

# PRACTICAL WIRELESS

APRIL  
1977

40p

## GAS/SMOKE SENSOR ALARM



## TUG`O`WAR game



## DUAL POWER SUPPLY



Also: FM STEREO TOUCH TUNER (Part 2)

# RADIO EXCHANGE LTD.

**ALL PRICES  
INCLUDE VAT**

## NEW EDU-KIT MAJOR

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



Total Building Costs **£9.00**

P & P + Ins. 85p.

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

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

## VHF AIR CONVERTER KIT

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

All Parts including Case and Plans. **£3.95**  
 P & P and Ins. 45p.

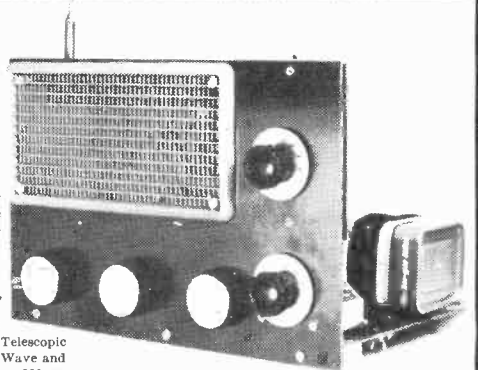


## NEW ROAMER TEN MODEL R.K.3.

MULTIBAND V.H.F. AND A.M. RECEIVER  
 13 TRANSISTORS AND FIVE DIODES  
 QUALITY 5" x 3" LOUDSPEAKER

WITH Multiband V.H.F. section covering Mobiles, Aircraft, T.V. Sound, Public Service Band, Local V.H.F. Stations, etc. and Multiband A.M. section with Airspaced Slow Motion Drive Tuning Capacitor for easier and accurate tuning, covering M.W.1, M.W.2, L.W., Three Short Wave Bands, S.W.1, S.W.2, S.W.3, & Trawler Band. Built in Ferrite Rod Aerial for Medium Wave, Long Wave and Trawler Band, etc. Chrome Plated 7 section Telescopic Aerial, single and rotatable for peak Short Wave and V.H.F. reception. Push Pull output using 600mw Transistors. Gain, Wave-Change and Tone Controls. Plus two Slider Switches. Negative Feedback circuit and SPECIAL POWER BOOSTER SOCKET AND RESISTOR, to virtually double gain if required. Powered by P.P.9.9 volt battery. Complete kit of parts including carrying strap. Building instructions and Operating Manuals.

**£13.99** Including Post and Packing  
 Case Enclosure Kit (if required) £1.80 inc. P & P.



## POCKET FIVE

NOW WITH 3" LOUDSPEAKER  
 3 Tuneable wavebands, M.W., L.W., and Trawler Band, 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, attractive black and gold case. Size 5½" x 1½" x 3½" approx.

All Parts including Case and Plans. **£3.60**  
 P & P + Ins. 60p.



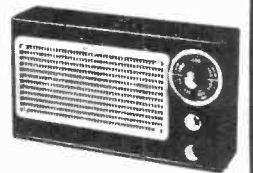
Total Building Costs

**£3.60**

P & P + Ins. 60p.

## NEW Everyday Series

Build this exciting new series of designs.



E.V.5. 5 Transistors and 2 diodes. MW/LW. Powered by 41 volt Battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" x 5½" x 2½" approx. All parts including Case and Plans.

Total Building costs **£4.30** P & P + Ins. 60p.

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

Total Building costs **£4.95** P & P + Ins. 65p.

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

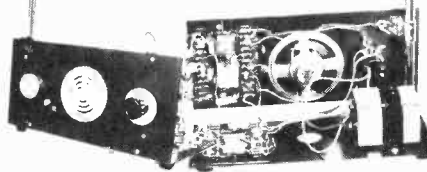
Total Building costs **£6.95** P & P + Ins. 70p.

## ELECTRONIC CONSTRUCTION KITS

### ECK2

Self Contained Multi-Band V.H.F. Receiver Kit. 8 Transistors and 3 Diodes. Push/Pull output. 3" Loudspeaker, Gain Control. Superb 9-section swivel ratchet and retractable chrome plated telescopic aerial, V.H.F. Tuning Capacitor, Resistors, Capacitors, Transistors, etc. Will receive T.V. Sound, Public Service Band, Aircraft, V.H.F. Local Stations, etc. Operates from a 9 Volt PP7 Battery (not supplied with kit). Complete kit of parts including construction plans.

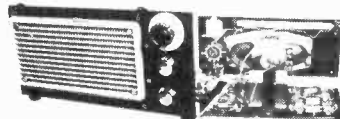
**£7.95** P & P and Ins. 70p.



### ECK4

7 Transistors, 6 tuneable wavebands, MW, LW, Trawler Band, 3 Short Wave Bands. Receiver Kit. With 5" x 3" Loudspeaker. Push/Pull output stage, Gain Control, and Rotary Switch. 7 Transistors and 4 Diodes. 6 section chrome-plated telescopic aerial. 8" Sensitive Ready Wound Ferrite Rod Aerial. Tuning Capacitor. Resistors, Capacitors, etc. Operates from a 9 Volt PP7 Battery (not supplied with kit). Complete kit of parts including construction plans.

**£7.25** P & P and Ins. 70p.

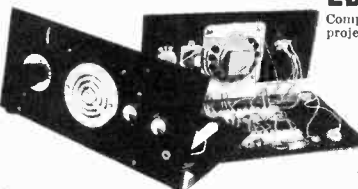


## EDU-KIT JUNIOR

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

- ★ Crystal Radio Medium Wave Coverage — No Battery necessary.
- ★ Electronic Metronome
- ★ One Transistor Radio.
- ★ 4 Transistor Push/Pull Amplifier.
- ★ 2 Transistor Regenerative Radio
- All parts including Loudspeaker, Earpiece, MW Ferrite Rod Aerial, Capacitors, Resistors, Transistors, etc. Complete kit of parts including construction plans.
- ★ 3 Transistor Earpiece Radio Medium Wave Coverage.
- ★ 4 Transistor Medium Wave Loudspeaker Radio.
- ★ Electronic Noise Generator

**£6.55** P & P + Ins. 60p.



To RADIO EXCHANGE LTD  
 61A HIGH STREET, BEDFORD MK40 1SA  
 Tel: 0234 52367

ALL PRICES INCLUDE VAT Reg. No. 788372  
 ★ Customers site entrance "Lavells" Shop.  
 ★ Open 10-1, 2.30-4.30. Mon-Fri. 9-12 Sat.

I enclose £.....  
 for .....  
 Name .....  
 Address .....

# PRACTICAL WIRELESS

VOL. 52 NO. 12

ISSUE 842

APRIL 1977

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

## EDITOR

Lionel E. Howes, G3AYA

## ASSISTANT EDITOR

Eric Dowdeswell, G4AR

## ART EDITOR

Peter Metall

## TECHNICAL EDITOR

Terry Carter

## PRODUCTION & NEWS

### EDITOR

Bill Tull

## TECHNICAL ARTIST

Alan Martin

## SECRETARIAL

Linda Walji

## ADVERTISING MANAGER

01-634 4612

Roy Smith

## CLASSIFIED ADVERTISING

01-261 5762

Colin R. Brown

**PLEASE NOTE:** We do not operate a Technical Query Service except on matters concerning constructional articles published in PW. We do not supply service sheets or information on commercial radios, TV's or electronic equipment.

All queries must be accompanied by a stamped, self-addressed envelope otherwise a reply cannot be guaranteed.

Send letters concerning advertising matters to the Advertising Manager, Roy Smith.

Send letters concerning editorial matters to the Editor, Lionel Howes.

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

## BINDERS

Binders £2.10 and indexes 45p (inc. VAT) can be supplied by the Post, Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London, SE1 0PF.

## ● NEWS & COMMENT

1002 LEADER ARTICLE—In Passing . . .

1003 NEWS . . . NEWS . . . NEWS . . .

1010 TELEVISION—What's in next month's issue

1021 KINDLY NOTE—Digital IC Tester and Audible Continuity Tester—February 1977. Chromachase 4—December 1976/January 1977

1022 PW READERS PCB SERVICE

1023 NEXT MONTH IN PRACTICAL WIRELESS

1045 ON THE AIR—Amateur Bands—Eric Dowdeswell G4AR

Broadcast Bands SW—Derek Bell

Broadcast Bands MW—Charles Molloy

VHF—Ron Ham

## ● CONSTRUCTIONAL

1004 FM STEREO TOUCH TUNER Part 2—

Francis How (B.A.Cantab.)

1011 UHF MODULATOR—E. Trundle

1017 S-DeC PROJECTS NO. 5—Simple Stroboscope—

David Gibson

1024 DUAL REGULATED POWER SUPPLY—T. J. Johnson

1029 TUG'O'WAR GAME—Richard Dudley

1035 GAS/SMOKE SENSOR ALARM—R. A. Jenkins

## ● OTHER FEATURES

1034 THE PW 'SUREFIRE'—D. Jones

1036 TECHNICROSS NO. 18 SOLUTION

1038 CIRCUITS FOR AUDIO AMPLIFIERS Part 2—

F. G. Rayer G3OGR

## COPYRIGHT AND QUERIES

© IPC Magazines Limited 1977. Copyright in all drawings, photographs and articles published in "Practical Wireless" is fully protected and reproduction or imitation in whole or in part is expressly forbidden. All reasonable precautions are taken by "Practical Wireless" 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 are those current as we go to press.

We regret that we cannot answer technical queries by telephone nor can we provide information or advice on manufacturers' products other than that given in the magazine. We will endeavour to assist readers who have queries relating to articles published but we cannot offer advice on modifications to our published designs. All correspondents expecting a reply should enclose a stamped addressed envelope.

# Can YOUR Antenna do all this?

You've read our ads with their recent testimonials and user histories—so this month we thought we'd remind readers of the selling points of the

## JOYSTICK VFA (World Patents)

- ★ Only 7' 6" long, comes in 3 easily assembled sections.
- ★ Tunes .5-30 MHz—no gaps.
- ★ Matching Antenna Tuner.
- ★ No harmonic resonances—means that the highest efficiency transfer of power and waveform from TX to ether takes place. In turn this ensures that TVI and other spurious emissions are just not substantially present.
- ★ Low angle radiation as an effective ground plane—that husbanded power goes on to reach destination with the least number of loss-making skips.
- ★ Gives receiver additional front end selectivity and gain—reduces cross-mod and out of band blocking.
- ★ Your installation can be 'tailored' to space available. Install VFA on mast or chimney or in roof space with a long or short feeder—or **SIMPLY STAND IN THE SHACK. One delighted user proved his VFA by operating FROM A BASEMENT!**

ALREADY IN USE BY AMATEUR TRANSMITTING AND SWL STATIONS WORLD-WIDE AND IN GOVERNMENT COMMUNICATION.

**SYSTEM 'A'** £32.40  
250 w.p.e.p. OR for the SWL.

**SYSTEM 'J'** £38.60  
500 w.p.e.p. (improved 'Q' on receive).

## PARTRIDGE SUPER PACKAGES

COMPLETE RADIO STATIONS FOR ANY LOCATION

All Packages feature the World Record Joystick Aerial (System 'A'), with 8' feeder, all necessary cables, matching communication headphones. Deliv. Securitor our risk. Assembled in seconds! BIG CASH SAVINGS!

**PACKAGE No. 1** As above with R.300RX £210.55  
SAVE £13.87!

**PACKAGE No. 2** Is offered with the FRG7 RX. £193.11  
SAVE £13.87!

**PACKAGE No. 3** New—low priced package. £154.86  
The all solid state SMC73 RX with all the Partridge extras.  
SAVE £26.05 plus!

RECEIVERS ONLY, inclusive delivery, etc.

R.300 £184.50 FRG7 £167.06 SMC73 £128.81

All prices are correct at time of going to press and carry VAT current at the time and carriage.



Just telephone your card number  
Phone 0843 62535  
(or 62839 after office hours)



or write for details, send 8½p stamp

**63CED PARTRIDGE ELECTRONIC LTD 63VFA**

Box 5, Partridge House, Prospect Road, Broadstairs, CT10-1LD. (Callers by appointment).

Vero Electronics Ltd, manufacture cases to give your projects a professional finish. Cases are available in plastic, extruded aluminium and PVC coated steel. A new catalogue describing these cases, Veroboard, pins, tools, card frame etc. is available (price 10p + S.A.E. 7" x 9")

# VERO

## THE CASE OF THE PROFESSIONAL FINISH...



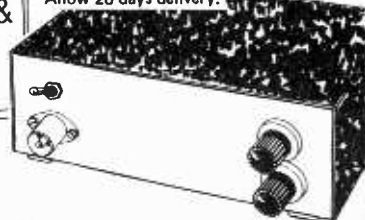
Vero Electronics Limited, Retail Dept., Industrial Estate, Chandler's Ford, Hants., SO5 3ZR  
Telephone: Chandler's Ford 2956 (STD 04125)

## DORAM kits

DORAM KITS CONTAIN EVERYTHING DOWN TO THE LAST NUT!

TV  
Crosshatch &  
Pattern  
Generator

NOW AVAILABLE IN MADE-UP FORM  
PRICE £29.95 + S VAT (Built, Tested & Guaranteed - order code 997-162)  
Allow 28 days delivery.



£19.77  
+ S

Subject to availability  
order code: 997-033

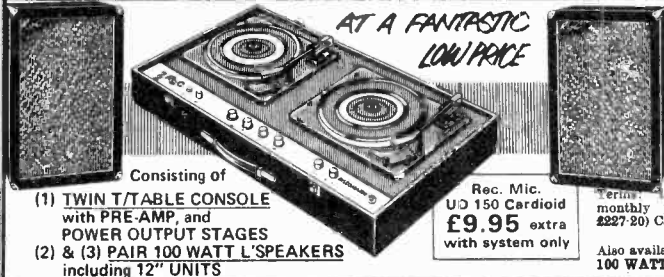
Completely self-contained unit requiring only connection to mains and TV UHF aerial socket. Incorporates its own pulse generator giving fully interlaced scan and has unique frequency adjustment control, calibrated using visual display on TV screen to ensure correct field frequency.  
Choice of outputs: blank raster, dots, crosshatch and greyscale plus set frequency position. Facilitates setting of static and dynamic convergence, purity, black level, linearity, focus.

O'seas orders—add 15% for P+P. All items offered for sale subject to the Terms of Business set out in Doram Edition 3 catalogue, price 60p. The Doram Kit brochure is also available, price 25p. Combined price only 70p which also entitles you to 2x25p vouchers, each one usable on any order placed to the value of £5.00 or more (ex. VAT).  
DORAM ELECTRONICS LTD  
P.O. BOX TR8, WELLINGTON RD. IND. EST., LEEDS LS12 2UF

An Electrocomponents Group Company

# RSC 200 WATT DISCO SYSTEM ALL RSC PRICES INCLUDE VAT

**AT A FANTASTIC LOW PRICE**



Consisting of

(1) TWIN T/TABLE CONSOLE with PRE-AMP, and POWER OUTPUT STAGES

(2) & (3) PAIR 100 WATT L'SPEAKERS including 12" UNITS

Rec. Mic. UD 150 Cardioid **£9.95** extra with system only

Terms: Deposit £40.00 and 12 monthly payments £16.60 (Total £227.20) Carr. £7.50.

Also available: **100 WATT SYSTEM with MIC**

**DISCOMAJOR POWER DISCO CONSOLE** with Integral Power Amplifier.

**TWIN** full size GARRARD turntables with cueing device.

**CARTRIDGES** with Diamond Styl!

**3 SEPARATE VOLUME CONTROLS** for each turntable and Mic.

**FULL HEADPHONE MONITORING FACILITIES**

**£199-95**

**£169-95**

**TDI DISCO CONSOLE**

Incorporating twin BBR type turntables and Sonotone or Acoos Cartridges with diamond styl. Separate Vol. controls for each turntable. Also **MONITORING FACILITIES**, plus Treble and Bass Controls. Separate input for 'mike' with vol. control. Black Vynide covered Cabinet with lid. Or DEP. £18.49 and 18 fortnightly pymts. £8.11 (Total £128.47) Carr. £1.50

**£109-95**

**TD2S STEREO VERSION OF ABOVE** Terms DEPOSIT £20 and 18 fortnightly payments £8.99 (Total £144.02) Carr. £2.00

**£125-00**

**40 WATT SYSTEM £99-95. 200 WATT SYSTEM £209.95** WRITE OR PHONE for Free catalogue

**OTHERS UP TO 300 WATTS AT UNBEATABLE PRICES**

**DISCOMAJOR TWIN TURNTABLE POWER CONSOLE - £129-95**

Twin Full size BBR turntables. Sonotone or Acoos Cartridges with Diamond Styl. Facilities as TDI Console but with built-in 100 watt Power Amplifier complete with lid. Terms: Deposit £19-95 and 18 fortnightly pymts. £7-08 (Total £146.49) Carr. £2-50

**STEREO VERSION £179-95** Carr. £3 or Deposit £28-95 and 18 fortnightly pymts £9-79 (Total £201-55)



**RSC PHANTOM 50 COMBO AMP. £69-95**

Rating 50 watts. 3 inputs, 2 vol. controls—Bass, Treble Presence. Carr. £1-50 Suitable for Lead or Rhythm Guitar, mic., Radio, Tape etc. Inc. High Flux 12" 50W Speaker. Dep. £10-95 & 8 monthly payments £8-71 (Total £80-68).



**100W POWER (SLAVE) AMP** Suitable for use with DISCO-Consoles. Also for increasing output of lower-powered Amp. Dep. £9-00 and 8 mthly pymts of £6-05 (Total £57-40) Carr. £1

**£49-95**

**100 + 100W MODEL £69-95** Carr. £1-50



**TITAN TA/50A 50W AMP.** Solid state, 3 sep. controlled inputs plus Master control, Bass, Treble & Presence Controls. Vynide covered cab. with corner protectives. List price £60. Terms: Dep. £9 & 8 monthly payments £6-05 (Total £87-40), Carr. £1.

Matching Cabinet Spkrs. 1 x 12" £89-95 2 x 12" £49-95

**TITAN TA/100A 100W AMP.** **TWIN CHANNEL—4 INPUTS (NORMAL OR BRIGHT)**

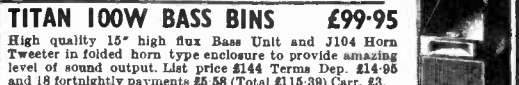
A De-lux professional unit with many facilities. R.M.S. Rating. Matching 2 x 12" 120w Cabinet speaker £69.95 Carr. £1-50

£69.95 Carr. £1-50



**TITAN 100W BASS BINS £99-95**

High quality 15" high flux Bass Unit and J104 Horn Tweeter in folded horn type enclosure to provide amazing level of sound output. List price £144 Terms Dep. £14-95 and 18 fortnightly payments £5-58 (Total £115-39) Carr. £3.



**FANE HIGH POWER SPEAKERS**

Power ratings R.M.S. Cont. 2 YRS GUARANTEE

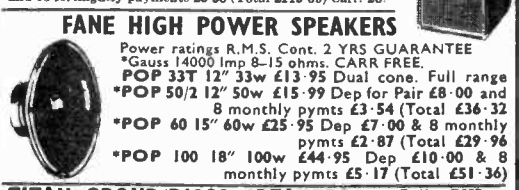
\*Gauss 14000 Imp 8-15 ohms. CARR FREE.

\*POP 33T 12" 33w £13-95 Dual cone. Full range

\*POP 50/12" 50w £15-99 Dep for Pair £8-00 and 8 monthly pymts £3-54 (Total £36-32)

\*POP 60 15" 60w £25-95 Dep £7-00 & 8 monthly pymts £2-87 (Total £29-96)

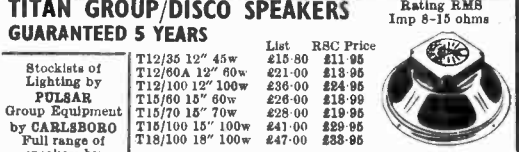
\*POP 100 18" 100w £44-95 Dep £10-00 & 8 monthly pymts £5-17 (Total £51-36)



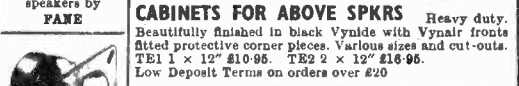
**TITAN GROUP/DISCO SPEAKERS GUARANTEED 5 YEARS**

Rating RMS Imp 8-15 ohms

Stockists of Lighting by PULBAR Group Equipment by CARLSBORO Full range of speakers by FANE	List	RSC Price
T12/35 12" 45w	£15-80	£11-95
T12/60A 12" 60w	£21-00	£13-95
T12/100 12" 100w	£36-00	£24-95
T15/60 15" 60w	£26-00	£18-99
T15/70 15" 70w	£28-00	£19-95
T18/100 15" 100w	£47-00	£29-95
T18/100 18" 100w	£47-00	£35-95



**CABINETS FOR ABOVE SPKRS** Heavy duty. Beautifully finished in black Vynide with Vynal fronts fitted protective corner pieces. Various sizes and cut-outs. TE1 1 x 12" £10-95. TE2 2 x 12" £16-95. Low Deposit Terms on orders over £20



**TITAN TA/100C**

A combo version of TA/100 100 watt R.M.S. Amp. incorporating a fabulous Fane Crescendo 12" 100 watt spkr for really superlative results with Lead Guitar Carr. £5119-95

Or Dep £17-95 & 18 f'tly pymts £6-52 (Total £135-31)

**50W H.F. HORNS**

Imp 8 Ω Range 3-15 kHz. Very Sensitive. Complete with 2mtd non-elect. capacitor

£7-95 Pair for series wiring plus single 'X-over' unit £17-95



**INTEREST REFUNDED** on Credit Purchases settled in 3 months

**RSC TRANSFORMERS, L.F. CHOKES FULLY GUARANTEED.** Impreg. and interleaved where necessary.

**AUTO (STEP UP/STEP DOWN) TRANSFORMERS** 0-110/120v 200-230-250v. 80w. £2-90; 150w. £5-20; 250w £8-37; 500w £9-84.

**OUTPUT TRANSFORMERS**

Pentode 5000 or 7000 to 3 Ω £1-18; Push Pull 8w EL84 to 3 or 15 Ω £1-88; 12w 6V6 to 3, 8 or 15 Ω £2-61; 12w 6V6 to 3, 8 or 15 Ω £2-72; EL84 to 3 or 15 Ω 12w £2-61; Ultra Linear for Mullard 510 etc. £4-35; 18w. sect. wound 6L6, KT66 etc. £4-35; to 3 to 15 Ω £3-71; 20w. sect. wound EL34, 6L6, KT66 etc. to 3 or 15 Ω £6-37.

**L.F. CHOKES** 150mA. 7-10H. 250 Ω £1-28; 100mA. 10H. 200 Ω £1-10; 60mA. 10H. 400 Ω 41p.

**MIDGET CLAMPED TYPE 200-250v 50 Hz**

250v. (Or 250-0-250v) 60mA 6-3v. 2a. £1-75

**STD. UPRIGHT MOUNTING OR DBO/THERO**

250-0-250v. 100mA 6-3v. 4a. 0-5-6-3v. 3a. £4-35

300-0-300v. 130mA 6-3v. 4a. C.T. 6-3v. 1a. for Mullard 610 Amplifier £5-90

350-0-350v. 100mA 6-3v. 4a. 0-5-6-3v. 3a. £4-35

350-0-350v. 150mA 6-3v. 4a. 0-5-6-3v. 3a. £5-30

425-0-425v. 200mA 6-3v. 4a. C.T. 3v. 3a. £9-35

200mA 6-3v. 4a. 0-5-6-3v. 3a. £10-00

450-0-450v. 250mA 6-3v. 4a. C.T. 5v. 3a. £10-45

260-0-250v. 70mA 6-3v. 2a. 0-5-6-3v. 2a. £2-60

260-0-250v. 100mA 6-3v. 3-5a. £2-90

260-0-250v. 100mA 6-3v. 2a. 6-3v. 1a. £2-80

350-0-350v. 80mA 6-3v. 2a. 0-3-6-3v. 2a. £2-80

300-0-300v. 100mA 6-3v. 4a. 0-5-6-3v. 3a. £4-35

**FILAMENT OR TRANSISTOR POWER PACK**

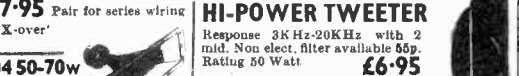
12v. 1a. £1-10, 6-3v. 1-5a. £1-06, 6-3v. 2a. £1-10, 6-3v. 3a. £1-70, 6-3v. 6a. £2-60, 12v. 3a. or 24v. 1-5a. £2-60 0-9-18v. 1 1/2a. £3-25, 0-12-26-42v. 2a. £3-19

**CHARGE TRANS** 0-9-15v. 1 1/2a. £2-03; 2fa. £2-25; 3a. £2-32; 5a. £2-84. 6a. £2-19; 8a. £3-48.

**HI-POWER TWEETER**

Response 3KHz-20KHz with 2 mtd. Non elect. filter available 50p. Rating 50 Watt

**£6-95**



**TITAN H.F. UNIT**

A super sensitive 8 Ω unit 70w Rating. 4-15 kHz. Use with pair 15 Ω 12" or single 8 Ω 15" Drive unit. Carr 75p

**£27-95**



**FAL SOUND-TO-LITE UNIT £21-60 COMPLETE SYSTEM £58-95**

Incl. 2 Spotbanks and built



**JINGLE MACHINES from £37-95**

**ECHO CHAMBERS from £49-95**

**COLUMN SPEAKERS from £29-95**

**GROUP/DISCO SPKRS £11-95** in CABINETS from



**New Branches at HANLEY WOLVERHAMPTON, YORK, LIVERPOOL**

OPEN ALL DAY SATURDAYS (5 Day Week)

BRADFORD 10 North Parade (Closed Wed.). Tel. 25349

BOLTON 23 Deansgate. (Closed Wed.). Tel. 33512

BIRMINGHAM 30/31 Great Western Arcade. Tel. 021-236 1279 (Closed Wed.).

CARLISLE 8 English Street. (Closed Thurs.). Tel. 38744

COVENTRY 17 Shelton Sq., The Precinct. Tel. 25983

DERBY 97 St. Peter's Street. (Closed Wed.). Tel. 41361

DARLINGTON 19 Northgate (Cl. Wed.). Tel. 68043

DEWSBURY 9/11 Kingsway (Closed Tues.). Tel. 468058

DONCASTER 3 Queensgate. Waterdale Centre. (Closed Thurs.). Tel. 63061

EDINBURGH 101 Lothian Rd. (Cl. Wed.). Tel. 229 8501

GLASGOW 326 Argyle St. (Cl'd Tues.). Tel. 248 4158

HANLEY, Stoke-on-Trent, 44 Piccadilly

HULL 7 Whitefriargate (Closed Thurs.). Tel. 20508

LEICESTER 32 High Street (Closed Thurs.). Tel. 56420

LEEDS 5-7 County (Mecca) Arcade, Briggate (Closed Wed.). Tel. 458252

LIVERPOOL 35 Dawson's Way, St. John's Shopping Centre Tel: 708 9380 (Cl. Wed.).

LONDON 238 Edgware Road, W.2. (Closed Thurs.). Tel. 723 1829

MANCHESTER 60A Oldham Street (Closed Wed.). Tel. 236 2778

MIDDLESBROUGH 103 Linthorpe Rd. Tel. 210555 (Closed Wed.)

NEWCASTLE UPON TYNE 59 Granger St. (Closed Wed.). Tel. 21469

NOTTINGHAM 19/19A Market Street (Closed Thurs.). Tel. 48068

PRESTON 41 Friargate Walk, St. Georges Shoppg Prec. Tel. 51870

SHEFFIELD 13 Exchange Street (Castle Mkt. Bldg.) (Closed Thurs.). Tel. 20710

STOCKPORT 8 Little Underbank (Closed Thurs.). Tel. 480-0777

SUNDERLAND 5 Market Sq. (Closed Wed.). Tel. 70873

WOLVERHAMPTON 6, Wolfrun Way (Closed Wed.). Tel. 34355

YORK 5 Church St. (Closed Wed.)

Barclaycard & Access PHONE ORDERS quoting CARD NO. accepted

All items subject to availability. Prices correct at 25.1.77 B. & O.E.

MAIL ORDERS & EXPORT ENQUIRIES TO: AUDIO HOUSE, HENCONNER LANE, LEEDS, 18. Tel: 0532 577631. MAIL ORDERS MUST BE SENT TO SHOPS TERMS O.W.O. or O.O.D. No O.E.D. under £1. POSTAGE 40p PER ORDER OR AS QUOTED. PHONE OR WRITE FOR FREE CATALOGUE.



# Handy size Reels & Dispensers

## OF THE WORLD'S FINEST CORED SOLDER TO DO A PROFESSIONAL JOB AT HOME

Ersin Multicore Solder contains 5 cores of non-corrosive flux that instantly cleans heavily oxidised surfaces and makes fast, reliable soldering easy. No extra flux is required.



### SAVBIT

handy solder dispenser

Contains 2.3 metres approx. of 1.22 mm Ersin Multicore Savbit Solder. Savbit increases life of copper bits by 10 times. Size 5 49p

For soldering fine joints

Two more dispensers to simplify those smaller jobs. PC115 provides 6.4 metres approx. of 0.71 mm solder for fine wires, small components and printed circuits. PC115 57p  
Or size 19A for kit wiring or radio and TV repairs. 2.1 metres approx. of 1.22 mm solder. Size 19A 53p



### handy size reels of SAVBIT, 40/60, 60/40 & ALU-SOL solder alloys

These latest Multicore solder reels are ideal for the toolbox. Popular specifications cover all general and electrical applications, plus a major advance in soldering aluminium. Ask for a free copy of 'Hints on Soldering' containing clear instructions to make every job easy.

Ref.	Alloy	Diam. mm	Length metres approx.	Use	Price
Size 3	40/60 Tin/Lead	1.6	10.0	For economical general purpose repairs and electrical joints.	£1.79
Size 4	ALU-SOL	1.6	8.5	For aluminium repairs. Also solders aluminium to copper, brass etc.	£2.42
Size 10	60/40 Tin/Lead	0.7	39.6	For fine wires, small components and printed circuits.	£1.79
Size 12	SAVBIT	1.2	13.7	For radio, TV and similar work. Increases copper-bit life tenfold.	£1.79



### BIB WIRE STRIPPER & CUTTER

Fitted with unique 8-gauge selector and handle locking device. Sprung for automatic opening. Strips flex and cable in seconds.

Pat. No. 1443913

Model 8B 86p

### SOLDER-WICK



Absorbs solder instantly from tags, printed circuits etc. Only needs 40-50 Watt soldering iron. Quick and easy to use. Non-corrosive.

Size 18 97p

Sole U.K. Sales Concessionaires:

### Bib Hi-Fi Accessories Limited,

Kelsey House, Wood Lane End, Hemel Hempstead, Herts. HP2 4RQ.

Prices shown are recommended retail, inc. V.A.T. From Electrical and Hardware Shops. In difficulty send direct, plus 20p P&P. Prices and specifications subject to change without notice.

## TECHNICAL TRAINING IN ELECTRONICS TELEVISION AND RADIO SERVICING

ICS can provide the technical knowledge that is so essential to your success, knowledge that will enable you to take advantage of the many opportunities open to the trained person. You study in your own home, in your own time and at your own pace and if you are studying for an examination ICS guarantee coaching until you are successful.

### City & Guilds Certificates:

- Telecommunications Technicians
- Radio, TV, Electronics Technicians
- Technical Communications
- Radio Servicing Theory
- Radio Amateurs
- Electrical Installation Work
- MPT Radio Communications Certificate

### Diploma Courses:

- Colour TV Servicing
- Electronic Engineering and Maintenance
- Computer Engineering and Programming
- Radio, TV, Audio Engineering and Servicing
- Electrical Engineering, Installation and Contracting

POST OR PHONE TODAY FOR FREE BOOKLET.

### ICS To: International Correspondence Schools

Dept. No. 777D, Intertext House, LONDON SW8 4UJ or telephone 622 9911

Subject of interest.....

Name .....

Address .....

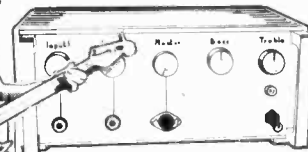
Tel: .....

## DORAM kits

DORAM KITS CONTAIN EVERYTHING DOWN TO THE LAST NUT!



### 50W PA/Guitar AMP



£29.95 + H

£29.95 + H VAT (Order code 997-011)

Subject to availability

Especially designed for general purpose use with guitars, PA systems etc. This amp will provide 50 Watts RMS into 8 ohms with harmonic distortion level as low as 0.15%. Robust case and load fault protection contribute to the rugged design, which incorporates an IC mixer/pre-amp (giving 2 separate inputs) and a thermally compensated power amplifier. Overall freq. response (-3dB) is 15Hz to 100KHz with sensitivity 30mV for full output and 52dB sig. to noise ratio.

O'seas orders--add 15% for P+P. All items offered for sale subject to the Terms of Business set out in Doram Edition 3 catalogue, price 60p. The Doram Kit brochure is also available, price 25p. Combined price only 70p which also entitles you to 2x25p vouchers, each one usable on any order placed to the value of £5.00 or more (ex. VAT).

DORAM ELECTRONICS LTD.

P.O. BOX TR8, WELLINGTON RD IND. EST., LEEDS LS12 2UF.

An Electrocomponents Group Company

# 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 equalization—Low noise—Low distortion—High overload—Two simply combined for stereo.

**APPLICATIONS:** Hi-Fi—Mixers—Disco—Guitar and Organ—Public address

**SPECIFICATIONS:**

**INPUTS:** Magnetic Pick-up 3mV; Ceramic Pick-up 30mV; Tuner 100mV; Microphone 10mV; Auxiliary 3-100mV; Input Impedance 4-7k $\Omega$  at 1kHz.

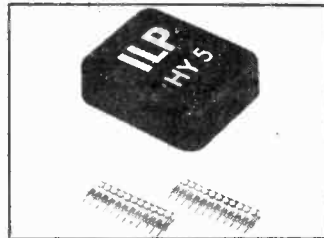
**OUTPUTS:** Tape 100mV; Main output 500mV R.M.S.

**ACTIVE TONE CONTROLS:** Treble  $\pm$  12dB at 10kHz; Bass  $\pm$  at 100Hz.

**DISTORTION:** 0-1% at 1kHz; Signal/Noise Ratio 65dB.

**OVERLOAD:** 38dB on Magnetic Pick-up. **SUPPLY VOLTAGE**  $\pm$  16-50V.

**Price** £5.22 + 65p VAT P&P free.



## HY30 15 Watts into 8 $\Omega$

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.

**SPECIFICATIONS:**

**OUTPUT POWER** 15W R.M.S. into 8 $\Omega$ ; **DISTORTION** 0-1% at 1-5W.

**INPUT SENSITIVITY** 500mV. **FREQUENCY RESPONSE** 10Hz-16kHz—3dB.

**SUPPLY VOLTAGE**  $\pm$  18V.

**Price** £5.22 + 65p VAT P&P free.

**Available  
June '76**

## HY50 25 Watts into 8 $\Omega$

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

**SPECIFICATIONS:** **INPUT SENSITIVITY** 500mV

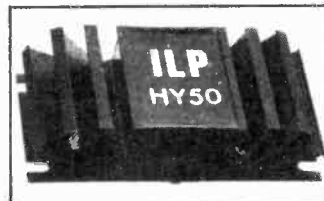
**OUTPUT POWER** 25W RMS into 8 $\Omega$  **LOAD IMPEDANCE** 4-16 $\Omega$  **DISTORTION** 0-04% at 25W

at 1kHz

**SIGNAL/NOISE RATIO** 75dB **FREQUENCY RESPONSE** 10Hz-45kHz—3dB.

**SUPPLY VOLTAGE**  $\pm$  25V **SIZE** 105 50 25mm

**Price** £6.82 + 85p VAT P&P free.



## HY120 60 Watts into 8 $\Omega$

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

**SPECIFICATIONS:**

**INPUT SENSITIVITY** 500mV.

**OUTPUT POWER** 60W RMS into 8 $\Omega$  **LOAD IMPEDANCE** 4-16 $\Omega$  **DISTORTION** 0-04% at 60W

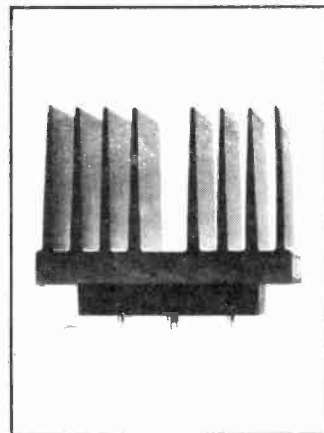
at 1kHz

**SIGNAL/NOISE RATIO** 90dB **FREQUENCY RESPONSE** 10Hz-45kHz—3dB **SUPPLY VOLTAGE**

$\pm$  35V

**SIZE** 114 50 85mm

**Price** £15.84 + £1.27 VAT P&P free.



## HY200 120 Watts into 8 $\Omega$

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

**SPECIFICATIONS:**

**INPUT SENSITIVITY** 500mV

**OUTPUT POWER** 120W RMS into 8 $\Omega$  **LOAD IMPEDANCE** 4-16 $\Omega$  **DISTORTION** 0-05% at

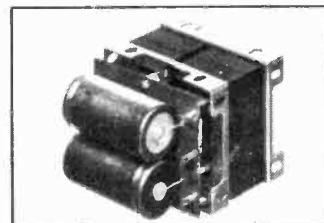
100W at 1kHz.

**SIGNAL/NOISE RATIO** 96 dB **FREQUENCY RESPONSE** 10Hz-45kHz—3dB **SUPPLY VOLTAGE**

$\pm$  45V

**SIZE** 114 100 85mm

**Price** £23.32 + £1.87 VAT P&P free.



## HY400 240 Watts into 4 $\Omega$

The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4 $\Omega$ ! It has been designed for high power disco 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

**SPECIFICATIONS:**

**OUTPUT POWER** 240W RMS into 4 $\Omega$  **LOAD IMPEDANCE** 4-16 $\Omega$  **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** £32.17 + £2.57 VAT P&P free.

PSU36 suitable for two HY30's £5.22 plus 65p VAT, P/P free.

PSU50 suitable for two HY50's £6.82 plus 85p VAT, P/P free.

PSU70 suitable for two HY120's £13.75 plus £1.10 VAT, P/P free.

PSU90 suitable for one HY200 £12.65 plus £1.01 VAT, P/P free.

PSU180 £23.10 + £1.85 VAT

BT £0.48 + £0.06 VAT.

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

## POWER SUPPLIES

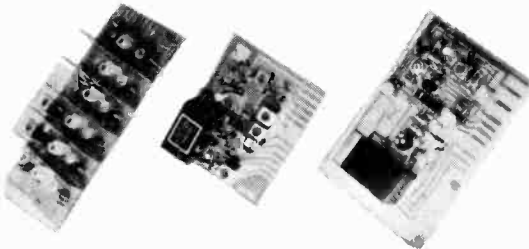
**I.L.P. Electronics Ltd.**  
**Crossland House**  
**Nackington, Canterbury**  
**Kent CT4 7AD**  
**Tel. (0227) 63218**

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 \_\_\_\_\_

# ambit INTERNATIONAL Trade Mark

The Wireless Specialists for components & modules.

EF5800, 7030 & 91196 - .9uV/30dB S/N., 0.2% THD  
Our top three FM tunermodules. (EF5800 shown with can off).



From left to right, the EF5800 6 circuit varicap FM tunerhead with the 7030 linear phase IF and the 91196 PLL stereo decoder with integral 55kHz 'birdy' filter. The system provides afc muting, meter drives, agc, auto stereo switch, & a specification that exceeds broadcast requirements. Now available with a new EF5801 tunerhead, with FET buffered oscillator output for synthesiser/frequency readout facilities.

EF5801..£17.45; EF5800..£14.00; 7030..£10.95; 91196..£12.99

Complete FM tuner kits/systems (Carriage £3 extra.)

*The Mark 8 Signalmaster - by Larsholt Electronics*

This tuner is based on the popular 7252 tunerset, and provides an incomparable combination of style and performance that can be built by even the relatively inexperienced constructor. Complete kit...£85.00; matching 25+25W amplifier...£79.00.

*International Mark 2 Tuner kits:*

Complete tuner kit, based around the 7253 tunerset, £65.00. Or just the chassis, cabinet, heavy aluminium front panel - for your own choice of modules- see our new info. leaflet on the International Tuner. (SAE please)

## NEW NEW NEW NEW NEW NEW NEW NEW BIONIC FERRET METAL LOCATOR

Ambit has designed a new approach to cost effective sensitive metal locators, and now we proudly present the first of the family of 'Bionic Ferrets'. Details OA, but we can say it will detect a 10p piece at 8-10 inches. Coupled with low power consumption and many innovations, this is the first radically advanced detector that can be made from a kit. £37.99

*Radio module selection: (Prices for kits in our catalogue & PL)*

EF5800	Ambit 6 stage varicap 88-108MHz tunerhead	£14.00
EF5600	TOKO 5 stage varicap	£12.95
EC3302	TOKO 3 stage varicap	£7.50
7020	Dual ceramic filter FM IF system module	£6.95
92310	MPX decoder, with stereo filter and preamp	£6.95
93090	MPX decoder with CA3090AQ + filter stage	£7.35
91197	MW/LW varicap AM tuner module	£11.35
771	New 'Off-Air' UHF varicap TV sound tunermodule with mute, AFC, dual conversion, PSU	£27.00
9014	MW/LW/Stereo FM tuner chassis, Mech. tuned	£26.00

*Components: ICs, coils, filters, trimmers, diode law pots etc.*

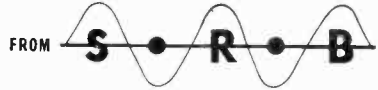
HA1137W/3089E	FM IF	1.94	TOKO AM IF TS:	
TBA120	FM IF and demod.	0.75	455/470kHz types	0.30
MC1350	FM IF preamp	0.97	10.7MHz types	0.33
SN76660N	FM IF and det.	0.75	(10mm square, with int. cap.)	
MC1310/4400	PLL MPX	2.20	455kHz Mechanical filters	
CA3090AQ	PLL MPX	3.75	4 or 7 kHz bandwidths	1.95
HA1196	PLL MPX	4.20	455kHz ceramic IF filters	
uA720	AM radio system	1.40	6 or 8 kHz bandwidth CFT	0.55
TBA651	AM radio system	1.81	SFD455 (Murata)	0.75
HA1197	AM radio system	1.40	455kHz dual ceramic CFX	1.80
LM1496	balanced mixer	1.25	10.7MHz filters for WBFM:	
11C90	600MHz decade ctr	14.00	3132A 6 pole lin phase	2.25
LM380N	2 W Audio	1.00	3125N 4 pole lin phase	1.30
LM381N	audio preamp st.	1.81	CFS ceramic filters:	0.50
TDA2020	20W audio amp	2.99	Pilot tone (MPX) filters:	
TCA940	10W audio amp	1.80	BLR3107N stereo	1.90
NE723	voltage reg IC	0.80*	BLR2007N	1.95
TDA1412	12v 600mA reg	0.95*	BLR3152/mono	0.97
78M20	20v 500mA	1.20*	BLR3172N tape bias trap, with	0.97
TAA550B	varicap regulator	0.50*	85 or 100kHz pole	0.97
NE560/1/2B	PLL ICs	3.50*	various chokes etc. see price list	
ICL8038CC	function gen	4.50*		

22turn 100k diode law trim pots, with integral knob 40p  
270° rotary 100k diode law tuning pot 32p  
Also.....meters for tuners, AM tuning varicaps, MOSFETs etc....

post/packing 22p per order - except where indicated  
General: All prices shown here exclude VAT, which is generally 12½%. (Except where marked\*). The latest price leaflet is available FOC with an SAE. Please send a (large) SAE with any enquiries. Full catalogue still 40p.

37 High Street, Brentwood, Essex. CM14 4RH.  
TELEPHONE (0277) 216029 - after 3pm if possible please.

## INTRODUCING



### A New Miniature Soldering Iron

220 - 240 Volts  
16 - 18 Watts

Insulation tested at 1500 V ac

with  
**7★**  
FEATURES

BIT TYPE

19 1.5mm

20 3.0mm

21 4.5mm

22 6.0mm

★ Lightweight

★ Slim, easy to hold

★ Four tip sizes

★ Complies with Consumer Protection Regulations B.S. No 3456 2/14

★ All parts easily replaced

★ New bit securing method

★ Built in suspension hook

As  
Advertised  
on TV

PRICES: IRONS £3-70 each  
BITS 41p each

Trade enquiries welcome.

Cheques & Postal Orders to Manufacturers & Distributors

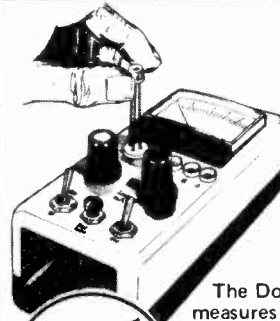
**S. & R. BREWSTER LIMITED**

86-88 UNION STREET, PLYMOUTH, PL1 3HG

Telephone: 0752 65011

## Doram kits

DORAM KITS CONTAIN  
EVERYTHING DOWN TO  
THE LAST NUT!



### TRANSISTOR TESTER

CUT-OUT THE  
GUESSWORK!

£9.95  
+ S

The Doram Transistor Tester measures  $h_{FE}$  and leakage for PNP or NPN transistors; Silicon or Germanium. TO5 socket, TO18 socket, flying leads and battery check facility inc

COMPLETE WITH CASE AND BATTERY  
(Order code 991-990) Subject to availability

O'seas orders—add 15% for P+P. All items offered for sale subject to the Terms of Business set out in Doram Edition 3 catalogue, price 60p. The Doram Kit brochure is also available, price 25p. Combined price only 70p which also entitles you to 2x25p vouchers, each one usable on any order placed to the value of £5.00 or more (ex. VAT).

DORAM ELECTRONICS LTD.  
P.O. BOX TR8. WELLINGTON RD. IND. EST. LEEDS LS12 2UF

An Electrocomponents Group Company



## RETURN OF POST MAIL-ORDER SERVICE

### R.C.S. 100 watt MIXER/AMPLIFIER ALL VALVE CHASSIS



Four inputs. Four way mixing, master volume, treble and bass controls. Suits all speakers. This professional quality amplifier chassis is suitable for all groups, disco, P.A., where high quality power is required. 5 speaker outputs. A/C mains operated. Slave output. Produced by demand for a quality valve amplifier. Send for details. Suitable carrying cabinet £14. Price **£85** carr. £2-50

### ANOTHER R.C.S. BARGAIN!

ELAC 9 + 5in. HI-FI SPEAKER TYPE 59RM  
This famous unit now available, 10 watts, 8 ohm.

Price **£3-25** Post 40p

### 10" ELAC HI-FI SPEAKER



Large ceramic magnet. 50-18,000 cps. Bass resonance 55 cps. 16 ohm impedance. 10 watts.

Post40p **£4-45**

### TEAK VENEER HI-FI SPEAKER CABINETS

MODEL "A". 20 x 13 x 12in.  
For 12 in. dia. or **£13-50** Post 85p.  
Illustrated

MODEL "B".  
For 13 x 8in. or **£7-50** Post 75p.  
8 in. speaker

### R.C.S. ROSEWOOD SPEAKERS

Size 12in. x 9in. x 5in.  
Response 50 to 14,000 cps  
8 watts rms 4 or 8 or 16 ohms.  
**£12 pair** Post 75p

LOUDSPEAKER CABINET  
WADDING 18in. wide, 20p ft.



### GOODMANS CONE TWEETER

3 1/2 in. diam. 18,000 C.P.S. 25 WATTS 8Ω **£3-25**  
8 inch woofer 15 watts 8Ω-75.

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt battery operated. **£5-75**



STEREO VERSION OF ABOVE £7-50.

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated. Mains Supply £2-95.

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER. Suitable for cassette, and all sizes of tape reels. A.C. mains 200/240V. Leaflet S.A.E. **£4.25** Post 40p



### WAFER HEATING ELEMENTS THIN

OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10 1/2 x 8 1/2 x 1/4 in. Operating voltage 200/250V. a.c. 250 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopiers and print drying equipment.  
Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails—ideal for airing cupboards. Ideal for anti-frost device for the garage preventing frozen radiators or acting as oil rump heater. Use in greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

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

### BAKER MAJOR 12" £14-95



Post £1  
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 16 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£18-95**

Please state 4 or 8 or 16 ohms. Post £1-60

### BAKER SPEAKERS "BIG SOUND"

Robustly constructed to stand up to long periods of electronic power. As used by leading groups. Useful response 30-13,000 cps. Bass resonance 55 cps.

GROUP "25" **£11-95**  
12in 30 watt  
4, 8 or 16 ohms. Post £1

GROUP "35" **£13-95**  
12in 40 watt  
4, 8 or 16 ohms. Post £1

GROUP "50/12" **£20-95**  
12in 60 watt professional model, 8 ohms or 16 ohms. Post £1-60  
With aluminium presence dome.

GROUP "50/15" **£24-95**  
16in 75 watt  
8 or 16 ohms. Post £1-60



### BAKER 150 WATT QUALITY TRANSISTOR MIXER/AMPLIFIER

Professional amplifier using advanced circuit design. Ideal for disco, groups, P.A. or musical instruments. 4 inputs 4 way mixing. Master treble, bass and volume controls. 3 speaker output sockets to suit various combinations of speakers. 4 to 16 ohm. Slave output. A/C mains. Guaranteed. Details S.A.E. 150w SLAVE £60  
Latest 50 watt Model **£49** Carr. £1-00



100 WATT DISCO AMPLIFIER CHASSIS  
MADE BY JENNINGS MUSICAL INSTRUMENTS **£52**  
4 speaker outputs, vol., treble, bass controls  
CAN BE USED AS 100WATT SLAVE Carr. £1

B.S.R. SINGLE PLAYER DECK  
3 speed. Plays all size records. Stereo Cartridge. Cueing. Ideal Disco Deck **£13-50**

### QUALITY LOUDSPEAKER ENCLOSURE

Teak veneered 1/2 inch thick wood cabinet. Size 18 1/2 in x 18 1/2 in x 8 in. Weight 23lb. This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for 6 in. Woofer £6-95. Rosewood Version £8-95. Carr. £1-60. Baffle could be cut for larger speaker.



P.W. SOUND TO LIGHT DISPLAY  
Complete kit of parts with R.C.S. printed circuit. Three channels. 600 to 1,000 watts each. As featured in Practical Wireless. Price **£12-50**  
Cabinet extra £3.

8 inch PHILIPS LOUDSPEAKER  
4 ohm. 4 watt. ceramic magnet **£1-95**  
General purpose replacement unit.

MAINS TRANSFORMERS Post 50p  
6 VOLT 1 AMP. £1-00 3 AMP. £1-40  
12 VOLT 500 MA. £1-00 750 MA. £1-30  
30 VOLT 2 AMP. AND 34 VOLT 2 AMP. G.T. £2-45  
20 VOLT 1 AMP. £1-75 1 AMP. £2-00 3 AMP. £2-20  
30-0-30 VOLT 1 AMP. £2 30 VOLT 1 1/2 AMP. £1-75  
40 VOLT 2 AMP. £2-95. 0-30-40-0 VOLT 1 AMP. £2-50

E.M.I. TAPE MOTOR  
4 pole, 240 v. Size 3 1/2 x 2 1/2 in.  
1200 rpm. Spindle 1/4 in. diameter. 76v version £1. **£2** Post 45p

E.M.J. GRAM MOTOR  
240V a.c. 2,400 rpm  
2-pole. Size 2 1/2 x 2 1/2 in.  
Collaro gram motor 120v. 75p. **£1-25** Post 35p



### BAKER DISCO SPEAKERS HIGH QUALITY—BRITISH MADE 2 x 12" CABINETS

for Disco or PA all fitted with carrying handles and corners. Black finish. Other cabinets in stock. SAE For leaflet

**50  
WATT  
R.M.S.  
£50**  
Carr. £3

**70  
WATT  
R.M.S.  
£55**  
Carr. £3

**100  
WATT  
R.M.S.  
£69**  
Carr. £4



1 x 15" + 1 x 12" 100 WATT CABINET  
Size 36" x 24" x 15" **£75-00.** Carr. **£5**  
Ideal for Disco, Ogran or PA work.  
High quality. Full range.

### "SUPERB HI-FI"

12in 25 watts

A high quality loudspeaker. Its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.  
Bass Resonance 25cps  
Flux Density 18,500 gauss  
Useful response 20-17,000cps  
8 or 16 ohms models.

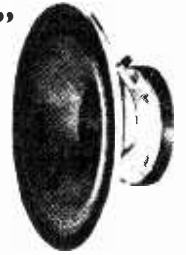


**£21-95** Post £1-60

### "AUDITORIUM"

12in. 35 watts

A full range reproducer for high power. Electric Guitars, public address, multi-speaker systems, electric organs. Ideal for Hi-Fi and Discotheques.  
Bass Resonance 35cps  
Flux Density 15,000 gauss  
Useful response 25-16,000cps  
8 or 16 ohms models.



**£20-95** Post £1-60

### "AUDITORIUM"

15in. 45 watts

A high wattage loudspeaker of exceptional quality with a level response to above 8,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home Hi-Fi.  
Bass Resonance 35cps  
Flux Density 15,000 gauss  
Useful response 20-14,000cps  
8 or 16 ohms models.



**£24-95** Post £1-60

Loudspeaker Cabinet Wadding 18in wide. 20p per ft.  
Hi-Fi Enclosure Manual containing plans, designs, crossover data and cubic tables, 68p

## RADIO COMPONENT SPECIALISTS 337 WHITEHOUSE ROAD, CROYDON

Open 9—6 Wed. 9—1 Sat. 9—5 (Closed for lunch 1-15-2.30)  
Access & Barclay cards welcome. Rail Selhurst. Tel. 01-484 1665

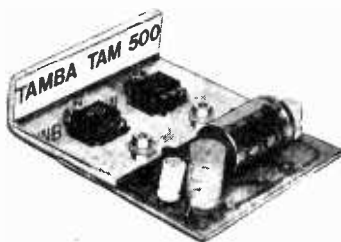
# TAMBA ELECTRONICS

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

## AMPLIFIER AND MIXER MODULES

## 25 WATTS — 100 WATTS RMS

TAM1000 100W 4 OHMS 65V	£9.80
TAM500 50W 4 OHMS 45V	£7.50
TAM250 25W 8 OHMS 45V	£4.75
<b>POWER SUPPLIES</b>	
For 1 or 2 TAM250/500	£7.50
For 1 or 2 TAM1000	£9.80
(Carr. 50p on supplies)	



## ALL PURPOSE MIXER/PREAMP

(WITH 60 mm SLIDER VOLUME)

- Anodised & printed facia
- Suitable for multiple input systems
- High & low impedance inputs
- High sensitivity
- Built in supply smoothing
- 20-20,000 hz ±1dB
- 80dB Noise level
- Accepts a wide variety of inputs
- Wide range bass & treble controls
- Use up to 10 preamps with 1 power

COMPLETE & TESTED assembly with Treble & Bass controls plus slider Volume Control. **£6.50**

- Suits loads 4-16 ohms
- 20-20,000 hz ±1dB
- Silicon circuitry throughout
- Glass fibre P.C.B.
- High sensitivity (100mV 10k)
- Low distortion (0.1%)
- Low profile (1" High 3 1/4" x 3")
- 75% efficient
- Accepts most mixer/preamps
- Four simple connections

High Grade Components used throughout: Texas, Mullard, R.C.A., Plessey, etc.

You may order as follows: C.W.O. (crossed cheques, P.O.s, M.O.s, etc.) C.O.D. (60p 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 12 1/2% for 25W units

Hours, 9.30 a.m.-5 p.m. Monday-Saturday. Callers welcome. Tel: (01) 684 0098

# TAMBA ELECTRONICS

BENSHAM MANOR ROAD PASSAGE, BENSHAM MANOR ROAD, THORNTON HEATH, SURREY

## LEKTROPACKS

17 Turnham Green Terrace, Chiswick, London, W.4. Tel: 01-994 2784  
★ NEW ★ FULLY GUARANTEED COMPONENT PACKS ★ FULL SPEC. SEMI-CONDUCTORS ★ AVAILABLE IN LOW COST PACKS OF TEN ★ ALL PRICES INCLUDE VAT AND U.K. POSTAGE ★ NO HIDDEN EXTRAS ★ TEN PACKS LESS 15%.

Price per 10	Price per 10	Price per 10	Price per 10	Price per 10	Price per 10
AC126 £1.50	BD131 £3.00	OA10 £2.00	TIP34B £14.00	2N2219 £2.20	
AC128 £1.20	BD132 £3.50	OA200 £0.80	TIP34C £15.30	2N2904 £2.00	
AC176 £1.20	BF194 £1.00	OA202 £0.80	TIP35A £13.50	2N2906 £2.50	
BC107 £1.00	BF195 £1.00	OA211 £2.50	TIP35B £14.50	2N2907 £2.00	
BC108 £1.00	BFY50 £2.20	OC71 £1.00	TIP35C £15.30	2N2926 £1.20	
BC114 £1.00	BFY52 £2.00	TIP29A £4.50	TIP36A £30.00	2N3053 £2.20	
BC126 £1.00	BFY90 £10.00	TIP29B £5.50	TIP36B £32.00	2N3054 £4.50	
BC147 £1.20	BFX29 £2.80	TIP29C £6.00	TIP36C £38.00	2N3055 £5.00	
BC148 £1.20	BFX84 £3.00	TIP30A £5.40	TIP41A £8.30	2N3643 £2.60	
BC168 £1.20	BFX87 £3.00	TIP30B £6.90	TIP42A £8.10	2N3702 £1.50	
BC182 £1.20	BFX88 £2.50	TIP30C £7.80	TXAL228B 3A	2N3703 £2.48	
BC183 £1.20	BY127 £1.20	TIP31A £5.50	400V Triac £9.50	2N3706 £1.20	
BC184 £1.20	BZ250 £1.00	TIP11B £6.90	1N914 £0.60	2N3707 £1.50	
BC212 £1.20	C106B £5.00	TIP31C £7.00	1N4003 £0.60	2N3819 £2.20	
BC213 £1.20	D30 Diac	TIP32A £6.80	1N4004 £0.70	2N3820 £2.50	
BC214 £1.20	£1.50	TIP32B £8.50	1N4005 £0.75	2N3904 £1.80	
BC237 £1.20	MFC4000	TIP32C £9.00	1N4006 £0.90	2N3905 £1.80	
BCY38 £10.00	£6.00	TIP33A £9.00	1N4148 £0.70	2N3906 £2.00	
BCY70 £2.20	MFP103 £3.00	TIP33B £11.90	2N706 £1.20	40360 £4.00	
BCY71 £2.00	MPF104 £3.00	TIP33C £13.00	2N708 £1.50	40361 £4.00	
BCY72 £2.00	NKT135 £2.00	TIP34A £13.50	2N930 £2.00	40362 £4.00	

SUB-MINIATURE PRESET POTS (horiz. or vert. P.C. Mounting) 10 for 50p. 50, 100, 250, 500, 1K, 2K, 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M, ohms.

THERMAL GAS SENSOR. Figaro TGS105 £2.25 each. As used in Sept. '76 P.E. Gas/Smoke Detector. Organ Constructors

### 13-NOTE BASS PEDAL BOARD

Hard wearing plastic covered steel levers. Change-over contacts on each note. Slightly shop-soiled therefore less than half price. £12.50 each Miniature Mains Transformers Prl. 240V a.c. Sec. 12V 150mA 10 for £5.75.

CELESTION 2in and 3in Tweeters. Suitable for systems up to 20W. Available in 4, 8, 16 ohms. Impedance £1.50 each. 2 for £2.90, 10 for £12.50. Crossover network suitable for above tweeters £1.50.

### WIRE ENDED ELECTROLYTICS

mF		Volts		mF		Volts	
4	64	10	63	47	10		
4.7	63	15	40	50	40		
5	50	22	10	64	64		
6.8	40	22	35	100	10		
10	12	33	40	100	16		
10	25	33	100	100	40		

### LOUDSPEAKERS

5" x 2" 3 Ω Celestion	£1.00 each
8" x 5" Elac 10W. 8 Ω	£3.50
8" Elac Twin cone 8 Ω	£4.25
10" Elac 10W. 8 Ω	£4.75

### BLANK CASSETTES

### AUDIO MAGNETICS

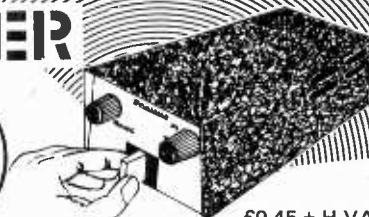
H.C.L.	Professional		Standard		Super		X.H.E.	
	1	10	1	10	1	10	1	10
C60	.70	6.50	.60	5.50	.96	8.90	1.33	11.00
C90	.95	8.50	.82	7.50	1.33	12.20	1.87	15.50
C120	1.24	11.50	1.00	9.20	1.84	15.00	2.24	18.50

## DORAM kits

DORAM KITS CONTAIN EVERYTHING DOWN TO THE LAST NUT!

## CMOS MORSE KEYER

£9.45 + H



£9.45 + H VAT

(Order code 997-049)

Fully electronic automatic morse keyer giving perfectly spaced dots and dashes of correct duration. Sidetone or silent operation with variable speed to suit novice or expert. Very low current drain on internal battery. Single paddle operation, suitable for most transmitters with a keying facility. Give your morse that precision quality.

Subject to availability

O' seas orders—add 15% for P+P. All items offered for sale subject to the Terms of Business set out in Doram Edition 3 catalogue, price 60p. The Doram Kit brochure is also available, price 25p. Combined price only 70p which also entitles you to 2x25p vouchers, each one usable on any order placed to the value of £5.00 or more (ex. VAT).

DORAM ELECTRONICS LTD.

P.O. BOX TR8. WELLINGTON RD. IND. EST., LEEDS LS12 2UF

An Electrocomponents Group Company

P.B. ELECTRONICS' OFFER TO PRACTICAL WIRELESS READERS

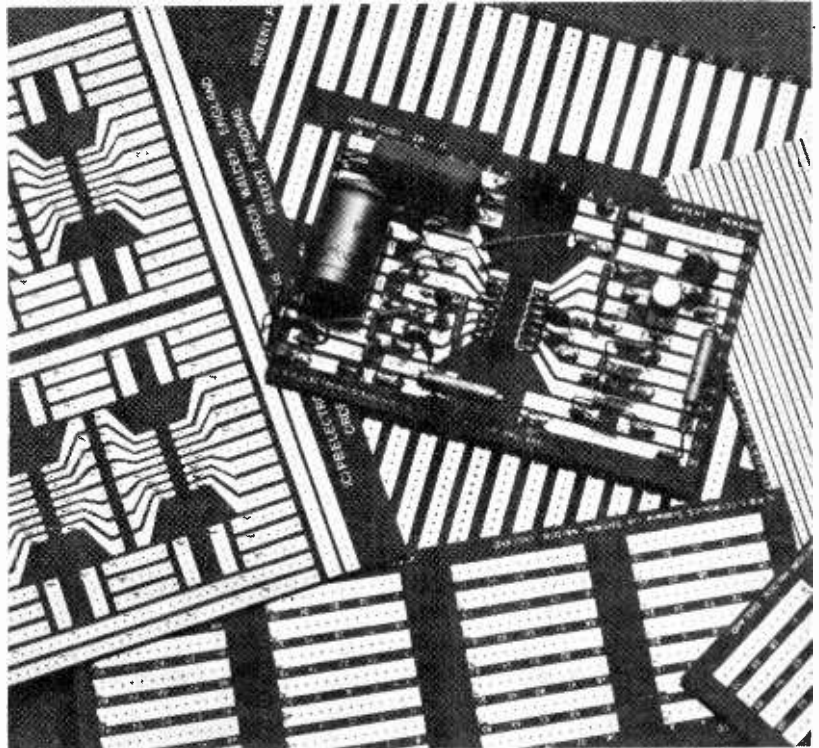
# BLOB BOARD OFFER

Save over 30% on this new experimenter's product from P.B. Electronics!

Blob Board is a superb new aid to the home constructor, it allows prototypes to be built quickly and accurately, without the need to work out complex component patterns first.

Normally half the price of previously competitive boards, they allow the user to go direct from circuit diagram to completed board in a matter of minutes and without the use of messy chemicals. Component layout can be drawn directly onto the Blob Board, with a felt-tip eliminating many of the errors which can occur in transferring from circuit diagram to ordinary PCBs.

Components can be re-used and re-soldered making circuit prototype modifications and amendments both fast and easy. All Blob Boards are roller-tinned to facilitate easy and reliable soldering, and are re-usable. The boards in this month's offer have been chosen to make up two packs—one for the I.C. experimenter, and one for discrete users. The savings are at least 30% on RRP—this on a price already very low, for such a useful tool.



## I.C. PACK

Comprises one of each:  
ZB11C (for one 16-pin I.C. pad, total area  $4\frac{1}{2} \times 3$ in.)  
ZB21C (for two 16-pin I.C. pads, total area  $4\frac{1}{2} \times 3\frac{1}{2}$ in.)  
ZB81C (for eight 16-pin I.C. pads, total area  $9\frac{1}{2} \times 7\frac{1}{2}$ in.)  
Regular Price: £2.66

**OFFER PRICE £1.79 inc**

## DISCRETE PACK

Comprises one of each:  
ZB1V (  
ZB5D (total area  $3\frac{1}{2} \times$   
ZB8D (total area  $9 \times 7\frac{1}{2}$ in.)  
Regular Price: £2.29

**OFFER PRICE £1.64 inc**

Send to:  
**BLOB BOARD OFFER**  
P.B. Electronics (Scotland) Ltd.,  
57 High Street,  
Saffron Walden,  
Essex  
CB10 1AA

Please supply me with . . . . I.C. PACKS (at £1.79 each) and . . . . . DISCRETE PACKS (at £1.64 each). In addition I enclose 30p postage irrespective of the number of packs ordered. I enclose my cheque/P.O. for £ . . . . .

Name .....

Address .....

.....

.....

Please allow 28 days for delivery



## SOLDERLESS BREADBOARDING—DECS

The famous DEC System of Solderless Breadboarding is ideal for both the young and more mature students of Electronic Engineering as it enables circuits to be tried and tested without the use of soldering and because of the specially designed contacts allows components to be used over and over again. It is also extremely useful for the Circuit Designer who wishes to experiment with and perfect his circuit quickly yet economically.

### S-DEC (Model PB11)

This, the most popular Board, is designed solely for the use of discrete components and is particularly useful for basic educational purposes.

(No. of Contacts: 70) 1 off £1-98  
5 off £1-76

### T-DEC (Model PB21)

This Board allows 2 TOS or 1 DIL IC Station to be used and so is primarily intended for discrete work or for linear IC application where considerable numbers of discrete components may be required.

(No. of Contacts: 208) 1 off £3-62  
5 off £3-21

### μ-DEC 'A' (Model PB31)

The μ-DEC 'A' is specially designed for ease of use with IC's and allows 2 DIL or 4 TOS stations to be used but will accommodate discrete components with equal facility.

(No. of Contacts: 208) 1 off £3-97  
5 off £3-53

### μ-DEC 'B' (Model PB41)

The μ-DEC 'B' is for similar uses as μ-DEC 'A', but has two 16 lead IC sockets as part of the Board.

(No. of Contacts: 208) 1 off £6-97  
5 off £6-19

### DEC ACCESSORIES

16 DIL adaptor (with socket) PB062	£1-92
10 TOS adaptor (with socket) PB072	£1-80
Single ended leads (set of ten) PB101	£0-90
Double ended leads (set of ten) PB102	£0-99
1mm plugs (set of ten) PB103	£0-45

All prices include 8% VAT. P. & P. 25p.

Our retail counter is now open, stocking a large variety of audio and electronic parts and accessories, branded and surplus.

WE ARE SITUATED 2 MIN. WATFORD JUNCTION STATION

## THE COMPONENTS CENTRE

7 Langley Road, Watford, Herts., WD1 3PS.

Tel.: Watford 45335

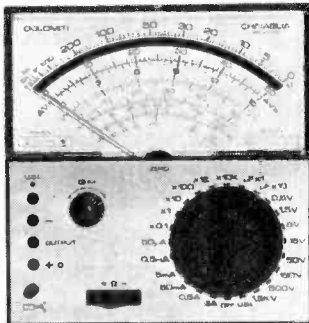
## CHINAGLIA DINO — ELECTRICAL AND ELECTRONIC TEST EQUIPMENT MANUFACTURERS

PRESENT THE

## DOLOMITI

20kΩ/V a.c. and d.c.

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



Accuracy: D.C. ranges, ± 2.0%, A.C. & Ω ranges ± 2.5%.

39 ranges: d.c. V, 0-150mV, 500mV, 1-5V, 5V, 15V, 50V, 150V, 500V, 1-5kV; d.c. I, 0-50 μA, 500 μA, 5mA, 50mA, 0-5A, 5A; a.c. V, 5V, 15V, 50V, 150V, 500V, 1-5kV; a.c. I, 5mA, 50mA, 0-5A, 5A; dB -10 to +65 in 6 ranges; Ω 0-0.5kΩ, 5kΩ, 50kΩ, 500kΩ, 5MΩ, 50MΩ; PF 50kPF, 500kPF.

Automatic overload protection and high current range fusing. Scale mirror and fine pointer for accuracy of reading. Single knob main range switching and all panel controls. C.E.I. Class 1 movement with sprung jewel bearings. Extended 92mm scale length for extra clarity. Compact ABS case 125 x 131 x 37mm. Weight 750g with batteries. Supplied complete with carrying case, fused leads, handbook and full 12-month guarantee. Optional 30kV d.c. probe available.

Meter £45-90 incl. VAT (£1 P. & P.)  
30kV Probe £ 12-85 incl. VAT

For details of this and the many other exciting Instruments in the Chinaglia range, including multi-meters, component measuring, automotive and electronic instruments please write or telephone.

# ALCON

19 MULBERRY WALK . LONDON SW3 6DZ TEL: 01-352 1897

# Sparkrite mk2

## Capacitive discharge electronic ignition kit

VOTED BEST OF 8 SYSTEMS TESTED BY 'POPULAR MOTORING' MAGAZINE OCT 74



- \* 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

Note—Vehicles with current impulse tachometers (Smiths code on dial RV1) will require a tachometer pulse slave unit. Price £3-35 inc. V.A.T. post & packing.

**POST TODAY!**

**Quick installation**  
No engine modification required

Electronics Design Associates, Dept., PW/4  
82 Bath Street, Walsall, WS1 3DE. Phone: (0922) 33652

Name .....  
Address .....

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





# WILMSLOW AUDIO

## THE Firm for speakers!

### SPEAKERS

Baker Group 25, 3, 8 or 15 ohms  
 Baker Group 35, 3, 8 or 15 ohms  
 Baker Group 50/12 8 or 15 ohms  
 Baker Group 50/15 8 or 15 ohms  
 Baker Deluxe 12" 8 or 15 ohms  
 Baker Major 3, 8 or 15 ohms  
 Baker Superb 8 or 15 ohms  
 Baker Regent 12" 8 or 15 ohms  
 Baker Auditorium 12" 8 or 15 ohms  
 Baker Auditorium 15" 8 or 15 ohms  
 Celestion G12M 8 or 15 ohms  
 Celestion G12H 8 or 15 ohms  
 Celestion G12/80 8 or 15 ohms  
 Celestion G12/50TC 8 or 15 ohms  
 Celestion G15C 8 or 15 ohms  
 Celestion G16C 8 or 15 ohms  
 Celestion HF1300 8 or 15 ohms  
 Celestion HF2000 8 ohms  
 Celestion MH1000 8 or 15 ohms  
 Celestion CO3K  
 Decca London ribbon horn  
 Decca London CO/1000/8 Xover  
 Decca DK30 ribbon horn  
 Decca CO/1/8 Xover (DK30)  
 EMI 14 x 9 Bass 8 ohms 14A770  
 EMI 8 x 5, 10 watt, d/cone, roll surr.  
 EMI 8 1/2" d/cone, roll surr. 8 ohms  
 EMI 8 roll surr. bass  
 EMI 5" mid range  
 EMI 59RM109 (15) 59RM114 (8)  
 EMI 8 1/2" d/cone, roll surr. 8 ohms  
 EMI 10" 10RM239 8 ohms  
 Eagle 3 roll surr. bass  
 Eagle Crossover 3000hz 3, 8 or 15 ohm  
 Eagle FR4  
 Eagle FR65  
 Eagle FR8  
 Eagle FR10  
 Eagle HT15  
 Eagle HT2  
 Eagle MHT10  
 Eagle FF28 multicell. horn  
 Fane Pop 15, 8 or 16 ohm  
 Fane Pop 33T, 8 or 16 ohm  
 Fane Pop 50, 8 or 16 ohm  
 Fane Pop 55, 8 or 16 ohm  
 Fane Pop 60, 8 or 16 ohm  
 Fane Pop 70, 8 or 16 ohm  
 Fane Pop 100, 8 or 16 ohm  
 Fane Crescendo 12A, 8 or 16 ohms  
 Fane Crescendo 12BL, 8 or 16 ohms  
 Fane Crescendo 16/100A, 8 or 16 ohms  
 Fane Crescendo 15/125, 8 or 16 ohms  
 Fane Crescendo 18, 8 or 16 ohms  
 Fane 910 Mk II horn  
 Fane 920 Mk II horn  
 Fane HPX1 crossover 200 watt  
 Fane 13 x 8, 15 watt dual cone  
 Fane 801T 8" d/c, roll surr.  
 Goodmans Acent 100  
 Goodmans Audiom 200 8 ohm  
 Goodmans Axilom 402 8 or 15 ohm  
 Goodmans Twinaxiom 8, 8 or 15 ohm  
 Goodmans 8P 8 or 15 ohm  
 Goodmans 10P 8 or 15 ohm  
 Goodmans 12P 8 or 15 ohm  
 Goodmans 12PG 8 or 15 ohm  
 Goodmans 12PD 8 or 15 ohm  
 Goodmans 12AX 8 or 15 ohm  
 Goodmans 15AX 8 or 15 ohm  
 Goodmans 15P 8 or 15 ohm

### SPEAKERS

£13-00 Goodmans 18P 8 or 15 ohm  
 £14-50 Goodmans Hifax 750P  
 £21-00 Goodmans 5" midrange 8 ohm  
 £25-75 Gauss 12"  
 £17-50 Gauss 15"  
 £15-00 Gauss 18"  
 £22-50 Jordan Watts Module 4, 8 or 15 ohm  
 £12-50 Kef T27  
 £21-00 Kef T15  
 £25-75 Kef B110  
 £12-95 Kef B200  
 £15-95 Kef B139  
 £18-00 Kef DMS  
 £20-00 Kef DN12  
 £28-95 Kef DN13 SP1015 or SP1017  
 £39-95 Lowther PM6  
 £7-50 Lowther PM6 Mk 1  
 £8-55 Lowther PM7  
 £13-50 Peerless KO10DT 4 or 8 ohms  
 £4-48 Peerless DT10HFC 8 ohms  
 £31-50 Peerless KO40MRF 8 ohms  
 £6-95 Peerless MT225HFC 8 ohms  
 £20-50 Richard Allan CA12 12" bass  
 £4-75 Richard Allan HP8B  
 £12-50 Richard Allan LP8B  
 £3-95 Richard Allan DT20  
 £3-95 Richard Allan CN8280  
 £6-75 Richard Allan CN820  
 £3-50 Richard Allan Super disc 60W 12"  
 £3-50 Richard Allen CG15 15" bass  
 £23-95 Richard Allen Super Disco 10" 50 watt  
 £3-95 Richard Allen Super Disco 8" 50 watt  
 £1-57 Radford MD9  
 £6-75 Radford MD6 dome mid range  
 £11-95 Radford TD 3  
 £14-95 Radford Crossover network  
 £18-50 BD25 Mk II  
 £4-50 Coles 4001 G & K  
 £23-50 Tannoy 10" HPD  
 £5-25 Tannoy 12" HPD  
 £7-50 Tannoy 15" HPD  
 £5-75 Castle 8 RS/DD

### SPEAKER KITS

£39-95 Fane Mode One Mk2 each £10-35  
 £16-95 Wharfedale Denton 2XP Kit pair £23-25  
 £4-25 Wharfedale Linton 3 x P Kit pair £34-25  
 £132-00 Wharfedale Glendale 3XP Kit pair £49-50

### HI-FI

## ON DEMONSTRATION in our showrooms

Akai, Armstrong, Bowers and 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! Carr.**  
 £2-50. Sansui 331 £114-00. Pioneer 7070 £199-00. Trio KR 2600 £109-00. Sugden A21 £130-00. Minimax MK II £46-95. Sansui SC 2000/2002 £160-00.

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.

### SPEAKER KITS

£42-95 Baker Major Module 3, 8 or 15 ohms each £18-00  
 £24-95 Goodmans DIN 20 4 or 8 ohms each £15-75  
 £84-95 Goodmans Mezzo Twin Kit pair £51-95  
 £75-95 Helme XLK 20 pair £17-50  
 £15-75 Helme XLK 30 pair £21-95  
 £45-95 Helme XLK 35 pair £26-75  
 £2-50 Helme XLK 40 pair £38-50  
 £5-50 KEF kit I pair £39-50  
 £8-95 KEF kit III pair £56-00  
 £8-50 Peerless 1060 pair £61-50  
 £14-95 Peerless 1070 each £54-95  
 £22-50 Peerless 1120 each £61-50  
 £10-60 Peerless 2050 pair £43-95  
 £6-50 Peerless 2060 pair £38-50  
 £6-95 Richard Allan Twin assembly each £13-95  
 £16-50 Richard Allan Triple 8 each £20-75  
 £17-75 Richard Allan Triple 12 each £25-95  
 £18-75 Richard Allan Super Triple each £28-50  
 £44-00 Richard Allan RA8 Kit pair £37-60  
 £49-00 Richard Allan RA82 Kit pair £39-40  
 £24-00 Richard Allan RA82L Kit pair £65-70

All Prices include VAT  
(Prices correct at 2.2.77)

Send stamp for Free 38 page booklet 'Choosing a Speaker'.

All units guaranteed New and Perfect. Carriage and Insurance:

Speakers up to 12" 60p  
 12" £1-00  
 15" £1-75  
 18" £2-50

Kits £1-00 each (£2-00 per pair)  
 Tweeters & Crossovers 33p each

# WILMSLOW AUDIO

Dept. PW

Loudspeakers, Mail Order and Export:  
 Swan Works, Bank Square, Wilmslow.  
 Hi-Fi, Radio & TV: Swift of Wilmslow  
 5 Swan Street, Wilmslow, Cheshire.  
 PA, Hi-Fi & Accessories: Wilmslow  
 Audio, 10 Swan Street, Wilmslow,  
 Cheshire.

Telephone:  
 Loudspeakers, Mail Order and Export  
 Wilmslow 29599

Hi-Fi, Radio, etc., Wilmslow 26213  
 (Access and Barclay Card orders  
 accepted by phone).

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

Construction leaflets for Radford, Kef, Jordan Watts, Tannoy, Hi-Fi On dem. Answers Monitor, State of Art, Free on Request.

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

FREE with orders over £10—"HiFi Loudspeaker Enclosures" Book











**A**MONG our constructional projects this month is a Gas/Smoke Sensor Alarm that is designed to give a visual and audio warning when the gas or smoke content of the atmosphere rises above a predetermined level. In view of the apparent spate of explosions around the country in recent times, frequently due to the leakage of natural gas, it might be thought that we are trying to 'cash-in' on other people's misfortunes.

Nothing could be further from the truth. The project was scheduled for publication in this issue several months ago. Observant readers may have noticed that issues with major projects in them are being interspersed with issues containing a number of smaller constructional designs. The Gas/Smoke Alarm is just one of those designs, among a number that we shall be presenting to our readers in the forthcoming months.

Should any of our readers make up this Alarm gadget then we sincerely hope that it never goes off! It's like an insurance policy, really. One pays and pays but hopes that the need to collect will never arise! On the other hand, the Dual Power Supply also presented in this issue is something that ought to be seen to be working all the time.

There is nothing more annoying than to finish an interesting and enjoyable project only to find that there are not enough batteries in the shack to get your pride and joy working. Our design comprises two completely independent supplies, each fully monitored for voltage and current output, which should prove to be just about the most useful bit of gear to have around.

On a slightly different tack, the generally forecast shortage of components, and the inevitable increase in prices for those that are available, should tend to favour the smaller electronic project in the future. Every constructor, if he is wise, soon begins to collect bits and pieces, in the way of capacitors, resistors etc and every nut and washer should be preserved. There are those among us who can remember stripping down government surplus radio and radar equipment after the last war and getting jars full of lovely cadmium plated bolts, washers, nuts and so on, plus many hundreds of various components, not to mention untold numbers of that elegant and ubiquitous valve, the EF50! They must have been produced by the million!

'Ah!' I hear you saying 'but we can't get that sort of stuff today'. No, maybe not, but is there a home, house, shed or attic in the land that does not have a discarded TV in some dark corner? But whatever you do, be careful when handling the tube, especially when removing it from the chassis. If tube is sound and you intend to use it again, all well and good, but if you are going to dispose of it to the dustman then place it face downwards in a substantial cardboard box and mark it accordingly. **DO NOT** try to break it yourself or the resulting implosion could cause injury to the eyes or face.

From then on it is an enjoyable few hours work, pulling the set to pieces and sorting the 'swag' into types of components as you go along. Later, every component ought to be checked for actual value before being used again. This is where a lack of test equipment begins to show up. One of the more instructive and rewarding of pastimes is the building and using of test gear because when there is something wrong with a component or circuit it needs a little brain work to find the fault and that is where the learning begins.

ERIC DOWDESWELL *Assistant Editor*

## SILENT KEY

Readers will be sorry to learn of the death of Austin Forsyth, OBE, G6FO, in his 70th year. He had been Editor of *Short Wave Magazine* since 1938

## Fair enough

**F**OLLOWING on from the story in the February issue concerning the cancellation of the 1976 Audio Fair, we are now pleased to see the return of this major event in 1977. Due to take place at Olympia from September 12th to the 18th, this latest show promises to be an even greater success than those in past years.

The organisers, Iliffe Promotions Ltd., say that "although the show will retain its appeal to the specialist audio and Hi-Fi enthusiasts, the 1977 Audio Fair will take account of the greatly increased family demand for sound and visual home entertainment".

Provisional bookings have already been taken up by such firms as BSR, Shure, National Panasonic, Eagle, Hitachi and JVC. It would appear that this is just the beginning of the list of exhibitors and that 'on the day' all the old firms, together with many new ones, will again be under the one Olympia roof.

*Audio Fair, Iliffe Promotions Ltd., Dorset House, Stamford Street, London SE1 9LU.*

## No free plugs for this product

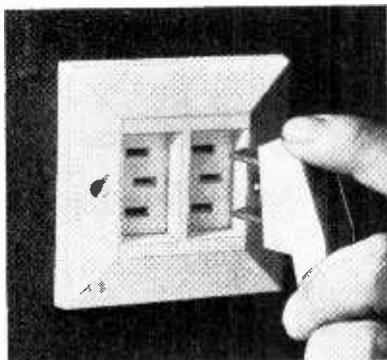
**W**HY is it that we British always seem to knuckle under to ideas and technical innovations, when all and sundry KNOW that our standards in the field of electrical safety are second to none? The point that we're getting at, is the recent revelation from those Barons of the EEC, that there will shortly be a new "World Plug", designed specifically to be compatible in any corner of the world. Fine ideas indeed you may say, but no amount of persuasion will convince these EEC commissioners and their bevy of technical advisers to incorporate a fuse within the plug. You see the plug is a 16A moulded de-

# NEWS...

# NEWS...

# NEWS...

vice with three in-line flat pins, permanently fixed to the lead and totally fuseless. This of course would mean that all equipment purchased would have to be fused in the unit itself, and



should you decide that you would like to keep your "antiquated" 13A system, recently installed at the expense of next year's holidays, you will be delighted to know that any new equipment would have to have its plug physically cut off and a new—sorry old—plug put on.

Another controversial, and in our opinion downright dangerous idea, is that generally, the sockets for these plugs will be without shutters, although the commissioners do state that "provision MAY be made in the UK for the use of shuttered socket outlets"—how thoughtful of them! Maybe if they do, we won't have a spate of dead children—the result of poking knitting needles and the like into the open holes. It's a pity we can't say the same thing for those unsuspecting French or German children. Still we suppose that the Commissioners have thought all about this—or have they?

This sort of situation epitomises the depths that our negotiators in Brussels have sunk to, and it's up to the general public and the electrically orientated press in this country to say STOP—ENOUGH—we know what's right, and we refuse to be browbeaten into accepting an expensive second-rate article.

## Tiny Tele!

FOR the past four or five years, rumours have been flying around thick and fast concerning the imminent appearance of a pocket sized TV. It's true to say that a couple were produced and shown to the Press, but were never marketed due to some fundamental design fault. There were also more, we are led to believe, that were never revealed to the Press, but were sent back to the "Drawing board" for a further re-think. However, Sinclair—possibly one of the leading exponents of the miniature electronics industry in this country, are now producing a truly tiny TV, which really is "Pocket" size—well large pocket size anyway!—and are claiming a World first.

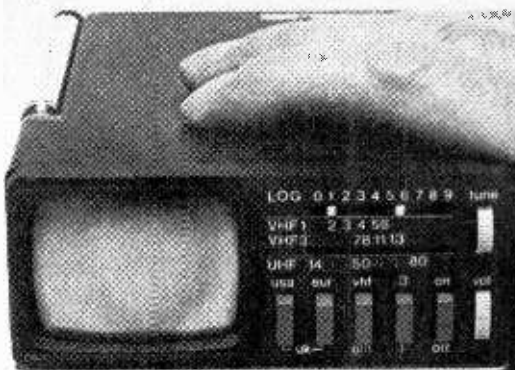
Called the Microvision, it's just  $6 \times 4 \times 1\frac{1}{2}$ in with a 2in screen, and is claimed to work just about anywhere in the Western World. It can tune in to any UHF or

VHF channel in bands 1, 3, 4 or 5 and consume less power than a large pen torch bulb—to be exact 750mW from 4 AA nickel cadmium rechargeable batteries. When fully charged, life is about 4 hours, with a 14-hour recharging cycle. Audio output is 50mW, while EHT to the tiny tube is 2kV.

The Microvision is the result, say Sinclair, of 12 years research and some £500,000 spent in development work alone. Readers may also remember that the NEB granted a large sum of money to Sinclair, which really does prove that some Civil Servants know a good thing when they see it!

Manufactured at Sinclair's Headquarters at St Ives, the Microvision is priced at \$300 in the USA or £175.00 plus VAT in the UK.

*Sinclair Radionics Ltd., London Road, St Ives, Huntingdon, Cambs PE17 4HJ. Tel: (St Ives) 0480 64646.*



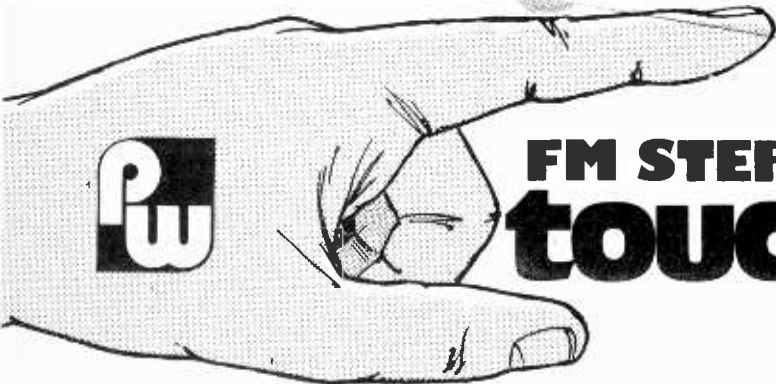
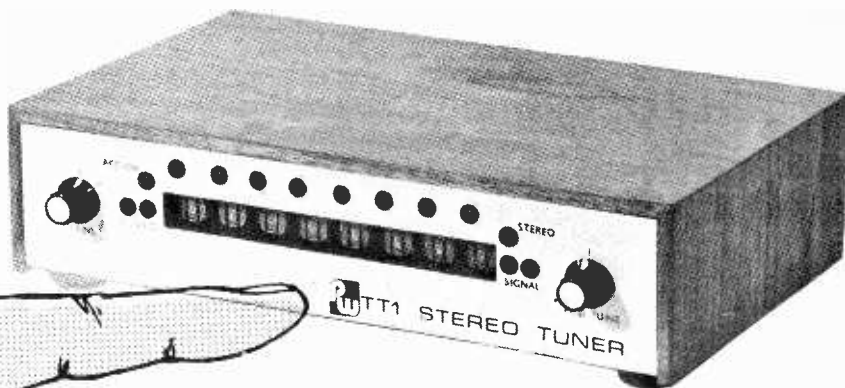
## Alex Marshall

IT IS with regret that we have to announce the death of Alex Marshall, founder of A. Marshall (London) Ltd. of Cricklewood Broadway, London, after a short illness. Mrs. Marshall is continuing the business with the same management staff.

## Sutton & Cheam RS

THE ANNUAL Dinner Dance, will take place on Saturday 19 March at the Woodstock Hotel, Morden when the guest of honour will be the President of the RSGB, the Lord Wallace of Coslany. Details from Bob Tillin G3MES, 11 Great Ellshams, Banstead, Surrey or telephone Burgh Heath 56095.

## Part 2



# FM STEREO touch tuner

FRANCIS HOW (B.A. Cantab)

## CONSTRUCTION

You may wish to construct the whole unit at one go and then test it, but you can run the risk of being faced with a totally baffling case of absolute silence at the end! The method to be described is a "build and test as-you-go" procedure which to some extent avoids this. Construction cannot be described as elementary, but neither is it particularly difficult. Be methodical in your approach and do not try to rush. First to be assembled is PCB1 according to the plan given in Fig. 5b. If you have not attempted PCB construction before, do not be afraid of making a start now. Follow the usual rules when mounting components; semiconductor connections are given in the drawings. With the board drilled as shown, the LP1186 and BLR3107 modules will only fit in one way round, as will L2. CF1 and CF2 may be mounted either way round. The relay may present a slight problem.

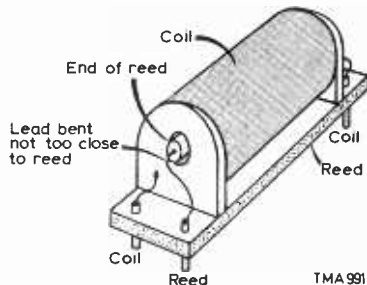


Fig. 6. Diagram of the reed relay assembly as used by the author.

Fig. 6 shows how the reed was mounted in the coil in the prototype, when a fairly standard type was used. If the relay used has different base connections, either it or the board will have to be suitably altered. Fig. 7 shows the heatsink for Tr1, which is mounted vertically as indicated. Note that

to avoid the tuner current passing through the fixing screws of the heatsink a separate lead is soldered between the heatsink and the PCB. Apart from the power input, aerial and output leads, and the tuning voltage lead to the tunerhead, leave all flying connections off at this stage, which makes initial testing considerably easier. Finally, check all wiring thoroughly against the diagrams.

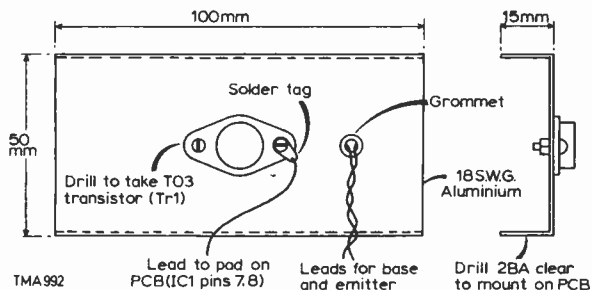


Fig. 7. Details of the heatsink for transistor Tr1, which is bolted on direct without any insulating kit. Avoid shorting the heatsink, which is at +25V, to earth.

Figs. 8 and 9 show the layouts for PCB2 and PCB3. Notice that PCB3 is not drawn full length; to each end of what is shown in the diagram should be added another 1 $\frac{3}{4}$ in of unetched board, making a total board length of 11in. On these unetched portions holes should be drilled to take the mains switch and fine tune control (both of which are bolted to PCB3). Brackets may be bolted on for fixing the completed assembly of PCB2 and PCB3 to the chassis bottom. The positions for these holes can be calculated from Fig. 10.

When mounting the LEDs observe that they lie on the copper side of PCB3, with their leads taken in a loop and back through the second set of holes provided on the board, for soldering. C45 to C52 must be bent flat on the board in order to leave clearance for mounting PCB2.

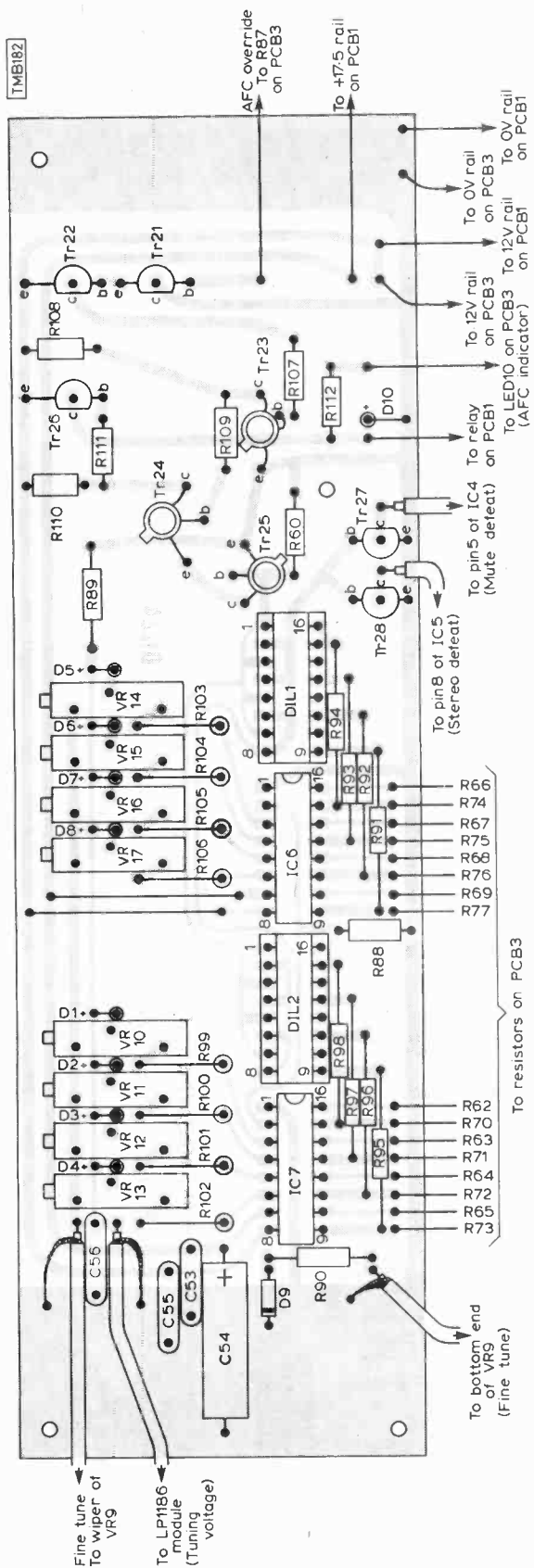
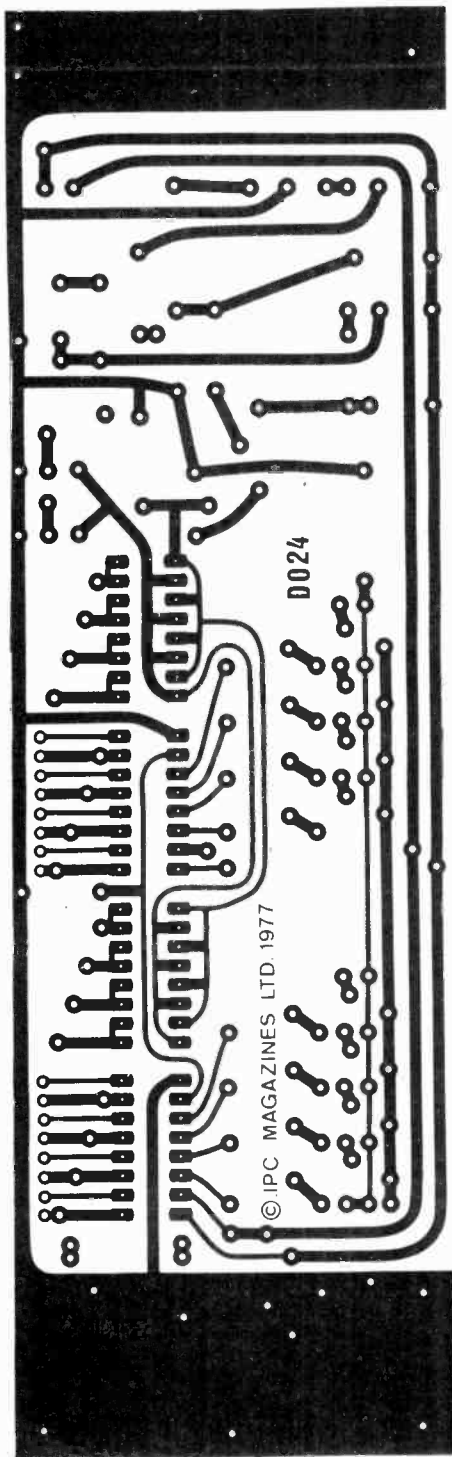


Fig. 8. PCB2 containing the touch and selection and AFC circuitry. The foil side, above, is shown full size with the component layout below. Before mounting any components on this board or on PCB3 it is a good idea to ensure that the mounting holes on the boards are coincident.

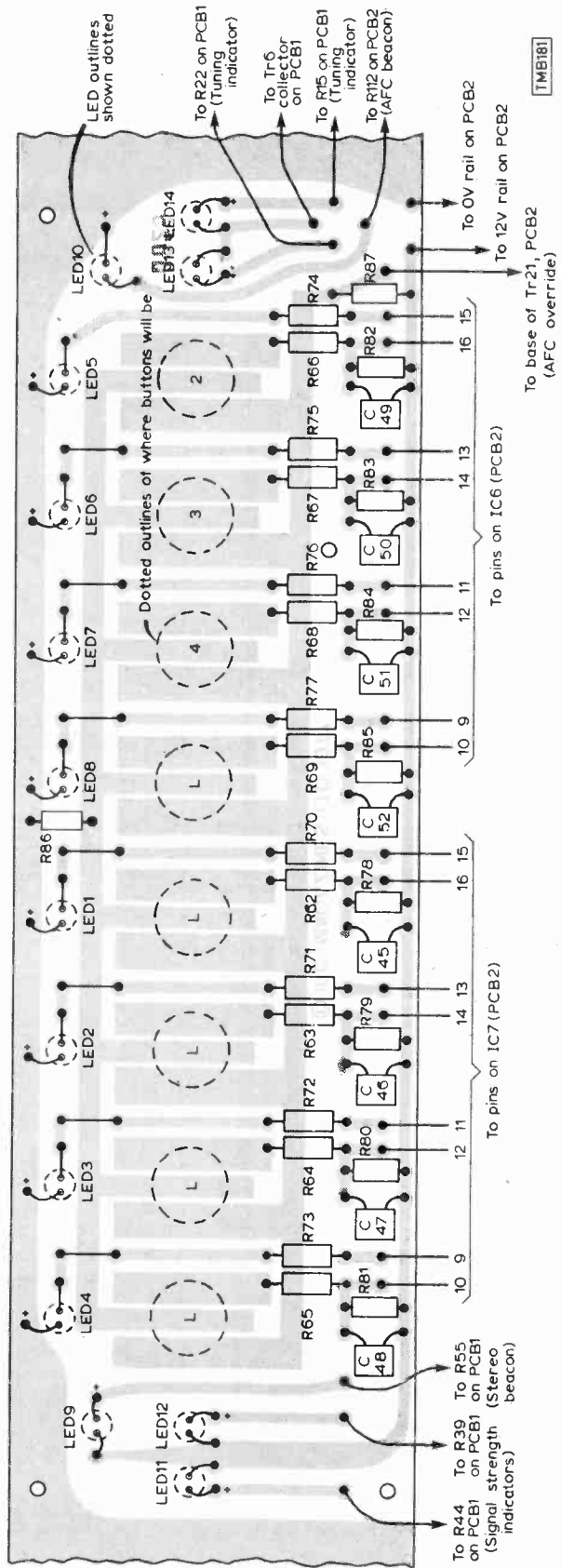
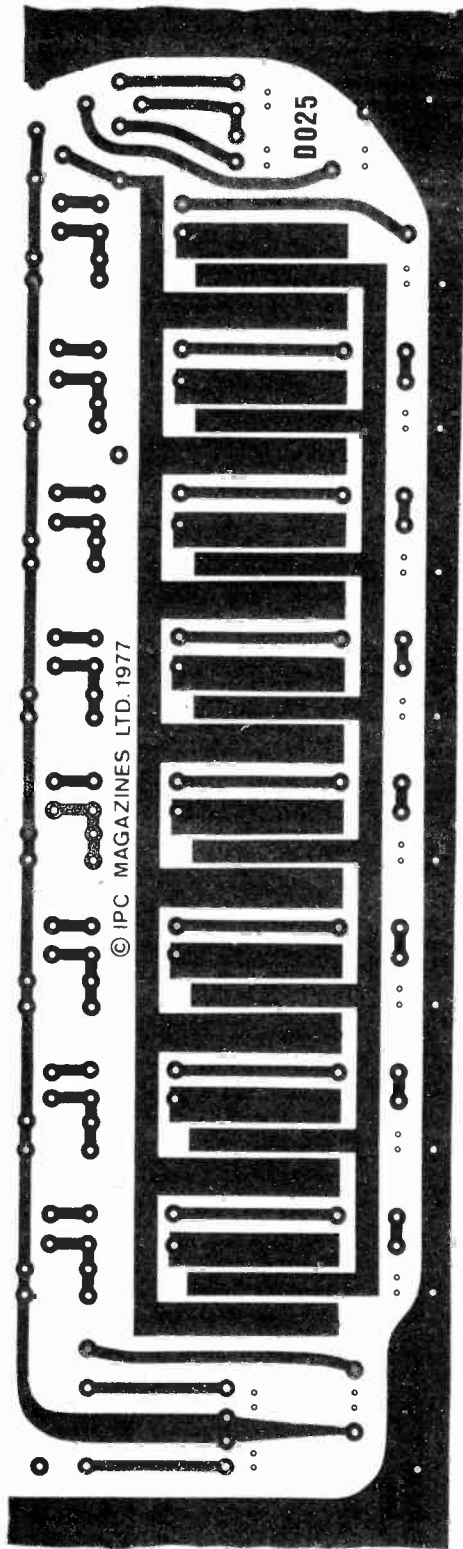


Fig. 9. Touch button board, PCB3. The etched part is shown above, full size, but the foil section either end is extended symmetrically to give an overall length of 280mm (11in). The component layout is shown below. Note that the LEDs are mounted on the copper side.



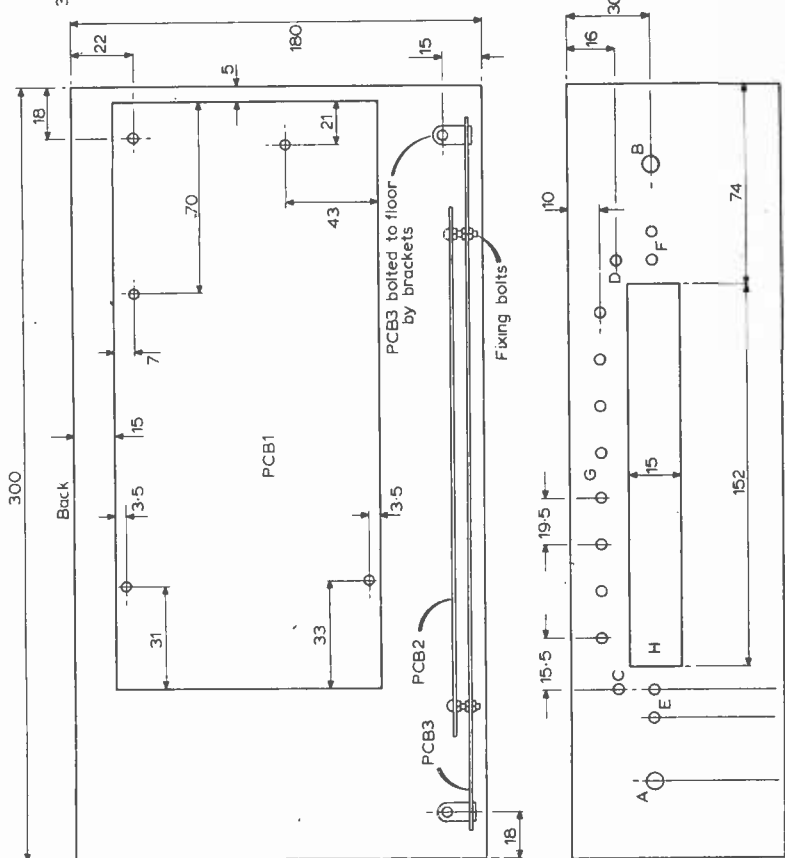
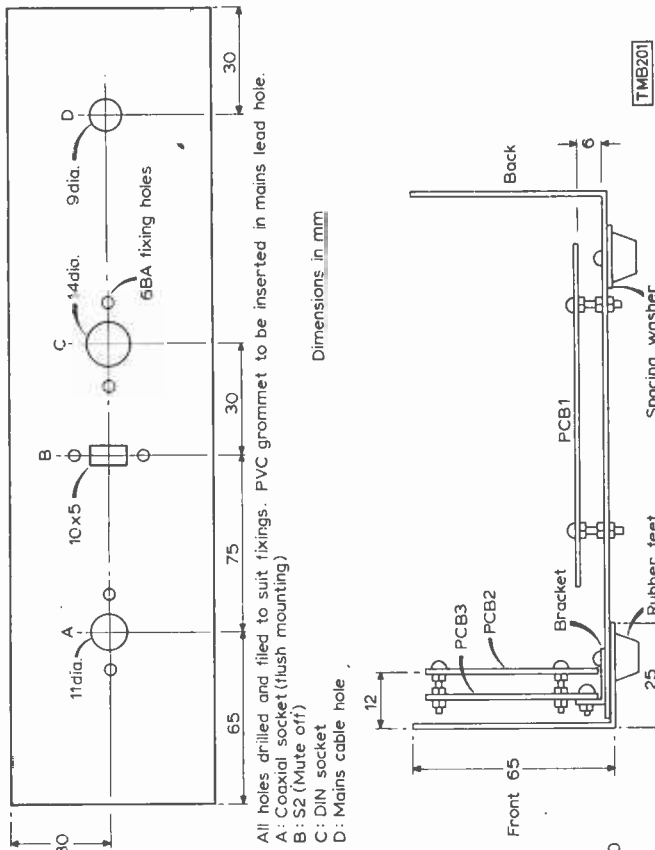


Fig. 11. Drilling details for the rear panel are given at the top, with an end view of the arrangement of the PCBs in the chassis. Note the two-piece construction of the chassis. **NOTE: Material for main chassis is 300 x 245mm and not as indicated in Components List.**

Photograph of the front panel of the Touch Tuner to show the way in which the foil side of PCB3 is painted to leave the touch 'buttons'.



Fig. 10. Details of the layout of the three PCBs on the metal chassis are shown at the top. The drilling and cutting information for the front panel is given below. Check hole sizes required from components actually used.

PCB2 itself is relatively straightforward to construct and assemble; use screened lead where indicated; this is important as wires carrying the tuning voltage are particularly likely to introduce hum into the system, which then appears at the output.

Next construct the first part of the chassis. It will be seen from Fig. 11 that the metalwork is made of 18SWG aluminium in two L-shaped pieces. One forms the back and bottom, the other the front panel with a 25mm (1in) flange for attaching it to the bottom. It is the first-mentioned piece which must be made now; cut, bend and drill as appropriate, making any alterations as necessary for the components actually used. For accurate drilling it is probably best to locate the positions of the holes for PCB1 by using the board as a template. Any treatment intended for the back panel such as labelling should be done now. The prototype was sprayed white, the lettering put on and then a very thin protective coat of polyurethane varnish sprayed on top. Allow adequate time for the paint to thoroughly harden off.

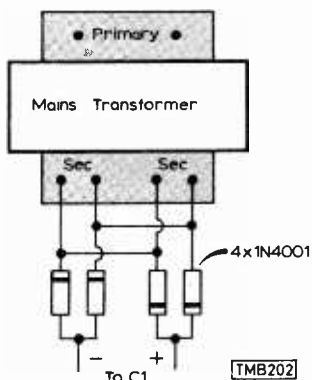


Fig. 12: Method of connecting the four 1N4001 diodes to the secondary tags of the mains transformer to form the bridge rectifier.

Now mount the switch S2, the sockets, the mains transformer and capacitor C1. If the recommended transformer is used, its windings should be wired in parallel and in phase Fig 12, and the four secondary tags may conveniently be used for soldering the diodes D11 to D14 into the circuit. Temporarily connect a mains supply direct to the transformer, connect C1 in circuit, and ensure that this unregulated supply gives about 35V. If all is well, PCB1 may be mounted on the chassis floor and the aerial, output, and power supply connections wired up.

## PRELIMINARY TESTING

Note that C57 and C58 are mounted directly on the DIN socket, not on PCB1. Wire in S2 but during testing leave it switched off (open circuit) until testing the mute circuitry. Leave the C1 end of the wire link on PCB1 between C1 and the rest of the board circuitry unconnected at this stage. Switch on and if all is well, Tr1, IC1 and IC2 should all remain cold; VR1 and VR2 are adjusted to give 12V at the output of the main supply regulator, and 17.5V from the tuning voltage regulator. Then connect a milli-ammeter across the broken link mentioned above, thus delivering power to the board. About 70mA should flow and the supply rail remain at 12V. See that none of the ICs or transistors are hot; all the ICs and Tr1 will be warm under normal

conditions. When satisfied, the link may be soldered in place.

Plug in an aerial and amplifier, and feed a tuning voltage to the tunerhead using the 17.5V supply and a 100kΩ potentiometer. With L2 adjusted so that the top of the core is one or two turns below the top of the screening can it should be possible to tune in a station. Adjust the core for maximum audio level (corresponding to maximum inter-station noise). Find a stereo transmission and adjust VR8 so that the decoder separates the two channels: if necessary an LED may be connected in place of LED9 between R55 and the 12V rail which will then illuminate when a station is being received in stereo. Check the voltages provided in Table 1. If at any stage it is suspected that something may be wrong, switch off immediately and check the circuitry.

TABLE 1

Test	Volts
Unregulated supply when loaded	22 to 26
Main supply	12
Tuning supply	17.5
Decoder supply (top of C40)	10.5
Detector supply (top of C23)	10
IF amp supply (top of C19)	9.5
Tunerhead supply (top of C18)	7.8
IC4 reference volts (pin 10, IC4)	5.6

(All measurements made with a 20kΩ/V voltmeter on 5 or 25V range as applicable).

Now attach all the leads to PCB1 not previously soldered in place, and connect all the wires leading between PCB2 and PCB3, and those between these two boards and PCB1 (the 100kΩ potentiometer used earlier is not now needed). Bolt PCB2 and PCB3 together and mount the assembly on the bottom of the chassis using two small brackets as indicated in Fig. 11. The four rubber feet should also be attached, and the mains switch S1 wired into circuit. The copper side of PCB3 is painted matt black all round the touch buttons (the positions of which are indicated in Fig. 10) so that above, below, and at the ends of the row of buttons a ¼in border of black exists. The copper-less lines in between the electrodes on each button should also be painted.

The stations should be labelled, from left to right, 2, 3, 4, L, L, L, L, L, (three BBC national stations and five local). This may be done either on the central electrodes (in which case a small covering of varnish should be placed over the letters if 'magic letters' are used, but not so as to cover the whole electrode which would then insulate it), or on the front panel underneath the buttons.

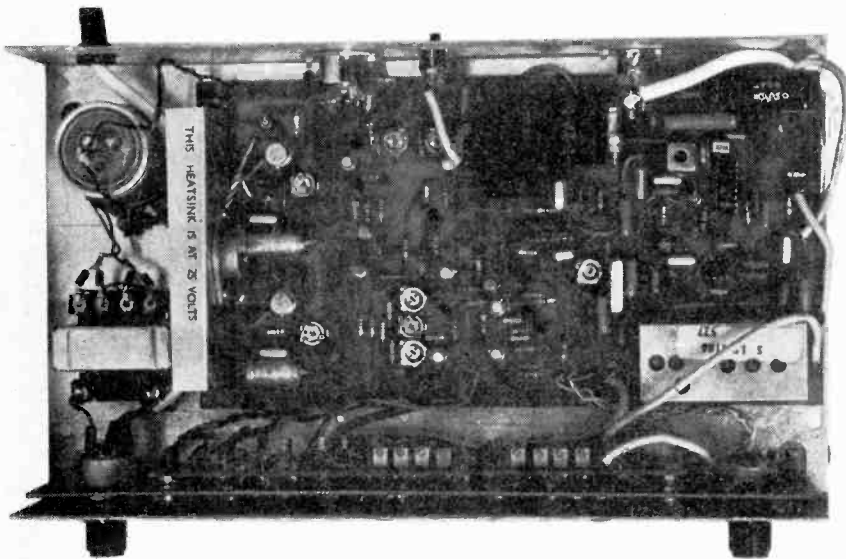
## SELECTOR TESTING

Now comes the station selector testing. Switch on once more and ensure that the two supply rails remain at their correct voltages (an indication that the circuitry is not taking too high a current). One of the station LEDs should be on, and touching other buttons should select the corresponding stations; try adjusting the tuning presets to see that they all tune the receiver satisfactorily. When a stereo broadcast is being received the stereo beacon should be illuminated.

To set up the switching levels of the signal strength and tuning indicator LEDs it is necessary to peak up the tuning of L2. Detune the receiver so that a station is just distorted, and connect a link across the reed contacts of relay, RLA. If the AFC is working, the station should return to tune. Connect a voltmeter across the reed contacts; set the fine tune control to its midway position and adjust a tuning preset so that a station is in tune (when no voltage should be read). Detuning the receiver with the fine tune control should give equal but opposite voltage variations when the control is moved to equal positions either side of the midway position. If not, adjust L2 and re-tune the receiver such that this is so. It should be possible to do this with variations up to about 3V, which will mean that the system is sufficiently well adjusted for use.

## AFC ADJUSTMENTS

Lastly the AFC override circuitry and the DIL socket defeat functions must be tested. During the above work, it will be found that when the tuning LEDs go off, the output is muted. Now insert a diode across pins 2 and 15 of DIL1, in the orientation shown in Fig. 4. The mute function should now be inoperative on Radio 2; that is, instead of the output being quiet when the tuning lights are extinguished, the station will gradually fade into a loud background hiss as the receiver is detuned. The station should also be permanently in mono. The same applies to diodes inserted across corresponding pairs of pins for other stations. Now similarly insert a diode between pins 1 and 16 on DIL1. Again select Radio 2, where the AFC should now be operative,



*View down on to the Touch Tuner with mains transformer and smoothing capacitor to the left, both bolted direct to the chassis. The Tr1 heatsink is at extreme left of main PCB while PCBs 2 and 3 are fitted behind the front panel. The longer of these two boards carries the fine tuning control and mains switch. The shorter board carries the eight station tuning potentiometers which can be clearly seen.*

Now place the voltmeter across R8. Turn VR5 fully anticlockwise and adjust VR3 and VR4 so that LED14 and LED13 switch on and off at voltages about 0.4V below and above the in-tune voltage respectively. Leaving the receiver exactly in tune, place the voltmeter on pin 13 of IC4, and adjust VR5, VR6 and VR7 so that LEDs 13 and 14 switch on at 2V, LED12 at 3V, and LED11 at 4.5V. Alteration of the voltage on pin 13 for this purpose may be done by de-tuning the receiver, but the best method is to remove the aerial and then slowly bring it up to the centre pin on the socket. When the receiver is tuned to a strong signal and the presets correctly adjusted the LEDs should progressively switch on as the signal strength is increased by the method outlined.

It is emphasised that all the LED adjustment should be done when the tuner is warmed up as the level indicator circuits are rather temperature-sensitive. Under normal operating circumstances the room temperature should not vary too much, but if it were to do so the voltages at which the LEDs switch on would vary considerably. With the signal level indicators set to the above values, when LED 12 is on the signal is strong enough for reasonable mono reception, and when both LED11 and LED12 are on then noise-free stereo reception should be possible.

signified by the fact that the sound remains clear and undistorted and the tuning indicators permanently on, over a considerable frequency range. At the extremes of this range the AFC will suddenly cease to operate and the station will be lost, denoted by the extinguishing of the tuning and signal strength LEDs. Try holding your finger on the Radio 2 button; it will need a firmer touch than when selecting a station, but the AFC should be rendered inoperative by this action, and the AFC beacon will go out. This permits accurate tuning of the station.

The same can be done for all the other stations by inserting a diode across the appropriate pins. Switching S2 to the off position will permanently defeat the mute function. This completes the electronics of the tuner and you can now insert diodes as required, and tune in the stations. The in-tune position is, of course, indicated by both tuning LEDs being illuminated. Although a simple piece of wire will suffice as an aerial in many cases, the benefits of a better arrangement are considerable when trying to receive high quality stereo broadcasts or signals from distant transmitters.

The last part of the work is to construct the front panel Fig. 10. As stated before, this is an L-shaped piece of aluminium (Fig. 11). Drill holes on the flange so that it may be fixed to the chassis bottom with the same bolts as are used to keep PCB2, PCB3

and the front rubber feet in place. Great care must be taken when cutting and drilling the front itself; there is considerable use of straight lines and symmetrical patterns which, if not strictly adhered to will mean that the panel will not coincide with the components on PCB3, and the appearance will be disastrous! Although positions are given in Fig. 10 for drilling the holes and cutting the slot it is strongly recommended that each hole is positioned with reference to the reader's version of PCB3. This means placing the panel in position against the LEDs (it may be necessary to remove the mains switch and fine tune control) and marking where the holes should be drilled on the inside of the panel.

Now drill each LED hole, one at a time; drill them only to 0.2in diameter and file out the hole to take the black clip. This way ensures that straight lines of LEDs are obtained. Similarly drill the holes for the spindles of the controls, and cut out the slot. Any painting and lettering intended should be done at this stage, removing the LED clips to do so, of course.

The prototype was treated in the same way on the front and back panels, as has already been described. When the paint has hardened, glue to the inside of the front panel, all round the slot, some 1/4in square balsawood rod, painted matt black. This will hide undesirable parts of the printed circuit from view and prevent reflections from the LEDs on the buttons.

A three-sided wooden sleeve was made for the tuner from teak veneered plywood. Simple tack and glue joints were used, with wooden fillets for strengthening the corners. Small 90° brackets were bolted to the inside of the sides so that when the sleeve was fitted on the chassis these brackets lay on the floor of the chassis. Self-tapping screws, put through holes in the floor from the underside, then held the brackets rigidly to the chassis.

## NOTES

Clearly there are faults that could be encountered during construction; the most likely cause is a wiring error. If the receiver has a background hum on some or all stations check the decoupling on the tuning voltage lines, both into IC6 and IC7, and from the presets which tune the stations. Also try reducing the main supply voltage a little; the system will work with as little as 9V.

It may be that some of the stations cannot be selected, or that the receiver sticks on one position and pushing other buttons has no effect. Moisture on the electrodes could cause the latter fault, although the former is more likely to be a wiring error. It should never be possible to simultaneously have two stations selected (unless you hold fingers on two buttons). When first switching on it may be that although a station light is illuminated, no sound is heard. This is normal for these ICs and touching that button will immediately bring the station into tune. PW

Please note the following amendments to Fig. 4 in Part 1.

1. The common line at the bottom of R78 to R85 and C45 to C52 should be shown as going to +12V.
2. LED20, in the collector line of Tr26, should be marked LED10.
3. Capacitor C53 is not polarised and should not be shown as an electrolytic.

next month in

# Television

## ● THE DECCA 80 CHASSIS

The Decca 80 chassis, released in early 1976, is representative of the latest approach to colour set design, featuring an in-line gun c.r.t. and extensive use of new i.c.s. Barry Pamplin describes basic circuit operation, fault diagnosis procedures and common faults. The first of two articles.

## ● CRT BOOSTER

A c.r.t. booster can save money and do wonders for a set displaying a dull picture. This design, by Andy Denham, can be used with both colour and monochrome tubes and can be built up using components from the spares box. Boosting should give a tube at least six months' extra life.

## ● HAVE YOU NOTICED ... ?

What's Les up to this time? His latest discourse on servicing experiences describes various failure patterns he has encountered time and time again.

## ● SCOPE TUBES

Oscilloscope tubes are constructed to meet quite different requirements from the normal receiver display tube. This can be confusing to anyone selecting a tube to build an oscilloscope around. 'Phosphor' describes basic scope tubes and the features they offer.

**MORE ON THE TV TELETXT  
DECODER AND ON BEOVISION  
COLOUR SETS ...**

**PLUS ALL THE REGULAR FEATURES**

**ORDER YOUR COPY ON THE FORM BELOW:**

TO .....  
(Name of Newsagent)

*Please reserve/deliver the APRIL issue of  
TELEVISION (45p), on sale MARCH 21st, and  
continue every month until further notice.*

NAME .....

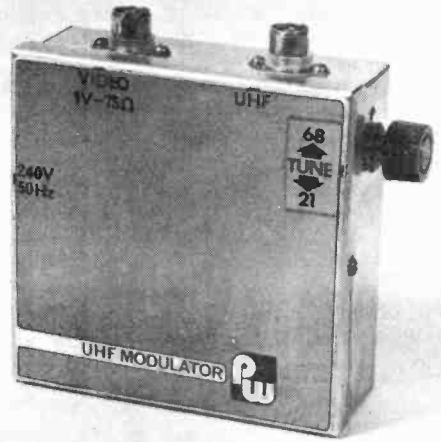
ADDRESS .....

.....

.....

# Pw UHF Modulator

E. TRUNDLE



THE modulator to be described is based on the standard Mullard varicap tuner type ELC1043 or ELC1043/05. These are currently being advertised in this and other magazines.

The basic idea is to isolate the RF amplifier and self-oscillating mixer sections after which the oscillator is tuned down so that it comes into line with the RF amplifier. The oscillator output is then applied to the redundant RF input so that the RF stage amplifies the oscillator's signal. The video input is applied to the AGC line to vary the gain of the RF amplifier, the net result being a negatively-modulated RF signal at UHF, whose frequency may

Replace R2 by R32, 47 $\Omega$ .

Position of R2 in ELC1043/05

Position of R2 in ELC1043

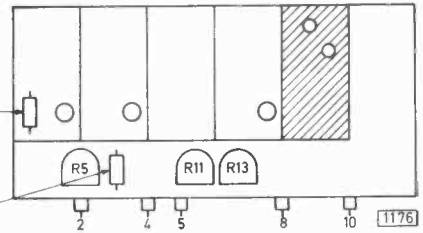


Fig. 2. The location of R2 and the three tuning presets, R5, R11 and R13.

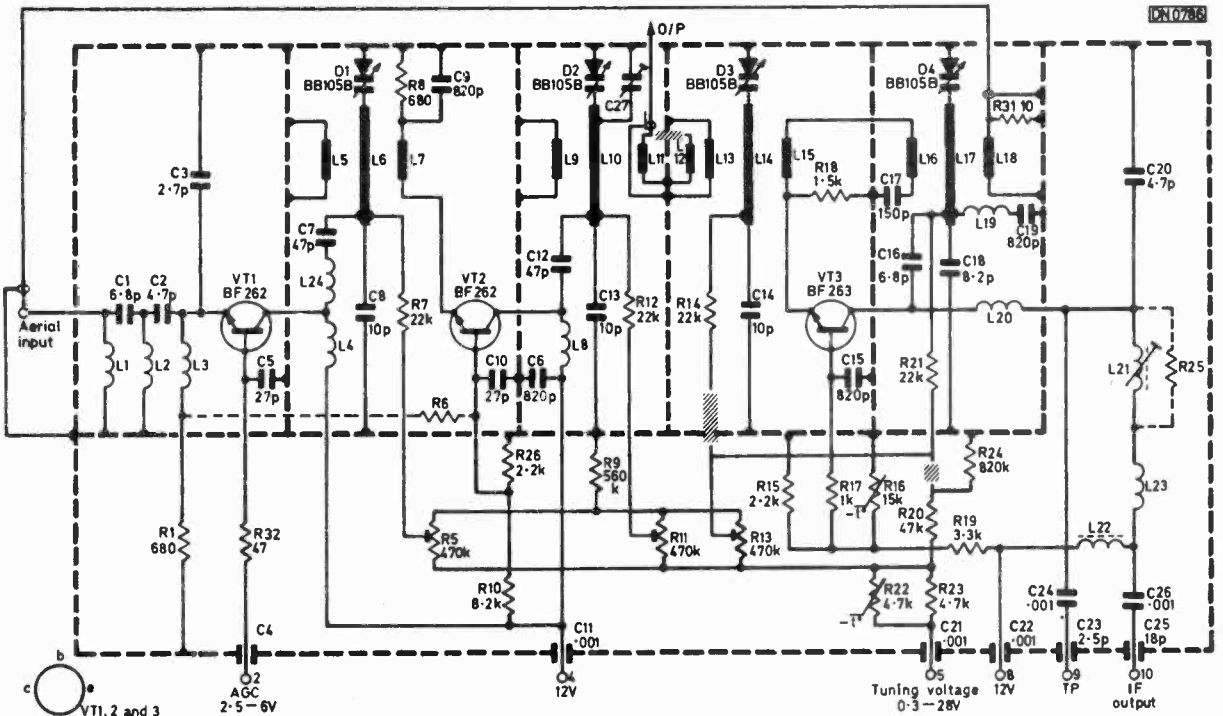


Fig. 1. Circuit of the ELC1043 after modification. The ELC1043/05 is similar apart from transistor types. The shaded areas indicate breaks in the P.C. tracks. R31 is added in series with L18 to provide the oscillator output tapping point.

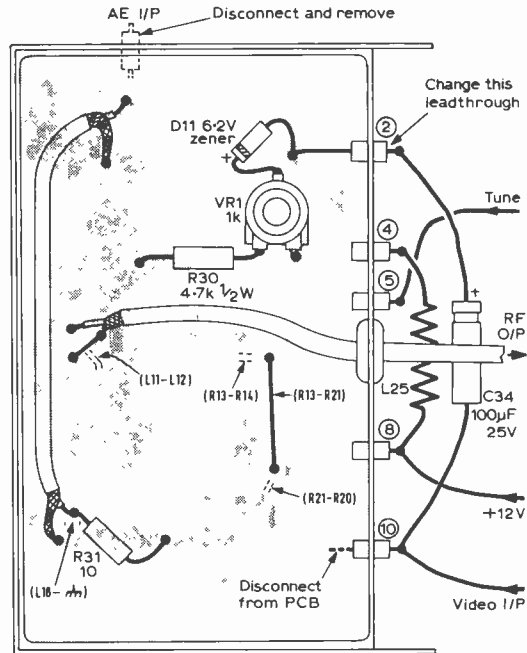
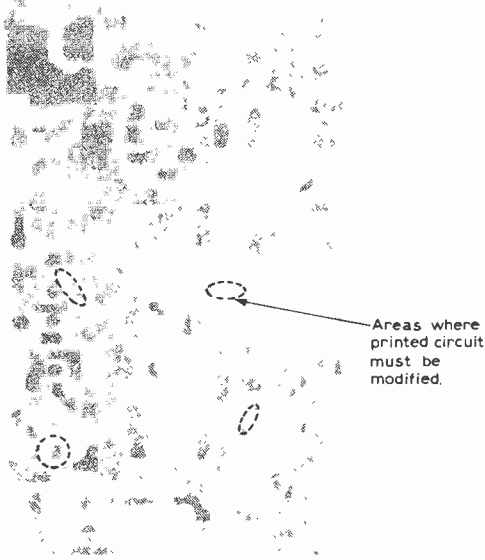
be set in the usual way by adjusting the bias on the tuning diodes from an external source. The RF output is several millivolts, sufficient to drive several sets if required, and may require attenuation if a signal set is used.

Unlike some commercial types, few spurious outputs are generated and such problems as microphony and drift are virtually eliminated.

## TUNER MODIFICATIONS

The tuner circuit, after modification, is shown in Fig. 1. The bandwidth of the AGC line is first increased by replacing the ceramic feedthrough capacitor C4 by one of lower capacity, eg a ferrite bead or sleeved wire, and the original R2 (470Ω) by R32 (47Ω), see Fig. 2 for location.

DN 0787



DN 0788

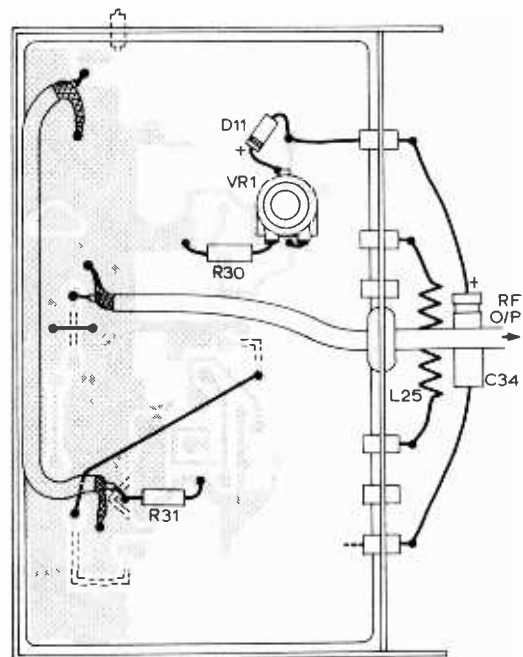
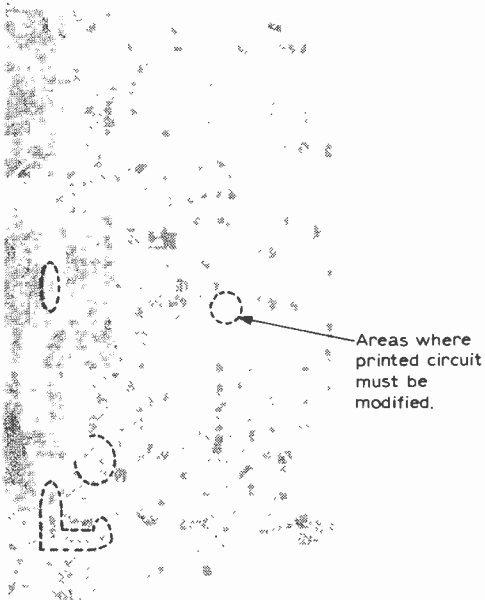


Fig. 3. Layout of the printed boards and modification details for the ELC1043/05 (top) and ELC1043 (bottom). In each case the left-hand drawing shows the print pattern before modification. The right-hand drawing shows track and components to be removed in broken lines, links and components to be added in full lines. Links should be made in 16 or 18 swg tinned copper wire, formed to stand clear of the board. External connections are identical for both versions.

The rest of the modifications are to the print pattern inside the tuner and are illustrated in Fig. 3 for each type. The link between L11 and L12 is severed, and an earth bridge soldered across the gap. The RF output is taken out by a thin screened lead from the "top" end of L11 through the vacant hole adjacent to pin 5.

One end of L18 is isolated from earth and a 10Ω carbon resistor, R31, fitted across the break. From the same point a screened lead is routed to L1, the original aerial input. The existing aerial input tag should be removed.

The lecher line, L14, is not required for our purpose, and the control potential from R13 is diverted to D4 by disconnecting the lower end of R21 from the junction of R20/R24 and linking it to R13 slider, which must be isolated from R14.

Finally, D11, VR1 and R30 are fitted inside the tuner on the print side, being suspended in the wiring, as shown in Fig. 3. The now redundant IF output pin (no. 10) is cut inside the tuner and used to anchor C34, the video coupler, which is mounted externally.

## POWER SUPPLIES

The modulator requires a 12V line, positive of chassis, which must be capable of supplying 14mA with a peak-to-peak ripple not exceeding 50mV. A suitable circuit is given in Fig. 4, using a subminiature mains transformer. L25 is a UHF choke mounted on the tuner between pins 4 & 8, and consisting of a few turns of ordinary plastic insulated wire. F1 is important from the safety angle and should not be omitted.

A further supply line is necessary for tuning purposes. If a fixed-frequency UHF output is required, the arrangement of Fig. 5 may be adopted, VR2 taking the form of a slider or rotary potentiometer.

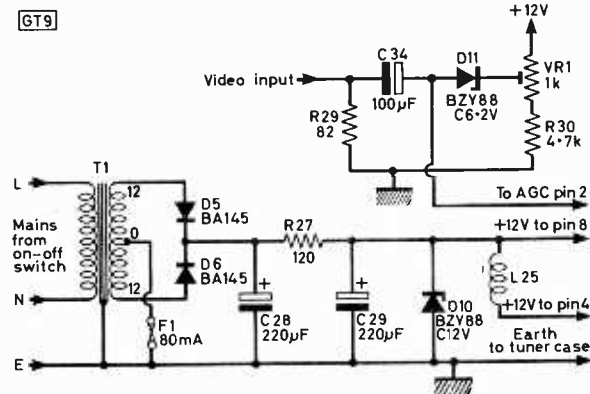


Fig. 4. The Power Supply and Input Bias circuits.

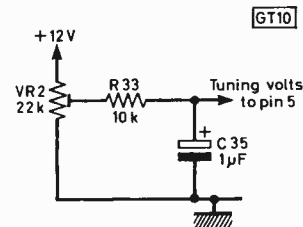


Fig. 5. The tuning circuit for a preset spot frequency output.

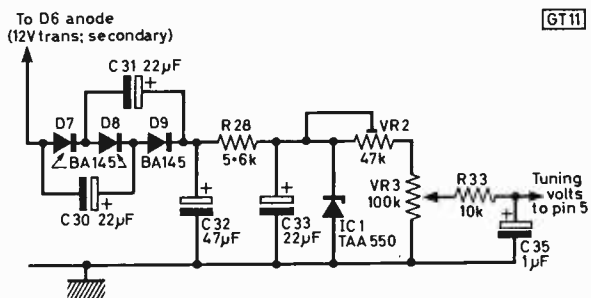


Fig. 6. The circuit for continuous coverage of Band IV and V.

meter mounted on the tuner body. This will give pre-set coverage up to about channel 44. The more elaborate circuit of Fig. 6 utilises a voltage tripler and an IC to give a stabilised 32V line derived from one-half of the transformer secondary. This offers coverage of the UHF band up to channel 68 but at greater expense.

A suitable arrangement of the components required for the power supply and the variable, total coverage, tuning circuit of Fig. 6 is shown as Fig. 7. This drawing also shows the arrangement of the tuner and the extra board in the box.

## ★ components list

### General

Varicap tuner type ELC1043 or ELC1043/05. Aluminium box, 102 × 102 × 38mm (4 × 4 × 1½ ins) with lid. 2 surface mounting coaxial sockets. Knob for VR3 (when used).

### Power supply and input bias cct.

R27 120Ω 5%, ¼W  
R29 82Ω 5%, ¼W  
R30 4.7kΩ 5%, ¼W  
VR1 1kΩ, min. skel. horz.  
C28 220µF, 25V  
C29 220µF, 25V  
C34 100µF, 25V  
D5 } BA145 or BA148  
D6 } or BY206  
D10 BZY88C12V  
D11 BZY88C6V2

T1, 12-012V at 50mA or 100mA subminiature mains transformer. F1, 80mA, antisurge fuse (20mm) and holder. L25, home made inductor (see text). Mounting board.

### Tuning circuit (Fig. 5)

R33 20kΩ 5%, ¼W  
VR2 22kΩ min. skel. horz.  
C35 1µF, 35V, tant.

### Tuning circuit (Fig. 6)

R28 5.6kΩ 5%, ¼W  
VR2 47kΩ, min. skel. horz.  
VR3 100kΩ, carbon, linear  
C30 22µF, 35V  
C31 22µF, 35V  
C32 47µF, 63V  
C33 22µF, 63V  
D7 } BA 145 or  
D8 } BA148 or  
D9 } BY206  
IC1 TAA550 or ZTK33B or SN76550

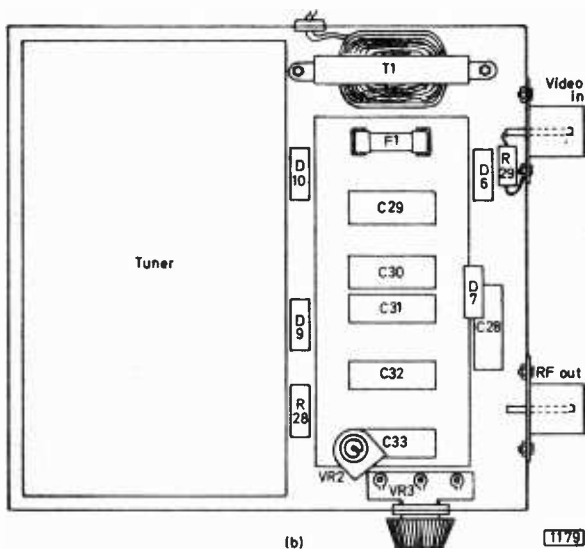
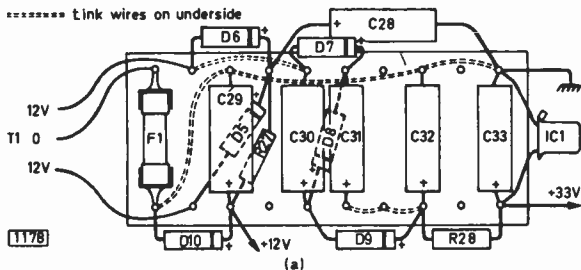
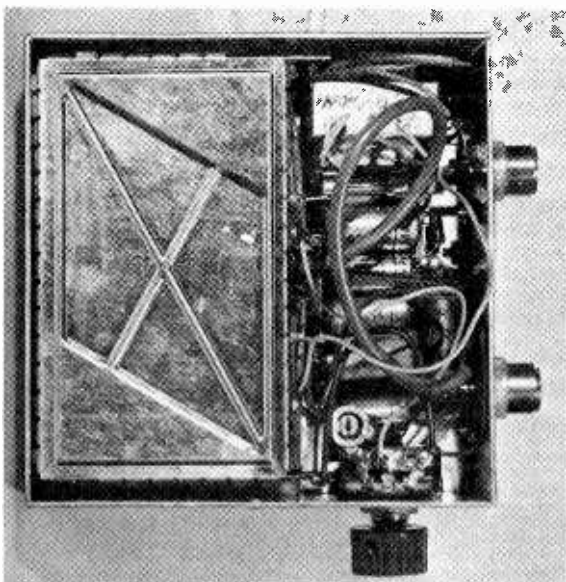


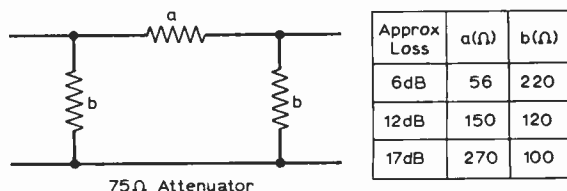
Fig. 7. A diagrammatic representation (above) of the extra board, with wiring for the components of the power supply and continuous coverage tuning circuit shown. A photograph of the inside of the prototype (below) shows that although the extra components are not too cramped there is not much surplus space available.



## SETTING-UP

Ensure that the input to the modulator is not in excess of 1.2V p-p. Connect the RF output to a TV receiver tuned to about channel 35. Adjust the output tuning (VR2 or VR3) for best results.

Set VR1 to mid-point and adjust R13 for the strongest RF signal, indicated by minimum "snow" on the TV receiver. It will be necessary to attenuate the signal for this test. If a standard attenuator is not available a temporary circuit can be constructed to Fig. 8 using the values in the table. Try 6dB first.



GT20

Fig. 8. The arrangement and values of the resistors for a 75  $\Omega$  attenuator. This unit is not exactly 75  $\Omega$  impedance nor does it give exactly 6, 12 and 17dB. So, although it is quite adequate for this purpose, it should be used with caution in other applications.

Alternatively, a UHF field strength meter may be used by adjusting R13 for maximum deflection, again via attenuation if necessary.

VR1 sets the initial bias on Tr1 and should be adjusted as follows: With the modulated signal displayed rotate the control to one end, whereupon line pulling and frame roll will occur. Back off the control until sync returns to normal and mark this position of the wiper. Now fully rotate the control to the opposite end, the white characters will become grey and crushed. Again, back off until full white level is restored and mark the wiper position. The pre-set may now be sealed with the wiper mid-way between the two marks.

If the circuit of Fig 6 is used, VR2 should be adjusted to position the output on channel 68 with the main output tuning control VR3 set at maximum. The other two pre-sets within the tuner, R5 and R11 should not need any adjustment provided the tuner alignment was originally correct.

## MOUNTING

The positioning of this unit inside another piece of equipment is not critical. The tuning-voltage lead to pin 5 should be screened if it is more than 150mm long and, in any case, should be routed as far from mains transformers, PCBs and other wiring as practical.

In the unlikely event of microphony, mount the tuner on foam rubber pads and secure it by sticking or by rubber bands rather than by screws.

## POSSIBLE APPLICATION

This unit is particularly suited to the Video-Writer project in this magazine and, in fact, the second Video-Writer, used for demonstration purposes, uses the prototype modulator on which this article is based.

The design of this tuner was first published in April 1975 by our sister magazine "Television". PW



# Unique full-function 8-digit wrist calculator... available only as a kit.

A wrist calculator is the ultimate in common-sense portable calculating power. Even a pocket calculator goes where your pocket goes – take your jacket off, and you're lost!

But a wrist-calculator is only worth having if it offers a genuinely comprehensive range of functions, with a full-size 8-digit display.

This one does. What's more, because it *is* a kit, supplied *direct* from the manufacturer, it costs only a very reasonable £9.95 (plus 8% VAT, P&P). And for that, you get not only a high-calibre calculator, but the fascination of building it yourself.

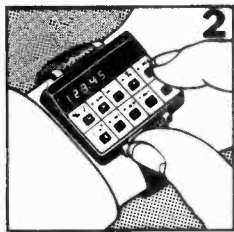
## How to make 10 keys do the work of 27

The Sinclair Instrument wrist calculator offers the full range of arithmetic functions. It uses normal algebraic logic ('enter it as you write it'). But in addition, it offers a % key; plus the convenience functions  $\sqrt{x}$ ,  $1/x$ ,  $x^2$ ; plus a full 5-function memory.

All this, from just 10 keys! The secret? An ingenious, simple three-position switch. It works like this.



1. The switch in its normal, central position. With the switch centred, numbers – which make up the vast majority of key-strokes – are tapped in the normal way



2. Hold the switch to the left to use the functions to the left above the keys...

3. and hold it to the right to use the functions to the right above the keys.



The display uses 8 full-size red LED digits, and the calculator runs on readily-available hearing-aid batteries to give weeks of normal use.

Dimensions:  
1 1/8" (46 mm) wide,  
1 1/8" (37 mm) deep.  
Weight:  
less than 1 oz (28 g).

**KIT  
ONLY  
£9.95  
PLUS VAT,  
P&P**

Sinclair Instrument Ltd,  
6 Kings Parade, Cambridge,  
Cambs., CB2 1SN.  
Tel: Cambridge (0223) 311488.

## Assembling the Sinclair Instrument wrist calculator

The wrist calculator kit comes to you complete and ready for assembly. All you need is a reasonable degree of skill with a fine-point soldering iron. It takes about three hours to assemble. If anything goes wrong, Sinclair Instrument will replace any damaged components *free*: we want you to enjoy assembling the kit, and to end up with a valuable and useful calculator.

**Contents**  
Case and display window.  
Strap.  
Printed circuit board.  
Switches.  
Special direct-drive chip (no interface chip needed).  
Display.  
Batteries.

Everything is packaged in a neat plastic box, and is accompanied by full instructions.

The only thing you need is a fine-point soldering iron.

All components are fully guaranteed, and any which are damaged during assembly will be replaced free.

The wrist-calculator kit is available **only direct from Sinclair Instrument**. Take advantage of this 10-day money-back undertaking.

Send the coupon today.

To: Sinclair Instrument Ltd,  
6 Kings Parade, Cambridge, Cambs., CB2 1SN.

\* Please send me . . . (qty) Sinclair Instrument wrist-calculator kits at £9.95 plus 80p VAT plus 25p P&P (Total £11).

\* I enclose cheque/PO/money order for £.....

\* Complete as applicable.

Name \_\_\_\_\_

Address \_\_\_\_\_

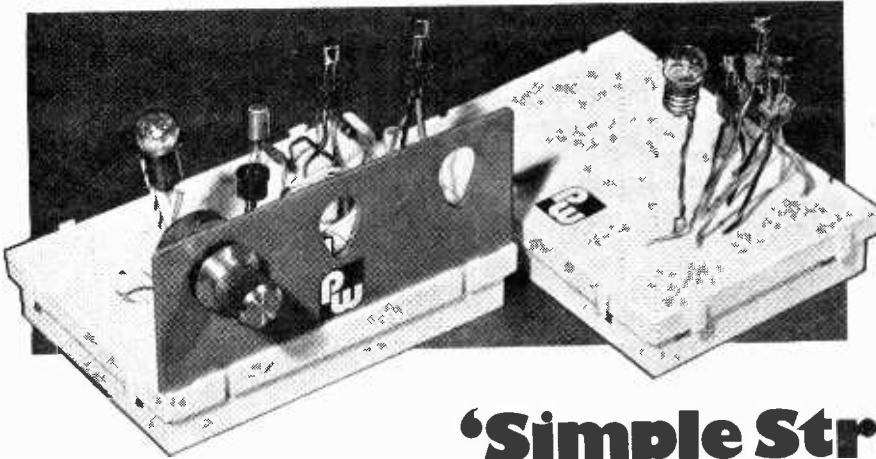
(Please print)  
I understand that you will refund my money in full if I return the kit undamaged within 10 days of receipt.

PW/4



# S-DeCnology

DAVID GIBSON



THIS MONTH

## 'Simple Stroboscope'

THE majority of "lamp flashing" circuits seen in the popular constructional journals seem to employ a two-transistor multivibrator circuit with a bulb as one of the collector loads. In this month's S-Dec circuit I've tried to reproduce similar results, but with different circuitry.

The final arrangement is shown in Fig. 1. Readers who have built the previous projects in this series will see most of the components used again in this circuit.

### Circuit details

Note that Tr1 is a BC109, a NPN type transistor, whereas Tr2 is a AC126, a PNP type. These two semiconductor components are connected in a complementary arrangement and are DC coupled, i.e. the connection

from the collector of Tr1 to the base of Tr2 is direct and not through any capacitor which, of course, would block the DC. Transistor Tr2 derives its base bias from a resistive divider chain formed by R4 and Tr1. The load for Tr2 is the lamp LP1 connected in its collector lead. The circuitry around Tr1 seems quite conventional, too. A base bias from the resistor chain (R3, VR1, R1, R2) and R4 as a collector load.

Then there's the capacitor C1. This is a feedback component which applies the output signal back to the input or base of Tr1 and this is why the whole circuit oscillates.

The oscillator is of the "RC" type, meaning that its frequency of operation (or the rate at which the bulb flashes on and off) is determined and controlled by resistance and capacitance values. Since there is only one capacitor in the circuit then this takes care of the "C". The resistance variation is afforded by the potentiometer VR1 allowing the flashing rate to be varied over a set range. The other resistance in series with VR1 also have an effect on the flashing rate.

### Construction

To build the circuit, simply plug the components (via their own leads) into the S-DeC holes indicated on the diagram of Fig. 1. The lamp, for example, is

you will need . . . .

R1	5-6k $\Omega$	Tr1	BC109 or 2N1613
R2	5-6k $\Omega$	Tr2	AC126
R3	39k $\Omega$	B1	12V battery
R4	1k $\Omega$	L1	6V 100mA bulb
VR1	50k $\Omega$ pot		solid core wire for wiring
C1	4-7 $\mu$ F 12V		One S-DeC

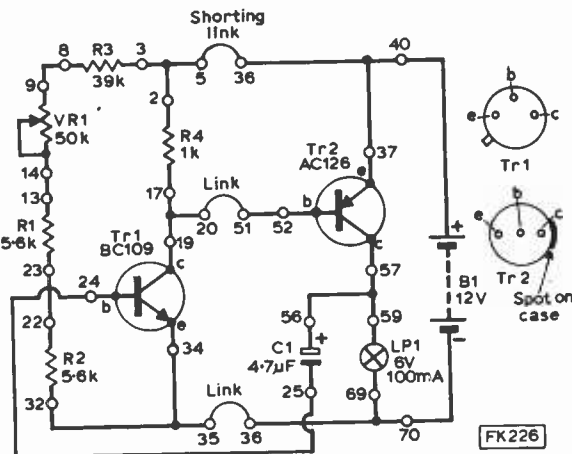


Fig. 1: Circuit diagram of the Simple Stroboscope. Varying the rate of flash can be achieved by experimenting with the values of C1 and R3. The lower link should be connected between 35 and 66.

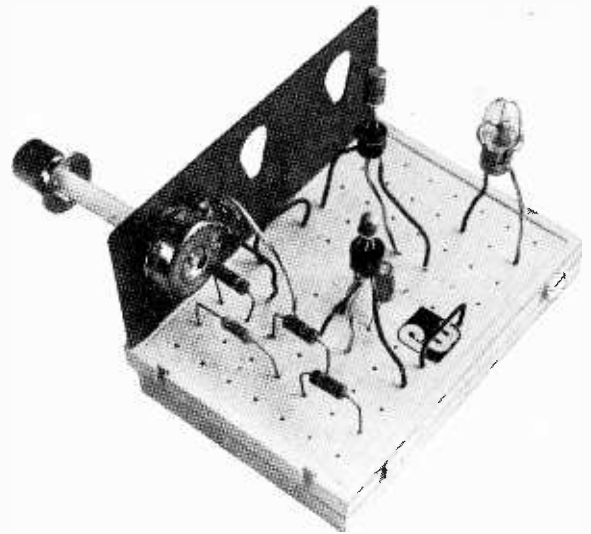
plugged into holes 59 and 69 while R2 is plugged into S-DeC holes 22 and 32. The three lines marked "links" in Fig. 1 are simply short lengths of wire which have their ends plugged into the S-DeC holes as marked. Figure 2 shows a full size drawing of an actual S-DeC and the holes and component locations can be clearly seen. Be careful when you plug in Tr2, remember that it is a PNP device unlike the BC109, and has a small spot or mark on its case signifying that the lead nearest to it is the collector.

## Component trials

One of the great advantages of using an S-DeC is the ease and simplicity in experimenting with different devices and alternative values for components. Constructors might like to conduct their own experiments to see if they agree with my own findings.

For example: why is R3 39k $\Omega$ ? Why not 47k $\Omega$  or 10k $\Omega$ ? When the circuit was first "plugged in" on the S-DeC, R3 was omitted. After all, if one can vary VR4 one could obtain a variable resistance.

The first attempt to get the circuit to oscillate used a 10k $\Omega$  potentiometer for VR1. The result was that the BC109 got very hot very quickly! Look at Fig. 1 and you'll see why. If VR1 is at zero resistance, then the base of Tr1 is connected via R1 to the positive 12V rail (I didn't have R3 in circuit) so the transistor was biased very hard "on". But even with 10k $\Omega$  in circuit (i.e. maximum setting of VR1) the BC109 was still hot and the flashing rate was not very good although the circuit did work. Substituting a 50k $\Omega$  pot gave some improvement but again, if the pot was set to minimum resistance, the base of Tr1 would be connected via R1 to the 12V positive rail. Clearly a "safety" resistor was needed in series with the pot to ensure that there was always some sensible resistance value between Tr1 base and the 12V rail.



Rearview photograph of the S-DeC showing the simple nature of the circuit. It's advisable to use holders for the transistors, as their leads tend to be on the short side.

Various values were tried for R3 but the optimum value was found to be 39k $\Omega$ .

Changing the value of the capacitor in this circuit did not prove a good move. Using a 10 $\mu$ F component reduced the flashing rate, and swinging VR1 from maximum to minimum gave far less variation in the rate than with a 4.7 $\mu$ F capacitor for C1.

All values given in Fig. 1 were found to be optimum although there is no reason why readers should not experiment for themselves with other values. The 2N1613 used in earlier S-DeC projects in this series can be substituted for the BC109 with very little effect on the overall performance. (Lead connections the same.)

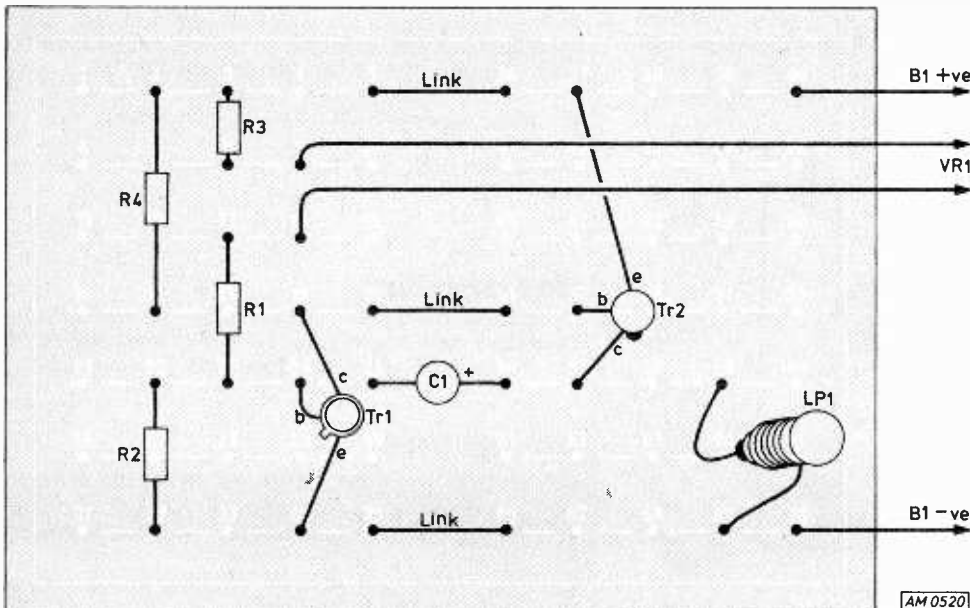


Fig. 2: Full size drawing of the S-DeC giving the exact location of the components necessary for this project.

# SAXON ENTERTAINMENTS LTD

A FULL RANGE OF MODULES & READY-TO-USE EQUIPMENT TO PROFESSIONAL STANDARDS FOR THE PROFESSIONAL  
**SYSTEM 7000** COMPLETE & READY-FOR-USE EQUIPMENT  
 MODULES AND INDIVIDUAL UNITS

## POWER AMPLIFIER MODULES 30-240 WATTS



- Fully tested & guaranteed.
- Full RMS Sine Wave output.
- Distortion typically 0.2%
- 10 Transistors, 4 Diodes.
- Response 30Hz-30KHz
- Fully short & open circuit proof
- Sensitivity suite most mixers.
- Built-in surge suppression & compensation
- Twin D.C. & output fuses.
- Top-grade components throughout.

30 Watts rms		60 Watts rms		120 Watts rms		240W rms	
SA308	SA604	SA608	SA1204	SA1208	SA2404	SA2408	SA2404
30W rms/	60W rms/	60W rms/	120W rms/	120W rms/	120W rms/	18 ohms/	240W rms/
8 ohms	4 ohms	8 ohms	4 ohms	4 ohms	18 ohms	4 ohms	4 ohms
£9.50	£12.50	£13.50	£14.50	£21.00	£25.50	£25.50	£25.50

POWER SUPPLIES FOR THE ABOVE MODULES—READY WIRED & FUSED ON GLASS FIBRE PCB

PM301	PM601/4	PM601/8	PM1201/4	PM1201/8	PM1202/4	PM1202/8	PM2404/1
For 1/2 SA308	For 1/2 SA604	For 1/2 SA608	For 1/2 SA1204	For 1 SA1208	For 2 SA1208	For 2 SA1208	For 1 SA2404
£9.90	£12.50	£12.50	£12.50	£12.50	£18.50	£19.50	£19.50

## SYSTEM 7000 COMPLETE DISCO MIXERS (With Autofade)

Mono or Stereo



- Ready to plug in & use
- Automatic Mic override
- Two tone panel
- Twin deck & mic & tape inputs
- Left/Right deck fader
- 20W-20KHz Noise -77 dB

The choice of the professional D.J.  
 Controls: Mic volume, Bass, Treble, A/Fade Depth, Tape, L/Deck, R/Deck volumes, Bass, Treble, Master, Headphone volume, Selector & On/Off.

Mono 18v £37.50 Mains £43.50 Stereo 18v £53.50 Mains 59.50

**IN MODULAR FORM**—All you require is front panel (see below) knobs & sockets etc. All electronics are assembled & tested.

- Specification as for complete mixer
- All Potentiometers supplied & fitted
- Low cost do it yourself with step by step easy to follow instructions.

Mono £19.50 Stereo £29.50 Panel £3.50 Supply unit £8.50

## SYSTEM 7000 LIGHTING CONTROL UNIT MK II (Four channel)



Has your light unit 60T:

- 4,000 W handling
- Sequence facility
- Smart 2 tone panel
- Advanced IC circuitry
- Top grade components
- All your needs in one superbly designed unit
- Integral dimmers
- Automatic audio level

OURS HAS:

ONLY £42.50

## IN MODULAR FORM—THE QUADRAFET

As with the mixers the Mk II L.C. unit may be purchased in module form with all controls, requiring only a panel, case & knobs etc. There are 13 simple connections

- 1-240W Audio
- 8A RCA triacs
- 0.5-20Hz Sequence
- Fully suppressed

## CUSTOM MIXER MODULES (Complete or in printed circuit form only)

Make your own mixer, mono or stereo, up to 2 channels, with full monitoring facilities, and provision for echosend/return etc.

- Inputs for low and high 2 mic, ceramic & magnetic cartridge etc.
- Up to 20 input modules per single mixing module
- Feed most types of amplifier—accepts all inputs
- Professional low noise circuitry 20 Hz-30KHz
- Infinitely adaptable—Extremely economical



## COMPLETE MODULES With facia panel, Knobs & sockets, Monitor buttons, Ready wired & tested

Mono Input £8.50 Mono mixing stage £8.50  
 Stereo Input £12.00 Stereo mixing stage £12.00

- 0.5W headphone circuit
- Full range bass/treble controls
- Noise—80dB

## PRINTED CIRCUIT MODULES With controls fitted, requires only sockets, facia & knobs

Mono Input £5.50 Mono mixing stage £5.50  
 Stereo Input £9.00 Stereo mixing stage £9.00

Power supply for up to 20 channels—PPM18—£8.50.

## SYSTEM 7000 SOUND—LITE (3-CHANNEL)

IN COMPLETE OR MODULAR FORM (Modular form illustrated)

- Complete unit similar to Mk II unit above
- Long established & proven design
- 3 Channels—100W per channel
- RCA 8A Triacs—individual channel fuses
- 1-240 W input—master audio level plus Bass/Middle/Treble



**COMPLETE UNIT**—Fully cased with rear terminations—just plug in & go! £24.75

**MODULAR FORM** Facia & knobs etc. Needs only 11 simple connections £16.50 (Panel £2.50)

## CENTAUR—THE 100W RMS STEREO DISCO COMPLETE WITH SOUND-TO-LIGHT SEQUENCER & LIGHTS

ONLY £199 (+4.50 carr) or Low interest terms Deposit £24.78 12 months at £18.77 or 24 months at £19.85

- 100W RMS stereo output
- Twin heavy duty loudspeaker
- Four channel sound lite—sequencer complete with display
- Separate mic., music bass & treble controls
- Sturdy vinylite cabinets with all leads
- Twin BSR decks with lift arm



NOW AVAILABLE

**SUPER CENTAUR**

200W Stereo output—other details as above £265 (carr. 4.50)

or Deposit £31.06 12 months at £25.83 or 24 months at £14.28  
 Cut-price condenser mic & headphones £15.00 (only with complete discos)

## SAXON MINI-DISCO 50W RMS £119.00 (carr. £2.50) 100W RMS £139.00

- Complete with twin heavy duty loudspeakers
- Includes mic input & headphone monitor circuit
- Twin BSR decks with liftarm
- Tremendous value—just plug in & go
- Wide range bass & treble controls

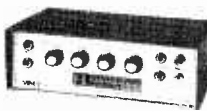


Cut-price condenser mic & headphones £15.00 (only with complete discos)

SEND YOUR SPECIAL REQUIREMENTS FOR A CUSTOM DISCO QUOTATION

## SYSTEM 7000

### MINOTAUR 100—All Purpose Wide Range Amplifier



- 100W rms — 1dB
- Standard 8 ohm output
- Twin mixed inputs accept a wide range of signals
- 30Hz-30KHz ±2dB
- 23dB bass/treble
- Four individually mixed inputs
- Wide range bass/treble + master

An extremely compact and versatile amplifier with full protection and a clean, attractive appearance. Ideal for all groups, disco's & clubs



£49.50

- Vinylite covered case
- Fully short proof
- Superb value for money

**SAXON 150 HEAVY DUTY AMPLIFIER £59.00**

## STROBES & PROJECTORS (We stock the full Pluto range) Send for details

### SUPERSTROBE £19.75

- 2-3 Joules
- 80W Tube for long life
- Compact 4" x 4" x 4"

### PRO-STROBE £32.50

- 4-8 Joules
- External trigger
- Long Life tube timer circuit



### 150 WATT LIQUID WHEEL PROJECTOR

- Accepts all accessories
- C/w with wheel & motor plate
- Sturdy steel construction
- Remarkable value—Sold elsewhere at £39.50. Our price is only: £31.50

## ACCESSORIES

Condenser mics ECM77 600 ohm £12.00  
 ECM 81 Dual Impedance £13.95 Crown headphones £8.75  
 Heavy duty boomstand £12.50

All prices subject to VAT @ 8% except SA308/PM301, microphones & headphones  
 All prices include carriage & packing except where shown otherwise  
 Ordering: By Telephone—Access, Barclay Card or COD Ring (01) 884 6385/0098  
 By post —Send cheque or crossed P.O.'s or 60p for COD or send in your Access/Barclay card NUMBER

MAIL ORDERS & CALLERS TO: **CROYDON**

327-333 Whitthorpe Road, Croydon Surrey CR0 2HS  
 24 Hour Ansafone service (01) 884 6375

## WALLINGFORD

Filnt House, High St., Wallingford, Oxon (By Public Library) (0491) 35529

Both premises open 9 a.m.—5 p.m. Monday—Saturday Lunch 1—2 p.m.

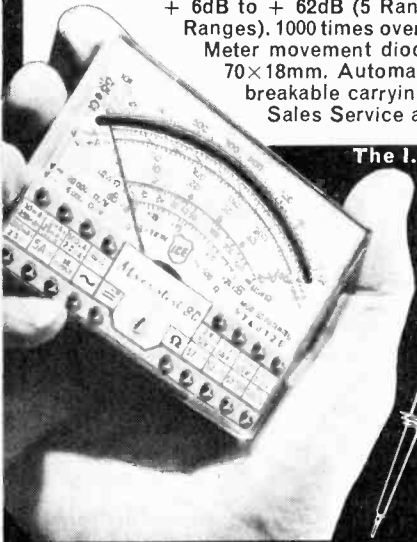
Exporters to 17 countries—enquiries welcomed  
 U.K. Trade Distribution by Norman Rose Electrical Ltd.

# Incredible Value in Precision Test Meters

AVAILABLE FROM SELECTED STOCKISTS. WRITE OR PHONE FOR LIST

## MICROTEST 80—I.C.E. 20,000 Ohms/Volt 40 RANGES

20,000 Ohms/Volt, (d.c.) 4,000 Ohms/Volt (a.c.) 2% accuracy. V d.c. 100mV to 1kV (6 Ranges). I d.c. 50 $\mu$ A to 5A (6 Ranges). V a.c. 1-5V to 1kV (5 Ranges) I a.c. 250 $\mu$ A to 2.5A (5 Ranges). Resistance, Low Ohms, Ohms $\times$ 1, Ohms $\times$ 10, Ohms $\times$ 100. Output Level Measurements 1-5V to 1000V (5 Ranges) + 6dB to + 62dB (5 Ranges). Capacitance 25 $\mu$ F to 25,000  $\mu$ F (4 Ranges). 1000 times overload protection (on Resistance ranges). Meter movement diode protection. Size (without case) 90 $\times$ 70 $\times$ 18mm. Automatic zero, non-parallax mirror scale. Unbreakable carrying case and probes supplied. Full After Sales Service available. **Price £15.66 inc. VAT**



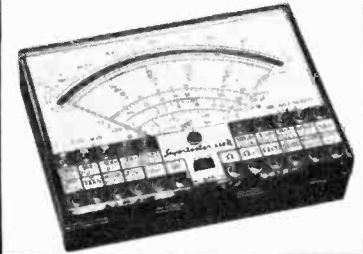
The I.C.E. Measurement System includes a comprehensive range of accessories: shunts, transformers, specialised probes, transistor-tester etc. I.C.E. High-Voltage d.c. Probe, Model 18. Input Impedance: 500M Ohm, nominal (Other values available to order). The Model 18 d.c. Probe consists of a highly insulated moulded plastic body, fitted with a hand guard-ring, containing a stable, precision 500M Ohm resistor, which may be used to extend the d.c. voltage measuring capability of analogue multi-meters or electronic voltmeters, to a maximum value of 25kV. The probe is fitted with a prod-tip for connection to the voltage source to be measured and a connecting lead terminating in a 2mm plug for insertion into the measuring instrument's d.c. voltage input socket. (4mm plug available to order). **£6.42 inc. VAT**

## SUPER TESTER 680R—I.C.E.

20,000 Ohms/Volt 80 RANGES

20,000 Ohms/Volt 1% d.c., 4,000 Ohms/Volt a.c. 2% V d.c. 100mV to 2kV (13 ranges). V a.c. 2V to 2kV (11 Ranges). I d.c. 50 $\mu$ A to 10A (12 Ranges). I a.c. 250 $\mu$ A to 5A (10 Ranges). Resistance Ohms  $\times$  1,  $\times$  100,  $\times$  1000,  $\times$  10,000 and Low Ohms. Reactance Detector 0-10M Ohms. Freq. Measurement 0-5000 Hz (2 Ranges). Output Level 10-2000V (9 Ranges). Decibels -24-+70dB (10 Ranges). Capacitance 0-500,000 pF (2 Ranges using mains supply) 0-20,000  $\mu$ F (4 Ranges using Internal 3 Volt battery). 1000 times overload protection on Resistance ranges and meter movement diodes protection. 10 Measurement Functions and 80 Ranges. Size 128  $\times$  95  $\times$  32mm. Non-parallax mirror scale. Unbreakable carrying case supplied which contains probes, mains lead, crocodile clips and shorting link.

**Price £24.30 inc. VAT**



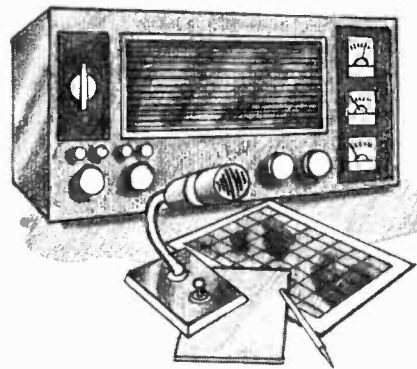
Sole Importers and Distributors

**Electronic Brokers Ltd**

49-53 Pancras Rd., London NW1 2QB. Tel: 01-837 7781

# Careers and Hobbies in Electronics.

Enrol in the BNR & E School and you'll have an entertaining and fascinating hobby. Stick with it and the opportunities and the big money await you, if qualified, in every field of Electronics today. We offer the finest home study training for all subjects in radio, television, etc., especially for the CITY AND GUILDS EXAMS (Technicians' Certificates); the Grad. Brit. I.E.R. Exam; the RADIO AMATEUR'S LICENCE; P.M.G. Certificates; the R.T.E.B. Servicing Certificates; etc. Also courses in Television; Transistors; Radar; Computers; Servo-mechanisms; Mathematics and Practical Transistor Radio course with equipment. We have OVER 20 YEARS' experience in teaching radio subjects and an unbroken record of exam successes. We are the only privately run British home study College specialising in electronics subjects only. Fullest details will be gladly sent without any obligation.



## Become a Radio Amateur.

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

**FREE!** Brochure without obligation to  
**BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL,**  
 P.O. BOX 156, JERSEY, CHANNEL ISLANDS. WL 4 7

NAME \_\_\_\_\_  
 ADDRESS \_\_\_\_\_  
 \_\_\_\_\_ BLOCK CAPS PLEASE

## Frozen motion

If this circuit is to be used as a miniature stroboscope, then the bulb LP1 should be put into some kind of reflector. This will increase the intensity. A cycle lamp reflector is useful but a simple "cup" made from aluminium baking foil is also effective. By shining the light onto something in motion, the motion can be apparently stopped or frozen provided the speed of the movement is within the range of the strobing light or a certain mathematical relationship to it.

If you set the flasher up and point it at a tap in a darkened kitchen, then by adjustment of the tap and the flashing rate, the apparently solid stream of water can be broken up into many tiny individual droplets all suspended in space.

A further use for this month's circuit would be to take it with you to a party. Here it could be used as a pocket disco light. Lay in flat with the bulb and reflector pointing at the ceiling (coz ceilings are usually white and they reflect well). The result is a kind of freezing of motion as people "dance".

## A warning

A word of warning about this stroboscope circuit. Under no circumstances use it near anyone who is subject to epilepsy or fits. It will probably trigger them off and it could be very dangerous.

Be careful about looking into the strobe, especially in a darkened room. At some frequencies strange "hallucinations" can be caused in some people. It may be that the flashing rate is, at a particular setting of VR1, synchronised to the brain rhythms of the viewer.

Most of the projects in this series have been aimed at amusement plus, hopefully, some more serious suggested uses. In next month's Practical Wireless the S-DeC circuit will be one which will be of use to everyone and anyone who builds or constructs. An absolute must for any workbench which will save time and money. It's simple, easy to use, very easy to construct and it's called, simply ..... well, bless me, I've run out of space—but I will tell you all about that circuit—in the next issue.

**AVAILABLE NOW!**

**REPRINT OF PW's**

**TELE-TENNIS SERIES**

**July-November 74**

Send 75p + 10p (post & packing) to: Chief Cashier  
(PW Tele-Tennis), IPC Magazines, King's Reach  
Tower, Stamford St., London, SE1 9LS.

# KINDLY NOTE!

## DIGITAL IC TESTER

February 1977

- (1) P831, col 2, line 7—for 'sockets N, K, J, J' read 'sockets A, B, C, D'
- (2) P832, col 1, line 3—delete the figure '5'.

## AUDIBLE CONTINUITY TESTER

February 1977

Note that R4 in the components list should be 180k $\Omega$  as in the circuit diagram and not 100k $\Omega$ .

## CHROMACHASE 4.

December 1976/January 1977

1. A fault in the diode matrix prevents operation in the 'forward' modes.  
To correct it, remove the cathode (ring end) of D8 and stand the diode vertically. Insert the anode of an extra diode into the hole left by D8. Stand this diode vertically also. Remove the wire from S1a to edge pin 15. Solder a new wire from S1a to both cathodes of the vertical diodes. The diode should be the same type as D8.  
To correct the circuit diagram (page 676) replace the direct link between edge pin 15 and the Reverse Stop line by a diode symbol in the same direction as D8.
2. The rotary switch for 'Program' works in reverse to the front panel. To correct, reverse the wiring connections to the switch.
3. A drawing error has been made in the circuit on pages 677. The symbol for Tr10 is shown as NPN when it should be PNP. Provided a PNP transistor is used the drawing error has no effect. To correct, draw the arrow-head inwards on the emitter instead of outwards.
4. A possible fault can occur in that lamps lock on and the display isn't as set. This would be due to sharp pulses from the triggering transformers, T2 to T5, being picked-up on the leads and wiring of IC4. To correct it, add decoupling capacitors (0.1 $\mu$ F) between ground and the following points,  
A. IC4 pin 9  
B. IC4 pin 10  
C. IC4 pin 11  
D. IC4 pin 16  
(The circuit board already has holes for these components. The prototypes functioned without them so they were not included on the components list.)  
E. If yet more decoupling is required, add 0.1 $\mu$ F's from ground to IC4 pins 4, 5 and 6.

# PCB SERVICE FOR READERS

AM 03

All boards, except SRBP, are glassfibre, drilled and roller-tinned

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

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

Issue	Project	Ref	Price P/P	
Sep 75	Electronic Clock (set of three)	DN0795/6/7	2.40+15	<input type="checkbox"/>
Dec 75	Random Number Selector	DN0793A	0.98+12	<input type="checkbox"/>
Dec 75	Sound-To-Light Display	DN0798	1.15+12	<input type="checkbox"/>
Dec 75	12V PA System	DN2/JM	0.98+12	<input type="checkbox"/>
Dec 75	Disco System, Amplifier (2 required)	each AM0421	4.40+22	<input type="checkbox"/>
Dec 75	Disco System, Light Modulator	AM0423	3.50+22	<input type="checkbox"/>
Jan 76	Music Box	SRBP DN1/JM	2.25+18	<input type="checkbox"/>
		glassfibre DN1/JM	3.00+18	<input type="checkbox"/>
Mar 76	CMOS Crystal Calibrator	AM0438	1.19+12	<input type="checkbox"/>
Apr 76	DF Receiver (set of two)	DN4/JM DN5/JM	1.92+15	<input type="checkbox"/>
Apr 76	Wobbulator	AM0443	1.08+12	<input type="checkbox"/>
Apr 76	Auto. Slide Synchroniser	AM0441	2.33+15	<input type="checkbox"/>
June 76	Dig. Freq. Meter (set of 5)	A015 and 4x A004	3.17+15	<input type="checkbox"/>
July 76	Transistor Tester	A002	3.08+18	<input type="checkbox"/>
July 76	Disco Preamplifier	A003	0.65+12	<input type="checkbox"/>
Aug 76	Cassette Player Power Supply	A001	0.65+12	<input type="checkbox"/>
Sep 76	Jingle Machine	A005	2.30+12	<input type="checkbox"/>
Sep 76	Capacitance Meter	A009	2.59+14	<input type="checkbox"/>
Sep 76	Octavia AF Source	A010	1.30+12	<input type="checkbox"/>
Oct 76	Jingle Machine, Mains Unit	A006	2.08+12	<input type="checkbox"/>
Oct 76	Digital Car Clock (set)	A001/2/3	2.58+12	<input type="checkbox"/>
Oct 76	Interwipe	DN8JM	0.80+12	<input type="checkbox"/>
Oct 76	Video-Writer (set)	D002/3/4/6 A007	21.44+50	<input type="checkbox"/>
Oct 76	Hazard Flasher	D005	0.76+12	<input type="checkbox"/>
Nov 76	Low Level Battery Indicator	A016	0.40+12	<input type="checkbox"/>
Nov 76	Electronic Thermostat	A017	1.30+12	<input type="checkbox"/>
Nov 76	Cirtest Probe	A018	0.48+12	<input type="checkbox"/>
Nov 76	Burglar Alarm	A019	0.50+12	<input type="checkbox"/>
Dec 76	Chromachase	A021	5.70+22	<input type="checkbox"/>
Jan 77	Oscilloscope Calibrator	A023	1.25+12	<input type="checkbox"/>
Jan 77	Icelert	A020	1.45+12	<input type="checkbox"/>
Jan 77	Polyphon, motor and main boards	A025/4	7.90+20	<input type="checkbox"/>
	Polyphon, tune disc, blank, SRBP	A008*	0.90+15	<input type="checkbox"/>
Feb 77	Transistor Checker	A026	1.18+12	<input type="checkbox"/>
Mar 77	FM Stereo Touch Tuner	D023/4/5	7.50+20	<input type="checkbox"/>
Apr 77	Tug 'o' War (set)	A029/030	2.88+12	<input type="checkbox"/>
Apr 77	Gas/Smoke Sensor Alarm	A028	0.65+12	<input type="checkbox"/>

Post and packing is for one board or set of boards. Prices include VAT  
Remittances with overseas orders must be sufficient to cover despatch  
by sea or air mail as required.

I enclose Postal Order/Cheque

ACCESS welcome.

No.....

Send card number only.

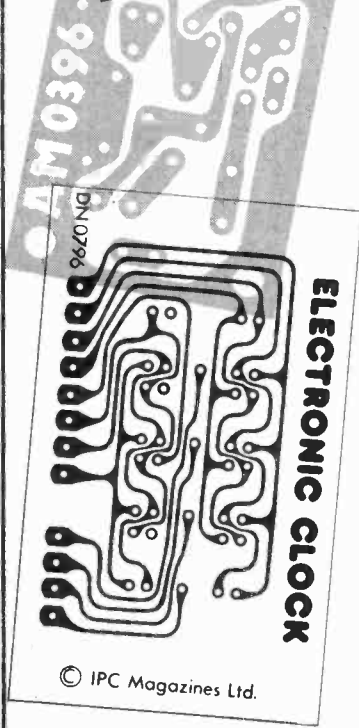
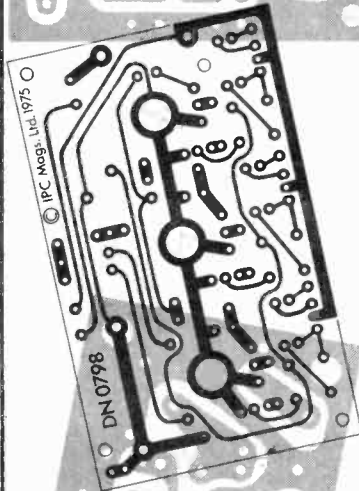
for £..... made payable to READERS PCB SERVICES LTD.

NAME.....

ADDRESS.....

Post Code.....

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





# FREE INSIDE!

# IN NEXT MONTH'S PRACTICAL WIRELESS

3-Case

**PRACTICAL MAY  
WIRELESS 1977**

**SEMICONDUCTOR  
CHARACTERISTICS**

**INFO-CARDS**



TO92  
M10

## Here's another!

Have you wondered about the "how" and "why" of semiconductors or what those "cheap" transistors are good for?

Some of the answers are given in our second Info-Card which introduces the Semiconductor and shows generalised curves as well as classifying some 70 commonly available transistors.

PLUS THE



# SEEKIT<sup>9</sup>

This new locator is a significant advance in the tried, tested and approved range of Beat Frequency Detectors. Externally it offers a distinctive shape and exchangeable, fully waterproof search coils. Internally the circuitry allows detection to a convenient depth in most non-metallic materials with switched sensitivity and meter plus earphone or speaker monitoring.

**&  
2-WAY INTERCOM  
PROTECTED BATTERY CHARGER**

**ON SALE 1st APRIL**

*Practical Wireless, April 1977*



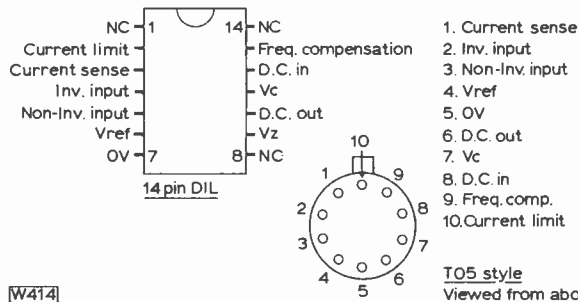
# The **P** **DUAL** **REGUL**

# POWER SUPPLY

**T**HIS power unit has been designed for general purpose, bench use. It is based on the Integrated Circuit regulator type 723. Whilst this regulator is suitable for a wide variety of stabilised circuits this is probably the most common.

The principles of the regulator are the same as those for discrete component devices, i.e. a portion of the output voltage is compared with a known, stable, reference and the difference used to control the output. If the output rises for any reason the positive variation decreases the base current in a

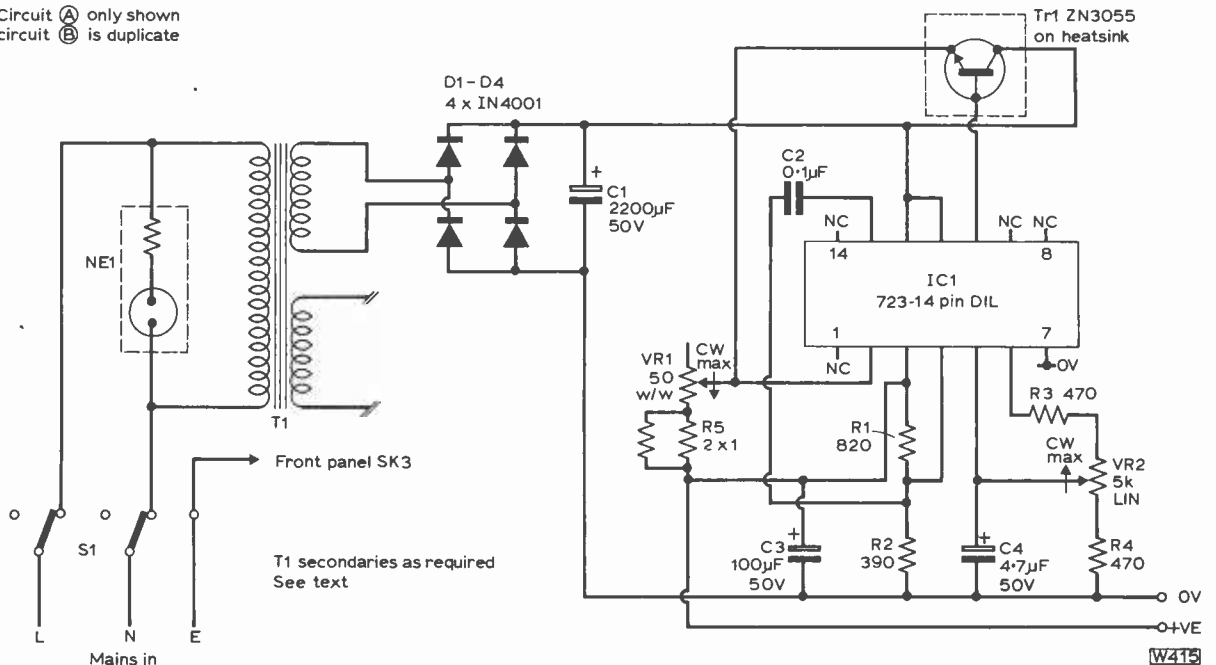
series control transistor which, in turn, decreases the emitter (output) current and the output voltage falls until it becomes that originally set. Similarly,



**Fig. 1.** The pin connections for the two case variations of the 723 integrated circuit. Note that both devices have the same connection sequence but pin 10 on the TO5 corresponds to pin 2 on the DIL

Circuit (A) only shown  
circuit (B) is duplicate

W414



W415

**Fig. 2.** The circuit diagram of one supply. The second supply is identical and the components have been numbered in the series R101, C101, where R1 and R101 perform the same functions in their respective circuits. Note that T1 should be 2N3055.

# ATED

# PPPLY



## T. J. JOHNSON

the circuit increases the emitter current if the output voltage falls below that set. This correction occurs very fast and, to all intents and purposes, the output stays constant.

### ★ components list

#### Resistors

R1 and R101	820Ω 5% ½W
R2 and R102	390Ω 5% ½W
R3 and R103	470Ω 5% ½W
R4 and R104	470Ω 5% ½W
R5 and R105	0.5Ω 5% 1W (2 x 1Ω in parallel for each)
R6	To suit meter used (approx 10% of the meter resistance)
VR1 and VR101	50Ω Wire Wound
VR2 and VR102	5kΩ lin.

#### Capacitors

C1 and C101	2200μF, 50V
C2 and C102	0.1μF Polyester
C3 and C103	100μF 50V
C4 and C104	4.7μF 50V

#### Semiconductors

IC1 and IC101	723 regulator, 14 pin DIL
Tr1 and Tr101	2N3055, TO3 package
D1 to D4 and D101 to D104	1N4001

#### Miscellaneous

T1, mains transformer, two separate secondaries as required (16V used in prototype). NE1, mains neon. S1, switch DPDT. S2, switch DPDT. S3, switch DPST. S4, switch DPST. S5, switch 4 pole 2 way rotary. S6, switch DPST. SK1 to SK5, terminals 4mm (two red, two black and one green). M1, meter 0 to 20V dc (type MR38p). M2 meter 0 to 100mA dc (type MR38p). Four round knobs. One pointer knob. Heatsink for two transistors, 4½" x 4" x 1" (Marston type C or similar). Stripboard, 0.1" track, 5" x 3½". Material for front plate and case. Covering for case. Two IC sockets, 14 pin DIL.

The pin configuration for both 14 pin DILs and 10 pin TO5 packages are given in Fig. 1. It should be noted that by aligning the pins on the TO5 package to have 6 in one line and 4 in the other the pins can be made to correspond to those of the DIL and can therefore be inserted into the same holes on the board.

The maximum current for the 723 is 150mA and, since 1A is required from the unit, external power transistors are used. The inbuilt protection of the 723 against short circuits, excessive power dissipation and overheating are still available when extra transistors are used.

### CIRCUIT OPERATION

The schematic circuit for one supply is given as Fig. 2. The second supply is identical in design and operation.

The mains supply is stepped down by T1 and the low voltage output is bridge rectified by diodes D1 to D4. Capacitor C1 provides a limited amount of smoothing to enable the 723 to accept the voltage as its input.

Since the input is always higher than 12V there is a reference voltage of a nominal 7.15V at pin 6 and this voltage is used for the stabilisation. However, since the unit is designed to operate down to approximately 2V, the reference voltage has to be divided. R3, VR2 and R4 permit a range of voltages from 0.6V to 5.6V to be selected and applied to the non-inverting input, pin 5.

The output voltage is applied to a second, fixed, potential divider consisting of R1 and R2. The voltage developed across R2 is applied to the inverting input, pin 4.

Now, as the potential at pin 6 is varied, by adjusting VR2, the output voltage will vary in step with it.

The unit is required to produce up to 1A output current and as this is in excess of the IC capability a series regulator transistor, Tr1, is used. The DC

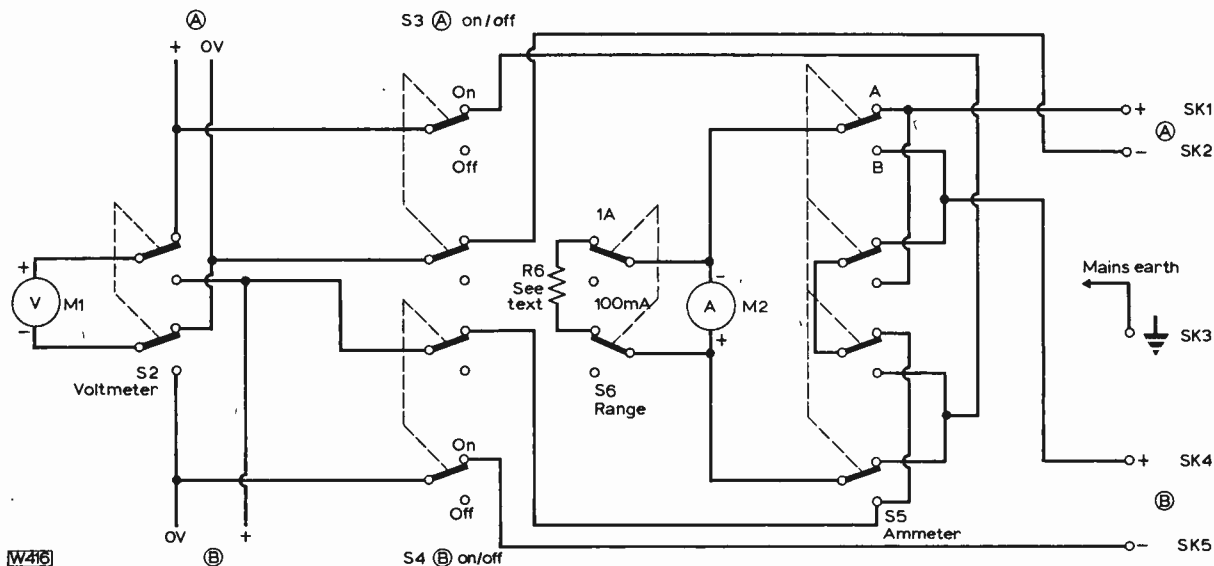


Fig. 3. The switching requirements to monitor both supplies by using only one voltmeter and one ammeter. The use of separate meters for each supply would reduce the switching significantly.

output at pin 10 is used to provide the base current for the transistor, the smoothed output of the bridge provides the collector voltage and current and the output is the emitter load.

The emitter current flows through VR1 and R5 but, since the sampling potentiometer is across the output load only, potentials dropped across VR2 and R5 do not affect regulation.

The 723 has a built in shut down transistor which comes into operation when the potential between pins 2 and 3 reaches 0.65V. This voltage is developed across VR1 and R5 so the maximum current that can flow before the cut-out becomes operative is determined by the setting of VR1 (for large currents R5 is effective). The need for R5 is explained later.

Because of the limited smoothing of the supply voltage there is a certain amount of hum present on the output, unless C3 is fitted, despite the effect of the 723.

Two meters have been used on the prototype, one voltmeter and one milliammeter. To enable the full range of output current to be used the milliammeter can be shunted, by S6, to read 1A. The value of R6 will depend on the resistance of the meter used and may need to be custom made from resistance wire in order to obtain a reasonably accurate scale. Both meters are switchable to read either output A or output B. S2 performs the switching for the voltmeter and S5 for the ammeter.

In addition to the mains ON/OFF switch, S1, both supplies have individual switches, S3 and S4. The switching details are given as Fig. 3. Small dial meters have been used and this results in less than perfect readability, particularly on the ammeter, and if accurate settings of voltage or current are required a larger meter will be needed.

## CONSTRUCTION

The integrated circuits and the small components associated with them are mounted on a piece of stripboard. The size, cutting required, component location and orientation is given as Fig. 4. The two power transistors are mounted on the heatsink,

using insulated bushes and mica washers. The heatsink is fixed to the outside of the case to assist cooling.

The transformer and the board are bolted to the base of the case, which is chipboard to give the necessary rigidity to the unit. The switches, meters and the variable controls are mounted on an aluminium front plate. The sides and top are plywood, pre-assembled to form an inverted 'U'. The back is a combination of chipboard and plywood. To improve the appearance of the prototype the top, sides and back were covered with wood-patterned paper.

The major dimensions for the front panel are given as Fig. 5 and those for the remainder of the case as Fig. 6.

## SETTING-UP

Each supply should be switched on in turn and, with no load connected, the voltage control should be checked for the relevant supply. The output should indicate from approximately 2V to 20V.

Set the voltage control of one section to minimum and switch the ammeter to 1A. Connect a high wattage resistor of about 20 ohms to the supply selected. Set the current control to minimum and the voltage control to about 10V. No current should flow. Increase the current control and note that the current increases. The increase should continue until it reaches the expected value (with 10V and 20Ω this would be 0.5A). When further increase in the control produces no corresponding increase in current the overload condition should have been reached. Apply a short circuit to the output. The current should not increase by an appreciable amount but the voltage should fall to nearly zero.

Remove the short circuit and repeat the test for the second supply.

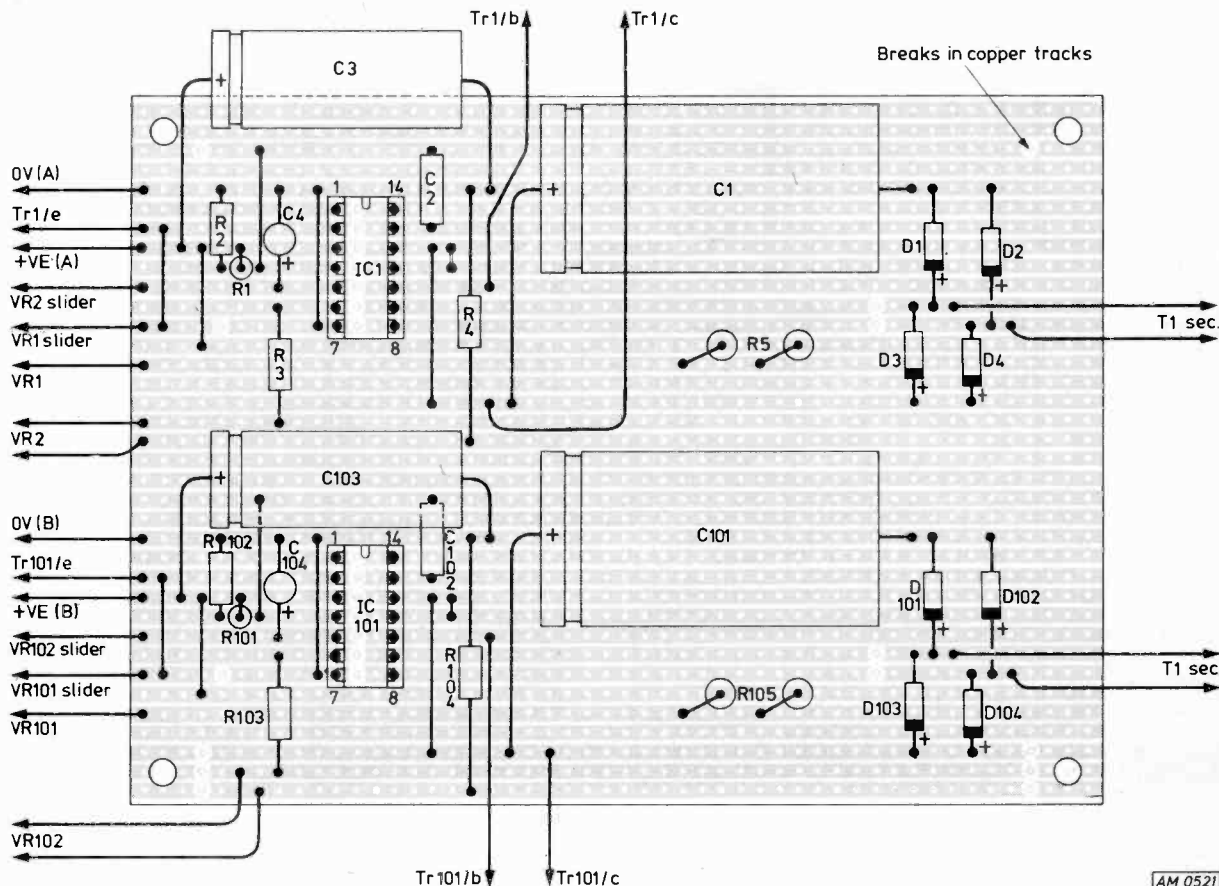
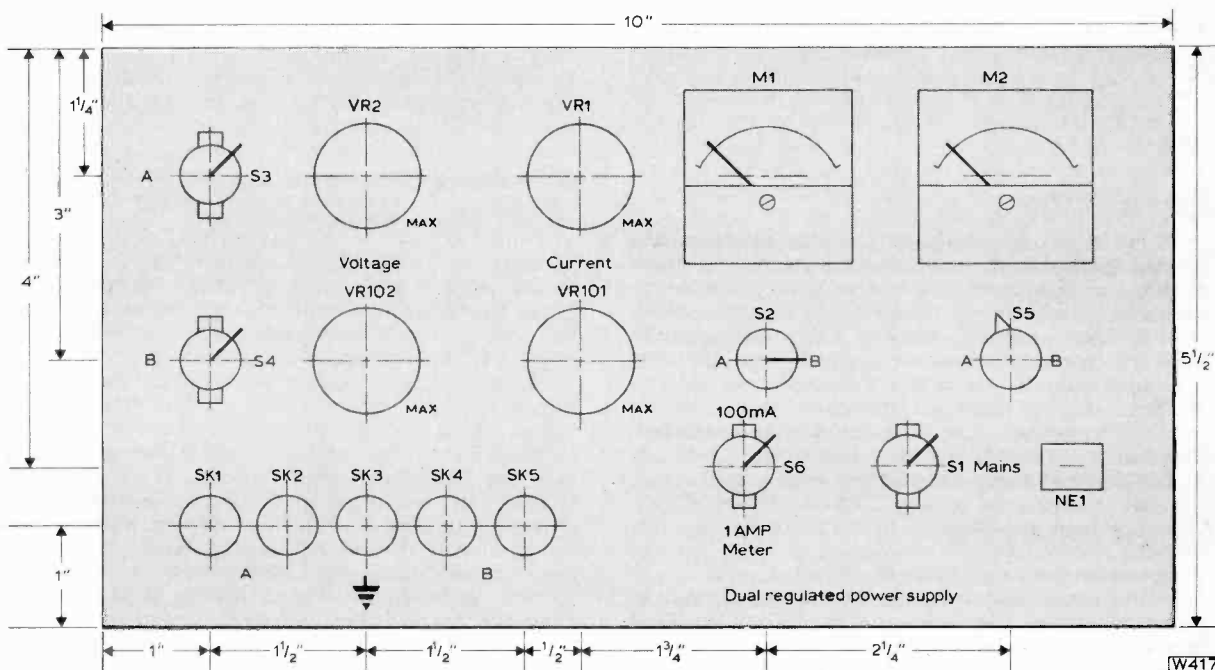


Fig. 4. The cutting and component locations on the stripboard. The minimum number of breaks has been made. If nylon screws and nuts are used the breaks to isolate the fixing holes can be omitted.

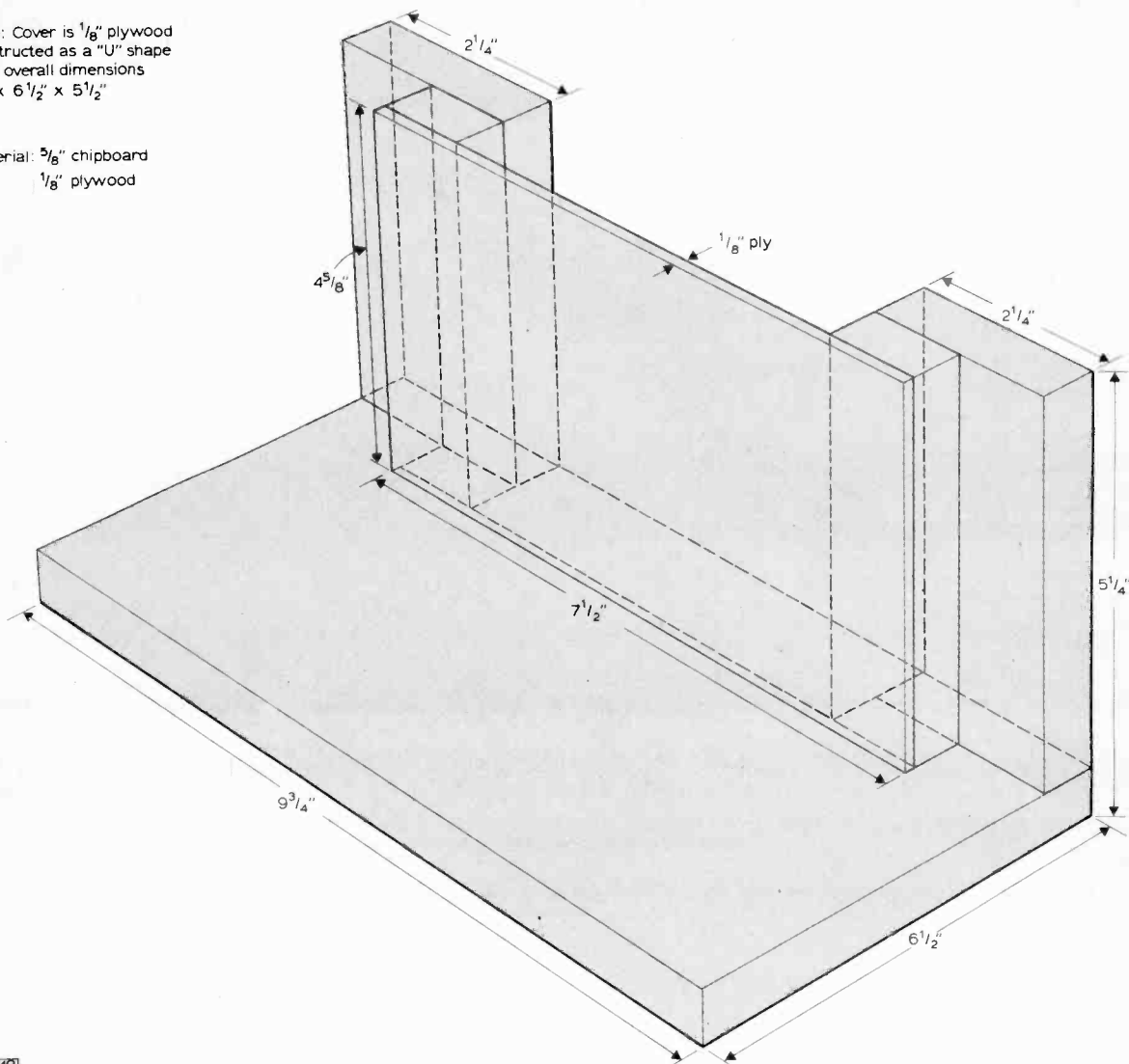
Fig. 5. The layout of components on the front panel of the prototype. This layout is not critical and may be re-arranged to suit other cases or components.



W417

Note: Cover is  $\frac{1}{8}$ " plywood constructed as a "U" shape with overall dimensions  $10" \times 6\frac{1}{2}" \times 5\frac{1}{2}"$

Material:  $\frac{5}{8}"$  chipboard  
 $\frac{1}{8}"$  plywood



W418

## OPERATION

For standard applications, (i.e. as a single supply or two independent supplies) no external interconnections are required. For use as split supplies the negative of one supply is connected to the positive of the other with the common point, connected to the earth terminal if required, used as the 0V line.

For currents in excess of 1A the two supplies can be connected in parallel. However, some care is required to ensure that both supplies are matched. This can be achieved by setting the voltages, off load, to be identical for both sections before connecting the two sections in parallel. When connected but with the load not applied the voltage on the two sections should still be the same. If they are not then one or the other must be adjusted.

Before connecting the load ensure that both current controls are at minimum. Connect the load and increase both current controls as near simultaneously as possible whilst monitoring the individual

Fig. 6. The dimensions of the base and back of a case to match the front panel of Fig. 5. If alternative cases are used ensure that the heat sink has adequate cooling.

currents. A level will be reached where increases in one supply will cause decreases in the other. When this occurs set both currents to be the same. The short circuit protection still applies in this method of operation.

For applications where the voltage required is higher than 20V the supplies may be connected in series. Again the two supplies need to be balanced. In this case set the voltage controls so each supply will give half the required voltage. Set the current controls to maximum (R5 will give over-current protection at about 1.2A). Connect the load. Reduce the current control of one supply, whilst monitoring the current drawn, until the control decreases the current. Increase the control slightly until it doesn't effect the current. Repeat for the second supply. The short circuit protection will apply in this method as well.

DW

# TUG 'O' WAR GAME

THE fairly complex logic of the PW Tug 'o' War game is contained within 9 CMOS ICs containing about 600 MOS transistors. The game is simple and fun to play in that the reaction times of two players are compared and the player with the faster reaction time wins the point. The score is shown graphically on a row of LEDs and the knot in the "rope" between the two players is represented by a lit LED. The object of the game is to get the "knot" to one's own end by winning sufficient points.



Richard DUDLEY

## CMOS technology

Complementary Metal Oxide Semiconductor Logic, to give it its full name is based on two types of MOSFETS, n-channel and p-channel enhancement devices. Each has four electrodes, Fig 1, the sub-

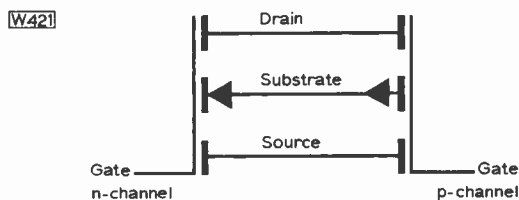


Fig. 1: Drawing of a n-channel and p-channel complementary MOSFET device.

strate terminal is taken to one supply rail,  $V_{DD}$  (positive rail) for p-channel transistors, and  $V_{SS}$  (-ve) for n-channel devices. The n-channel type can be thought analogous to an NPN transistor in the way it operates, although the gate takes negligible current and the source drain path when the transistor is switched fully on, appears as a resistance (about  $500\Omega$ ) rather than a voltage drop. For

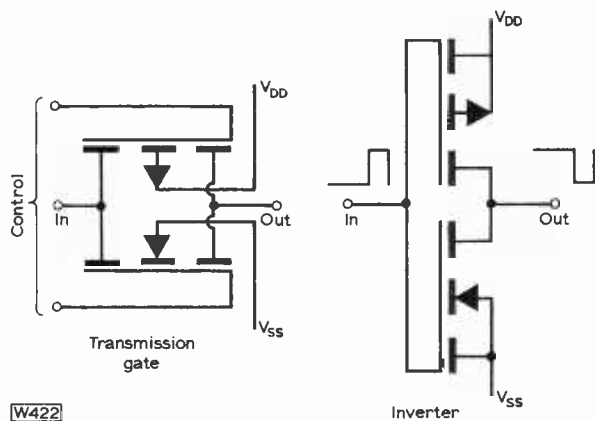


Fig. 2: Transmission gate and Inverter of CMOS logic.

an n-channel transistor, the source is negative with respect to the drain, and conduction occurs when the gate is sufficiently more positive than the source. The p-channel devices require opposite polarities to those of the n-channel version.

Pairs of complementary MOSFETS are used to make up the two basic building blocks of CMOS logic, the transmission gate and the inverter, Fig 2. When an inverted is connected between the control pins, both transistors are either on or off and the transmission gate acts as an analogue or digital

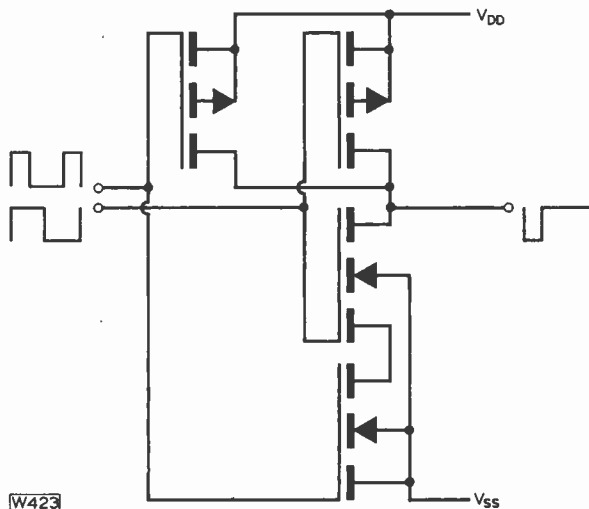


Fig. 3: Combination of transmission gate and inverter, so forming a 2-input NAND gate.

switch capable of passing signals in both directions. The off/on resistance ratio of this solid state switch is better than 3000000:1.

Inverters, when connected in parallel/series combinations can be made to form gates as in Figs 3 and 4. However, the arrangements are asymmetrical,

hence the NAND has a greater pull up capability, while the converse holds for the NOR. If gates with more inputs are needed, the output impedance will rise, unless two extra inverters are added to the

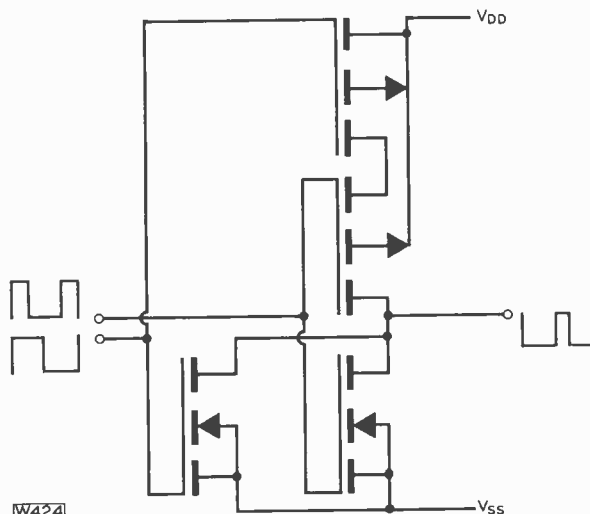


Fig. 4: Similar combination as in Fig. 3, but forming a 2-input NOR gate.

output to restore symmetrical output characteristics. These extra inverters are standard on ICs with a B suffix.

### Circuit description

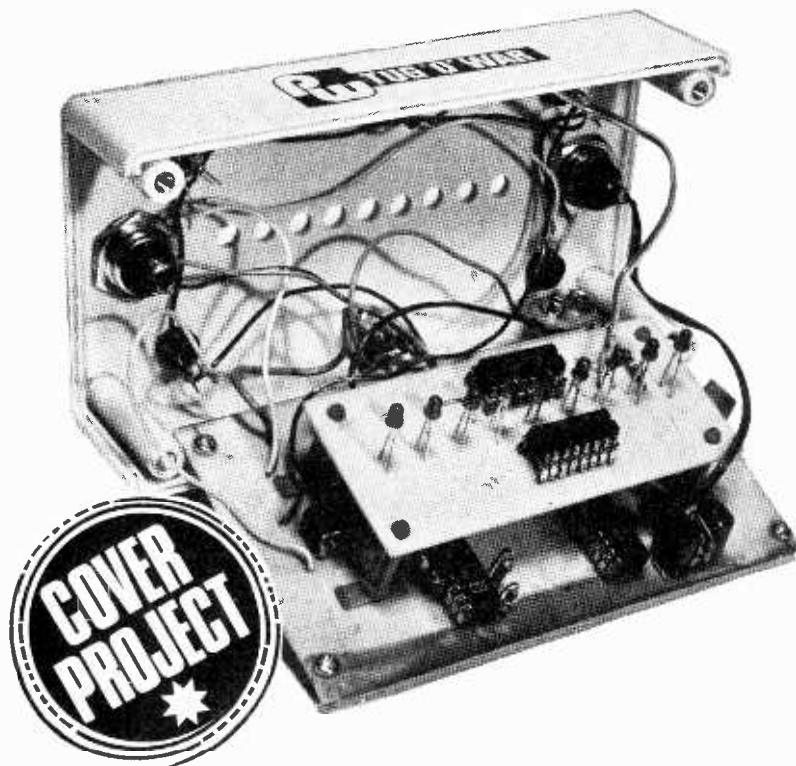
Reference to the circuit diagram in Fig 5 and the block diagram Fig 6, will show that the logic of the game splits into three main parts—the random time

delay monostable, control and scoring logic. The monostable comprises two NOR gates, capacitor C5 and resistors R7-R11. The time delay is determined by the combination of resistors selected by IC2 which, in turn, is controlled by IC1, a 7-bit binary counter (only 4 outputs are used). The latter is clocked by an oscillator formed by IC3c, IC6c, R4, R5 and C4. A logic 1 on the input to the NOR disables the clock.

The control logic consists basically of an RS latch IC4a and b, and various other gates and inverters which drive the indicator lamps, and score counter IC8. This is an up/down counter, the direction of counting being dependent on the output of the EXCLUSIVE OR gate, IC7d. A logic "1" on the up/down input of the IC persuades it to count up, a logic "0", down. This up/down counting is the whole basis of the scoring system in Tug 'o' War. The counter is clocked by inverters which are preceded by a pulse delayer R1 and C1. A BCD output is also provided by the counter which drives IC9, a BCD to Decimal decoder which feeds the LEDs.

### Circuit operation

Play begins when both push buttons are depressed by the two players. This causes two logic "0"s to appear on the inputs of IC3, whose output then rises to a logic 1. This stops the counting action of IC1 and so produces a random binary output on the four data lines linked to IC2. This IC contains four transmission gates which are wired across each of the resistors R7-R10. If a logic 1 is present on the output lines, the resistor associated with that bit of the counter will be shunted. The overall effect is to produce one of sixteen different resistance values



General interior photograph of the Tug-O-War, showing the board layout, inter-board wiring and switch positioning.



## ★ components list

### Resistors

R1 68k $\Omega$	R7 680k $\Omega$
R2 10k $\Omega$	R8 1.2M $\Omega$
R3 10k $\Omega$	R9 2.7M $\Omega$
R4 220k $\Omega$	R10 5.6M $\Omega$
R5 100k $\Omega$	R11 3.3M $\Omega$
R6 100k $\Omega$	R12 270 $\Omega$

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

### Capacitors

C1 180pF	C4 10nF
C2 100nF Mylar	C5 1 $\mu$ F tantalum
C3 100nF Mylar	

### Semiconductors

IC1 CD4024AE	IC8 CD4029AE
IC2 CD4016AE	IC9 CD4028AE
IC3 CD4001AE	D1 to D9 TIL209 red LEDs
IC4 CD4011AE	D10 0.2in yellow LED
IC5 CD4069BE	D11 0.2in yellow LED
IC6 CD4069BE	D12 0.2in green LED
IC7 CD4070BE	D13 0.2in green LED

### Miscellaneous

S1, S2, S3, single pole push to make switch. S4, single pole miniature toggle switch. Main PCB, 125 x 73mm. LED PCB, 90 x 40mm. Vero case 150 x 80 x 50mm. Four off, Vero 19mm stand-off pillars. Clips for all LEDs. 9V PP3 battery with snap on connector. Lengths of coloured wire.

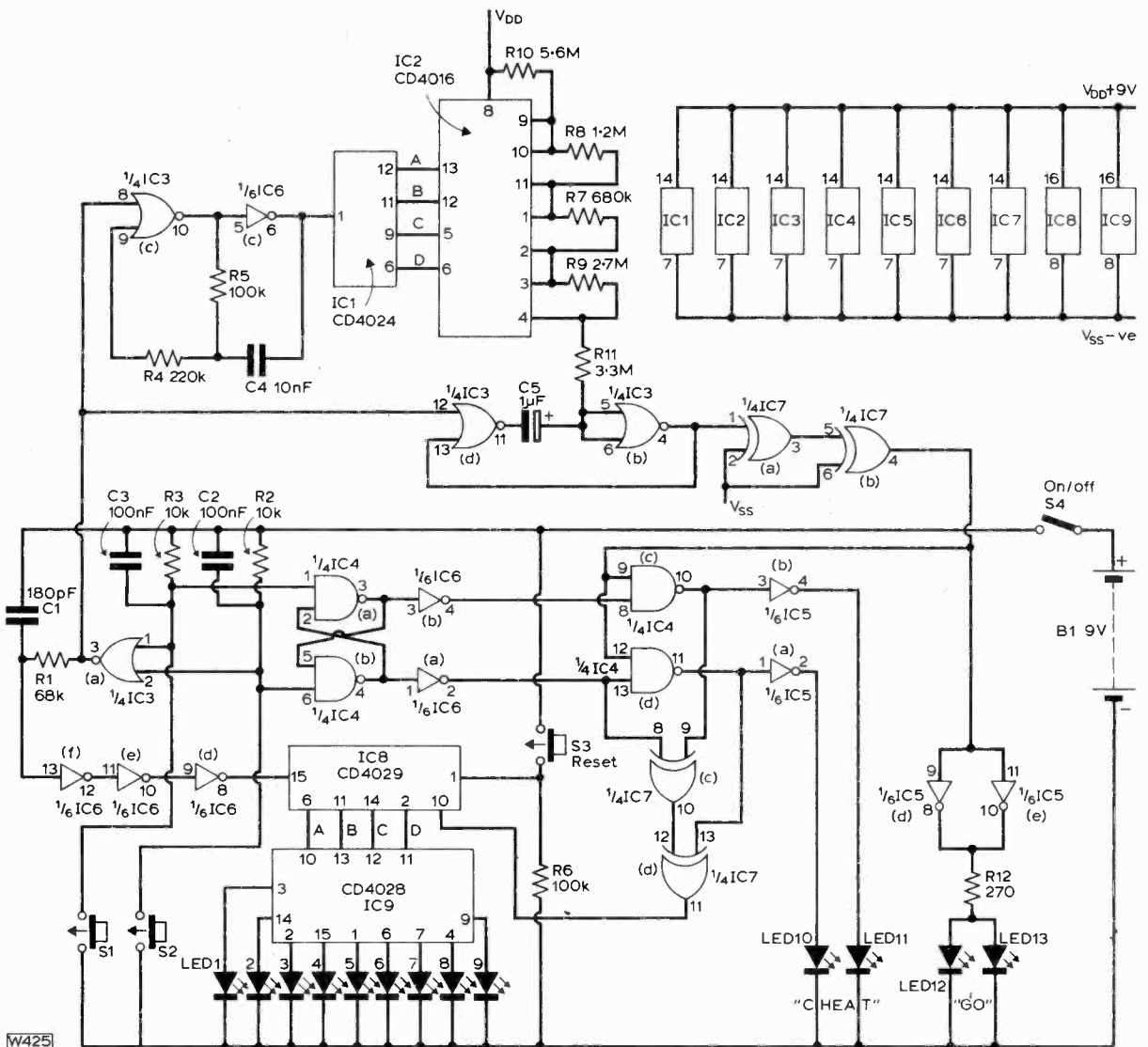


Fig. 5: Full circuit diagram of the Tug-O-War, giving details of the nine integrated circuits used in its construction. The 'rope' is formed by LED's 1 to 9.

which controls the time constant of the monostable.

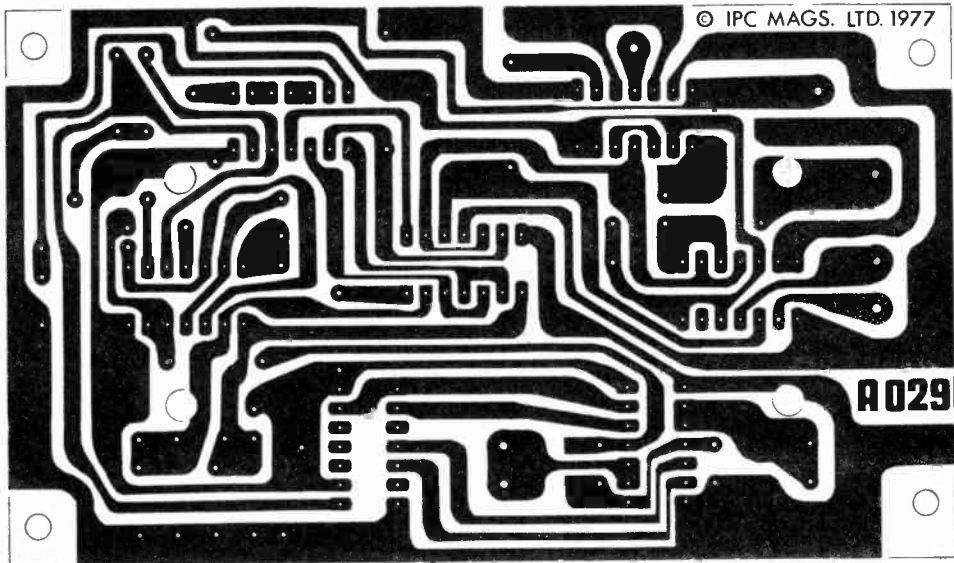
The positive pulse on the input of the monostable which also disables the oscillator means that the output of IC3 will go low. Since C5 is initially uncharged, the input of IC3b will go low also, taking its output high. The output of IC3d is held low during the timing cycle as the output of the monostable is connected to its other input. Meanwhile C5 charges at a rate dependent on the resistance chain, but when the voltage across it reaches the transfer voltage of the gate IC3b (approx 70 per cent of V), the output reverts to low level. This signal is buffered with two EXCLUSIVE OR gates and then inverted and delivered to the two "go" LEDs.

The RS latch connected to the two push buttons is set by the first player to release his button. The

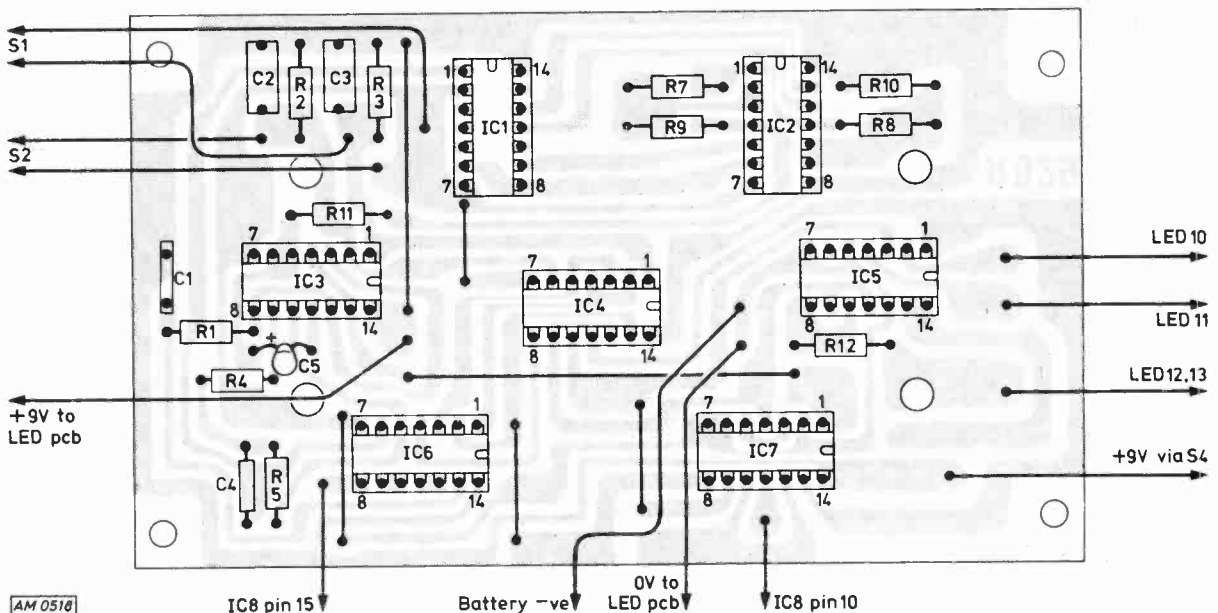
other button will then have no effect. The two outputs are inverted, then compared with the monostable output by IC4c and d. Should the output be high when the latch is set, both inputs to the NAND in question will be high thus its output will go low and the respective "cheat" light will come on.

### Cheating

Two EXCLUSIVE OR gates IC7c and d, produce an output from the latch and the "cheat" outputs which causes the counter IC8, to count up or down. If neither player cheats, the outputs of IC4c and d will not go low thus the output of IC7c will be low (an EXCLUSIVE OR gives a 1 output if its inputs differ). The level on the up/down input to the



Main PCB for this project, containing all components with the exception of IC8, IC9, LED's 1 to 9 and R6. Foil side above and component overlay below.



AM 0516

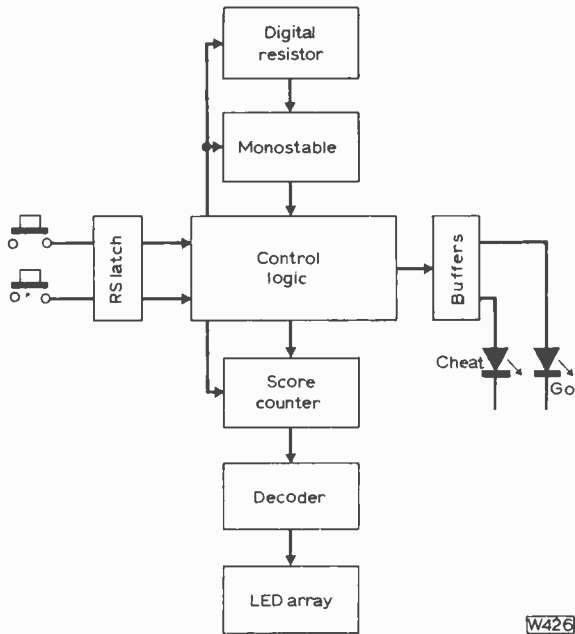


Fig. 6: Simplified block diagram of the logic used in this project.

counter will be high if the input to IC7d is high, and vice-versa. However, should there be a cheat in our midst and he releases his button before the GO signal, one of the inputs of IC7c will be high and the second EXCLUSIVE OR gate will invert its output, and reverse the direction of counting.

The clock pulse to the counter is initiated when one button is released, but it is not delivered until

the time interval set by R1 and C1 has elapsed (about 12μs). This short delay ensures that the counter is only clocked after all the other logic has settled. The inverters IC6d to f produce a fast rise time pulse for reliable clocking.

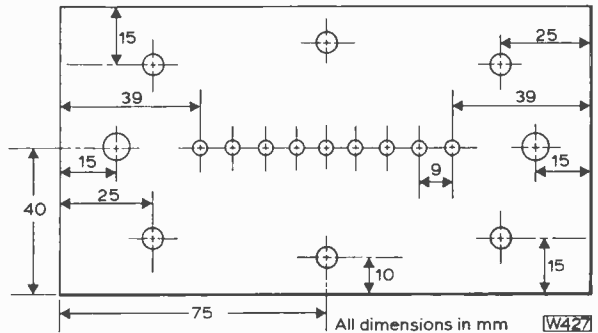
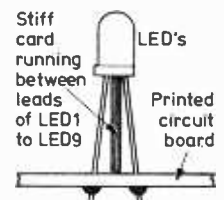
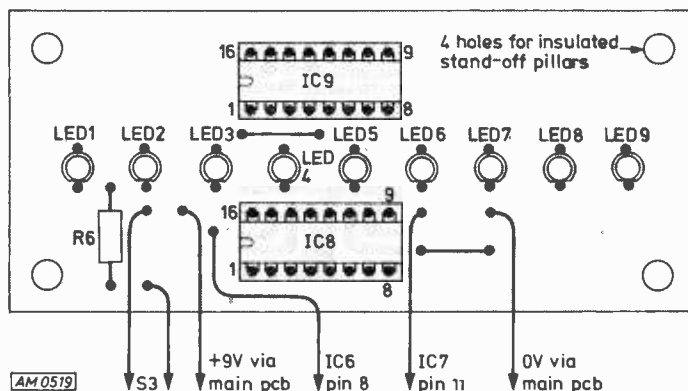


Fig. 7: Dimensions for drilling the front panel which has all switches, and LED's for the 'rope' mounted on it.

Pressing the reset button sets the 'knot' in the centre of the rope of the LEDs. This is accomplished with the help of inputs to the counter which allow presetting of the counter to any required BCD code when the preset enable pin is taken high. In this case the button, when pressed, sets the output to 4, which illuminates the middle LED.

### Construction

The unit was housed in a two-tone plastic verobox 150mm x 80mm x 50mm which gives a very neat final appearance. The top should be drilled to take the LEDs and switches, hole positioning is shown in



Full size reproduction of the LED board, showing the foil side above with the component overlay below. A certain amount of pressure is exerted on the LED's when the lid is offered up to them, this tends to lift the track. It is recommended that a stiff piece of card be inserted (between the top of the board and the LED's).

Fig. 7. When drilling the case, take care not to let the drill bit slip, as bitter experience has shown how easily an expensive plastic case can be ruined with little or no effort! The electronics is held on two printed circuit boards, to enable the components to be mounted in a reasonable space, and to reduce the amount of free wiring to the lid, see Figs 8 and 9.

Begin construction with the nine wire links, then go on to the passive components, flying leads and finally the ICs. The latter should be kept in their conductive foam until needed. Check the polarity of LEDs, tantalum capacitor and especially the ICs before soldering. The small red LEDs should be soldered as proud of the board as their leads will allow or they will not protrude through the lid. To this end the PCB is mounted with a nut between board and case in each corner so that the LEDs can be secured to the lid by means of the clips supplied.

When soldering the LEDs, beware of keeping the iron on them too long, as the red plastic is easily softened and then all that holds the leads on, is the light emitting junction itself.

Resistors R1 and R4 and capacitor C1 should be mounted flush with the board so that the battery will not foul the push button when it is installed. The push buttons S1 and S2 must be wired up correctly or the game may well become a push, rather than a tug 'o' war.

## Playing the game

After switching the game on, the score should be reset with the push button opposite the on-off switch. Both players should now press their push buttons whereupon the green 'go' LEDs will go out. After a random time interval which was from 2 to 10s on the prototype, the LEDs will come on again. The first player to release his button after this signal, has the light moved one place closer to his end. A cheat who removes his finger before the signal will have the light moved one place closer to his opponent. Play then continues in this manner until the light reaches one end. The player at that end is declared the winner of the contest.

## Modifications

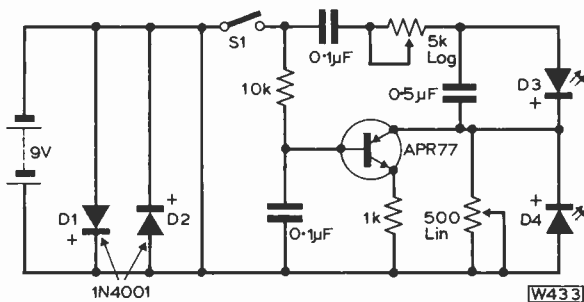
The game can be expanded for team use—the push buttons for each member of the team are wired in series. The fastest person in the two teams will then win the point but who it was . . . ?

A small problem encountered with the prototype was that the switches used were rather prone to contact bounce causing irregularities in the scoring, however one does get used to the feel of the buttons after a while. A worthwhile improvement would be to replace S1 and S2 with touch switches etched from copper clad board offcuts, this would eliminate contact bounce and reduce strain on the finger whilst waiting for the 'go' signal. If this modification is carried out then R2 and R3 should be increased in value to about  $3.3\text{M}\Omega$ ; C2 and C3 may need to be reduced in value or omitted altogether to achieve the desired effect. PW

# THE D. JONES 'SUREFIRE'

**T**HIS project is aimed at those constructors who are unable to make an electronic circuit work first time. It is hoped that even the most ham-fisted reader, with little trouble, should be able to build and operate this device.

The main function of the circuit, Fig. 1, is to do nothing, a very difficult achievement in a continually changing universe. The circuit layout has been designed so that it would take a very large number of mistakes for nothing not to happen. Should a constructor wish, peripheral devices can be added, but he is warned that too complicated a circuit may do something.



The battery was obtained from a transistor radio that did nothing when switched on; this is a good indication of the batteries condition. It should also do nothing when connected across a meter. But to make certain of its integrity a length of wire was connected between its terminals and left for a few hours. The two protection diodes D1/2 were taken from a burnt-out bridge rectifier, but new ones would work just as effectively.

The mechanical switch was included because it was felt that a touch switch would have increased the price of the project and may have caused something to happen contrary to the aim of this project. The potentiometers were added to fill two holes in the box used to house the circuit board, but having included them it became apparent that they were a 'must', especially when showing the finished product to admiring relatives.

VR1 acts as a Kenotron and causes all positrons present in the surrounding magnetic medium to undergo an adiabatic contraction. This contraction excites the ICW from VR2 causing the Lorenz transformations to be temporarily invalid within the immediate Hamaltonian space. The combined effect is that nothing is created and then passed on to the detector.

When the circuit is assembled and switched on nothing should happen. If, however, something does happen it is advised that the builder does not take up a career in electronics.

# GAS/SMOKE SENSOR ALARM



R. A. JENKINS

SINCE the introduction of gas and smoke detectors various circuits and constructional articles have been published, usually with features that may be redundant in a purely domestic unit. The majority of sensors available have unusual power requirements (typically 1.2V at 500mA), resulting in the need for specially wound transformers or, if portable, very short battery life. Since the introduction of the Type 812 sensor a very economic and easily constructed alarm system can be made without losing facilities or effectiveness and gaining, due to circuit simplicity, overall reliability. This article describes such a unit.

The circuit (Fig. 1) is basically a blocking oscillator formed by Tr1 and 2. In the presence of any de-oxidising agent such as smoke, gas, or petrol vapour the semiconductor coating of the sensor decreases in resistance which increases the bias applied to Tr1 base. This triggers the oscillator, producing both an audio alarm from the speaker and a direct intensity reading by the meter. VR1 sets the sensitivity of the oscillator and may be set to trigger the audio alarm at any given gas/smoke intensity.

The supply requirement of the sensor circuit may be derived from the mains power supply (Fig. 2) or the unit can be made portable and a 12V battery supply used. Diode D1 is included to give reverse polarity protection.

## Construction

The printed circuit board Fig. 3a should be assembled as shown (Fig. 3b). The front panel is then cut or drilled to suit the meter, speaker, LED and mains switch. Next the power supply fuseholder and sensor socket are installed in the case. The circuit board is then bolted directly on the meter terminals which establishes the connections to the meter. The unit may now be wired as shown, paying particular attention to the connection of the sensor socket terminals.

Set VR1 to mid-track and plug in the sensor unit. Now switch on, when the alarm should sound almost immediately and then rise in pitch. After five

seconds or so, as the sensor warms up, the pitch will decrease to a steady note, maintaining a meter reading, typically 100 $\mu$ A.

If a small amount of cigarette smoke or gas from a butane lighter is released near the sensor the meter reading will rise and the alarm will sound. The sensitivity control VR1 of the audio alarm should be set so that the alarm is not triggered by

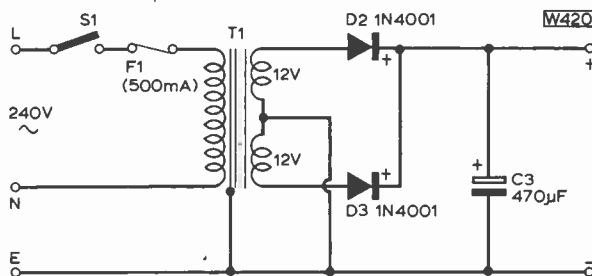
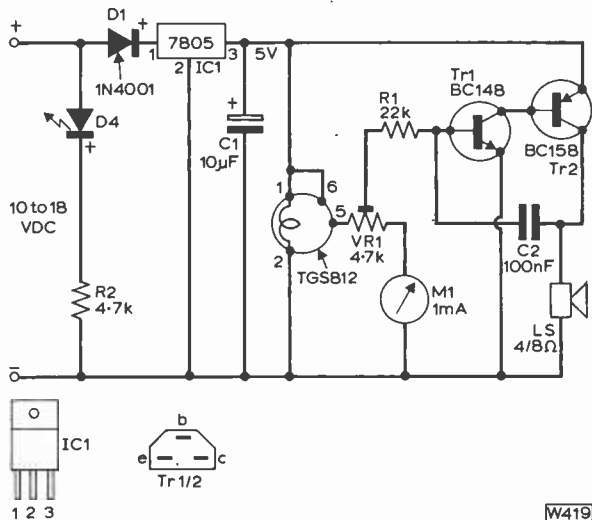
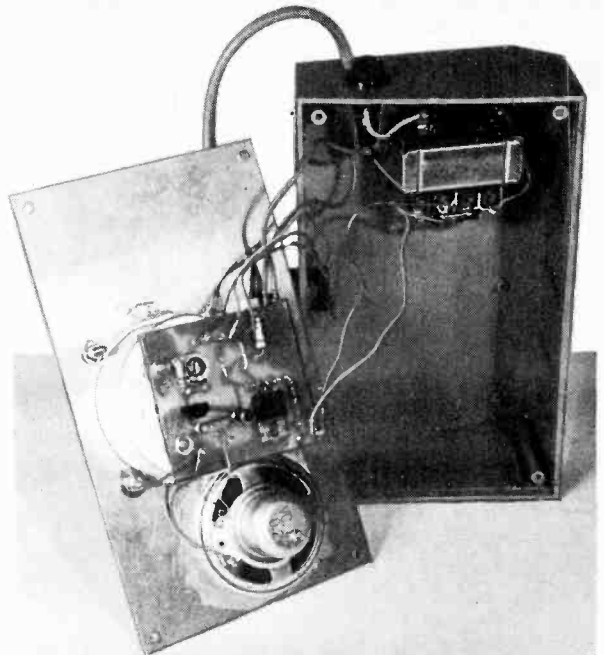
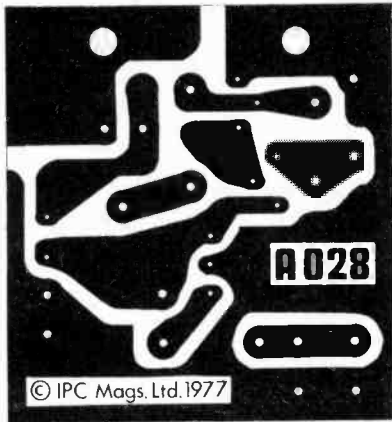


Fig. 1: top, is the circuit of the Alarm with Fig. 2, below, the mains power supply circuit. Both are incorporated in the Alarm shown in the heading photograph.



View of the PCB, mounted directly on the meter terminals. The mains transformer and smoothing capacitor C3 are mounted in the box.

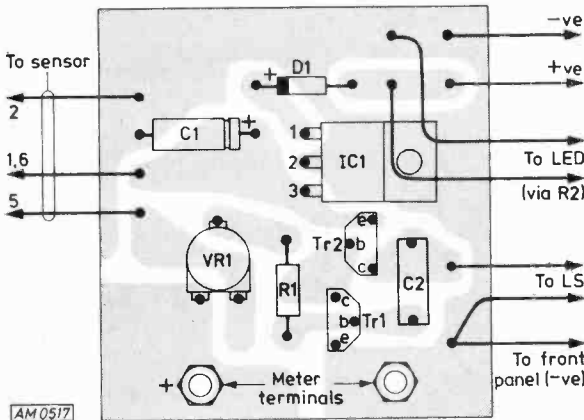


Fig. 3a, top, is the full size drawing of the PCB with the component layout, Fig. 3b, below.

any cigarette or cigar smoke that may be present normally. Usually VR1 is set at approx 75% rotation triggering the audio alarm at 200 $\mu$ A (0.2mA).

The unit described is suitable for continuous operation. Type 812 sensors have an approximate operational life of two years continuous use and may be periodically checked as previously described. Replacement is a mere formality, just plugging in a new sensor. When the sensor is nearing replacement time the reaction to gas and smoke will be sluggish.

### ★ components list

#### Resistors

R1 22k $\Omega$   $\frac{1}{2}$ W R2 4.7k $\Omega$   $\frac{1}{2}$ W VR1 4.7k $\Omega$  submin. horizontal pot.

#### Capacitors

C1 10 $\mu$ F 10V C2 100nF C3 470 $\mu$ F 25V

#### Semiconductors

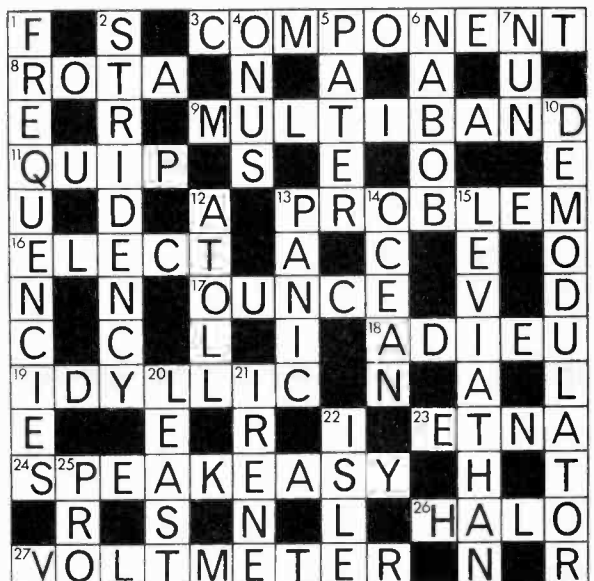
Tr1 BC148 Tr2 BC158 IC1 7805 regulator D1/2/3 1N4001 D4 LED 0.2" and clip TGS812 Sensor with holder (Watford Electronics)

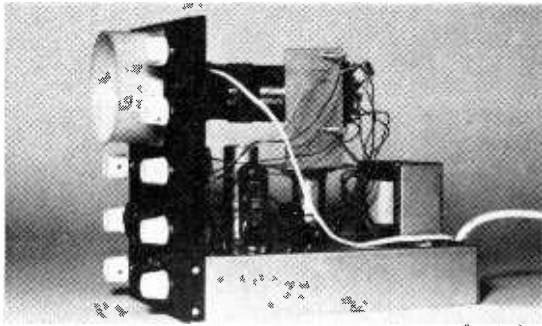
#### Miscellaneous

Speaker 1 $\frac{1}{2}$ " dia. 4 to 8 $\Omega$ . Meter 1mA FSD (Watford Electronics Type T24). Transformer T1, 0-12V, 0-12V 6VA total, 240V primary. Fuse 500mA and holder. Mains on-off switch. Plastic case and panel approx. 6 $\frac{1}{2}$ " x 3 $\frac{1}{2}$ " x 2".

## PW TECHNICROSS PUZZLE

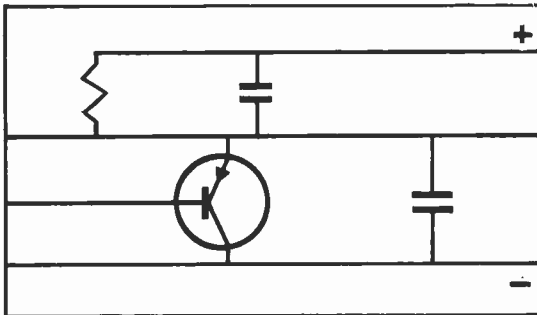
Solution to No. 18  
presented last month





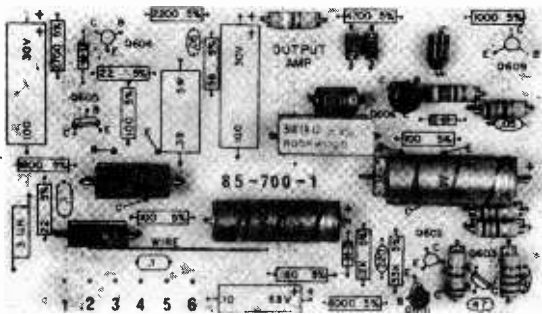
## 1 Build an oscilloscope.

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.

*Practical Wireless, April 1977*

# 'There's only one way to master electronics... to see what is going on and learn by doing.'

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 learn the practical way in easy steps mastering all the essentials of your hobby or to further your career in electronics or as a self-employed electronics engineer.

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.



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.

Write to:- British National Radio & Electronic School  
P.O. Box 156, Jersey, Channel Islands.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

WB 4/7

# Circuits for AUDIO AMPLIFIERS

## PART 2

F.G.RAYER G3OGR

### HEAT SINKS

The power dissipated in a transistor is the product of the current flowing through it and the voltage across the junction. The emitter/collector voltage is lower than the supply voltage, by the extent of the voltage drop in collector and emitter circuits. In low level stages, dissipation will be considerably less than the safe limit for the transistor.

In output stages, and some driver stages, the power dissipated in the transistor becomes quite large. This power causes heating, which can damage the transistor. This damage is avoided either by limiting operation conditions so that dissipation is low enough for the particular transistor when used without a heat sink, or by providing the transistor with a heat sink. A heat sink is a metal clip, plate, chassis or something similar, either flat or finned, thermally in contact with the transistor. It carries away heat from the transistor which can then operate at higher ratings. The heat is lost by convection of air currents, radiation and conduction.

The thermal capacity of the sink, or its ability to carry away heat, is arranged to suit conditions. The heat sink is an essential item and should not be omitted when specified. The chassis or metal case is often used, to avoid a separate heat sink.

It is sometimes necessary to provide electrical insulation between the transistor and its heat sink and a thin mica washer can be used. Sink surfaces should be flat for good thermal contact, with no rough holes

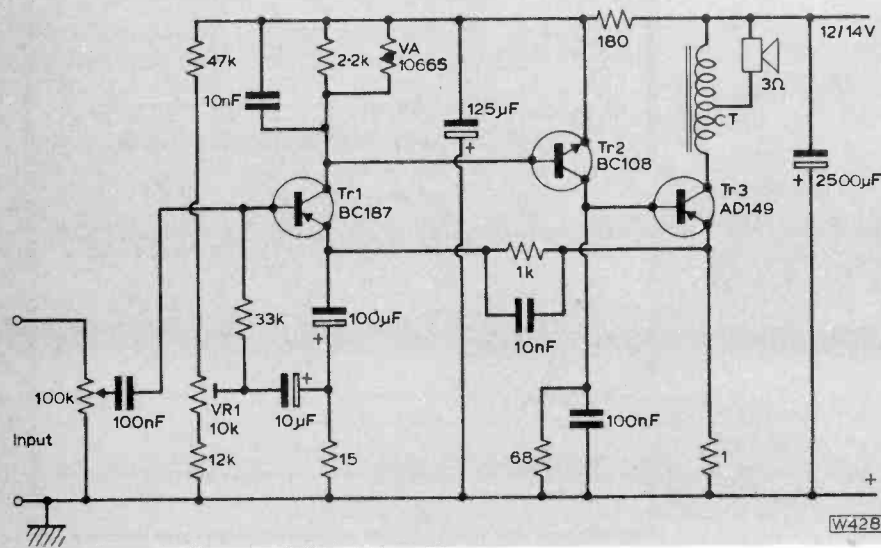
or edges which may penetrate the insulation. To obtain a low thermal resistance (good transfer of heat) silicone grease, available for this purpose, may be smeared on the surfaces.

### PNP AMPLIFIER

Fig. 13 is a directly coupled circuit for 14V, either from an accumulator (nominally 12V) or derived from the mains. Pre-amplifier and driver stages are included. VR1 is pre-set and adjusted so that a meter placed in one supply lead reads about 900mA. The output transformer is centre-tapped. With output stages drawing a heavy current, significant voltage is dropped and efficiency reduced if the transformer winding has an unnecessarily high resistance, so a large component intended for such circuits is necessary. Tr3 requires a heat sink which can be 5 x 4in 16SWG aluminium, or a larger area obtained by using the case or chassis.

### THERMAL RUNAWAY

If operating conditions of a stage, or directly-coupled stages, are not sufficiently stable, changes in working conditions arise. The amplifier may shift into operating conditions which reduce gain, cause distortion, or increased collector current. With low power stages, emitter and collector resistors assist stabilisation, and limit currents to safe levels. But with higher powered stages, adequate safeguards in this way are not possible.



13

A directly coupled amplifier using an AD149 transistor in the output stage. The supply should be around 12 to 14V, a car battery being an ideal source, the quiescent current of the whole amplifier being about 900mA.

W42B







# TRAMPUS ELECTRONICS LTD

58-60 GROVE RD.  
WINDSOR, BERKS.  
SL4 1HS.  
TEL. 54525

ADD 8% VAT TO PRICES MARKED \*  
ADD 12% TO ALL OTHER PRICES.  
OR AS CURRENT VAT LEGISLATION  
SEND C.W.O. (EXCEPT GOV'T DEPT)  
POST & PACKING 20P FOR THE U.K.  
BARCLAYCARD & ACCESS BY POST  
OR 15 MIN ON TELEPHONE ORDERS.  
NEW CATALOGUE LIST FREE S.A.E.  
MONEY BACK IF NOT SATISFIED.

## FAST SERVICE

ON EX STOCK ITEMS  
NORMALLY 24 HOURS



SEVEN SEGMENT LED DISPLAYS  
BRIGHT DL707 COM ANODE &  
DL704 COM CATH. 0.3" £1\*  
DL747 0.8" JUMBO CA £1.25\*

DIGITAL CLOCK IC 51224 £4\*  
ZENON STROBE TUBES £4 & £7\*  
ORP12 54p\* 2N5777/OC71 34p\*

## RED LEDS 10P.

RED LEDS 209 STYLE 0.125" &  
OR 0.2" DIA. NO CLIP 10p\*  
TIL209 RED LED & CLIP 12p\*  
BIG 0.2" RED LED & " 14p\*  
GREEN OR ORANGE LEDS 29p\*  
ORP12 54p\* 2N5777/OC71 34p\*

TRAMPUS  
THE GREAT  
BRITISH  
DISTRIBUTOR



INDUSTRIAL, EDUCATIONAL, TRADE  
& EXPORT SUPPLIED. SEND FOR  
OUR FREE CATALOGUE LIST SAE  
MANUFACTURERS EXCESS STOCKS  
PURCHASED. DISCOUNTS 10% OFF  
100 up, 15% OFF 1000 up, ...

## TOP DISCOUNTS.

### INTEGRATED CIRCUITS

555 TIMER	34p*	LM380(60745) £1	
556 2 x 555	90p*	LM381 Preamp £2	
703 RF/IF AMP	29p	LM3900 4xOPA 53p*	
709 T099 or DIL28p		MC1303 2xPrre £2	
710 DIL14	35p*	MC1310 stereo £2	
723 Regulator	44p*	MC1312P SQ £1.70	
741 DIL 8pin	21p*	MC1330	75p
741 DIL 14pin	31p*	MC1339 Preamp £2	
741 T099	33p*	MPC4000B 1W 72p	
747 DUAL 741	69p*	MPC6030	£1
748 DIL 8 pin	32p*	NE536 FETOPA £2*	
7805 5V14+reg £1.35*		NE540 or 550 £2*	
7812 & 7815 ea £1.40		NE555 TIMER 34p*	
78013 6W AF	£1.50	NE556 2x555 90p*	
AT51224 CLOCK	£4	NE580/1/2/5/6/7/3	
CA3048	54p*	SN72741 aa 741	
ICL8038 Sigen	£4	SN76660 IF 74p	
LM3008	£1	SN76611 IF £1	
LM3018 DIL 8	33p*	TBA800 5W AP 84p	
LM309K 5V reg	£2	TBA810 7W AF 94p	
LM309H T05 can	£1*	ZN414 Radio £1.19	
LM318 70VusOPA	£3	NEW 1468/89 £4	

## CMOS TTL

4000 14p*	7400 12p*	7480 39p*
4001 15p*	7401 13p*	7491 75p*
4002 16p*	7402 15p*	7492/93 45p*
4007 16p*	7404 19p*	7495/98 72p*
4009 50p*	7408/10 18p*	74100 £1.25*
4011 16p*	7413 29p*	74107 32p*
4012 17p*	7440 16p*	74121 29p*
4048 50p*	7441 71p*	74123 89p*
4069 20p*	7442 72p*	74141 74p*
4501 26p*	7447 79p*	74145 85p*
4511 £1.65*	7470/72 27p*	74147 £2.50*
4528 £1*	7473/74 31p*	74151 75p*
4543 £2*	7475/36 35p*	74154 £1.40*
4553 £5*	7488 35p*	74198 £1.50*

DIL SOCKETS PROFESSIONAL QUALITY  
8pin, 14pin & 16pin ALL 12p ea\*  
SOLDERCONS 100 49p\* 1000 £3.95\*

## NEW LOW PRICES.

### TRANSISTORS AND DIODES

INS BUSH SET 5p ea*	TIP31/32 50p*		
MATCHING 20p Pr*	TIP31c32c68p*		
AC127/8 176 15p*	TIP41/42ea 66p*		
AD161/162 ea36p*	TIP41c42c" 11.50*		
BC107	8p*	TIP2955	68p*
BC107B	13p*	TIP3055	65p*
BC108	8p*	T1843 UJT	26p
BC108B or C	13p*	1N914/4148	4p
BC109	9p*	1N4001/2	4p*
BC109B or C	12p*	1N4004	5p*
BC147/8/9	8p	1N4007	7p*
BC157/8/9	11p	2N706/8	14p*
BC167/8/9	12p	2N2646 UJT	40p*
BC177/8/9	16p	2N2904/5pn29p*	
BC182/3/4a/110p		2N2926 ory 7p	
BC212/3/4a/112p		2N3053	17p*
BCY70/1/2	15p*	2N3055 90V 33p*	
BD131/132ea 36p*		2N3055 115w45p*	
BFY50/51	15p*	2N3614 T03	51p*
BFY52/53	16p*	2N3702/3/4 10p	
BSX 19/20/21/22p*		2N3705/6/7 9p	
BZY88 ZENER 10p		2N3708/9	9p
CL06D SCR 54p*		2N3710/11 15p	
MJ2355 T03 99p*		2N3819 423p17p	
MJE2955	89p*	2N3820 PDET 40p	
MJE3055	65p*	2N3904/5/6 15p	
OA81/91	5p	2N5457 PET 32p	
TIP29 & 30	40p*	BRIDGE1A50 20p*	

### BARGAIN PAKS FULL SPEC 11ea,

PAK A: 11 RED LEDS full spec 11\*  
PAK B: 5 741C 8 PIN OP AMP 11\*  
PAK C: 4 2N3055 11\* D 12 BC109 11\*  
PAK E: 11 BC182 11 P 11 2N3704 11\*  
PAK G: 7 BFY51 11\* H 8 2N3819 11\*  
PAK J: 6 2N3053 11\* K 40x1N914 11\*  
PAK M: 3 T099 3055 11\* N 25 OA811 11\*  
PAK P: 20 PLASTIC BC109 TYPENpn11

10-365PF TUNER, SINGLE GANG FOR  
MED/SHORT WAVE, XTAL SET etc £1\*  
SETS/IF CANS 455/470KHZ TOKO £1\*

## Full spec devices

# DALO pen 75p

PCB ETCH KIT 3 ITEMS £2\*  
ETCH RESIST PEN 2TIPS 75p\*  
FPC ETCH PAK TUB 800um £1\*  
6x4" SREP 45p\*NTLON F/G£1\*

SCR AND TRIACS BR100 25p\*  
TAG 1A400V 50p\*1A600V 65p\*  
1A50V 37p\*.C106D 4A400 60p\*  
TRIACS: SC146D 10A400V £1\*  
DISCO TRIAC 15A400V £2\*

AUDIBLE WARNING BLEEPER  
12V35mA £1.20 10 off 11\*  
CAPACITORS 22pf - .01 5p  
ELECTROLYTIC IN 10 & 25V  
1/2/10/50/100 7p 50V 10p  
200/500 10p. 1000/25 20p  
POTENTIOMETERS AB etc20p  
PRESETS 8p 1RESISTORS 2p  
HEATSINKS T05 or 8 7p  
T03 18p. T03 4" fanned 50p  
DIN-PLUGS all 15p. Sock 10p  
SWITCHES SPST 20p Dpdt 29p  
GAS DETECTOR TGS 30etct £4\*

## vero

VERO 0.1" PITCH COPPERCLAD  
21"x5" 40p\* 31"x5" 45p\*  
21"x3" 36p\* 31"x3" 40p\*  
31"x17" £2 FACE CUTTER 65p\*  
DIL BREARDBOARD 2"x4" 11 or  
6"x4" £2, VERO PINS 36 30p\*

BLACK PLASTIC CASES 42mmx  
80x80 50p\*100x75 80p\*99p  
120 70p. DESOLDER BRAID 50p



Yeah - it's electronic.  
I built it with components  
from HOME RADIO!

Although the gear worn by today's electronic enthusiasts may differ somewhat from that sported by our friends in the photo, conversations similar to that above can be heard any day of the week in this fair land of ours. Of course, the subjects under discussion are by no means limited to musical instruments—they are as varied as the skill and ingenuity of modern man can devise. The components incorporated in them are of course even more varied, and thousands of them are to be found in the famous Home Radio Components catalogue. No matter what project you wish to tackle it will pay you to purchase this superb catalogue and then, for quick and helpful service, to order your actual components from Home Radio.

The Home Radio Components catalogue has 200 pages filled with over 5,000 items, well over a thousand of them illustrated. With every catalogue comes a free bargain list showing many items at such give-away prices that the savings can pay for the catalogue several times over. The catalogue costs just £1 plus 40p for post and packing. Send for one today!

Please write your Name and Address in block capitals

NAME .....

ADDRESS .....

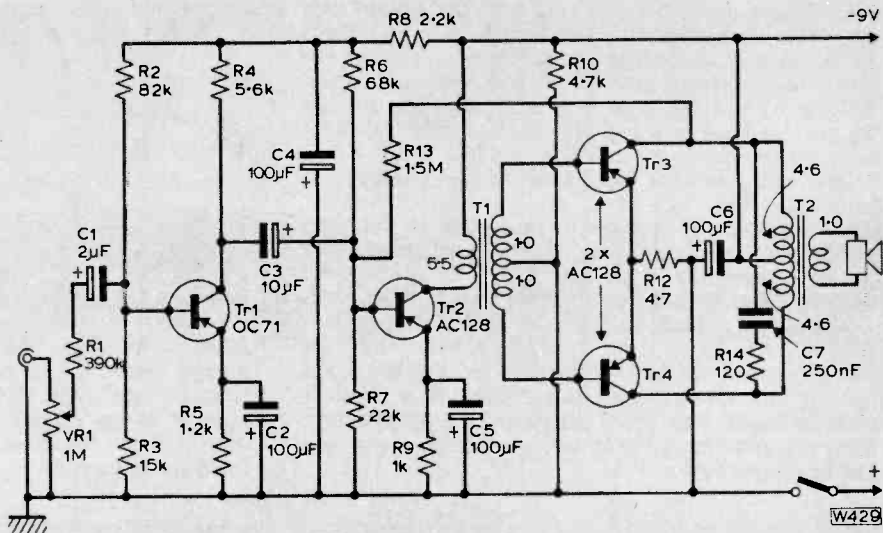
HOME RADIO (Components) LTD., Dept. PW  
234-240 London Road, Mitcham, Surrey CR4 3HD (Regn. No London 912966)



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

14

A practical circuit for an audio amplifier having a push-pull output stage. Quiescent current is low so a 9V battery is satisfactory as a power supply.



In these circumstances, when external circuit resistance and operating conditions do not limit current to a safe level, thermal runaway may develop. Power dissipated in the transistor produces heat, and as the junction temperature rises the collector current increases even more. This, in turn, causes a further rise in dissipation and temperature which again increases current. This situation continues until the current and thus the junction temperature is limited by external circuit values or until the transistor is destroyed.

## THERMISTORS

Component R2 in Fig. 12 (Part 1) is a thermistor and its resistance falls as its temperature rises. The rise of temperature of R2 may be due to external conditions, to heat in the equipment or to the current passing through it, or both. An increase in ambient temperature or in operating voltage will cause the collector current of the stage to increase. But the effect on R2 will be to reduce the base voltage since the value of R2 falls. The drop in base-emitter voltage reduces collector current. The stage can thus operate satisfactorily over a wider range of temperatures and voltages than it could if the thermistor were not present.

## PUSH-PULL OUTPUT

If the audio cycle is divided into two, each peak can be taken to an individual transistor and can drive it into conduction. The outputs of the transistors can be combined to obtain the original audio signal. The advantage of this method lies in the fact that both transistors can have a low resting or quiescent current.

Each transistor of the output pair draws current in turn so this is called a push-pull stage. As the transistors are each dealing with only about one-half of the audio cycle, they are operating in Class B. (This distinguishes operation from Class A, where a single transistor deals with the whole audio cycle.)

Many circuits with Class B push-pull output dispense with transformers, but Fig. 14 is a useful circuit, representative of many transformer coupled

amplifiers. Its push-pull operation is also easy to understand, while it has the advantage that the DC operating conditions of each stage are isolated from other stages. The output is around 500mW ( $\frac{1}{2}$ W).

Tr1 is a Class A pre-amplifier, and can be fed from a pick-up or tuner. R2 and R3 set base conditions, which R5 is the emitter bias resistor. The audio signal is developed across the collector load R4, and is coupled to Tr2 by C3. Tr2 is also a Class A amplifier, and termed the driver as its purpose is to drive the output pair, Tr3 and Tr4. The primary of the driver transformer T1 furnishes the collector load for Tr2.

The primary of T2 is centre-tapped. Bias conditions of Tr3 and Tr4 (from R10 and R11) are such that Tr3 and Tr4 collector currents are small (say, 10mA for the pair). Since T1 secondary is centre-tapped, Tr3 and Tr4 are alternately driven negative into conduction. Outputs are combined by the centre-tapped transformer T2.

Current drawn by the output pair depends very much on the audio signal level, rising to peaks of 30 to 60mA or more, according to volume. (This can be observed by placing a meter in one battery lead.) The average current is, however, much lower. Battery life is lengthened, and the two transistors can deal with appreciably more power.

R13 provides negative feedback (see later) over Tr2, T1 and Tr3/4. C7 and R14 are to reduce the effects of phase shifts at higher frequencies. Connecting R13 should cause a drop in volume but an improvement in quality. If this effect is reversed or oscillation arises, take R13 to Tr4 collector instead of to Tr3. With the values shown for the "1/2-watt" amplifier, a maximum output of 500mW is obtainable, and no heat sinks are necessary.

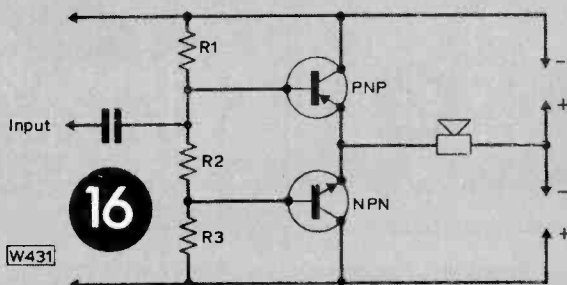
A wide range of transistors can be used in this circuit and the operation of each stage can be checked and adjusted if needed. R10 may be a preset resistor and adjusted so that Tr3/4 draw about 10mA, with no signal. If the value of R10 is too high, current will be low and cross-over distortion caused. On the other hand, if R10 is low in value, the quiescent current is high.

Fig. 15 is typical of circuits using a driver transformer with a split secondary. Each output transistor

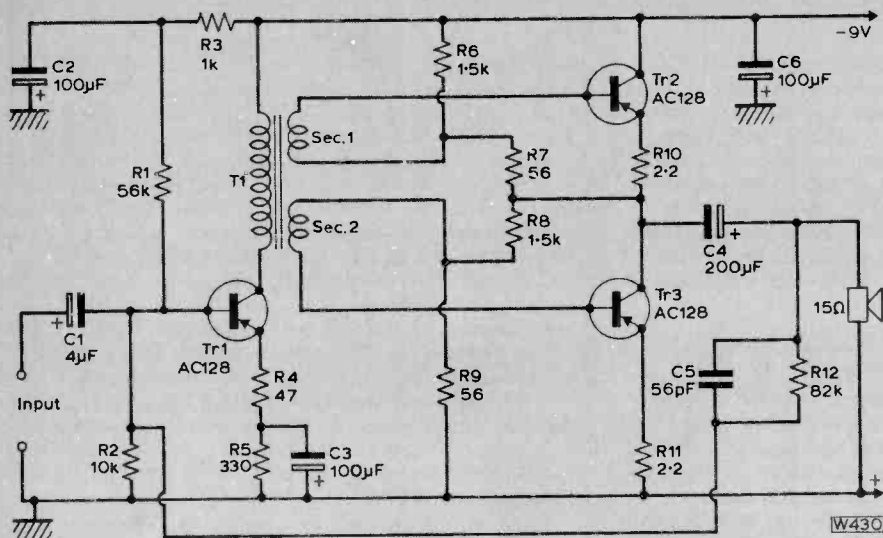
operates on approximately one half the supply voltage. The circuit has the advantage that no output or speaker transformer is necessary. Tr1 is the driver stage, with transformer T1 as described earlier. R6 and R7 provide base bias for Tr2, while R8 and R9 provide base bias for Tr3. Each output transistor has its own emitter resistor R10 and R11.

It is essential that the halves of the transformer secondary, Sec.1 and Sec.2, are correctly phased for the transistors to operate in push-pull. If not, connections to one secondary winding must be reversed. The negative feedback network C5/R12 is to improve response, and operates over the whole amplifier.

The circuit allows an identical or matched pair of transistors to be used, as for Fig. 14. Maximum output is reduced but battery drain is smaller than that for Fig. 14. Overall gain is sufficient if a tuner is used as input. For other purposes, any of the low-level pre-amplifier circuits with a positive earth line can be placed before Tr1.



duction. As phase shifts may arise near upper frequency limits, it may be necessary to suppress these, as by using C7 and R14, Fig. 14, so that they are not applied to an earlier stage in positive phase. Circuits with no transformers are arranged so that the feedback is correct.



In this circuit a transformer with a split secondary drives the output transistors, their output being directly coupled to the speaker.

## NEGATIVE FEEDBACK

A negative feedback circuit of some kind will be seen in virtually all but the very simplest amplifiers. This circuit takes a part of the amplifier output and applies it to the amplifier input. The feedback must be arranged so that it is out of phase. If it were fed back with the same phase as the original input signal, it would cause uncontrollable oscillation.

An amplifier does not normally give exactly the same amplification at all frequencies, because components in it (especially capacitors, transistors and transformers) do not have the same characteristics over a wide range of frequencies. Thus, some frequencies may be emphasised. If so, they are of greater amplitude in that part of the signal fed back to the input, and so help maintain a more level response at all frequencies.

Negative feedback may be over a single stage or may extend over two or more stages. In some circuits, negative feedback is purposely made frequency sensitive. This is one method of obtaining tone control, or in securing more satisfactory repro-

## COMPLEMENTARY SYMMETRICAL OUTPUT

With a PNP transistor, a negative-going base input increases the collector current. The NPN transistor, however, requires a positive-going base input to increase collector current. So by combining PNP and NPN transistors it is possible to make a push-pull output stage which does not require a centre-tapped driver transformer or other means of phase splitting. Such circuits are used extensively.

In the basic circuit, Fig. 16, forward bias is developed across R2 in conjunction with R1 and R3. As explained, the audio input will cause first one transistor to conduct, then the other, for successive half cycles. The speaker is connected to the emitters, and two batteries (or a tapped battery) provides a supply for the transistors.

In Part 3 next month the matching of speakers to amplifiers is dealt with together with the use of IC's in audio amplifiers.

### CASIO

**fx-201P** (illus.) 127 step programmable 10 digit or 8 digit, 2 Exp. 127 Steps. 10 Inde. mems, cos, sin, tan. All log functions Degree Rad. Un-conditional jump and manual jump as well as Indirect address, subroutine etc. The programme function allows you to handle any type of calc. under any condition **\*£49-95**



**fx-102.** The world's first fractional calculator. 10 digits or 8 plus 2 Exp. sin, cos, tan, Deg. rad. (exp. 10<sup>±99</sup>). Trig. Inverse common & Natural logs. Reciprocal. Sexagesimal, Pi entry. Statistical calcs. incl. 2 kinds of Standard deviation and other applications. **\*£19-95**

**fx-19.** 8 digits or 6 plus 2 Exp. as 102. Trig. Inverse trig. All log functions. Sqr roots. Reciprocals. Sexagesimal/Decimal conversions. Fractions. 2 kinds of Standard Deviation and other applications. **\*£16-95**

**fx-21.** 8 digits 2 exponents. 21 Scientific functions. **\*£15-95**

**AL8 8-dig.** Fractional Calcs. standard deviations remainder from division. Time calcs. 2 mem. facs. **\*£13-95**

**AL10.** As AL8 but with 10 digits! **\*£15-95**

### TEXAS

**SR56.** (illus.) 100 Step programmable 10 digit, 2 Exp. 10 Inde memories, all log trig and Stat functions. Can be programmed for maths, electronic engineering, statistical, financial and navigation. **\*£57-95(R)**



**SR52.** 224 programme steps. 20 2-level independent memories. 9 level parentheses. Card programmable. Supplied with 20 blank magnetic cards and prog. manual. **(R)£194-40**

Any of the following pre-programme manuals: 1. Statistics. 2. Electrical Engineering. 3. Mathematics. 4. Finance. **ONLY £25 each**

**SR51 II.** 10 digit, 2 Exp Rechargeable. Hyperbolic x to the root of y. Rad & Deg. Factorial. Mem. 3 Inde. mems. Linear regression. Mean, variance, standard deviation. Generation + 7 basic conversions, and their Inverse Engineering Notation. **(R)£47-95**

**T130.** 48 functions plus Algebraic operating system. 15 seats parentheses. Constant, roots, powers, reciprocals. Sci notation. Log, trig, deg rad, mem, step function. **\*£15-95.** Nickel Charger Kit **\*£7-95**

### The ZYCON New range of Quality Electronic Watches

#### L.C.D.

#### KLC3A

Constant display. Hrs, Mins & pulsating secs. Chrome with Stainless Steel back. Square face with back light. FREE Adjustable S/Steel bracelet. **£22-50**



Gold Plate **£24-50**

#### KLC

Stop Watch Constantly shows hrs, mins & Pulsating secs. Press command button for mth & date, press again for mins & secs. May be set to alternate hr & mins to mth & date every 2 secs. resets to time. 4 yr cal. 'Nite Lite'. **PLUS STOP WATCH FACILITIES** Thinnest on the market. **£39-50** Gold Plate **£42-50** FREE matching bracelets with each.



#### KLC9

Continuous hrs, mins & pulsating secs. Press command button for mth & date. Press again for secs readout. Setting for alternating hrs & mins to mth & date every 2 secs. Auto-time reset. 4 yr calendar. 'Nite-lite'. FREE matching S/Steel bracelet **£36-95**



#### LADIES DIGITAL THE IDEAL PRESENT!

An elegant 6-function watch. Shows Hrs, Mins, Secs, Mth, Date, Day! She'll love this piece of miniaturised electronic wizardry! Gold Plate or with stylised Chrome Bezel, each with matching bracelet. **GOLD PLATE £26-90** S/Steel **£24-90**



#### L.E.D.

#### KED1A

Ideal present! This stylish 3-function L.E.D. shows Hours, Minutes, Seconds. Beautifully finished with S/steel back & FREE stylised leatherette strap or Matching S/steel Bracelet. Watch & bracelet in gold plate **£13-95** ONLY **£11-95**



#### KED5B

6-Functs. Shows Hrs, Mins, Secs, Mth & Date and Day. 4-Yr calendar. Beautifully finished with S/steel back & FREE Matching Stainless Steel Bracelet **£18-95** Gold Plate **£20-95**



#### KED6C

A fantastic 6-Functions—window display shows Hrs, Mins, Secs, Mth & Date. Day of week in letters. Single button. Auto-hold & Fade-out. 4 Yr calendar. Case in Heavy Rhodium on Brass + S/steel back. FREE matching S/steel adjustable bracelet. **£29-95** Gold Plate **£33-90**



#### KED6D

Month & Day of the Week in Letters! Shows Hrs, Mins, Secs, Date, Mth & Date, Day of Week, Auto 4-Yr calendar, A.M./P.M. Set/Indicate. One of the most sophisticated watches at this price. Accurate to within a few secs a year. Finished in Satin Stainless Steel with FREE matching Steel bracelet. Luxury scratch-proof glass—jewellery piece **£36-90** **£33-90 ONLY** Gold Plate **£36-90**



### HEWLETT PACKARD

HP25R **£105-30**  
SCI Printer 91R **£344-50**  
Full Prog Printer **£552-95**

### NEW ZYTRONIC TELE-GAMES

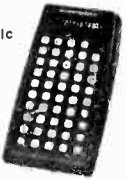
**DE LUXE**  
THIS DELUXE MODEL HAS Tennis, Football, Squash, Solo, 2 bat sizes, 2 Ball speeds. 3 distinct plings—one for point score, one for bat strike ball, one for ball strike boundary and automatic scoring. **£48-90**



These games are easy to play and a joy for all the family!  
**ALL ITEMS CARRY 1 YR GUAR. PRICES INCLUDE VAT**  
\*FREE B.S.I. adaptor. (R) FREE Charger

### CBM

**5190R** (illus.) 10-digit, 2 Exp. 90 function pre-programmed. Metric converters. Extra functions to the 4148R: Perms and combinations. Gamma. Poisson and Binomial distributions, factorial, complex numbers, hyperbolic functions, linear regression and Integration of Y = f(x). **(R)£29-95**



**7949D** 50 functions. 10+2 mems. Means & standard devs. All logs & trigs. etc. Polar rec co/ord. **\*£11-75**

**4148.** 10-digit + 2 Exp. Full log and trig funct. X<sup>2</sup>. Reciprocal, π, x root of y. Polar rectangular co-ordinates. 2-store mem. Mean and Standard deviation. **(R)£21-95**

**1800.** As 4148 but Green display and Bat operation. **\*£19-95\***  
PR100 New Prog. Scientific **£42-95**  
N60 (Navigator) **£12-95**

### ROCKWELL

**64RD** (illus.) 11-digit or 8-digit + 2 Exp. Additional to the 44RD. Polar rec., co-ordinates. Log Trig, rad or grad. **\*£24-50\***



**44RD.** 9-digit or 5-digit and 2 Exp. Green Display. Store. Similar to the 63R less factorial. **\*£19-50\***

**24K.** Stainless Steel Slimline. Green display. In beautiful leatherette wallet to hold pen, note pad and credit cards (all included). Full memory. Click buttons. Rechargeable. **(R)£21-95** Including recharger.

### DECIMO DIGITAL CLOCK RADIO

**LARGE DIGITAL READOUT**  
This is the most unique clock/radio in the country today having a soft, 1 1/2" high orange-glow digital readout which is completely silent and non-pulsating. In a beautifully styled enclosure with up-to-date VHF/MW radio. You can awake to soft music or alarm. Automatic 80 minute 'sleep' button in case you drop off while the radio is on!  
**OUR PRICE £33-95**  
Plus £1 P&P



### NOVUS

**4640** (illus.) 10 digit, 2 Exp. 54 functions. 4-level roll stack. 3 Fully addressable memories. Logs, Trigs, Stat and Metric conversions etc. **(R)£42-95**



**4650.** 8 digit, 2 Exp. Algebraic logic. Addressable. Trig, sin, cos, fan and Inverse trig functions. Deg rad. Reciprocal, Sq root. Powers and Pi entry. Mem Ex and Register Ex **(R)£27-50**

**4525.** 8 + 2 Exp. 100 step prog. R.P.N. Full log and trig. XY Exchange. Mem. 4 roll stack, skip, delete. Additional progs within the 100 step **(R)£26-80**

**4515.** 100 step prog version **(R)£23-80**

**6010.** Metric. **\*£15-95\***

**6035.** 100-step programmable Statistician. Rechargeable. **(R)£34-95**

**6025.** Rechargeable. Financier 100-step programmable **(R)£34-95**

**4510.** 3 digits. 3 level stack. All trig & log functions. √. π. Reciprocal Memory, etc. **\*£12-95\***

**6030.** Statistician. **\*£15-95\***

### SINCLAIR

CAMBRIDGE SCIENTIFIC all trig, log & deg. rada etc. **£8-95**  
OXFORD SCIENTIFIC larger version of above. Green display PARENTHESIS. **\*£12-95\***

## ORDER FORM

PHONE CALLS AND PERSONAL CALLERS WELCOME MONS TO THURS BETWEEN 2 & 5 p.m. 01-458 4755. SUNDAYS 10 a.m. to 1 p.m. To: BARCLAY ELECTRONICS Dept. 4PW, 1115 FINCHLEY ROAD, TEMPLE FORTUNE, LONDON N.W.11 (Near the M1)

Please send me.....  
with/without optional mains adaptor. I enclose cheque/money order total value £..... Please add 55p to all items to cover p. & p.

NAME.....  
ADDRESS.....

COMPANY, GOVT. DEPT. AND HOSPITAL ORDERS, BARCLAY, ACCESS ACCEPTED BY PHONE







## AMATEUR BANDS

by Eric Dowdeswell G4AR

**N**IGEL Roberts G8JEF of Prescot got a bit hot under the collar over my comments on repeaters so here is an agreed version of his comments.

"I feel that I must take strong exception to Eric Dowdeswell's unwarranted attack on repeater users. (On the Air, Amateur Bands, January). I am not an FM or repeater nut, my main interest lies with SSB DX on 144MHz but I do use it for local working and the repeaters for mobile. There is abuse, mostly 'things' without a callsign, making funny comments which admittedly don't reflect much credit on FM and repeaters. But the public service potential, especially with Raynet (Emergency Network) does. It is not my intention to perform a defence of repeater operation, the fact that a large number of amateurs use them justifies their existence but to but to point out that there are abuses on other bands and methods of operation. Excessive power is one. On 160m where the limit is 10W it has been reported that one station has a capability of 1kW! Bad manners is another.

If the amateur movement starts publicly squabbling over the best way to operate then in 1979 we might turn round and find no repeaters, and no other bands either."

Now I must point out to Nigel that I had been asked by several readers for my views on repeaters, and I gave them, but I did not even mention the users! I could have said that the service is often abused but I didn't. You did, Nigel! (The problem with abuse, whatever band is involved, is that the Home Office must catch the offender in the act, and that is patently just about impossible!) The number of amateur licencees is around 23000 but how many use the repeaters for their intended purpose? A few hundred, at the most. And how many of these are members of the RSGB? So how does this 'large number' justify all the trouble that the RSGB has gone to to get the repeater service established? They should distribute their services to suit the majority not the minority!

Several readers have commented on the continuing improvement of the 15m band. Steve Cottis A8961 (Harrogate) wonders why so many stations stay on 20m fighting the QRM when they could work just as much DX on 15m! So it's back to my long-held theory that the bands are never as bad as we make them out to be but just lack of activity. Steve says that 15m has opened regularly to west and south Africa on most week-ends but, of course, it is probably like that every day but, unfortunately, most of us have to earn a living! Steve is very pleased

with some of his QSL returns lately which included M1D, D4CBS, A6XR, 5U7AG and F08DO.

J. Taylor in Cheadle Hulme, Cheshire, bemoans the fact that, in his opinion, there is no good textbook for the RAE. He'd like one written in the style of the ARRL Handbook. He goes on to make some blush-making comments on this column which have been duly framed! He'd also like to see some good articles in PW on general coverage communication receivers as 'there would appear to be a gap between the crystal set and the Video-Writer! Point taken! Paul Bradbeer writing from Braunton in N. Devon was pleased to find that J. R. Beer (PW Feb) lives only five miles away. Have a look at your names OM, you could be related! Anyway, Paul wonders if there is enough activity among types like himself to form a club in that part of the world. He hopes to be getting a PR40 preselector for his CR70A very soon but at the moment his life revolves around mock 'O' levels!

Paul Barker BRS34898 DXing from Sunderland added TG9 on 20m for a new one and KP4 and FP8 on 80m to swell the list there. However Paul is now busy playing with his new baby, a Robot 70C SSTV monitor, for which it seems no praise is too great. Apparently it is regarded as the Rolls Royce of SSTV. His previous monitor is now up for sale so ring him on Sunderland 226883 or write to 11 Dipton Gardens, Tunstall Estate, Sunderland, if you have some cash to spare. Down in the Channel Islands Alan Troy sports a Trio 9R59DE with an indoor aerial in a downstairs flat so he hasn't exactly got the best start for DXing. He's been fiddling around for about ten years and now feels he really ought to have a go at getting his ticket. What better OM, if you don't want to waste time listening for the unobtainable DX! For those who may be out of touch Alan points out that the general C.I. prefix of GC has now become GJ for Jersey where Alan resides and GU for neighbouring Guernsey. The Jersey ARS station GJ3DVC has had massive pile-ups, doling out the new prefix!

Calling you out there in Leeds land! Bob Firth G3WWF Hon. Sec. of the Wakefield and District RS tells me that they have recently conducted a wide-ranging survey, in the form of a questionnaire, into the likes and dislikes of members and potential members, with a view to rejuvenating the club. A special all-comers meeting has already been held but if you slipped through the net and live in the district why not contact Bob on Leeds 825519. Meetings are held at 1930 at the Youth Centre, Ings Road School, Wakefield. On 15 March it's John Hey G3TDZ speaking and showing off his constructional projects, on 29 March a ragchew and operating night while 12 April should be quite popular, it's a Junk Sale.

If your QTH is in the Derby area then you should be off to the Derby and District ARS AGM at 1930 on 16 March to be held at the clubroom at 119 Green Lane, Derby. Old news now, but at their Annual Dinner in February the new President of the RSGB, Lord Wallace of Coslany was their guest of honour.

John Wood G3YQC of the British Amateur Television Club has just sent me details of their new publication A Guide to Amateur Television. Written by members of BATC it covers all aspects of receiving and transmitting amateur TV signals including colour TV and closed circuit systems. The price for 112 pages of concentrated information is

just £1.25 post paid to members, which strikes me as remarkable value today! For non-members it's £1.75 so it might pay one to join the BATC at the same time! Orders to BATC Publications, 64 Showell Lane, Penn, Wolverhampton, Staffs WV4 4TT.

In Leyland, Lancs, **Paul Cowburn** has had continuing trouble with his CR300/2 receiver but a multimeter and soldering iron for Christmas helped him to put it right and he is active on the bands again. His efforts to learn the code using records are bearing fruit as Paul has been copying a lot of CW stuff from 160m to 20m. Paul was one of those fooled by GJ3DVC of Jersey, mentioned earlier! **Eric Hill** of Guildford got bitten by the bug and returned to the bands about a year ago with a National Panasonic RF1700 but soon graduated to a Hammarlund HQ100A plus a Codar PR30, which together with about 170ft of wire, seems a pretty good set-up. First DX for the New Year was ZD8EW on 80m SSB so let's hope that is a portent of good DX to come!

**John Reynolds** in Bridgend very wisely decided to stay on the amateur bands having abandoned the broadcast frequencies. He has completed a regenerative set which can copy SSB so we can look forward to some logs soon. A letter from **Neil Braeman**, near Horsham, sent me details of the December RAE paper. Unfortunately, I can't tell you the pass mark Neil so you will have to wait out the couple of months or so. Let's all hope you made it Neil since you have now passed the morse test! Congrats! **D. Peck** BRS37621 of Cambridge sends in a detailed log of stuff copied in a new mode for this column, RTTY! He's logged over 30 countries so far but doesn't mention the gear. So let's have some more info OM, please.

Now lads and lassies, there were several logs received after the deadline this month. Please make it a bit earlier or, regrettably, they will not make the column.

### Log Extracts

**P. Barker:**— 20m TG9DV TG9QK 5V7WT 80m FP8DX KP4AST SSTV 20m DJ8LV EA2JO F3RT HA5KBM K4TGC SP3PJ VE3PT W8KZM YU1NWJ

**A. Troy:**— 80m CN8BF CT3BM D4CBS (Cape Verdes Is.) EA8CR EA9FE (Mellila) FP8ZZ HK4DF KZ5HP PZ1AC W6NLZ 9G1JX

**B. Harrison:**— 80m FG7AO VP9CP 7Z8VA (Saudi Arabia) 9M2MK 20m FY7AW P29GR XT2AE

**S. Cottis:**— 80m EA8CR EL7F KP4AST KZ5HP 20m YB1KW 9J2PC 15m CT2BB EA8CR EA9FC

**P. Bradbeer:**— 80m EA8JP JA6DG 20m YN1CCA ZL3FV AH6UM (KH6)

**P. Cowburn:**— 160m CW K1PBW W3HXK W4BRB W8LRL KV4FZ 80m FP8ZZ HI8LC HK4DF JH0BQU JX2FL KZ5HP PY7BZD UK9AAN W7KW 5Z4GX 9Y4NP 40m PY2CAR PY8AKA LU4MEE VK3ZL ZL1AIZ 6W8AAD 20m KG6SW VK5BC YB4ACJ ZL1GG

**D. Peck:**— 15m TU2GG WB2CJS/HZI VE2ZN/SU WB6EWH/VQ9 DK5EC/ET3 WB4BWG/KG6 20m RTTY AC3KEK CT1EQ EA8IT VE2QO VK2SG WB6EWP/VQ9 3A2FB 9H1EL 9M2MW

**N. Braeman:**— 80m CT2BS CT3BM KZ5HB VP2LDU XE1KB 20m WB6EWH/VQ9 8P6AH

**E. Hill:**— 80m FM7WS JY3ZH PJ2FR VP2LCT VP2SN ZD8EW 5B4PW 9K2DR

All stations are SSB except CW, in bold, and RTTY in italic.



## SHORT WAVE BROADCASTS

by Derek Bell

I RECENTLY stated with much conviction that Radio Australia could not be heard around mid-day in the UK. However, the unprecedented conditions over Christmas and New Year period proved me wrong. This is pointed out by **Alan Spencer** from Ryhall, in Lincolnshire, who, on his Heathkit SW717 plus a long wire, pulled the signal in on 9560 from 1230 to 1300, admittedly at low strength but there, nevertheless. This disturbance was one of the strongest winter upsets that I have experienced and it lasted for around six days, from Christmas Eve onwards.

This month's overseas letter comes from Radio Finland who sent me their schedule from March to May and they offer a service from 0930 to 1000 on 9550, 11755 and 15270. From 1430 to 1500 on 6120, 11755 and 15110 and from 1900 to 1930 on 9720 and 11755. From 2000 to 2030 it's 6120, 9550. It seems that Radio Finland has thrown in the towel as far as North America is concerned. They admit that the Pori transmitter is too far north to give an adequate signal to the US and Canada, due to the beam having to cross the auroral zone which attenuates the lower frequencies.

Bournemouth School has among its after-hours activities a thriving radio club and the boys sent along a very wide ranging log pulled in on their Eddystone 730 and AR88. They managed to gather the following:—

Radio Pekin	on 7590 at 1700
Radio Cairo	on 17920 at 1436
WYFW	on 15110 at 1745
Radio Sweden	on 9630 at 2300
R. Nac. Do. Brasil	on 11780 at 2010
Radio Athens	on 15345 at 1520

Mind you, if the lads were to admit the truth their master Mr Thomas must come in for some credit! Word is coming in of the assorted literature that the stations have been sending out recently. **Jim Coombs** of Walsall has had two copies of a questionnaire from Radio Kiev pointing out that 1977 is the 60th anniversary of the great October revolution and what would you like to hear from Radio Kiev, all in one sentence! I personally have had two similar style items, from Radio Poland and Radio Sofia.

**David Wyatt** of Oswestry has come up with a log of rarely reported items, and, although few, are stations that seldom seem to figure in reports these days.

Radio Pyongyang	on 9678 at 1605
Korean BS Seoul	on 9640 at 1140
UNRS	on 9615 at 0635

The last service is the broadcast of the proceedings of the United Nations, relayed through Voice of America and of course it is only available during sittings of the General Assembly of the U.N. A Vega Selena hung on the end of a 78ft long wire is the equipment that young **David Birch** uses. He



**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 **UNIT**  
BC Fitting **£9.55**  
E.S. Fitting **£10.35**  
EACH

**Sound to Light MASTER UNIT** 600 WATTS PER CHANNEL  
**£30.95**  
INCLUDING 3 LAMP  
OUTPUT PLUGS AND  
MAINS INPUT SOCKET.

**TYPE A SPOT**  
(less lamp)  
BC Fitting **£1.95** E.S. Fitting **£2.12**  
EACH

**TYPE B 3 BANK UNIT**  
(Less Lamps)  
BC Fitting **£6.90** E.S. Fitting **£7.26**  
EACH

**TWIN BANK 12 LIGHT UNIT**  
Length 31 1/2  
(less lamps)  
BC Fitting **£15.60** E.S. Fitting **£17.00**  
EACH

**100 WATT SPOT LAMPS**  
RED, YELLOW, GREEN  
BLUE CLEAR **£1.30** each  
3 lamps  
B.C. or E.S. Fitting

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

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

**FANE SPECIALIST RANGE SPEAKERS**

Each designed to produce the individual sound requirement for its purpose. Robust Cast Aluminium Chassis

**DISCO/80** **£25.95**  
Linen Cone Surround  
**GUITAR/80L** **£24.75**  
For Lead Guitar  
**GUITAR/80B** **£24.95**  
For use in multiples for Bass Guitar.  
**PA/80** **£24.75**  
For general purpose P.A.  
**15" BASS/85 85w** **£37.95**  
**15" BASS/100** **£39.95**  
For Bass Guitar

**FANE 'POP' RANGE SPEAKERS**  
12" POP 33T 33w **£13.95** 15" POP 60 60w **£25.95**  
12" POP 50/2 50w **£15.99** 15" POP 70 70w **£28.95**  
12" POP 55 60w **£22.95** 18" POP 100 100w **£44.95**

**HIGH FREQUENCY HORNS**

**J44** Range: 2.5KHz-15KHz Power: 50w with HPX2  
Power: 30w with HPX1  
Imp: 8 ohms  
Size approx 3 1/4" x 3 1/4" x 3" **£7.95**

**910/2** Range: 2KHz-15KHz Power: 50w with HPX1  
Imp: 8-16 ohms  
Size approx 6 1/4" x 5 1/4" x 6 1/4" **£17.75**  
Rec. Price

**J104** Range: 2KHz-15KHz Power: 50w with HPX1  
Power: 70w with HPX2  
Imp: 8 ohms  
Size approx 10 1/4" x 3 1/4" x 7 3/4" **£16.95**  
Rec. Price

**HIGH POWER 'CROSS-OVERS'**  
HPX1 (3.5KHz) **£2.75**  
HPX2 (5KHz) **£2.75**  
Rec. Price

Distributors (Wholesale & Retail)  
**LINEAR PRODUCTS LTD, ELECTRON WORKS, ARMLEY, LEEDS.**  
Manufacturers & Export enquiries to:  
**FANE ACOUSTICS LTD, 286 BRADFORD ROAD, BATLEY, YORKS.**

# Your free start to a rewarding new hobby.



Heathkit make the world's largest range of electronic kits.

Including amateur radio, test equipment, educational and general interest kits.

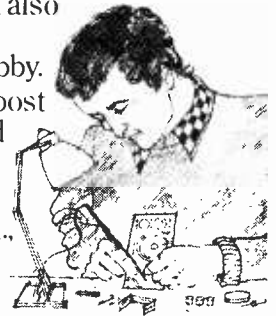
Every one of which comes to you absolutely complete—right down

to the last nut and bolt.

You'll also get a very easy to understand instruction manual that takes you step by step through the assembly.

So, besides making an attractive, useful piece of equipment, you'll also have the makings of a satisfying, rewarding hobby.

To find out more, post the coupon and we'll send you our latest catalogue. Heath (Gloucester) Ltd., Dept. Bristol Rd., Gloucester, GL2 6EE. Tel: Glos (0452) 29451.



## HEATHKIT

BETTER BUILT BECAUSE YOU BUILD IT YOURSELF

The new Heathkit catalogue. Out now. FREE.

To: Heath (Gloucester) Ltd., Dept. PW47, Gloucester, GL2 6EE. Please send me my Heathkit catalogue. I enclose an 11p stamp for postage.

Name \_\_\_\_\_

Address \_\_\_\_\_

Postcode \_\_\_\_\_



**ACCESS AND  
BANKCARD  
WELCOMED**

Showrooms at 233 Tottenham Court Road, London and Bristol Road, Gloucester.



has written giving the background to the Radio Athens English service, David logged them on 17830 at 1230 and has forwarded the address which is:— Director of Technical Services, EIRT, 16 Mourouzi Street, Athens, Greece. The latest schedule is as follows:—

0115 on 11730  
0230 on 9760 and 9750  
1230 on 17830 and 15345  
1530 on 17830, 15345 and 11730  
1930 on 9675, 7215 and 6140  
0930 on 15345 and 9530

Since starting this month's column I have had the pleasure of being able to assist, in a practical way, a member of the DXing fraternity. Some time ago Jim Coombs asked for any information on an R1392D receiver. By the good offices of another reader a circuit diagram arrived chez Bell, so Jim is happy. On that happy note I will close this month and wish 73s to you and yours.

## BROADCAST BANDS

### MEDIUM WAVE DX

by Charles Molloy

VINTAGE Radio is not usually associated with DXing so readers may be surprised to learn of transatlantic reception this winter by a DXer using a vintage medium wave receiver. Tudor Rees Vintage Services, who advertise in PW, mention in the January issue of their Antique Wireless Newsheet, their reception the previous month of WINS New York City on 1010kHz with a 1930 TRF receiver. Quite a remarkable achievement! Transatlantic medium wave reception was commonplace in the early days of radio, and wireless magazines of the mid-twenties made frequent reference to it. The circumstances were quite different then. Anti-fading transmitting aerials had not been invented and the flat-topped aerials of the day radiated lots of sky wave. There was little interference either electrical or from other stations and the unselective wireless sets in use could really pull in the DX. The writer is attempting to refurbish a receiver of circa 1924 vintage with the intention of trying it under the very different conditions that prevail today. Has any reader tried DXing with a vintage radio? The most likely channels for North America are 710kHz, 930kHz and 1010kHz and at this time of year it will be 0100GMT before the path is open.

It appears that we have now reached the minimum of the current sunspot cycle, a period that favours DXing on the lower frequencies, and logs are now recording some of the less common North Americans. F. T. Shortridge of Llandudno Junction has his AR88 back in circulation and he reports hearing, when using a loop, CHNS in Halifax NS on 960kHz, CKEC New Glasgow NS on 1320, WVOJ Jacksonville, Florida also on 1320, WEVD New York on 1330, WPOP Hartford on 1410 and WOKO Albany NY on 1460. G. Braithwaite who writes from Belfast

used a Drake SW4A and loop to log VOCM St John's, Newfoundland on 590kHz, WHAS in Louisville, Kentucky on 840, WHDH in Boston on 850, CFRB Toronto on 1010, WWWE Cleveland, Ohio, on 1100 and WHAM in Rochester NY on 1180. Michael Tallent does his DXing in Stafford with a Realistic DX160 and a 300ft long wire. His log includes KDKA Pittsburg on 1020 and he mentions that he can pick up many distant broadcasts which he cannot identify. All North American broadcasters on the medium waves are allotted call letters which they are obliged to give over the air but with the characteristic slow fading that occurs on this band it requires time and patience on many occasions in order to obtain a positive identification.

Reader James Birkett of South Kensington sends a report of stations heard between 1245 and 1355GMT during December using a Telefunken portable receiver attached to his TV aerial! Broadcasts from as far away as Monte Carlo on 1466 and Andorra on 701 were heard in daylight. In mid-winter, when the sun rises only to a low angle above the horizon, there are occasions when the D layer in the ionosphere only partly reforms at sunrise. Normally the D layer reforms completely then and absorbs signals in the medium wave band, inhibiting long distance reception. At the time of the last sunspot minimum in 1965-66 North American DX was heard as late as 1000 because of this phenomena but it is very unusual. Readers might follow James's example and try their TV aerial for MW DXing as it makes a good vertical for medium wave reception. Try connecting the receiver to the inner and the screen of the co-ax lead in turn for optimum reception, or both!

Monday morning is a familiar time for DXers in North America. Many high power outlets in that area, though nominally on the air 24 hours a day, close down for transmitter maintenance between midnight on a Saturday and 0500 on Monday, local time. DXers in the United States regard Monday morning as the best time of the week for local and foreign DXing. In the UK too, advantage can be taken of this period of quiet, provided that the DXer is prepared to be out of bed at five in the morning! Owing to the different time zones in operation in the USA, midnight in New York corresponds to 2300 in Chicago and 2100 in Seattle and 0500 in the UK, which means that stations on the east coast close down earlier than those further inland. When conditions are good it is worth trying the band at 0500 on a Monday. KING in Seattle on 1090 has been heard on a Monday with WBAL in Baltimore off the air, KEX in Portland, Oregon on 1190 was logged by the writer with WOWO in Fort Wayne, Indiana off and WOKJ Jackson, Mississippi on 1550 with CBE Windsor, Ontario off the air.

## VHF

by Ron Ham

ON December 29th, Cmdr. Henry Hatfield (Sevenoaks) located two sunspots and an angry-looking filament with his spectrohelio-

scope (see *Amateur Photographer*, March 24, 1976) and, true to form, both he and your scribe recorded strong radio noise at 136MHz from this event the following day. Henry found another pair of sunspots on January 11th and, like the earlier ones, these were active and emitting radio noise at metre wavelengths. Although several tiny bursts of solar noise were recorded between the 12th and 17th the strongest and most continuous was heard on the 12th at both 95 and 136MHz, and again on the 14th, but this was limited to the higher radio frequency. (Reports of exceptional HF DX during this period would be most welcome.)

From the heavens came the Quadrantid meteor shower (Jan 1 to 6), and this looked good by radio. As the earth approached the shower on January 2nd the writer's equipment counted 5,515 "pings", of signal from the Gdansk broadcast station (70.31MHz) during the 15-hour observation period (0800 to 2300hr daily). On the 3rd, peak day, more than 28,000 "pings" were recorded which should have given excellent conditions for the meteor scatter enthusiasts. As usual the daily rate of "pings" reduced *pro rata* as the earth passed through the main swarm of particles; 4th was 11,100, 5th was 8,612 and 6th was 6,858.

Throughout the peak day "pings" of signals were also heard simultaneously with Gdansk from a Russian TV transmitter on 49.75MHz (R1) which shows that signals can bounce off meteor trails at a variety of radio frequencies. Last month's report about the Geminid meteors prompted Chris Webster G3TBJ (Ringwood) to write about meteor "pings" on signals in Band II. During the early hours of the morning Chris often turns his 6-element beam (with 3N200 pre-amp) north-east for a listen to Capitol Radio on 95.8MHz. "This provides a splendid stereo signal", says Chris, "except for interruptions every few minutes by chunks of German speech or music", probably from the GDR 50kW DDR1 from Berlin. Chris suggests that readers without 4m gear wishing to observe radio meteor "pings" should tune to a quiet spot in Band II and listen for a German station. Chris leaves his receiver tuned around 96.5MHz for this purpose. The next meteor shower to watch out for is the April Lyrids, April 19 to 24, peaking 22nd.

Whilst on the subject of Band II, another interesting letter came from Nick Taylor (Sunbury-on-Thames) who has now added a barometer to his station equipment and will be watching for those atmospheric pressure changes which bring the VHF DX. He already has a good score on Band II judging from the copy of his log which includes more than 20 each German and French broadcast stations, plus a dozen Italians; and a few Dutch and Spanish, all between 88 and 104MHz, and of that lot 32 broadcasts were heard in stereo! A most interesting list Nick and one that we can refer to when your future reports come in. Needless to say there is a good selection of both G and GW DX in his log. You are dead right, Nick, the VHF's were quiet in January, however there was a pressure change between the 6th and 9th which gave a mild "lift" to parts of the VHF spectrum.

During the evening of the 6th, Alan Baker G8LGQ (Newhaven) was listening to the Kent repeater, GB3KR Dover, and heard a station in Ipswich say that he was receiving a colossal signal from the repeater as well as signals on "two" from both PA0 and DL. It is interesting to note that there has to be a slight lift in conditions before G8LGQ can use

the Kent repeater. At midday on the 8th, the writer received a good picture from the IBA transmitter at Lichfield on Channel 8 (189MHz), but this did not last long.

Alan Baker is a member of the Brighton Repeater Group and reports that the equipment for GB3BR on 70cm had satisfactory tests on January 15th and 16th and by now should be on the air permanently (RB6, input 434.750, output 433.150MHz).

Although the recognised sporadic-E "season" in Europe is between mid-April and mid-August, our fellow enthusiasts "down under" had sporadic-E disturbances throughout the Christmas period. A most welcome letter, dated January 8th, came from Anthony Mann, a reader in Applecross, Australia, who says "we are at present enjoying an active sporadic-E season which has seen Malaysian TV (Channels E2 and E3) received here and Samoan TV (Channel A2) received in Sydney on Christmas day. The distances involved being 2,400, 2,600 and 2,700 miles respectively."

Anthony is a keen TV and VHF DXer and regularly monitors the 10m band looking for any unusual activity which might indicate that sporadic-E or high MUF-F2 is present. The writer is always pleased to hear about VHF activity from any part of the world, because, apart from the interest for our readers, it all helps to build up a general pattern which aids the study of propagation. The only International Beacon Project station that Anthony has heard so far is 3B8MS (28.190MHz) in Mauritius and he asks for the frequency of the others on "ten": DL0IG1 is on 28.195MHz, GB3SX on 28.185MHz and 5B4CY on 28.180MHz.

Your scribe heard a 549 signal from the Cyprus beacon (5B4CY) at 0826 on January 1st and again at 0929 on the 7th and would like to hear more from readers about their reception of the 10m beacon signals.

It is worth remembering that there is a great deal of enjoyment to be had and a lot of knowledge about propagation to be gained by listening in, or taking part in the RSGB VHF/UHF contests and there are some good ones in store; 144MHz Open on March 5/6, 432MHz Open on March 20, 70MHz Open in April 2/3. So what about it readers, have a go, and good luck!

Thanks again for your letters, several of you have said that you are pleased to see a VHF report again in PW so keep on writing and between us we will make it an interesting feature for both our regular readers and for science in general.

#### **BROADCAST BANDS**

Short Wave Reports by the 15th of the month to Derek Bell, c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.  
Medium Wave Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

#### **AMATEUR BANDS**

Logs covering any amateur band/s in band/ alphabetical order by the 25th of the month to Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashted, Surrey, KT21 2TW.

#### **VHF**

Reports on VHF matters to Ron Ham, Faraday, Greyfriars, Storrington, Sussex RH20 4HE.

# Stirling Sound

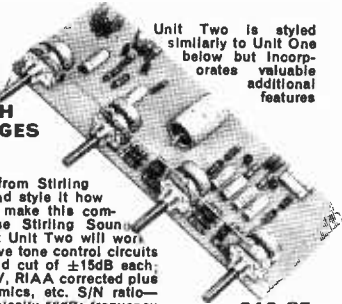
Q.V. MODULES FOR COST CONSCIOUS CONSTRUCTORS

MADE IN OUR OWN U.K. FACTORY

NEW THIS MONTH!

## UNIT TWO FOR LOW AND HIGH OUTPUT CARTRIDGES

Another real money saver from Stirling Sound! Wire this unit in and style it how you wish. Full instructions make this completely straight-forward. Use Stirling Sound power amps. for choice, but Unit Two will work superbly in any system. Active tone control circuits give bass and treble rise and cut of  $\pm 15\text{dB}$  each; accepts inputs from 1 to 5 mV, RIAA corrected plus a 50-100 mV input for ceramics, etc. S/N ratio—60dB; channel separation typically 50dB; frequency range—30-20,000 Hz  $\pm 1\text{dB}$ . Tested ready built and guaranteed. For 10-20 V. operation.



Unit Two is styled similarly to Unit One below but incorporates valuable additional features

£10.85

## 100 WATT R.M.S. POWER AMP AND MATCHING 70V. POWER SUPPLY

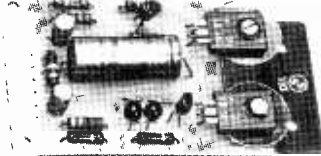
Your chance to save £1.95

To-day's best 100 watt value is now made even greater by including the Stirling Sound SS.370 power supply together at the sensational price of £21.95\*. A ruggedly built and guaranteed assembly, ideal for disco, P.A. guitar use etc. Normal selling price for items bought separately is £22.95\*—already superb value—so don't delay—order NOW!



SS.1100  
100 watt power amp  
with heatsink type  
mounting flange £9.45\*  
Full size heat sink £1.90  
SS.370  
70V/2A power supply  
with low volt take-off £12.50\*  
SS.1100H (with large heat sink)  
and SS.370 £21.00\*  
P/p on item sinc. SS.370 £1.00

## MORE STIRLING SOUND Q.V. MODULES TO SAVE YOU MONEY



### UNIT ONE TONE CONTROL/PRE-AMP

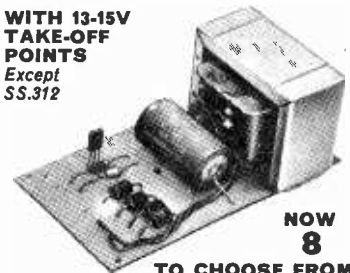
A real money saver this. Compatible with all relevant Stirling Sound modules as well as other makes. Combined pre-amp with active tone-control circuits.  $\pm 15\text{dB}$  at 10KHz treble and 30Hz bass. Stereo. Vol./balance/treble/bass. 200mV out for 50mV in. Operates from 10 to 16V supply. £7.80

### F.M. TUNING MODULES

SS.201 Front end tuner, slow geared drive, two gang. A.F.C. facility. Tunes 88-108 MHz. £5.00  
SS.202 I.F. amplifier. Metering and A.F.C. facilities. £2.65  
SS.203 Phase lock loop Stereo Decoder for use with the above or other FM mono tuners. A LED may be fitted. £3.85  
SS.203-1 Coil-type stereo decoder for use with SS.201 and SS.202, recommended where economy is called for. Available in two forms:-  
SS.203-1N with I.C. for neg. earth £2.50  
SS.203-1P transistor type for pos. earth £2.00

### POWER SUPPLY UNITS

WITH 13-15V  
TAKE-OFF  
POINTS  
Except  
SS.312



NOW  
8

TO CHOOSE FROM

Complete with mains transformers and low volt take-off points (not SS.300). All at 8% V.A.T. rate.

Model	Output	Price	P/p
SS.312	12V/1A	£3.75*	50p
SS.318	18V/1A	£4.15*	50p
SS.324	24V/1A	£4.60*	50p
SS.334	34V/2A	£5.20*	50p
SS.345	45V/2A	£6.25*	50p
SS.350	50V/2A	£6.75*	50p
SS.370	70V/2A	£12.50*	£1

SS.300 Power stabilising unit 10-50V adjustable for adding to unstabilised supplies. Built in protection against shorting (p/p 35p) £3.28\*  
SS.310/50 Stabilised power supply with variable output from 10V to 50V/2A. Built-in protection against shorting £11.95\*

### POWER AMPLIFIERS

3 TO 40 WATTS R.M.S.  
SS.103 3 watt r.m.s.mono.I.C. £1.75  
SS.103-3 Stereo version of above using two I.C.s £3.25  
SS.105 5 watts r.m.s. into 4 ohms, using 12V £2.25  
SS.110 10 watts r.m.s. using 24V and 4 ohm load £2.75  
SS.120 20 watts r.m.s. into 4 ohms, using 34V £3.25  
SS.140 Delivers 40 watts R.M.S. into 4 ohms using 45 volts supply unit such as SS.345. Ideal for small disco, P.A. etc. £3.95\*

If ordering Stirling Sound power supply units with Modules SS.103 to SS.120, V.A.T. becomes 12½%.

### TONE CONTROLS/PRE-AMPS

SS.100 Active tone control, stereo.  $\pm 15\text{dB}$  on bass and on treble £1.60  
SS.101 Pre-amp for ceramic cartridges, etc. Stereo. Passive tone control details supplied. £1.60  
SS.102 Stereo pre-amp for low output magnetic P.Us. R.I.A.A. corrected. £2.65

### WHAT QV MEANS TO YOU

It means Stirling Sound QUALITY and VALUE from modules made in our own Essex factory. They are all tested and guaranteed and offer unbeatable value. Designed by highly specialist electronic engineers with wide experience of constructors' and experimenters' needs. WATCH HOW THE STIRLING SOUND RANGE GROWS!

LARGE S.A.E. BRINGS LATEST STIRLING SOUND 16 LARGE PAGE EQUIPMENT COMPONENTS PRICE LIST

WHEN ORDERING add 35p for p/p unless stated otherwise. V.A.T. add 12½% to total value of order unless price is shown\* when the rate is 8%. Make cheques, etc. payable to Bi-Pre-Pak Ltd. Every effort is made to ensure correctness of information at time of going to press. Prices subject to alteration without notice.

# Stirling Sound

A member of the Bi-Pre-Pak group (Westcliff-on-Sea)

Dept. PE/4, 220-224 West Road, Westcliff-on-Sea, Essex SS0 9DF  
Tel: Southend (0702) 46344. Personal callers welcome.

## DE-LUXE 25 WATT HI-FI AMP BARGAIN

Made to sell at £7.25  
LIMITED NUMBER  
AVAILABLE AT

£5.20

This is the Bi-Pre-Pak SS.125, designed and made for the connoisseur market of hi-fi and technical specialists. 25w r.m.s. into 8 ohms using 50V; 25 w.r.m.s. into 4 ohms, (33V). Input sensitivity—150 mV for full output; distortion less than 0.05% at all powers. Size 4½" x 3" x 1" (120 x 76 x 22mm). With full instructions. TESTED & GUARANTEED. LIMITED NUMBER ONLY AVAILABLE. Ideal with Unit Two described above and SS.310/50



SS.125  
DE-LUXE  
POWER AMP





**PRINTED CIRCUIT KIT £4.25**  
 Make your own printed circuits. Contains etching dish, 100 sq. in. of pc board, 1 lb ferric chloride, etch resist pen, drill bit and instructions.

**JC12 AMPLIFIER**  
 6W IC audio amp with free data and printed circuit  
**£2.25**



**DELUXE KIT FOR JC12**  
 Contains extra parts except JC12 needed to complete the amp including balance, volume, bass and treble controls. Mono £2.39. Stereo £5.25.

**JC12 POWER KIT**  
 Supplies 25V 1 Amp £3.95.  
**JC12 PREAMP KITS**  
 Type 1 for magnetic pickups, mics and tuners. Mono £1.50. Stereo £3.00. Type 2 for ceramic or crystal pickups. Mono 88p. Stereo £1.76.

**SINCLAIR IC20**  
 IC20 10W+10W stereo integrated circuit amplifier kit with free printed circuit and data  
**£4.95.**  
 PZ20 Power supply kit for above £3.95.  
 VP20 Volume, tone-control and preamp kit £3.55.

**JC40 AMPLIFIER**  
 New integrated circuit 20W amplifier kit complete with chip, printed circuit and data £4.45.

**FERRANTI ZN414**  
 IC radio chip £1.44. Extra parts and pcb for radio £3.85. Case £1. Send sae for free data.

**BATTERY ELIMINATOR BARGAINS**  
**RADIO MODELS**  
 50mA with press-stud battery connectors. 9V £3.75. 6V £3.75. 9V+9V £3.45. 6V+6V £3.45. 4½V+4½V £3.75.  
**CASSETTE MAINS UNITS**  
 7½V with 5 pin din plug. 150mA £3.95  
**3-WAY MODELS\***  
 With switched output and 4-way multi-jack connector. Type 1: 3/4½/6V at 100mA £3.20. Type 2: 6/7½/9V at 150mA £3.30.  
**FULLY STABILIZED MODEL £5.45\***  
 Switched output of 3/6/7½/9V stabilized at 400mA.  
**CAR CONVERTERS £5.10\***  
 Input 12V DC. Output 6/7½/9V DC 1 Amp stabilized.

**BATTERY ELIMINATOR KITS**  
 Send sae for free leaflet on range.  
 100mA radio types with press-stud battery terminals. 4½V £2.10. 6V £2.10. 9V £2.10. 4½V+4½V £2.80. 6V+6V £2.80. 9V+9V £2.80.  
 100mA cassette type 7½V with 5 pin din plug £2.10.

Transistor stabilized 8-way type for low hum. 3/4½/6/7½/9/12/15/18V. 100mA £3.50. 1 Amp £8.50.  
 Heavy duty 13-way types 4½/6/7½/9/11/13/14/17/21/25/28/34/42V. 1 Amp model £4.95. 2 Amp model £7.95.  
 Car converter kit Input 12V DC. Output 6/7½/9V DC 1A transistor stabilized £1.95.

**MILLENNIA KITS\***  
 5 Transistor highly stabilized power units. Switched 1 to 30V in 0.1V steps. Send sae for free leaflet. 1 Amp kit £12.45. 2 Amp kit £14.95. Case £2.95 extra.

**MAINS TRANSFORMERS**  
 6-0-6V 100mA £1. 9-0-9V 75mA £1. 18V 1A £1.95. 0/12/15/20/24/30V 1A £4.30. 12/0/12V 50mA £1. 0/12/15/20/24/30V 2A £5.95. 20V 2½A £2.95. 6-0-6V 1½A £2.85. 9-0-9V 1A £2.55. 12-0-12V 1A £2.95. 15-0-15V 1A £3.20. 30-0-30V 1A £4.10.

**S-DECS AND T-DECS**  
 S-Dec £2.24. T-Dec £4.95.  
 u-DeCA £4.45. u-DeCB £7.85.  
 IC carriers with sockets—16 dll £2.05. 10T05 £1.95.



**SINCLAIR CALCULATORS & WATCHES**  
 Cambridge Memory £5.95. Cambridge Scientific £8.95. Oxford Scientific £13.30. New Sinclair pocket television set £165. Mains adaptors for other models (state type) £3.20. Assembled Grey Watch with free stainless steel bracelet £16.45. White watch £13.95.

**SINCLAIR PROJECT 80 AUDIO MODULES**  
 P25 £4.95. Z40 £5.75. Project 805Q £18.95.  
**BL-PAK AUDIO MODULES**  
 S450 tuner £20.95. AL60 £4.60. PA100 £14.95. MK60 audio kit £31.95. Teak 60 £12.95. Stereo 30 £16.95. SPM80 £3.95. BM780 £3.02. Send sae for free data.

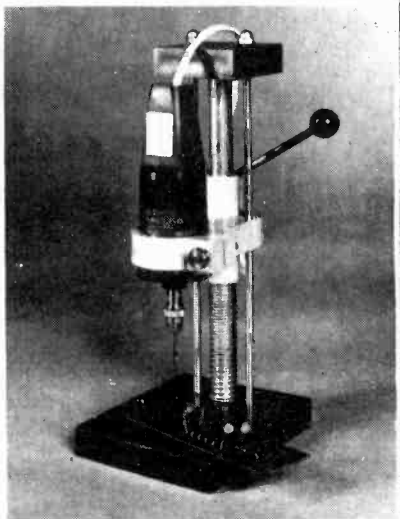
**SAXON ENTERTAINMENTS MODULES**  
 SA1208 £28.50. SA1209 £14. SA608 £13. SA604 £12. PM1201/8 £12. PM1202/8 £19. PM1201/4 £12. PM1202/4 £19. PM601/8 £12. PM601/4 £12.

**SWANLEY ELECTRONICS**  
 DEPT. PW, PO BOX 68,  
 32 GOLDSL RD., SWANLEY, KENT.

Mail order only. We will not serve callers under any circumstances. Post 30p on orders under £2.23, otherwise free. Prices include VAT. Official orders welcome. Overseas customers please deduct VAT. Send sae for free leaflets on kits.

# A MINIATURE POWER TOOL to speed your building

- Super 30 Kit (30 Tools) (incl. drill without stand) £17.62 plus P. & P. 85p
- Mk. II Drill Stand £4.40 plus P. & P. 35p
- Mk. II Drill only £8.79 plus P. & P. 35p
- Flexible Drive Shaft £5.46 plus P. & P. 25p
- Transformer 240V a.c./12V d.c. £6 plus P. & P. 70p
- Variable Speed Transformer £8.25 plus P. & P. 70p



Replacement drills, stones, burrs, etc. 40p each. Circular saw blades 50p each. £2 per set of 4 sizes. P. & P. any quantity 20p.

All VAT inclusive  
**PRECISION PETITE LTD.**  
 119a High Street, Teddington, Middlesex TW11 8HG  
 Tel. 01-977 0878 (24 hour answering service)  
 9" x 4" S.A.E. please for leaflet and order form

**H.A.C. SHORT-WAVE KITS**  
**WORLD-WIDE RECEPTION**

Famous for over 35 years for Short-Wave Equipment of quality. "H.A.C." were the Original suppliers of Short-Wave Receiver Kits for the amateur constructor. Special offer AR8 valves—70p each.

**1977 "DX" RECEIVER**  
 Complete kit—Price £6.60 (incl. p. & p. & V.A.T.). Customer writes: "I think the performance is astonishing for such an inexpensive and foolproof kit. I would wholeheartedly recommend this kit to anyone, however inexperienced, as an antidote to TV-tis, and as an entry into a fascinating hobby".  
 This kit is ready to assemble and contains all genuine short-wave components, drilled chassis, valve, accessories and full instructions. Full range of other S.W. kits, including the famous model "K plus" (illustrated above). All orders despatched within 7 days. Send now for free descriptive catalogue of kits and components.  
 Send stamped envelope for details.

**"H.A.C." SHORT-WAVE PRODUCTS**  
 P.O. Box No. 16, 10 Windmill Lane  
 Lewes Road, East Grinstead, Sussex  
 RH19 3SN

**SOUTHERN VALVE COMPANY**  
 Upper Floor, 3 Potters Road,  
 New Barnet, Herts. Tel: 01-440 8441

"QUALITY" Branded Valves—90 day guarantee.  
 ALL NEW & BOXED VALVES (incl. tax)—many makes. Radio Societies, trade etc. welcome.

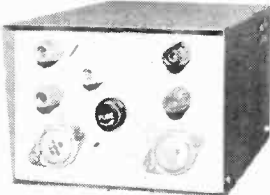
AZ31 80p	PC885 44p	PY801 41p
DY86/7 38p	PC888 62p	UBF89 47p
DY802 42p	PC889 50p	UC885 46p
EB91 18p	PCC189 53p	UCH42 75p
ECC81 35p	PCF80 40p	UCH81 42p
ECC82 35p	PCF82 45p	UCL82 42p
ECC83 34p	PCF86 58p	UCL83 53p
ECC85 40p	PCF200 85p	UP41 72p
ECC88 48p	PCF801 50p	UF89 48p
ECH42 76p	PCF802 55p	UL41 75p
ECH81 40p	PCF805 £1.40	UL84 45p
ECH83 82p	PCF806 75p	UY85 40p
ECH84 52p	PCF808 £1.40	U25 72p
ECL80 52p	PCH200 85p	U26 60p
ECL82 47p	PCL83 40p	UI91 60p
ECL83 68p	PCL85 50p	6/30L2 70p
ECL86 48p	PCL84 48p	6BW7 88p
EF80 30p	PCL85 62p	6P23 60p
EF85 37p	PCL806 62p	6P28 75p
EP86 52p	PCL86 50p	6V6 60p
EP89 38p	PCL200 £1.40	6L6 (near 90p equiv KT66)
EP183 38p	PD500 22.50	
EP184 38p	PFL200 73p	20L1 80p
EH90 56p	PL36 70p	20P4 80p
EL34 99p	PL81 50p	30C1 40p
EL41 63p	PL81A 54p	30C15 78p
EL84 38p	PL82 38p	30C17 80p
EL509 22.50	PL83 46p	30C18 £1.40
EM84 50p	PL84 46p	30F5 60p
EY61 47p	PL600 90p	30FL1 70p
EY86/7 38p	PL604 90p	30FL2 97p
EY800A1 45p	PL608 £1.10	30L1 35p
EZ40/1 53p	PL609 22.00	30L15 78p
EZ80 35p	PL619 22.50	30L17 72p
EZ81 35p	PL802 22.00	30L12 75p
EY501 £1.10	PY33 52p	30P19 70p
GZ30 52p	PY81/3 41p	30PL1 £1.40
PC86 82p	PY88 41p	30PL3 75p
PC88 63p	PY800 41p	30PL4 85p
PC97 45p	PY500A } 110p	30PL5 85p
PC900 43p	PY800 41p	30P4M 90p
PCC84 35p		

We offer return of post service. Post free over £15.00. Postage: 1st valve 12p, extra valves 6p. Max. 75p. Most types available, send sae for lists. Discount Prices. All prices subject to alteration without notice due to market fluctuations etc. Telephone enquiries welcomed, sae with enquiries PLEASE! C.W.O. ONLY. No C.O.D. Export enquiries welcomed. VAT Invoices on request. Mail order only (LARGE valves 2p extra).





## INVERTORS



240v-50Hz from your 12v car battery  
25 watt-£4-75      300 watt (12v)-£33-08  
40 watt-£8-27      400 watt (24v)-£39-05  
75 watt-£12-03      500 watt (24v)-£48-18  
150 watt-£21-27      1 Kw (50v)-£127-00  
300 watt (24v)-£26-45 1.5 Kw (110v)-£140-80  
All above invertors are in kit form but may be purchased built up in metal case and ready for use. Price list sent on receipt of s.a.e. Prices include p. and p.

### P.W. AUTOMATIC EMERGENCY SUPPLY

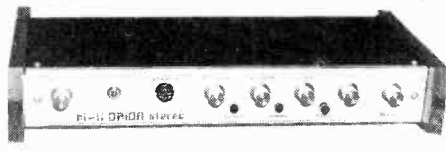
240v-50Hz-150 watt inverter with built in battery charger. In event of power failure switches over automatically from battery charging to inverter operation. Cct. as appeared in Dec. 72 P.W. Complete kit of parts (excluding meter) £24-50 plus £1-70p.p.

**DIGITAL WATCH**  
FOUR FUNCTION DIGITAL WATCH  
FOR ONLY £16 with 1 Year Guarantee  
HOURS . MINS. . SECONDS . DATE  
American Design, UK Manufacture.

### TRANSFORMERS AND COILS

Both high volume and small order capacity available.  
Special offer. Miniature mains transformer 6-0-6v-6VA. 85p + 10p p. & p.

## P.E. ORION STEREO AMPLIFIER & TUNER



20 + 20 Watts r.m.s. into 8 ohm load. Distortion less than 0.01% 100Hz-10kHz. Frequency response  $\pm 1$ dB 20 Hz to 20kHz. 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 and knobs £48-60 inc. VAT and p. & p.

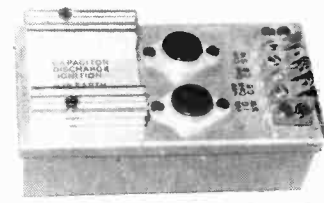
The bookend case, I.C.'s and semiconductors, P.C. board, Transformer, etc. may be purchased separately if desired. Send S.A.E. for further information.

### P.E. ORION TUNER UNIT

PARTS MAY BE PURCHASED AS FULL KIT OR SEPARATE ITEMS. SEND S.A.E. FOR DETAILS.

**N.B.—DELIVERIES ON ALL ITEMS MAY TAKE UP TO 28 DAYS, DEPENDING ON AVAILABILITY AND DEMAND. CASH IN REGISTERED ENVELOPE OR POSTAL ORDERS CAN REDUCE TIME BY NOT HAVING TO CLEAR CHEQUES**

## ASTROIGNITION



### ASTRO IGNITION SYSTEM

Complete kit of parts for this proven and tested system £10-45 inc. VAT  
Ready built with only two connections to alter £13-75 inc. 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 ON ALL PRODUCTS

**ASTRO ELECTRONICS**  
Springbank Road, West Park  
CHESTERFIELD. 31475

## B. BAMBER ELECTRONICS

Dept. PW, 5 STATION ROAD, LITTLEPORT, CAMBS. CB6 1QE  
Telephone: ELY (0353) 860185 (2 lines) Tuesday to Saturday

PLEASE ADD 8% VAT UNLESS OTHERWISE STATED

**SPECIAL OFFER...**  
STARPHONE HIGH BAND RF PC boards, with conversion data for making into a good 2M Converter. (All that is needed: 1 x 100pF caps. 2 resistors, and 9V DC.) PCB contains 2 Dual gate Mos Fet RF stages (3N140), Diode ring mixer, 3 stage Osc/Multiplier. All on one PCB, approx. size 6" x 1 1/2", ext. connections, 9V DC supply, AGC input, IF output (works from a few MHz to over 30MHz). All Brand New. £6-50 each, while stocks last.

**TELEPHONE HANDSETS** with "PRESS-TO-TALK" buttons, on curly lead, brand new, £3-50 (few only).

**GARRARD 9V DC MINIATURE MOTORS**, Type 318M, 3200 RPM, governed, size approx. 1 1/2in. dia. x 1 1/2in. high, with 2mm spindle. Brand New. 60p each or 2 for £1.

**SILICON HIGH VOLTAGE RECTIFIER STICKS**, BY185 (new) 35kV 2.5mA £1 each, BY140 (ex-stock) 12kV 2.5mA 45p each.

**VARIABLE STABILISED POWER SUPPLY**, mains input, 0-24V output, stabilised and current limiting at 500mA + 32V at 50mA. Brand new by British manufacturer. Size approx. 7 1/2 x 2 1/2 x 4in. complete with external 5K 3-turn pot for voltage control. Connection data supplied. £7.

**14 DIL REED RELAYS**, 5 to 12V DC, 450 ohm coil. Designed to work directly from TTL Logic. Single Pole Change over. Contact ratings 28V 3A 3W. £1-75 each.

**PLASTIC BOXES** 3 1/2" square, 1 1/2" deep (wall-mounting type) with 5-pin din plug on front panel, 50p each.

**2N3055** type Transistors. O.K., but unmarked, 5 for £1.

**110V NEONS, SCREW-IN-TYPE**, 4 for 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.

**MAINS ISOLATION TRANSFORMERS**. Tapped mains input, 240V at 3A + 12V at 500mA output. New, boxed, made by Gardners. £12-.

**4MHz XTAL PACKS** (10 assorted xtals between 4MHz and 5MHz), our selection only. £1 Pack.

**MINIATURE PLIERS**. High quality "Crescent", made in USA. £4-35 + VAT (35p).

**SIDE CUTTERS**. High quality. £3-70 + VAT 30p.

**SPERRY 7-SEGMENT P.G.D. DISPLAYS**, digit height 0.3in. red, with decimal points, 150V to 200V (nominal 150V) 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. (Sorry, no single digit available.) Data supplied.

BSX20 (VHF Osc/Mult), 3 for 50p.  
BC108 (metal can), 4 for 50p.  
PEC108 (plastic BC108), 5 for 50p.  
BFY51 Transistors, 4 for 60p.  
BCY72 Transistors, 4 for 50p.  
PNP audio type TOS Transistors, 12 for 25p.  
BF152 (UHF amp/mixer), 3 for 50p.  
2N3819 Fet, 3 for 60p.  
BC148 NPN SILICON, 4 for 50p.  
BC158 PNP SILICON, 4 for 50p.  
BAY31 Signal Diodes, 10 for 35p.  
BA121 Varicap Diodes, 4 for 50p.  
1N914 Diodes, 10 for 25p.

**SMALL MAINS SUPPRESSORS** (small chokes, ideal for radio, Hi-Fi inputs, etc.), approx. 3in. x 1 1/2in., 3 for 50p.

**PERSPEX TUNER PANELS** (for FM Band 2 transistors) marked 88-108MHz and Channels Q-70, 10A rating) + 4 change over contacts + 1 break contact. New, complete with mounting bracket. (Ideal for switching HT on Linears.) Many uses for this high quality unit. £1-50 each.

Lead suppressors (10kohm) for mobile plug leads, 4 for 50p.

**HEAVY DUTY RELAYS**, 24V d.c. operated (will work on 18V) 3 heavy duty make contacts (around 10A rating) + 4 change over contacts + 1 break contact. New, complete with mounting bracket. (Ideal for switching HT on Linears.) Many uses for this high quality unit. £1-50 each.

T03 transistor insulator sets, 10 for 50p.

**MIXED COMPONENT PACKS**, containing resistors, capacitors, pots, etc. All new. Hundreds of items. £2 per pack, while stocks last.

**ALU-SOL ALUMINUM SOLDER** (made by Multicore). Solders aluminium to itself or copper, brass, steel, nickel or tinplate, 16 s.w.g. with multicore flux, with instructions. Approx. 1 metre coil 40p pack. Large reel £2-75.

**VARICAP TUNERS** Mullard Type ELC1043/05. Grand New. £4-40 + 12 1/2% VAT.

I.C.'s some coded, 14 DIL type, untested, mixed, sorry sold out.

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).

We now stock Spiralux Tools for the electronic enthusiast: Screwdrivers, Nut Spanners, EA and Metric sizes, spot rivet guns, etc. S.A.E. for list.

Miniature earphones with min. jack plug, 2 for 50p + 12 1/2% VAT.  
**TWIN I.F. CANS**, approx. 1in. x 3in. x 1 1/2in. high, around 3.5-5MHz, 2 separate transformers in 1 can, internally screened, 5 for 50p + 12 1/2% VAT.

Dubilier Electrolytics, 50µF, 450V, 2 for 50p.  
Dubilier Electrolytics, 100µF, 275V, 2 for 50p.  
Plessey Electrolytics, 470µF, 63V, 3 for 50p.  
TCC Electrolytics, 1000µF, 30V, 3 for 60p.  
DC Screw terminals, £1-50 each.  
Plessey Electrolytics, 1000µF, 180V, 40p each (3 for £1).  
Dubilier Electrolytics, 5000µF, 35V, 50p each.  
Dubilier Electrolytics, 5000µF, 50V, 60p each.  
ITT Electrolytics, 8800µF, 25V, high grade, screw terminals, with mounting clips, 50p each.  
Plessey Electrolytics, 10,000µF at 63V, 75p each.  
Plessey Cathodray Capacitors, 0-0-4µF at 12.5kV DC. Screw terminals, £1-50 each.  
**PLEASE ADD 12 1/2% VAT TO ALL CAPACITORS.**

**TV PLUGS AND SOCKETS**  
TV Plugs (metal type), 5 for 50p.  
TV Sockets (metal type), 4 for 50p.  
TV Line Connectors (back-to-back sockets), 4 for 50p.  
**Please add 12 1/2% VAT.**

PLEASE ADD 8% VAT UNLESS OTHERWISE STATED

**A LARGE RANGE OF CAPACITORS AVAILABLE AT BARGAIN PRICES, S.A.E. FOR LIST.**

**PLUGS AND SOCKETS**  
N-Type Plugs 50 ohm, 60p each, 3 for £1-50.  
PL259 Plugs (PTFE), brand new, packed with reducers, 65p or 5 for £3.  
SO239 Sockets (PTFE), brand new (4-hole fitting type), 50p each or 5 for £2-25.

**SOLDER SUCKERS** (Plunger Type). Standard Model, £4-50. Skirted Model, £4-95. Spare Nozzles 60p each.

**WELLER SOLDERING IRONS**  
EXPERT, Bull-Head, poolight illuminates work. Pistol grip with fingertip trigger. High efficiency copper soldering tip.  
**EXPERT SOLDER GUN**, £8-80 + VAT (54p).  
**EXPERT SOLDER GUN KIT** (spare bits case, etc.), £9-80 + VAT (78p).  
**SPARE BITS, PAIR**, 30p + VAT (2p).  
**MARKSMAN SOLDERING IRONS**  
TYPE D 15W £3 + VAT (24p).  
SP25D 25W £3 + VAT (24p).  
SP25DK 25W + bits, etc. kit £3-85 + VAT (31p).  
SP40D 40W £3-44 + VAT (28p).  
**BENCH STAND** with spring Marksmans Irons. £2-22 + VAT (18p).

**SPARE BITS**  
MT6 for 15W, 48p + VAT (4p).  
MT14 for 25W, 38p + VAT (3p).  
MT70 for 40W, 42p + VAT (31p).  
**TCPI TEMPERATURE CONTROLLED IRON**. Temperature controlled iron and PSU. £20 + VAT (£1-60).  
**SPARE TIPS**  
Type CC single flat, Type K double flat fine tip. Type P very fine tip. £1 each + VAT (8p).

**MOST SPARES AVAILABLE.**

**MULTICORE SOLDER**  
Size 5 Savit 18 s.w.g. in alloy dispenser, 32p + VAT (3p).  
Size C15AV18 Savit 18 s.w.g., 56p + VAT (4p).  
Size 12 Savit 18 s.w.g. on plastic reel £1-80 + VAT (11p).  
‡ Kit (1-11) 60 x 40, 20 s.w.g. on plastic reel £3.

Terms of Business: CASH WITH ORDER. MINIMUM ORDER £2. 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 WELCOME BY APPOINTMENT ONLY.



4 1/4 in x 3 1/2 in METER. 30µA, 50µA or 100µA, £4.78. P. & P. 16p.

**MICROPHONES FOR TAPE RECORDERS**

DM228R 200 ohm with 3.5 & 2.5mm Jack Plugs £1.30

DM229R 50K with 3.5 & 2.5mm Jack Plugs £1.60

DM18D 200 ohm with 5 & 3 pin DIN plug £1.75

Postage on above microphones 1p.



**CARDIOID DYNAMIC MICROPHONE**

Model UD-130. Frequency response 50-15,000c/s. Impedance Dual 50K and 600 ohms, £7.55. P. & P. 26p.

42 x 42mm METERS 1mA, 10mA, 100mA, 500mA, £2.92, 11p P. & P.

60 x 45mm METERS 50µA, 100µA, 500µA and 1mA VU METER £4.13, 13p P. & P.

EDGEWISE METERS, 90mm x 34mm, 1mA £3.40, 13p P. & P.

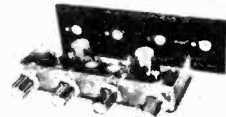
**MULTI-METER**

Model ITI-2  
20,000 ohm/volt, £10.05.  
P.&P. 24p.



**3 WATT STEREO AMPLIFIER**

1 1/2 W PER CHANNEL  
£4.30. P. & P. 13p.



All above prices include V.A.T. LARGE S.A.E. for NEW LIST Special prices for quantity quoted on request.

**M. DZIUBAS**

158 Bradshawgate · Bolton · Lancs. BL2 1BA

**CMOS WITH DISCOUNTS!**

Any mix; Discount 10% 25+, 25% 100+, 33 1/3% 1000+

Quartz Crystals. 100kHz, 1MHz, 2.097152MHz, 3.2768MHz, 4.194304MHz, all same price £3.75. 32.768kHz, TO5 can £4.50. 50Hz Timebase kit for clocks etc., £5.91. 'DALO' Pen 75p. Liquid crystal display 4 x 0.5" digits, 40 pin, £13.95. Clock clip, 1 1/2v battery operated, to suit our L.C.D. 40 pin DIL, 14440 £11.58.

4000	0-20	4039	3-09	4081	0-24	14505	4-38	'E' LED Displays
4001	0-20	4040	1-19	4082	0-24	14506	0-57	DL-704E 0-3" 70p
4002	0-20	4041	0-93	4085	0-80	14507	0-60	DL-707E 0-3" 70p
4006	1-31	4042	0-93	4086	0-80	14508	3-08	DL-728E 2 x 0-5" 1.80
4007	0-20	4043	1-12	4089	1-74	14510	1-51	DL-727E 2 x 0-5" 1.80
4008	1-07	4044	1-04	4093	0-89	14511	1-74	DL-750E 0-6" 1-50
4009	0-60	4045	1-56	4094	2-08	14512	1-03	DL 747E 0-6" 1-50
4010	0-60	4046	1-48	4095	1-16	14514	3-47	Red Leds
4011	0-20	4047	1-01	4096	1-16	14515	3-47	0 1" 15p
4012	0-20	4048	0-60	4097	4-13	14516	1-51	0 2" 15p
4013	0-60	4049	0-60	4098	1-22	14517	4-02	Clock Chips
4014	1-12	4050	0-60	4099	2-03	14518	1-39	AY-5-1224A 3-50
4015	1-12	4051	1-04	40101	1-76	14519	0-57	MK50253 5-50
4016	0-60	4052	1-04	40102	2-16	14520	1-39	Soldercon Pins
4017	1-12	4053	1-04	40103	2-16	14521	2-77	100 60p
4018	1-12	4054	1-29	40104	2-26	14522	2-15	1000 4-00
4019	0-60	4055	1-46	40107	0-66	14526	2-15	2500 8-75
4020	1-24	4056	1-46	40108	6-18	14527	1-78	DIL Sockets
4021	1-12	4057	29-81	40109	2-21	14528	1-22	8/14/16 pin 15p
4022	1-07	4059	6-20	40181	4-30	14529	1-72	Timer I/C
4023	0-20	4060	1-24	40182	1-73	14530	0-95	Ne555 45p
4024	0-87	4061	25-60	40194	2-26	14531	1-74	Push Switches
4025	0-20	4062	10-10	40257	2-26	14532	1-39	Type SW9 15p
4026	1-92	4063	1-22	4700	1-75	14534	0-15	Op-Amps
4027	0-60	4066	0-69	7083	4-25	14536	4-00	CA3130
4028	1-00	4067	4-13	14160	1-18	14537	13-17	(COS/MOS) 1-00
4029	1-27	4068	0-24	14161	1-18	14539	1-24	CA3140
4030	0-60	4069	0-24	14162	1-18	14541	1-82	(BI/MOS) 95p
4031	2-46	4070	0-24	14163	1-18	14543	1-82	741 Minidip 25p
4032	1-19	4071	0-24	14174	1-08	14549	4-10	
4033	1-55	4072	0-24	14175	1-04	14552	10-50	
4034	2-11	4073	0-24	14194	1-17	14553	4-66	
4935	1-31	4075	0-24	14490	6-51	14554	1-67	
4936	3-08	4076	1-71	14501	0-20	14555	1-08	
4037	1-08	4077	0-85	14502	1-38	14556	1-01	
4038	1-20	4078	0-24	14503	0-75	14557	4-65	

Terms: C.W.O. Add VAT to all prices at 8%. Post etc. U.K. 25p + 2p + 27p per order. All orders processed same day. Official Govt. 'Varsity, Poly etc. orders (written or telephoned) welcome.

**GREENBANK ELECTRONICS (Dept. W4P)**  
94 New Chester Road, New Ferry, Wirral, Merseyside  
L62 5AG Tel: 051-645 3391

**BOOKS for Electronics Enthusiasts**



**COMING SOON—Radio, TV & Audio Technical Reference Book - S.W. Amos.** The complete reference book compiled by 31 experts in all aspects of radio, TV & audio.  
Spring 77. 1,200 pages

**COMING SOON—Beginner's Guide to Radio—8th Edition - Gordon J. King.** Completely updated and rewritten it surveys the whole field of radio.  
Summer 77. 260 pages

**SPECIAL SERIES FEATURE**  
*Master Books*

Authoritative yet easily understood by those with no technical knowledge whatsoever, the texts are supplemented by many highly informative illustrations. Each book is written by an expert in his own special field.

**MASTER ELECTRONICS IN MUSIC**  
T.D. Towers

Contents: Creating Musical Sounds by Electricity. Making Musical Instruments Louder. Musical Special Effects by Electronics. Electronic Keyboard Instruments. Electric Guitars. Magnetic Tape Music. The Robot Drummer. Music Synthesizers. Music by Computer. Index.  
130 pages. £2.50

**MASTER HI-FI INSTALLATION**  
Gordon J. King

Contents: How it Works. The Amplifier. Programme Signal Sources. Importance of a Good F.M. Signal. The Loudspeaker. Mono, Stereo & Quadrophonic Sound. Four-channel Techniques. Room Effects. Best Use of Controls. Terminology. Index.  
150 pages. £2.50

**MASTER STEREO CASSETTE RECORDING**  
I.R. Sinclair

Contents: Stereo Systems. Signal Sources. Controls and Facilities. Making the Recording. Replaying and Monitoring. Essential Maintenance. Aids to Better Recording. Noise Reduction Systems. Cassette Recorder and Hi-Fi.  
140 pages. £2.50

**STANDARD WORKS**

**FOUNDATIONS OF WIRELESS AND ELECTRONICS**  
9th Edition. M.G. Scroggie. 552 pages. £3.75

**RADIO VALVE AND SEMICONDUCTOR DATA**  
10th Edition. A.M. Ball. 240 pages. £2.00



**Newnes Technical Books**

Borough Green, Sevenoaks, Kent TN15 8PH



NOSTALGIA

## VINTAGE RADIO

1920 to 1950

COLLECTING

Receivers, valves, components, service data, historical research, books, magazines, repairs and restorations. A complete service for the collector and enthusiast of vintage radio.

S.a.e. with enquiries and for monthly newsheet. Full 1976 catalogue, 50p post paid.

**TUDOR REES (Vintage Services)**, 84, Broad Street, Staple Hill, Bristol, BS16 5NL. Tel. Bristol 565472.

**MAINS TRANSFORMERS:** Primary-240V AC, Secondary-12V at 7Amps. Price: £3.00. Carriage £1.50. **IDEAL FOR BATTERY CHARGER!** NE555 Timer IC's. Price: 35p each, or £3.00 for 10. Post 30p. All prices are inclusive of VAT. **J.K.M. Electronics**, Rear Coach House, 85 Ashley Road, Montpellier, Bristol, BS6 5NR. Avon.

## VALVES

Radio - T.V. - Industrial - Transmitting  
We Dispatch Valves to all parts of the world by return of post, Air or Sea mail, 2700 Types in stock, 1930 to 1976. Obsolete types a speciality. List 20p. Quotation S.A.E. Open to callers Monday to Saturday 9.30 to 5.00 closed Wednesday 1.00. We wish to purchase all types of new and boxed Valves.

**COX RADIO (SUSSEX) LTD.**  
Dept. P.W. The Parade, East Wittering,  
Sussex PO20 8BN West Wittering  
2023 (STD Code 024366)

**DIODES** 1N914E 2p ea. £1.30/100, £10/1,000 5% Zeners 2.7-36V 5p ea. £4/100, 800V 1 amp Low VF 5p ea. £4/100 20p p & p. **Bale Electronics**, 'Nanock' Dalton, Dumfrireshire.

## For Sale

**NEW ISSUES OF "PRACTICAL WIRELESS"** available from April 1974 up to date. Cover price plus 17p postage per copy—Bell's Television Services, 190 Kings Road, Harrogate, N. Yorkshire. Tel: (0423) 55885.

**ASCOT** Cassette with all transistors, £30. All i.c.'s for Video Writer, £30. Heathkit IB-102 Prescaler, £30. S.A.E. J. Berden, 57 Hilton Road, Gurnard, Codes, I.O.W.

**WANTED.** Volumes P.W. 68/69/70, will pay £2-00 Volume plus postage. Write: Kemas, 58 Stratford Terrace, Leeds LS11 6JE.

## Aerials

### G2DYM SWL AERIALS

All aerials custom built by G2DYM, Ex-B.B.C. Transmitter and Aerial Engineer. **CONSULT US for DESIGN & ADVISORY SERVICE**, send large S.A.E., 3, 64 stamps. We will quote you for Custom building aerials to your individual requirements, and space available.

**LAMBDA ANTENNA STUD FARM**  
WHITEBALL, WELLINGTON, SOMERSET

## Ladders

**LADDERS.** Varnished, 20ft 9in extd. £25.33. Carr. £1.90. Leaflet. Also alloy ext. up to 62½ft. The Ladder Centre (WLS) Halesfield (1) Telford, Salop. Tel: 586644. Callers welcome.

Practical Wireless, April 1977

## Service Sheets

### SERVICE SHEETS — COLOUR TV SERVICE MANUALS

Service Sheets for Mono TV, Radios, Record Players and Tape Recorders 75p.

Please send large Stamped Addressed Envelope.  
We can supply manuals for most makes of Colour Television Receivers by return of post.  
**B.R.C. PYE ECKO PHILIPS ITT/KB SONY G.E.C. HITACHI BAIRD ULTRA INVICTA FERGUSON H.M.V. MARCONI AND MANY MORE**

Let us quote you. Please send a Stamped Addressed Envelope for a prompt reply.  
Also comprehensive T.V. repair manuals by J. M. Court. S.A.E. for details.

**G. T. TECHNICAL INFORMATION SERVICE**  
10 DRYDEN CHAMBERS, 119 OXFORD ST., LONDON W1R 1PA  
MAIL ORDER ONLY

**BELL'S TELEVISION SERVICES** For Service Sheets on Radio, TV, etc., 75p plus S.A.E. Colour TV Service Manuals on request. S.A.E. with enquiries to B.T.S., 190 Kings Road, Harrogate, N. Yorkshire. Tel: (0423) 55885.

## LARGE SUPPLIER OF SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOGRAMS, RADIOGRAMS, CAR RADIOS, TUNER SHEETS)  
ALL AT 75p EACH (Except colour) and CAR RADIOS  
Please state if Circuit will do if Service Sheet not in stock.

**"PLEASE ENCLOSE LARGE S.A.E WITH ALL ENQUIRIES & ORDERS"**

Otherwise cannot be attended to  
(Uncrossed P.O. a please, original returned if service sheets not available.)

**PLEASE NOTE**  
We operate a "by return of post" service. Any claims for non-delivery should be made within 7-days of posting your order.

### C. CARANNA

71 BEAUFORT PARK  
LONDON, N.W.11 6BX

We have the largest supplies of Service Sheets (strictly by return of post). Please state make and model number alternative. Free TV fault tracing chart or TV list on request with order.

Mail order or phone 01-458 4882  
Large Stocks of Colour Manuals  
NO OVERSEAS MAIL PLEASE

**SERVICE SHEETS**, radio, TV etc. 10,000 models. Catalogue 24p, plus SAE with orders, enquiries. Telfray, 154 Brook Street, Preston PR1 7HP.

**SERVICE SHEETS**, Radio, TV, etc., 50p and s.a.e. Catalogue 20p and s.a.e. **HAMILTON RADIO**, 47 Bohemia Road, St. Leonards, Sussex.

## Wanted

**WANTED—NEW VALVES, TRANSISTORS, TOP PRICES**, popular types. Kensington Supplies (C), 367 Kensington Street, Bradford 8, Yorkshire.

**BACK ISSUES OF:** Everyday Electronics, Practical Electronics, Practical Wireless, Electronics Today International and Short Wave Magazine from 1970 onwards. Michael Hayes, 37 College Park, Corbally, Limerick, Ireland.

## Situations Vacant

**TELERADIO** have vacancy for technician capable of building and testing electronic prototypes such as instruments and amplifiers. Write for appointment to 325 Fore Street, Edmonton, London N9.

## Books and Publications

### RADIO BOOK SERVICE

Servicing Transistor Radio Receivers	£1-00
The Cathode Ray Oscilloscope and its Uses	£1-90
1st & 2nd Books of Transistors & Substitutes (Set)	£1-55
Radio Receiver Construction using IC's & Transistors	£2-70
Radio Antenna Handbook for Long Dist. Reception	£0-95
79 Electronic Novelty Circuits	£0-85
Audio Enthusiast Handbook	£0-95
The Complete Car Radio Manual	£0-85
Solid State Power Supply Handbook	£0-95
IC's & Transistor Gadgets Construction Handbook	£0-95
Integrated Circuits Equiv. & Substitutes Handbook	£0-95
Manual of Electronic Circuits for the Home	£0-60
Electronic Gadgets & Games	£0-95

PRICES INCL. P&P. SEND S.A.E. FOR FULL LIST  
NOTE NEW ADDRESS  
4 CHILCHESTER COURT, WICHAMAN RD, BECKENHAM KENT BR3 2JW

### 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. A goldmine of information and knowledge.

Only £3.90 plus 26p P&P.

**Magnum Publications Dept PW5**  
Brinksway Trading Estate, Brinksway,  
Stockport SK3 0BZ.  
Overseas Distributors wanted.

## Electrical

**STYLI, CARTRIDGES & AUDIO LEADS** etc. For the best at keenest prices send S.A.E. for free illustrated list to: Felstead Electronics (PW), Longley Lane, Gatley, Cheadle, Cheshire. SK8 4EE.

## Educational

**GO TO SEA** as a Radio Officer. Write: Principal, Nautical College, Broadwater Fleetwood FY78JZ.

# TELEVISION TRAINING

**12 MONTHS'** full-time course in Radio & TV for beginners. (GCE—or equivalent—in Maths. and English).

**26 WEEKS'** full-time course in Mono & Colour TV. (Basic electronics knowledge essential).  
**13 WEEKS'** full-time course in Colour TV. (Mono TV knowledge essential).

These courses incorporate a high percentage of practical training.

Next session starts on April 18th.

Prospectus from: **London Electronics College, Department B4, 20 Penywern Road, London SW5 9SU. Tel. 01-373 8721.**

## Miscellaneous

### MAGNETIC MICROPHONE SPEAKERS

4T Inserts, Ideal for all sound speaking and listening applications. Very rugged—d.c. resistance 20 ohms. Size: 1 1/2" dia. 1 1/2" deep. 40p ea. + 10p P & P. 6 for £2.20 + 20p P & P. 12 for £4.50 P & P free. S.A.E. for list of many other items. Trade enquiries welcome.

B.B. Supplies, 141 Shalmford Street, Nr. CANTERBURY, Kent CT4 7QZ.

### LOW COST — HIGH EFFICIENCY AUDIO TEST OSCILLATOR £22



RANGE: 10Hz to 100kHz. OUTPUT: 1V, sine/sq. DISTORTION: less than 0.02%. 9V battery. Also available in Kit form at £17. Add 8% VAT. P. & P. and ins. 75p. Leaflet available, also F.M. Signal Generator, Millivoltmeter, freq. meter, THD analyser, P.S. Units. S.A.E. please for literature.

**TALERADIO ELECTRONICS**  
325 Fore Street, London, N9 0PE  
Tel. 01-807 3719

### GORSE'S

MAIN STOCKISTS FOR  
**GRUNDIG**

Satellit 2100, 21 Wave Band Radio, TK547 and TK747 Stereo Tape Recorders, Radios, Radio/Cassette Recorders, Cassette Recorders, Microphones, etc., etc. Please write (send S.A.E.), phone or call for full details and prices.  
42-44 CHURCH ST., BLACKBURN Tel: 51682  
77 THE MALL BURNLEY Tel: 35229

**SUPERB INSTRUMENTS 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 82p. Examples: width, depth, height, 8in x 5in x 3in, £1.70. 10in x 6in x 3in £2.42. 10in x 8in x 3in £3.02. 12in x 10in x 3in £3.96. 8in x 4in x 4in £1.98. 10in x 6in x 4in £2.97. 12in x 8in x 4in £3.96. 7in x 7in x 5in £2.91. 8in x 10in x 6in £3.96. 12in x 8in x 7in £4.40. 12in x 12in x 7in £4.84. Plus 85p carriage and 8% VAT. Over 400 models to choose from. Prompt despatch. Free literature (stamp would be appreciated). Bazelli, Dept No. 25, St. Wilfrid's, Foundry Lane, Halton, Lancaster LA2 6LT.

### NOW YOU CAN DIG

out the DX from under a strong whistle or CW interference, FAST, with a TUNABLE AUDIO NOTCH FILTER between your receiver and speaker. All parts, case, etc. instructions, money back assurance, SEND £5.30 NOW.

CAMBRIDGE KITS

45 (PR) Old School Lane, Milton, Cambridge.

### ARMATURE & COIL WINDING ENAMELLED COPPER WIRE

Only top quality materials supplied.

All orders dispatched within 24 hrs.

S.W.G.	1 lb reel	1/2 lb reel
10 to 19	£2.95	£1.60
20 to 29	£3.15	£1.80
30 to 34	£3.45	£1.90
35 to 40	£3.65	£2.10

All prices are inclusive of P. & P. in U.K.

### COPPER SUPPLIES

102 Parrswood Road, Withington, Manchester 20 Tel: 061-445 8753

## Musical Miracles!

by Dewtron®

Build your own synthesiser or musical effects using some of the huge range of DEWTRON modules. Or build fuzz or waa-waa at budget prices using special kits.

Send 25p for Catalogue from—

D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset BH22 9AE.

## PRINTED CIRCUITS and HARDWARE

Readily available supplies of Constructors' hardware, Aluminium sheet and sections. Printed circuit boards, top quality for individual designs. Prompt service. Send 15p for catalogue.

Ramar Constructor Services,  
Masons Road, Stratford on Avon,  
Warwicks. Tel. 4879

# ELECTRONIC BROKERS



**ELECTRONIC BROKERS LTD**  
49/53 Pancras Road  
London NW1 2QB  
Tel: 01-837 7781

## Computer parts for hobby, experimental, educational and professional use.

### FRESH STOCKS OF THE POPULAR CLARE-PENDAR ASC11 KEYBOARD TYPE KB6 NOW TO HAND

ASCII-Coded TTL-compatible 4-bank alphanumeric reed-switch keyboard with ROM encoder chip, strobed output, two-key rollover and debounce. Standard 7-bit ASCII code (no parity). Supplied complete with circuit diagrams and code chart.

**SPECIFICATIONS** Power Supply: + 5VDC ± 5% 150mA; -12VDC ± 10% 10mA Output Logic Levels: Data Bits 1 through 7: 0v "0"; 4.5v "1"; 5.25v Fan Out: One standard TTL load. Strobe: 2.6v "1"; 5.25v "0"; 10" 48v. Fan Out: 10 standard TTL loads. Strobe signal delay 10 milliseconds nominal to allow date to stabilise.

**KB6:** 56-station standard Teletype layout. AS RECOMMENDED FOR PRACTICAL WIRELESS VIDEO-WRITER PROJECT. Price £39.50 plus £1 P&P + 8% VAT (send £43.74).

**ALSO AVAILABLE SPECIAL LOW COST KEYBOARDS**  
**KB3:** 3-bank alphanumeric Baudot-coded 36-station keyboard. TTL compatible, strobed output. Price £26.00 plus £1 P&P + 8% VAT (send £22.68).

### NEW ARRIVALS

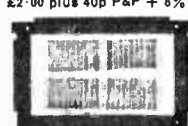
**FABULOUS NEW 96-STATION CRT DISPLAY KEYBOARDS** 8-bit ASCII code, upper and lower case output PLUS separate numeric pad. TTL logic. Delayed strobe signal and two-key rollover feature. Mounted in attractive box, overall dimensions 20 1/2 x 7 1/2 x 3 1/2". Price £65.00 + £3 carriage + 8% VAT (Send £73.44).

**BCD-coded keyboard**, upper and lower case outputs. 54 Key-stations PLUS 5 Indicator lamps and on/off switch. Set in attractive mounting panel, dimensions 15 1/2 x 5 x 2 1/2". Price £39.50 + £2 P&P + 8% VAT (send £44.82).

Also available a few only of above model WITHOUT ENCODING. Price £25.00 + £1.50 P&P + 8% VAT (Send £28.62).

### FOR THE EXPERIMENTER

Single plane core memory ideal for experimental and instructional applications. 42 x 52 cores storage capacity with 230 0A10 diode-loaded buffer. £2.00 plus 40p P&P + 8% VAT (Send £2.69).



Ferrite core memory plane mounted on plastic frame 5 x 8" consisting of matrix 40 x 52 x 4 cores, divided into four individually addressable planes with separate sense and inhibit wires per plane giving 1000 bits capacity, comprising of a grid of wires passing through ferrite cores at a 90 degree. £2.50 plus 40p + 8% VAT (Send £3.13).









Head Office and Warehouse  
44A WESTBOURNE GROVE  
LONDON W2 5SF  
Tel: 727 5641/2/3

# Z & I AERO SERVICES LTD.

Retail Shop  
85 TOTTENHAM COURT ROAD  
LONDON W1  
Tel: 580 8403  
Open all day Saturday

Please send all correspondence and Mail-Orders to Head Office

## AC/DC TAUT SUSPENSION MULTIMETERS (Made in USSR)



TYPE	U4312	U4313	U4315
Sensitivity D.C.	667 o.p.v.	20,000 o.p.v.	20,000 o.p.v.
Sensitivity A.C.	667 o.p.v.	2,000 o.p.v.	2,000 o.p.v.
D.C. Current	300 $\mu$ A-6A	60 $\mu$ A-1.5A	50 $\mu$ A-2.5A
A.C. Current	1.5mA-6A	0.6mA-1.5A	0.5mA-2.5A
D.C. Volts	75mV-900V	75mV-600V	75mV-1000V
A.C. Volts	300mV-900V	15V-600V	1V-1000V
Resistance	0-02-3k $\Omega$	1K-1M	300 $\Omega$ -500k $\Omega$
Capacity	—	0.5 $\mu$ F	0.5 $\mu$ F
Accuracy	1% D.C., 1.5% A.C.	1.5% D.C., 2.5% A.C.	2.5% D.C., 4% A.C.

Price complete with pressed steel carrying case and test leads.

£14.50      £17.50      £14.95

TYPES U4313 AND U4315 ARE PROVIDED WITH ANTI-PARALLAX MIRROR SCALES



### TYPE U4341

Sensitivity:  
16700 $\Omega$ /V D.C.,  
330 $\Omega$ /V A.C.

Ranges:  
D.C. current: 0.06-0.6-60-600mA  
A.C. current 0.3-3-30-300mA  
D.C. Voltage: 0.3-1.5-6-30-60-150-300-900V  
A.C. Voltage: 1.5-7.5-30-150-300-750V  
Resistance: 2-20-200 $\Omega$ -2M $\Omega$   
Transistor collector cut-off current 60 $\mu$ A  
Transistor D.C. current gain in two ranges 10-350  
Accuracy: 2.5% D.C.,  
4.0% A.C.,  
5% D.C. current gain  
Power supplies: 4.5V battery (Eveready 1289)

Complete with steel carrying case, test lead, battery and instruction manual £14.50

**NO OVERLOAD PROTECTION IS INCORPORATED IN THESE INSTRUMENTS**



### TYPE U4324

D.C. Current:	0.06-0.6-60-600mA-3A
A.C. Current:	0.3-3-30-300mA-3A
D.C. Voltage:	0.6-1.2-3-12-30-60-120-600-1200V
A.C. Voltage:	3-6-15-60-150-300-600-900V
Resistance:	500 $\Omega$ -5-50-500k $\Omega$
Accuracy:	D.C. 2.5%; A.C. 4% (of F.S.D.)

PRICE complete with test leads and fibreboard storage case £14.50

THE ABOVE PRICES ARE EXCLUSIVE OF VAT (at present 8%) HANDLING AND POSTAGE CHARGES £1.25 PER INSTRUMENT

OUR NEW 1976/1977 CATALOGUE IS NOW READY AND WILL BE SENT ON RECEIPT OF REMITTANCE FOR £0.30

## poly-planar

20-Watt Full Range Speaker

Completely replaces the conventional cone speaker  
Super-thin construction permits new installation ideas.

Power capability: 40 watts peak. Frequency range: 40 Hz-20 KHz  
Sensitivity: 85 dB/M for 1 watt electrical input. Input impedance: 8 ohms. Operating temperature range: -20°F to +175°F. Size (WxDxL): 1-7/16" x 1-3/4" x 1-11/16". Weight: 19 ounces.

£9.50 each Stereo pair £18.50

INCLUSIVE OF VAT AND POSTAGE

**web europa**

P.O. Box 9, Ruthin Clwyd



## PRACTICAL WIRELESS T.V. SOUND TUNER

(Nov. 75 article by A. C. Alnsle)

IF Sub-Assembly (G8) £6.80. P & P 75p.

Mullard ELC1043 Varicap UHF Tuner £4.00. P & P 30p.

3-way Station Control Unit £1.20. P & P 25p.

6-way Station Control Unit (Special Offer) £1.00.

Resistors, Caps, Semiconds etc. £5.22. P & P 55p.

Printed Circuit Board £1.00. P & P 30p.

Mains Transformer £2.50. P & P 30p.

Add 12½% VAT to price of goods. P & P all items 75p.

Copy of original article supplied on request

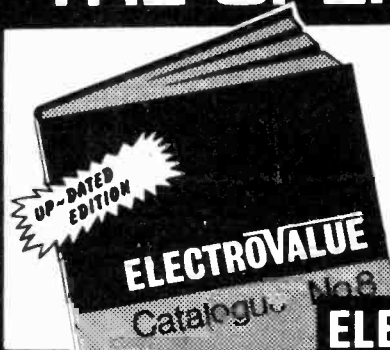
Callers welcome at shop premises.

**MANOR SUPPLIES**

172 WEST END LANE, LONDON NW6

(Near W. Hampstead Tube Stn.) Tel. 01-794 8751

# THE OPEN DOOR TO QUALITY



Latest revised issue (4th Edition, Cat. 8). Includes new ranges of meters and switches as well as price adjustments together with items from advanced opto-electronic components to humble (but essential) washers. Many things listed are very difficult to obtain elsewhere. The Company's own computer expedites delivery and maintains customer satisfaction. Attractive discounts are allowed on many purchases. ACCESS AND BARCLAYCARD ORDERS ACCEPTED.

144 pages

**40p**

POST PAID  
inc. 40p Refund  
Voucher

+ FREE POSTAGE

on all C.W.O. mail orders in U.K. over £2.00 list value (excluding V.A.T.) If under, add 15p handling charge.

All communications to Dept. PW/47  
28 ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY  
TW20 0HB. Tel Egham 3803, Telex 264475 Shop 9.5.30, 9.1 pm Sats  
NORTHERN BRANCH: 680 Burnage Lane, Burnage, Manchester  
M19 1NA. Tel: (061) 432 4945. Shop 9.5.30pm, 1 pm Sats.

**ELECTROVALUE LTD**

Published on approximately the 7th of each month by IPC Magazines Limited, Fleetway House, Farringdon Street, London EC4A 4AD. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon and Gotch (Asia) Ltd.; South Africa—Central News Agency Ltd. PRACTICAL WIRELESS is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to V.A.T., and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever

## 30x30 WATT AMPLIFIER KIT

Specially designed by RT-VC for the experienced constructor, this kit comes complete in every detail. Same facilities as Viscount IV amplifier. Chassis is ready punched, drilled and formed. Cabinet is finished in teak veneer. Black fascia and easy-to-handle aluminium knobs. **£2900**  
Output 30+30 watts rms, 60+60 peak.  
+ p & p £2.10

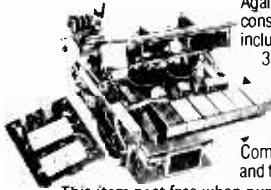


## 35-WATT DISCO AMP

Here's the mono unit you need to start off with. Gives you a good solid 35 watts rms, 70 watts peak output. Big features include two disc inputs, both for ceramic cartridges, tape input and microphone input. Level mixing controls fitted with integral push-pull switches. Independent bass and treble **£2750**  
controls and master volume. + p & p £1.50

## STEREO CASSETTE DECK KIT

Again, this kit is specially designed for the experienced constructor - for mounting into his own cabinet. Features include solenoid-assisted AUTO-STOP, **£3250**  
3-digit counter, record/replay PC board, + p & p  
mains transformer and input and output controls. AC BIAS AND ERASE. £1.50



## DELUXE ACCESSORY KIT

**£395**  
Comprises of a matched pair of dynamic mics. and two replacement slider level controls. P & P + p & p £1.00

This item post free when purchased together with Cassette Deck Kit

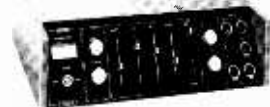
## FANTASTIC SAVING. sinclair NEW B.I.C. 20, 20 WATTS STEREO AMPLIFIER KIT WITH PZ 20 POWER UNIT

A build-it-yourself stereo power amplifier with latest integrated circuitry. 10W RMS per channel output, full short-circuit and overheat protection. **£5.95** OUR PRICE  
Complete with PZ20 Power Supply + p & p £1.00 LIST £14.50



## PORTABLE DISCO CONSOLE with built-in pre-amplifiers

Here's the big-value portable disco console from RT-VC! It features a pair of BSR MP 60 type auto-return, single-play professional series record decks. Plus all the controls and features you need to give fabulous disco performances. Simply **£6400**  
connects into your existing slave or external amplifier. + p & p £6.50



## 70 & 100 WATT DISCO AMPS

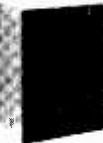
Brilliantly styled for easy disco performance! Sloping fascia, so that you can use the controls without fuss or bother. Brushed aluminium fascia and rotary controls. Five smooth-acting, vertically mounted slide controls - master volume, tape level, mic level, deck level, PLUS INTER-DECK FADER for perfect graduated change from record deck No. 1 to No. 2, or vice versa. Pre-fade level control (PFL) lets YOU hear next disc before fading it in. VU meter monitors output level 70 watts rms, 140 watts peak output. All the big features as on the 70-watt disco amplifier, but with a massive 100 watts rms, 200 watts peak output power.

**70 WATT  
£4900**  
+ p & p £3.00  
**100 WATT  
£6500**  
+ p & p £4

## DIY SPEAKER KITS

### EASY-TO-BUILD WITH ENCLOSURE

Specially designed by RT-VC for cost-conscious hi-fi enthusiasts, these kits incorporate two teak-simulate enclosures, two EMI 13" x 8" (approx.) woofers, two tweeters and a pair of matching cross-overs. Easily constructed, using a few basic tools. Supplied complete with an easy-to-follow circuit diagram, and crossover components. Input 15 watts rms, 30 watts peak, each unit. **£2550**  
Cabinet size 20" x 11" x 9 1/2" PER PAIR  
(approx.) + p & p £5.50



### 15-WATT KIT IN £17.00 PER STEREO CHASSIS FORM

When you are looking for a good speaker, why not build your own from this kit. It's the unit which we supply with the above enclosures. Size 13" x 8" (approx.) woofer, (EMI) tweeter, and matching crossover. Power handling capacity 15 watts rms, 30 watts peak.

### 'COMPACT' FOR TOP VALUE

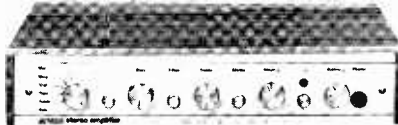
How about this for incredible bookshelf value from RT-VC! A pair of high efficiency units for only £7.50 - just what you need for low-power amplifiers. These infinite baffle enclosures come to you ready mitred and professionally finished. Each cabinet measures 12" x 9" x 5" (approx.) deep, and is in wood simulate. Complete with two 8" (approx.) speakers for max. **£750** per pair  
power handling of 7 watts. + p & p £1.70

## BSR TURNTABLES

BSR MP60 TYPE  
Single play record player  
(Chassis form) less cartridge **£15.95**  
Cartridges to suit above + p & p £2.00  
ACOS MAGNETIC STEREO... **£4.95**  
CERAMIC STEREO... **£1.95**  
BSR automatic record player deck  
(Chassis form) with cueing device  
and stereo ceramic head **£9.95**  
+ p & p £2.00



## 20x20 WATT STEREO AMPLIFIER



**£2900**  
+ p & p £2.10

Superb Viscount IV unit in teak-finished cabinet. Silver fascia with aluminium rotary controls and pushbuttons, red mains indicator and stereo jack socket. Function switch for mic, magnetic and crystal pick-ups, tape, tuner, and auxiliary. Rear panel features two mains outlets, DIN speaker and input sockets, plus fuse. 20 + 20 watts rms, 40 + 40 watts peak.

## HOW YOU CAN SAVE

**SYSTEM 1B** For only £80, you get the 20+20 watt Viscount IV amplifier, a pair of our 12-watt-rms Duo Type 1lb matched speakers, a BSR MP 60 type deck complete with magnetic cartridge, de luxe plinth **£8000**  
and cover. + p & p £10.00  
Carriage surcharge to Scotland

**SYSTEM 2** Comprising our 20+20 watt Viscount IV amplifier; a pair of our large Duo Type III matching speakers which handle 20 watts rms each, and a BSR MP 60 type deck with magnetic cartridge, **£9200**  
de luxe plinth and cover. + p & p £10.00

**SPEAKERS** Two models: Duo 1lb, teak veneer, 12 watts rms, 24 watts peak, 18 1/2" x 13 1/2" x 7 1/4" approx. **£34** PER PAIR  
+ p & p £6.50  
Duo III, 20 watts rms, 40 watts peak, 27" x 13" x 11 1/2" approx. **£52** PER PAIR  
+ p & p £7.50



**TURNTABLE** Popular BSR MP 60 type, complete with magnetic cartridge, diamond stylus, and de luxe plinth and cover. **£2900**  
+ p & p £4.50



## 4x4 STEREO AMP KIT £14.50 + p & p £2.00

For the experienced constructor who wants to design his own stereo, kit includes all necessary components including constructors manual. Plus Pair of easy to build 4 watt speakers in kit form, with teak simulate finish cabinets 12" x 9" x 5" approx

## CAR RADIO KIT



Complete with speaker, baffle and fixing strip. The Tourist IV for the experienced constructor only. The Tourist IV has five push buttons, four medium band and one for long wave band. The tuning scale is illuminated and attractive small aluminium control knobs are used for manual tuning and volume control.

The modern style fascia has been designed to blend with most car interiors and the finished radio will slot into a standard car radio aperture. Size approx 7" x 2" x 4" Power Supply Nominal 12 volts positive or negative earth (altered internally) Power Output 4 watts into 4 ohms **£1050**  
+ p & p £1.50

**MOTOR  
TOP 10  
AWARD**



## BSR T145 8-TRACK CARTRIDGE PLAYER MECHANISM

Requires some attention. Complete with built in pre-amp, A.C. 240V + p & p £1.50

**SPECIAL  
OFFER**

## ALL PRICES INC. VAT. AT 12 1/2%

GOODS NOT DESPATCHED OUTSIDE UK  
All items subject to availability. Price correct at 1st Feb. and subject to change without notice  
We are unable to show all our products, so please send stamped addressed envelope for our fully descriptive catalogue and any further information

Minimum order on Access and Barclaycards £15  
**DO NOT SEND CARD**  
Just write your order giving your credit card number



21c HIGH STREET, ACTON, LONDON W3 6NG  
323 EDGWARE ROAD, LONDON W2  
Personal Shoppers EDGWARE ROAD 9am - 5.30pm Half day Thurs  
ACTON: Mail Order only No callers

# The new Maplin Catalogue is no ordinary catalogue...



We stock some super digital clocks. A mains driven clock with alarm, snooze and all the features you'd expect. A digital car clock with automatic display blanking when you switch the engine off. A very accurate timer that switches on at a preset time and off at a preset time—if you've got a tape-recorder there's no need to miss your favourite programmes ever again.



The book section contains over 150 titles of books about electronics, radio, TV, Hi-Fi, etc. Browse through the pages and choose from some of the best titles around including a superb set of books that will teach you electronics by experimentation! (foot of catalogue page 142).



Pages 59 to 61 of our catalogue show you our range of Veroboards and S-Decs or if you prefer to make your own PCB's a range of etching systems including the novel Dalo etch-in-a-bag system, plus printed circuit transfers for that professional finish to your boards.

Catalogue includes a very wide range of components: hundreds of different capacitors; resistors; transistors; I.C.'s; diodes; wires and cables; discotheque equipment; organ components; musical effects units; microphones; turntables; cartridges; styli; test equipment; boxes and instrument cases; knobs, plugs and sockets; audio leads; switches; loudspeakers; books; tools — AND MANY MANY MORE.



\* Our bi-monthly newsletter keeps you up to date with latest guaranteed prices — our latest special offers (they save you pounds) — details of new projects and new lines. Send 30p for the next six issues (5p discount voucher with each copy).

# MAPLIN

ELECTRONIC SUPPLIES  
P.O. BOX 3, RAYLEIGH, ESSEX SS6 8LR

Telephone: Southend (0702) 715155  
Call at our shop: 284 London Road, Westcliff-on-Sea, Essex.  
(Closed all day Monday) Telephone: Southend (0702) 47379

SEND THIS COUPON FOR YOUR COPY OF OUR CATALOGUE ON APPROVAL! Price 50p—SEND NO MONEY NOW.

Please rush me a copy of your brand new 1977/78 catalogue by return of post. Only if I am completely satisfied that it is worth every penny, will I send 50p within 14 days of receipt. If I am not satisfied, I may return the catalogue to you within 14 days without obligation. I understand that I need not purchase anything from your catalogue should I choose to keep it.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

PW4

Maplin Electronic Supplies P.O. Box 3, Rayleigh, Essex, SS6 8LR

DON'T DELAY  
POST COUPON NOW  
IT COULD BE THE BEST 50p  
YOU'VE EVER SPENT.

69 Rayd y Reford