PRACTICAL WIRELESS

MAY 1973

20p

8 PAGE SUPPLEMENT

EXTRA INSIDE

SIMPLE PROJECTS FOR THE HOME

Australia 50c
New Zealand 45c
South Africa 45c
Rhodesia 45c
Nigeria K.40
Malaysia $1.80
Sweden Kr.3.50

RADIO ALARM CLOCK

INTERCOM AMPLIFIER

BABY ALARM

TAPE TUNER

LAMP DIMMER

LIGHT POWERED RADIO

WATER LEVEL DETECTOR

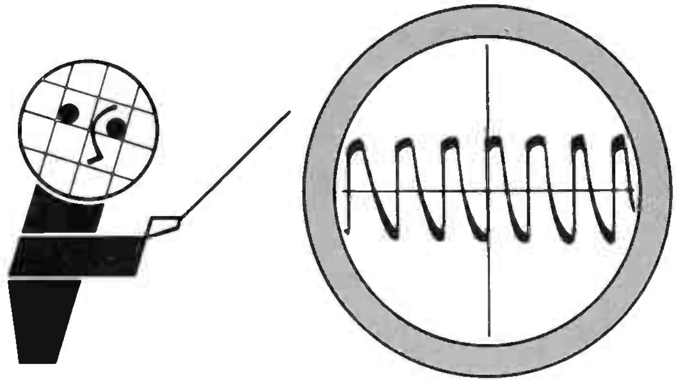
TWO TONE DOOR BELL

PLUS ALL THE REGULAR FEATURES

look! electronics really mastered

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

no previous knowledge
no unnecessary theory
no "maths"



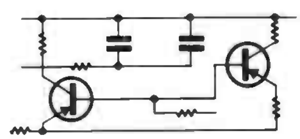
RAPY

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

1/ BUILD AN OSCILLOSCOPE

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

2/ READ, DRAW AND UNDERSTAND CIRCUIT DIAGRAMS



as used currently in the various fields of electronics.

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

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

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

FREE POST NOW for BROCHURE

or write if you prefer not to cut page

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

NAME BLOCK CAPS

ADDRESS PLEASE WL53

special free gift also to all our students

// PRACTICAL WIRELESS

VOL. 49 NO. 1
ISSUE 795
MAY 1973

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

PRACTICAL WIRELESS

EDITOR
Morris A. Colwell

ASSISTANT EDITOR
Lionel E. Howes, G3AYA

ART EDITOR
Peter Metalli

TECHNICAL EDITORIAL
Eric Dowdeswell, G4AR

NEWS & PRODUCTION
Colin R. Riches

SECRETARIAL
Jenny Phelps
Jill Alflatt
Telephone 01-634 4292

ADVT. MANAGER
Roy Smith
Telephone 01-634 4293

CLASSIFIED ADVTS.
Colin R. Brown
Telephone 01-634 4301

SUBSCRIPTIONS
Subscription Rates for one year to any part of the world £2·65 including postage. Enquiries to Subscription Department, IPC Magazines Ltd., Carlton House, 66 Gt. Queen Street, London, WC2 5DD. Phone 01-242 4477
Binders and indexes can be supplied by the Binders Dept. at the same address.

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

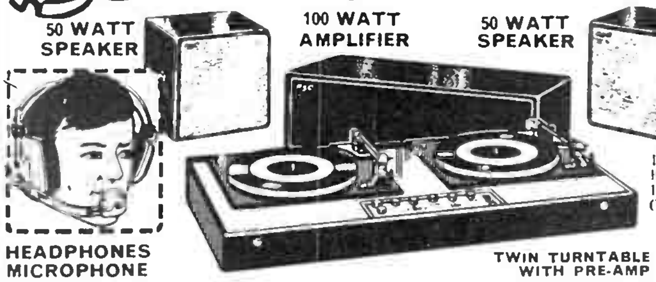
● NEWS & COMMENT

● CONSTRUCTIONAL

● OTHER FEATURES

★ SUPPLEMENT Extra eight centre pages

RSC GROUP/DISCO UNITS



PACKAGE OFFER
Units listed below
(a) 100w POWER AMPLIFIER
(b) PAIR OF HI-FI HEADPHONES
(c) MATCHING DYNAMIC 'MIKE' (attached to headphones)
(d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18" × 18" × 8"
(a)(b)(c)&(d) **£72·85** Carr. £1·25
Terms on Amplifier, Speakers and Headphone/Mike. Deposit £15 and 18 monthly payments of £4·00 (Total £87·00).

RSC TDI DISCO CONSOLE

Incorporating twin Garrard SP25 Mk.III turntables and Sonotone or Acos Cartridges with diamond styli. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control switch. Black Rexine covered Cabinet with lid. see illus. on left
Carr. £1·25 **£67·10**
Or Dep. £13·25 and 9 mthly pymts £6·88 (Total £75·17) or Dep. £15 and 18 mthly payments £3·62 (Total £80·16).

R.S.C. COLUMN SPEAKERS

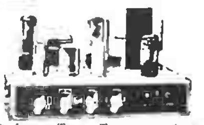
IDEAL FOR VOCALISTS AND PUBLIC ADDRESS
All types 15 Ohms covered in Rexine and Vynair
TYPE C4100 IS ALSO SUITABLE FOR BASS GUITAR OR ELECTRONIC ORGAN

TYPE C132 30-40 WATTS Fitted two exceptionally efficient, low feedback howl characteristic high flux 13" x 8" 20 watt speakers. Terms: Dep. £3 and 9 monthly payments £2·22 (Total £22·98) Carr. 50p. **£19·95**

TYPE C412S 50 WATTS Fitted four 12" 11,000 line 15 watt speakers: Overall size approx. 56 x 14 x 9in Terms: Dep. £4 and 9 monthly payments £3·37 (Total £34·33) Carr. 75p **£31**

TYPE C4100 100 WATTS inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx. 58 x 16 x 10" Acoustically filled and pressurised. Terms: Dep. £11 and 12 mthly. pyts. £5·18 (Total £73.16). **£65** Carr. £1

R.S.C. A10 30 WATT ULTRA LINEAR HI-FI AMPLIFIER



Highly sensitive. Push-Pull high output, Hum level −70dB. Response ±3dB 30-20,000 c/s. All high grade components. Valves EF86 EF86, ECC83, EL34, EL34, GZ34. Separate Bass and Treble Controls. Sensitivity 36 millivolts. For High Impedance microphones. For Clubs, Schools, Theatres, Dance Halls, Outdoor Functions, etc. For Electronic Organ, Guitar, String Bass, etc. Gram, Radio or Tape. Two separate inputs with vol. controls permit such as "mike" and Pick-up etc. for mixing purposes. 200-250v. 50 c/s A.C. mains. For 3 and 15 ohm speakers. Twin-handled perforated cover £1 90. 12 MONTHS' GUARANTEE. Carr. 65p **£19·75**
TERMS: Deposit £4 and 9 monthly payments of £2·10 (Total £22·90). Send S.A.E. for leaflet.

LINEAR T40/60D 50W GROUP/DISCO AMPLIFIER

- ★ FULL MONITORING FACILITIES
- ★ Individual Bass and Treble controls
- ★ Twin jack output sockets for speakers
- ★ Input sockets for medium or high impedance Microphones or Guitar P.Us and Crystal or Ceramic Gram. P.Us
- ★ Frequency response 30-20,000 Hz.
- ★ Output overload protection plus double fusing

£49·50 Carr. free
Or Deposit £7·50 and 9 monthly payments £5·37 (Total £55·83)

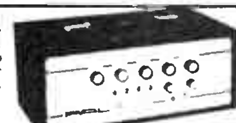
Simulated black rexine, plastic bonded metal case.

FRONT PANEL (Jack inputs) Gram, Gram, Microphone/Guitar P.U.; plus monitoring socket.
CONTROLS Vol. (1) (2) (3) and (4). Bass, Treble, Master Vol., Monitor Selection Switch Gram (1) or (2). Mains Switch.

ALSO STOCKED-LINEAR T80/100D £69·75

FAL PHASE 50 Mk.III AMPLIFIER 50 WATT.

Solid state. 4 Separately controlled inputs Plus master vol. control. Ind. Bass and Treble Controls. Protective circuit to guard against damage from accidental shorts. Output for Speaker/s 3 to 30 ohms. Size 17" × 7" × 7½" 200-250v. A.C. mains. Output 50 watts mr.s.c rating. Or deposit £7·25 & 9 monthly payments £3·55. Total £39·20. **£34·95** Carr. 75p.



RSC PHANTOM '50'

Combined 50W Amplifier and 12in. Loudspeaker.

For Lead Guitar, Mic., Gram, Radio, Tape (Not for use with Bass instruments). Inc. 3 inputs and 2 vol. controls plus Treble, Bass and Presence. Output Jack for additional 15 ohm Speaker. Attractively finished in black with silver-finished fascia and trimmings. Compact size. Fitted carrying handle.
Terms: Deposit £8·95 and 9 monthly payments £6 (Total £62·95). Carr. £1·50 **ONLY £55·95**

FANE ULTRA HIGH POWER LOUDSPEAKERS

All power ratings are R.M.S. continuous. 2 YEARS' GUARANTEE High flux ceramic magnets. ALL CARRIAGE FREE.

'POP' 100	'POP' 60	'POP' 50
18" 100 Watt 14,000 gauss 8/15Ω **£22·95** Dep: £6 and 9 mthly payments £2·20 (Total £25·80)	15" 60 Watt 14,000 gauss 8/15Ω **£12·90** Dep. £3·30 and 9 monthly payments £1·30 (Total £15).	12" 50 Watt 13,000 gauss 15Ω **£10·90** Dep £2 and 9 monthly payments £1·20 (Total £12·80) PAIR SUITABLE ALL PURPOSES

FOR BASS GUITAR, ELECT. ORGAN, ETC.

FANE SPEAKERS 'POP' 25/2 12 in. 25 WATT

Dual Cone 15 Ω (for uses other than Bass Guitar or Electronic Organ). Carr. free **£6·75** or Dep. £1·25 and 9 mthly payments 75p (Total £8·00).

GROUP/DISCO EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 MK.III AMPLIFIER £34·95
PR. FANE POP 25/2 25W L/SPEAKERS £13·50
£48·45
Terms: Deposit £6.50 and 9 monthly payments of £4.92 (Total £50.78)
PACKAGE PRICE **£45** carr. £1

F.A.L. PHASE 50 MK.III AMPLIFIER £34·95
PR. FANE POP 50 L/SPEAKERS £21·80
£56·75
Terms: Deposit £10 and 9 monthly payments of £5·37 (Total £58.33)
PACKAGE PRICE **£52** carr. £1

F.A.L. PHASE 50 MK.III AMPLIFIER £34·95
PAIR L12/25 25W L/S in cabinets £23·90
£58·85
Terms: Deposit £10 and 9 monthly payments of £5·88 (Total £62·92)
PACKAGE PRICE **£56** carr. £1·25

F.A.L. PHASE 100 AMPLIFIER £61·95
4 FANE POP 50 L/SPEAKERS £43·60
£105·55
Terms: Deposit £15·95 and 9 monthly payments of £10·73 (Total £112·52)
PACKAGE PRICE **£99·95** carr. £2

HIGH QUALITY LOUDSPEAKER UNITS

ALL TWO TONE REXINE AND VYNAIR FINISH
L125 50 WATT Fitted pair of 12" 50 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Carr. £1·50 **£34·50**
Or deposit £5·50 and 9 monthly payts. of £3·70. Total £38·80

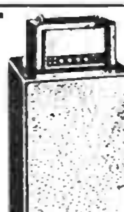
L12/20 12" 20-25 WATT 13,000 lines 15 ohms. Carr. 50p. **£11·95**

L13 13" × 8" 10 Watt 10,000 lines 3 or 15 ohms. State impedance required. Carr 40p **£5·25**

CREDIT TERMS AVAILABLE ON PURCHASES OVER £8 (Kits Excepted) INTEREST CHARGES REFUNDED ON CREDIT SALES Settled in 3 months

VAT FOR INFORMATION ON PRICES MARKED WITH • SEE OPPOSITE PAGE

RSC BASS-REGENT 50 WATT AMPLIFIER



A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape. Peak Output rating. Loudspeaker unit either horizontal or vertical mounting.
- ★ Two extra heavy duty 12in. 50w Loudspeakers.
- ★ Four Jack inputs and two Volume Controls for instant use of up to four pick-ups or "mikes". Bass and Treble controls. Send S.A.E. for leaflet.

Credit Terms: Deposit £15 & 9 monthly payments of £6·25. (Total £71·25.) Carr. £2 **£65**

RSC GP30 HI-FI AMPLIFIER

For Guitar, Vocal or Instrumental Group
A 4 input, 2 vol. control Hi-Fi 30 watt unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/silver P.V.C. fascia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Terms: Deposit £4·40 and 9 monthly payments of £2·45 (Total £26·45). **£23·50** Carr. 65p

NOW FIVE NEW BRANCHES

BOLTON open shortly
NOTTINGHAM 19/19A MARKET STREET
SUNDERLAND 5 MARKET SQUARE
STOCKPORT 8 LITTLE UNDERBANK
COVENTRY 17 SHELTON SQUARE

NEW LARGER PREMISES AT HULL, DARLINGTON & NEWCASTLE See Addresses

RSC HI-FI CENTRES LTD.

MAIL ORDERS & EXPORT ENQUIRIES TO:— AUDIO HOUSE, HENCONNER LANE, LEEDS, 13. Tel: Pudsey (09735) 77631.
TERMS C.W.O. or C.O.D. No C.O.D. under £1. POSTAGE 25p EXTRA UNDER £2. 30p EXTRA OVER £2 OR AS QUOTED. TRADE SUPPLIED. S.A.E. PLEASE WITH ENQUIRIES.
SUPPLIERS TO GOVT. DEPTS. H.M. FORCES. EDUCATION AUTHORITIES & HOSPITALS. Etc.
MAIL ORDERS MUST NOT BE SENT TO SHOPS

R.S.C. Branches operate a 5-day week
Open all day Saturday

BRADFORD 10 North Parade (Closed Wed.). Tel. 25349
BLACKPOOL (Agent) O & C Electronics 227 Church Street
BIRMINGHAM 30/31 Great Western Arcade. Tel. 021-236 1279 (Closed Wed.).
COVENTRY 17 Shelton Square, The Precinct
DERBY 26 Osmaston Rd., The Spot (Closed Wed.). Tel. 41361
DARLINGTON 19 Northgate (Closed Wed) Tel 68043
EDINBURGH 101 Lothian Rd. (Closed Wed.). Tel. 229 9501
GLASGOW 326 Argyle St. (Closed Tues.). Tel. 248 4158
HULL 7 Whitefriargate Tel. 20505
LEICESTER 32 High Street (Closed Thurs.). Tel. 56420
LEEDS 5-7 County (Mecca) Arcade, Briggate (Closed Wed.). Tel. 28252
LIVERPOOL 73 Dale St. (Closed Wed.). Tel. 236 3573
LONDON 238 Edgware Road, W.2. (Closed Thurs.). Tel. 723 1629
MANCHESTER 60A Oldham Street, (Closed Wed.). Tel. 236 2778
MIDDLESBROUGH 106 Newport Rd. (Closed Wed.). Tel. 47096
NEWCASTLE UPON TYNE 24 Newgate Shopping Centre (Closed Wed.). Tel. 21469
NOTTINGHAM 19/19A Market Street (Closed Thurs.). Tel: 48068
SHEFFIELD 13 Exchange Street (Castle Market Bldg.) (Closed Thurs.). Tel. 20716
STOCKPORT 8 Little Underbank. Tel: 480-0777.
SUNDERLAND 5 Market Sq. (Closed Wed.) Tel. 70573

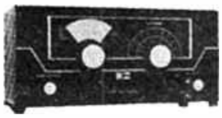
TOP QUALITY — LOW COST

AMATEUR RADIO EQUIPMENT

P.R.40

SOLID STATE
R.F. PRESELECTOR

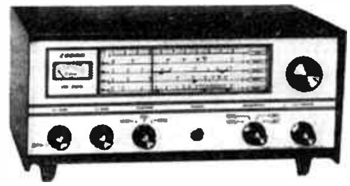
The PR40 R.F. Preselector is the solid state version of the world famous PR30 which it now supercedes.
It employs Silicon "N" Channel FET (Field Effect Transistor) front end, followed by silicon NPN Broad Band R.F. Amp., and will substantially improve receiver performance over the range 1·5 to 35 MHz, providing a considerable increase in gain up to an overall average of 30 dB, with improved image rejection and noise ratio.
Supplied complete with co-ax plug (less standard 9 volt PP6 Battery), 12 months Guarantee . . .



MULTIBAND—6

SOLID STATE
SHORT WAVE RECEIVER KIT

All transistor T.R.F. Receiver tunes 550 KHz to 30 MHz (540 to 10 metres) complete coverage—no gaps. Medium waves—Trawlers—Ship/Shore Telephone—All Six Amateur Bands 160–10 metres—International Broadcast from Australia, Far East, Russia, USA etc. using 4 miniature plug in Coils.
Hi-Gain FET Regen. Det./AF/AF Module giving full loudspeaker output to any external 2/3 ohm speaker. Receives AM/CW/SSB.
Separate Electrical Bandspread, Calibrated Main Tuning.
A Quality CODAR-KIT with 12 months Guarantee. No technical knowledge required, simple to build, printed circuit and Pictorial Instruction Manual, fully detailed step by step.
Complete Kit with 4 Coils (less standard PP6 battery).
Stamp brings illustrated leaflets.



CR70A

COMMUNICATION RECEIVER

The CODAR CR70A is an outstanding general coverage communication receiver, ideal for the keen S.W.L.
It tunes from 540 metres medium through to 10 metres with no gaps. Covers shipping, coastguard and distress frequencies, all six amateur bands 160-10 metres, International broadcast, Met. stations etc. etc. giving world-wide reception. Exclusive features include Air-spaced CODAR-COIL Hi-"Q" Aerial input, illuminated Meter and Slide Rule Scale, Two Speed vernier tuning, Switched B.F.O. for CW/SSB signals. Separate output for Tape recorder.
Ready to plug in to 200/240 volts A.C. it only needs your aerial and a 2/3 ohm loudspeaker to bring the world to your finger tips. 12 months full guarantee.

Complete ready built.

SEND FOR YOURS TODAY!

NOTE: These CODAR Receivers meet the B.R.E.M.A. specification for Communication Receivers. Some portable receivers being advertised as Communication Receivers do not meet these requirements.

ON THE DESIGN STAFF—
G3SZM G3IRE

CODAR ®

TELECOMMUNICATIONS AND ELECTRONIC EQUIPMENT SUPPLIERS TO H.M. AND OVERSEAS GOVERNMENTS

VALCON WORKS · BURRELL BUILDINGS · CHURCHILL INDUSTRIAL ESTATE · LANCING · SUSSEX

Tel. 090-63-61901 BN15 – 8TZ

The Pictorial Method

BASIC ELECTRICITY (5vols) ELECTRONICS (6vols) TELEVISION (3vols)

You'll find it easy to learn with this outstandingly successful PICTORIAL METHOD. The essential facts are explained in the simplest language, one at a time, and each is illustrated by an accurate cartoon-type drawing. These clear and concise illustrations make study a real pleasure. The books are based on the latest research into simplified learning techniques. This easy-approach-to-learning method has proved beyond doubt that acquiring knowledge can be an enjoyable experience.

YOUR 100% GUARANTEE

Should you be, in any way dissatisfied with the MANUALS your money will be refunded by return of post.

The series will be of exceptional value in training mechanics and technicians in Electricity, Radio and Electronics.

WHAT READERS SAY

. . . after studying them for a while, I came to the conclusion there is only one word to describe these manuals—BRILLIANT.
E.J. Southampton.

Their appeal is in their simplicity.
E.P. Basingstoke.

An ordinary person like me can soon acquire a first rate understanding of the subject.
C.B. Maidstone.

I have passed my theory exam. on electronics with the help of your manuals. *D.F.F. Ely.*

POST NOW FOR THIS OFFER!

To The SELRAY BOOK CO., 60 HAYES HILL, HAYES, BROMLEY, KENT. BR2 7HP

Please find enclosed P.O./Cheque value £...........
BASIC ELECTRICITY 5 parts £4·50 ☐
BASIC ELECTRONICS 6 parts £5·40 ☐
BASIC TELEVISION 3 parts £3·60 ☐
Tick Set(s) required. Prices include Postage and Packing.

YOUR 100% GUARANTEE. If after 10 days examination you decide to return the Manuals your money will be refunded in full.

NAME ....
BLOCK LETTERS
FULL POSTAL..
ADDRESS ....
....

Another! winner! fane MODE ONE HIGH FIDELITY LOUDSPEAKER KIT

ONLY £9·59

Post free

Price includes VAT rate of 10%. Any applicable reduction will be made to accord with the Mar. 1973 Budget.

Consisting of a Fane Model 803 ultra-low resonance 8″ speaker unit with PVC cone surround, and a Fane Model 303 high frequency pressure tweeter together with a printed circuit cross-over assembly with ferrite cored coils.

SPECIFICATION OF UNITS

	Model 803	Model 303
Overall Diameter	8″	3″
Natural resonance	30Hz	—
Main resonance	*35Hz	1200Hz
Magnet Pole Diameter	1″	¾″
Magnet Flux Density	13,000 gauss	10,000 gauss
Frequency response	30Hz–8kHz	10kHz–17kHz
Impedance	8–15 ohms	8–15 ohms
Power Handling	*15 watts	*15 watts

Very easy to assemble, this boxed kit comes with acoustic foam damping material, panels, screws, wire, wiring diagrams and instructions to provide a remarkable loudspeaker assembly—a pair is ideal for stereo.

CABINETS for the 'Mode One' are available in Teak veneer finish. **SIZE** 15¼″ x 10¼″ x 9″.

*When used with above cabinet.

Please send S.A.E for fully descriptive leaflet.

Distributors to the wholesale and retail trade
LINEAR PRODUCTS LTD.
Electron Works, Armley, Leeds LS12 3SA Tel. 630126

Manufactured by
FANE ACOUSTICS LTD.
Hick Lane, Batley, Yorkshire.
Tel. Batley 6431

ERSIN Multicore 5 CORE SOLDER

for fast, easy reliable soldering

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

EASY-TO-USE DISPENSERS

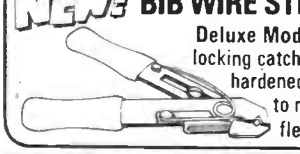
Size 5
Savbit alloy
18 swg, **18p**
(illustrated).
Size 19A
60/40 alloy
18 swg, **18p**
Size 15
60/40 alloy
22 swg, **22p**

IDEAL FOR HOME CONSTRUCTORS

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

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

NEW! BIB WIRE STRIPPER AND CUTTER



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

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

---

4 CHANNEL STEREO CONVERTER

TRANSFORMS YOUR STEREO SYSTEM INTO SENSATIONAL QUADRAPHONIC SOUND

Create a new dimension in sound — sound that engulfs you with natural realism from every corner of your room. Simply wired to your amplifier or Tuner/Amp. speaker outputs and again into 4 speakers. Neat styling with brushed effect console panel. Peak input power 50w into 8 ohms. Front Hi/Low Level 6dB. Phone jacks for input and output. Size: 6″ x 3½″d. x 2″h. Guaranteed.

INTRODUCTION PRICE **£7·50** 35 P & P

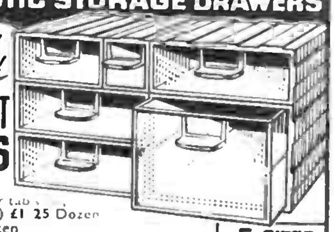
CCIL LTD (Dept. PW 5), 43 BARTHOLOMEW CLOSE, LONDON, EC1A 7HP. Tel. 01-600 3211.

I-N-T-E-R-L-O-C-K-I-N-G PLASTIC STORAGE DRAWERS

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

NEAT! HANDY! TIDY!

DISCOUNT PRICES



5 SIZES ALL INTERLOCK

SINGLE UNITS (5″ x 2¼″ x 2¼″) £1·25 Dozen
DOUBLE UNITS £2·15 Dozen
TREBLE (3D) £2·20 for 8
DOUBLE TREBLE 2 drawers in one outer case (6D2) £3·25
for 8 extra large size (6D1) £3·10 for 8, carriage 35p orders over £ .
QUANTITY DISCOUNTS! 5% in £1 for orders over £6. 7½% over £10. 10% over £20. Quotation for large quantities.
PLEASE ADD VAT TO TOTAL REMITTANCE.

IVORYET LIMITED Dept. PW5), 124 CRICKLEWOOD BROADWAY, LONDON N.W.2 01-450 4844

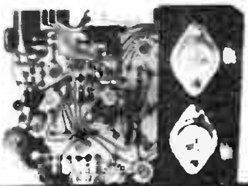
SAXON ENTERTAINMENTS LTD.

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

SA25-SA35-SA100

LOW-PRICED AUDIO MODULES FOR DOMESTIC & COMMERCIAL USE

New Versions using 3A 'Plastic Power' Driver Transistors Now Available



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

SA25 £2·95 carr. free
25 WATTS RMS. 7 transistors 7 diodes

SA35 £4·45 carr. free
35 WATTS RMS. 7 transistors 7 diodes

SA100 £10·90 carr. free
100 WATTS RMS. 11 transistors 6 diodes

ALL THREE MODULES HAVE OPEN & SHORT CIRCUIT PROTECTION, AND THE SA100 IS PROOF AGAINST OVER-DISSIPATION & FAULTY INDUCTIVE LOADS. ONLY ADVANCED DESIGN TECHNIQUES MAKE THESE EXTRA-ORDINARILY LOW PRICES POSSIBLE.

BRIEF SPEC. FOR ALL THREE MODULES

Freq. response	15-40,000 Hz ± 1dB
Distortion	0·2% at 1 kHz
Loads	4 to 16 ohms
Quiescent current	15 mA
Noise	Better than −75 dB
Supply voltage	25-45 volts SA25/35 40-70 volts SA100
Size	4½" x 4" x 1" (SA100) 4" x 3" x 1" (SA25/SA35)

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

POWER SUPPLIES FOR THE SA25/35 & SA100 AUDIO MODULES

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

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

OTHER SAXON PRODUCTS . . .

120 WATT HEAVY DUTY MODULE £13·90 + 20p carr. or with supply **£18·95** + 40p carr.

Featuring a rugged class A driver stage, this module will run from all our mixers, etc., and most other makes of mixer. It delivers 120 watts into an eight ohm load and employs 4 T03 can (115 watt) output transistors.

SPECIFICATION

Power output	120 watts into 8 ohms
Freq. response	20-20,000 HZ ± 2dB
Input sensitivity	200 mV into 10K
Construction	Fibreglass board
Size	8" x 4" x 4" (5" with supply)

Low distortion parallel push-pull output stage.

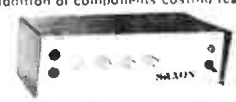
NEW 160 watt version & supply **£27·90**

SINGLE CHANNEL SOUND/LIGHT CONVERTER

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

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

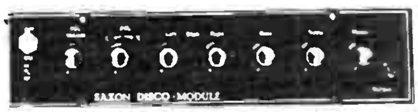
£8·90 carr. free



THREE CHANNEL SOUND TO LIGHT UNIT

Handling the total of 3000 watt (3kw) this unit is unique for its price in that not only bass, middle and treble but also master controls are provided. Two amplifier sockets eliminate the need for split leads, etc. Supplied in Tough Steel case for free mounting or panel fixing. Fully guaranteed. **£19·75** carr. 30p

MONO VERSION £6·50 carr. 20p (As illustrated. S.A.E. details 9 volt operation) Outputs up to 1 volt RMS



£15·80 carr. 30p

SAXON STEREO CONTROL UNIT

Two decks, and full headphone monitoring. The unit is mains operated and measures 17½" x 3" x 4" deep and is finished with a smart white on black facia. The controls are: Left/Right deck fader, volume, bass, treble, Headphone Selector and volume, Microphone volume, bass, treble, mains on/off. **THIS IS A MUST FOR THE HOME BUILT HIGH QUALITY DISCOTHEQUE AND IS COMPARABLE TO UNITS AT OVER TWICE THE PRICE.** (N.B.—Stereo only has mic input.)

COMPLETE AMPLIFIERS

The CSE 100. £34·90 carr. free

This versatile unit is now available in a black vynide case and so represents even better value than ever delivering speech and music powers of up to 100 watts RMS and continuous signal outputs of 70 watts. Two individually controlled inputs with wide range bass and treble controls. Ideal for small groups D.J.S., etc.

The SAXON 100 £48·50 carr. free

With an RMS output of 120 watts speech and music, 100 watts continuous power, four individually controlled FET input stages and wide range bass and treble controls, this amplifier has established itself as a unit offering quality and reliability at low cost.

600 Watt 3 colour Light Boxes Smart Rexine finish £15 carr free.

LOUDSPEAKERS British made bargains!!
12" 25 watt 8/15 ohms £5·95 carr. 30p. 15" 50W.8/15 ohm £14·50 carr. 50p.
12" 40 watt 15,000 gauss magnet system 8/15 ohm £11·50 carr. 40p.

A.K.G. MICROPHONES suitable for disco, group or general P.A. use.
D11 DHL IDEAL DISCO MIKE ONLY £9·45 (rrp £11·00).

SEND SAE FOR OUR AKG PRICE LIST. DISCOUNTS ON ALL MICS.

All prices subject to VAT at standard rate

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

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

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

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

COMET HI-FI discount warehouses

NEW LOW PRICES

STEREO AMPLIFIERS	Rec. Retail Price £ p	Comet Price £ p
AKAI AA5200	87·45	64·95
AKAI AA5500	109·45	80·95
AKAI AA5800	164·45	121·95
ALBA UA 700	41·72	27·95
ALPHA 212 by Highgate	41·53	25·95
AMSTRAD IC 2000	50·88	30·95
AMSTRAD Integra 4000	39·05	23·95
ARMSTRONG 521	64·90	48·50
FERROGRAPH F307 Mk. II (cased)	74·80	49·95
GLIXOR MW3000, 15 watts RMS per channel	54·45	25·95
GOODWIN RH 25 25	65·95	49·95
JVC Nivico VN 300	63·80	52·95
JVC Nivico MCA 104Z	93·50	74·95
MCA 105E	143·55	119·95
MCA V5E/VN550 Quadraphonic	97·90	81·95
MCA V9E/VN880 Quadraphonic	162·80	136·95
KELETRON KSA 700	31·90	19·95
KELETRON KSA 1500	42·90	26·50
LEAK Delta 30 (cased)	76·89	51·95
LEAK DELTA 70 (cased)	94·49	63·95
METROSOUND ST20E	43·45	26·95
METROSOUND ST60	77·00	50·95
PHILIPS RH521	119·90	98·95
PIONEER SA500A	51·81	35·95
SA600A	105·03	65·95
SA800	139·21	99·95
SA1000	171·40	107·95
QL600A Quadraphonic Convertor	130·85	93·95
QD 210 Quadraphonic decoder	47·14	32·95
QA 800A Quadraphonic	Sp. Price	159·95
QC800A Pre-amp	Sp. Price	114·95
QM800A Pow. amp.	Sp. Price	135·95
Reverberation 202w	60·45	43·50
RANK ROTEL 210	38·39	26·50
RANK ROTEL 310	57·20	39·95
RANK ROTEL 610	86·35	56·95
RANK ROTEL RA 810	116·05	83·50
RANK ROTEL RA 1210	141·90	101·95
ROGERS Ravensbourne	77·00	59·50
Ravensbourne (cased)	82·50	64·95
Ravensbrook Mk. II	57·75	44·95
Ravensbrook (cased) Mk. II	63·25	48·50
SINCLAIR 2000	38·50	27·75
3000	49·50	34·95
PROJECT 605	32·95	23·75
SOLARVOX 20. 10 watts RMS per channel	43·95	26·95
SOLARVOX 30. 15 watts RMS per channel	51·65	35·95
SOLARVOX MA801 2 x 8 watts RMS plus MATRIX 4 channel	42·30	29·75
SOLARVOX MA813 2 x 18 watts plus MATRIX 4 channel	56·52	42·95
TANDBERG TA300	76·89	59·95
TANDBERG TA300M	87·45	72·50
WHARFEDALE Linton amplifier	71·50	50·95

Amplifiers listed all take both ceramic and magnetic cartridges.

TUNERS	Rec. Retail Price £ p	Comet Price £ p
AKAI AT550 AM/FM/MPX/FET	84·10	61·95
AKAI AT580 AM/FM/MPX/MOS. FET	131·09	96·95
AMSTRAD Multiplex 300 FM	37·55	26·95
ARMSTRONG M8 Decoder	10·45	7·75
*DULCI FMT 7 FM	22·96	14·90
JVC Nivico MCT V5E/VT500 AM/FM	80·96	62·95
MCT V7E AM/FM	115·25	94·95
LEAK Delta FM	74·43	52·95
LEAK Delta AM/FM	83·79	62·25
METROSOUND FMS 20	51·70	36·95
PHILIPS RH 690	45·66	33·50
PHILIPS RH 621	102·61	78·80
PIONEER TX500A AM/FM	72·47	48·95
PIONEER TX600 AM/FM	100·35	68·95
RANK ROTEL 320	55·91	39·95
RANK ROTEL 620	87·86	62·95
ROGERS Ravensbourne in Teak Case	61·05	44·95
Ravensbrook (cased)	46·75	34·95
SINCLAIR 2000	42·44	28·95
3000	42·44	28·95
Project 60 Tuner (stereo)	23·57	16·95

All Tuners listed are complete with MPX Stereo Decoder except where starred.

TUNER/AMPLIFIERS	Rec. Retail Price £ p	Comet Price £ p
AKAI CR80T AM/FM Tuner Amplifier with built in Eight Track Tape Recorder	140·78	84·95
AKAI AA8030	131·09	96·95
AKAI AA8080	178·07	131·95
AKAI AS8100S Quadraphonic	243·85	181·95
AKAI AA8500	235·97	166·95
AKAI 6300	130·31	74·95
ARENA 2600	104·62	55·95
ARMSTRONG M8 Decoder	10·45	7·75
ARMSTRONG 525	84·96	66·50
ARMSTRONG 526	96·81	74·95
GOODMANS Module 80, 35w. RMS	87·55	66·95
Module 80 Compact	158·16	119·95
Module 90	112·04	85·95
Module 110 FM/MW/LW/SW/ 100w. RMS	130·86	99·95
GOODMANS Module 110, Compact	230·65	175·95

These prices are effective April 1st, 1973 and are calculated assuming a V.A.T. rate of 10%. Should the V.A.T. rate differ, please check prices before ordering.

TUNERS/AMPLIFIERS—*continued*	Rec. Retail Price £ p	Comet Price £ p
JVC Nivico 4MM 1000 Quadraphonic	149·93	124·95
JVC Nivico VR 550/5501 AM/FM	93·68	75·95
VR 5521L AM/FM and SEA	164·74	135·95
4VR 5414 Quadraphonic	211·82	176·95
KYOTO 1000 AM/FM Tuner/Amplifier with built in Stereo Cassette Recorder. Complete with two speakers and two microphones	79·90	57·95
LEAK Delta 75	163·83	123·95
PHILIPS RH 720	202·41	154·95
PIONEER SX525	134·86	92·95
SX626	184·72	126·95
SX727	222·39	152·95
SX828	285·21	196·95
QX 4000 Quadraphonic	216·81	150·95
QX 8000 Quadraphonic	274·69	190·95
ROTEL RX 150A	65·68	47·95
ROTEL RX200A	84·10	61·95
ROTEL RX 400A	101·12	74·95
ROTEL RX 600A	140·01	103·95
ROTEL RX 800A	178·07	131·95
ROTEL RX 154A Quadraphonic	121·68	89·95
SOLARVOX TAM 1105 2 x 5 watts RMS AM/FM Multiplex comp. with 2 speakers and featuring Matrix 4 channel	36·28	28·95
TANDBERG TR200 MPX	99·79	83·95
TANDBERG TR1000 FM MPX (teak)	146·86	124·95
TANDBERG TR1010 AM/FM MPX	159·09	133·95
TELETON CR55	118·06	64·95
TELETON R8000 AM/FM	39·74	20·95
WHARFEDALE LINTON WE40	107·66	81·95

All Tuner/Amplifiers listed take magnetic cartridges except Teleton R8000 and Kyoto 1000 which take ceramic only. All include MPX Stereo Decoder with the exception of Armstrong where M8 decoder is extra.

TURNTABLES	Rec. Retail Price £ p	Comet Price £ p
CONNOISSEUR BD1 Kit	12·65	10·50
CONNOISSEUR BD2 Chassis	31·02	24·95
CONNOISSEUR BD2 P/C/SAU2	39·16	32·25
GARRARD SP25 Mk. II	15·25	9·75
GARRARD 40B	12·85	9·50
GARRARD SL65B	18·78	12·95
GARRARD SL95B	46·40	30·60
GARRARD 401	40·43	27·50
GARRARD SL72B	30·73	20·25
GARRARD AP76	26·82	18·95
GARRARD Zero 100A	51·57	37·25
GARRARD Zero 100S	47·44	34·25
GOLDRING G101P/C	28·05	19·50
GOLDRING GL72 Chassis	29·70	20·25
GOLDRING GL72P	38·61	26·50
GOLDRING GL75	39·60	26·50
GOLDRING GL75P	48·84	33·50
GOLDRING GL85P/Cover	82·50	55·50
LEAK Delta	65·07	49·95
JVC Nivico SRP 473 Quadraphonic, including plinth and cover	65·88	52·65
McDONALD MP60	13·96	9·25
McDONALD 610	17·71	12·25
McDONALD HT70	19·49	13·50
PHILIPS GA212 Electronic	64·95	50·95
PIONEER PL12D with base and cover	47·19	32·50
PIONEER PL61 with base and cover	170·53	114·95
THORENS TD125 Mk. II	77·00	62·95
THORENS TD125AB	109·04	77·95
THORENS TD 125AB Mk. II with TP 16 arm	116·05	95·50
THORENS TD 160/c including base and cover	65·04	53·50
WHARFEDALE Linton	35·11	25·95

The following Turntables are complete with base, plinth, plastic cover and cartridge. Fully wired and ready for use. All at special prices.

GARRARD SP25 Mk. III with Goldring G800	Special Price	17·75
McDONALD MP60 with Goldring G800	Special Price	17·25
McDONALD MP60 with SHURE M 44/7	Special Price	16·25
McDONALD HT70 with Goldring G800	Special Price	24·25
GARRARD AP76 with Goldring G800	Special Price	25·95
GARRARD AP76 with Shure M55E	Special Price	28·95
GARRARD AP76 with Shure M75EJ	Special Price	31·25
GARRARD 2025TC with Sonotone 9TAHC	Special Price	12·10
GOLDRING GL75 with G800	Special Price	36·95
GOODMANS TD100 with G800E	73·94	48·95

SPEAKERS	Rec. Retail Price £ p	Comet Price £ p
AKAI SW 155	70·95	50·95
AMSTRAD ACOUSTA 1500 (pair)	44·00	25·95
AMSTRAD ACOUSTA 2500 (pair)	55·00	32·95
AMSTRAD 138 (pair) Teak	28·60	15·50
B and W Model 70	175·45	125·95
B and W DM2	65·89	46·95
B and W DM4	46·75	35·95
B and W D5 (pair)	55·99	41·95
CELESTION COUNTY (pair)	46·13	34·50
Ditton 120 (pair)	52·80	37·95
Ditton 15	35·20	25·50
Ditton 25	71·50	51·50
Ditton 44	59·40	42·95
Ditton 66	108·90	78·75
FERROGRAPH S1 inc. stand	104·50	75·95
GOODMANS Minister (pair)	46·33	34·95
Havant (pair)	53·77	38·50
Magister	72·19	46·75
Double Maxim (pair)	63·45	45·95
Mezzo 3	39·27	26·95
Magnum K2	50·82	34·95
Goodwood	60·50	41·95
Dimension 8	79·68	54·95
DIN 20 NT Kit (pair)	22·95	16·50
KELETRON KS4 (pair	22·66	14·50
KS6 (pair)	28·16	17·95
KS8 (pair)	36·30	23·50
KS10 (pair)	46·86	30·50
KS15 (pair)	69·85	44·95
KS20 (pair)	78·76	50·95
LEAK 150 (pair)	46·82	35·95
LEAK 250 (pair)	80·85	46·50
LEAK 600	54·45	38·50
METROSOUND HFS 103 (pair)	27·50	19·95
202	23·65	16·95
Duplex 15	35·20	26·95
Duplex 25	61·60	42·95
PIONEER CS53	51·39	34·95
SINCLAIR Q16	8·47	6·20
TANDBERG Tan 7	27·78	22·25
Tan 11 (pair)	37·66	29·95
TL 12 Teak (pair)	52·25	42·95
TL 25 Teak (pair)	67·32	55·50
TL 50 Teak	74·80	58·75
TELETON 8000 (pair)	19·87	11·50
THORPE GRENVILLE TG100 (pair)	31·85	19·50
TG200 (pair)	46·15	28·50
TG300 (pair)	61·55	34·50
WHARFEDALE Denton Mark II (pair)	39·32	27·50
Linton Mark II (pair)	48·68	34·50
Triton III (pair)	60·85	42·50
Melton Mark II	38·50	26·95
Dovedale 3 Mark II	52·25	35·95
Rosedale	75·90	52·95
Unit 3 speaker kit (pair)	23·40	16·50
Unit 4 speaker kit (pair)	41·80	29·25
Unit 5 speaker kit (pair)	60·50	42·50

PICK UP ARMS AND HEADS	Rec. Retail Price £ p	Comet Price £ p
AUDIO Technica AT 1005 Mk. II	17·85	12·95
AUDIO Technica L2 lifts	2·46	1·90
CONNOISSEUR SAU2	13·86	11·25
GOLDRING Lenco 75	13·20	8·95
GOLDRING Lenco L69	9·90	6·25
GOLDRING PH6 Head Shell for 69/75	2·81	1·90
GOLDRING PH7 Head Shell for 85	3·47	2·40
GOLDRING PH8 Head Shell for 101	0·92	0·70
SME 3009 ser 11 improved	34·65	25·95
SME 3009-S2 ser 11 improved	37·95	28·95
SME S2 Head Shell	2·77	1·90

CHASSIS SPEAKERS	Rec. Retail Price £ p	Comet Price £ p
GOODMANS Twin-axiom 8	8·58	6·25
Twin Axiom 10	9·47	6·90
Axiom 401	19·45	13·95
Audiom 8P	5·17	3·75
Audiom 10P	5·62	4·10
Audiom 12P	14·30	10·40
Audiom 15P	23·10	16·50
Audiom 18P	39·27	27·95
Audiom 100 40 watts din.	13·20	9·50
ARU 172	4·95	3·60
Axent 100	7·59	5·40
Midax 650	14·95	9·60
Attenuator	4·10	2·95
Crossover network XO/950	8·55	5·95
WHARFEDALE 8 in. Bronze/RS/DD	4·44	3·20
Super 8/RS/DD	7·95	5·75
Super 10/RS/DD	13·11	9·45

CARTRIDGES	Rec. Retail Price £ p	Comet Price £ p
AMSTRAD 900C	5·02	3·15
AMSTRAD 900D	7·63	4·75
AMSTRAD 900 EX	11·23	7·75
AUDIO TECHNICA AT 66	5·98	3·30
*CONNOISSEUR Ceramic SCU1	5·78	4·75
GOLDRING G850	5·78	2·95
GOLDRING G800	Sp. price	3·75
GOLDRING G800E	Sp. price	6·50
GOLDRING G800 Super E	Sp. price	12·50
GOLDRING G820	11·00	7·50
GOLDRING G820E	16·50	11·40
GOLDRING G820 Super E	22·00	15·20
EMPIRE 1000ZE/X	58·50	37·95
EMPIRE 999VE/X	41·79	26·95
EMPIRE 999TE/X	24·58	16·25
EMPIRE 999SE/X	19·86	12·95

OVER 1000 ITEMS ALWAYS IN STOCK

All items brand new and fully Guaranteed and backed by after-sales service

— latest models in manufacturers' sealed cartons

COMET for after-Sales Service
THROUGHOUT THE U.K.

Service Departments at Hull, Birmingham, Bridlington, Dagenham, Doncaster, Edinburgh, Eastleigh, Goole, Hackbridge, Hayes, Jarrow, Leeds, Leicester, Nottingham, Renfrew, Rochdale, Rochester, Sheffield, Teesside, Wigan, with engineers covering York and Scarborough

	Rec. Retail Price £ p	Comet Price £ p
CARTRIDGES SPEAKERS—cont.		
EMPIRE 999E/X	15·40	10·30
EMPIRE 909E/X	12·03	7·95
EMPIRE 90EE/X	9·36	6·20
SHURE M3DM	Sp. Price	3·60
SHURE M44-G	Sp. Price	4·60
SHURE M44-7	Sp. Price	4·20
SHURE M-44C	Sp. Price	4·60
SHURE M44E	Sp. Price	4·60
SHURE M55E	Sp. Price	5·30
SHURE M75G	Sp. Price	7·90
SHURE M75-6 (S)	Sp. Price	4·95
SHURE M75-6	Sp. Price	7·10
SHURE M75EJ	Sp. Price	8·25
SHURE M75ED	Sp. Price	10·10
SHURE M75E/95G	Sp. Price	12·15
SHURE M91ED	Sp. Price	9·50
SHURE V15-11	Sp. Price	24·95
*SONOTONE 9TAHC Diam/Saph	3·53	1·30

Cartridges listed are magnetic—except those starred which are ceramic

	Rec. Retail Price £ p	Comet Price £ p
BASES AND COVERS		
CONNOISSEUR Plinth BD1	5·28	4·30
CONNOISSEUR Cover	3·96	3·20
CONNOISSEUR P.U. Mount Board	0·88	0·70
GARRARD WB1 Base	3·56	2·70
GARRARD WB4 Base	5·28	3·90
GARRARD SPC1 Cover	3·47	2·60
GARRARD SPC4 Cover	4·13	3·00
Special Offer of Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500	Sp. Price	2·50
Special offer of base and cover to fit McDONALD MP60 and 610	Sp. Price	3·50
GOLDRING Plinth 75	9·24	6·40
GOLDRING Plinth 72	8·91	6·20
GOLDRING Covers for 72P	4·46	3·10
Cover for 75P De Luxe	4·95	3·40
Cover for 85P	6·60	4·60
THORENS TX 25 (for TD125AB)	8·25	6·40
THORENS TX11 Cover	4·18	3·40
SME Plinth System 2000 with motor-board	43·56	34·95
MOTORBOARDS only	5·51	4·00
SME P1 Spacer	0·92	0·70
HEADPHONES		
AMSTRAD HPS5A	8·25	4·30
HPS6A with volume control	11·77	7·40
HPS 7A bass and treble controls	15·35	10·90
AKAI ASE9	7·98	4·70
AKAI ASE22	13·09	7·95
AKG K180	30·80	18·70
AKG K60	16·50	9·90
AKG 100	8·80	5·50
AKG 120	11·00	4·95
KOSS HV1	22·00	17·60
KOSS ESP-9 Electrostatic	75·90	58·25
KOSS ESP-6 Electrostatic	49·50	38·50
KOSS K2 plus 2 Quadrafone	49·50	39·95
KOSS PRO 5 L/C	33·00	26·50
KOSS PRO-4AA	30·80	23·25
KOSS KO-727B	18·15	13·75
KOSS 747	22·00	16·50
KOSS K-711	11·00	8·50
KOSS K6	13·75	10·50
KOSS K6/LC (with volume control)	15·40	11·60
KOSS K6/LCQ Quadrafone	22·00	18·75
PIONEER SE 50	24·09	14·50
PIONEER SE 30A	13·86	9·25
PIONEER SE 20A	8·67	5·50
PIONEER SEL 20	11·58	7·50
PIONEER SEL 40	19·17	12·50
SOUND MD806	7·15	3·10
WHARFEDALE DD1	13·75	9·75
WHARFEDALE Isodynamic	21·95	16·50
BLANK TAPES		
SCOTCH DYNARANGE CASSETTES		
C60	0·77	0·40
C90	1·08	0·55
C120	1·63	0·80

	Rec. Retail Price £ p	Comet Price £ p
BLANK TAPES—continued		
SCOTCH HIGH ENERGY COBALT CASSETTES		
C60	1·20	0·75
C90	1·54	0·95
SCOTCH CASSETTE HEAD CLEANER	0·61	0·40
SCOTCH Low Noise 8-TRACK BLANK CARTRIDGES		
40 mins.	1·65	0·99
80 mins.	1·98	1·20
MAGCAM 8-track 80 mins.	Sp. Price	0·75
SCOTCH HI-FI DYNARANGE SPOOLED TAPES		
5" L.P. 900	2·02	1·25
5¾" L.P. 1200	2·37	1·45
7" L.P. 1800	3·18	1·99
SCOTCH HI-FI DYNARANGE DOUBLE PLAY		
5" D.P. 1200	2·50	1·55
5¾" D.P. 1800	3·41	2·15
7" D.P. 2400	4·37	2·75

Postage—5p per order. Packs of ten post free.

	Rec. Retail Price £ p	Comet Price £ p
HI-FI STEREO SYSTEMS—COMPLETE		
BUSH A1005	66·25	47·95
BUSH 1006 with radio	89·06	64·25
DANSETTE 4005	67·73	43·95
DECCA SOUND 613	Sp. Price	47·50
DECCA SOUND 614	Sp. Price	51·95
DECCA COMPACT 2 with radio	Sp. Price	72·95
DECCA 403	Sp. Price	40·95
FERGUSON 3450 B with Radio (new Model)	75·35	55·95
FERGUSON 3451 B with Radio (new Model)	101·42	75·95
FERGUSON 3454	39·34	29·95
FIDELITY UA1 Music Master with Radio	95·52	66·95
FIDELITY UA2 Music Master	40·98	27·95
FIDELITY Stereo Nine	Sp. Price	21·95
FIDELITY UA3 incl. stereo radio	59·73	41·95
G.E.C. 2810	74·89	52·95
GROSVENOR MPX 8400 AM/FM/MPX Tuner/Amplifier, magnetic input, built-in 8-track cartridge player with speakers	65·75	36·95
HMV 2451	115·64	85·95
HMV 2452	62·57	47·95
HMV 2455	165·89	122·95
I.T.T. 1025 with 662 speakers	45·72	33·95
I.T.T. 2250 with 659 speakers and radio	136·98	99·95
PHILIPS 808	99·53	69·95
PHILIPS 825	46·92	32·95
PHILIPS 826	71·09	49·95
PHILIPS 835 with radio	65·88	46·50
PHILIPS 836 with radio	90·05	63·50
ULTRA 6027	54·50	40·95
ULTRA 6028	56·83	42·50
ULTRA 6450 B (new model) with radio	75·35	55·95
ULTRA 6451	75·35	55·95
ULTRA 6455	39·19	28·95
ULTRA 6454	36·83	27·95
TAPE RECORDERS		
AKAI 1721L	93·87	66·95
AKAI 4000 DS	93·50	68·95
AKAI X201D	168·30	123·95
AKAI X1810	215·18	159·95
AKAI GX221D	215·18	159·95
AKAI GX1900D	224·57	166·95
AKAI GX370D	328·95	244·95
AKAI CR80D 8-track stereo tape deck	79·90	53·95
AKAI CR80 8-track stereo recorder	117·02	66·95
AKAI CR80DSS Quadraphonic	149·88	109·95
AKAI CR80T 8-track stereo recorder and tuner amplifier	140·78	84·95

	Rec. Retail Price £ p	Comet Price £ p
TAPE RECORDERS—continued		
AKAI CR81T 8-track cartridge stereo recorder and tuner amplifier	145·65	107·95
AKAI CR81	102·89	75·95
AKAI CR81D	84·10	61·95
FERGUSON 3258 4-track	66·77	47·00
FERROGRAPH 702/704 Dolby	267·30	226·95
FERROGRAPH 702H Dolby	278·30	235·95
FERROGRAPH 722/724 Dolby	305·80	258·95
FERROGRAPH 722H Dolby	316·80	268·95
FERROGRAPH 702/704	220·00	167·95
FERROGRAPH 722/724	258·50	194·95
FIDELITY Braemar 4-track	32·64	17·95
GROSVENOR 8-track record, play-back deck	51·15	36·95
GROSVENOR MPX 8400 AM/FM MPX Tuner/Amplifier, magnetic input, built-in 8-track cartridge player with speakers	65·75	36·95
GRUNDIG TK 121 (twin-track)	53·09	37·95
GRUNDIG TK 141 (4-track)	58·60	42·95
GRUNDIG TK 147 (4-track auto)	92·87	69·95
GRUNDIG TK 148 (4-track auto 2 speed)	63·54	52·95
GRUNDIG TK 246 4-track stereo deck	115·25	92·95
GRUNDIG TK 3200 Hi-Fi (Battery)	135·15	94·75
MARCONI 4248 4-track, 2 speed	49·66	33·00
PHILIPS 4307 4-track	47·40	33·95
PHILIPS 4308 De Luxe 4-track	55·92	39·95
PHILIPS 4414 4-track stereo	113·75	77·95
PHILIPS 4416 4-track stereo recorder	137·46	99·95
PHILIPS 4418 4-track stereo	189·59	137·95
PHILIPS 4450 4-track stereo	279·64	199·95
TANDBERG 3341X 4-track stereo deck	122·11	102·95
TANDBERG 6041X 4-track stereo	187·62	153·95
TANDBERG 9021X 2-track stereo deck	216·20	182·95
TANDBERG 9041X 4-track stereo deck	216·20	182·95
TAPE RECORDERS (CASSETTE)		
AKAI CS35D tape deck	75·13	49·95
AKAI CS35 Stereo incl. Speakers	105·71	77·95
AKAI GXC 400 tape deck	89·74	65·95
AKAI GXC 40	105·71	75·95
AKAI GXC 40T recorder, tuner/amplifier	157·40	116·95
AKAI GXC 45D tape deck	112·28	83·95
AKAI GXC 46 Dolby tape recorder	143·30	106·95
AKAI GXC 46D Dolby tape deck	131·09	96·95
AKAI GXC 65D Dolby auto-reverse deck	145·18	107·95
BUSH TP 66 Battery/Mains	26·70	19·50
FERGUSON 3253 (mains)	41·15	25·00
FERGUSON 3256 (mains)	36·60	22·50
FERGUSON 3257	53·51	37·95
FERGUSON 3257/7 speakers for above	15·15	11·25
GEC CR200 AM/FM Cassette/Radio, Battery/Mains with slide controls	Sp. Price	32·95
GRUNDIG C210 Battery/Mains	46·00	34·95
HARVARD Elite Cassette/AM/FM Radio (battery/mains)	Sp. Price	21·50
JVC Nivico 9420 LS with AM/FM radio, battery/mains	57·84	38·95
JVC Nivico 1710 Radio/Cassette, AM/FM	Sp. Price	34·95
PHILIPS 2202/2203	22·59	16·50
PHILIPS 2204 battery/mains	28·25	21·95
PHILIPS 2405 Stereo with 2 RH401 L/S	67·78	50·95
PHILIPS 3302	20·24	14·95
PIONEER CT 4141 Dolby Deck	143·97	98·95
PYE 9116 Stereo	65·80	47·95
PYE 9140	20·24	14·95
WHARFEDALE Dolby DC9 Mk. II	111·41	82·50

FREE Technical Advisory Service. If in doubt ask us! Price list on request.

Comet guarantees that all prices quoted are genuine. All offers subject to availability. Add 75p for postage, packing and insurance on all orders (Cartridges 20p) **OR, IF SECURICOR DELIVERY REQUIRED** add £1 95 only. Make cheques, Money Orders payable to 'COMET'.

COMET HIGH FIDELITY DISCOUNT WAREHOUSES

OPEN DAILY TO THE PUBLIC FROM:
9am–8pm Monday
9am–1pm Tuesday
9am–8pm Wednesday
9am–8pm Thursday
9am–8pm Friday
9am–5.30pm Saturday

BIRMINGHAM: Heeley Road, Selly Oak, B29 6EY. *Tel: 021-472 6181*
BIRMINGHAM: Tivoli Shopping Centre, 1570-1572 Coventry Road, Yardley B26 1BJ. *Tel: 021-706 0684*
LONDON, DAGENHAM: Rainham Road South, Dagenham, RM10 8ST. *Tel: 01-595 5111*
EDINBURGH: 1 Newhaven Road, EH6 5QX. *Tel: 031-554 4454 (9 lines)*
HULL: Reservoir Road, Clough Road, HU6 7QD. *Tel: 0482 46441 (6 lines)*
LEEDS: 78 Armley Road, LS12 2EF. *Tel: 0532 40551*
SHEFFIELD: The Mill, 1 Loxley Road, Malin Bridge, S6 4TN. *Tel: 0742 341721/6*
STOCKTON: Teesway, Portrack Lane, Teesside, TS18 2RH. *Tel: 66132/65215*
ROCHDALE: Corner of Well I'th'Lane and Queensway. *Tel: 50606*
LEICESTER: Syston Street. *Tel: 0533 52236*
WIGAN: Wharf Mill, Princess Street, WN3 4EZ. *Tel: 0942 34741*
LONDON, HACKBRIDGE (Nr. Croydon): 190 London Road, Hackbridge, Wallington, Surrey. *Tel: 01-669 0271*
SUNDERLAND: 4-7 St. Thomas Street, Sunderland, SR1 1HR. *Tel: Sunderland 59993*
RENFREW: Blythswood Trading Estate, Argyle Avenue, Renfrew, RA4 9EL. *Tel: 041 886 5731*
JARROW: 56/64 Ellison Street, Jarrow, NE32 3MT. *Tel: 0632 892211*
LONDON, HAYES: Silverdale Road, Pump Lane, Hayes. *Tel: 01-573 1841*
SANDIACRE: 121 Town Street, Sandiacre, Nottingham, NG10 5DW. *Tel: Sandiacre 6116*
EASTLEIGH: Chickenhall Lane, Eastleigh, SO5 5ZQ. *Tel: Eastleigh 4722*
LONDON, ROCHESTER: Maidstone Road, Rochester. *Tel: Medway 49171*

SECURICOR within 72 hours.
(Add £1.95 only for Securicor delivery)
ALL GOODS FULLY INSURED AGAINST LOSS OR DAMAGE WHILST IN TRANSIT

Would you spend an hour a day to earn more money in Electronics-Television-Radio?

If you're willing to give up one hour or more a day we can help you get into the lucrative growth industries of electronics, television, radio.

And if you're already *in*, we can help you get on!

With our know-how and our wide experience in teaching, plus your determination to study, we can turn your interest into the technical knowledge you need for success. Once you've got the qualifications you need, you'll be in a good position to take full advantage of the opportunities which exist today in all fields of electronics – in television (colour and black/white) and in radio. (We teach you the theory and practice of valve and transistor portable circuits while you build your own 5 valve receiver, transistor portable and high grade test instruments).

With ICS you study at home – at your own pace, when *you* choose, in the time you've got available. Your ICS tutors will give you all the help and encouragement you need to pass any exams you want to take.

Don't waste another day. Take your first step *now* towards a better paid, more assured future. Send for your FREE Careers Guide today.

ICS your key to the door of opportunity

Tick or state subject of interest and post to:
International Correspondence Schools, Dept. 232H.
Intertext House, Stewarts Road, London SW8 4UJ.

Subject of interest

- ☐ Society of Engineers Graduateship (Electrical Engineering)
- ☐ C & G Telecommunications Technicians Certificates
- ☐ C & G Electrical Installation Work
- ☐ C & G Certificate in Technical Communication Techniques
- ☐ MPT General Certificate in Radio Telegraphy
- ☐ Audio, Radio & TV Engineering & Servicing
- ☐ Electronic Engineering, Maintenance, Engineering systems, Instrumentation & Control systems
- ☐ Computer Engineering and Technology
- ☐ Electrical Engineering, Installations, Contracting, Appliances
- ☐ Self-build radio courses

Name ______________________________

Address ______________________________

____

Occupation ______________________ Age ________

■Accredited by the Council for the Accreditation of Correspondence Colleges■

ELECTRONIC ORGAN KITS

★ Portable—4 octave keyboard with 10 voices, 3 pitches—vibrato, **£145·29.** ★ Console—5 octave keyboard with 10 voices, 3 pitches. Keyboard can be split into solo and accompaniment. Vibrato, built in amplifier and speaker **£250·93.** ★ Console—2 x 4 octave keyboards and 13 note pedal board, 29 voices, Vibrato, Delay Vibrato, Sustain, Reverberation, Percussion, Wah Wah, **£406·00.** ★ Console—2 x 5 octave keyboards and 32 note pedal board, 32 voices. Vibrato, Delay Vibrato, Sustain, Reverberation, Percussion, 3 Couplers, etc., at **£572·55.**

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

ELVINS ELECTRONIC
MUSICAL INSTRUMENTS
8, PUTNEY BRIDGE ROAD, LONDON, S.W.18
TEL: 01-870 4949

NEW VALVES! GUARANTEED AND TESTED

24-HOUR SERVICE

1R5	·25	30P19	·53	ECC82	·17	EL33	·54	PCF86	·44	PY801	·30
1S5	·21	30PL1	·54	ECC83	·21	EL41	·52	PCF801	·27	R19	·27
1T4	·14	DAF91	·21	ECC85	·31	EL84	·20	PCF802	·38	U191	·54
3S4	·24	DAF96	·35	ECH35	·48	EM80	·35	PCF805	·55	U251	·60
3V4	·46	DF91	·14	ECH42	·56	EM81	·35	PCL82	·28	U329	·65
6/30L2	·53	DF96	·35	ECH81	·26	EM84	·30	PCL83	·53	U801	·73
6AT6	·18	DH77	·18	ECL80	·27	EY86	·27	PCL84	·31	UABC80	·29
6AQ5	·21	DK91	·25	ECL82	·27	EZ80	·19	PCL85	·36	UBF89	·28
6BW7	·48	DK96	·43	ECL86	·32	EZ81	·21	PCL86	·35	UCC85	·32
6F1	·57	DL92	·24	EF39	·36	KT61	·54	PFL200	·49	UCH42	·56
6F23	·64	DL94	·46	EF41	·56	KT66	·75	PL36	·45	UCH81	·28
6F25	·49	DL96	·36	EF80	·22	N78	£1·00	PL81	·41	UCL82	·30
12AU7	·17	DY86	·21	EF85	·26	PC86	·42	PL82	·29	UF41	·49
25L6GT	·18	DY87	·21	EF86	·27	PC88	·42	PL83	·31	UF89	·28
30C15	·56	DY802	·28	EF89	·24	PC97	·36	PL84	·28	UL41	·52
30C17	·73	EABC80	·28	EF91	·12	PC900	·28	PL500	·59	UL84	·27
30C18	·55	EBC33	·38	EF92	·26	PCC84	·27	PL504	·59	UY41	·37
30F5	·60	EBC41	·47	EF183	·25	PCC89	·41	PY81	·23	UY85	·22
30PL1	·59	EBF89	·27	EF184	·27	PCC189	·46	PY82	·23	W77	·42
30PL14	·67	ECC81	·15	EH90	·33	PCF80	·25	PY800	·30	Z77	·18

Post/Packing on 1 valve 7p. plus 3p. per valve on each extra valve. Any parcel insured against damage in transit 3p. extra. Office address, no callers.

GERALD BERNARD 83 Osbaldeston Road, Stoke Newington, London N.16

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 11·3/4" x 14·11/16". **Weight:** 19 ounces.

£6·50 each Stereo pair £12·50
post free

web europa
P.O. Box 162, Watford WD1 1AA

Build yourself a TRANSISTOR RADIO

ROAMER 10 WITH VHF INCLUDING AIRCRAFT

10 TRANSISTORS. 9 TUNABLE WAVEBANDS, MW1, MW2, LW, SW1, SW2, SW3, TRAWLER BAND, VHF AND LOCAL STATIONS ALSO AIRCRAFT BAND

Built in Ferrite Rod Aerial for MW/LW. Retractable, chrome plated 7 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600mw Transistors. Car Aerial and Tape Record Sockets. 10 Transistors plus 3 Diodes. Fine tone moving coil speaker. Ganged Tuning Condenser with VHF section. Separate coil for Aircraft Band. Volume on/off. Wave Change and tone Control. Attractive Case in black with silver blocking. Size 9" × 7" × 4". Easy to follow instructions and diagrams. Parts price list and easy build plans 30p (FREE with parts). Earpiece with plug and switched socket for private listening 33p extra.

Total building cost £9·35 P. P. & Ins. 52p
Overseas P. & P. £1·05)

ROAMER EIGHT Mk I

NOW WITH VARIABLE TONE CONTROL

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Retractable chrome plated Telescopic aerial for Short Waves. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts Price List and Easy Build Plans 25p (FREE with parts).
Earpiece with plug and switched socket for private listening 33p extra.

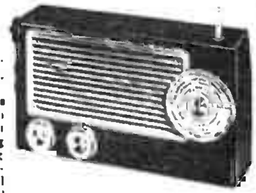
Total building cost £7·68 P. P. & Ins. 47p.
(Overseas P. & P. £1·05)

ROAMER SEVEN MK IV

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for MW and LW. Retractable 4 section 24in. chrome plated telescopic aerial for SW. Socket for Car Aerial. Powerful push-pull output. 7 transistors and 2 diodes, fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with carrying handle Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 25p (FREE with parts).
Earpiece with plug and switched socket for private listening 33p extra.

Total building costs £6·58 P. P. & Ins. 47p.
(Overseas P. & P. £1·05)

ROAMER SIX



6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 Trawler, band plus an extra Medium waveband for easier tuning of Luxembourg etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2½in. approx. Easy build plans and parts price list 25p (FREE with parts).

Total building costs £4·38 P. P. & Ins. 31p
(Overseas P. & P. £1·05)

TRANS EIGHT

8 TRANSISTORS and 3 DIODES

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2½in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 25p (FREE with parts).

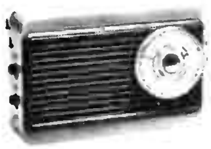
Total building costs £4·95 P. P. & Ins. 33p
(Overseas P. & P. £1·05)

POCKET FIVE

3 Tunable Wavebands. MW, LW, Trawler Band with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes. supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5½ × 1½ × 3½in. Easy build plans and parts price list 10p (FREE with parts).

Total building costs £2·50 P. P. & Ins. 24p
(Overseas P. & P. 65p)

TRANSONA FIVE



5 TRANSISTORS AND 2 DIODES

3 Tunable Wavebands: MW, LW and Trawler Band. 7 stage—5 transistors and 2 diodes, ferrite rod aerial. tuning condenser volume control, fine tone moving coil speaker. Attractive case with red speaker grille. Size 6½ × 4½ × 1½in. Easy build plans and parts price list 10p (FREE with parts).

Total building costs £2·75 P. P. & Ins. 25p
(Overseas P. & P. 65p)

NEW! "EDU-KIT"

BUILD RADIOS, AMPLIFIERS, ETC., FROM EASY STAGE DIAGRAMS. FIVE UNITS INCLUDING MASTER UNIT TO CONSTRUCT.
COMPONENTS INCLUDE:
Tuning Condenser: 2 Volume Controls: 2 Slider Switches: Fine Tone Moving Coil Speaker: Terminal Strip: Ferrite Rod Aerial: 2 Plugs and Sockets: Battery Clips: 4 Tag Boards: Balanced Armature Unit: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ½" Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction.
Parts price list and easy build plans 25p (FREE with parts).

(Overseas P. & P. £1·05)

All parts including Case and Plans £6·05 P. P. & Ins. 33p

FULL AFTER SALES SERVICE
- Callers side entrance "Lavells" Shop
- Open 10–1, 2.30–4.30 Mon.–Fri. 9–12 Sat.

PLEASE NOTE: ALL PRICES NOW INCLUDE VAT

RADIO EXCHANGE CO

61a HIGH ST., BEDFORD, MK40 1SA. Tel. 0234 52367
Reg. no. 788372

I enclose £ .... please send items marked.

ROAMER TEN	☐	ROAMER SEVEN	☐
ROAMER EIGHT	☐	TRANS EIGHT	☐
TRANSONA FIVE	☐	ROAMER SIX	☐
POCKET FIVE	☐	EDU-KIT	☐

Parts price list and plans for ....

Name ....

Address ....

PW 53

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

Cut these 3 pages out and keep for reference

BRAND NEW FULLY GUARANTEED DEVICES

Type	Price p
AC107	22
AC113	22
AC115	25½
AC117K	22
AC122	13
AC125	18½
AC126	18½
AC127	18½
AC128	18½
AC132	15½
AC134	15½
AC137	15½
AC141	15½
AC141K	18½
AC142	15½
AC142K	18½
AC151	16½
AC154	22
AC155	22
AC156	22
AC157	26½
AC165	22
AC166	22
AC167	22
AC168	26½
AC169	15½
AC176	22
AC177	26½
AC178	31
AC179	31
AC180	18½
AC180K	22
AC181	18½
AC181K	22
AC187	24
AC187K	22
AC188	24
AC188K	22
ACY17	27½
ACY18	22
ACY19	22
ACY20	22
ACY21	22
ACY22	17½
ACY27	19½
ACY28	21
ACY29	38½
ACY30	31
ACY31	31
ACY34	23
ACY35	23
ACY36	31
ACY40	18½
ACY41	19½
ACY44	38½
AD130	42
AD140	53
AD142	53
AD143	42
AD149	55

Type	Price p
AD161	36½
AD162	36½
AD161 & AD162 (MP)	60½
ADT140	55
AF114	26½
AF115	26½
AF116	26½
AF117	26½
AF118	38½
AF124	33
AF125	27½
AF126	31
AF127	31
AF139	33
AF178	33
AF179	55
AF180	55
AF181	49½
AF186	49½
AF239	40½
AL102	71½
AL103	71½
ASY26	27½
ASY27	33
ASY28	27½
ASY29	27½
ASY50	27½
ASY51	27½
ASY52	27½
ASY54	27½
ASY55	27½
ASY56	27½
ASY57	27½
ASY58	27½
ASZ21	44
BC107	10
BC108	10
BC109	11
BC113	11
BC114	16½
BC115	16½
BC116	16½
BC117	16½
BC118	11
BC119	33
BC120	88
BC125	13
BC126	20
BC132	13
BC134	20
BC135	13
BC136	16½
BC137	16½
BC139	44
BC140	33
BC141	33
BC142	33
BG143	33

Type	Price p
BC145	49½
BC147	11
BC148	11
BC149	13
BC150	20
BC151	22
BC152	18½
BC153	31
BC154	33
BC157	20
BC158	13
BC159	13
BC160	49½
BC161	55
BC167	13
BC168	13
BC169	13
BC170	13
BC171	15½
BC172	15½
BC173	15½
BC174	15½
BC175	24
BC177	21
BC178	21
BC179	21
BC180	26½
BC181	26½
BC182	11
BC182L	11
BC183	11
BC183L	11
BC184	13
BC184L	13
BC186	31
BC187	31
BC207	12
BC208	12
BC209	13
BC212L	12
BC213L	12
BC214L	15½
BC225	27½
BC226	38½
BCY30	26½
BCY31	28½
BCY32	33
BCY33	24
BCY34	27½
BCY70	15½
BCY71	20
BCY72	15½
BCZ10	22
BCZ11	27½
BCX12	27½
BD121	66
BD123	71½
BD124	66
BD131	55
BD132	66

Type	Price p
BD133	71½
BD135	44
BD136	44
BD137	49½
BD138	55
BD139	60½
BD140	66
BD155	88
BD175	66
BD176	66
BD177	71½
BD178	71½
BD179	77
BD180	77
BD185	71½
BD186	71½
BD187	77
BD188	77
BD189	82½
BD190	82½
BD195	93½
BD196	93½
BD197	99
BD198	99
BD199	1·04½
BD200	1·04½
BD205	88
BD206	88
BD207	1·04½
BD208	1·04½
BDY20	1·10
BF115	26½
BF117	49½
BF118	77
BF119	77
BF121	49½
BF123	55
BF125	49½
BF127	55
BF152	60½
BF153	49½
BF154	49½
BF155	77
BF156	53
BF157	60½
BF158	60½
BF159	66
BF160	44
BF162	44
BF163	44
BF164	44
BF165	44
BF167	24
BF173	24
BF176	38½
BF177	38½
BF178	33
BF179	33
BF180	33
BF181	33

Type	Price p
BF182	44
BF183	44
BF184	27½
BF185	33
BF188	44
BF194	13
BF195	13
BF196	15½
BF197	15½
BF200	49½
BF222	1·04½
BF257	49½
BF258	66
BF259	93½
BF262	60½
BF263	60½
BF270	38½
BF271	33
BF272	88
BF273	38½
BF274	38½
BFW10	66
BFX29	30
BFX84	24
BFX85	33
BFX86	24
BFX87	26½
BFX88	24
BFY50	22
BFY51	22
BFY52	22
BFY53	18½
BPX25	93½
BSX19	16½
BSX20	16½
BSY25	16½
BSY26	16½
BSY27	16½
BSY28	16½
BSY29	16½
BSY38	20
BSY39	20
BSY40	31
BSY41	31
BSY95	14
BSY95A	14
Bu105	2·20
C111E	55
C400	33
C407	27½
C424	22
C425	55
C426	38½
C428	22
C441	33
C442	33
C444	38½
C450	24
MAT100	21
MAT101	22

Type	Price p
MAT120	21
MAT121	22
MPF102	46
MPF104	40½
MPF105	40½
OC19	38½
OC20	69½
OC22	42
OC23	46
OC24	61½
OC25	42
OC26	27½
OC28	55
OC29	55
OC35	46
OC36	55
OC41	22
OC42	26½
OC44	16½
OC45	14
OC70	11
OC71	11
OC72	15½
OC74	15½
OC75	16½
OC76	16½
OC77	27½
OC81	16½
OC81D	16½
OC82	16½
OC82D	16½
OC83	22
OC84	22
OC139	22
OC140	22
OC169	27½
OC170	27½
OC171	27½
OC200	27½
OC201	31
OC202	31
OC203	27½
OC204	27½
OC205	38½
OC309	44
OCP71	47½
ORP12	47½
ORP60	44
ORP61	44
P346A	22
P397	46
ST140	14
ST141	18½
T1843	33
UT46	30
2G301	21
2G302	21
2G303	21
2G304	26½
2G306	44

Type	Price p
2G308	38½
2G309	38½
2G339	22
2G339A	17½
2G344	20
2G345	17½
2G371	17½
2G371B	13
2G373	18½
2G374	18½
2G377	33
2G378	17½
2G381	17½
2G382	17½
2G401	33
2G414	33
2G417	27½
2N388	38½
2N388A	60½
2N404	22
2N404A	31
2N524	46
2N527	54
2N598	46
2N599	49½
2N696	14
2N697	14½
2N698	26½
2N699	38½
2N706	9
2N706A	10
2N708	13
2N711	33
2N717	38½
2N718	26½
2N718A	55
2N726	31
2N727	31
2N743	22
2N744	22
2N914	15½
2N918	33
2N929	23
2N930	23
2N1131	22
2N1132	24
2N1302	15½
2N1303	15½
2N1304	18½
2N1305	18½
2N1306	23
2N1307	23
2N1308	25½
2N1309	25½
2N1613	22
2N1711	22
2N1889	35
2N1890	49½
2N1893	40½
2N2147	79

Type	Price p
2N2148	62½
2N2160	66
2N2192	38½
2N2193	38½
2N2194	38½
2N2217	24
2N2218	22
2N2219	22
2N2220	24
2N2221	22
2N2222	22
2N2368	18½
2N2369	15½
2N2369A	15½
2N2411	26½
2N2412	26½
2N2646	51½
2N2711	23
2N2712	23
2N2714	23
2M2904	18½
2N2904A	23
2N2905	22
2N2905A	23
2N2906	16½
2N2906A	20
2N2907	22
2N2907A	24
2N2923	15½
2N2924	15½
2N2925	15½
2N2926(G)	14
2N2926(Y)	12
2N2926(O)	11
2N2926(R)	11
2N2926(B)	11
2N3010	77
2N3011	15½

Type	Price p
2N3053	18½
2N3054	50½
2N3055	55
2N3391	15½
2N3391A	17½
2N3392	15½
2N3393	15½
2N3394	15½
2N3395	18½
2N3402	23
2N3403	23
2N3404	31
2N3405	46
2N3414	16½
2N3415	16½
2N3416	31
2N3417	31
2N3525	82½
2N3646	10
2N3702	11
2N3703	11
2N3704	12
2N3705	11
2N3706	10
2N3707	12
2N3708	7½
2N3709	10
2N3710	10
2N3711	10
2N3819	31
2N3820	55
2N3821	38½
2N3823	31
2N3903	31
2N3904	33
2N3905	31
2N3906	30
2N4058	13

Type	Price p
2N4059	11
2N4060	13
2N4061	13
2N4062	13
2N4284	18½
2N4285	18½
2N4286	18½
2N4287	18½
2N4288	18½
2N4289	18½
2N4290	18½
2N4291	18½
2N4292	18½
2N4293	18½
2N5172	13
2N5457	35
2N5458	35
2N5459	44
2S301	55
2S302A	46
2S302	46
2S303	60½
2S304	77
2S305	92½
2S306	92½
2S307	92½
2S321	61½
2S322	46
2S322A	46
2S323	61½
2S324	77
2S325	77
2S326	77
2S327	77
2S701	46
40361	44
40362	49½

DIODES AND RECTIFIERS

AA119	9	BY133	23	OA70	7½
AA120	9	BY164	55	OA79	7½
AA129	9	BYX38/30	46	OA81	7½
AAY30	10	BYZ10	38½	OA85	10
AAZ13	11	BYZ11	33	OA90	6½
BA100	11	BYZ12	33	OA91	6½
BA116	23	BYZ13	27½	OA95	7½
BA126	24	BYZ16	44	OA200	6½
BA148	15½	BYZ17	38½	OA202	7½
BA154	13	BYZ18	38½	SD10	5½
BA155	15½	BYZ19	31	SD19	5½
BA156	14½	CG62		1N34	7½
BY100	16½	(OA91 Eq.)	5½	1N34A	7½
BY101	13	CG651		1N914	6½
BY105	18½	(OA70-OA79		1N916	6½
BY114	13	Eq.)	6½	1N414B	6½
BY126	15½	OA5	38½	1S021	11
BY127	16½	OA58L	23	1S951	6½
BY128	16½	OA10	38½		
BY130	17½	OA47	7½		

NEW COMPONENT PAK BARGAINS

Pack No.	Qty.	Description	Price
C 1	250	Resistors mixed values approx. count by weight ..	0·55
C 2	200	Capacitors mixed values approx. count by weight ..	0·55
C 3	50	Precision Resistors ·1%, ·01% mixed values	0·55
C 4	75	⅛th W Resistors mixed preferred values ..	0·55
C 5	5	Pieces assorted Ferrite Rods	0·55
C 6	2	Tuning Gangs, MW/LW VHF	0·55
C 7	1	Pack Wire 50 metres assorted colours	0·55
C 8	10	Reed Switches	0·55
C 9	3	Micro Switches	0·55
C10	15	Assorted Pots & Pre-Sets	0·55
C11	5	Jack Sockets 3 × 3·5m 2 × Standard Switch Types ..	0·55
C12	40	Paper Condensers preferred types mixed values ..	0·55
C13	20	Electrolytics Trans. types	0·55
C14	1	Pack assorted Hardware—Nuts/Bolts, Grommets etc...	0·55
C15	4	Mains Toggle Switches, 2 Amp D/P	0·55
C16	20	Assorted Tag Strips & Panels	0·55
C17	10	Assorted Control Knobs	0·55
C18	4	Rotary Wave Change Switches	0·55
C19	3	Relays 6—24V Operating	0·55
C20	4	Sheets Copper Laminate approx. 10" × 7"	0·55

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

Component Lists for mail order available on request

JUMBO COMPONENT PAKS

MIXED ELECTRONIC COMPONENTS

Resistors, capacitors, pots, electrolytics and coils plus many other useful items. Approximately 3lbs in weight. Price incl. P. & P. £1·65 only.

Exceptionally good value

BRAND NEW POST OFFICE TYPE TELE-PHONE DIALS ONLY 83p each

THE NEW S.G.S. EA 1000 AUDIO AMP MODULE *Guarantee

3 Watts R.M.S. ONLY £2·89 each

Module Tested and Guaranteed. Qty. 1—9 £2·89; 10—25 £2·50 Price each. Larger quantities quoted on request. Full hook-up diagrams and complete technical data supplied free with each module or available separately at 10p each.

SYSTEM 12 STEREO

Each Kit contains two Amplifier Modules, 3 watts RMS, two loudspeakers, 15 ohms, the pre-amplifier, transformer, power supply module, front panel and other accessories, as well as an illustrated stage-by-stage instruction booklet designed for the beginner.

Further details available on request.

ONLY £18·64 FREE P. & P.

NOW-TURN OVER FOR MORE FANTASTIC OFFERS

The largest selection

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

PIV	1A TO5	3A TO66	5A TO66	5A TO64	7A TO48	10A TO48	16A TO48	30A TO48
50	0·26	0·28	0·39	0·39	0·52	0·55	0·59	1·27
100	0·28	0·37	0·52	0·52	0·55	0·64	0·70	1·54
200	0·39	0·41	0·54	0·54	0 63	0·67	0·83	1·76
400	0·48	0·52	0·62	0·62	0·74	0·83	1·03	1·93
600	0·59	0·63	0·75	0·75	0·85	1·07	1·38	—
800	0·70	0·77	0·88	0·88	0·99	1·32	1·65	4·40

SIL. RECTS. TESTED

PIV	300mA	750mA	1A	1·5A	3A	10A	30A
50	0 04	0·06	0·06	0·08	0·16	0·23	0·66
100	0·04	0·07	0·06	0·15	0·18	0·26	0·83
200	0·06	0·10	0·07	0·16	0·22	0·27	1·10
400	0·07	0·15	0·08	0·22	0·30	0·41	1·38
600	0·08	0·18	0·11	0·26	0·38	0·50	2·05
800	0·11	0·19	0·12	0·28	0·41	0·61	2·20
1000	0·12	0·28	0·16	0·33	0·51	0·70	2·75
1200	—	0·37	—	0·42	0·63	0·83	—

TRIACS

VBOM	2A TO-5	6A TO-66	10A TO-48
	£p	£p	£p
100	33	55	82½
200	55	66	99
400	77	82½	1·21

DIACS

FOR USE WITH TRIACS
BR100 (D32) 40½p each

FREE

One 50p Pak of your own choice free with orders valued £4 or over.

BRAND NEW TEXAS GERM. TRANSISTORS

Coded and Guaranteed

Pak No.			EQVT
T1	8	2G3713	OC71
T2	8	D1374	OC75
T3	8	D1216	OC81D
T4	8	2G381T	OC81
T5	8	2G382T	OC82
T6	8	2G344B	OC44
T7	8	2G345B	OC45
T8	8	2G378	OC78
T9	8	2G399A	2N1302
T10	8	2G417	AF117

All 55p each pak

D1699 NPN SILICON DUAL TRANSISTOR

(Similar to 2N2060)

1	25	100+
0·27½	0·25½	0·23

ND 120 NIXIE DRIVER TRANSISTOR.

Suitable replacement for BSX 21, C 407, 2N 1893 120vcb.

1	25	100+
0·18½	0·16½	0·15½

Sil. trans. suitable for P.E. Organ. Metal TO-18 Eqvt. ZTX300 5½p each. Any Qty.

GP 100 TO3 METAL CASE GERMANIUM

Vebo = 80V. Vceo = 50V. I.C. = 10 amps. Ptot = 30W. hfe = 30–170. Replaces the majority of Germanium power transistors in the OC, AD and NKT range.

1	25	100+
0·47½	0·44	0·39½

GP 300 TO3 METAL CASE SILICON

Vebo = 100V. Vceo = 60V I.C. = 15 amps. Ptot = 115W. hfe = 20. 100fT. = 1MHz. Suitable replacement for 2N 3055, BDY 11 or BDY 20.

1	25	100+
0·55	0·53	0·50½

FULL RANGE OF ZENER DIODES

VOLTAGE RANGE 2-33V. 400mW (DO-7 Case) 15p ea. 1½W (Top-Hat) 20p ea. 10W (SO-10 Stud) 33p ea.

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

2 Amp. BRIDGE RECTS.

50 v RMS	35p each
100 v RMS	40½p ..
400 v RMS	50½p ..

Size 16 mm × 16 mm.

UT 46 UNIJUNCTION TRANSISTORS

Direct replacement for TIS 43rand BEN 3000 also electrically equivalent to 2N2646

1	25	100+
0·30	0·27½	0·22

CADMIUM CELLS

ORP12 47½p
ORP60, ORP61 44p each

GENERAL PURPOSE NPN SILICON SWITCHING TRANS. TO-18 SIM. TO 2N706/8. BSY-27/28/95A.

All usable devices no open or short circuits. ALSO AVAILABLE in PNP Sim. to 2N2906, BCY70. When ordering please state preference NPN or PNP.

		£p
20	For	0·55
50	For	1·10
100	For	1·92
500	For	8·25
1000	For	14·30

SIL. G.P. DIODES £p

300mW	30..	0 55
40PIV(Min.)	100..	1·65
Sub-Min.	500.	5·50
Full Tested	1,000.	9·90

Ideal for Organ Builders.

R 2400 TO3 NPN SILICON HIGH VOLTAGE

Vebo = 250V. Vceo = 100V. I.C. = 6 amps. Ptot = 30W. hfe = typ.20 fT = 5MHz.

1	25	100+
0·55	0·49½	0·44

2N3055

115 WATT SIL POWER NPN 55p EACH

KING OF THE PAKS — Unequalled Value and Quality

SUPER PAKS — NEW BI-PAK UNTESTED SEMICONDUCTORS

Money back refund if not satisfied

Pak No.		Description	Price £p
U 1	120	Glass Sub-Min. General Purpose Germanium Diodes	0·55
U 2	60	Mixed Germanium Transistors AF/RF	0·55
U 3	75	Germanium Gold Bonded Sub-Min. like OA5, OA47	0·55
U 4	40	Germanium Transistors like OC81, AC128	0·55
U 5	60	200mA Sub-Min. Silicon Diodes	0·55
U 6	30	Sil. Planar Trans. NPN like BSY95A, 2N706	0·55
U 7	16	Sil. Rectifiers TOP-HAT 750mA VLTG. RANGE up to 1000	0·55
U 8	50	Sil. Planar Diodes DO-7 Glass 250mA like OA200/202	0·55
U 9	20	Mixed Voltages, 1 Watt Zener Diodes	0·55
U10	20	BAY50 charge storage Diodes DO-7 Glass	0·55
U11	25	PNP Sil. Planar Trans. TO-5 like 2N1132, 2N2904	0·55
U12	12	Silicon Rectifiers Epoxy 500mA up to 800 PIV	0·55
U13	30	PNP-NPN Sil. Transistors OC200 & 2S 104	0·55
U14	150	Mixed Silicon and Germanium Diodes	0·55
U15	25	NPN Sil. Planar Trans. TO-5 like BFY51, 2N697	0·55
U16	10	3 Amp Silicon Rectifiers Stud Type up to 1000PIV	0·55
U17	30	Germanium PNP AF Transistors TO-5 like ACY 17-22	0·55
U18	8	6 Amp Silicon Rectifiers BYZ13 Type up to 600 PIV	0·55
U19	25	Silicon NPN Transistors like BC108	0·55
U20	12	1·5 Amp Silicon Rectifiers Top Hat up to 1000 PIV	0·55
U21	30	AF. Germanium Alloy Transistors 2G300 Series & OC71	0·55
U23	30	MADT's like MHz Series PNP Transistors	0·55
U24	20	Germanium 1 Amp Rectifiers GJM Series up to 300 PIV	0·55
U25	25	300 MHz NPN Silicon Transistors 2N708, BSY27	0·55
U26	30	Fast Switching Silicon Diodes like IN914 Micro-Min.	0·55
U27	12	NPN Germanium AF Transistors TO-1 like AC127	0·55
U29	10	1 Amp SCR's TO-5 can, up to 600 PIV CRS1/25-600	1·10
U30	15	Plastic Silicon Planar Trans. NPN 2N2926	0·55
U31	20	Silicon Planar Plastic NPN Trans. Low Noise Amp 2N3707	0·55
U32	25	Zener Diodes 400mW DO-7 case 3–18 volts mixed	0·55
U33	15	Plastic Case 1 Amp Silicon Rectifiers 1N4000 Series	0·55
U34	30	Silicon PNP Alloy Trans. TO-5 BCY26 2S302/4	0·55
U35	25	Silicon Planar Transistors PNP TO-18 2N2906	0·55
U36	25	Silicon Planar NPN Transistors TO-5 BFY50/51/52	0·55
U37	30	Silicon Alloy Transistors SO-2 PNP OC200, 2S322	0·55
U38	20	Fast Switching Silicon Trans. NPN 400 MHz 2N3011	0·55
U39	30	RF. Germ. PNP Transistors 2N1303/5 TO-5	0·55
U40	10	Dual Transistors 6 lead TO-5 2N2060	0·55
U41	25	RF Germanium Transistors TO-1, OC45, NKT72	0·55
U42	10	VHF Germanium PNP Transistors TO-1 NKT667, AF117	0·55
U43	25	Sil. Trans. Plastic TO-18 A.F. BC113/114	0·55
U44	20	Sil. Trans. Plastic TO-5 BC115/116	0·55
U45	7	3A SCR. TO66 up to 600PIV	1·10

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

SILICON PHOTO TRANSISTOR.

TO-18 Lens end NPN Sim. to BP×25 and P21. BRAND NEW. Full data available. Fully guaranteed.

Qty.	1-24	25-99	100 up
Price each	49p	44p	38p

F.E.T.'S

2N3819	31p	2N5458	35p
2N3820	55p	2N5459	44p
2N3821	39p	BFW10	66p
2N3823	31p	MPF105	41p

NEW 6th EDITION

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

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

QUALITY TESTED SEMICONDUCTORS

Pak No.			Price £p
Q1	20	Red spot transistors PNP	0·55
Q2	16	White spot R.F. transistors PNP	0·55
Q3	4	OC 77 type transistors	0·55
Q4	6	Matched transistors OC44/45/81/81D	0·55
Q5	4	OC 75 transistors	0·55
Q6	5	OC 72 transistors	0·55
Q7	4	AC 128 transistors PNP high gain	0·55
Q8	4	AC 126 transistors PNP	0·55
Q9	7	OC 81 type transistors	0·55
Q10	7	OC 71 type transistors	0·55
Q11	2	AC 127/128 Complementary pairs PNP/NPN	0·55
Q12	3	AF 116 type transistors	0·55
Q13	3	AF 117 type transistors	0·55
Q14	3	OC 171 H.F. type transistors	0·55
Q15	7	2N2926 Sil. Epoxy transistors mixed colours	0·55
Q16	2	GET880 low noise Germanium transistors	0·55
Q17	5	NPN 2 × ST.141 & 3 × ST.140	0·55
Q18	4	MADT'S 2 × MAT 100 & 2 × MAT 120	0·55
Q19	3	MADT'S 2 × MAT 101 & 1 × MAT 121	0·55
Q20	4	OC 44 Germanium transistors A.F.	0·55
Q21	4	AC 127 NPN Germanium transistors	0·55
Q22	20	NKT transistors A.F. R.F. coded	0·55
Q23	10	OA 202 Silicon diodes sub-min.	0·55
Q24	8	OA 81 diodes	0·55
Q25	15	IN914 Silicon diodes 75 PIV 75mA	0·55
Q26	8	OA95 Germanium diodes sub-min IN69	0·55
Q27	2	10A PIV Silicon rectifiers IS425R	0·55
Q28	2	Silicon power rectifiers BYZ 13	0·55
Q29	4	Silicon transistors 2 × 2N696, 1 × 2N697, 1 × 2N698	0·55
Q30	7	Silicon switch transistors 2N706 NPN	0·55
Q31	6	Silicon switch transistors 2N708 NPN	0·55
Q32	3	PNP Silicon transistors 2 × 2N1131, 1 × 2N1132	0·55
Q33	3	Silicon NPN transistors 2N1711	0·55
Q34	7	Silicon NPN transistors 2N2369, 500MHz (code P397)	0·55
Q35	3	Silicon PNP TO-5. 2 × 2N2904 & 1 × 2N2905	0·55
Q36	7	2N3646 TO-18 plastic 300 MHz NPN	0·55
Q37	3	2N3053 NPN Silicon transistors	0·55
Q38	7	NPN transistors 4 × 2N3703, 3 × 2N3702	0·55

ELECTRONIC SLIDE-RULE

The MK Slide Rule, designed to simplify Electronic calculations features the following scales:— Conversion of Frequency and Wavelength. Calculation of L, C and fo of Tuned Circuits. Reactance and Self Inductance. Area of Circles. Volume of Cylinders. Resistance of Conductors. Weight of Conductors. Decibel Calculations. Angle Functions. Natural Logs and 'e' Functions. Multiplication and Division. Squaring, Cubing and Square Roots. Conversion of kW and Hp. A must for every electronic engineer and enthusiast. Size: 2 cm × 4cm. Complete with case and instructions. Price each: £3·68½

INTEGRATED CIRCUIT PAKS

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

Pak No.	Contents	Price	Pak No.	Contents	Price	Pak No.	Contents	Price
UIC00	12 × 7400	0·55	UIC46	5 × 7446	0·55	UIC86	5 × 7486	0·55
UIC01	12 × 7401	0·55	UIC47	5 × 7447	0·55	UIC90	5 × 7490	0·55
UIC02	12 × 7402	0·55	UIC48	5 × 7448	0·55	UIC91	5 × 7491	0·55
UIC03	12 × 7403	0·55	UIC50	12 × 7450	0·55	UIC92	5 × 7492	0·55
UIC04	12 × 7404	0·55	UIC51	12 × 7451	0·55	UIC93	5 × 7493	0·55
UIC05	12 × 7405	0·55	UIC53	12 × 7453	0·55	UIC94	5 × 7494	0·55
UIC06	8 × 7406	0·55	UIC54	12 × 7454	0·55	UIC95	5 × 7495	0·55
UIC07	8 × 7407	0·55	UIC60	12 × 7460	0·55	UIC96	5 × 7496	0·55
UIC10	12 × 7410	0·55	UIC70	8 × 7470	0·55	UIC100	5 × 74100	0·55
UIC13	8 × 7413	0·55	UIC72	8 × 7472	0·55	UIC121	5 × 74121	0·55
UIC20	12 × 7420	0·55	UIC73	8 × 7473	0·55	UIC141	5 × 74141	0·55
UIC30	12 × 7430	0·55	UIC74	8 × 7474	0·55	UIC151	5 × 74151	0·55
UIC40	12 × 7440	0·55	UIC75	8 × 7475	0·55	UIC154	5 × 74154	0·55
UIC41	5 × 7441	0·55	UIC76	8 × 7476	0·55	UIC193	5 × 74193	0·55
UIC42	5 × 7442	0·55	UIC80	5 × 7480	0·55	UIC199	5 × 74199	0·55
UIC43	5 × 7443	0·55	UIC81	5 × 7481	0·55			
UIC44	5 × 7444	0·55	UIC82	5 × 7482	0·55	UICXI	25 Assorted 74's	1·65
UIC45	5 × 7445	0·55	UIC83	5 × 7483	0·55			

Packs cannot be split, but 25 assorted pieces (our mix) is available as PAK UIC X1.

BI-PAKS NEW COMPONENT SHOP NOW OPEN WITH A WIDE RANGE OF ELECTRONIC COMPONENTS AND ACCESSORIES AT COMPETITIVE PRICES—

18 BALDOCK STREET (A10), WARE, HERTS.
TEL. (STD 0920) 61593.

OPEN MON.-SAT. 9.15 a.m. to 6 p.m., FRIDAY UNTIL 8 p.m.

AD161/162 *PNP*

M/P COMP GERM TRANS. OUR LOWEST PRICE OF 60p *PER PAIR*

BIP 19/20 TO3 NPN PLASTIC SILICON

Vebo = 100V. Vceo = 50V I.C. = 10 amps. Ptot = 50W. hfe = typ. 100 fT = 3MHz

1	25	100+
0·37½	0·35	0·32

BIP 19/20 Matched Pair.

1	25	100+
0·66	0·60½	0·55

Please add 10p postage and packing per order. Cash with order please. Orders to BI-PAK SEMICONDUCTORS, P.O. BOX 6, WARE, HERTS.

-the lowest prices!

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

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

	1	25	100+		1	25	100+			25	100+
SN7400	0·17	0·16	0·13	SN7450	0·17	0·16	0·13	SN74141	0·74	0·71	0·64
SN7401	0·17	0·16	0·13	SN7451	0·17	0·16	0·13	SN74145	£1·65	£1·54	£1·43
SN7402	0·17	0·16	0·13	SN7453	0·17	0·16	0·13	SN74150	£3·30	£2·97	£2·75
SN7403	0·17	0·16	0·13	SN7454	0·17	0·16	0·13	SN74151	£1·10	£1·05	0·99
SN7404	0·17	0·16	0·13	SN7460	0·17	0·16	0·13	SN74153	£1·32	£1·21	£1·05
SN7405	0·17	0·16	0·13	SN7470	0·32	0·29	0·27	SN74154	£1·98	£1·87	£1·76
SN7406	0·39	0·34	0·31	SN7472	0·32	0·29	0·27	SN74155	£1·54	£1·43	£1·32
SN7407	0·39	0·34	0·31	SN7473	0·41	0·39	0·35	SN74156	£1·54	£1·43	£1·32
SN7408	0·20	0·19	0·18	SN7474	0·41	0·39	0·35	SN74157	£2·09	£1·98	£1·87
SN7409	0·20	0·19	0·18	SN7475	0·50	0·48	0·46	SN74160	£1·98	£1·87	£1·76
SN7410	0·17	0·16	0·18	SN7476	0·44	0·43	0·42	SN74161	£1·98	£1·87	£1·76
SN7411	0·28	0·27	0·26	SN7480	0·74	0·71	0·64	SN74162	£4·40	£4·13	£3·85
SN7412	0·39	0·34	0·31	SN7481	£1·32	£1·27	£1·21	SN74163	£4·40	£4·13	£3·85
SN7413	0·32	0·29	0·27	SN7482	0·96	0·95	0·94	SN74164	£2·43	£2·37	£2·31
SN7416	0·48	0·44	0·42	SN7483	£1·21	£1·16	£1·05	SN74165	£2·48	£2·42	£2·37
SN7417	0·48	0·44	0·42	SN7484	£1·10	£1·05	0·99	SN74166	£3·85	£3·58	£3·30
SN7420	0·17	0·16	0·13	SN7485	£3·96	£3·85	£3·74	SN74174	£2·53	£2·42	£2·31
SN7422	0·55	0·53	0·50	SN7486	0·35	0·34	0·33	SN74175	£1·76	£1·65	£1·54
SN7423	0·55	0·53	0·50	SN7489	£6·05	£5·78	£5·50	SN74176	£2·75	£2·64	£2·53
SN7425	0·55	0·53	0·50	SN7490	0·74	0·71	0·64	SN74177	£2·75	£2·64	£2·53
SN7426	0·50	0·46	0·44	SN7491	£1·10	£1·05	0·99	SN74180	£2·20	£1·76	£1·54
SN7427	0·50	0·46	0·44	SN7492	0·74	0·71	0·64	SN74181	£6·05	£5·50	£5·23
SN7428	0·77	0·72	0·66	SN7493	0·74	0·71	0·64	SN74182	£2·20	£1·98	£1·76
SN7430	0·17	0·16	0·13	SN7494	0·85	0·82	0·75	SN74184	£3·85	£3·58	£3·30
SN7432	0·50	0·46	0·44	SN7495	0·85	0·82	0·75	SN74190	£2·15	£2·09	£2·04
SN7433	0·88	0·83	0·77	SN7496	0·96	0·93	0·86	SN74191	£2·09	£2·04	£1·98
SN7437	0·71	0·68	0·66	SN74100	£1·82	£1·76	£1·71	SN74192	£2·15	£2·09	£2·04
SN7438	0·71	0·68	0·66	SN74104	£1·07	£1·04	0·97	SN74193	£2·20	£1·98	£1·93
SN7440	0·17	0·16	0·13	SN74105	£1·07	£1·04	0·97	SN74194	£2·97	£2·86	£2·75
SN7441	0·74	0·71	0·64	SN74107	0·44	0·42	0·40	SN74195	£2·20	£2·09	£1·98
SN7442	0·74	0·71	0·64	SN74110	0·61	0·59	0·55	SN74196	£1·98	£1·87	£1·76
SN7443	£1·43	£1·38	£1·32	SN74111	£1·38	£1·27	£1·21	SN74197	£1·98	£1·87	£1·76
SN7444	£1·43	£1·38	£1·32	SN74118	£1·10	£1·05	0·99	SN74198	£6·05	£5·50	£4·95
SN7445	£1·98	£1·95	£1·93	SN74119	£1·49	£1·38	£1·21	SN74199	£6·05	£5·50	£4·95
SN7446	£1·07	£1·04	0·97	SN74121	0·44	0·41	0·38	3 Terminal Pos Volt Reg. TO.3			
SN7447	£1·10	£1·07	£1·05	SN74122	£1·54	£1·43	£1·21	Plastic O/P 1.5 Amps. µA7805			
SN7448	£1·10	£1·07	£1·05	SN74123	£3·08	£2·97	£2·86	5V. & µA7812 12V. £1·76 each			

LINEAR I.C's—FULL SPEC.

Type No.	Price 1-24	25-99	100 up
BP 201C—SL201C	69½p	58½p	49½p
BP701C—SL701C	69½p	55p	49½p
BP 702C—SL702C	69½p	55p	49½p
BP 702—72702	58½p	49½p	44p
BP709—72709	39½p	37½p	33p
BP 709P—µA709C	39½p	37½p	33p
BP 710—72710	48½p	46p	44p
BP 711—µA711	49½p	47½p	44p
BP 741—72741	55p	50p	45p
µA703C	31p	28½p	26½p
TAA 263	77p	66p	60½p
TAA 293	99p	82½p	77p
TAA 350	£1·87p	£1·74p	£1·65p

S.G.S. EA1000 £2·89½p

ROCK BOTTOM PRICES LOGIC DTL 930 Series I.C's

Type Type	Price 1	25	100+
BP930	13p	12p	11p
BP932	14p	13p	12p
BP933	14p	13p	12p
BP935	14p	13p	12p
BP936	14p	13p	12p
BP944	14p	13p	12p
BP945	27½p	26½p	24p
BP946	13p	12p	11p
BP948	27½p	26½p	24p
BP951	71½p	66p	60½p
BP962	13p	12p	11p
BP9093	44p	42p	38½p
BP9094	44p	42p	38½p
BP9097	44p	42p	38½p
BP9099	44p	42p	38½p

Devices may be mixed to qualify for quantity price. Larger quantity prices on application. (DTL 930 Series only).

NUMERICAL INDICATOR TUBES

MODEL	CD66	GR116	3015F Minitron
Anode voltage (Vdc)	170min	175min	5
Cathode Current (mA)	2·3	14	8
Numerical Height (mm)	16	13	9
Tube Height (mm)	47	32	22
Tube Diameter (mm)	19	13	12 wide
I.C. Driver Rec.	BP41 or 141	BP41 or 141	BP47
PRICE EACH	£1·87	£1·70	£1·09

All indicators 0-9 + Decimal point. All side viewing. Full data for all types available on request.

RTL MICROLOGIC CIRCUITS

Epoxy TO-5 case	Price each 1-24	25-99	100 up
uL900 Buffer	38p	36p	29p
uL914 Dual 2I/p gate	38p	36p	29p
uL923 J-K flip-flop	55p	51p	49p

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

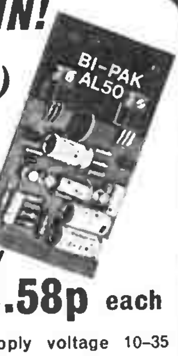
DUAL-IN-LINE SOCKETS.

14 & 16 Lead Sockets for use with DUAL-IN-LINE I.C's. TWO Ranges PROFESSIONAL & NEW LOW COST.

PROF. TYPE No.	1-24	25-99	100up.
TSO 14 pin type	33p	30p	27½p
TSO 16 ,, ,,	38½p	35p	33p
LOW COST No.			
BPS 14	16½p	14½p	12p
BPS 16	17½p	15½p	13p

BI-PAK DO IT AGAIN!

50W pk 25w (RMS)



0·1% DISTORTION!
HI-FI AUDIO AMPLIFIER

THE AL50

★ Frequency Response 15Hz to 100,000—1dB.

★ Load—3, 4, 8 or 16 ohms.

★ Distortion—better than ·1% at 1KHz.

★ Signal to noise ratio 80dB.

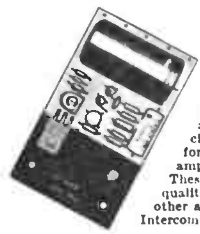
ONLY £3.58p each

★ Supply voltage 10-35 Volts.

★ Overall size 63mm × 105mm × 13mm.

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

STABILISED POWER MODULE SPM80



AP80 is especially designed to power 2 of the AL50 Amplifiers, up to 15 watt (r.m.s.) per channel simultaneously. This module embodies the latest components and circuit techniques incorporating complete short circuit protection. With the addition of the Mains Transformer MT80, the unit will provide outputs of up to 1·5 amps at 35 volts. Size: 63mm × 105mm × 30mm.
These units enable you to build Audio Systems of the highest quality at a hitherto unobtainable price. Also ideal for many other applications including:—Disco Systems, Public Address, Intercom Units, etc. Handbook available, 10p **PRICE £3·25**

TRANSFORMER BMT80 £2·14½ p. & p. 27½p.

STEREO PRE-AMPLIFIER TYPE PA100

Built to a specification and NOT a price, and yet still the greatest value on the market, the PA100 stereo pre-amplifier has been conceived from the latest circuit techniques. Designed for use with the AL50 power amplifier system, this quality made unit incorporates no less than eight silicon planar transistors, two of these are specially selected low noise NPN devices for use in the input stages.
Three switched stereo inputs, and rumble and scratch filters are features of the PA100, which also has a STEREO/MONO switch, volume, balance and continuously variable bass and treble controls.

SPECIFICATION

Frequency Response	20Hz – 20KHz ± 1dB
Harmonic Distortion	better than 0·1%
Inputs: 1. Tape Head	1·25 mV into 50K Ω
2. Radio, Tuner	35 mV into 50K Ω
3. Magnetic P.U.	1·5 mV into 50K Ω

All input voltages are for an output of 250mV. Tape and P.U. inputs equalised to RIAA curve within ± 1dB. from 20Hz to 20KHz.

Bass Control	± 15dB at 20Hz
Treble Control	± 15dB at 20KHz
Filters: Rumble (High Pass)	100Hz
Scratch (Low Pass)	8KHz
Signal/Noise Ratio	better than – 65dB
Input overload	+ 26dB
Supply	+ 35 volts at 20mA
Dimensions	292mm × 82mm × 35mm

ONLY £13·14½

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

All prices quoted in new pence Giro No 388 7006
Please send all orders direct to warehouse and despatch department

BI-PAK

P.O. BOX 6, WARE · HERTS

Postage and packing add 10p. Overseas add extra for airmail.
Minimum order 50p. Cash with order please.
Guaranteed Satisfaction or Money Back

DISCOUNTS UP TO 60%

Global's GOLDEN Guarantee

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

GARRARD SP25 Mk III Special Purchase. £17·45
Limited number available
Garrard SP25 Mk. III
Goldring G800
Teak plinth and tinted cover
All leads supplied.
Please add £1·25 P. & P. & Ins.

TURNTABLES

Please add 75p P. & P. & Ins.

Connoisseur BD1 Chassis	£12·75
Garrard SP25 Mk. III	£9·90
Garrard AP76	£17·20
Garrard SL65B	£13·95
Garrard 401	£28·75
Garrard Zero 100 (Auto)	£36·90
Garrard Zero 100 (Single)	£35·80
BSR MP60	£9·40
Goldring GL72	£20·90
Goldring GL72/P	£27·45
Goldring GL75	£26·85
Goldring GL75/P	£34·95
Goldring 101/P.C.	£20·00
Wharfedale Linton + cart.	£25·90
Thorens TD125AB Mk. II.	£27·95
Thorens TD150 Mk. II	£91·45
Thorens TD160 AB & C	£53·95

TUNERS

Please add 85p P. & P. & Ins.

Amstrad Multiplex 3000	£28·75
Armstrong S23	£39·50
Armstrong S24	£31·45
Rogers R/brook FET4 (Chassis)	£37·25
Rogers R/brook FET4 (Cased)	£43·50
Rogers R/bourne FET4 (Chassis)	£45·00
Rogers R/bourne FET4 (Cased)	£49·50
Sinclair PR060 (Module)	£17·45
Sinclair 2000/3000 Tuner	£29·90
Leak Delta FM (Cased)	£53·60
Leak Delta AM/FM (Cased)	£63·75
Alpha Highgate FT150	£37·95
Metrosound FMS 20	£38·70
Philips RH 690	£33·00

TUNER/AMPLIFIERS

Please add £1 P. & P. & Ins.

Alpha Highgate 150	£48·95
Armstrong 525 (Teak cased)	£69·45
Armstrong 526 AM/FM (Teak cased)	£77·25
Leak Delta 75	£119·00
Teleton 2100	£32·50
Goodmans One Ten	£98·90
Goodmans Mod 90	£87·95
Rotel 150	£49·50
Rotel 400	£75·50
Rogers Ravensbrook (Teak cased)	£77·00
Rogers R/brook (Chassis)	£72·00
Alpha FR 3000. New product	£72·00

AMPLIFIERS

Please add 85p P. & P. & Ins.

Amstrad 8000 Mk. II	£14·95
Amstrad IC2000	£27·50
Amstrad Integra 4000	£21·45
Armstrong 521 (Teak cased)	£43·90
Alpha Highgate 212	£24·85
Alpha Highgate FA300	£32·25
Alpha Highgate FA400	£35·65
Leak Delta 30	£44·85
Leak Delta 70	£54·90
Metrosound ST20E	£24·20
Metrosound ST60	£45·95
Pioneer SA600 & 610	£57·25
Pioneer SA500A	£31·95
Pioneer SA1000	£96·95
Rogers R/brook (Chassis)	£37·95
Rogers R/brook (Cased)	£41·50
Rogers R/bourne (Chassis)	£49·95
Rogers R/bourne (Cased)	£52·75
Sinclair PR060 2 X Z30/PZ5	£14·70
Sinclair PR060 2 X Z30/PZ6	£16·70
Sinclair PR060 2 X Z50/PZ8/ Trans	£22·95
Sinclair AFU (Filter Unit)	£4·20
Sinclair 60S	£18·25
Sinclair 2000 Mk. II	£21·50
Sinclair 3000 Mk. II	£28·00
Wharfedale Linton	£42·95
Teleton SAQ 307	£22·95
Rotel RA310	£34·95
Rotel RA610	£52·95

SPEAKERS

Please add £1·50 per pair P. & P. & Ins. Price per pair

Amstrad 138	£13·90
Wharfedale Denton 2	£29·50
Wharfedale Linton 2	£35·85
Wharfedale Melton 2	£45·90
Wharfedale Dovedale 3	£59·80
Celestion Ditton 120	£38·40
Celestion Ditton 15	£50·90
Celestion Ditton 25	£84·50
Celestion County (new prod.)	£34·50
Goodmans Double Maxim	£47·40
Goodmans Mezzo 3	£45·95
Goodmans Magister	£82·95

Special bulk purchase

£2·90

Plus 65p P. & P. & Ins.
Finished in teak veneer with tinted dust cover. (Fully assembled). For Garrard SP25; 2025TC; 3000; AT60; 2000; 2500; 3500; S100; 1025; SL65B; Also for BSR, McDonald MP60 and others. For AP76; AP75; SL72B; SL75; SL95B*. £4·20 + 65p. P. & P. & Ins. Also finished in walnut to match Japanese equipment—at no extra.

CARTRIDGES
Please add 10p P. & P. & Ins.

Goldring G850	£3·35
Goldring G800	£4·70
Goldring G800E	£7·50
Goldring G800 Super E	£14·15
Shure M3D	£3·70
Shure M44E	£4·75
Shure M55E	£5·55
Ortofon SL15	£15·85
Sonotone 9TAHC	£1·35

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

GLOBAL AUDIO DISCOUNT WAREHOUSES

Dept (PW5) 174 Pentonville Road, London, N1. Telephone 01-278 1769
Or: 4 High View Parade, Redbridge Lane East, Woodford Avenue, Ilford, Essex. Tel: 01-550 1086.

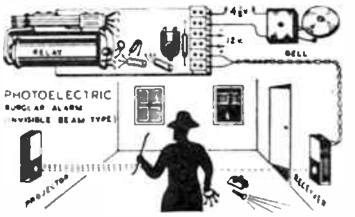
Open Monday to Saturday 9.30 a.m. to 6 p.m. LATE NIGHT FRIDAY 7 p.m.

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

2 minutes from KING'S CROSS, EUSTON & ST. PANCRAS on main road leading to the East and West Country

PHOTOELECTRIC KIT

CONTENTS. P.C. Chassis Board, Chemicals, Etching Manual, Infra-Red Photo-transistor, Latching Relay, 2 Transistors, Diode, Resistors, Gain Control, Terminal Block, Elegant Case, Screws, etc. In fact everything you need to build a Steady-Light Photo-Switch/Counter/Burglar Alarm, etc. (Project No. 1) which can be modified for modulated-light operation with a few additional components.



PHOTOELECTRIC KIT £2·85

Postage and Pack. 15p (U.K.)
Commonwealth
SURFACE MAIL 25p
AIR MAIL £1·40

Australia, New Zealand, S. Africa, Canada and U.S.A. Also Essential Data Circuits and Plans for Building 10 advanced Designs

INVISIBLE BEAM OPTICAL KIT
Everything needed (except plywood) for building: 1 Invisible-Beam Projector and 1 Photocell Receiver (as illustrated). Suitable for all Photoelectric Burglar Alarms, Counters, Door Openers, etc.
CONTENTS: 2 lenses, 2 mirrors, 2 45-degree wooden blocks, Infra-red filter, projector lamp holder, screws, nails, brackets, building plans, etc. Price £1·45. Postage and Pack. 10p (U.K.). Commonwealth: Surface Mail 20p. Air Mail 50p.

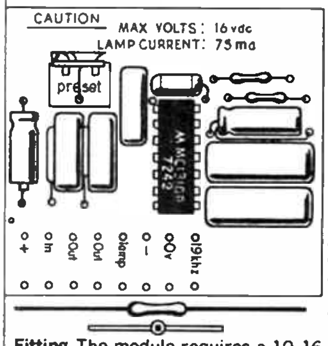
LONG RANGE INVISIBLE BEAM OPTICAL KIT
CONTENTS: As above. Twice the range of standard kit. Large Lenses, Filter, etc. Price £2·10. Postage 15p (U.K.) Commonwealth: Surface 20p. Air Mail £1·15.

BIOFEEDBACK AMPLIFIER KIT
Tunable, General-Purpose. Interference-Rejecting Differential Amplifier for experimental investigation of signals produced by the brain, heart and muscles. When used with an oscilloscope, or aural indicator, it enables you to monitor your brain-waves, learn to relax, meditate, etc.
CONTENTS: All Capacitors, Resistors, Pots, Semiconductors, I.C., Electrodes, Leads, Chassis, Case, Batteries, Plans and Instructions. Price £4·75 postage and pack. 25p (U.K.). Commonwealth: Surface 30p. Air Mail £1.

ALPHA-BETHA-THETA BRAINWAVE MONITOR KIT
Aural Brainwave Indicator for use with a Biofeedback Amplifier. Converts subsonic brain frequencies into audible signals for easy recognition.
CONTENTS: Resistors, Pots, Capacitors, Transistors, Diodes, Leads, Chassis, Case, Earphone, Battery, Plans and Instructions. Price £3·25, postage and pack. 15p (U.K.) Commonwealth: Surface 25p. Air Mail 75p.

YORK ELECTRICS Mail Order Dept.
335 BATTERSEA PARK ROAD, LONDON, S.W.11
Send S.A.E. for full details, a brief description of all Kits and Projects.

Stereo radio from your existing tuner.



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

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

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

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

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

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

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

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

To Jermyn Industries
83 Vestry Estate
Sevenoaks
Kent

Please rush me ☐ Kit(s), ☐ made up Stereo decoders.
I enclose cheque/postal order for £
Name
Address

Block Capitals Please

UNISOUND FOR THE NEW SOUND

AT **£26·12** INC. VAT

It's the RT-VC system that screws together to save you pounds! Unisound comprises two superb speakers and an amplifier/record deck plinth—all beautifully finished in simulated teak. The stereo amplifier (4 watts per channel into 8 ohms) is based on the famous Mullard Unilex system brought up-to-date by RTVC using intergrated circuits. Turntable is the proven Garrard 2025TC complete with stereo cartridge and tinted acrylic cover. Speakers are big EMI Twin-cone units all ready for mounting in their elegant cabinets, which simply need screwing and glueing together. Easy step-by-step instructions. £26·12 **complete plus £1·40 packing + £1·40 post.** Diamond Stylus £1·25 extra. Stereo headphones with adaptor £4 extra. Send for leaflet.

AN RTVC EXCLUSIVE DESIGN

UNISOUND MODULES ONLY £6·95 + 50p. p. & p.
For the man who wants to design his own stereo—here's your chance to start, with Unisound—pre-amp, power amplifier and control panel. No soldering—just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic power chips which ensure very low distortion at all power levels over the audio spectrum.

RTVC No price in

If you can solder on printed circuit board, you can build this push-button car radio kit. It's simple—just follow the step-by-step instructions.

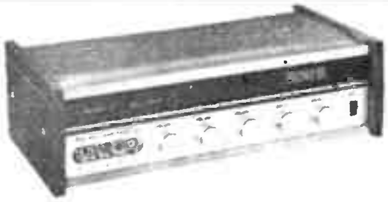
THE TOURIST PB CAR RADIO KIT
AN INCREDIBLE BUY
ONLY FROM RTVC

£7·70 inc. vat

The Tourist PB is suitable for 12 volt working on both negative and positive earth vehicles. It covers the full medium and long wave bands. It is permeability tuned and sturdily constructed. Output is a full 2·5 watts into an 8ohms speaker. But the Tourist PB will operate into any loudspeaker from 8 to 15 ohms.
Apart from the output stage, which is an intergrated circuit, the only other electronic components that need soldering are some capacitors, resistors, etc. The kit includes a pre-built RF tuner unit, and fully modulised IF stages which are pre-aligned before despatch. As well as electronic components this kit also contains 2 diamond-spun aluminium knobs, elegant matching front panel, dial, washers, screws and wire.
The Tourist PB can be mounted in any standard size dash panel and it has an illuminated tuning scale. Chassis size is: 7" wide, 2" high and 4 1/2" deep.

* Circuit diagram and comprehensive instructions 50p free with parts.
* Fully retractable lockable car aerial £1·25 post paid.

PRICE ONLY £7·70 p. and p. 55p
Speaker with baffle and fixing strips £1·50. 25 p. & p., post free if bought with the kit. Send for leaflet.



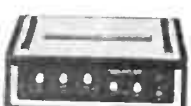
RELIANT MkIV

A GOOD QUALITY AMPLIFIER—12 Watts £10·50 (inc. VAT). 20 Watts £13·50 (inc. VAT)
*5 Electrically Mixed inputs. *3 Individual Mixing controls. *Separate bass and treble controls common to all 5 inputs. *Mixer employing F.E.T. (Field Effect Transistors). *Solid State Circuitry. *Attractive Styling INPUTS 1. Crystal Mic or Guitar 9mV. 2. Moving coil Mic. or Guitar 8mV Inputs. 3, 4 & 5 are suitable for a wide range of medium output equipment (Gram. Tuner, Monitor, Organ, etc.) All 250mV sensitivity.
Size approx. 12 1/2 x 6 x 3 1/2 ins.

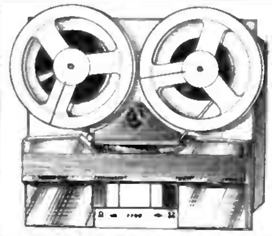
12W 3 ohms only version £10·50 plus 60p p & p
20W 8-15 ohms version £13·50

SOUND 50

50 WATT AMPLIFIER. Output Power: 45 watts R.M.S. (Sine Wave) Frequency Response 3dB points 30Hz and 18KHz. Total Distortion: less than 2% at rated output. Signal to noise ratio: better than 60dB. Bass Control Range: 13dB at 60Hz. Treble Control Range: 12dB at 10KHz. Inputs: 4 inputs at 5mV into 470K. Each pair of inputs conrotlled by separate volume control. 2 inputs at 200mV into 470K. Size: 19 1/4 x 10 1/2 x 8ins. Amplifier £31·35 plus £1·50 p. and p.



£31·35 (inc. VAT)



PE TAPE LINK CONSTRUCTORS
Suitable 3 speed tape deck, less heads. Caters up to 7ins. spools. Unused but store soiled hence no warranty.
£8 plus £1 p & p

* Denotes VAT has been absorbed in the price without increase on VISCOUNT audio systems.

crease* with VAT!

PRICES: SYSTEM 1

Viscount III R 101 amplifier	£24·20 + £1 p & p
2 Duo Type II speakers	£15·40 + £2·20 p & p
Garrard SP25 Mk.III with MAG. cartridge plinth & cover	£25·00 + £1·75 p & p
total	£64·60

Available complete for only **£52*** + £3·50 p. & p.

PRICES: SYSTEM 2

Vicount R 101 amplifier	£24·20 + £1 p & p
2 Duo Type III speakers	£35·20 + £3·30 p & p
Garrard SP25 Mk. III with MAG. cartridge plinth & cover	£25·00 + £1·75 p & p
total	£84·40

Available complete for **£69*** + £4 p. & p.

VISCOUNT III AUDIO STILL ONLY £52* COMPLETE

14 + 14w. r.m.s. 40Hz to 40kHz ± 3dB. Total distortion at 10w. at 1kHz - 0·1%. This is real value for money! We have designed 2 systems and the heart of them both is the Viscount III amplifier. A unit of great eye appeal with teak finished cabinet. FET's (Field effect, transistors) are incorporated on the input stages, just like top priced units. FET's give you more of the signal you want and almost none of the hiss you don't. Both units have output sockets for headphones and tape recorder.

For both systems we have chosen the famous Garrard SP25 Mk. III deck, with fitted magnetic cartridge, which comes complete with simulated teak plinth and tinted acrylic cover.

The exclusive Duo loudspeaker systems are incomparable for quality within their price range. Large speakers in extremely substantial cabinets. There's a choice of the Duo II's for the smaller room or the big Duo III's for real bass response.

SPEAKERS: Duo Type II Size approx. 17in. × 10½in. × 6½in. Drive unit 13in. × 8in. with parasitic tweeter. Max. power 10 watts ohms. Simulated Teak cabinet. £15·40 a pair (inc. VAT), £3·30 p. and p. Duo Type III Size approx. 23½in. × 11½in. × 9½in. Drive unit 13½in. 8½in. with H.F. speaker. Max. power 20 watts, 8 ohms. Freq. range 20Hz to 20KHz. Teak veneer cabinet.
SPECIFICATION R101: 14 watts per channel into 3 to 4 ohms (suitable 3–15 ohms.) Total distortion @ 10W 1kHz @ 0·1%. P.U.1 (for ceramic cartridges) 150mV into 3 Meg. P.U.2 (for magnetic cartridges) 4mV @ 1kHz into 47K equalised within idB R.I.A.A. *Radio* 150mV into 220K. (Sensitivities given at full power). Tape out facilities: headphone socket, power out 250mW per channel. Signal-to-noise ratio: (all controls at max.)—P.U.I. and radio — 65dB, P.U.2 — 58dB. Cross talk better than — 35dB on all inputs. Size approx. 13½in. × 9in. × 3½in. Send S.A.E. for fully illustrated brochure. 12 month's written guarantee.

ONLY FROM US

TIMES OF OPENING: Acton—Mon.-Sat. 9.30–5. Closed all day Wed.
Edgware Rd.—Mon.-Sat. 9.30–5. Closed all day Thurs.

VISIT OUR SHOWROOMS

RTVC

Radio and TV Components (Acton) Ltd.
21c High Street, Acton, London W3 6NG
323 Edgware Road, London W2
Mail orders to Acton. Terms C.W.O.
Goods not despatched outside U.K.
All enquiries S.A.E.

SUPPORT SERVICE

WHY did you buy this copy of *Practical Wireless?* Were you influenced by advanced publicity or advertising; are you a regular reader with a devotion to follow our activities month by month; or are you one of many thousands who pick up this magazine to seek guidance on what makes radio and electronics tick? It has been said that people read *Practical Wireless* to learn something about the subject. After all, it is a technical field that demands some education and understanding and it is really this aspect that makes most people read.

To supplement professional career requirements there is a growing band of people who are bank clerks, clergymen, accountants, businessmen, as well as students and technicians who are seeking part time courses on the practical side of radio and electronics. Some colleges are able to offer facilities, subject to minimum class size, but we have heard of cases where they cannot find enough qualified engineers who are willing to spend extra time in the evenings to instruct these students. It is a pity because it often means that a course has to be dropped because of this.

So we come back to magazines; *Practical Wireless* is used in schools and colleges to a great extent because it provides an excellent support service to instructors, many of whom cannot always find sufficient time in addition to their everyday jobs to make full preparation for classes. *Practical Wireless* is a leader because its articles and designs are "down-to-earth" and, in spite of competition from elsewhere, we still offer the greatest constructional project support to instructors, technicians and engineers, while encouraging the confidence of newcomers.

This month we have rubber-stamped this policy by giving you for the first time a unique supplement containing eight extra straightforward constructional projects for the home, attractively presented with abundant illustrations and a full colour cover picture. To make it easier for you to find this supplement and worthwhile to keep for reference, we have printed it on a pleasant shade of "apple-green" coloured paper—another first for *Practical Wireless.*

Don't let this divert your curiosity too far from our other usual features because you will also find much more to interest you in this issue. For the benefit of quick and easy reference you will also find our contents list just inside the front cover, together with information on many aspects of our service. And watch out for next month's issue too for more special attractions, some of which are mentioned in this issue.

M. A. COLWELL—*Editor*

The June issue, on sale May 4th, will include a new easy competition to win a Digital Multimeter, a special feature on what to look for when buying Hi-Fi Equipment, and "Special Valves in Electronics", plus the usual abundance of constructional projects.

Further details on page 48.

NEWS...

B.R.C. change their name

BRITISH Radio Corporation Limited announced on the 1st April that it has changed its name to Thorn Consumer Electronics Limited. It continues to manufacture and market audio and TV products under the Ferguson, HMV, Ultra and Marconiphone brands and remains a wholly-owned subsidiary of Thorn Electrical Industries Ltd.

VAT

To the best of our knowledge, the prices quoted in this issue were correct at the time of going to press.

As from April 1st, 1973, there is no purchase tax but a large number of goods carry Value Added Tax.

The "N.F.A.C."

THE National Federation of Aerial Contractors Limited is making an attempt to "clean up" the aerial contracting industry.

The Ministry of Posts and Telecommunications listed 55,000 complaints of bad reception in their recent annual report. Out of 32 listed causes of complaints, the largest numbers were for "inefficient aerial installations" and the N.F.A.C. feels that it can help this state of affairs by alerting the consumer and all who employ aerial contractors that there are in existence a very large number of "Rooftop Racketeers".

Plans currently being considered by the Federation include random inspections of members' installations and a system whereby new companies applying for membership will have their work inspected in addition to the trade references that are already required. A special Standards Committee will hear reports of faulty workmanship.

By this system, the N.F.A.C. hopes to assist in narrowing the field of consumer complaints and possibly convince dealers that they mean to play their part in cleaning up the aerial contracting industry.

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

Mullard film on I.C. design

MULLARD Ltd. have announced a new 16mm colour film lasting 18 minutes. It's called *The Computer-Aided Design of Integrated Circuits* and is available on free loan from the Mullard Film Library, 269 Kingston Road, Merton Park, London, SW19 3NR.

The film, which was shot mainly on location at the Mullard semiconductor plant at Southampton, describes in detail the use of the computer and its peripheral equipment in such functions as IC design and layout, mask-making and testing at every stage of production.

Tandberg in the jungle

SERGEANT J. Murtagh of the Royal Signals is seen in the picture using a Tandberg Series 11 portable tape recorder. This machine and a TP4-1 portable radio accompanied a recent British Trans-Americas expedition which took in 18,000 gruelling miles from Alaska to the tip of South America. The purpose of the journey was to survey a road through the uncrossed 300 miles of swamp and jungle bordering the Panama canal which blocks the Pan American highway system.

During the trip, the expedition kept in touch with the outside world with the TP4-1 receiver, picking up BBC news broadcasts and weather reports.

In the jungle and swamps, the electrical equipment was carried in man-packs or by ponies and although it was partially immersed in water, rolled on several times by the ponies and carried through thick mud, it continued to function without a fault.

Sgt. Murtagh of the Royal Signals.

Signals "piped" through waveguide

THE core of a system which, when fully implemented, will transmit 300,000 phone conversations or 200 colour TV signals at the same time through a waveguide "pipe" is now operating at the GEC-Marconi works at Great Baddow.

This equipment will be used by Post Office engineers in a field trial system to be installed between the Post Office Research Station at Martlesham, Suffolk and a Post Office site at Wickham Market, 15 kilometres away.

The new "pipe" is a 50mm diameter circular waveguide capable of supporting signals throughout the frequency band from about 32 to 110GHz. The photograph shows 32-50GHz channel separating filters and band-branching assembly.

Texan reprints

REPRINTS of the "Texan" 20+20W Stereo Amplifier are available.

They may be obtained by sending 35p (30p+5p) postage/packing to "Texan" Reprint, c/o *Chief Cashier, Practical Wireless Tower House, Southampton Street, London WC2E 9QX.*

World Radio Club

FURTHER to the item on the World Radio Club in the March issue, we have been informed by the programme Producer that an extra broadcast in the BBC World Service will be made each week at 20.30 GMT on Thursdays.

The midday edition has now been moved to 13·30 GMT on Wednesdays. The other Friday and Sunday transmissions remain unaltered. *BBC, Bush House, P.O. Box 76, Strand, London WC2B 4PH.*

Some S.E.R.T. meetings

THE Society of Electronic and Radio Technicians, Faraday House, 8-10 Charing Cross Road, London, W.C.2. will be holding the following meetings:

April 11: "Test Equipment" by B. Ellison from Tektronix. Venue is The Conference Theatre, I.B.A., 70 Brompton Road, London, S.W.3 and the lecture commences at 7·00 p.m.

April 5: "Colour TV Forum and Exhibition". This will be held in the Byng Kendrick Suite, University of Aston, Birmingham, commencing at 7.00 p.m.

April 24: "The CVC5 Colour Receiver" by A. E. Thomas from ITT. This will be held in the Cleveland Scientific Institution, Corporation Road, Middlesborough. Meeting starts at 7.30 p.m.

VHF Regen Receiver

R.H.LONGDEN

THIS is a self-contained receiver which may be used over the range 115-150MHz, or 140-190MHz, according to the coil fitted. It was actually found to maintain good efficiency even up to 210MHz. A vertical telescopic aerial or improved aerial system will provide reception on the internal speaker, an outlet being present for headphones when required. An optional preamplifier is also described.

The receiver has a superregenerative detector, which is a great advantage from the point of view of simplicity. This type of detector is highly sensitive, and it should be possible to copy a signal of under 1μV. There is also only one tuned circuit, so no alignment or ganging difficulties arise. The bands include the 2-metre amateur band (144-146MHz). In terms of sensitivity, most signals which can be well received with the simpler type of converter-communications receiver combination can also be received satisfactorily with this receiver.

A disadvantage sometimes encountered with this type of receiver is tricky tuning and hand-capacity effects. These do not arise here, due to sound construction and a metal case and so actual use of the receiver is easy.

Circuit Details

Fig. 1 is the circuit, employing a junction f.e.t. in the first stage. The rod or other aerial is coupled by L1, and L2 is tuned by VC1. The network R2, C4, R3 and C5 gives a suitable quench frequency and regeneration is controlled by VR1. To modify the tuning range, L2 only need be changed.

A three-stage audio amplifier assembled on a separate circuit board follows. Tr2 is the first audio amplifier, Tr3 the driver, and Tr4/5 the output pair, operating a small speaker in the case. The outlet takes a jack plug for an external speaker or phones, if wanted, and VR2 is the volume or audio gain control. R12 is a small pre-set potentiometer, which allows working conditions for the output pair to be suitably adjusted.

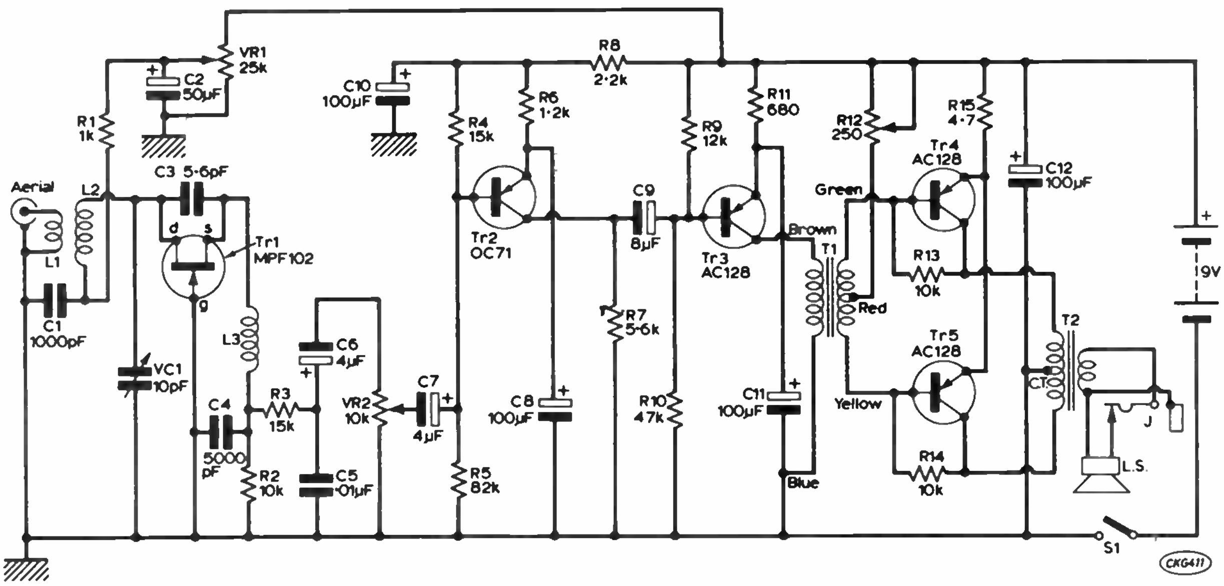


Fig. 1 : Circuit of the main receiver. The circuit of the pre-amplifier is shown in Fig. 4. The heading photograph shows the two units bolted together.

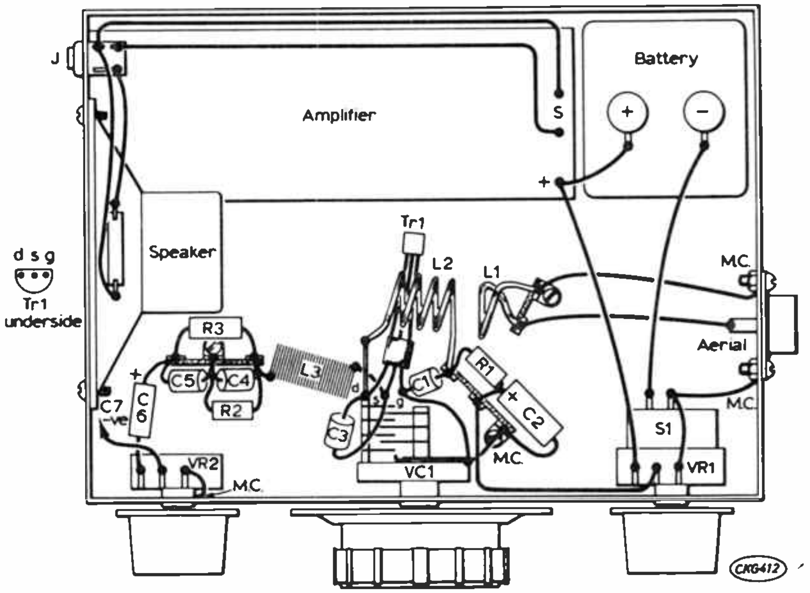
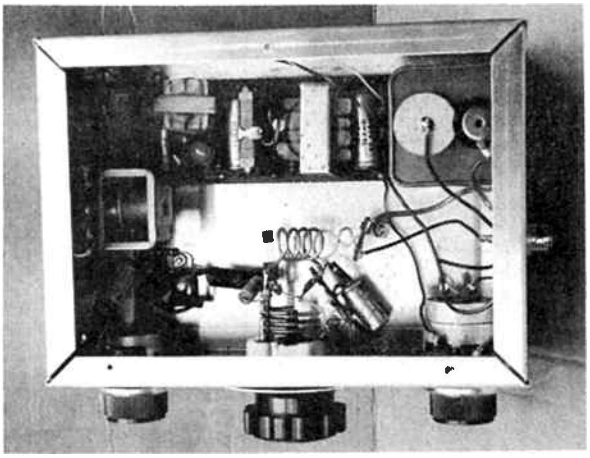


Fig. 2: Layout of the main components and audio amplifier board within the cabinet. When the preamplifier is fitted the coaxial aerial socket is removed and used on the preamplifier box.

Photograph looking into the top of the receiver which may help when locating components as in Fig. 2 above.



Cabinet Construction

Flanged universal chassis members 7 x 3in form the front and back, and similar parts 5 x 3in are the sides. The top and bottom are 7 x 5in flat plates.

The front member is drilled for VC1, VR1 and VR2, as in Fig. 2. Also punch or drill holes for a co-axial socket on the right hand side, or for an insulated terminal or socket, if a co-axial feeder is not required here.

An opening is cut in the left member for the speaker, taking care that this will clear the amplifier and other parts. Perforated zinc or expanded metal is placed over the aperture, and the speaker is bolted on. The jack outlet is placed as shown.

The four flanged members are then assembled by bolts through the holes present in them. Four holes are drilled in one 7 x 5in plate, these are marked through so that the flanges can be drilled to suit. The case bottom can then be attached. Two rubber feet were placed on the front bolts, to raise the front of the receiver slightly.

It is easier to assemble the receiver if the sides and back are left off until later. When all construction is finished, the top 7 x 5in flat plate is fixed with four self-tapping screws.

Detector Stage

This is wired as in Fig. 2. A 3-lead holder is used for Tr1. This avoids possible damage from heating while soldering, and also allows the transistor to be changed, if necessary. The MPF102 is listed as having a top frequency of 200MHz. Some were found to perform satisfactorily at well above this, but others, not up to specification, would only operate at relatively low frequencies.

The holder *drain* tag is soldered directly to the lower fixed plates pillar of VC1. The leads of C3 are cut short, and this item is soldered from the *source* tag, to the top pillar of VC1. A stout wire is also soldered to this pillar, projecting back about $\frac{1}{2}$in so that L2 can be changed without unsoldering other items.

A stout lead from the *gate* tag goes to the moving plates contact of VC1, just clearing the moving plates. The tag strip holding R1 and C2 is raised on a long bolt, so that wires from C1 are as short as possible. A wire projects upwards about $\frac{1}{2}$in to take the other end of L2.

L1 is a single turn of insulated wire. Coupling can be adjusted by rotating this small tag strip slightly on its fixing bolt, but it is not very critical.

L3 is self-supporting, and is 30 turns of 26swg enamelled wire, wound on a $\frac{1}{4}$in diameter object which is afterwards removed. Turns are closewound. One end is soldered to the tag supporting R2, C4 and R3, and the other end is soldered to the source tag of Tr1 holder.

The potentiometers and other parts can then be wired as in Fig. 2. A lead will run from VR2 under the speaker to the input pin of the audio amplifier.

Audio Amplifier

This is assembled on Veroboard 5 x $1\frac{3}{4}$in, as in Fig. 3. First drill two holes for the chassis bolts, position the board in the case, and mark and drill matching holes in the metal bottom. Tags held with the bolts form earthing points, Fig. 3. The bolts are $\frac{1}{2}$in long, so that extra nuts hold the assembly clear of the metal case, lock-nuts underneath securing the amplifier. A piece of card 5 x $1\frac{3}{4}$in may be put between the amplifier and case bottom, though shorts to the metal will not arise if joints are kept close to the board.

Coils

These are self-supporting, wound with 18swg, 20-swg or other stout wire, with spaced turns. A coil having 4 turns, $\frac{1}{2}$in outside diameter, and $\frac{7}{8}$in long, was found to tune 115-150MHz. This is suitable for 2 metre reception.

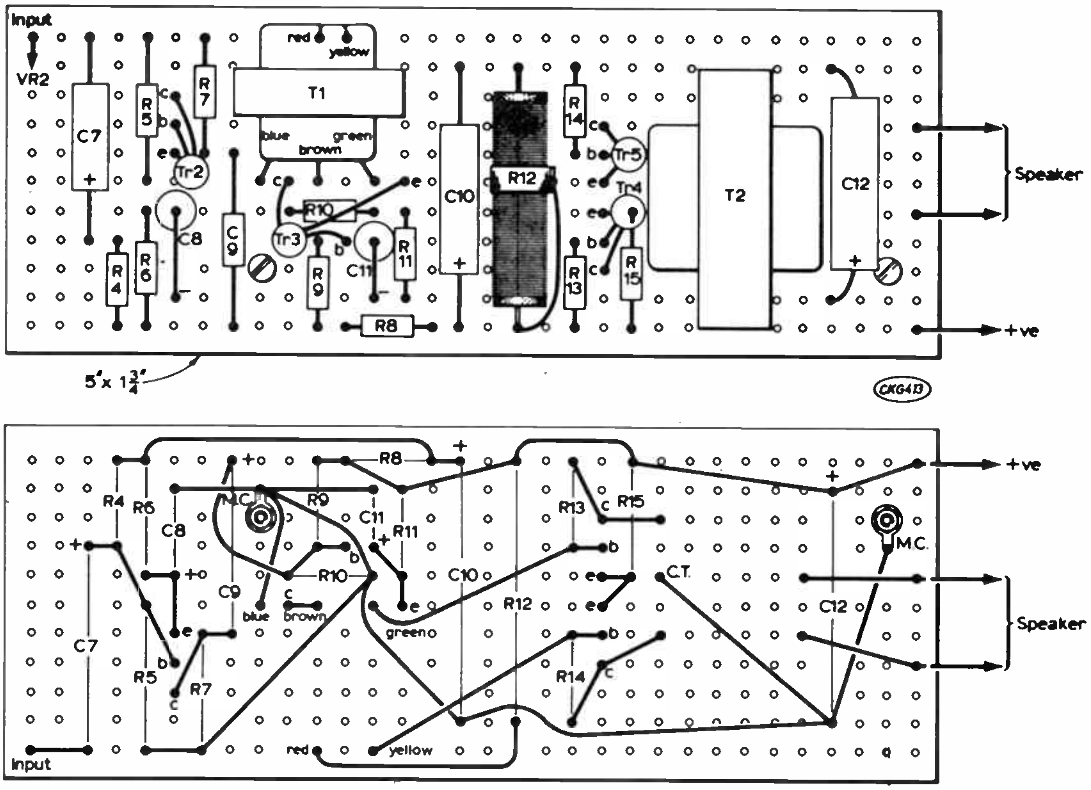


Fig. 3: Diagrams of the component layout and wiring of the audio amplifier board.

Take care to fit the electrolytic capacitors as indicated. With a unit of this kind, it is helpful to place black 1mm sleeving on the negative line leads, and red sleeving on positive leads. With another colour for other wiring, it will be easy to check connections if this should prove necessary.

The amplifier may be tested before fixing it. Place the slider of R12 at about the central position. Connect the speaker and a 9V battery, negative to one of the chassis tags. Either place a meter in one battery lead and move the slider of R12 for a current of 10mA, or adjust R12 to place just enough resistance in circuit for speech to sound normal. If R12 is at a very low value, current drawn will be small but cross-over distortion will be present.

For this test, input can be from any convenient source; a signal generator, diode tuner, pick-up, or from the first stage of the completed receiver. If VR2 is not in circuit, avoid overloading the amplifier by the test signal.

The amplifier is fitted as shown, negative return being through the metal case. Connect the speaker leads and amplifier to the jack so that the contacts which open silence the speaker, when phones or an external speaker are in use.

A coil $\frac{1}{2}$in long and $\frac{7}{16}$in in diameter, having three turns, tuned 192-150MHz, while a similar coil having two turns allowed 216MHz to be reached.

Stray circuit capacitances and the length of connecting leads influence the frequencies tuned. The frequency can be raised by reducing the number of turns, or by stretching the coil to separate turns, or by reducing the overall diameter.

Operating notes

When VR1 is advanced, a position should be found where a strong hiss begins. This is roughly the correct setting for VR1, though it will be found that further slight adjustment may be helpful, depending on the strength of the signal tuned in.

The hiss should cease when any signal of sufficient strength is tuned in, provided VR1 has not been turned too far. VR2 adjusts volume in the usual way, and can probably be advanced about half way, for the internal speaker.

If superregeneration is impossible on some part of the band, move L1 a little further from L12. This

★ components list

Resistors

R1	1kΩ	R9	12kΩ
R2	10kΩ	R10	47kΩ
R3	15kΩ	R11	680Ω
R4	15kΩ	R12	250Ω miniature slide pot.
R5	82kΩ	R13	10kΩ
R6	1·2kΩ	R14	10kΩ
R7	5·6kΩ	R15	4·7Ω All ¼W, 5%
R8	2·2kΩ		

VR1 25kΩ linear pot. with switch
VR2 10kΩ log. pot.

Capacitors

C1	1000pF disc ceramic	C7	4µF 4V
C2	50µF 10V	C8	100µF 10V
C3	5·6pF	C9	8µF 6V
C4	5000pF	C10	100µF 10V
C5	0·01µF	C11	100µF 10V
C6	4µF 4V	C12	100µF 10V

VC1 10pF variable Jackson C804

Transistors

Tr1	MPF102	Tr3	AC128
Tr2	OC71	Tr4/5	2xAC128

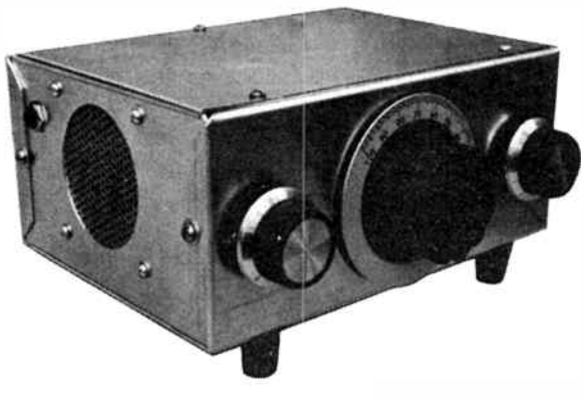
Miscellaneous

Case: Two 5x3in. and two 7x3in. flanged universal chassis members, and two 5x7in. flat plates (Home Radio, Mitcham); KN2 2¾in. dial and knob (Home Radio); Two 1in. knobs; tag strips, etc.; T1 Osmor driver transformer; T2 Output transformer, 2xAC128 type to 2/3 ohms; 2½in. 3Ω speaker; Jack socket with break contacts; 3-lead transistor holder, co-axial socket.

is not critical, but tight coupling will tend to prevent regeneration, while very loose coupling will reduce signal strength.

Aerials

There is room for considerable experiment here. Some local transmissions (range about 10 miles) were received with about 6in of wire projecting from the socket, which shows how sensitive this type of circuit can be.



This view of the receiver shows the positioning of the internal loudspeaker and the socket for an external loudspeaker or headphones.

With a telescopic aerial extending to three feet, a considerable number of transmissions were received, including amateurs over 50 miles away. This aerial performed poorly with the receiver and aerial near a metal window, but was better in the centre of a downstairs room, and even better in an upstairs room. Reducing the length to about two feet made almost no difference, and sliding the sections up and down did not give any notably best or critical resonant length.

Best results of all on 2 metres were obtained with a dipole made from ¼in aluminium tubing, 38½in overall, with a centre co-axial feeder. This aerial was mounted out of doors on a light pole. A long or lossy feeder would tend to lose much of the advantage such an aerial can give.

The angle and slope (polarisation) of all these aerials had some influence on results. No doubt an improved VHF aerial would increase signal strength, but some means of rotating it would be needed, and this was not felt justified.

Pre-amplifier

The receiver has high sensitivity, but in some circumstances there are advantages to be obtained by adding an r.f. stage. This stage will materially reduce radiation from the superregenerative detector, and also help isolate the aerial to avoid dead spot or damping effects on some frequencies. In fact, these are the most important advantages, and much gain must not be expected from the r.f. stage at frequencies over 150MHz or so.

Fig. 4 is the circuit, the f.e.t. being used in a grounded-gate arrangement which does not need neutralising. L1 is peaked by the small capacitor VC1. Tuning is flat, and needs no adjustment over a small band.

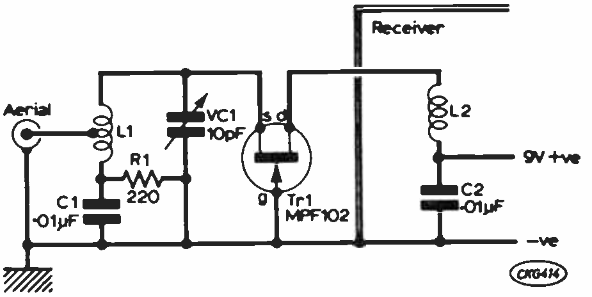


Fig. 4: Circuit of the pre-amplifier and connections to the input circuit of the main receiver.

The f.e.t. drain circuit is to the coupling loop L2, which was originally used for aerial coupling in the receiver. Alternatively, a broadly resonant winding can be used here, resulting in better gain over a narrow band of frequencies.

Cabinet

The box is 3 x 2 x 2in and is bolted on the metal side of the receiver case. It is made from a flat piece of aluminium 7 x 2in and one 7 x 3in flanged "universal chassis" member.

The long flanges are cut 2in from each end, a 90° piece being removed. A piece of wood about

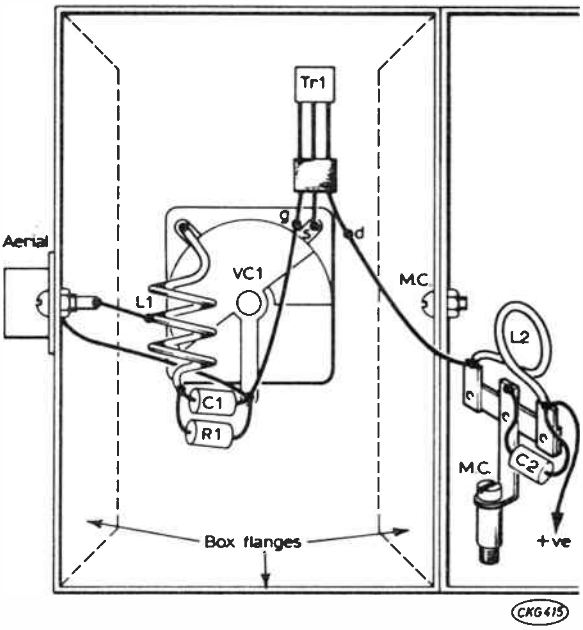


Fig. 5: Positioning of the few components within the preamplifier box.

3 x 2in and ½in or so thick is then placed between the flanges, and another piece of wood is placed level with this, and the whole gripped tightly in a vice. The 7 x 3in member is then bent into a 3 x 2 x 2in box, with the flanges inwards. Fig. 5 shows this part from behind. The front is drilled for VC1, and one side for the co-axial or other aerial socket. Three holes are also drilled in the other side, to match up with the holes which are exposed when the co-axial socket is removed from the receiver.

The 7 x 2in piece is bent at 2in from each end, in the same manner, so will fit on to enclose the box. It is held with a number of self-tapping screws.

Pre-amplifier Wiring

The transistor holder (or transistor) is soldered directly to VC1, as in Fig. 5. All leads are as short as possible.

L1 is wound with 18 or 20swg copper wire, and is similar to the coil in the receiver, but will generally have to be stretched somewhat, or have about one less turn. If maximum volume is with VC1 fully open, this shows that L1 should be changed, by removing a turn, spacing turns further apart, or winding a new coil of smaller diameter.

The position of the aerial tapping depends somewhat on the use of a co-axial fed dipole or similar aerial, or a short vertical rod type aerial. This tapping can usually be about one-quarter to one-third the total number of turns from the C1 (earthed) end.

Two bolts fix the r.f. stage to the side of the receiver, and a lead from Tr1 drain passes through the original aerial socket hole to L2.

★ components list

R1 220Ω ¼W, 5%
C1 0·01μF
C2 0·01μF
VC1 10pF or similar miniature variable, or pre-set.
Tr1 MPF102 Holder optional

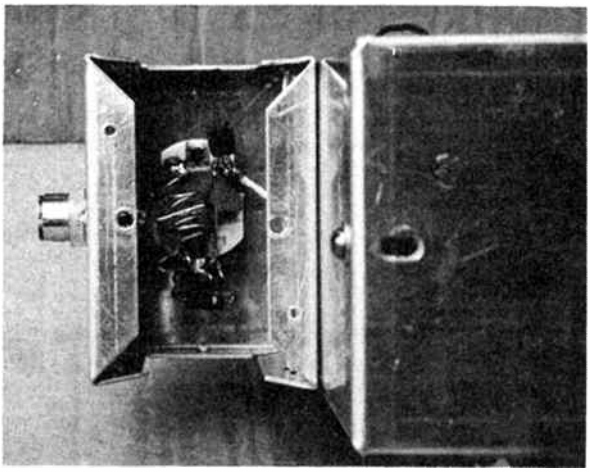
Universal Chassis flanged side 7x3in. (Home Radio)
Aluminium 7x2in.
Knob, tag-strip, etc.

The components listed above for the pre-amplifier are additional to those required for the main receiver.

Receiver Changes

The tag strip holding L2 is replaced by one having two insulated tags. A lead from one tag is run to a positive pin on the a.f. amplifier and C2 is connected from this tag to the chassis tag, as in Fig. 5. The drain lead is taken to the other tag.

L2 is one turn of insulated wire, positioned near the detector coil. Coupling is adjusted for best regeneration, by bending the loop L2 to adjust the distance to the detector coil, as with the original circuit.



Rear view of the completed pre-amplifier bolted to the receiver.

It was found that results were better with coupling in one phase. To check for this, twist L2 180°, to change its sense with relation to the detector coil.

As mentioned, L2 can be resonant over a narrow band. This increases gain, but makes it a little more troublesome to change coils or cover a wide band of frequencies. If this method is to be tried, wind L2 with one or two extra turns, compared with the detector coil, using insulated wire to avoid shorts. It is then necessary to stretch or compress L2, or change the number of turns, until it is found to peak up signals in the wanted frequency range. The resonant effect is quite flat, but these adjustments, and the degree of coupling with the detector coil, and position of the aerial tapping, can make quite a difference to reception. ■

Because superregenerative receivers are notorious for their radiation it is strongly recommended that the pre-amplifier be fitted as an essential part of the receiver. Complete screening, as described by the author, is very important.

SPECIAL PRODUCT REPORT

FETRONS ...

FETRONS

THE field effect transistor (FET) is currently being used in the front end of a.f. and r.f. circuits, as well as being developed into simplified forms of logic circuitry for micro-miniature applications such as wrist watches and pocket calculators. Aside from the manufacturers of such luxury items, our attention is turned here to more domestic matters such as television receivers, radio transmitters and receivers. Where thermionic valves are still being used, there is some reluctance to effect a total conversion to semiconductor techniques. We can have the best of both worlds because we can now replace valves in some circumstances with direct equivalent improved performance transistors. Particular areas of application also include unattended relay stations, and telecommunications terminals, as well as domestic receivers.

TRIODE EQUIVALENT

These transistors, called "fetrons," have emerged from the military applications stable and are being made available for other applications, although very little is generally known about the performance so far. The fetron is basically an arrangement of two n-channel field effect transistors (Fig. 1) connected to provide the equivalent working characteristics of a triode valve but with a much better frequency response at both ends of the spectrum. This is because the fetron has an extremely low channel resistance and inter-electrode capacitance. Furthermore, since there are no heaters, operation is immediate on switch-on.

OTHER FEATURES

The life of the fetron is likely to be much greater than the thermionic valve under normal working conditions and the degradation of operational characteristics is minimal. Other important features include a higher amplification factor (almost ten times that of a valve) and a lower noise figure. Since no heaters are used, power requirements are simplified to just one high tension supply.

PENTODE CHARACTERISTIC

Both the thermionic valve and the FET are voltage controlled devices, hence design equations are virtually the same. Although the pentode anode voltage-current characteristics are similar to the drain characteristics of the fetron, the latter are more clearly defined at the cut-off region or "knee" and exhibit stable current drain for various drive conditions (Fig. 2).

Since the main purpose of the fetron is to act as a direct replacement for the triode valve, it is essential that it should withstand high voltages and have a matched gm. The single junction FET cannot do this, but when two specially selected FETs are cascaded the problem is overcome. It is also possible to reduce the Miller (gate to source capacitance) effect by using a low capacitance, small signal, high gm FET at the input circuit, coupled with a high voltage output FET.

With the arrangement shown in Fig. 1, the output FET acts as a voltage dropper for the input FET and the Miller effect capacitance of each is in series. The output impedance is also greater than in a valve pentode, resulting in the excellent characteristics shown in Fig. 2. Since the input gate circuit is effectively a reversed bias junction, it presents a very high resistance load to the signal source.

Fig. 3 shows the transfer characteristic of a fetron which has been made

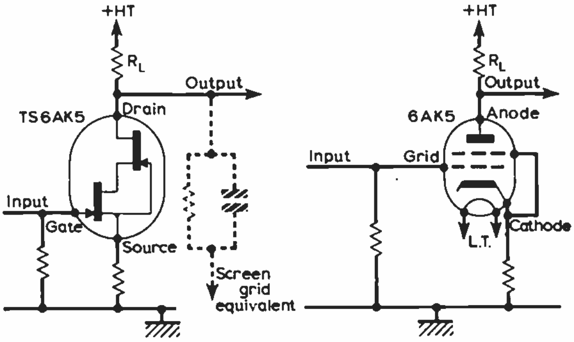


Fig. 1: Basic arrangement of two field effect transistors in one package to form a fetron, and the symbol of the 6AK5 valve.

TABLE 1:

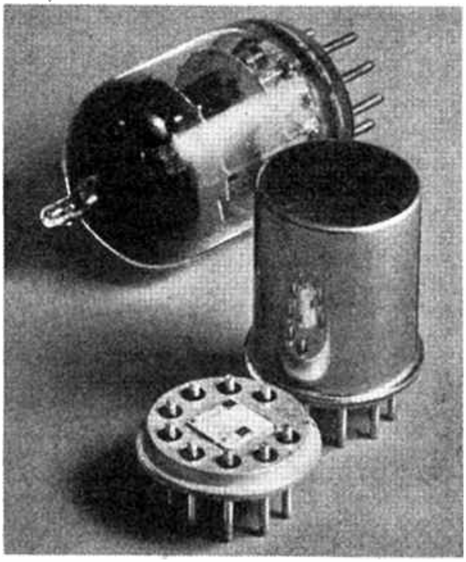
TYPICAL PENTODE DEVICE CHARACTERISTICS—Rk=200 Ω, Eb=120V

PARAMETER	6AK5	TS6AK5
Plate voltage breakdown	350V	350V
Plate resistance	0·5MΩ	5·0MΩ
Transconductance	5,000μmhos	4,500μmhos
Plate current (Rk=200Ω)	7·5mA	7·0mA
Grid voltage for Ib=10μA	−8·5V	−5·0V
Amplification factor	2,500	22,500
Input capacitance	4·0pF	6·5pF
Output capacitance	0·02pF	0·02pF
Useful frequency limit	400MHz	600MHz

TABLE 2:

TYPICAL TRIODE DEVICE CHARACTERISTICS (EACH SIDE)—Rk=2—70 Ω, Eb=130V

PARAMETER	12AT7	TS12AT7
Plate voltage breakdown	400+V	350V
Plate resistance	15kΩ	250kΩ
Transconductance	4,000μmhos	3,000μmhos
Plate current (Rk=240Ω)	5·0mA	9·0mA
Grid voltage for Ib=110μA	−7·0V	−7·0V
Amplification factor	60	750
Input capacitance	2·2pF	25pF
Output capacitance	1·5pF	3·5pF



up from selected FETs to approximate closely that of a particular valve (shown dotted) operating within the same limits. If special requirements include partial operation beyond this FET cut-off then clearly a more appropriate FET device must be selected for this, perhaps providing a higher current for the same control voltage. The gm or transconductance ratio of the fetron gives a true square law property with consequent harmonic distortion figures of an extremely low order. In fact, harmonics beyond second order are claimed to be negligible.

Although the simulation of the "screen grid" principle can be effected within the fetron package, the similarity of the transfer curves to those of a pentode must not be taken as an assumption that the fetron is an ideal replacement for the pentode, even though the noise figure may be lower. The fetron has a markedly improved performance over the triode due to square law operation.

POWER REQUIREMENTS

Power supplies can be greatly simplified: first by the elimination of low voltage lines; secondly by the use of less stringent h.t. regulation. Current requirements are similar to or slightly higher than for a triode, but surge currents of up to about 1,000 times can be tolerated. Due to the lack of heating requirements the fetron will operate at more confortable temperatures around 65°C. The case is ruggedised by using a deep-drawn steel cap welded to a large diameter header, using the same pin arrangement for connections.

Fetrons that have been made so far include replacements for the 6EW6, 6JC6, 6AK5 and 12AT7 but with ready made FET junctions currently available it is expected that the majority of common types can be simulated. More familiar types such as 6V6 and 6AQ5 are next on the list. The type number given to fetrons consists of the equivalent valve number but prefixed TS. Hence the fetron for replacing the 12AT7 is TS12AT7.

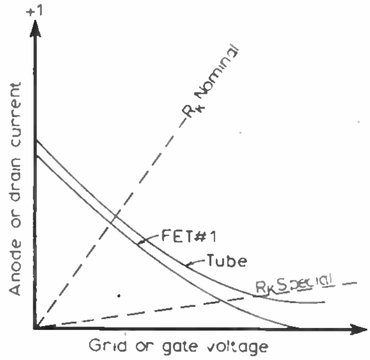
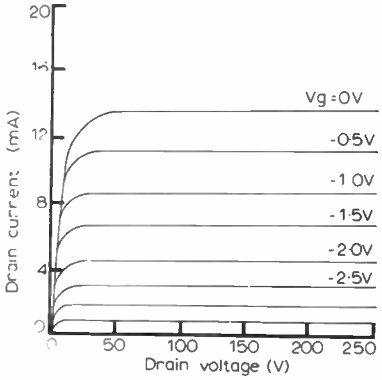


Fig. 3: Transfer characteristic of a fetron compared with a valve.

The manufacturer who has announced these activities in fetrons is the American company Teledyne Semiconductors, who are selling in the U.K. via the distributors GDS Sales Ltd. of Slough. Prices are higher than for valves but this is offset by the long term performance advantages described. GDS Sales quotes £8 for the TS12AT7 and £6·50 for the TS6AK5 for orders of 1 to 99, these being the first available in the U.K. Although this price is high the long term advantages of reliability and performance are compensatory.Small orders for these devices are being handled by the subsidiary company *Best Electronics (Slough) Ltd, Michaelmas House, Salt Hill, Bath Road, Slough, Bucks, SL1 3UZ.*

Elsewhere in this issue we are taking a closer look at some of the valves that still have a unique role to play in radio and electronics. Look out for our special feature "Special Valves for Communications".



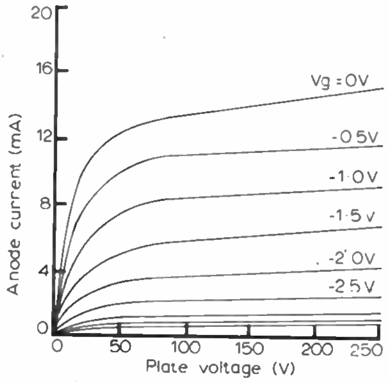


Fig. 2: Comparison of output drain characteristics with those of the 6AK5 anode.

BRAND NEW SEMICONDUCTORS & COMPONENTS GUARANTEED

WE SUPPLY NEARLY ALL THE COMPONENTS FOR PROJECTS ADVERTISED IN THIS MAGAZINE

TRANSISTORS

2G301	0·15
2G302	0·15
2G303	0·25
2G306	0·30
2G309	0·30
2G344A	0·25
2G345B	0·25
2G371	0·15
2G374	0·15
2G381	0·22
2G417	0·20
2N109	0·49
2N174	1·40
2N176	0·75
2N274	0·75
2N335	0·75
2N351	0·95
2N376	1·00
2N384	0·93
2N388A	0·40
2N404	0·43
2N456	0·75
2N456A	0·75
2N457A	0·80
2N491	3·25
2N584	0·26
2N591	0·34
2N696	0·15
2N697	0·15
2N698	0·25
2N699	0·29
2N706	0·10
2N706A	0·12
2N708	0·13
2N709	0·38
2N711	0·30
2N718	0·21
2N718A	0·30
2N720	0·50
2N721	0·55
2N914	0·22
2N916	0·17
2N918	0·30
2N919	0·20
2N929	0·14
2N930	0·14
2N1090	0·23
2N1091	0·24
2N1131	0·20
2N1132	0·20
2N1184	1·27
2N1302	0·16
2N1303	0·16
2N1304	0·20
2N1305	0·20
2N1306	0·22
2N1307	0·22
2N1308	0·25
2N1309	0·25
2N1483	0·90
2N1507	0·24
2N1613	0·20
2N1631	0·35
2N1637	0·30
2N1638	0·27
2N1671	1·25
2N1701	1·10
2N1702	2·15
2N1711	0·17
2N1893	0·34
2N2102	0·30
2N2147	0·70
2N2148	0·60
2N2192	0·40
2N2192A	0·40
2N2193	0·40
2N2193A	0·42
2N2194	0·27
2N2194A	0·30
2N2195	0·37
2N2195A	0·18
2N2218A	0·30
2N2219	0·37
2N2219A	0·51
2N2220	0·20
2N2221	0·20
2N2221A	0·33
2N2222	0·31
2N2222A	0·41
2N2368	0·11
2N2369	0·39
2N2369A	0·17
2N2646	0·50
2N2647	1·20
2N2711	0·12
2N2712	0·13
2N2713	0·17
2N2714	0·17
2N2904	0·18
2N2904A	0·25
2N2905	0·26
2N2905A	0·23
2N2906	0·18
2N2906A	0·23
2N2907	0·18
2N2907A	0·25
2N2923	0·12
2N2924	0·12
2N2925	0·12
2N2926	
Green	0·10
Yellow	0·10
Orange	0·10
2N3053	0·31
2N3054	0·47
2N3054	0·46
2N3055	0·60
2N3390	0·20
2N3391	0·20
2N3391A	0·23
2N3392	0·13
2N3393	0·12
2N3394	0·12
2N3402	0·17
2N3403	0·19
2N3404	0·24
2N3405	0·27
2N3414	0·10
2N3415	0·10
2N3416	0·15
2N3417	0·21
2N3570	1·25
2N3571	1·12
2N3572	0·97
2N3702	0·10
2N3703	0·10
2N3704	0·14
2N3705	0·10
2N3706	0·09
2N3707	0·10
2N3708	0·70
2N3709	0·09
2N3710	0·12
2N3711	0·90
2N3712	0·95
2N3713	1·08
2N3714	1·15
2N3715	1·23
2N3716	1·30
2N3773	2·35
2N3774	3·33
2N3775	4·19
2N3776	5·95
2N3777	4·84
2N3778	2·25
2N3779	3·15
2N3780	4·50
2N3781	3·67
2N3782	3·37
2N3789	1·76
2N3790	2·20
2N3791	2·06
2N3792	3·20
2N3794	0·10
2N3819	0·37
2N3820	0·47
2N3823	0·62
2N3824	0·75
2N3826	0·23
2N3854	0·16
2N3854A	0·16
2N3855	0·16
2N3855A	0·16
2N3856	0·16
2N3856A	0·16
2N3858	0·16
2N3858A	0·16
2N3859	0·16
2N3859A	0·16
2N3860	0·16
2N3866	0·70
2N3877	0·25
2N3877A	0·26
2N3878	1·22
2N3879	1·91
2N3900	0·20
2N3900A	0·21
2N3901	0·32
2N3903	0·20
2N3904	0·17
2N3905	0·21
2N3906	0·22
2N4036	0·63
2N4037	0·42
2N4058	0·16
2N4059	0·09
2N3059	0·90
2N4060	0·11
2N4061	0·11
2N4062	0·11
2N4302	0·25
2N4303	0·32
2N4913	0·80
2N4914	0·87
2N4915	0·95
2N4916	0·20
2N4917	0·17
2N4918	0·50
2N4919	0·53
2N4920	0·60
2N4921	0·50
2N4922	0·55
2N4923	0·60
2N4926	0·90
2N4927	1·00
2N4928	1·80
2N4929	2·23
2N4930	2·25
2N4931	2·70
2N5172	0·08
2N5174	0·22
2N5175	0·26
2N5176	0·32
2N5245	0·43
2N5190	0·92
2N5191	0·96
2N5192	1·24
2N5193	1·01
2N5194	1·10
2N5195	1·46
2N5245	0·43
2N5457	0·35
2N5458	0·33
2N5459	0·33
3N128	0·63
3N138	1·65
3N199	1·36
3N140	0·92
3N141	0·81
3N142	0·58
3N143	0·75
3N152	0·92
3N153	0·81
3N154	0·84
3N159	1·17
3N187	1·30
3N200	3·49
3N201	1·05
40050	0·78
40251	0·81
40309	0·33
40310	0·50
40313	0·92
40316	0·50
40318	0·92
40322	0·92
40360	0·46
40361	0·48
40362	0·50
43063	0·88
40389	0·46
40394	0·56
40395	0·50
40406	0·44
40407	0·33
40408	0·50
40409	0·52
40410	0·53
40411	2·25
40414	3·55
40438	1·44
40467A	0·69
40468A	0·44
40600	0·69
40601	0·67
40602	0·46
40603	0·58
40604	0·56
40636	1·10
40673	0·50
AC107	0·35
AC113	0·16
AC115	0·16
AC117	0·20
AC121	0·13
AC126	0·25
AC127	0·25
AC128	0·25
AC141K	0·30
AC142K	0·30
AC151V	0·14
AC152V	0·17
AC153	0·22
AC153K	0·25
AC154	0·20
AC176	0·18
AC176K	0·20
AC187K	0·20
AC188K	0·26
ACY17	0·25
ACY18	0·15
ACY19	0·20
ACY20	0·20
ACY21	0·18
ACY22	0·13
ACY28	0·18
ACY30	0·42
ACY39	0·55
ACY40	0·17
ACY41	0·17
ACY44	0·31
AD136V	0·96
AD140	0·50
AD140	0·55
AD142	0·50
AD143	0·45
AD149V	0·50
AD149V	1·26
AD150	0·63
AD161	0·37
AD162	0·37
AD161 }	PR
AD162 }	0·69
ADZ11	1·50
ADZ12	1·75
AF106	0·37
AF109R	0·40
AF114	0·25
AF115	0·24
AF116	0·25
AF117	0·20
AF118	0·50
AF121	0·22
AF124	0·24
AF125	0·20
AF126	0·19
AF127	0·20
AF139	0·38
AF170	0·25
AF172	0·25
AF178	0·55
AF179	0·65
AF180	0·50
AF186	0·40
AF200	0·35
AF239	0·41
AF240	0·72
AF279	0·54
AF280	0·54
AFY42	0·74
AF211	0·55
AL102	0·75
AL103	0·70
ASY26	0·30
ASY27	0·36
ASY28	0·28
ASY29	0·30
ASY50	0·20
ASY55	0·35
ASZ21	0·55
AU103	1·25
BC107	0·14
BC108	0·13
BC109	0·14
BC113	0·13
BC114	0·12
BC115	0·15
BC116	0·15
BC116A	0·18
BC117	0·21
BC118	0·11
BC119	0·27
BC121	0·23
BC123	0·29
BC125	0·15
BC126	0·20
BC132	0·30
BC134	0·11
BC135	0·11
BC136	0·15
BC137	0·15
BC138	0·20
BC140	0·34
BC141	0·39
BC142	0·24
BC143	0·21
BC144	0·24
BC145	0·21
BC147	0·11
BC148	0·10
BC149	0·13
BC153	0·18
BC154	0·18
BC157	0·14
BC158	0·13
BC159	0·14
BC160	0·37
BC167B	0·11
BC168B	0·13
BC168C	0·11
BC169B	0·13
BC169C	0·13
BC170	0·11
BC171	0·13
BC172	0·11
BC182	0·10
BC182L	0·12
BC183	0·09
BC183L	0·09
BC184	0·11
BC184L	0·11
BC186	0·25
BC187	0·25
BC204	0·11
BC205	0·10
BC206	0·11
BC207	0·10
BC208	0·09
BC209	0·10
BC211	0·30
BC212K	0·10
BC212L	0·10
BC214L	0·23
BC236	0·16
BC237	0·09
BC238	0·09
BC239	0·09
BC251	0·20
BC252	0·18
BC253	0·23
BC257	0·09
BC258	0·09
BC259	0·13
BC261	0·20
BC262	0·18
BC263	0·23
BC300	0·42
BC301	0·34
BC302	0·27
BC303	0·54
BC304	0·43
BC307	0·10
BC307A	0·10
BC307VI	0·10
BC308	0·09
BC308A	0·09
BC308B	0·09
BC309	0·10
BC309A	0·10
BC309B	0·10
BC313	0·30
BC327	0·24
BC328	0·22
BC337	0·19
BC338	0·19
BCY30	0·35
BCY31	0·40
BCY32	0·60
BOY32	0·75
BCY33	0·34
BCY34	0·35
BCY38	0·40
BCY39	1·05
BCY40	0·50
BCY42	0·15
BCY43	0·15
BCY58	0·21
BCY59	0·22
BCY66	0·66
BCY67	0·94
BCY70	0·17
BCY71	0·22
BCY72	0·13
BCY87	3·47
BCY88	3·40
BCY89	0·30
BCZ10	0·35
BCZ11	0·50
BD115	0·75
BD116	0·75
BD121	0·75
BD123	0·82
BD124	0·67
BD130	0·57
BD131	0·40
BD132	0·50
BD135	0·43
BD135	0·49
BD137	0·55
BD138	0·63
BD139	0·71
BD140	0·83
BDY10	1·35
BDY11	1·50
BDY17	1·50
BDY18	1·75
BDY19	1·97
BDY20	0·92
BDY38	0·65
BDY60	0·90
BDY61	0·35
BDY62	0·75
BF115	0·23
BF117	0·43
BF119	0·58
BF121	0·25
BF123	0·27
BF125	0·25
BF127	0·27
BF152	0·20
BF153	0·29
BF154	0·16
BF158	0·15
BF159	0·27
BF160	0·23
BF161	0·35
BF163	0·20
BF166	0·35
BF167	0·18
BF173	0·19
BF177	0·25
BF178	0·25
BF179	0·30
BF180	0·35
BF181	0·32
BF182	0·30
BF183	0·40
BF184	0·17
BF185	0·17
BF194	0·14
BF195	0·15
BF196	0·15
BF197	0·15
BF198	0·15
BF199	0·18
BF200	0·35
BF224J	0·14
BF225J	0·19
BF257	0·22
BF238	0·22
BF244	0·16
BF245	0·33
BF246	0·43
BF247	0·49
BF254	0·14
BF255	0·15
BF257	0·41
BF258	0·46
BF259	0·48
BF261	0·23
BF264	1·45
BF270	0·25
BF271	0·21
BF272	0·53
BF273	0·25
BF274	0·23
BF457	0·53
BF458	0·65
BF459	0·57
BFS21	3·10
BFS21A	2·30
BFS28	0·92
BF861	0·27
BF898	0·28
BFW10	0·61
BFW11	0·61
BFW15	0·35
BFX13	0·23
BFX29	0·25
BFX30	0·25
BFX37	0·30
BFX44	0·33
BFX63	2·48
BFX68	0·30
BFX84	0·24
BFX85	0·29
BFX86	0·24
BFX87	0·25
BFX88	0·20
BFX89	0·45
BFY10	0·35
BFY11	0·45
BFY17	0·90
BFY18	0·25
BFY19	0·25
BFY20	0·50
BFY29	0·40
BFY37	0·20
BFY41	0·43
BFY43	0·62
BFY50	0·16
BFY51	0·18
VFY52	0·16
BFY53	0·15
BFY56	0·34
BFY64	0·41
BFY75	0·40
BFY76	0·22
BFY77	0·24
BFY78	0·36
BFY90	0·30
BRY39	0·30
BSX19	0·13
BSX20	0·14
BSX21	0·20
BSX26	0·34
BSX27	0·34
BSX28	0·25
BSX29	0·47
BSX30	0·68
BSX59	0·78
BSX60	0·54
BSX61	0·42
BSX76	0·15
BSX77	0·20
ASX78	0·25
BSW70	0·28
BSY24	0·20
BSY25	0·15
BSY26	0·20
BSY27	0·15
BSY28	0·15
BSY38	0·15
BSY39	0·15
BSY51	0·25
BSY52	0·25
BSY53	0·25
BSY54	0·30
BSY56	0·79
BSY65	0·15
BSY78	0·40
BSY79	0·40
BSY790	0·45
BSY95A	0·09
BU104	1·42
BU105	2·35
C111	0·53
D40N3	0·62
GET111	0·45
GET113	0·20
GET114	0·20
GET115	0·50
GET119	0·35
GET120	0·25
GET535	0·20
GET536	0·20
GET538	0·20
GET873	0·12
GET880	0·30
GET883	0·20
GET887	0·20
GET890	0·22
GET895	0·25

RETURN OF POST SERVICE

Post & Packing 13p per order. Europe 25p. Commonwealth (Air) 65p (MIN.) Matching charge (audio transistors only) 15p. extra per pair. Prices subject to stock availability.

TTL. LOGIC I.C. NEW PRICES

	1-24 £p	25+ £p		1-24 £p	25+ £p		1-24 £p	25+ £p
SN7400	0·20	0·18	SN7428	0·50	0·41	SN7460	0·20	0·18
SN7401	0·20	0·18	SN7430	0·20	0·18	SN7470	0·30	0·26
SN7402	0·20	0·18	SN7432	0·48	0·42	SN7472	0·30	0·25
SN7403	0·20	0·18	SN7433	0·71	0·62	SN7473	0·40	0·34
SN7404	0·20	0·18	SN7437	0·52	0·45	SN7474	0·40	0·34
SN7405	0·20	0·18	SN7438	0·52	0·45	SN7475	0·45	0·35
SN7406	0·30	0·24	SN7439	0·52	0·45	SN7476	0·44	0·39
SN7407	0·56	0·48	SN7440	0·20	0·18	SN7480	0·75	0·70
SN7408	0·20	0·18	SN7441AN	0·75	0·72	SN7481	1·25	1·07
SN7409	0·20	0·18	SN7442	0·79	0·68	SN7482	0·87	0·61
SN7410	0·20	0·18	SN7443	1·04	0·88	SN7483	1·00	0·82
SN7411	0·22	0·20	SN7444	1·04	0·88	SN7484	0·95	0·85
SN7412	0·42	0·38	SN7445	1·85	1·70	SN7485	3·50	3·38
SN7413	0·30	0·27	SN7446	2·00	1·60	SN7486	0·45	0·40
SN7416	0·45	0·40	SN7447	1·30	1·20	SN7488	13·40	11·80
SN7417	0·45	0·40	SN7448	1·04	0·92	SN7489	4·97	4·40
SN7420	0·20	0·18	SN7449	Price to be		SN7490	0·80	0·75
SN7421	0·22	0·20		announced shortly		SN7491	1·20	1·06
SN7422	0·48	0·42	SN7450	0·20	0·18	SN7492	0·75	0·70
SN7423	0·52	0·45	SN7451	0·20	0·18	SN7493	0·75	0·70
SN7425	0·48	0·42	SN7452	0·20	0·18	SN7494	0·84	0·80
SN7426	0·32	0·28	SN7453	0·20	0·18	SN7495	0·80	0·74
SN7427	0·48	0·42	SN7454	0·20	0·18	SN7496	1·00	0·90

SUB-MIN ELECTROLYTIC

Axial lead — 6p each

Values (μF/V). 6·64/64; 1/40; 1·6/25. 2 5/16; 2·2/63; 4·7/16; 4·7/25; 6·4/6·4. 6·4/25; 10/16; 10/25; 10/64; 12·5/25; 16/40; 20/16; 20/64; 25/6·4; 25/25; 32/10; 32/40; 40/16; 50/6·4; 50/25; 50/40. 64/10; 80/16; 80/25; 100/6 4. 125/10; 125/16; 200/10.

SILICON RECTIFIERS

PIV	50	100	200	400	600	800	1000	1200
1A	8p	9p	10p	11p	12p	15p	20p	—
3A	15p	17p	20p	22½p	25p	27p	30p	35p
6A		—	25p	30p	32½p	35p	—	—
10A	30p	35p	40p	47p	56p	66p	75p	
15A	36p	45p	48p	55p	65p	75p	87p	
35A	70p	80p	90p	£1·00	£1·40	£1 70	£2·75	—

1 amp and 3 amp are plastic encapsulation.

DIODES & RECTIFIERS

1N34A	10p	AA119	7p	BAX16	12½p	FST3/4	22½p
IN914	7p	AA129	15p	BAY18	17½p	OA5	17p
IN916	7p	AAZ13	18p	BAY31	7p	OA10	30p
IN4007	20p	AAZ15	12p	BAY38	25p	OA9	10p
IS44	7p	AAZ17	10p	BY100	15p	OA47	8p
IS113	15p	BA100	15p	BY103	22p	OA70	7p
IS120	12p	BA102	25p	BY122	47½p	OA73	10p
IS121	14p	BA110	35p	BY124	15p	OA79	7p
IS130	8p	BA114	15p	BY126	15p	OA81	8p
IS131	10p	BA115	7p	BY127	17p	OA82	10p
IS132	12p	BA141	17p	BY164	57p	OA90	7p
IS920	7p	BA142	17p	BYX10	22p	OA91	7p
IS922	8p	BA144	12p	BYZ10	35p	OA95	7p
IS923	12p	BA145	17p	BYZ11	32p	OA200	7p
IS940	5p	BA154	12p	BYZ12	30p	OA202	10p
		BAX13	5p	BYZ13	25p	TIV307	50p

OPTOELECTRONICS

MINITRON 3015F 7-SEGMENT INDICATOR (16 PIN DIL) £2·00
May be driven by SN7447

TIL 209 LIGHT EMITTING DIODE. Made by TEXAS INST. (Red). 35p

B9900 PHOTORESISTOR 38p

VEROBOARD

	0.15 Matrix	0.1 Matrix
2½ × 3¾in	18p	25p
2½ × 5in	27p	27p
3¾ × 3¾in	27p	27p
3¾ × 5in	32p	31p
5 × 17in (Plain)	82p	

Vero Pins (Bag of 36) 22p
Vero Cutter 45p
Pin insertion Tools (·1 and ·15 matrix) at 58p.

"SCORPIO" CAP DISCHARGE IGNITION SYSTEM

(As published in P.E. November 1971)

Complete kit £10·00

P. & P. 50p.

SLIDE POTENTIOMETERS

58 mm, TRACK
SINGLE GANGED. LOG or LIN 1k to 1M. 40p each.
TWIN GANGED. LOG or LIN 1k to 500k 60p each

All Prices Exclusive of V.A.T.

WIRE-WOUND RESISTORS

2·5 watt 5% (up to 270 ohms only). 7p
5 watt 5% (up to 8·2k Ω only). 9p
10 watt 5% (up to 26k Ω only), 10p

POTENTIOMETERS

Carbon:
Log. or Lin., less switch, 16p
Log. or Lin., with switch, 27p
Wire-wound Pots (3W), 38p
Twin Ganged Stereo Pots, Log. or Lin. 43p.

PRESETS (CARBON)

0·1 Watt 6p
0·2 Watt 6p
0·3 Watt 7½p
VERTICAL OR HORIZONTAL

SPECIAL OFFER

TOSHIBA TH9013P 20 WATT AMP £3·50
TH9014P PRE-AMP £1·25

Tel. 01-452 0161/2/3
Telex 21492

A. MARSHALL & SON
28 CRICKLEWOOD BROADWAY, LONDON, N.W.2

CALLERS WELCOME
HRS. 9-5.30 MON.-FRI.
9-5.0 SAT.

EXPERIMENTERS CORNER

6–9V STABILISED SUPPLY

J. ROWLEY

THIS inexpensive unit will enable cassette recorders, portable radios, portable record players and the like requiring 6 to 9V to be run from a 12V car battery, in or out of the car. This not only saves their internal batteries but ensures that they run at peak efficiency.

CIRCUIT

In the basic circuit, Fig. 1, the reference voltage is determined by a zener diode ZD which controls the output voltage. Tr1, a power transistor, takes a small current from the zener diode, amplifies it, and feeds the resulting current to the output circuit.

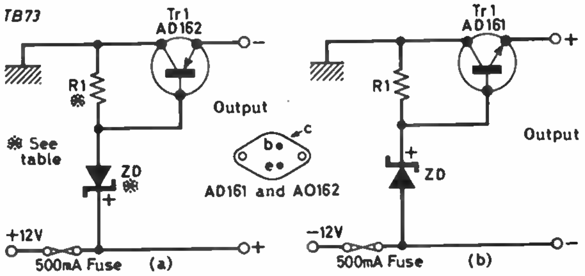


Fig. 1: Basic stabilising circuits for a) negative and (b) positive "earth".

With the output circuit left open Tr1 remains off, but as soon as a load is connected the current will increase until the voltage at the output is a little less than that of the zener diode. If for any reason the output voltage increases the voltage across Tr1's base-emitter decreases causing the collector current to drop. Conversely, if the output voltage decreases the base-emitter voltage will increase, raising the collector current. The overall effect being that the output voltage will remain constant despite varying load currents.

OVERLOAD

Although the basic circuit will work quite satisfactory, if the output leads are accidentally shorted together a heavy current will flow which may damage the transistor before the fuse can blow. To insure against this the circuit can be modified to the form shown in Fig. 2. Here, no matter what the load, even a short circuit, no more than 330mA will flow. Under normal loads the voltage across R2 will be less than the 500mV or so required to start Tr2 conducting, so the circuit will work as in Fig. 1.

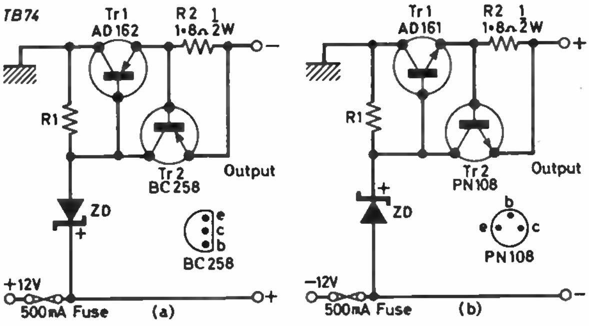


Fig. 2: Protected circuits for negative or positive "earth".

However when the current exceeds 280mA this will no longer obtain and Tr2 will start to draw current from the zener diode. At first this will have no effect, but if the voltage across R2 increases further Tr2 will draw more and more current until finally the zener will stop conducting, thus enabling the output voltage to fall to a level where no more than 330mA flows.

Output Voltage	ZD (400mW)	R1 (¼W)
6V	6·2V	680Ω
7·3V	7·5V	390Ω
9V	9·1V	220Ω

CONSTRUCTION

The unit is built into an aluminium box approx. 3×2×2in. (Type AB12) the power transistor being bolted to the box after applying silicone grease. The few components are connected directly to the pins of the power transistor. Since the quiescent current is only about 13mA no on-off switch is fitted. ■

TWO VERSATILE TRANSISTOR AMPLIFIERS

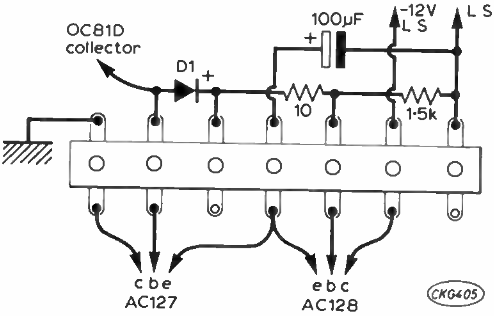
C. E. MILLER

As an independent service engineer one is often called on to repair car radios whose age, or foreign origin, make it difficult, if not impossible, to obtain spares. Quite often there is a burnt-out output or driver transformer which would normally result in the set involved being scrapped. To avoid this it has been possible, over a period of time, to evolve two output stages which employ no transformers or "difficult" components. The transistors used are easily obtained and cheap. In fact, one aspect of the design was to take advantage of the ex-computer panels now widely on sale, which contain large numbers of suitable transistors, etc.

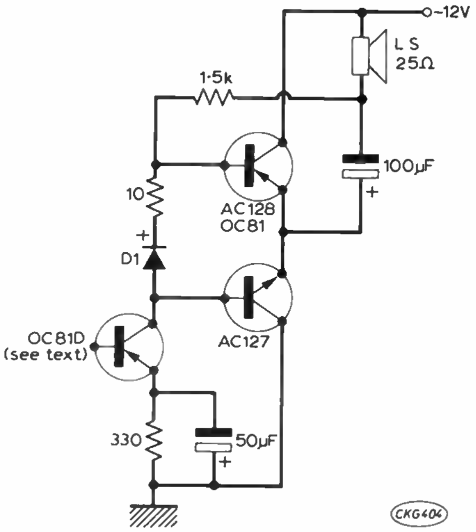
CIRCUIT No.1

The first design is intended to take the place of the relatively low-powered output stage used by several firms in hybrid car radios. A typical set employed two "12 volt h.t." valves and three transistors, an OC81d driving a pair of OC81's. The original OC81d is retained, but with a slightly different emitter resistor, and feeds directly into a complementary pair, AC127 and AC128.

The actual construction is so simple that it may be done on a seven-way tag strip. It will usually be possible to use the heat sinks previously fitted to the OC81's. The sole drawback, if such it be, is that the loudspeaker has to be changed to a high impedance type.



Suggested layout of Circuit No. 1 using a tag strip.

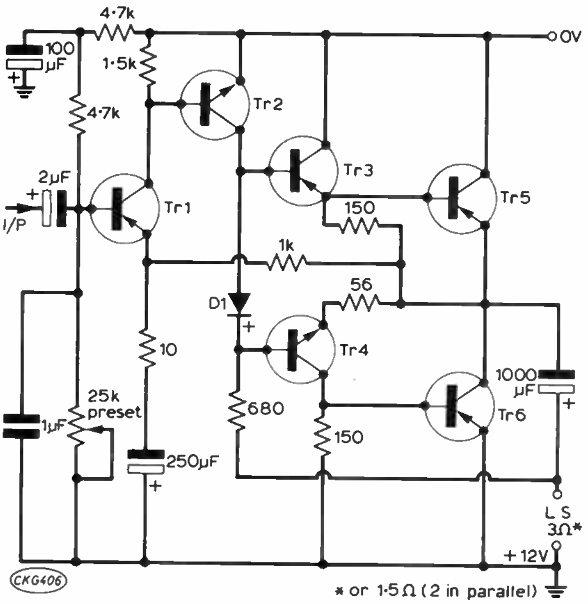


Two transistor output stage added to existing OC81D stage in receiver.

CIRCUIT No.2

It was to provide more power than the AC127/128's could give, and also to avoid having to use special loudspeakers, that the second circuit was evolved. It consists of an amplifier, a driver, and a complementary stage, which in turn drives the output transistors. In this circuit the computer panels really came into their own. Those used contained mainly 2G302's (p.n.p.), 2N1091's (n.p.n.), OC23's (p.n.p. output) and OA10 diodes. There were also some anonymous devices which looked, and behaved, like OC81's. The alternatives for the various transistors, etc., in the design are as follows:—

- Tr1. AC128, OC81, 2G302.
- Tr2. AC127, AC176, 2N1091.
- D1. AA119, OA10, AC128 with base/collector strapped.
- Tr3, as Tr1.
- Tr4, as Tr2.
- Tr5, Tr6. AD149, OC23. (Etc.—any large output type).



Higher powered output stage of Circuit 2.

As a final construction point, the output transistors should be mounted on a piece of aluminium of some 30 sq. in. This may conveniently be shaped to act as a screen for the rest of the amplifier. The prototype was deliberately mounted in the worst possible place, in a confined space close to the vehicle heater, but no overheating has been observed. ■

There are 195 other good reasons for buying AMTRON electronic kits

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

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

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

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

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

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

PLEASE SEND FOR BROCHURE

AMTRON® UK

TRADE & EDUCATION ENQUIRIES WELCOME

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

practically wireless commentary by HENRY

No. 99

Age cannot wither them

WHERE wireless engineers foregather, talk inevitably veers toward: 'I remember . . . '

It is either a model with such idiosyncracies that a catalogue of 'common faults' would have called for an appendix to the service manual, a manufacturer whose crass perfidy extended to an invoice before the goods arrived —or worse, so long afterwards that one had to guess at the cost of the spares before one dared complete the repair—or a customer.

But my subject today is not so much the trials and tribulations of the working engineer as this 'harking back' tendency we all evince, once we converse with fellows of like mind. Go to a meeting of the RSGB, the SERT, the BARTG or even your local Gramophone Society and before the last strains of the demonstration or mutters of the lecture have died away, everybody is avidly recounting his or her personal experiences.

. . . a donkey-driven gramophone.

Watching two members of the Royal Television Society taking coffee last week reminded me of Ralph Richardson and John Gielgud in the Royal Court Theatre production of *Home*. Parallel tracks of reminiscence, meeting rarely at some way-station. From the few words I caught in that BBC Hospitality Room, member A was waffling on about videotape while the other had some bee in his bonnet about phase-lock loop and pulse-code-modulation.

Henry was dying to know how Mr. B allied the two subjects, but couldn't find out because the charming production assistant he was trying to chat up with his memories of Marconi would insist on relating her opinions of Arthur Negus every time I had to pause for breath.

All this is brought on by hearing about the Fetron.

The Fetron is a genuine solid state substitute, mounted in a case like a valve, with pin formation and characteristics of the valve it is meant to replace.

You can read the ins and outs of it in the "Special Product Report" elsewhere in this issue, if it grips your curiosity like it did mine. Suffice it to say on this page that all those "everlasting" relay stations, built around valves designed to run forever, could not die without putting up a fight first.

Use of the Fetron saves major circuit modification when a valve-change is needed. Ain't science wunnerful?

Trouble is, Henry took a look at the types available and found there listed the dear old 12AT7. Now the TS12AT7 sounds a good idea until you remember some of those old 'universal' radiograms, and one or two series-heatered television sets that used them.

What happens if you plug in a Fetron? Have they made a resistive heater 'bridge', or do we have to solder a resistor across the socket? And, if we do, shouldn't there be a thermistor provided? Should we not also protect the h.t. line because the Fetron is operative immediately?

So many questions . . . reminds Henry of that unfortunate chap in an electronics magazine who offered a simpler way of getting over some stabiliser problems. Only snag was, somebody had to remember to turn the control back to zero after use unless the next chap along blew the thing up—you know, the way your loudspeaker creases when you have left the amplifier gain up high and a 'friend' flicks your stylus!

Well, the upshot of this poor chap's sensible economy was that

. . . and the inevitable happened.

electronic geniuses wrote in, both calling him gormless and detailing complicated protection circuits that would automatically switch off, from any given function. I wonder if Mrs. Mary W. would like one built into every TV?

I remember one TV we could never switch 'Off' because the maker had fitted too-substantial suppressors across the contacts.

We all tend to hark back. You should see the glee with which Colin Riches unearths a donkey-driven gramophone. At the wedding of a friend's daughter, hardly out of her teens, one of the speakers, Marketing Director of a worldwide Telecommunications company, had to remind the reception that his first acquaintance with the charming Sally was when she sat in his lap—at eighteen months—and the inevitable happened.

He might, at least, have reminded them of the days when he was hawking cheap radios round the council estates. It is just as funny a story. Remind me to tell it to you, one day . . .

Special Valves

PART 1 COMMUNICATION TYPES

M.K.TITMAN B. Sc(Eng), C. Eng , MIEE.

THERMIONIC devices still have a wide range of applications in modern electronic circuits and, despite the semiconductor takeover, they remain essential components in a variety of applications from high power r.f. amplifiers to electro-optical transducers.

The requirement for valves for u.h.f. and s.h.f. has led to the development of special techniques. The following valves were all developed from the necessity to exploit new ways to enable communication systems to use the wide bandwidths available at u.h.f. and microwave frequencies. The principles used are mathematically complex but their operation can be readily understood.

DISC SEAL VALVES

The form of construction used for both triode and tetrode configurations is illustrated in Fig. 1. The structure consists of a thimble-like cathode, spaced from a parallel wire grid further separated from a disc anode. The structures are very rigidly held by the ceramic space discs and because of the annular configuration co-axial input and output terminations can be used. The advantage of this system is that high power operation with reasonable efficiency in the GHz region is possible.

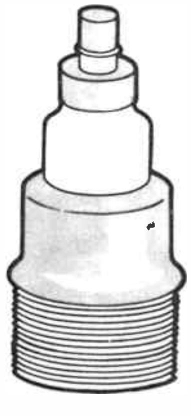
Disc seal triodes are used for amplifier and oscillator applications from 0·5GHz to 4GHz frequencies, at power levels of 1W to 600W. Typical values of g_m are 6mA/V to 25mA/V. At lower power levels (<25W) the envelope is designed for convection cooling but forced air cooling is used for the higher power levels. Examples of this valve type are the ES157 at 2W, and TDO4-20 at 12W.

KLYSTRONS

Klystrons are also essentially microwave valves which operate as oscillators in the frequency range from u.h.f. to more than 100GHz. Generally they are available for discrete commercial frequencies such as 6, 7, 8 or 9GHz and mechanical tuning by micrometer adjustment is possible.

The klystron consists of a cavity (or for power devices, multiple cavities) through which a stream of electrons is beamed from a normal electron gun assembly, as shown in Fig. 2. The electrons are velocity modulated by a field produced by a toroidal modulating structure known as a rhumbatron. The electrons therefore become bunched in regions of high electron density and rarified in low density regions, as they travel through a further section known as the drift space. Consequently if critical frequencies are utilised the bunching allows resonant oscillation to occur in a mode controlled by the rhumbatron.

Power levels for high frequencies are in the region of 1kW with special u.h.f. power devices operating at 460 to 1000MHz at levels of 20kW. The electronic tuning range for such devices is from 30 to 100MHz,



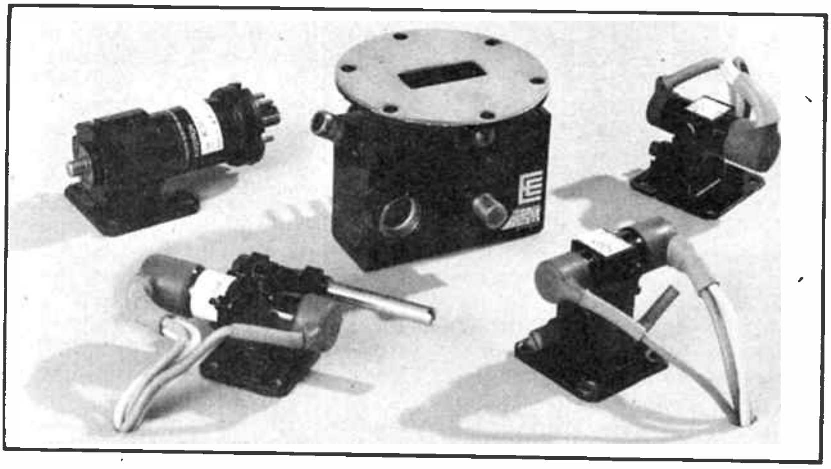


Fig. 1: at left, shows the general configuration of a disc seal valve. The picture shows a collection of oscillator klystrons, the centre one being used in communications relay equipment. The others are used in radar local oscillators.

BRITAIN'S FASTEST SERVICE!

A SELECTION FROM OUR COMPREHENSIVE CATALOGUE

ALL ITEMS ARE BRAND NEW AND FULLY GUARANTEED

AA119	6p
AC107	50p
AC126	20p
AC127	25p
AC128	24p
AC128/AC176	44p
AC151	20p
AC152	25p
AC153	26p
AC176	20p
AC153/176K	62p
AC187K	17p
AC188K	23p
AC187/188K	40p
ACY17	27p
ACY18	20p
ACY19	20p
ACY20	20p
ACY21	19p
ACY22	10p
AO140	55p
AD149	50p
AO161	49p
AD162	55p
AO161/162	£1·04
AF106	32p
AF114	25p
AF115	25p
AF116	25p
AF117	25p
AF118	44p
AF124	25p
AF125	24p
AF126	17p
AF139	47p
AF186	40p
AF239	50p
AF279	55p
ASY26	25p
ASY27	30p
ASY28	22p
ASY29	30p
BA138	15p
BAX16	8p
BB103	16p
BB104	28p
BB105	32p
BC107	10p
BC107/BC177	24p
BC108	10p
BC108/BC178	23p
BC109	10p
BC109/BC179	24p
BC109C	11p
BC140	30p
BC147	10p
BC148	9p
BC149	10p
BC157	12p
BC158	11p
BC159	12p
BC147/157	22p
BC148/158	20p
BC149/159	22p
BC167	11p
BC168	10p
BC169	11p
BC169C	12p
BC177	14p
BC178	13p
BC179	14p
BC182	10p
BC182L	10p
BC183	9p
BC183L	10p
BC184	13p
BC184L	12p
BC212	12p
BC212L	12p
BC238	10p
BC238/308	20p
BC257	9p
BC258	8p
BC259	9p
BC307	12p
BC308	10p
BCY30	25p
BCY31	48p
BCY32	50p
BCY33	20p
BCY34	25p
BCY38	30p
BCY58	18p
BCY70	15p
BCY71	30p
BCY72	15p
BD124	75p
BD131	75p
BD132	75p
BD131/132	£1·50
BDY20	92p
BF115	23p
BF163	35p
BF167	25p
BF173	39p
BF177	25p
BF178	31p
BF180	35p
BF194	15p
BF195	15p
BF196	15p
BF200	35p
BF254	14p
BF255	15p
BFX13	25p
BFX29	25p
BFX84	25p
BFX85	34p
BFX86	25p
BFX87	30p
BFX88	24p
BFY50	15p
BFY51	15p
BFY52	15p
BFY53	17p
BFY90	£1·05
BP101	75p
BPX66	£1·35
BRY39	40p
BSX19	16p
BSX20	16p
BSX21	20p
BSY27	20p
BSY29	25p
BSY95A	12p
BY100	20p
BY127	22p
BTY79/400R	92p
BT106	£1·20
BZY88C3V3	13p
BZY88C3V6	13p
BZY88C3V9	13p
BZY88C4V3	13p
BZY88C4V7	13p
BZY88C5V1	13p
BZY88C5V6	13p
BZY88C6V2	13p
BZY88C6V8	13p
BZY88C7V5	13p
BZY88C8V2	13p
BZY88C9V1	13p
BZY88C10V	13p
BZY88C11V	13p
BZY88C12V	13p
BZY88C13V	13p
BZY88C15V	13p
BZY88C16V	13p
BZY88C18V	13p
BZY88C20V	13p
BZY88C22V	13p
BZY88C24V	13p
BZY88C27V	13p
BZY88C30V	13p
BZX61C7V5	23p
BZX61C8V2	23p
BZX61C9V1	23p
BZX61C10V	23p
BZX61C11V	23p
BZX61C12V	23p
BZX61C13V	23p
BZX61C15V	23p
BZX61C16V	23p
BZX61C18V	23p
BZX61C20V	23p
BZX61C22V	23p
BZX61C24V	23p
BZX61C27V	23p
BZX61C30V	23p
CA3004	£2·25
CA3005	£1·50
CA3011	92p
CA3013	£1·30
CA3014	£1·52
CA3018	88p
CA3018A	£1·19
CA3020	£1·55
CA3028A	88p
CA3035	£1·52
CA3043	£1·73
CA3044	£1·42
CA3046	86p
CA3048	£2·34
CA3052	£1·80
CA3065	£1·42
CA3088E	£1·38
CA3090O	£4·70
CD4001AE	54p
CO4009AE	£1·16
CO4011AE	54p
CO4012AE	54p
CO4013AE	£1·11
CO4015AE	£2·92
CO4017AE	£2·92
CD4018AE	£2·92
CD4020AE	£3·25
CO4024AE	£2·09
CR1/051C	45p
CR1/401C	60p
CRS3/05AF	£1·08
CRS3/40AF	£1·53
CZ6	15p
D10 (NTGO10)	40p
IRT84	£2·90
LIC709C/5	42p
LIC709C/8	42p
LIC723C/5	£1·02
LIC723C/14	£1·00
LIC741C/5	45p
LIC741C/8	40p
MC1303L	£1·75
MC1305P	£2·80
MC1307P	£1·65
MC1310P	£2·95
MC1312P	£2·75
MC1330P	80p
MC1352P	£2·00
MC4024P	£2·20
MC4044P	£2·20
MFC6030	£1·63
MFC6040	£1·15
MFC8010	£1·38
MFC8040	£1·24
MFC9020	£2·12
MJE371	68p
MJE520	65p
MJE521	62p
MJE2955	£1·06
MJE3055	66p
MJ480	97p
MJ481	£1·25
MJ491	£1·35
MJ802	£4·12
MJ802/MJ4502	£8·56
MJ900	£1·80
MJ1000	£1·50
MJ4502	£4·44
MPF102	37p
MPF103(2N5457)	49p
MPF104(2N5458)	49p
MPF105(2N5459)	46p
NKT0033	96p
NKT211	25p
NKT212	25p
NKT213	25p
NKT216	46p
NKT217	50p
NKT218	25p
NKT223	27p
NKT271	18p
NKT274	18p
NKT275	20p
NKT279A	12p
NKT281	29p
NKT351	75p
NKT401	71p
NKT402	77p
NKT403	65p
NKT404	60p
NKT405	79p
NKT406	62p
NKT713	29p
NKT773	25p
NKT781	29p
NTGD10	40p
OA47	8p
OA79	8p
OA81	8p
OA90	6p
OA91	5p
OA95	5p
OA200	6p
OA202	7p
OC20	97p
OC25	37p
OC28	70p
OC29	76p
OC35	60p
OC36	63p
OC41	40p
OC42	40p
OC44	20p
OC45	20p
OC71	20p
OC72	20p
OC75	25p
OC76	25p
OC77	40p
OC81	20p
OC81O	20p
OC83	23p
OC84	25p
OC139	25p
OC170	25p
OC171	30p
OCP71M	42p
ORP12	50p
ORP60	40p
ORP61	40p
ORP69	50p
PN70	9p
PN71	9p
PN107	7p
PN108	7p
PN109	7p
PN3819(2N3819)	20p
ST2	28p
SL103A	50p
SL403A (Rect)	60p
SL803A	80p
SL403O (IC Amp.)	£1·50
TAA263	75p
TAA293	97p
TAA310	£1·25
TAA320	75p
TAA861	45p
TAD100	£1·97
TAO110	£1·97
TIL112	£2·00
TIL209	35p
TIP31A	60p
TIP32A	70p
TIP41A	85p
TIP42A	£1·00
TIS43	30p
VA1066s	15p
VA1039	15p
VA1040	15p
VA1077	15p
W005	30p
W01	31p
W02	32p
W04	33p
W06	35p
W08	44p
ZTX107	12p
ZTX108	11p
ZTX300	13p
ZTX302	18p
ZTX303	15p
ZTX304	23p
ZTX314	11p
ZTX320	30p
ZTX330	18p
ZTX500	14p
ZTX501	15p
ZTX502	18p
ZTX503	17p
ZTX504	45p
1N914	4p
1N3754	20p
1N4001	7p
1N4002	7p
1N4003	10p
1N4004	10p
1N4005	12p
1N4006	15p
1N4007	19p
1N4148	4p
1N5400	14p
1N5404	18p
1N5408	25p
1S44	4p
1S920	7p
1S940	6p
1S5009	80p
1S5012	80p
1S5015	75p
1S5018	75p
1S5024	75p
1S5047	75p
2N404	23p
2N696	15p
2N697	17p
2N698	30p
2N706	10p
2N706A	12p
2N708	16p
2N911	50p
2N914	20p
2N918	42p
2N929	25p
2N930	28p
2N1131	24p
2N1132	24p
2N1302	17p
2N1303	17p
2N1304	24p
2N1305	24p
2N1306	30p
2N1307	30p
2N1308	34p
2N1309	34p
2N1559 (CR1/401C)	60p
2N1613	15p
2N1711	15p
2N1893	54p
2N2218	33p
2N2218A	44p
2N2219	38p
2N2219A	53p
2N2368	17p
2N2369	17p
2N2369A	17p
2N2484	42p
2N2646	45p
2N2904	44p
2N2904A	49p
2N2905	65p
2N2905A	75p
2N2924	18p
2N2925	20p
2N2926	10p
2N3053	27p
2N3054	50p
2N3055	60p
2N3391A	29p
2N3525	£1·04
2N3702	10p
2N3703	10p
2N3704	10p
2N3705	10p
2N3706	10p
2N3707	10p
2N3708	8p
2N3709	10p
2N3710	10p
2N3711	10p
2N3819	25p
2N3820	60p
2N3823E	20p
2N3826	30p
2N3866	£1·10
2N3904	28p
2N3906	28p
2N4058	13p
2N4060	11p
2N4061	11p
2N4062	11p
2N4444	£2·20
2N4871	40p
2N5245	45p
2N5457(MPF103)	49p
2N5458(MPF104)	49p
2N5459(MPF105)	46p
2N5777	45p
2N6027(D13T1)	45p
3N84	£1·30
3N128	73p
3N140	92p
3N152	92p
3015F	£2·00
3015G	£2·00
7400	16p
7401	20p
7402	20p
7403	20p
7404	25p
7405	25p
7408	25p
7409	25p
7410	20p
7413	30p
7420	20p
7425	30p
7430	20p
7440	24p
7442	£1·16
7443	£1·45
7444	£1·45
7445	£2·06
7446	£1·45
7447	£1·25
7450	28p
7451	20p
7453	20p
7454	20p
7460	20p
7470	45p
7472	32p
7473	45p
7474	46p
7475	45p
7476	45p
7480	67p
7482	87p
7483	£1·32
7486	33p
7490	80p
7491A	£1·28
7492	85p
7493	75p
7494	£1·13
7495	80p
7496	£1·48
74100	£1·64
74107	52p
74121	43p
74141	£1·00
74150	£3·35
74151	£1·10
74153	£1·35
74154	£2·00
74155	£1·55
74156	£1·55
74190	£1·80
74191	£1·80
74192	£1·74
74193	£1·74
74196	£1·50
74197	£1·50
40250	66p
40309	40p
40310	60p
40311	42p
40312	62p
40320	42p
40360	56p
40361	45p
40362	45p
40406	52p
40407	40p
40408	54p
40409	62p
40410	62p
40430	£1·13
40432	£1·60
40468A	44p
40512	£1·88
40576	£1·46
40600	70p
40601	70p
40602	45p
40603	70p
40669	£1·00
40673	68p
40739	£1·50

ELECTROLYTIC AXIAL LEADS

Mfd.	Working Voltage	Price	Mfd.	Working Voltage	Price
1·0	40v	7p	100	16v	6p
1·0	100v	5p	100	25v	6p
2·2	25v	7p	100	40v	7p
2·2	63v	5p	100	63v	10p
4·7	40v	5p	220	25v	8p
10	25v	5p	220	40v	9p
10	63v	6p	470	25v	12p
22	25v	6p	1000	25v	16p
22	40v	6p	2200	25v	30p
47	25v	6p	4700	16v	33p
47	40v	6p			

CAPACITORS—METALLISED POLYESTER

Stock values: MFD	Price each
0·01, 0·015, 0·022, 0·033	3p
0·047, 0·068, 0·10	4p
0·150, 0·220	5p
0·33	7p
0·47	8p
0·68	11p
1·0	14p
1·5	20p
2·2	24p

Order as "Polyesters" + Capacitance.

CAPACITORS—POLYSTYRENE

Axial leads, Clear encapsulation, 5% Tolerance. 160 volt working.

Stock values	Price each
100pF, 150pF, 220pF, 330pF, 470pF, 560pF, 680pF, 820pF, 1000pF, 1500pF, 2200pF, 3300pF, 4700pF, 5600pF, 6800pF,	3p

Order as: "Polystyrenes" + Capacitance.

ALUMINIUM HEAT SINKS

10DN 34p (Plain All undrilled)
10OOR 43p (Plain All drilled 2 x To3)

LOW PRICED DIL IC HOLDERS

DRD 7 14 Pin DIL 15p ORO 8 16 Pin OIL 17p

NYLON NUTS AND BOLTS

Cheese head screw bolts. Nuts with integral washer. Moulded in high density nylon. Ideal for mounting "live" assemblies, power transistors, etc.
Each pack consists of four nuts and four screw bolts.

Pack No.	Thread	Length	Quantity	Pack Price
HSN1	6BA	¼"	4	10p
HSN3	6BA	¾"	4	10p

Order as "Nuts and Bolts" + Pack No.

OPTO ELECTRONICS—3 devices

from our range—OCP71—42p, ORP12—50p, TIL209 Red led 35p

TEST PROBES

Probably the best test probes ever made. When you push a plunger a spring steel forked tongue pushes out and holds the components, wires etc., while you take readings etc. It won't let go until you release it.
KLEPS 30 Black and Red, per pair £1·20

RESISTORS—METAL OXIDE

Metal Oxide resistors by Electrosil. Ultra low noise, ½ Watt, 2%. Available in the range E24 between 10 ohms and 1 Meg.
E24 series = 1·0, 1·1, 1·2, 1·3, 1·5, 1·6, 1·8, 2·0, 2·2, 2·4, 2·7, 3·0, 3·3, 3·6, 3·9, 4·3, 4·7, 5·1, 5·6, 6·2, 6·8, 7·5, 8·2, 9·1, and their decades.
Type No. TR5 Price: 4p each
Order as "Metox" + value.

RESISTORS—CARBON FILM

A range of miniature high stability resistors with very low noise characteristics and long life. Tolerances, ranges and wattages as indicated. (Wattage ratings are at max. limiting voltage).

Type No.	Wattage	Tol.	Range	Series	Price
UPM050	0·5	5%	10E-1M	E12	1p each
UPM050	0·5	10%	1M -4·7M	E12	1p each
UPM075	0·75	5%	10E-1M	E12	1p each
UPM075	0·75	10%	1M -4·7M	E12	1p each
UPM100	1·00	10%	10E-1M	E12	2½p each

ARROW SERVICE PLUS

10% DISCOUNT OVER £4. NO POSTAGE AND PACKING. TOP QUALITY PRODUCTS ALWAYS BY RETURN

COMPREHENSIVE CAT. →

Important Notice "All prices are exclusive of V.A.T. Please add 10% V.A.T. to the final total of your order after deducting any discount which may be due"

ARROW ELECTRONICS LTD.

DEPT. PW 7; 7 COPTFOLD ROAD
BRENTWOOD
ESSEX

I enclose PO/Cheque for 10p
Name ....
Address ....

Arrow Electronics Limited
Dept. PW 7
7 Coptfold Road,
Brentwood,
Essex

ELECTROKIT

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

SCORPIO IGNITION SYSTEMS (P.E. Nov. 1971) £9·50. This kit includes all the parts for the assembly of this popular and reliable system. The hardware and the construction data are included.

DRILL SPEED CONTROLLER (E.E. Aug. 1972) Kit consists of resistors, rectifiers, thyristors and tag board as specified in the article, price **£1·15**. Kit with M.K. box, switch and plate included **£2·30**.

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

POWER SUPPLY **£6·60**, including all semiconductors, resistors, capacitors, transformer, heat sink and hardware less P.C.B.

PREAMP AND TREMELO **£3·20**, complete with switches hardware and electronic components, less P.C.B.

MAIN AMP **£4·20**, complete with IC-12, electronic components and P.C.B.

13 PITCH BOARDS **£39·50**. Kit contains all the resistors, capacitors and semiconductors as published, but not the P.C.B's or the inductor.

LIGHT DIMMER. Kit contains all parts including circuit and construction data, 480 watts, fully suppressed. Price **£2·10**.

MUSIC MAKER ELECTRONIC ORGAN (P.W. Nov. 1972) complete kit **£4·40** or kit less resistors, P.C.B. and plastic box **£2·80**. Stylus not supplied.

MIGHTY MIDGET (P.W. Jan. 1973) kit contains all parts, less the battery, box and knob, **£2·25**.

TRIFFID RADIO (P.E. Feb. 1973). Kit includes all parts listed, less "tuning coil" and "miscellaneous components". **£4·95**. Ferrite rod and wire, optional extra at **50p**, P.C.B. optional extra at **65p**.

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

Use Access here

BARCLAYCARD welcome here

Send for details of kits available (please enclose S.A.E.)

All kits sent POST FREE within the limits of U.K.

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

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

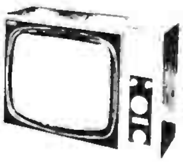
ELECTROKIT

12 Lauderdale Road, London, W.9
Telephone 01-286 0011
Mon.-Fri. 9.30-5.30 Thurs. 9.30-6.30

TV's 19" NOW £11·95

TWO YEARS' GUARANTEE ALL MODELS

405/625: 19" £25·95
23" £35·95
FREE CATALOGUE
CARR £1·95



COLOUR TV 19" £145 OR 25" £185

LIMITED SUPPLY, REGRET PERSONAL CALLERS ONLY
A SELECTION OF RECENT YEARS MODELS
U.K. MANUFACTURE

TV TUBES REBUILT GUARANTEED 2 YEARS

17" and 19" £5·95; 21" and 23" £6·45

Exchange Bowls carr. 55p

COMPONENTS MUST BE CLEARED

Transistor Radio Cases: 25p each. Size 9½" x 6½" x 3½". Post 22p.
Speakers: 35p. 2½" 8Ω. Brand new. Post 15p.
Record Player Cabinets. £3·75p Designed for the modern autochanger. Size 17" x 15" x 7½". p.p. 55p.
Radio: £3·95 8 transistor LW/MW. Free case, battery. Post 15p.
Precision Tape Motors: £1·95. 200/250V. Famous German manufacturer. Post 20p.

Transistor Gang Condensers: 20p. Miniature AM. Post free.
Modern Gang Condensers: 30p. AM/FM or AM only 20p. Post 10p.
Press Button VHF Tuner 75p. Brand new, takes PCF806, PCC89. Post 25p.
Valve ELL80 50p

SPECIAL OFFER

Pots.: 25p each. Post 5p. D/SW 500/500 KΩ. D/SW 500/100 KΩ. D/SW 1 meg./100. KΩ. S/SW 500/500 KΩ. S/SW 500/1 meg.

DUKE & CO. (LONDON) LTD.

621/3 ROMFORD ROAD, MANOR PARK, E.12. Phone 01-478 6001-2-3

BARGAIN PARCELS 14lb at £1·45 plus 32½p p.p.; 28lb at £2·75 plus 52½p p.p.; 56lb at £4·50 plus £1·25 p.p. Contain pots, Res. Valves, Diodes Tagboards, Chassis, Valveholders, etc. Good value save £££s. Lucky Dip Service.

FANTASTIC BARGAIN. New 6 inch tubes. E450 4/B/16 4VH, medium Persistance, green. Ideal scope tube.

Also 09J 4½in. dia. Length 15in, Also 7BP7. All unused as new. Price £1·40 post paid.

NEW HEAVY COAX CABLE dia. ½" 70 ohms approx. 50ft. lengths £1·40, p. & p. 30p. 100 ft. lengths £2·70, p. & p. 50p.

AERIALS. New Condition Whip Type. 4ft. 20p: 11ft. 75p. all collapsible type. P. & p. 4ft. 10p, 11ft. 15p. New bases on adjustable clamp for the above, 62½p. p. & p. 25p.

CRYSTALS AS NEW. Hc 6u, 5,345; 5,030; 4,945; 4,875; 4,840; 4,795; 4,580; 4,660; 4,520; 4,510; 2,300; 2.295 Kc/s. 50p each plus 8p p.p.

OUR SELECTION OF 6–Ex. Equ. METERS consisting of 3in., 2½in., 2in. mill amps, volts, amps. Mixed at the bargain price of £2 P. & P. 25p. minimum order of six.

ANY HEIGHT AERIAL TUBULAR SECTIONS ⅞" dia. × 3ft. long. Brass screw in ends, copper coated and painted. Good condition. 20p p. & p. 5p each. Minimum order 6.

AS NEW AERIAL TUNER UNIT No. 6 RF, consisting of 1½ inch 500 mico/ampmeter 3 gang tuner 75 PF geared BNC type socket size 5½" × 4½" × 5". Price £1·50, p. & p. 25p.

NEW AERIAL WIRE ON BOARDS 7/22 UNCOVERED 90ft 47½p, 100ft. 55p, p. & p. 20p.

AERIAL MAST POLES approx. 5ft high 2" dia. Interlocking ends. Minimum order three. New condition. £1 each section. Carriage 35p each section. ½" 75 ohms Coax in 50ft coils with BNC plugs good condition. Price £1 + 30p p.p.

AS NEW 500ua PENNY SIZE METERS complete with jack plug price £1 each, p. & p. 10p.

C.W.O. CARRIAGE CHARGES MAINLAND ONLY

WOULD CUSTOMERS PLEASE ENSURE THAT ALL ORDERS ARE PRINTED IN BLOCK CAPITALS AND INCLUDE YOUR ADDRESS.

A. H. THACKER & SONS LTD.

Radio Dept., High Street, Cheslyn Hay, Nr Walsall, Staffs.

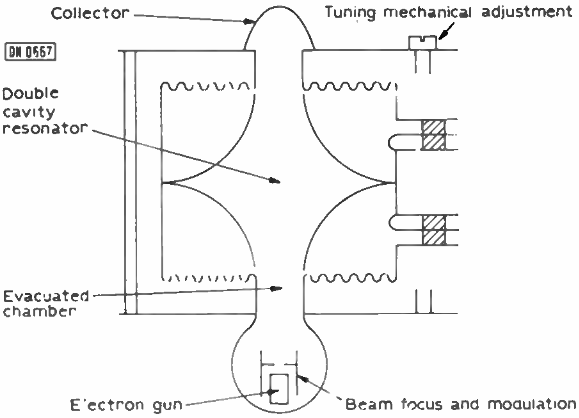


Fig. 2: Internal arrangement of a klystron valve.

whilst the mechanical range is considerably more. Typical device types are the KS6, 7, 9 family and YK1010 to 1090. Most of these utilise waveguide outputs but some have coaxial probes. The higher power devices require forced air cooling, whilst the u.h.f. power units need a cooling water supply.

TRAVELLING WAVE TUBES

These are microwave power amplifier valves used extensively in communication systems particularly for microwave links. The basic construction is shown in Fig. 3 and consists of an electron gun assembly, a modulating helix structure and a collector electrode. The electron gun forms a narrow electron beam focused by means of the grid and anode. The beam passes along the axis of an accurately formed helix structure and is continually focussed by a magnet system. The modulating microwave frequency is passed along the helix and travels at approximately the same speed as electrons in the beam. Thus the r.f. field produces an electric field which velocity modulates the electron beam as it travels along the helix axis. After modulation the electron beam bombards the collector electrode which is often water cooled.

For low power valves the helix is of wire but for power devices a ring bar structure is used. As the helix is in a long glass envelope, heat dissipation is by radiation and thus the power is limited, especially since the mechanical helix structure must be very accurate. For very high power devices a ring-bar helix system is used and is a development of the cross-wound opposite band helix system. Where very high power is necessary the ring bar structure is supported by annular beryllium insulators of high thermal conductivity.

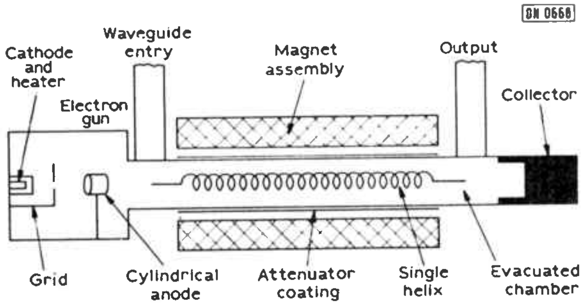


Fig. 3: Diagram to illustrate the construction of a travelling wave tube.

Travelling wave tubes are very efficient microwave amplifiers which produce amplitude modulated output signals. The frequency range is determined by the mechanical structure and the helix in particular and, for the simple helix, it is roughly an octave about the centre frequencies from 1 to 9GHz.

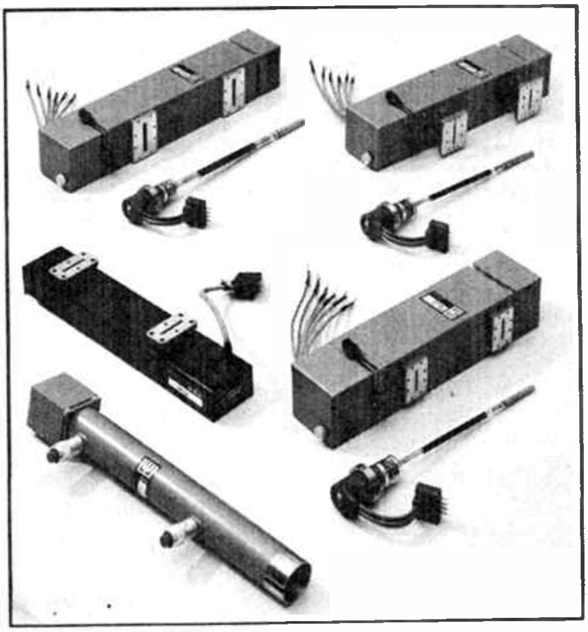
Power levels for continuous operation are usually 1 to 10W but kilowatts are possible while operation in pulsed modes can result in peak power levels in the megawatt region. The band-width at high power levels is usually reduced to as low at 10% or 400MHz at 4GHz.

Both forward and backward wound helices are used and typical gains in the X band are in the region of 30 to 40dB, with noise factors of 20 to 28dB. Generally they are designed to fit into special mountings which incorporate the permanent magnet systems. The input and output are usually taken directly from waveguide connections, with the forward wave tubes operating as amplifiers and the backward wave tubes as oscillators. Typical forward wave types are LB4-20 and 30, at 4GHz and LB6-15 to 25 at 6GHz, with backward wave oscillators like the YH1100 and BA16.

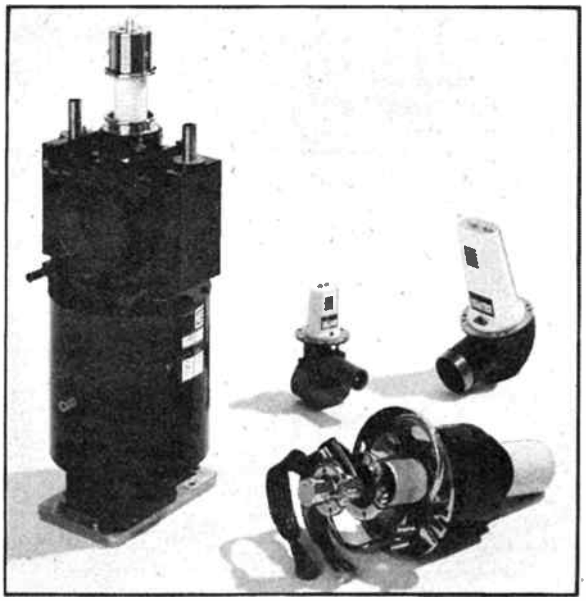
MAGNETRONS

These are essentially high efficiency oscillator valves and are used for producing fixed frequency, fixed amplitude oscillations and, in a pulsed mode, are widely used in radar equipment. The normal frequency is in the X band (5·2 to 10·9GHz) although other bands are covered.

The magnetron, as illustrated in Fig. 4, consists of one or more very carefully machined cylindrical cavities with a cathode adjacent to the cylinder and formed of a thin wire. A permanent magnet provides



A selection of travelling wave tubes used for communications in the S, C and X-bands. Three are replaceable types, shown beside their mounts.



In this collection of magnetrons the large one is an L-band 2·3MW tunable pulse magnetron intended for high power surveillance radar. In the foreground is a 25kW CW model for industrial use. The remaining two magnetrons are rated at 50kW and 900kW pulse operation in the S-band.

a magnetic flux at right angles to the cylinder and thus at right angles to the electric field formed by the diode. Electrons released from the cathode travel in a circular path and at a given frequency just graze the anode. The oscillation frequency is determined by the physical characteristic of the cylinder and therefore is often fixed. Slight tuning is however provided with some magnetrons.

Continuous-wave magnetrons are available in the frequency range 8 to 9·5GHz at power levels of 6W to 20W. Typical operating conditions are $V_a=1kV$, $I_a=50mA$, $V_h=6\cdot3$ and I_h starting at 1A. Typical types are JPT 9-01 and JPG 8-01.

Pulsed magnetrons are designed for short pulse durations in the region 1 to 5μs for X band devices at approximately 9GHz. Power outputs range from 25W to 50kW with devices such as JPT9-02 and YJ1050. The lower frequency 1·25GHz (L Band) and 5·5GHz (C Band) devices operate at higher power levels up to 1,000kW.

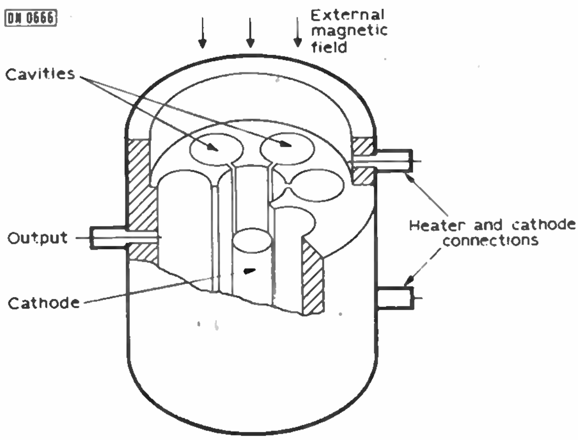


Fig. 4: General arrangement of a multiple cavity magnetron.

FUTURE TRENDS

Although trends continue towards the use of semiconductor devices, the power transmitter valve at all frequencies cannot yet be replaced directly. Thus power valves at all frequencies are still of very considerable use and development continues to improve all these designs.

A trend which undoubtedly will continue is the replacement of high power microwave transmitters by low power solid state components such as varactor chains. This has been made possible by improved receiver and aerial design.

We are indebted to the English Electric Valve Co. of Chelmsford for permission to reproduce the photographs in this article.

TO BE CONTINUED

I.C. OF THE MONTH

L.A.J. IRELAND

Number 37

SGS NE555 Precision Timer

A highly stable timing device, type NE555, recently released by SGS, is the topic for this month's article. It allows precision timing from microseconds to hours with a mere handful of components; its uses however are not limited solely to the timing field as it can also find wide application in such diverse spheres as pulse generation, frequency division, pulse-width modulation, etc., to mention but a few. Such versatility coupled with low cost should make it an attractive i.c. to the amateur experimenter and a few of its more interesting features and applications will be outlined in the following notes.

Applications

A block diagram of the NE555 is shown in Fig. 1 and the first application to be considered is its use as an accurate timer, Fig. 2. The timing period is set by one additional resistor capacitor network with additional terminals allowing control over the triggering and resetting of the device. The external

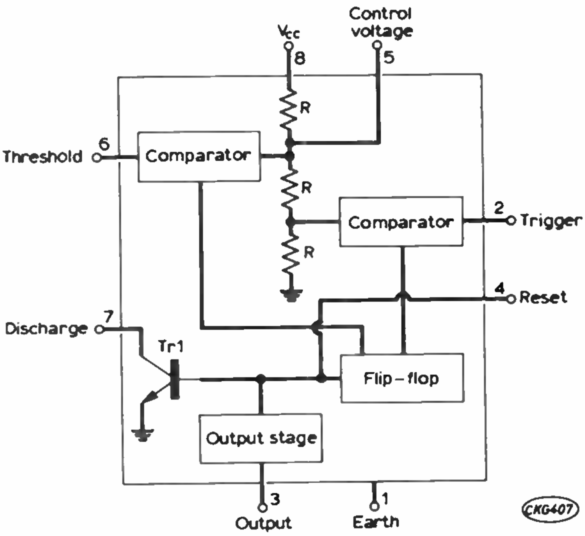


Fig. 1: Block diagram of the NE555 timing device.

capacitor connected between pin 7 and earth is initially held discharged by the short circuit path of the saturated transistor Tr1. When a negative trigger pulse is applied to pin 2 the flip-flop changes state and biases off Tr1 thereby allowing C1 to charge via R1. The time constant associated with R1C1 determines the rate at which C1 charges and when its voltage reaches $\frac{2}{3}V_{cc}$ the threshold comparator

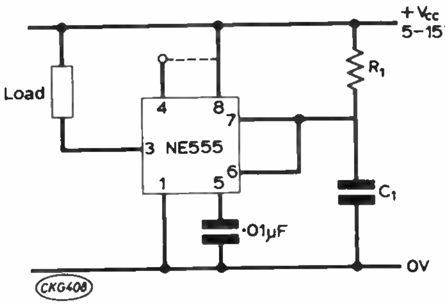


Fig. 2: Typical application of the NE555. The values of R1 and C1 for a delay of 1 second would be 1MΩ and 1µF.

resets the flip-flop and discharges C1 in addition to providing an output pulse at pin 3. One of the great advantages of this type of circuit is that the timing rate, for all practical purposes, is independent of the supply voltage. Timing periods from as short as 1 microsecond to as long as 1 hour may be obtained with this rather simple arrangement.

Multivibrator

Another interesting application of the NE555 is obtained when pins 2 and 6 are joined together as illustrated in Fig. 3. Here the device is operated as

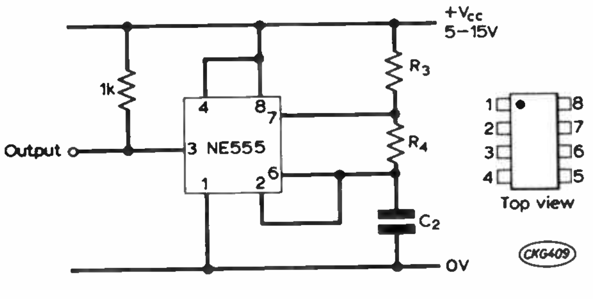


Fig. 3: In this circuit the NE555 is used as a free-running multivibrator.

a free-running multivibrator with the frequency and duty-cycle set by the R3-R4-C2 arrangement. The combined value of R3 and R4 in conjunction with C2 determines the frequency while the duty cycle is set by the ratio R3/R4. As the transistors fabricated in the silicon chip are of the highest quality excellent square waves are obtained from the output at pin 3. Once again, in this arrangement the operating frequency is independent of the power supply voltage.

Pulse-width modulator

The final application of the NE555 to be considered is its use as a pulse-width modulator. Here an external square wave generator's output is connected to pin 2 with the modulating signal applied to pin 5 as indicated in Fig. 4. (Incidentally, another NE555 operated in the astable mode will function quite well

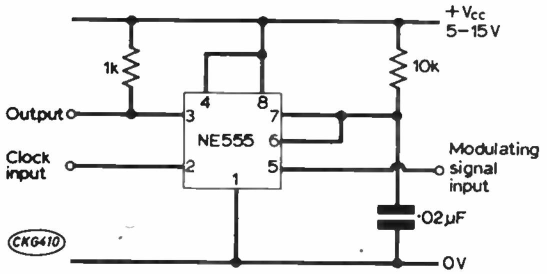


Fig. 4: Yet another application is as a pulse-width modulator.

as the clock generator.) As the control voltage on pin 5 increases, it affects the threshold voltage of the comparator resulting in an increase of the pulse width. The exact opposite occurs as the modulating voltage decreases so the output train of pulses obtained at pin 3 has a frequency identical to the clock input frequency with the pulse width controlled by the modulating signal.

A few of the more interesting applications of the NE555 i.c. have been reviewed in this article and further uses of the device are left to the ingenuity of the experimenter. The NE555 is available from Quarndon Electronics Ltd., Slack Lane, Derby.

Improving VHF Radio April PW

Although our information was taken from a normally reliable valve and transistor manual the connections for the BF200 transistor in Fig. 6 were incorrect. They should read, clockwise from the tag: emitter, base, collector and shield.

Receiver Matching Unit

F. G. RAYER

AN end-connected wire of random length is often used as a short wave aerial and this can, in fact, give good results if reasonably high and clear of earthed objects. At some frequencies, when the aerial length is a half wave or multiple of a half wave, the end impedance at the receiver can be very high, over 1000 ohms. At the other frequencies (a quarter wave or odd number of quarter waves) the impedance is low, probably under 50 ohms. Therefore, for an efficient transfer of energy from the aerial to the receiver at all frequencies, some matching device is needed. The one described here covers about 3·5MHz to 30MHz, and it is over this range that such an accessory is most likely to prove useful.

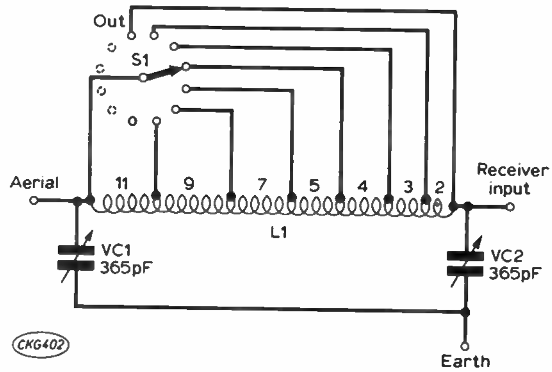
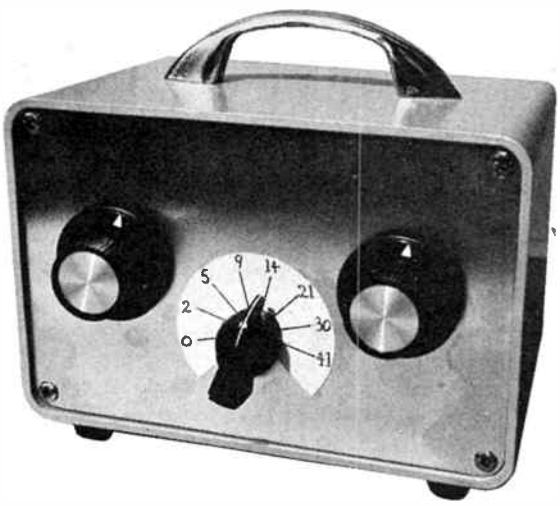


Fig. 1: above, shows the circuit of the receiver matching unit. When switched to "Out" the two variable capacitors should be turned to minimum capacity.

THE PI NETWORK

In the circuit, Fig. 1, the tapped inductor L1 has a variable input capacitor VC1 and variable output capacitor VC2. A 12 position rotary switch S1 allows turns to be selected as follows—0, 2, 5, 9, 14, 21, 30, and 41, the last four positions remaining unused. This switch and adjustment of VC1 and VC2 allows a wide range of aerials to be matched to the receiver.

Many communications receivers have a nominal aerial input impedance of about 75 ohms while others, and especially some popular older models, are 600 ohms. On some frequencies the aerial may chance to match the receiver. The Receiver Matching Unit will then give no improvement in signal strength, but can be left in circuit by setting VC1



and VC2 at minimum and the switch at "O".

At other frequencies the switch is progressively rotated to bring more turns into circuit, each time adjusting VC1 and VC2 for best results. This is merely a matter of peaking the matching unit controls for best volume, or best S-meter reading. Where the mis-match is bad, quite a significant improvement should be had. If peaking the signal by ear, switch off the receiver a.g.c. or choose a weak signal or adjust for maximum general noise picked up by the aerial.

capacitors. Solid dielectric components are not recommended. A value of 350pF or so is useful for the lower frequencies, but for the h.f. bands only 200pF or even 150pF capacitors may be suitable, if to hand.

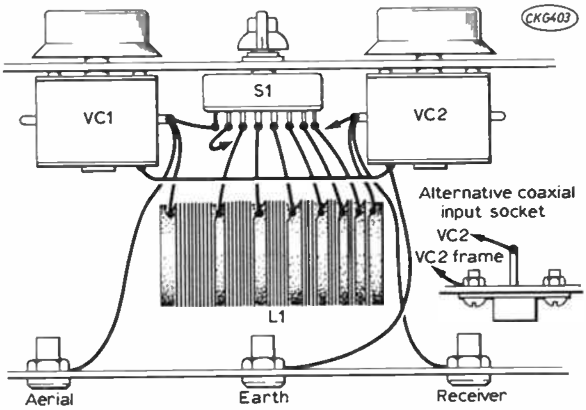
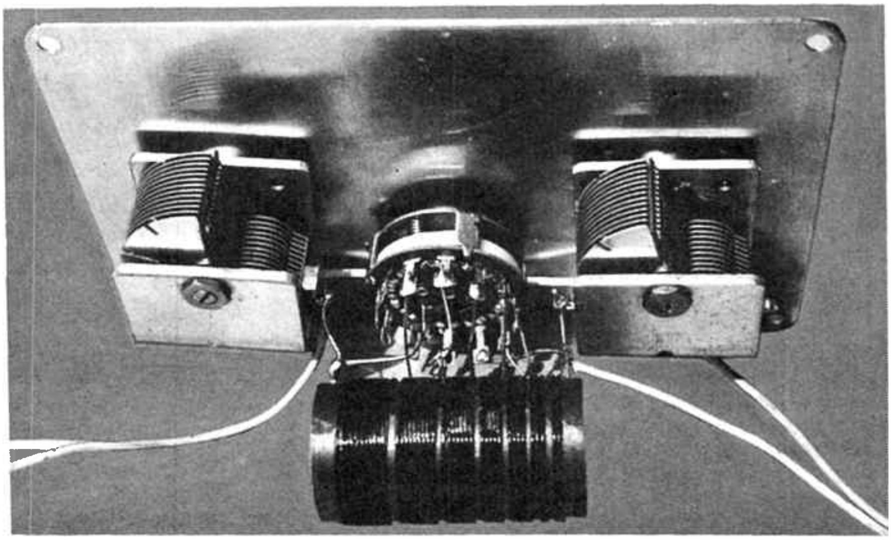


Fig. 2: Wiring diagram of the matching unit. Unused positions on the switch have been ignored.

Fig. 2 shows construction, the coil being supported by its leads. The plastic case used was 6×4×4in. but had no removable back, so flying leads were left just long enough to reach Aerial, Receiver, and Earth terminals fitted at the rear. Communication receivers often have a 75 ohm co-axial aerial input socket when a co-axial socket can be fitted to the

The photograph, right, shows the author's prototype unit. The multiple leadouts from the coil are sufficient to hold it firmly on the switch.



The coil is wound with 22 s.w.g. enamelled wire on a paxolin tube 1in. in diameter and about 2in. long. Anchor the wire through small holes near one end. Wind 2 turns side by side, and twist a small loop. Leave a space of about $\frac{1}{16}$in. and wind 3 turns, making a further loop. Continue in this way, adding 4, 5, 7, 9 and 11 turns, with a small space between each section. Scrape all the loops and solder on leads for the switch.

Solder the leads to the switch so that the first position shorts the whole coil, subsequent positions leaving 2 turns, 5 turns, 9 turns, and so on, in circuit, position 8 having no connection so that the whole coil is in use.

VC1 and VC2 are each 365pF miniature air-spaced

back of the matching unit. The inner conductor of the co-axial lead to the receiver will be the aerial lead, and the outer braiding will act as the earth connection no earth being needed on the unit.

The switch has a scale showing the number of turns in circuit. The lowest frequency reached depends on the aerial and receiver, but can extend down to 1·5MHz in some cases. On some ranges, the unit is useful in reducing second channel interference. If a numbered dial is fitted to each capacitor a very useful chart can be made up showing dial readings and switch positions for the various amateur and short wave broadcast bands, which will considerably shorten the time taken to tune the unit to any particular frequency. ■

IN NEXT MONTH'S PRACTICAL WIRELESS

STEREO HEADPHONES REMOTE CONTROL UNIT

Listen to your stereo records and radio programmes in the comfort of your armchair, perhaps several feet away from the amplifier. Settle down and enjoy the music in the "ideal stereo" position. You don't have to get up to adjust volume or balance controls because you have this small unit on your lap to do it remotely, with balance meter and socket for private listening on stereo phones. Easy construction details given next month.

FREE COMPETITION

4 DIGITAL MULTIMETERS WORTH £200 TO BE WON!

OPEN TO ALL READERS OF P.W.

FULL DETAILS AND ENTRY FORMS IN THE JUNE ISSUE—ORDER NOW

ALL IN THE JUNE ISSUE ON SALE 4th MAY. PRICE 20p.

SIMPLE MEDIUM WAVE RECEIVER

This small easy to build radio is designed to include the 160 metre band and local radio stations on the medium wave. It is easily converted for the long wave 1500 metres by adding one component. Ideal for bedroom, garage or holidays.

REGULATED POWER SUPPLIES FOR TRANSISTOR RADIOS

Save battery costs at home. Run your pocket radio from a mains power unit. This unit replaces small 9 volt batteries for radios drawing up to 50mA current.

MANY OTHER CONSTRUCTIONAL ARTICLES, SPECIAL FEATURES AND REGULAR COLUMNS

PRACTICAL WIRELESS

SIMPLE PROJECTS FOR THE HOME

8 PAGE SUPPLEMENT

MAY 1973

Two Tone Door Bell

This oscillator produces a pleasing tone, different in frequency for either of two doors. By using a suitable centre-tapped transformer T1, the collector circuit of each transistor can drive the base of the other transistor.

Assembly is on a perforated srbp board and wired as in Fig. 2. This board is fitted in the speaker cabinet or to a flat speaker panel fitted across the corner of the room.

One push-button switch is wired to A, and the other to B. The return leads of both switches go the common terminal C. When one switch is operated both R1 and R2 are in circuit, while with the second push R2 only is present. Wires A-C can run to the front door, and B-C to the back door.

The note can be altered by changing the resistance of R1 or R2 or the capacitance of C1, C2 or C3.

Connections for OC81, NKT271: collector wire nearest spot, then base, emitter. ●

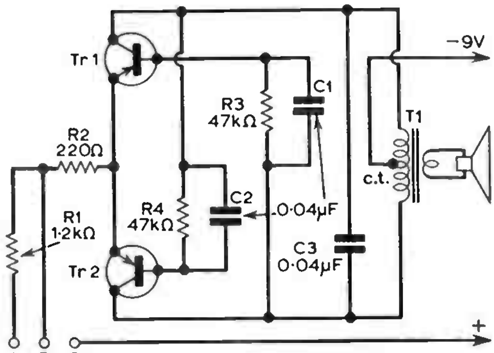


Fig. 1: Circuit diagram

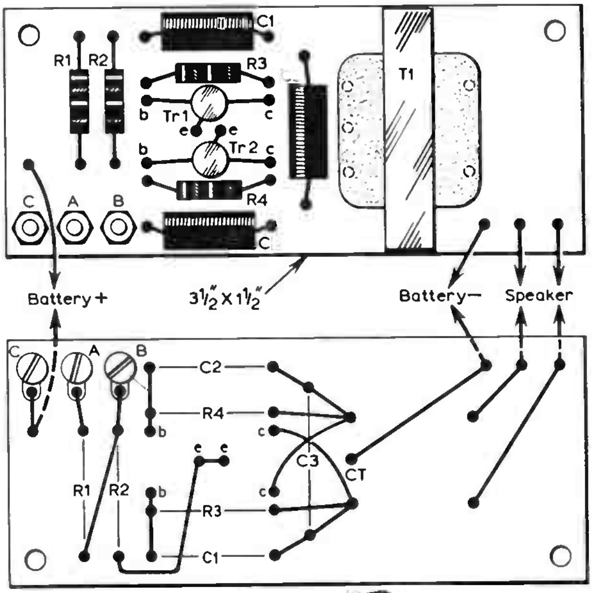
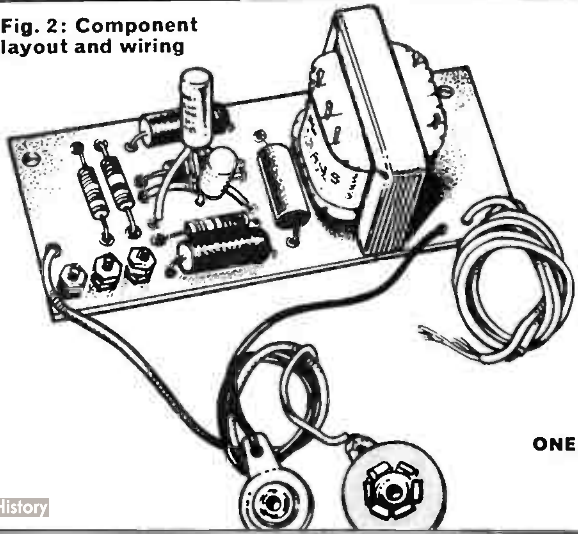


Fig. 2: Component layout and wiring



components

R1	resistor 1·2kΩ ±10% ¼w
R2	resistor 220Ω ±10% ¼w
R3	resistor 47kΩ ±10% ¼w
R4	resistor 47kΩ ±10% ¼w
C1	capacitor 0·047μF polyester
C2	capacitor 0·047μF polyester
C3	capacitor 0·047μF polyester
Tr1	transistor OC81 or NKT271
Tr2	transistor OC81 or NKT271
T1	transformer 9·2:1 CT primary, type T/T7 Repanco
	Loudspeaker 3Ω 5in. and wooden board 12in. × 9in.
	Battery 9V type PP6 or PP9 with connectors
	Perforated srbp component board
	Nuts and bolts 6BA, soldering tags, pvc wire

Intercom Amplifier

Ready-made amplifier module used to give press-button calling and communication in both directions. Fig. 1 is the complete circuit.

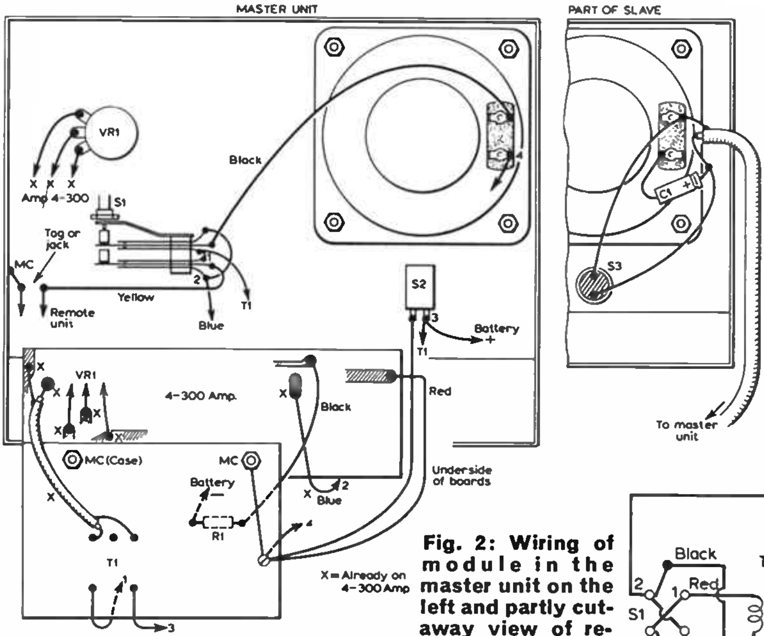


Fig. 2: Wiring of module in the master unit on the left and partly cut-away view of remote unit

S1 is the "push-to-call and push-to-speak" switch. When it is pressed, the circuit is completed in such a way as to cause an audio tone (R1 limits current in this condition). S2 switches the unit on so that the master position may speak to the remote position, or vice versa. S3 at the remote unit causes a tone at the master unit, to gain attention.

At the master unit, press S1 a few times to gain attention, then close S2, with S1 released to listen. Press S1 again to speak. Switch off with S2 when contact is finished. At the remote unit, press S3 a few times to call master unit and await reply. VR1 is set to a suitable volume level, and is ready wired to the 4-300 unit.

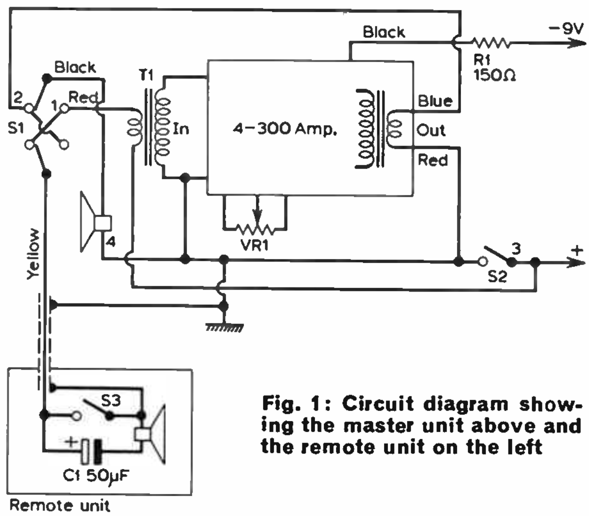


Fig. 1: Circuit diagram showing the master unit above and the remote unit on the left

components

R1	resistor 150Ω ±10% ¼ watt
VR1	potentiometer supplied with amplifier module
C1	capacitor 50μF 12V electrolytic
T1	transformer 9·2:1 CT primary, type T/T7 Repanco
S1	2-pole, changeover spring loaded push button, type S746 with S768 operator, or type S415 Bulgin
S2	single-pole, on-off toggle switch
S3	single-pole, on-off push button
	Loudspeakers 3Ω 2½in. or 3½in.
	Battery 9V type PP6 or PP9 and connectors
	Amplifier module type 4-300
	Component board srbp 3½in. × 2½in.
	Case 8in. × 6in. × 6in. (Master unit)
	Case 4in. × 4in. × 4in. (Remote unit)
	PVC connecting wire and knob
	Nuts and bolts 6BA and 4BA
	Soldering tags 6BA

Numbers 1 to 4 in Fig. 1 refer to connection points 1 to 4 in Fig. 2. Fig. 2 shows the master unit. Two 6BA bolts secure the 4-300 amplifier and also the srbp board for T1 and R1. Solder coloured leads to S1 as indicated before fitting this item. Input and output circuits and T1 are

continued on page three

Water Level Detector

A sensor, on the end of twin flexible lead, can be placed in a water tank, swimming pool, bath or wash-boiler. A buzzer sounds when the water level reaches the sensor.

The minimum battery current drain is about 0·3mA; rises to about 400mA when water reaches the sensor.

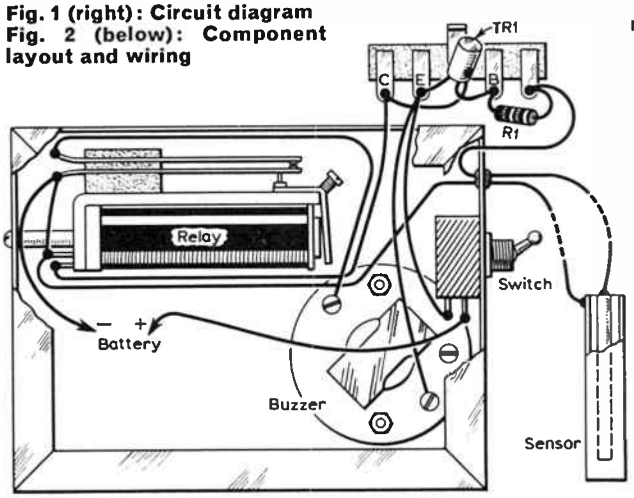
Fig. 1 shows the circuit. The presence of water shorts the sensor probe and allows base current to flow through R1, resulting in a collector current of about 40–50mA to close the relay. The buzzer sounds until the sensor is removed from the water, or the device is switched off.

Fig. 2 shows all wiring, in a case made from aluminium. The tag strip (shown detached) is mounted vertically in the adjacent corner of the case. Space is left for a flat 3-cell 4·5 volt battery.

components

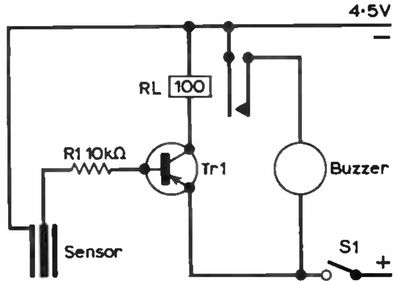
R1	resistor 10kΩ ±10% ½ watt
Tr1	transistor OC76 or any high gain pnp type
S1	single-pole, on-off switch
RLA	relay 100Ω coil, single-pole on-off contacts, 3-6V operation
	Battery 4½ to 6V depending on relay obtained
	Buzzer 4½ to 6V
	Sensor probe (see text)
	Case 6in. × 4in. × 2in. aluminium box or chassis with lid.

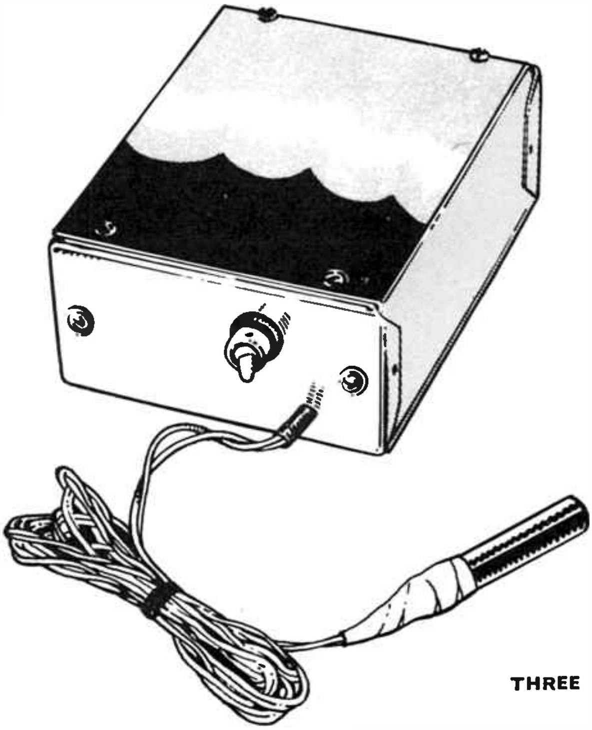
Fig. 1 (right): Circuit diagram
Fig. 2 (below): Component layout and wiring



The sensor is made in coaxial form to avoid any accidental short (and wrong indication) by metal items. It has an outer metal tube about 2in. long by ⅜in. diameter, with a slightly shorter internal pin (actually a length of 4BA threaded rod). The inside part is fixed by a tight binding of insulating tape, or by an insulated sleeve. The sleeve and pin must not touch. Several feet of thin twin flex are soldered on, the sensor inner part going to R1.

An alternative probe can be a coaxial plug as used for TV aerial wire, although it must be kept free from corrosion. ●





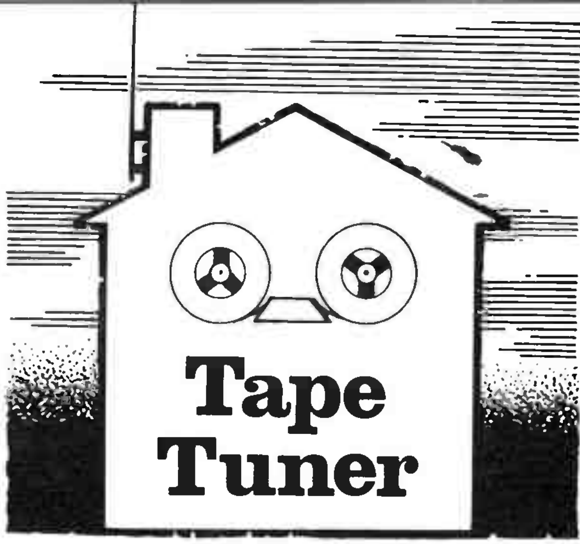
INTERCOM AMPLIFIER
continued from page two

positioned to avoid feedback which would cause instability. In addition to VR1, the 4-300 has a preset sensitivity control, which can be left at about the middle of its travel.

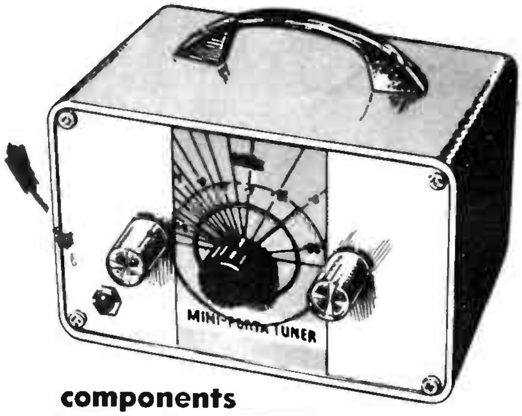
Easy connecting of a remote unit lead can be by a jack plug and socket, the outer conductor being the common positive return. Do not connect or disconnect while battery is switched on.

The equipment will operate as a baby alarm by placing the remote unit near the cot and closing S2.

Connections to the 4-300 amplifier module are shown in Fig. 2, indicating appropriate copper pads used for connections. MC indicates connection made to the metal case by soldering tags. S1 does not necessarily need to resemble that shown in Fig. 2 but can be any style with the operation as in components list. ●



Tape Tuner



This portable medium wave tuner gives an output for a tape recorder or amplifier.

Note that the AA119 diode has a *black* mark to denote plus polarity; wrong polarity here will upset avc action. Components are positioned as in Fig. 2 and wired as shown in grey. The perforated srbp board is bolted to the metal bracket carrying VR1, VC1/2 and S1. MC is the metal case connection.

A bracket, srbp strip, and strip of card wrapped round the rod and drawn tight with a

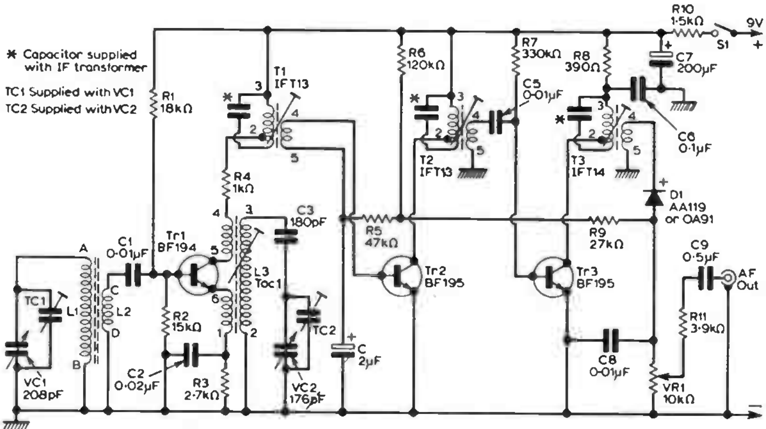


Fig. 1: Circuit diagram of the tuner

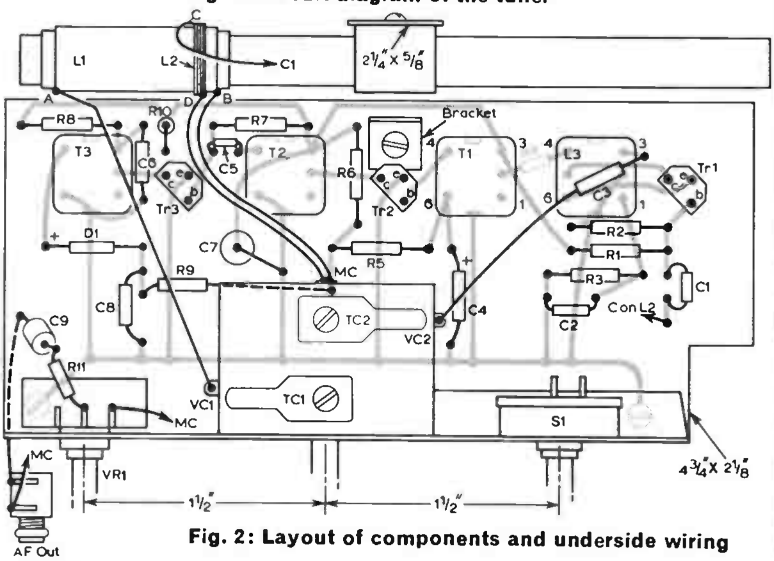


Fig. 2: Layout of components and underside wiring

components

Resistors

R1	18kΩ	R7	330kΩ
R2	15kΩ	R8	390Ω
R3	2·7kΩ	R9	27kΩ
R4	1kΩ	R10	1·5kΩ
R5	47kΩ	R11	3·9kΩ
R6	120kΩ		

All resistors ±10% ¼ watt

Potentiometer
VR1 10kΩ log.

Diode
D1 AA119 or OA91

Capacitors
- C1 0·01µF mica or ceramic
- C2 0·02µF mica or ceramic
- C3 180µF mica or ceramic
- C4 2µF electrolytic
- C5 0·01µF mica or ceramic
- C6 0·1µF polyester
- C7 200µF 9V electrolytic
- C8 0·01µF polyester
- C9 0·5µF polyester

(Note: C9 not required if used only with IC-12 audio amplifier)

Variable Capacitors
VC1 & VC2 208+176pF with trimmers type 00 Jackson (slow motion optional)

Preset Trimmers
TC1, TC2 fitted to VC1, 2

Transistors
Tr1 BF194 Tr2 BF195 Tr3 BF195

Coils
- L1, L2 Medium wave ferrite rod aerial coil type MW/FR5 Denco
- L3 Oscillator coil type TOC1 Denco

Transformers
- T1 I.F. transformer type IFT13 Denco
- T2 I.F. transformer type IFT13 Denco
- T3 I.F. transformer type IFT14 Denco

Switch
S1 Single-pole, on-off toggle switch

Miscellaneous
- Perforated srbp, 0·15in. matrix 4¾in. x 2⅛in.
- Control panel and bracket 4¾in. x 2in. aluminium
- Nuts and bolts 6BA, pvc wire
- Case, insulated, of wood or plastic

Radio Alarm Clock

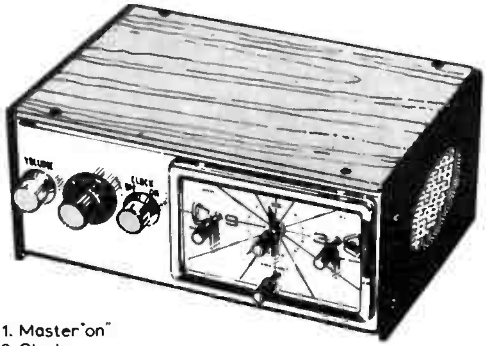
This radio alarm is designed to awaken you at a preset time set on the clock movement, and to switch off automatically if required.

Use the "Tape Tuner" (page four of this supplement) with an integrated circuit audio amplifier. The synchronous clock runs from 250V a.c. mains and is supplied with contacts which are set by a front mounted control. A second control sets the duration, then automatically switching off. (A minute timer ringer is also provided, but is not used in this circuit.)

The master or programming switch, which is arranged as in Fig. 1 and shown in two views in Fig. 2, allows the radio to be switched on irrespective of the clock settings, or switched off separately, giving complete freedom of operation without any need to change clock settings.

components

Tape tuner as described on page four of Supplement
Amplifier i.c. type "Super IC12" with heat sink (Sinclair)
Electric programmer clock as illustrated with switch contacts glass and bezel (various advertisers)
Loudspeaker 8Ω to match IC12
Switch single pole, 3-way to select operation
Connection block, 3-way for mains connection
Fabric or expanded aluminium speaker grille
Case approx. 10in × 7in. × 4½in.



A mains connector joins mains leads and clock leads.

The i.c. amplifier is mounted on brackets. The whole unit is powered by a PP9 9V battery. A mains unit could be fitted instead and several proprietary brands can be purchased or the reader can make his own. All units can be mounted in a suitable wooden case. ●

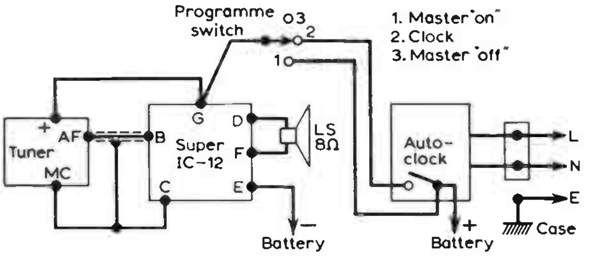


Fig. 1 (left): Circuit diagram
Fig. 2 (below): Component layout and wiring (the programme switch is shown twice for wiring detail)

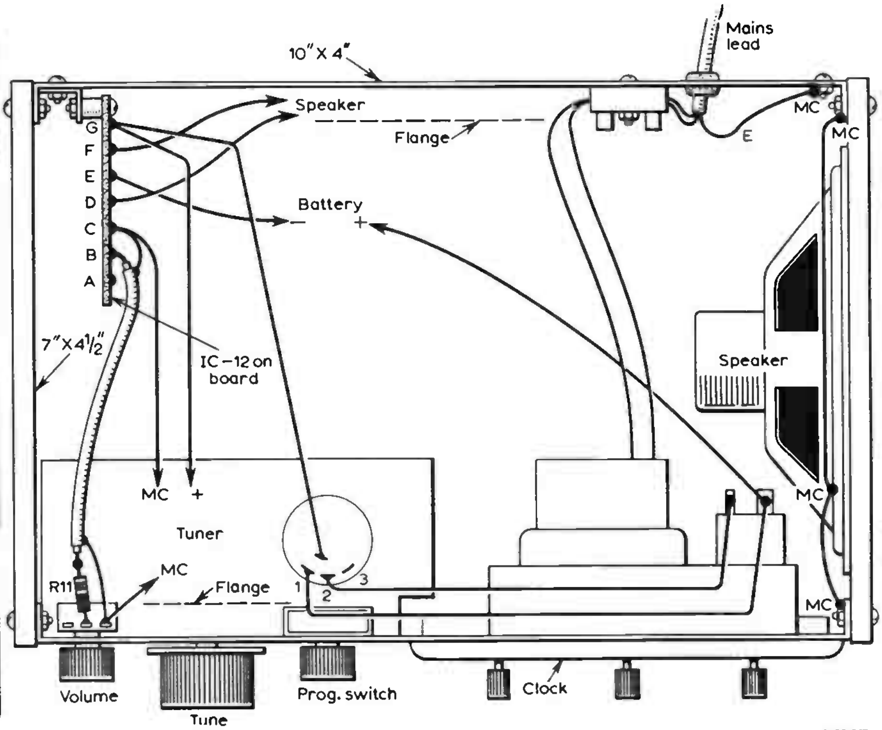
TAPE TUNER

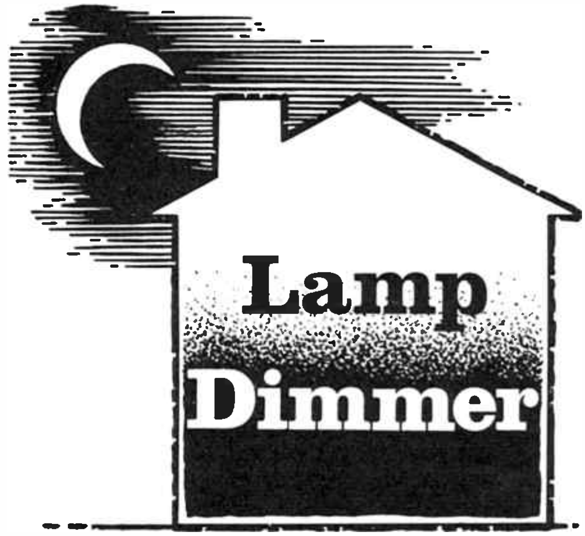
continued from page four

nut and bolt hold the ferrite rod aerial.

The i.f. transformers T1, T2, T3 are pre-aligned but the effect of slight core adjustment can be tried. Adjust TC1 and TC2 at the high frequency (200 metres) end of the band, and the core of L3 (if necesary). The position of L1/L2 on the ferrite rod is adjusted at the low frequency end of the band.

Note that the specified case is insulated material, not metal to avoid screening the ferrite rod aerial. Audio output should be heard on high impedance phones connected to the output jack socket. The output is of high impedance and should be fed into the high impedance input of a tape recorder via screened cable (but see also the Radio Alarm Clock). Transistor connections as indicated by top view in Fig. 2. ●





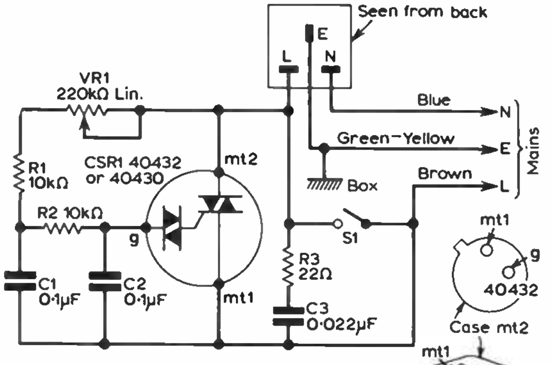


Fig. 1: Circuit diagram and triac connections looking at the wire or pin ends

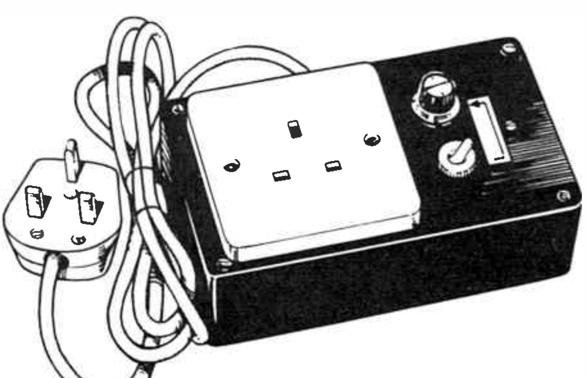
This lamp dimmer is constructed in an electrical switch box. The 40432 triac is rated at 0·5A without a heat sink, or 1A with the type 5F clip-on heat sink shown. With 240V a.c. mains, this is suitable for lamp loads of 120 watts and 240 watts respectively. An alternative triac type 40430 can also be used.

The dimmer can be fitted in place of an ordinary lamp switch. With the portable unit shown, the dimmer box and a 13A type outlet are assembled in a larger box. A table or standard lamp can be plugged into it, or it can be used for heat control of a soldering iron. This unit is not rated for power drills and is not suitable for them nor for fluorescent lamps.

Fig. 1 is the circuit, with wiring to integral 13A type outlet. The metal box, Fig. 2, provides screening. Complete closure by a metal plate was not found necessary. The triac case is connected, via a soldering tag bolted to the heat sink or case, to VR1. It must be insulated from the box and any other metal part. Flexible leads to VR1 and S1 allow these to be positioned in the front holes.

Assure proper earthing is maintained right up to any appliance controlled by the unit. The mains plug is fitted with a 3A fuse.

Triac connections shown in diagram. ●



components

R1	resistor 10kΩ ±10% ½ watt
R2	resistor 10kΩ ±10% ½ watt
R3	resistor 22Ω ±10% ½ watt
VR1	potentiometer 250kΩ linear
C1	capacitor 0·1μF 1,000V d.c. or 300V a.c.
C2	capacitor 0·1μF 1,000V d.c. or 300V a.c.
C3	capacitor 0·022μF 1,000V d.c. or 300V a.c.
CSR1	triac type 40432 with heat sink clip type 5F or triac type 40430
S1	Single-pole, on-off toggle switch 250V a.c.
	Metal electrical switch box 2¾in. × 2¾in. × 1⅜in. or 6½in. × 3½in. × 2in. with 13A mains socket
	Tag strip 8-way, knob, pvc wire, rubber grommet

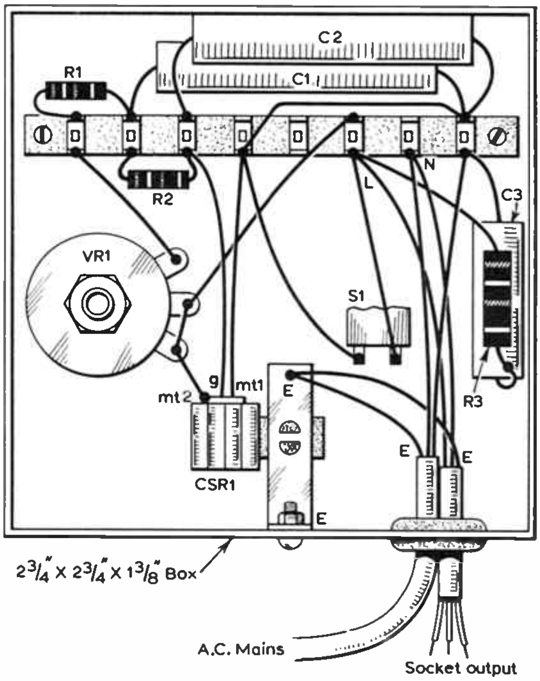


Fig. 2: Component layout and wiring

This alarm gives a warning by means of a bell, buzzer or lamp, so it can be used as a baby alarm, or as an extension for a door-bell or telephone bell. As it is sound operated, no direct connection is necessary to a telephone or other equipment.

The input transducer is a small loudspeaker, followed by Tr1 and Tr2 as amplifiers. VR1 is a sensitivity control, allowing adjustment of the sound level at which the unit operates.

All components except the speaker and VR1 are mounted on the perforated srbp board in Fig. 2. Underside wiring is shown in grey. Points A, B and C carry connecting wires to VR1. Wires A and C are connected so that sensitivity increases as the control knob is rotated from the "off" position in the usual way. The case is an aluminium box or chassis.

Test by connecting a meter to the output terminals. A brief pulse of current is indicated when switching on, due to C5. The reading should then remain at zero, rising to 100-250mA while snapping the fingers or speaking quietly.

Place the unit adjacent to the source of sound. Where extraneous sounds may operate the unit, reduce sensitivity by turning back VR1 just enough to avoid this.

Twin bell wire or a long twin flexible lead run from the output terminals to the bell or relay. A diode 1N4148 should also be connected across the output terminals to suppress back e.m.f. through Tr4; diode plus to collector.

Connections for OC71, OC81: Collector nearest spot, then base, emitter. ●

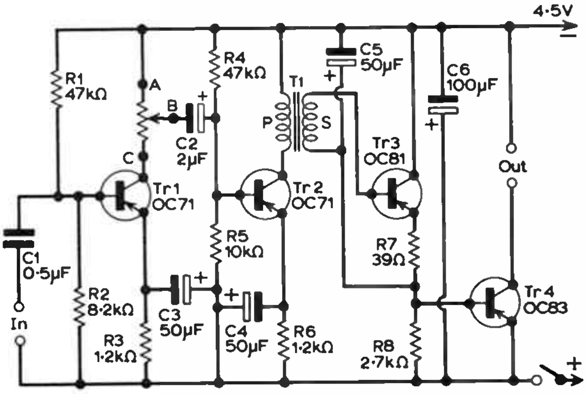


Fig. 1: Circuit diagram of the amplifier

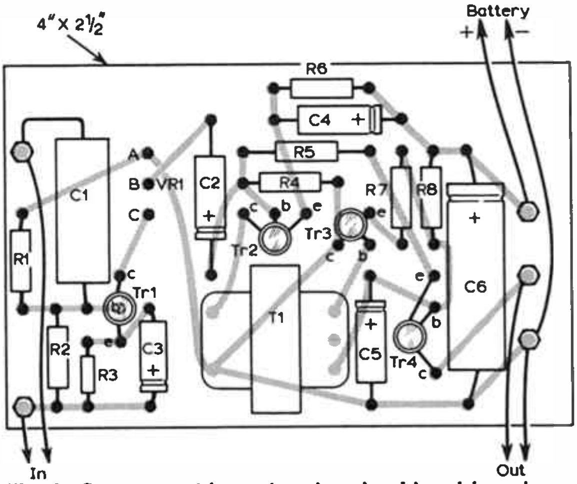


Fig. 2: Component layout and underside wiring shown grey

components

Resistors

R1 47kΩ R5 10kΩ
R2 8·2kΩ R6 1·2kΩ
R3 1·2kΩ R7 39Ω
R4 47kΩ R8 2·7kΩ

All ±5% ¼w

Potentiometer

VR1 5kΩ with switch S1 attached

Capacitors

C1 0·5μF polyester C4 50μF 6V electrolytic
C2 2μF 6V electrolytic C5 50μF 6V electrolytic
C3 50μF 6V electrolytic C6 100μF 6V electrolytic

Transistors

Tr1 OC71 Tr3 OC81
Tr2 OC71 Tr4 OC83

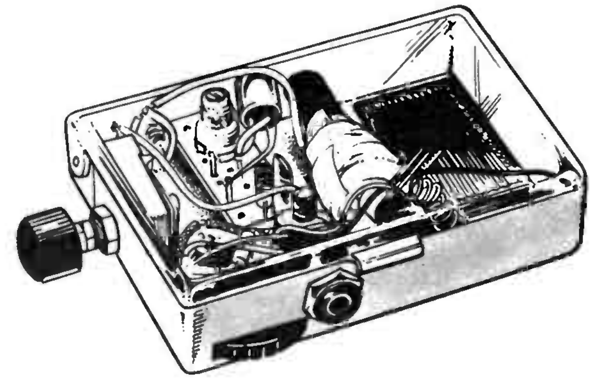
Transformer

T1 9·2:1, CT primary, type T/T7 Repanco

Miscellaneous

Miniature 40 ohm speaker
Perforated srbp board 4in. × 2½in.
Screw terminals or sockets
Case, aluminium or wood, 10in. × 4in. × 3in.

Light Powered Radio



components

R1	resistor 270Ω ±10% ¼ watt
VR1	potentiometer 20kΩ miniature edge control with switch S1
C1	capacitor 0·1μF low voltage
C2	capacitor 2μF 6V or higher electrolytic
VC1	variable capacitor 300pF mica dielectric
TC1	trimmer capacitor 2-10pF screw driver control
Tr1	transistor AF117 or similar pnp type
RFC	R.F. cored choke 5mH
	Ferrite rod ⅜in. diameter, 2in. long
	Wire 26 s.w.g. enamelled copper wire for tuning coil
	Phones high impedance with jack plug and socket
	Solar cell 0·5volt or dry cell 1·5V
	Component board 1⅛in. × ⅞in. and box
	PVC connecting wire

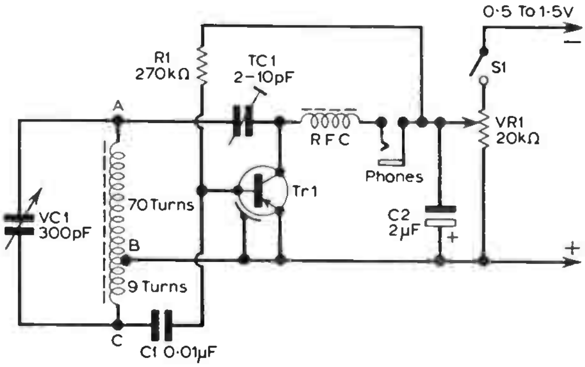


Fig. 1: Circuit diagram

Simple regenerative receiver providing headphone reception of local medium wave stations only. Power derived from a mercury cell when energised from daylight or good artificial light. A 1·5 volt dry cell can be used instead.

Tuned circuit consists of 79 turns of 26 s.w.g. enamelled copper wire (A to C) close wound on ferrite rod ⅜in. diameter, in parallel with small tuning capacitor VC1. This coil has a tapping (B) nine turns from one end (C). Trimmer capacitor TC1 controls regeneration and is set so that oscillation is just possible with VR1 near maximum voltage setting when using a single 0·5V solar cell.

Tuning coil is wound on thin card or thick paper tube so that it can be moved along ferrite rod for best reception. A few feet of flexible wire aerial connected at A may help reception. Phones should be high impedance 2,000 ohms or more and connected via jack socket on box. Small components are mounted on perforated srbp board and wired underneath. Keep wires short. Minimum recommended box size 3in. x 2¼in. x ¾in. Connections for AF711: collector wire nearest spot, then screen, base, emitter. ●

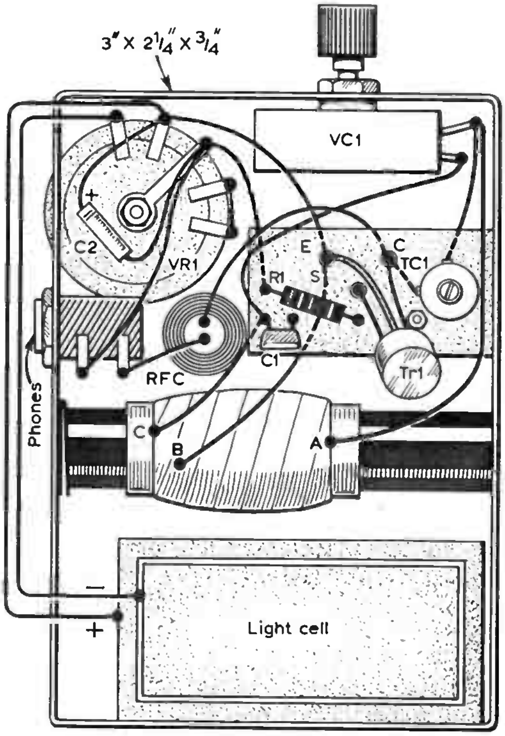


Fig. 2: Component layout and wiring

TRICOLOUR
Mood Lighting System

PART TWO JUREK BUDEK*

THE *P.W. Tricolour* provides a versatile but straightforward form of colour lighting effect that is much improved on earlier designs, due largely to the use of the principle of zero voltage switching. Last month's article explained how this was done so now it is time to do the construction and see the results.

Construction

In the *P.W. Tricolour* lighting system, the bass frequencies are 'presented' by the red lamps, middle frequencies by the green lamps and treble frequencies by the blue lamps. The control unit referred to in the following text is the *P.W. Tricolour* filter and control unit.

The construction of the control unit is not complicated if care is taken to follow the drawings and assembly notes. Before connecting any mains supply to any unit, double-check all wiring against the circuit diagrams (last month) and wiring diagrams, making quite sure that all thyristors, triacs and diodes are correctly connected.

It is recommended that sockets are used for mounting the integrated circuits. *Do* not solder the I.C.'s directly to the printed circuit board.

Assemble the eight way socket to the back panel in such a manner that when plug is inserted the five core cable to the lamps leads horizontally away from the fuse assembly.

The lights output socket is a Bulgin type P552 and the plug to fit this (for the lamps unit lead) is a Bulgin P551.

Attach the fuse holders, rubber grommets and speaker socket to the back panel. Assemble the components on to the printed circuit board, making sure that no accidental solder bridges occur across adjacent copper pads. The heat sink for the triacs is "live" and should not be connected to, or allowed to come in contact with, any metal part except the triac mountings, which are also the connections to their "main terminal 2". For safety connect this, the "zero" voltage indicated on the mains transformer, to the neutral terminal of the mains, and connect the control unit chassis to earth on the mains plug.

Insert the rubber grommet for the l.e.d. lamp indicator into the front panel. Switches S1, S2, S3 and S4 are as used in the Texan amplifier.

The mains switch shown on the front panel uses detachable connecting clips, but any suitably rated mains switch is suitable. The front panel is mounted on the front of the chassis frame with spacers so that clearance of the control fixing nuts provides a neat and uncluttered appearance to the panel. The assembly

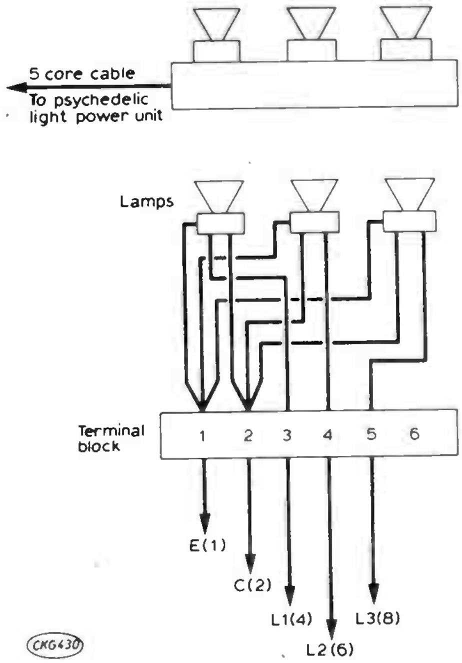


Fig. 13: The simplest arrangement in which one control unit drives three lamps, each 100 to 150 watts. E represents the earth or chassis connection via tag 1 on the Bulgin 8 pin plug/socket arrangement. The figures in parenthesis are the pin numbers. C is the common lead to the lamps—which is the 240V live lead. L1, L2 and L3 are the leads to the respective lamps shown as LP1, LP2 and LP3 (Fig. 12 last month).

* *TEXAS INSTRUMENTS LIMITED*

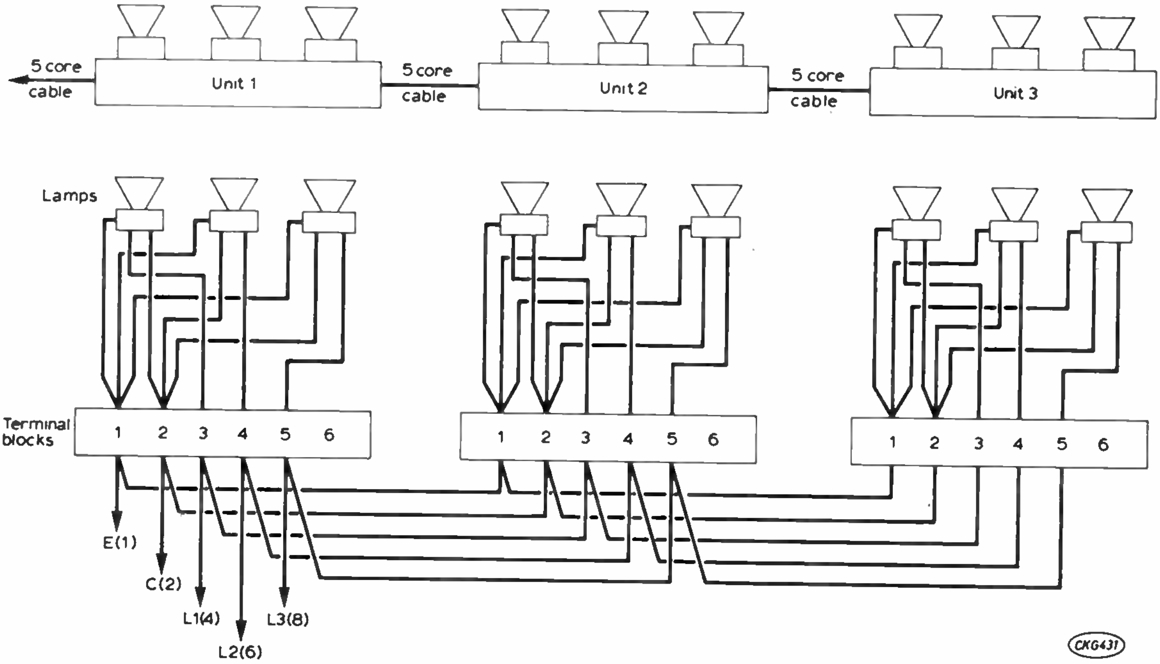


Fig. 14: Three banks of lamps, each 100w maximum, driven from one control unit.

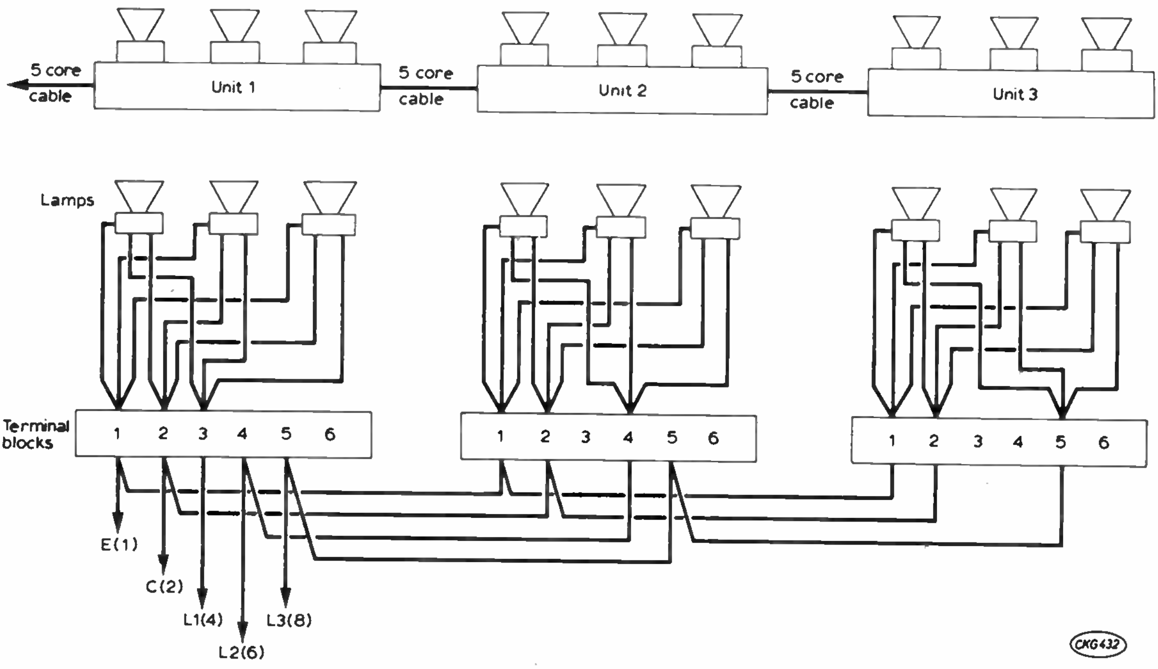


Fig. 15: Three banks of lamps, each 100W maximum, controlled by one frequency range.

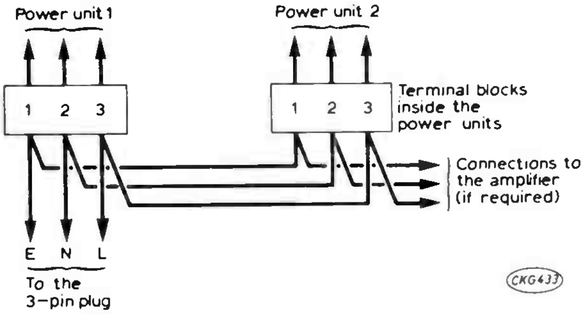


Fig. 16: Mains terminal block connections when using two control units.

uses 6BA nuts and bolts.

The three triacs and their associated heat sink uses 4BA nuts and bolts.

Fuses FS1, FS2 and FS3 are in the bass (red lamp), middle (green lamp) and treble (blue lamp) circuits respectively.

Unit Arrangement

The equipment consists of two units. One unit contains the control for the psychedelic lights, the filter circuits and the necessary power supply. It is advisable, but not essential, that this unit is located near to the 13A power socket and amplifier. The second unit is mobile and consists of three colour lamps mounted on a panel with a five core flexible cable attached to it. This unit can be hung on the wall, left on the table, or placed in some other convenient position.

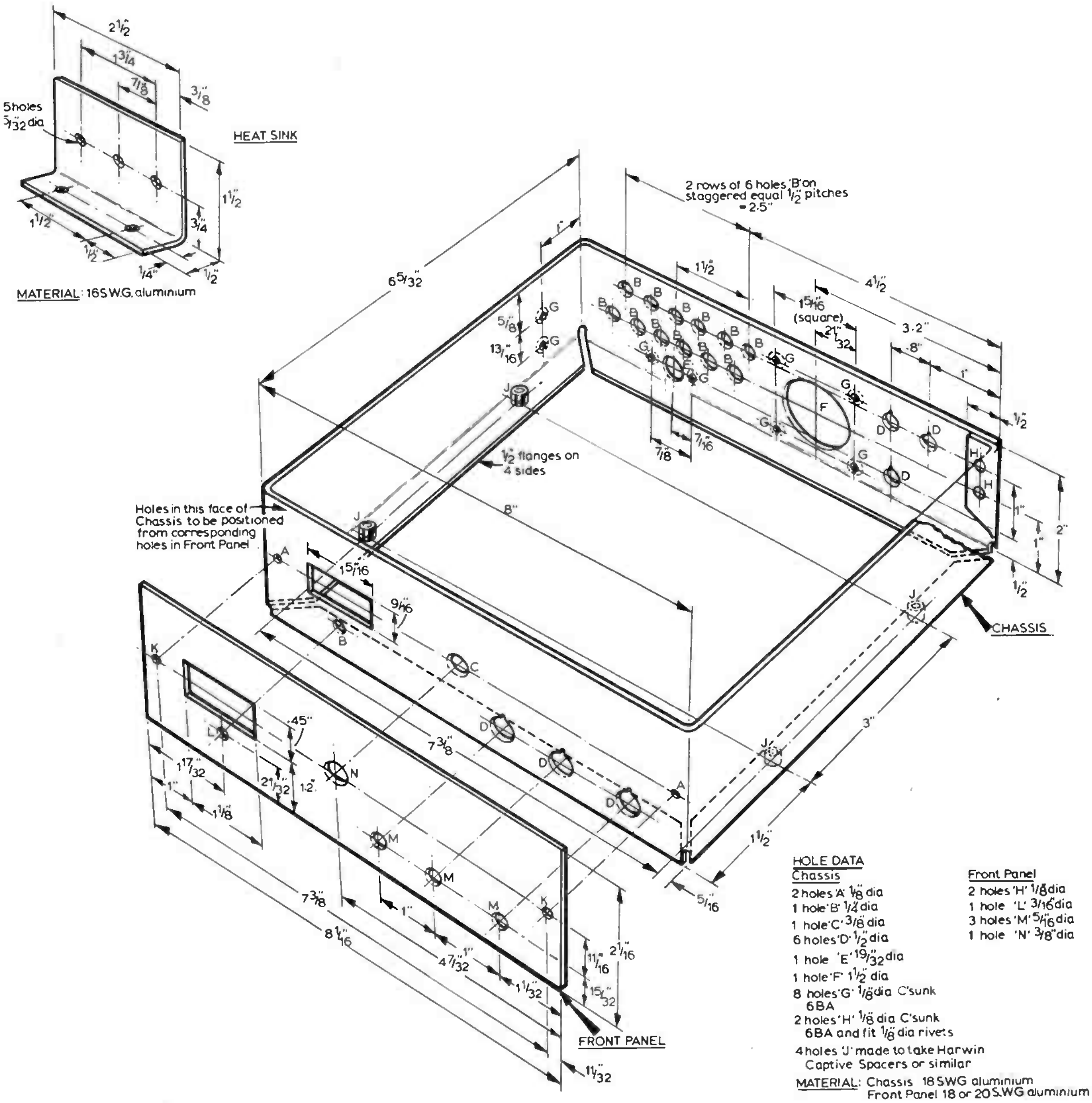
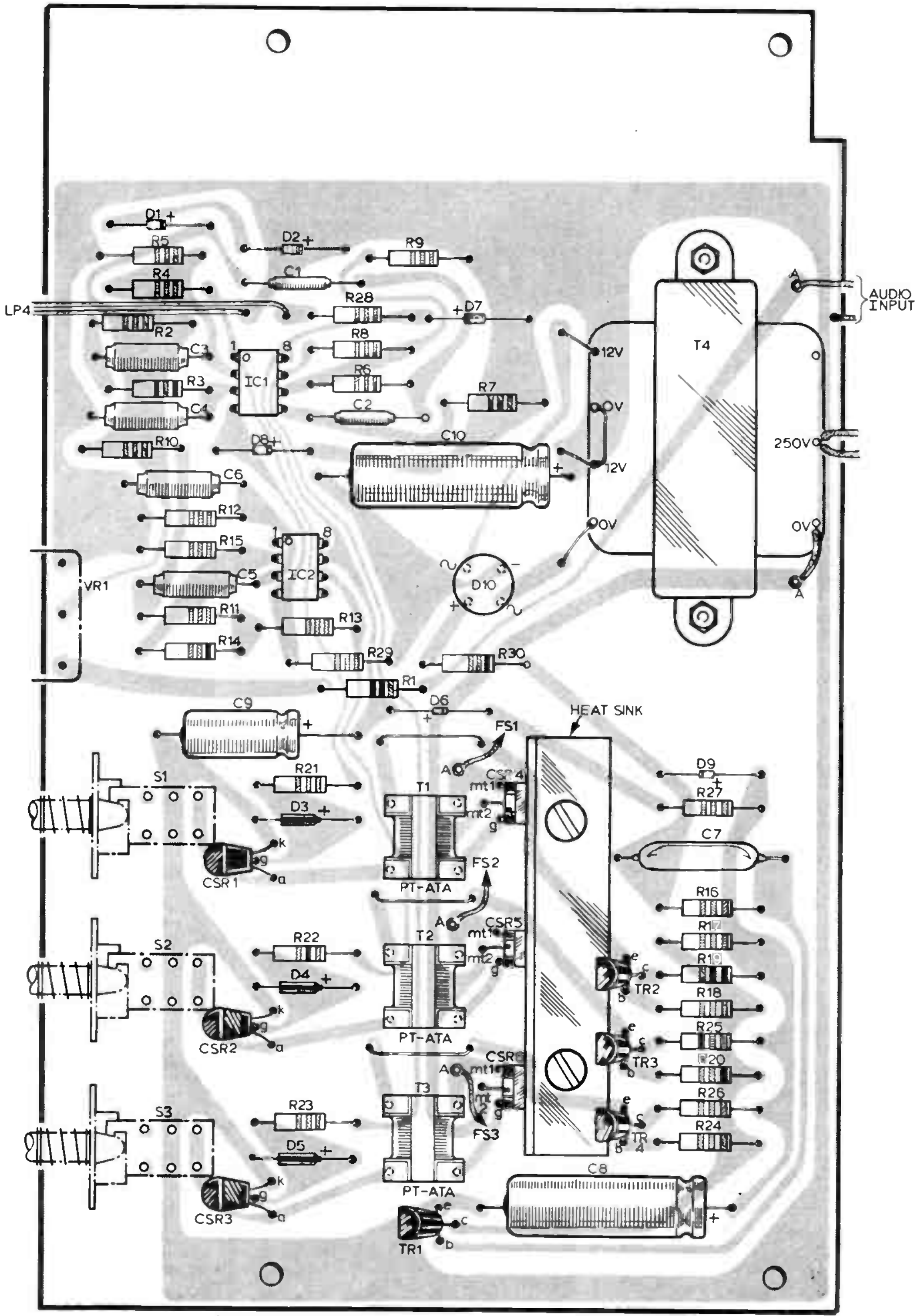
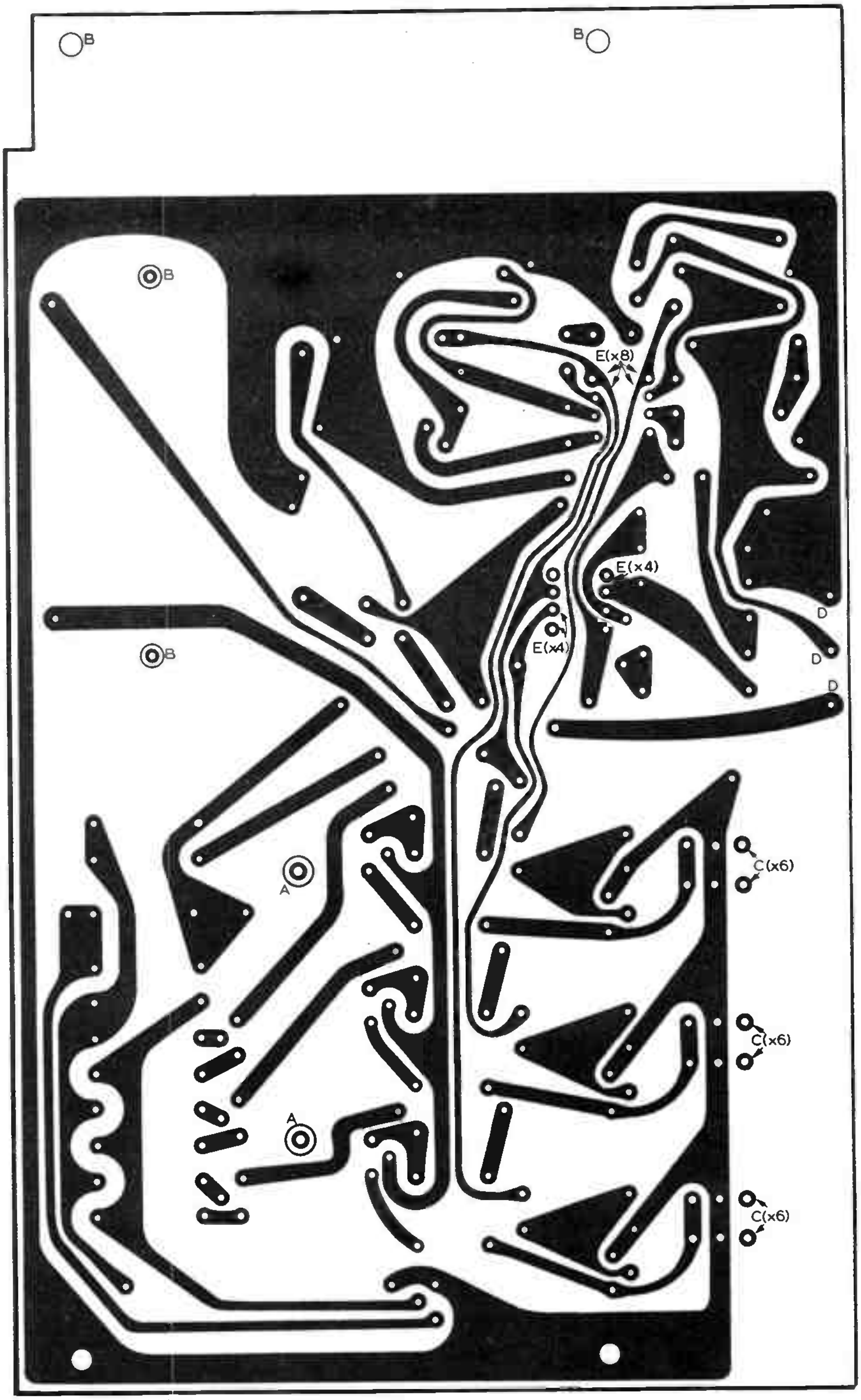


Fig. 17: Details of chassis construction and drilling with the heat sink shown top left, front panel left.



◎ Indicates solder pins
in 5 positions A

Fig. 18: Component layout and wiring to the printed circuit board. It will be observed that there are two leads from the 250V tag on T4. One lead is the live (L) lead from the mains terminal block. The other lead goes to tag 2 on the lights output socket.



HOLE DATA
2 holes 'A' 5/32" dia
6 holes 'B' 1/8" dia
18 holes 'C' 1.3 mm dia
3 holes 'D' 1.8 mm dia
16 holes 'E' 1/32" dia
All other holes 1.0 mm dia

Fig 19: Full size pattern and drilling positions of the printed circuit board.

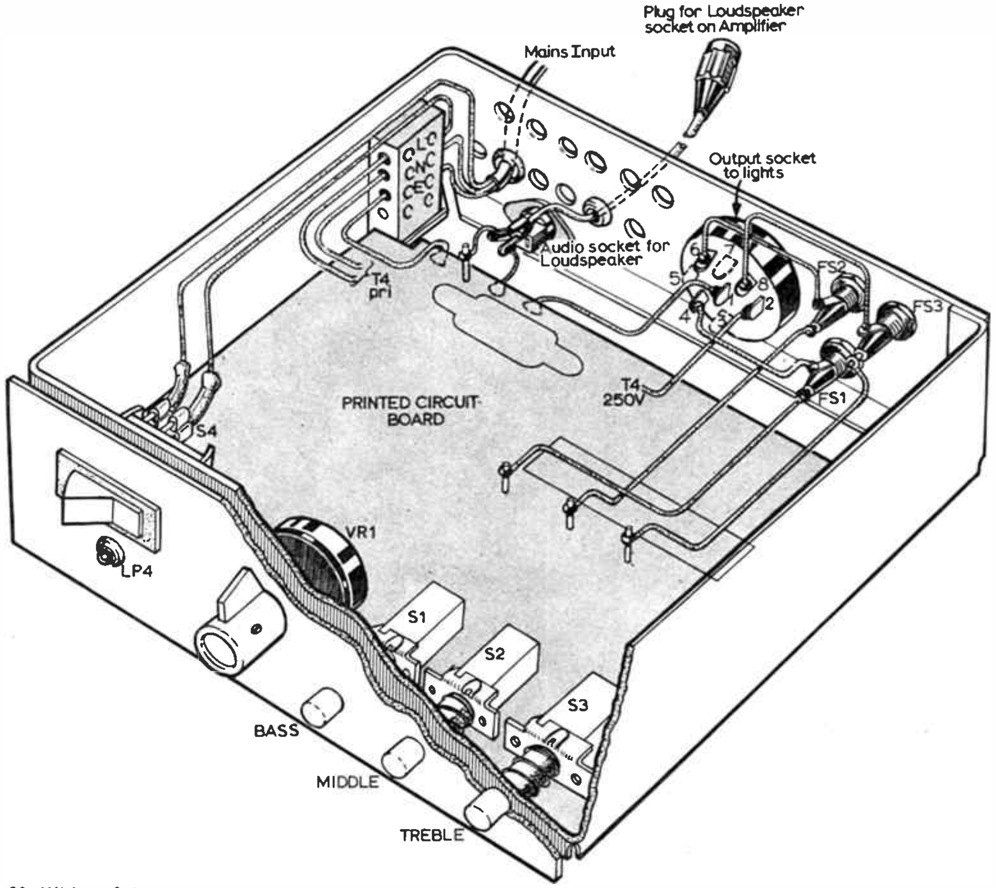


Fig. 20: Wiring of chassis mounted components to the printed circuit board. Tag 1 on the lights output socket goes to chassis (and mains earth). The live lead (L) from the mains terminal block goes to the 250V tag on T4 transformer.

The power control unit is capable of supplying three of these lamp units in parallel, each with its three coloured 100 watt lamps, i.e. a total power capability of 3×300 watts. Each lamp unit has a six way terminal block for interconnecting as shown in the diagrams.

Fig. 13 shows the connections for a single lamp unit. The five core cable is terminated with a plug suitable for connecting to the control unit. The figures in brackets show the pin numbers on the plug used. Connected thus, the three lamps will flash in accordance with frequency ranges present in the music.

Fig. 14 shows a triple unit arrangement, where each unit is connected in the same way as shown in Fig. 13. Here, however, the overall light level is increased and flexibility of lamp positioning is allowed, each lamp unit maintaining its three frequency range response.

A great deal of experimentation of lamp arrangement is worthwhile to achieve the best effect to suit your room and music. Fig. 15 gives another arrangement, using three lamp units, which is basically similar to that shown in Fig. 14, except that here each lamp unit will flash according to one frequency range.

The interconnections between speaker, amplifier and control units are also straightforward. Simply connect the speaker's DIN plug into the control unit and then plug in the cable from the control unit, now terminated with a DIN plug, into the amplifier. This should be done while all power is switched off. The amplifier should be connected via the control unit to a suitable loudspeaker before switching on.

The arrangement for a stereo system is very simple. Two control units and two lamp sets are required. A three core cable from a 13A socket is connected to the terminal board of control unit 1. From the same terminal board the second three core cable is connected to control unit 2 as shown in Fig. 16.

The advantage of this arrangement is obvious, i.e. only one 13A plug is used for both control units. If required, the power supply to the amplifier can also be taken from the terminal board of control unit 2 as shown in Fig. 16, thus achieving further simplification.

The interconnections between the control units, amplifier and speakers are similar to that described for the mono system but duplicated. Connect one speaker DIN plug into control unit 1 and then plug in the cable from it into the amplifier socket. This is repeated for the second speaker and control unit.

The effectiveness of the association of the light and music can be further improved if the lamps are placed near the speaker from which they are actuated. It is extremely effective when standing each lamp unit on or behind each speaker cabinet and projecting the lights up the walls behind.

The printed circuit board shown in this issue is for the zero voltage control version of the *P.W. Tricolour* only. A different printed circuit board, alternative components and slight alterations to the metalwork will be required for the version with lamp dimming facilities.

TO BE CONTINUED

PRODUCTION LINES

colin riches

ADJUSTABLE SPANNER

The picture shows a self-adjusting spanner suitable for all nut sizes from $\frac{7}{16}$in. to $\frac{13}{16}$in. A.F.

The end of the tool is placed over the nut and turned until the "tongue" of the spanner locks onto the nut.

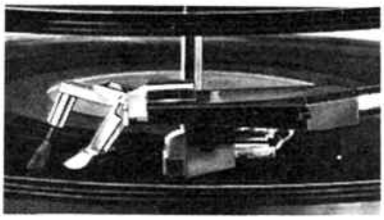
It is constructed from chrome-vanadium steel and weighs $5\frac{1}{2}$ ozs. Finish is either matt (£1·49) or polished (£1·79). *Thunder Screw Anchors Ltd., Victoria Way, Burgess Hill, Sussex, RH15 9NF.*

TUAC EQUIPMENT

Tuac Ltd., are marketing a new range of ready-assembled modules and complete units. They are a "waa-waa" unit, fuzz box, disco "auto fade", octave doubler and a phase-splitter.

Leaflets which are issued in conjunction with Tuac kits can be obtained on receipt of a 3p stamp from: *Transistor Universal Amplification, Co. Ltd., 163 Mitcham Road, London, SW17 9PG.*

AUTO GROOVE-KLEEN



If you have an autochanger record playing unit, you have not been able up to now, to use a groove-cleaning brush to remove the dust and dirt from the records.

Bib seem to have solved this problem with their model 45 unit which just sticks onto the cartridge housing. Obviously to avoid any increase in stylus weight, the tone-arm should be re-balanced or the calibration control reduced by two grammes.

Due to the design, the velvet shoe and brush will not drag across the record when the tone arm moves from the end of one record to the outside of the record stack.

After the records have been played, the velvet shoe can be lifted off for cleaning with the separate brush supplied.

The price of this unit is 98p plus tax. *Bib Sales, P.O. Box 78, Hemel Hempstead Herts.*

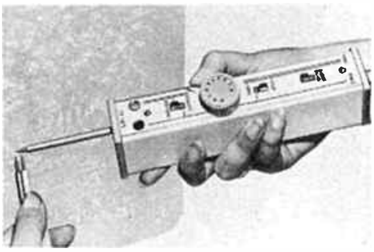
GUIDE TO SEMICONDUCTORS

Motorola Semiconductors Ltd. have published a "master selection guide". It includes in its 150 pages brief technical details of 17 diode families from 4-layer to zener, hybrid circuits, microwave devices, optoelectronic components, rectifiers, triacs, diodes, linear integrated circuits and much more than we can describe here. The guide, which is free of charge, may be obtained from *Motorola Semiconductors Ltd., York House, Empire Way, Wembley Middlesex.*

TRANSISTOR TESTER

Transistor tester type TT169 has been announced by Avo. It is designed for GO/NO-GO in-circuit testing of p.n.p. and n.p.n. signal or power transistors. The tester is battery operated and small enough to be held in the hand. Front panel lights show whether a device is faulty or OK.

The TT169 comes with all the necessary leads and connector in a plastic case. The price is £17·50 plus VAT and readers may obtain them from the usual retailers and distributors. *Avo Limited, Avocet House, Dover, Kent.*

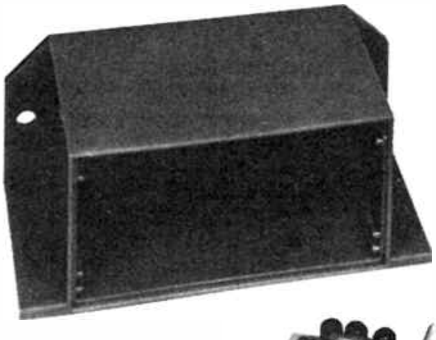


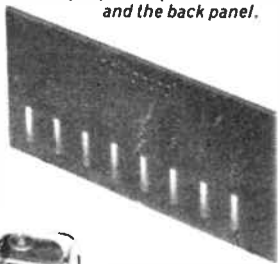
COMPONENT HOUSING TYPE LK8

Logikontrol Ltd., announce a compact component housing. It is made from high impact polystyrene and measures 90 x 50 x 37m.m. and at 25·4m.m. to the inch, you can work it out for yourselves! The internal volume is 10c.c. and it has facility for 2 printed circuit boards on which the components can be mounted.

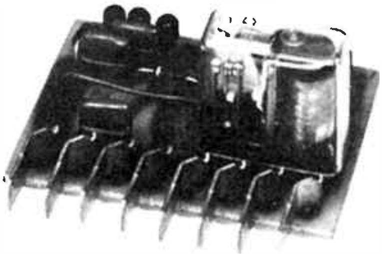
Printed circuit connections and a snap-fit lid eliminate the need for a special plug and socket.

These units which are available in five different colours may be obtained from large component suppliers or in quantities of 10 upwards from Logikontrol direct, the 10 off price being 22p each. *Logikontrol Ltd., 17 Little Edward Street, London, NW1 4AT.*





(left) The plastic housing and the back panel.



(right) A component board which can be slotted into the housing

160 – 80 metre CONVERTER

R.A. PENFOLD

THIS is a simple device which is easy to construct and which when placed ahead of a medium wave receiver will enable it to cover the 80 and 160 metre amateur bands. The unit is self contained, and is housed in a diecast box measuring $4\frac{3}{4}$in × $3\frac{3}{4}$in × $2\frac{5}{32}$in. An external long wire aerial and an earth are required.

Only two transistors are used, including a field-effect type in the mixer stage. Frequency stability is excellent as the oscillator is crystal controlled.

Heterodyne Principle

What is required of the converter is to receive a signal in either the 160 or 80 metre band and change this signal to a frequency which lies in the MW band. This can be achieved by heterodyning.

This is a process in which two signals are mixed to produce at the output, (a) the original two frequencies, (b) the sum of the two, and (c) the difference between the two. By the use of tuned circuits in the output, whichever of the two new frequencies produced is required can be selected.

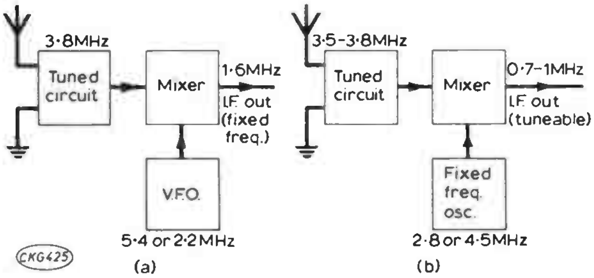


Fig. 1: Diagrams showing methods of converting a signal to a fixed or variable intermediate frequency.

The manner in which this process can be used in a converter is shown in Fig. 1. In the type of converter shown in Fig. 1a, the circuit is arranged so that the frequency to which the tuned circuit at the input is tuned is different from the operating frequency of the oscillator by the i.f. The tuning capacitors for the aerial tuned circuit and the oscillator would be ganged.

An example is given in the diagram of how a 3·8MHz signal is converted to a 1·6MHz i.f. There are two oscillator frequencies which will allow this (3·8 − 1·6 = 2·2MHz, or 3·8 + 1·6 = 5·4MHz). In this type of converter the receiver is tuned to the i.f., and the tuning is carried out on the converter.

A second type of converter is shown in Fig. 1b. This type is often used in 2 and 4 metre VHF amateur band converters. This time the tuning is carried out on the receiver, the oscillator on the converter being at a fixed frequency. The aerial tuned circuit should either be a broadband unit i.e. resonant over the entire band which is to be tuned, or should be tuneable over this range. Again there are two possible oscillator frequencies (3·8 − 1 = 2·8MHz, 3·5 − 0·7 = 2·8MHz, 3·8 + 0·7 = 4·5MHz, 3·5 + 1 = 4·5MHz).

This type of converter has the advantage that the oscillator can be crystal controlled, simplifying alignment and giving very good stability. This type is also very much more simple and inexpensive. The system does have drawbacks as discussed later but the author's converter, which is of this type, has proved very successful.

Practical Circuit

A circuit diagram of the converter is shown in Fig. 2. Tr2 is operated as a Pierce oscillator the crystal being used on its parallel resonant frequency. The primary winding of the oscillator r.f. transformer, L5, forms the collector load for Tr2. R2 biases the transistor, C3—C5 produce a centre tap on the crystal, this centre tap being earthed.

Tr1 is the f.e.t. mixer stage. L1 is the aerial input coupling winding and L2 the aerial tuned winding. This can be tuned over the range 70-230 metres by VC1. Tr1 is used in the common-source mode, source bias being provided by R1 and C1 is its decoupling capacitor. Tr1's source and R1 are connected via the

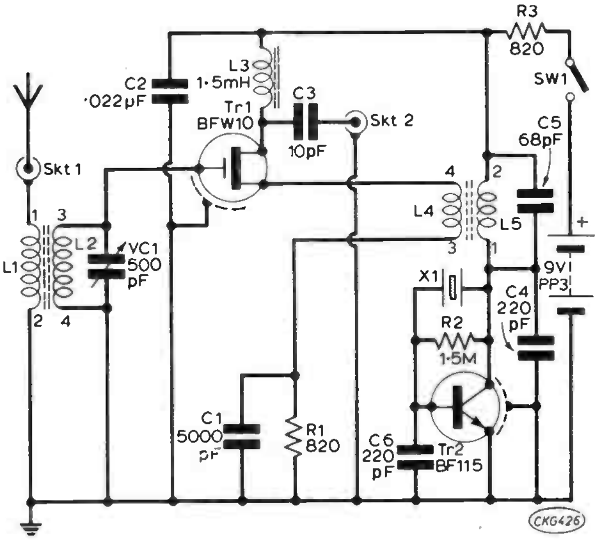


Fig. 2: Complete circuit of the converter unit.

secondary winding on the transformer, L4. The voltage across L4 modulates Tr1's drain and source voltages and thus mixes the oscillator signal and the input signal. A small r.f. choke, L3, forms the drain load for Tr1, the mixed output being coupled to the receiver via C3.

SW1 is the on-off switch, and R3 reduces the 9V supply to the required level. C2 is the supply decoupling capacitor.

The crystal frequency is chosen so that it can be used to convert signals in both the 80 and 160 metre bands to the MW band, the desired band being selected by tuning VC1—L2 to the correct frequency. Using a 2·8MHz crystal the 80 metre band will be converted to 0·7 – 1MHz (3·8 – 2·8 = 1, 3·5 – 2·8 = 0·7), and the 160 metre band will be converted to 0·8 – 1MHz (2·8 – 1·8 = 1, 2·8 – 2 = 0·8).

It is not essential for the crystal to operate exactly on 2·8MHz, as if it is a little either side of this frequency the converter will still operate but the tuning range on the receiver over which the amateur bands are covered will be slightly altered. A 2·794MHz crystal was used on the prototype.

Construction

The circuit is housed in an STC diecast box. The wiring is broken into two sections, a 5-way tagstrip on which the oscillator is constructed, and a 6-way tagstrip on which the mixer is built.

Diagrams illustrating the wiring of these two tagstrips are shown in Fig. 3 (mixer) and Fig. 4 (osc.). These two diagrams also show all other wiring of the converter. All the wiring is quite straightforward and should present no difficulty, even to a beginner. The only point which should be noted is that the screen lead of Tr1 is too short to reach to the appropriate tag unless a short piece of insulated wire is used to lengthen it.

Figure 5 shows the interior layout of the unit and also gives details of the mounting bracket of the crystal. This bracket is constructed from 18-22 swg sheet aluminium. The two tagstrips are mounted by ½in 6BA bolts, a stand-off insulator ¼ to ⅜in long being used to hold them clear of the sides of the case.

The battery is held in place by being trapped between the front, and rear of the case. A pad of expanded polystyrene, foam rubber or a similar material should be glued to the rear of the case where the battery would otherwise come into contact with it. This is to make it fit more firmly and to insulate the battery terminals from the case.

★ components list

Resistors
R1 820Ω
R2 1·5MΩ
R3 820Ω
All ¼W, 5 per cent types

Capacitors
C1 5000pF
C2 0·022μF polystyrene etc.
C3 10pF ceramic or silver mica
C4 220pF polystyrene or silver mica
C5 68pF polystyrene or silver mica
C6 220pF polystyrene or silver mica

Semiconductors
Tr1 BFW10 or similar f.e.t.
Tr2 BF115

Miscellaneous
L1/2 Repanco RA3; L3 miniature r.f. choke, about 1·5mH; L4/5 Repanco RO3; SW1, on-off switch; STC diecast box, size 2 ($4\frac{3}{4}$ x $3\frac{3}{4}$ x $2\frac{5}{32}$in.); HC6U crystal, about 2·8MHz with holder (see text) (Henry's Radio); 1-off each 5-way and 6-way tag strip; 2-off coax sockets; Knob; Battery and clip.

As supplied, the exterior finish of the diecast box is rather rough and dirty. If the case is to be painted it will be necessary to thoroughly clean it first with a scouring pad. If preferred it can be cleaned in this way, and then polished to a bright natural finish.

Using the Converter

An external aerial is required; this merely consists of a length of wire which is mounted as high as possible and is as long as possible. An earth of some sort is essential for the correct operation of the circuit, although this does not necessarily have to be a very efficient one. The prototype is fitted with coaxial sockets for the aerial, earth and output connections.

Ideally the converter should be used in conjunction with a broadcast receiver which requires an external aerial. The receiver and the converter are connected by a short screened cable. In this way there is a minimum of interference picked up on the MW band directly by the receiver.

It was found possible to use the converter with an

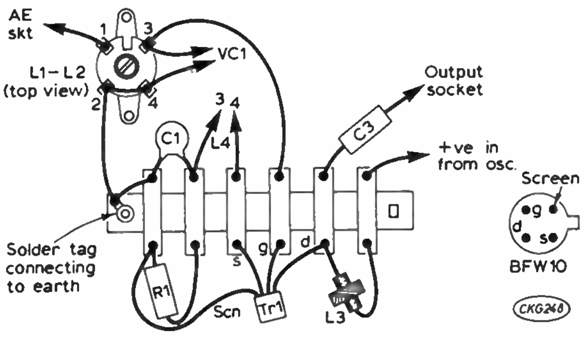


Fig. 3: Method of wiring the mixer stage components.

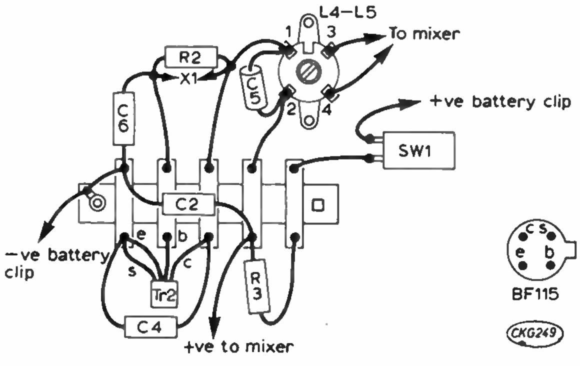


Fig. 4: Tagstrip construction of the oscillator stage.

ordinary transistor receiver. C3 should be removed, and a piece of wire connected in its place. It is then merely necessary to take a short lead from the converters output socket, and to place this alongside the receiver's ferrite aerial.

In this way it was found possible to receive a number of amateur stations on both the 80 and 160 metre bands. MW stations received directly by the receiver can prove bothersome, especially after dark.

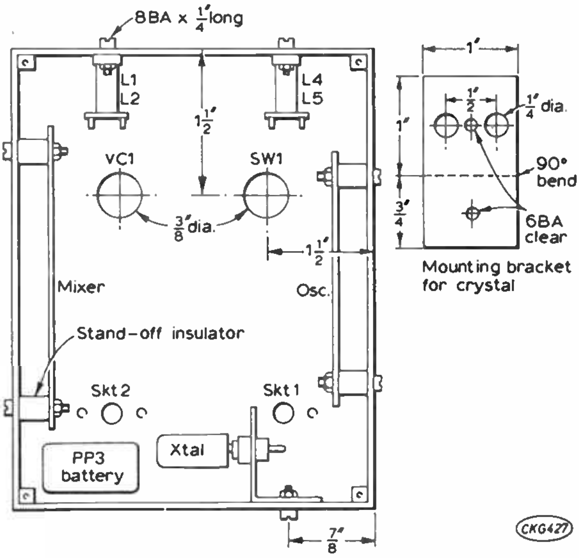


Fig. 5: Layout of components and tagstrips inside the die-cast box.

Operating the controls on the converter is very simple, as there are only two. SW1 is the on-off switch. VC1 tunes the converter to the desired band. With this control turned almost fully anti-clockwise it should be found possible to tune the 80 metre band and with it turned almost fully clockwise it should be possible to tune 160 metres.

With VC1 approximately adjusted in this way, it should be possible to receive a few signals. VC1 can then be peaked for maximum sensitivity. A simple dial can be marked around the control knob of VC1 showing the areas over which the amateur bands are tuned.

Results

Using the converter with a 132ft. longwire aerial at about 20ft., in conjunction with a 6 transistor MW portable receiver, a large number of amateur stations have been heard. The 160 metre band is of course used mainly for local working, and a.m. is still used to a certain extent. Stations up to about 50 miles distant have been received on this band without too much difficulty.

Due to its simplicity, the circuit does have one drawback. Top Band is not only used for amateur transmissions but also for maritime ones. These transmissions are fairly powerful and occasionally when tuning the 80 metre band transmissions from ships in the nearby Thames estuary did break through. Conversely, a local amateur using a powerful SSB transmitter on 80 metres did tend to break through on the 160 metre band. ■

ON THE AIR

BROADCAST BANDS

SHORT WAVE RECEIVER CHOICE

by MALCOLM CONNAH

By far the largest portion of my mailbag consists of lettters from readers asking my advice on the choice of a receiver. I have often said that this is a very difficult subject on which to give advice, partly because the letters give very little information and partly because "one man's meat is another man's poison".

In order to assist the less technically minded reader to select a receiver to meet his requirements I am going to devote this article to discussing the various features of receivers which are important for good short wave reception.

1. **Frequency Coverage:** The most common type of receiver is the General Coverage Receiver. This type of receiver usually tunes from 540kHz to 30MHz in four bands. One of these bands covers the medium wave band leaving three bands of short wave coverage.

Due to the number of stations on the bands it is very desirable to have a separate bandspread, or fine tuning, control. This control has the effect of expanding a small portion of the tuning scale making it much easier to tune in a particular station. The much-advertised transistor portable receivers are usually lacking in this respect.

An alternative method of frequency coverage is found in the more expensive receivers which have a number of bands each covering 500kHz of the spectrum. These receivers usually cover the Amateur bands only but can be ordered with coverage of the Broadcast bands. The tuning of these receivers is so fine that a separate bandspread control is not required.

In general the listener must ensure that the receiver covers the bands in which he is interested and that the tuning can be finely controlled.

2. **Number of Conversions:** The number of conversions that a receiver has is the number of different i.f.'s (Intermediate Frequencies) that it has. The normal single conversion receiver has a single i.f. usually in the range 455-470kHz, although 1·6MHz is sometimes used. The double conversion receiver has two different i.f.'s. In general, the more i.f.'s a receiver has, the better the selectivity and image rejection will be.

3. **RF Stages:** Some of the simpler receivers available have no r.f. stage and the signal is passed from the aerial to the mixer stage directly. The addition of an r.f. stage will increase the sensitivity of the receiver and also improve the image rejection of a single conversion set. As mentioned last month this problem can be overcome by adding a preselector between the aerial and the receiver.

4. **Operating Modes:** The Broadcast Bands listener is usually only interested in amplitude modulated (a.m.) signals and this mode of operation is, therefore, essential. If the set is also to be used for reception of Amateurs provision should be made for code (c.w.) reception, this also allows reception of single sideband (s.s.b.) transmissions. However, the provision of a product detector gives much better s.s.b. reception. If the provision also exists for manual selection of the upper or lower sideband this facility can be used during the reception of a.m. signals to avoid interference and fading effects.

5. **Selectivity:** The selectivity of a receiver is its ability to separate stations on adjacent frequencies. It is extremely useful to have the facility of varying the selectivity of the receiver. When interference is heavy a narrow selectivity can be used to cut out the interference. Mechanical or crystal filters help to improve the selectivity of a receiver.

6. **Stability:** It is essential for a good receiver to be stable in operation. With some valve receivers the heating effects involved caused frequency drift and other annoying effects. The introduction of transistors and, in particular, field-effect transistors has greatly improved the situation due to the low heating effects associated with these devices.

7. **Valves vs. Transistors:** Apart from improving stability, as mentioned above, transistors have many advantages in communication receivers. They have a longer life, require simpler power supplies and are low cost. The benefits of this are that transistor receivers tend to be smaller, lighter in weight, less expensive and also have the option of being operated from an external battery.

8. **Automatic Volume or Gain Control (a.v.c. or a.g.c.)** Almost every receiver has some form of a.v.c. or a.g.c. which adjusts the gain of the receiver to compensate for changes in signal strength. A receiver with variable a.v.c. or a.g.c. is to be preferred as the optimum setting can then be used.

9. **Extras:** Most receivers have various extras of which the following are the most useful. (a) The provision of a headphone socket. (b) An aerial trimmer to match the aerial to the set. (c) A signal strength meter (S-meter) to assist with tuning. (d) A crystal calibrator to check the dial accuracy. (e) A noise limiter which should be variable if possible. (f) A notch filter to reduce hetrodynes.

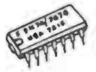
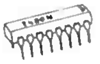
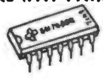
Henry's

YOUR COMPLETE AUDIO-ELECTRONIC STORES

More of everything at the right price. All your electronic requirements within 200 yards – call and see for yourself.

INTEGRATED CIRCUITS

Why buy alternatives when you can buy the genuine article from us at competitive prices from stock. BRANDED FROM TEXAS I.T.T FAIRCHILD

Type	1/11 p	12/24 p	25/99 p	Type	1/11 p	12/24 p	25/99 p	Type	1/11 p	12/24 p	25/99 p
SN7400	0·20	0·18	0·16	SN7450	0·20	0·18	0·16	SN74145	1·50	1·40	1·30
SN7401	0·20	0·18	0·16	SN7451	0·20	0·18	0·16	SN74150	3·35	2·95	2·15
SN7402	0·20	0·18	0·16	SN7453	0·20	0·18	0·16	SN74151	1·10	0·95	0·90
SN7403	0·20	0·18	0·16	SN7454	0·20	0·18	0·16	SN74153	1·35	1·27	1·20
SN7404	0·20	0·18	0·16	SN7460	0·20	0·18	0·16	SN74154	2·00	1·75	1·55
SN7405	0·20	0·18	0·16	SN7470	0·30	0·27	0·25	SN74155	1·55	1·47	1·35
SN7406	0·30	0·27	0·25	SN7472	0·30	0·27	0·25	SN74156	1·55	1·47	1·35
SN7407	0·30	0·27	0·25	SN7473	0·40	0·37	0·35	SN74157	1·80	1·70	1·50
SN7408	0·20	0·19	0·18	SN7474	0·40	0·37	0·35	SN74160	2·60	2·40	2·25
SN7409	0·45	0·42	0·35	SN7475	0·55	0·52	0·50	SN74161	2·60	2·40	2·25
SN7410	0·20	0·18	0·16	SN7476	0·45	0·42	0·39	SN74162	3·40	3·25	2·70
SN7411	0·23	0·22	0·20	SN7480	0·80	0·75	0·67	SN74163	3·40	3·25	2·70
SN7412	0·42	0·40	0·35	SN7481	1·25	1·15	1·10	SN74164	2·75	2·30	2·10
SN7413	0·30	0·27	0·25	SN7482	0·87	0·80	0·70	SN74165	4·00	3·50	3·00
SN7416	0·30	0·27	0·25	SN7483	1·00	0·90	0·85	SN74166	4·00	3·50	3·00
SN7417	0·30	0·27	0·25	SN7484	0·90	0·85	0·80	SN74167	6·25	5·60	5·10
SN7420	0·20	0·18	0·16	SN7486	0·45	0·41	0·38	SN74170	4·10	3·55	3·05
SN7422	0·48	0·44	0·40	SN7490	0·75	0·70	0·65	SN74174	2·00	1·75	1·30
SN7423	0·48	0·44	0·40	SN7491AN	1·00	0·95	0·90	SN74175	1·35	1·27	1·15
SN7425	0·48	0·40	0·35	SN7492	0·75	0·70	0·65	SN74176	1·60	1·35	1·20
SN7427	0·42	0·39	0·35	SN7493	0·75	0·70	0·65	SN74177	1·60	1·35	1·20
SN7428	0·50	0·45	0·42	SN7494	0·80	0·75	0·70	SN74180	1·55	1·30	1·20
SN7430	0·20	0·18	0·16	SN7495	0·80	0·75	0·70	SN74181	7·00	6·00	5·50
SN7432	0·42	0·39	0·35	SN7496	1·00	0·97	0·95	SN74182	2·00	1·80	1·60
SN7433	0·70	0·61	0·44	SN7497	6·25	5·50	5·00	SN74184	2·40	2·00	1·80
SN7437	0·65	0·60	0·50	SN74100	2·50	2·30	2·00	SN74185A	2·40	2·00	1·80
SN7438	0·65	0·60	0·50	SN74104	1·45	1·35	1·20	SN74190	1·95	1·85	1·75
SN7440	0·20	0·18	0·16	SN74105	1·45	1·35	1·20	SN74191	1·95	1·85	1·75
SN7441AN	0·75	0·72	0·70	SN74107	0·50	0·45	0·40	SN74192	2·00	1·90	1·80
SN7442	0·75	0·72	0·70	SN74110	0·80	0·70	0·60	SN74193	2·00	1·90	1·80
SN7443	1·00	0·95	0·90	SN74118	1·00	0·95	0·90	SN74194	2·50	2·35	1·90
SN7445	2·00	1·75	1·60	SN74119	1·90	1·78	1·65	SN74195	1·85	1·70	1·60
SN7446	2·00	1·75	1·60	SN74121	0·60	0·55	0·50	SN74196	1·50	1·40	1·30
SN7447	1·75	1·60	1·45	SN74122	1·35	1·25	1·10	SN74197	1·50	1·40	1·30
SN7448	1·75	1·60	1·45	SN74123	2·70	2·55	2·47	SN74198	4·60	3·70	3·35
				SN74141	1·00	0·95	0·90	SN74199	4·60	3·70	3·35

PRICES OF 7400 SERIES ARE CALCULATED ON THE TOTAL NUMBER ORDERED REGARDLESS OF MIX

LARGER QUANTITY PRICES PHONE (01) 402 4891

HIGH POWER SN 74 HOO } Now in stock—send
LOW POWER SM 74 LOO } for list No. 36

A SELECTION OF SEMI-CONDUCTORS FROM STOCK

AAY30	10p	BC147	12p	BU105	2·25	OC44	15p	TI843	35p	2N3055	55p
AAY42	15p	BC169C	12p	BY100	15p	OC45	15p	V405A	25p	2N3440	75p
AAZ13	10p	BC182	10p	BY126	15p	OC57	50p	ZTX108	12p	2N3442	1·25
AC107	35p	BC214	15p	BY127	15p	OC71	15p	ZTX300	12p	2N3525	75p
AC126	25p	BCY32	75p	BYZ13	35p	OC72	25p	ZTX301	15p	2N3614	59p
AC127	25p	BCY34	35p	C106D	65p	OC77	45p	ZTX302	18p	2N3615	75p
AC128	25p	BCY39	1·00	GET111	55p	OC81	25p	ZTX341	20p	2N3702	10p
AC176	25p	BCY42	30p	GET115	55p	OC83	25p	ZTX500	15p	2N3704	10p
AC187	25p	BCY43	25p	GET880	45p	OC140	55p	ZTX503	17p	2N3705	10p
AC188	25p	BCY55	2·50	LM309K (T03)	1·87	OC170	25p	2G301	30p	2N3714	1·30
ACY17	30p	BCY70	15p	MAT121	25p	OC171	30p	2N404	20p	2N3771	1·75
ACY20	20p	BCY71	20p	MJE340	50p	OC200	45p	2N527	35p	2N3773	2·00
ACY21	20p	BCY72	15p	MJE370	70p	OC201	75p	2N696	15p	2N3790	2·25
ACY39	55p	BCY87	2·99	MJE520	75p	OC202	30p	2N697	15p	2N3819	35p
AD140	50p	BCZ11	50p	MJE2955	1·10	OC203	50p	2N706	10p	2N3820	50p
AD149	50p	BD124	80p	MJE3055	75p	OCP71	1·25	2N930	20p	2N3866	85p
AD161	35p	BD131	75p	MPF105	40p	ORP12	50p	2N987	45p	2N3903	15p
AD162	35p	BD132	80p	NKT214	20p	ORP60	40p	2N1131	25p	2N3906	12p
AF117	20p	BF115	25p	NKT216	40p	P346A	20p	2N1132	25p	2N4061	12p
AF118	50p	BF167	25p	NKT217	40p	RAS310AF	45p	2N1302	18p	2N4062	12p
AF124	25p	BF173	25p	NKT403	70p	RAS508AF	55p	2N1304	22p	2N4126	15p
AF139	30p	BF179	30p	NKT404	50p	TAA263	75p	2N1305	22p	2N4871	35p
AF186	40p	BF180	30p	OA5	50p	TIL209	39p	2N1307	25p	2N5457	30p
AF239	40p	BF194	15p	OA10	35p	TIP29A	50p	2N1308	25p	2N5777	55p
ASY27	30p	BF195	15p	OA81	10p	TIP30A	60p	2N1613	20p	2S001	1·00
ASY28	25p	BF861	25p	OA91	7p	TIP31A	60p	2N1671	1·00	2S012	10·00
BA102	30p	BF898	25p	OA200	7p	TIP32A	70p	2N2147	75p	2S018	6·25
BA115	7p	BFX13	25p	OA202	10p	TIP33A	1·00	2N2160	59p	2S026	8·90
BA145	15p	BFX34	75p	OC16	75p	TIP34A	1·50	2N2217	25p	2S301	50p
BAX13	5p	BFX37	30p	OC20	95p	TIP35A	2·50	2N2221	20p	2S303	65p
BAX16	7p	BFX88	20p	OC23	85p	TIP36A	3·00	2N2222A	25p	2S324	95p
BC107	10p	BFY50	20p	OC25	40p	TIP41A	75p	2N2369A	15p	40250	50p
BC108	10p	BFY51	20p	OC28	65p	TIP42A	85p	2N2906	20p	40360	40p
BC109	10p	BFY52	20p	OC35	50p			2N2926 (all cols)	10p	40361	40p
BC109C	12p	BFY64	50p	OC36	65p			2N3053	20p	40362	50p
BC113	15p	BFY90	59p	OC42	40p			2N3054	50p	40408	50p
BC117	20p	BLY36	3·00							40486	75p
BC143	35p	BSX20	15p							40636	1·10
		BSY27	15p							40430	1·00

VAT Prices DO NOT include Value Added Tax. From 1st April, 1973 10% must be added and shown separately to your total order (inclusive Post/packing). Help us to help you receive your order without delay. E. & O. E.

QUANTITY DISCOUNTS

10% 12+ ; 15% 25+ ; 20% 100+ ; 25% 250+ — ANY ONE TYPE

From above sections except Integrated Circuits and Special Offers where discounts are included.
Minimum order value £1 please.
Postage 7p on all orders.

SPECIAL OFFERS! SEMI-CONDUCTORS

BFY90 59p
1000 MC/S
25 + 50p
100 + 45p
500 + 40p

2N2926 10p
All Colours
25 + 9p
100 + 8p
500 + 6p
1000 + 5p

AF117 Mullard 25p
25 + 17p
100 + 15p
500 + 12p

2N3819 Texas 35p
25 + 30p
100 + 25p
500 + 20p
1000 + 15p

OC170 Mullard 25p
25 + 20p
100 + 18p
500 + 15p
1000 + 13p

BC107, BC108, BC109 10p each
All Makes
25 + 8p
100 + 7p
500 + 6p
1000 + 5p

BY127 Mullard 15p
25 + 12p
100 + 10p
500 + 9p
1000 + 8p

AD161, AD162 35p each
25 + 32p
100 + 28p
500 + 25p
1000 + 22p

OA202 10p
25 + 8p
100 + 7p
500 + 6p
1000 + 5p

2N3053 20p
25 + 18p
100 + 15p
500 + 12p
1000 + 10p

OC35 Mullard 50p
25 + 45p
100 + 40p
500 + 35p
1000 + 30p

2N3055 55p
25 + 50p
100 + 45p
500 + 38p
1000 + 33p

ZENER DIODES

400 M/W 5% Miniature
BZY 88 Range
All voltages 3·3 – 33 Volt
10p each.

25+ 9p
100+ 8p
500+ 6·5p
1000+ 5p

Any one type.

1½ Watt 5%
Wire Ends
Metal Case
All voltages
6·8 – 100 Volts
20p each

25+ 18p
100+ 16p
500+ 12p
1000+ 10p

Any one type.

3 Watt Plastic
Wire Ends 5%
SEZ Range
All voltages
6·8 – 100 Volts
30p each.

SILICON RECTIFIERS WIRE ENDED PLASTIC

Type	P.I.V.	1-11
1 amp miniature		
IN4001	50	6
IN4002	100	7
IN4003	200	8
IN4004	400	8
IN4005	600	10
IN4006	800	12
IN4007	1000	15
1·5 amp miniature		
PL4001	50	8
PL4002	100	9
PL4003	200	10
PL4004	400	10
PL4005	600	12
PL4006	800	15
PL4007	1000	16

LINEAR (O/P AMPS)

702C	TO5	75p
709C	TO99	35p
709C	D.I.L.	35p
723C	TO99	£1·00
723C	D.I.L.	95p
725C	TO99	£4·50
741C	TO99	55p
741C	D.I.L.	55p
747C	TO99	£1·10
747C	D.I.L.	£1·10
72741P	D.I.L.	60p
72748P	D.I.L.	60p

SINCLAIR IC12 £1·80
TOSHIBA TH9013P 20 WATT AMP £4·47 POST PAID
TH9014P Pre Amp £1·50

DATA AND CIRCUITS REF. 42 10p
FREE WITH PURCHASES

TRANSISTORS, IC's, TRIACS, BRIDGES, SCR's, LDR's

NEW FREE BOOKLET (No. 36) OVER 1500 TYPES—
Send for yours today

PLESSEY INTEGRATED CIRCUIT

3 Watt Amplifier SL403D
Complete with 8-page booklet, circuits and data
£1.50 each

TRIACS

STUD WITH ACCESSORIES

Type	Volts P.I.V.	Price 1-11
3 AMP RANGE		
SC35A	100	75p
SC35B	200	79p
SC35D	400	85p
6 AMP RANGE (TO48)		
SC40A	100	85p
SC40B	200	90p
SC40D	400	£1·00
SC40E	500	£1·20
10 AMP RANGE (TO48)		
SC45A	100	95p
SC45B	200	£1·00
SC45D	400	£1·25
SC45E	500	£1·45
15 AMP RANGE (TO48)		
SC50A	100	£1·25
SC50B	200	£1·35
SC50D	400	£1·65
SC50E	500	£1·85

DIAC D32 25p
TRIACS—Additional Types
40430 (TO66) 85p
40669 (Plastic) £1·00
40486 (TO5) 80p


3 Amp T048


15 Amp T048

NEW BRIDGE RECTIFIERS

SMALL SIZE AND LOW COST

Type	Volts P.I.V.	Price 1-11
HALF AMP		
BO5/05	50	20p
BO5/10	100	25p
ONE AMP ¼ × ¼ H TUBULAR		
B1/05	50	25p
B1/10	100	25p
B1/20	200	30p
B1/60	600	35p
ONE AMP (G.I.) TUBULAR		
W005	50	30p
W01	100	35p
W02	200	40p
W06	600	45p
TWO AMPS ½ H × ½ L × ⅛		
B2/05	50	35p
B2/100	100	40p
B2/200	200	45p
B2/600	600	50p
B2/1000	1000	60p
FOUR AMPS ½H × ½L × ⅛		
B4/100	100	60p
B4/200	200	65p
B4/400	400	70p
B4/600	600	75p
B4/800	800	£1·00
SIX AMPS ½H × ½L × ⅛		
B6/100	100	70p
B6/200	200	75p
B6/400	400	90p
B6/600	600	£1·00



SILICON CONTROLLED RECTIFIERS

Type	Volts P.I.V.	Price 1-11
ONE AMP		
CRS 1/05	50	25p
CRS 1/10	100	30p
CRS 1/20	200	30p
CRS 1/40	400	35p
CRS 1/60	600	45p
THREE AMP (TO48)		
CRS 3/05	50	30p
CRS 3/10	100	30p
CRS 3/20	200	35p
CRS 3/40	400	45p
CRS 3/60	600	55p
FIVE AMP (TO66)		
CRS 5/400	400	60p
SEVEN AMP (TO48)		
CRS 7/100	100	60p
CRS 7/200	200	65p
CRS 7/400	400	70p
CRS 7/600	600	95p
SIXTEEN AMP		
SCR 16/100	100	65p
SCR 16/200	200	70p
SCR 16/400	400	80p
SCR 16/600	600	£1·00


1 Amp T05


3 Amp T048

Henry's RADIO LIMITED
EDGWARE ROAD, W2

404-406 Electronic Components and Equipment 01-402 8381
354-356 High Fidelity and Tape Equipment 01-402 5854/4736
309 PA-Disco-Lighting High Power Sound 01-723 6963
303 Special offers and bargains store
All mail to 303 Edgware Road, London W2 1BW

Open:- 9 am-6 pm 6 days a week (309 closed Thursday) All stores open all day Saturday

BAKER 12in MAJOR £9

30–14500 cps. Double cone woofer and tweeter combination. Baker ceramic magnet assembly flux density 145000 gauss. Bass resonance 40 c.p.s. 20 watt RMS.

MAJOR MODULE KIT £11·50

30–17000 cps. with tweeter, crossover and baffle.

Baker Loudspeakers full range

Regent 12in	£8	Superb 12in	£15	Group 25 12in	£8
Major 12in	£9	Auditorium 12in	£14	Group 35 12in	£9
Deluxe 12in	£10	Auditorium 15in	£20	Group 50 15in	£20

Baker Loudspeaker Co., Bensham Manor Passage, Thornton Heath, Surrey. Tel. 01-684 1665

FERRANTI ZN414 Radio i.c. only £1·32

WITH FREE DATA

BF859	15p	ZTX300	12p	ZTX502	17p	Z8178	38p
BF860	20p	ZTX301	13p	ZTX503	14p	Z8270	11p
BF861	20p	ZTX302	17p	ZTX504	43p	Z8272	18p
BF896	15p	ZTX303	14p	ZTX530	21p	Z8274	19p
BF897	23p	ZTX304	21p	Z8142	33p	Z8276	26p
BF898	20p	ZTX310	9p	Z8170	10p	Z8278	37p
ZTX107	9p	ZTX330	15p	Z8171	13p		
ZTX108	8p	ZTX384	18p	Z8172	16p	• Zeners •	
ZTX109	11p	ZTX500	12p	Z8174	17p	KSG30A to	
ZTX214	15p	ZTX501	13p	Z8176	23p	KS180A	19p

All devices top grade, brand new, fully guaranteed. We specialize in Ferranti semiconductors and can supply any device. Postage & Packing 10p. Free over £2. Send S.A.E. for full list and data. All prices include V.A.T.

DAVIAN ELECTRONICS
PO BOX 38, OLDHAM, LANCS. OL2 6XJ

GUNTON ELECTRONIC IGNITION KIT £9·35 inc. V.A.T.

PRINTED CIRCUIT BOARD DESIGN. ALL METALWORK READY-DRILLED

READY BUILT UNIT £11·55 inc. V.A.T.
GUARANTEED 5 YEARS

Patents pending. 12 volt only—state pos. or neg. earth

Capacitive discharge ignition is recognised as being the most efficient system and will give you:

★ Continual Peak-Tuned Performance
★ Up to 20% reduced fuel consumption
★ Easier All-weather Starting
★ Increased Acceleration and Top Speed
★ Longer Spark Plug Life
★ Increased Battery Life
★ Elimination of Contact Breaker Burn
★ Purer Exhaust Gas Emission

Kit includes absolutely everything for assembly: Case, Cables, Coil Connectors, Silicon Grease, etc. 8 page illustrated instructions cover fitting of all Types of Tachometers. Call in for a Workshop Demonstration. S.A.E. all enquiries please or Phone 33652 (many letters from satisfied customers)

ALUMINIUM BOXES

Complete with baseplate and screws

At direct from manufacturer prices with return of post service

Type No.	L	W	D	Price
7*	5¼	2¾	1½	44p
8*	4	4	1½	44p
9*	4	2¾	1½	44p
10*	5¼	4	1½	53p
11	4	2½	2	44p
12	3	2	1	39p
13	6	4	2	59p
14	7	5	2½	68p
15	8	6	3	88p
16	10	7	3	96p

*THESE SIZES ACCEPT STANDARD VEROBOARD RANGE ALL PRICES INCLUDE V.A.T.

20% DISCOUNT ON ORDERS FOR 10 OR MORE BOXES

DEPT. PW 4 **ELECTRONICS DESIGN ASSOCIATES**
82 BATH STREET, WALSALL WS1 3DE

TEXAN 20+20 WATT. STEREO AMPLIFIER

Electro Spares can now supply all the components to build the "Texan" Amplifier, featured in *Practical Wireless* May/June 1972. All components are brand new with fibre glass p.c. board, all metalwork, knobs, finished silver trim front panel, etc. etc.

TOTAL COST OF COMPLETE COMPONENTS ONLY £27·85—POST FREE !

All components are available separately, to enable the constructor to obtain just what parts he requires at any one time. Please send S.A.E. for free list.

SPECIAL CONTEMPORY STYLE SLIMLINE METAL CASE WITH WOODEN END CHEEKS IS NOW AVAILABLE FOR THIS AMPLIFIER—DETAILS INCLUDED WITH ALL LISTS, OR AVAILABLE ON RECEIPT OF S.A.E.

P. E. 'GEMINI' STEREO AMPLIFIER

30 Watts (R.M.S.) per Channel into 8 Ohms ! !
Total Harmonic Distortion 0·02% ! !
Frequency Response (–3 dB) 20Hz–100kHz ! !

This high quality Stereo Amplifier for the Home Constructor was described in a series of articles in "Practical Electronics", from November 1970 to March 1971. It is now recognised as practically the ultimate in High Fidelity and is certainly equal to anything one can buy, no matter what the cost, but it is well within the capabilities of the ambitious constructor.

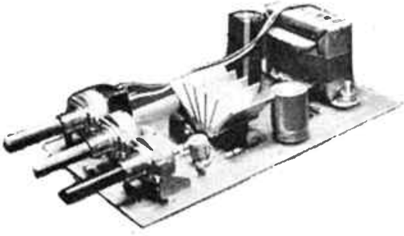
We can now supply a reprint of the articles in booklet form, price 55p plus 4p postage, with free complete component price list.

For free price list only, or a complete free specification, please send a foolscap size S.A.E.

All parts available separately.

ELECTRO SPARES
21 BROOKSIDE BAR, CHESTERFIELD, DERBYSHIRE.
QUALITY ● SERVICE ● VALUE

RAYMER MICROCHIP RE500



This advanced high-fidelity integrated amplifier is completely self-contained and only requires connecting to mains, speaker and input.

Ideally suited for:
MONO RECORD PLAYERS
MONO CONVERSION TO STEREO
STEREO CONVERSION TO QUADRAPHONIC (x 2 Microchip + Decoder)
T.V. AMPLIFIER
TAPE AMPLIFIER
P.A. INSTALATIONS
AUDIO ALARM ETC.

SPECIFICATIONS
OUTPUT 5 watt RMS (10w peak)
FREQUENCY RESPONSE 10hz to 50khz ±3db
TOTAL HARMONIC DISTORTION less than 1%
LOAD IMPEDANCE 4 to 16 ohms
INPUT IMPEDANCE 100k ohm Nominal
POWER GAIN 40db Typical
SIZE 140 x 80 x 45mm

With free instruction sheet.

PRICE £6. 93 (inc. VAT) plus 25p p. & p.

Guaranteed 12 months against failure in normal use.

TRADE ENQUIRIES WELCOMED

NAME ....
ADDRESS ....
....
Please send ....
....
I enclose P.O./Cheque/Money Order

RAYMER ELECTRONICS LTD, STANLEY RD. CAMBRIDGE CB5 8LB
Reg. Bus. 1031205

ON THE AIR

COMMERCIAL RADIO

by CHARLES MOLLOY

COMMERCIAL radio in the UK has come a step nearer with the start of medium wave tests in the London area by the Independent Broadcasting Authority. **Kevin Peel** (Hornchurch Essex) has heard the IBA on 557kHz with transmissions of music and announcements stating that the tests were being made by the IBA for an indefinite time. The choice of frequency is a surprise as the two IBA London stations are expected to be on 1151kHz (London News) and 1546kHz (London Entertainment). The first regular broadcasts from the IBA are scheduled to start this year with the opening of the London stations to be followed in 1974 by others in the provinces.

Harold Emblem (Mirfield, Yorkshire) has logged a number of medium wave stations in the Persian Gulf area between 0230hrs and 0300hrs GMT. He reports Kuwait on 539kHz; Tabriz, Iran on 645kHz; Bagdad 760kHz; 'The Voice of the Arab Emirates' Dubai 1250kHz with an Arabic religious programme followed by pop music at 0300hrs; Teheran 1325kHz; Kuwait 1345kHz. Harold mentions that Kuwait 539kHz can be heard during the evening under Budapest, which uses the same frequency. Baghdad on 760kHz is also audible in the evening.

Commercial radio is well established in Spain where several chains of low power locals operate alongside the government owned Radio Nacional Espana networks. The commercial stations are allocated call signs and about 150 of these outlets can be found all over the band. Those most frequently heard in the UK are EAJ5 Radio Sevilla on 809kHz; EAJ1 Radio Barcelona on 827kHz; EAJ2 Radio Espana (Madrid) 917kHz; EAJ29 Radio Intercontinental 953kHz; EAJ8 R. San Sebastian 1025kHz; EFE14 La Voz de Madrid 1097kHz; EAJ15 Radio Reloj (Barcelona) 1124kHz; EFJ43 Radio Juventud Bilbao 1133kHz; ECS11 Radio Centro Madrid 1385kHz; EAJ20 Radio Sabadell 1475kHz; EFE25 La Voz de Calabria 1570kHz. The common channels 1106kHz, 1133kHz, 1394kHz, 1412kHz, 1430kHz, 1475kHz, 1502kHz, 1520kHz and 1570kHz are crowded with stations. They sign-off for the night from 2300hrs GMT onwards and at this time the DXer can hear one station after another dominate a channel only to close down and leave the frequency free for a weaker occupant. Many a rare catch can be had at this time.

L. J. Hook asks for information about the MW Command receiver. Also known as the BC946 it was part of the ARC5 aircraft communications equipment used in the last war. It performs very well on the medium waves but it does require some modification as it was designed to work from a 28 volt aircraft supply.

IBA ON VHF

by SIMON DAVID

THIS new v.h.f. section will be a regular feature giving news and views on transmissions usually found on the 88 to 108MHz dial, but may be extended to include related topics. VHF is generally taken to include transmissions between 30 and 300-MHz, i.e. below 10 metres, but since this area is also covered in David Gibson's Short Wave column, this section has been specially started to provide some information more appropriate to broadcasting.

Since f.m. broadcasts began in the U.K. on a regular basis, it has been continually predicted that the medium wave band was due for banishment. This has not come about however and the medium wave is in fact still being exploited. What is expected is that the new Independent Broadcasting Authority Stations will use the upper reaches of the f.m. dial for stereo programmes, but will not necessarily use the same transmitters as the BBC. Receivers within close proximity of a BBC transmitter and collecting signals of around 100μV may find that they will be able to pick up a 20mV signal from the local IBA station.

One of the main headaches is expected to come from cross modulation effects due to emergency services being tuned in close to the commercial channels. This will undoubtedly result in a number of semi-redundant old tuners, although there is no fear of upsetting their present usefulness for BBC programmes. Whether politics come into this we are not too sure, but it is strange how the commercial side of broadcasting frequently has to accept second rate operational conditions.

In order to help find space for the new IBA commercial radio stations, the BBC will be nudging its local stations along the v.h.f. tuning scale a little, changing the operating frequencies of Radios London, Medway, Oxford, Brighton, Bristol, Leicester, Nottingham, Stoke, Humberside, and Sheffield. These adjustments are expected later this year when the appropriate details should be given in the local Press and *Radio Times*.

The new station at Carlisle is still expected to "appear" on 95·6MHz, but it looks as if Swaledale will be "lost" for want of a suitable site for a relay station.

Although some way off yet, it is not a bad idea to look into the needs and possibilities of incorporating very sharp rejection filters to suppress adjacent local transmitters. The use of a field effect transistor at the front end will also help to reduce cross modulation effects. Several tuners have automatic gain control and since this would not be helpful in this situation it is worth incorporating a switch so that it can be cut out of service as necessary.

Furthermore, the mixer stage design becomes critical and the noise generated here must be at a very low level. This will mean that the r.f. circuit will not have such a high gain as in the past but this can be made up by increasing the gain through the i.f. stages.

The use of phase-lock integrated decoders will provide tuners with lower distortion and better frequency response, both of which have become necessary for good stereo reception.

We shall always be pleased to hear of readers' experiences of v.h.f. reception, especially those who listen in to continental stations. Please be brief and confine your letters to stations received, aerial and tuner used and the effect of interfering transmissions.

ON THE AIR

AMATEUR BANDS

SHORT WAVES

by DAVID GIBSON, G3JDG

THIS month's postbag has been conspicuous by the very marked absence of 14MHz logs. It seems that the twenty-metre-only addicts are as dead as their band these days. Meanwhile, back at the eighty-metre ranch it's been a right merry r.f. square dance. The amount of DX on eighty has been quite remarkable with west coast W stations romping in at times. In fact, stations further down the globe have also put in an almost regular appearance on this band; Mexico, Brazil and Argentine, etc. Some real goodies have put in an appearance for the persistent enthusiast. Callsigns like DU1EJ and VS6DO have shown that your reciever dial need not read above 4MHz in order to log some rewarding DX signals both on phone and c.w.

News from VE land. An enthusiastic band of Canadian Amateurs are building a large ocean-going trimaran. Their object is to put the 40 most "wanted" countries on the air. I will pass on information about their ports of call as soon as I hear.

Great hopes that an Amateur station will be allowed on Clipperton Island. Callsign to listen for will probably be FO8C. Anyone heard the station reported to be located in the Spanish Sahara yet?

Time to pass on to some queries, curses and comments. **Michael Green** (Cheshire) uses a UR1A. The drawing of his antenna system bears a harrowing resemblance to the national grid. (Bet he's the only s.w.l who tunes topband in rubber gloves and wellies). Michael queries queer callsigns heard in the wee small hours on 80 metres s.s.b.; Rudolph, Scrooge, Virgin Mary and Snowman. Michael's problem is simply, "How do I QSL them?" (Perhaps the nearest Asylum is licensed?).

Letter from a long, long way off bears the signature of **Lindsay Pennell** and the post mark Hong Kong (Ah, those were the days, Chow Mein butties and cocoa on the Kowloon ferry). Lindsay wonders why so few G s.w.l.s hear the Hong Kong throng signing VS6. There are some 40 licensed Amateurs many of them being very active into Europe. Confess now, you're all logging VS6's and not telling your Auntie David.

Simon Baines (Hitchin) reports a number of W stations including W5NMA, heard on forty metres s.s.b. Gear is a five-vale receiver, transistor b.f.o. and 30ft of wire end fed.

M. Harrison (Derby) sends in a log of numerous G stations heard on topband. Incidentally, a good non-G to listen for on 1·8MHz is W1BB/1 whose stalwart support and interest in topband is well known all over the world. It is interesting to note that PY1DVG has been heard on 1·8MHz.

Kevin Smith is thirteen summers old and lives in Brighton. (Wish I was and did.) Whereas most boys of 13 are the proud possessors of pieces of string and marbles, Kevin settles for a CR100 and a 215ft long wire end fed. His best areas on topband were: DL8PC, GI3GRD, GM4BBL, GW3ZQN all on s.s.b., and OK1ATP on c.w. His log for 28MHz reads: CN8BF, CN8CF, CR4BS, CR7AF, CR7IZ, CT2AT, ET3USF, ET3USP, KV4CF, ST2SA, VP2LAF, WB4WOI/P, ZE4JW, ZS6AD, 4Z4ME, 6W8DL, 7Q7RM, 9G1HE, 9H4D, 9J2AY, 9J2DT all s.s.b.

Best times for listening on eighty metres are from midnight to around 0300 hours according to **Alan Smith** (Lancs). He bemoans the Lids who test incessantly by blowing into the mike (it's unhygienic but they can't touch you for it). Alan has a JR31), 60ft end fed and an a.t.u. Heard on eighty: EP2TW, K1UAT, K2LQA, KP4AN, KV4CI, PY4BTK, VE1ADV, VP2LI, VP7ND, W1GEY, W2BXA, W3WGH, W4AG, ZB2CF, ZS1MH, ZS3GH, 9H1CW, 9V1RE. A cheap day excursion to 14MHz s.s.b. raised: EP2ES, HZ1AB, KG6JBE, KL7HFA, KX6BQ, LU1DAC, MP4TEE, VE1ASJ, VE3MO, VK3ADR, YK1AA, ZL1KN, ZL1WE, ZL2AVE, ZL2BQC, ZL3QN.

David Sharred (Birmingham) had a quick tour of eighty metres. Main listening times were "after my paper-round", and the gear is a CR150/2 with a V-shaped antenna (60ft each leg). Goodies bagged on 3·5MHz: CN8BF, JY1, K5PFL, KV4AM, OA6NCT, PI1ROS, VE3CDP/W9, W2HCW, W4MYA, W9QLD, WA5JMK, WB4MCI/P4, ZK2BO, ZL4BT, ZL4KF, ZS3GH, 3A2EG, 5U7AX. On twenty metres David's best were VK5RN and VK6XO.

Where are all you v.h.f. types hiding? No logs at all for lonely little 70MHz and only one for 144MHz. **Michael Prescott** (Lancs.) uses a Roamer 10 receiver and a two metre dipole. He reports signals from the following: G3AHD/A, G3PVC, G3VIM, G3XIM, G3VME, G8EYO/A, G8ESU, G8GYS, G8VLE and G8XDL. Well done Michael, you've kept the v.h.f. flag flying—just.

For the contest and Rally enthusiasts, April is a busy, busy month. Jottings from my Events diary read: April 1, White Rose Mobile Rally at Leeds; 1, WAB phone contest (l.f.); 8, WAB c.w. l.f. contest; 8, eighty metre QRP (low power) contest; 15, four metre portable contest (no excuse now for not sending in a log); 21-22, Bermuda contest (phone); 29, Rugby DF qualifying round; May 5-6, two metre and 70cm open contest (another chance for the v.h.f. s.w.ls to shine); 5-6, Bermuda contest (c.w.); 6, Spalding Tulip Time Mobile Rally.

BROADCAST BANDS

Short Wave Reports by 15th of the month to Malcolm Connah, 59 Windrush, Highworth, Swindon, Wiltshire, SN6 7DT.

Medium Waves Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

VHF Reports to Simon David, c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4 4AD.

AMATEUR BANDS

Short Wave/VHF

Logs in alphabetical order please by 15th of the month to David Gibson, G3JDG, 12 Cross Way, Harpenden, Hertfordshire.

MANUFACTURERS OF ELECTRONIC AND AMPLIFICATION EQUIPMENT
SPECIALISTS IN QUALITY TRANSISTOR EQUIPMENT
OPEN 6 DAYS A WEEK. 9.30 a.m. – 6.00 p.m.

TUAC

TRANSISTOR UNIVERSAL AMPLIFICATION COMPANY LTD.
163 MITCHAM ROAD, LONDON SW17 9PG
01-672 3137/9080

ARE PROUD TO ANNOUNCE AN ENTIRELY NEW RANGE OF PROFESSIONAL STANDARD DISCOTHEQUE EQUIPMENT AND AUDIO MODULES

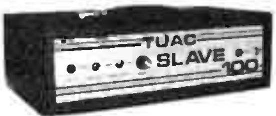
TUAC DISCOTHEQUE MIXER FEATURING AUTO FADE

£20·00 Complete p. & p. 50p. PSU £2·95 p. & p. 25p.

FEATURES: Mic input with volume and tone control. Two deck inputs for ceramic/crystal P.U.'s. Tape input with volume control. Master volume, treble and bass controls. Automatic mic overide, with adjustable fade depth; fades the music down when you make your announcements, then the music automatically returns to its original level. Automatic/manual overide switch. Full headphone facilities. Panel mounting, satin enamel finish. 40V D.C. operation. 1V low impedance output.

CONTROLS: Mic vol. mic tone. Overide depth. Tape vol. Left deck fader, right deck fader. Deck vol, treble, bass. Master vol. Headphone vol, left/right fader. Auto/manual overide switch. Power on/off switch.

TUAC HIGH POWER AMPLIFICATION—built to high standards, and built to last



£49·50 p. & p. £1·00

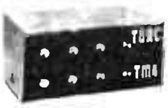
100 Watt RMS Sine Wave Slave Amplifier. Suitable for use with above mixer. Slave input, gain control, slave output, Hi/Lo sensitivity switch. Rugged circuit. Rugged leather-cloth covered case. Short and open circuit protection. Over 200 watts peak output. 8Ω output. Impedance. FULLY FUSED

CELESTION, GOODMANS & FANE speakers, condenser and dynamic mics, mic stands, headphones—all readily available.

£41·25 p. & p. £1·00
100 watt version £60·50 p. & p. £1·00.

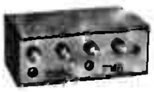
50 Watt RMS Sine Wave General Purpose Amplifier. Suitable for Disco, PA, Guitar. 4 inputs, 2 volume controls. Master volume, treble, middle and bass controls. Rugged circuit, rugged leather-cloth covered case, short and open circuit protection. Tone control specification as VA08 pre-amp. FULLY FUSED

TUAC MICROPHONE MIXERS—*battery operated—all steel construction*



£14·12 p. & p. 40p

FEATURES: 4 inputs with adjustable sensitivity, volume and extra wide range tone control on each input. 2 outputs, stereo or mono use. Max. output 2V. Low noise silicon transistor line up. 18V. D.C. operation.



£8·25 p. & p. 35p.

FEATURES: 2 Inputs with adjustable sensitivity, volume and extra wide range tone control on each input. Single output. Mono use max. output 2V. Low noise silicon transistor line up. 18V. D.C. operation.

TUAC COMBO AMP.

25 Watt RMS Sine Wave
Ideal for small groups, clubs and studio use. 4 inputs, 2 vol. controls. Master vol, treble, middle and bass controls. Heavy duty Celestion 12" speaker. Available May.

£60·00 complete.

TUAC POWER AMPLIFIER MODULES—TP 100W now with 4 RCA 150 watt output transistors TP 50W now with 2 RCA 115 watt output transistors

TP100W T.H.D. at full power 2%.

All output power ratings are R.M.S. continuous sine wave using specified supply.
Each circuit incorporates a robust driver transformer stage with thermal overload protection and is short and open circuit proof. Full power response 10HZ–20KHZ ±2dB. Input sensitivity 30mV into 3KΩ. Hum and noise better than –70dB. Output impedance 8Ω. Constructed on glass fibre P.C. board.
O/P matching transformer 4-8-16-60-100Ω £8·00 p. & p. 40p.
An additional Heatsink is required. An aluminium chassis is ideal, just bolt the module Heatsink on.

TP100W 100 watts RMS output into 8Ω £15·18 p. & p. 45p.
PS100 Power supply and transformer £9·10 p. & p. 50p.
PS100/100 Supply for two TP100W modules £18·00 p. & p. 65p
TP50W 50 watts RMS output into 8-15Ω £10·36 p. & p. 40p.
PS50 Power supply and transformer £6·86 p. & p. 50p.
PS50/50 Supply for two TP50W modules £11·95 p. & p. 65p.
Two TP100W modules can be wired in a bridge output circuit to give a single 200W R.M.S. output into 8Ω using PS100/100 supply. Use phase splitter PS201 to drive modules.

TUAC PRE-AMPLIFIER MODULES 30mV O/P into 3K.

40V D.C. operation except where stated.

VA06 £3·72 — Suitable crystal/ceramic P.U., Mic., guitar, radio tuner, vol., treble & bass controls. Sensitivity 8mV for 30mV O/P Treble + 22 –15db @ 12KHz. Bass ± 18dB @ 40Hz.

VA08 £4·22 — As VA06, but with extra middle control. Treble +28dB @ 18KHz. Middle +20 –15dB @ 4KHz. Bass +20 –10dB @ 40Hz. Sensitivity 4mV.

SVA01 £9·47 — As VA08 but stereo with bal. control.

MVA01 £4·50 — Suitable for disco, mic., tape input. 2 inputs, with Vol. & tone control on each input. Sensitivity 2mV. +25dB @ 12KHz to +20dB @ 40Hz.

MEVA01 £2·60 — Magnetic Cartridge equalisation. Connects to input of VA06 or VA08 with volume control.

SIPAM £2·40 — Master volume and presence control. High treble boost of +15dB @ 15KHz.

EFVA01 £2·50 — Increases the output of any of the above to 1V. RMS. Low impedance emitter follower output.

NEW RANGE

Includes 3 guitar effects units!

HPA01 £3·72 — **Headphone Amplifier.** 8-15Ω 200mW output. Left right fader. Volume control. 200mV 1MΩ I/P Adjustable sensitivity.

AMF01 £4·40 — **Auto Fade Unit.** Feed deck and Mic. Pre-amps in, output to power module. Fade depth and Master Vol. Control. 30mV operating Level. Spec. as disco mixer.

PS201 £1·75 — **Phase Splitter** unit to drive two TP100W modules in bridge O/P.

WAA01 £2·75 — **WAA-WAA Module.** This is an exceptional unit, producing a superb WAA-WAA for guitars. Pedal soon available. 18V D.C. operation.

FUZ01 £4·75 — **Fuzz Module.** Professional standard. Volume, tone & fuzz sustain controls. Case soon available. 9V D.C. operation.

FXD01 £3·17 — **Frequency Doubler Module.** Doubles the frequency of any sinusoidal wave, such as that obtained from the WAA-WAA module. 9V D.C. operation.

POSTAGE AND PACKING 20p EA.

TUAC LIGHT MODULATORS

3 Channel SILM8 illus.

Constructed on glass fibre P.C. board, individually tested.
Three channel light modulator will control three separate sets of lights, up to 1000 watts each set. One channel responds to the bass, one to the middle, and one to the high frequencies. Input sensitivity only 0·5 watt! Three individual controls allow for adjustment of the three channels, and a master sensitivity control allows for input levels up to 100 watts to be safely accommodated. Full interference suppression. Full wave control. Isolating input transformer does not affect Amplifier operation. Fully Fused.

SILM8 3 Channel £17·45 p. & p. 35p.

Single Channel version. S2LM8 Increased capacity of 1800 watts. Sensitivity control. Isolating input transformer does not affect amplifier operation.

S2LM8 1 Channel £6·47 p. & p. 25p.

PRE-AMP POWER SUPPLY UNIT

For use with all pre-amp modules and discotheque mixer. Not necessary if PS100 or PS50 supply is used. Output 40V D.C. 250mA. Mains fuse also incorporated. £2·95 p. & p. 25p.

All TUAC Modules are ready assembled on glass fibre P.C. board and are individually tested.

ALL PRICES ARE INCLUSIVE OF V.A.T.

ALL TUAC KITS ARE SUPPLIED COMPLETE WITH EASY TO FOLLOW WIRING INSTRUCTIONS AND CIRCUIT DIAGRAM. CALL FOR A DEMONSTRATION OF ANY OF THE ABOVE UNITS. SPEAKERS AND CABINETS ALSO SUPPLIED.

TUAC

LARGE S.A.E. WITH ALL ENQUIRIES PLEASE.
OUR TECHNICAL STAFF WILL BE PLEASED TO ADVISE YOU ON ANY PROBLEM. ALL TUAC EQUIPMENT CARRIES A 12 MONTH GUARANTEE. TRADE AND EXPORT ENQUIRIES WELCOME.

TAKE 20

JULIAN ANDERSON

No. 48
PULSE GENERATOR

A series of simple transistor projects, each using less than twenty components and costing less than one pound to build.

ALTHOUGH the prices of unijunctions have not taken the normal course of falling in cost, they are cheap enough to be used in one of our circuits.

The unijunction transistor bears little resemblance to the conventional transistor; it doesn't amplify, has only limited use and doesn't even have a collector. The connections are to an emitter, base 1 and base 2. In fact the best thing that the unijunction is good for is as a relaxation oscillator, as in Fig. 1.

Operation

When a voltage is applied to the circuit, the capacitor C1 starts to charge up through R1 and VR1. Initially the emitter of Tr1 will be at negative potential but as the capacitor charges, the voltage at this point rises. When it reaches a certain point, b_1 and b_2 are virtually short circuited and current will pass through R2, R3 and Tr1. At the same time C1 will be discharged through R3 and the device will become open circuit again. The same process will start all over again so that a series of pulses appears across R3 via C2. Since the output will be a series of pulses whose rise and fall times are very rapid, only a low value capacitor is necessary despite the low value of R3. The output will be in the form of a positive-going pulse; if a negative-going pulse is required this capacitor should be connected to b_2. A sawtooth waveform is available from the emitter but it should only be connected to a high impedance load otherwise the operation of the relaxation oscillator will be affected.

The frequency of the pulses depends on the relationship of the resistance made up from VR1 and R1 and the capacitor C1. Resistor R1 limits the current

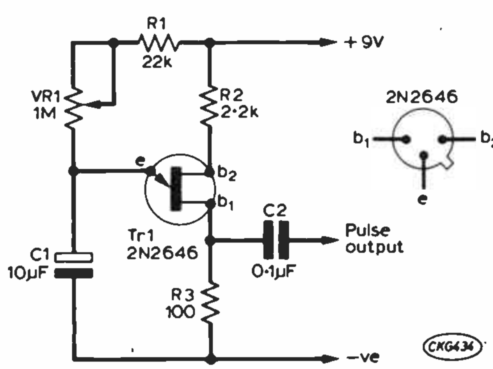


Fig. 1: Circuit and suggested valves for the pulse generator.

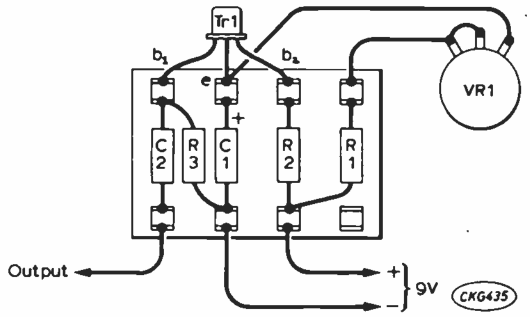


Fig. 2: Practical layout of components on a piece of tagboard.

through the emitter so that it cannot be connected directly to the positive line; this would cause damage to the device.

Experimenting

There is room for experiment here; C1 can be altered in value from 500µF down to 0·01µF. The high value will produce pulses with very long intervals; it is difficult to say how long as the natural leakage through the electrolytic will play a major role. If a low leakage device is used the time interval can be a minute or more. Using the low value capacitors the pulses could extend to ultrasonic frequencies.

★ components list

R1	22kΩ ¼W, 5 per cent	1p
R2	2·2kΩ ,,	1p
R3	100Ω ,,	1p
VR1	1MΩ linear pot	12p
C1	10µF 12V	5p
C2	0·1µF mylar, etc.	4p
Tr1	2N2646	40p
		64p

Prices are those recently advertised and may have changed. No allowance is made for minimum order costs or for postage and packing and these points should be checked carefully before ordering.

Modifications

The output can be taken to an amplifier to act as a metronome. In fact if only a low level output is required, a high impedance loudspeaker (50Ω to 80Ω) can take the place of R3; in this case of course C2 will not be needed.

A suggested layout is shown in Fig. 2 making use of a small piece of tag board; this is far from critical and almost any layout may be used. ■

HOTLINES ON RECENT DEVELOPMENTS

Do you ever have that feeling that you are being watched? Well, maybe you are at that and have been for the past 13,000 years. A theory has been put forward that we are getting intelligent messages from space. To be more precise, from an interstellar "thingy" which is buzzing round the earth—probably in an orbit which is similar to that of the moon. (Good gracious, Holmes).

LONG WAY ROUND

Before you rush out and wave your hanky at the sky, hear what the experts have done about it. It is all tied in with things called long-delayed echoes. These were observed as far back as 1928. A transmitter using 15kW on 9550kHz was radiating its Morse signal which in turn was being received by a number of receiving stations. A Morse signal was being sent and received almost instantaneously. Now a signal can go two ways—direct to the receiver by the shortest route and also in the opposite direction. This latter signal can quite easily travel right round the world before it is received by our receiver. Thus two signals are heard; the direct one, and the one which goes the "long" way round. The latter takes about one seventh of a second and is heard as an "echo" of the direct signal which, because it travels direct (therefore less distance) arrives almost instantaneously i.e., with negligible delay.

So far so good. But imagine the effect on the minds of the listeners when other echoes were heard—not delayed by one seventh of a second but at various intervals varying from about three seconds to 15 seconds! These long-delayed echoes were also noticed independently at other times, on other dates, by different receiving stations listening to a different transmitter and on a different frequency.

Then, someone plotted a graph of one of these echo sequences and another piece of the intrigueing jigsaw came to light. The plotted points bore a striking likeness to the constellation Bootis. Other echo sequences were plotted and produced patterns which were clearly identifiable with other constellations.

The hypothesis has been put that the long-delayed echoes are being returned to Earth from a space probe; a probe which arrived from the Bootis constellation 13,000 years ago. Moreover, the probe was sent to search for evidence of intelligent life in the form of radio transmissions.

People who are in doubt about the validity of all this should bear in mind that all the evidence so far corroborates this hypothesis. So closely, in fact, that EMI engineers are to set up a high-power transmitter and high gain antenna (probably around 144MHz) in order to put the hypothesis to the test. Are they just being starry-eyed? I do not think so.

ERNIE

Apart from driving the fastest milk cart in the west, Ernie has achieved fame in other ways. For example, he painstakingly avoids selecting *your* premium bond number every month without a single complaint or grumble. To date, his selections have paid happy punters prizes amounting to some £350 million—none of which has yet reached your scribe!

So it is with ageing joy and renewed hope that I report a new Ernie who will produce the monthly list of prize-winners in under three hours. The old Ernie used to take ten days to complete the same task.

Before we non-winners get too elated, let us examine what we are up against. Just what (or who) is Ernie and how does he choose winners?

First, Ernie comes from Ernie Harrison, Managing Director of Racal, whose idea it was. Ernie himself (the number picker) has been described as the most advanced electronic system in the world for generating numbers in a completely random fashion. How does he/it go about the task?

The first job is to monitor the noise level of a pair of zener diodes (actually, a pair for each digit). Each "pair" noise is amplified and then compared with a reference voltage. Because of the nature of noise there are peaks, and each time one of these exceeds the set reference level it is counted and used in the production of a digit.

Once a complete digit is generated it is safely entrusted to the memory of a computer. Here, it is checked to see if it is eligible. If it is, then it will be stored in the computer's memory, if it is not, it will be discarded.

Ernie presses on until the memory or store has 60 numbers in its care. These are then "written" onto magnetic tape and this is then "played" to another computer for checking and finally linking the lucky numbers to the bondholders' names and addresses.

I am already making the most careful measurement of the noise generated by a pair of zener diodes—well, you never know.

TRANSISTORISED TED?

How about an electronic government, a big computer tucked away beneath Parliament in a Guy Fawkes-proof vault? Maybe not yet, but in America the computer has managed to secure itself a small governmental foothold.

The House of Representatives is to vote by computer. Problem has been the 435-name list of members and the time wasted in correcting attendance errors. Other little hitches like finding a vote recorded from a member who wasn't even there were also proving annoying. The mind boggles.

The new system means that each member has a small plastic "card". He can use this card to vote at any one of some 50 stations located at various points about the House. Behind the Speaker's seat is a scoreboard which gives the latest updated score on how the voting is going. Electronic voting is reckoned to save at least 50 per cent of the time previously taken for such a task. The computer will also give written records of votes simultaneously plus an instant breakdown of these into States or Parties as required.

Look out members of Parliament—you might be replaced by a pair of zener diodes one day—they're cheaper, smaller and generate less noise!

Ginsberg

BI-PRE-PAK

SUPPLIERS OF SEMI-CONDUCTORS TO THE WORLD

COMPLETE TELEPHONES

EX. G.P.O. NORMAL HOUSEHOLD TYPE

ONLY 95p

POST & PACKING 35p EACH

TELEPHONE DIALS

Standard Post Office type. Guaranteed in working order.

ONLY 25p

POST & PACKING 15p

TESTED AND GUARANTEED PAKS

B79	4	1N4007 Sil. Rec. diodes. 1,000 PIV lamp plastic	50p
B81	10	Reed Switches, mixed types large and small	50p
B99	200	Mixed Capacitors. Approx. quantity, counted by weight	50p
H4	250	Mixed Resistors. Approx. quantity counted by weight	50p
H7	40	Wirewound Resistors. Mixed types and values.	50p
H9	2	OCP71 Light Sensitive Photo Transistor	50p
H28	20	OC200/1/2/3 PNP Silicon uncoded TO-5 can	50p
H30	20	1 Watt Zener Diodes. Mixed Voltages 6.8 – 43V.	50p
H35	100	Mixed Diodes. Germ. Gold bonded, etc. Marked and Unmarked.	50p
H38	30	Short lead Transistors, NPN Silicon Planar types.	50p
H39	10	Integrated Circuits. 6 Gates BMC 962, 4 Flip Flops BMC 945	50p
H40	20	BFY50 2, 2N696, 2N1613 NPN Silicon uncoded TO-5	50p
H41	2	Sil Power transistors comp pair BD131/132	50p

UNMARKED UNTESTED PACKS

B66	150	Germanium Diodes Min. glass type	50p
B83	200	Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ.	50p
B84	100	Silicon Diodes DO-7 glass equiv. to OA200, OA202	50p
B86	100	Sil. Diodes sub. min. 1N914 and 1N916 types	50p
B88	50	Sil. Trans. NPN, PNP equiv. to OC200/1 2N706A, BSY95A, etc.	50p
B1	50	Germanium Transistors PNP, AF and RF	50p
H6	40	250mW. Zener Diodes DO-7 Min. Glass Type	50p
H17	20	3 amp. Silicon Stud Rectifiers, mixed volts	50p
H15	30	Top Hat Silicon Rectifiers, 750mA. Mixed volts	50p
H16	15	Experimenters' Pak of Integrated Circuits. Data supplied	50p
H20	20	BY126/7 Type Silicon Rectifiers 1 amp plastic. Mixed volts.	50p
H34	15	Power Transistors, PNP, Germ. NPN Silicon TO-3 Can.	50p

MAKE A REV COUNTER FOR YOUR CAR

The 'TACHO BLOCK'. This encapsulated block will turn any 0-1mA meter into a linear and accurate rev. counter for any car with normal coil ignition system.

£1 each

OVER TRANSISTORS IN STOCK 1,000,000

We hold a very large range of fully marked, tested and guaranteed transistors, power transistors, diodes and rectifiers at very competitive prices. Please send for free catalogue.

600,000 Silicon planar plastic transistors. Unmarked, untested, factory clearance. A random sampling showed these to be of remarkably high quality.

Audio PNP, similar to ZTX500, 2N3702/3, BCY70 etc.

Audio NPN, similar to ZTX300, 2N3708/9, BC107/8/9, BC168/9 etc.

Please state Audio NPN or Audio PNP when ordering.

ALL AT 500 for £3, 1,000 for £5, 10,000 for £40 P. & P. 10p/1,000.

OUR VERY POPULAR 3p TRANSISTORS

TYPE "A" PNP Silicon alloy, TO-5 can.
TYPE "B" PNP Silicon, plastic encapsulation.
TYPE "E" PNP Germanium AF or RF.
TYPE "F" NPN Silicon plastic encapsulation.
TYPE "G" NPN silicon similar ZTX 300 range
TYPE "H" PNP silicon similar ZTX 500 range

8 RELAYS FOR VARIOUS TYPES £1
P & P 25p

FREE CATALOGUE FOR

TRANSISTORS, RECTIFIERS, DIODES, INTEGRATED CIRCUITS, FULL PRE-PAK LISTS

100,000 Plastic Power Transistors in stock, more on way!

NOW IN TWO RANGES

These are 40W and 90W Silicon Plastic Power Transistors of the very latest design, available in NPN or PNP at the most shatteringly low prices of all time. We have been selling these successfully in quantity to all parts of the world and we are proud to offer them under our Tested and Guaranteed terms.

Range 1. VCE. Min 15. HFE Min 15.

	1–12	13–25	26–50
40 Watt	20p	18p	16p
90 Watt	24p	22p	20p

Range 2. VCE. Min 40. HFE Min 40.

	1–12	13–25	26–50
40 Watt	30p	28p	26p
90 Watt	35p	33p	30p

Complementary pairs matched for gain at 3 amps. 10p extra per pair. Please state NPN or PNP on order.

INTEGRATED CIRCUITS

We stock a large range of I.Cs at very competitive prices (from 10p each). These are all listed in our FREE Catalogue, see coupon below.

METRICATION CHARTS now available

This fantastically detailed conversion calculator carries thousands of classified references between metric and British (and U.S.A.) measurements of length, area, volume, liquid measure, weights etc. Pocket Size 15p. Wall Chart 18p.

LOW COST DUAL IN LINE I.C. SOCKETS

14 pin type at 15p each
16 pin type at 16p each.
Now new low profile type

BOOKS

We have a large selection of Reference and Technical Books in stock.
These are just two of our popular lines:

B.P.1 Transistor Equivalents and Substitutes; 40p
This includes many thousands of British U.S.A., European and C.V. equivalents.

The Iliffe Radio Valve & Transistor Data Book 9th Edition; 75p
Characteristics of 3,000 valves and tubes, 4,500 Transistors, Diodes, Rectifiers and Integrated Circuits.

Postage and Packing 21p.
Send for lists of publications
N.B. Books are void of V.A.T.

VALUE ADDED TO YOU — ON ORDERS OF £4 OR OVER

SEE BELOW

Please read very carefully:
We will give a discount to customers who send in an order for £4 or over. This discount will be equal to the V.A.T. rate current at this time. If your order does amount to £4 or over, all you need to send is the total cost of goods and postage as stated in this advertisement. No addition for V.A.T. is needed.

V.A.T. for orders under £4:
If the total cost of goods plus postage and packing is less than £4, kindly add 10% (10p in the £) to your remittance. Incorrect amounts will delay your order.

A CROSS HATCH GENERATOR FOR £3.50 ! ! !

YES, a complete kit of parts including Printed Circuit Board. A four position switch gives X-hatch, Dots, Vertical or Horizontal lines. Integrated Circuit design for easy construction and reliability. This is a project in the September edition of Television.

This complete kit of parts costs £3.50, post paid.

A MUST for Colour T.V. Alignment.

Our famous PI Pak is still leading in value for money.

Full of Short Lead Semiconductors & Electronic Components, approx. 170. We guarantee at least 30 really high quality factory marked Transistors PNP & NPN, and a host of Diodes & Rectifiers mounted on Printed Circuit Panels. Identification Chart supplied to give some information on the Transistors.

Please ask for Pak P.1. Only 50p.
10p P & P on this Pak.

Please send me the FREE Bi-Pre-Pak Catalogue.

NAME...

ADDRESS ....

....

MINIMUM ORDER 50p. CASH WITH ORDER PLEASE. Add 10p post and packing per order OVERSEAS ADD EXTRA FOR POSTAGE

BI-PRE-PAK LTD DEPT. D, 222-224 WEST ROAD WESTCLIFF-ON-SEA ESSEX SS0 9DF
TELEPHONE: SOUTHEND (0702) 46344

WEYRAD

COILS & TRANSFORMERS FOR CONSTRUCTORS

Special versions of our P50 Series are now available for AF117 or OC45 Transistors. They can be used in the standard superhet circuit with slight changes in component values.

Oscilator Coil	P50/1AC (For OC45)	P50/1AC (For AF117)	33p
1st I.F. Transformer	P50/2CC (For OC45)	P51/1 (For AF117)	36p
2nd I.F. Transformer	P50/2CC (For OC45)	P51/2 (For AF117)	36p
3rd I.F. Transformer	P50/3CC (For OC45)	P50/3V (For AF117)	36p

Rod Aerial	RA2W	72p
Driver Transformer	LFDT4/1	58p
Output Transformer	OPT1	58p
Printed Circuit	PCA1	58p

I.F. TRANSFORMERS FOR "PRACTICAL WIRELESS" CIRCUITS

Components for several receivers are available, including the following for the "Clubman".

T41/1E	1st I.F. Transformer	39p
T41/2E	2nd I.F. Transformer	39p
T41/3T	3rd I.F. Transformer	57p
T41/3T	B.F.O. Coil	57p

Details of these and our other components are given in an illustrated folder which will be supplied on request with postage please.

WEYRAD (ELECTRONICS) LIMITED

SCHOOL STREET, WEYMOUTH, DORSET

P. C. BOARDS

Reverberation Unit PCB.

FOR P.W. PROJECTS

All PCB's Fibreglass, Drilled, Roller-Tinned
Circuit and Layout Diagrams free with each PCB

REVERBERATION UNIT (Nov/Dec 1972)
PCB (2in x 11½in). Specially designed to also hold Slider Pots with spacing compatible with published front panel £1·20
SET or R's, C's, S/C's, Slider Pots, Transformer £6·80

8 WATT AMPLIFIER (Nov 1972)
PCB (Mono—2½in x 3in) 60p
R's, C's, Semiconductors: Stereo Set £7·70, Mono Set £3·90

PRE-AMPLIFIER (Nov 1972)
PCB (Stereo—3½in x 7½in) Specially designed to also hold all Pots, either rotary or slider, plus Selector Switch £1·50
R's, C's, Rotary Pots, Selector Switch, Semiconductors: Stereo Set £5·20, Mono Set £2·50

LOUDHAILER & SIREN (Dec 1972)—PRE-AMP & SIREN GENERATOR
Set of R's, C's, Pot, Semiconductors PCB (2½in x 2½in) £2·20

VIBRASONIC GUITAR PRE-AMP (Sept 1970)
PCB (4in x 13in) for Mic Pre-Amp, 2-Guitar Pre-amp, Tremulant & Tone Controls, Master Volume. Specially designed to also hold Rotary or Slider Pots £2·30
Set of S/c's, R's, C's, Rotary Pots, LDR, Lamp, Coupling T/former £7·75 Power Supply £2·80

DIGITRONIC DIGITAL CLOCK (Feb. 1973)
PCB (1½in x 3½in) for 6-digit read-out 60p

POSTAGE: U.K. 10p any order. OVERSEAS at cost.

P.E. DESIGNS ALSO AVAILABLE—S.A.E. FOR FREE LIST.

ALL PRICES V.A.T. EXCLUSIVE

PHONOSONICS

DEPT. PW5, 25 KENTISH ROAD, BELVEDERE, KENT, DA17 5BW
MAIL ORDER ONLY

BROADWAY ELECTRONICS

92 MITCHAM ROAD, TOOTING BROADWAY, LONDON S.W.17 01-672 3984

CARTRIDGES—Stereo Sonotone 9TA H/C Diamond £2·40, Ronette S105 Medium Output £1·40, S106 High Output £1·40, Acos GP93/1 Sapphire £1·90, GP94/1 Sapphire £2, Japanese equivalent to B.S.R. TC8s £1·75. P. & P. 7p on each.

CARTRIDGES—Mono GP91 Stereo Compatible £1·25, B.S.R. TC8H Jap. equivalent £1·25. P. & P. 7p.

HI-FI STEREO HEADPHONES Padded ear cushions seal out room noise. Perfect coupling between reproducer and ears assure full response impedance 8 ohms, frequency range 20–20,000 Hz 6ft. cord and standard stereo plug. Only £2·57. P. & P. 27½p.

STEREO HEADPHONE JUNCTION BOX Simple unit connects direct to amplifier and speakers to give attenuated headphone output has 3 position switch to give headphones only, speakers only, speakers and headphones. Only £1·50. P. & P. 13p.

VYNAIR Widths from 50 to 54in., 75p yd. off roll. P. & P. 10p, ½ yard 40p. P. & P. 10p. Send 5p stamps for samples.

LEARN RADIO

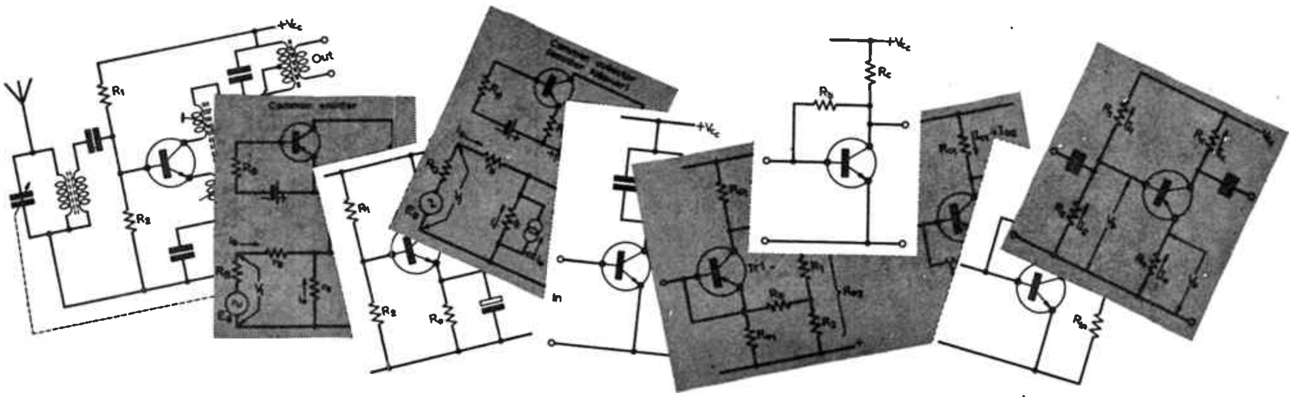
& ELECTRONICS AT HOME

No knowledge needed—build as you learn with the exciting new 'Technatron' kit. No Extras.Tools,transistors, meter etc. All supplied. You could build a radio in weeks.

SEND FOR FREE 76 PAGE GUIDE TO RADIO/TV, ELECTRONICS, C & G, TELECOMMS ETC.

Dept. BPW15 Aldermaston Court, Reading RG7 4PF
Name...
Address...
....
.... Age........ .CV | BPW15

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY



TRANSISTOR CIRCUITRY for beginners

PART 16

H.W. HELLYER & MICHAEL HOLLIER

Practicalities

A BC109 is chosen to give an open-loop gain of 260, with an input of about 30mV at 1kHz. We shall aim to keep this level constant for further tests. Connecting the two resistors of Fig. 76 to the input, we have the virtual earth type of circuitry. This has been discussed at some length in previous articles. It can now be simpified to the triangle of Fig. 77, the input shown conventionally at the blunt end; the output at the sharp end (i.e., the 'arrow' points the way the signal is going). Fig. 77 is a simplified diagram, the letter A within its triangle denoting that it is an amplifier.

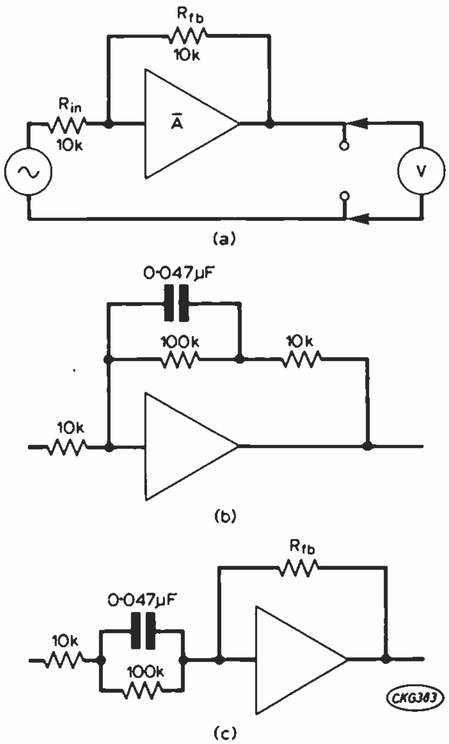


Fig. 77: (a) Simplified representation, with the symbols denoting an inverting amplifier. (b) a frequency-dependent development, and (c) the bass cut variation, with the frequency-selective portion before the feedback loop.

Previously you will have noted reference to an 'inverter'. By this, is meant that the input is 180° antiphase to the output. In Fig. 77, we see a bar over the A, denoting an inverter. For the benefit of old-timers like me, this can be regarded as exactly parallel to valve technology: a positive-going waveform at the grid produces a negative-going waveform at the anode.

If previous articles have been followed, it will be noted that the closed loop gain, which is the circuit gain calculated after feedback has been applied, is derived from the formula: $G_c = R_{fb}/R_{in}$.

If we now make R_{in} equal to 10kΩ and R_{fb} also 10kΩ, the closed loop gain is unity, i.e., 10/10. In practice, we shall measure 0·8 rather than 1. If, with R_{in} at 10kΩ and R_{fb} at 100kΩ, giving a theoretical gain of 10, we were again to measure, we should find the answer more like 7·7. Carrying this experiment a little further—and please do not merely take our word for this; try it and see for yourself—we find that with R_{in} at 100kΩ and feedback resistors varying between 10kΩ and 1MΩ, the closed loop gain varies between 0·1, via 0·98 (at 100kΩ) and 5·8. Which only goes to prove that the actual gain is always less than calculated, and, secondly, the lower the circuit impedance, the greater the error.

Practically, therefore, it would seem that our circuit was not the best. But, as it is typical of the majority of commercial designs, we make no apology. It has to be remembered that the tone control circuitry does not have to contribute a lot of gain. We do not normally need a gain at any frequency of more than 'times 10', plus a stage gain of around 4, and so a maximum gain of about 40. Refinements will be added, never fear . . .

Reverting to Fig. 77(a) and making R_{in} 10kΩ, with a similar value for R_{fb}, we obtain a gain of 0·98, and the virtual earth point is at the junction of the two resistors. If we insert a resistor as shown at

Fig. 77(b) we reduce the gain somewhat, 0·96, but let's return to that later, the important point being that we can arrange the gain that we require by choice of R_{in} and R_{fb}.

Here I part with Mike and assert that many modern circuits are resolved and arranged (rather than designed) by what are euphemistically called 'empirical methods'; more cynically described as 'hit or miss'. With the basis of existing circuits and a mass of mathematics that go to support them, the modern designer takes for granted the previous researches, and builds upon them. Exceptions, like John Linsley Hood, who question every fact and do their own research, are as rare as gold nuggets in a leadmine.

All of which digression leads me to Fig. 77(b). Here we have R_{in} at 10kΩ with a similar feedback resistor R_{fb} in series with a 0·047μF capacitor (itself, practically, paralleled by 100kΩ). The impedance of the feedback network can, if you want to be meticulous, be calculated at any point in the frequency range.

This is all very fine, but, in practice, we can say that at very high frequencies the capacitor will be an effective short-circuit. In these circumstances, the circuit becomes effectively R_{in}/R_{fb} having unity gain. Lowering the frequency raises the reactance X_c until it eventually becomes an open-circuit, and, in comparison with the 100kΩ previously mentioned, the gain will be nearly 11. Theory gives us 110/10, practice a little less, hence my question-begging formula. We shall settle for a gain of around 20dB, which is ten times the input voltage.

In the frequency range that C is effective we will have an impedance change in the feedback network giving us a slope of 6dB/octave. At frequencies below where unity gain is produced, the slope will flatten, so that further reduction of frequency does not change the output from unity gain. At frequencies above where the effective R_{fb} is 110kΩ, i.e., for a theoretical gain of x11, the curve again flattens. The transitions from slope to flat are not sudden and our dotted curves show the practical results obtained.

Turnover

Reference has already been made to f_t, and by this we mean the turnover frequency, (in the case of Fig. 75 we have two turnover points, at 3dB positive or negative position on the curve, depending on the way the calculations are carried out, as should become apparent).

The f_t points can be calculated from the formula $f_t = \frac{1}{2\pi CR}$ where the frequency is in hertz; the

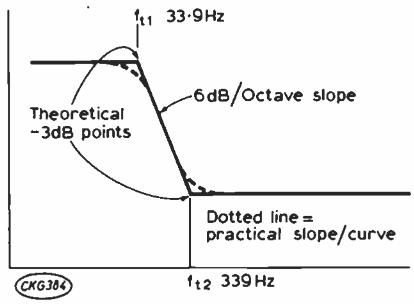


Fig. 78: The bass lift curve in theory (solid line) and in practice (dotted line).

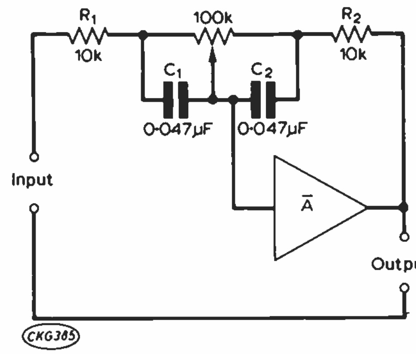


Fig. 79: A combined bass lift and cut circuit.

constant 2π can be taken as 6·28, C is in farads and R in ohms. Taking the component values of Fig. 77(b), we obtain a lower frequency turnover point of 33·9Hz while the upper frequency turnover point works out to 339Hz.

In practice, of course, the points are not definite. The plotted curve, as can be shown later, follows rather the dotted than the hard line of Fig. 78. Plotting the curve obtained from a 'hook-up' replica of Fig. 76, we get the actual curve of Fig. 78, from a generator with a 600Ω source impedance, and reading across the 'open' output with a high impedance valve-voltmeter. (Amendment, please: our habit these days is to use the battery-powered millivoltmeter so the use of the term 'valve-voltmeter' is mostly a matter of habit—although we certainly continue to use our old faithful instruments where the low value of hum and noise will not prove an embarrassment.)

One of the reasons for the smoothing of a theoretical curve is, of course, that other circuit considerations take effect. In theory, we take the two extremes, when the 0·047μF capacitor is in parallel with the 100kΩ resistor and the 10kΩ resistor is not effective, and when the capacitor is in series with the 10kΩ resistor, the effect of the 100kΩ resistor then being ignored. In practice, of course, it cannot be ignored: its real effect is to modify our 10kΩ to 9kΩ under these circumstances.

Taking the worked theoretical examples:

$$f_t = \frac{1}{2\pi CR} = \frac{10^6}{6{\cdot}28 \times 0{\cdot}047} \times 10\text{k}\Omega \quad \ldots\ldots\ldots\ldots (1)$$

$$\text{and } \frac{10^6}{6{\cdot}28 \times 0{\cdot}047} \times 100\text{k}\Omega \ldots\ldots\ldots\ldots (2)$$

$$(1) = 339\text{Hz and } (2) = 33{\cdot}9\text{Hz}$$

These figures agree very nearly with our practical measurements, This, from the curve of Fig. 78., gives us our Bass Lift circuit.

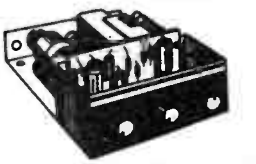
Bass cut

If we now reverse the networks R_{in} and R_{fb} as depicted in Fig. 77(c), we get an inverse of the previous curve. That is to say, we get bass cut instead of bass lift, because the feedback is now resistive, while the input circuit, up to the 'virtual earth point', is frequency-dependent.

Combining both these circuits, as in Fig. 79, we get bass cut and lift according to the position of the slider of the control. With the slider on the left, C1 is effectively short-circuited and we are left with

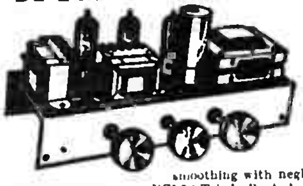
—continued on page 76

SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 5 ohm. Frequency response 12Hz—30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume, Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high x 6" wide x 7½" deep. AC 200/250V.
PRICE £10·50. P. & P. 25p.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:—2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300m/v for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. PRICE £8·92 P.&P. 45p.

POWER SUPPLY UNIT 200/240v. A.C. input. Four switched fully smoothed D.C. outputs giving 6v. and 7½v. and 9v. and 12v. at 1 amp continuous (1½amp intermittent).
Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" × 3½" × 2½". Suitable for Transistor Radios, Tape Recorders. Amplifiers etc. etc. Ready built and tested. **PRICE £4.50** P. & P. 35p.

BLACK ANODISED 16g. ALUMINIUM HEAT SINKS. For TO3, complete with mica's and bushes. Size 2½" × 3" approx. 25p pair. P. & P. 5p.

HIGH GRADE COPPER LAMINATE BOARDS 8" × 6" 5 for 50p P. and p. 13p.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0-210-240v. Secondary combinations 0-5-10-15-20-25-30-35-40-60v. half wave at 1 amp. or 10-0-10, 20-0-20, 30-0-30v. at 2 amps full wave. Size 3in. long × 3½in. wide × 3in. deep. Price £1·85 P. & P. 30p.

MAINS TRANSFORMER. For transistor power supplies. Pri 200/240v. Sec. 9-0-9 at 500mA. 85p. P. & P. 13p.
Pri. 200/240v. Sec. 12-0-12 at 1 amp. 95p. P. & P. 13p.
Pri. 200/240v. Sec. 10-0-10 at 2 amp. £1·45. P. & P. 30p.

British made solid state all silicon stereo amplifier. 15 watts rms per channel output. Fre. res. 20Hz to 20KHz. Suitable for magnetic or ceramic pickup tape mic. etc. built in switchable scratch filter, rumble filter and loudness control. 60 m/m slider controls for base, treble and volume. 10 way push button function, selector switch. This amplifier has specification and performance usually only found in amplifiers costing twice as much. Each amplifier supplied, tested and fully guaranteed. Finished in the most attractive contemporary style teak cabinet. Size 16½in × 8½in. × 4½in. Makers recommended price £42·15. Our price (while stocks last) £32·50 + 7½p. p. & p.+ V.A.T. Send SAE for full details of specification.

CENTRE ZERO MINIATURE MOVING COIL METER. 100μA. For balance or tuning. Approx. size 1" x 1" x ¾" deep. Limited number. 75p. P. & P. 10p.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER
For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz—25KHz. Gain 26dB. Solid encapsulation size 1½" x 1½" x ½". Brand new complete with instructions. Price 88p. P. & P. 13p.

HANDBOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES
A must for servicemen and home constructors. Including many 1000's of British, U.S.A. European and Japanese transistors. ONLY 40p. Post 5p.

VAT. Prices in this advertisement (incl. p. and p.) will be subject to VAT as from 1st April, 1973.

4-SPEED RECORD PLAYER BARGAINS

Mains models. All brand new in maker's packing.
LATEST B.S.R. C109/C129 4-SPEED AUTOCHANGER. With latest mono compatible cartridge £6·97 Carr. 50p. With stereo cartridge £7·97 Carr. 50p.
GARRARD SP25 Mk III with heavy precision machined die cast turntable £10·95. carr. 50p.

SPECIAL BARGAIN OFFER!

PRECISION ENGINEERED PLINTHS
Beautifully constructed in heavy gauge "Colorcoat" plastic coated steel. Resonance free. Designed to take Garrard 1025, 2000, 2025TC, 2500, 3000, 3500, 5100, SP25 II and III, SL65B, AT60 etc. or B.S.R. C109, C129, A21 etc. Black leatherette finish. Size 12¼" × 14½" × 3½" high (approx. 7½" high, including rigid smoked acrylic cover).
NOW ONLY £4·50, P. & P. 35p.

LATEST ACOS GP91/1SC mono compatible cartridge with t/o stylus for LP/EP/78. Universal mounting bracket. £1·50 P. & P. 8p.

SONOTONE 9TAHC COMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78. **ONLY** £2·50 P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £3. P. & P. 10p.

LATEST RONETTE T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. £1·63 P. & P. 10p.

LATEST RONETTE T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only £1·50 P. & P. 10p.

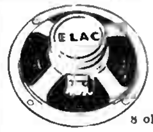
QUALITY RECORD PLAYER AMPLIFIER MK II
A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide × 3in. deep × 6in. high. Ready built and tested. PRICE £3·95 P. & P. 40p
ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE £5·25 P. & P. 50p.

SPECIAL OFFER !
HI-FI LOUDSPEAKER SYSTEMS

Beautifully made teak finish enclosure with most attractive Tygan-Vynair front. Size 16" high x 10½" wide x 6" deep. Fitted with E.M.I. Ceramic Magnet 13" x 8" bass unit, two H.F. tweeter units and crossover. Maximum power handling 10 watts. Available 3 or 8 or 15 ohms impedance.
OUR PRICE £8.40 Carr. 65p
Cabinet Available Separately £4·50 Carr 60p
Also available in 8 ohms with EMI 13" x 8" bass speaker with parasitic tweeter £6·50 Carr. 65p

LOUDSPEAKER BARGAINS

5in. 3 ohm £1·05, P. & P. 15p. 7 × 4in. 3 ohm £1·15, P. & P. 20p, 10 × 6in. 3 or 15 ohm £1·90, P & P. 30p, E.M.I. 8 × 5in. 3 ohm with high flux magnet £1·62, P. & P. 20p
E.M.I. 13½ × 8in. with high flux ceramic magnet with parasitic tweeter 3, 8 or 15 ohm £3·20, P. & P. 30p. E.M.I. 13 × 8in. 3, 8 or 15 ohm with two inbuilt tweeters and crossover network £4·20, P. & P. 30p.
EMI Ceramic magnet heavy duty tweeter. Approx 3½". Available 3 or 8 or 15 ohms. £1·25 + 15p p. & p.
BRAND NEW. 12in. 15w. H/D Speakers, 3 or 15 ohms. Current production by well-known British maker. Now with Hiflux ceramic ferrobar magnet assembly £6·75. Guitar models: 25w. £6·75. 35w. £8·50. P. & P. 38p



SPECIAL OFFER!
LIMITED NUMBER OF BRAND NEW ELAC 10" TWIN CONE LOUDSPEAKERS
With large ceramic magnet and plasticised cone surround. 8 ohm impedance. £2·75. P. & P. 25p.

12in. "RA" TWIN CONE LOUDSPEAKER. 10 watts peak handling. 3, 8 or 15 ohm £2·20. P. & P. 30p.
35 ohm SPEAKERS 3in. only 63p P. & P. 13p.

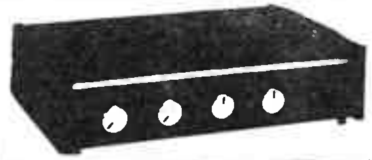
"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER
Size 11½" x 14⅝" x 1$\frac{3}{16}$" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz-20kHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details. Only £5·95 each. P. & P. 25p.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Usually £1·75 yd., our price 75p yd. length. P. & P. 15p per yd (min 1 yd.) S.A.E. for samples.

HI-FI STEREO HEADPHONES

Adjustable headband with comfortable flexifoam earmuffs. Wired and fitted with standard stereo ¼in jack plug. Frequency response 30-15,000Hz. Matching impedance 8-16 ohms. Easily converted for Mono. PRICE £2·95, P. & P. 15p.
HIGH IMPEDANCE CRYSTAL STICK MIKES. OUR PRICE £1·05, P. & P. 8p

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



NEW FURTHER IMPROVED MODEL WITH HIGHER OUTPUT AND INCORPORATING HIGH QUALITY READY DRILLED FIBRE GLASS PRINTED CIRCUIT BOARD WITH COMPONENT IDENTIFICATION CLEARLY MARKED FOR EVEN EASIER CONSTRUCTION

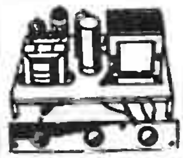
A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 5 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled fibreglass printed circuit board, smart brushed anodised aluminium front panel with matching knob, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification; Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response ±3dB 12-30,000 Hz Sensitivity: better than 80mV into 1MΩ. Full power bandwidth: ±3dB 12-15,000 Hz. Bass boost approx. to ±12dB. Treble cut approx. to −16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp.
Overall Size 12"w. x 8"d. x 2½"h.
Fully detailed 7 page construction manual and parts list free with kit or send 18p plus large S.A.E.

AMPLIFIER KIT	£10·50	P. & P. 15p
(Magnetic input components 30p extra)		
POWER PACK KIT ..	£3·00	P. & P. 30p
CABINET	£3·00	P. & P. 30p

(Post Free if all units purchased at same time)
Full after sales service

Also available ready built and tested £21·00. Post Free.
Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi Fi Discotheque use, etc.

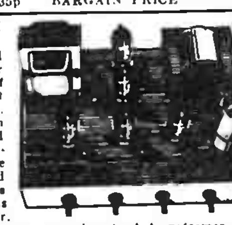
3-VALVE AUDIO AMPLIFIER HA34 MK II.



Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½" w. × 4" d. × 4½" h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £4·95. P. & P. 35p.
HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. £4·10. P. & P. 40p.

HARVERSON'S SUPER MONO AMPLIFIER
A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3.5 watts. Volume and tone controls. Chassis size only 7in. wide × 3in. deep × 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer.
P. & P. 35p BARGAIN PRICE **£2.95**

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and 2 independent volume controls, and separate base and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier Simple instruction booklet 13p (Free with parts). All parts sold separately. ONLY £7·97 P. & P. 55p. Also available ready built and tested £10·97 P. & P. 60p.

Open 9-5.30 Monday to Saturday
Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station.

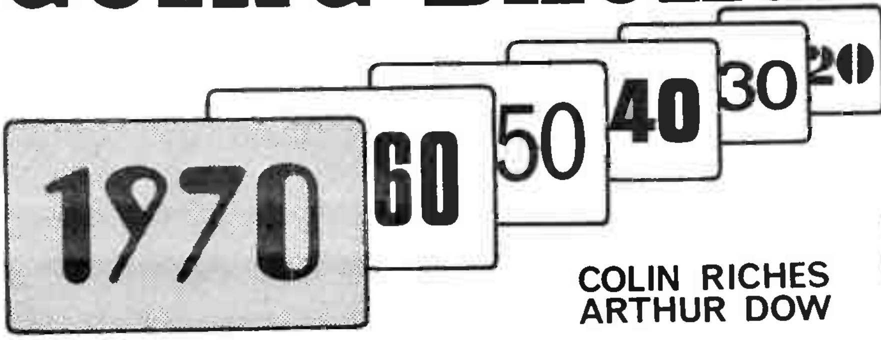
HARVERSON SURPLUS CO. LTD.

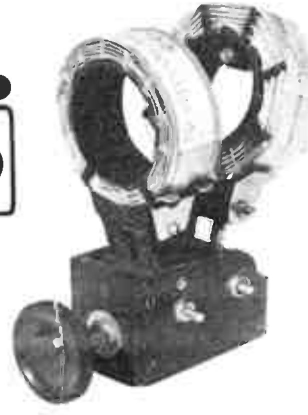
(Dept. P.W.) 170 HIGH ST., MERTON, LONDON, S.W.19 Tel.: 01-540 3985

SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

(Please write clearly)
PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

GOING BACK...





COLIN RICHES
ARTHUR DOW

QUITE a large number of letters addressed to us involve queries or seek information on the date or origin of bits and pieces of old wireless equipment or valves. So this month we thought that we would try to give some very broad indications of the form of construction and appearance of domestic wireless sets at the interesting stage of their development. This should enable readers to date a piece of apparatus, if called upon to express an opinion, or if an interesting bit of gear is found in a junkshop.

History

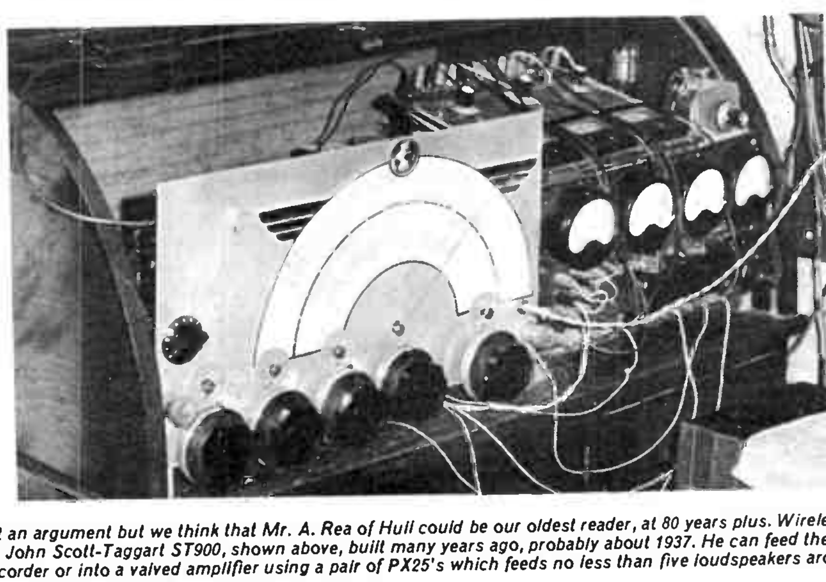
From the turn of the century when Marconi was experimenting with the first tuned spark transmitter, until 1922 when the first official broadcast was made and valve circuits had been developed to the extent that they were no longer regarded as freak, the amount of equipment produced was comparatively small and that which remains is mostly in safe hands.

Once broadcasting had begun the boom in home constructed receivers got under way very rapidly since there were few commercial receivers available at that time. It is this period from about 1922 until the mid-30's that is probably of most interest to those who specialise in collecting vintage wireless equipment and with which we will concern ourselves here.

Components

There were many firms supplying components such as coils and holders, tuning condensers, audio transformers and valves as well as ebonite panels and associated hardware. Basket-wound or wave-wound coils were frequently home-made and plugged into holders which were adjustable from the panel to vary the coupling between the coils. Resistors looked like cartridge fuses and were pushed in to clips. The grid-leak was often changed to suit the 'softness" of the detector valve or it might be a panel-mounted variable resistance.

'Spaghetti' resistors had the resistance wire wound on a flexible core and looked like a piece of string with end tags. These could be connected directly between terminals of components. Most components such as audio transformers, valveholders and condensers etc. had terminals, usually 6BA, often with a soldering tag. Sets of this period were characterised by the great effort that went into the wiring up.



We don't want to start an argument but we think that Mr. A. Rea of Hull could be our oldest reader, at 80 years plus. Wireless is still his hobby and he is very proud of the John Scott-Taggart ST900, shown above, built many years ago, probably about 1937. He can feed the output of the receiver into a tape recorder or into a valved amplifier using a pair of PX25's which feeds no less than five loudspeakers around the place.

Square sectioned copper wire was common, always arranged with neat corners or angles and straight parallel runs and neat loops under the terminals. The need for short, direct wiring was not appreciated then, and indeed, was probably of little importance where only medium and long waves were concerned and stage gains were very low.

Construction

Such receivers were built on a wooden baseboard to which the components were fixed with wood-screws and an ebonite panel was fixed to one edge of the board. Along the back edge was a row of terminals, mounted on a strip of ebonite, for connecting the set to the accumulator, high tension battery, grid bias battery, aerial and earth and headphones or speakers. Incidentally, the cabinets for these sets were also given a great deal of attention and often were works of art in themselves to ensure that they fitted in with the rest of the furniture. Indeed, the receiver was often built in to an existing piece of furniture. The panels of sets of this period were a mass of knobs and controls with possibly a rheostat for each filament, variable grid-leaks, tuning condensers for each stage, coil coupling controls and reaction controls. Later, when shorter wavelengths were in use, metal panels were employed in order to prevent 'hand capacity' effects which upset the rather critical tuning.

Valves

Valves can be dated fairly accurately from a study of their physical characteristics. At the beginning of the period we are discussing, say 1922-24, the Marconi-Osram R valve was common along with the Mullard ORA and the Cossor P1 all of which were bright emitters with tungsten filaments. Generally they had a metal sleeve base and a pinch on top of the glass envelope, formed during the evacuation process. 1924-25 saw the introduction of the dull emitter valves using oxide-coated filaments such as the MO DE5, Mullard DO6 and the Cossor WR1. These valves still had the pinch on top but the bases were the more familiar moulded type.

Between 1925 and 1927 saw the advent of the now famous Mullard PM range of valves which were dull emitters with filament voltages from two to six volts. The pinch was now concealed in the base of the valve thus eliminating a very vulnerable feature of the older valves.

The first 'mains' type valves emerged in 1927 with the heaters, usually four volts, being run from a mains transformer instead of accumulators or batteries. In the early 30's r.f. type valves appeared with sprayed-on metallic coating for screening purposes and the glass envelopes, especially for the audio amplifier valves, developed a waisted section at the top of the envelopes intended to support the mica discs of the electrode assembly and thus reduce any tendency to microphony.

For those that are really interested in these old radios there is no finer pastime than trying to get one of them to work even if it means using equivalent modern components as replacements for faulty parts. Our CQ column is open to those readers who wish to appeal to other readers for old components if it is felt that only a 100% genuine vintage receiver is acceptable.

TRANSISTOR CIRCUITRY FOR BEGINNERS—

continued from page 72

the effective bass lift circuit of Fig. 77(b). With the slider to its right we get the alternative condition, with C2 short-circuited and the bass cut circuit of Fig. 77(c).

Balance

Take the case of the slider at its middle position. Then, the input and output circuits are identical and balanced. That word, BALANCED is important. It is the basis of the Baxandall tone control circuit—one of the most elegant solutions to an audio problem yet posed, and not to be under-rated. In the full circuit, the impedance change with the slider control moved (a change in frequency-dependence, looked at in the basic way of our approach) is exactly balanced with the movement of the slider in the other

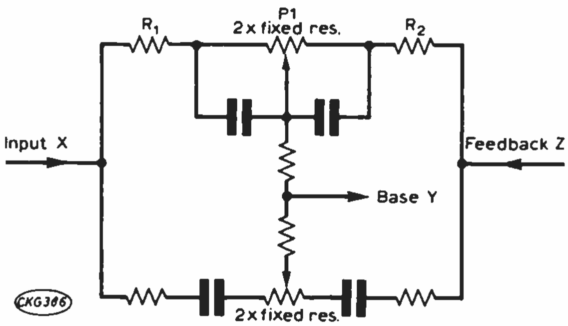


Fig. 80: The eventual network to be inserted in the feedback loop, giving bass and treble lift and cut.

section of the ganged potentiometer. It remains only that the ganged potentiometers themselves shall be within at least 1dB of linearity.

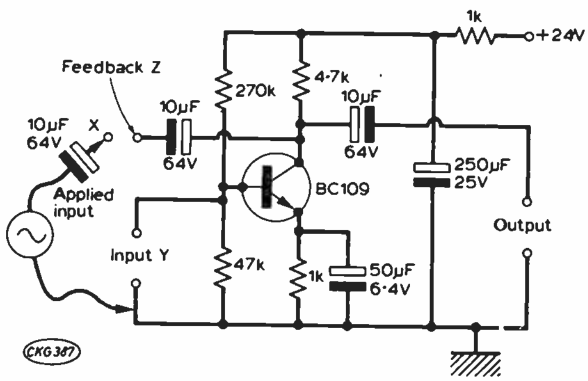


Fig. 81: The basic amplifier circuit over which the feedback is applied.

From the simple experiments we have already carried out, we know that when the input resistance, R_{in} is equal to the feedback resistance R_{fb}, then the theoretical gain is unity. In practice, findings are not far removed from the theoretical. At intermediate positions of the sliders, we shall get variations from the theoretical norm, between maximum bass and maximum cut.

2N414 £1.25 POST FREE

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

I.C. Sockets

Dual-in line or Zig-Zag (Quil). 14 and 16 pin
Our Price 1p per pin

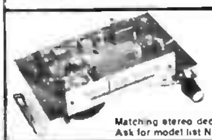
Slider Pots

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

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

Diodes & Rectifiers

AA119 9p	BA156 15p	BY176 £1·50
AA120 9p	BA243 56p	BY182 £1 50
AA129 9p	OA47 10p	BY250 23p
BA102 25p	OA79 9p	IN4001 6p
BA115 17p	OA90 7p	IN4002 7p
BA130 10p	OA91 7p	IN4003 8p
BA145 20p	OA200 10p	IN4004 8p
BA148 20p	BY100 15p	IN4005 10p
BA154 13p	BY126 15p	IN4006 12p
BA155 14p	BY127 15p	IN4007 15p



FM TUNER chassis fully transistorised 9 volt operation. OUR PRICE £6 25
Matching stereo decoder £4 97
Ask for model list No. 11

VDR's & Thermistors

A15B	75p	GL23	£1 00	VA1005	15p
CZ1	15p	R53	£1 32	VA1026	13p
CZ4	13p	R54	£1 46	VA1033	13p
CZ13A	13p			VA1040	10p
E298 ED/A258	10p			VA1053	10p
E298 ZZ/06	10p			VA1055S	10p
GL16	£1			VA1034	10p

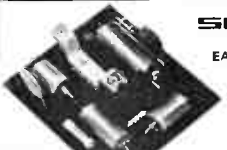
Resistors

½ watt 5% Carbon Film – low noise Hi-Stabs
All E24 values 1p each plus p. & p. 7p for up to 50 Resistors and a further 2p for each additional 50. Deduct 33⅓% for 100 of one type or 25% for mixed orders over £1 in value.

1 W	10% Carbon Composition	3p each
2 W	10% Carbon Composition	6p each
2½ W	5% Wire wound	9p each
5 W	Wire wound	9p each
10 W	Wire wound	10p each

plus p & p 7p for up to 25 resistors plus 1p for each additional 25

SGS



EA1000

3 Watt Audio Amplifier
Our Price inc. handbook £2·40

10 + less 15%
25 + less 25%
100 + less 33⅓%

5 Watt Audio Amplifier
Our Price £3·90
Less quantity discount.

Potentiometers

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

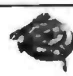
log or lin less switch (& 1KΩ lin)	12p
log or lin with switch	24p
dual less switch	40p
dual with switch 10K, 100K & 1M log only	52p
10K log 10K antilog less switch	40p

Eliminators

9 volt @ 20mA (PP3)	£1.25
6 volt @ 50mA	£1.50
9 volt @ 50mA	£1.50
6 + 6 volt, 50mA	£2.50
9 + 9 volt, 50mA	£2.50
7½ volt for cassette recorders	£2.00
6, 7½ or 9 volt	£3.00
3, 4½, 6, 7½, 9, 12 @ 500mA (illus.)	£3.99
Car Battery Converter fully stabilised to provide 6, 7½ or 9 volts	£4.99

(p & p 15p on all types)

Presets



Vertical or Horizontal

0 1 watt 5p		0 25 watt 7p		
100	1K Ω	10K Ω	100K Ω	1M Ω
250	2·5K Ω	25K Ω	250K Ω	2·5M Ω
500	5K Ω	50K Ω	500K Ω	5M Ω

Capacitors

disc ceramic		low voltage		
·01µF 18v	5p	0·1µF 30v		5p
·022µF 18v	5p	0·22µF 6v		5p
·047µF 12v	5p	0·47µF 3v		5p
ceramic plate		30V		
1000pf	10p	4700pf		10p
2200pf	10p	10,000pf		10p

Ceramic – plate		63V (C333)	
1·8pf	8 2pf	33pf	120pf
2 2pf	10pf	39pf	150pf
3·3pf	12pf	47pf	180pf
3·9pf	15pf	56pf	220pf
4 7pf	18pf	68pf	270pf
5 6pf	22pf	82pf	330pf
6 8pf	27pf	100pf	

all 5p. each

mylar film		100V			
1000pf	2p	·01µF	3p	·068µF	4p
2000pf	2p	·02µF	3p	·1µF	4p
5000pf	2p	·04µF	3p	·2µF	5p
		·05µF	3p		

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

metallised polyester	250V (C280)				
·01µF	3p	·068µF	3½p	·47µF	8p
·015µF	3p	·1µF	4p	·68µF	11p
·022µF	3p	·15µF	4p	1µF	13p
·033µF	3p	·22µF	5p	1 5µF	20p
·047µF	3p	·33µF	6½p	2 2µF	24p

metallised polyester	400V (C281)				
·01µF	4½p	·047µF	6p	·22µF	10p
·015µF	4½p	·068µF	6p	·33µF	14p
·022µF	4½p	·1µF	7p	·47µF	15p
·033µF	5½p	·15µF	8p		

silvered mica 1% (+·50pf) 500V

2·2pf—820pf	7p	4·7nF—5600pf	19p
1nF—2·2nf	9p	6800pf—·01µF	29p
2·7nF—3·6nF	16p		

mixed dielectric		600V			
·01µF	7p	·047µF	7p	·22µF	16p
·022µF	7p	·068µF	8p	·47µF	24p
·033µF	7p	·1µF	8p	1µF	33p

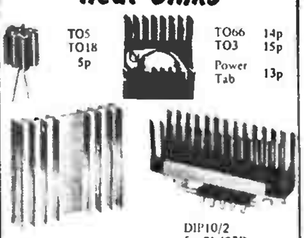
MAIL ORDERS Where no p & p charge is shown a minimum of 7p applies, p & p on overseas orders is charged at cost
ADDRESS TO: **Component Dept.**
56, Fortis Green Road, London N10 3HN
Telephone 01-883 3705

CHROMASONIC electronics

mixed dielectric		1000V			
1000pf	6p	6800pf	9p	·1µF	12p
2200pf	6p	·01µF	9p	·22µF	22p
3300pf	6p	·022µF	9p	·47µF	30p
4700pf	6p	·047µF	12p		

Ceramic 12KV.d.c.		8KV.d.c.		HI-K 750V.	
10pf	9p	200pf	9p	1000pf	5p
15pf	9p	220pf	9p	1500pf	5p
22pf	9p	250pf	9p	2000pf	5p
68pf	9p	270pf	9p	3000pf	5p
82pf	9p	300pf	9p	5000pf	5p
100pf	9p	750V DISC		10,000pf	5p
120pf	9p	470pf	5p	feed-	
140pf	9p	1000pf	5p	through	
150pf	9p	5000pf	5p		
180pf	9p	10,000pf	5p	1000pf	5p

Heat Sinks



TO5 TO18 5p
TO66 TO3 14p 15p
Power Tab 13p
DIP10/2 for SL403D 15p
10D 50p

Veroboard

	Copperclad 0.1"	Copperclad 0.15"	Plain 0.15"
2½" x 1"	6p	6p	–
2½" x 3¾"	20p	16p (9)	10p
2½" x 5"	24p	21p (7)	12p
3¾" x 3¾"	24p	21p (8)	–
3¾" x 5"	27p	27p (10)	17p
17" x 2½"	67p	50p	37p
17" x 3¾"	90p	70p	52p
17" x 5"	–	–	75p

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

NEW LISTS
BOXES CHASSIS etc. No. 7
TRANSISTORS, I.C.'s, etc. (soon)
(postage 5p)

Aluminium Boxes

Including baseplate and screws

No.	L.	W.	D.	Price	p. & p.
(7)	2¼"	x 5¼"	x 1½"	35p	8p
(8)	4"	x 4"	x 1½"	35p	8p
(9)	4"	x 2¼"	x 1½"	35p	8p
(10)	4"	x 5¼"	x 1½"	40p	8p
11	4"	x 2½"	x 2"	35p	8p
12	3"	x 2"	x 1"	32p	9p
13	6"	x 4"	x 2"	50p	10p
14	7"	x 5"	x 2½"	58p	12p
15	8"	x 6"	x 3"	75p	18p
16	10"	x 7"	x 3"	85p	20p

Transistors & Integrated Circuits

AC107	25p	BC147	10p	BF196	15p	OC81	19p	2N1304	22p	2N5172	15p
AC126	17p	BC148	10p	BF197	15p	OC140	20p	2N1711	25p	LO05TI	£1·50
AC127	15p	BC149	10p	BF272	53p	OC170	23p	2N1893	30p	LO36TI	£1·50
AC128	15p	BC157	12p	BFY50	24p	OC171	30p	2N2926 all	10p	LO37TI	£1·50
AC176	15p	BC158	10p	BFY51	21p	ZTX107	15p	2N3053	23p	MC1303L	£1·75
AC167	25p	BC159	12p	BRY39	36p	ZTX108	12p	2N3054	50p	MC1330	80p
AC167K	25p	BC169	15p	BSX21	26p	ZTX109	15p	2N3055	49p	MC1350	75p
AC188	25p	BC268	15p	BSY95A	14p	ZTX300	12p	2N3702	12p	MC1351	£1 00
AC188K	25p	BO115	67p	BU105/02	£1.75	ZTX301	15p	2N3703	12p	MC1352	£1 00
ACY20	20p	BO131	70p	MJE340	67p	ZTX302	20p	2N3704	10p	MFC4000B	49p
AO140	40p	BO132	70p	MPF192	40p	ZTX303	20p	2N3705	10p	MFC4010A	55p
AO149	40p	BO131/2M.P. 149p		MPF103	37p	ZTX304	25p	2N3706	10p	LM380	£1 45
				MPF104	37p	ZTX341	20p	2N3707	15p	PA234	£1 99
AD161 / AD162	80p	BF160	21p	MPF105	40p	ZTX500	15p	2N3708	12p	SL403D	£1 50
AF114	18p	BF167	20p	MPF106	45p	ZTX501	15p	2N3709	12p	TAD100	£1 50
AF115	18p	BF173	20p	OC28	40p	ZTX502	20p	2N3710	12p	FILTER LP1175	£1.50
AF116	18p	BF180	25p	OC35	40p	ZTX503	17p	2N3711	12p	µA709C	34p
AF117	18p	BF181	30p	OC44	15p	ZTX504	50p	2N3819	35p	µA710	45p
AF139	28p	BF184	25p	OC45	15p	ZTX531	25p	2N3903	15p	µA723C	95p
BC107	10p	BF185	25p	OC71	11p	2N697	18p	2N3904	17p	µA741C	47p
BC108	10p	BF194	15p	OC72	17p	2N706	12p	2N3905	21p	µA748C	80p
BC109	10p	BF195	15p	OC76	15p	2N708	15p	2N3906	12p		

THE TEXAN

Complete Kit (inc. Teak Case) **£28.50** P&P 45p

20 Watts per channel integrated stereo amplifier developed by engineers of 'Texas Instruments Ltd. This designer approved kit, has a state-of-the-art specification, including distortion of only 0.09% at 20 Watts into 8 ohms and a bandwidth of 5 – 35,000 at –3db. The semiconductor compliment of this superb kit includes no less than 6 integrated circuits, 10 Silicon transistors, 4 rectifiers and 2 zeners. Controls include bass; treble; volume; balance; on/off; 'on' indicator; headphone sockets; scratch filter; rumble filter; inputs for magnetic phono; tuner; aux or tape; tape head etc; input; selector; mono/stereo switch. The construction of this kit was featured in 'Practical Wireless' May - Aug. 1972.

Mullard & Siemens Electrolytics

CAP µF	VOLTAGE 4	6.3	10	16	25	40	63
1	—	—	—	—	—	—	6p
1·5	—	—	—	—	—	—	6p
2·2	—	—	—	—	—	—	6p
3·3	—	—	—	—	—	—	6p
4·7	—	—	—	—	—	—	6p
6·8	—	—	—	—	—	6p	6p
10	—	—	—	—	6p	—	6p
15	—	—	—	6p	—	6p	6p
22	—	—	6p	—	6p	—	6p
33	—	6p	—	6p	—	6p	—
47	6p	—	6p	—	6p	6p	6p
68	—	6p	—	6p	—	—	10p
100	6p	—	6p	—	6p	6p	12p
150	—	6p	—	6p	6p	10p	12p
220	6p	—	6p	6p	10p	12p	18p
330	6p	—	6p	10p	—	—	21p
470	—	6p	10p	—	12p	18p	40p
680	—	10p	—	12p	18p	21p	—
1000	10p	—	12p	18p	21p	40p	60p
1500	—	12p	16p	21p	—	—	—
2200	—	18p	21p	40p	45p	55p	93p
3300	—	21p	—	—	—	—	—
4700	21p	—	—	60p	75p	93p	—

CAP µF	VOLTAGE 16	25	40	64
500			33p	40p
1250			50p	—
1600			—	75p
2000	40p	50p	—	—
2500	—	—	75p	93p
3200	50p	—	—	—
4000		75p	93p	—
6400	75p	93p	—	—

Quantity Prices on application.

Hi~Volt Electrolytics

1, 2, 4, 8µF 450V	14p	32µF	450V	20p
16µF 450V	15p	50µF	350V	20p
8 + 8µF, 450 V.W	18p	32 + 32µF	350 V W	25p
8 + 16µF; 450 V W	20p	32 + 32µF,	450 V W	43p
16 + 16µF, 450 V W	25p	50 + 50µF,	350 V W	35p

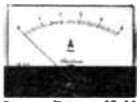
SEW PANEL METERS

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

● LOW COST ● QUICK DELIVERY ● OVER 200 RANGES IN STOCK
● OTHER RANGES TO ORDER

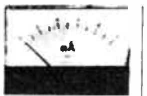
CLEAR PLASTIC PANEL METERS

Type SW.100 100 x 80 mm.



50µA	£3·80	5 amp. D.C.	£3·40
50-0-50µA	£3·80	300V. A.C. ..	£3·40
100µA	£3·80	VU Meter ..	£4·15
100-0-100µA	£3·70		
500µA	£3·50		
1mA	£3·40		
20V. D.C. ..	£3·40		
50V. D.C. ..	£3·40		
300V. D.C.	£3·40		
1 amp. D.C.	£3·40		

Type SD.830 82.5mm x 110mm Fronts



		10mA	£2·50
		50mA	£2·50
		100mA	£2·50
		500mA	£2·50
		1 amp.......	£2·50
		5 amp.......	£2·50
		10 amp.	£2·50
50µA	£2·75	5V. D.C. ..	£2·50
50-0-50µA	£2·70	10V. D.C. ..	£2·50
100µA	£2·70	20V. D.C. ..	£2·50
100-0-100µA	£2·70	50V. D.C. ..	£2·50
200µA	£2·70	300V. D.C. ..	£2·50
500µA	£2·55	15V. A.C. ..	£2·75
1mA	£2·50	300V. A.C. ..	£2·75
5mA	£2·50	VU Meter ..	£3·00

Type SD.640 63.5mm x 85mm Fronts

50uA	£2·60	500mA	£2·85
50-0-50µA	£2·55	1 amp.......	£2·35
100µA	£2·55	5 amp.......	£2·35
100-0-100µA	£2·55	10 amp	£2·35
200µA	£2·55	5V. D.C. ..	£2·35
500µA	£2·35	20V. D.C. ..	£2·35
1mA	£2·35	50V. D.C.	£2·35
5mA	£2·35	300V. D.C.	£2·35
10mA	£2·35	15V. A.C. ..	£2·40
50mA	£2·35	300V. A.C. ..	£2·40
100mA	£2·35	VU Meter	£2·70

Type SD.460 46mm x 59.5mm Fronts

50µA	£2·40	1 amp.......	£2·15
50-0-50µA	£2·35	5 amp.......	£2·15
100µA	£2·35	10 amp.	£2·15
100-0-100µA	£2·35	5V. D.C. ..	£2·15
200µA	£2·35	10V. D.C.	£2·15
500µA	£2·20	20V. D.C. ..	£2·15
1mA	£2·15	50V. D.C. ..	£2·15
5mA	£2·15	300V. D.C.	£2·15
10mA	£2·15	15V. A.C. ..	£2·30
50mA	£2·15	300V. A.C. ..	£2·30
100mA	£2·15	VU Meter ..	£2·55
500mA ...	£2·15		

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

Type MR.85P. 4¼in. x 4¼in. fronts

		50mA	£3·10
		100mA	£3·10
		500mA	£3·10
		1 amp.......	£3·10
		5 amp.......	£3·10
		15 amp.	£3·10
		30 amp	£3·20
		20V. D.C.	£3·10
		50V. D.C.	£3·10
50µA	£3·95	150V. D.C.	£3·10
50-0-50µA	£3·40	300V. D.C.	£3·10
100µA	£3·40	15V. A.C. ..	£3·10
100-0-100µA	£3·30	300V. A.C. ..	£3·10
200µA	£3·30	8 Meter 1mA	£3·15
500µA	£3·20	VU Meter ..	£3·95
500-0-500µA	£3·10	1 amp. A.C.*	£3·10
1mA	£3·10	5 amp A.C.*	£3·10
1-0-1mA	£3·10	10 amp. A.C.*	£3·10
5mA	£3·10	20 amp. A.C.*	£3·10
10mA	£3·10	30 amp. A.C.*	£3·10

Type MR.52P. 2¼in. square fronts

50µA	£3·40	10V. D.C. ..	£2·20
50-0-50µA	£2·85	20V. D.C. ..	£2·20
100µA	£2·85	50V. D.C. ..	£2·20
100-0-100µA	£2·75	300V. D.C.	£2·20
500µA	£2·55	15V. A.C. ..	£2·20
1mA	£2·20	300V. A.C. ..	£2·30
5mA	£2·20	8 Meter 1mA	£2·30
10mA	£2·20	VU Meter ..	£3·50
50mA	£2·20	1 amp. A.C. *	£2·20
100mA	£2·20	5 amp. A.C. *	£2·20
500mA	£2·20	10 amp. A.C. *	£2·20
1 amp	£2·20	20 amp. A.C. *	£2·20
5 amp	£2·20	30 amp. A.C. *	£2·20

Type MR.65P. 3½in. x 3¼in. fronts

50µA	£3·70	10V. D.C. ..	£2·40
50-0-50µA	£3·00	20V. D.C. ..	£2·40
100µA	£3·00	50V. D.C. ..	£2·40
100-0-100µA	£2·90	150V. D.C.	£2·40
200µA	£2·90	300V. D.C.	£2·40
500µA	£2·65	15V. A.C. ..	£2·55
500-0-500µA	£2·40	50V. A.C. ..	£2·55
1mA	£2·40	150V. A.C. ..	£2·55
5mA	£2·40	300V. A.C. ..	£2·55
10mA	£2·40	500V. A.C.	£2·55
50mA	£2·40	8 Meter 1mA	£2·60
100mA	£2·40	VU Meter ..	£3·70
500mA	£2·40	50mA A.C. *	£2·40
1 amp.......	£2·40	100mA A.C. *	£2·40
5 amp.......	£3·40	200mA A.C. *	£2·40
10 amp.	£2·40	500mA A.C. *	£2·40
15 amp.	£2·40	1 amp. A.C. *	£2·40
20 amp.	£2·40	5 amp. A.C. *	£2·40
30 amp.	£2·55	10 amp. A.C. *	£2·40
50 amp.	£2·75	20 amp. A.C. *	£2·40
5V. D.C. ..	£2·40	30 amp. A.C. *	£2·40

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

Type MR.38P. 1 21/32in. square fronts

		200mA	£1·75
		300mA	£1·75
		500mA	£1·75
		750mA	£1·75
		1 amp.......	£1·75
		2 amp.......	£1·75
		5 amp.......	£1·75
		10 amp.	£1·75
		3V. D.C. ..	£1·75
50µA	£2·30	10V. D.C. ..	£1·75
50-0-50µA	£2·10	15V. D.C. ..	£1·75
100µA	£2·10	20V. D.C. ..	£1·75
100-0-100µA	£1·95	50V. D.C. ..	£1·75
200µA	£1·95	100V. D.C.	£1·75
500µA	£1·80	150V. D.C.	£1·75
500-0-500µA	£1·75	300V. D.C.	£1·75
1mA	£1·75	500V. D.C.	£1·75
1-0-1mA	£1·75	750V. D.C.	£1·75
2mA	£1·75	15V. A.C. ..	£1·85
5mA	£1·75	50V. A.C. ..	£1·85
10mA	£1·75	150V. A.C. ..	£1·85
20mA	£1·75	300V. A.C. ..	£1·85
50mA	£1·75	500V. A.C. ..	£1·85
100mA	£1·75	8 Meter 1mA	£1·85
150mA	£1·75	VU Meter ..	£2·30

Type MR.45P. 2in. square fronts

50µA	£2·50	5 amp.......	£1·85
50-0-50µA	£2·30	10V. D.C. ..	£1·85
100µA	£2·30	20V. D.C. ..	£1·85
100-0-100µA	£2·05	50V. D.C. ..	£1·85
200µA	£2·05	300V. D.C.	£1·85
500µA	£1·95	15V. A.C. ..	£2·00
500-0-500µA	£1·85	300V. A.C. ..	£2·00
1mA	£1·85	8 Meter 1mA	£2·05
5mA	£1·85	VU Meter ..	£2·50
10mA	£1·85	1 amp. A.C. *	£1·85
50mA	£1·85	5 amp. A.C. *	£1·85
100mA	£1·85	10 amp. A.C. *	£1·85
500mA	£1·85	20 amp. A.C. *	£1·85
1 amp.......	£1·85	30 amp. A.C. *	£1·85

"SEW" EDGWISE METERS

Type PE.70. 3 17/32in. x 1 15/32in. x 2¼in. deep

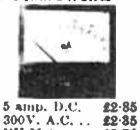
50µA	£3·40	500µA	£3·05
50-0-50µA	£3·30	1mA	£2·70
100µA	£3·30	300V. A.C. ..	£2·70
100-0-100µA	£3·20	VU Meter ..	£3·75
200µA	£3·20		

"SEW" BAKELITE PANEL METERS

Type MR.65. 3½in. square fronts

		1 amp.......	£2·15
		5 amp.......	£2·15
		15 amp.	£2·15
		30 amp.	£2·15
		50 amp.	£2·15
		5V. D.C. ..	£2·15
		10V. D.C. ..	£2·15
		20V. D.C. ..	£2·15
		50V. D.C. ..	£2·15
		150V. D.C.	£2·15
		300V. D.C.	£2·15
25µA	£3·35	50mV. D.C.	£2·40
50µA	£3·00	100mV. D.C.	£2·40
50-0-50µA	£2·60	30V. A.C. *	£2·20
100µA	£2·60	50V. A.C. *	£2·20
100-0-100µA	£2·50	150V. A.C. *	£2·20
500µA	£2·45	300V. A.C. *	£2·20
500-0-500µA	£2·15	500mA A.C. *	£2·15
1mA	£2·15	1 amp. A.C. *	£2·15
1-0-1mA ..	£2·15	5 amp. A.C. *	£2·15
5mA	£2·15	10 amp. A.C. *	£2·15
10mA	£2·15	20 amp. A.C. *	£2·15
50mA	£2·15	30 amp. A.C. *	£2·15
100mA	£2·15	50 amp. A.C. *	£2·15
500mA	£2·15	VU Meter ..	£3·40

Type S-80 80 mm. square fronts



50µA	£3·50		
50-0-50µA	£3·40		
100µA	£3·40		
100-0-100µA	£3·30		
500µA	£3·05		
1mA	£2·85		
20V. D.C. ..	£2·85		
50V. D.C. ..	£2·85	5 amp. D.C.	£2·85
300V. D.C.	£2·85	300V. A.C. ..	£2·85
1 amp. D.C.	£2·85	VU Meter ..	£3·70

"SEW" EDUCATIONAL METERS

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

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

50µA	£5·50	20V. d.c. ..	£4·85
100µA	£5·10	50V. d.c. ..	£4·85
1mA	£4·85	300V. d.c. ..	£4·85
50-0-50µA	£5·10		
1-0-1mA	£4·85	Dual range	
1A d.c.	£4·85	500mA/5A d.c.	£5·10
5A d.c.	£4·85	5V/50V d.c.	£5·10
10V d.c.	£4·85		

POWER RHEOSTATS

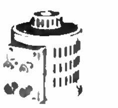
High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range ex-stock. Single hole fixing. ¼in. dia. shafts. Bulk quantities available.

25 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms, 90p. P. & P 10p.
50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. £1·15 P. & P. 10p.
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms. £1·65 P. & P. 15p.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

Excellent quality · Low price · Immediate delivery

S-260 General Purpose Bench Mounting



1 Amp	£7·00
2·5 Amp	£8·05
5 Amp	£11·75
8 Amp	£15·90
10 Amp	£22·50
12 Amp	£23·60
20 Amp	£49·00
25 Amp	£58·00
40 Amp	£82·50

S-260B Panel Mounting

1 Amp	£7·00
2·5 Amp	£8·05

Please add postage
ALL MODELS
INPUT 230 V 50/60 CYCLES
OUTPUT VARIABLE 0-260 VOLTS
Special discounts for quantity

AUTO TRANSFORMERS

0/115/230V. Step up or step down. Fully shrouded.

80 W	£2·10	P. & P. 18p
150 W	£2·70	P. & P. 18p
300 W	£3·60	P. & P. 23p
500 W	£5·25	P. & P. 33p
1000 W	£7·50	P' & P. 38p
1500 W	£10·20	P. & P. 43p
2250 W	£17·25	P. & P. 50p
5000 W	£35·00	P. & P. £1

MCA.220 AUTOMATIC VOLTAGE STABILISER

Input 88 125 VAC or 176 250VAC. Output 120V AC. or 240 VAC. 200 VA rating. £11·97, carr. 50p.

230 VOLT A.C. 50 CYCLES RELAYS

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

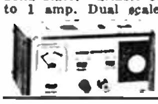
BH.001 HEAD SET AND BOOM MICROPHONE

Moving Coil. Ideal for language teaching, communications. Headphone imp. 16 ohms. Microphone imp. 200 ohms. £4·62. P. & P. 15p.

240° Wide Angle 1mA Meters

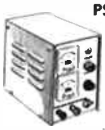
MW 1·6 60mm square £3·97
MW 1·8 80mm square £4·97
P. & P. extra

RP214 REGULATED POWER SUPPLY



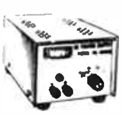
Solid state. Variable output 0-24V DC up to 1 amp. Dual scale meter to monitor voltage and current Input 220/240V AC. Size 185 × 85 × 105mm. £8·97 P. & P. 25p.

PS.200 REGULATED P.S.U.



Solid state. Variable output 5-20 volt D.C. up to 2 amp. Independent meters to monitor voltage and current. Output 220/240 V. A.C. Size 7½" × 5¼" × 3¼". £14·97. P. & P. 25p.

P5.1000B REGULATED POWER SUPPLY

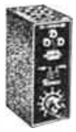


Solid state. Output 6, 9 or 12 volt DC up to 3 amps. Meter to monitor current. Input 220/240v AC. Size 4" × 3¼" × 6¼". £11·97. P. & P. 25p.

230V/240V SMITHS SYNCHRONOUS GEARED MOTORS

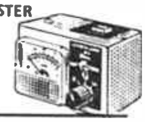
Built in gearbox. All brand new and boxed. 30 RPH CW; 2 RPH CW; 20 RPH CW; 2 RPH ACW; 30 RRH CW;
50p each Post 12p.

LB4 TRANSISTOR TESTER



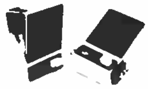
Tests PNP or NPN transistors. Audio indication. Operates on two 1·5v batteries. Complete with all instructions, etc. £4·50. P. & P. 20 p.

LB3 TRANSISTOR TESTER



Tests ICO and B. PNP / NPN. Operates from 9v battery. Complete with all instructions, etc. £3·95. P. & P. 20p.

HOMER INTERCOMS



Ideal for home, office, stores, factories, etc. Supplied complete with batteries, cable and free instructions.

2 Station, £2·97, 3 Station £5·25, P. & P. 15p. 4 Station £6·62, P. & P. 17p.

SEND SAE FOR LIST OF SEMI CONDUCTORS & VALVES

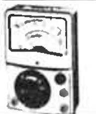
G. W. SMITH & CO. (RADIO) LTD.
Also see next three pages

MULTIMETERS *for EVERY purpose!*

TS60 POCKET MULTIMETER
High-precision at low-cost. Ranges: D.C. 15V, 150V, 1,000V (10,000 opv). A.C. 15V, 150V, 100V (1,000 opv). D.C. Current 150mA. Resistance 100k ohms. **£1·85.** Post 15p.

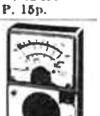
MODEL 1092 TESTMETER

5,000 O.P.V.
0/3/15/150/300/1200 V. D.C. 0/6/30/300/600 V. A.C. 0/300µA/300 MA 0/10K/1 meg Ω
Decibels −10 to +16db
£2·75 each +15p P. & P.



HIOKI MODEL 720X
20,000 O.P.V.
Overload protection
5/25/100/500/1000 VDC. 10/50/250/1000 VAC. 50µA/250mA. 20K/2 meg ohm. −5 to +62db.
£4·97. P. & P. 15p.

HIOKI MODEL 730X



30,000 O.P.V. Overload protection. 6/30/60/300/600/1200 VDC. 12/60/120/600/1200 VAC. 60/µA/30 mA/300 mA. 2K/200K/2 megohm. −10 to +63db. **£6·50.** P. & P. 15p.

KAMODEN 72.200 MULTITESTER

High sensitivity tester. 200,000 o.p.v. Overload protection. Mirror scale. Ranges:
0 / ·06 / ·3 / 3 / 30 / 120 / 600 / 1200V. D.C.
0 / 3 / 12 / 60 / 300 / 1l. 200V. A.C.
0 / 6µA / 1·2mA / 120mA / 600mA / 12A. D.C.
0 / 12A. A.C.
− 20 to + 63dB.
0 / 2K / 200K / 2 meg / 200 meg ohms.
£16·95. Post 30p

MODEL TE-200

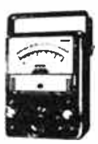
20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000V. D.C. 0/10/50/250/1,000V. A.C. 0/50 µA/250 mA. 0/60K/6 meg Ω. −20 to +62db. **£3·95.** P. & P. 15p.

MODEL 500
30,000 O.P.V. with overload protection mirror scale 0/·5/2·5/10/25/100/250/500/1,000v. D.C. 0/2·5/10/25/100/250/500/1,000V. A.C. 0/50µA/5/50/500mA. 12 amp. D.C. 0/60/K/6 Meg./60 Meg Ω
£8·87. Post paid.

HIOKI MODEL 750X

50,000 o.p.v. 43 ranges 0-0·3 to 1,200v D.C. 0-3 to 1,200v A.C. 0-30µA/300mA. 0-3K/30 meg ohms. − 10 to + 17dB. **£8·97.** Post 20p.

HT100B4 MULTI-METER

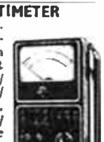


Features A.C. current ranges. 100,000 o.p.v. Mirror Scale, Overload protection.
0/·5/2·5/10/50/250/500/1000 V D.C.
0/2·5/10/50/250/1000 V. A.C. 0/10/250µA/2·5/25/250 MA/10 Amp. D.C.
10 Amp A.C. 0/20K/200K/2 MEG/20 MEG. − 20 + 62db.
£12·50. P. & P. 25p.

370 WTR MULTI-METER

Features A.C. current ranges. 20,000 o.p.v. 0/·5/2·5/10/50/250/500 1000 V. D.C.
0/2 5/10/50/250/500/1000V AC 0/50uA/1/10/100mA/1/10 Amp D.C.
0/100mA/1/10 Amp AC 0/5K/50K/500K/5 MEG/ 50 MEG.
−20 +62db.
£15. P. & P. 25p.

RUSSIAN 22 RANGE MULTIMETER

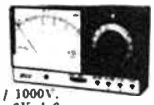


Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2·5/10/50/250/500/1000v D.C. 2·5/10/50/250/500/1000v A.C. DC Current 100wA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3m Ω. Complete with batteries, test leads, instructions and sturdy steel carrying case. OUR PRICE **£5·97.** P. & P. 25p

ROUND SCALE TYPE PENCIL TESTER MODEL T.S.68

Completely portable, simple to use pocket sized tester. Ranges 0/3/30/300V AC and DC at 2,000 o.p.v. Resistance 0-20K ohms. ONLY **£1·97** P. & P. 13p.

LT601 MULTIMETER



New style 20,000 o.p.v. pocket multimeter. 5/25/50/250/500 / 2500 V. D.C. 10 / 50 / 100 / 500 / 1000V. A.C. 50µA / 250mA. 6K / 6 meg ohms. −20 to + 22 dB. **£3·75.** Post 20p.

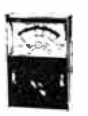
MODEL TH-12
20,000 o.p.v. Overload protection. Slide switch selector 0 / ·25 / 2·5 / 10 / 50 / 250 / 1000V. D.C. 0 / 10 / 50 / 250 / 1000V. A.C. 0 / 50µA / 25 / 250mA. D.C. 0 / 3K / 30K / 300K / 3 meg − 20 to + 50dB **£4·97.** Post 15p.

MODEL TE-300

30,000 O.P.V. Mirror scale, overload protection 0/·6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30µA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm −20 to +63 db. **£5·97.** P. & P. 15p.

MODEL PL436
20k Ω/Volt D.C. 8k Ω/Volt AC. Mirror scale. ·6/3/12/30/120/600 V D.C. 3/30/120/600 V A.C. 50/600µA/60/600 mA. 10/100K/1 Meg/10 Meg Ω −20 to +46db. **£8·97.** P. & P. 12p.

TMK MODEL TW-50K

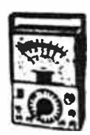


46 ranges, mirror scale. 50K/Vol. D.C. 5K/Volt A.C. D.C.: Volts ·125, ·25, 1·25, 2·5, 5, 10, 25, 50, 125, 250, 500, 1000V, A.C. Volts: 1·5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50µA, 2·5, 5, 25, 50, 250, 500mA. 5, 10 amp. Resistance: 10K, 100K, 1 MEG, 10 MEG Ω. Decibels: −20 to +81·5db **£8·50.** P. & P. 17p.

MODEL K228A

Taut band suspension. Overload protection. Polarity reversing switch. 30,000 o.p.v. 0 / ·5 / 2·5 / 15 / 50 / 250 / 500 / 1000 / 2500V. D.C. 0 / 15 / 50 / 150 / 500 / 1000V. A.C. 0 / 50µA / 5 / 50 / 150 / 500mA / 5A D.C. 0 / 3K / 300K / 3 meg. **£8·95.** Post 20p.

HIOKO MODEL 700X



100,000 O.P.V. Overload protection. Mirror scale. ·3/·6/1·2/1·5/3/6/12/30/60/120/300/600/1200V DC 1·5/3/6/12/30/60/150/300/600/1200 V. A.C. 15/30µA/3/6/30/60/150/300mA 6/12 AMP. DC. 2K/200K/2 Meg/20 Meg ohm −20 to +63dB. **£13·50.** P. & P. 20p.

MODEL C-7080 EN

Giant 6" mirror scale. 20,000 o.p.v. 0 / ·25 / 1 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. D.C. 0 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. A.C. 0 / 50µA / 1 / 10 / 100 / 500mA / 10 amp. D.C. 0 / 2K / 200K / 20 meg − 20 to + 50 dB. **£13·95.** Post 35p.

U4312 MULTIMETER
Extremely sturdy instrument for general electrical use. 667 o.p.v.

0/·3/1·5/7·5/30/60/150/300/600/900 VDC and 75mV.
0/·3/1·5/7·5/30/60/150/300 600/900 VAC.
0/300µA/1·5/6/15/60/150 600MA/1·5/6 AMP. D.C.
0/1·5/6/15/60/150/600MA/1·5/6 AMP. AC.
0/200 Ω/3K/30K Ω.
Accuracy DC 1%. AC 1·5%.
Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. **£9·50** plus P. & P. 25p.

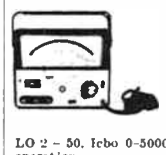
Selected TEST EQUIPMENT

FTC-401 TRANSISTOR TESTER

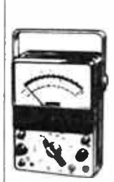
Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads.
£7·50. Post 20p.

Model S-100TR MULTIMETER/ TRANSISTOR TESTER

100,000 o.p.v. mirror scale/overload protection. 0/·12/·6/3/12/30/120/600 V DC. 0/6/30/120/600. V AC. 0/12/600µA/ 12/300mA/12 AMP DC. 0/10 K/1 MEG/100MEG. −20 to +50db. 0·01–2 MFD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. **£13·50.** P/P 25p.

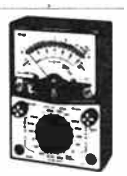


MODEL 449A IN CIRCUIT TRANSISTOR TESTER
Checks true A.C. beta in / out. Checks Icbo. Checks diodes in / out. Checks SCR. etc. Beta HI 10 - 500, LO 2 - 50. Icbo 0-5000µA. 220/240 V A.C. operation
£17·50. Post 25p.



KAMODEN HM 720B F.E.T. V.O.M.
Input impedance 10 meg ohms.
Ranges:
0 / ·25 / 1 / 2·5 / 10 / 50/ 250 / 1000V. D.C.
0 / 2·5 / 10 / 50 / 250 / 1000V. A.C.
0 / 25µA / 2·5 / 25 / 250 MA D.C.
− 20 to + 62dB
0 / 5K / 50K / 500K / 5meg/ 500meg ohms.
£14·95. Post 30p

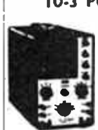
MODEL L-55 FET V.O.M.



Input impedance 10 meg ohms. 0 / ·3 / 1·2 / 6 / 30 / 120 / 600V. D.C. 0 / 3 / 12 / 60 / 120 / 600V. A.C. 0 / 120µA / 120mA D.C. 0 / 1K / 100K / 10 meg /100 meg ohms
£15·97. Post 15p.

CI-5 PULSE OSCILLOSCOPE
For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/mm. ·1-25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz, V RMS/mm. ·3-25; Preset triggered sweep 1-3,000usec.; free running 20-200,000Hz in nine ranges. Calibrator pips. 220 × 360 × 430mm. 115-230V. AC operation.
£39·00. Carr. paid.

TO-3 PORTABLE OSCILLOSCOPE



3in. tube, Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps-1·5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0·9v. p-p/CM. Bandwidth 1·5cps-800kHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps 300 kHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½lb. 220/240V. A.C. Supplied brand new with handbook. **£47·50.** Carr. 50p.

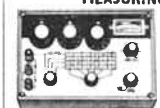
RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPE

5 mc/s Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 5in. × 4in. C.R.T. Calibrated triggered sweep from ·2 u/sec. to 100 milli-sec. per cm. Free running time base 50 c/s-1 mc/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with all accessories and instruction manual
£87. Carr. Paid.

TE-16A TRANSISTORISED SIGNAL GENERATOR

5 ranges 400kHz-30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5¼ × 5¼ × 3½in. Complete with instructions and leads. **£7·97.** Post 25p.

TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE

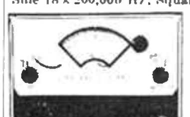


A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω 11·1 meg Ω 6 Ranges ±1% L.1 µ H - 111 HENRYS 6 Ranges 2 % C.10pF ± 1110mFd 6 Ranges ± 2%. TURNS RATIO 1 : 1/1000-1 : 1/100. 6 Ranges ± 1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100µA. Meter indication. Attractive 2 tone metal case. Size 7¾ × 5 × 2in. **£20.** P. & P. 25p.

MODEL TE.15 GRID DIP METER

Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440Kc/s-280Mc/s in 6 coils. 500µA Meter. 9V battery operation. Size 180 × 80 × 40mm.
£12·50. Post 20p.

BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR
Sine 18 × 200,000 Hz; Square 18 × 50,000 Hz

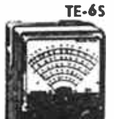


Output max. + 10 dB. (10 K ohms) Operation internal batteries Attractive 2-tone case 7" × 5" × 2". Price **£17·50.** Carr. 17½p.

MODEL MG-100 SINE SQUARE WAVE AUDIO GENERATOR
Range 19-220,000Hz Sine Wave 19-100,000 Hz Square Wave. Output Sine or Square wave 10v. P. to P. Size 180 × 90 × 90mm. Operation 220/240v. A.C.
£17·50. Post 37p.

MODEL AT201 DECADE ATTENUATOR
Frequency range 0-200KHz. Attenuator 0-111db. 0·1db step. Impedance 600 ohms. Max. input power 30dbm. Size 180 × 90 × 55mm.
£12·50. Post 37p.

TE-65 VALVE VOLTMETER



28 ranges. D.C. volts 1·5-1,500v. A.C. volts 1·5-1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions.
£17·50. P. & P. 30p.
Additional probes available: R.F. **£2·12½**; H.V. **£2·50.**

MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER

Sensitivity 330 ohms/Volt AC and DC. Accuracy 5% D.C. 1% AC. Scale length 165mm. 0/300/750µA/1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5AMP DC 0 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5 AMP AC 0 / 75 / 150 / 300 / 750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750V DC 0/750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 /750V AC. Automatic cut out. Supplied complete with test leads, manual and test certificates. **£49·00.** Post 50p.

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

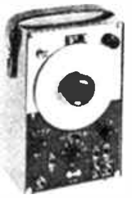
KAMODEN HM.350 TRANSISTOR TESTER

High quality instrument to test Reverse Leak current and DC current. Amplification factor of NPN, PNP, transistors, diodes, SCR's etc. 4" × 4½" clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. £12·50. Post 30p.

KAMODEN HMG-500 INSULATION RESISTANCE TESTER

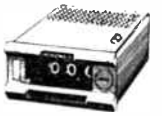
Range 0–1000 Megohms, 500 Volt. Battery operated. Wide range clear meter 4½" × 4". Complete with deluxe carrying case, batteries, instructions. £19·95. Post 30p

ARF-300 AF/RF SIGNAL GENERATOR



All transistorised, compact, fully portable. AF sine wave 18 Hz to 220 KHz. AF square wave 18 Hz to 100 KHz. Output sine / square 10v. P-P. RF 100 KHz to 200 MHz. Output 1v. maximum. Operation 220/240v. AC. Complete with instructions and leads. £29·95. Post 50p.

HONEYWELL DIGITAL VOLTMETER VT.100



Can be panel or bench mounted. Basic meter measures 1 volt D.C. but can be used to measure a wide range of AC and DC volt. current and ohms with optional plug in cards. Specification: Accuracy: ± 0·2, ±1 digit. Resolution: 1mV. Number of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1·999). Input impedance: 1000 Meg ohm. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100v. D.C. Input: Fully floating (3 poles). Input power. 110–230v. A.C. 50/60 cycles. Overall size: 5⅜in. × 2 13/16in. × 8 3/16in. AVAILABLE BRAND NEW AND FULLY GUARANTEED. £35·50. Carr. 50p.

HAND HELD 2-WAY WALKIE TALKIES

Industrial quality in robust metal cases. Battery operation. Volume and squelch controls. Call button and press to talk button. Telescopic aerial. Complete carrying cases.

2 channel 300 mW	£52·50	Pair. Post 50p.
3 channel 2 watt.	£79·50	Pair. Post 50p.

EMI LOUDSPEAKERS

Model 350. 13" × 8" with single tweeter/crossover. 20–20,000 Hz. 15 watt RMS. Available 8 or 15 ohms. £7·25 each P. & P. 37p.

Model 450. 13" × 8" with twin tweeter/crossover. 55–13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. £3·62 each. P. & P. 25p.

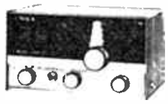
SPECIAL OFFER! STEREO SPEAKERS

Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size 14½" × 9" × 7½". 8 ohms. 8 watt RMS. 16 watt peak. Complete with DIN lead. £12·95 pr. Carr. 50p.

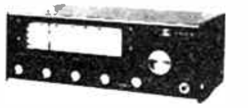
EA.41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, guitar, etc., and output into your amplifier. Volume control, depth of reverberation control. Beautiful walnut cabinet. 7½ × 3 × 4½in. £5·97. P. & P. 15p.

UNR-30 RECEIVER



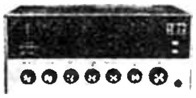
4 Bands covering 550Kc/s – 30Mc/s. B.F.O. Built-in Speaker 220/240v A.C. Brand new with instructions. £15·75. Carr. 37p.



UR-1A SOLID STATE COMMUNICATION RECEIVER

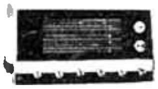
4 Bands covering 550Kc/s–30Mc/s. FET S Meter. Variable BFO for SSB, Built-in Speaker, Bandspread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12¼"×4½"×7" Brand new with instructions. £25. Carr. 37p.

SKYWOOD CX203 COMMUNICATION RECEIVER



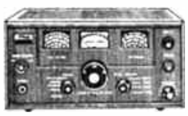
Solid state. Coverage on 5 bands 200-420 KHz and ·55 to 30 MHz. Illuminated slide rule dial. Bandspread. Aerial tuning BFO, AVC, ANL, 'S' meter. AM/CW/SSB. Integrated speaker and phone socket. Operation 220/240v AC or 12v DC. Size 325 × 266 × 150 mm. Complete with instructions and circuit. £32·50. Carr. 50p.

LAFAYETTE HA-600 SOLID STATE RECEIVER



General coverage 150–400Kc/s. 550 Kc/s–30Mc/s. FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter. S. Meter, Bandspread, RF Gain. 15"× 9½"×8½". 18 lbs. 220/240v. A.C. or 12v. D.C. Brand new with instructions. £50. Carr. 50p.

TRIO 9R59DS COMMUNICATION RECEIVER

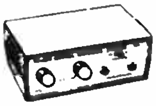


4 band covering 550Kc/s. to 30 Mc/s. continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW. ANL. Variable BFO. S meter. Sep. bandspread dial. IF frequency 455 Kc/s. audio output 1·5w. Variable RF and AF gain controls 115/250v. A.C. Size: 7" × 13" × 10" with instruction manual. £49·50. Carr. Paid.

HA-10 STEREO HEADPHONE AMPLIFIER

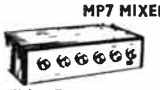
All silicon transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9v battery. Inputs 5MU/100MU. Output 50MW. £5·97. P. & P. 15p.

1021 STEREO LISTENING STATION



For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" × 4" × 2½". £2·25. P. & P. 15p.

MP7 MIXER PREAMPLIFIER



5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9½" × 5" × 3" Inputs Mics: 3 × 3mV 50K: 2 × 3mV 600 ohm. Phono meg. 4mV 50K, Phono ceramic 100mV 1 meg. Output 250mV 100K. £8·97. P. & P. 20p.

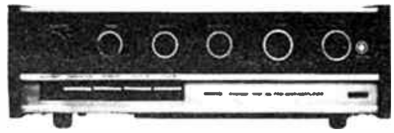
HI-FI EQUIPMENT

SAVE UP TO 33⅓% OR MORE

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

FANTASTIC OFFER!

NIKKO TRM 50 STEREO AMPLIFIER



17 + 17 watts rms stereo amplifier with inputs for Magnetic and Crystal phono, Tuner, Tape, Aux and Tape Monitor. Outputs for two pairs of stereo speakers and Tape. Stereo headphone socket. Full range of controls including loudness control, scratch filter, etc. Size 13" × 9¼" × 3½". Unrepeatable offer—limited stocks!

List price £59·50
OUR PRICE **£39·95**
Carriage 50p

AA6300 AM/FM STEREO TUNER AMPLIFIER

20+20 watts rms. Magnetic, ceramic and tape inputs. FM 88–108 MHz. AM 535–1605 kHz. Dual stereo speaker outputs. Headphone socket. (Rec. List Price £117·46)

OUR PRICE **£61·95** P & P 75p

AKAI AA6300 SYSTEM

20+20 watt AM/FM stereo tuner amplifier. Garrard AP76, plinth and cover. G800 cartridge, pair of Mezzo III speakers.

OUR PRICE **£132·50** Carriage & Pack. £2·00

WHARFEDALE LINTON SYSTEM

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

OUR PRICE **£95·95** Carr. and Ins. £1·25

LINTON RECEIVER SYSTEM £125·00. Carr. & Ins. £1·25.

AMSTRAD 8000 II SYSTEM

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

OUR PRICE **£45·50** Carr. £1·00

NIKKO TRM.50 SYSTEM

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

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

LEAK DELTA 30 SYSTEM

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

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

TELETON SAQ206B SYSTEM

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

OUR PRICE **£51·50** Carr. £1·50

B.S.R. TD8S 8-TRACK STEREO TAPE PLAYER DECK

Integrated preamps (output 125 mV) to feed into any stereo amplifier. Automatic and manual programme selector. 4 pole synchronous motor. 210/240 V.

OUR PRICE **£12·75** Post 50p

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

Fully guaranteed Individually packed VALVES

B12H	£1·75
CY31	35p
DAF96	43p
DF96	45p
DK96	48p
DL92	32p
DL94	45p
DL96	45p
DM70	30p
DY86	33p
DY87	32p
DY802	48p
E88CC/01	£1·00
E180CC	42p
E181CC	90p
E182CC	£1·20
EA50	20p
EABC80	30p
EAF42	52p
EB91	18p
EBC33	50p
EBC41	50p
EBC81	31p
EBF80	40p
EBF83	40p
EBF89	30p
ECC81	30p
ECC82	28p
ECC83	80p
ECC84	30p
ECC85	40p
ECC86	45p
ECC88	37p
ECC189	52p
ECF80	35p
ECF82	35p
ECF83	75p
ECF801	62p
ECF802	62p
ECH35	90p
ECH81	28p
ECH83	40p

ECH84	45p
ECH200	62p
ECL80	42p
ECL82	35p
ECL83	70p
ECL86	40p
EF36	45p
EF37A	£1·25
EF40	50p
EF41	65p
EF80	25p
EF83	55p
EF85	35p
EF86	30p
EF89	28p
EF91	30p
EF92	35p
EF95	35p
EF183	30p
EF184	35p
EFL200	75p
EL34	50p
EL41	53p
EL84	24p
EL85	42p
EL86	40p
EL90	35p
EL95	35p
EL500	85p
EM31	25p
EM80	40p
EM84	35p
EM87	70p
EY51	40p
EY86	40p
EY81	40p
EY88	40p
EZ41	50p
EZ80	25p
EZ81	27p
GZ34	58p
GZ37	70p
KT66	£2·05
KT88	£2·40
N78	£1·75

OA2	35p
OB2	35p
PABC80	37p
PC97	45p
PC900	47p
PCC84	40p
PCC89	50p
PCC189	55p
PCE800	75p
PCF80	30p
PCF82	33p
PCF84	60p
PCF86	60p
PCF200	73p
PCF201	73p
PCF801	45p
PCF802	50p
PCF805	80p
PCF806	70p
PCF808	85p
PCH200	70p
PCL81	47p
PCL82	35p
PCL83	60p
PCL84	42p
PCL85	42p
PCL86	43p
PFL200	61p
PL36	36p
PL81	48p
PL82	40p
PL83	42p
PL84	35p
PL500	73p
PL504	75p
PL509	£1·25
PX4	£2·50
PY33	60p
PY80	35p
PY81	27p
PY82	35p
PY83	35p
PY88	37p
PY800	40p
PY801	50p

SPECIAL OFFER O9J TUBE £2·50 p & p 50p

TRANSISTORS, ZENER DIODES etc.

OA5	20p
OA10	25p
OA70	10p
OA71	10p
OA73	7p
OA74	7p
OA79 (6D15	10p
OA81	8p
OA91	7p
OA200	7p
OA202	10p
OA210	25p
OA211	30p
OAZ200	55p
OAZ201	50p
OC16	50p
OC22	50p
OC25	40p
OC26	25p
OC28	60p
OC29	60p
OC35	50p
OC36	56p
OC38	42p
OC44	17p
OC45	12p
OC70	12p

OC71	12p
OC72	20p
OC73	30p
OC75	25p
OC76	25p
OC81	20p
OC81D	20p
OC81DM	20p
OC82	25p
OC82DM	30p
OC83	25p
OC83B	15p
OC84	25p
OC122	50p
OC139	25p
OC140	40p
OC170	25p
OC171	30p
OC172	37p
OC200	40p
OC201	75p
OC206	95p
1N21B	30p
IN23	60p
IN43	10p
IN70	7p
1N677	12p
IN702-725	36p

IN823A	£1·30
1N4785	50p
IZMT5	35p
IZMT10	33p
IZT5	67p
IZT10	63p
2G385	51p
2G403	51p
2N918	37p
2N1304	22p
2N1306	25p
2N1307	25p
2N2147	64p
2N2411	£1.50
2N2904A	25p
2N2989	£4.00
2N3053	20p
2N3054	50p
2N3055	64p
2N3730	50p
2N3731	£2·75
2N4172	50p
82303	50p
3F100	62p
3FR5	32p
3N128	87p
3N139	£1·75
3N140	97p

3N154	95p
3N159	£1·45
6FR5	45p
12FR60	73p
40954	£1·25
40595	£1·25
40636	£1·25
40668	£1·25
40669	£1·40
AC126	25p
AC127	25p
AC128	20p
AC176	20p
ACY17	25p
ACY28	17p
AD149	50p
AD161	35p
AD162	35p
AF118	50p
AF127	20p
AF139	30p
AF178	48p
AF186	40p
ASY26	25p
ASY28	25p
ASY67	48p
BAW19	28p
BC107	10p

BC108	10p
BC113	10p
BC118	20p
BCY72	15p
BF115	25p
BF173	20p
BFY51	20p
BFY52	20p
BS	45p
BS2	47p
BSY29	25p
BU100	£1·80
BYZ13	25p
BYZ16	63p
CR81/10	25p
CR81/20	38p
CR81/30	40p
CR81/35	43p
CR81/40	48p
CR83/05	30p
CR83/20	38p
CR83/30	43p
CR825/025	55p
CR83/40	50p
CS2A	65p
CV102	25p
GET103	23p

GET115	45p
GET116	50p
GEX66	£1·50
NKT222	20p
NKT304	50p
RAS310AF	33p
SD918	26p
SD928	31p
SD938	32p
SD94	21p
SD988	46p
V405A	40p
Z2A51CF	78p
ZR11	33p
ZR21	46p
ZR22	42p

ZENER DIODES
All preferred voltage

¼W	0·17
1W	0·37
1·5W	0·25
7W	0·40

QQV03-10	£1·25
R17	48p
R19	87p
STV280/40	£3·40
STV280/80	£9·00
TT21	£3·30
U25	72p
U26	72p
U27	50p
U191	70p
U801	80p
UABC80	35p

UAF42	55p
UBC41	46p
UBF80	40p
UBF89	35p
UCC85	40p
UCF80	55p
UCH42	70p
UCH81	33p
UCL82	35p
UCL83	60p
UF41	50p
UF80	36p
UF89	40p
UL41	63p
UL84	60p
UU5	55p
UY41	43p

UY85	40p
VR105/30	35p
VR150/30	35p
Z801U	£2·00
Z803A	£1·25
Z900T	95p
IL4	15p
IR5	40p
1S4	40p
1S5	30p
IT4	22p
1X2A	40p
1X2B	50p
2K25	£7.50
3A4	35p
3D6	15p
3Q4	45p

3S4	35p
3V4	45p
5B254M	£2·20
5B/255M	£2·00
5R4GY	75p
5U4G	35p
5V4G	45p
5Y4G	40p
5Y3GT	35p
5Z3	55p
5Z4	75p
5Z4GT	40p
6AB7	30p
6AC7	30p
6AH6	50p
6AK5	30p

6AK8	32p
6AL5	15p
6AL5W	40p
6AM6	30p
6AN8	50p
6AQ5	35p
6AQ5W	50p
6AS6	37p
6AS7G	80p
6AT6	30p
6AU6	25p
6AX4GT	60p
6AX5GT	70p
6B7	40p
6BK7	60p
6BA6	25p
6BE6	30p

6BG6G	55p
6BJ6	45p
6BQ7A	40p
6BR7	85p
6BW6	85p
6BW7	80p
6C4	30p
6C6	25p
6CH6	55p
6CL6	49p
6D6	20p
6EA8	55p
6F23	75p
6F33	£1·50
6H6M	20p
6J4WA	75p
6J5	40p

MANY OTHERS IN STOCK include Cathode Ray Tubes and Special Valves. U.K. P. & P. Up to £1 12p, £1-£2 17p, £2-£3 22p. Over £3 post free. C.O.D. 25p extra.

COLOMOR

ALL valves guaranteed

6J5GT	25p
6J6	20p
6J7G	35p
6J7M	40p
6K6GT	56p
6K7	32p
6K7G	20p
6K8GT	40p
6K25	70p
6SA7	40p
6SA7GT	32p
6SC7GT	25p
6SG7	35p
6SJ7	37p
6SJ7GT	32p
6SK7	40p
6SL7GT	32p
6SN7GT	32p
6SQ7	39p
6SQ7GT	35p
6V6G	17p
6V6GT	40p
6X4	30p
6X5G	30p
6X5GT	37p
6Y6G	60p
6-30L2	80p
6Z4	36p
7B7	45p
7Y4	60p
9D6	37p
11E2	£2·80
12AT6	30p
12AT7	30p
12AU7	29p
12AV6	38p
12AX7	30p
12BA6	37p
12BE6	40p
12BH7	27p
12C8	32p
12E1	£2·70
12K5	55p
12K7GT	40p
12K8GT	45p
12Q7GT	35p
12SG7	35p
14S7	75p
19AQ5	40p

19G3	£4·25
19G6	£1·50
19H4	£5·00
20P4	£1·00
25L6GT	40p
30C15	70p
30C17	80p
30C18	70p
30F5	80p
30FL1	75p
30FL12	£1·15
30FL13	50p
30FL14	83p
30L15	80p
30L17	80p
30P12	80p
30P19	77p
30PL1	75p
30PL13	92p
30PL14	90p
35L6GT	50p
35W4	35p
35Z4GT	45p
50C5	50p
50CD6G	60p
50EH5	60p
75	40p
76	40p
78	40p
80	50p
723A/B	£7·00
803	£3·25
805	£12·00
807	50p
813	£4·00
832A	£3·00
866A	80p
931A	£4·00
954	40p
955	25p
956	20p
957	30p
991	40p
2051	55p
5933	£1·12
6057	50p
6060	50p
6064	45p

6065	65p
6080	£1·50
6146	£1·75
8020	£2·25
9001	20p
9002	25p
9003	50p
9004	15p
9006	15p

C.R. Tubes

VCR97	£4·50
VCR517B	£5·50
VCR517C	£7·50
88D	£9·00
88J	£9·00
88L	£9·00

Photo Tubes

CMG25	£2·75
931A	£4·00
6097C	£17·50

Special Valves

CV2339	£20·00
JP9/7D	£37·50
K301	£5·00
K305	£12·00
K308	£16·00
K337	£16·00
KRN2A	£3·50
WL417A	£1·50
3J/92/E	£37·50
5C22	£18·00
714AY	£4·00
725A	£16·00

TR1143 TRANSMITTER RECEIVER 100/126 mcs. Price £12·00 Carriape £1·50.
H.F. TRANSCEIVER TR26 Brand new £15·00 Carriage £1·50.
SCR 522 RECEIVERS—no valves. £2·50 carriage 50p.
RS METERS 0-8 amp. 2½" (U.S.A.) £2·25 Carriage 15p.
METERS Full List of our very large stock of meters on request.

TEXAS INTEGRATED CIRCUIT SN 76131N Stereo pre-amp £0·65. **VACUUM CONDENSERS** 12, 50, 55pF each 20,000v. £1·50, P. & P. 20p. 4, 5 and 8 bank 25 way uniselectors, 24V, guaranteed perfect, £3·75; £4·50; £6·87 respectively. **MODULATION TRANSFORMERS** made by **COLLINS**. Freq. resp. 200-5000 CPS; Prl. 6000zCT 3000 TV Sec. 60000z 3000 TV Audio power 20W. £1·25. Post and packing 25p.

Colomor (Electronics) Ltd.
170 GOLDHAWK ROAD, LONDON W12.
RETAIL: 743 4946 **TRADE:** 743 0899
Open 9-12.30, 1.30-5.30 p.m. Thursday 9-1 p.m.

Train for television

Course commences 5th September, 1973

This is your opportunity to train as a television and radio engineer on our full-time Two-Year College Diploma Course specially designed to cover the examinations of the City and Guilds Radio, Television and Electronics Technicians' Certificate. Full theoretical and practical instruction on all types of modern receivers—including the latest colour sets.
Minimum entrance requirements are Senior Cambridge or 'O' Level, or equivalent in Mathematics and English.

Please send free prospectus to:

Name ____________________

Address ____________________

____

____

THE PEMBRIDGE COLLEGE OF ELECTRONICS
(Dept. PW2) 34a Hereford Rd., London W2 5AJ

FUTURE TECMATICS LTD

Manufacturers of Capacitor Discharge Ignition Systems

PRESENT

THE HIGHWAYMAN

Performance Comparison	"Highwayman"	Standard
Input Voltage	12 volts	12 volts
Output voltage	Higher than 30,000	10-18,000
Operating Limit	4-15 volts	8-15 volts
Coil Risetime	2-50 microseconds	100-250 microseconds
Current Drain	Less than 1·5 amps	5 amps
Current & Voltag at CB	0·15 amps @ 12 volts	5 amps @ 200-300 volts
CB Resistance Limit	25 ohms	0·2 ohms

COMPLETELY SHOCKPROOF 1 YR'S GUARANTEE £9·90 plus 35p P. & P.

ADVISE VEHICLE MODEL, POLARITY, TACHOMETER. TACHO COMPENSATOR MAY BE REQUIRED £1·60.

FUTURE TECHMATICS LTD., WALDECK HOUSE, WALDECK RD., MAIDENHEAD, BERKS. Tel: 0628 30071

AUTOMATIC EMERGENCY SUPPLY

250v 50Hz—150 watt Inverter. Full kit of parts excluding meter. Circuit as appeared in December P.W. Complete kit—£16·95 + 80p P. & P.

OTHER INVERTERS AVAILABLE IN KIT FORM

150 Watt—£13·50 + 60p P. & P.
75 Watt—£7·80 + 60p P. & P.
300 Watt—£17·90 + 85p P. & P.
40 Watt—£5·20 + 40p P. & P.
25 Watt—£2·60 + 20p P. & P.

All above operate from 12v. battery and give 250v.-50Hz. Output.
24 volt types are also available, alternative outputs or taps can be supplied. Transformers and/or Transistors can be supplied separately.

SPECIAL OFFER

12v. Fluorescent lights, suitable for tents, caravans, houses or secondary lighting for factories, hotels, etc. 12 inch—8 watt—£3·40 post paid. 21 inch—13 watt—£4·20 post paid. Large discounts available for quantities.

TEXAN AMPLIFIER

Fibre glass P.C. board—£2·00 + 10p P. & P.
Transformer—£4·00 + 30p P. & P.
Other components including Teak Cabinet—£24·00 + Postage.

ASTRO ELECTRONICS
6, BARNES ROAD, CHESTERFIELD, DERBYSHIRE

MAINS MOTOR

Precision made—as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at 65p. Postage 20p for first one then 10p for each one ordered.

MUSIC ON TAPE

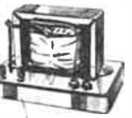
A further buy enables us to offer these at an even lower price—namely 65p each or 5 for £2·50. Send for list of titles. We can't repeat when sold out.

BALANCED ARMATURE UNIT

500 ohm, operates as speaker or microphone, so useful in intercom or similar circuits, 33p each, £3·50 doz.

CAR ELECTRIC PLUG

Fits in place of cigarette lighter. Useful method for making a quick connection into the car electrical system, 38p each or 10 for £3·42.



12 VOLT 1½ AMP POWER PACK

This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 mF smoothing. Price £2·00, plus 20p post & packing. **Heavy Duty Mains Power Pack.** Output voltage adjustable from 15-40V in steps — maximum load 250W—that is from 6 amp at 40V to 15amp at 15V. This really is a high power heavy duty unit with dozens of workshop uses. Output voltage adjustment is very quick—simply interchange push on leads. Silicon rectifiers and smoothing by 3,000mF. Price £5·75 plus 65p post.

MAINS RELAY BARGAIN

Special this month are some single, double and treble pole change-over relays. Contacts rated at 15 amps. Operating coil wound for 240V A.C. Good British Make. Unused. Size approx. 1½" × 1". Open construction.

Single pole 25p each 10 for £2·25
Treble pole 35p each 10 for £3·15

DOOR INTERCOM

Know who is calling and speak to them without leaving bed or chair. Outfit comprises microphone with call push button, connectors and master intercom. Simply plugs together. Originally sold at £10. Special snip price £3·50 plus 20p postage.

TYPE 25 RELAYS

These are miniature relays. Size approx. 1 3/16th in. high × 1¼ in. wide × ⅝ in. deep, 4 change over silver/gold contacts. Contact rating lamp 100v. D.C. Fitted with a plastic cover. Coil operates approx. 250Mv. D.C. Available with the following coils:

28 ohm for 1·2-5v. 45 ohm for 4·7-5v. 52 ohm for 4·9-6v. 90 ohm for 5·5-11·5v. 130 ohm for 10·15v. 530 ohm for 17-36v. 1250 ohm for 27-44v. 2500 ohm for 31-65v. 5800 ohm for 27-44v. 75p each, 10 for £6·75. Also one with 16,500 ohm coil but this has only 2 heavy duty change-over gold contacts. Price 85p.

MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at 20p each £1·80 for ten, your assortment.

REED SWITCHES

Glass encased, switches operated by external magnet—gold welded contacts. We can now offer 3 types:

Miniature, 1" long × approximately ⅛" diameter. Will make and break up to ½A up to 300V. Price 18p each, £1·20 dozen.

Standard, 2" long × 3/16" diameter. This will break currents of up to 1A, voltage up to 250V. Price 10p each, 90p per dozen.

Flat. Flat type, 2" long, just over 3/16 thick, flattened out, so that it can be fitted into a smaller space or a larger quantity may be packed into a square solenoid. Rating 1A 200V. Price 30p each £3 per dozen.

Small ceramic magnets to operate these reed switches 9p each, 90p dozen.

Dry Reed Relays. Solenoids on moulded bobbins within magnetic shields—printed circuit, or panel mounting.

Ref.	*Coil Resistance*	*Reed Switches*	*Price*
71005	2 K	1 normally open	25p
81916	5 K	1 normally open 1 normally closed	75p
05003	4 K	1 normally open	25p
62040	1500 & 500 ohms	1 normally open	85p

Multiple Reed Relay. Ref. 53001. Contains 13 normally open reeds within a solenoid. Operates on 600 mW. Coil resistance 9K ohms. Price £1·95 each.

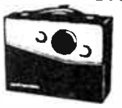
Multiple Reed Relay. Ref. 631. 2 normally open 1 normally closed coil resistance 30 ohms. Price 75p.

MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied.
Model 1153 500mW power output 65p.
Model 1172 750mW power output 85p.
Model EP9000 4 watt power output £1·65.
EP9001 twin channel or stereo pre amp. £1·60
10% discount if 10 or more ordered.

CENTRIFUGAL BLOWER

Miniature mains driven blower centrifugal type blower unit by Woods. Powerful but specially built for quiet running—driven by cushioned induction motor with specially built low noise bearings. Overall size 4½" × 4½" × 4". When mounted by flange, air is blown into the equipment but to suck air out, mount it from centre using clamp. Ideal for cooling electrical equipment or fitting into a cooker hood, film drying cabinet or for removing flux smoke when soldering etc., etc. A real bargain at £1·85.



GOOD COMPANION I.C. VERSION

We can now offer these again in I.C. version using Ferranti ZN414 and Mullard AF Module 1172. Cabinet size approx. 11in. wide × 8in. high × 3in. deep. Complete assembly instructions—Excellent tone wood cabinet £5·75 + 25p post & ins.

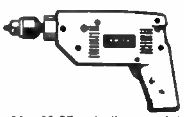
MIGHTY MIDGET

Probably the tiniest possible radio, as described in Practical Wireless, January '73. All electronic parts £3 post paid.

THIS MONTH'S SNIP

10 AMP DIMMER/CONTROLLER

For the control of lighting of stage or studio or portable equipment in workshops etc. This has socket outlets each controlled by 5 AMP Solid State regulator. Also fitted with master switch fuse and neon indicator and terminating with 6 feet of flex. Overall length 17in. 3½in. x 1½in. deep. £7·50, plus 25p P. & P.



PORTABLE ELECTRIC DRILL

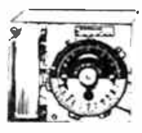
Very superior quality made by a famous Dutch Toolmaker. Model No. ASM 830. 300w - 2 speed 2200/3000. With ⅜" chuck and chuck key, also separate side handle and hammer facility for dealing with concrete, etc. An equivalent British made drill would cost £15·00. £9·95—similar model but without the hammer attachment £7·95. Have either model on approval for 7 days.

DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 × 13 amp. sockets in metal box to take standard 13 amp. fused plugs and on/off switch with neon warning light. Supplied complete with 7 feet of heavy cable. Wired up ready to work, £2·25 plus 20p post and ins.

CAPACITOR DISCHARGE CAR IGNITION

This system which has proved to be amazingly efficient and reliable was first described in the *Wireless World* about a year ago. We can supply kit of parts for an improved and even more efficient version (*Practical Wireless*, June). Price £5·95 plus 20p post. When ordering please state whether for positive or negative systems. De-luxe model including printed circuit board etc. £6·95.

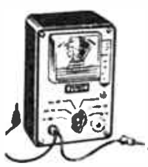


24-HOUR TIME SWITCH

Made by Smiths, these are AC mains operated, NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. Two completely adjustable time periods per 24 hours, 5A changeover contacts will switch circuit on or off during these periods. £2·50 post and ins. 25p. Additional time contacts 60p pair.

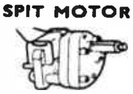
THYRISTOR LIGHT DIMMER

For any lamp up to 1kw. Mounted on switch plate to fit in place of standard switch. Virtually no radio interference. Price £2·95, plus 20p post and insurance. Industrial model 5A £3.



BATTERY CONDITION TESTER

Made by Mallory but suitable for all batteries made by Ever Ready and others, most of which are zinc carbon types but also mercury manganese—nicad—silver oxide and alkaline batteries may be tested. The tester puts a dummy load on the battery and the meter scale indicates the condition depending upon which section the pointer rests. The section reads "replace" "weak" or "good". The tester is complete in its case, size 3¾" × 6¼" × 2" with leads and prods. Price £2·25 plus 20p postage.



SPIT MOTOR

200-250v Induction Motor, driving a carter gear box with 1¼" of output drive shaft running at 5 revs per minute. Intended for roasting chickens, also suitable for driving models—windmills, coloured disc lighting effect, etc. etc. £1·85 plus 20p post and insurance.

DRILL CONTROLLER

NEW 1KW MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1·50. 13p post and p. Made up model also available. £2·50.

MAINS TRANSISTOR POWER PACK

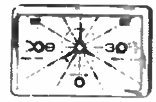
Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip only £1.

SWITCH TRIGGER MATS

So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc.
24" × 18" £1·40
13" × 10" £1·00

PP3 BATTERY CHARGER

Almost 3 times the life can be obtained from PP3 battery if you re-charge it from the mains—this ready to use charger with instructions only 50p.



15A ELECTRICAL PROGRAMMER

Learn in your sleep: Have radio playing and kettle boiling as you awake switch on lights to ward off intruders — have a warm house to come home to. All these and many other things you can do if you invest in an electrical programmer. Clock by famous maker with 15 amp. on/off switch. Switch on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price £1·95 + 20p p. & p. or with glass front, chrome bezel, 75p extra.

BAKELITE INSTRUMENT CASE

Size approx. 6½" × 3¾" × 2" deep with brass inserts in four corners. This is a very strong case suitable to house instruments and special rigs, etc. Price 45p each. Fixolin lid 10p extra.

TELEPHONES

Complete as illustrated. Save your legs, time and temper, simply by putting in some telephones. Ex. G.P.O. not new — but guaranteed in good condition and serviceable. Supplied with diagram and instructions showing how to connect. Price £1 each + 50p post or 2 for £2·50 post paid. Also available separately, dials and handsets 50p each + 20p post

RADIO ALARM CLOCK, LAMP DIMMER, INTERCOM-AMPLIFIER, LIGHT POWERED RADIO, BABY ALARM, TWO TONE DOOR BELL, TAPE TUNER, WATER LEVEL DETECTOR. To receive kits for these and other projects featured in this issue send S.A.E. for PW Kits Ltd.

ROCKER SWITCH

13 amp self-fixing into an oblong hole. Size approximately 1" × ⅝" 8p each, 10 for 72p.

SLIDE SWITCHES

Slide Switch. 2-pole changeover panel mounting by two 6B.A. screws. Size approx. 1in × ⅜in rated 250V lamp. 6p each, 10 for 54p, 100 for £5·10, 500 for £24. Ditto as above but for printed circuit 5p each, 10 for 45p, 100 for £4·25. **Sub Miniature Slide Switch.** DPDT 19mm (¾in approx.) between fixing centres. 18p each or 10 for £1·08. SP Change over spring return 250v 1 amp. 10p.

SPRING COIL LEADS

as fitted to telephones, 4 core 15p each, 10 for £1·35. 3 core 10p each 10 for 90p.

V.A.T. Please add V.A.T. 10% on total order after April 1st.

TERMS: 10% discount if ten of an item ordered, send postage where quoted—other terms, post free if order for these over £6·00 otherwise add 20p.

J. BULL (ELECTRICAL) LTD.

(Dept. P.W.) 7 Park Street, Croydon CRO IYD

Callers to: 102/3 Tamworth Road, CROYDON

BSR LATEST SUPERSLIM
STEREO & MONO

Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. AC 200/250v. Size 18¼ × 11¼in. Above motor board 3¼in. Below motor board 2¼in.

with STEREO and MONO XTAL **£8·25** Post 25p

ANOTHER RCS BARGAIN!
4 TRANSISTOR MONO AMPLIFIER

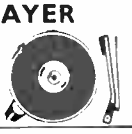
Powerful 3 watts output, 15 ohm. AC mains operated with transformer. 3-Controls, volume, treble, bass and On/Off switch with knobs. Ready made on printed circuit board. Fused inputs and outputs. Famous make.

Size 8" wide × 4" deep × 3" high.
Price £5·95 post 25p.

Suitable 7" × 4" Speaker £1·00.

RCS DE-LUXE 3 WATT AMPLIFIER. Ready made, tested. Printed circuit. 3 watts output. Tone and volume controls. Complete with output valve and rectifier, two knobs, and high performance loudspeaker. Double wound fully isolated mains transformer. A.C. mains 200/250V. Response 50-12,000 cps. Sensitivity 300mV. **£4** Post 25p

BSR SINGLE PLAYER



Heavy duty 4-speed motor with separate pick-up arm fitted LP 78 stereo compatible cartridge. **£5·50** Post 25p

HI-FI PICK UP CARTRIDGES. Stereo/Mono 9TA £2·50; GP94 £2·50; GP93 £2. Sapphire Mono GP91 £1·50; Powerpoint LP/78 60p.

GARRARD DECCA DISCO DECK

Single play Stereo/Mono Deram transcription head and arm. Four speeds. 10½in. turntable. Anti-rumble filter. Bias compensation. Laboratory motor.

SPECIAL PRICE **£18·50** Post 25p

METAL PLINTH AND PLASTIC COVER

Cut out for most Garrard or B.S.R. Most will play with cover in position. 12½ × 14¾ × 7¼in. Covered in black leatherette. **£4·95** Post 35p

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

SPECIAL OFFER!
SMITH'S CLOCKWORK 15 AMP TIME SWITCH

Single pole two-way Surface mounting with fixing screws. Will replace existing wall switch to give light for return home, garage, automatic anti-burglar lights etc. Variable knob Turn on or off at full or intermediate settings. Two types available 0 to 60 minutes or 0 to 6 hours. Fully insulated. Makers last list price £4·50. Brand new and fully guaranteed.

OUR PRICE **£1·50** P. & P. 15p or £3 pair. (STATE TYPE A OR B WHEN ORDERING.)

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides. 6 × 4in. 45p; 8 × 6in. 53p; 10 × 7in. 65p; 12 × 8in. 85p; 14 × 9in. 90p; 16 × 6in. 90p; 12 × 3in. 50p; 16 × 10in. £1.

ALUMINIUM PANELS 18 s.w.g. 6 × 4in. 9p; 8 × 6in. 15p; 14 × 3in. 16p; 10 × 7in. 19p; 12 × 5in. 20p; 12 × 8in. 28p; 16 × 6in. 28p; 14 × 9in. 34p; 12 × 12in. 40p; 16 × 10in. 50p.

RADIO BOOKS (Post 3p)

Handbook of transistor equivalents	40p
Handbook of Simple Transistor Circuits	35p
Master colour code folder	15p
Boys' book of crystal sets and simple circuits	18p
Universal gram motor speed indicator	8p
High fidelity loudspeaker enclosures	40p
Practical Stereo handbook	30p
Sound and Loudspeaker Manual	50p
Coil design and construction manual	30p
Radio, TV and electronics data book	25p
Handbook of tested Transistor Circuits	40p
38 Practical Tested Diode Circuits	35p
Hi Fi, PA and Disco Amplifier Design	75p
Practical Transistor Novelty Circuits	40p
Resistor colour code disc calculator	10p
Engineers' and Machinists' reference tables	20p
TV fault finding	50p

R.C.S. STABILISED POWER PACK KITS

All parts and instructions with Zener Diode, Printed Circuit, Bridge Rectifiers and Double Wound Mains Transformer. Input 200/240V a.c. Output voltages available 6 or 9 or 12 or 15 or 18 or 20V d.c. at 100mA or less. PLEASE STATE VOLTAGE REQUIRED. Details S.A.E. Size 3½ × 1½ × 1½in. **£2·20** Post 15p

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

Ideal for Mike, Tape, P.U., Guitar, etc. Can be used with Battery 9-12v. or H.T. line 200-300v. D.C. operation. Size 1½" × 1½" × ½". Response 25 c.p.s. to 25 Kc/s, 26 db gain. For use with valve or transistor equipment. Full instructions supplied. Details S.A.E. **99p**

MAINS TRANSFORMERS
ALL POST 25p each

Eagle MT12 12-0-12v 90p
250-0-250 80 mA. 6·3 v. 3·5 a. 6·3 v. 1 a. or 5 v. 2 a. £2·50
350-0-350 80 mA. 6·3 v 3·5 a. 6·3 v. 1a. or 5 v. 2 a. £3·00
300-0-300 v. 120 mA., 6·3 v. 4 a. C.T.; 6·3 v. 2 a. £3·25
MINIATURE 200 v. 20 mA., 6·3 v. 1 a. 2½ × 2½ × 2in. 75p
MIDGET 220 v. 45 mA., 6·3 v. 2 a. 2½ × 2½ × 2in. ... 90p
HEATER TRANS. 6·3 v. 3a. 60p
GENERAL PURPOSE LOW VOLTAGE. Tapped outputs at 2 amp., 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. £2·25
1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £2·25
2 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £3·25
5 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £8·75
3 amp., 5, 8 and 13V .... £1·00
5 amp., 5, 8 and 13V .... £1·20
3 amp., 3, 5, 8, 10, 13 and 5-0-5V .... £1·30
5 amp., 3, 5, 8, 10, 13 and 5-0-5V .... £1·50
AUTO TRANSFORMERS. 115v to 230v or 230v to 115v. 150w. £2·25; 500w. £6·25; 750w. £10; 1000w. £15.
CHARGER TRANSFORMERS. Input 200/250v. for 6 or 12v., 1½ amp. £1·50; 2 amp. £1·80; 4 amp. £2·50
BATTERY CHARGERS. Ready built with leads and clips 1½ amp. £2; 4 amp. £4; 5 amp. £4·50.
FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12v. outputs. 1½ amp. 40p; 2 amp. 55p; 4 amp. 85p.
LUCAS 2DS500 Full wave Bridge 70v, 5 amp. 95p.

MAINS ISOLATING TRANSFORMER

Primary 0-110-240v. Secondary 0-240v. 3 amps. 720 watts. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. Famous make. (Value £19) OUR PRICE **£10** Carr. 50p
Can be used as 800 watt auto transformers 240-110V.

NEW TUBULAR ELECTROLYTICS				CAN TYPES	
2/350V	14p	250/25V	14p	50+50/350V	35p
4/350V	14p	500/25V	20p	60+100/350V	58p
8/450V	14p	1000/25V	35p	32+32/250V	18p
16/450V	15p	1000/50V	47p	32+32/450V	33p
32/450V	20p	8+8/450V	18p	350+50/325V	50p
25/25V	10p	8+16/450V	20p	32+32+32/350V	43p
50/50V	10p	16+16/450V	25p	100+50+50/350V	48p
100/25V	10p	32+32/350V	25p		

LOW VOLTAGE ELECTROLYTICS.
1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 10p.
500mF 12V 15p; 25V 20p; 50V 30p.
1000mF 12V 17p; 25V 35p; 50V 47p; 100V 70p.
2000mF 6V 25p; 25V 42p; 50V 57p.
2500mF 50V 62p; 3000mF 25V 47p; 50V 85p.
5000mF 6V 25p; 12V 42p; 25V 75p; 35V 85p; 50V 95p.

CERAMIC 1pF to 0·01mF, 4p. Silver Mica 2 to 5000pF, 4p. PAPER 350V-0·1 4p; 0·5 13p; 1mF 15p; 2mF 150V 15p. 500V-0·001 to 0·05 4p; 0·1 5p; 0·25 8p; 0·47 25p. SILVER MICA. Close tolerance 1%. 2·2-500pF 8p; 560-2,200pF 10p; 2,700-5,600pF 20p; 6,800pF-0·01, mfd 30p each. TWIN GANG. "0-0" 208pF + 176pF, 65p; Slow motion drive 365pF + 365pF with 25pF + 25pF, 50p; 500pF standard 45p; small 3-gang 500pF £1·60. SHORT WAVE SINGLE. 10pF, 30p; 25pF, 55p; 50pF, 55p.

SHORT WAVE SINGLE GANG. Precision Silver Plated Gangable Tuning Condensers. Values up to 100pF. **50p** each. Section Couplers supplied FREE with two or more gangs.

NEON PANEL INDICATORS. 250V AC/DC Amber, 20p. RESISTORS. ¼ w., ½ w., 1 w., 20%, 1p; 2 w. 5p. 10 Ω to 10M. HIGH STABILITY. ½ w. 2% 10 ohms to 6 meg., 10p. Ditto 5%. Preferred values 10 ohms to 10 meg., 4p. WIRE-WOUND RESISTORS. 5 watt, 10 watt, 15 watt, 10 ohms to 100K, 10p each; 2w 0·5 ohm to 8·2 ohms 10p. TAPE OSCILLATOR COIL. Valve type, 35p.

WEYRAD P50 — TRANSISTOR COILS

RA2W Ferrite Aerial	72p	Spare Cores	3p
Osc. P50/1AC	33p	Driver Trans. LFDT4	58p
I.F. P50/2CC 470 kc/s	36p	Printed Circuit, PCA1	58p
3rd I.F. P50/3CC	36p	J.B. Tuning Gang	65p
P51/1 or P51/2	36p	Weyrad Booklet	10p
P50/3V	36p	OPT1	58p

Mullard Ferrite Rod 8 × ⅜in. 20p. 6 × ⅜in. 20p.

VOLUME CONTROLS

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

80 Ohm Coax 4p yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £1·40; 60 yd. £2.
FRINGE LOW LOSS **10p** per yd. Ideal 625 and colour.

1½inch DIAMETER WAVECHANGE SWITCHES, 25p. 2 p. 2-way, or 2 p. 6-way, or 3 p. 4-way, 25p each. 1 p.l 2-way, or 4 p. 2-way, or 4 p. 3-way, 25p. TOGGLE SWITCHES, sp. 14p; dp. 22p; dp. dt. 22p. Sub-miniature, sp. 30p; dp. 37p; dp. dt. 45p.

E.M.I. 13½ × 8 in. SPEAKER SALE!

With twin tweeters. And crossover. 10 watt. State 3 or 8 or 15 ohm. As illustrated. **£4·50** Post 25p

With flared tweeter cone and ceramic magnet. 10 watt. Bass res. 45-60 cps. Flux 10,000 gauss. State 3 or 8 or 15 ohm. **£2·75** Post 25p

TEAK CABINET
16 × 10 × 9in. Modern Design **£5·50** Post 25p

GOODMANS 6½in. HI-FI WOOFER

8 ohm, 10 watt. Large ceramic magnet. Special Cambric cone surround. Frequency response 30-12,000 cps. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. **£4**
Suitable cabinet 12 × 8 × 6 £4·00.
Suitable Tweeter £2·00.

ELAC CONE TWEETER

The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 cps to 18,000 cps. Size 3½ × 3½ × 2in. deep. Rating 10 watt, 3 ohm or 15 ohm models. **£1·90** Post 10p
Crossover 95p.

GOODMANS 8in. WOOFER

8 ohm 12 watt. Deep cone. Heavy ceramic magnet. Bass resonance 35 cps. Frequency response 30-8,000 cps. **£4·50**

LOUDSPEAKERS P.M. 3 OHMS. 7 × 4in. £1·25; 6½in. £1·50; 8 × 5in. £1·60; 8in. £1·75; 10 × 6in. £1·90; 10in. £2·00. SPECIAL OFFER: 80 ohm, 2½ in. 2¾in. 35 ohm, 2in.; 3in; 5in. 25 ohm, 2½in. dia.; 3in. dia; 15 ohm. 3½in. dia.; 5in. /8 × 4in.; 7 × 4in.; 8 × 5in **£1** EACH TYPE 3 ohm, 2¼in, 2½in., 3½in., 5in. dia. (6 × 4in., 8 ohm, £1·50). RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8in. diameter 4 watt; 10in. diameter 5 watt; 12in. diameter 6 watt, 3 or 8 or 15 ohm models £2·20 each. Post 15p. SPEAKER COVERING MATERIALS. Samples Large S.A.E. Horn Tweeters 2-16Kc/s, 8W 8 ohm or 15 ohm £1·95. De Luxe Horn Tweeters 2-18 Kc/s, 15W, 15 ohm £3. TWO-WAY 3,000 c.p.s. CROSSOVERS 3, 8 or 15 ohm 95p.

FM/VHF TUNING HEART

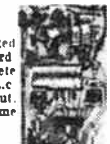
88 to 108 M/CS British made. 2 Transistors ready aligned—requires 10·7 M/CS IF. Complete with tuning gang. Connections supplied but some technical experience essential. OUR PRICE **£3·95**

VALVE OUTPUT TRANS. 25p. MIKE TRANS. mv metal 100-1 £1·25. 5 WATT MULTI RATIO. 3, 8 and 15 ohms, 80p. PUSH-PULL VALVE OUTPUT TRANSFORMERS. 50 watt .... £9·50 100 watt .... £12·50

STEREO / MONO HEADPHONES

New Model with new type slider volume controls. Stereo / Mono switch. 8 ohms. £10.
High Quality with tweeters and volume controls. 8 ohm. £7.
Budget Model. 8 ohm. £3·25.
HEADPHONE JUNCTION BOX with switch £1·75.
Mono Stethoscope. 8 ohms. 65p.
EAR PIECES. Crystal. 25p.
Magnetic. 8 ohms. 18p.
Magnetic. 250 ohms. 23p.
ACOS. 1000 ohms. 53p.

BRITISH MADE STEREO MULTIPLEX DECODER



Brand New. 7 transistors plus integrated circuit. Fibre glass printed circuit board Size 2½ × 6½ × ⅞in. Pre-aligned. Complete with stereo beacon indicator. 12V d.c operation. 400mV output for 100μV input. Full instructions for any FM Tuner. Some technical experience essential. **£6·50** Post 15p

DIPOLE LOFT AERIAL £1·50.
CABLE 4p yard.

COAXIAL PLUG 10p, PANEL SOCKETS 10p, LINE 18p. OUTLET BOXES, SURFACE OR FLUSH 25p. BALANCED TWIN RIBBON FEEDER 300 ohms, 5p yd. JACK SOCKET Std. open-circuit 14p, closed circuit 23p; Chrome Lead Socket 45p. Phono Plugs 5p. Phono Socket 5p JACK PLUGS Std. Chrome 15p; 3·5mm Chrome 12p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 15p. DIN PLUGS 3-pin 18p; 5-pin 25p. VALVE HOLDERS 5p; CERAMIC 8p; CANS 5p.

ALL PRICES INCLUDE VAT — MINIMUM POST AND PACKING 15p.

RADIO COMPONENT

Illustrated Colour Brochure, Radio Books & Component Lists 10p. Written guarantee.

E.M.I. WOOFER AND TWEETER KIT

£5·75 THE PAIR. Post 25p. (Available separately. Woofer £4 25; Tweeter £1 90).

Comprising a fine example of a Woofer 10½ 6½in. with a massive Ceramic Magnet, 44oz. Gauss 13,000 lines. Aluminium Cone centre to improve middle and top response. Also the E.M.I. Tweeter 3½in. square has a special lightweight paper cone and magnet flux 10,000 lines. Crossover condenser and full instructions supplied.

Impedance Standard 8 ohms
Maximum power 12 watts
Useful Response 35 to 18,000 cps
Bass Resonance 45 cps

SUITABLE ENCLOSURE 20 13 9in. MODERN DESIGN. TEAK WOOD FINISH. **£9·90** Post 25p

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

Dual cone plasticised roll surround. Large ceramic magnet. 50 16,000 cps. Bass resonance 55 cps. 8 ohm impedance. 8in. 10 watts. **£3·75**
10in. model. 12 watts music power. Post 25p

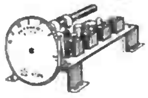
TEAK VENEER SPEAKER CABINET
Fluted Wood Front

MODEL "A". 20 13 9in. For 12in. dia. or 10in. speaker. **£9** Post 25p

MODEL "B". 16 10 9in. For 13 8in. or 8in. speaker. **£5** Post 25p

MODEL "C". 16 8 6in. For 8 5in. or 6in. speaker. **£4** Post 25p

LOUDSPEAKER CABINET WADDING 18in. wide. 15p ft.



BARGAIN AM TUNER. Medium Wave. Transistor Superhet Ferrite aerial. 9 volt. **£4·95**

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. **£3·95**

STEREO VERSION OF ABOVE £5 95

BARGAIN FM TUNER. 88-108 Mc/s Six Transistor. 9 volt. Printed circuit. Calibrated slide dial tuning. Walnut Cabinet. Size 7 5 4in. **£14·85**

BARGAIN FM TUNER. As above less cabinet. **£9·85**

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control 9 volt battery operated. **£4·50**

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER. Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/250V. Leaflet S.A.E. **£2·50** Post 15p

WAFER THIN HEATING ELEMENTS

OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10½ 8½ 1/16in. 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 photo-copiers and print drying equipment.

Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails ideal for airing cupboards. Ideal for anti-frost device for the garage preventing frozen radiators or acting as oil sump heater. Use in the greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

ONLY **40p** EACH (FOUR FOR £1 50)

ALL POST PAID Discounts for quantity

BAKER 12in. MAJOR £10

Post 25p

30-14,500 c.p.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.p.s. Rated 20 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit, 30-17,000 c.p.s. with tweeter, crossover, baffle and instructions. **£12·50** Post 25p

BAKER "BIG SOUND" SPEAKERS

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" 12in. 25 watt 3, 8 or 15 ohms. **£8·80** Post 25p

GROUP "35" 12in. 35 watt 3, 8 or 15 ohms. **£9·90** Post 25p

GROUP "50" 15in. 50 watt 8 or 15 ohms. **£22** Post 25p

MAJOR 100 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

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

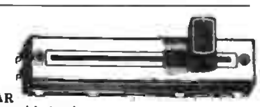
CALLERS ONLY: DE-LUXE 100 WATT AMPLIFIER CHASSIS. 7 Valve version. 4 inputs, 10 wide range controls. For Mikes, Discos, Organs, Guitars, etc. 4, 8 and 15 ohm matching. **£55**

Q MAX CHASSIS CUTTERS

A die, punch and Allen Screw

3/8in. Round	68p	1 3/32in. Round	98p	Key "B" for above	8 p
7/16in. Round	75p	1in. Round	98p	2in. Round	£2·05
Key "T" for above	5p	1 1/16in. Round	98p	2 3/32in. Round	£2 30
1/2in. Round	83p	1 1/8in. Round	98p	Key "C" for above	12p
9/16in. Round	83p	1 3/16in. Round	£1 05	2 1/4in. Round	£4·10
5/8in. Round	83p	1 7/32in. Round	£1 05	2 1/2in. Round	£5·25
11/16in. Round	88p	1 1/4in. Round	£1·05	3in. Round	£8·10
3/4in. Round	88p	1 5/16in. Round	£1 10	Key "E" for above	18p
13/16in. Round	90p	1 3/8in. Round	£1·10	1in. Square with key	£1 93
7/8in. Round	90p	1 1/2in. Round	£1·25		
Key "A" for above	5p	1 5/8in. Round	£1·43		
		1 3/4in. Round	£1 50		

SLIDER VOLUME CONTROLS



Mono LOG or LINEAR
Size 3 1/4 1/2 1/16in. with knobs.
5K, 10K, 25K, 50K, 100K, 250K, 500K, 1 MEG, 2 MEG. **65p** EACH

E.M.I. TAPE MOTORS. 120 volts AC each. 1,200 r.p.m. 4 pole or 2 in series 240 volts AC. Size 3½ 2½ 2¼in. (illustrated). Post 15p. **£1**

BALFOUR GRAM. MOTORS. 120v. or 240v. AC. 1,200 r.p.m. 4 pole 50mA. Spindle ¼ 3/20. Size 2½ 2½ 1½in. Post 15p **85p**

E.M.I. GRAM. MOTORS. 120V or 240V AC. 2,400 r.p.m. 2-pole 70mA. Spindle ¼ 1/8in. Size 2½ 2½ 2½in. **£1** Post 15p

BAKER HI-FI SPEAKERS
HIGH QUALITY — BRITISH MADE

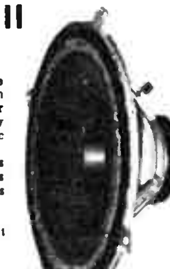
REGENT
12in. 15 watts

An inexpensive unit for the beginner in high fidelity and for general purposes. May be used to improve any Radio, Amplifier, Hi-Fi or Television receiver.

Bass Resonance 45cps
Flux Density 12,000gauss
Useful response 45-13,000cps
3 or 8 or 15 ohm models.

£8 Post 25p

DE-LUXE Mk II
12in 15 watts



Especially designed to provide full range reproduction at an economical cost. Suitable for use with any high fidelity system. Built-in concentric tweeter cone.

Bass Resonance 30cps
Flux Density 14,000gauss
Useful response 25-16,000cps
8 or 15 ohms models.

£10 Post 25p

SUPERB
12in. 20 watts

A high quality loudspeaker, its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.

Bass Resonance 25cps
Flux Density 16,500gauss
Useful response 20-17,000cps
8 or 15 ohms models.

£15 Post 25p

AUDITORIUM
12in. 25 watts

A full range reproducer for high power. Electric Guitars, public address, multi-speaker systems, electric organs. Ideal for Hi-Fi and Discotheques.

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

£14 Post 25p

AUDITORIUM
15in. 35 watts

A high wattage loudspeaker of exceptional quality with a level response to above 8,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home hi-fi.

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

£20 Post 25p

Hi-Fi Enclosure Manual containing 20 plans designs, crossover data and cubic tables. 42p. Post Free.

ALL PRICES INCLUDE VAT

OPEN 9-6 p.m. WEDNESDAYS 9-1 p.m., SATURDAYS 9-5 p.m. (closed for lunch 1.15 to 2.30)

SPECIALISTS 337 WHITEHORSE ROAD . CROYDON

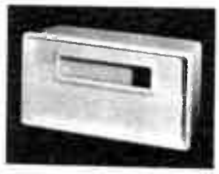
(Export: Remit cash and extra postage.) Buses 50, 68, 159. Rail Selhurst Telephone 01-684-1665

TRANNIES

I DOCKYARD, STATION ROAD, OLD HARLOW, ESSEX
Phone Harlow 37739

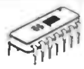
P/P 10p. Price list S.A.E. (Saturday callers welcome)
ALL PRICES INCLUDE VAT

£19·50 ELECTRONIC DIGITAL CLOCK
(For complete kit of parts including case.)



This 4 digit 24 hour clock is available to readers at this special price for 1 month only. Parts would normally cost over £25. Kit of parts includes twelve IC's, indicators, and a smart white plastic case.

74 Series TTL



	1	25		1	25		1	25		1	25
SN7400	16p	15p	SN7423	55p	50p	SN7450	16p	15p	SN7489	6·05p	5·85p
SN7401	16p	15p	SN7425	55p	50p	SN7451	16p	15p	SN7490	74p	72p
SN7402	16p	15p	SN7427	49p	46p	SN7453	16p	15p	SN7491	1·10p	1·04p
SN7403	16p	15p	SN7428	77p	72p	SN7454	16p	15p	SN7492	74p	72p
SN7404	16p	15p	SN7430	16p	15p	SN7460	16p	15p	SN7493	74p	72p
SN7405	16p	15p	SN7432	49p	46p	SN7470	33p	29p	SN7494	85p	72p
SN7406	38p	35p	SN7433	94p	82p	SN7472	33p	29p	SN7495	85p	72p
SN7407	38p	35p	SN7437	72p	69p	SN7473	41p	39p	SN7496	95p	92p
SN7408	20p	18p	SN7438	72p	69p	SN7474	41p	38p	SN74100	1·80p	1·75p
SN7409	20p	18p	SN7440	16p	15p	SN7475	50p	47p	SN74104	1·09p	1·06p
SN7410	17p	15p	SN7441	74p	70p	SN7476	44p	43p	SN74105	1·09p	1·06p
SN7411	27p	25p	SN7442	74p	70p	SN7480	73p	70p	SN74107	44p	42p
SN7412	38p	35p	SN7443	1 43p	1·37p	SN7481	1·32p	1·26p	SN74110	61p	59p
SN7413	32p	29p	SN7444	1·43p	1·37p	SN7482	97p	95p	SN74111	1·37p	1·27p
SN7416	47p	43p	SN7445	2·00p	1·92p	SN7403	1·20p	1·15p	SN74118	1·10p	1·05p
SN7417	47p	43p	SN7446	1·07p	1·02p	SN7484	1·10p	1·05p	SN74119	1·47p	1·37p
SN7420	16p	15p	SN7447	1·10p	1·03p	SN7485	3·96p	3·85p	SN74121	44p	41p
SN7422	55p	50p	SN7448	1·10p	1·03p	SN7486	36p	35p	SN74122	1·54p	1 43p

- Devices may be mixed to qualify for Price Breaks
- 100 Plus less 10% off 25 plus break

Linear Integrated Circuits

301	DIL	50p	723c	DIL	99p
301	TO99	55p	723c	TO99	95p
301	8 PIN DIL	46p	741c	8 PIN DIL	38p
301A	DIL	69p	741c	14 PIN DIL	39p
301A	TO99	69p	741c	TO99	41p
301A	8 PIN DIL	66p	747c	DIL	46p
307	DIL	69p	748c	DIL	39p
307	TO99	69p	748c	TO99	41p
307	8 PIN DIL	66p	1437	DIL	1·27p
308	TO99	6·45p	1458	TO99	1·27p
308A	TO99	6·40p	3046	DIL	84p
709c	DIL	35p	7503	DIL	1·27p
709c	TO99	31p			

Electrolytic Capacitors

4 VOLT	
47µF	6½p
100µF	6½p
220µF	6½p
330µF	6½p
1000µF	13p
4700µF	29p

6 3 VOLT	
33µF	6½p
68µF	6½p
150µF	6½p
470µF	11p
680µF	13p
1500µF	18p
2200µF	18p
3300µF	26p

10 VOLT	
22µF	6½p
47µF	6½p
100µF	6½p
220µF	8p
330µF	10p
470µF	10p
1000µF	11p
1500µF	20p
2200µF	24p

16 VOLT	
15µF	6½p
33µF	6½p
68µF	6½p
150µF	8p
220µF	9p
680µF	17p
1000µF	17p
1500µF	25p
2000µF	43p

25 VOLT	
10µF	6½p
22µF	6½p
47µF	6½p
100µF	8p
150µF	8p
220µF	10p
470µF	13p
680µF	20p
1000µF	22p
2200µF	39p
5000µF	68p

40 VOLT	
6·8µF	6½p
15µF	6½p
33µF	6½p

40 VOLT	
47µF	6½p
100µF	9p
150µF	10p
220µF	11p
470µF	19p
680µF	25p
1000µF	25p
2200µF	44p

63 VOLT	
1µF	6½p
2·2µF	6½p
4·7µF	6½p
6·8µF	6½p
10µF	6½p
22µF	6½p
68µF	10p
100µF	11p
150µF	13p
220µF	19p
330µF	22p
470µF	26p
1000µF	44p

BARGAIN PACKS

Unmarked Packs

Pack of 25
1N4148
55p

Pack of 10
BC108 55p
BC107 55p
(Plastic can)

Pack of 10
Plastic BC109
55p

Pack of 10
BC169 55p
(unmarked)
but tested

2N2646
(unmarked)
33p each

Pack of 10
2N2926G 55p
unbranded but
tested

Unmarked but fully tested
2N3055
1–9 33p
10 plus 27p

FULLY MARKED TYPES

AD161, AD162
M/P
1–9 59p
10 plus 53p

BC107–BC108
BC109
1–9 9p
10–99 8p
100 plus 6½p

BC 182L-3-4-212-4
1–9 9p
10 plus 8p

AC127 or AC128
1–9 13p
10 plus 12p
100 plus 11p

ZENER DIODES

400 M/W 5%
Miniature
BZY 88 Range

All voltages
3·3–33 Volt
9p each

1 watt 5%

All voltages
6·8–200 Volts
14p each

10 watt 5%

All Voltages
7·5–100 Volts
51p each

Transistors

AC107	16p	BC138	36p	BF260	29p	OC44	14p
AC126	14p	BC142	33p	BF329	18p	OC45	14p
AC127	13p	BC143	33p	BF330	18p	OC70	23p
AC128	13p	BC144	30p	BF390	37p	OC71	14p
AC142K	22p	BC145	26p	BFX84	28p	OC72	14p
AC141K	20p	BC147	9p	BFX85	35p	OC81	14p
AC176	15p	BC148	9p	BFX86	22p	OC83	22p
AC187	13p	BC149	9p	BFX87	28p	OC84	28p
AC187K	20p	BC153	16p	BFX88	26p	TIP29A	53p
AC188	13p	BC154	17p	BFY50	21p	TIP30A	64p
AC188K	20p	BC157	13p	BFY51	17p	TIP31A	64p
ACY17	24p	BC158	12p	BFY52	17p	TIP32A	73p
ACY18	21p	BC159	14p	BFY64	39p	TIP33	£1·05
ACY19	25p	BC167	13p	BFY90	72p	TIP34A	
ACY20	22p	BC168	11p	BSX20	19p		£1·54
ACY21	23p	BC169	11p	C407	22p	TIP35A	
ACY22	18p	BC177	15p	C426	33p		£2·53
ACY39	68p	BC179	15p	C428	31p	TIP36A	
AD140	40p	BC182L	9p	C450	17p		£3·19
AD142	44p	BC183L	9p	MP8111	35p	TIP41A	79p
AD143	39p	BC184L	9p	MP8112	42p	TIP42A	91p
AD149	38p	BC186	33p	MP8113	35p	2N706	13p
AD150	60p	BC212L	11p	MP8121	33p	2N930	23p
AD161	29p	BC213L	11p	MP8122	44p	2N1131	22p
AD162	29p	BC214L	11p	MP8123	50p	2N1132	28p
AD M/P	50p	BC258	9p	NKT211	28p	2N1613	22p
AF114	14p	BC259	9p	NKT212	28p	2N1711	26p
AF115	14p	BC267	14p	NKT214	25p	2N2904	40p
AF116	14p	BC268	15p	NKT217	55p	2N2904A	
AF117	14p	BC300	40p	NKT261	23p		44p
AF118	92p	BC301	32p	NKT271	20p	2N2905	46p
AF124	27p	BC302	30p	NKT274	20p	2N2924	18p
AF139	39p	BC303	50p	NKT275	25p	2N2926	10p
AF239	41p	BC304	40p	NKT403	71p	2N3053	26p
AL100	77p	BCY70	17p	NKT405	83p	2N3054	55p
AL102	66p	BCY71	37p	NKY603F		2N3055	52p
AL103	55p	BCY72	17p		66p	2N3405	44p
ASY26	31p	BD123	66p	NKT613G		2N3663	57p
ASY27	40p	BD130	50p		33p	2N3702	9p
AU103	99p	BD131	68p	NKT674	26p	2N3703	9p
AU110	£1·10	BD132	90p	NKT677G		2N3704	9p
AU111	77p	BD135	42p		24p	2N3705	9p
BC107	9p	BD136	50p	NKT713	32p	2N3706	9p
BC108	9p	BD141	£1·87	NKT773	27p	2N3707	9p
BC109	9p	BD142	50p	OC19	55p	2N3708	9p
BC113	15½p	BF159	33p	OC20	55p	2N3709	9p
BC116	16p	BF173	29p	OC23	33p	2N3710	9p
BC125	16p	BF177	28p	OC25	28p	2N3711	9p
BC126	25p	BF178	29p	OC28	33p	2N3794	17p
BC132	16p	BF179	35p	OC29	33p	2N3819	28p
BC134	16p	BF194	15p	OC35	38p	40361	50p
BC135	16p	BF195	17p	OC36	38p	40362	50p
BC137	16p	BF244	27p	OC41	14p	40636	50p

Diodes & Rectifiers

1N914	8p
1N916	8p
1N4148	8p
1S44	10p
1N4007	22p
1S113	17p
1S120	17p
1S121	15p
1S130	9p
1S131	11p
1S132	13p
1S920	8p
1S922	9p
1S923	13p
1S940	6p
AA119	11p
AA129	11p
AAZ13	11p
AAZ15	14p
AAZ17	14p
BA100	16p
BA102	25p
BA115	8p
BA144	14p
BA145	22p
BA154	14p
BAX13	14p
BAX16	14p
BAY18	19p
BAY31	9p
BY100	19p
BY126	16p
BY127	19p
BYX10	24p
OA5	19p
OA9	11p
OA10	24p
OA47	9p
OA70	8p
OA73	11p
OA79	8p
OA81	9p
OA85	11p
OA90	8p
OA91	8p
OA95	8p
OA200	11p

MULLARD POLYESTER'S

MULLARD POLYESTER CAPACITORS C280 SERIES

250V P.C. mounting: 0·01µF, 0·015µF, 0·22µF, 3½p. 0·33µF, 0·047µF, 0·068µF, 4p. 0·1µF, 4½p 0·15µF, 0·22µF, 5½p. 0·33µF, 7p. 0·47µF, 9½p. 0·68µF, 12p. 1·0µF, 14p. 1·5µF, 22p. 2·2µF, 27p

MULLARD POLYESTER CAPACITORS C296 SERIES

400V: 0·001µF, 0·0015µF, 0·0022µF, 0·0033µF, 0·0047µF, 2½p. 0·0068µF, 0·01µF, 0·015µF 0·022µF, 0·033µF, 3½p. 0·047µF, 0·068µF, 0·1µF, 4½p. 0·15µF, 6½p. 0·22µF, 8½p. 0·33µF, 12p. 0·47µF, 14p.

160V: 0·01µF, 0·015µF, 0·22µF, 0·033µF, 0·047µF, 0·068µF, 3p. 0·1µF 3½p. 0·15µF, 4½p. 0·22µF, 5½p. 0·33µF, 6½p. 0·47µF, 8½p. 0·68µF, 12p. 1·0µF, 14½p.

VOLUME CONTROLS

Potentiometers
Carbon track 500 Ω to 2·2M Ω
Log or Linear
Single 13p. Dual gang (stereo) 44p
Single type with D.P. switch 13p extra.

SLIDE POTENTIOMETERS

58mm. TRACK
SINGLE GANGED, LOG or LIN 1k to 1M. 45p each
TWIN GANGED, LOG or LIN 1k to 500k. 66p each.

CARBON SKELETON PRESETS

Small high quality type (linear only).
All valves 100-5 meg ohms.

·1 watt	5½p each
·2·5 watt	6½p each

VEROBOARD

	0·15 Matrix	0·1 Matrix
2½in × 3¾in	19p	26p
2½in × 5in	28p	28p
3¾in × 3¾in	28p	28p
3¾in × 5in	33p	32p
5in × 17in (plain)	94p	—

Vero Pins (bag of 36), 22p
Vero cutter, 50p; Pin insertion Tools (0·1 and 0·15 matrix) at 61p.

SLIDE SWITCH

SPST 11p each. D.P.D.T. 13p each.

MINIATURE NEON LAMPS

240V or 110V 1–4 5p, 5 plus 4½p each.

MINITRON DIGITAL INDICATOR TYPE 3015F

Reads 0–9 and decimals
(Data Sheet on request)
ONLY £1·50

16 DIL Socket	33p
Driven by 7447	£1·05

RECTIFIERS

P.I.V.	1 AMP	1·5 AMP
50	1N4001 4½p	PL4001 8p
100	1N4002 4½p	PL4002 9p
200	1N4003 5½p	PL4003 10p
400	1N4004 6½p	PL4004 10p
600	1N4005 8p	PL4005 13p
800	1N4006 9p	PL4006 15p
1000	1N4007 10p	PL4007 20p

BRIDGE RECTIFIERS

P.I.V.	1 AMP	2 AMP	5 AMP	10 AMP
50	33p	53p	£1·76p	£2·20p
100	35p	57p	—	—
200	37p	60p	£1·98p	£2·31p
400	40p	64p	£2·15p	£2·42p
600	44p	66p	£2·42p	£2·75p
800	49p	—	—	—

THYRISTORS

PIV	50	100	200	300	400
1 Amp	28	25	41	44	53
3 Amps	44	50	60	—	66
7 Amps	—	96	1·01	—	1·24

RESISTORS

¼ watt 5% carbon 1p each
½ watt 10% carbon 1p each
1 watt 10% carbon 2½p each
Range 10 ohms to 4·7 meg.
½ watt m/o 2% 3p each
Range 10 – 1 meg ohms

Sinclair Project 60

Now–the Z.50 Mk.2

with built-in automatic transient overload protection

When originally introduced, the Sinclair Z.50 proved how it was possible to design and produce a popularly priced modular power amplifier having characteristics to challenge the world's costliest amplifiers. Many thousands of Z.50's are now giving excellent service day in, day out. But we have also learned that constructors do not always use their Z.50's ideally. That is why we have introduced modifications whereby risk of damage through mis-use is greatly reduced and performance further enhanced. The Z.50 Mk.2 has improved thermal stability, more accurately regulated D.C. limiting to ensure more symetrical output voltage swing and clipping and still less distortion at lower power. Z.50 Mk.2 is compatible with all other Project 60 modules, and may be incorporated to advantage in existing systems. Eleven silicon epitaxial planar transistors are now used, two more than in the original Z.50. circuitry has been re-designed, making this versatile high performance amplifier better than ever.

with free manual
£5.48

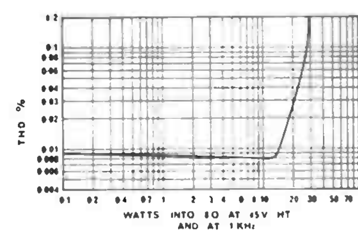
Z.30 the power amplifier for quality and economy

with free manual
£4.48

The Z.30 provides excellent facilities for the constructor requiring a high fidelity audio system of less power than that available from Z.50's. Using a power supply of 35 volts, Z.30 will deliver 15 watts RMS into 8 ohms, or 20 watts RMS into 3 ohms using 30 volts. Total harmonic distortion is a fantastically low 0.02% at 15 watts into 8 ohms with signal to noise ratio better than 70 dB unweighted. Input sensitivity 250mV into 100K ohms. Size 80 x 57 x 13 mm ($3\frac{1}{8}$ x $2\frac{1}{4}$ x $\frac{1}{2}$) Z.30, Z.50 and Z.50 MK 2 modules are compatible and interchangeable.

Brilliant new technical specifications

Input impedance 100 KΩ
Input (for 30w into 8Ω) 400mV
Signal to noise ratio, referred to full o/p at 30v HT 80dB or better
Distortion 0.02% up to 20W at 8Ω. See curve
Frequency response 10Hz to more than 200 KHz ±1dB
Max. supply voltage 45v (4Ω to 8Ω speakers) (50v 15Ω speakers only)
Min. supply voltage 9v
Load impedance – minimum: 4Ω at 45v HT
Load impedance – maximum: safe on open circuit



Guarantee

If, within 3 months of purchasing any product direct from Sinclair Radionics Ltd., you are dissatisfied with it, your money will be refunded at once. Many Sinclair appointed Stockists also offer this same guarantee in co-operation with Sinclair Radionics Ltd.

Each Project 60 module is tested before leaving our factory and is guaranteed to work perfectly. Should any defect arise in normal use, we will service it at once and without any charge to you, if it is returned within two years from the date of purchase. Outside this period of guarantee a small charge (typically £1.00) will be made. No charge is made for postage by surface mail. Air Mail is charged at cost.

Typical Project 60 applications

System	The Units to use	together with	Units cost
Simple battery record player	**Z.30**	Crystal P.U., 12V battery volume control, etc.	**£4.48**
Mains powered record player	**Z.30, PZ.5**	Crystal or ceramic P.U. volume control, etc.	**£9.45**
12W. RMS continuous sine wave stereo amp. for average needs	**2 x Z.30s, Stereo 60; PZ.5**	Crystal, ceramic or mag. P.U., F.M. Tuner, etc.	**£23.90**
25W. RMS continuous sine wave stereo amp. using low efficiency (high performance) speakers	**2 x Z.30s, Stereo 60; PZ.6**	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc.	**£26.90**
80W. (3 ohms) RMS continuous sine wave de luxe stereo amplifier. (60W. RMS into 8 ohms)	**2 x Z.50s, Stereo 60; PZ.8, mains transformer**	As above	**£34.88**
Indoor P.A.	**Z.50, PZ.8, mains transformer**	Mic., guitar, speakers, etc., controls	**£19.43**

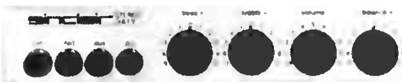
F.M. Stereo Tuner **(£25)** & A.F.U. **(£5.98)** may be added as required.

sinclair

SINCLAIR RADIONICS LTD., R.O. London Road, St. Ives, Huntingdonshire, PE17 4HJ (Phone St. Ives 4311) Reg. No. 699483 England

the world's most advanced high fidelity modules

Stereo 60 Pre-amp/control unit



Designed specifically for use on Project 60 systems, the Stereo 60 is equally suitable for use with any high quality power amplifier. Since silicon epitaxial planar transistors are used throughout, a really high signal-to-noise ratio and excellent tracking between channels is achieved. Input selection is by means of press buttons, with accurate equalisation on all input channels. The Stereo 60 is particularly easy to mount.

SPECIFICATIONS—Input sensitivities: Radio – up to 3mV. Mag. p.u. 3mV correct to R.I.A.A. curve ± 1dB 20 to 25,000 Hz. Ceramic p.u. – up to 3mV. Aux – up to 3mV. **Output:** 250mV. **Signal to noise ratio:** better than 70dB. **Channel matching:** within 1dB. **Tone controls:** TREBLE + 12 to —12dB at 10KHz. BASS + 12 to —12dB at 100Hz. **Front panel:** brushed aluminium with black knobs and controls. **Size:** 66 x 40 x 207mm.

Built, tested and guaranteed. **£9.98**

Project 60 Stereo F.M. Tuner

The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. tuner with fantastically good results. Other advanced features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stero decoder and switchable squelch circuit for silent tuning between stations. In terms of high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with most other high fidelity systems.

SPECIFICATIONS—Number of transistors: 16 plus 20 in I.C. **Tuning range:** 87.5 to 108MHz. **Sensitivity:** 7µV for lock-in over full deviation. **Squelch level:** Typically 20µV. **Signal to noise ratio:** >65dB. **Audio frequency response:** 10Hz – 15KHz (± 1dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2µV. **Cross talk:** 40dB. **Output voltage:** 2 x 150mV R.M.S. maximum. **Operating voltage:** 25–30VDC. **Indicators:** Stereo on, tuning. **Size:** 93 x 40 x 207mm

Built and tested. Post free. **£25**

Super IC.12 Integrated circuit high fidelity amplifier

Having introduced Integrated Circuits to hi-fi constructors with the IC.10, the first time an IC had ever been made available for such purposes, we have followed it with an even more efficient version, the Super IC.12, a most exciting advance over our original unit. This needs very few external resistors and capacitors to make an astonishingly good high fidelity amplifier for use with pick-up, F.M. radio or small P.A. set up, etc. The free 40 page manual supplied, details many other applications which this remarkable IC make possible. It is the equivalent of a 22 transistor circuit contained within a 16 lead DIL package, and the finned heat sink is sufficient for all requirements. The Super IC.12 is compatible with Project 60 modules which would be used with the Z 50 and Z.30 amplifiers. Complete with free manual and printed circuit board.

SPECIFICATIONS

Output power: 6 watts RMS continuous (12 watts peak), 6–8Ω. **Frequency Response:** 5Hz to 100KHz ± 1dB. **Total Harmonic Distortion:** Less than 1% (Typical 0·1%) at all output powers and frequencies in the audio band (28V). **Load Impedance:** 3 to 15 ohms. **Input Impedance:** 250 Kohms nominal. **Power Gain:** 90dB (1,000,000,000 times) after feedback. **Supply Voltage:** 6 to 28V. **Quiescent current:** 8mA at 28V. **Size:** 22 · 45 · 28mm including pins and heat sink.

Manual available separately 15p post free.

With FREE printed circuit board and 40 page manual.
£2.98 Post free

Power Supply Units The new PZ.8 Mk.3

The most reliable power supply unit ever made available to constructors. Brilliant circuitry makes failure from over load and even direct shorting of the output impossible. This is due to an ingenious re-entrant current limiting principle which, as far as we know has never before been available in any comparable unit outside the most expensive laboratory equipment. Ripple and residual noise have been reduced to the point of almost total elimination. This is, of course, the perfect unit for Project 60 assemblies, particularly where the new Z 50 MK.2 amplifiers are used. Nominal working voltage – 45.

PZ.8 Mk.3—£7.98
(Mains transformer, if required) £5.98
PZ.5 30v unstabilised
(not suitable for Project 60 tuner) £4.98
PZ.6 35v stabilised
(not suitable for IC. 12) £7.98

Project 605

the easy way to buy and build Project 60 without soldering

Project 605 in one pack contains one PZ.5, two Z 30's, one Stereo 60 and one Masterlink, which has input sockets and output components grouped on a single module and all necessary leads cut to length and fitted with clips to plug straight on to the modules thus eliminating all soldering.

Complete with comprehensive manual, post free **£29.95**
All you need for a superb 30 watt high fidelity stereo amplifier

Order form

Please send ______________________
I enclose cash/cheque/money order.

Name ______________________

Address ______________________

____

____

PW5

SINCLAIR RADIONICS LTD., R.O. London Road, St. Ives, Huntingdonshire, PE17 4HJ

sinclair

Practical Wireless Classified Advertisements

Classified advertisements 10p per word (minimum 12 words). Box No. 20p. Semi-display setting £8 per single column inch. Advertisements must be prepaid and addressed to Classified Advertisement Manager, PRACTICAL WIRELESS, IPC Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD. All cheques, postal orders, etc., to be made payable to PRACTICAL WIRELESS and crossed "Lloyds Bank Ltd."

Service Sheets

SERVICE SHEETS, Radio, TV etc., 8,000 models. Catalogue 15p. S.A.E. enquiries. Telray, 11 Maudland Bank, Preston.

SERVICE SHEETS for Televisions, Radios, Transistors, Tape Recorders, Record Players, etc., from 5p with free Fault-Finding Guide. S.A.E. orders/enquiries. Catalogue 15p. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex. Telephone Hastings 29066.

LARGE SUPPLIER OF SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOGRAMS, RADIOGRAMS, CAR RADIOS)

Only 40p each

"PLEASE ENCLOSE LARGE S.A.E. WITH ALL ENQUIRIES & ORDERS"

Otherwise cannot be attended to

(Uncrossed P.O.'s please, original returned if service sheets not available.)

C. CARANNA

71 BEAUFORT PARK

LONDON, N.W.11

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

Books and Publications

DENCO CLACTON LIMITED
355-7-9 Old Road
Clacton-on-Sea, Essex

Catalogue 20p post paid

S.A.E. all enquiries

RadioBOOKS

Handbk of Transistor Equiv and Substitutes	45p
Handbook of Tested Transistor Circuits	45p
Rad & Electr Colour Codes and Data Chart	20p
Hi Fi, PA & Disco Amplifier Design H'bk	80p
Boys Bk of Crystal Sets and Simple Circuits	23p
How to make FM & TV Aerials, Bands 1,2,3	23p
Radio Servicing for Amateurs	25p
High Fidelity Loudspeaker Enclosures	45p
Practical Tape Recording Handbook	35p
Practical Stereo Handbook	35p
Practical Radio Inside Out	45p
Transistor Circuits Manual No. 1	20p
Transistor Circuits Manual No. 2	20p
Coil Design and Construction Manual	35p
Radio TV and Electronics Data Book	30p
Transis Circuits for Radio Controlled Models	45p
Pract Transistor Audio Amplifiers, Book 1	25p
Transistor Test Equip and Servicing Manual	30p
Handbook of Simple Transistor Circuits	40p
Modern Transistor Circuits for Beginners	45p
Sound and Loudspeaker Manual	55p
Resistor Colour Code Disc Calculator	15p
Manual Transistor Audio Amplifiers	45p
Practical Car Radio Handbook	35p
Radio TV and Industrial Tube & Valve Equiv	45p
Practical Transistor Novelty Circuits	45p
Television Servicing Vol. 1	95p
Television Servicing Vol. 2	95p
Television Servicing Vol. 3	70p
Television Servicing Vol. 4	95p
Using an Oscilloscope	80p
Servicing Transistor Radio Receivers	85p
Television Timebase Circuits	£1.10p
Pal D Colour Receiver Questions & Ans	78p

All prices include postage & packing
FREE lists of other titles avail on request. *Send to:*

RADIO BOOK SERVICE
40 Elwill Way, Beckenham BR3 2RZ

SHORT WAVE MAGAZINE, now in its 36th year and published monthly, covers the whole field of Radio Amateur transmission and reception including regular news features (DX, VHF, Clubs and SWL) and the design, construction and operation of AMATEUR Radio equipment of every type. Cover price 25p at newsagents. Specimen copy 30p post free, first class. Annual subscription £3·00 (or £2·75 second class posting) year of 12 issues. —Circulation Dept. (P.), Short Wave Magazine Ltd., 55 Victoria Street, London SW1H 0HF. (Tel: 01-222 5341/2)

DIGITAL COMPUTER LOGIC and Electronics. Four volume self-instructional course. £2·95 including p & p. Money back assurance. Cambridge Learning (PW), 8a Rose Crescent, Cambridge.

TRANSISTOR DATA
THE INTERNATIONAL TRANSISTOR DATA MANUAL

1973 EDITION is now ready. Data on upwards of 18,000 transistors of international origin. £5·25 plus 35p post & packing in the UK. Brochure available. Order direct from

SEMICON INDEX LTD.,
Freepost, Wokingham, Berks. RG11 2AY.

★ KILRIMONT BOOKS ★

Understanding Electronic Components	£3·50
Practical Wireless Circuits	£1·20*
Audio Technicians Bench Manual	£3·00
Using an Oscilloscope	£0·70*
Mazda Book of PAL Receiver Servicing	£3·80
Beginners Guide to Radio	£1·00*
Computer Science	£2·00
Colour T.V. Picture Faults (Ill.)	£2·50

* Please enclose 5p postage on orders less than £2·00. Lists gladly sent on application. **Kilrimont Books (A), Kilrimont House, London Road, Braintree, Essex. CM7 8QL**

Aerials

Direct from the Manufacturers

U.H.F. AERIALS

in EASY ASSEMBLY KITS

SAVE 40% on normal retail price

10 Element **£1·25**

14 Element **£1·50** 18 Element **£1·75**

Ready assembled add 20p allow 35p carriage and packing Please state which channels or group.

APEX AERIALS (E.M.)
ALBAN WORKS, MARY ST., JOHNSTONE, RENFREWSHIRE

BAINES for High Frequency Aerials

UHF Multibeams by J. Beam

MBM 10 £2·20 MBM 18 £2·90 MBM 30 £3·90
MBM 46 £6·00 MBM 70 £11·00
VHF FM Aerials
Dipole £1·40, FM/H £2·00, FM3 £3·00, FM4S £5·55, FM6S £7·80
Masthead Pre-amps
Single Stage £6·00. Two stage £8·00, Wideband £7·00
Accessories: SAE for full list. Co-ax 5p, low loss 9p
11 Dale Cres., Tupton, Chesterfield S42 6DR

GENUINE FULL SIZE 18 element TV aerial
as used by leading TV companies

ITV BBC1 & 2 BLACK/WHITE & COLOUR

FOR ONLY £1.99 + 35p carr

Guaranteed Perfect Pictures. Save ££s. We supply this genuine U.H.F. aerial for only £1·99, can be fitted out side or inside. Quality made, technically advanced design. Precision grid reflector eliminates ghosting. Complete with clamp, instructions, advice.

Money Back Refund Wall/Caravan Bracket 25p. Low Loss Cable 10p per yard. Plug 8p & FREE with order maps & channel reference of all Radio & TV Transmitters.

Send direct to
Dept PW10, 219 Mansfield Rd., Nottingham

IMPERIAL TRADING (AERIALS) LTD.
the quality Aerial Specialists

DIRECT FROM MANUFACTURER—a comprehensive catalogue of UHF & VHF/FM aerials, fixing brackets, chimney lashings, clamps, masts, amplifiers, cable, etc., for the D.I.Y. enthusiast. Complete with useful installation hints. Send 3p stamp to CLAYDEW ENTERPRISES (PW), 261 Hardess Street, London, S.E.24.

★ **SERVICE SHEETS • MANUALS • BOOKS** ★

SERVICE SHEETS 30p + Postage | OVER 12,000 SERVICE SHEETS AND MANUALS IN STOCK ON RADIOS, TV's, R.PLAYERS AND T.RECORDERS, ETC.. PLEASE ENCLOSE S.A.E. WITH ENQUIRIES... | **SERVICE SHEET Catalogue 20p.**

NEW BOOKS AND PUBLICATIONS	PRICE
AUDIO TECHNICIANS BENCH MANUAL by John Earl. 182 pages 114 Illustrations	£3.00
RADIO TECHNICIANS BENCH MANUAL by H.W.Hellyer. 215 pages 131 Illustrations	£3.00
BEGINNERS GUIDE TO RADIO by G.J.King. 7th Edition. 204 pages. Illustrated	£1.00
ELECTRONICS IN MUSIC by F.C.Judd. Circuit designs. 169 pages. Illustrated	£3.15
FOUNDATIONS OF WIRELESS AND ELECTRONICS by M.G.Scroggie. 552 pages	£3.00
F.M.RADIO SERVICING HANDBOOK by G.J.King. 2nd Edition. 206 pages	£3.00
FAULT LOCATION EXERCISES IN RADIO & TV SERVICING by K.J.Bohlman. Vol.1.	£0.80
SERVICING WITH THE OSCILLOSCOPE by G.J.King. 176 pages. Illustrated	£1.80
WORLD RADIO-TV HANDBOOK 1973. Immense amount of tabulated matter listed	£3.00
50 PHOTOELECTRIC CIRCUITS AND SYSTEMS by P.S.Smith. 88 pages. Illustrated	£2.30

NOTE. Postage on all books is now 5p up to £1. ORDERS OVER £1.00 POST FREE. (UK only)
Send large S.A.E. for FREE booklists and book pamphlets on Radio, Television & Electronics.
NEWNES RADIO & TELEVISION SERVICING books bought & sold (all years) Good prices paid.

BELL'S TELEVISION SERVICES
★ Albert Place, Harrogate, Yorks. Tel. 0423-86844 ★

Educational

TRAIN FOR SUCCESS WITH ICS

Study at home for a progressive post in Radio, TV & Electronics. Expert tuition for C & G (Telecoms Techn's Cert and Radio Amateurs') RTEB, etc. Many non-exam courses including Colour TV Servicing, Numerical Control and Computers. Also self-build kit courses—valve and transistor.

Write for FREE prospectus and find out how ICS can help you in your career.

ICS, DEPT. 732M1 INTERTEXT HOUSE, STEWARTS RD., LONDON, SW8 4UJ

RADIO, TV, RTEB Certs., City and Guilds, Computers, Radio Amateurs Cert., Practical Electronics (with kit). Thousands of successes. Details of home study courses and illustrated book—FREE. BIET (Dept ZL BPW 26), Aldermaston Court, Reading RG7 4PF. Accredited by CACC.

CIE, AMSE, City & Guilds, etc. Thousands of exam successes. Postal courses in all branches of Engineering. Prospectus FREE. State subject of interest: BIET (Dept ZL BPW 37), Aldermaston Court, Reading RG7 4PF. Accredited by CACC.

GO TO SEA as a Radio Officer. Write: Principal, Nautical College, Broadwater, Fleetwood FY7 8JZ.

Situations Vacant

TEKTRONIX U.K. LIMITED

have vacancies for

Product Service Technicians

to repair and recalibrate our range of oscilloscopes and other products at our Harpenden office.

A good knowledge of basic electronics is necessary and a flair for fault-finding would be an advantage.

We offer good working conditions, profit sharing, non-contributory life assurance and pension schemes.

Please write or telephone:

R. M. Garrett,
Tektronix U.K. Limited,
36/38 Coldharbour Lane,
Harpenden, Herts.
Telephone: Harpenden 61251 Ext. 25

ASSISTANT CHIEF ELECTRONICS ENGINEER. Duties will include servicing of all types of audio domestic appliances, plus sample specification reports on imported Hi-Fi equipment. The use and familiarisation of test equipment. Experience on FM/MPX and tape recorder techniques is essential. Successful applicant will work in close liaison with the chief service engineer. Remuneration according to experience and qualifications. Three weeks' holiday per year. Tel.: 01-594 1473. Personnel Manager, Harris Overseas Ltd., Harvard House, 14 Thames Road, Barking, Essex.

MEN! £50 p.w. can be yours

Jobs galore! 144,000 new computer personnel needed by 1977. With our revolutionary, direct-from-America, course, you train as a Computer Operator in only 4 weeks! Pay prospects? £2500+p.a.
After training, our exclusive appointments bureau—one of the world's leaders of its kind—introduces you FREE to world-wide opportunities. Write or 'phone TODAY, without obligation.

London Computer Operators Training Centre
M97, Oxford House
9-15, Oxford Street, W.1.
Telephone: 01-734 2874
127, The Piazza, Dept. M97.
Piccadilly Plaza, Manchester 1.
Telephone: 061-236 2935

Wanted

TOP PRICES PAID for NEW VALVES
popular T.V. and Radio types.
KENSINGTON SUPPLIES (C),
367 Kensington Street, Bradford 8.
Yorkshire.

WE BUY New Valves, Transistors and clean new components, large or small quantities, all details, quotation by return. WALTON'S, 55 Worcester Street, Wolverhampton.

WANTED: Built or partly built Heathkit A.F.M.2 Tuner. 64, Green Lane, Coventry.

For Sale

BBC 2 TV'S 7.50 Including Delivery

Thorn 850 Chassis with UHF Tuner. Ex-rental sets sold complete but unserviced, with repolished cabinets. Rush £7·50. Cash with Order.

U.H.F. TUNERS

For Ferguson 850, 900 Chassis, but adaptable for most D/STD Chassis. £2·50 each. Plus 50p P&P. C.W.O.

Send S.A.E. for list of TVs, Tubes, Valves, etc. Allow 10-14 days delivery.

TRADE DISPOSALS (PW),

Midlands & North: 1043 Leeds Road, Bradford 3.
Scotland: Unit 5, Peacock Cross Industrial Estate, Burnbank Road, Hamilton.
Cornwall: Pencoys, Four Lanes, Redruth.

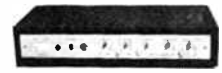
SEEN MY CAT? 5,000 items. Mechanical & Electrical Gear, and materials. S.A.E. K. R. WHISTON, Dept. PW, NEW MILLS, Stockport.

Receivers and Components

TV LINE OUTPUT TRANSFORMERS Tidman Mail Order Ltd., 236 Sandycombe Rd., Richmond, Surrey, TW9 2EQ. 01-948 3702.

THE **TEXAN**

NOW ON DEMONSTRATION



Designer approved Kit only £28·50
Instructions only 35p

Pack 1. RESISTORS	80p
Pack 2. SMALL CAPS	£1·50
Pack 3. LARGE CAPS	£1·40
Pack 4. SUNDRIES	£1·90
Pack 5. SWITCHES	90p
Pack 6. CONTROLS	£1·45
Pack 7. SEMI COND.	£8·25
Pack 8. TRANSFORMER	£4·95
Pack 9. P.C. BOARD	£2·50
Pack 10. CHASSIS, etc.	£4·20

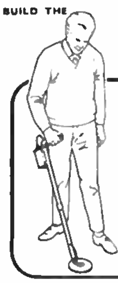
Post extra—parts available separately
Send for list and technical spec.

Kits also available for

★ Radio Control Systems
★ Digital Clock Systems
★ Integrated Circuit Amplifiers (to 50W)
★ Hi-Fi Pre-amps
★ Stabilized Power Supply Units

TELERADIO HI FI, 325 Fore Street, Edmonton, London N.9 01-807 3719
CLOSED ALL DAY THURSDAY

BUILD THE **TREASURE TRACER MK III** Metal Locator



- Varicap tuning
- Excellent sensitivity and stability
- Weighs only 22oz.
- Speaker and earphone operation
- Knocks down to only 17in.
- Prebuilt search coil assembly
- Ministry approved design
- Thoroughly professional finish
- You only need soldering iron, screwdriver pliers and snips
- Completely new design

Send s.a.e. for leaflet

Complete kit Post 30p **£8·90** Built, tested and guaranteed Post 30p **£12·50**

MINIKITS ELECTRONICS, 35a LANGLEY DRIVE, WANSTEAD, LONDON E11 2LN. (Mail order only)

MINI MAINS PACK KIT. Safe double wound mini transformer, silicon rects., 1000μF smoothing. Delivers 9V d.c., 120mA. Components with data sheet; pack buildable to size of PP6 etc. battery. £0·90+U.K. post 5p. By mail only from AMATRONIX LTD., 396 SELSDON RD., SOUTH CROYDON, SURREY, CR2 0DE.

BRAND NEW COMPONENTS by return, Electrolytics 16V, 25V, 50V—0·47, 1, 2·2, 4·7, 10 mfds—4p, 22, 47—4½p (50V-5p) 100—5½p (50V-7p). Subminiature bead-type tantalums 0·1/35V, 0·22/35V, 0·47/35V, 1/35V, 2·2/35V, 4·7/35V, 10/16V—8p. Mylar Film 100V —0·001, 0·002, 0·005, 0·01, 0·02—2p, 0·04, 0·05—3p, 0·1—3½p. Polystyrene 63V E.12 series 10 pf—10,000 pf—2p. Miniature Highstab resistors E.12 series. 5% carbon film 1Ω-10MΩ (10% over 1 Meg.) Metal Film ⅛W 10Ω-2·2MΩ and 1W-27Ω-10MΩ all ¾p ea. Postage 8p. The C.R. Supply Co., 127 Chesterfield Rd., Sheffield S8.

CASED AMPLIFIERS

2xECC83, EL84, EZ80. 20µV I/P sensitivity 2 watts O/P into 7 × 4" 3Ω Speaker. All contained in polished cabinet with non-standard single motor deck. Tested with circuit £3 (£1). Suitable cassettes £1 (25p); spare heads 40p.

COMPUTER PANELS

Lots of Transistors inc. Power Types, Diodes, R's, C's, Pot Cores, etc. Some boards broken, but good value at 3lbs. £1 (25p), 7lbs. £2 (40p).

1,000 R's & C's £3·00. Amazing Variety of resistors, including Carbon Film, Metal Oxide, Hi-Stabs, 1, 2 & 5%. ⅛, ¼, ½ and 1W From a few ohms to a few Megohms. Also Mica, Ceramic, Foil, Paper, Electrolytic, Polystyrene Capacitors. About 1000 Components £3 (30p).

FERRIC CHLORIDE

Anhydrous Technical Quality in sealed 1lb packs 40p (15p), 10lbs £3·50 (50p).

COMPONENTS: BC107-8-9, 8p ea., 14 for £1; 709C 25p; 741C 25p; 723C 40p; 2N3055 35p; IN4003 7p; IN4006 11p; Crofon 1610 Light Guide, 64 Filament £1 per metre, 5+ 80p, 10+ 70p. SURPLUS CAPACITORS MFD/V: 0·47/350 6p; 2/150 2p; 8/350 8p; 8/450 10p; 25/25 5p; 500/50 12p; 550/6 3p; 1000+ 500/18 12p—Lots of others. Lots of Odd Units, Scopes, Meggers, Avo's, Sig. Gens., etc. at shop for callers. SAE List. Post in brackets, small parts 3p.

GREENWELD (PW12)

24 Goodhart Way, West Wickham, Kent. Tel: 01-777 2001. Shop at 21 Deptford Broadway, S.E.8. Tel: 01-692 2009.

U.K. ADD VAT TO ORDER TOTAL. MICROCIRCUITS: 709 28p; 710 36p; 723 57p; 741 28p; 748 37p; PA230 70p; SL402A £1·00; FET Op.Amp. £1·62. TRANSISTORS: 2N696 14p; 2N697 14p; 2N706A 11p; 2N1613 16p; 2N1711 16p; 2N2218 19p; 2N2219 19p; 2N2219A 19p; 2N2904 17p; 2N2926 RED 6p; ORANGE 7p; YELLOW 8p; GREEN 9p; 2N3053 15p; 2N3054 40p; 2N3055 35p; 2N3702 10p; 2N3703 10p; 2N3704 10p; 2N3705 9p; 2N3706 9p; 2N3709 8p; 2N3710 9p; 2N3711 9p; 2N4058 12p; 2N4059 9p; 2N4061 11p; 2N4062 11p; AC107 28p; AC126 28p; AC127 12p; AC176 15p; ACY17 23p; ACY21 17p; AF114 14p; AF115 14p; AF116 14p; AF117 14p; AF124 22p; BC107A 7p; BC107B 8p; BC108A 8p; BC108B 8p; BC108C 8p; BC109B 7p; BC109C 7p; BC125 14p; BC147A 9p; BC167A 10p; BC168B 9p; BC169B 10p; BC177 13p; BC178 12p; BC179 16p; BCY70 15p; BCY71 22p; BD142 35p; BF115 20p; BF194 13p; BFX29 24p; BFX84 20p; BFX86 15p; BFX87 24p; BFX88 15p; BFY50 15p; BFY51 15p; BFY52 15p; BLY47A 40p; BSX20 12p; OC44 12p; OC45 12p; OC71 12p; OC72 12p; OC81 18p; OC83 24p; ME SERIES AVAILABLE. RECTIFIERS: 1 AMP: 50V 3½p; 100V 4p; 200V 4½p; 400V 5p; 800V 6p; 1000V 7p. ZENERS BZY88 SERIES 2·7V to 33V 8p each. DIODES 1N916 4p; OA90 6p; OA200 7p; OA202 8p. SCR IR122D (400V 5A) £1·14; LED PANEL LAMP WITH BUSH AND DATA 40p. CARBON FILM ¼W 5% RESISTORS E12 values 22 to 2·2M 1p EACH or 7p per 10 of ONE VALUE. DALO ETCH RESIST FILLED FIBRE TIP PEN 80p. MINIATURE METAL GLAZE RESISTORS 1/16W 5% 4½p each. 1K THERMISTOR 9p. 2N3819 26p. TESTED TRANSISTOR CIRCUITS BOOKLET 40p. ITT POCKET MULTIMETER 27 ranges £17. C.W.O.

(Above prices on Feb. 12. Check our list)

JEF ELECTRONICS (P.W.5)

York House, 12 York Drive, Grappenhall, Warrington WA4 2EJ. Mail Order Only. P & P at Cost—10p minimum per order. List Free.

DISC Ceramics 100 55p. Resistors 100 40p. Lists and samples 20p. Plus postage. Derwent Radio, Scarborough.

IRISH READERS! Up to 20% off stereo amplifiers, tuners, decks, speakers etc. FREE catalogue Berne Bros, Auburn Terrace, Athlone, Co. Westmeath, Ireland.

COMPONENTS GALORE. Pack of 500 mixed components manufacturers surplus plus once used. Pack includes resistors, capacitors, transistors, diodes, I.C., gang, pots, etc. Tremendous value. Send £1 incl. postage C.W.O. to Caledonian Components, Fosterton Firs, Strathore Road, Thornton, Fife.

VALVE BARGAINS any 5—Give Free ECC82 EF183-EF184. PCF80. PCL82 PY800. PL36, When buy TVS. 19in. U.H.F./V.H.F. TV £6·50 carriage £1·50. Slotmeters. Perfect working £1·50. Post Free. MIR Radio & TV, 193 Ramsay St., Rochdale, Lancs. Tel. 40599.

Trampus electronix

ALL BRAND NEW, no rejects. Money back warranty. 5V DIGITAL INDICATOR. 0-9DP socket and filter £1·45. LED TYPE ⅓" 0-9DP DIL £2·25 ea. **LIGHT EMITTING DIODES.** All with data and panel clip. TIL 209 ⅛" dia 26p. Red ⅕" dia type 33p. Green 75p. INFRA RED beam LEO £1·10. TGS GAS detector £1·69. ULTRASONIC TRANSDUCERS £2.

DALO PCB resist marking pen 69p. Copper board 12" × 6" SRBP 40p FeC etch PAK 19p.

INTEGRATED CIRCUITS: with data if required. **IC LITE SWITCH:** Photo amp/trigger 40ma / 11-20 relay or TTL 87p. Dil relay £1·10.

IC digital clock

MOS/LSI type 28 pin 4 or 6 digit 12/24 hr. Chip with socket £13, PCB £1·69, KIT £21·49. 741 Dil 8 pin 28p, 709 14p, Dil 29p, 748 29p, 710 33p, 555 TIMER mono/astable osc. clock 93p. REGULATORS: 1½A 5 to 20V £1·49. 723 57p.

RECEIVER ZN414 £1·19. Mini Rx kit £1·99. 1310 stereo decoder for tuners £2·69. Kit £3·45.

74N TTL: Gates 7400 etc. 14p ea. 7413 27p. 7441 78p. 7447 £1·09. 7490 59p. 7492 67p. 74121 45p.

DIL SOCKETS: lo or hi profile 8/14/16 pin 13p.

SEMICONDUCTORS

2N3055 40p. BC107 8p. BC108 8p. BC109 8p. BC147/8/9 10p. BC167/8/9 13p. BC177/8/9 15p. BC182/3/4 10p. BC212/3/4 11p. BCY70/72 13p. BD131/2 55p. BFY50/51/52 13p. TI843 UJT 24p. 2N706 11p. 2N2369 12p. 2N2926 OY 8p. 2N2646 49p. 2N3053 17p. 2N3614 55p. 2N3702/3/4/5/6/7/8/9/10/11 All 9p ea.

FETS: 2N3819 27p. 2N3823 29p. SCR 400V 1A 23p. 4A 55p. TRANSFORMER: ½A 6 & 12V £1.

CAPACITORS: Disc 22pf to 0·1µf 4p. 25V electrolytic 10, 50, 100 µf 5p. 1000 µf 15p.

PRESETS 5p ea. **RESISTORS** ⅓W. 5% 1½p. ea.

CARBON POTS 12p ea. Dual 40p. Switch + 12p.

FLUORESCENT LIGHTS 12VOLT £2·79

13" 8 watt fully built with diffuser.

TRIO

All TRIO equipment available i.e. 9R-59DS Rx £49·50. JR310 Rx. £75. Also CODAR gear PR40 £8·90. Multiband Rx kit £13·20. CR70A Rx £27·50. V.A.T. You must add 10% (1/10) to all prices.

FREE CAT. S.A.E. Data shts. 8p ea. P.&P. 8p CWO. P.O. BOX 29, BRACKNELL, BERKS.

World-wide acclaim, the incomparable

GLOBE-KING

V.H.F. & S.W. KITS

Precision standard, inexpensive, low-cost valve and transistor Kits for Short-Wave 10–350 m. V.H.F. 80–180 M/cs. Ideal for beginners with unique "Easy-Build" diagrams and simplified instructions. Send to-day for free literature price list and order form, kindly enclose stamped addressed envelope (Overseas: Int. Reply Coupon). Direct to the sole manufacturers:

JOHNSONS (RADIO)
SHAW ST., WORCESTER.
WR1 3QQ

Please note new address, city centre. Pioneers in DX radio—Established for over 30 years.

(A JOHN BANNER COMPANY)

5-N-CHANNEL FETs 3819E—£1

Full specification devices complete with data and circuit details for building voltmeter, timer, ohmmeter, etc.

Send 10p for full list of field effect transistors and other top quality transistors available at bargain prices.

REDHAWK SALES LIMITED

45 Station Road, Gerrards Cross, Bucks. Mail Order only

NEW MODEL V.H.F. KIT MK2

Our latest kit. Improved design and performance plus extra amplifier stage, receives aircraft, amateurs, mobile, radio 2, 3, 4, etc., this novel little set will give you endless hours of pleasure and can be built in one evening. Powered by 9 volt battery, complete with easy to follow instruction and built in jack socket for use with earphones or amplifier.

Only £3·50 + p.&p 10p U.K. only.

Illustrated catalogue of selected kits and components. 15p P&P free.

Galleon Trading Co,
12, Burrs Way,
Corringham,
Stanford-Le-Hope,
Essex. SS17 9OE

PRECISION

POLYCARBONATE CAPACITORS

Close tolerance. High stability. All 63V d.c.

0·47µF:	±5%	30p;	±2%	40p;	±1%	50p
1·0µF:	±5%	40p;	±2%	50p;	±1%	60p
2·2µF:	±5%	50p;	±2%	60p;	±1%	75p
4·7µF:	±5%	70p;	±2%	90p;	±1%	£1·15
6·8µF:	±5%	95p;	±2%	£1·15;	±1%	£1·60
10µF:	±5%	£1·10;	±2%	£1·40;	±1%	£1·80
15µF:	±5%	£1·60;	±2%	£2·10;	±1%	£2·70

TANTALUM BEAD CAPACITORS—Values available 0·1, 0·22, 0·47, 1·0, 2·2, 4·7, 6·8µF at 35V, 10µF 25V, 15µF 20V, 22µF 15V, 33µF 10V, 47µF 6V, 100µF 3V—all at 9p each; 6 for 50p; 14 for £1. Special pack 6 off each value (78 capacitors) £5.

NEW!—TRANSISTORS. BC107, BC108, BC109, All at 9p each; 6 for 50p; 14 for £1. All brand new and marked. Full spec. devices. May be mixed to qualify for quantity prices. **AF178**—42p each; 3 for £1.

POPULAR DIODES IN914—7p each, 8 for 50p; 18 for £1. **IN916**—9p each, 6 for 50p, 14 for £1. **IS44**—5p each, 11 for 50p, 24 for £1. All brand new and marked.

NEW LOW PRICE—400 mW Zeners. Values available 4·7, 5·6, 6·8, 7·5, 8·2, 9·1, 10, 11, 12, 13·5, 15V. Tol. ± 5% at 5 mA. All new and marked. Price 10p each, 6 for 50p, 14 for £1·00 Special offer 6 off each voltage (66 zeners) £4·50

RESISTORS. Carbon film ½W 5%. Range from 2·2Ω to 2·2MΩ in E12 series, i.e. 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades. High stability, low noise. All at 1p each; 8p for 10 of any one value; 70p for 100 of any one value. Special development pack—10 off each value 2·2Ω to 2·2MΩ (730 resistors) £5.

440V A.C. CAPACITORS. 0·1µF, size 1⅛in × ⅝in, 25p; 0·25µF, size 1⅛in × ⅝in, 30p; 0·47 and 0·5µF, size 1⅛in × ⅝in, 35p; 1·0µF, size 2in × ⅝in, 45p; 2·0µF, size 2in × 1in, 75p each.

SILICON PLASTIC RECTIFIERS 1·5 Amp Brand new wire-ended DO27. 100PIV at 8p each or 4 for 30p; 400PIV at 9p each or 4 for 34p; 800PIV at 14p each or 4 for 50p.

5p post and packing on all orders below £5.

10% VAT Effective April 1st.

MARCO TRADING (formerly V. Attwood)
Dept. W.5. The Maltings, Station Road, Wem, Salop

13A SCOPE. Handbook with Circuit Diagram — £2·00. Complete range spares, probes, transformers, chokes, potentiometers, graticules, etc. Cheap. SAE or phone. CT.316 Scope. Handbook with Circuit Diagram — £2. SPEAKES, 12 Kenley Avenue, Shrewsbury. Tel. 56949.

NEW RECEIVER MODULE RM-A A small circuit board, wired, tested and aligned and requiring only addition of tuning capacitor, coils and controls (not included) to make a complete AM/CW/SSB superhet RX for up to 30 MHz. Headphone output. Runs off 6v to 15v. PP9 suitable. Contains RCA IC (equiv. 14 transistors) plus BFO, FET local osc. and 2 double-tuned IFT's at 465 kHz. Full instructions and colour coded leads make connexion simple, even for beginners—£7·85 post paid.
Provides good stable reception of DX on CW/SSB or can be used with HF or VHF converters as double superhet. Suitable add-on RF and Audio Amp modules also available from £2. SAE details.

P. R. GOLLEDGE G3EDW
Glen Tor, Torrington, Devon.
Tel: 08-052 2411

VISIT AUTO TRACTION. Thousands of bargains in surplus radio equipment. Meters, motors, relays, TR/TX, telephone equipment, aircraft equipment. SAE enquiries. 27A, Arragon Road, Twickenham, Middx. 892 9489.

TAPE HEADS

For valve and transistorized recorders from £2 ea.

Send stamp for lists.
R.D.I. Ltd.
Chilton Works,
Garden Rd.,
Richmond,
Surrey,
TW9 4NS

Miscellaneous

Darned Electronic Wizardry
by Dewtron

Famous kits, e.g. waa-waa complete kit £2·95; Fuzz kit £4·75, auto rhythm modules P & P 20p min. Ring Modulator modules £8 and whole range of synthesiser modules, musical novelties, etc. Catalogue 15p from D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset.

ONE CHIP CALCULATOR
MOS INTEGRATED CIRCUIT

- Add, subtract, multiply, divide
- 12-digit display
- Fixed decimal point at 0, 2, 3 or 4
- Automatic lockout of "unsure" repeat operation
- True credit balance sign display
- Automatic overflow indication
- Leading zero suppression
- Data Sheet 50p (refund on purchase)

£12·50
p & p inc.

O'Driscoll, 68 Hammer Hill, Haslemere, Surrey, GU27 3QZ
Tel: 0428-2058

GLASS FIBRE P.C. BOARD. Large supplies available $\frac{1}{16}$in single sided one ounce copper 2p per 3 sq. inches (under 1 foot). 75p per sq. ft. (over 1 foot). $\frac{1}{16}$in double sided one ounce copper 1p per sq. inch (under 1 ft.), £1 per sq. ft. (over 1 foot). Please add 10p per sq. foot postage and packing. We can cut to your size at 1p per cut. Solid State Lighting, The Firs, Smallworth Lane, Garboldisham, Diss, Norfolk.

HARDWARE—Screws, nuts, washers and other useful items in small quantities. Sheet aluminium to individual requirements, punched/drilled. Send 6p for list. Ramar Constructor Services, 29 Shelbourne Rd. Stratford-on-Avon, Warwks.

MANUFACTURER'S SURPLUS, RECORD PLAYER Cabinets with motor board £3·00. Radio Cabinets make ideal speaker cabinets 13in x 7in x 5in 50p, AM/FM gang condensers with S/M drive 25p. UHF/IF Transformers, set including sound discriminator, 75p with data. F/M Tuner with valve £1·50. All items new includes P & P. ARCHER, 9 Pine Grove, Maidstone, Kent.

BUILD IT in a **DEWBOX** quality cabinet. 2in x 2½in x any length. D.E.W. Ltd., Ringwood Road, FERNDOWN, Dorset. S.A.E. for leaflet. Write now—Right now.

EXPERIMENTERS! Hundreds of unusual items cheap. 1973 catalogue 5p. Grimsby Electronics, 64 Tennyson Road, Cleethorpes, Lincs. (Mail Order Only).

"AT LAST YOU CAN TRANSMIT AND FORGET ABOUT LICENCE EXAMINATIONS"

because this Ministry approved transmitter/receiver kit does not use R.F. Your transmissions will be virtually SECRET since they won't be heard by conventional means. Actually it's TWO KITS IN ONE because you get the printed-circuit boards and components for both the transmitter AND receiver. You're going to find this project REALLY FUN-TO-BUILD with the EASY-TO-FOLLOW instructions. An extremely flexible design with quite an AMAZING RANGE—has obvious applications for SCHOOL PROJECTS, LANGUAGE LABORATORIES, SCOUT CAMPS, etc.

GET YOURS! SEND £5·80 (inc. VAT) NOW
'(S.A.E. for details)' 'MAIL ORDER ONLY'

TO: **'BOFFIN PROJECTS'**
DEPT. KW2010
4 CUNLIFFE ROAD
STONELEIGH, EWELL, SURREY

ALUMINIUM SHEET to individual sizes or in standard packs, 3p stamp for details. Ramar Constructor Services, 29 Shelbourne Road, Stratford on Avon, Warwicks.

BEDFORD ELECTRONICS

2 Grove Place, Bedford
Bedford 51961
YOUR LOCAL COMPONENTS SUPPLIER
Free catalogue on request

ENGRAVING. Give your Fascia Panels that professional look. Have the letters machine engraved. 3p per letter, minimum order 50p. Plus P & P. Colourstones, 9 Broadway Close, Harwell, Berkshire.

CONSTRUCTION AIDS—Screws, nuts, spacers etc., in small quantities. Aluminium panels punched to spec. or plain sheet supplied. Fascia panels etched aluminium to individual requirements. Printed circuit boards—masters, negatives and boards, one-off or small numbers. Send 6p for list. Ramar Constructor Services, 29 Shelbourne Rd., Stratford on Avon, Warwks.

Ladders

LADDERS. 20ft, £7·80; 24½ft £9·80. Carr. 80p. Leaflet. (Dept. WLS) Home Sales Ladder Centre, Baldwin Road, Stourport, Worcs. Tel. 029-93 5222.

AERIAL BOOSTERS—£3·25

We make three types of Aerial Boosters: B45-UHF 625, B12-VHF 405, B11-VHF RADIO

VALVE BARGAINS

ANY 5—50p, 10—75p, 50—£3·30:—
ECC82, ECL80, EB91, EBF89, EF80, EF85, EF183, EF184, EY86, PCC84, PCC89, PCC189, PC97, PCF80, PCF86, PCF805, PCF808. PCL82, PCL83, PCL84, PCL85, PFL200. PL36, PL81, PL504, PY33, PY82, PY800, PY801, 30L15.

19" UHF/VHF (BBC2) £8·00

Thorn-850 or Pye, with set of spare valves. Carriage £2·00 (Untested).

100 MIXED RESISTORS—65p

¼ to 2 watt—10 ohms to above 1m-ohms (our choice) **100 mixed Capacitors up to 500MFD—£1·10** (our choice).

BARGAINS PARTS

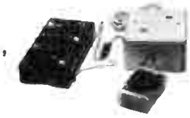
Transistor **UHF Tuners—£2·00, 500K-ohms V/C** with Switch—20p. **50 mixed Tuner Valves—£2·25. Brand New Transistors** BF115, BF173, BC171, BC153, BC135, BC113, BC117, BC115, BA102, BA129. **All 10p each.**

All prices include V.A.T. p. & p. 10p per order
Money back guarantee. S.A.E. for leaflets.

ELECTRONIC MAILORDER (BURY) LTD.
62 Bridge St., Ramsbottom, Bury, Lancs. Tel. Rams 3036

The BATTERIES That Won't Let You Down! RECHARGEABLE

Mallory Cells in U2, U11 and Penlite U7 sizes, Kestrel Battery Charging Unit



Uses :
Tape recorders, Portable radio and TV, Radio controlled model aircraft and boats, Cine cameras, Flashguns, Cordless shavers and other battery appliances.

Whenever you *must* have utterly dependable battery power—then these new Alkaline-Manganese rechargeable cells will provide it. The cells can be recharged many times, a simple job with the Kestrel Charging Unit which has been specially designed for these new type batteries.

PRICES
Batteries U2 equiv. £1·38
Penlite U7 equiv. 50p
U11 equiv. £1·03
Charging unit £3·99 with one battery holder

KESTREL
Bush & Meissner

Send to:
275 WEST END LANE
LONDON, N.W.6
01-794 9611

TRANSFORMERS

DOUGLAS GUARANTEED
12 or 24 volts
Add 10% V.A.T.

Output V.	& Amps.	Ref. No.	Price	P. & P.
12V × 2	250 mA × 2	MT111 CS*†	£0·91	9p
12V × 2	500 mA × 2	MT213 CT*†	£1·12	16p
12V × 2	1A × 2	MT 71 AT‡	£1·48	24p
12V × 2	2A × 2	MT 18 AT	£2·06	30p
12V × 2	3A × 2	MT 70 AT	£2·59	32p
12V × 2	4A × 2	MT 108 AT	£2·92	34p
12V × 2	5A × 2	MT 72 AT	£3·33	42p

30 volts. All tapped at 0-12-15-20-24-30V

Output Amps.	Ref. No.	Price £	P.P.	Output Amps.	Ref. No.	Price £	P.P
500 mA	MT 112 CT‡	1·12	16p	3A	MT 20 AT	2·64	32p
1A	MT 79 AT‡	1·55	29p	4A	MT 21 AT	3·10	40p
2A	MT 3 AT	2·23	30p	5A	MT 51 AT	4·31	42p

50 volts. All tapped at 0-19-25-33-40-50V.

Output Amps.	Ref. No.	Price £	P.P.	Output Amps.	Ref. No.	Price £	P.P
500 mA	MT 102 AT‡	1·45	24p	3A	MT 105 AT	3·91	41p
1A	MT 103 AT	2·00	32p	4A	MT 106 AT	5·06	41p
2A	MT 104 AT	3·10	32p	6A	MT 107 AT	7·47	50p

60 Volts. All tapped at 0-24-30-40-48-60V.

Output Amps.	Ref. No.	Price £	P.P.	Output Amps.	Ref. No.	Price £	P.P
500 mA	MT 124 AT‡	1·46	30p	2A	MT 127 AT	3·16	41p
1A	MT 126 AT	2·24	32p	3A	MT 125 AT	4·59	41p

AUTO-WOUND RANGE

Power output	Winding tapped at	Ref. No.	Price	P. & P.
20 VA	0-115-210-240	MT 113 CT	£0·89	16p
75 VA	,, ,,	MT 64 AT	£1·72	30p
150 VA	0-115-200-220-240	MT 4 AT	£2·15	32p
200 VA	,, ,,	MT 65 AT	£3·00	32p

	Price	P. & P.
400 V. Output at 50 HZ. Ref. IT3 AT C-D Ignition system by R. M. Marston Esq.	£2·30	29p

EQUIPMENT RANGE

Sec. Output (r.m.s.)		Ref. No.	Price	P. & P.
3-0-3 V.	200 mA	MT 238 CS*†	£0·89	8p
9-0-9 V.	100 mA	MT 13 CS*†	£0·91	8p
12-0-12	50 mA	MT 239 CS*†	£0·91	8p
20-0-20	30 mA	MT 241 CS*†	£0·91	8p
0-20 × 2	300 × 2	MT 214 CT*‡	£1·21	16p
0-8-9 × 2	500 mA × 2	MT 207 CT*‡	£1·46	19p
0-15-20 × 2	500 mA × 2	MT 205 AT*‡	£2·12	29p
0-15-27 × 2	500 mA × 2	MT 203 AT*	£2·45	29p
0-15-27 × 2	1A × 2	MT 204 AT*	£3·42	30p
10-12-0-12-20	700 mA (d.c.)	MT 221 AT*	£1·11	26p

AT indicates open universal fixing with tags; CT is open U-clamp fixing with tags; CS is open U-clamp fixing with P.C. spills; *with interwinding screen; † untapped 240V Primary; ‡ Primary tapped at 210-240V. other Primaries tapped at 200-220-240V.
Over 200 types in stock through agents or direct. Send for lists.

DOUGLAS ELECTRONICS INDUSTRIES LTD.
(Dept. MO.18PW), Thames St., LOUTH, Lincs. LN11 7AD

G. F. MILWARD 369 Alum Rock Road, Birmingham B8 3DR. Tel. 021-327 2339

SPECIAL OFFER ! ! !

SMALL ELECTROLYTICS

Ref. No.	Capacity	Voltage	Price	Ref. No.	Capacity	Voltage	Price
H8/1	1µf	150v	4p	H7/4A	64µf	35v	5p
H8/1A	2µf	150v	2p	H7/5	80µf	16v	4p
H8/2	2·2µf	25v	4p	H7/6	100µf	25v	5p
H8/2A	3·3µf	25v	4p	H7/6A	100µf	15v	4p
H8/3	3µf	50v	4p	H7/7	100µf	25v	4p
H8/3A	4µf	50v	4p	H7/8	125µf	16v	5p
H8/4	4·7µf	25v	4p	H7/8A	100µf	35v	6p
H8/4A	5µf	64v	4p	H7/9	100µf	63v	6p
H8/5	5µf	10v	4p	H7/9A	125µf	4v	4p
H8/5A	5µf	150v	4p	H7/10	125µf	25v	6p
H8/6A	10µf	10v	4p	H7/10A	160µf	2·5v	3p
H8/7	10µf	70v	4p	H7/11	160µf	25v	6p
H8/8	16µf	35v	4p	H7/11A	150µf	16v	5p
H8/8A	16µf	16v	4p	H7/13A	200µf	25v	8p
H8/9	20µf	6v	2p	H7/14	220µf	50v	10p
H8/9A	20µf	70v	4p	H7/14A	220µf	16v	6p
H8/10	22µf	50v	4p	H7/15	220µf	25v	5p
H8/10A	22µf	100v	4p	H7/15A	220µf	35v	10p
H8/11	25µf	12v	4p	H6/1A	250µf	4v	3p
H8/11A	24µf	275v	4p	H6/2	250µf	25v	3p
H8/12	32µf	15v	4p	H6/3A	320µf	2·5v	3p
H8/12A	30µf	10v	4p	H6/4	320µf	10v	4p
H8/13A	32µf	50v	4p	H6/4A	330µf	16v	5p
H8/14	40µf	25v	5p	H6/5	330µf	25v	10p
H8/14A	40µf	16v	4p	H6/5A	330µf	35v	15p
H8/15	47µf	50v	4p	H6/7	400µf	15v	5p
H8/15A	40µf	35v	4p	H6/8	470µf	25v	10p
H7/1	50µf	6v	3p	H6/8A	470µf	35v	20p
H7/1A	50µf	10v	4p	H6/9	500µf	15v	4p
H7/2	50µf	50v	4p	H6/9A	400µf	40v	20p
H7/2A	64µf	2·5v	2p	H6/10	750µf	12v	5p
H7/3A	64µf	25v	4p	H6/13A	1000µf	25v	16p
H7/4	64µf	15v	4p	H5/2A	2200µf	16v	15p

POSTAGE: 15p PER ORDER

ALL GOODS PLUS 10% V.A.T.

MULLARD ELECTROLYTIC CAPACITORS

071 and 072 Series

Type No.	Working Voltage Vdc.	Capacitance µF	Max. Ripple Current at 50°C	Weight	Price
071 15332	16	3300	2·4 amps	1oz	15p
071 15472	16	4700	3·9 amps	1oz	17p
071 15682	16	6800	5·8 amps	1½oz	22p
071 15103	16	10000	7·9 amps	2½oz	27p
071 18222	63	2200	5·8 amps	3oz	30p
072 15752	16	7500 + 7500	10·5 amps	3oz	37p
072 15113	16	11000 + 11000	13·8 amps	4½oz	49p
071 16222	25	2200	2·2 amps	1oz	15p
071 16472	25	4700	5·4 amps	1½oz	22p
072 16502	25	5000 + 5000	9·6 amps	3½oz	37p
072 16752	25	7500 + 7500	12·6 amps	4½oz	49p
072 17342	40	3400 + 3400	9·1 amps	3½oz	37p
072 17502	40	5000 + 5000	12·0 amps	4½oz	49p
071 18681	63	680	2·1 amps	1oz	15p
072 18172	63	1650 + 1650	7·8 amps	3oz	37p

106 and 107 Series

Type No.	Working Voltage Vdc.	Capacitance µF	Max. Ripple Current at 50°C	Weight	Price
106 15103	16	10000	7 amps	2½oz	65p
106 16223	25	22000	17 amps	10oz	£1·12
106 17103	40	10000	12 amps	7½oz	94p
106 18153	63	15000	28 amps	18oz	£1·79
107 10222	100	2200	10 amps	5½oz	74p

Type No.	Voltage	Capacitance	Weight	Price
102 15163	16	16000	8oz	20p
104 90003	20	39000	16oz	30p
102 16802	25	8000	7oz	25p
104 17562	40	5600	5oz	25p
104 90001	45	20000	16oz	50p
104 18332	63	3300	5oz	25p

A further 10% discount on lots of 100 of any one type.

Please calculate the weight of your order and include appropriate postage.

Not over	Ordinary Parcels	Not over	Ordinary Parcels
1½lb	16p	10lb	37p
2lb	21p	14lb	47p
4lb	25p	18lb	57p
6lb	29p	22lb	67p

£1 100 ¼-½ WATT RESISTORS 100 CERAMIC CAPACITORS 100 DIODES — POSTAGE 15p — PACK No. 1

£1 1 VERO-BOARD CUTTER 5 2½ in. x 1 in. x ·15 BOARDS 50 SQ. INS. "ODD PIECES" VERO — POSTAGE 15p — PACK No. 3

£1 20 ASSORTED UNUSED MARKED, TESTED TRANSISTORS BC108 ETC. — POSTAGE 15p — PACK No. 5

£1 6 COMPUTER PANELS CONTAINING MASSES OF DIODES, TRANSISTORS, INDUCTORS, RESISTORS & CAPACITORS — POSTAGE 25p — PACK No. 7

£1 100 RESISTORS 100 CERAMIC CAPACITORS 100 POLYSTYRENE CAPACITORS — POSTAGE 15p — PACK No. 2

£1 100 RESISTORS 100 CERAMIC CAPACITORS 50 MULLARD POLYESTER CAPACITORS — POSTAGE 15p — PACK No. 4

£1 1 TRANSISTORISED SIGNAL TRACER KIT 1 TRANSISTORISED SIGNAL INJECTOR KIT — POSTAGE 15p — PACK No. 6

£1 100 RESISTORS 100 CAPACITORS (ASSORTED TYPES) — POSTAGE 15p — PACK No. 8

INDEX TO ADVERTISERS

Head Office and Warehouse
44A WESTBOURNE GROVE
LONDON W2 5SF
Tel: 727 5641/2/3

Z & I AERO SERVICES LTD.

Please send all correspondence and Mail-Orders to Head Office
When sending cash with order, please include 12½np in £ for postage and handling
MINIMUM CHARGE 15np. No C.O.D. orders accepted
Please note that the valves offered below are not necessarily of U.K. origin

Retail Shop
85 TOTTENHAM COURT ROAD
LONDON W1
Tel: 580 8403
Open all day Saturday

First Quality Fully Guaranteed

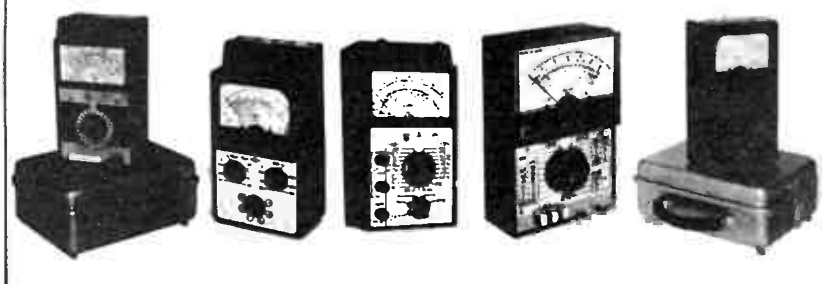
ZAERIX BRAND

ELECTRONIC VALVES

OA2	0.40
OA3	0.48
OB2	0.40
OB3	0.70
OC3	0.40
OD3	0.40
1B3GT	0.45
1L4	0.25
1R4	0.50
1R5	0.45
1S4	0.80
1S5	0.30
1T4	0.30
1U4	0.40
1U5	0.75
1V2	0.55
1X2B	0.55
2D21	0.40
3A4	0.45
3A5	0.75
3BP1	3.50
3S4	0.40
3V4	0.65
5R4GY	0.75
5U4G	0.40
5V4G	0.50
5Y3GT	0.45
5Z3	0.75
5Z4G	0.45
6/30L2	0.90
6AB4	0.45
6AF4A	0.60
6AG5	0.25
6AG7	0.45
6AH6	0.60
6AJ8	0.30
6AK5	0.40
6AK6	0.60
6AL3	0.43
6AL5	0.22
6AM5	0.40
6AM6	0.37
6AQ5	0.42
6AQ6	0.70
6AR5	0.55
6AR6	0.65
6AR11	1.25
6AS5	0.50
6AS7G	0.85
6AT6	0.38
6AU6	0.30
6AV6	0.40
6AW8A	0.65
6BA6	0.28
6BE6	0.32
6BF6	0.55
6BH6	0.75
6BJ6	0.55
6BK7A	0.75
6BN5	0.43
6BN6	0.60
6BQ5	0.25
6BR8	0.75
6BS7	1.35
6BW6	0.90
6BW7	0.90
6BX6	0.25
6BZ6	0.45
6C4	0.35
6C5GT	0.55
6CB6	0.40
6CD6GA	1.30
6CG7	0.60
6CH6	0.60
6CL6	0.60
6CU6	0.80
6CW4	0.70
6CY5	0.50
6CY7	0.75
6D3	0.55
6DC6	0.80
6DK6	0.60
6DQ6B	0.75
6DS4	1.25
6EA8	0.65
6EH7	0.30
6EJ7	0.35
6EW6	0.70
6F1	0.75
6F5	0.75
6F6G	0.45
6F11	0.50
6F13	0.50
6F14	0.70
6F15	0.65
6F18	0.50
6F23	0.90
6F24	0.80
6F25	1.00
6F26	0.35
6F28	0.70
6GK6	0.60
6J4	0.60
6J5GT	0.40
6J6	0.30
6J7	0.45
6K4П	0.60
6K6GT	0.75
6K7	0.43
6K8G	0.45
6K25	0.75
6L6GT	0.55
6L7	0.45
6L18	0.50
6LD20	0.50
6N7GT	0.55
6P28	0.65
6Q7	0.50
6SA7	0.45
6SG7	0.45
6SK7	0.50
6SL7GT	0.45
6SN7GT	0.45
6SQ7	0.50
6SR7	0.50
6T8	0.38
6U4GT	0.70
6U5G	0.75
6U8A	0.48
6V6GT	0.45
6X4	0.40
6X5GT	0.45
6X8	0.65
6Y6G	0.80
7Y4	0.75
9BW6	0.70
10C2	0.60
10D1	0.65
10D2	0.55
10F1	0.75
10F9	0.65
10F18	0.60
10L1	0.60
10LD11	0.70
10P13	0.75
12AB5	0.70
12AC6	0.60
12AE6	0.60
12AL5	0.55
12AQ5	0.50
12AT6	0.40
12AT7	0.40
12AU6	0.45
12AU7	0.33
12AV6	0.45
12AV7	0.70
12AX7	0.33
12AY7	0.75
12B4A	0.65
12BA6	0.45
12BA7	0.50
12BE6	0.50
12BH7	0.50
12BY7	0.65
12K5	1.00
12K7GT	0.50
12Q7GT	0.45
12SR7	0.50
20D1	0.60
20L1	1.10
20P1	0.50
20P4	1.10
20P5	1.20
25C5	0.60
25L6GT	0.50
25Z4G	0.35
25Z6GT	0.75
30A5	0.60
30AE3	0.40
30C1	0.30
30C15	1.00
30C17	1.10
30C18	0.90
30F5	1.00
30FL1	0.80
30FL12	1.10
30FL14	0.90
30L1	0.40
30L15	0.95
30L17	0.95
30P12	1.00
30P19	0.95
30PL1	0.95
30PL13	1.10
30PL14	1.25
35A3	0.60
35A5	0.75
35B5	0.65
35C5	0.60
35D5	0.75
35L6GT	0.75
35W4	0.40
35Z3	0.75
35Z4G	0.40
35Z5GT	0.70
50A5	0.80
50B5	0.70
50C5	0.60
50CD6G	1.20
50EH5	0.65
50L6GT	0.60
85A2	0.55
90AG	2.40
90AV	2.50
90C1	0.75
90CV	2.40
807	0.50
813	4.00
866A	0.85
5642	0.70
6080	1.75
6146	1.60
6146B	2.50
6360	1.25
6939	2.25
7199	0.85
7586	1.50
7895	1.50
A2295	2.20
AZ1	0.60
AZ31	0.55
CBL1	0.90
CBL31	1.00
CY1	0.50
CY31	0.50
DAF96	0.50
DF96	0.50
DK92	0.70
DK96	0.60
DL96	0.55
DM70	0.60
DM160	0.68
DY51	0.55
DY86	0.35
DY87	0.36
DY802	0.37
E80F	1.10
E88CC	0.70
E180F	1.00
E810F	2.90
EABC80	0.38
EAF42	0.60
EBC33	0.60
EBC41	0.65
EBC81	0.33
EBF80	0.40
EBF83	0.40
EBF89	0.32
EBL31	1.50
EC53	0.50
EC86	0.60
EC88	0.60
EC90	0.35
EC92	0.45
EC93	0.60
ECC35	1.00
ECC40	0.70
ECC81	0.40
ECC82	0.33
ECC83	0.33
ECC84	0.30
ECC88	0.40
ECC89	0.50
ECC91	0.30
ECC189	0.65
ECC807	1.00
ECF80	0.35
ECF82	0.35
ECF804	1.65
ECH42	0.75
ECH81	0.30
ECH83	0.45
ECH84	0.45
ECL80	0.50
ECL81	0.50
ECL82	0.35
ECL83	0.70
ECL84	0.55
ECL85	0.55
ECL86	0.40
EF37A	1.00
EF40	0.50
EF41	0.65
EF42	0.70
EF80	0.30
EF85	0.35
EF86	0.30
EF89	0.28
EF91	0.37
EF92	0.35
EF95	0.40
EF97	0.65
EF98	0.75
EF183	0.30
EF184	0.35
EF804	1.25
EK90	0.35
EL34	0.50
EL36	0.50
EL37	1.70
EL41	0.75
EL81	0.55
EL83	0.50
EL84	0.25
EL85	0.43
EL86	0.40
EL90	0.42
EL360	1.15
EL821	0.60
EL822	1.40
ELL80	0.75
EM34	1.00
EM71	0.80
EM80	0.45
EM81	0.60
EM83	0.50
EM84	0.35
EM85	1.00
EM87	0.70
EN91	0.40
EY51	0.40
EY80	0.75
EY81	0.40
EY83	0.55
EY86	0.40
EY87	0.43
EY88	0.43
EZ40	0.50
EZ41	0.75
EZ80	0.28
EZ81	0.29
GT1C	3.00
GY501	0.70
GZ30	0.45
GZ31	0.40
GZ32	0.50
GZ33	0.75
GZ34	0.60
HABC80	0.55
HK90	0.50
KT66	2.35
KT88	2.25
N78	1.60
PABC80	0.40
PC86	0.60
PC88	0.60
PC92	0.05
PC97	0.50
PC900	0.48
PCC84	0.40
PCC85	0.40
PCC88	0.55
PCC89	0.55
PCC189	0.60
PCC805	0.95
PCC806	0.95
PCF80	0.30
PCF82	0.35
PCF84	0.60
PCF86	0.60
PCF87	1.10
PCF801	0.50
PCF802	0.50
PCF805	0.90
PCF806	0.75
PCF808	0.90
PCH200	0.70
PCL81	0.50
PCL82	0.35
PCL83	0.65
PCL84	0.45
PCL86	0.45
PCL88	1.25
PCL200	0.75
PCL800	1.10
PCL801	0.95
PCL805	0.50
PD500	1.30
PF86	0.70
PF818	1.00
PFL200	0.65
PL33	0.40
PL36	0.55
PL81	0.50
PL82	0.45
PL83	0.45
PL84	0.40
PL302	0.95
PL504	0.75
PL508	0.90
PL509	1.10
PL801	1.00
PL802	0.95
PM84	0.60
PY31	0.35
PY33	0.63
PY80	0.40
PY81	0.30
PY82	0.35
PY83	0.38
PY88	0.40
PY800	0.47
PY801	0.50
PZ30	0.38
QQV02-6	2.25
QQV03-10	1.25
QQV03-20A	5.25
TT21	3.40
TT22	3.50
U18/20	0.75
U25	0.85
U26	0.85
U31	0.70
U37	6.50
U52	0.40
U76	0.40
U78	0.40
U191	0.75
U201	0.50
U281	0.55
U282	0.55
U301	0.55
U403	0.70
U404	0.70
U801	0.80
UABC80	0.40
UAF41	0.70
UAF42	0.60
UB41	0.65
UBC41	0.55
UBC81	0.45
UBF80	0.40
UBF89	0.40
UBL1	0.70
UBL21	0.70
UC92	0.45
UCC85	0.45
UCF80	0.70
UCH21	0.60
UCH42	0.70
UCH81	0.40
UCL81	0.60
UCL82	0.35
UCL83	0.65
UF9	0.65
UF11	0.60
UF41	0.65
UF42	0.65
UF43	0.65
UF80	0.35
UF85	0.40
UF89	0.40
UL41	0.65
UL84	0.43
UM84	0.30
UY1N	0.50
UY11	1.00
UY41	0.48
UY82	0.50
UY85	0.40
W729	0.75
Y63	0.75
Z759	3.00
Z803U	1.35

TRANSISTORS

2N696	0.15
2N697	0.15
2N698	0.80
2N705	0.70
2N706	0.10
2N708	0.15
2N753	0.25
2N929	0.20
2N930	0.20
2N997	0.80
2N1131	0.25
2N1132	0.25
2N1184	1.25
2N1302	0.17
2N1303	0.17
2N1304	0.20
2N1305	0.20
2N1306	0.25
2N1307	0.25
2N1308	0.25
2N1309	0.25
2N1613	0.17
2N1711	0.20
2N1756	0.75
2N2147	0.75
2N2160	0.60
2N2217	0.25
2N2218	0.20
2N2219	0.20
2N2369A	0.15
2N2477	0.65
2N2646	0.40
2N2905	0.25
2N2923	0.12
2N2924	0.13
2N2926	0.10
2N3053	0.20
2N3054	0.50
2N3055	0.60
2N3133	0.25
2N3134	0.25
2N3391	0.17
2N3392	0.17
2N3393	0.15
2N3394	0.15
2N3395	0.20
2N3402	0.15
2N3403	0.15
2N3404	0.32
2N3414	0.20
2N3415	0.15
2N3417	0.25
2N3702	0.10
2N3703	0.10
2N3704	0.12
2N3707	0.12
2N3709	0.10
2N3710	0.10
2N3819	0.35
2N3906	0.25
28702	0.50
28746	0.25
AC113	0.15
AC125	0.80
AC126	0.20
AC127	0.17
AC128	0.15
AC132	0.35
AC153	0.20
AC154	0.15
AC157	0.17
AC169	0.10
AC176	0.17
AC187	0.25
AC188	0.25
ACY17	0.25
ACY18	0.20
ACY19	0.25
ACY20	0.20
ACY21	0.20
ACY22	0.10
AD140	0.50
AD149	0.45
AD161	0.35
AD162	0.35
ADZ11	1.25
ADZ12	1.25
AF114	0.17
AF115	0.17
AF116	0.17
AF117	0.17
AF118	0.30
AF125	0.20
AF127	0.20
AF180	0.35
AF181	0.35
AF186	0.40
AF239	0.36
AFZ11	0.45
AFZ12	1.00
ASY26	0.25
ASY27	0.30
ASY28	0.25
ASY29	0.30
ASY54	0.25
ASZ15	0.70
ASZ16	0.70
ASZ17	0.75
ASZ18	0.75
ASZ20	0.25
ASZ21	0.40
AUY10	1.00
BC107	0.10
BC108	0.10
BC109	0.10
BC113	0.10
BC118	0.20
BC134	0.20
BC147	0.10
BC148	0.10
BC149	0.12
BC152	0.15
BC158	0.15
BC175	0.20
BC186	0.25
BCY30	0.25
BCY31	0.30
BCY33	0.25
BCY34	0.30
BCY72	0.15
BCZ10	0.30
BCZ11	0.40
BD121	0.65
BD123	0.80
BD124	0.60
BD131	0.75
BD132	0.80
BF115	0.20
BF167	0.18
BF173	0.20
BF179	0.30
BF180	0.30
BF181	0.30
BF184	0.20
BF185	0.20
BF194	0.14
BF195	0.14
BF196	0.12
BF197	0.12
BF200	0.35
BFW87	0.25
BFW88	0.20
BFW89	0.20
BFW91	0.20
BFX88	0.20
BFY17	0.40
BFY19	0.25
BFY50	0.20
BFY51	0.20
BFY52	0.20
BSY26	0.17
BSY27	0.15
BSY28	0.17
BSY65	0.20
BSY95A	0.12
OC16	0.50
OC22	0.50
OC23	0.60
OC24	0.60
OC25	0.35
OC26	0.25
OC29	0.60
OC35	0.50
OC36	0.45
OC42	0.20
OC44	0.15
OC45	0.12
OC70	0.10
OC71	0.12
OC72	0.12
OC73	0.30
OC75	0.15
OC76	0.15
OC78	0.25
OC78D	0.20
OC81	0.20
OC81D	0.20
OC83	0.20
OC139	0.30
OC140	0.35
OC141	0.60
OC170	0.25
OC171	0.25
OC200	0.30
OC201	0.60
OC202	0.65
OC203	0.40
OC204	0.40



MULTIMETERS MADE IN USSR
Prices of these exceptionally well made instruments range from £4·95 to £10·50. Please write for illustrated catalogue.

SYNCHROSCOPE TYPE C1-5

Made in USSR

3-in tube fitted with telescopic viewing hood, giving bright display in full daylight. Sensitivity 10mV/mm (narrow band) to 30mV/mm (wide band).
Bandwidth 10 c/s—10 mc/s. Triggered sweep pre-set at 1-2-5-10-30-100-300-1000-3000 μsec per stroke.
Free-running time base 20 c/s to 200kc/s with built-in crystal calibrator providing timing marks at ·05-.2-1·5-20-100 μ sec.
Amptitude calibrator directly calibrated in volts.
Input attenuator 1-10-100.
Power supplies 127/230v AC.
PRICE £39·00. Packing and carriage £1·50.

Series BZX61 1-watt ZENER Diodes
Available in: 7·5-8·2-11-15-16-24-27-30-33-36-62-68 volts. £0·20 each.

VARIABLE AUTOTRANSFORMERS LATR2M

Made in USSR
Max. current 2 amps
Input voltage 115-220-250V
Output voltage 0 to 255V
Bench mounting

PRICE £6·55

VALUE ADDED TAX

THE ABOVE PRICES DO NOT INCLUDE V.A.T. WHEN REMITTING CASH WITH ORDERS PLEASE ADD 10% OF THE VALUE OF GOODS. AS SOME OF THE ITEMS STILL CONTAIN THE PROPORTION OF PURCHASE TAX, RESPECTIVE AMOUNT WILL BE REFUNDED.

Published approximately on the 7th of each month by IPC Magazines Limited, Fleetway House, Farringdon Street, London, E.C.4. Tel: 01-634 4444. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon and Gotch (A/sia) Ltd.; South Africa—Central News Agency Ltd.; Rhodesia and Zambia—Kingston Ltd.; East Africa—Stationery and Office Supplies Ltd. Subscription rate (including postage): For one year to any part of the world £2·65.
PRACTICAL WIRELESS is sold subject to the following conditions, namely, that it shall not, without the written consent of the Publishers first given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, and that it shall not be lent, resold or hired out or otherwise disposed of in a mutilated condition or any unauthorised cover by way of Trade, or affixed to as part of any publication or advertising, literary or pictorial matter whatsoever.

Henry's

YOUR COMPLETE AUDIO-ELECTRONIC STORES

More of everything at the right price. All your electronic requirements within 200 yards – call and see for yourself.

BUILD THE TEXAN

20 + 20 WATT INTEGRATED I.C. STEREO AMPLIFIER

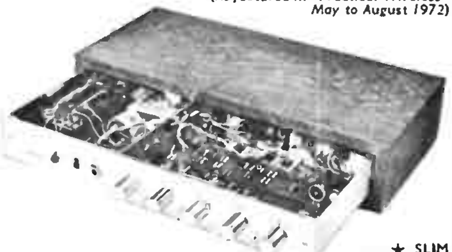
(As featured in "Practical Wireless" May to August 1972)

★ FREE TEAK CABINET with complete kits!

FEATURES. New slim design with 6 - IC's, IC Sockets, 10 silicon transistors, 4 rectifiers, 2 zeners. Special Gardeners low field slim line transformer. Fibre glass PC panel. Complete chassis work.

HIGH QUALITY & STABILITY ARE PREDOMINATE FEATURES —DEVELOPED BY TEXAS ENGINEERS FOR PERFORMANCE, RELIABILITY AND EASE OF CONSTRUCTION.

FACILITIES. On/off switch indicator, headphone socket, separate treble, bass, volume and balance controls, scratch and rumble filters, mono/stereo switch, Input selector; Mag. P.U Radio Tuner, Aux. Can be altered for Mic., Tape, Tape-head, etc (Parts list Ref. 20 on request).
Constructional details Ref. No. 21 30p



★ SLIM DESIGN WITH SILVER TRIM

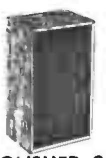
Overall chassis size $14\frac{1}{2}'' \times 6'' \times 2''$ high

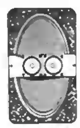
SPECIAL KIT PRICE **£28·50** P & P 45p

COMPLETE WITH FREE TEAK CABINET

Designer approved kits distributed by Henrys!

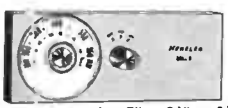
LOW COST HI-FI SPEAKERS





E.M.I. Size $13\frac{1}{2}'' \times 8\frac{1}{2}''$. Large Ceramic Magnet.
TYPE 150 6 watt. 3. 8 or 15 ohms £2·20. Post 22p.
TYPE 150 TC Twin cone version £2·75. Post 22p.
TYPE 450 10 watt with twin tweeters and crossover. 3, 8 or 15 ohms. £3·85. Post 25p.
TYPE 350 20 watt with tweeter and crossover. 8 and 15 ohms. £7·70: Post 28p.
POLISHED CABINETS 150, 150TC 450 £4·60. Post 30p.
ASSEMBLED IN POLISHED CABINETS (8 ohms)
SERIES 6 (Assembled 150 T/C) per pair £16·50. Post 70p
SERIES 8 (Assembled 450) per pair £18·95. Post 70p

ML-3 MW/LW TUNER to BUILD

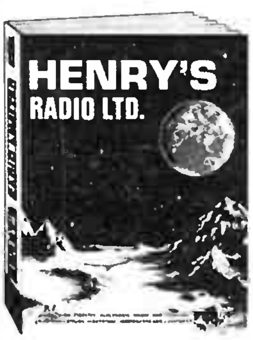


Uses Mullard Module. Slow motion tuning. Built in battery. Ferrite aerial. Overall size $7'' \times 2\frac{1}{4}'' \times 3\frac{1}{2}''$. TOTAL COST TO BUILD £4·85. Post 15p. All parts sold separately. Leaflet No. 6

"BANDSPREAD" PORTABLE TO BUILD

Printed circuit all transistor design using Mullard RF/IF Module. Medium and Long Wave bands plus Medium Wave Bandspread for extra selectivity. Also slow motion geared tuning, 600 mW push-pull output, fibre glass PVC covered cabinet, car aerial. Attractive appearance and performance.
TOTAL COST TO BUILD £7·98, p.p. 32p. (Battery 22p). All parts sold separately—Leaflet No. 2

CATALOGUE

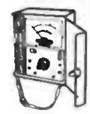


Fully detailed and illustrated covering every aspect of Electronics—plus data, circuits and information. 10,000 Stock lines at Special Low Prices and Fully Guaranteed.
PRICE **55p** Post Paid (40p FOR CALLERS)

PLUS! FIVE 10p VOUCHERS

Send to this address—HENRY'S RADIO LTD. (Dept. PW) 3 ALBEMARLE WAY, LONDON, E.C.1.—for catalogue by post only. All other mail and callers to "303" see above.

TEST EQUIPMENT Just a selection!

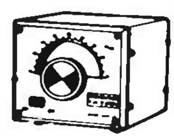


SE250B Pocket Pencil Signal Injector £1·90
SE500 Pocket Pencil Signal Tracer £1·50
THL33D Robust 2K/Volt £4·55 with case £4·95
TE15 Grid Dip Meter 440 KHz–280 mHz £13·45
500 30 K/V Multimeter £9·25 With leather case £10·50
200H 20K/V Multimeter £4·20. With case £4·95
AF105 50K/V Multimeter £8·50. With case £9·50
U4341 AC/DC Multimeter with transistor tester with steel case £10·50
TE20D RF Generator 120KHz–500MHz £15·95. Carr. 35p
TE22D Audio Generator 20Hz–200KHz £17·50. Carr. 35p
CI-5 3" Pulse Scope 10Hz–10mHz £39·00. Carr. 50p
TE65 Valve Voltmeter 28 ranges £17·50. Carr. 40p
ALL NOMBREX MODELS IN STOCK

PA-Disco-Lighting

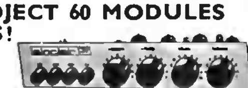
UK's Largest Range—Write phone or call in. Details and demonstrations on request.
DJ30L 3 Channel sound to light unit, 3KW. £29·50
DJ40L 3 channel Mic (built-in) to light., 3kW. £38·75
DJ70S 70 watt Disco amp/mixer. £49·75
DISCOAMP 100 watt amp/mixer, £68·85
DJ105S 30 watt Disco amp/mixer, £32·25
Anti-Feedback Quality Mic., £11·50
DJ500 50 watt PA Amplifier £43·95
DJ700 70 watt £52·75
GROUP 300 150 watt rms "Group" Valve Amplifier £86·00
FIBRE OPTICS LIGHTING. — MICS. EFFECTS. PROJECTORS. SPOTS. DIMMERS — STANDS. MIXERS. SPEAKERS.
Everything for PA — Disco — Lighting.
FREE Stock List Ref. No. 18
- PORTABLE DISCOS — DETAILS ON REQUEST
- CREDIT TERMS FOR CALLERS

BUILD THIS VHF FM TUNER



5 TRANSISTORS 300 kc/s BANDWIDTH, PRINTED CIRCUIT, HIGH FIDELITY REPRODUCTION. MONO AND STEREO
A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately. Free Leaflet No. 3 & 7.
TOTAL £6·97, p.p. 20p. Decoder Kit £5·97.
Tuning meter unit £1·75
Mains unit for Tuner and/or Decoder PS6/12 £3·25. Post 20p

SINCLAIR PROJECT 60 MODULES —SAVE POUNDS!



Z30 £3·57; Z50 £4·37
STEREO 60 £7·97; PZ5 £3·97
PZ6 £6·37; PZ8 £4·77
Transformer for PZ8 £2·95
Active Filter Unit £4·45
Stereo FM Tuner £16·95
IC12 £1·80; Q16's £15 pr.
Post etc. 20p per item

PACKAGE DEALS Post 25p
2xZ30, Stereo 60, PZ5 £15·95
2xZ30, Stereo 60, PZ6 £18·00
2xZ50, Stereo 60, PZ8 £20·25
Transformer for PZ8 £2·95
PROJECT 605 KIT £19·95

ELECTRONIC KITS

Henry's introduce new huge range of audio and electronic kits now in stock, everything supplied, tremendous value. Detailed list Ref. No. 14 on request.

IC RECEIVER

ZN414 Radio integrated circuit as featured in Practical Wireless, January 1973, Practical Electronics, February 1973. Price £1·20.

BATTERY TAPE DECK

Garrard 9 volt Tape Deck with heads, etc. As previously advertised. Limited quantity. £9·50, post 30p.

LEARN A LANGUAGE

Recorded Cassettes with step by step phrase books. French, German, Spanish Italian. £1·36 per course. £5·00 per set of four.

DISCO SPOTBANK

3 channel Disco Spotbank for use with any psychedelic lighting display. £12·75, p. & p. 35p.

HI-FI EQUIPMENT

Warehouse prices with BIG DISCOUNTS plus demonstrations (for callers) and GUARANTEES. FREE—24 page detailed brochure (Ref. No. 17). You can see the savings!

HIGH QUALITY CASSETTES

The best UK low noise tapes but at a special price. 'Living Sound' cassettes meet the highest international standard (IEC 94A). Fantastic price savings.

	RRP each	3 for	6 for	10 for
C60	70p	1·00	1·80	2·80
C90	97p	1·33	2·57	4·20
C120	1·47	1·62	3·15	5·00

Full guarantee. Post paid.

Made by EMI especially for Henry's. See earlier page of this magazine for transistors and semi-conductor devices.

ULTRASONIC TRANSDUCERS

Operate at 40kc/s up to 100 yds. Ideal remote switching and signalling. Complete with data and new I.C. circuits. £5·90 per pair. Post 10p.

MARRIOT TAPE HEADS 4 TRACK MONO or 2 TRACK STEREO

'17' High Impedance £2·00
'18' Med. Impedance £2·00
'36' Med.-Low Imp. £3·50
Erase Heads for above 75p
'63' 2 track mono—Hi Imp. £1·75
'43' Erase Head for above 75p

7 SEG & NIXIE TUBES

(Post 15p per 1 to 6)
XN3, XN13, GN6 0–9 side view with data, 85p.
GNP-7, GNP-8 0–9 side view with decimal points and data, 95p.
3015F 7 seg £2 each. £7 per 4 with data.
12 and 24 hour clock circuits Ref. No. 31 15p.

Miniature Amplifier

5 transistor. 300mW o/p. Fitted volume and sensitivity control, 9 volt operated. £1·75 each P/P 15p.

Quality Slider Controls

60mm stroke singles and ganged. Complete with knobs. 5K, 10K, 25K, 100K, 250K, 500K. 1 meg. Log and Lin. 40p each, 10K, 25K, 50K, 100K, 250K, Log and Lin ganged. 60p each.

VAT

Prices DO NOT include Value Added Tax. From 1st April, 1973 10% must be added and shown separately to your total order (inclusive Post/packing). Help us to help you receive your order without delay. E. & O.E.

Henry's RADIO LIMITED

EDGWARE ROAD, W2

404-406 Electronic Components and Equipment 01-402 8381
354-356 High Fidelity and Tape Equipment 01-402 5854/4736
309 PA-Disco-Lighting High Power Sound 01-723 6963
303 Special offers and bargains store
All mail to 303 Edgware Road, London W2 1BW

Open:- 9 am-6 pm 6 days a week (309 closed Thursday) All stores open all day Saturday