.

NEW PRODUCT DISCO 35 MONO AMPLIFIER

An ideal general purpose 35 watt mono amplifier with full mixing facilities. Suitable for DISCO, PUBLIC ADDRESS & GUITAR/MUSICAL INSTRUMENTS. Unit housed in an attractively styled teak veneered cabinet. 4 Inputs: DISC 1 & DISC 2 (BOTH FOR CERAMIC CARTRIDGES), tape and microphone. **CONTROLS:** All level mixing controls are fitted with integral switches, push button type. DISC 1 & DISC 2: Volume combined treble filter. TAPE: Volume combined bass booster switch. MASTER: Volume control combined on/off. MIC: Volume combined bass booster switch. **INDEPENDENT BASS AND TREBLE CONTROLS.**

TECHNICAL SPECIFICATION

Power output: 35RMS into 4 ohms. Speaker: (Suitable for 4 to 15 ohms speakers). Sensitivities: DISC 1 & DISC 2: 30mv (into 120k RIAA). Treble Filter Switch: 12 db@ 10 KHz. Tape: 100 mv (into 120k Flat). Bass Booster Switch+18 db@ 60 Hz. Mic: 2 mv (equilised for dynamic). Bass Booster Switch+20 db@ 60 Hz. Bass Control: ±15 db@ 60 Hz. Treble Control: ±12 db@ 10 KHz. **£25.00** +£1.40 p&p

8 TRACK HOME CARTRIDGE PLAYER



Yours for only

£12.60 +£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) **£24.50** + 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.

£8.00 £1.05 p & p.

Also available with the 'Compact' (see opposite page) easy build speaker kit **£14.50+ £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. MP60 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 7", 10" or 12" records. Rumble, wow and flutter Rumble Better than —35dB. Wow Better than 0.2%. Flutter Better than 0.06% (GauMont kalee meter).
Finish — Satin black mainplate with black turntable mat inlaid with brushed aluminium trim. Tonearm and controls in black and brushed aluminium.

Console size —

Unit Closed — 17 1/2" x 13 1/2" x 8 1/2" (app.)
Unit Open — 35 1/2" x 13 1/2" x 4 1/2" (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 +£8.50 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.

All items subject to availability. Prices correct at 1st May 1978, 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



21 D 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.

NEW

from the newest name in Technical Publishing... Newnes Technical Books

ELECTRONICS POCKET BOOK—3rd Edition

P. J. McGoldrick

320 pages 1976 0 408 00209 3 £3.75

QUESTIONS AND ANSWERS ON RADIO AND TELEVISION—4th Edition

H. W. Hellyer & I. R. Sinclair

128 pages 1976 0 408 00249 2 £1.25

MASTER ELECTRONICS IN MUSIC

T. D. Towers

130 pages approx. 1976 August 0 408 00262 X
Approx. £2.50

MASTER HI-FI INSTALLATION

Gordon J. King

140 pages approx. 1976 August 0 408 00237 9
£2.50

MASTER STEREO CASSETTE RECORDING

I. R. Sinclair

180 pages approx. 1976 August 0 408 00238 7
Approx. £2.50

Order from your bookseller, or from:—



Butterworths, Borough Green, Sevanoaks, Kent TN15 8PH

Telephone: Borough Green 884567

H.B. ELECTRONICS

Semiconductors

AA119	10p
AC126/7/8	16p
AC176/187/8	19p
AD149/161/2	50p
AF114/5/6/7	25p
AF118	45p
BA145/8/15/4	16p
BC107/8/9	10p
BC147/8/9	10p
BC157/8/9	10p
BC177/8/9	18p
BC182/3/4L	12p
BC212/3/4L	12p
BC237/8/337/8	16p
BC547/8/9	12p
BCY70/1/2	15p
BD131/2	40p
BF194/5/6/7	10p
BF198/9	12p
BF200	30p
BFX28/30	28p
BFX86/88	25p
BFY150/1/2	18p
BRV38	40p
BY127	15p
MJE340	50p
MJE341	80p
MJE2955	120p
MJE3055	75p
MPE102	30p
TIP31A	50p
TIP32A	55p
TIP41A	70p
TIP42A	85p
T1S43	20p
ZTX107/8/9	20p
ZTX300/500	40p
IN4148	20p
IN4001/2	4p
IN4003/4/5	5p
IN4008/7	5p
IN4008/7	5p
2N1613	20p
2N2646	20p
2N2926 (BROYC)	45p
2N3053	10p
2N3054	16p
2N3055	45p
2N3819	20p

Bulk offers

IN4001/2	30p/10
IN4003/4/5	45p/10
IN4008/7	50p/10
BC107/8/9	85p/10
741 8 diode	£2-10/10
NE555	£1-70/4
Red LED 0-2m	£1/10
Yellow/Green/Amber LED	0-2m
BCY50/1/2	£1-50/10
BCY212L	80p/10
IN4148	30p/10
Push to make switch	£1-50/10
DPST slide switch	£1-50/10

TTL

7400	12p	7474	26p
7401	12p	7483	75p
7402	12p	7486	26p
7403	12p	7490	40p
7404	12p	7491	55p
7405	15p	7492	45p
7406	30p	7493	40p
7408	15p	74100	89p
7410	13p	74121	28p
7413	31p	74122	28p
7432	25p	74141	63p
7441	62p	74145	58p
7442	55p	74174	83p
7445	71p	74177	100p
7447	79p	74196	134p

Other components

Zener diode 400mW 3-3V to 47V E12, 12p; Resistors, carbon film $\pm 5\%$ E12, 2p; Veroboard 0-1in and 0-15in, 2 $\frac{1}{2}$ in x 5in, 40p; Sub. min vertical preset, 10 0-1in board, 8p; Resistors WW 2-5W 0-22 to 10 ohm E24, 20p; Clock chip special MM5316, £5-50.

VAT: add high rate to * items, standard rate to all others. POST free on orders over £5 otherwise please add 30p.

54 Montagu Street, Kettering Northants. Tel. Kettering 83922

Shop open daily. PAYMENT: C.W.O. Access and Barclaycard for phone orders. GUARANTEE: All devices are brand new and full spec. Any faulty item returned unused within 7 days refunded or exchanged.

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 £16-75; 25V 2A + 25V 2A £7, 12V 4A + 12V 4A £7.

LT TRANSFORMERS TAPPED SEC. Prim 200/240V 0-10-12-14-16-18V 2A, £4; 4A, £5-25, 0-12-15-20-24-30V 2A, £4-50; 4A, £6-75, 0-5-20-30-40-60V 1A, £4-85; 2A, £6-75, 0-40-50-60-80-100-110V 1A, £7.

MIDGET RECTIFIER TRANSFORMERS

For FW rect. 200/240V a.c., 6-0-6V 1-5A or 9-0-9V 1A £1-80 each; 12-0-12V 1A, or 20-0-20V 0-75A, or 9-0-9V 0-3A, or 12-0-12V 0-25A, or 20-0-20V 0-15A, or 6V 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 $\frac{1}{2}$ in 8 or 75 Ω , 2 $\frac{1}{2}$ in 8 or 25 Ω , 3in 3, 8 or 35 Ω , 3 $\frac{1}{2}$ in 15 Ω , £1 each; 8 x 5in 3, 8 or 25 Ω , £1-75; Goodmans 6 $\frac{1}{2}$ in twin cone, hi-fi, 4 Ω , £2-50; 7 x 4in, 3-8, 15 or 25 Ω , £1-90.

"INSTANT" BULK TAPE/CASSETTE ERASER

Instant erasure any diameter tape spool or cassette, demagnetises tape heads. 200/240V a.c., £3-75.

SYNCHRONOUS GEARED MOTORS 200/240V a.c. Brand new Smiths, built in gearbox, 6 r.p.h., 75p each.

PAPER TUBULAR CONDENSERS

47mF, 160V, 30 x 20mm, 20p (100 for £10).

SPEAKER MATCHING AUTO TRANSFORMER

12 $\frac{1}{2}$ W, 3 to 8 or 15 Ω , up or down, £1-65.

G.E.C. MANUAL OF POWER AMPLIFIER COVERING VALVE AMPLIFIERS OF 30W TO 400W 35p.

CABLES — CABLES — CABLES

MICROPHONE TWIN H/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 35 way £1; 25 way 75p; 14 way 50p; 4 way 14p; 2 way 10p; 1 way 8p per metre.

LOW LOSS CO-AXIAL CABLE 75 Ω UHF, white, 12p per metre; VHF, white, 9p per metre.

FLEXIBLE PVC MINI 3-CORE CABLE, 19/0-10MM 100 metres £3. Ideal for speakers, intercoms, etc.

TWIN FIG. 8 CABLE Polarised; £2-50 100 metres.

ALL TYPES DOMESTIC AND COMMERCIAL CABLES. ALL SIZES AND COLOURS CONNECTING 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 9314

Mail Order Protection Scheme

The Publishers of *Practical Electronics* are members of the Periodical Publishers Association which has given an undertaking to the Director General of Fair Trading to refund monies sent by readers in response to mail order advertisements, placed by mail order traders, who fail to supply goods or refund monies owing to liquidation or bankruptcy. This arrangement does not apply to any failure to supply goods advertised in a catalogue or in a direct mail solicitation.

In the unhappy event of the failure of a mail order trader readers are advised to lodge a claim with *Practical Electronics* within three months of the date of the appearance of the advertisement, providing proof of payment. Claims lodged after this period will be considered at the Publisher's discretion. Since all refunds are made by the magazine voluntarily and at its own expense, this undertaking enables you to respond to our mail order advertisers with the fullest confidence.

For the purpose of this scheme, mail order advertising is defined as:

'Direct response advertisements, display or postal bargains where cash had to be sent in advance of goods being delivered'. Classified and catalogue mail order advertising is excluded.

SAXON ENTERTAINMENTS LTD

**NOW ALSO AT WALLINGFORD
WITH SALES & SERVICE 6 DAYS A WEEK**

(BETWEEN READING
and OXFORD)

**FLINT HOUSE HIGH ST
WALLINGFORD OXON OX10 0DE
Phone (0491) 35529**

A423
Henley

M4 to
London
& M40

A 329

Reading
M4 to Wales

FLINT
HOUSE

HIGH STREET

4413
Didcot

POWER AMPS AT LOWER* PRICES MODULE RANGE FROM 30 TO 120 W.R.M.S



SA1208 (120 w.r.m.s/8Ω/95V)	£19.50
SA1204* (120 w.r.m.s/4Ω/75V)	£13.50
SA608 (60 w.r.m.s/8Ω/65V)	£12.50
SA604* (60 w.r.m.s/4Ω/50V)	£10.50
SA308 (30 w.r.m.s/8Ω/50V)	£9.50

- Only 4 connections
- Distortion typically 0-4%
- Single supply rail
- Input—240 mV
- Size—6in x 3in x 1in
- Individually tested and guaranteed

Power Supplies for

1 x SA1208—PM1201/8	£11.60;	2 x SA1208—PM1202/8	£15.30;
1 x SA1204—PM1201/4	£11.60;	2 x SA1204—PM1202/4	£15.30;
1 or 2 x SA608—PM601/8	£10.50;	1 or 2 x SA308—PM301/8	£8.80

SAXON EQUIPMENT IS DESIGNED AND MADE IN OUR OWN CROYDON FACTORY

SYSTEM 7000 CONTROL UNIT



- Ready to plug in—no soldering at all
- Stainless steel front panel
- Inputs for 2 ceramic cartridges/tape/microphone
- Individual deck controls AND left/right fader
- Low noise (−80dB) 20Hz–50kHz ±1dB
- CONTROLS—Master, Monitor, Volume, Selector, X-fade, etc.

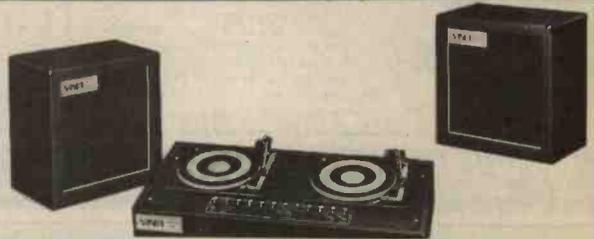
BUILT Mono	£34.50
Stereo	£49.50
MODULAR PCB with all electronics	
Mono	£18.50
Stereo	£27.50
Front panel	£3.50

SAXON CENTAUR 100W STEREO SOUND-LIGHT MOBILE DISCO

To-day's most challenging value—with sound-light converter, synchronous motor twin turntables, and features that give you professional levels of operation, it still costs under £200 (V.A.T. extra). With full-range heavy duty speakers which pack to make a single complete transportable unit. ABSOLUTELY COMPLETE INC. HEADPHONES, CONDENSER MIC. AND CONNECTING CABLES.

- 4-channel sound/light converter, variable speed
- X-fade and P.F.L.
- Tape and microphone inputs
- Strong wood cabinets, Vynide covered

£199.00
Delivered UK



MINOTAUR 100 100 WATT RMS TOTAL RANGE AMPLIFIER

Compatible with all Saxon System 7000 units, this is a superb amplifier readily adaptable to a wide range of applications.

- 100 w.r.m.s into 8Ω
- Two mixed inputs, wide range bass and treble controls.
- May be operated as a slave amplifier
- Extremely compact (27cm x 16cm x 10cm)



- Fully protected against all incorrect loads and short circuits
- Plug isolated terminals
- Silver anodised fascia

£47.50

SYSTEM 7000 LIGHTING CONTROL

- Full control of 3kW of lights (1kW/channel)
- Audio control plus sequence plus override
- Variable speed sequence
- Stainless steel two tone panel—matches mixer
- Operates from any amplifier
- Attractive Bondene case—free standing or panel mounting



Inc. case and plug—ready to use	£38.00
Superfect Module On P.C.B. panel mounting	£27.75
Soundlite 3kW Converter Use with any amplifier	£15.50

SYSTEM 7000 MODULAR MIXING

UP TO 20 CHANNELS MONO/STEREO/MIXED

- Inputs for all sources inc. mag. cartridge
- Wide range bass and treble controls
- ½W monitor power outlet
- Echo send/return facility
- Feeds most amplifiers
- With front panels, ready to use
- Individual monitor buttons

INPUT		MIXER	
Mono	£8.50	Mono	£8.50
Stereo	£12.00	Stereo	£12.00
PCB Modules only		PCB Modules only	
Mono	£5.50	Mono	£5.50
Stereo	£9.00	Stereo	£9.00



Power Supply
£7.50

SAXON STROBES & LIQUID WHEEL

- SUPERSTROBE**
- 1 flash/2 secs.—up to 20/sec.
- Compact black Bondene case
- Ideal for mobile disco or smaller club

- PRO-STROBE**
- Giant 80 watt tube
- Discharge energy up to 6 Joules
- External trigger—audio up to 240V

- 150 WATT LIQUID WHEEL PROJECTOR**
- Complete with wheel and 150 watt tungsten lamp
- Wide range of extra effects may be attached

Spare wheels £4.90

NOW ONLY
£17.50

NOW ONLY
£29.50

£29.20



Loudspeakers 12"/50W high grade chassis units: 14000 gauss: presence dome: £14.50

Cabinets Attractive range of speaker and other cabinets at our showrooms. Enquiries welcomed.

ACCESSORIES
Mics: Headphone: Special Lamps.

PRICES include carr. and packing. VAT must be added to all orders at 8%. C.O.D. 65p extra: S.A.E. all enquiries please.

Send or phone your ACCESS or BARCLAYCARD No. for prompt attention. After 5.0 p.m. leave your message on our answerphone.

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

SAXON ENTERTAINMENTS LTD.

327-333 WHITEHORSE ROAD, CROYDON, SURREY CR0 2HS

Telephone: 01-634 6385/0098

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

**TRADE ENQUIRIES
NORMAN ROSE
(ELECTRICAL) LTD**

London 01-837 9111; Birmingham 021-236 4710; Manchester 061-273 1498; Bradford, Yorks. 0274 26104

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

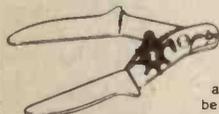


Dispensers of Ersin Multicore Solder make those small jobs easier. 21ft of 22 s.w.g. (6.4 metres of 0.71mm) solder, specially suitable for soldering fine wires, small components and for repairing printed circuits.

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.

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

Send S.A.E. for details

Clef Products
 31 Mountfield Road, Bramhall Stockport, Cheshire SK7 1LY

G8CZW DIGITAL FREQUENCY METER



COMPLETE 50MHz KIT £54 inc. VAT and Post

ZN 1040E Count/Display I.C.	8-90
Integrated Circuit Pack	9-25
Displays and Filter	7-28
Semiconductor and Diode Pack	2-38
Resistor and Capacitor Pack	2-98
Logic and Display P.C.B.'s	4-84
5 MHz Crystal	3-45
Transformer 8-0-8V (+ 60p P. & P.)	2-48
I.C. Sockets Pack	2-30
Switches, Knob, BNC Sockets, etc.	4-15
Hardware and Wire Pack	1-45
Case—Two-tone PVC-faced steel punched and lettered (+ 75p P. & P.)	5-75
Spare min. BNC Sockets (50 ohm)	0-65
Spare min. BNC Plugs (50 ohm)	0-70
Complete kit of parts for High Impedance Buffer (Includes PCB)	3-62
High Impedance Buffer P.C.B. only	0-80
Complete kit for VHF pre-scaler (includes PCB but less I.C.)	1-78
VHF Pre-scaler printed circuit board only	0-80
SP8631B 500MHz Pre-scaler I.C.	8-96

All prices inc. VAT at the standard rate. Please add 20p P. & P. for packs, S.A.E. for full lists.

abc ELECTRONICS (OLDHAM) LTD.

83 Lees Road, Oldham OL4 1JW
 Tel. 061-624 8812

ELECTRONI-KIT

Build, Dismantle and Rebuild Over 100 Different Projects and Design New Circuits too

Radio Receivers and Transmitters, Telephone Amplifiers, Time Buzzers, Battery Checkers, Computer Circuits, Amplifiers, Directional Transmitters, Metal Detectors, Continuity Testers, Electronics Birds, Guns, Metronomes, Sirens, Roulette, etc. All in one kit

"... educational kits of exceptional quality"
 (Audio mag.)

"... worthwhile ... good value for money"
 (Everyday Electronics mag.)

Educational manuals included with each kit. No previous experience required. Suitable for beginners and experts too.

100 project kit £19-60
 45 project kit £15-60
 25 project kit £12-10

(Add-on kits available too)
 Prices include manuals, batteries, VAT and P. & P.

Cheque/P.O. (or 11p for illustrated literature) to Dept. PE

Satisfaction guaranteed
ELECTRONI-KIT LTD. 408 St. John's Street, London, E.C.1. (01-278 4579)



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

FREE WELLER 25W (SP25) SOLDERING IRON (worth £3.24 inc. VAT) with all orders over £20 Limited period only. Send now.

HEAVY DUTY RELAYS, 24V d.c. operated (will work on 18V) 3 heavy duty make contacts (around 10A rating) 5 - 4 change over contacts + 1 break contact. New, complete with mounting bracket (ideal for switching HT or Linears.) Many uses for this high quality unit. £1-50 each.

Good Quality Pressure Gauges, 2 1/2in dia. flange mounting, 2 models avail. 0-60 lba/sq. in., 0-100 lba/sq. in., 0-200 lba/sq. in. state which £1-25 each.
2N3055 type Transistors, O.K., but unmarked, 5 for £1.

ALU-SDL ALUMINIUM SOLDER (made by Multi-core.) Solders aluminium to itself or copper, brass, steel, nickel or tinplate. 18 s.w.g. with multicore flux, with instructions. Approx. 1 metre coil 30p pack. Large reel (approx. 12 metres) £2-75.

MIXED COMPONENT PACKS, containing resistors, capacitors, switches, pots, etc. All new (random sample bag revealed approx. 700 items), £2 per pack, while stocks last.
TUNED COILS, 2 section coils, around 1MHz, with a black smart tuning knob, which moves an internal core to vary the inductance, many uses, easily rewound, 3 for 50p.

SMALL MAINS SUPPRESSORS (small chokes, ideal for kit, Hi-Fi inputs, etc.) approx. 1/2in x 1 1/2in x 3/4in.

PERSPECT TUNER PANELS (for FM Band 2 tuners) marked 88-108 MHz and Channels 9-70, clear numbers, rest blacked out, smart modern appearance, size approx. 5 1/2in x 1 1/2in, 2 for 35p.
Multiturn Pots, 10 turn, 1/2in spindle (ex-ship), following values available, 20kohm, 50kohm, 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, 2 for £3.
R/S Midget 3 pole 4 way, rotary switches, 40p each.

HIGH QUALITY SPEAKERS, 8 1/2in x 6in elliptical, only 2in deep, inverse magnet, 4ohms, rated up to 10W, £1-50 each, or 2 for £2-75 (qty. discount available + 12% VAT).

TV PLUGS AND SOCKETS
N-Type Plugs 50 ohms, 50p each, 3 for £1-50.
N-Type Sockets (4-hole chassis mounting, 50 ohms (a small coil lead type), 50p each.
PL259 Plugs (PTFE), brand new, packed with reducers, 85p or 5 for £2.
SO238 Sockets (PTFE), brand new (4-hole fixing type), 50p each or 5 for £2-25.
25-way ISEP Plugs and Sockets, 40p set (1 plug + 1 socket) 80p, + 12% VAT.

PLUGS AND SOCKETS
N-Type Plugs 50 ohms, 50p each, 3 for £1-50.
N-Type Sockets (4-hole chassis mounting, 50 ohms (a small coil lead type), 50p each.
PL259 Plugs (PTFE), brand new, packed with reducers, 85p or 5 for £2.

SO238 Sockets (PTFE), brand new (4-hole fixing type), 50p each or 5 for £2-25.
25-way ISEP Plugs and Sockets, 40p set (1 plug + 1 socket) 80p, + 12% VAT.
Plugs and sockets sold separately at 25p each.
Buign Round Free Skts, 3 pin, for mains input test equipment, etc., 25p 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).
Pots of 26A Nuts (the self-locking ones with the nylon insert) 100 for 50p.

We now stock Spiratex Tools for the electronic enthusiast. Screwdrivers, Nut Spanners, SA and Metric sizes, pop rivet guns, etc. S.A.E. for list.

I.F. Cans, 9in square, suitable to rewind, 5 for 80p, + 12% VAT.
Miniature earphones with min. jack plug, 2 for 50p + 12% VAT.

TWIN I.F. CANS, approx. 1in x 1/2in x 1 1/2in high, around 3-5 MHz, 2 separate transformers in 1 can, internally screened, 5 for 50p + 12% VAT.

Dublier Electronics, 50uF, 450V, 2 for 50p.
Dublier Electronics, 100uF, 275V, 2 for 50p.
Plessey Electronics, 470uF, 63V, 3 for 50p.
TCC Electronics, 1000uF, 30V, 3 for 60p.
Plessey Electronics, 1000uF, 180V, 40p each (3 for £1).
Dublier Electronics, 5000uF, 35V, 50p each.
Dublier Electronics, 5000uF, 50V, 50p each.

PLEASE ADD 8% VAT UNLESS OTHERWISE STATED

Dublier Electronics, 5000uF, 70V, 85p each.
ITT Electrolytics, 6800uF, 25V, high grade, screw terminals, with mounting clips, 50p each.
Plessey Electronics, 10,000uF at 53V, 75p each.
Plessey Cathoray Capacitors 0-0-4uF at 12 1/2kV DC, Screw terminals, £1-50 each.
PLEASE ADD 12% VAT TO ALL CAPACITORS

A LARGE RANGE OF CAPACITORS AVAILABLE AT BARGAIN PRICES, S.A.E. FOR LIST.

SPECIAL OFFER!
MAINS TRANSFORMER, Type 14/4, 14V at 4A, £2-50

TO3 transistor insulator sets, 10 for 50p.

MINIATURE 2 PIN PLUGS AND SOCKETS (fit into 1/2in 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.
HEAVY DUTY HEATSHINK BLOCKS, unfinned, base area 2 1/2in x 2in, with 6 fins, total height 2 1/2in 50p each.
RUBBER MAGNETS 1/2in square, with mounting hole, 20 for 30p.

SERVO 7 SEGMENT P.Q.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 in one mount) £1-50. (Sorry, no single digit available.) Data Supplied.

BSX20 (VHF Osc/Mult), 3 for 50p.
BC108 (metal can), 4 for 50p.
PBC 100 (plastic BC108), 5 for 50p.
OC20 Transistors, 5 for 50p.
BFY51 Transistors, 4 for 60p.
BCY72 Transistors, 4 for 60p.
PNP audio type TO5 Transistors, 12 for 25p.
SP12C diode (single), 5 for 50p.
BA121 Varicap Diodes, 4 for 50p.
1N914 diodes, 10 for 25p.

1 1/2in polythene chassis mounting fuseholders, 6 for 30p.
Mullard Tubular ceramic trimmers, 1-18pF, 6 for 50p.
16C, some coded, 14 DIL type, untested, mixed, 20 for 25p.

DIECAST BOXES (approx size in inches)	
4.3 x 2.3 x 1.2	85p
4.8 x 2.3 x 1.5	95p
4.8 x 3.8 x 1	£1-00
4.8 x 3.8 x 2	£1-25
6.8 x 4.8 x 2	£1-75
4.8 x 3.8 x 3	£1-85
6.8 x 4.8 x 4	£2-75
6.8 x 5.8 x 2	£2-25
10.6 x 6.8 x 2	£2-85

PLEASE ADD 8% VAT

WELLER SOLDERING IRONS
EXPERT, 30W with fingertip illuminates work. Pistol grip with anti-spit trigger. High efficiency copper soldering tip.
EXPERT SOLDER GUN, 18-80 + VAT (54p)
EXPERT SOLDER GUN KIT (spare bits case, etc.), £9-80 + VAT (78p).
SPARE BITS, PAIR, 25p + VAT (2p)
MARKSMAN SOLDERING IRONS
SP150 15W £3 + VAT (24p)
SP250 25W £3 + VAT (24p)
SP25DK 25W + bis, etc. kit £3-85 + VAT (31p)
SP400 40W £3-44 + VAT (28p)
BENCH STAND with spring for Marksmans Irons, £2-22 + VAT (18p)
SPARE BITS
M79 for 15W, 46p + VAT (4p).
M74 for 25W, 38p + VAT (3p).
M710 for 40W, 42p + VAT (3p).
TCPI TEMPERATURE CONTROLLED IRON, Temperature controlled iron + PSU, £20 + VAT (£1-60).

SPARE BITS
Type CC single flat. Type K double flat fine tip. Type P, very fine tip. £1 each + VAT (8p).
ALL SPARES AVAILABLE

MULTICORE SOLDER
Size 5 Savbit 18 s.w.g. in alloy dispenser, 32p + VAT (3p).
Size 6 Savbit 18 s.w.g. in alloy dispenser, 32p + VAT (3p).
Size 12 SAVBIT 18 s.w.g. on plastic reel £1-80 + VAT (15p).

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. CALLERS SATURDAYS ONLY 9.30-12.00, 1.30-5.00.

FND500 Jumbo 0-5" C.C. Red LED display now only £1-02

ADVANCED CLOCK KIT

(P.E. Mains Clock Feb./Mar. 76)

Complete kit including attractive slim case for 6 digit alarm clock with beep alarm, snooze, high brightness driving of Jumbo LED displays, automatic intensity control—with optional add-ons of touch snooze control and crystal control/battery back-up. £28-80

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 including case, PCB's and all components. Full instructions. £39-50

Easy to Build E.E. DIGITAL CLOCK (Jan. issue). Kit of all components, including case etc., for this attractive clock with 12mm green display. Full instructions. £15-70

50 Hz Xtal Timebase Kit for clocks (inv. cancelled kit above). £8-28

CMOS ICs	CD4029	0-99	CD4059	4-77	CD4510	1-18	Displays
RCA MOT ONLY	CD4030	0-48	CD4060	0-97	CD4511	1-36	5LT-01 5-80
	CD4031	1-92	CD4061	18-92	CD4514	2-72	DL704E 0-75
	CD4032	0-92	CD4062	7-77	CD4515	2-72	FND500 1-02
	CD4033	1-21	CD4063	0-95	CD4516	1-18	TL321 1-30
	CD4034	1-65	CD4066	0-61	CD4518	1-08	TL322 1-20
	CD4035	1-02	CD4067	3-12	CD4520	1-08	XAN652 1-75
	CD4036	2-23	CD4068	0-20	CD4527	1-37	XAN654 1-75
	CD4037	0-83	CD4069	0-20	CD4532	1-25	MAN3M 0-48
	CD4038	0-83	CD4070	0-48	CD4555	0-78	
	CD4039	2-23	CD4071	0-20	CD4556	0-78	
	CD4040	0-92	CD4072	0-20	MC14528	1-01	
	CD4041	0-73	CD4073	0-20	MC14534	0-84	
	CD4042	0-73	CD4075	0-20	MC14553	4-07	
	CD4043	0-87	CD4076	1-34	MC14568	1-21	
	CD4044	0-81	CD4077	0-48	MCM14552		
	CD4045	1-22	CD4078	0-20		8-05	
	CD4046	1-16	CD4081	0-20			
	CD4047	0-78	CD4082	0-20			
	CD4048	0-48	CD4085	0-62			
	CD4049	0-48	CD4086	0-62			
	CD4050	0-48	CD4089	1-34			
	CD4051	0-81	CD4093	0-69			
	CD4052	0-81	CD4094	1-82			
	CD4053	0-81	CD4096	0-91			
	CD4054	1-01	CD4098	0-91			
	CD4055	1-14	CD4097	3-12			
	CD4056	1-14	CD4099	1-59			
	CD4057	21-58	CD4502	1-07			

ADD VAT at 8% (Higher rate does not apply to any of above). 25p P & P on all orders. Despatch by 1st Class Post.
Price list and data sent FREE with an order, or on request (an SAE helps). Official orders welcomed (written or phoned)—Univs, Polys, Govt. Cos, etc. Export orders: No VAT, add 50p (Europe) £1 (overseas) for Airmail P & P. (No Export outside Europe for databooks and transformers).

SINTEL, 53b Aston Street, Oxford. Tel. 0365 49791

CRESCENT RADIO LTD.

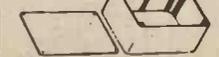
164-166 HIGH ROAD, WOOD GREEN, N22 (also) 13 SOUTH MALL, EDMONTON, N9

MAIL ORDER DEPT.
1 ST. MICHAELS TERRACE, WOOD GREEN, LONDON N22 4JL
Phone: 888-4474

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 260V 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 160 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)

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 51mm x 28mm.
OUR PRICE 40p. + 8%.



U.K. CARRIAGE 50p UNLESS OTHERWISE STATED
VAT—All prices are excluding VAT. Please add to each item the VAT rate indicated.

"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: 76mm. Our price £11-20. + 8%.

GOODMANS CROSSOVER
Bargain price Crossovers manufactured by Goodmans for the "Ravant" loudspeaker system. IMP - 8 OHM. £1 each + 12% VAT.

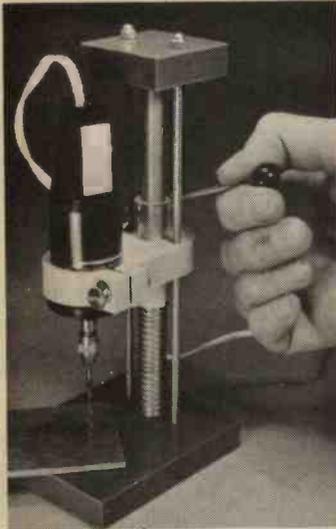
Low Voltage Stereo Amplifier
8 transistor stereo amplifier with volume, bass, balance and tone controls. Approx. 3W into 8 ohm per channel. Needs a 9/12V d.c. supply and is complete on a 2 1/2in x 7 1/2in P/C board. Ideal for domestic record players, etc.

A BARGAIN AT £5 + 12% VAT

PRECISION PETITE LTD.

Dept. P.E.
119A HIGH STREET,
TEDDINGTON TW11 8HG
Tel. 01-977 0878

**INTRODUCING A
MINIATURE
PRECISION 12V. D.C.
DRILL DESIGNED FOR
THE ELECTRONIC
ENGINEER**

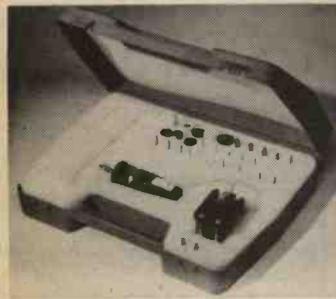


Mk. II Drill only

£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**

Greenbank Electronics (Established 1970)

DIGITAL CLOCK MODULES, KITS
Further details free on request.

DL-750E 0-6in
DL-747E 0-6in

£1-50
£1-50

AY-5-1202

£4-76

"E" LEO DISPLAYS

DL-704E 0-3in
DL-707E 0-3in
DL-728E 2 x 0-5in
DL-727E 2 x 0-5in

70p
70p
£1-80
£1-80

PHOSPHOR DISPLAYS

5LTU1 4 x 0-5in

£5-80

CLOCK CHIPS

AY-5-1224A
MK 50253

£3-50
£5-50

OP-AMPS
CA 3130 (COS/MOS)
741 Minidip.

75p
25p

IC SOCKET PINS

100
1000

50p
£4-00

CMOS WITH DISCOUNTS! (Any mix: disc. 10% 25 + .25% 100 +)

CA 3130	0-75	4030/14507	0-45	4059/—	3-60	4099/—	1-50	14530/—	0-65
4000/14000	0-15	4031/—	1-80	4060/—	0-90	—	—	14531/—	1-25
4001/14001	0-15	4032/14032	0-85	4061/—	16-40	—	—	14532/4532	1-80
4002/14002	0-15	4033/—	1-10	4062/—	7-30	4700/—	1-50	14534/—	6-00
4006/14006	0-95	4034/14034	1-55	4063/—	0-90	7083/—	4-25	14536/—	2-85
4007/14007	0-15	4035/14035	0-95	4066/14066	0-55	—	—	14537/—	15-25
4008/14008	0-75	4036/—	1-80	4067/—	2-95	—	—	14539/—	1-05
4009/14009	0-45	4037/—	0-75	4068/14068	0-15	14501/—	0-15	14541/—	1-80
4010/14010	0-45	4038/14038	0-85	4069/14069	0-15	14502/4502	1-00	14543/—	1-50
4011/14011	0-15	4039/—	2-85	4070/14070	0-45	14505/—	3-30	14549/—	2-95
4012/14012	0-15	4040/14040	0-85	4071/14071	0-15	14506/—	0-35	14552/—	8-05
4013/14013	0-45	4041/—	0-65	4072/14072	0-15	14508/4508	2-35	14553/—	3-50
4014/14014	0-80	4042/14042	0-65	4073/14073	0-15	14510/4510	1-10	14554/—	1-20
4015/14015	0-80	4043/14043	0-80	4075/14075	0-15	14511/4511	1-25	14555/4555	0-70
4016/14016	0-45	4044/14044	0-75	4076/14076	1-25	14512/—	1-05	14556/4556	0-70
4017/14017	0-80	4045/—	1-15	4077/14077	0-45	14514/4514	2-55	14557/—	3-20
4018/—	0-80	4046/14046	1-10	4078/14078	0-15	14515/4515	2-55	14558/—	0-60
4019/14519	0-45	4047/—	0-70	4081/14081	0-15	14516/4516	1-10	14559/—	2-85
4020/14020	0-90	4048/—	0-45	4082/14082	0-15	14517/—	5-40	14560/—	1-55
4021/14021	0-80	4049/14049	0-45	4085/—	0-55	14518/4518	1-00	14561/—	0-45
4022/14022	0-75	4050/14050	0-45	4086/—	0-55	14520/4520	1-00	14562/—	5-25
4023/14023	0-15	4051/14051	0-75	4089/—	0-65	14521/—	2-00	14566/—	1-35
4024/14024	0-60	4052/14052	0-75	4093/14093	0-65	14522/—	1-75	14572/—	0-35
4025/14025	0-15	4053/14053	0-75	4094/—	1-50	14524/—	N/S	14580/40108	6-00
4026/—	1-40	4054/—	0-95	4095/—	0-85	14526/—	1-50	14581/40181	3-05
4027/14027	0-45	4055/—	1-05	4096/—	0-85	14527/4527	1-20	14582/40182	1-15
4028/14028	0-70	4056/—	1-05	4097/—	2-95	14528/4098	0-85	14583/—	0-71
4029/—	0-90	4057/—	20-35	4098/14528	0-85	14529/—	1-30	14585/—	1-45

Terms: C.W.O. Add VAT to all prices at 8%. Post etc.. U.K. 10p per order. Orders processed same day. Official govt., varsity, poly. etc. orders welcomed.

GREENBANK ELECTRONICS (Dept E7P)

94 New Chester Road, New Ferry, Wirral, Merseyside, L62 5AG, England. Tel: 051-645 3391

4-STATION INTERCOM



£16.95
+ VAT £1.36

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 6ft and other accessories. P. & P. 85p.

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 £28-24 per pair. P. & P. 85p.

NEW! AMERICAN TYPE CRADLE TELEPHONE AMPLIFIER

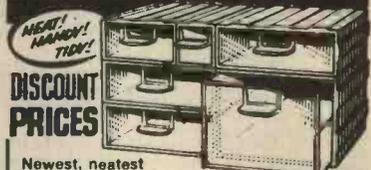


ONLY
£12.95
+ VAT £1.04

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 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 model at £13-95 + VAT £1-12 P. & P. 75p. 10-day price refund guarantee.

WEST LONDON DIRECT SUPPLIES (PE7)
189 KENSINGTON HIGH STREET, LONDON, W.8

INTERLOCKING PLASTIC STORAGE DRAWERS



NEARLY
WARRANTY
THICK!
DISCOUNT
PRICES

Newest, neatest system ever devised for storing small parts and components: resistors, capacitors, diodes, transistors, etc. Rigid plastic units interlock together in vertical and horizontal combinations. Transparent plastic drawers have label slots. 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 Depts.

SINGLE UNITS (1D) (5in x 2½in x 2½in).
£2-40 DOZEN.

DOUBLE UNITS (2D) (5in x 4½in x 2½in).
£4-20 DOZEN.

TREBLE (3D) £4-20 for 8.

DOUBLE TREBLE 2 drawers, in one outer case (8D), £5-90 for 8.

EXTRA LARGE SIZE (8D1) £5-40 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. PE7)
24 Cricklewood Broadway, London NW2
Tel. 01-450 4844

SEMICONDUCTORS

from

LYNX ELECTRONICS (LONDON) LTD.

THYRISTORS PIV	1A		3A		4A		6A		8A		10A		15A	
	(TO92)	(TO5)	(C106)	(TO220)										
50	0.20*	0.25	0.35	0.32	0.41	0.42	0.47	0.96						
100	0.25*	0.25	0.40	0.37	0.47	0.48	0.54	1.02						
200	0.27*	0.35	0.45	0.40	0.58	0.60	0.68	1.14						
400	0.30*	0.40	0.50	0.45	0.87	0.88	0.98	1.40						
600	—	0.65	0.70	—	1.09	1.19	1.26	1.80						

TRIACS (PLASTIC TO—220 PKGE ISOLATED TAB)													
4A		6.5A		8.5A		10A		15A		20A		30A	
(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
100V	0.60	0.60	0.70	0.70	0.78	0.78	0.83	0.83	1.01	1.01			
200V	0.64	0.64	0.75	0.75	0.87	0.87	0.87	0.87	1.17	1.17			
400V	0.77	0.78	0.80	0.83	0.97	1.01	1.13	1.19	1.70	1.74			
600V	0.96	0.99	0.87	1.01	1.21	1.26	1.42	1.50	2.11	2.17			

N.B. Triacs without internal trigger diode are priced under column (a). Triacs with internal trigger diode are priced under column (b). When ordering please indicate clearly the type required.

OPTOELECTRONICS	
Displays	Discretes
704	0.80
707	0.80
727	1.20
728	1.20
747	1.50
750	1.50

NATIONAL CLOCK CHIPS	
MM5314	£3.75
(Basic clock chip giving 6 digit display)	
MM5316	£5.25
(Sophisticated device including alarm)	

Special Offer
MV54
Red 125
8p
Axial lead

74 Series TTL	
Less 5% for 10+	
Less 10% for 25+	

LINEAR ICs	
301A	8 Pin Dill 0.35*
307	8 Pin Dill 0.55*
308	14 Pin Dill 0.90*
381	14 Pin Dill 1.60*
709	8/14 Pin Dill 0.35
741	8/14 Pin Dill 0.28
748	8 Pin Dill 0.35
749	14 Pin Dill 0.70*



REGULATORS	
723	0.45
1 amp Plastic	
7805	0.90*
7812	1.60*
7815	1.60*
7818	1.60*
LM340-5	1.50*
LM340-12	2.00*
LM340-15	2.00*
LM340-18	2.00*

SPECIAL OFFER	
LM309K	9p
IA TO 3V	

IC SOCKETS	
8 Pin	0.12
14 Pin	0.13
16 Pin	0.14
24 Pin	0.45
40 Pin	0.80

TO3 HARDWARE	
INC	
1 Mica - 2 washers	
Solder TA6	
2 Nuts/Bolts	
Washers	
100 for 45p	

TO3 HARDWARE	
7440	0.14
7401	0.14
7402	0.14
7403	0.14
7404	0.16
7408	0.16
7409	0.16
7410	0.16
7413	0.29
7417	0.27
7420	0.16
7427	0.27
7430	0.16
7432	0.27
7437	0.27
7441	0.75
7445	0.85
7447	0.81
7448	0.75
7447A	0.95
7470	0.30
7472	0.25
7473	0.30
7474	0.32
7475	0.47
7476	0.32
7482	0.75
7485	1.30
7486	0.32
7489	2.92
7490	0.49
7491	0.65
7492	0.57
7493	0.45
7495	0.67
74100	1.08
74107	0.35
74121	0.34
74122	0.47
74141	0.78
74145	0.68
74154	1.62
74174	1.00
74180	1.06
74181	3.20
74192	1.35
74193	1.35
74196	1.64

TO3 HARDWARE	
LM309K	9p
IA TO 3V	

P. & P. 20p per order - Overseas 80p - Matching 20p per pr.
 VAT 8% except for items * which are 12% - No VAT on overseas.

LYNX ELECTRONICS (LONDON) LTD.
 Higham Mead Chesham Bucks. Telephone (02405) 75151 Telex 837571

TRANSISTORS, DIODES, RECTIFIERS

AC126	0.15	BD181	0.86	OA90	0.08
AC127	0.16	BD182	0.92	OA91	0.08
AC128	0.13	BD183	0.97	OC41	0.15
AC128K	0.25	BD232	0.60*	OC42	0.15
AC141	0.18	BD233	0.48*	OC44	0.12
AC141K	0.28	BD237	0.55*	OC45	0.10
AC142	0.18	BD238	0.60*	OC70	0.10
AC142K	0.28	BD184	1.20	OC71	0.10
AD176	0.16	BDY20	0.80	OC72	0.22
AC176K	0.25	BDY38	0.60	OC84	0.14
AC187	0.18	BDY60	0.60	SC40A	0.75
AC187K	0.25	BDY61	0.65	SC40B	0.81
AC188	0.18	BDY62	0.55	SC40D	0.98
AC188K	0.25	BF178	0.28	SC40F	0.65
AD140	0.50	BF179	0.10	SC41A	0.65
AD142	0.50	BF194	0.10*	SC41B	0.70
AD143	0.46	BF195	0.10*	SC41D	0.85
AD149	0.45	BF196	0.12*	SC41F	0.60
AD161	0.35	BF197	0.12*	ST2	0.20
AD162	0.35	BF247	0.18*	TIP29A	0.44
AL102	0.95	BF244	0.17*	TIP31A	0.54
AL103	0.95	BF257	0.30*	TIP32A	0.64
AF114	0.20	BF258	0.35	TIP34	1.05
AF115	0.20	BF237	0.32	TIP41A	0.68
AF116	0.20	BFW60	0.17*	TIP42A	0.72
AF117	0.20	BFX29	0.26	IN2069	0.14
AF118	0.50	BFX30	0.30	IN2070	0.16
AF139	0.33	BFX34	0.23	IN2071	0.16
BF107	0.09	BFY35	0.25	IN4001	0.84
BF107B	0.09	BFY30	0.20	IN4002	0.06*
BF108	0.09	BFY51	0.18	IN4004	0.07*
BF109	0.09	BFY52	0.19	IN4005	0.08*
BF109C	0.12	BFY64	0.35	IN4006	0.09*
BF117	0.19*	BFY90	0.65	IN4007	0.10*
BF125	0.18*	BR100	0.20	2N696	0.14
BF126	0.20*	BFY39	0.40	2N697	0.12
BF141	0.28	BSX19	0.16	2N706	0.10
BF142	0.23	BSX20	0.18	2N929	0.14
BF143	0.23	BSX21	0.20	2N930	0.14
BF144	0.20	BSY95A	0.12	2N1131	0.15
BF147	0.09*	BT100	1.00	2N1132	0.16
BF148	0.09*	BT107	1.60	2N1304	0.20
BF149	0.09*	BT108	1.60	2N1305	0.20
BF152	0.25*	BT109	1.00	2N1711	0.18
BF153	0.25*	BT114	1.00	2N1202	0.44
BF157	0.09*	BU105	1.80*	2N2369	0.14
BF158	0.09*	BU105.021.90*	1.80*	2N2369A	0.14
BF159	0.09*	BU126	1.60*	2N2484	0.16
BF160	0.32	BU204	1.80*	2N2666	0.50
BF161	0.38	BU206	2.60*	2N2905	0.18
BF168B	0.09*	BY206	0.20	2N2905A	0.22
BF182	0.11*	BY207	0.20*	2N2926	0.10*
BF182L	0.11*	BYX36	—	2N2926.09*	—
BF183	0.10*	—	300	2N2926.09*	—
BF183L	0.10*	—	600	2N2926.010*	—
BF184	0.11*	—	900	2N3053	0.15
BF184L	0.11*	—	1200	2N3054	0.40
BF207B	0.12*	BYX38	—	2N3055	0.50
BF212	0.11*	—	300	2N3440	0.56
BF212L	0.11*	—	600	2N3442	1.20
BF213	0.12*	—	900	2N3525	0.50
BF213L	0.12*	—	1200	2N3570	0.80
BF214	0.14*	BZX61 Series	—	2N3702	0.10*
BF214L	0.14*	Zeners	0.20	2N3703	0.10*
BF237	0.16*	BZX83 or	—	2N3704	0.10*
BF238	0.16*	BZX88	—	2N3705	0.10*
BF300	0.34	Series	—	2N3706	0.10*
BF301	0.32	Zeners	0.11	2N3707	0.10*
BF323	0.60	—	0.40	2N3714	0.84
BF327	0.18*	—	0.65	2N3715	1.15
BF328	0.16*	C106D	0.50	2N3716	1.25
BF337	0.17*	C106F	0.35	2N3771	1.60
BF338	0.17*	CRS1.05	0.25	2N3772	1.60
BCY30	0.55	CRS1.10	0.25	2N3773	2.10
BCY31	0.55	CRS1.20	0.35	2N3819	0.28*
BCY32	0.60	CRS1.40	0.40	2N3904	0.16*
BCY33	0.55	CRS1.60	0.65	2N3906	0.11*
BCY34	0.55	CRS1.80	0.80	2N4124	0.14
BCY38	0.50	CRS1.10.45	—	2N4290	0.12*
BCY39	1.15	CRS1.20.50	—	2N4348	1.20
BCY70	0.12	CRS3.40.60	—	2N4870	0.35*
BCY71	0.18	CRS3.60.85	—	2N4871	0.50*
BCY72	0.12	MJ480	0.80	2N4919	0.70*
BD115	0.55	MJ481	1.05	2N4920	0.20*
BD131	0.36	MJ490	1.15	2N4922	0.58*
BD132	0.40	MJ491	1.15	2N4923	0.64*
BD135	0.36	MJE140	0.40*	2N5060	0.30*
BD136	0.39	MJE371	0.60	2N5061	0.25*
BD137	0.40	MJE520	0.45	2N5062	0.27*
BD138	0.48	MJE521	0.55	2N5064	0.30*
BD139	0.08	OAS	0.50	2N5496	0.65

GIRO NO 331 7056 Access and Barclay-card accepted
 C.W.O. only Terms of business as in our Catalogue
 Export Order enquiries welcome (65 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 DAVS
 CLOSED WEDNESDAY

1976 ISSUE 66 PAGES—3,000 ITEMS
 FULLY ILLUSTRATED
 20p CREDIT VOUCHERS
 *ALL NEW STOCK
 *SATISFACTION GUARANTEED
 *DISCOUNTS

20p plus postage
 ELECTRONIC COMPONENTS Catalogue 5
 BOXES LTD.

Boxes - Cases - Kits - PC Materials - Tools - Resistors - Test Meters - Capacitors - Hardware - Semiconductors - Books - Pots - Coils - Audio Accessories - Schemes - Connectors - Audio - Modules - Veroboard - Transformers - Knobs - Calculators - Audio Leads - Batteries - 5 dec Storage Units - Testkits, etc., etc.

SPECIAL CAPACITOR KITS
 C280 Kit—PC Mounting polyester 250V 5 of each value: 0.01, 0.022, 0.047, 0.1, 0.22uF, 2 of 0.47uF, 1uF, £1.81 net.
 C296 Kit—Tubular polyester, 400V, 5 of each value: 0.01, 0.022, 0.047, 0.1, 0.22uF, 2 of 0.47uF, £2.43 net.
 Ceramic kit—square plaques, 50V 5 of each value: 22, 33, 47, 100, 220,

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 GMG Classified Advertisement Manager, Room 2337, "Practical Electronics" IPC MAGAZINES LTD., Room 2337, King's Reach Tower, Stamford Street, London SE1 9LS. Tel. 01-261 5918

RECEIVERS AND COMPONENTS

A-MP 14 PIN DIL IC HOLDERS with non-ferrous clip, 11p each; 10 for £1. Belling Lee Instrument Pointer Knob, 8p; 10 for 20p. Diamond H. 20A, 250V, D.P.S.T. Toggle Switch, 65p each; 4550 for 10. BZZX79 51 volt 400mW, 8p each; 10 for 60p. 1Z15 15 volt 1 watt, 10p each; 10 for 90p. IN194 50 for £1. Motorola 2N3055, 50p each, 10 for £4.50. Texas Zener Diodes 6v, 7v, 8v, 9v, 10v, 11v, 12v, 13v, 15v, 16v, 18v, 20v, 22v, 39v, all 10w, 20p each. Bush set for T.L.P. transistors, 10 for 20p; 100 for £1.75. Sude Sw. S.P.C.C., 15p each; £1.20 for 10. Minimum post 20p. All prices include VAT. All components full spec. **FIELD ELECTRIC LTD.**, 3 Shenley Road, Boreham Wood, Herts. 01-953 6008

VALVES, RADIO, TV, TRANSMITTING, INDUSTRIAL. 1930 to 1975. 2,200 types in stock, many obsolete. List 20p. Quotation S.A.E. 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.

LED panel clip 1p	S	0-125	0-2	INFRA RED
	RED	15p	19p	550µW
	G/Y	27p	33p	Axial lead 40p 1.5mW £1.55
	OR	27p	33p	6mW £1.55
				ORP12 55p

OPTO-ISOLATORS		SCR's		50V		100V		400V	
IL74	1.5KV. 150mhz	TC15A	25p	27p	45p				
4350	2.5KV. 5MHz	TC66.3A	27p	35p	50p				
Data files with all OPTO		TRIAC		TOS		2A		50p	

AC125/6/7/8	15p	2N2926(G)	12p	VOLTAGE REGS
AD161/162	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 £1.50
BC109C	12p	2N3903/4/5/6	16p	723 DIP14 50p
BC147/8/9	10p	2N2646	35p	BRIDGE RECTS.
BC157/8/9	11p	MPF102	40p	2A 50V 30p
BC167/8/9	11p	2N3819	25p	2A 100V 36p
BC169C	12p	2N3823	30p	2A 200V 41p
BC177/8/9	17p			2A 400V 46p
BC182/3/4/1	17p	BR100 Diac	21p	
BC186/7	30p	IN514	3p	ZENERS BZ85P
BC212/3/4/1	12p	IN4001	5p	7.7-33V 9p
BCY70/71/72	13p	IN4004/5	7p	NE555V 60p
BF194/5	12p	IN4006/7	8p	NE555E £1.10
BF196/7	14p	IN4008/7	8p	LM380 £1.00
BFY50/51	16p	IN4148	4p	ZN414 £1.10
BFX29	30p	OA47	6p	7400 16p
BFX84	24p	OA70 OA79	9p	
BSX19/20	16p	OA81 OA90	9p	D.I.L. SOCKETS
OC71	10p	OA91 OA95	6p	8-pin 12p
2N706	10p	OA200	6p	14-pin 13p
2N1711	20p	OA202	7p	16-pin 14p
2N2219	20p	OP. AMPS		
2N2904/5/6/7	16p	709 all	25p	Mica + bushes
2N2904/5/6A	18p	741 8-pin	29p	TO3 TO66 5p
2N2926(R)	7p	748 D.I.L.	36p	Daio 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.

BRAND NEW COMPONENTS BY RETURN
Electrolytic Capacitors 16V, 25V, 50V — 0-47, 1-0, 2-2, 4-7 and 10mF 5p; 22, 47 54p (50V 8p); 100 7p (50V 8p); 220 8p (60V 10p); 500 11p (50V 16p); 1,000 (16V) 15p, 1,000 (25V) 18p, 1,000 (50V) 22p.
Subminiature Tantalum Bead Electrolytics — 0.1, 0.22, 0-47, 1-0, 2-2 at 35V, 4-7/25V 11p; 10/25V, 22/16V, 47/6V and 100/3V 12p.
Mullard Min. Ceramic E12 Series 63V 2% — 10-47pF 3p; 56-330pF 4p. Ceramic plate 50V E12 series 22-1,000pF and E6 series 1,500-47,000pF 2p.
Polystyrene E12 Series 63V Horizontal Mounting — 10-1,000pF 3p; 1,200-10,000pF 4p.
Mullard Polyester 250V Vertical Mounting E6 Series — 0-01-0.1 4p; 0-15, 0-22 6p; 0-33, 0-47 8p; 0-68 11p; 1-0 13p; 1-5 20p; 2-2 22p.
Mylar (Polyester) Film 100V Vertical Mounting — 0-001, 0-002, 0-005 3p; 0-01, 0-02 31p; 0-04, 0-05 4p.
Miniature Resistors Elctstab. E12 Series 5% — Carbon Film 1W 1Ω-10MΩ 10% 1M up 1p; Metal Film 1W 10Ω-2MΩ 1-5p; Metal Film 1W 10Ω-2MΩ 1-5p; Metal Film 1W 27Ω-10MΩ 1-75p.
1N4148 3p; 1N4002 5p; 1N4006 7p; 1N4007 8p; BC107/8/9, 147/8/9, 157/8/9, BF194/7 9p.
Fuses 20mm glass, 1 1/2in glass, 1in ceramic 2p.
Post 10p (free over £4). Prices inclusive of VAT.
THE C.R. SUPPLY CO.
127 Chesterfield Road, Sheffield S8 0RN

Precision Polycarbonate Capacitors

All High Stability — extremely Low Leakage		83V D.C. RANGE	
440 V A.C. RANGE	Price	Value (µF)	Price
µF	Diagonals (mm) each	Diagonals (mm) each	Diagonals (mm) each
L	D	L	D
0-1	27 12-7 68p	0-01-0-2	£1-28 75p 50p
0-10	27 12-7 80p	0-22-0-47	£1-32 77p 51p
0-22	33 16 86p	1-0	£1-56 81p 60p
0-25	33 16 82p	1-5	£1-74 £1-18 87p
0-33	33 16 98p	2-2	£1-98 £1-32 75p
0-47	33 19 £1-10	3-3	£2-40 £1-60 99p
0-5	33 19 £1-16	4-7	£2-82 £1-88 £1-28
0-68	50-8 19 £1-25	6-8	£3-48 £2-32 £1-47
1-0	50-8 19 £1-37	10	£4-88 £3-32 £2-01
1-5	60-8 25-4 £1-04	15	£7-14 £4-78 £2-88
2-0	60-8 25-4 £1-26	22	£9-68 £6-44 £3-99

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 16 for £1.00, 1N4148 5p, 6 for 27p, 12 for 48p; 1N4001 5p; 0.02 6p; 0.03 8p; 0.04 7p; 0.05 7p; 0.08 8p; 0.07 8p. **LOW PRICE ZENERS**—400mW, Tol. ± 5% at 5mA. 3V; 3V3; 3V6; 4V; 5V; 5V6; 6V; 6V8; 7V; 8V; 8V2; 9V; 10V; 11V; 12V; 13V; 13-5V; 15V; 16V; 18V; 20V; 22V; 24V; 27V; 30V; 33V. All at 7p each, 6 for 38p, 10 for 65p, 50 for £3.12. **SPECIAL OFFER:** 100 Zeners (may be mixed) for £6.00.

TRANSISTORS & I.C.'s
BC107/8/9 9p *BC212/212L 12p 2N3055 50p
*BC114 12p *BC213/213L 12p OC112 20p
*BC147/8/9 10p *BC214/414L 11p *NE555 Timer 80p
*BC163 16p *BF194/5 12p *741C 8pin DIL
*BC164/7/8/9 16p BFY50/1/2 20p 38p
*BC189/182L 11p AF178 40p ZN414 £1-15
*BC183/183L 11p AF234 38p SN76013ND
*BC184/184L 12p *2N3702/4 11p £1-50

POPULAR DIODES—1N914 6p, 8 for 45p, 18 for 80p; 1N916 8p, 6 for 45p; 14 for 60p; 1S44 5p, 11 for 48p; 1N4001 5p; 0.02 6p; 0.03 8p; 0.04 7p; 0.05 7p; 0.08 8p; 0.07 8p. **LOW PRICE ZENERS**—400mW, Tol. ± 5% at 5mA. 3V; 3V3; 3V6; 4V; 5V; 5V6; 6V; 6V8; 7V; 8V; 8V2; 9V; 10V; 11V; 12V; 13V; 13-5V; 15V; 16V; 18V; 20V; 22V; 24V; 27V; 30V; 33V. All at 7p each, 6 for 38p, 10 for 65p, 50 for £3.12. **SPECIAL OFFER:** 100 Zeners (may be mixed) for £6.00.

RESISTORS—High stability, low noise carbon film 5% 1/4W at 40°C, 1/4W at 70°C. E12 series only—from 2-2Ω to 2-2MΩ. 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 2-2MΩ (730 resistors) 25p.
SILICON PLASTIC RESISTORS—1% and 5% wire-ended DO27; 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; 500V 55p.

SUBMINIATURE VERTICAL PRESETS—0-1W only; All at 5p each; 50; 100; 220; 470; 680 ohm; 1k; 2k3; 4k7; 6k8; 10k; 15k; 22k; 47k; 100k; 320k; 680k; 1M; 2M; 5M.
PLAS ADD 20p POST AND PACKING ON ALL ORDERS. EXPORT—ADD COST OF BEA/AIRMAIL. Add 8% VAT to all items except those marked with * which are 12 1/2%.

Send S.A.E. for additional stock lists.
Wholesale price lists available to bona fide companies.
MARCO TRADING (Dept. P.3)
The Old School, Edstaston, Wem, Shropshire
Tel: Whixall 454/465 (STD 094 872)
(Proprs. Minicost Trading Ltd.)

500 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. PENNENY (PE)**, Bankhead Farm, South Queensferry, West Lothian.

250 WATTS

Power Amplifier 250W into 4 ohms, 140W into 8 ohms. Very low noise. Suitable for public address, group amplification or super power Hi-Fi. Very reliable, high quality power amp. Power amp kit includes transistors, special heat sinks, circuit board, fuse, etc., and full instructions. £23-50
Circuit board and instructions only £2-25
120V power supply for 250W amp. kit £18-00 (Transformer weighs over 5kg. Postage overseas extra.)
Guitar or microphone preamp with two inputs, with volume, bass, and treble controls and extra high switch. Kit £7-50
Circuit board and instructions only £1-20
Microphone preamp to suit microphones of 200 ohms to 50k. Very low noise. Will take overload up to 300mV without distortion. Level control. Ideal for stage mixers or group amplifiers. Complete kit £4-00
Circuit board and instructions only £1-00
Note: The kits do not include cabinets. Many other kits available. Send S.A.E. for more information.
Includes postage and postage in U.K.
Mail order only. Callers by arrangement only.

ALFA ELECTRONICS
96a Glengall Road, London, N.W.6

SUMMER PRICES FOR TTL

(All famous makes. Prices include VAT)		Prices include VAT	
7400	10p	7447	71p
7401	11p	7448	73p
7402	11p	7450	11p
7403	11p	7451	11p
7404	12p	7453	11p
7405	12p	7454	11p
7406	27p	7460	11p
7408	12p	7472	22p
7410	11p	7473	24p
7411	20p	7474	25p
7412	16p	7475	44p
7413	27p	7476	27p
7414	65p	7480	38p
7417	26p	7483	74p
7420	11p	7484	87p
7422	20p	7485	£1-03
7425	26p	7486	27p
7427	26p	7489	£2-50
7430	11p	7490	35p
7432	24p	7491	58p
7437	24	7492	38p
7440	11p	7493	38p
7441	63p	7495	54p
7442	57p	7496	69p
7445	60p	74100	97p
ZTX108	7p	1N4001	4p

Intel 2102 K1 Memory £3
DL707E 0-3in. Display 69p
Min. order £2. P. & P. 20p (first class) C.W.O.

Send S.A.E. for full list
J. C. JONES (Dept. PE19)
46 Burstallars, St. Ives, Camb.
PE17 4XX
(Mail Order only)

ORCHARD ELECTRONICS

I.C.s. TTL, C/Mos. Linear. Capacitors. Resistors (E12) 5L/Rectifiers. Diodes. LED. Thyristors. Zeners. Voltage Reg. DIL Sockets. Bridge Rectifiers. Potentiometers. Presets. Triacs. Diac. Plugs. Sockets. Cable. Verro. Carefully selected range, excellent despatch service. Same day turn round. S.A.E. List.

ORCHARD ELECTRONICS
Flint House, High St., Wallingford, Oxon.
Telephone 0491-35529

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.

Cruzet Gated Motors 240V. 5/6/15/20 r.p.m. New £1-75 P.P.

Panel with 220 approx. marked IC's only £4-50 inc. VAT. P.P.

Memory Array Panel. £1-50 inc. VAT. P.P.

Electrolytic Capacitors, 2,500 at 40V. Size 3 x 1 1/2in. 2 for £1 P.P. NEW.

Transformers. 12-0-12V, 100mA, 9-0-9V, 100mA, 6-0-6V, 100mA, 99p each P.P.

P.C. Board. S/S, 5 1/2 x 5 1/2in, 10 for £1-25 P.P.

Mixed Pack of C280 series Mullard capacitors. 100 for £1-30 inc. P.P.

Very large quantity of Mullard C280 capacitors. In sacks. Mixed values. Also Mullard electrolytics in sacks. Mixed values. Enquiries invited from bulk buyers.

Tel. 061-236 1541
All prices include VAT and P.P.

MINIATURE CARBON FILM RESISTORS. 5% $\frac{1}{4}$ W, $\frac{1}{2}$ W, E12 Series. 22ohm to 1M Ω . 10 for 15p, 50 for 50p, 100 for 85p, p. & p. 10p. Mixed values and wattages to your choice. CANDAR, Freepost, Reading RG1 1BR.

Bank of 20 Neons 74p (16p); 5 figure resettable Counter 18/22 v, works on 12, £2.50 (50p); Box with 20 x LA2 Pot Cores + 20 x 1% Caps £1.75 (75p); Copper clad Flux Panels 5" x 5" £6.75p.; 12" x 12" 75p.; 17" x 9" 78p.; 8" x 9" 3-£1.25; Fibre Glass 12" x 7" 90p., 15" x 3" 65p., 7" x 8" 60p., Double-sided plus 10%. All CP. 74 Series ICs on Panel(s) 10-85p (10p); 100 Ass. Polystyrene Caps 80p (10p). Lists 15p. Refund on purchase. 7 lbs assorted components £2.50 c.p.

J. W. B. RADIO
2 Barnfield Crescent, Sale, Cheshire M33 1NL
Postage in brackets Mail order only

SITUATIONS VACANT

PHYSICS TEACHER seeks to broaden his horizons during year from September. Experience in writing, editing, electronics. Full, part time or home work considered. Box No. 64.

University of Glasgow Department of Music ELECTRONIC MUSIC STUDIO

A Technician, Grade 5, is required to maintain, modify and build equipment for the Electronic Music Studio in the Department of Music.

Applicants should be interested in digital and audio electronics, be able to maintain analogue and digital audio equipment and have at least an ONC and seven years of relevant experience.

The studio is developing a course as part of the University's B.Mus. degree and provides facilities for professional composers. Equipment includes 16-track recording facilities, based on an Ampex 1000 and including Dolby noise reduction, quadraphonic and stereo playback, a computer-controlled (PDP8/A) Synthi 100 and other synthesizing equipment.

Salary range: £2,751-£3,207

Further information from, and all applications including a curriculum vitae and the names of two referees, to: **The Personnel Officer, The University of Glasgow, Glasgow, G12 8QQ**, not later than 25th June 1976.

SERVICE SHEETS

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

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, radio, TV, etc. 10,000 models. Catalogue 24p plus S.A.E. with orders-enquiries. TELRAY, 154 Brook Street, Preston, PR1 7HP.

LADDERS

LADDERS, varnished 20' 9" extd. £19.82. Carr. £1.40. Leaflet. Also aluminium ext. and loft ladders. Tel. Telford 686644.

EDUCATIONAL

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.**

771V, Intertext House, London, SW8 4UJ.
Tel. 01-622 9911 (all hours).

TAPETALK

THE CLEVER WAY TO LEARN

TWO C60 Cassettes entitled
INTRODUCING ELECTRONICS

£5.44 plus 55p VAT/P. & P.

TAPETALK, P.O. Box 99 (PE)

Milton Keynes MK3 5BR
Tel.: Milton Keynes (0908) 77710

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.**

771V, 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 September 13th.

Prospectus from London Electronics College, Dept. A7, 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.**

771V, Intertext House, London, SW8 4UJ.
Tel. 01-622 9911 (all hours).

ELECTRICAL

STYLI AND CARTRIDGES. For the best at keenest prices send SAE for free illus. list to **FELSTEAD ELECTRONICS (PE)**, Longley Lane, Gatley, Cheshire, SK8 4EE.

BOOKS AND PUBLICATIONS

START YOUR OWN BUSINESS REWINDING ELECTRIC MOTORS

This unique instruction manual shows step by step how to rewind motors, working part or full time, without previous experience. Everything you need to know easily explained, including where to obtain materials, how to get all the work you need, etc., etc. A goldmine of information and knowledge. Only £3.65 plus 25p P. & P. From:

MAGNUM PUBLICATIONS, Dept. PES
Brinksway Trading Estate, Brinksway
Stockport SK3 0BZ
Overseas Distributors wanted.

YOUR KEY TO ELECTRONICS

We specialise in supplying technical magazines (English Language) throughout the world. Also, we are able to supply certain past issues and buy and sell technical publications and books. Write for details. Stamped addressed envelope or International Reply Coupon please.

KEY MAGAZINE DISTRIBUTORS
Dept. E, P.O. Box 34, Ongar, Essex, CM5 9BP,
England

FREE T.V. CIRCUIT DIAGRAMS

All main British T.V. sets (plus many foreign) comprehensively covered in our easy-to-follow T.V. Repair Manuals—4 mono and 3 colour. Just send model no., if colour (mfrs. chassis type helps) with £4 and receive the manual covering your set—plus your set's circuit diagram on request free. Set of 7 only £25. British T.V. Circuit Diagram Manuals—the main mono (over 37 series) for £9.50 and virtually every colour for £16. Full details of these and other publications from:

T.V. TECHNIC
76 Church Street, Larkhall, Lanarks, ML9 1HE
Tel. (0698) 883334

FOR SALE

AMPS. We have some 8-track car stereo amps for sale. They are 2 $\frac{1}{2}$ +2 $\frac{1}{2}$ W and are complete with volume, tone and balance sliders. Includes wiring diagram. Price £3, post 20p. Cheques/P.O. to: W. B. SPENCER, "Mill Chase", Old Mill Road, Calster-on-Sea, Norfolk, NR30 5HE.

PRACTICAL ELECTRONICS September '65 to September '76 (6 missing). Practical Wireless May '66 to October '69, March '71 to February '76 (6 missing). Offers? **KNELLER**, 3 Bernays Close, Stanmore, Middlesex.

OSCILLOSCOPE. Heathkit 10.18U, £40. R. E. COOTE, 47 Edmunds Avenue, Orpington, Kent, BR5 3LE.

HEATH OSCILLOSCOPE with probes £90; trace doubler £20; sine-square generator £50; or £150 the lot. **TOMS**, 01-729 1717 (office hours).

WANTED

TOP PRICES PAID
NEW VALVES AND TRANSISTORS
Popular T.V. and Radio types
KENSINGTON SUPPLIES (B)
367 Kensington Street
Bradford 8, Yorks.

MISCELLANEOUS

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.

MISCELLANEOUS

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.

MINI ACCUMULATORS

2 volt **MULTI-USE** Sealed Lead Acid Rechargeable Cells.

Size LA50—1'4" x 1'1" x 0'44" 3 for £2'15 inc. P. & P.

Size GA2—1'7" x 1'3" x 0'5" 3 for £2'65 inc. P. & P.

Suits Fi-Cord

GARFIELDS, 295 Rye Lane, London SE15

TRANSMIT!

★ **Unique TRANSMITTER RECEIVER** Kit. No licence examinations or tests required to operate this transistorised equipment. Easy to build. Get transmitting. Send £7'95 plus 20p P. & P.

★ **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-top. Send £3.50 plus 20p P. & P.

(All prices include V.A.T.)

Send remittance to:

BOFFIN PROJECTS
4 CUNLIFFE ROAD
STONELEIGH, EWELL, SURREY
(Mail order U.K. only)

Or for more details, send 20p for lists

ENAMELLED COPPER WIRE

S.W.G.	1lb reel	1/2lb 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 Parrwood Road, Wingham,
Manchester 20
Telephone 061-445 8753

SUPERB INSTRUMENT CASES by Bazelli, manufactured from heavy duty pvc faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range, competitive prices start at a low 75p. Examples: width, depth, height, 8in. x 5in x 3in, £1-55; 10in x 6in x 3in, £2-20; 10in x 8in x 3in, £2-75; 12in x 10in x 3in, £3-60; 8in x 4in x 4in, £1-80; 10in x 6in x 4in, £2-70; 12in x 8in x 4in, £3-60; 7in x 7in x 5in, £2-65; 8in x 10in x 6in, £3-60; 12in x 8in x 7in, £4; 12in x 12in x 7in, £4-40. Plus 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.

12 VOLT FLUORESCENTS

35% OFF RRP

MADE BY THORN LIGHTING. Ideal for Caravan, Boat, Tent, Emergency Lighting etc. All lamps guaranteed for 12 months.

21 in 13 watt £4.90

12 in 8 watt £4.00

All lamps have On/Off Switch, Wrong Polarity Protection Device and Diffuser.

C60 CASSETTES 22p
C90 CASSETTES 45p

All Cassettes in Plastic Case with Index and Screwed Assembly.

All prices include VAT. Add Postage 5p in £1.

Quantity Discounts:
10 Units 5%
50 Units 7%
100 Units 10%

SALOP ELECTRONICS
23 WYLE COP
SHREWSBURY
Tel. 53206

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

H.M. ELECTRONICS
275a Fulwood Road, Broomhill, Sheffield S10 3BD

Give your project that professional looking finish. Build it in a BEC.

Dry transfer lettering now available.

BEC CABINETS

ORION cabinet still available punched or unpunched. Send 15p (refundable) for leaflets.

PHOTOTECH (EUROPE)
New Optoelectronic Detectors

Type 1: Photodiode, 2 pin Configuration: Photosensitive area 0.85 x 10⁻³ 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.W.O. or S.A.E. for data only to: Phototech (Europe), 23a Upper Elmers End Road, Beckenham, Kent

GLASS FIBRE P.C.B.'s. Send 1:1 master and 7p per square inch tinned or 10p per square inch drilled and tinned. Plus 40p per board. Send for quotation on double sided boards. Discount for quantity. **PROTO DESIGN, 4 Highcliffe Way, Wickford, Essex, SS11 6LA.**

FERRANTI ZN1040E
COUNT/DISPLAY IC
£9.50 inc. VAT, P. & P.

GJD ELECTRONICS
105 Harperfold Road
Radcliffe, Manchester
(MAIL ORDER ONLY)

DO-IT-YOURSELF LOUDSPEAKERS for hi-fi are 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. PE-776, 4 Princes Square, Harrogate, North Yorkshire.**

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 Q, Starline Works, Grainger Road
Southend-on-Sea, Essex.

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

BUILD THE TREASURE TRACER
MK III Metal Locator



- Variable tuning
- Britain's best selling metal locator kit
- Fitted with Faraday shield
- Speaker and earphone operation
- 4,000 already sold
- Prebuilt search coil assembly
- Five variable circuits
- Thoroughly professional finish
- You only need soldering iron, screwdriver, 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)

I.C. EXPERIMENTER'S KITS

Learn about modern electronics with our new series of Kits on digital logic techniques. Each Kit contains specially selected I.C.s, Holders, Veroboard, L.E.D.s, and Instructions. Available at £3-50 each (including P. & P.)

Kit One—Gates
Kit Two—Flip-Flops
Kit Three—Shift Registers
Kit Four—Counters
Kit Five—Displays

S.A.E. for further details to:
AUTOMATED HOMES
69 High Street, Ryton, Coventry CV8 3FJ
(Mail Order Only)

MORSE IMPROVEMENT

C90 Cassettes 1-12 w.p.m. with simple exercises. 12-24 w.p.m. computer produced professional level operator material including international symbols.

Price: complete with instruction and exercise booklets £4 including postage. Overseas £1 extra.

Morse Key and Buzzer Unit suitable for sending practice and DIY tape preparation.

Price £3 including postage. Overseas £1 extra.

MHEL ELECTRONICS
12 Longshore Way, Milton,
Portsmouth (UK), PO4 8LS

DIG THIS! Already over £500,000 worth of treasures have been uncovered with electronic metal detectors. C. SCOPE offer the best in BFO, IB and TR machines at competitive prices. Tel. Ashford 29141 for details.

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)

RECHARGEABLE NICAD BATTERIES. Pencil, AA 94p; Sub. "C" £1.16; "D" £1.92; "D" £2.59; PP3 £4.48. Chargers: £4.48, £4.48, £4.98, £4.98, £3.98 respectively. Others available. All prices include VAT. Add 10% P. & P. S.A.E. for price list plus 25p for information booklet. **SANDWELL PLANT LTD.**, 1 Denholm Road, Sutton Coldfield, West Midlands. Tel. 021-354 9764.

DIGITAL CLOCK MODULE
SIZE 3" x 1.75"

C/W 15V + 4.5-0.45V TRANSFORMER. Requires only switches and case. DATA SUPPLIED.

OUR PRICE ONLY £9.74

Features:
Bright 0.5" Display. 12 hr. Format with 24 hr. alarm capability. Flashing Colon, Power Failure Indication, P.M. Indicator, Alarm Set Indicator, Hrs. and Mins. or Mins. and Secs. Display, Output Drives from Alarm and Sleep Timers, 9 min. Snooze Timer and 59 Min. Sleep Timer.

CAR, BOAT OR CARAVAN
CLOCK MODULE

We have at the expense of a slightly reduced display brightness operated this unit successfully from a 12V d.c. supply. Data for conversion to 12V d.c. supplied. All the above features plus crystal time base, less transformer.

PRICE £13.88

IF REQUIRED WITH
TRANSFORMER £14.75

CRYSTAL TIME BASE SUITABLE
FOR C.MOS CLOCKS

(Built and Tested)

OUR PRICE ONLY £5.25

ALL PRICES INCLUDE VAT AND
POST AND PACKING

Terms: Cash With Order
Mail Order Only

Orders to: **F.E.K. SUPPLIES**,
18 STARRING LANE,
LITTLEBOROUGH, LANCs.

COLCHESTER'S COMPONENT SHOP open
Sunday-Friday, 12-6 p.m. **J. K. ELECTRONICS**, 11 Mersea Road. Tel. 04433.

ALARM
CLOCK MODULES

Require only switches and transformer for operation. 12 hour, 4 digit 0-5in readout plus either clock-radio type or tone-type alarm outputs.

MA1001F or MA1002F—
Clock-radio **£7.97**

MA1001H or MA1002H
Tone Alarm **£7.97**

Suitable Vero case
6in x 3½in x 2½in **£2.95**
+ 25p post & pack.

Send SAE for data and catalogue.

BYWOOD

68 Ebbens Road,
Hemel Hempstead,
Herts HP3 9QRA
TEL: 0442 62757

VAT: All prices
exclude VAT (8%)
P/P: 15p

ELECTRONICS ENGINEER'S
REFERENCE BOOK

by L. W. Turner **Price £25.65**

THE ELECTRONIC MUSICAL INSTRUMENT MANUAL by A. Douglas. **Price £8.**

SERVICING WITH THE OSCILLOSCOPE by G. J. King. **Price £5.**

PRACTICAL CIRCUIT DESIGN FOR THE EXPERIMENTER by D. Tuite. **Price £2.60.**

PRINCIPLES OF TRANSISTOR CIRCUITS by S. W. Amos. **Price £3.65.**

SOLID STATE HOBBY CIRCUITS by RCA. **Price £2.**

TELEVISION ENGINEERS' POCKET BOOK by P. J. McGoldrick. **Price £4.**

HOW TO USE INTEGRATED CIRCUIT LOGIC ELEMENTS by J. W. Streeter. **Price £3.**

110 COSMOS DIGITAL IC PROJECTS FOR THE HOME CONSTRUCTOR by R. M. Marston. **Price £3.**

THE RADIO AMATEUR'S HANDBOOK 1976 by A.R.R.L. **Price £4.85.**

RADIO VALVE AND SEMI-CONDUCTOR DATA by A. M. Bail. **Price £2.50.**

★ 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.

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

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**
SOLDER 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 n. **£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 8n **£4.85**
SPEAKERS -75mm dia. 8n **£1.00**

Due to the time lag involved in publishing, readers are advised to check with advertisers about changes in prices, post Budget VAT rates, etc., before sending any money orders or cheques.

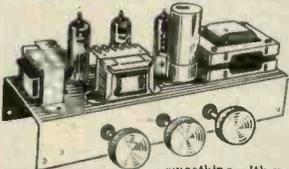
SUPERSONIC 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 Silicon transistors plus 2 power out put transistors in push-pull. Full wave rectification. Output approx. 15 watts r.m.s. into 8 ohms. Frequency response 12Hz-30KHz ± 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" high x 6" wide x 7 1/2" deep. AC 200/240V. PRICE £13-75. P. & P. 85p.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. U.I. 1.1 g heavy duty fully isolated mains transformer with full wave rectification and a 400 ohm smoothing inductance

smoothing with negligible hum. Valve line-up—2 x ECL86 Triode Pentodes. 1 x E280 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 8 ohm speakers. Full negative feedback in a carefully balanced 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. £12-40. P. & P. 95p.

ALL PURPOSE POWER SUPPLY UNIT 200/240V. A.C. input. Four switched fully smoothed D.C. outputs giving 6v, and 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". Ready built and tested. Price £5-75. P. & P. 85p.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Our price £1-50 yd. length. P. & P. 35p per yd. (min. 1 yd.). S.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. 3.5 watts. Volume and tone controls. Chassis size only 7 1/2" wide x 3 1/2" deep x 6 1/2" high overall. A.C. mains 200/240V. Supplied absolutely Brand New completely wired and tested with good quality output transformer. P. & P. 85p. BARGAIN PRICE £5-00

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0-210-240V. Secondary combinations 0-5-10-15-20-25-30-35-40-60v. half wave at 1 amp, or 10-0-10, 20-0-20, 30-0-30v, at 2 amps full wave. Size 3in. long x 3 1/2in. wide x 3 1/2in. deep. Price £2-80. P. & P. 75p.

MAINS TRANSFORMER. For power supplies. Pri. 200/240V. Sec. 9-0-9 at 500 mA. £1-50. P. & P. 35p. Pri. 200/240V. Sec. 12-0-12 at 1 amp. £1-85. P. & P. 65p. Pri. 200/240V. Sec. 10-0-10 at 2 amp. £2-85. P. & P. 70p.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER

For P.U. Tap, 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 £1-60 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 net. 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 (in form of hints and tips) supplied. 25-62 plus 20p. P. & P. Stereo beacon light if required 40p extra.

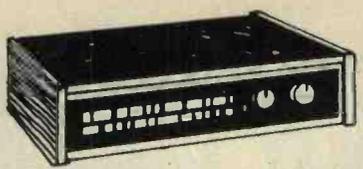


QUALITY RECORD PLAYER AMPLIFIER MK. II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7 1/2" wide x 3 1/2" deep x 6 1/2" high. Ready built and tested. PRICE £6-20. P. & P. 90p.

ALSO AVAILABLE mounted on board with output transformer and speaker. PRICE £7-50. 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-gain, 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. A.C. mains 200/240V (not available in kit form).

Special Offer £22-50 + £1-20 P. & P.

LATEST ACOS GP91/18C mono compatible cartridge with 1/2" stylus for LP/EP/78. Universal mounting bracket. £1-60. P. & P. 18p.

CERAMIC STEREO CARTRIDGE. Universal mounting brackets and turnover stylus. 70mV per channel output. ONLY £1-90. P. & P. 15p.

SONOTONE STABCOMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78. ONLY £2-26. P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £2-86. P. & P. 18p.

LATEST CRYSTAL T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo 78. £1-80. P. & P. 18p.

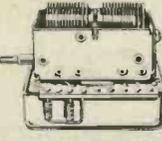
LATEST 1/2" MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only £1-58. P. & P. 18p.

SPECIAL OFFERS

Mullard LP1159 RF-1F Double Tuned Amplifier Module for nominal 400KHz. Sweet 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. £2-25 + P. & P. 12p.

Pye VHF/FM Tuner Head

covering 88-108MHz. 10-7M/Hz IF output 7-8V + earth. Supplied pre-aligned, with full circuit diagram. Connection details supplied. Beautifully made with precision-gated FM and 223 Ft + 323 Ft AM Tuning Gang only £3-16 + P. & P. 35p.



PRECISION MADE

Push Button Switch bank. 8 Buttons giving 16 S/P C/O interlocked wittches 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 now with most attractive slatted 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 £12-00 each. Carr. £1-60

Cabinet Available Separately £7-25. Carr. £1-20. Also available in 8 ohms with EM1 13" x 8" bass speaker with parasitic tweeter £10-25. Carr. £1-60

LOUDSPEAKER BARGAINS

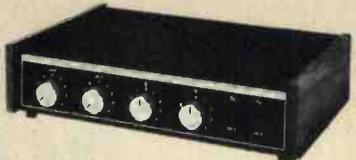
3in. 3ohm £1-45. P. & P. 35p. 7 x 4in. 3ohm £1-60. P. & P. 48p. 10 x 6in. 3 or 15 ohm £2-50. P. & P. 75p. E.M.I. 8 x 5in. 3ohm with high flux magnet £2-06. P. & P. 50p. E.M.I. tweeter. Approx. 3 1/2". Available 3 or 8 or 15 ohms, £2-00 + 20p. P. & P.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER

Size 11 1/2" x 14 1/2" x 1 1/2" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz-20KHz. Can be mounted on ceilings, walls. Send S.A.E. for details. Only £7-25 each. P. & P. 60p for one, 80p for two.

Now also available 8" x 8 ohm. 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. £4-80 + P. & P. (one 35p, two 65p).

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT

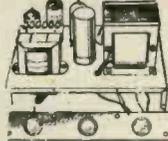


A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal 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, smart brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specifications: Power output: 14 watts r.m.s. per channel into 8 ohms. Frequency response ± 3 dB 12-30,000 Hz. Sensitivity: better than 80mV into 1M Ω . Full power bandwidth: ± 3 dB 12-15,000 Hz. Bass, boost approx. to ± 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 large S.A.E. **AMPLIFIER KIT** £13-50 P. & P. 56p (Magnetic input components 33p extra) **POWER PACK KIT** £4-85 P. & P. 85p **CABINET** £4-85 P. & P. 75p

Special offer—only £22-50 if all 3 units ordered at one time including P. & P.

Full after sales service Also available ready built and tested £29-25. 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 H434 MK II.

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7 1/2" w. 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 41 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £7-80. P. & P. 85p. **HBL "FOUR" AMPLIFIER KIT.** Similar in appearance to H434 above but employs entirely different and advanced circuitry. Complete set of parts, etc. £7-00. 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 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EFS6 and E280 rectifier. Simple instruction booklet 25p x S.A.E. (free with parts). All parts sold separately. ONLY £11-25. P. & P. £1-25. Also available ready built and tested £16-20. P. & P. £1-20.



SPECIAL OFFER

Limited number of the latest BSR C141R1 Auto/Manual changer de-luxe. Lightweight tubular arm out-loading lever bias compensator £12-80 + £1-10 P. & P.

OUR PRICES INCLUDE VAT AT CURRENT RATES

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

(Please write clearly)

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

Published approximately on the 15th of each month by IPC Magazines Ltd., Fleetway House, Farringdon Street, London EC4. Printed in England by Chapel River Press, Andover, Hants. Sole Agents for Australia and New Zealand—Gordon & Gotch (Asia) Ltd.; South Africa—Central News Agency Ltd. Subscriptions not available at home or overseas. International Giro facilities Account No. 3122007. Please state reason for payment. "message to payee". Practical Electronics is sold subject to the following conditions, namely, that it shall not, without the written consent of the Publishers first given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to V.A.T., and that it shall not be lent, resold or hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

Make it with MAPLIN!

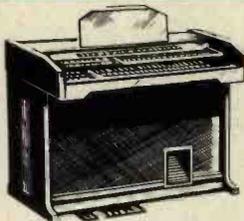
ELECTRONIC COMPONENTS
WIDE RANGE • HIGH QUALITY • FAST SERVICE

The 4600 SYNTHESISER



We stock all the parts for this brilliantly designed synthesiser, including all the PCB's, metalwork and a drilled and printed front panel, giving a superb professional finish. Opinions of authority agree the ETI International Synthesiser is technically superior to most of today's models. Complete construction details in our booklet now available price £1.50, or send SAE for specification.

ELECTRONIC ORGAN



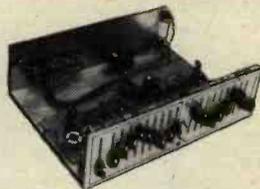
BUILD IT YOURSELF ... IN STAGES

Get started with a 49 note instrument - features tremulant and reverb. Ideal to learn on. Leaflet MES 51. Price 15p gives full details to build this complete instrument.

Extend the range of MES 51 by adding another keyboard and several new tone colours. Leaflet MES 52. Price 15p also shows how to use 61 note keyboards.

Fully controllable attack and decay controls (normally found only on the most expensive organs), up to seven footages on each keyboard, up to 70 controls including drawbars, and a 13 note pedalboard, make up the additions described in the step-by-step 32 page instruction leaflet MES 53. Price 35p.

GRAPHIC EQUALIZER



A really superior high quality stereo graphic equalizer featuring nine octaves per channel. We stock all the parts (except woodwork) including the metalwork drilled and printed. 15p brings you a reprint of the article.

DIGITAL CLOCK KITS

ONLY **£8.60** INC. VAT
E/P/P



This is a fully constructed and tested electronic clock module as illustrated. Data sheet supplied. Simple to connect to alarm and your battery/mains radio. Smart case available.

Data sheet available separately. Please send SAE.

- Bright 4 Digit 0.5" Display
- Flashing Colon (1Hz)
- Switch for Display Seconds
- Alarm Set Indicator
- P.M. Indicator
- Power Failure Indicator
- Sleep Timer
- Snooze Timer
- Time can be set accurately to within one second
- Leading Zero Blanking

SIMPLE ALARM KIT - £9.38 ALARM CLOCK KIT - £10.99.
ALARM CLOCK & RADIO CONTROLLER KIT - £11.51.
SMART PLASTIC CASE with fully punched chassis - £2.49.
Please send SAE for our Clock data sheet.



100 W PER CHANNEL STEREO DISCO

- Automatic voice operated fader
- Belt drive turntables
- Monitor facilities (Headphones and VU meters)
- Sound operated light show - plus many other advantages.

Send for our leaflet MES 41, giving full details for construction. Price 20p. Soon you'll be the Deejay everyone wants at their party!

Get our FABULOUS NEW 1977/78 CATALOGUE

PUBLICATION DATE OCT. 28, 1976 ON APPROVAL

All new • Completely re-written • Thousands of new lines
Lots of exciting new projects to build - PRICE 50p.
SEND NO MONEY NOW. Overseas send 8 International reply coupons.

JOIN OUR MAILING LIST NOW!

Published every two months our Newsletter gives full details of our latest guaranteed prices.

- SAVE ££'s ON SPECIAL OFFERS!
- DETAILS OF NEW PROJECTS AND NEW LINES

NAME _____

ADDRESS _____

If you do not wish to cut magazine, write your request for catalogue on separate sheet.
1975/76 GREEN COVER CATALOGUE STILL AVAILABLE - PRICE 40p.

MAPLIN ELECTRONIC SUPPLIES
All mail to: P.O. Box 3, Rayleigh, Essex S56 8LR.
Shop: 284 London Road, Westcliff-on-Sea, Essex
(Closed on Monday). Tel: Southend (0702) 44101