

PRACTICAL WIRELESS

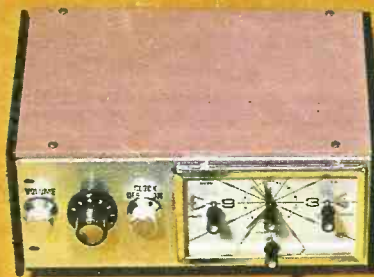
MAY
1973

20p

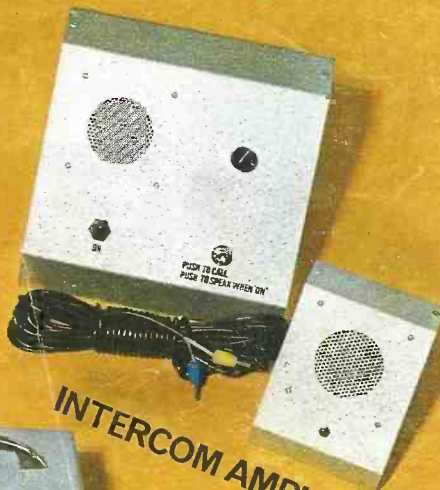
8 PAGE SUPPLEMENT

EXTRA INSIDE

SIMPLE PROJECTS FOR THE HOME



RADIO ALARM CLOCK



INTERCOM AMPLIFIER



BABY ALARM



TAPE TUNER



LAMP DIMMER



WATER LEVEL DETECTOR



LIGHT
POWERED
RADIO



TWO TONE DOOR BELL

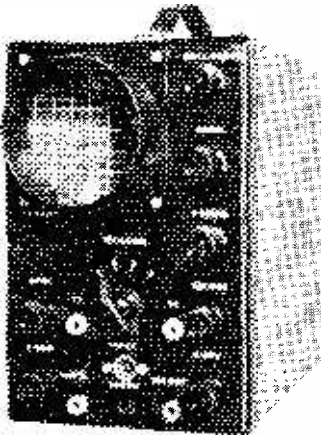
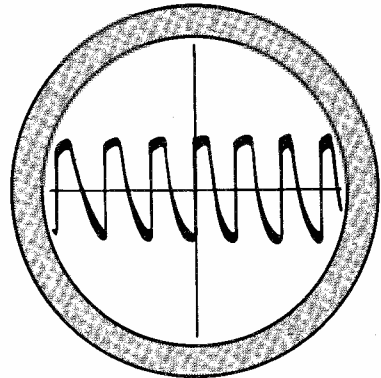
PLUS ALL THE REGULAR FEATURES

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electronics really mastered

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

no previous knowledge
no unnecessary theory
no "maths"



RAPY

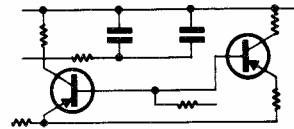
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step by step, we take you through all the fundamentals of electronics and show how easily the subject can be mastered. Write for the free brochure now which explains our system.

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PRACTICAL WIRELESS

VOL. 49 NO. 1

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

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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

22 SUPPORT SERVICE—Leader article and June preview

23 NEWS . . . NEWS . . . NEWS

37 PRACTICALLY WIRELESS—Light hearted view by Henry

42 TELEVISION—This month's attractions

48 NEXT MONTH in Practical Wireless

56 PRODUCTION LINES—New products reviewed

by Colin Riches

60 ON THE AIR—Reports on Broadcast Bands:

60 Short Wave—Malcolm Connah

63 Medium Wave—Charles Molloy

63 V.H.F./F.M.—Simon David

64 Amateur Bands, Short Wave—David Gibson G3JDG

68 HOTLINES on recent developments—Ginsberg

● CONSTRUCTIONAL

24 V.H.F. REGEN. RECEIVER—R. H. Longden

33 EXPERIMENTERS CORNER—Ideas for further development:

33 6-9 volt Stabilised Supply—J. Rowley

34 Two Versatile Transistor Amplifiers—C. E. Miller

46 RECEIVER MATCHING UNIT—F. G. Rayer G3OGR

49 "P.W. TRICOLOUR" Mood Lighting System, Part 2—

Jurek Budek

57 160-80 METRES CONVERTER—R. A. Penfold

67 TAKE 20 No. 48 Pulse Generator—Julian Anderson

● OTHER FEATURES

29 FETRONS Semiconductor substitutes for valves

38 SPECIAL VALVES Part 1 Communications—M. K. Titman

45 I.C. OF THE MONTH, NE555 Precision Timer—

L. A. J. Ireland

71 TRANSISTOR CIRCUITRY FOR BEGINNERS—

H. W. Hellyer and M. Hollier

75 GOING BACK Equipment of yesteryear—

Colin Riches and Arthur Dow

★ SUPPLEMENT Extra eight centre pages

SIMPLE PROJECTS FOR THE HOME

Two Tone Door "Bell"; Intercom Amplifier; Water Level Detector; Tape Tuner; Radio Alarm Clock; Lamp Dimmer; Baby Alarm; Light Powered Radio

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

PACKAGE PRICE

R.S.C. STEREO PACKAGE OFFERS

HIGH FIDELITY UNITS

FOR ILLUSTRATED UNITS

ONLY £39-95

Carr. £1-00
Or deposit £8-95
and 9 monthly
payments £4-22
(Total £44-95)



Individual Rec. Retail Prices:
LINEAR 505 6 + 5 Watt Amplifier... £17-50
GARRARD 2025 Autochanger + KS40A Cartridge... £23-50
Teak Veneer Plinth with Transparent Plastic Cover... £26-10
Pair A55 LOUDSPEAKERS (Inc 8" x 6" 10,000 Gauss)... £21-50
TOTAL £48-88

SEND S.A.E. FOR
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SAVE £31-60



'SUPER 30' AMP

PACKAGE PRICE £99-95 Carr. £1-76

FOR ILLUSTRATED UNITS

Or deposit £15-00 + 12 monthly payments £8-00 (Total £111-00)
Individual Rec. Retail Prices:
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GOLDRING G800 Magnetic Cartridge *£12-21
DE-LUXE PLINTH with Roll-over Cover *£10-50
Pair R.S.C. MONARCH LOUDSPEAKERS *£38-70
R.S.C. SUPER 30 Mk III AMPLIFIER *£38-75
TOTAL £131-65

FANE 'MODE ONE' HIGH FIDELITY SPEAKER KIT



Incorporating a model 803 8" 13,000 Gauss Bass Speaker with ultra low resonance. P.V.C. surround cone. Printed circuit cross-over assembly with ferrite cored coils. Model 303 Pressure Tweeter, Acoustic damping material, Screws, Panels etc., and instructive diagrams, Frequency *£9-95 post free
Response 25 Hz-20 KHz.
Impedance 8-15 ohms.

Or Dep. £2-25 & 9 monthly payments. £1 (Tot. £11-25)

HIGH FIDELITY LOUDSPEAKER UNITS

Cabinets latest style Satin Teak veneer. Acoustically lined or filled acoustic damping. Ported where appropriate. Credit terms available.
DOORCHESTER (Illustrated) Size 16 1/2 x 11 x 9 in. appr. Range 45-15,000 c.p.s. Rating 8-10 watts. Fitted High Flux 13 x 8 in. £9-45 Carr. 40p.
MONARCH Size 19 x 10 1/2 x 9 in. approx. Rating 10 watts. Inc. 13 x 8 in. speaker with highly flexible P.V.C. cone surround, long throw voice coil and 10,000 line magnet. High flux pressure tweeter. Handsome design cabinet. Range 35-20,000 c.p.s. Imp. 8 ohms. Gives smooth realistic sound output.
See 'package offers' for illustration. Carr. 50p **£19-35**

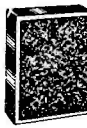
RSC G66 MkII 6+6 WATT high quality STEREO AMPLIFIER

Individual Ganged Controls: Bass, Treble, Volume and Balance. Printed circuit construction employing 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Bass Control ± 12db. Treble Control ± 13db. Selector switch for P.U. or Tape/Radio. For loudspeaker output impedances of 3 to 15 ohms. For standard 200-250v. A.C. mains operation. Attractive Black and Silver finished metal fascia plate and matching control knobs. COMPLETE KIT OF PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT and COMPREHENSIVE WIRING DIAGRAMS & INSTRUCTIONS **£11-50** Carr. 40p
Or FACTORY BUILT IN TEAK VENEERED CABINET as illustrated £14-95 or dep. £2-20 and 9 monthly payments £1-70 (Total £17-50).



HI-FI SPEAKER ENCLOSURES MODERN DESIGN

Teak veneer finish. Acoustically lined. Sizes approx. Carr. 55p. per enc.
JE8 Size 15 1/2" x 10 1/2" x 9". SE8. For optimum performance with any 8in. *£6-47
Pressurised. Gives pleasing results with any 8in. Hi-Fi speaker.
Size 19 x 10 1/2 x 9 in. SE12. For excellent performance with 12in. Hi-Fi speaker and tweeter
SE10 For outstanding results with 10in. Hi-Fi speaker. Size 25 1/2 x 16 *£6-74
Size 25 1/2 x 16 x 9 in. *£7-87



AUDIOTRINE HIGH FIDELITY SPEAKERS

Heavy construction. Latest high efficiency ceramic magnets. Plasticised cone surround. "D" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 8-15 ohms. PLEASE STATE CHOICE.

Exceptional performance at low cost.
*HF808T 8" 10W £2-98 HF120D 12" 15W £4-99
*HF102D 10" 10W £3-40 HF126 12" 15W £5-75
HF120 12" 15W £4-50 HF180D 18" 15W £6-25



FANE 807T HIGH FIDELITY SPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. Cast chassis Roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 30 c.p.s. Tweeter cone is fitted to extend high note response. Frequency range 25 Hz to 15 KHz. Gauss 10,000. Impedance 3 or 8-15 Ω.
PLEASE STATE IMPEDANCE WHEN ORDERING
MODEL 803T 8" 15w. with parasitic Tweeter.
Response 25 Hz to 15 KHz. Gauss 13,000 Imp 3 or 8-15. *£4-95

R.S.C. BATTERY/MAINS CONVERSION UNITS

TYPE BUL An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2 1/2 in. approx. Completely replaces batteries supplying 1-5v and 90v, to battery radio where A.C. mains 200/250v.
50c/s is available. ASSEMBLED READY FOR USE **£3-75**



AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. £5-95 Carr. 30p
OR SENIOR 15 WATT INCLUDING HF126 15,000 LINE SPEAKER £6-95 Carr. 35p



R.S.C. TA6 6 Watt HI-FI AMPLIFIER

200-250v. A.C. mains operated. Frequency Response 30-20,000 c.p.s. ± 2db. Harmonic Distortion 0-3% at 1,000 c.p.s. Separate Bass and Treble 'lift and cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3-16 ohm spkrs. Max. sensitivity 5mV Output rating I.H.F.M. Fully enclosed enamelled case, 9 1/2 x 2 1/2 x 5 1/2 in. Attractive brushed silver finish fascia plate 10 1/2 x 5 1/2 in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions.
OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE **£7-75** Carr. 40p.



ASTERISK * INDICATES UNITS WHICH UP TO APRIL 1st INCLUDED PURCHASE TAX

With effect from the same date other items will be charged at 10% (i.e. 10p in the £1)

In the event of the March Budget announcing an alteration in the rate of VAT the appropriate adjustment will be made

R.S.C. TRANSFORMERS, L.F. CHOKES & RECTIFIERS

MIDGET CLAMPED TYPE 2 1/2 x 2 1/2 x 2 1/2 in.
250v., 60mA, 6-3v. 2a 95p
250-0-250v., 60mA 6-3v 2a £1-05

FULLY SHROUDED UPRIGHT MOUNTING
250-0-250v. 60mA, 6-3v. 2a., 0-5-6-3v. 2a. £1-40
250-0-250v. 100mA, 6-3v. 4a., 0-5-6-3v. 3a. £2-20
300-0-300v. 100mA, 6-3v. 4a., 0-5-6-3v. 3a. £2-20
300-0-300v. 130mA, 6-3v. 4a., c.t., 6-3v. 1a. £2-20

For Mullard E10 Amplifier £2-65
350-0-350v. 100mA, 6-3v. 4a., 0-5-6-3v. 3a. £2-20
350-0-350v. 150mA, 6-3v. 4a., 0-5-6-3v. 3a. £2-65
425-0-425v. 200mA, 6-3v. 4a., c.t., 5v. 3a. £4-85
425-0-425v. 200mA, 6-3v. 4a., c.t., 6-3v. 3a., 5v. 3a. £5-10
450-0-450v. 250mA, 6-3v. 4a., c.t., 5v. 3a. £5-50

TOP SHROUDED DROP-THERO TYPE

250-0-250v. 70mA, 6-3v. 2a. 0-5-6-3v. 2a. £1-85
250-0-250v. 100mA, 6-3v. 3-5a. £1-55
250-0-250v. 100mA, 6-3v. 2a., 6-3v. 1a. £1-60
350-0-350v. 80mA, 6-3v. 2a., 0-5-6-3v. 2a. £1-65
250-0-250v. 100mA, 6-3v. 4a., 0-5-6-3v. 3a. £2-20
300-0-300v. 100mA, 6-3v. 4a., 0-5-6-3v. 3a. £2-20
300-0-300v. 130mA, 6-3v. 4a., c.t. 6-3v. 1a. £2-20

Suitable for Mullard E10 Amplifier. £2-60
350-0-350v. 100mA, 6-3v. 4a., 0-5-6-3v. 3a. £2-20
350-0-350v. 160mA, 6-3v. 4a., 0-5-6-3v. 3a. £2-80

FILAMENT or TRANSFORMER POWER PACK

6F5 6-3v. 1-5a. 49p; 6-3v. 2a. 54p; 6-3v. 3a. 70p;
6-3v. 4a. £1-00; 12v. 1a. 55p; 12v. 3a. or 24v. 1-5a. £1-35; 0-9-18v 1 1/2a £1-10; 0-12-25-42v 2a £1-75.

FULLY GUARANTEED: Impregnated and Interleaved where necessary.

Primarys 200-250v. 500c/s. Screened

CHARGER TRANSFORMERS 0-9-15v. 1 1/2a. 90p
2 1/2a. £1-10; 3a. £1-25; 5a. £1-45; 6a. £1-65; 8a. £2-00
AUTO (Step UP/STEP DOWN) TRANSFORMERS
0-110/120v. 200-230-250v. 60-50 watts £1-10
150 watts, £1-90 250 watts £2-75; 500 watts £5-75

OUTPUT TRANSFORMERS
Standard Pentode 5,000 Ω to 7,000 Ω to 3 Ω 50p
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω... 35p
Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω... £1-35
Push-Pull EL84 to 3 or 15 Ω 10-12 watts... £1-37
Push-Pull Ultra Linear for Mullard E10, etc. £2-20
Push-Pull 16-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω... £1-89
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω £3-30

SELENIUM RECTIFIERS

F. W. (Bridged)
All 6/12v. D.C. output. Max. A.C. input 15v.
1a, 25p. 2a, 35p.
3a, 50p. 4a, 65p.
6a, 80p.

SMOOTHING CHOKES
150mA, 7-10H, 250 Ω 70p; 100mA, 10H, 200 Ω 80p; 80mA, 10H, 350 Ω 50p; 60mA, 10H, 400 Ω 25p.

R.S.C. MkIII SUPER 30 HIGH FIDELITY STEREO AMPLIFIER

BUILD AN AMPLIFIER WORTH APPROXIMATELY DOUBLE THE KIT PRICE INCLUDING CABINET
Only high grade components by leading manufacturers

- * Push Button Selector Switching
- * Jack Socket for Headphones
- * Neon Indicator
- * Satin Silver Finish Metal Fascia
- * Solid State Circuitry
- * Twenty Silicon Transistors
- * Four Diodes, Four Rectifiers

For Magnetic or Ceramic Pick-Ups regardless of Price. Output (per channel) 15 watts RMS into 8 Ω. Frequency Response 7 Hz to 70 KHz ± 1 1/2 db.



COMPLETE KIT (less cabinet). Carr. 65p. Cabinet if req. £5 extra. **£25**

FACTORY BUILT UNIT INC. CABINET with 12 months' guarantee. Or Dep. £7 and 9 monthly payments £3-99 (Total £42-91). **£38-75**

R.S.C. STEREO FM TUNER.

Visually matches Super 30 Mk. III **£44-95***

'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

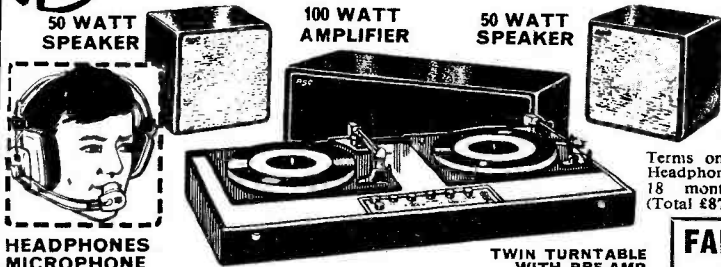
- * Moderate size only 25 x 14 x 10 in. approx.
- * Response 30-20,000 c.p.s. Impedance 15 ohms
- * Performance comparable with units costing considerably more Carr. 65p

COMPLETE KIT **£23**

Consists of (1) 12in. 15 watt Bass unit with cast chassis, Roll rubber cone surround for ultra low resonance, and ceramic magnet.
(2) 3-way quarter section series cross-over system.
(3) 8 x 5 in. high flux middle range speaker.
(4) High efficiency tweeter. (5) Appropriate quantity acoustic damping material. (6) Handsome Teak veneered cabinet.
(7) Circuit and full instructions. Terms: Dep. £4-60 and 9 monthly payments £2-47 (Total £26-83).



RSC GROUP/DISCO UNITS



PACKAGE OFFER

- Units listed below
- (a) 100w POWER AMPLIFIER
- (b) PAIR OF HI-FI HEADPHONE PHONES
- (c) MATCHING DYNAMIC 'MIKE' (attached to headphones)
- (d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets

Size approx. 18" x 13" x 8" (a)(b)(c)&(d) **£72-85**

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 stylus. 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

Or Dep. £13-25 and 9 monthly pymts £6-88 (Total £75-17) or Dep. £15 and 18 mthly payments £8-82 (Total £80-16).

£67-10

HEADPHONES MICROPHONE

TWIN TURNTABLE WITH PRE-AMP

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 char-acteristic high flux 13" x 8" 20 watt speakers. Terms: Dep. £3 and 9 monthly payments £2-22 (Total £22-98) Carr. 60p. **£19-95**

TYPE C4125 50 WATTS Fitted four 12" 11,000 line 15 watt speakers: Overall size approx. 56 x 14 x 9 1/2 inches. Terms: Dep. £4 and 9 monthly payments £2-37 (Total £24-93) 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 18 mthly. pymts. £5-18 (Total £73.16). Carr. £1 **£65**

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" 100Watt 14,000 gauss 8/15p	15" 60 Watt 14,000 gauss 8/15p	12" 50 Watt 13,000 gauss 15p
£22-95	£12-90	£10-90
Dep. £6 and 9 monthly payments £2-20 (Total £25-80)	Dep. £3-30 and 9 monthly payments. £1-30 (Total £15).	Dep. £2 and 9 monthly payments £1-20 (Total £12-80)

FOR BASS GUITAR, ELECT. ORGAN, ETC.

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, EC083, EL34, EL84, 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 16 ohm speakers. Twin-handled perforated cover £1-10. 12 MONTHS' GUARANTEE. Carr. 65p

TERMS: Deposit £4 and 9 monthly payments of £2-10 (Total £22-90). Send S.A.E. for leaflet.

£19-75

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 monthly payments 75p (Total £8-00).

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.U.s and Crystal or Ceramic Gram. P.U.s
- ★ Frequency response 30-20,000 Hz.
- ★ Output overload protection plus double fusing

FRONT PANEL (Jack inputs) 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.

Simulated black rexine, plastic bonded metal case. **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 Speakers/3 to 30 ohms. Size 17" x 7" x 7 1/2" 200-250v. A.C. mains. Output 50 watts music 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 16 ohm Speaker. Attractively finished in black with silver-finished fascia and trimmings. Compact size. Fitted carrying handle. Terms: Deposit £8-05 and 9 monthly payments £8 (Total £82-85). Carr. £1-50 **ONLY £55-95**



GROUP/DISCO EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 MK.III AMPLIFIER	£84-95	PACKAGE PRICE
PR. FANE POP 25/2 25W L/SPEAKERS	£12-50	£45 carr.
Terms: Deposit £6.50 and 9 monthly payments of £4.92 (Total £50.78)	£48-45	£1
F.A.L. PHASE 50 MK.III AMPLIFIER	£84-95	PACKAGE PRICE
PR. FANE POP 50 L/SPEAKERS	£21-80	£52 carr.
Terms: Deposit £10 and 9 monthly payments of £6-37 (Total £58.33)	£58-75	£1
F.A.L. PHASE 50 MK.III AMPLIFIER	£84-95	PACKAGE PRICE
PAIR L12/25 25W L/S in cabinets	£22-90	£56 carr.
Terms: Deposit £10 and 9 monthly payments of £5-88 (Total £52-92)	£58-85	£1-25
F.A.L. PHASE 100 AMPLIFIER	£61-95	PACKAGE PRICE
4 FANE POP 50 L/SPEAKERS	£48-80	£99-95 carr.
Terms: Deposit £15-95 and 9 monthly payments of £10-78 (Total £112-52)	£106-55	£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

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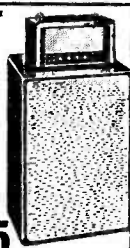
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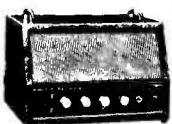
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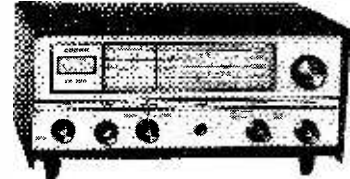
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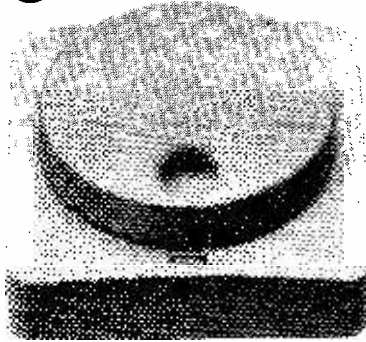
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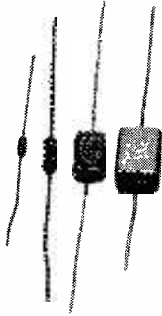
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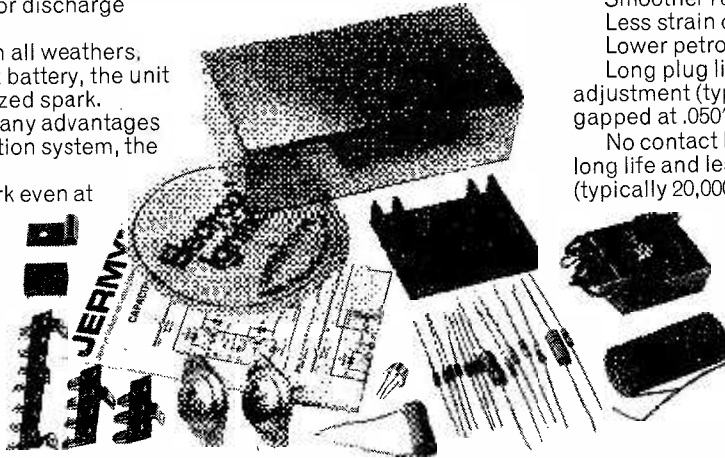
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Overall Diameter	8"	3"
Natural resonance	30Hz	—
Main resonance	*35Hz	1200Hz
Magnet Pole Diameter	1"	3"
Magnet Flux Density	13,000 gauss	10,000 gauss
Frequency response	30Hz-8kHz	10kHz-17kHz
Impedance	8-15 ohms	8-15 ohms
Power Handling	*15 watts	*15 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 15½" x 10½" x 9".

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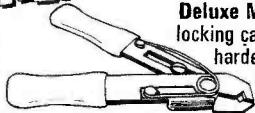
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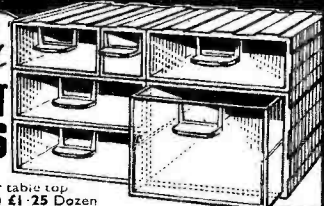
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Full lists and technical data will be found in Catalogue No. 6.

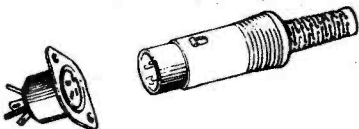
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0-8A 400V 58p, 600V 70p
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ZENER DIODES full range E24 values; 400mW: 2.7V to 36V, 14p each; 1W: 6.8V to 82V, 21p each; 1.5W: 4.7V to 76V, 48p each. Clip to increase 1.5W rating to 3 watts (type 266F) 4p.

DIN PLUGS & SOCKETS

by Hirschmann, 4A rating



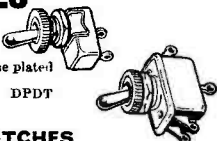
2 way LS—socket 10p; plug 12p. 3 way ser. socket 10p; plug 12p. 5 way ser. socket 12p; plug 15p.

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To3 cover 7p
 Heat sinks 1°C/W, type 6WL, undrilled 60p

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1011C SPST toggle 20p
 409 DPDT toggle 28p. (These are chrome plated—2.5A rating)
 7301 Sub-miniature DPDT 250V a.c./2A 48p

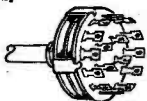


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Radioactive Miniature Make-switch (in assembly kit form) Shaft 48p
 Wafers, MBB-2P6W, 1P11W: BRM-1P12W, 2P6W, 3P4W, 4P3W, 6P2W, each, 32p

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1P12W, 2P6W, 3P4W, 4P3W, each 24p



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AXIAL LEAD	3V	6.3V	10V	16V	25V	40V	63V	100V
Rated voltage: 3V								
Capacity μF								
0.47							7p	7p
1.0						7p	7p	7p
2.2					7p	7p	7p	7p
4.7				7p	7p	7p	7p	7p
10				7p	7p	7p	7p	7p
22				7p	7p	7p	7p	7p
47	7p			7p	7p	7p	7p	7p
100	7p	7p		7p	7p	7p	7p	7p
220	7p	7p		7p	7p	7p	7p	7p
470	7p	7p		7p	7p	7p	7p	7p
1000	9p	12p		12p	17p	20p	23p	26p
2200	14p	18p		22p	25p	36p	40p	
4700	28p	36p		37p				
10,000	37p	40p						

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250V up to 0.1 μF ; 100V/0.1 μF and above.
 0.01; 0.012; 0.015; 0.018; 0.022;
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 0.18; 0.22 each 5p.
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SILVERED MICA non-polarised capacitors in 34 values from 2.2 pF to 680 pF, each 6p

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Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99	100 μp
C	1/20W	5%	82 Ω —220K Ω	E12	8	8	7.5
C	1/8W	5%	4.7 Ω —470K Ω	E24	1	0.9	0.75 nett
C	1/4W	10%	4.7 Ω —10M Ω	E12	1	0.9	0.75 nett
C	1/2W	5%	4.7 Ω —10M Ω	E24	1-8		0.8 nett
C	1W	10%	4.7 Ω —10M Ω	E12	2-5	2	1.6 nett
MO	1/2W	2%	10 Ω —1M Ω	E24	4	3	2 nett
WW	1W	10% \pm 1/20 Ω	0.22 Ω —3.9 Ω	E12	7	7	6
WW	3W	5%	1 Ω —10K Ω	E12	7	7	6
WW	7W	5%	1 Ω —10K Ω	E12	8	8	8

Codes: C—carbon film, high stability, low noise.
 MO—metal oxide, Electrovol TR5, ultra low noise.
 WW—wire wound, Plessey.

Values:
 E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82
 and their decades.
 E24 denotes series: as E12 plus 11, 13, 16, 20, 24, 30, 36, 43, 51,
 62, 75, 91 and their decades.

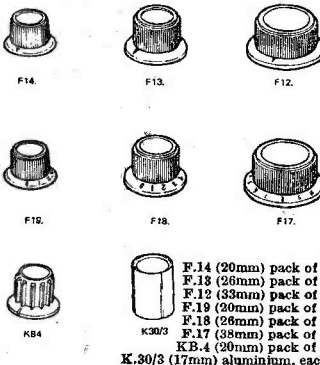
Prices are in pence each for quantities of the same ohmic value and power rating. NOT mixed values. (Ignore fractions on total value of resistor order).

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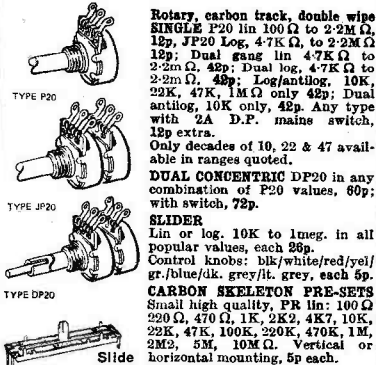
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 KB.4 (30mm) pack of 4 40p
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COMMUNICATIONS HEADPHONES £2.86 (D)

(All including carriage, packing, accessories & insurance.)

PARTRIDGE PACKAGE No. 1

9R59DS receiver ..	£54.45
* Items (A); (B); (D) above ..	£12.10
Complete Gen. Coverage Station ..	£66.55

PARTRIDGE PACKAGE No. 2

JR310 receiver ..	£82.50
* Items (A); (B); (D) above ..	£7.70
Complete Amateur RX Station ..	£90.20

PARTRIDGE PACKAGE No. 3

JR599 receiver ..	£203.50
* Items (A); (B); (D) above ..	FREE
Complete Amateur RX Station ..	£203.50

PARTRIDGE PACKAGE No. 4

TS/PS15 Transceiver 180W ..	£231.00
* Items (A); (C); (D) above ..	FREE
Complete TX-RX Station ..	£231.00

BARCLAYCARD — ACCESS — PERSONAL LOANS!!

ALSO: SP5D SPKR. £4.95; OA2 MAINS STABILISER 74p

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LATEST 1973 MODEL

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WHAT A GLOBE SCANNER! AND WHAT A DISCOUNT! The best battery or mains operated communications receiver you're ever likely to hear—anywhere. You could pay well over £150 to match all the specifications of this latest advanced 1973 model—and still be left disappointed. You'll never be without an exciting broadcast. The best time of day—or night—from anywhere in the world! NO LESS THAN 4 SHORT wavebands scan the entire globe—pinpointing 100's of crystal clear broadcasts. Exciting, thrilling & unusual events from all 5 continents come alive in your living room at the press of a button. **Save** drop on what's happening—when & where it happens. **JUST THINK—**you could strike lucky and pick up an exclusive world news scoop—even before you read about it in your paper! Or chance on a **SECRET or EMERGENCY SITUATION** as it happens! AND THAT'S NOT ALL—the specialist hands track exciting public services as if you were listening in on an operations room—police & special security services, aircraft, Ocean going liners and trawlers, ambulances, fire brigades, A.A. RAC, Taxicabs, Radio Hams and many many more. **PLUS** all those ever popular BBC, Local Radio, Luxembourg, Continental, Pop & even Commercial stations yet to be introduced. Among the electronic advances you'll find AGC (Automatic Gain Control) to prevent signal overloading and maintain uniform output. BFO (Beat Frequency Oscillator) for reception of SSB (Single Side Band) and Morse Code (Constant Wave) signals on the Short bands. Squelch switch for the elimination of background noise between stations on the VHF bands. Tuning Indicator **PLUS** Fine Tuning for extra sensitive reception or Marine & Short bands. Advanced push button keyboard band selector. World time zone map and indicator. Built-in aerial **PLUS** 2 external telescopic antennas. Dial light. Earphone for private listening and Tape Jack for direct recording from radio.

FREQUENCIES: Long 150-350 KHz. Medium 540-1605 KHz. Marine 1.6-4 MHz. Short 1.4-8 MHz. Short 2 8-12 MHz. Short 3 12-18 MHz. Short 4 18-30 MHz. FM/VHF 88-108 MHz. AIRCRAFT/VHF 108-136 MHz. 2 POLICE/SPECIAL SERVICE VHF BANDS 78-86 MHz & 148-174 MHz.

N.B.—The Ministry of Post & Telecomm. state that a licence (not generally avail. to the public) is req. for reception of transmissions by Fire Brigade, Air-seal, Shipping, etc.

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The new 1973 VAT edition of Lasky's famous Audio-Tronics catalogue will be available in early April—FREE on request. The 48 tabloid size pages—many in full colour—have been reprinted with VAT price changes for your convenience, together with many new items. Over half the pages are devoted exclusively to every aspect of Hi-Fi (including Lasky's budget Stereo Systems and Package Deals), Tape Recording and Audio Accessories. Send for your copy now and see for yourself that VAT can mean a saving on many of the 1000's of items we offer.

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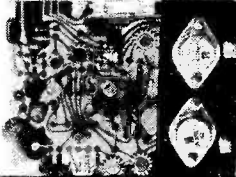
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THESE THREE MODULES HAVE ENJOYED UNPARALLELED SUCCESS DURING THE FIRST FEW MONTHS OF THEIR BEING MADE AVAILABLE TO THE GENERAL PUBLIC. WE ARE PLEASED TO ANNOUNCE THAT WE CAN NOW OFFER FAST DISPATCH ON MOST OF OUR ADVERTISED ITEMS, INCLUDING THESE THREE 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 \pm 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	4 1/2" 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	£2-85 carr. 20p £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 \pm 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

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£15-80 carr. 30p

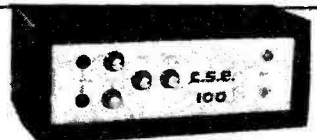
SAXON STEREO CONTROL UNIT

Two decks, and full headphone monitoring. The unit is mains operated and measures 17 1/2" x 3" x 4" deep and is finished with a smart white on black fascia. 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 vinyl 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

This versatile unit is now available in a black vinyl 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.

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.

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).

All prices subject to VAT at standard rate

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NEW LOW PRICES

STEREO AMPLIFIERS

	Rec. Price	Retail Price	Comet Price
	£ p	£ p	£ 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	50-38	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	85-45	52-95	
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/VN680 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	72-50	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 Converter	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	
CM800A Pow. amp	Sp. Price	135-95	
Reverberation 202w	60-45	43-50	
RANK ROTEL 210	38-39	28-50	
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	109-95	
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 M4001 2 x 8 watts RMS plus MATRIX 4 channel	42-30	29-75	
SOLARVOX M4813 2 x 18 watts plus MATRIX 4 channel	56-52	42-95	
TANDBERG TA300	78-89	59-95	
TANDBERG TA300M	87-45	72-50	
WHARFEDALE Linton amplifier. Amplifiers listed all take both ceramic and magnetic cartridges.	71-50	65-95	
TUNERS			
AKAI AT550 AM/FM/MPX/FET	84-10	61-95	
AKAI AT580 AM/FM/MPX/MOS. FET	131-09	96-95	
AMSTRAD Multiple 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/V1500 AM/FM	80-98	62-95	
MCT V7E AM/FM	115-25	94-95	
LEAK Delta FM	74-43	55-95	
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	48-95	
RANK ROTEL 820	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)	25-57	16-95	
All Tuners listed are complete with MPX Stereo Decoder except where starred.			
TUNER/AMPLIFIERS			
AKAI CR80T AM/FM Tuner Amplifier with built in Eight Track Tape recorder	140-78	84-95	
AKAI A.A8030	131-09	96-95	
AKAI A.A8080	178-07	131-95	
AKAI AS8100S Quadraphonic	243-85	181-95	
AKAI A.A8500	235-97	166-95	
AKAI 8300	130-31	74-95	
ARENA 5800	104-62	55-95	
ARMSTRONG MS Decoder	10-45	7-75	
ARMSTRONG 525	84-96	66-50	
ARMSTRONG 528	96-81	74-95	
GOODMANS Module 80, 35w. RMS Module 80 Compact	87-55	66-95	
Module 90	158-16	119-95	
Module 90	112-04	85-95	
Module 110 FM/MW/LW/SW/10w. 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. Price	Retail Price	Comet Price
	£ p	£ p	£ 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	184-74	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	
SX825	184-72	126-95	
SX727	222-39	152-95	
SX828	285-21	196-95	
QX 4000 Quadraphonic	216-81	159-95	
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 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.	107-66	81-95	
TURNABLES			
CONNOISSEUR BD1 Kit	12-65	10-50	
CONNOISSEUR BD2 Chassis	31-02	24-95	
CONNOISSEUR BD2 P/C/SAU2	39-16	32-25	
GARRARD SR25 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	16-95	
GARRARD Z420 100A	51-57	37-25	
GARRARD Z420 100C	47-44	34-25	
GOLDRING G101P/C	23-05	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	52-95	
MCDONALD MP60	13-96	9-25	
MCDONALD P610	17-71	12-25	
MCDONALD HT70	19-48	13-50	
PHILIPS GA212 Electronic	64-95	50-95	
PIONEER PL12D with base and cover	47-19	32-50	
PIONEER PL12 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 M44/7	Special Price 18-25
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 2025/TC with Sonotone 9T AHC	Special Price 12-10
GOLDRING GL75 with G800	Special Price 36-95
GOODMANS TD100 with G800E	73-94 48-95

SPEAKERS

	Rec. Price	Retail Price	Comet Price
	£ p	£ p	£ p
AKAI SW 155	70-95	50-95	
AMSTRAD ACOUSTA 2500 (pair)	44-00	25-95	
AMSTRAD ACOUSTA 1500 (pair)	55-00	32-95	
AMSTRAD 138 (pair) Teak	28-60	15-90	
B and W Model 70	175-45	128-95	
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	50-90	35-95	
Ditton 45	50-40	42-95	
Ditton 66	103-90	78-75	
FERROGRAPH S1 inc. stand	104-50	75-95	
GOODMANS Minister (pair)	46-33	34-50	
Havant (pair)	53-77	38-95	
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	79-88	54-95	
DIN 20 NT Kit (pair)	22-95	16-50	
KELETRON KS4 (pair)	22-60	16-50	
KS6 (pair)	23-16	17-95	
KS8 (pair)	36-30	23-50	
KS10 (pair)	46-86	34-50	
KS15 (pair)	69-85	40-95	
KS20 (pair)	78-76	50-95	
LEAK 150 (pair)	46-89	34-95	
LEAK 250 (pair)	60-85	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	61-20	42-95	
PIONEER CS53	31-39	34-95	
SINCLAIR O16	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	49-95	
TL 50 Teak	74-90	57-95	
TELETON 8000 (pair)	19-87	11-50	
THORPE GREENVILLE 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)	23-46	17-50	
Unit 5 speaker kit (pair)	41-80	29-25	
Unit 5 speaker kit (pair)	60-50	42-50	
PICK UP ARMS AND HEADS			
AUDIO Technica AT 1005 Mk. II	17-85	12-95	
AUDIO Technica L2 Hifs	2-46	1-90	
CONNOISSEUR SAU2	13-86	11-25	
GOLDRING Lenco V5	13-20	8-95	
GOLDRING Lenco L69	9-90	6-25	
GOLDRING PH6 Head Shell for 69/75	2-81	2-00	
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			
GOODMANS Twin-axiom 8	8-58	6-25	
Twin Axium 10	9-47	6-90	
Axiom 40P	19-45	13-95	
Axiom 101	5-17	3-75	
Axiom 10P	5-62	4-10	
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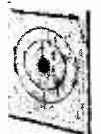
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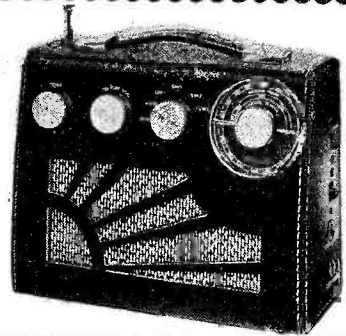
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P. P. & Ins. 52p

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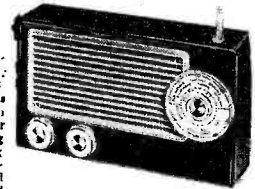
ROAMER SEVEN MK IV



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 x 7 x 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.

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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—5 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 8 1/2 x 2 1/2in. 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)

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 6 1/2 x 2 1/2 x 2 1/2in. 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

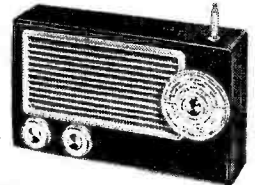


5 TRANSISTORS AND 2 DIODES

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 6 1/2 x 4 1/2 x 1 1/2in. Easy build plans and parts price list 10p (FREE with parts).

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TRANS EIGHT



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SN7427	0-50	0-46	0-44	SN7492	0-74	0-71	0-64	SN74181	£2-05	£1-50	£1-28
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	0-76	SN74184	£3-95	£3-58	£3-30
SN7432	0-50	0-48	0-44	SN7495	0-95	0-93	0-76	SN74190	£2-15	£2-04	£1-98
SN7433	0-58	0-53	0-48	SN7496	0-98	0-93	0-76	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	£2-15	£2-09
SN7440	0-17	0-16	0-13	SN74105	£1-07	£1-04	0-97	SN74194	£2-20	£2-15	£2-09
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	0-53	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	£2-05	£1-50	£1-28
SN7445	£1-98	£1-95	£1-93	SN74119	£1-49	£1-38	£1-21	SN74199	£2-05	£1-50	£1-28
SN7446	£1-07	£1-04	0-97	SN74121	0-44	0-41	0-38	Terminal Pos Volt Ref.	TO.3		
SN7447	£1-10	£1-07	£1-05	SN74122	£1-54	£1-43	£1-21	£21 Plastic O/P 1.5 Amps	MA7805		
SN7448	£1-10	£1-07	£1-05	SN74123	£3-08	£2-87	£2-89	5V. & MA7812 12V.	£1-76	each	



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.

ONLY **£3.58p** each

★ Load—3, 4, 8 or 16 ohms.

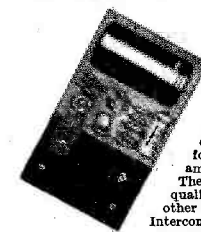
★ Supply voltage 10-35 Volts.

★ Distortion—better than 0.1% at 1KHz.

★ Overall size 63mm x 105mm x 13mm.

Tailor made to the most stringent specifications using top quality components and incorporating the latest solid state circuitry and AL50 was conceived to fill the need for all your A.F. amplification needs.
FULLY BUILT—TESTED—GUARANTEED.

STABILISED POWER MODULE SPM80



AF80 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 x 105mm x 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—Discos 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
2. Radio, Tuner
3. Magnetic P.U.

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 20KHz
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 x 82mm x 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

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Postage and packing add 10p. Overseas add extra for airmail.

Minimum order 50p. Cash with order please.

Guaranteed Satisfaction or Money Back

LINEAR I.C's—FULL SPEC.

Type No.	Price	1-24	25-99	100 up
BP 201C—SL201C	89p	58p	49p	
BP701C—SL701C	89p	55p	49p	
BP 702C—SL702C	89p	55p	49p	
BP 702—72702	58p	49p	44p	
BP709—72709	39p	37p	33p	
BP 709P—MA709C	39p	37p	33p	
BP 710—72710	49p	45p	44p	
BP 711—MA711	49p	47p	44p	
BP 741—72741	55p	50p	45p	
MA703C	31p	28p	26p	
TAA 233	77p	66p	60p	
TAA 293	89p	82p	77p	
TAA 350	£1-87p	£1-74p	£1-65p	

S.G.S. EA1000 £2-89p

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

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	27p	26p	24p	
BP946	13p	12p	11p	
BP948	27p	26p	24p	
BP651	71p	66p	60p	
BP932	13p	12p	11p	
BP9093	44p	42p	38p	
BP9094	44p	42p	38p	
BP9097	44p	42p	38p	
BP9099	44p	42p	38p	

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 Minित्र
Anode voltage (Vdc)	170min	170min	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

	Price each	1-24	25-99	100 up
Epoxy TO-5 case				
uL900 Buffer	38p	36p	29p	
uL914 Dual 2/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	27p
TSO 16 " "	38p	35p	33p

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BFS 14	18p	14p	12p
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GARRARD SP25 Mk III Special Purchase.
Limited number available
Garrard SP25 Mk. III
Goldring G800
Teak plinth and tinted cover
All leads supplied.
Please add £1.25 P. & P. ins.

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Please add 75p P. & P. ins.

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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	£9.49
Goldring GL72	£20.90
Goldring GL72/P	£27.45
Goldring GL75	£26.85
Goldring GL75/P	£34.95
Goldring 101/P.C.	£20.90
Wharfedale Linton + cart.	£23.90
Thorens TD125A 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 523	£39.50
Armstrong 524	£31.45
Rogers R/brook FET4 (Chassis)	£37.25
Rogers R/brook FET4 (Cased)	£43.30
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 HMS 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

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

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Please add 85p P. & P. ins.

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Amstrad IC2000	£27.50
Amstrad Integra 4000	£21.45
Armstrong 521 (Teak cased)	£43.90
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Alpha Highgate FA300	£32.25
Alpha Highgate FA400	£35.65
Leak Delta 30	£44.85
Leak Delta 70	£34.90
Metrosound ST20E	£24.20
Metrosound ST60	£45.95
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Pioneer SA500A	£31.95
Pioneer SA1000	£96.95
Rogers R/brook (Chassis)	£32.95
Rogers R/brook (Cased)	£41.50
Rogers R/bourne (Chassis)	£49.95
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Rotel RA310	£34.95
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Please add £1.50 per pair P. & P. ins. Price per pair

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Wharfedale Dovedale 3	£39.80
Celestion Ditton 120	£38.40
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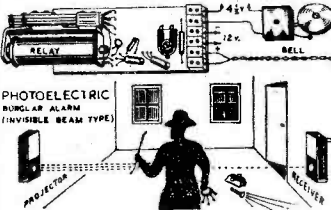
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Please add 10p P. & P. ins.

Goldring G850	£3.35
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Goldring G800E	£7.50
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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.



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Also Essential Data Circuits
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INVISIBLE BEAM OPTICAL KIT

Everything needed (except plywood) for building: 1 Invisible-Beam Projector and 1 Photo-cell Receiver (as illustrated). Suitable for all Photoelectric Burglar Alarms, Counters, Door Openers, etc.
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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 brainwaves, learn to relax, meditate, etc.
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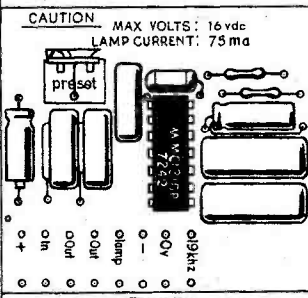
Aural Brainwave Indicator for use with a Biofeedback Amplifier. Converts subsonic brain frequencies into audible signals for easy recognition.
CONTENTS: Resistors, Pots, Capacitors, Transistors, Diodes, Leads, Chassis, Case, Earphone, Battery, Plans and Instructions. Price £3.25, postage and pack. 15p (U.K.). Commonwealth: Surface 25p, Air Mail 75p.

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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 Jermy 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 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!

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of damage to expensive transistors and integrated circuits, when soldering?

Use Antex low-leakage soldering irons

All prices exclusive of V.A.T.



220-240 Volts or 100-120 Volts

Model X25

The leakage current of the NEW X25 is only a few microamps and cannot harm the most delicate equipment even when soldered "live".

Tested at 1500v. A.C. This 25 watt iron with its truly remarkable heat-capacity will easily "out-solder" any conventionally made 40 and 60 watt soldering irons, due to its unique construction advantages.

Fitted long-life iron-coated bit 1/8"

2 other bits available 3/32" and 3/16".

Totally enclosed element in ceramic and steel shaft Bits do not "freeze" and can easily be removed

PRICE: £1.75 (rec. retail)
Suitable for production work and as a general purpose iron

Model CCN

220 volts or 240 volts

The 15 watt miniature model CCN. also has negligible leakage.

Test-voltage 4000v. A.C.

Totally enclosed element in ceramic shaft. Fitted long-life iron-coated bit 3/32"

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1/8", 3/16" 1/4" and 1/16"

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OR Fitted with triple-coated, (iron, nickel and Chromium) bit 1/8"

PRICE: £1.95 (rec. retail)

A SELECTION OF OTHER SOLDERING EQUIPMENT.



MODEL CN

Miniature 15 watt soldering iron fitted 3/32" iron-coated bit. Many other bits available from 3/64" to 3/16". Voltages 240, 220, 110, 50 or 24

PRICE: £1.70 (rec. retail)

MODEL CN2

Miniature 15 watt soldering iron fitted with nickel plated bit 3/32". Voltages 240 or 220.

PRICE: £1.70 (rec. retail)

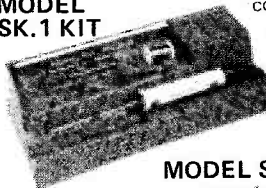


MODEL G

18 Watt miniature iron, fitted with long life iron-coated bit 3/32". Voltages 240, 220 or 110.

PRICE: £1.83 (rec. retail)

MODEL SK.1 KIT



contains 15 Watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32", heat sink, solder, stand and "How to Solder" booklet.

PRICE £2.75
(Rec. retail)

MODEL SK.2 KIT

contains 15 Watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32"

heat sink, solder and booklet "How to Solder"

PRICE £2.40
(Rec. retail)

MODEL MES.KIT

Battery-operated 12v. 25 watt iron fitted with 15" lead and 2 heavy clips for connection to car battery. Packed in strong plastic wallet with booklet "How to Solder."

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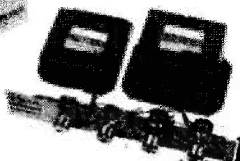
AT
£26.12
 INC.
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It's the RT-VC system that screws together to save you pounds! Unisound comprises two superb speakers and an amplifier/record deck plinth—all beautifully finished in simulated teak. The stereo amplifier (4 watts per channel into 8 ohms) is based on the famous Mullard Unilex system brought up-to-date by RTVC using integrated 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

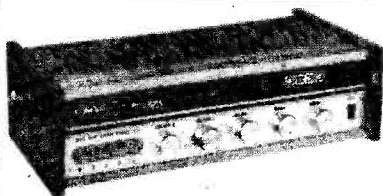
The Tourist PB is suitable for 12 volt working on both negative and positive earth vehicles. It covers the full medium and long wave bands. It is permeability tuned and sturdily constructed. Output is a full 2.5 watts into an 8ohms speaker. But the Tourist PB will operate into any loudspeaker from 8 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 modulsed 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 4½" 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 Mk IV

A GOOD QUALITY AMPLIFIER—12 Watts £10.50 (inc. VAT). 20 Watts £13.50 (inc. VAT)

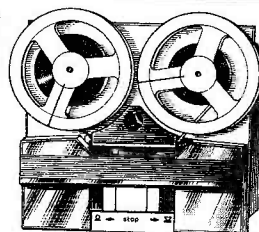
*5 Electrically Mixed inputs. *3 Individual Mixing controls. *Separate bass and treble controls common to all 5 inputs. *Mixer employing F.E.T. (Field Effect Transistors). *Solid State Circuitry. *Attractive Styling INPUTS 1. Crystal Mic or Guitar 9mV. 2. Moving coil Mic. or Guitar 8mV. Inputs. 3, 4 & 5 are suitable for a wide range of medium output equipment (Gram. Tuner, Monitor, Organ, etc.) All 250mV sensitivity. Size approx. 12½ x 6 x 3½ ins.

12W 3 ohms £10.50 plus 60p
20W 8-15 £13.50 p & p
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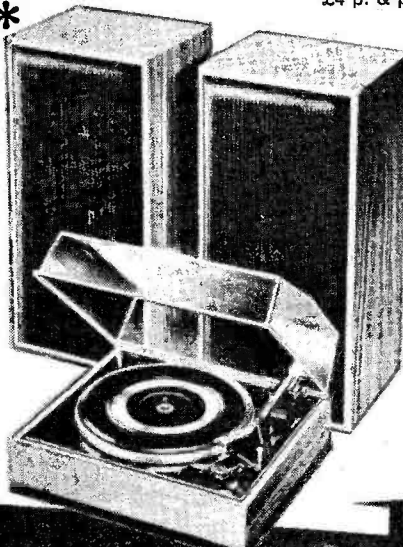
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WHY did you buy this copy of *Practical Wireless*? Were you influenced by advanced publicity or advertising; are you a regular reader with a devotion to follow our activities month by month; or are you one of many thousands who pick up this magazine 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 Multi-meter, 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

BBRITISH 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.

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-Américas 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.

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.

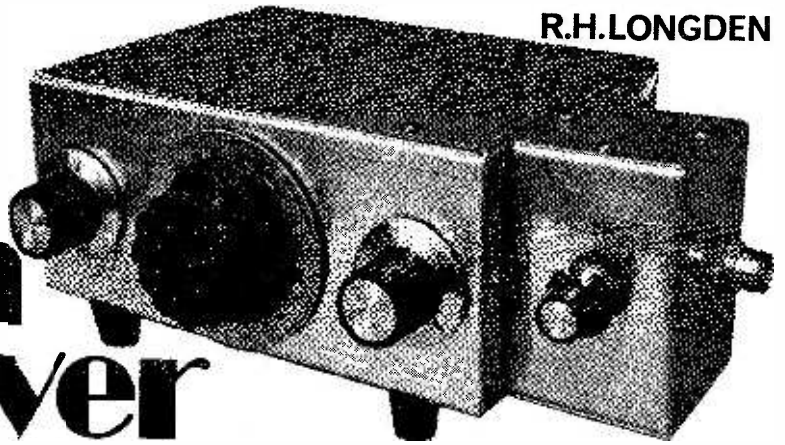
April 24: "The CVC5 Colour Receiver" by A. E. Thomas from I.T.T. This will be held in the Cleveland Scientific Institution, Corporation Road, Middlesbrough. Meeting starts at 7.30 p.m.

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.

VHF Regen Receiver



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 $1\mu\text{V}$. 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.

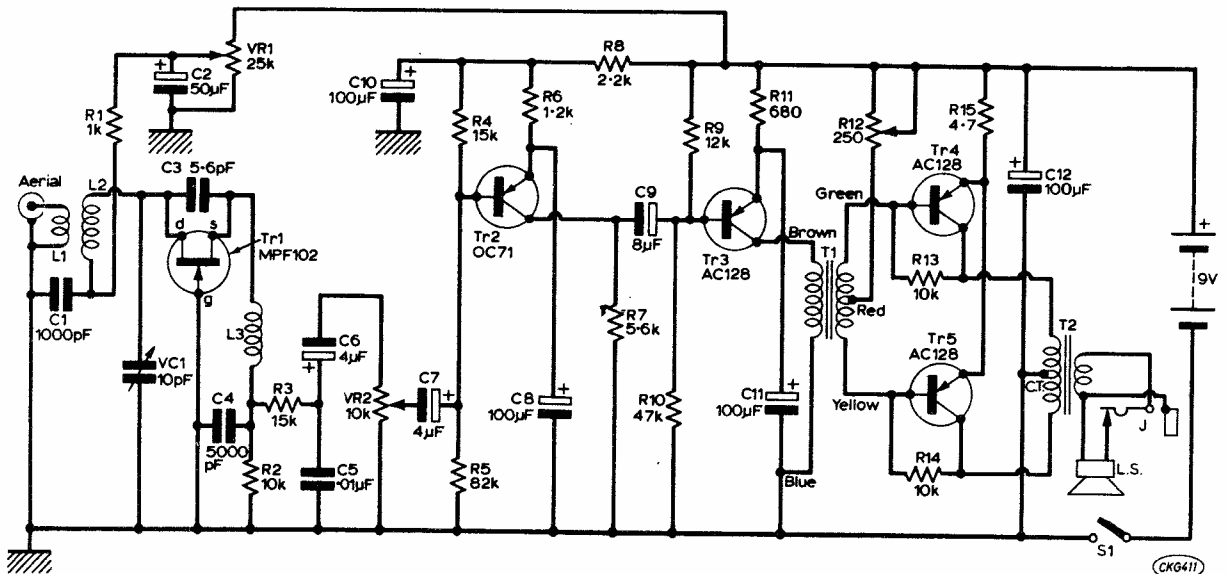


Fig. 1: Circuit of the main receiver. The circuit of the pre-amplifier is shown in Fig. 4. The heading photograph shows the two units bolted together.

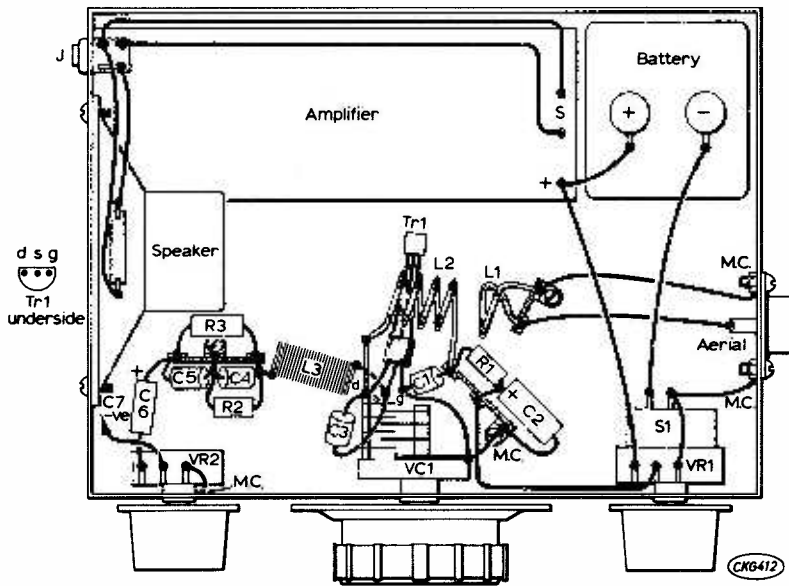


Fig. 2: Layout of the main components and audio amplifier board within the cabinet. When the preamplifier is fitted the coaxial aerial socket is removed and used on the preamplifier box.

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.

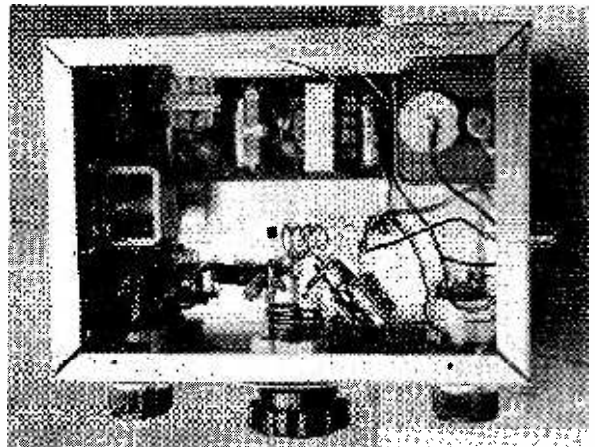
The four flanged members are then assembled by bolts through the holes present in them. Four holes are drilled in one 7 x 5in plate, these are marked through so that the flanges can be drilled to suit. The case bottom can then be attached. Two rubber feet were placed on the front bolts, to raise the 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 1/2in 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 1/2in 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 1/4in 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 3/4in, 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 $5 \times 1\frac{3}{4}$ 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 $\frac{7}{16}$ in long, was found to tune 115-150MHz. This is suitable for 2 metre reception.

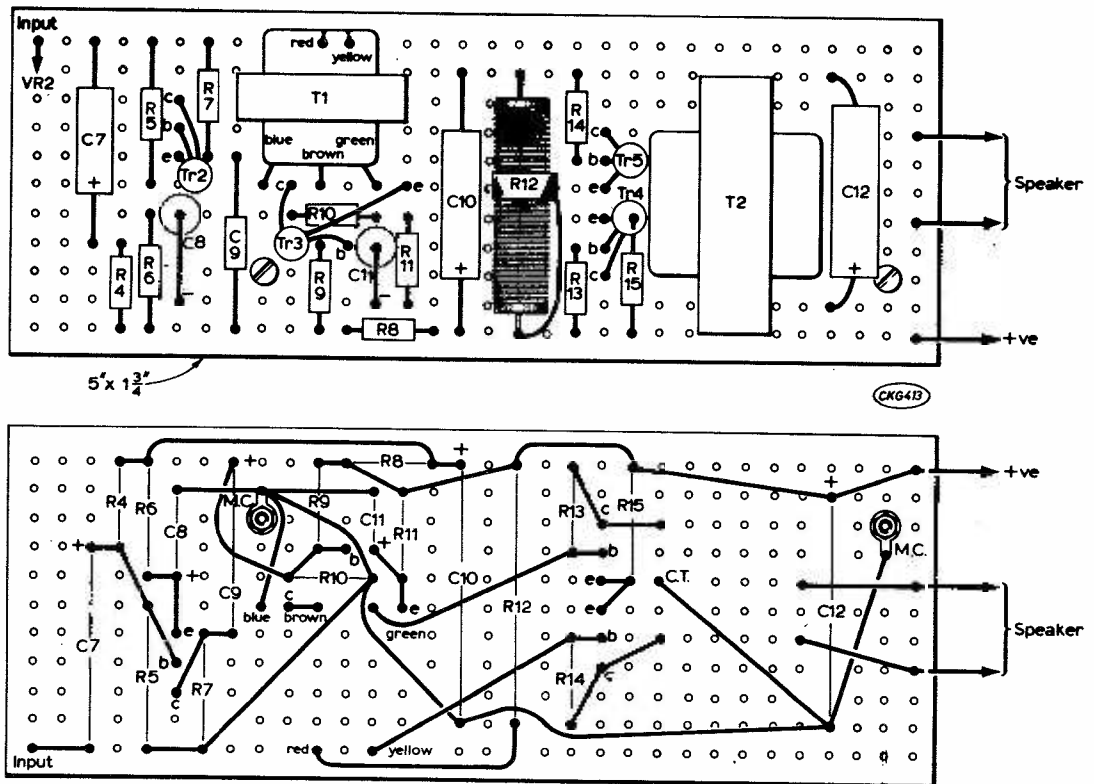


Fig. 3: Diagrams of the component layout and wiring of the audio amplifier board.

Take care to fit the electrolytic capacitors as indicated. With a unit of this kind, it is helpful to place black lmm 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

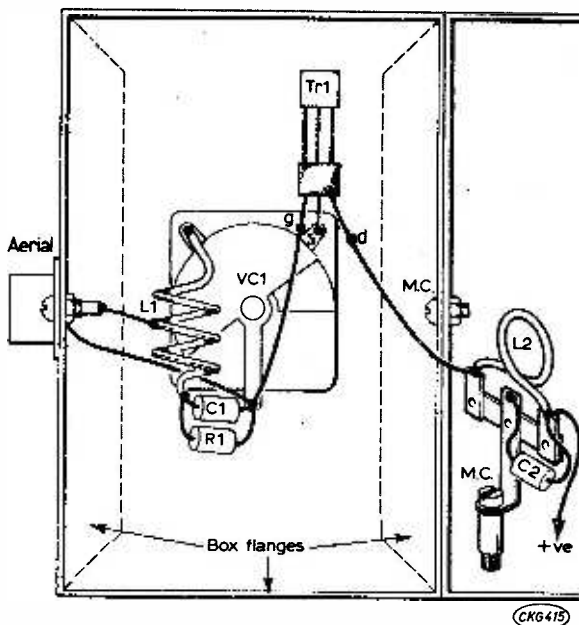


Fig. 5: Positioning of the few components within the preamplifier box.

3 x 2in and 1/2in 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

★ components list

R1 220Ω 1/4W, 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.

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.

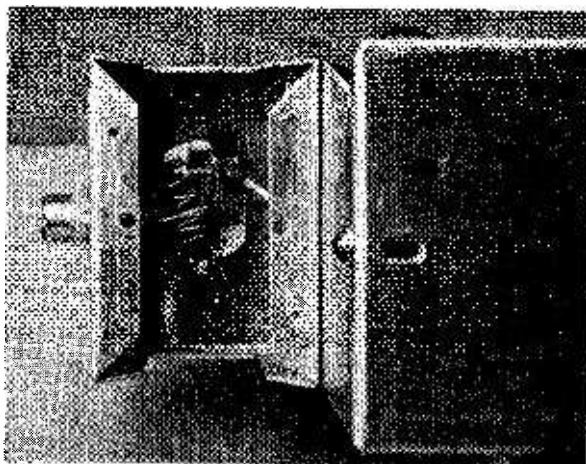
The position of the aerial tapping depends somewhat on the use of a co-axial fed dipole or similar aerial, or a short vertical rod type aerial. This tapping can usually be about one-quarter to one-third the total number of turns from the C1 (earthed) end.

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.

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.

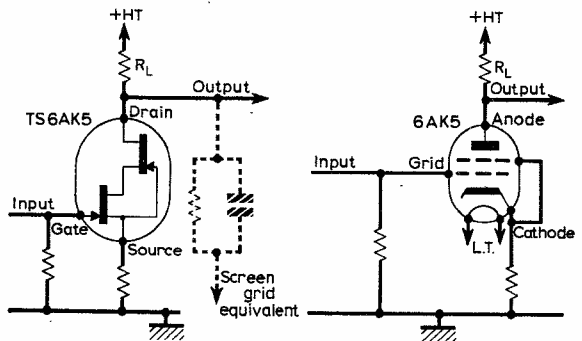
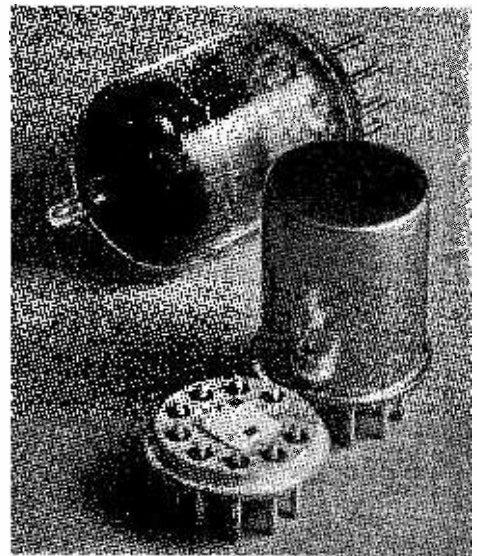


TABLE 1:

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.

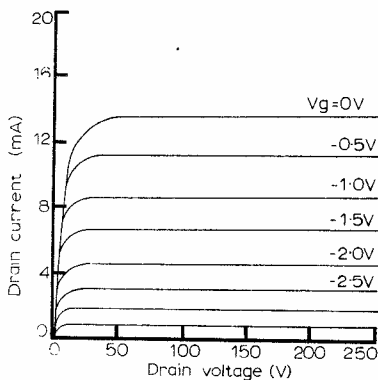


Fig. 2: Comparison of output drain characteristics with those of the 6AK5 anode.

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 comfortable 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

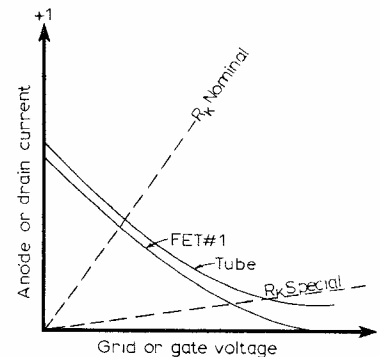
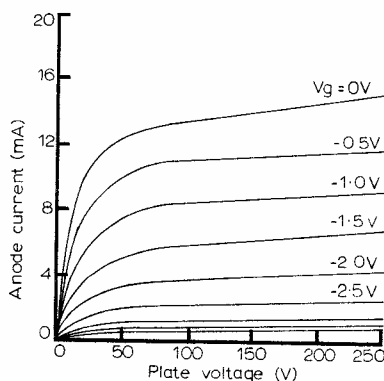


Fig. 3: Transfer characteristic of a fetron compared with a valve.

fetron for replacing the 12AT7 is TS12AT7.

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".

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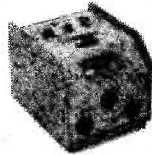
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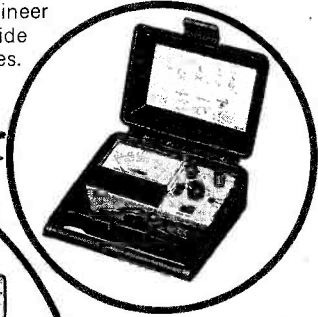
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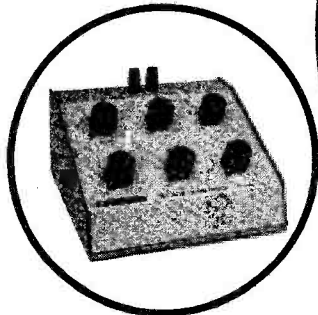
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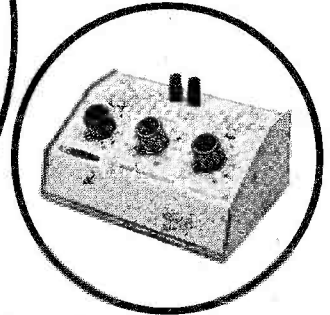
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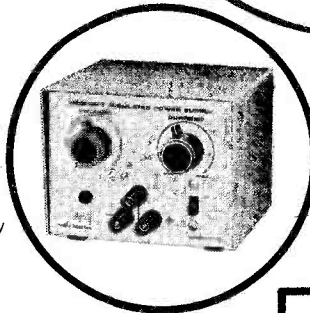
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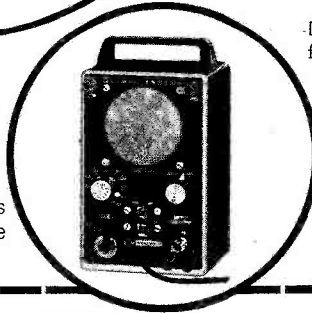


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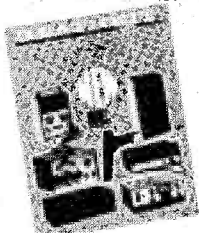


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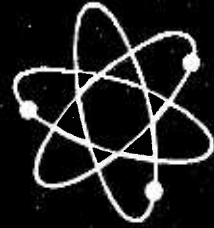
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2G302	0.15	2N2926		2N5174	0.08	AF116	0.20	BC307V1	0.10	BF272	0.53
2G303	0.25	Green	0.10	2N5176	0.32	AF124	0.24	BC308A	0.09	BF274	0.28
2G306	0.30	Yellow	0.10	2N5245	0.48	AF125	0.20	BC308B	0.09	BF458	0.95
2G309	0.30	Orange	0.10	2N5190	0.92	AF126	0.10	BC309	0.10	BF459	0.57
2G344A	0.25	2N3053	0.81	2N5191	0.92	AF127	0.20	BC309A	0.10	BF821	2.10
2G345R	0.25	2N3054	0.47	2N5192	1.24	AF129	0.38	BC309B	0.10	BF821A	2.30
2G371	0.15	2N3054	0.46	2N5193	1.10	AF129	0.38	BC309C	0.10	BF822	0.92
2G374	0.15	2N3065	0.50	2N5194	1.10	AF172	0.25	BC327	0.24	BF830	0.26
2G381	0.22	2N3390	0.20	2N5195	1.48	AF178	0.55	BC328	0.22	BF838	0.28
2G417	0.20	2N3391	0.20	2N5245	0.48	AF179	0.85	BC337	0.19	BFW10	0.61
2N109	0.48	2N3391A	0.22	2N5457	0.35	AF180	0.50	BC338	0.19	BFW11	0.61
2N174	1.40	2N3392	0.18	2N5458	0.35	AF186	0.40	BCY30	0.35	BFW15	0.85
2N176	0.75	2N3393	0.12	2N5459	0.38	AF200	0.35	BCY31	0.40	BFX13	0.28
2N274	0.75	2N3394	0.12	2N128	0.68	AF259	0.41	BCY32	0.75	BFX29	0.25
2N385	0.75	2N3402	0.10	2N138	1.65	AF240	0.72	BCY33	0.75	BFX30	0.26
2N351	0.95	2N3403	0.10	2N139	1.36	AF279	0.54	BCY34	0.84	BFX37	0.80
2N376	1.00	2N3404	0.24	2N140	0.92	AF280	0.54	BCY35	0.84	BFX44	0.83
2N384	0.98	2N3405	0.27	2N141	0.51	AFY42	0.74	BCY38	0.40	BFX63	2.48
2N388A	0.40	2N3414	0.10	2N142	0.68	AFY211	0.65	BCY39	1.05	BFX68	0.30
2N404	0.43	2N3415	0.10	2N143	0.75	AL109	0.75	BCY40	0.60	BFX84	0.24
2N456	0.75	2N3416	0.15	2N152	0.72	BCY43	0.70	BCY43	0.15	BFX85	0.24
2N468A	0.75	2N3417	0.81	2N153	0.81	AFY26	0.80	BCY43	0.15	BFX86	0.24
2N457A	0.80	2N3870	1.25	2N154	0.94	AFY27	0.38	BCY65	0.21	BFX87	0.25
2N491	8.25	2N3871	1.12	2N159	1.17	AFY28	0.28	BCY69	0.22	BFX88	0.20
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2N596	0.20	2N3703	0.38	2N201	1.05	BCY65	0.35	BCY70	0.17	BFY11	0.48
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2N698	0.25	2N3705	0.10	40050	0.78	AL103	1.25	BCY72	0.18	BFY18	0.25
2N699	0.20	2N3706	0.09	40051	0.01	BC107	0.14	BCY87	3.47	BFY19	0.25
2N706	0.10	2N3707	0.10	40059	0.31	BC108	0.13	BCY88	2.40	BFY20	0.50
2N708A	0.12	2N3708	0.70	40310	0.60	BC109	0.13	BCY89	0.80	BFY22	0.40
2N709	0.15	2N3709	0.09	40312	0.60	BC113	0.18	BCY91	0.75	BFY23	0.20
2N709	0.38	2N3710	0.10	40313	0.92	BC114	0.12	BCZ11	0.50	BFY41	0.43
2N711	0.80	2N3711	0.90	40316	0.50	BC115	0.15	BD116	0.75	BFY43	0.62
2N718	0.21	2N3712	0.95	40318	0.92	BC116	0.15	BD116	0.75	BFY50	0.18
2N718A	0.80	2N3713	1.08	40360	0.46	BC116A	0.18	BD121	0.75	BFY61	0.18
2N730	0.50	2N3714	1.15	40361	0.48	BC117	0.21	BD123	0.82	VFY52	0.18
2N730	0.15	2N3715	1.25	40362	0.11	BD116	0.11	BD124	0.87	BFY63	0.15
2N914	0.22	2N3716	1.35	40362	0.50	BC119	0.27	BD130	0.97	BFY64	0.41
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2N918	0.80	2N3774	3.33	40389	0.46	BC123	0.29	BD132	0.50	BFY76	0.40
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2N1131	0.20	2N3780	4.60	40409	0.52	BC136	0.15	BD140	0.83	BRX19	0.18
2N1182	0.20	2N3781	8.97	40411	0.53	BC137	0.15	BDY10	1.25	BRX20	0.14
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2N1307	0.22	2N3819	0.37	40602	0.46	BC145	0.21	BDY60	0.80	BRX69	0.78
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2N2196A	0.30	2N3904	0.17	AC178	0.15	BC204	0.11	BF182	0.30	C111	0.68
2N2210	0.37	2N3905	0.21	AC179	0.20	BC205	0.10	BF183	0.40	D40N3	0.82
2N2215A	0.51	2N3906	0.22	AC179	0.20	BC206	0.11	BF184	0.17	GET111	0.45
2N2220	0.20	2N4036	0.63	ACY20	0.20	BC207	0.10	BF185	0.17	GET113	0.20
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2N2221A	0.32	2N4058	0.16	ACY28	0.18	BC209	0.10	BF195	0.15	GET115	0.50
2N2222	0.31	2N4059	0.09	ACY30	0.42	BC211	0.20	BF192	0.15	GET119	0.65
2N2222A	0.41	2N3059	0.90	AD182	0.35	BC212K	0.10	BF197	0.15	GET120	0.25
2N2368	0.11	2N4060	0.11	ACY39	0.55	BC212L	0.16	BF198	0.15	GET135	0.20
2N2369	0.39	2N4061	0.11	ACY40	0.17	BC214	0.23	BF199	0.18	GET136	0.20
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2N2846	0.50	2N4302	0.25	AD136V	0.98	BC237	0.09	BF224J	0.14	GET138	0.20
2N2847	1.50	2N4303	0.32	AD140	0.50	BC239	0.09	BF236	0.22	GET183	0.12
2N2711	0.12	2N4312	0.87	AD140	0.55	BC239	0.09	BF257	0.22	GET187	0.20
2N2712	0.12	2N4313	0.87	AD142	0.50	BC251	0.20	BF238	0.22	GET188	0.20
2N2713	0.17	2N4915	0.96	AD143	0.45	BC252	0.18	BF244	0.18	GET188	0.20
2N2714	0.17	2N4916	0.20	AD149V	0.86	BC253	0.23	BF245	0.23	GET189	0.20
2N2904	1.18	2N4917	0.17	AD149V	1.28	BC257	0.09	BF246	0.48	GET189	0.20
2N2904A	0.25	2N4918	0.50	AD150	0.63	BC258	0.09	BF247	0.49	GET189	0.20
2N2905	0.26	2N4920	0.58	AD161	0.87	BC259	0.13	BF254	0.14	GET189	0.25
2N2905A	0.23	2N4921	0.50	AD162	0.37	BC261	0.20	BF255	0.15		
2N2906	0.18	2									



6-9V STABILISED SUPPLY

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.

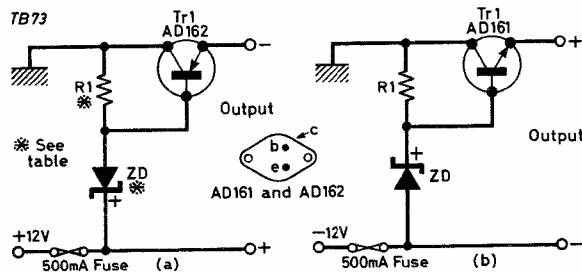


Fig. 1: Basic stabilising circuits for a) negative and (b) positive "earth".

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.

J. ROWLEY

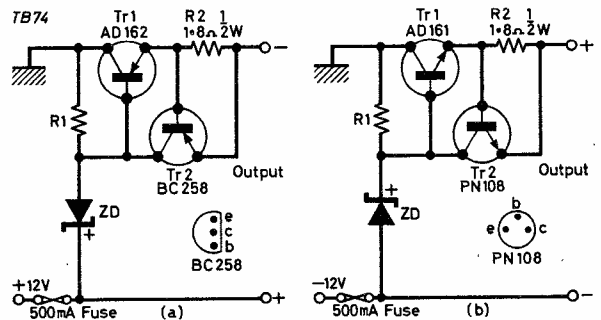


Fig. 2: Protected circuits for negative or positive "earth".

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 (½W)
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.

BACK NUMBERS

We regret that the back numbers department of P.W. has now closed and consequently we are unable to supply these. Requests for specific back issues can usually be included in our 'CQ' section; there is no charge for this but it is a service between readers and P.W. is unable to meet any of these requests.

TWO VERSATILE TRANSISTOR AMPLIFIERS

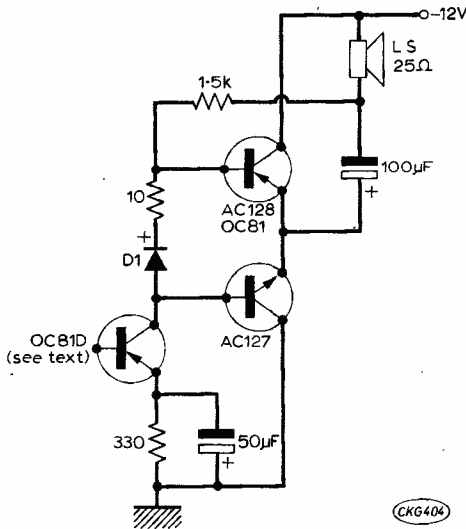
C. E. MILLER

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.

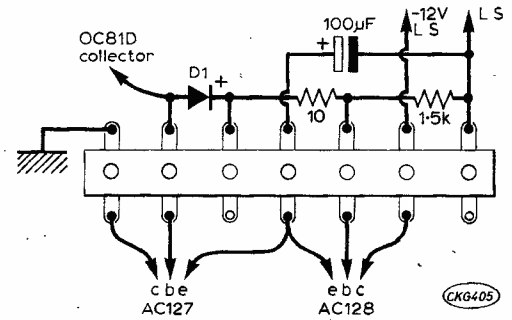


CKG404

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

CIRCUIT No.2

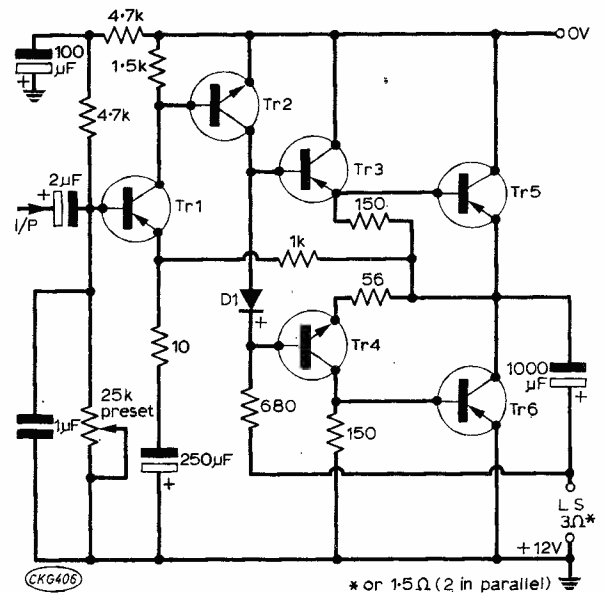
It was to provide more power than the AC127/128's could give, and also to avoid having to use special loudspeakers, that the second circuit was evolved. It consists of an amplifier, a driver, and a complementary stage, which in turn drives the output transistors. In this circuit the computer panels really came into their own. Those used contained mainly



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

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).



CKG406

* or 1.5Ω (2 in parallel)

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.

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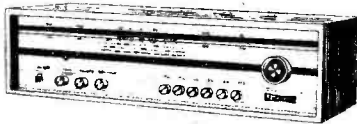


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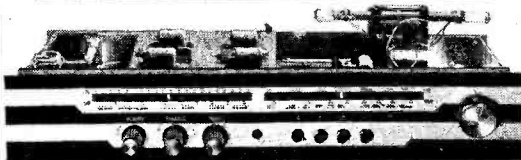
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1R5	-28	30C17	-78	EAF42	-50	EM80	-38	PCF808	-68	U301	-75
185	-22	30C18	-57	EB91	-18	EM81	-38	PCL82	-30	UAB090	-31
1T4	-16	30F5	-64	EBC33	-40	EM84	-32	PCL83	-55	UAF42	-50
354	-28	30FL1	-65	EBC41	-48	EM87	-50	PCL84	-38	UBC41	-45
3V4	-47	30FL12	-69	EBC81	-30	EY61	-88	PCL85	-28	UBF80	-84
6U4G	-31	30FL14	-68	EBC90	-22	EY86	-29	PCL86	-37	UBF89	-38
6V4G	-35	30LL	-29	EBF90	-32	EY97	-29	PCL88	-80	UC084	-32
6X3GT	-30	30LL15	-70	EBF93	-39	EZ40	-39	PCL900	-89	UC085	-35
6Z4G	-35	30L17	-70	EBF93	-29	EZ41	-39	PCL905	-38	UCF80	-30
6/30L2	-54	30P4	-54	ECC81	-17	EZ80	-21	PENAA4	-77	UCH42	-68
6AM6	-12	30P12	-60	ECC82	-20	EZ81	-22	PEN36C	-70	UCH81	-30
6AQ5	-23	30P19	-54	ECC83	-35	EZ90	-25	PFL200	-61	UCL82	-38
6AT6	-30	30P11	-58	ECC85	-34	EZ30	-34	PL36	-48	UCL83	-55
6AV6	-20	30PL13	-89	ECC804	-54	EZ32	-40	PL81	-43	UF41	-50
6BA6	-20	30PL14	-89	ECCF80	-30	KT41	-77	PL81A	-47	UF89	-80
6BE6	-21	35L6GT	-45	ECP82	-28	KT61	-55	PL82	-21	UL41	-58
6BE6	-41	35W4	-25	ECP85	-55	KT66	-78	PL83	-28	UL84	-80
6BW7	-50	35Z4GT	-25	ECH42	-59	LN319	-58	PL84	-80	UM84	-88
6P14	-35	50C6D6G	-68	ECH81	-20	LN329	-80	PL860	-83	UY41	-28
6P23	-68	907	-49	ECH93	-38	LN339	-65	PL504	-63	UY85	-25
6P25	-50	AC/VP2	-77	ECH84	-35	N78	£1-05	PM84	-30	VP4B	-77
6S6GT	-20	B349	-70	ECL80	-30	P61	-40	PX25	-65	Z77	-42
6J7G	-24	B729	-54	ECL82	-29	PABC80	-31	PY32	-52	Z77	-28
6K7G	-12	CCH35	-67	ECL86	-35	PC86	-44	PY33	-62	Transistors	
6K8G	-38	CY31	-28	EP29	-38	PC88	-44	PY81	-25	AO107	-17
6Q7G	-35	DAF91	-22	EF41	-57	PC96	-42	PY82	-28	AC127	-25
6SL7GT	-32	DAF96	-38	EP89	-23	PC97	-38	PY83	-28	AD148	-87
6SN7GT	-32	DF90	-16	EP85	-27	PC909	-29	PY88	-33	AF115	-20
6V6GT	-28	DF96	-38	EP86	-30	PCC94	-29	PY800	-81	AF116	-20
6V6GT	-28	DH77	-20	EP89	-26	PC85	-28	PY801	-31	AF117	-20
6X4	-23	DK32	-33	EP91	-13	PC88	-28	PY89	-30	AF125	-17
6X5GT	-28	DK91	-28	EP92	-27	PC89	-43	R20	-70	AF127	-17
10P13	-53	DK92	-50	EP93	-65	PCCL89	48	U25	-73	OC28	-25
12AX7	-17	DK96	-45	EP93	-27	PC805	-70	U96	-65	OC44	-12
12AU7	-20	DL35	-40	EP184	-29	PCF80	-28	U47	-73	OC45	-12
12AX7	-22	DL92	-26	EH90	-38	PCF82	-33	U49	-70	OC71	-12
19BG6G	-75	DL94	-47	EL33	-55	PCF86	-46	U52	-31	OC72	-12
20F2	-87	DL96	-38	EL34	-48	PCF800	-55	U78	-24	OC75	-12
20F3	-75	DY86	-24	EL41	-54	PCF801	-28	U91	-55	OC81	-12
25L6GT	-19	DY87	-24	EL44	-26	PCF802	-39	U93	-55	OC82	-12
25U4GT	-37	DY87	-24	EL44	-26	PCF802	-39	U93	-55	OC82	-12
30C1	-26	DY802	-33	EL95	-33	PCF805	-57	U301	-38	OC82D	-12
30C15	-58	EABC30	-32	EL500	-62	PCF806	-58	U329	-68	OC170	-32

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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-heated 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,

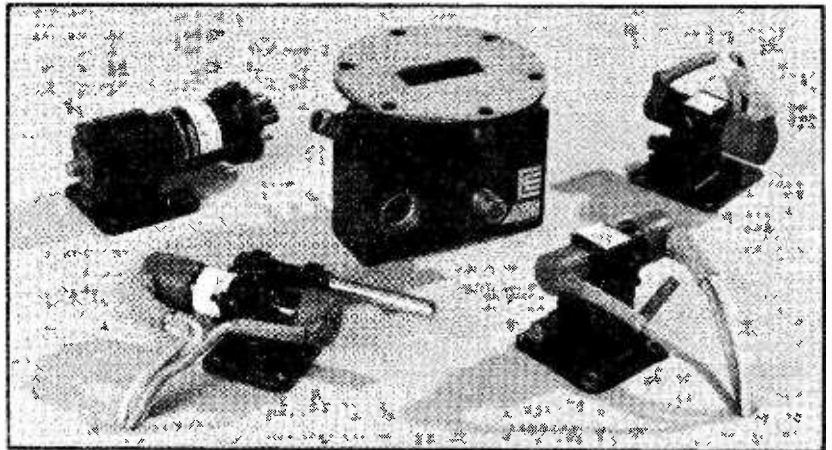
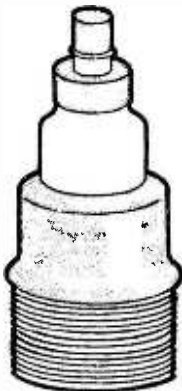


Fig. 1: at left, shows the general configuration of a disc seal valve. The picture shows a collection of oscillator klystrons, the centre one being used in communications relay equipment. The others are used in radar local oscillators.

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AC107	50p	BCY70	15p	CA3044	£1.42	OA90	6p	1N4148	4p		45p
AC126	20p	BCY71	30p	CA3046	86p	OA91	5p	1N5400	14p	3N84	£1.30
AC127	25p	BCY72	15p	CA3048	£2.34	OA95	5p	1N5404	18p	3N128	73p
AC128	24p	BD124	75p	CA3052	£1.86	OA200	6p	1N5408	23p	3N140	92p
AC128/AC176	44p	BD131	75p	CA3065	£1.42	OA202	7p	1S1500	4p	3N152	92p
AC151	20p	BD131/132	£1.50	CA3088E	£1.38	OC20	97p	1S1920	7p	3P15F	£2.00
AC152	25p	BDY20	92p	CA3090Q	£4.70	OC25	37p	1S1940	6p	3P15S	£2.00
AC153	26p	BF115	23p	CD4001AE	£1.54	OC28	70p	1S5009	80p	7400	16p
AC176	20p	BF163	35p	CD4009AE	£1.16	OC29	76p	1S5012	80p	7401	20p
AC153/176K	62p	BF167	25p	CD4012AE	£1.40	OC35	60p	1S5015	75p	7402	20p
AC187K	17p	BF173	39p	CD4013AE	£1.11	OC36	63p	1S5018	75p	7403	20p
AC188K	23p	BF177	25p	CD4015AE	£2.92	OC42	40p	1S5024	75p	7404	25p
AC187/188K	40p	BF178	31p	CD4017AE	£2.92	OC44	40p	2N4004	23p	7405	25p
ACV17	27p	BF180	35p	CD4018AE	£2.92	OC45	20p	2N696	15p	7409	25p
ACV18	20p	BF185	15p	CD4020AE	£3.25	OC71	20p	2N697	17p	7410	20p
ACV19	20p	BF195	15p	CD4023AE	£1.09	OC72	20p	2N698	30p	7413	30p
ACV20	20p	BF196	15p	CR1/051C	45p	OC75	25p	2N706	10p	7420	30p
ACV21	19p	BF200	35p	CR1/401C	60p	OC76	25p	2N706A	10p	7425	30p
ACV22	10p	BF254	14p	CRS3/05AF		OC77	40p	2N708	16p	7430	25p
AD140	55p	BF255	15p			OC81	20p	2N911	50p	7440	20p
AD149	50p	BFX13	25p	CRS3/40AF		OC81D	20p	2N914	20p	7442	£1.16
AD181	20p	BFX29	25p			OC83	23p	2N918	42p	7443	£1.45
AD162	55p	BFX84	25p	CZ6	15p	OC84	25p	2N929	25p	7444	£1.45
AD161/162	£1.04	BFX85	34p	D10 (NTGD10)		OC139	25p	2N930	28p	7445	£2.06
AF106	32p	BFX86	25p			OC170	25p	2N1131	24p	7446	£1.45
AF114	25p	BFX87	30p	IRT84	£2.90	OC171	30p	2N1132	24p	7447	£1.25
AF115	25p	BFX88	24p	LIC709C/5	42p	OC172	30p	2N1302	17p	7450	20p
AF116	25p	BFY50	15p	LIC709C/8	42p	ORP17M	42p	2N1302	17p	7450	20p
AF117	25p	BFY51	15p	LIC709C/14	40p	ORP12	50p	2N1303	17p	7450	20p
AF118	44p	BFY52	15p	LIC723C/14	40p	ORP60	40p	2N1304	24p	7453	20p
AF124	25p	BFY53	17p	LIC741C/5	45p	ORP61	40p	2N1305	24p	7454	20p
AF125	24p	BFY90	£1.05	LIC741C/8	40p	ORP69	50p	2N1306	30p	7460	45p
AF126	17p	BP101	75p	MC1303L	£1.75	PN70	9p	2N1307	30p	7470	45p
AF139	47p	BPX66	£1.35	MC1305P	£2.80	PN71	9p	2N1308	34p	7472	32p
AF196	50p	BSX10	16p	MC1310P	£2.95	PN107	7p	2N1309	34p	7473	45p
AF239	50p	BSX19	16p	MC1310P	£2.95	PN108	7p	2N1559 (CR1)	60p	7475	45p
AF279	55p	BSX20	20p	MC1312P	£2.75	PN109	7p	401C	60p	7475	45p
ASV26	25p	BSX21	20p	MC1330P	80p	PN3819(2N3819)	2N1613	15p	7476	45p	
ASV27	39p	BSX27	20p	MC1352P	£2.00		2N1711	15p	7480	87p	
ASV28	22p	BSY29	25p	MC4024P	£2.20	ST2	28p	2N1893	54p	7482	£1.32
ASV29	30p	BSY95A	12p	MC4044P	£2.20	SL103A	50p	2N2026	33p	7483	30p
BA138	15p	BY101	20p	MF0300	£1.63	SL403A (Rec)	42p	2N218A	38p	7486	80p
BAX16	8p	BY127	92p	MFC8040			60p	2N219	38p	7474	40p
BB103	16p	BTY79/400R	92p	MFC8010	£1.38	SL803A	60p	2N219A	53p	7481A	£1.28
BB104	28p	BT106	£1.20	MFC8040	£1.24	SL403D	60p	2N238	7p	7492	85p
BB105	32p	BZY88C3V3	£1.20	MFC9020	£2.12	(IC Amp.)	£1.50	2N2389	17p	7493	75p
BC107	10p	BZY88C3V6	13p	MJE371	66p	TA A263	75p	2N2369A	17p	7494	74p
BC107/BC178	24p	BZY88C3V9	13p	MJE920	65p	TA A293	97p	2N2484	42p	7495	80p
BC108	10p	BZY88C4V3	13p	MJE921	62p	TA A310	£1.25	2N2646	45p	7496	£1.48
BC108/BC178	24p	BZY88C4V7	13p	MJE985	62p	TA A320	75p	2N2904	49p	7474	40p
BC109	23p	BZY88C5V1	13p	MJE3055	£1.06	TA A861	45p	2N2904A	49p	74107	52p
BC109/BC179	24p	BZY88C5V6	13p	MJ480	97p	TAD100	£1.97	2N2905	65p	74121	43p
BC109C	24p	BZY88C7V5	13p	MJ481	£1.25	TAD110	£1.97	2N2905A	75p	74141	£1.00
BC140	30p	BZY88C9V1	13p	MJ491	£1.35	TIL112	£2.00	2N2924	18p	74150	£3.35
BC147	10p	BZY88C10V	13p	MJ800	£4.12	TIL209	35p	2N2925	20p	74151	£1.10
BC148	9p	BZY88C11V	13p	MJ802/MJ4502	£4.50	TIP31A	60p	2N2926	10p	74153	£1.35
BC149	10p	BZY88C13V	13p	MJ1000	£1.80	TIP32A	60p	2N3053	10p	74154	£2.60
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BC159	12p	BZY88C18V	13p	MPF103(2N5457)	49p	VA1066s	15p	2N3391A	29p	74190	£1.80
BC147/157	22p	BZY88C20V	13p	MPF104(2N5458)	49p	VA1077	15p	2N3325	£1.04	74191	£1.74
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BC149/159	11p	BZY88C24V	13p	W01	31p	2N3706	10p	2N3706	10p	40250	66p
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BC169	11p	BZY88C30V	13p	W03	35p	2N3708	8p	40310	8p	40310	60p
BC169C	12p	BZX61C7V5	23p	W05	25p	2N3709	10p	40311	10p	40311	42p
BC177	14p	BZX61C8V2	23p	W08	44p	2N3710	10p	40312	10p	40312	62p
BC178	13p	BZX61C9V1	23p	NKT213	25p	ZTX107	12p	2N3711	10p	40320	42p
BC179	14p	BZX61C10V	23p	NKT216	46p	ZTX108	11p	2N3819	25p	40360	58p
BC182	10p	BZX61C11V	23p	NKT217	50p	ZTX300	13p	2N3820	60p	40361	45p
BC182L	10p	BZX61C12V	23p	NKT218	25p	ZTX302	18p	2N3823E	20p	40362	45p
BC183	9p	BZX61C13V	23p	NKT223	27p	ZTX303	15p	2N3826	30p	40406	52p
BC183L	10p	BZX61C15V	23p	NKT271	19p	ZTX304	23p	2N3826	£1.10	40407	40p
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BC212	12p	BZX61C22V	23p	NKT279A	12p	ZTX330	18p	2N4058	13p	40410	62p
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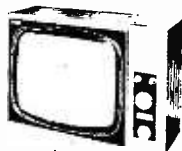
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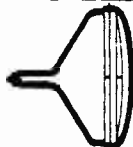
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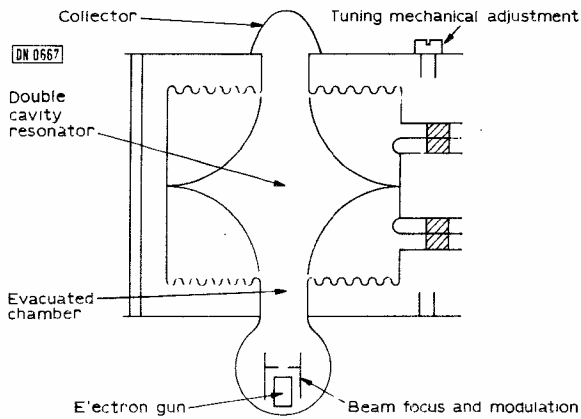


Fig. 2: Internal arrangement of a klystron valve.

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

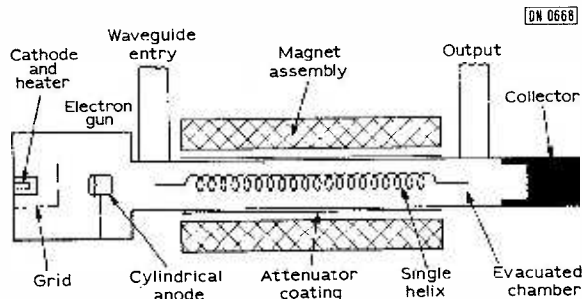


Fig. 3: Diagram to illustrate the construction of a travelling wave tube.

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.

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.

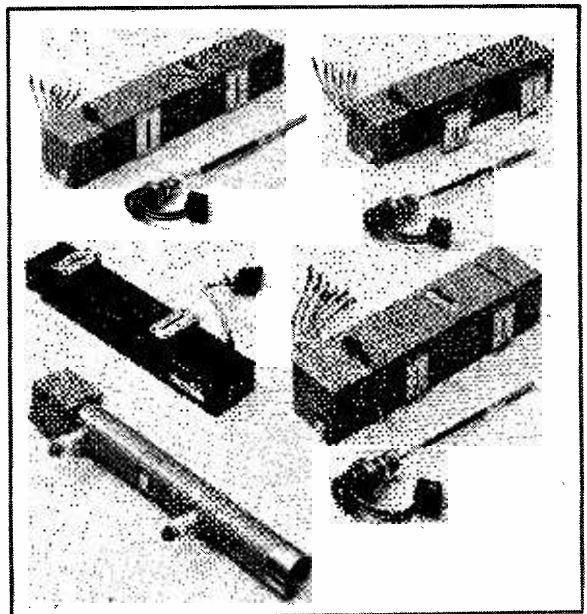
Power levels for continuous operation are usually 1 to 10W but kilowatts are possible while operation in pulsed modes can result in peak power levels in the megawatt region. The band-width at high power levels is usually reduced to as low as 10% or 400MHz at 4GHz.

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.

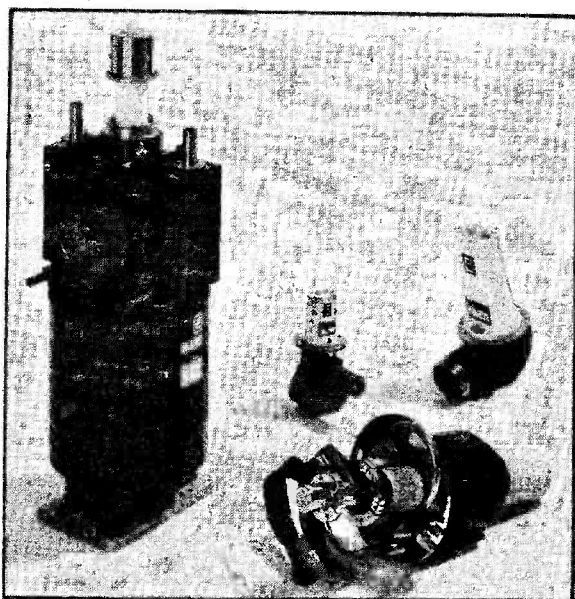
MAGNETRONS

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 $V_a=1kV$, $I_a=50mA$, $V_h=6.3$ 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 $5\mu s$ 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.

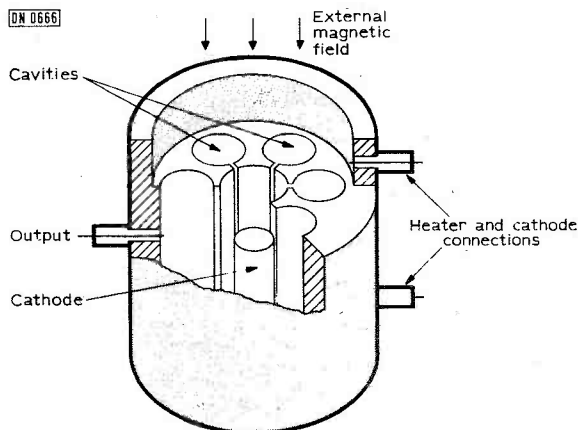


Fig. 4: General arrangement of a multiple cavity magnetron.

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

TELEVISION

MAY ISSUE

THE LID OFF VARICAPS

What exactly is a varicap tuner, how does it work and what goes wrong with it? This month Keith Cummins looks at all aspects of varicap tuners and sums up the pros and cons. Including an insight into the tricky servicing problems that can arise with their use.

TRANSISTOR I.F. PREAMPLIFIER

It is often worthwhile converting dual-standard sets to single-standard operation and fitting a modern transistor u.h.f. tuner. When this is done it is convenient to remove the v.h.f. tuner, but this usually means the need for extra gain between the u.h.f. tuner and the i.f. strip. A simple transistor i.f. pre-amplifier that has been used in converting sets such as the BRC 650 chassis is featured this month.

ASSESSING COLOUR RECEIVER PERFORMANCE

In the concluding article in his series E. J. Hoare provides a detailed account of how to assess the colour performance of receivers—purity and convergence etc. and the operation of the colour circuits.

SERVICE NOTEBOOK

Amongst the items in George Wilding Service Notebook this month is a detailed procedure for tackling that common condition, lack of e.h.t.

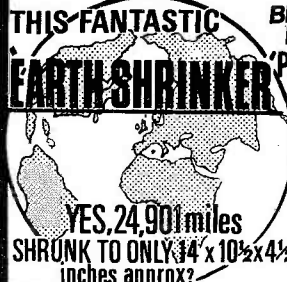
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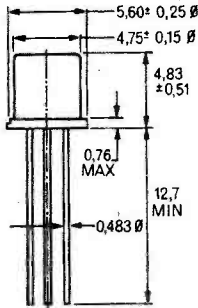
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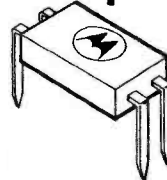


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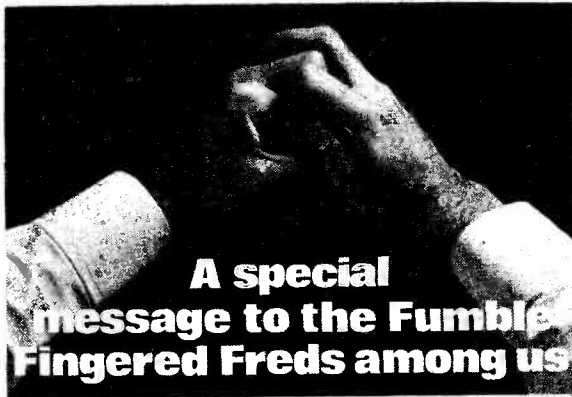


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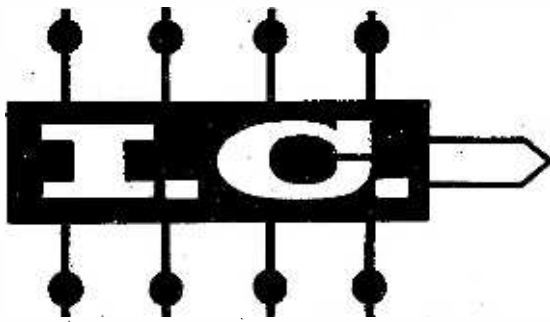
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EY86	22p	PL36	17p	20P3	12p
EF183	20p	PY81	10p	30F5	12p
EF184	20p	PY801	17p	30FL1	20p
		PY800	17p		



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

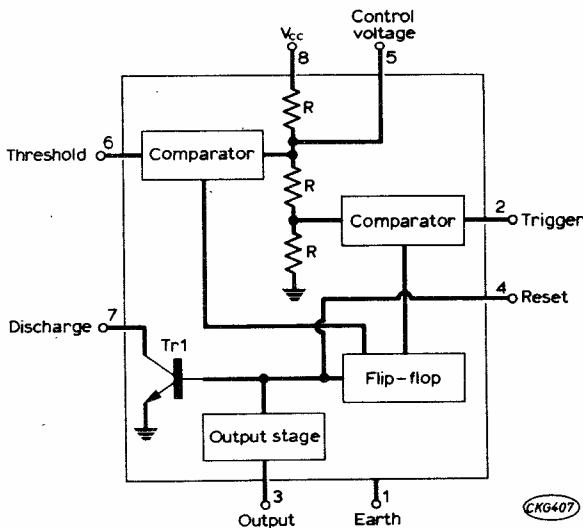


Fig. 1: Block diagram of the NE555 timing device.

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

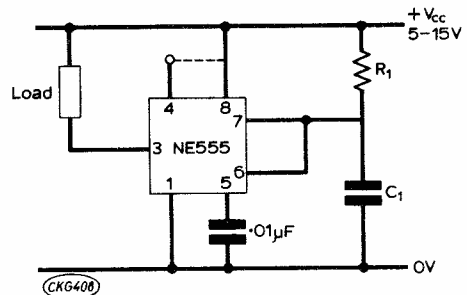


Fig. 2: Typical application of the NE555. The values of R1 and C1 for a delay of 1 second would be 1MΩ and 1µF.

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

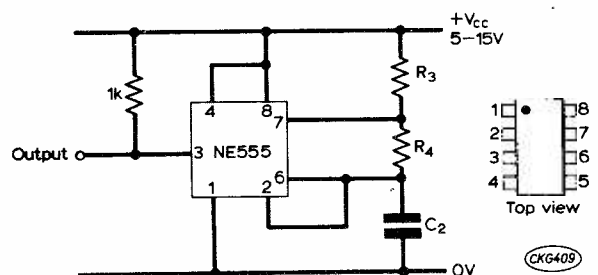


Fig. 3: In this circuit the NE555 is used as a free-running multivibrator.

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

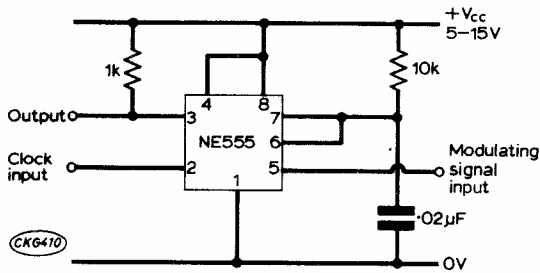


Fig. 4: Yet another application is as a pulse-width modulator.

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.

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 fre-

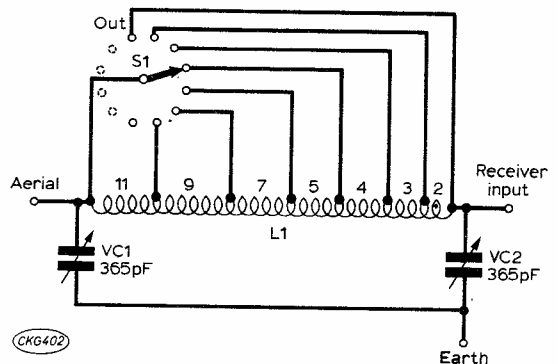


Fig. 1: above, shows the circuit of the receiver matching unit. When switched to "Out" the two variable capacitors should be turned to minimum capacity.

quencies, 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.

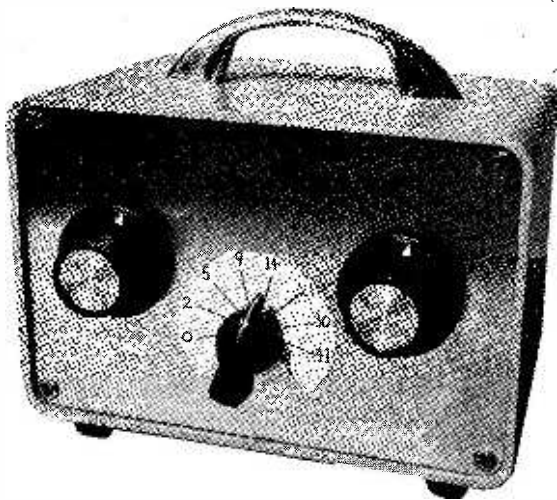
THE PI NETWORK

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

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.



and VC2 at minimum and the switch at "0".

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.

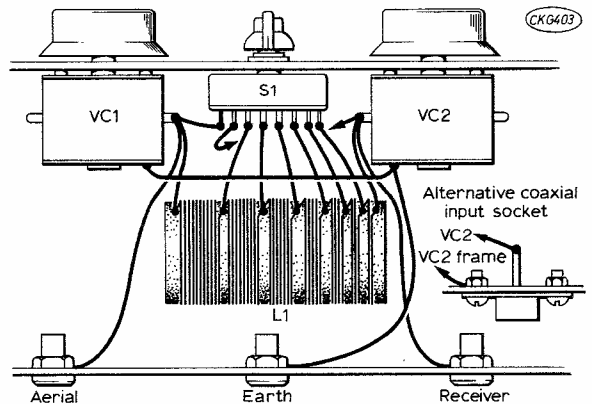
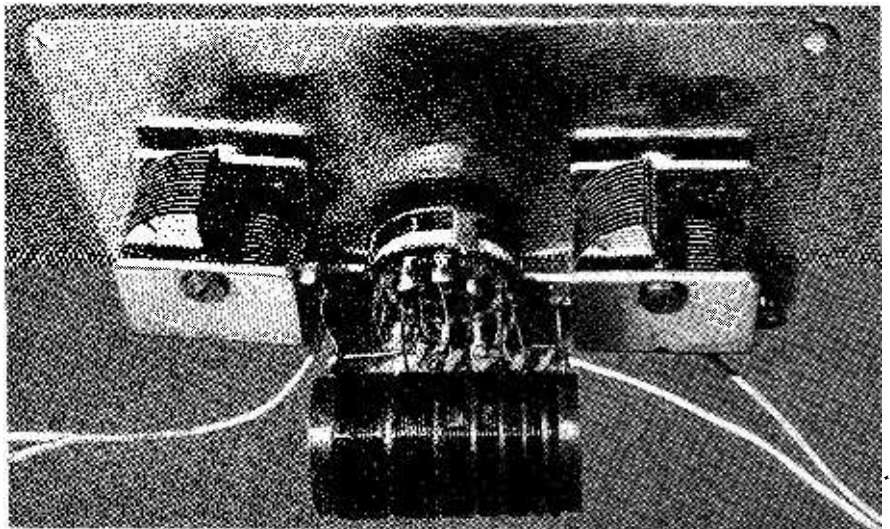


Fig. 2: Wiring diagram of the matching unit. Unused positions on the switch have been ignored.

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.

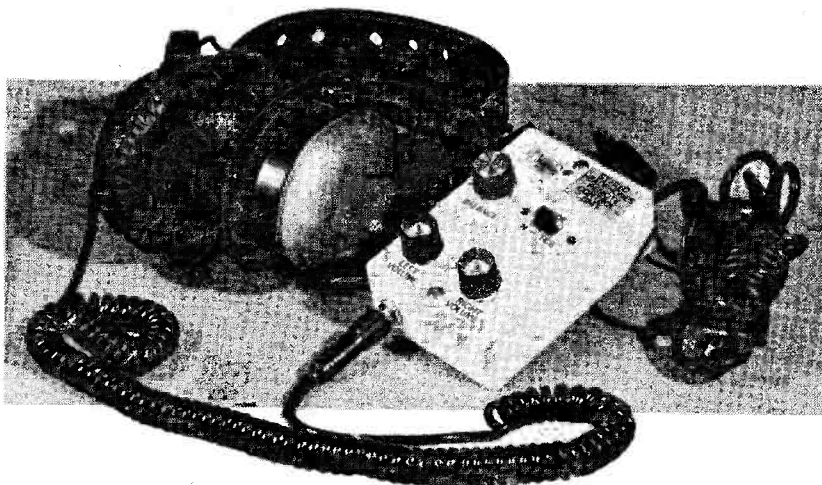
The switch has a scale showing the number of turns in circuit. The lowest frequency reached depends on the aerial and receiver, but can extend down to 1.5MHz in some cases. On some ranges, the unit is useful in reducing second channel interference. If a numbered dial is fitted to each capacitor a very 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. ■

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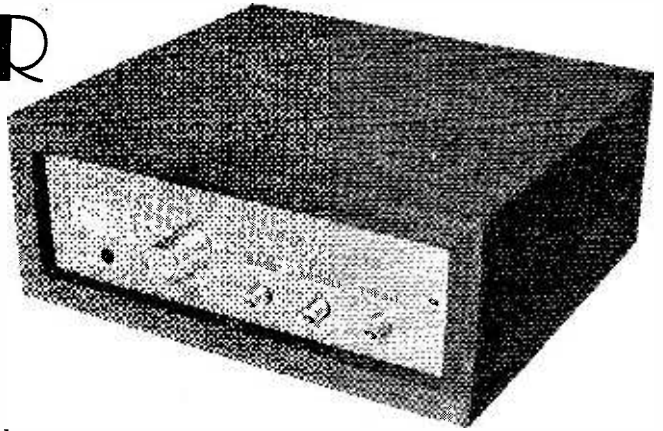


TRICOLOUR

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

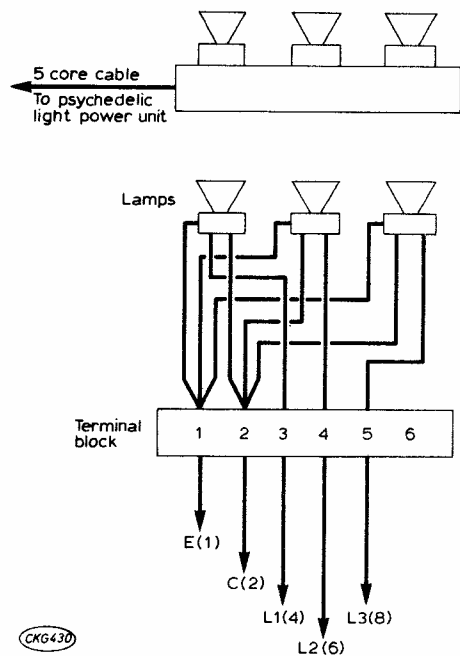


Fig. 13: The simplest arrangement in which one control unit drives three lamps, each 100 to 150 watts. E represents the earth or chassis connection via tag 1 on the Bulgin 8 pin plug/socket arrangement. The figures in parenthesis are the pin numbers. C is the common lead to the lamps—which is the 240V 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

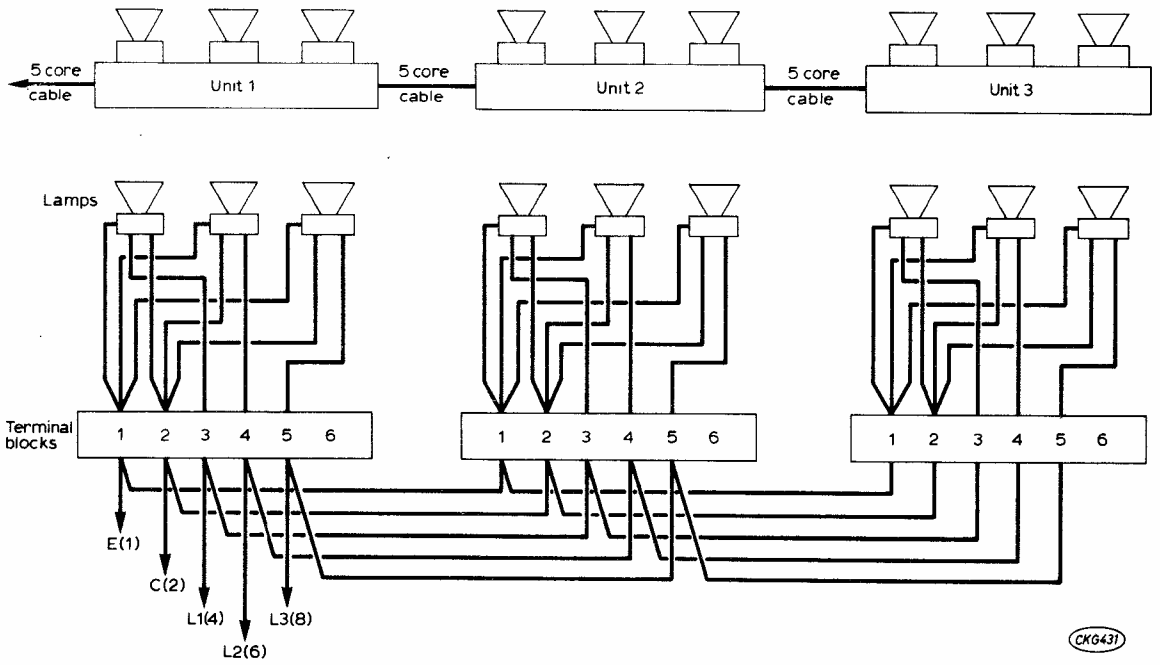


Fig. 14: Three banks of lamps, each 100w maximum, driven from one control unit.

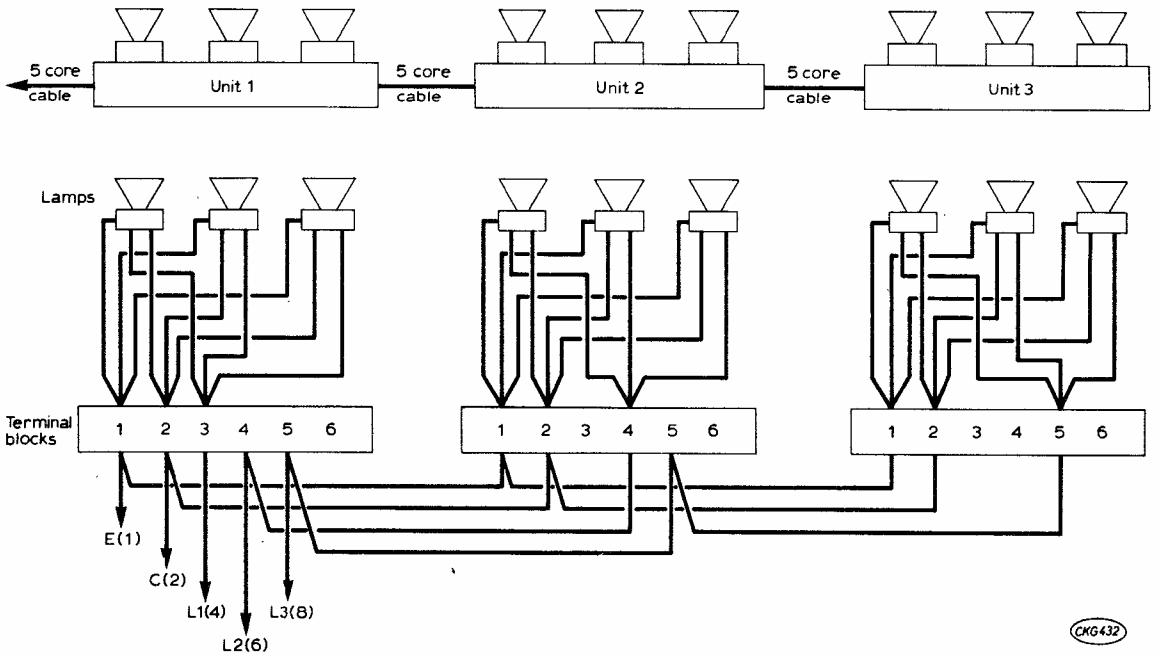


Fig. 15: Three banks of lamps, each 100W maximum, controlled by one frequency range.

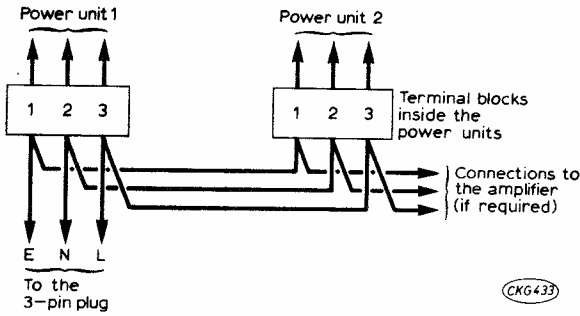


Fig. 16: Mains terminal block connections when using two control units.

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 core 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.

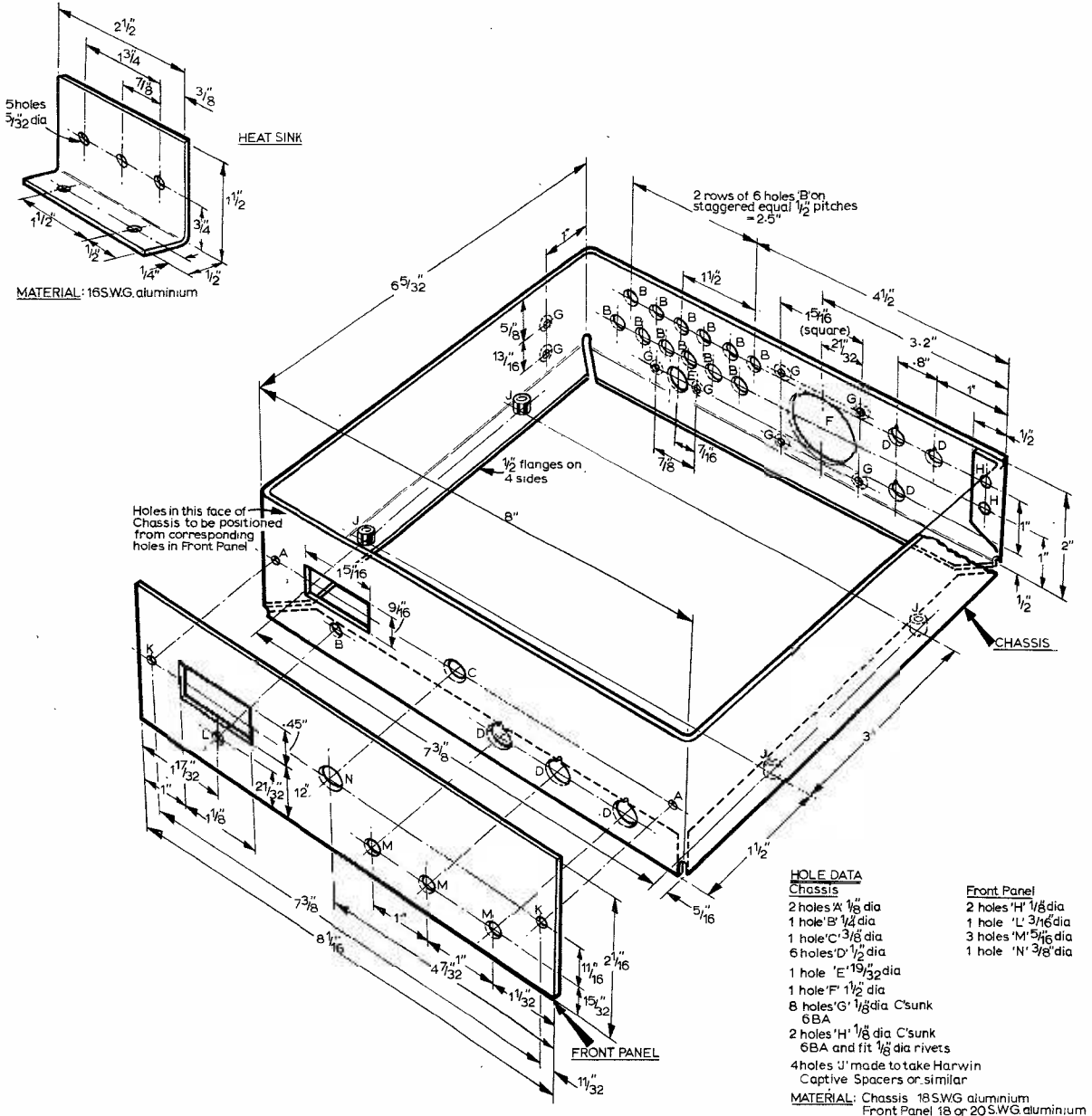
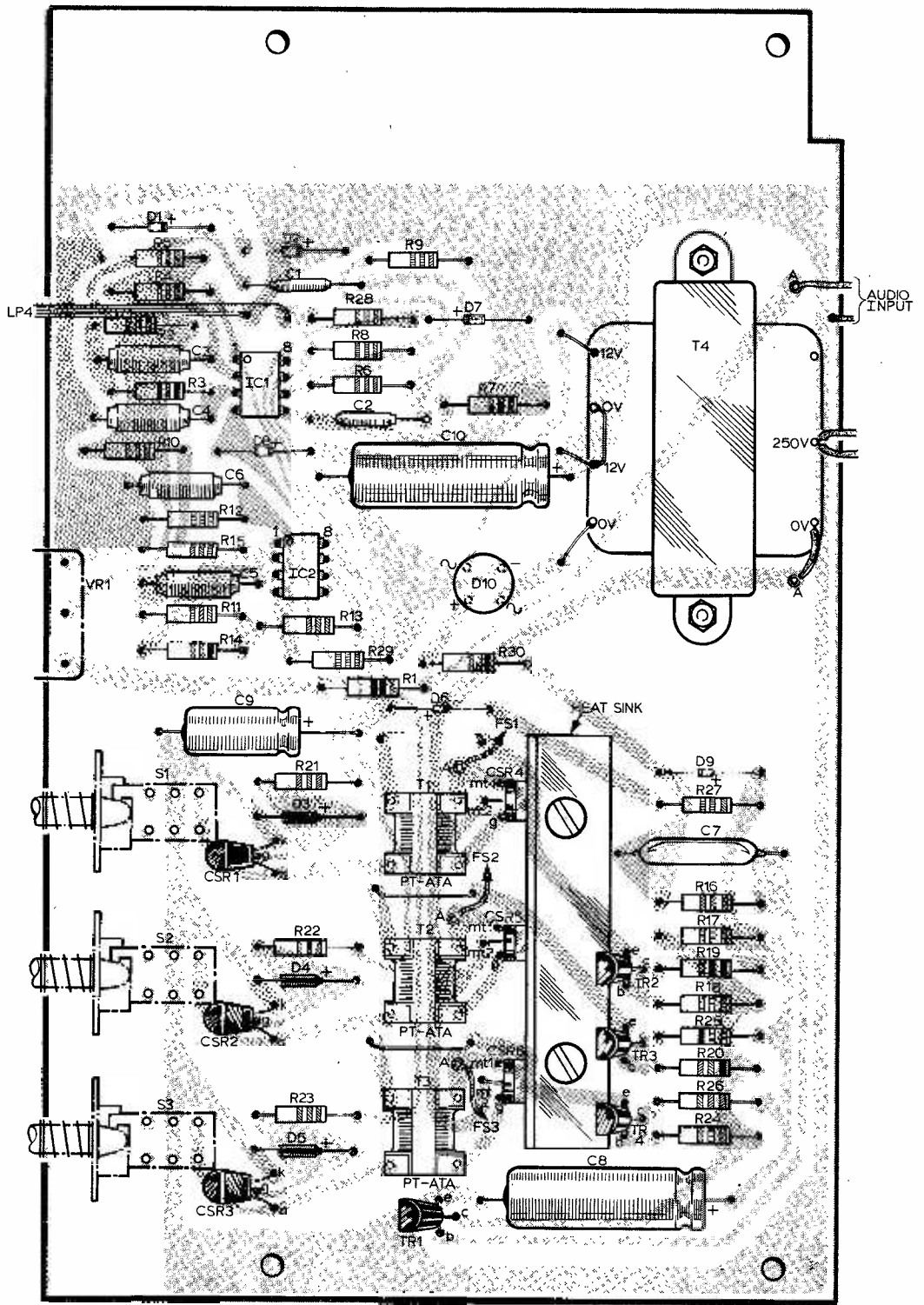
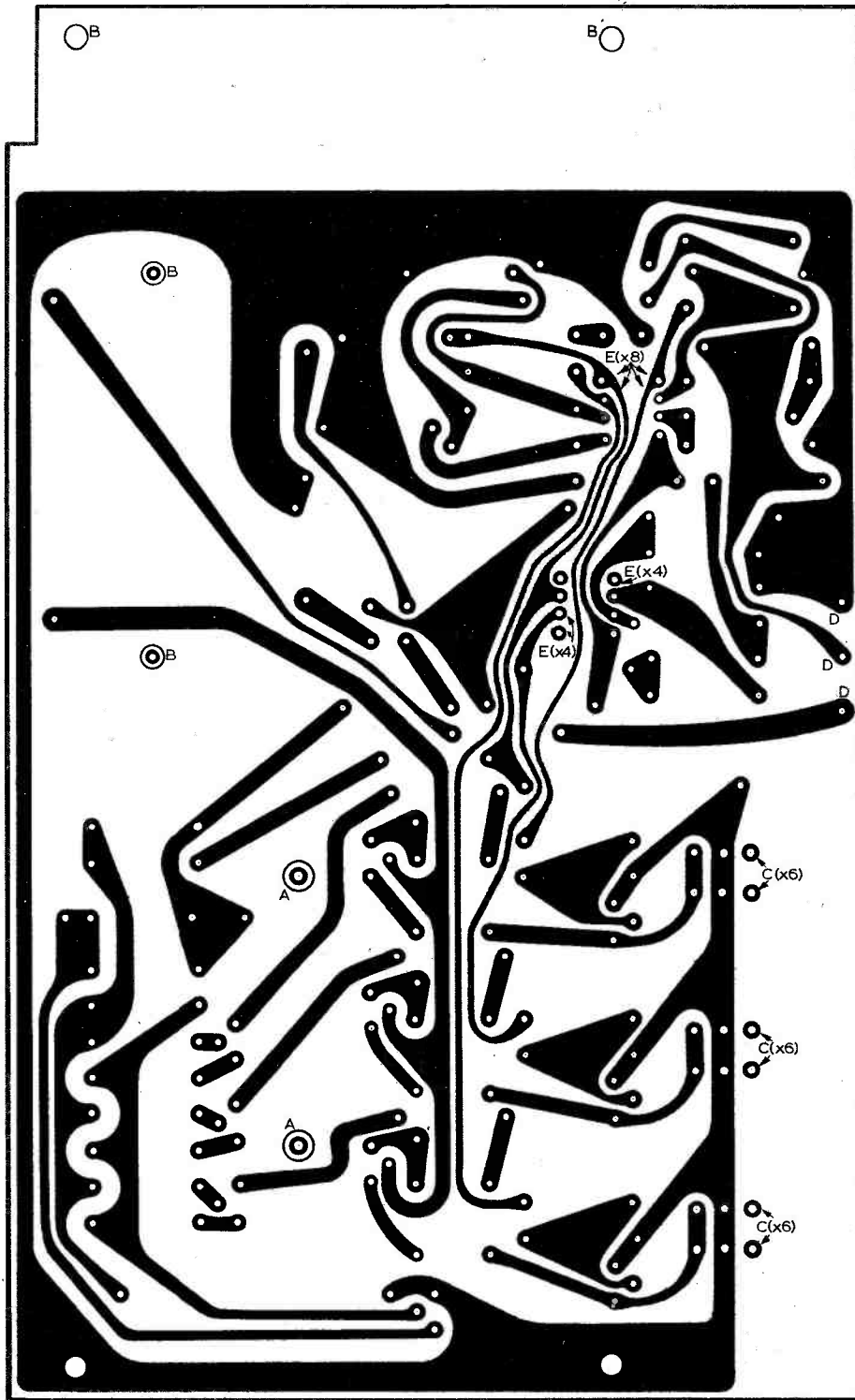


Fig. 17: Details of chassis construction and drilling with the heat sink shown top left, front panel left.



⊙ 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' $\frac{5}{32}$ " dia 3 holes 'D' 1.8mm dia
 6 holes 'B' $\frac{1}{8}$ " dia 16 holes 'E' $\frac{1}{32}$ " dia
 18 holes 'C' 1.3mm dia
 All other holes 1.0mm dia

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

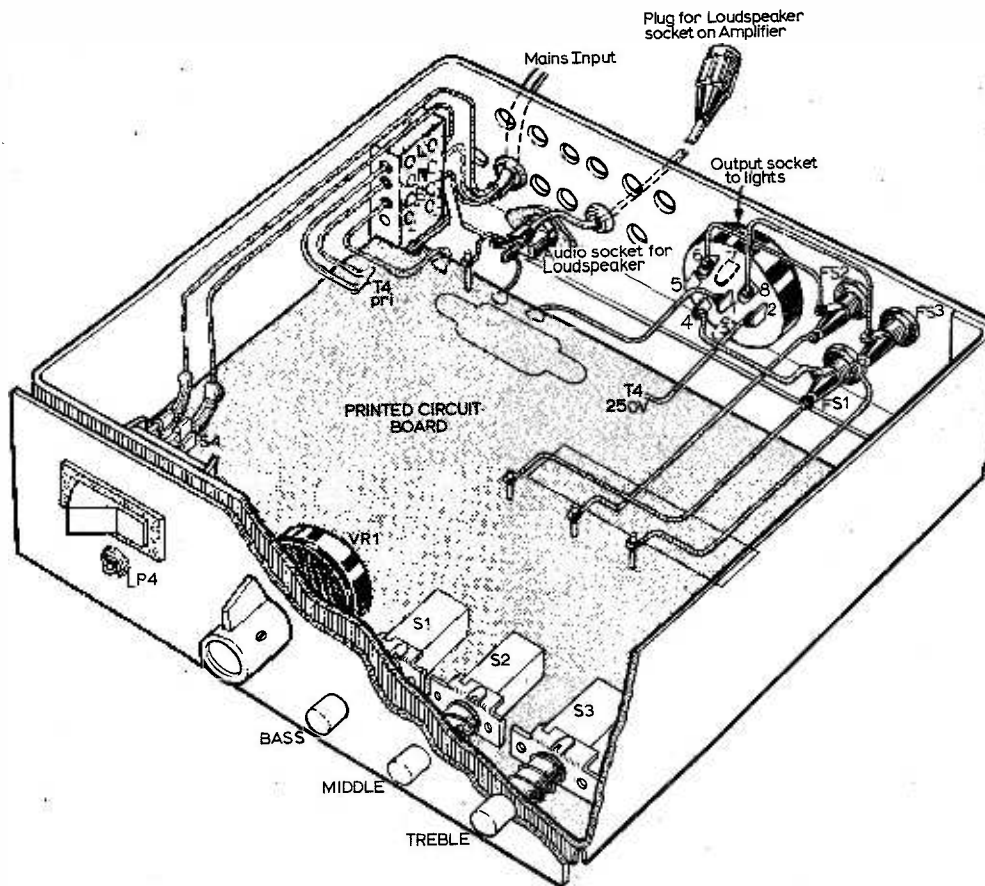


Fig. 20: Wiring of chassis mounted components to the printed circuit board. Tag 1 on the lights output socket goes to chassis (and mains earth). The live lead (L) from the mains terminal block goes to the 250V tag on T4 transformer.

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.

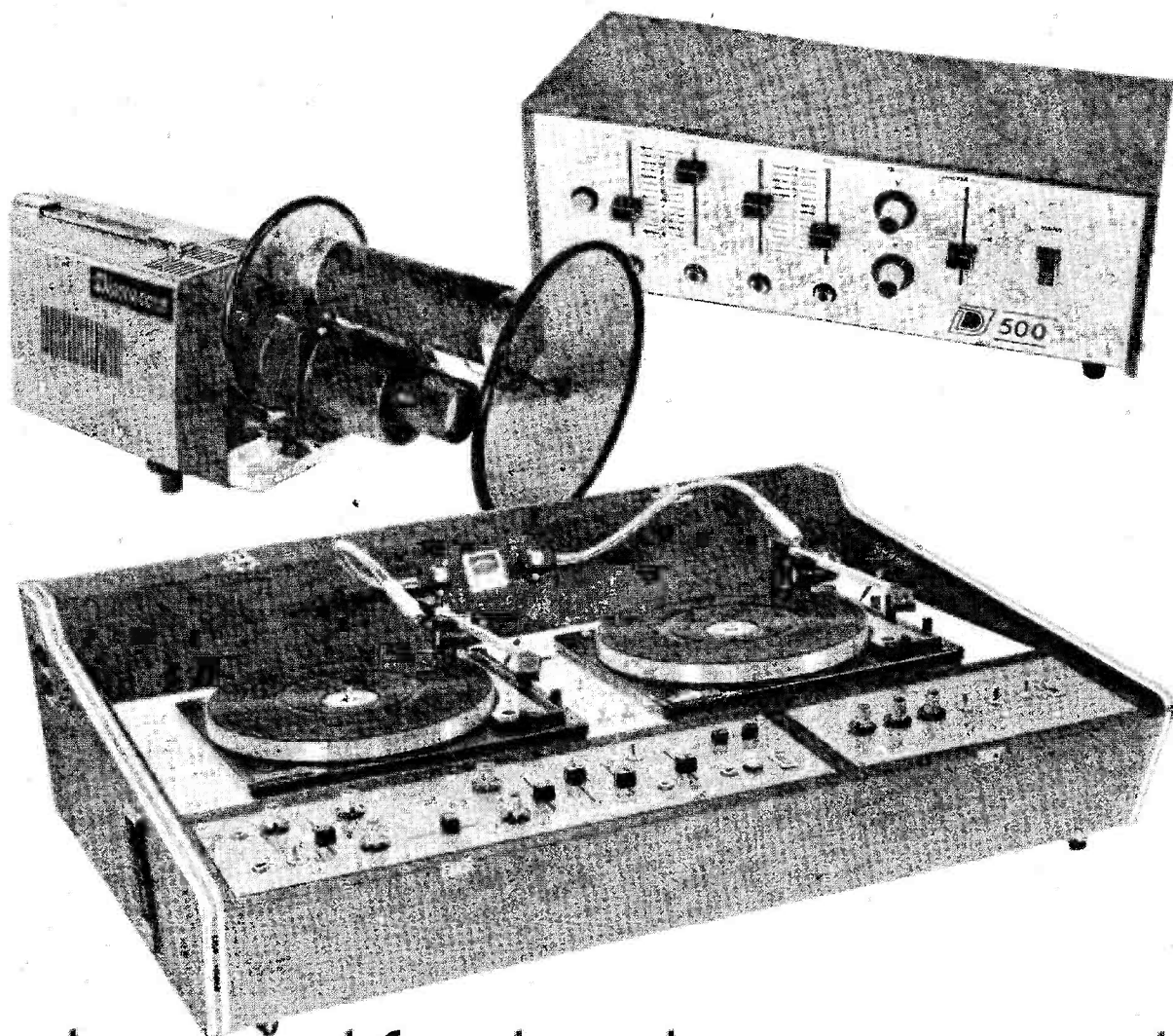
The advantage of this arrangement is obvious, i.e. only one 13A plug is used for both control units. If required, the power supply to the amplifier can also be taken from the terminal board of control unit 2 as shown in Fig. 16, thus achieving further simplification.

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



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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.*

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.*

AUTO GROOVE-KLEEN



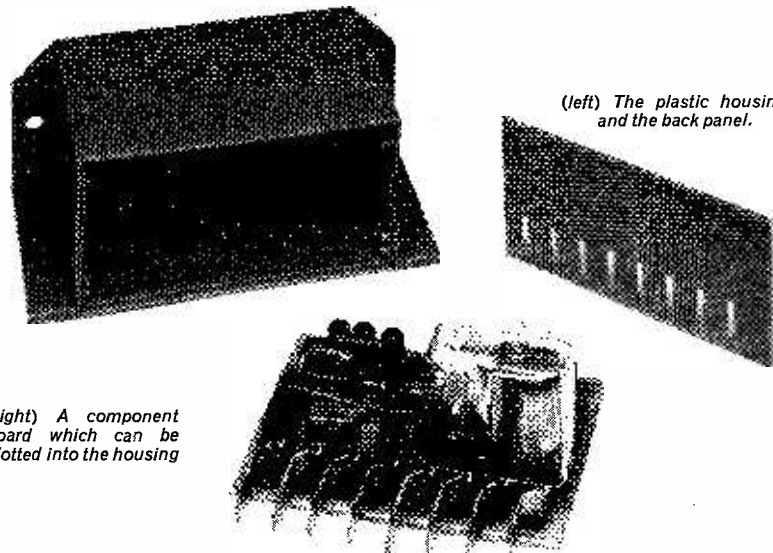
If you have an autochanger record playing unit, you have not been able up to now, to use a groove-cleaning brush to remove the dust and dirt from the records.

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.*



(left) The plastic housing and the back panel.

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

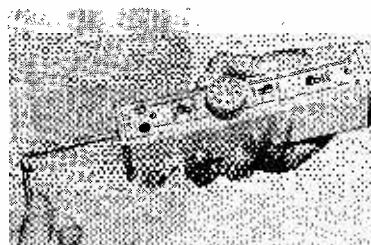
GUIDE TO SEMICONDUCTORS

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.*



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 4³/₄in × 3³/₄in × 2⁵/₃₂in. 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.

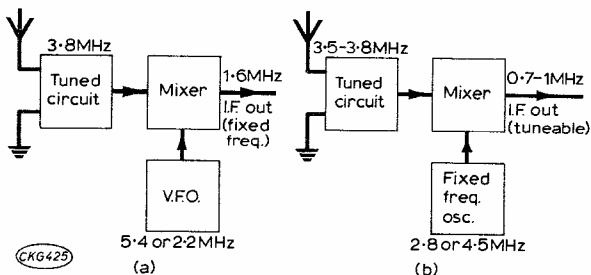


Fig. 1: Diagrams showing methods of converting a signal to a fixed or variable intermediate frequency.

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 ($3.8 - 1.6 = 2.2\text{MHz}$, or $3.8 + 1.6 = 5.4\text{MHz}$). 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 ($3.8 - 1 = 2.8\text{MHz}$, $3.5 - 0.7 = 2.8\text{MHz}$, $3.8 + 0.7 = 4.5\text{MHz}$, $3.5 + 1 = 4.5\text{MHz}$).

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

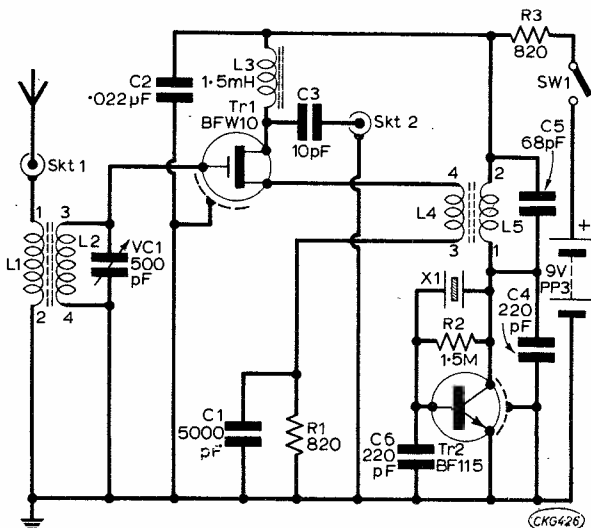


Fig. 2: Complete circuit of the converter unit.

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 $\frac{1}{2}$ in 6BA bolts, a stand-off insulator $\frac{1}{4}$ to $\frac{3}{8}$ in 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.

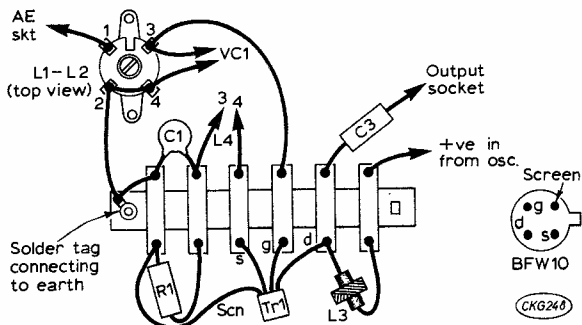


Fig. 3: Method of wiring the mixer stage components.

★ components list

Resistors

R1 820Ω
R2 1.5MΩ
R3 820Ω } All $\frac{1}{4}$ W, 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 ($4\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$ 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

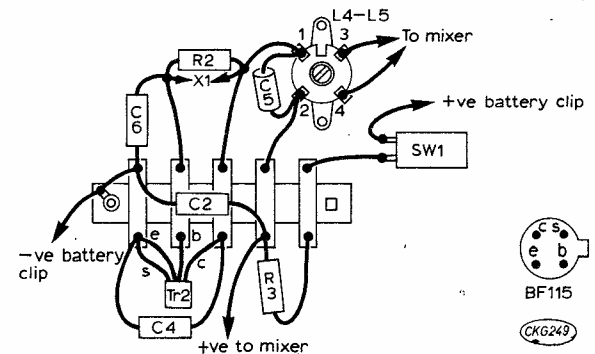


Fig. 4: Tagstrip construction of the oscillator stage.

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 converter's 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.

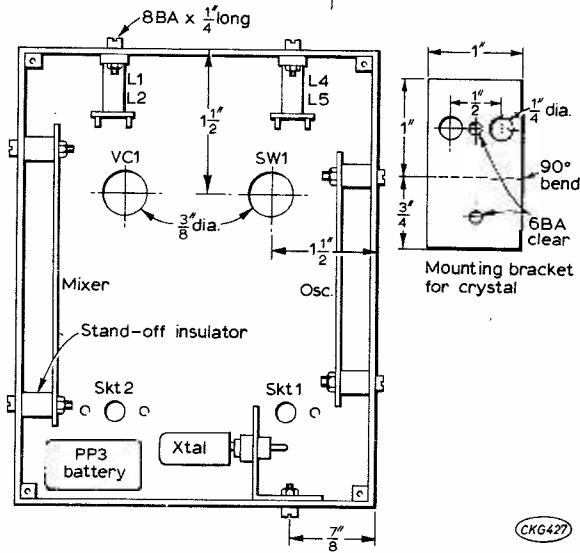


Fig. 5: Layout of components and tagsrips inside the die-cast box.

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.

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BROADCAST BANDS

SHORT WAVE RECEIVER CHOICE by MALCOLM CONNAH

By far the largest portion of my mailbag consists of letters 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 heterodynes.

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SN7401	0-20	0-18	0-16
SN7402	0-20	0-18	0-16
SN7403	0-20	0-18	0-16
SN7404	0-20	0-18	0-16
SN7405	0-20	0-18	0-16
SN7406	0-20	0-27	0-25
SN7407	0-20	0-27	0-25
SN7408	0-20	0-18	0-16
SN7409	0-45	0-42	0-25
SN7410	0-20	0-18	0-16
SN7411	0-23	0-22	0-20
SN7412	0-43	0-44	0-40
SN7413	0-20	0-27	0-25
SN7414	0-20	0-27	0-25
SN7417	0-20	0-27	0-25
SN7420	0-20	0-18	0-16
SN7422	0-48	0-44	0-40
SN7423	0-48	0-44	0-40
SN7425	0-48	0-44	0-40
SN7427	0-20	0-27	0-25
SN7428	0-50	0-45	0-42
SN7430	0-20	0-18	0-16
SN7432	0-42	0-39	0-35
SN7433	0-70	0-61	0-44
SN7437	0-20	0-18	0-16
SN7438	0-20	0-18	0-16
SN7440	0-20	0-18	0-16
SN7441	0-20	0-18	0-16
SN7442	0-75	0-72	0-70
SN7443	1-00	0-95	0-90
SN7445	2-00	1-75	1-60
SN7446	2-00	1-75	1-60
SN7447	1-75	1-60	1-45
SN7448	1-75	1-60	1-45

Type	1/11	12/24	25/99
SN7450	0-20	0-18	0-16
SN7451	0-20	0-18	0-16
SN7453	0-20	0-18	0-16
SN7454	0-20	0-18	0-16
SN7460	0-20	0-18	0-16
SN7470	0-20	0-27	0-25
SN7472	0-20	0-27	0-25
SN7473	1-40	0-37	0-35
SN7474	0-40	0-37	0-35
SN7475	0-55	0-52	0-50
SN7476	0-45	0-42	0-39
SN7480	0-20	0-18	0-16
SN7481	1-25	1-15	1-10
SN7482	0-20	0-18	0-16
SN7483	0-20	0-18	0-16
SN7484	0-20	0-18	0-16
SN7486	0-45	0-41	0-38
SN7490	0-75	0-70	0-65
SN7491	1-00	0-95	0-90
SN7492	0-75	0-70	0-65
SN7493	0-75	0-70	0-65
SN7494	0-20	0-18	0-16
SN7495	0-20	0-18	0-16
SN7496	1-00	0-97	0-95
SN7497	0-25	0-20	0-18
SN7498	0-20	0-18	0-16
SN7499	0-20	0-18	0-16
SN7500	0-20	0-18	0-16
SN7501	1-45	1-35	1-20
SN7502	1-45	1-35	1-20
SN7503	0-20	0-18	0-16
SN7504	0-20	0-18	0-16
SN7505	1-90	1-75	1-65
SN7506	0-20	0-18	0-16
SN7507	1-10	1-00	0-90
SN7508	2-00	2-55	2-47
SN7509	1-75	1-60	1-45

Type	1/11	12/24	25/99
SN7415	1-50	1-50	1-50
SN7416	3-35	2-95	2-15
SN7418	1-10	0-95	0-90
SN7419	1-25	1-27	1-20
SN7424	2-00	1-75	1-55
SN7426	1-55	1-47	1-35
SN7429	1-55	1-47	1-35
SN7431	1-50	1-70	1-50
SN7436	2-00	1-75	1-55
SN7439	2-40	2-35	2-30
SN7449	2-40	2-35	2-30
SN7452	2-40	2-35	2-30
SN7456	2-40	2-35	2-30
SN7458	2-40	2-35	2-30
SN7462	2-40	2-35	2-30
SN7464	2-40	2-35	2-30
SN7465	2-40	2-35	2-30
SN7466	2-40	2-35	2-30
SN7467	2-40	2-35	2-30
SN7468	2-40	2-35	2-30
SN7469	2-40	2-35	2-30
SN7471	2-40	2-35	2-30
SN7478	1-35	1-27	1-15
SN7479	1-60	1-35	1-20
SN7485	1-60	1-35	1-20
SN7487	1-60	1-35	1-20
SN7488	1-60	1-35	1-20
SN7489	1-60	1-35	1-20
SN7491	1-60	1-35	1-20
SN7492	1-60	1-35	1-20
SN7493	1-60	1-35	1-20
SN7494	1-60	1-35	1-20
SN7495	1-60	1-35	1-20
SN7496	1-60	1-35	1-20
SN7497	1-60	1-35	1-20
SN7498	1-60	1-35	1-20
SN7499	1-60	1-35	1-20
SN7500	1-60	1-35	1-20
SN7501	1-60	1-35	1-20
SN7502	1-60	1-35	1-20
SN7503	1-60	1-35	1-20
SN7504	1-60	1-35	1-20
SN7505	1-60	1-35	1-20
SN7506	1-60	1-35	1-20
SN7507	1-60	1-35	1-20
SN7508	1-60	1-35	1-20
SN7509	1-60	1-35	1-20

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AC107	35p	BC214	15p	BY127	15p	OC71	15p	ZTX300	12p	2N3625	25p
AC126	25p	BCY32	75p	BYZ13	35p	OC72	25p	ZTX301	15p	2N3614	55p
AC127	25p	BCY34	85p	O106D	65p	OC77	45p	ZTX302	15p	2N3615	75p
AC128	25p	BCY39	1-00	GET111	55p	OC81	25p	ZTX341	20p	2N3702	10p
AC176	25p	BCY48	25p	GET115	55p	OC82	25p	ZTX500	15p	2N3704	10p
AC187	25p	BCY43	25p	GETS80	45p	OC140	55p	ZTX503	17p	2N3705	10p
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ACY21	20p	BCY72	15p	MJE340	50p	OC296	75p	2N595	15p	2N3790	2-25
ACY39	55p	BOY87	2-95	MJE370	70p	OC292	80p	2N697	15p	2N3815	95p
AD140	50p	BCZ11	50p	MJE520	75p	OC203	50p	2N706	10p	2N3820	50p
AD149	50p	BD124	80p	MJE2955		OC271	1-25	2N930	20p	2N3866	85p
AD161	85p	BD131	75p		1-10	ORP12	50p	2N987	45p	2N3903	15p
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AF139	30p	BF179	30p	NKT216	40p	RA5508A		2N1305	25p	2N4871	35p
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BC108	10p	BFY51	20p	OC20	20p	TIP35A		2N2906	20p	40360	50p
BC109	10p	BFY52	20p	OC23	35p		2-50	2N2926	15p	40361	40p
BC109C	12p	BFY64	50p	OC25	40p	TIP36A		2N2926	all	40408	50p
BC113	15p	BFY90	50p	OC28	65p		3-00	col)	10p	40486	75p
BC117	20p	BSX20	15p	OC35	50p	TIP41A	75p	2N3053	20p	40636	1-10
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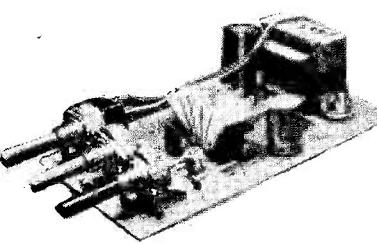
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COMMERCIAL RADIO

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 100 μ V 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 com-

mercial 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*.

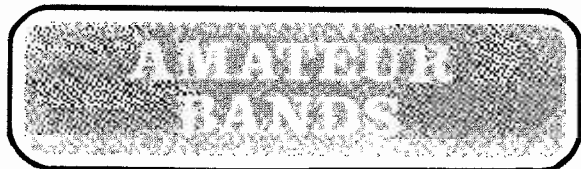
The new station at Carlisle is still expected to "appear" on 95.6MHz, but it looks as if Swaledale will be "lost" for want of a suitable site for a relay station.

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.



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 receiver 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 F08C. 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 through 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, 9GIHE, 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, LUIDAC, 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 (1.f.); 8, WAB c.w. 1.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.l.s 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.

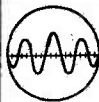
VHF Reports to Simon David, c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4 4AD.

AMATEUR BANDS

Short Wave/VHF

Logs in alphabetical order please by 15th of the month to David Gibson, G3JDG, 12 Cross Way, Harpenden, Hertfordshire.

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£20.00 Complete PSU £2.95
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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 override, with adjustable fade depth; fades the music down when you make your announcements, then the music automatically returns to its original level. Automatic/manual override switch. Full headphone facilities. Panel mounting, satin enamel finish. 40V D.C. operation. 1V low impedance output.

CONTROLS: Mic vol, mic tone. Override depth. Tape vol. Left deck fader, right deck fader. Deck vol, treble, bass. Master vol. Headphone vol, left/right fader. Auto/manual override switch. Power on/off switch.

TUAC HIGH POWER AMPLIFICATION—built to high standards, and built to last



£49.50 p. & p. £1.00
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mic stands, headphones—all readily available.

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



£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.

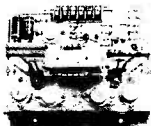
TUAC COMBO AMP.



£60.00 complete.

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).

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 200V 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 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 As VA06, but with extra middle control. Treble +28dB @ 18KHz. Middle +20 -15dB @ 4KHz. Bass +20 -10dB @ 40Hz. Sensitivity 4mV.

SVA01 As VA08 but stereo with bal. control. £9.47

MVA01 Suitable for disco, mic., tape input, 2 inputs, with Vol. & tone control on each input. Sensitivity 2mV. +25dB @ 12KHz to +20dB @ 40Hz.

MEVA01 Magnetic Cartridge equalisation. Connects to input of VA06 or VA08 with volume control. £2.60

SIPAM Master volume and presence control. High treble boost of +15dB @ 15KHz. £2.40

EFVA01 Increases the output of any of the above to 1V. RMS. Low impedance emitter follower output. £2.50

NEW RANGE

Includes 3 guitar effects units!

HPA01 Headphone Amplifier. 8-15Ω £3.72
200mW output. Left right fader. Volume control. 200mV 1MΩ I/P Adjustable sensitivity.

AMF01 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. £4.40

PS201 Phase Splitter unit to drive two TP100W modules in bridge O/P. £1.75

WAA01 WAA-WAA Module. This is an exceptional unit, producing a superb WAA-WAA for guitars. Pedal soon available. 18V D.C. operation. £2.75

FUZO1 Fuzz Module. Professional standard. Volume, tone & fuzz sustain controls. Case soon available. 9V D.C. operation. £4.75

FXD01 Frequency Doubler Module. Doubles the frequency of any sinusoidal wave, such as that obtained from the WAA-WAA module. 9V D.C. operation. £3.17

TUAC LIGHT MODULATORS



3 Channel S1LMB 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 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.

Single Channel version. S2LMB Increased capacity of 1800 watts. Sensitivity control. Isolating input transformer does not affect amplifier operation. £17.45 p. & p. 35p.

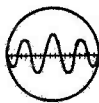
PRE-AMP POWER SUPPLY UNIT

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.

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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.



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1D5	50	6B26	30	6J7M	45	7C6	75	14H7	50	DAF96	45	EC90	33	EL41	60	N108	£1-50	PL504	80	U404	60		
1H5	50	6B6	75	6J7G	30	7D5	60	19AQ5	50	50B35	50	DC90	£1-35	ECC81	35	0A2	38	PL608	90	U801	£1-18		
1NSGT	45	6B36	50	6J7GT	45	7H7	50	20D1	50	50C65	50	DF33	55	ECC82	30	EL84	25	OC3	38	PL609	£1-00	UABC80	40
1R5	40	6BQ7A	45	6K6GT	75	7R7	75	20P2	70	50CD6G	£1-20	DF70	45	ECC83	30	EL95	35	0Z4	40	PL802	95	UAF44	55
1S4	30	6B87	£1-30	6K7G	35	7Y4	65	20P4	£1-10	75	50	DF92	20	ECC85	40	EM30	45	PC88	60	PX4	£2-50	UBC41	50
1S5	30	6B9W	85	6K8M	60	10C2	63	20P5	£1-20	75	45	DF96	45	ECC88	40	EM81	60	PC97	50	PY33	£2-50	UBF80	40
1T4	30	6C4	38	6K8G	40	10F1	90	25A6	35	80	55	DH77	35	ECH21	63	EM84	35	PCC84	40	PY81	30	UBF99	35
2A4	40	6C6	35	6K9T	50	10F3	90	25L6GT	50	85A2	50	DK32	45	ECH36	£1-00	EY51	40	PCO89	50	PY83	35	UCC84	43
3Q5	50	6C8	35	6L6G	50	10F8	50	25T5	65	150B2	60	DK31	40	ECH42	75	EY86	40	PCO89	50	PY83	38	UCC85	40
3V4	48	6C16G	£1-25	6L8	45	10L1D11	65	25Z5GT	50	50C94	60	DK32	45	ECH81	30	EZ25	40	PCF80	50	PY500	£1-00	UCH42	70
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3V4	48	6C16	40	6Q7G	40	10L13	65	25Z5GT	50	50C94	60	DK32	45	ECH81	30	EZ25	40	PCF80	50	PY500	£1-00	UCH42	70
3R4	35	6C16	40	6Q7G	40	10L13	65	25Z5GT	50	50C94	60	DK32	45	ECH81	30	EZ25	40	PCF80	50	PY500	£1-00	UCH42	70
3V4	48	6C16	40	6Q7G	40	10L13	65	25Z5GT	50	50C94	60	DK32	45	ECH81	30	EZ25	40	PCF80	50	PY500	£1-00	UCH42	70
3R4	35	6C16	40	6Q7G	40	10L13	65	25Z5GT	50	50C94	60	DK32	45	ECH81	30	EZ25	40	PCF80	50	PY500	£1-00	UCH42	70

TAKE 20

JULIAN ANDERSON

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, b₁ and b₂ 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 b₂. 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

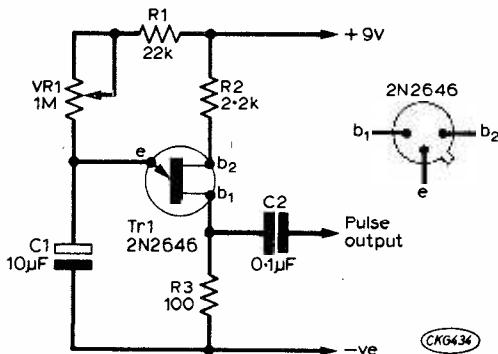


Fig. 1: Circuit and suggested valves for the pulse generator.

No. 48 PULSE GENERATOR

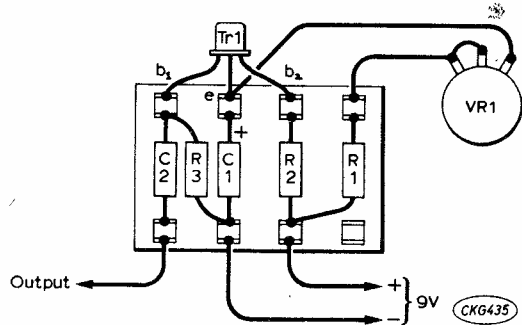


Fig. 2: Practical layout of components on a piece of tagboard.

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 500 μ F down to 0.01 μ F. 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	22k Ω $\frac{1}{2}$ W, 5 per cent	1p
R2	2.2k Ω "	1p
R3	100 Ω "	1p
VR1	1M Ω linear pot	12p
C1	10 μ F 12V	5p
C2	0.1 μ F 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 (50 Ω to 80 Ω) 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 intriguing 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.

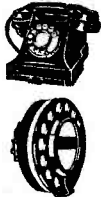
Look out members of Parliament—you might be replaced by a pair of zener diodes one day—they're cheaper, smaller and generate less noise!

Ginsberg

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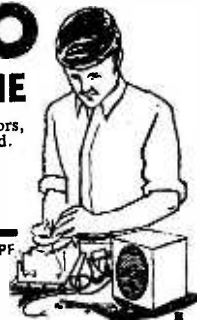
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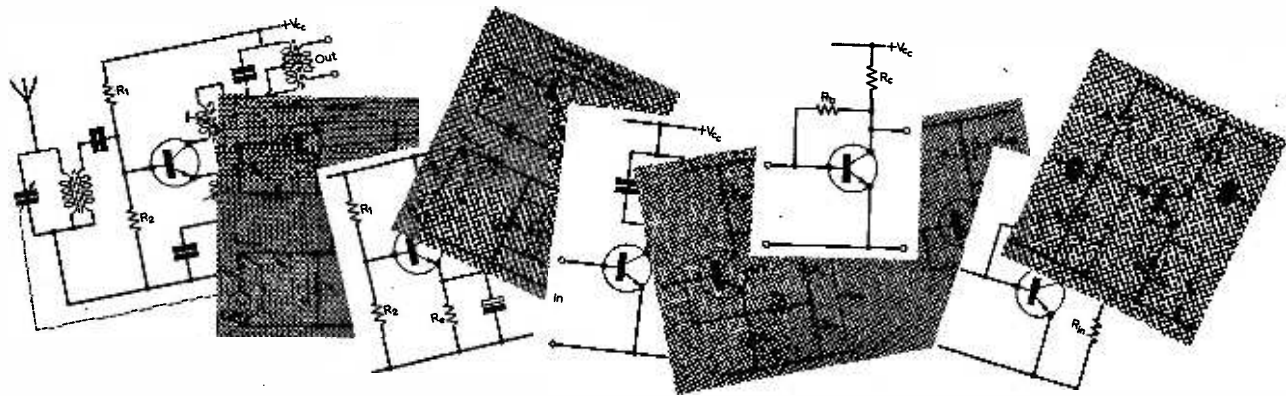
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BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY



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 simplified to the triangle of Fig. 77,

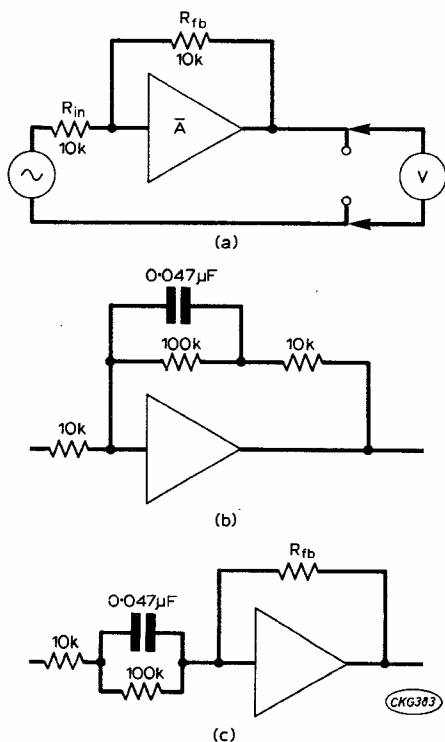


Fig. 77: (a) Simplified representation, with the symbols denoting an inverting amplifier. (b) a frequency-dependent development, and (c) the bass cut variation, with the frequency-selective portion before the feedback loop.

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.

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: $G_o = R_{fb}/R_{in}$.

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 $10k\Omega$ with a similar feedback resistor R_{fb} in series with a $0.047\mu F$ capacitor (itself, practically, paralleled by $100k\Omega$). 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 $100k\Omega$ 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 $110k\Omega$, 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

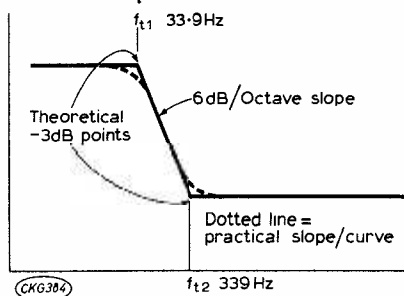


Fig. 78: The bass lift curve in theory (solid line) and in practice (dotted line).

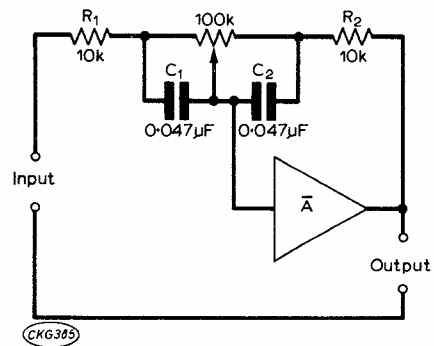


Fig. 79: A combined bass lift and cut circuit.

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 $0.047\mu F$ capacitor is in parallel with the $100k\Omega$ resistor and the $10k\Omega$ resistor is not effective, and when the capacitor is in series with the $10k\Omega$ resistor, the effect of the $100k\Omega$ resistor then being ignored. In practice, of course, it cannot be ignored: its real effect is to modify our $10k\Omega$ to $9k\Omega$ under these circumstances.

Taking the worked theoretical examples:

$$f_t = \frac{1}{2\pi CR} = \frac{10^6}{6.28 \times 0.047} \times 10k\Omega \dots\dots\dots (1)$$

$$\text{and } \frac{10^6}{6.28 \times 0.047} \times 100k\Omega \dots\dots\dots (2)$$

$$(1) = 339\text{Hz and } (2) = 33.9\text{Hz}$$

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

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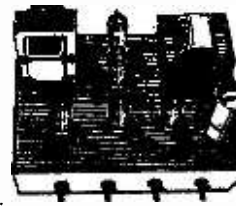


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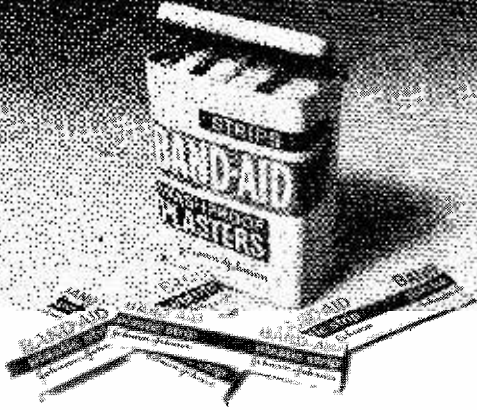
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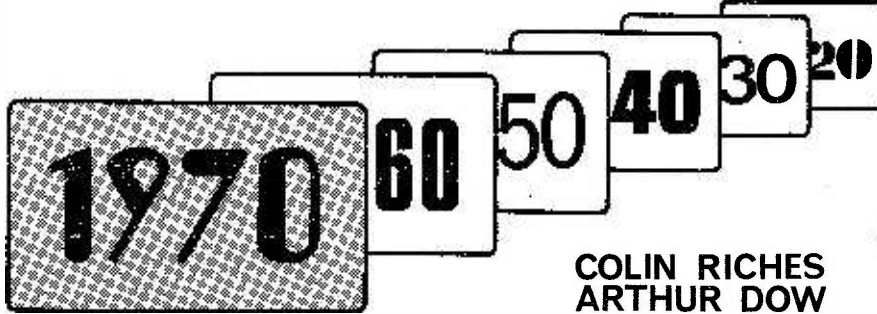
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GOING BACK...



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.

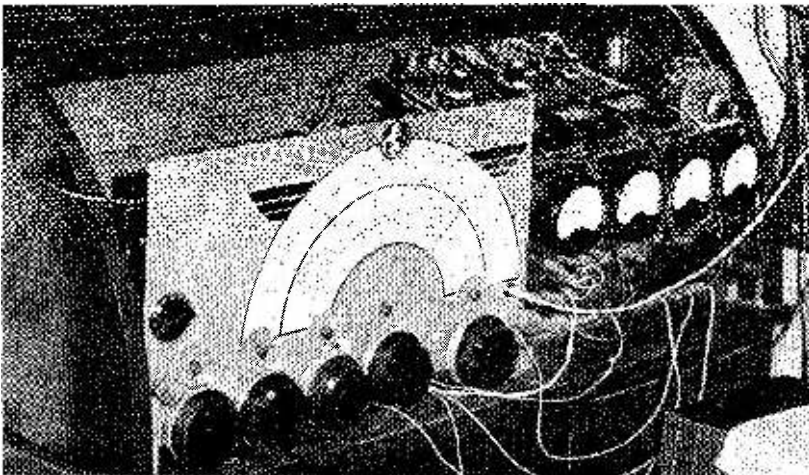
Once broadcasting had begun the boom in home constructed receivers got under way very rapidly since there were few commercial receivers available at that time. It is this period from about 1922 until the mid-30's that is probably of most interest to

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

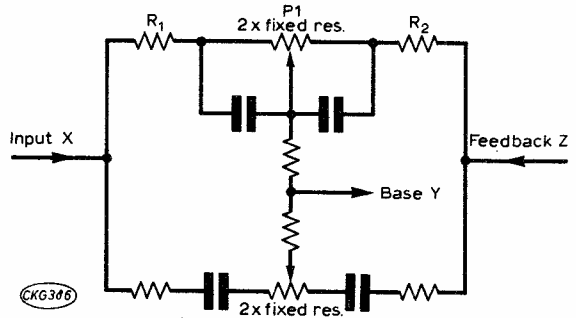


Fig. 80: The eventual network to be inserted in the feedback loop, giving bass and treble lift and cut.

section of the ganged potentiometer. It remains only that the ganged potentiometers themselves shall be within at least 1dB of linearity.

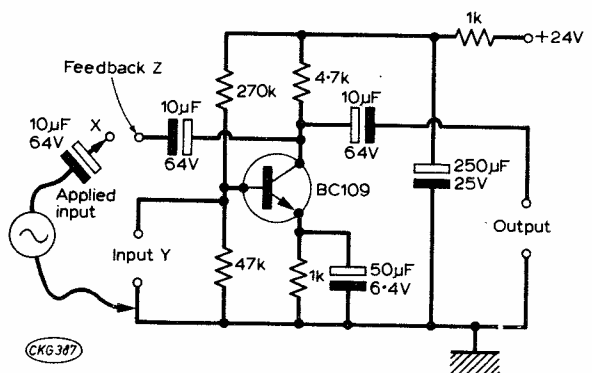


Fig. 81: The basic amplifier circuit over which the feedback is applied.

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.

ZN414 £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 (Dull), 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

82YM ZENER SERIES 50p each

FM TUNER
chassis fully transistorised
9 volt. operation.
OUR PRICE £2.25
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 16p		VA1053 10p
E298 ZD/06 16p		VA1055 10p
GL16 £1		VA1034 10p

Resistors

1/2 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 33% 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
2 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.

3 Watt Audio Amplifier
EA1000
Our Price inc. handbook £2.49

5 Watt Audio Amplifier
Our Price £3.99
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 (6 20mA (PP3)) £1.25
6 volt (6 50mA) £1.50
9 volt (6 50mA) £2.50
6 + 6 volt, 50mA £2.50
7 + 3 volt for cassette recorders £2.00
6, 7.5 or 9 volt £3.00
3, 4.5, 6, 7.5, 9, 12 or 500mA (illus.) £3.99
Car Battery Converter fully stabilised to provide 6, 7.5 or 9 volts £4.99
(p. & p. 15p on all types)

Presets

Vertical or Horizontal
0.1 watt 5p 0.25 watt 7p
100 1KΩ 10KΩ 100KΩ 1MΩ
250 2.5KΩ 25KΩ 250KΩ 2.5MΩ
500 5KΩ 50KΩ 500KΩ 5MΩ

Capacitors

dise 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 16p 4700pf 16p
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
6.8pf	22pf	82pf	330pf
8.2pf	27pf	100pf	

all 5p. each

mylar film 100V
1000pf 2p -01μF 3p -068μF 4p
2000pf 2p -02μF 3p -1μF 4p
5000pf 2p -05μF 3p -2μF 5p

polystyrene 160V
10pf to 10,000pf in multiples of 10, 15, 22, 33, 47 & 68. 3p each

metallised polyester 250V (C280)

-01μF 3p	0.08μF 3p	0.47μF 8p
-015μF 3p	-1μF 4p	-68μF 11p
-022μF 3p	-1.5μF 4p	1μF 13p
-033μF 3p	-2.2μF 5p	1.5μF 20p
-047μF 3p	-33μF 8p	2.2μF 24p

metallised polyester 400V (C281)

-01μF 4p	-0.47μF 6p	-2.2μF 10p
-015μF 4p	-0.68μF 6p	-33μF 14p
-022μF 4p	-1μF 7p	-47μF 15p
-033μF 4p	-1.5μF 8p	

silvered mica 1% (>50pf) 500V
2.2pf-300pf 7p 4.7nf-5600pf 19p
1nf-2.2nf 9p 6800pf-0.1μF 23p
2.7nf-3.6nf 16p

mixed dielectric 600V

-01μF 7p	-0.47μF 8p	-2.2μF 16p
-022μF 7p	-0.68μF 8p	-4.7μF 24p
-033μF 7p	-1μF 8p	-1μF 35p

CHROMASONIC electronics

Heat Sinks

TO5 TO18 5p
TO66 TO3 15p
Power Tab 13p
10D 50p
DIP10/2 for SL403D 15p

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	LO9571 £1.50
AC127 15p	BC149 10p	BF272 55p	OC170 23p	2N1888 30p	LO9671 £1.50
AC158 12p	BC157 12p	BF150 24p	OC171 30p	2N2926 all 16p	LO9771 £1.50
AC176 15p	BC158 10p	BFY51 21p	ZTX107 15p	2N3053 25p	MC1360L £1.75
AC187 25p	BC159 12p	BRV39 36p	ZTX108 12p	2N3054 50p	MC1390 80p
AC187A 25p	BC169 15p	BSX21 26p	ZTX109 15p	2N3055 45p	MC1390 75p
AC188 25p	BC268 15p	BSY95A 14p	ZTX300 12p	2N3702 12p	MC1391 £1.40
AC188A 25p	BD115 67p	BU105/02 £1.75	ZTX301 15p	2N3703 12p	MC1392 £1.60
AC200 20p	BD131 70p	MU1E340 67p	ZTX302 20p	2N3704 10p	MFC4008 69p
AD140 40p	BD132 70p	MPF192 40p	ZTX303 20p	2N3705 10p	MFC4010A 55p
AD149 40p	BD131/2M.P.	MPF103 37p	ZTX304 25p	2N3706 10p	LM380 £1.45
AD161 149p		MPF104 37p	ZTX341 20p	2N3707 15p	PA234 £1.99
AD182 1/2 60p	BF160 21p	MPF105 40p	ZTX500 15p	2N3708 12p	SL403D £1.50
AF114 18p	BF167 20p	MPF106 45p	ZTX501 15p	2N3709 12p	TA1D100 £1.50
AF115 18p	BF173 20p	OC28 40p	ZTX502 20p	2N3710 12p	TA1F100 £1.50
AF116 18p	BF180 25p	OC35 40p	ZTX503 17p	2N3711 12p	μA700 34p
AF117 18p	BF181 30p	OC44 15p	ZTX504 50p	μA719 45p	
AF139 28p	BF184 25p	OC45 15p	ZTX531 25p	2N3903 15p	μA723C 95p
AF157 10p	BF185 25p	OC71 11p	2N697 18p	2N3904 17p	μA741C 47p
BC108 10p	BF194 15p	OC72 17p	2N706 12p	2N3905 21p	μA748C 60p
BC109 10p	BF195 15p	OC76 15p	2N708 12p	2N3906 12p	

Mixed dielectric 1000V

1000pf 6p	6800pf 9p	-1μF 12p
2200pf 6p	-0.1μF 9p	-2.2μF 22p
3300pf 6p	-0.22μF 9p	-4.7μF 30p
4700pf 6p	-0.47μF 12p	

Ceramic
12K V.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-through
140pf 9p 1000pf 5p
150pf 9p 5000pf 5p
180pf 9p 10,000pf 5p 1000pf 5p

Mullard B Siemens Electrolytics

CAP μF	VOLTAGE							
	4	6.3	10	16	25	40	63	80
1.5	—	—	—	—	—	—	—	6p
2.2	—	—	—	—	—	—	—	6p
3.3	—	—	—	—	—	—	—	6p
4.7	—	—	—	—	—	—	—	6p
6.8	—	—	—	—	—	—	—	6p
10	—	—	—	—	—	—	—	6p
15	—	—	—	—	—	—	—	6p
22	—	—	—	—	—	—	—	6p
33	—	—	—	—	—	—	—	6p
47	—	—	—	—	—	—	—	6p
68	—	—	—	—	—	—	—	10p
100	—	—	—	—	—	—	—	6p
150	—	—	—	—	—	—	—	6p
220	—	—	—	—	—	—	—	10p
330	—	—	—	—	—	—	—	15p
470	—	—	—	—	—	—	—	21p
680	—	—	—	—	—	—	—	40p
1000	—	—	—	—	—	—	—	40p
1500	—	—	—	—	—	—	—	40p
2200	—	—	—	—	—	—	—	40p
3300	—	—	—	—	—	—	—	40p
4700	—	—	—	—	—	—	—	40p

Veroboard

Copperclad	Plain
0.1" 0.15"	0.15"
2 1/2" x 1" 6p	6p
2 1/2" x 3 1/2" 20p	16p (9) 10p
2 1/2" x 5" 24p	21p (7) 12p
3 1/2" x 3 1/2" 24p	21p (8) —
3 1/2" x 5" 27p	27p (10) 17p
17" x 2 1/2" 67p	50p 37p
17" x 3 1/2" 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)

Aluminium Boxes
Including baseplate and screws

No.	L.	W.	D.	Price	p. & p.
(7)	2 1/2"	x 5 1/4"	x 1 1/2"	35p	8p
(8)	4"	x 4"	x 1 1/2"	35p	8p
(9)	4"	x 2 1/2"	x 1 1/2"	35p	8p
(10)	4"	x 5 1/4"	x 1 1/2"	40p	8p
(11)	4"	x 2 1/2"	x 2"	35p	8p
(12)	3"	x 2"	x 1 1/2"	32p	9p
(13)	6"	x 4"	x 2"	50p	10p
(14)	7"	x 5"	x 2 1/2"	58p	12p
(15)	8"	x 6"	x 3"	75p	18p
(16)	10"	x 7"	x 3"	85p	20p

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 Hz. The semiconductor complement 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 phone; 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.

Hi-Volt Electrolytics

CAP μF	VOLTAGE			
	15	25	40	64
500	—	—	33p	40p
1250	—	—	50p	—
1600	—	—	—	75p
2000	—	—	40p	50p
2500	—	—	—	75p
3200	—	—	—	—
4000	—	—	75p	95p
6400	—	—	75p	95p

Quantity Prices on application.

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
6,000 O.P.V.
0/315/150/300/1200 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
30,000 O.P.V.
Overload protection 5/25/100/500/1000 VDC. 10/50/250/1000 V.A.C. 50μA/250mA. 20K/2 meg ohm. -5 to +62db.
\$4.97. P. & P. 15p.



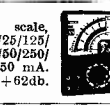
HIOKI MODEL 730X
30,000 O.P.V. Overload protection. 6/30/60/300/600/1200 VDC. 120/1200/600/1200 V.A.C. 50μA/30 mA/300 mA. 2K/200K/2 meg ohm. -10 to +63db.
\$8.50. P. & P. 15p.



KAMODEN 72.200 MULTITESTER
High sensitivity tester. 200,000 o.p.v. Overload protection. Mirror scale. Ranges: 0/0.6/3/3/30/120/600/1200V. D.C. 0/3/12/60/300/11,200V. A.C. 0/60μA/1.2mA/120mA/600mA/12A. D.C. 0/12A. A.C. -20 to +63dB. 0/2K/200K/2 meg/200 meg ohms.
\$18.95. Post 30p



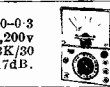
MODEL TE-200
20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000V. D.C. 0/10/50/250/600/1200 V.A.C. 0/50 μA/250 mA. 0/60K/6 meg Ω. -20 to +62db.
\$3.95. P. & P. 15p.



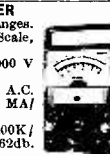
MODEL 500
30,000 O.P.V. with overload protection mirror scale 0/5/2.5/10/25/100/250/500/1,000V. D.C. 0/2.5/10/25/100/250/500/1,000V. A.C. 0/50μA/500/300mA. 12 amp. D.C. 0/60K/6 Meg. 60 Meg Ω
\$8.87. Post paid.



HIOKI MODEL 750X
60,000 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.



HT10084 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. 0/20K/200K/2 MEG/20 MEG. -20 +62db.
\$12.60. P. & P. 25p.



370 WTR MULTI-METER
Features A.C. current ranges. 20,000 o.p.v. 0/5/2.5/10/50/250/300 1000 V. D.C. 0/2.5/10/50/250/500/1000V. A.C. 0/50μA/1/10/100mA/1/10 Amp. D.C. 0/100mA/1/10 Amp. A.C. 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 100mA/1/10/100mA/1A Resistance 300 ohms/3/30/300K/3m Ω. Complete with batteries, test leads, instructions and sturdy steel carrying case. OUB PRICE **\$5.97. P. & P. 25p**

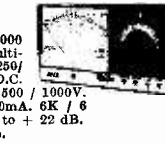


ROUND SCALE TYPE PENCIL TESTER

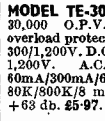


MODEL T.S.68
Completely portable, simple to use pocket sized tester. Ranges: 0/5/30/300V. AC and DC at 2,000 o.p.v. Resistance 0-20K ohms. **ONLY \$1.97 P. & P. 15p.**

LT601 MULTIMETER
New style 20,000 o.p.v. pocket multi-meter. 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 +60dB
\$4.97. Post 15p.



MODEL TE-300
30,000 O.P.V. Mirror scale, overload protection 0/6/315/600/3001,200V. 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.**



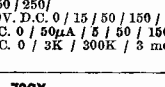
MODEL PL436
20k Ω/Volt D.C. 8k Ω/Volt A.C. Mirror scale. 6/8/12/30/120/600 V D.C. 3/30/120/600 V A.C. 50/600μA/60/600 mA. 10/100K/1 Meg/10 Meg Ω -20 to +46db.
\$6.87. P. & P. 12p.



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
\$3.50. P. & P. 17p.



MODEL K228A
Taut band suspension. Overload protection. 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. **\$3.95. Post 20p.**



HIKIO 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 1-4/3/6/12/30/60/150/300/600/1200 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 8" 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.
\$18.95. 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/1.5/6/15/60/160 600mA/1.5/6 AMP. D.C. 0/1.5/6/15/60/150/600mA/1.5/6 AMP. A.C. 0/200/30K/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

FULL-401 TRANSISTOR TESTER

Full capabilities for measuring A, B and I.C.O. 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.**

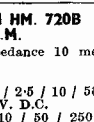


MODEL 449A IN CIRCUIT TRANSISTOR TESTER

Checks true A.C. beta in / out. Checks Ico. Checks diodes in / out. Checks SCR, etc. Beta HI 10 - 500, MA D.C. LO 2 - 50. Ico 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/60K/500K/5meg/500meg ohms.
\$14.95. Post 30p



MODEL L-55 FET V.O.M.

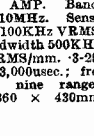
Input impedance 10 meg ohms. 0/3/1.2/5/30/120/600V. D.C. 0/3/12/60/120/600V. A.C. 0/120μA/120mA D.C. 0/1K/100K/10 meg/100 meg ohms
\$21.97. Post 15p.



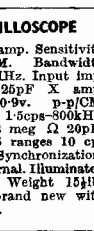
CI-5 PULSE OSCILLOSCOPE
For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 10MHz VRMS/mm. 1-25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz. V. RMS/mm. 8-25; Preset trigger sweep 1-3,000usec.; free running 20-300,000Hz in nine ranges. Calibrator pips. 220 x 360 x 430mm. 115-230V. AC operation. **\$39.00. Carr. paid.**



TO-3 PORTABLE OSCILLOSCOPE
3in. tube, V 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 x 215 x 330 mm. Weight 15lb. 220/240V. A.C. Supplied brand new with handbook. **\$47.50. Carr. 50p.**



RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPE
5 mcs Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 5in. x 4in. C.R.T. Calibrated triggered sweep from 2 usec. to 100 milli-sec. per cm. Free running time base 50 cps/1 mo/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with all accessories and instruction manual **\$87. Carr. Paid.**

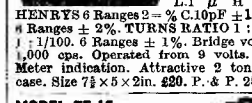


TE-16A TRANSISTORISED SIGNAL GENERATOR

5 ranges 400KHz-30mHz. A first class instrument for the handyman. Operates on 9V battery. Wide easy to read scale. 800KHz modulation. 5 1/2 x 5 1/2 x 3 1/2 in. 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. 1 Ω 11-1 meg Ω 6 Ranges ±1% 5.1 μ H ±11 HENRY'S 6 Ranges 2-3% C.10μF + 1110mFd Ranges ±2%. TURNS RATIO 1:1/1000:1/100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 8 x 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 40Kcps-280M/cps in 6 coils. 500μA Meter. 9V battery operation. Size 180 x 80 x 40mm. **\$12.50. Post 20p.**



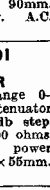
BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR

Sine 18 x 200,000 Hz; Square 18 x 50,000 Hz Output max. +10 dB. (10 K ohms) Operation internal batteries Attractive 2-tone case 7 1/2 x 5 x 2". Price **\$17.80. Carr. 17p.**



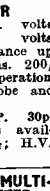
MODEL MG-100 SINE SQUARE WAVE AUDIO GENERATOR

Range 19-220,000Hz Sine Wave 19-100,000 Hz Square Wave. Output Sine or Square wave 10V. P. to P. Size 180 x 90 x 90mm. Operation 220/240V. A.C. **\$17.50. Post 37p.**



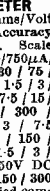
MODEL AT201 DEPENDABLE ATTENUATOR

Frequency range 0-200KHz. Attenuator 0-111db, 0-1db step. Impedance 600 ohms. Max. input power 20dbm. Size 180 x 90 x 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. **\$2.12**; H.V. **\$2.50.**



MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMPMETER

Sensitivity 330 ohms/Volt A.C. and D.C. Accuracy 5% D.C. 1% A.C. Scale length 165mm. 0/300/750μA 1.5/3/7.5/15/30/75/150/300/750mA 1.5/3/7.5/15/30/75/150/300/750V DC 0/3/7.5/15/30/75/150/300/750V AC. Automatic cut-off. Supplied complete with test leads, manual and test certificates. **\$40.00. Post 50p.**



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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" x 4 1/2" clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. £12-50. Post 30p.



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Range 0-1000 Meg-ohms, 500 Volt. Battery operated. Wide range clear meter 4 1/2" x 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 15 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 by maximum. Operation 220/240v. A.C. Complete with instructions and leads. £29-95. Post 50p.

HONEYWELL DIGITAL VOLTMETER VT.100



Can be panel or bench mounted. Basis 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: 5 1/2" x 2 13/16" x 8 8/16". 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.

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Model 350. 13" x 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" x 8" with twin tweeter/crossover. 55-13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. £8-62 each. P. & P. 25p.

SPECIAL OFFER! STEREO SPEAKERS

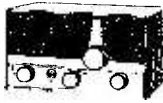
Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size 14 1/2" x 9" x 7 1/2". 8 ohms. 8 watt RMS. 16 watt peak. Complete with DIN lead. £12-95 pr. Carr. 50p.

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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 8 Meter. Variable BFO for SSB. Built-in Speaker, Bandsread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12 1/2" x 4 1/2" x 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. Bandsread. Aerial tuning BFO, AVC, ANL, '8' meter. AM/CW/SSB. Integrated speaker and phone socket. Operation 220/240v AC or 12v DC. Size 325 x 256 x 150 mm. Complete with instructions and circuit. £32-50. Carr. 50p.

LAFAYETTE HA-600 SOLID STATE RECEIVER

General coverage 150-400Kc/s. 650 Kc/s-30Mc/s. FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter. 8. Meter, Bandsread, RF Gain. 15" x 8 1/2" x 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 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW. ANL. Variable BFO. 8 meter. Sep. bandsread dial. IF frequency 455 Kc/s. audio output 1.5v. Variable RF and AF gain controls 115/250v. A.C. Size: 7" x 13" x 10" with instruction manual. £49-50. Carr. Paid.

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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" x 4" x 2 1/2". £2-25. P. & P. 15p.

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5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9 1/2" x 5" x 3" Inputs Mics: 3 x 3mV 50K; 2 x 5mV 800 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K. £8-97. P. & P. 20p.

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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

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20 + 20 watt AM/FM stereo tuner amplifier. Garrard AP76, plinth and cover. G800 cartridge, pair of Mezzo III speakers. Carriage & Pack. £2.00 OUR PRICE **£132-50**

WHARFEDALE LINTON SYSTEM

Wharfedale Linton Amplifier, Linton Turntable, pair of Linton 2 speakers and all leads. Carr. and Ins. £1-25 OUR PRICE **£95-95** 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. Carr. £1-00 OUR PRICE **£45-50**

NIKKO TRM.50 SYSTEM



OUR PRICE **£93-95** Carr. and Ins. £1-50

LEAK DELTA 30 SYSTEM



OUR PRICE **£109-95** Carr. and Ins. £1-50

TELETON SAQ206B SYSTEM



OUR PRICE **£51-50** Carr. £1-50



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OUR PRICE £1-80
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AUDIOTRONIC ACP-8 8 TRACK CAR PLAYER

Attractive black and silver finish. 12v neg. earth. Slider controls for volume, tone and balance. Channel selector button with red pilot lamp. Complete with speakers, mounting brackets and instructions.
ONLY £12-50 P. & P. 40p

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 Sensitive, soft earpads, adjustable headband. Magnetic, impedance 2,600 ohms.
 £1-97. P. & P. 15p.

HOSIDEN DH-08S DE-LUXE STEREO HEADPHONES
 Features unique mechanical 2 way units and fitted adjustable lever, controls. 8 ohm impedance. 20-20,000cps. Complete with spring lead & stereo jack plug £7-97. P. & P. 12p.

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 P. & P. 50p extra any item.

ROTEL RA210 SYSTEM

8+8 watt amplifier, BSR MP60, plinth and cover, G800 cartridge, pair of Medway T138 speakers and all leads.
OUR PRICE £54-50 Carr. & Ins. £1-25

ROTEL RX150 SYSTEM

AM/FM 7 1/2 + 7 1/2 watt stereo tuner amplifier, BSR MP 60, plinth and cover, G800, pair of Denton 2 speakers and all leads.
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AM/FM 4 + 4 watt stereo tuner amplifier, Garrard 2025 T/C, plinth and cover, stereo cartridge, pair of matching speaker and all leads.
OUR PRICE £30-50 Carr. £1-00

SPECIAL OFFER! ROTEL RH700 STEREO HEADPHONES
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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 lights 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.
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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 85p. Postage 20p for first one then 10p for each one ordered.

MUSIC ON TAPE

A further joy enables us to offer these at an even lower price—namely 85p each or 5 for £2.50. Send for list of titles. We can't repeat when sold out.

BALANCED ARMATURE UNIT

500 ohm, useful as speaker or microphone, so useful in intercom or similar circuits, 38p 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 1 1/2 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 £3-75 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. 1 1/2" x 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. Unit comprises microphone, phone 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 x 1 1/4 in. wide x 1 1/2 in. deep, 4 change over silver/gold contacts. Contact rating lamp 100V. D.C. Fitted with a plastic cover. Coil operates approx. 260mV. D.C. Available with the following coils:

28 ohm for 1-2.5v. 45 ohm for 4-7.5v. 52 ohm for 4-9.5v. 90 ohm for 5-11.5v. 130 ohm for 10-15v. 630 ohm for 17-36v. 1250 ohm for 27-44v. 2500 ohm for 31-65v. 5900 ohm for 27-44v. 75p each, 10 for £8-75. 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 x approximately 1/4" diameter. Will make and break up to 1/4A up to 300V. Price 15p each, £1-20 dozen.

Standard, 2" long x 1/4" 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 1/4" 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 8p each, 90p dozen.

Dry Reed Relays. Solenoids on moulded bobbins with magnetic shields—printed circuit, or panel mounting.

Ref.	Coil Resistance	Reed Switches	Price
71005	2 K	1 normally open	25p
18196	5 K	1 normally open	25p
		1 normally closed	75p
05003	4 K	1 normally open	25p
62040	1500 & 500 ohms	1 normally open	35p

Multiple Reed Relay, Ref. 53093. 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.

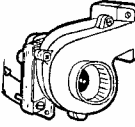


MULLARD AUDIO AMPLIFIERS

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.

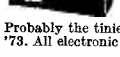
CENTRIFUGAL BLOWER

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 4 1/2" x 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 x 8in. high x 3in. deep. Complete assembly instructions—Excellent tone wood cabinet £5-75 + 25p post & ins.



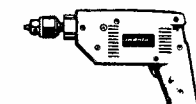
MIGHTY MIDGET

Probably the tiniest portable radio, as described in Practical Wireless, January '73. All electronic parts £2 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. 3 1/2in. x 1 1/2in. 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 3/4" 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.

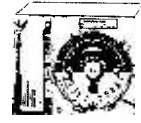


DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 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, 6A 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—nickel—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 3 1/2" x 6 1/2" x 2" with leads and prods. Price £2-25 plus 20p postage.

SPIT MOTOR

200-250v Induction Motor, driving a carter gear box with 1 1/2" 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.

TERMS: 10% discount if ten of an item ordered, send postage where quoted—other terms, post free if order for these over £8-00 otherwise add 20p.



DRILL CONTROLLER NEW IKW 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. 18p 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" x 18" £1-40
13" x 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

Leave your sleep: Leave 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 with 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 trigger. A beautiful unit. Price £1-95 + 20p p. & p. or with glass front, chrome bezel, 175p extra.

BAKELITE INSTRUMENT CASE

Size approx. 6 1/2" x 3 1/2" x 2" deep with brass inserts in four corners. This is a very strong case suitable to house instruments and special rigs, etc. Price £1-50 each. Fixolin lid 10p extra.

TELEPHONES

Complete as illustrated. Save your legs, time and temper, simply by putting in some telephones. 3x. G.P.O. not new — but guaranteed in good condition and serviceable. Supplied with diagrams and instructions showing how to connect. Price £1 each + 50p post or 2 for £2-50 post paid. Also available separately, dials and handsets 60p each + 20p post

RADIO ALARM CLOCK, LAMP DIMMER, INTERCOM AMPLIFIER, LIGHT POWERED BIRD, BABY ALARM, TWO POWER 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 List.

ROCKER SWITCH

13 amp self-fixing into an oblong hole. Size approximately 1" x 1" 8p each, 10 for 72p.

SLIDE SWITCHES

Slide Switch, 2-pole changeover panel mounting by two 6BA. screws. Size approx. 1in x 1/2in rated 250V lamp. 6p each. 10 for 54p, 100 for £5-10, 500 for £22. Dials as above but for printed circuit 5p each, 10 for 45p, 100 for £4-25. Sub Miniature Slide Switch, DPTT 19mm (1in 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 18p 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.

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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 1 1/2" x 1 1/2" Above motor board 3 1/2". Below motor board 2 1/2".



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 x 4" deep x 3" high. Price £5.95 post 25p.

Suitable 7" x 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 main 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. 10 in. 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. 12" x 14" x 7 1/2". Covered in black leatherette. £4.95 Post 35p

ALSO AVAILABLE IN SOLID NATURAL MAHOAGANY 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 23 pair. STATE TYPE A OR B WHEN ORDERING.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2 1/2 in. sides. 6 x 4 in. 35p; 8 x 6 in. 45p; 10 x 7 in. 65p; 12 x 8 in. 85p; 14 x 9 in. 90p; 16 x 6 in. 90p; 12 x 8 in. 90p; 16 x 10 in. £1. ALUMINIUM PANELS 18 s.w.g. 6 x 4 in. 9p; 8 x 6 in. 15p; 14 x 9 in. 18p; 10 x 7 in. 19p; 12 x 8 in. 20p; 12 x 8 in. 28p; 16 x 6 in. 28p; 14 x 9 in. 34p; 12 x 12 in. 40p; 16 x 10 in. 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 60p
- Coil design and construction manual 80p
- 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 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. £2.20 Post Details S.A.E. Size 3 1/2 x 1 1/2 in.

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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.

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A die, punch and Allen Screw

1/2in. Round 88p	1 1/2in. Round 98p	Key "B" for above 8p
3/4in. Round 75p	1in. Round 98p	2in. Round 22.05
Key "T" for above 5p	1 1/4in. Round 98p	2 1/2in. Round 22.30
1in. Round 83p	1 1/2in. Round 1.05	Key "C" for above 12p
1 1/4in. Round 83p	1 3/4in. Round 1.05	2 1/2in. Round 24.10
1 1/2in. Round 83p	1 1/2in. Round 1.10	2 1/2in. Round 25.25
1 3/4in. Round 83p	1 3/4in. Round 1.10	3in. Round 28.10
1in. Round 90p	1 1/2in. Round 1.25	Key "E" for above 18p
Key "A" for above 5p	1 1/2in. Round 1.43	1in. Square with key 1.93
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Mono LOG or LINEAR
Size 3 1/2" x 1 1/2" x 1/4" in. with knobs.
5K, 10K, 25K, 50K, 100K,
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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
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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
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"SCORPIO"
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SYSTEM



This Capacitor-Discharge Electronic Ignition system was described in the November and December issues of Practical Electronics. It is suitable for incorporating in any 12V ignition system in cars, boats, go-karts, etc., of either pos. or neg. earth and up to six cylinders. The original coil, plugs, points and contact-breaker capacitor fitted in the vehicle are used. No extra or special components are required. Helps to promote easier starting (even under sub-zero conditions), improved acceleration, better high-speed performance, quicker engine warm-up and improved fuel economy. Eliminates excessive contact-breaker point burning and the need to adjust point and spark-plug gaps with precision. Construction of the unit can easily be completed in an evening and installation should take no longer than half an hour. A complete complement of components is supplied with each kit together with ready-drilled roller-tinned professional quality fibre-glass printed-circuit board, custom-wound transformer and fully-machined die-cast case. All components are available separately. Case size 7 1/2" x 4 1/2" x 2 1/2" approx. Complete assembly and wiring manual 25p, refundable on purchase of kit. Price: £10.50 plus 50p P. & P.

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SINGLE CHANNEL
SOUND TO
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Single channel "Sound to Light" unit with slider fader controls for audio trigger level and background load dimmer. Switchable for response to High, Mid and Low frequency audio input signals selected by fascia control. D.J. Pulse-Flash push button fitted to fascia for manual flashing of lamp load. Neon load indicator fitted. Constructed on glassfibre printed circuit material with attractive black anodised fascia panel. Input and load connections via Cinch printed circuit connector. Maximum Load 1kW at 250V 50Hz. R.F.I. filtered. Price: £13 each post free U.K.

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THREE CHANNEL
SOUND TO
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STL/3

Three channel "Sound to Light" unit with slider fader controls for audio trigger level and background load dimmer. An attractive unit with independent control of High, Mid and Low frequency audio trigger levels. Slider fader background or dimmer controls on each channel. D.J. Pulse-Flash push buttons on each channel together with neon load indicators. Constructed on glassfibre printed circuit material with attractive black anodised fascia panel. Input and load connections at rear so unit is ideally suited for mounting into disco-console. Maximum Load 1.5kW per channel at 250V 50Hz. R.F.I. filters incorporated. Price: £38.50 each post free U.K. Trade enquiries Welcome

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UNIT Mk. 3



This unit represents a natural progression from our phenomenally successful Mk. 1 and 2 Units. As before the drive voltage is derived directly from the amplifier output or across the speakers. The unit converts the audio frequency signals into a three-coloured light display; the colour depending on the frequency of the signal and the intensity on the loudness of the audio source.

The unit is constructed on professional fibre-glass printed-circuit board material and uses latest full-wave triac circuitry. There is a master-level control, together with independent sensitivity controls for each channel. The original minimum ambient light level controls have been redesigned permitting their use as faders; allowing dimming from max. to zero at the turn of a knob. R.F.I. suppression is now incorporated as standard, as well as provision for D.J. "Pulse-Flash" controls. The choice of two inputs enables operation from both high and low power amplifiers. Max. power 1.5kW per channel at 240V a.c.

Complete assembly built and tested. Size 9in x 7in x 3in. Price £25 carr. paid.

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66 ELMS ROAD, ALDERSHOT, Hants (Closed Wednesday)



F.M. TUNER AMPLIFIER for 88-102 MHz. Self-powered for 200-250V. a.c. Valves ECC85, EF59, EF80, ECC82, 2 diodes, metal rect. Chassis 10" x 6" x 8". Audio amp. module giving 3W. Into 16-ohm. Price £14 (post 50p).

Kit and wiring instrs. for 12V windscreen wiper delay control; metal box 3 1/2" x 3 1/2" x 1 1/2" with fixing strap, relay and all compls. £1.50 (post 20p).

MAINS TRANSFORMERS. 240-250V. input Deduct 10% from total bill for more than one transformer.

- B. Charger 12v. at 1 1/2A. 60p (20p)
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- H. 90v. at 100m.a., & 220v. at 60m.a. 85p (20p)
- J. 37v. 2A. 24-0-24V. 150m.a. £2.50 (50p)
- K. 250-0-250V. 150m.a. 20V. 1 1/2A. 15V. 1A. 6.3V. 5A. £2 (20p)
- L. 275-0-275V. 60m.a. 6.3V. 2 1/2A. & 6.3V. 1 1/2A. 75p (25p)
- M. 110V. input; 200-0-200V. 50m.a. 6.3V. 1 1/2A. 60p (25p)
- N. 220V. 50m.a. 6V. 1A. 45p (25p)



STEREO AMPLIFIER 2 x 3W. Printed circuit. Valves E280 & 2 ECL82. Liquidated stock of well-known manufacturer. Front panel 12" x 2". Chassis 9" x 3". Controls on-off, balance, ganged vols., ganged tones; for 200-250V. a.c. Output transformers for 3-ohm speakers. With knobs. Also available for 110V. a.c. Only £6 (p. & p. 50p) 110V. type £5 plus post.

TRANSISTOR RADIO PARTS

Gang capacitors. Min. 180pf+180pf 20p (8p); 150+110pf 30p (10p) 250+250pf dust cover 30p (8p); 250+250p dust cover, slow motion 20p (5p); triple 335pf direct drive with slow motion 60p (10p). Driver transformers. 2.5 to 1-1.1 20p (8p); 5-7 to 1+1-1 20p (8p); Output trans. 2x OC81 to 3-ohm 25p (5p); 2x OC82 to 3-ohm 20p (5p); Edgewise pots (s.p.) 3/4" dia 2-5K or 5K 15p (5p); 2-5K 1/4" dia 25p (5p); pots with 5/64" dia spindle 2-5K 1/4" long spindle 15p (5p) with knob; 2-5K 1/4" spin. 15p (5p) with knob; all pots with s. pole switch.

Osc. coil & 3 i.f. trans. replacement for P50 LAC range set of 4 for 80p, post pd.

1 lb (min. 100) high stab resistors 1W to 1W up to 2-5M 50p (10p post); 1 lb mixed tag strips 2 to 12 way approx. 75 for £1 (10p post); spring back telephone cable, 10" coil ext. to 6ft, 4-core 15p (10p post) or 7 for £1 post pd.; **AUDIO CONNECTORS.** PLUGS 2-pin speaker 10p; 3-pin DIN 14p; 5-pin 17p; phono 5p; 1/4" jack 12p; 2-5mm & 3-5mm 6p; METAL phono 12p; 1/4" 12p; 2-5mm 10p; 3-5mm 12p; **SOCKETS** 2-pin speaker 10p; 3 & 5 pin DIN 9p; phono single 5p; double 7p; treble 10p; 4-way 12p; 1/4" jack open 15p; moulded 20p; stereo open 20p; moulded 25p; **LINE SOCKETS** speaker, 3-pin & 5-pin DIN 17p; phono metal 12p; co-ax. T.V. plug 8p; car radio plug 6p; either socket 8p. Post 10p any order.

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CARTRIDGES all with standard fittings and styli. Stereo-compatible Mono GP91/8C 98p; STEREO GP93 £1.35, Stereo Ceramic GP94 £1.75. (All at 7p each.) Comparatives shown in List, with more types etc. Sonotone 9TAHC, Stereo Ceramic Diamond £1.70 (7p). **DIAMOND STYLII:** single tip types: Acos GP37, GP59, GP65/67, GP71, BSR TOS/PLST; COLLARO O.P. and DC284; GARRARD GC2, GC8, GCS10, GC12, RONETTE BF40, O.P. and T. PHILIPS 3301 (3060, 3066, 3302, 3304), 3010/12/13/16, SONOTONE 19T/20T ALL at 38p each (7p). **SAPPHIRE 16p (7p) DIAMOND DOUBLE TIP TURNOVER TYPES** (78 sap. on other side). For ACOS GP75, GP91 (for cartridges GP78, GP79). **GP91SC** (for stereo compat. types) GP104 BSR ST4 (ST2, ST5), ST9 (ST3), ST12/14/16, SONOTONE ST4, 9TA, 9TACH. PHILIPS 3306 3310, 3224, 3223/22 GP280, GARRARD GCM21, and 22, GCS23, GKS25 and 26, GCM2T and 22T, GCM2AT GCS23, GKS25T and 26T, GCM31, GCS36, GCS38, GCS38, KS40A, KS41B ETC. ALL at 68p (7p). **SAPPHIRE 32p (7p). DOUBLE DIAMOND STYLII:** same dia STL/PL tip each side: no 78) All types £1.35 (7p). **SAPPHIRE DOUBLE STL/PL, TIPPED 32p (7p). PICK-UP WIRE:** super thin flex screened, sheathed, TWIN 7p per yard, 4-core 13p per yard (either up to 6 yds. 7p). Over, charges paid. **MICROPHONES:** CRYSTAL: LAPL 1 1/2", clip/hand, lead 3-5mm jack plug 39p (9p). CM20 Cream Plastic hand 59p (9p); CM70 "GLANET" Metal, tapered with neck cord, adaptor for stand £1.85 (11p). "MIC 42". Curved metal hand grip £1.10 (11p) ALL with leads. **DYNAMIC:** 209 Cardioid Ball. 50K/600 Ω built in volume control, on/off switch, special 20ft lead, the best value anywhere at £6.80 (33p); UD130, uni-dir mesh ball 50K/600 Ω jack plug, cable, adaptor, £5.28 (22p); DM160, omni-dir, Ball mesh. 50K, cable adaptor, jack plug, £4.29 (33p) each. **SPEAKERS:** Very popular 12" ROUND, fitted tweeter, 3, 8 or 15 ohms (state which) £2.06 (83p) or pair for stereo £4.65, chrome mid. SMALL 2 1/4", 3 Ω, 8 Ω or 64 Ω (state which) 36p (9p). More speakers in List. **HEADPHONES:** High resistance 2000 Ω adjustable £1.10 (11p). **EARPIECES:** with lead and min. 2-5mm or 3-5mm (state which) jack plug. **MAGNETIC 11p. CRYSTAL (3-5mm plug only) 28p** (up to 6 for 9p any type). **SOLDERING IRON:** Slim, modern, British high speed, 8 1/4", all parts replaceable, highest quality, fully guaranteed £1.29 (11p). **TRANSFORMERS:** Sub-min 1 1/2" x 1 1/2" x 12mm. **SOLEWDRIVER** (socket tester) 19p (7p either). **MAINS BATTERY ELIMINATOR:** Packs of 5 coils, each coil 5yds. Astal. coils. **SOLID CORE 16p (7p) FLEXIBLE CORE 16p (8p).** SUPER THIN flexible for transistor wiring, etc. 18p (7p) **RETRACTABLE FLEXIBLE LEADS (SOCKETLIES):** With phono plug, each end, 6ft 26p, 12ft 44p. With phono plug/phono socket other end 6ft. 26p, 12ft 50p (6p lead any type). **VIBRATORS:** 12V/4 pin non-synch 121HD/4, 2 1/2" ex. pins, 33p. SAME but 3 1/2" ex. pins, USA 15p. 12V/7 pin synch. (123B7) 2 1/2" ex. pins. 72p (9p any type). **MAINS NEONS:** 4x leads 11p. **NEON SOLEWDRIVER** (socket tester) 19p (7p either). **MAINS BATTERY ELIMINATOR:** Input 240V-a.c. Output 3, 4, 6, 7, 9 and 12 volt D.C. by switch selector. On/off switch, pilot lamp, leads, plug to suit most cassette recorders, £4.13 (7p). Highly suitable for all transistor receivers.

All above prices have been adjusted to include V.A.T.

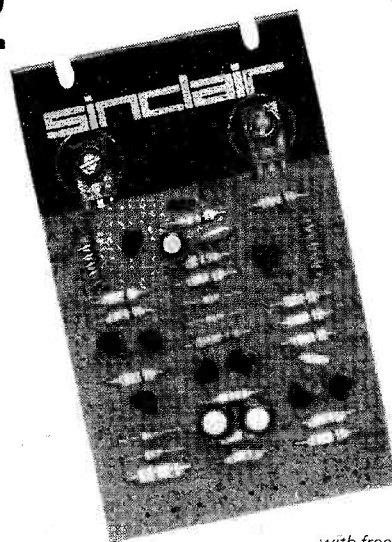
Our LIST (see heading) with Cartridge and Styli equivalents etc., contains details of very many more components, Accessories and Units at most reasonable prices, of great interest to the constructor and amateur.

Sinclair Project 60

Now—the Z.50 Mk.2

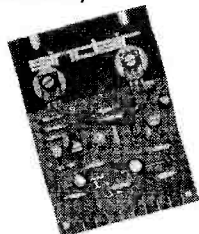
with built-in automatic transient overload protection

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 symmetrical 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.



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Z.30 the power amplifier for quality and economy



with free manual
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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 1/8 x 2 1/2 x 1/2). Z.30, Z.50 and Z.50 MK.2 modules are compatible and interchangeable.

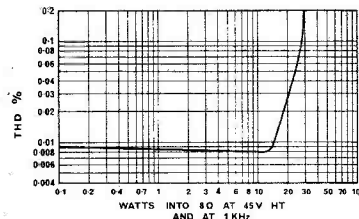
Guarantee

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.

Brilliant new technical specifications

Input impedance 100 K Ω
Input (for 30w into 8 Ω) 400mV
Signal to noise ratio, referred to full o/p at 30v HT 80dB or better
Distortion 0.02% up to 20W at 8 Ω . See curve
Frequency response 10Hz to more than 200 KHz \pm 1dB
Max. supply voltage 45v (4 Ω to 8 Ω speakers) (50v 15 Ω speakers only)
Min. supply voltage 9v
Load impedance — minimum: 4 Ω at 45v HT
Load impedance — maximum: safe on open circuit



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
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F.M. Stereo Tuner (£25) & A.F.U. (£5.98) may be added as required.

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SPECIFICATIONS—Input sensitivities: Radio — up to 3mV, Mag. p.u. 3mV; correct to R.I.A.A. curve ± 1 dB: 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.

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Project 60 Stereo F.M. Tuner

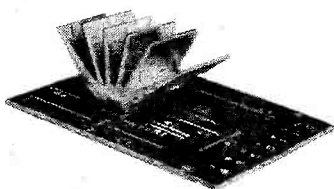


The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. tuner with fantastically good results. Other advanced features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stereo 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:** 7 μ V for lock-in over full deviation. **Squelch level:** Typically 20 μ V. **Signal to noise ratio:** > 65dB. **Audio frequency response:** 10Hz — 15KHz (± 1 dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2 μ V. **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.

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sistor 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: 8 watts RMS continuous (12 watts peak), 8–8 Ω . **Frequency Response:** 5Hz to 100KHz ± 1 dB. **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:** 5 to 28V. **Quiescent current:** 8mA at 28V. **Size:** 22 x 45 x 28mm including pins and heat sink.

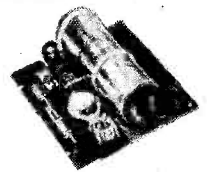
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INDEX TO ADVERTISERS

Amtron U.K.	35
Antex Ltd.	19
Apex Aerials	90
Arrow Electronics Ltd.	39
Astro Electronics	82
B.H. Components Factors Ltd.	94
Baines, R.	90
Baker Loudspeakers Co.	62
Bedford Electronics	93
Bell's Television	90
Bernard, Gerald	12
B.I.E.T.	70, Cov iii
Bi-Pak Semiconductors	15, 16, 17
Bi-Pre-Pak Ltd.	69
Boffin Projects	93
British National Radio & Electronic School	Cov ii, 59
Broadway Electronics	70
Bull, J. (Electrical) Ltd.	83
Bush & Meissner	93
C.C.I.L. Ltd.	6
Caranna, C.	90
Chiltmead Ltd.	74
Codar	4
Colomar Electronics Ltd.	82
Comet High Fidelity Discount Warehouses	10, 11
Chromasonic Electronics	77
D.E.W. Ltd.	93
Dabar Electronic Products	86
Davian Electronics	62
Denco	90
Discosound	55
Douglas Electronic Industries Ltd.	93
Duke & Co. (London) Ltd.	40
Elektrokitt	40
Electronic Design Associates	62
Electronic Mail Order (Bury) Ltd.	93
Electrosparres	62
Electrovalve	7
Elvins Electronic Musical Instruments	12

Felstead Electronics	86
Future Technmatics Ltd.	82
Galleon Trading	92
Gladstone Radio	86
Global Audio Discount Warehouse	18
Golledge P.R.	92
Greenwell Electronics	92
HAC Short-wave Products	66
Harverson Surplus Co. Ltd.	73
Heath (Gloucester) Ltd.	31
Henry's Radio Ltd.	61, Cov iv
Home Radio (Components) Ltd.	74
I.C.S.	12, 91
Imperial Trading	90
Ivoryet Ltd.	6
Jef Electronics	92
Jermyn Industries	5, 18
Johns (Radio) Ltd.	92, 94
Johnson & Johnson Ltd.	74
K.V.A. Electronics	94
Kensington Supplies	91
Keytronics	14
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Partridge Electronics Ltd.	8
Pembridge College	82
Photain Controls	94
Phonsonics	70
Radio Component Specialists	84, 85
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Radio & T.V. Components (Acton) Ltd.	20, 21
Radio Society of Great Britain	14
Raymer Electronics Ltd.	62
Readers Radio	36
Redhawk Sales	92
Riversdale Electronics	59
RDI	93
RSC (Hi-Fi Centres) Ltd.	2, 3
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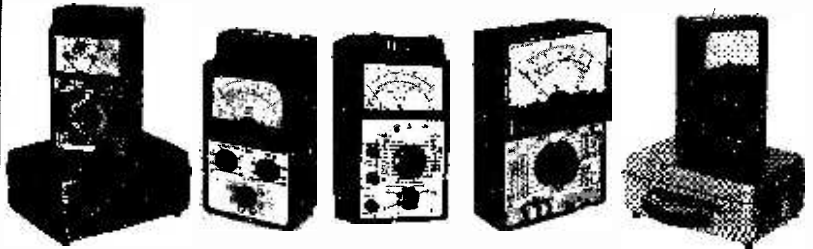
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OB3	0.70	6AR7G	0.85	6P13	0.50	10D1	0.65	EF183	0.30	HAB8C00.55		PL36	0.55	U801	0.80
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1R4	0.50	6BA6	0.28	6P24	0.80	10L1	0.80	EL36	0.50	PAB8C00.40		PL89	0.95	UB41	0.65
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1U5	0.75	6BN5	0.43	6J5GT	0.40	12AL5	0.55	EL85	0.43	PC84	0.40	PM84	0.60	UBL21	0.70
1V2	0.55	6BR5	0.60	6J6	0.50	12AQ5	0.50	EL86	0.40	PC85	0.40	PY31	0.35	UC92	0.45
1X2B	0.55	6BQ5	0.25	6J7	0.45	12AR7	0.65	EL89	0.42	PC88	0.55	PY33	0.63	UCC85	0.45
2D21	0.40	6BR8	0.75	6K47	0.60	12AT7	0.40	EL90	0.42	PC89	0.55	PY80	0.40	UCF80	0.70
3A4	0.45	6B87	1.35	6K6GT	0.75	12AU6	0.45	EL92	0.60	PC87	0.50	PY81	0.30	UCB2	0.60
3A5	0.75	6BW6	0.90	6K7	0.43	12AU7	0.33	EL92	1.40	PC85	0.95	PY82	0.35	UCB2	0.70
3BP1	3.50	6BW7	0.90	6K8G	0.45	12AV6	0.45	EL93	0.75	PC86	0.95	PY83	0.38	UCB1	0.40
384	0.40	6BX6	0.25	6K25	0.75	12AV7	0.70	EL94	0.40	PC80	0.80	PY88	0.40	UCL81	0.60
3V4	0.65	6BZ6	0.45	6LGT	1.00	12AX7	0.55	EL95	0.55	PC82	0.35	PY80	0.47	UCL82	0.35
5R4GT	0.75	6C5	0.55	6L7	0.45	12B7	0.75	EM30	0.45	PC84	0.60	PY81	0.50	UCL83	0.65
5U4G	0.40	6CGT	0.55	6L18	0.50	12B4A	0.65	EM81	0.40	PC86	0.60	PY81	0.38	UE9	0.45
5V4G	0.50	6CB6	0.40	6LD20	0.50	12BA6	0.55	EM83	0.50	PC87	1.10	QVQ0-6		UF11	0.60
5Y8GT	4.45	6CD6GA		6N7GT	0.55	12BA7	0.50	EM84	0.35	PC80	0.50	QVQ0-10	2.25	UF41	0.65
5Z5	0.75	1.30		6P28	0.65	12B6G	0.50	EM85	1.00	PC82	0.50	QVQ0-20A	1.25	UF43	0.65
5Z6G	0.45	6CG7	0.60	6P25	0.65	12B7	0.50	EM87	0.70	PC85	0.90	QVQ0-30	3.40	UF80	0.35
6B0L2	0.30	6CH6	0.60	6SA7	0.65	12B7T	0.65	EN91	0.40	PC86	0.75	T221	5.25	UF85	0.40
6B4	0.45	6CL6	0.60	6S67	0.45	12K5	1.00	EN91	0.40	PC88	0.75	T222	3.40	UF89	0.40
6AF4A	0.60	6CU6	0.80	6SK7	0.50	12K7GT	0.50	EN91	0.40	PC89	0.90	T222	3.50	UL41	0.65
6AG5	0.25	6CW4	0.70	6SL7GT	0.45	12L5	0.75	EY31	0.40	PC88	0.85	U18-20	0.75	UL84	0.43
6AG7	0.45	6CY5	0.50	6SN7GT	0.45	12R87	0.50	EY83	0.55	PC83	0.35	U25	0.85	UM84	0.30
6AB6	0.80	6CY7	0.75	6S7	0.50	12S5	0.75	EY86	0.40	PC84	0.45	U26	0.85	UY11	0.50
6A3	0.30	6D3	0.80	6S87	0.50	20L1	1.10	EY88	0.43	PC86	0.45	U31	0.70	UY11	1.00
6AK5	0.40	6DC6	0.80	6T8	0.38	20P1	0.50	EY88	0.43	PC87	0.60	U37	6.50	UY41	0.48
6AK6	0.60	6DK6	0.60	6U4GT	0.70	20P4	1.10	EY88	0.43	PC88	1.25	U52	0.40	UY85	0.40
6AL3	0.43	6DQ6B	0.75	6UG6	0.75	20P5	1.20	EY88	0.43	PC89	0.75	U75	0.40	W729	0.75
6AL5	0.22	6D8A	1.25	6U8A	0.48	25C5	0.60	EY88	0.43	PC90	1.00	U191	0.75	Y63	0.75
6AM5	0.40	6E8A	0.65	6VGGT	0.45	25L6GT	0.80	EY88	0.43	PC91	0.70	U201	0.50	Z759	3.00
6AM6	0.37	6E8B	0.80	6W5	0.65	30B5	0.70	EY88	0.43	PC92	0.45	U282	0.55	Z803U	1.35
6AG5	0.42	6EJ7	0.85	6X5GT	0.45	50C5	0.60	EY88	0.43	PC93	0.40				
6AQ6	0.70	6EWE	0.70	6X8	0.65	50C6D	1.20	EY88	0.43	PC94	0.30				
6AR5	0.55	6F1	0.75	6Y6G	0.80	30AE3	0.40	EY88	0.43	PC95	0.40				
								EY92	0.35	GZ31	0.40				

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2N697	0.15	AC132	0.35	BD123	0.80
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2N705	0.70	AC184	0.15	BD132	0.80
2N706	0.10	AC187	0.15	BF115	0.20
2N708	0.15	AC169	0.10	BF117	0.15
2N753	0.25	AC176	0.25	BF133	0.20
2N929	0.20	AC187	0.17	BF179	0.30
2N930	0.20	AC188	0.25	BF180	0.30
2N947	0.30	AC177	0.20	BF181	0.30
2N1131	0.25	ACY155	0.20	BF184	0.20
2N1132	0.25	ACY19	0.25	BF184	0.20
2N1184	1.25	ACY20	0.20	BF194	0.14
2N1302	0.17	ACY21	0.20	BF195	0.14
2N1303	0.17	ACY22	0.10	BF196	0.12
2N1304	0.20	AD140	0.50	BF197	0.12
2N1305	0.20	AD149	0.45	BF200	0.85
2N1306	0.25	AD161	0.35	BF200	0.85
2N1307	0.25	AD162	0.35	BF200	0.85
2N1308	0.25	AD211	1.25	BFW88	0.20
2N1309	0.25	AD212	1.25	BFW89	0.20
2N1613	0.17	AF110	0.17	BFW91	0.20
2N1711	0.20	AF115	0.17	BFX88	0.20
2N1756	0.75	AF116	0.17	BFY17	0.40
2N2147	0.75	AF117	0.17	BFY19	0.25
2N2160	0.60	AF118	0.30	BFY50	0.20
2N2170	0.25	AF125	0.30	BFY61	0.20
2N2198	0.20	AF127	0.20	BFY62	0.20
2N2919	0.20	AF180	0.30	BSY26	0.17
2N2869A	0.15	AF181	0.35	BSY27	0.15
2N2477	0.65	AF186	0.40	BSY28	0.17
2N2646	0.40	AF239	0.30	BSY65	0.20
2N2906	0.25	AF211	0.45	BSY95A	0.12
2N2923	0.12	AF212	1.00	OC16	0.50
2N2924	0.15	ASV26	0.25	OC22	0.50
2N2926	0.10	ASV27	0.30	OC23	0.60
2N3053	0.20	ASV28	0.25	OC24	0.35
2N3054	0.50	ASV29	0.30	OC25	0.25
2N3055	0.80	ASV30	0.25	OC29	0.60
2N3133	0.25	ASZ15	0.70	OC36	0.50
2N3134	0.25	ASZ16	0.70	OC36	0.50
2N3391	0.17	ASZ17	0.75	OC42	0.30
2N3392	0.17	ASZ18	0.75	OC44	0.15
2N3393	0.15	ASZ20	0.25	OC45	0.12
2N3394	0.15	ASZ21	0.40	OC70	0.10
2N3395	0.20	AVY14	1.00	OC71	0.12
2N3402	0.15	BCI07	0.10	OC72	0.12
2N3403	0.15	BCI08	0.10	OC73	0.30
2N3404	0.32	BCI09	0.10	OC75	0.15
2N3414	0.20	BCI13	0.10	OC76	0.15
2N3416	0.15	BCI18	0.20	OC78	0.25
2N3417	0.25	BCI24	0.20	OC78D	0.20
2N3702	0.10	BC147	0.10	OC81	0.20
2N3703	0.10	BC148	0.10	OC81D	0.20
2N3704	0.12	BC149	0.12	OC83	0.20
2N3707	0.12	BC152	0.15	OC139	0.30
2N3709	0.10	BC158	0.15	OC140	0.35
2N3710	0.10	BC175	0.20	OC141	0.60
2N3813	0.35	BC180	0.35	OC170	0.25
2N3906	0.20	BCY30	0.25	OC171	0.25
2S702	0.50	BCY31	0.30	OC200	0.30
2S746	0.25	BCY33	0.25	OC201	0.60
AC113	0.15	BCY34	0.30	OC202	0.65
OC125	0.30	BCY72	0.15	OC203	0.40
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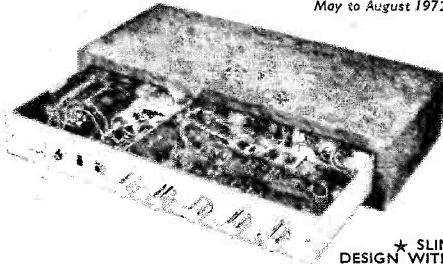
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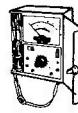
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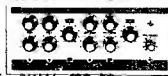


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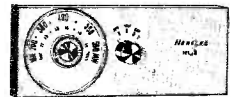
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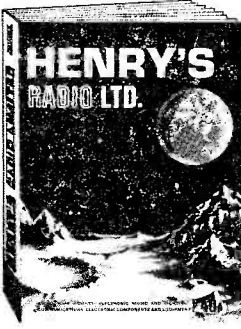
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SIMPLE PROJECTS FOR THE HOME

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 srpb 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.

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. x 9in.

Battery 9V type PP6 or PP9 with connectors

Perforated srpb component board

Nuts and bolts 6BA, soldering tags, pvc wire

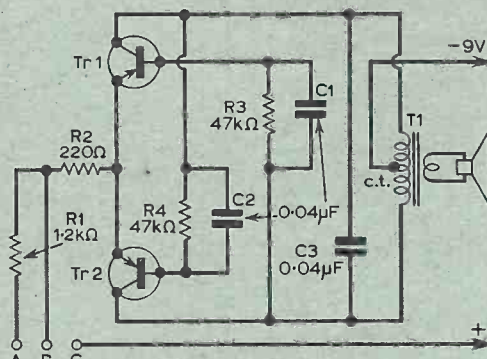


Fig. 1: Circuit diagram

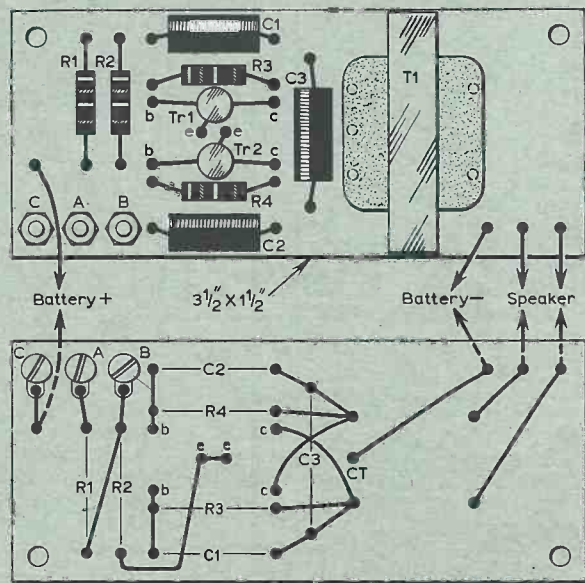
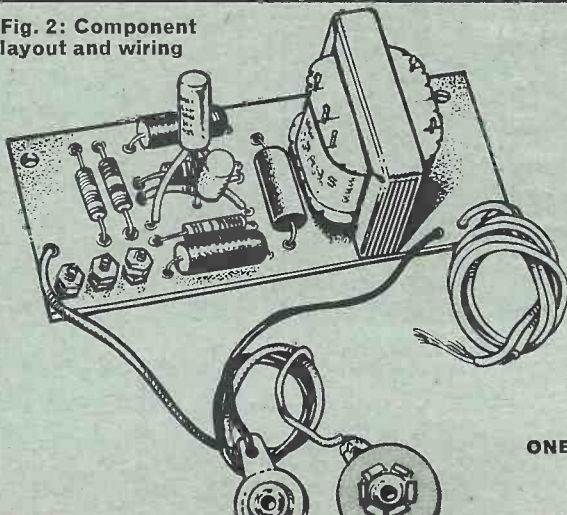


Fig. 2: Component layout and wiring





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

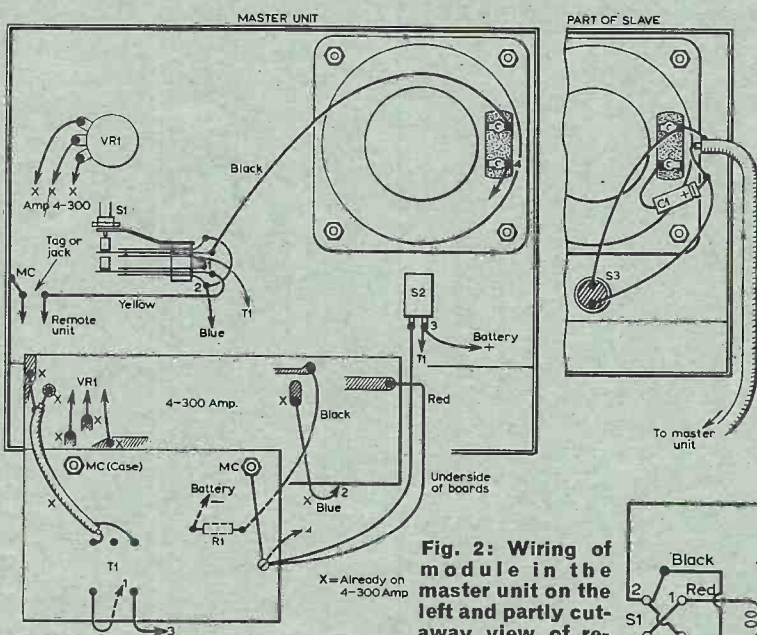
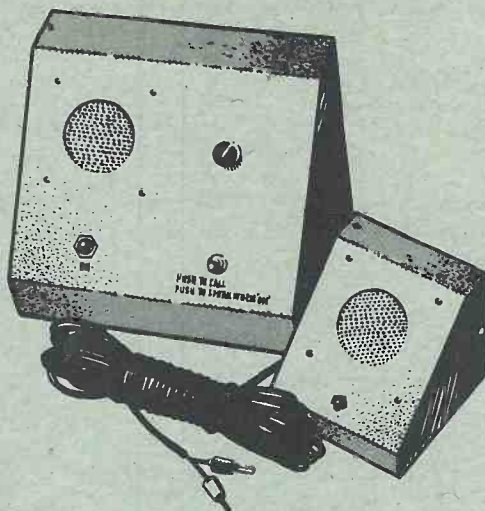


Fig. 2: Wiring of module in the master unit on the left and partly cut-away view of remote unit

components

- R1 resistor $150\Omega \pm 10\%$ $\frac{1}{4}$ watt
- VR1 potentiometer supplied with amplifier module
- C1 capacitor $50\mu\text{F}$ 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 $2\frac{1}{2}$ in. or $3\frac{1}{2}$ in.
- Battery 9V type PP6 or PP9 and connectors
- Amplifier module type 4-300
- Component board srpb $3\frac{1}{2}$ in. \times $2\frac{1}{2}$ in.
- Case 8in. \times 6in. \times 6in. (Master unit)
- Case 4in. \times 4in. \times 4in. (Remote unit)
- PVC connecting wire and knob
- Nuts and bolts 6BA and 4BA
- Soldering tags 6BA

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.

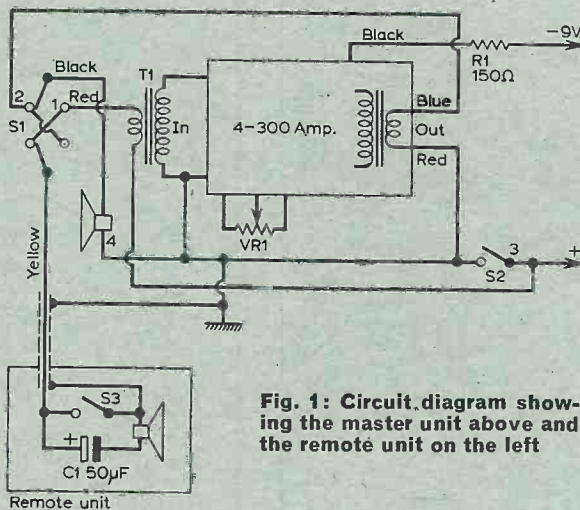


Fig. 1: Circuit diagram showing the master unit above and the remote unit on the left

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 srpb 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

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.

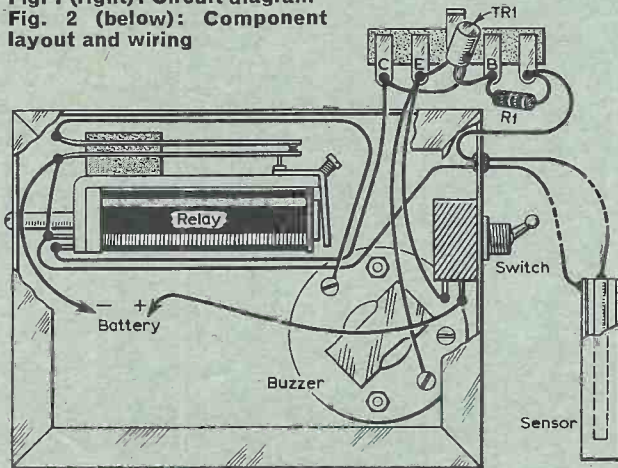
Fig. 1 shows the circuit. The presence of water shorts the sensor probe and allows base current to flow through R1, resulting in a collector current of about 40–50mA to close the relay. The buzzer sounds until the sensor is removed from the water, or the device is switched off.

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

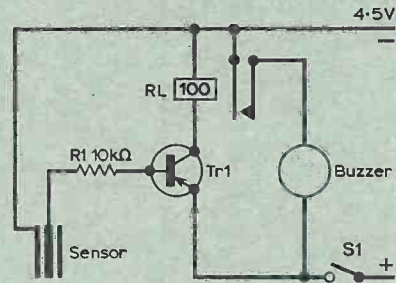
- | | |
|-----|--|
| R1 | resistor 10kΩ ±10% ½ watt |
| Tr1 | transistor OC76 or any high gain pnp type |
| S1 | single-pole, on-off switch |
| RLA | relay 100Ω coil, single-pole on-off contacts, 3-6V operation |
| | Battery 4½ to 6V depending on relay obtained |
| | Buzzer 4½ to 6V |
| | Sensor probe (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 3/16in. 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.



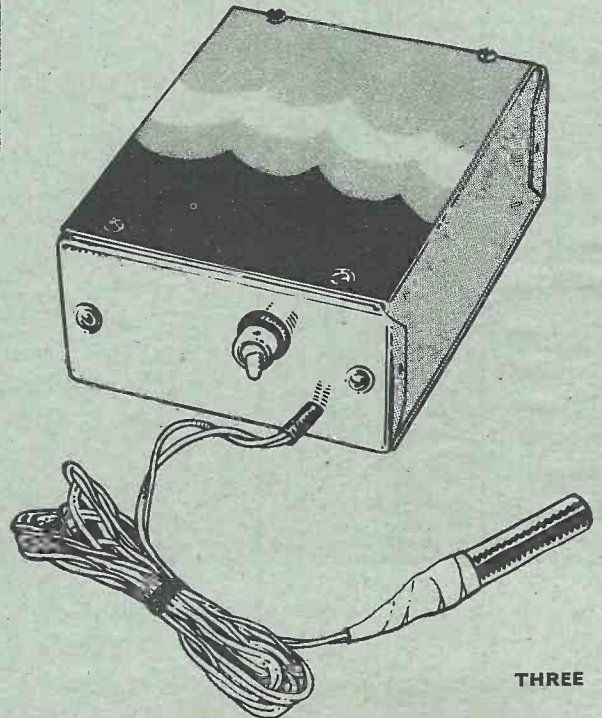
INTERCOM AMPLIFIER continued from page two

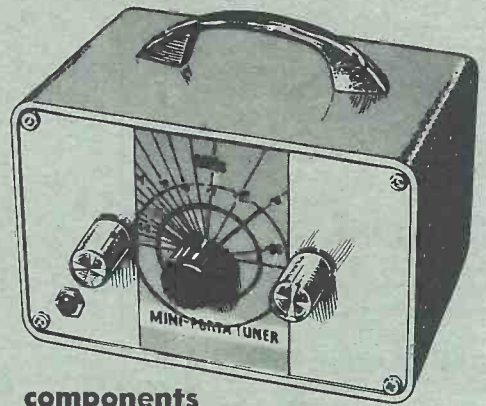
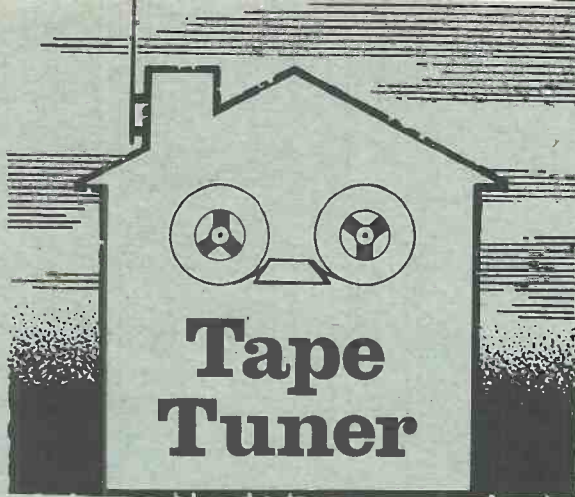
positioned to avoid feedback which would cause instability. In addition to VR1, the 4-300 has a preset sensitivity control, which can be left at about the middle of its travel.

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.





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 srpb board is bolted to the metal bracket carrying VR1, VC1/2 and S1. MC is the metal case cover.

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

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 Diode

VR1 10kΩ log.	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 srpb, 0.15in. matrix
4¾in. x 2½in.
Control panel and bracket 4¾in. x 2in. aluminium
Nuts and bolts 6BA, pvc wire
Case, insulated, of wood or plastic

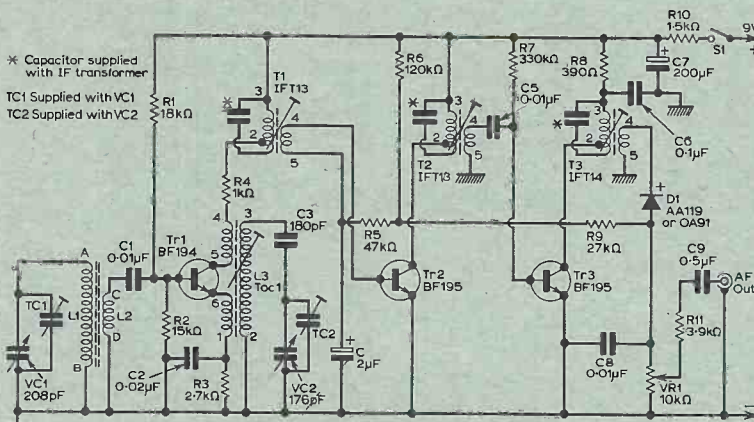


Fig. 1: Circuit diagram of the tuner.

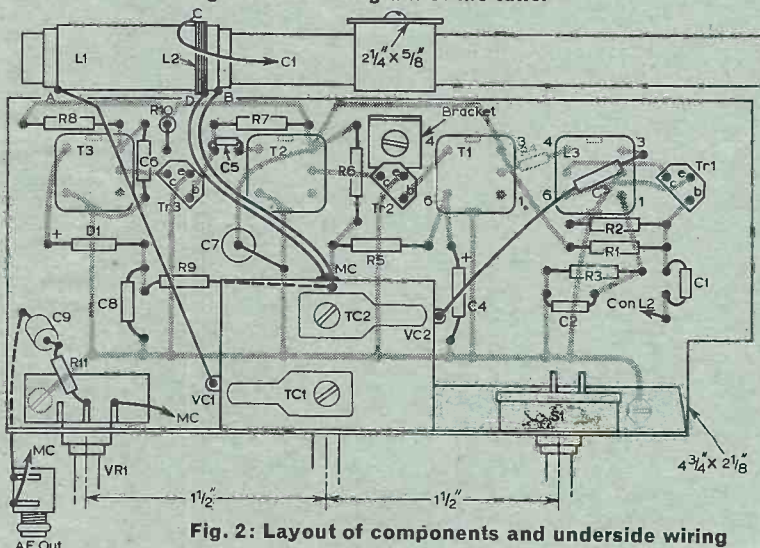
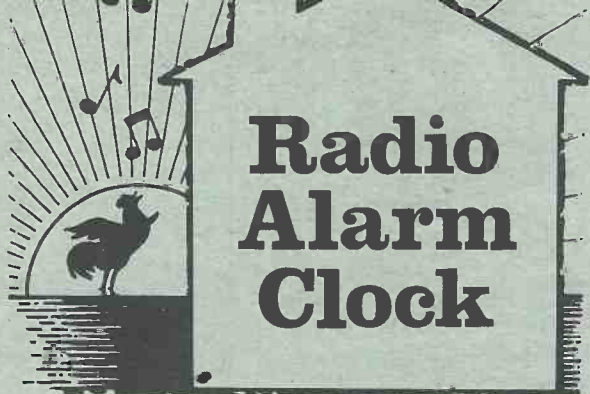


Fig. 2: Layout of components and underside wiring

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)

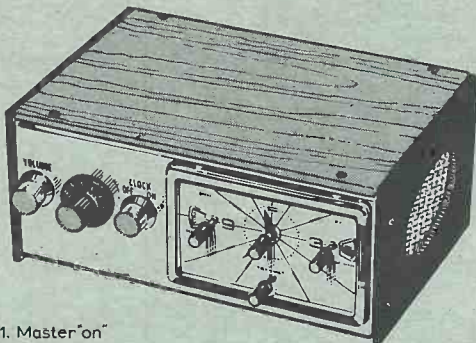
Loudspeaker 8Ω to match IC12

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. ●

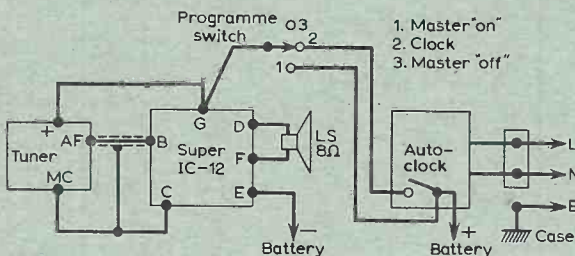


Fig. 1 (left): Circuit diagram

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

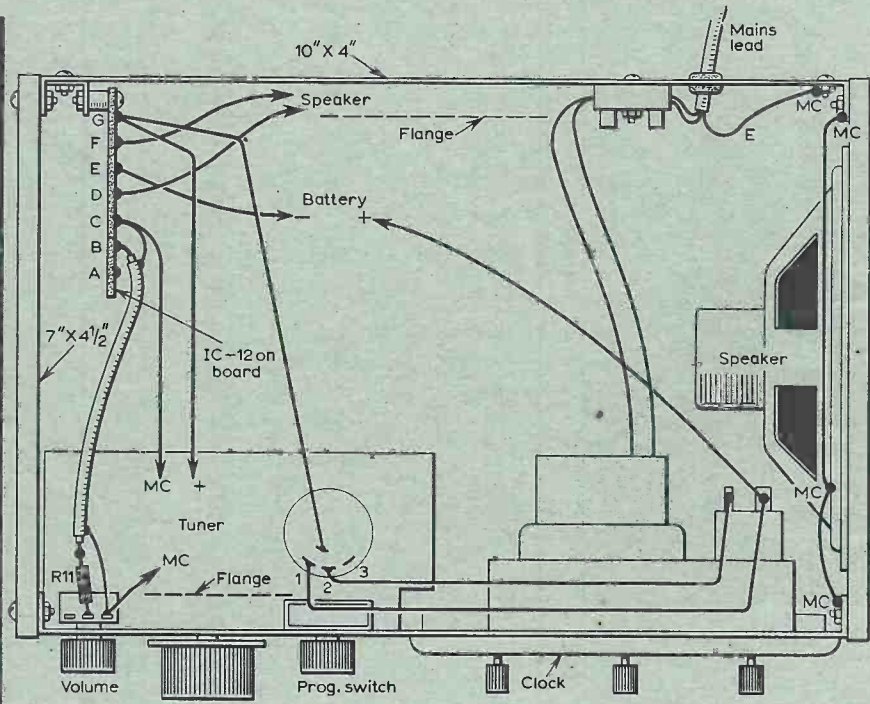
TAPE TUNER

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 necessary). 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. ●



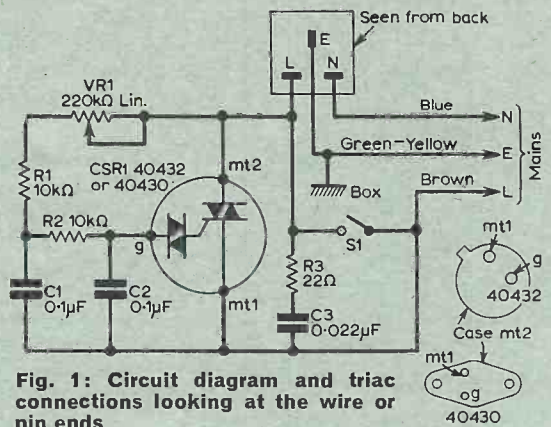
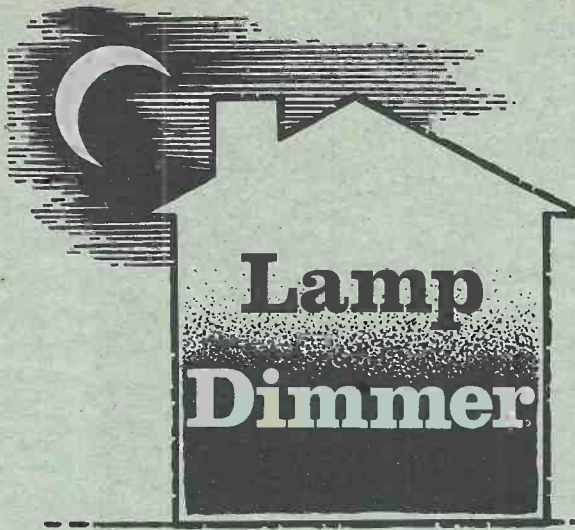


Fig. 1: Circuit diagram and triac connections looking at the wire or pin ends

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% ¼ 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 2½in. × 2½in. × 1½in. or 6½in. × 3½in. × 2in. with 13A mains socket Tag strip 8-way, knob, pvc wire, rubber grommet

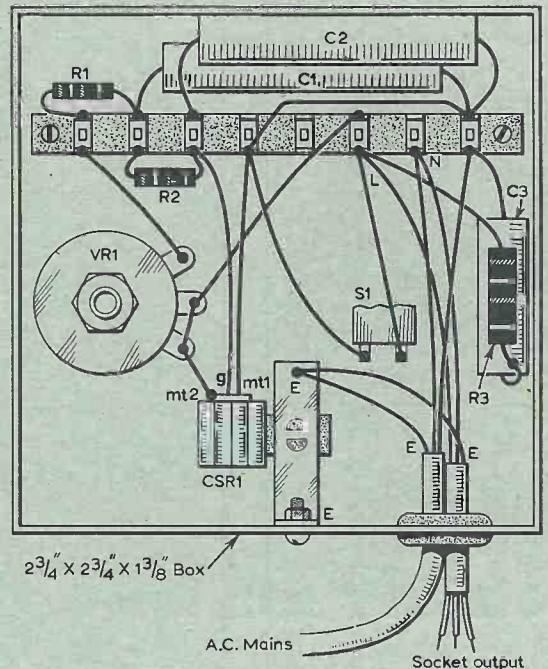
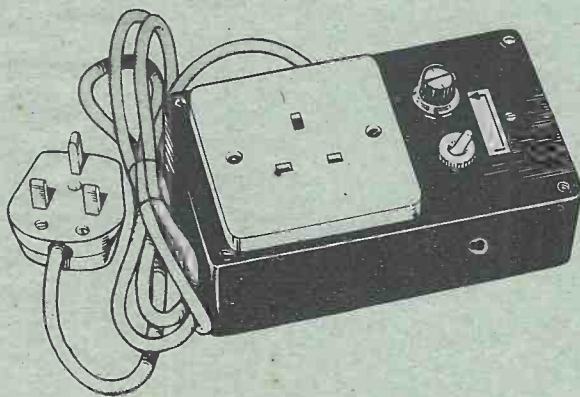


Fig. 2: Component layout and wiring

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 srpb 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.

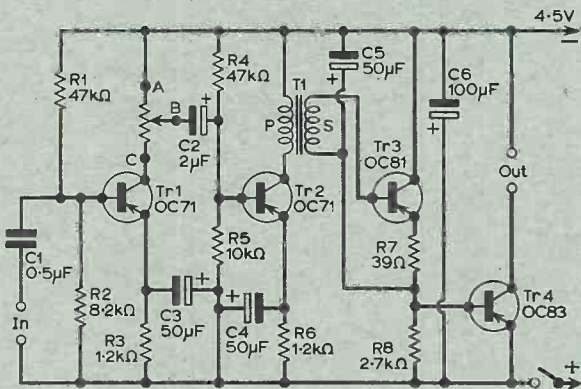


Fig. 1: Circuit diagram of the amplifier

components

Resistors

R1 47kΩ	R5 10kΩ
R2 8.2kΩ	R6 1.2kΩ
R3 1.2kΩ	R7 39Ω
R4 47kΩ	R8 2.7kΩ

All ±5% ±w

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 srpb board 4in. × 2½in.
- Screw terminals or sockets
- Case, aluminium or wood, 10in. × 4in. × 3in.



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.

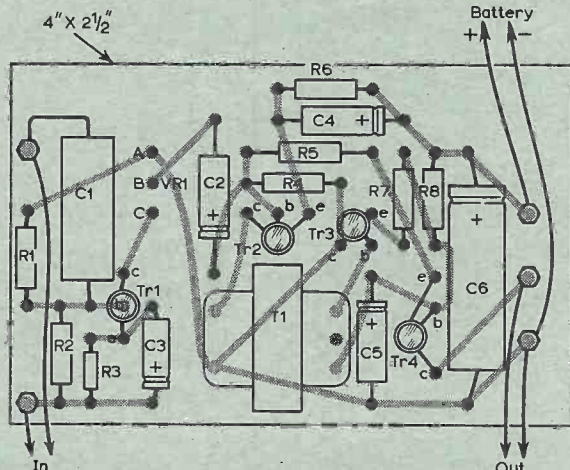
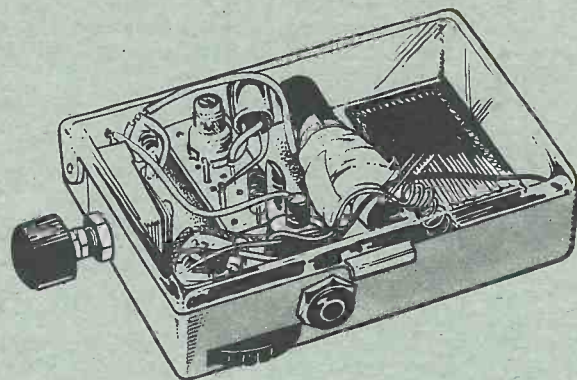


Fig. 2: Component layout and underside wiring shown grey





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 1½in. × ⅜in. and box
- PVC connecting wire

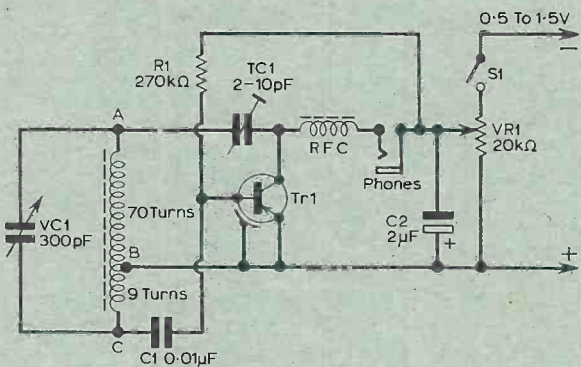


Fig. 1: Circuit diagram

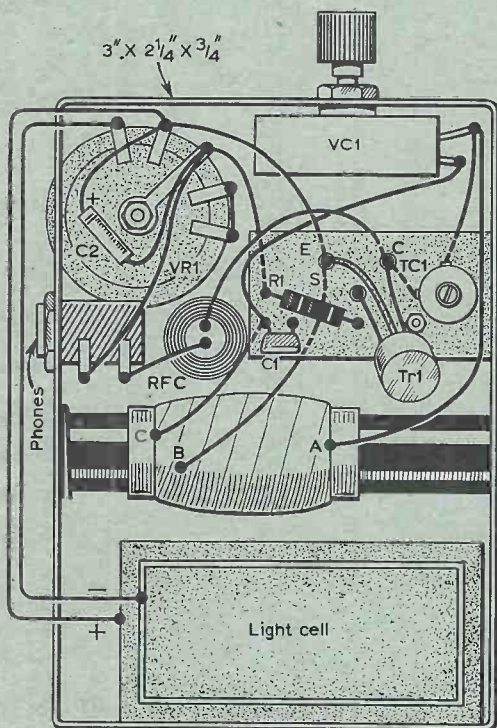


Fig. 2: Component layout and wiring

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 srpb 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. ●

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