PRACTICAL WIRELESS

SEPTEMBER 1973

20p

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* SIMPLE TWO I.C. RADIO

also: I.C. ANALOGUE D.C. VOLTMETER
POWER REGULATED MODULE

PRACTICAL WIRELESS

VOL. 49 NO. 5
ISSUE 799
SEPTEMBER 1973

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

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● NEWS & COMMENT

● CONSTRUCTIONAL

● OTHER FEATURES

R.S.C. STEREO PACKAGE OFFERS

PACKAGE PRICE

FOR ILLUSTRATED UNITS

ONLY **£39·99**

Carr. £1·00
Or deposit £6·95 and 9 monthly payments £4·22 (Total £44·93).

R.S.C. A55 LOUDSPEAKERS

GARRARD 2025

LINEAR 505 AMP

Individual Rec. Retail Prices:

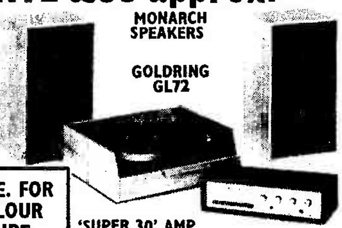
LINEAR 505 5 + 5 Watt Amplifier	£19·25
GARRARD 2025 Autochanger + KS40A Cartridge ..	£13·44
Teak Veneer Plinth with Transparent Plastic Cover	£5·90
Pair A55 LOUDSPEAKERS (Inc 8″ × 5″ 10,000 Gauss)	£10·82
TOTAL	£49·41

SEND S.A.E. FOR FREE COLOUR BROCHURE

SAVE £30 approx.

MONARCH SPEAKERS

GOLDRING GL72



'SUPER 30' AMP

HIGH FIDELITY UNITS

PACKAGE PRICE FOR ILLUSTRATED UNITS

£108·25 Carr. £1·75

Or deposit £15·00 and 12 monthly payments £8·78 (Total £120·36)

GOLDRING GL72 Transcription Turntable + P.U.
GOLDRING G800 Magnetic Cartridge
DE-LUXE PLINTH with Roll-over Cover
Pair R.S.C. MONARCH LOUDSPEAKERS
R.S.C. SUPER 30 Mk III AMPLIFIER

Total value of individual items listed above £138·14.

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 Response 25 Hz–20 kHz. Impedance 8–15 ohms. **£9·96** post free

Or Dep. £2 & 9 mthly pymnts. £1·07 (Tot. £11·63)

SP101 HIGH FIDELITY PLAYER UNIT

Comprising Goldring G101 hi-fi single player unit fitted high fidelity free field magnetic stereo cartridge with diamond stylus. Belt driven Attractive design super-slim plinth and 'roll-over' transparent tinted plastic cover. Or Deposit £4·95 and 9 Monthly Payments of £3·75 (Total £38·70) Excellent value. **£34·95** Post paid

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 **£12·65** Carr. 40p
Or FACTORY BUILT IN TEAK VENEERED CABINET as illustrated £16·50 or dep. £2 and 9 monthly payments £1·88 (Total £18·92).

HIGH FIDELITY LOUDSPEAKER UNITS

Cabinets latest style Satin Teak veneer. Acoustically lined or filled acoustic damping. Ported where appropriate. Credit terms available.

DORCHESTER (Illustrated) Size 16 × 11 × 9in. appr. Range 45-15,000 c.p.s. Rating 8-10 watts. Fitted High flux 13 × 8in. Dual Cone speaker. Imp. 3 or 15 ohms. **£9·45** Carr. 40p.

MONARCH Size 19 × 10½ × 9in. approx. Rating 10 watts. Inc. 13 × 8in. 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**

HI-FI SPEAKER ENCLOSURES MODERN DESIGN

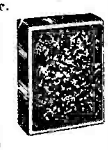
Teak veneer finish. Acoustically lined. Sizes approx. Carr. 35p. per enc.

JE8 Size 16″ × 11″ × 9″. Pressurised. Gives pleasing results with any 8in. Hi-Fi speaker. **£5·50**

SE10 For outstanding results with 10in. Hi-Fi spkr. Size 25¼ × 16 × 9in. Ported **£6·75**

SE8 For optimum performance with any 8in. Hi-Fi spkr. Size 19 × 10¼ × 9in. **£6·50**

SE12 For excellent performance with 12in. Hi-Fi speaker and tweeter Size 25¼ × 16 × 9in. **£7·95**



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.

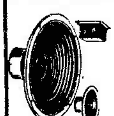
Exceptional performance at low cost.

HF808T	8″	10W	£2·98	HF120D	12″	15W	£5·50
HF102D	10″	10W	£3·30	HF126	12″	15W	£6·35
HF120	12″	15W	£4·95	HF126D	12″	15W	£6·85

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. **£3·70**
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 Ω. **£4·95**

AUDIOTRINE HI-FI SPEAKER SYSTEMS

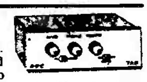


Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£6·50** Carr. 33p
OR SENIOR 15 WATT INCLUDING HF126 15,000 LINE SPEAKER **£7·65** Carr. 39p

R.S.C. BATTERY/MAINS CONVERSION UNITS

TYPE BM1. An all-dry battery eliminator. Size 5½ × 4½ × 2in. approx. Completely replaces batteries supplying 1·5v and 90v, to battery radio where A.C. mains 200/250v. 50c/s is available. Post 30p
ASSEMBLED READY FOR USE **£4·15**

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



200-250v. AC 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 3-15 ohm spkrs. Max. sensitivity 5mV Output rating I.H.F.M. Fully enclosed enamelled case, 9½ × 2¾ × 5½in. Attractive brushed silver finish facia plate 10¾ × 3¼in. and matching knobs.
Complete kit of parts with full wiring diagrams and instructions. **£8·50** Carr. 40p.
OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE £12·05

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

FULLY GUARANTEED. Impregnated and Interleaved where necessary. Primaries 200-250v. 50c/s. Screened

MIDGET CLAMPED TYPE 2½ × 2½ × 2½in.

250v., 60mA, 6·3v. 2a	£1·10
250-0-250v., 60mA 6·3v 2a	£1·16

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6·3v. 2a., 0-5-6·3v. 2a.	£1·55
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·45
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·45
300-0-300v. 130mA, 6·3v. 4a. c.t., 6·3v. 1a. For Mullard 510 Amplifier	£2·95
350-0-350v. 100mA, 6·3v. 4a., 0 5-6·3v. 3a.	£2·45
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·95
425-0-425v. 200mA, 6·3v. 4a., c.t., 5v. 3a.	£5·45
425-0-425v. 200mA, 6·3v. 4a., 6 3v. 3a., 5v. 3a	£5·60
450-0-450v. 250mA, 6·3v. 4a., c.t., 5v. 3a.	£6·00

TOP SHROUDED DROP-THRO' TYPE

250-0-250v. 70mA, 6·3v. 2a., 0-5-6 3v. 2a.	£1·49
250-0-250v. 100mA, 6·3v. 3·5a.	£1·71
250-0-250v. 100mA, 6·3v. 2a., 6·3v. 1a. ..	£1·75
350-0-350v. 80mA, 6·3v. 2a., 0-5-6·3v. 2a.	£1·81
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·45
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·45
300-0-300v. 130mA, 6·3v. 4a., c.t. 6·3v. 1a. Suitable for Mullard 510 Amplifier......	£2·85
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·45
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·85

FILAMENT or TRANSISTOR POWER PACK Types 6·3v. 1·5a. 55p; 6·3v. 2a. 60p; 6·3v. 3a. 85p; 6·3v. 6a. £1 45; 12v. 1a. 61p; 12v. 3a. or 24v. 1·5a £1·50; 0-9-18v 1½a £1·25; 0-12-25-42v 2a £1·95.

CHARGER TRANSFORMERS 0-9-15v. 1½a. £1·10, 2½a. £1·25; 3a. £1·40; 5a. £1·60; 6a. £1·85; 8a. £2·20

AUTO (Step UP/step DOWN) TRANSFORMERS 0-110/120v. 200-230-250v. 50-80 watts £1·25, 150 watts, £2·10 250 watts £3·00; 500 watts £6·40

OUTPUT TRANSFORMERS

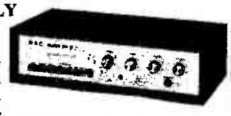
Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω	55p
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω..	95p
Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω	£1·55
Push-Pull EL84 to 3 or 15 Ω 10-12 watts..	£1·50
Push-Pull Ultra Linear for Mullard 510, etc.	£2·45
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω	£2·20
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω	£3·65

SELENIUM RECTIFIERS F. W. (Bridged)
All 6/12v. D.C. output. Max. A.C. input 18v. 1a, 28p. 2a, 39p. 3a, 55p 4a, 72p. 6a, 88p.

SMOOTHING CHOKES
150mA, 7-10H, 250 Ω 77p; 100mA, 10H, 200 Ω 56p; 80mA, 10H, 350 Ω 55p; 60mA, 10H, 400 Ω 28p.

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

Send S.A.E. for full descriptive leaflet.

For Magnetic or Ceramic Pick-Ups regardless of Price. Output (per channel) 15 watts RMS into 8Ω. Frequency Response 7 Hz to 70 KHz ± 1½ dB.

COMPLETE KIT (less cabinet). Carr. 70p. Cabinet if req. £5 extra. **£27·50**

R.S.C. STEREO FM III TUNER. in cabinet Visually matches Super 30 Mk. III **£37·50**

FACTORY BUILT UNIT—INC. CABINET with 12 months' guarantee. Or Dep. £7 and 9 monthly payments £4·54 (Total £47·86). **£42·50**

'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

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

COMPLETE KIT **£25·25** Carr. 65p

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 × 5in. 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 £2·64 (Total £28·36).

RSC GROUP/DISCO UNITS

PACKAGE OFFER

Units listed below
(a) 100w POWER AMPLIFIER
(b) PAIR OF HI-FI HEADPHONES
(c) MATCHING DYNAMIC 'MIKE' (attached to h'phone)
(d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18" × 18" × 8"
(e) RSC TDI DISCO CONSOLE

(a) (b) (c) (d) & (e) **£145** Carr. £2·50

Terms Deposit £30 and 18 monthly payments of £8·00 (Total £174·00).

RSC TDI DISCO CONSOLE

Incorporating twin Garrard SP25 Mk.III turntables and Sonotone or Acos Cartridges with diamond stylii. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control switch. Black Vynide covered Cabinet with lid. see illustration on left Or Dep. £10 and 9 mthly pymts £6·80 (Total £71·20) **£63·26** Carr. £1·50

R.S.C. COLUMN SPEAKERS

IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

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

TYPE C132 30-40 WATTS Fitted two exceptionally efficient, low feedback howl characteristic high flux 13" x 8" 20 watt speakers. Terms: Dep. £3 and 9 m'thly payments £2·42 (Total £24·78) Carr. 65p. **£21·95**

TYPE C313 50 WATTS Low feedback characteristic. Fitted three 13" × 8" deep cone high flux speakers with high power voice coils. Size approx. 54" × 14" × 11". Dep. £5 & 9 mthly pymts £3·54 (Total £36·86) Carr. 85p. **£32·72**

TYPE C4100 100 WATTS inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx. 58 × 16 × 10" Acoustically filled and pressurised. Terms: Dep. £11 and 12 mthly. pyts. £5·80 (Total £80·60). **£71·50** Carr. £1·50

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

Highly sensitive. Push-Pull high output, Hum level −70dB. Response ±3dB 30-20,000 c/s. All high grade components. Valves EF86 EF86, ECC83, EL34, EL34, GZ34. Separate Bass and Treble Controls. Sensitivity 36 millivolts. For High Impedance microphones. For Clubs, Schools, Theatres, Dance Halls, Outdoor Functions, etc. For Electronic Organ, Guitar, String Bass, etc. Gram, Radio or Tape. Two separate inputs with vol. controls permit such as "mike" and Pick-up etc. for mixing purposes. 200-250v. 50 c/s A.C. mains. For 3 and 15 ohm speakers. Twin-handled perforated cover £2·10. 12 MONTHS' GUARANTEE. Carr. 72p **£21·75**
TERMS: Deposit £4 and 9 monthly payments of £2·27 (Total £24·43). Send S.A.E. for leaflet.

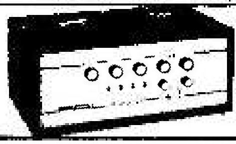
F.A.L. DISCO PRE-AMPLIFIER £18·97

Designed for use with a pair of Player Units and Amplifier with Bass and Treble Controls. Incorporates MONITORING FACILITIES and Mic. input. The 4 inputs are ind. controlled. Detector switch Gram (1), (2), and Tape. For operation on 200-250v A.C. Mains 50Hz. Size approx $16\frac{1}{2}$" × 3" × 4" deep. Brush Silver finished fascia. Fully enclosed but can be mounted in cabinet.

FANE "CRESCENDO" SPEAKERS

FULL RANGE AVAILABLE AT ALL BRANCHES

FAL PHASE 50 Mk.III AMPLIFIER 50 WATT.



Solid state. 4 Separately controlled inputs Plus master vol. control. Ind. Bass and Treble Controls. Protective circuit to guard against damage from accidental shorts. Output for Speaker/s 3 to 30 ohms. Size 17" × 7" × $7\frac{1}{4}$". 200-250v. A.C. mains. Output 50 watts music rating.
Or deposit £7·25 & 9 monthly payments £3·92. Total £42·53. **£37·95** Carr. 82p.

RSC PHANTOM '50'

Combined 50W Amplifier and 12in. Loudspeaker.

For Lead Guitar, Mic., Gram, Radio, Tape (Not for use with Bass instruments). Inc. 3 inputs and 2 vol. controls plus Treble, Bass and Presence. Output Jack for additional 15 ohm Speaker. Attractively finished in black with silver-finished fascia and trimmings. Compact size. Fitted carrying handle
Terms: Deposit £8·95 and 12 monthly payments £4·89 (Total £67·63). Carr. Free UK Mainland
SAE for leaflet

ONLY £59·95

FANE ULTRA HIGH POWER LOUDSPEAKERS

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

'POP' 100	'POP' 60	'POP' 50
18" 100 Watt	15" 60 Watt	12" 50 Watt
14,000 gauss	14,000 gauss	13,000 gauss
8/15Ω	8/15Ω	15Ω
£25·95	£14·75	£11·99
Dep: £6 and 9 mthly payments £2·49 (Total £28·41)	Dep. £3·30 and 9 monthly payments £1·50 (Total £16·80)	Dep £2 and 9 monthly payments £1·33 (Total £13·97)

FOR BASS GUITAR, ELECT. ORGAN, ETC. PAIR SUITABLE ALL PURPOSES

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

Dual Cone 15 Ω (for uses other than Bass Guitar or Electronic Organ). Carr. free **£7·95** or Dep. £1·25 and 9 mthly payments 89p (Total £9·26).

DISCO PACKAGE OFFER £45

Pair BSR MP60 T/tables GP91 PU Cartridges.
FAL Disco Pre-amp. Totel Rec. Ret. Price £50·11 Carr. £1

GROUP/DISCO EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 MK.III AMPLIFIER PR. FANE POP 25/2 25W L/SPEAKERS Terms: Deposit £7·50 and 9 monthly payments of £5·36 (Total £55·74)	£37·95 £15·90 £53·85	PACKAGE PRICE £49·50 carr. £1·10
F.A.L. PHASE 50 MK.III AMPLIFIER PR. FANE POP 50 L/SPEAKERS Terms: Deposit £10 and 9 monthly payments of £6·07 (Total £64·63)	£37·95 £23·98 £61·93	PACKAGE PRICE £57·50 carr. £1·10
F.A.L. PHASE 50 MK.III AMPLIFIER PAIR L12/20 25W L/S in cabinets Terms: Deposit £10 and 9 monthly payments of £6·52 (Total £68·68)	£37·95 £26·30 £64·25	PACKAGE PRICE £61 carr. £1 35
F.A.L. PHASE 100/2 AMPLIFIER 4 FANE POP 50 L/SPEAKERS Terms: Deposit £20 and 12 monthly payments of £8·63 (Total £123·56)	£69·85 £47·96 £117·81	PACKAGE PRICE £110 carr. £2

HIGH QUALITY LOUDSPEAKER UNITS

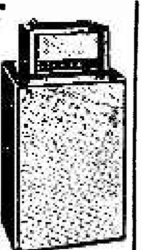
ALL TWO TONE REXINE AND VYNAIR FINISH
L125 50 WATT Fitted pair of 12" 50 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Carr. £1·50 **£37·95**
Or deposit £4·50 and 9 monthly payts. of £4·27. Total £42·93

L12/20 12" 20-25 WATT 13,000 lines 15 ohms Dep £2·50 & 9 mthly pymts £1·42 (Total £15·28) **£13·15** Carr. 55p.

L12/10 10-15 Watt veneer finish cabinet 12" unit 8-15 ohm. Size approx. 14" × 14" × 9". Carr. 50p **£8·25**

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

RSC BASS-REGENT 50 WATT AMPLIFIER



A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape. Peak Output rating. Loudspeaker unit either horizontal or vertical mounting.

- ★ Two extra heavy duty 12in. 50w Loudspeakers.
- ★ Four Jack inputs and two Volume Controls for instant use of up to four pick-ups or "mikes". Bass and Treble controls. Send S.A.E. for leaflet.

Credit Terms: Deposit £15 & 9 monthly payments of £7·22. (Total £79·98.) Carr. £2 **£71·50**

RSC GP30 HI-FI AMPLIFIER

For Guitar, Vocal or Instrumental Group

A 4 input. 2 vol. control Hi-Fi 30 watt unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/silver P.V.C. fascia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Terms: Deposit £4·40 and 9 monthly payments of £2·75 (Total £29·15). **£25·85** Carr. 72p

NOW SIX NEW BRANCHES

BOLTON 23 DEANSGATE
COVENTRY 17 SHELTON SQUARE
DONCASTER 3 QUEENSGATE Opening soon
NOTTINGHAM 19/19A MARKET STREET
STOCKPORT 8 LITTLE UNDERBANK
SUNDERLAND 5 MARKET SQUARE

NEW LARGER PREMISES AT HULL, DARLINGTON & NEWCASTLE See Addresses

RSC HI-FI CENTRES LTD.

MAIL ORDERS & EXPORT ENQUIRIES TO:—
AUDIO HOUSE, HENCONNER LANE, LEEDS, 13.
Tel: Pudsey (09735) 77631.
TERMS C.W.O. or C.O.D. No C.O.D. under £1.
POSTAGE 28p EXTRA UNDER £2. 33p EXTRA OVER £2 OR AS QUOTED. TRADE SUPPLIED.
S.A.E. PLEASE WITH ENQUIRIES.
SUPPLIERS TO GOVT. DEPTS. H.M. FORCES. EDUCATION AUTHORITIES & HOSPITALS. Etc.
MAIL ORDERS MUST NOT BE SENT TO SHOPS

R.S.C. BRANCHES OPERATE A 5-DAY WEEK OPEN ALL DAY SATURDAY

BRADFORD 10 North Parade (Closed Wed.). Tel. 25349
BOLTON 23 Deansgate Tel: 33512
BIRMINGHAM 30/31 Great Western Arcade, Tel. 021-236 1279 (Closed Wed.).
COVENTRY 17 Shelton Square, The Precinct
DERBY 26 Osmaston Rd., The Spot (Closed Wed.). Tel. 41361
DARLINGTON 19 Northgate (Closed Wed) Tel 68043
EDINBURGH 101 Lothian Rd. (Closed Wed.). Tel. 229 9501
GLASGOW 326 Argyle St. (Closed Tues.). Tel. 248 4158
HULL 7 Whitefriargate Tel. 20505
LEICESTER 32 High Street (Closed Thurs.). Tel. 56420
LEEDS 5-7 County (Mecca) Arcade, Briggate (Closed Wed.). Tel. 28252
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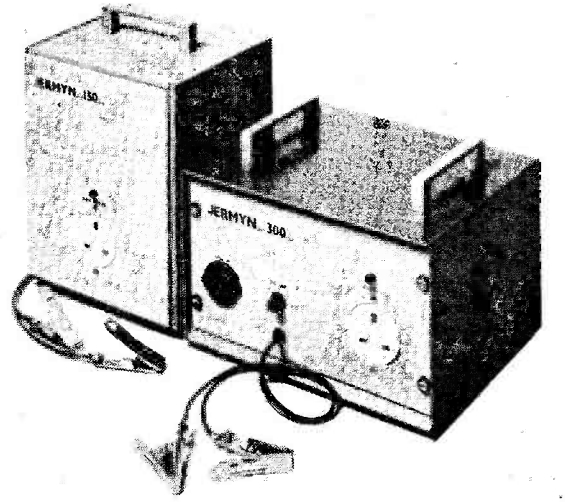

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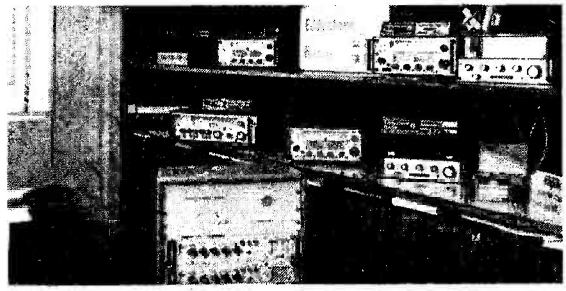

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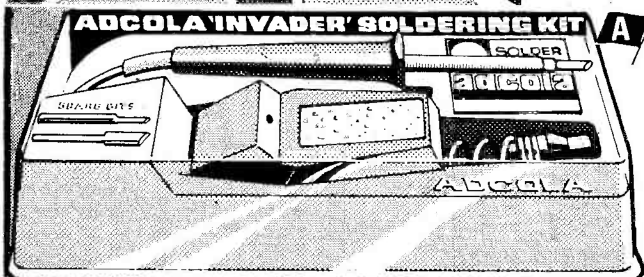

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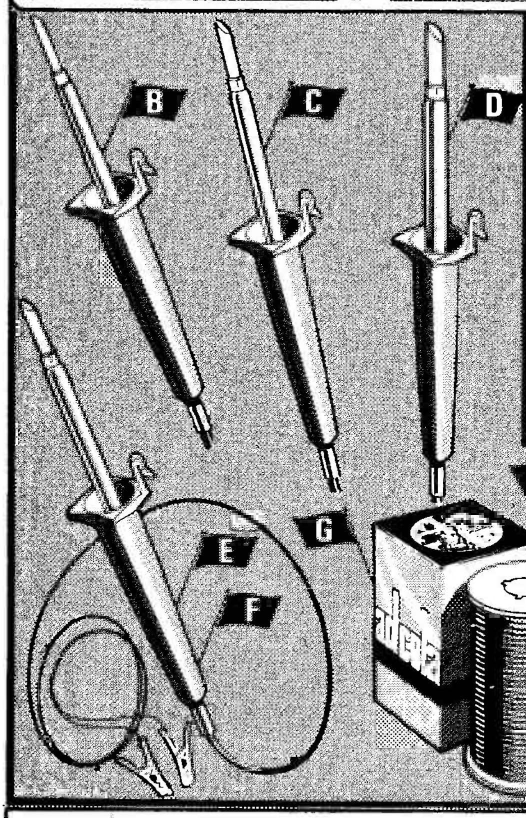

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SPEAKERS: **Duo Type II** Size approx. 17in × 10½in × 6½in. Drive unit 13in × 8in with parasitic tweeter. Max. power 10 watts 8 ohms. Simulated Teak cabinet. £14·00 a pair + £2·20 p. & p. **Duo Type III** Size approx. 23½in × 11½in × 9½in. Drive unit approx 13½in × 8½in with HF speaker. Max. power 20 watts, 8 ohms. Freq. range 20Hz to 20kHz. Teak veneer cabinet. £32·00 a pair + £3·30 p. & p.

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Viscount III R102 amplifier	£24·20 + £1 p & p
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Garrard SP25 Mk III with MAG. cartridge /plinth & cover	£18·00 + £1·75 p & p
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Apart from the output stage, which is an integrated circuit, the only other electronic components that need soldering are some capacitors, resistors, etc. The kit includes a pre-built RF tuner unit, and fully modulised IF stages which are pre-aligned before despatch. As well as electronic components this kit also contains 2 diamond-spun aluminium knobs, elegant matching front panel, dial, washers, screws and wire.
The Tourist PB can be mounted in any standard size dash panel and it has an illuminated tuning scale. Chassis size is: 7in wide, 2in high and 4 7/16in deep.
Circuit diagram and comprehensive instructions 55p free with parts.
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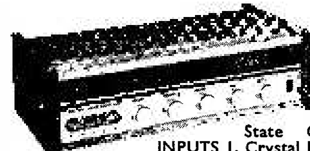

*5 Electrically Mixed inputs. *3 Individual Mixing controls. *Separate bass and treble controls common to all 5 inputs. *Mixer employing F.E.T. (Field Effect Transistors). *Solid State Circuitry. *Attractive Styling. INPUTS 1. Crystal Mic or Guitar 9mV. 2. Moving coil Mic. or Guitar 8mV. Inputs 3, 4 & 5 are suitable for a wide range of medium output equipment (Gram, Tuner, Monitor, Organ, etc.) All 250mV sensitivity. Output 20 watts into 8 Ω (suitable for 15 Ω.) Size approx. 12½ x 6 x 3½ ins. **£13·50** p. & p. 60p

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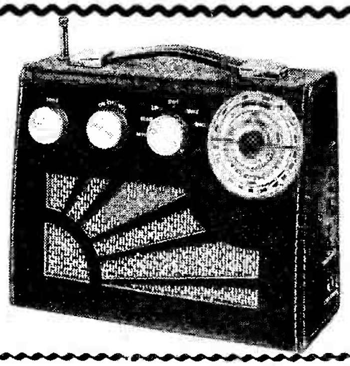

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Built in Ferrite Rod Aerial for MW/LW. Retractable, chrome plated 7 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600mw Transistors. Car Aerial and Tape Record Sockets. 10 Transistors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

Total building cost £9·35
P. P. & Ins. 52p
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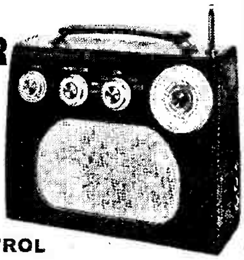

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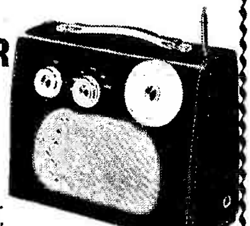

ROAMER SEVEN MK IV

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 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts price list and plans 25p (FREE with parts).

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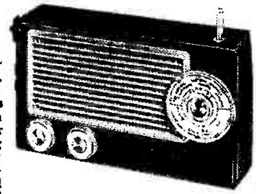

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 Trawler, band plus an extra Medium waveband for easier tuning of Luxembourg etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs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

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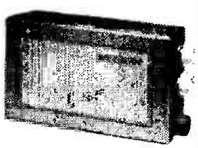

3 Tunable Wavebands: MW, LW, Trawler Band with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5½ × 1¼ × 3½in. Plans and parts price list 15p (FREE with parts).

Total building costs £2·50 P. P. & Ins. 24p
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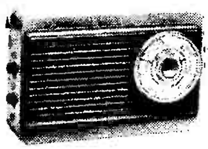

5 TRANSISTORS AND 2 DIODES

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 6¼ × 4½ × 1½in. Plans and parts price list 15p (FREE with parts).

Total building costs £2·75 P. P. & Ins. 25p
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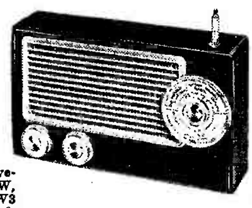
TRANS EIGHT



8 TRANSISTORS and 3 DIODES

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

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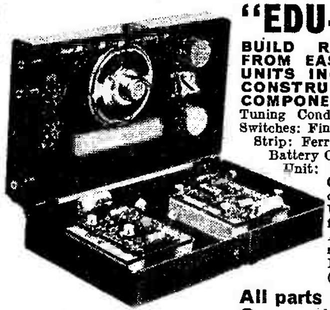

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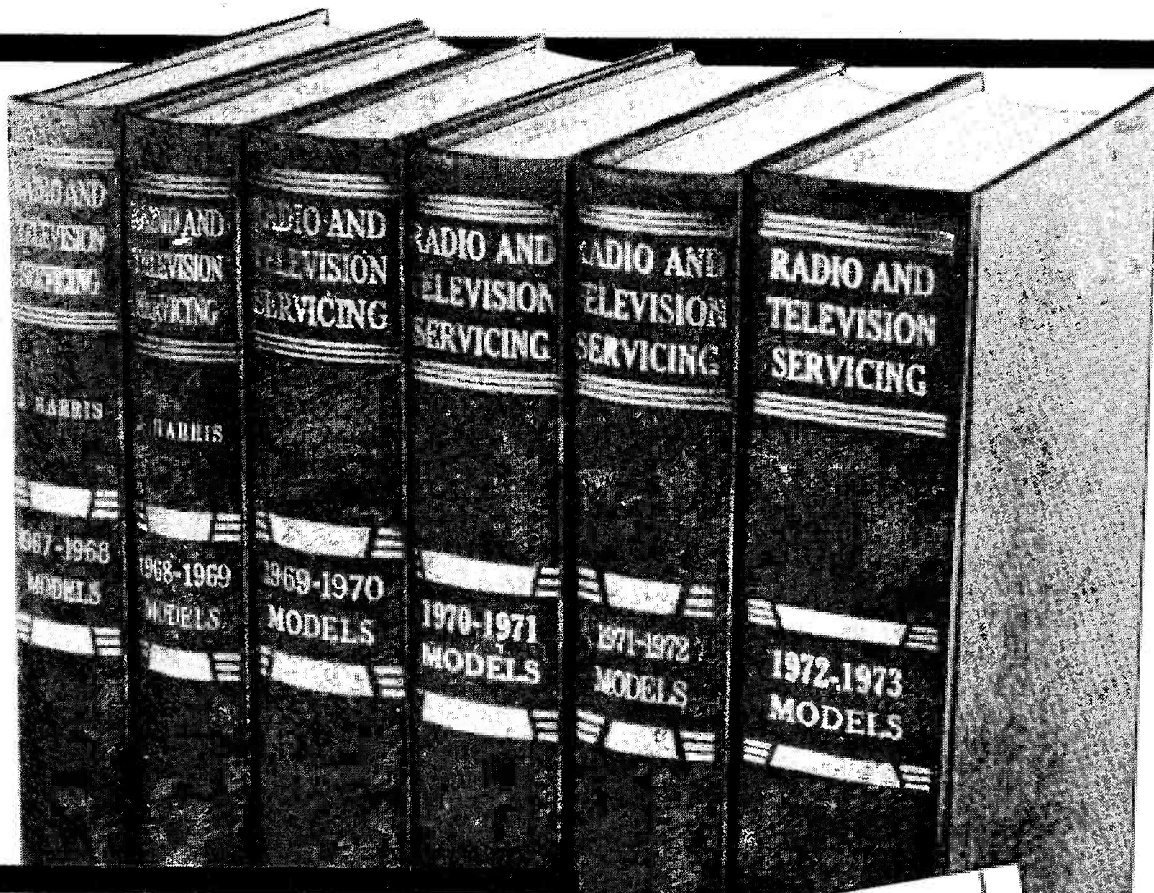

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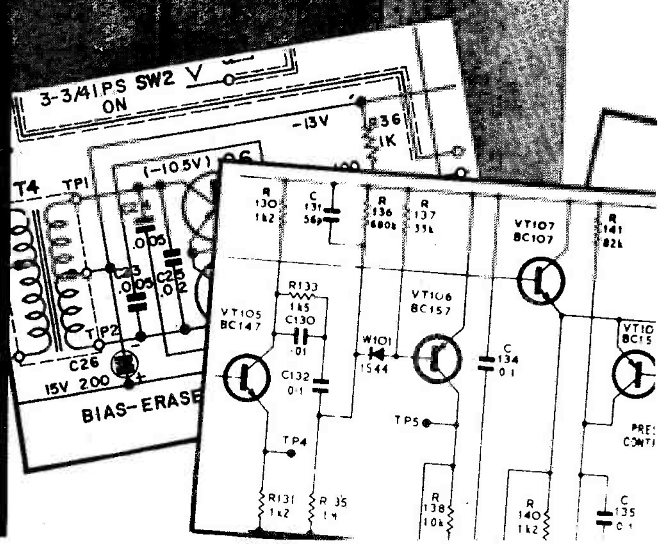

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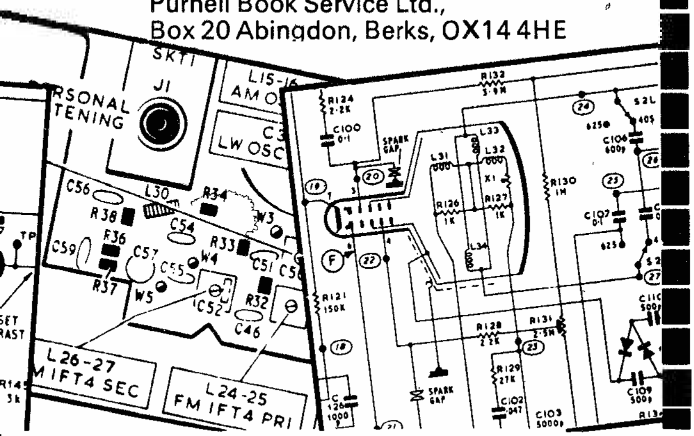

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BC167 **11p**; BC168 **10p**; BC169 **11p**
BC177 **21p**; BC178 **19p**; BC179 **21p**; } pnp
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BD135 npn med power **37p**
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OA200 **9p**; OA202 **10p**
Other semiconductors
AC128 **17p**; AF117 **32p**
BFY51 **19p**

Full lists and technical data will be found in Catalogue No. 6. See also amendments list.

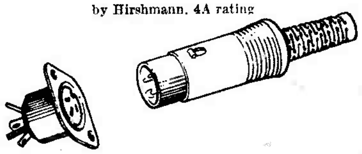
SIEMENS' THYRISTORS

0·8A 400V **56p**, 600V **70p**
3A 400V **60p**, 600V **88p**

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 75V, **48p each.** Clip to increase 1·5W rating to 3 watts (type 266F) **4p.**

DIN PLUGS & SOCKETS

by Hirshmann. 4A rating

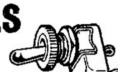


2 way LS—socket **10p**; plug **12p**. 3 way scr. socket **10p**; plug **12p**. 5 way scr. socket **12p**; plug **15p**.

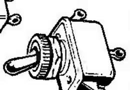
TRANSISTOR ACCESSORIES

To3 cover **7p**
Heat sinks 1°C/w, type 6W1, undrilled **60p**

SWITCHES



1011C SPST toggle **20p**:
409 DPDT toggle **29p.** (These are chrome plated 2·5A rating)

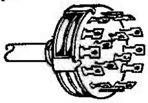


7201 Sub-miniature DPDT 250V a.c/2A **48p**

ROTARY SWITCHES

Radiospares Miniature Maka-switch (in assembly kit form) Shaft **48p.**
Wafers, MBB-2P5W, 1P11W: BBM-1P12W. 2P6W, 3P4W, 4P3W, 6P2W, each, **6p.**

WAVECHANGE SWITCHES



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

ELECTROLYTIC CAPACITORS

AXIAL LEAD Prices subject to amendment by the manufacturer.

Rated voltage: Capacity µF	3V	6·3V	10V	16V	25V	40V	63V	100V
0·47							10p	7p
1·0						10p		7p
2·2					10p		7p	8p
4·7				10p		7p	8p	7p
10					7p	8p	7p	8p
22			7p	7p		7p	7p	9p
47	7p		8p	7p	8p	7p	9p	12p
100	8p	7p	7p	7p	7p	9p	11p	19p
220	7p	8p	8p	8p	9p	10p	17p	27p
470	8p	9p	9p	10p	12p	17p	24p	43p
1000	10p	12p	12p	17p	20p	24p	40p	
2200	14p	17p	22p	25p	36p	40p		
4700	25p	28p	37p	41p	54p			
10,000	40p	43p						

Polycarbonate —5% Tolerance

250V up to 0·1µF: 100V/0·1µF and above.
0·01; 0·012; 0·015; 0·018; 0·022; 0·027; 0·033; 0·047; 0·056; **each 4p.**
0·068; 0·082; 0·1; 0·12; 0·15 **each 4p.**
0·18; 0·22; **each 5p.**
0·27; 0·33; **6p.** 0·39 **7p.** 0·47 **8p.** 0·56 **10p.**
0·68 **11p.** 1µF **13p.**
Prices subject to amendment by the manufacturer.

SILVERED MICA non-polarised capacitors in 34 values from 2·2 pF to 680 pF, each **6p**

RESISTORS 10%, 5%, 2%

Code	*Power*	*Tolerance*	*Range*	*Values available*	*1 to 9*	*10 to 99* (see note below)	*100 up*
C	1/20W	5%	82 Ω–220K Ω	E12	9	8	7·5
C	1/8W	5%	4·7 Ω–470K Ω	E24	1	0·9	0·75 nett
C	1/4W	5%	4·7 Ω–10M Ω	E12	1	0·9	0·75 nett
C	1/2W	5%	4·7 Ω–10M Ω	E24	1·2	1	0·9 nett
C	1W	5%	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% ± 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	9	9	8

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

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

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.

★ Please remember to add V.A.T. to your order.

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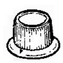
KNOBS

All grub screw fitting for ¼" shafts. Black. For other types—see Catalogue No. 6, P.54

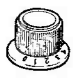


F14.

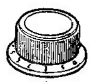
F13.

F12.

F19.

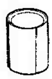


F18.



F17.

K84



K30/3

F.14 (20mm) pack of 2 **32p**
F.13 (26mm) pack of 2 **38p**
F.12 (33mm) pack of 2 **40p**
F.19 (20mm) pack of 2 **32p**
F.18 (26mm) pack of 2 **38p**
F.17 (38mm) pack of 2 **40p**
KB.4 (20mm) pack of 4 **40p**
K.30/3 (17mm) aluminium, each **24p**

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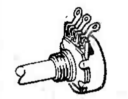
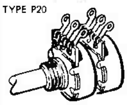
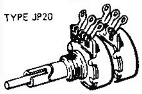


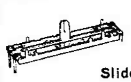
TYPE P20



TYPE JP20



TYPE DP20



Slider

Rotary carbon track, double wiper
SINGLE P20 lin 100 Ω to 2·2M Ω **12p**, P20 log 4·7K Ω to 2·2 meg. **12p** JP20 Log, 4·7K Ω, to 2·2M Ω **12p**, Dual gang lin 4·7K Ω to 2·2m Ω, **42p**; Dual log, 4·7K Ω to 2·2m Ω **42p**; Log/antilog, 10K, 22K, 47K, IM Ω only **42p**; Dual anti-log, 10K only, **42p.** Any type with 2A D.P. mains switch, **12p** extra.
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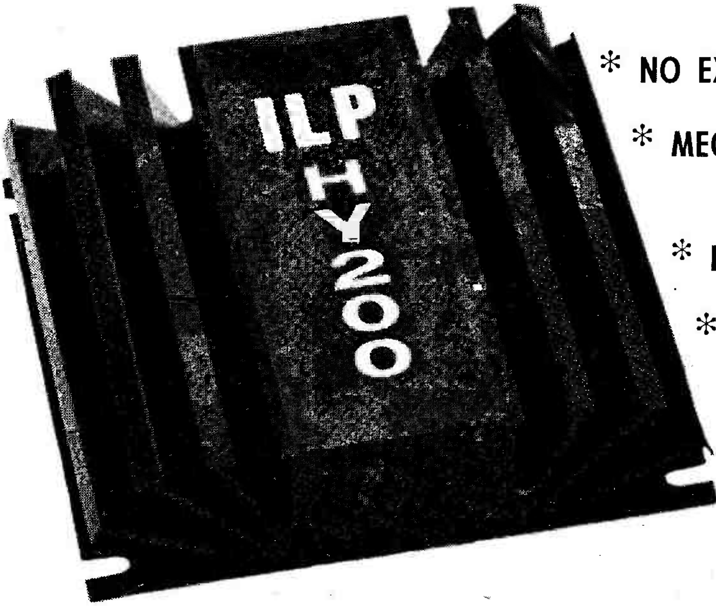

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AC115	26	AD161 &		BC148	11	BD136	44	BF184	28	MPF102	46	2G339	22	2N2192	39	2N3055	55	2N4061	13
AC117K	22	AD162 (MP)		BC149	13	BD137	50	BF185	33	MPF104	41	2G339A	18	2N2193	39	2N3391	16	2N4062	13
AC122	13		61	BC150	20	BD138	55	BF188	44	MPF105	41	2G344	20	2N2194	39	2N3391A	18	2N4284	19
AC125	19	ADT140	55	BC151	22	BD139	61	BF194	13	OC19	39	2G345	18	2N2217	24	2N3392	16	2N4285	19
AC126	19	AF114	27	BC152	19	BD140	66	BF195	13	OC20	70	2G371	18	2N2218	22	2N3393	16	2N4286	19
AC127	19	AF115	27	BC153	31	BD155	88	BF196	16	OC22	42	2G371B	13	2N2219	22	2N3394	16	2N4287	19
AC128	19	AF116	27	BC154	33	BD175	66	BF197	16	OC23	46	2G373	19	2N2220	24	2N3395	19	2N4288	19
AC132	16	AF117	27	BC157	20	BD176	66	BF200	50	OC24	62	2G374	19	2N2221	22	2N3402	23	2N4289	19
AC134	16	AF118	39	BC158	13	BD177	72	BF222	1·05	OC25	42	2G377	33	2N2222	22	2N3403	23	2N4290	19
AC137	16	AF124	33	BC159	13	BD178	72	BF257	50	OC26	28	2G378	18	2N2368	19	2N3404	31	2N4291	19
AC141	16	AF125	28	BC160	50	BD179	77	BF258	66	OC28	55	2G381	18	2N2369	16	2N3405	46	2N4292	19
AC141K	19	AF126	31	BC161	55	BD180	77	BF259	94	OC29	55	2G382	18	2N2369A	16	2N3414	17	2N4293	19
AC142	16	AF127	31	BC167	13	BD185	72	BF262	61	OC35	46	2G401	33	2N2411	27	2N3415	17	2N5172	13
AC142K	19	AF139	33	BC168	13	BD186	72	BF263	61	OC36	55	2G414	33	2N2412	27	2N3416	31	2N5457	35
AC151	17	AF178	33	BC169	13	BD187	77	BF270	39	OC41	22	2G417	28	2N2646	52	2N3417	31	2N5458	35
AC154	22	AF179	55	BC170	13	BD188	77	BF271	33	OC42	27	2N388	39	2N2711	23	2N3525	83	2N5459	44
AC155	22	AF180	55	BC171	16	BD189	83	BF272	88	OC44	16	2N388A	61	2N2712	23	2N3646	10	2S301	55
AC156	22	AF181	50	BC172	16	BD190	83	BF273	39	OC45	14	2N404	22	2N2714	23	2N3702	11	2S302A	46
AC157	27	AF186	50	BC173	16	BD195	94	BF274	39	OC70	11	2N404A	31	2M2904	19	2N3703	11	2S302	46
AC165	22	AF239	41	BC174	16	BD196	94	BFW10	66	OC71	11	2N524	46	2N2904A	23	2N3704	12	2S303	61
AC166	22	AL102	72	BC175	24	BD197	99	BFX29	30	OC72	16	2N527	54	2N2905	23	2N3705	11	2S304	77
AC167	22	AL103	72	BC177	21	BD198	99	BFX84	24	OC74	16	2N598	46	2N2905A	23	2N3706	10	2S305	93
AC168	27	ASY26	28	BC178	21	BD199	1·05	BFX85	33	OC75	17	2N599	50	2N2906	17	2N3707	12	2S306	93
AC169	16	ASY27	33	BC179	21	BD200	1·05	BFX86	24	OC76	17	2N696	14	2N2906A	20	2N3708	8	2S307	93
AC176	22	ASY28	28	BC180	27	BD205	88	BFX87	27	OC77	28	2N697	15	2N2907	22	2N3709	10	2S321	62
AC177	27	ASY29	28	BC181	27	BD206	88	BFX88	24	OC81	17	2N698	27	2N2907A	24	2N3710	10	2S322	46
AC178	31	ASY50	28	BC182	11	BD207	1·05	BFY50	22	OC81D	17	2N699	39	2N2923	16	2N3711	10	2S322A	46
AC179	31	ASY51	28	BC182L	11	BD208	1·05	BFY51	22	OC82	17	2N706	9	2N2924	16	2N3819	31	2S323	62
AC180	19	ASY52	28	BC183	11	BDY20	1·10	BFY52	22	OC82D	17	2N706A	10	2N2925	16	2N3820	55	2S324	77
AC180K	22	ASY54	28	BC183L	11	BF115	27	BFY53	19	QC83	22	2N708	13	2N2926(G)	14	2N3821	39	2S325	77
AC181	19	ASY55	28	BC184	13	BF117	50	BPX25	94	OC84	22	2N711	33	2N2926(Y)	12	2N3823	31	2S326	77
AC181K	22	ASY56	28	BC184L	13	BF118	77	BSX19	17	OC139	22	2N717	39	2N2926(O)	11	2N3903	31	2S327	77
AC187	24	ASY57	28	BC186	31	BF119	77	BSX20	17	OC140	22	2N718	27	2N2926(R)	11	2N3904	33	2S701	46
AC187K	22	ASY58	28	BC187	31	BF121	50	BSY25	17	OC169	28	2N718A	55	2N2926(B)	11	2N3905	31	40361	44
AC188	24	ASZ21	44	BC207	12	BF123	55	BSY26	17	OC170	28	2N726	31	2N3010	77	2N3906	30	40362	50
AC188K	22	BC107	10	BC208	12	BF125	50	BSY27	17	OC171	28	2N727	31	2N3011	16	2N4058	13		
ACY17	28	BC108	10	BC209	13	BF127	55	BSY28	17	OC200	28	2N743	22						
ACY18	22	BC109	11	BC212L	12	BF152	61	BSY29	17	OC201	31	2N744	22						
ACY19	22	BC113	11	BC213L	12	BF153	50	BSY38	20	OC202	31	2N914	16						
ACY20	22	BC114	17	BC214L	16	BF154	50	BSY39	20	OC203	28	2N918	33						
ACY21	22	BC115	17	BC225	28	BF155	77	BSY40	31	OC204	28	2N929	23						
ACY22	18	BC116	17	BC226	39	BF156	53	BSY41	31	OC205	39	2N930	23						
ACY27	20	BC117	17	BCY30	27	BF157	61	BSY95	14	OC309	44	2N1131	22						
ACY28	21	BC118	11	BCY31	29	BF158	61	BSY95A	14	OCP71	48	2N1132	24						
ACY29	39	BC119	33	BCY32	33	BF159	66	Bu105	2·20	ORP12	48	2N1302	16						
ACY30	31	BC120	88	BCY33	24	BF160	44	C111E	55	ORP60	44	2N1303	16						
ACY31	31	BC125	13	BCY34	28	BF162	44	C400	33	ORP61	44	2N1304	19						
ACY34	23	BC126	20	BCY70	16	BF163	44	C407	28	P346A	22	2N1305	19						
ACY35	23	BC132	13	BCY71	20	BF164	44	C424	22	P397	46	2N1306	23						
ACY36	31	BC134	20	BCY72	16	BF165	44	C425	55	ST140	14	2N1307	23						
ACY40	19	BC135	13	BCZ10	22	BF167	24	C426	39	ST141	19	2N1308	26						
ACY41	20	BC136	17	BCZ11	28	BF173	24	C428	22	TIS43	33	2N1309	26						
ACY44	39	BC137	17	BCX12	28	BF176	39	C441	33	UT46	30	2N1613	22						
AD130	42	BC139	44	BD121	66	BF177	39	C442	33	2G301	21	2N1711	22						
AD140	53	BC140	33	BD123	72	BF178	33	C444	39	2G302	21	2N1889	35						
AD142	53	BC141	33	BD124	66	BF179	33	C450	24	2G303	21	2N1890	50						
AD143	42	BC142	33	BD131	55	BF180	33	MAT100	21	2G304	27	2N1893	41						
AD149	55	BC143	33	BD132	66	BF181	33	MAT101	22	2G306	44	2N2147	79						

DIODES AND RECTIFIERS

AA119	9	BY133	23	OA70	8
AA120	9	BY164	55	OA79	8
AA129	9	BYX38/30	46	OA81	8
AAY30	10	BYZ10	39	OA85	10
AAZ13	11	BYZ11	33	OA90	7
BA100	11	BYZ12	33	OA91	7
BA116	23	BYZ13	28	OA95	8
BA126	24	BYZ16	44	OA200	7
BA148	16	BYZ17	39	OA202	8
BA154	13	BYZ18	39	SD10	6
BA155	16	BYZ19	31	SD19	6
BA156	15	CG62		1N34	8
BY100	17	(OA91 Eq.)	6	1N34A	8
BY101	13	CG651		1N914	7
BY105	19	(OA70-OA79		1N916	7
BY114	13	Eq.)	7	1N414B	7
BY126	16	OA5	39	1S021	11
BY127	17	OA5SL	23	1S951	7
BY128	17	OA10	39		
BY130	18	OA47	8		

LINEAR I.C's—FULL SPEC.

Type No.	Price 1–24	25–99	100 up
BP 201C—SL201C	70p	59p	50p
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BP 702C—SL702C	70p	55p	50p
BP 702—72702	59p	50p	44p
BP709—72709	40p	38p	33p
BP 709P—µA709C	40p	35p	33p
BP 710—72710	50p	46p	44p
BP 711—µA711	50p	48p	44p
BP 741—72741	55p	50p	45p
µA703C	31p	29p	27p
TAA 263	77p	66p	61p
TAA 293	99p	83p	77p
TAA 350	£1·87p	£1·74p	£1·65p

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GR116	£1·70
3015F Minitron	£1·50
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I.C. Radio Rec. incl. full cir. data. All indicators 0·9 + Decimal point. All side viewing. Full data for all types available on request.

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UL923	55p	51p	49p

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Type	Price 1	25	100+
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BP932	14p	13p	12p
BP933	14p	13p	12p
BP935	14p	13p	12p
BP936	14p	13p	12p
BP944	14p	13p	12p
BP945	28p	27p	24p
BP946	13p	12p	11p
BP948	28p	27p	24p
BP951	72p	66p	61p
BP962	13p	12p	11p
BP9093	44p	42p	39p
BP9094	44p	42p	39p
BP9097	44p	42p	39p
BP9099	44p	42p	39p

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

VOLTAGE REGULATORS

TO.3 Plastic 0/5 1·5 Amps

UA.7805. 5v. (Equiv. to MVR 5V) £1·76

UA.7812. 12v. „ „ MVR 12V) £1·76

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

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LOW COST No.			
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BI-PAK STILL LOWEST IN PRICE. FULL SPECIFICATION GUARANTEED. ALL FAMOUS MANUFACTURERS

	1	25	100+		1	25	100+		1	25	100+
SN7400	0·17	0·16	0·15	SN7450	0·17	0·16	0·15	SN74141	0·74	0·71	0·64
SN7401	0·17	0·16	0·15	SN7451	0·17	0·16	0·15	SN74145	£1·65	£1·54	£1·43
SN7402	0·17	0·16	0·15	SN7453	0·17	0·16	0·15	SN74150	£3·30	£2·97	£2·75
SN7403	0·17	0·16	0·15	SN7454	0·17	0·16	0·15	SN74151	£1·10	£1·05	0·99
SN7404	0·17	0·16	0·15	SN7460	0·17	0·16	0·15	SN74153	£1·32	£1·21	£1·05
SN7405	0·17	0·16	0·15	SN7470	0·32	0·29	0·27	SN74154	£1·98	£1·87	£1·76
SN7406	0·39	0·34	0·31	SN7472	0·32	0·29	0·27	SN74155	£1·54	£1·43	£1·32
SN7407	0·39	0·34	0·31	SN7473	0·41	0·39	0·35	SN74156	£1·54	£1·43	£1·32
SN7408	0·20	0·19	0·18	SN7474	0·41	0·39	0·35	SN74157	£2·09	£1·98	£1·87
SN7409	0·20	0·19	0·18	SN7475	0·50	0·48	0·46	SN74160	£1·98	£1·87	£1·76
SN7410	0·17	0·16	0·15	SN7476	0·44	0·43	0·42	SN74161	£1·98	£1·87	£1·76
SN7411	0·28	0·27	0·26	SN7480	0·74	0·71	0·64	SN74162	£4·40	£4·13	£3·85
SN7412	0·39	0·34	0·31	SN7481	£1·32	£1·27	£1·21	SN74163	£4·40	£4·13	£3·85
SN7413	0·32	0·29	0·27	SN7482	0·96	0·95	0·94	SN74164	£2·43	£2·37	£2·81
SN7416	0·48	0·44	0·42	SN7483	£1·21	£1·16	£1·05	SN74165	£2·48	£2·42	£2·37
SN7417	0·48	0·44	0·42	SN7484	£1·10	£1·05	0·99	SN74166	£3·85	£3·58	£3·30
SN7420	0·17	0·16	0·15	SN7485	£3·96	£3·85	£3·74	SN74174	£2·53	£2·42	£2·31
SN7422	0·55	0·53	0·50	SN7486	0·35	0·34	0·33	SN74175	£1·76	£1·65	£1·54
SN7423	0·55	0·53	0·50	SN7489	£6·05	£5·78	£5·50	SN74176	£2·75	£2·64	£2·53
SN7425	0·55	0·53	0·50	SN7490	0·74	0·71	0·64	SN74177	£2·75	£2·64	£2·53
SN7426	0·50	0·46	0·44	SN7491	£1·10	£1·05	0·99	SN74180	£2·20	£1·76	£1·54
SN7427	0·50	0·46	0·44	SN7492	0·74	0·71	0·64	SN74181	£6·05	£5·50	£5·23
SN7428	0·77	0·72	0·66	SN7493	0·74	0·71	0·64	SN74182	£2·20	£1·98	£1·76
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SN7432	0·50	0·46	0·44	SN7495	0·85	0·82	0·75	SN74190	£2·15	£2·09	£2·04
SN7433	0·88	0·83	0·77	SN7496	0·96	0·93	0·86	SN74191	£2·09	£2·04	£1·98
SN7437	0·71	0·68	0·66	SN74100	£1·82	£1·76	£1·71	SN74192	£2·15	£2·09	£2·04
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SN7443	£1·43	£1·38	£1·32	SN74111	£1·38	£1·27	£1·21	SN74197	£1·98	£1·87	£1·76
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T2	8 D1374	OC75
T3	8 D1216	OC81D
T4	8 2G381T	OC81
T5	8 2G382T	OC82
T6	8 2G344B	OC44
T7	8 2G345B	OC45
T8	8 2G378	OC78
T9	8 2G399A	2N1302
T10	8 2G417	AF117

All 55p each pak

ND 120 NIXIE DRIVER TRANSISTOR. Suitable replacement for BSX 21, C 407, 2N 1893 120veb.

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

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

Qty.	1-24	25-99	100 up
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Q11	2 AC 127/128 Complementary pairs PNP/NPN	0·55
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Q13	3 AF 117 type transistors	0·55
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Q15	7 2N2926 Sil. Epoxy transistors mixed colours	0·55
Q16	2 GET880 low noise Germanium transistors	0·55
Q17	5 NPN 2 × ST.141 & 3 × ST.140	0·55
Q18	4 MADT'S 2 × MAT 100 & 2 × MAT 120	0·55
Q19	3 MADT'S 2 × MAT 101 & 1 × MAT 121	0·55
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Q28	2 Silicon power rectifiers BYZ 13	0·55
Q29	4 Silicon transistors 2 × 2N696, 1 × 2N697, 1 × 2N698	0·55
Q30	7 Silicon switch transistors 2N706 NPN	0·55
Q31	6 Silicon switch transistors 2N708 NPN	0·55
Q32	3 PNP Silicon transistors 2 × 2N1131, 1 × 2N1132	0·55
Q33	3 Silicon NPN transistors 2N1711	0·55
Q34	7 Silicon NPN transistors 2N2369, 500MHz (code P397)	0·55
Q35	3 Silicon PNP TO-5. 2 × 2N2904 & 1 × 2N2905	0·55
Q36	7 2N3646 TO-18 plastic 300 MHz NPN	0·55
Q37	3 2N3053 NPN Silicon transistors	0·55
Q38	7 NPN transistors 4 × 2N3703, 3 × 2N3702	0·55

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U 3	75 Germanium Gold Bonded Sub-Min. like OA5, OA47	0·55
U 4	40 Germanium Transistors like OC81, AC128	0·55
U 5	60 200mA Sub-Min. Silicon Diodes	0·55
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U 7	16 Sil. Rectifiers TOP-HAT 750mA VLTG. RANGE up to 1000	0·55
U 8	50 Sil. Planar Diodes DO-7 Glass 250mA like OA200/202	0·55
U 9	20 Mixed Voltages, 1 Watt Zener Diodes	0·55
U10	20 BAY50 charge storage Diodes DO-7 Glass	0·55
U11	25 PNP Sil. Planar Trans. TO-5 like 2N1132, 2N2904	0·55
U12	12 Silicon Rectifiers Epoxy 500mA up to 800 PIV	0·55
U13	30 PNP-NPN Sil. Transistors OC200 & 2S 104	0·55
U14	150 Mixed Silicon and Germanium Diodes	0·55
U15	25 NPN Sil. Planar Trans. TO-5 like BFY51, 2N697	0·55
U16	10 3 Amp Silicon Rectifiers Stud Type up to 1000PIV	0·55
U17	30 Germanium PNP AF Transistors TO-5 like ACY 17-22	0·55
U18	8 6 Amp Silicon Rectifiers BYZ13 Type up to 600 PIV	0·55
U19	25 Silicon NPN Transistors like BC108	0·55
U20	12 1·5 Amp Silicon Rectifiers Top Hat up to 1000 PIV	0·55
U21	30 AF. Germanium Alloy Transistors 2G300 Series & OC71	0·55
U23	30 MADT's like MHz Series PNP Transistors	0·55
U24	20 Germanium 1 Amp Rectifiers GJM Series up to 300 PIV	0·55
U25	25 300 MHz NPN Silicon Transistors 2N708, BSY27	0·55
U26	30 Fast Switching Silicon Diodes like IN914 Micro-Min.	0·55
U27	12 NPN Germanium AF Transistors TO-1 like AC127	0·55
U29	10 1 Amp SCR's TO-5 can, up to 600 PIV CRS1/25-600	1·10
U30	15 Plastic Silicon Planar Trans. NPN 2N2926	0·55
U31	20 Silicon Planar Plastic NPN Trans. Low Noise Amp 2N3707	0·55
U32	25 Zener Diodes 400mW DO-7 case 3–18 volts mixed	0·55
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U34	30 Silicon PNP Alloy Trans. TO-5 BCY26 2S302/4	0·55
U35	25 Silicon Planar Transistors PNP TO-18 2N2906	0·55
U36	25 Silicon Planar NPN Transistors TO-5 BFY50/51/52	0·55
U37	30 Silicon Alloy Transistors SO-2 PNP OC200, 2S322	0·55
U38	20 Fast Switching Silicon Trans. NPN 400 MHz 2N3011	0·55
U39	30 RF. Germ. PNP Transistors 2N1303/5 TO-5	0·55
U40	10 Dual Transistors 6 lead TO-5 2N2060	0·55
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U43	25 Sil. Trans. Plastic TO-18 A.F. BC113/114	0·55
U44	20 Sil. Trans. Plastic TO-5 BC115/116	0·55
U45	7 3A SCR. TO66 up to 600PIV	1·10

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

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

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

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

SIL. RECTS. TESTED

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

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

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

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LISTENERS' CHOICE

THINGS are hotting up on the sound broadcasting front. With a very large part of England now tuned up for local radio from the BBC, we look forward with fascinating interest to see how the independents, supported nobly by the IBA, will fare this autumn, when they start transmitting official commercially sponsored programmes. Already the test transmissions on the medium wave have acted as a preliminary publicity exercise. Their intentions are to go straight into v.h.f. as well and incorporate pilot-tone stereo facilities. Circular polarisation of transmitting aerials will be used so that car radios and portables stand a very good chance of receiving these broadcasts.

At the same time, the BBC is pressing ahead with expansion of stereo broadcasting using pulse-code modulation systems for better quality reception. It has taken too many years for them to improve stereo capability and (we suspect) it is due largely to pressure from commercial competition that such a hive of buzzing activity has now resulted in the extended service.

One other point not to be forgotten is the influence of television on radio audiences; with colour now commonplace, sound radio (or "steam" as you prefer) must have threatened to fall on hard times.

The much welcome uplift of interest in sound radio provides the manufacturing industry with impetus for meeting the demand for new receivers. In what proportions (a.m. or f.m. or both) these will need to be is anyone's guess. With the improved service of f.m. broadcasting techniques, allowing for the added interest in stereo, as well as the "booming" in-car entertainment business, we have a hunch that there will be a fairly even distribution.

In the following issues of *Practical Wireless*, you will find many articles devoted to sound broadcasting. We kick off this month with an article to help you understand how and why you should pay special attention to your f.m. aerial installation, particularly if you want to get the best from stereo. We also offer the constructor with little experience a simple a.m. radio, using two integrated circuits.

M. A. COLWELL—*Editor*

PRACTICAL WIRELESS
The October issue (No 800), on sale 7th September, will start you on the road to making your own quadraphonic sound system, will include the first pair of PW Datacards on resistors and capacitors, will commence a tutorial series for learning how circuits work by practical experiments, and will give first details on our audio supplement for the November issue.

Further details on page 431

TELEVISION
The October issue of *Television*, on sale 17th September, will have for the first time an additional Colour TV Fault Finding Chart. Full colour photographs of fault conditions will be provided on a special quality paper in the magazine. With the additional fault-finding chart you can not only find where the trouble lies, but also learn a bit about how colour television works.

Further details on page 417

NEWS...

Britain/Canada telephone cable

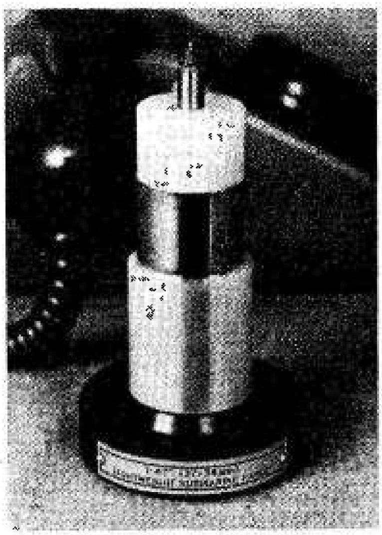
Practical Wireless was recently invited to watch the loading of the Cable & Wireless Ltd. cableship "Mercury" with the first 200 miles of a £30m telephone cable linking Britain and Canada.

CANTAT-2 as it is called, will handle more than 1,800 phone conversations at the same time. It will have 473 repeaters at 6-mile intervals and 31 equalisers at 90 mile intervals.

The 2,800 nautical mile cable is financed by the Post Office and the Canadian Overseas Telecommunications Corp. S.T.C. Limited have supplied the system and the transistors used in the repeater are being supplied to them by the Post Office Research Dept. Dollis Hill. These transistors (2,800 in all) each have a design life of at least 25 years.

The 1,840 circuits in CANTAT-2 are arranged as 23 supergroups transmitting between 312-6,012kHz. in the UK-Canada direction and 8,000-13,700kHz the other way.

The cable (see picture) weighs under 5 tons a mile, it has an outer conductor of aluminium and is strengthened by a core of steel rope inside an inner conductor of copper.



A piece of the cable showing how it is formed

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

Practical Wireless in Italy

PRACTICAL WIRELESS will be taking part in the Italian International Music and High Fidelity Exhibition at the Milan Fair from September 6th to 10th 1973. This is the seventh time that the exhibition is being held and will cover hi-fi equipment, components and accessories. Also of related interest is the section devoted to musical instruments and amplifier equipment for them. Concerts, audio shows and lecture meetings will be held at the same time.

This exhibition will occupy about 20,000 sq metres and around 35,000 visitors are expected. There will be about 800 foreign buyers expected from 45 countries including African and Middle East countries.

Practical Wireless will take part in the Technical Journals section of the exhibition where visitors from all over the world will see some of the recent work that we have published and be given detailed information of our Project Q4 (see page 431) which will commence publication in next month's issue.

It is worth remembering that, if you are near Milan during that long weekend and hold a non-Italian passport you will be admitted free of charge.

London Independent Radio

THE IBA have announced officially the following allocations of broadcasting frequencies for the London area:

London Broadcasting Company (News Service) 719kHz (417 metres) medium wave and 97·3 MHz v.h.f.

Capital Radio (entertainment) 557kHz (539 metres) medium wave and 95·8MHz v.h.f.

At the time of going to press no definite date had been announced for commencement but it is expected to be in October or November.

'English as she is spoke'

IMMIGRANT children who speak little or no English are now learning the language with the aid of the "Language Master System", marketed by Bell and Howell A-V Ltd.

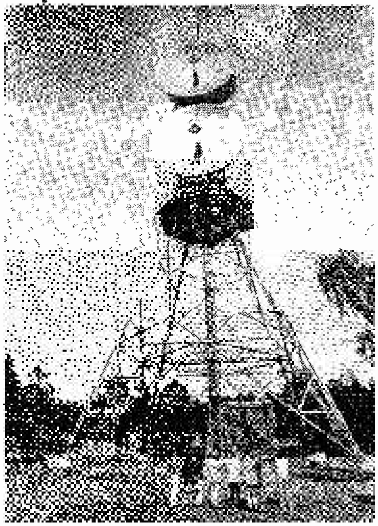
This is a new card programme specifically designed for teaching English to foreign children. Entitled "Let's Speak English", the programme teaches the essential elements of everyday speech using the established Language Master technique of sentence repetition and Q&A.

The pupil learns from audio-visual cards bearing words, pictures and a magnetic tape recording of the same words in the teacher's voice. When the pupil places a card in the machine, the teacher's recording is automatically reproduced.

As the phrases and sentences on the cards are seen and heard at the same time, and are backed up by illustrations of the objects and actions described, new language forms and vocabulary can be grasped more easily and retained better. The system also makes provision for the pupil to record his own voice for practise of pronunciation. He can then listen to the teacher's voice and compare it with his own.

Berlin F.M. Tx

NEW f.m. transmitter for broadcasts and mobile radio at Frohnau, West Berlin. See article "Broadcasting in Berlin" on page 411.

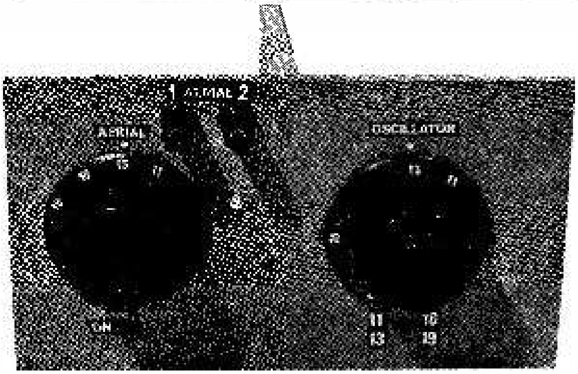


Diary Date

September 23—Harlow and District Mobile Rally will be held at Netteswell Comprehensive School, Harlow, Essex. All the information can be obtained by writing to V. Neard, 106 Vicarage Road, Harlow, Essex.

THE RADIO NETHERLAND

shortwave converter



THE shortwave converter is a unit that is connected between the aerial and the receiver and serves to convert radio signals in the shortwave bands into one fixed frequency. In our design, this frequency is 1600kHz (1·6MHz) or 190 metres, medium wave. This choice enables us to use the converter, in conjunction with a normal broadcast receiver tuned to 1·6 MHz, for the reception of the shortwave signals for which the converter was designed.

The connection between the converter and the receiver is effected by a few feet of coaxial cable, which is connected to the aerial and earth inputs of the receiver. So no changes in the circuitry of the receiver are needed, which is available for the reception of other radio signals as soon as the converter is disconnected and the aerial connection restored. The unit described here was designed to be acceptable for the listener with little experience in electronics.

The shortwave range of the unit runs from about 15 to 26·5 MHz, incorporating the 11, 13, 16 and 19 metres broadcasting bands. This range has been selected because it is not available on many radio receivers and yet comprises three of the best shortwave-bands for long-distance communication. For those listeners who prefer the range from 5·5-12 MHz (49-25 metres), we have listed additional data.

THE CIRCUIT

The circuit diagram of the converter is given in Fig. 1 which shows the tunable bandpass filter consisting of L1, L2 and the associated fixed and variable capacitors; the oscillator circuit, of which transistor Tr2 is the heart; and the frequency changer (mixer), comprising, among other things, the transistor Tr1 and output coil L4. The converter can be powered by a dry battery of between 6 and 12 volts since the current consumption is very small, about 3mA. The connection of the unit to the receiver is effected via the terminals A and E of the secondary winding of coil L4. They are connected respectively to the aerial and earth terminals of the receiver. At the converter, a long wire aerial is connected to Input 1 and Input 2 is connected to the chassis. If, however, a dipole is used this can be connected to both of the inputs. The chassis connection of number 2 is now omitted.

The bandpass filter comprises two circuits, which are mutually coupled. It serves to obtain a preselection for a limited frequency range, in which the desired stations can be found. A dual tuning capacitor of 2 x 470pF or 2 x 365pF is used for this purpose. If we use the 470pF variable capacitors, 330pF fixed (ceramic) series capacitors are necessary to arrive at the right 10-200pF capacity range. If the 365pF variable capacitors are used instead, series capacitors of 470pF must be applied.

The oscillator circuit frequency is determined by the properties of the tuned circuit comprising L3 and the capacities connected in parallel. The 92pF capacity (10pF and 82pF connected in parallel) can be inserted by a switch. This determines the range of the converter: the 15 and 17, or the 21 and 25MHz bands. For the 25 and 17MHz frequency ranges, the oscillator frequency is selected so as to be 1·6 MHz **below** the frequency to which the bandpass-filter is tuned. For the 21 and 15MHz, respectively, the oscillator frequency is chosen 1·6 MHz **above** the resonant frequency of the aerial circuit. This makes it possible to use a small tuning capacitor for the oscillator stage of the converter. A 30pF variable is used here, VC3.

The oscillator signal is coupled to the frequency changer stage via capacitor Ck. This consists of two

---

'Radio Nederland', the Dutch World Broadcasting System, is well-known to short wave listeners throughout the world. It was one of the early pioneers of broadcasting on the high frequencies and today it still keeps in close touch with its listeners through the DX Information Service.

Detailed technical data sheets are issued free of charge under such headings as crystal calibrators, aerial systems, radio interference suppression and many more.

We are pleased to publish here a suitably edited version of the data sheet on the Radio Netherland Short Wave Converter together with our photographs of the prototype so kindly provided by the Engineering Section of Radio Nederland.

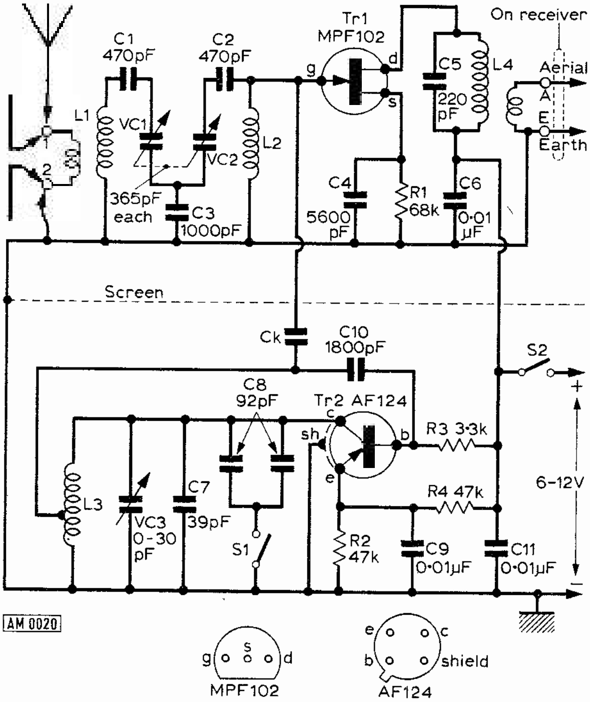
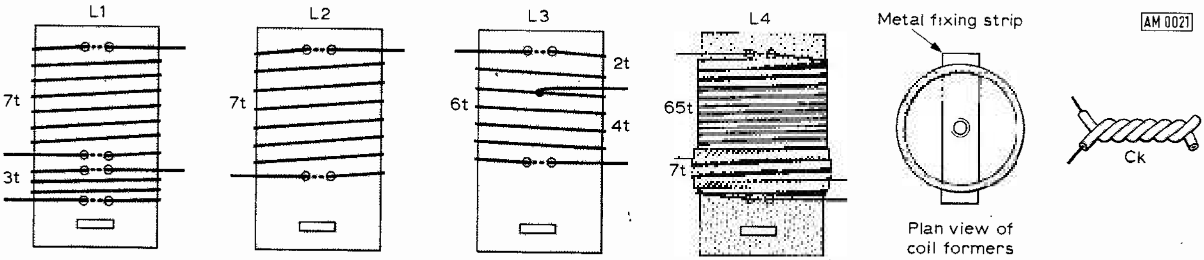


Fig. 1, above, is the complete circuit diagram of the RN converter.

Fig. 2, below, gives winding information for all the coils and illustrates coupling capacitor Ck



To further support the dual tuning capacitor, another small wooden block of about 1″ x $\frac{3}{4}$″ x $\frac{3}{4}$″ is glued in the appropriate place. It carries coil L4 and a small terminal strip to support the smaller components like the transistor and some capacitors. The woodscrews with which the tuning capacitor is fixed, must not touch the metal sheet on the back of the mounting plate, as they would then short-circuit the 1000pF series capacitor. After the chassis has been made the components can be put in their right positions. Care should be taken to insulate the aerial input terminals from the front panel, and to make the holes for the shafts of the tuning capacitor big enough to prevent metallic contact.

Preferably, the wiring should be made with a small 25 watt soldering iron. Keep the connections short and use the sheet metal for the chassis connections. Go carefully when connecting the transistors. If using the alternative types, make sure the connections are right. To prevent damage to the transistor by heat conduction hold the transistor wire near the semiconductor with a pair of pliers, which will act as a heat sink.

The coils of the converter can be easily home-made. For this, obtain a few short pieces of $\frac{5}{8}$″ outer diameter pvc (plastic) conduit. Use SWG 22 or 21 enamelled copper wire to wind the coils, each over a length of about $\frac{5}{8}$″, as illustrated in Fig. 2. Before putting them in their proper place, carefully clean the ends of the wires to remove the enamel insulation, and apply some solder. Proceed in the same manner for making the tap on coil L3. Slots are made in the insulated wires, twisted over a length of 1 inch as illustrated in Fig. 2.

The mixer uses a field-effect transistor (FET), Tr1, for best results. In its drain circuit, coil L4 and its 220pF parallel capacitor form a resonant circuit that is tuned to 1·6 MHz. The correct frequency of this circuit can be determined more exactly when the unit is operating when variation of the receiver tuning shows the spot where the combination of converter and receiver works most satisfactorily. If necessary, change the resonant frequency of this circuit by inserting a slightly different capacitor.

CONSTRUCTION

The front panel measures 8″ x 4½″ and consists of hardboard or plywood, the inside covered with a piece of copper, brass, zinc or tin of the same size. In the middle, and at right angles to it, a piece of plywood measuring 4″ x 4½″ is fixed. This is also covered with sheet metal of the same dimensions, stuck to it on the left side where the oscillator is located. The two metal sheets are interconnected by soldering while a wooden block of about 3″ x $\frac{3}{4}$″ x $\frac{3}{4}$″ serves to reinforce the joint. It is glued in its proper place and also carries the dual tuning capacitor and coil L2.

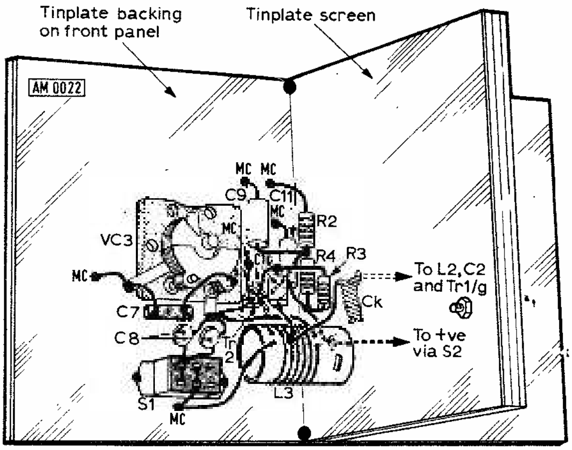
★ components list

Resistors
R1 68kΩ ¼W 10% — R3 3·3kΩ ¼W 10%
R2 47kΩ ¼W 10% — R4 47kΩ ¼W 10%

Capacitors
C1 470pF SM or Ceramic — C6 0·01μF tubular
C2 470pF SM or Ceramic — C7 39pF SM or tubular
C3 1000pF SM or Ceramic — C8 92pF SM or tubular*
C4 5600pF tubular — C9 0·01μF tubular
C5 220pF SM or ceramic — C10 0·01μF tubular
* see text.
VC1/2 2 x 365pF (Jackson O2)
VC3 30pF variable air spaced (Jackson C804)

Semiconductors
Tr1 MPF102 — Tr2 AF124
Note: In the prototype the BF245 and AF106 were used but since difficulty will be experienced in obtaining these types they have been substituted by the MPF102 and AF124.

Miscellaneous
Material for chassis, see text. S1, S2, miniature on/off slide switches. Coil formers, see text. Tag strips 2 way (2). Aerial sockets (2). Insulated coupling or rod for VC1/2.



Points marked MC denote earthing connections to chassis (−ve line)

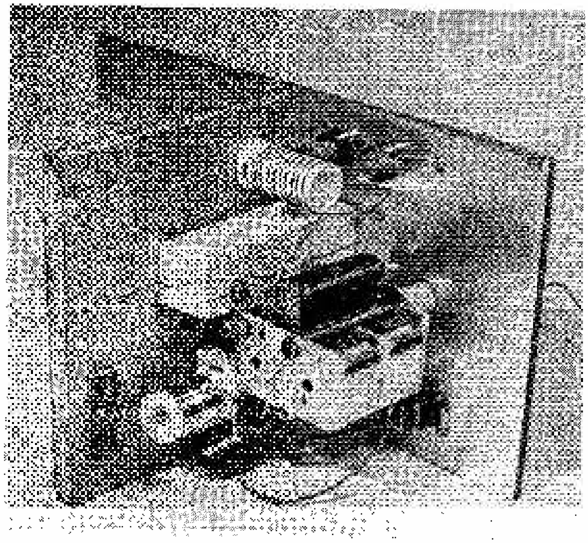
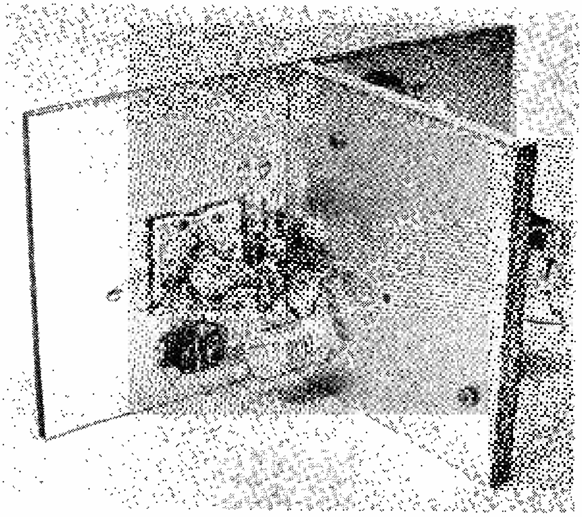
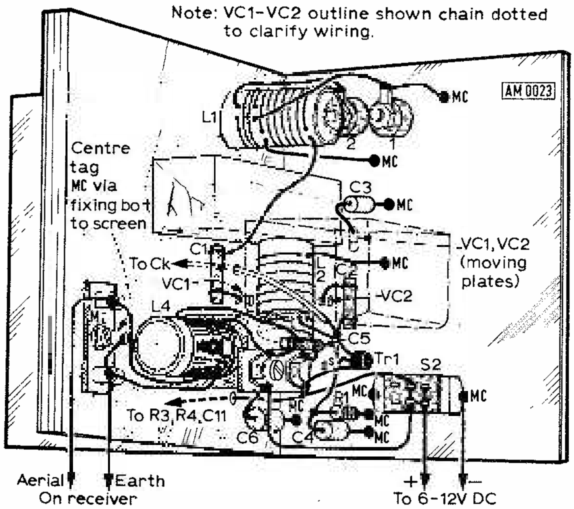


Fig. 3, above, and photograph below show the oscillator section of the converter while to the right are the circuit and photograph of the input and mixer stage.





plastic form, through which a small strip of metal is run with a hole in the middle. This is a commonly applied method for mounting the coils. Instead, however, you can use a proper cement, like Araldite, to fix the coils in place.

The wire used for L4 is SWG 30. The primary winding has 65 turns, the secondary is wound around the first one, after a thin strip of plastic is applied, to separate the windings. The secondary winding consists of 7 turns.

The layout of the components is illustrated in Figs. 3 and 4. It is possible to deviate from this design without trouble, but if you have little experience in electronics, we advise that you stick to it.

OPERATION ON 5·5 TO 12·5 MHz

This range covers the 25, 31, 41 and 49 metre bands. L1 should be wound with 15 turns over a length of $\frac{5}{8}''$, the coupling winding consisting of 5 turns. L2 is the same as L1. Oscillator coil L3 also is the same as L1 but a tap is taken at 5 turns from the bottom end. L4 remains unchanged. The oscillator tuning capacitor should be increased to 120pF (VC3).

ADJUSTMENT

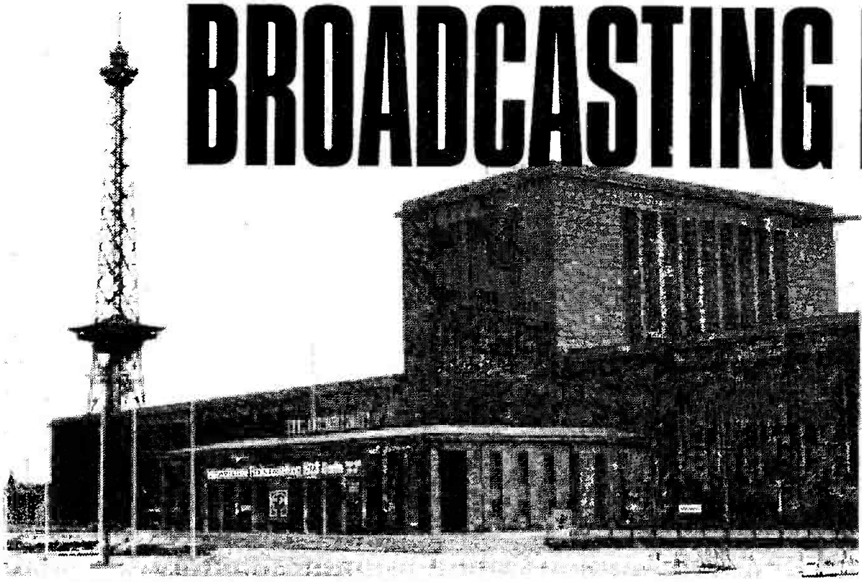
After all the connections have been made check the wiring thoroughly before the unit is connected. Join the converter output terminals to the aerial and earth terminals on the receiver, preferably with coaxial cable to prevent the direct pick up of signals by the receiver on 1·6MHz to which frequency the receiver should be tuned.

It is advisable to first tune the oscillator to the required signal and then to peak the signal with the aerial tuning which will be found to be comparatively flat. After the proper positions of the knobs have been found for all the bands mark them for easy tuning in the future with the help of some dabs of coloured paint or very small labels typed with the frequency bands.

When the whole unit works satisfactorily it can be put in a small wooden cabinet or preferably an aluminium case, again to protect the receiver from direct pick up.

Information on the DX Information Service can be obtained from Radio Nederland, English Section, POB 222, Hilversum, Holland. ■

BROADCASTING IN BERLIN


Exhibition halls of the Palace at the Funkturm where the Internationale Funkausstellung is to be held.

50 Jahre Deutscher Rundfunk

SINCE 1920, when the German Post Office broadcast its first test programme from the long wave radio station Konigswasterhausen, German broadcasting services and associated equipment manufacturers have earned the respect and admiration of many people all over the world. This year they are celebrating fifty years of broadcasting with special events.

The International Radio and TV Exhibition (Internationale Funkausstellung 1973) brings together the combined resources of broadcasting organisations of West Germany and twenty other countries in the Palace at the Funkturm, Berlin, from August 31st to September 9th. *Practical Wireless* was privileged to be given a preview of some of the current activities in the industry in West Berlin recently.

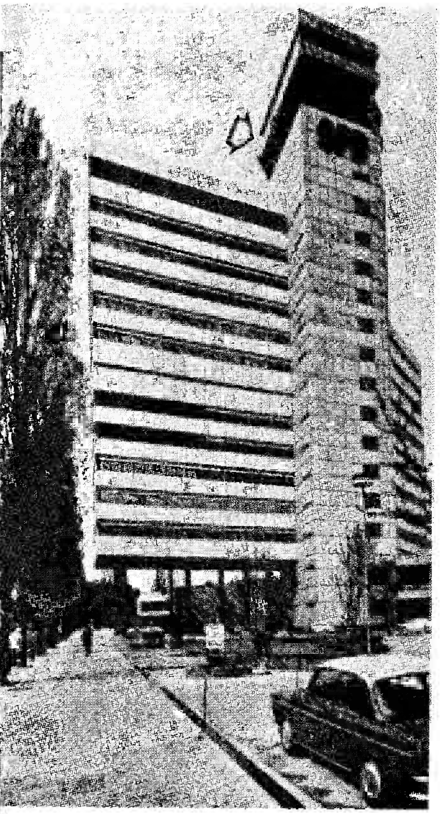
The exhibition will cover all aspects of entertainment electronics and will show modern forms of transmission techniques using satellites and pulse code modulation, private radiophones, projection colour television, traffic guidance systems and s.s.b./a.m. radio.

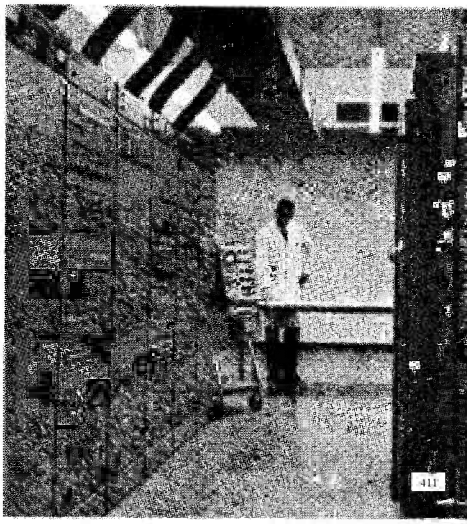
Television Studios

The two television transmitting organisations in West Germany are the Arbeitsgemeinschaft der Rundfunkstalten (ARD) and the Zweite Deutsche Fernsehen (ZDF) which will broadcast the opening ceremony of the exhibition over the Eurovision network on August 31st. As well as the customary display of domestic equipment from industry there will be additional attractions including a fully operational television studio, transmitting equipment, a radio and television servicing workshop, demonstration of historic equipment by the Deutsches Rundfunk Museum, special transmissions by the Deutschen Amateur Radio club and numerous cultural and sporting events for visitors' relaxation.

The Television Centre in West Berlin is run by the SFB which now broadcasts from the new buildings completed in 1971. The photograph shows the tower block on which are mounted the directional parabolic reflectors linking the centre with the transmitting stations and mobile units. Of particular interest in the Centre is the use of unmanned television studios. Computer equipment installed can operate television cameras and lighting from a remote console, so that the control room has direct control of floor equipment.

SFB (Sender Freies Berlin) has only an 8% share in ARD and


◀ *The new SFB television studios with the parabolic reflectors in the recess near the top.*


Some of the remote control equipment in the SFB building used to provide automatic operation of studio cameras and lighting. ▶

The film scanning room in the technical centre of the SFB.

broadcasts television programmes on Channel 7 (v.h.f.) and Channel 39 (u.h.f.). Sound radio on v.h.f. is on 88·75, 92·4 and 96·3MHz, and on 202m and 530m medium wave, the third programme being distributed through Norddeutscher Rundfunk (NDR). SFB will broadcast during the exhibition using a specially converted hall in the exhibition centre.

New Video Disc

A special feature will be the demonstration of video recording techniques for the home and in particular a new video disc player shown by Telefunken. This system is the production model version of TELDEC (first demonstrated three years ago) and has been developed to provide up to 10 minutes on one side of a 21cm flexible plastic disc. The first demonstration was designed for monochrome pictures but now the new version, affectionately renamed TED, can provide colour pictures of excellent quality in various simultaneous multiple geometric arrangements, including superimposition. Of significant interest is its ability to be "stopped" to provide still pictures and short excerpt repeats.

The video disc works on the principle of "out-of-contact" pressure scanning, using a small pick-up cartridge about the size of that used for sound record players. The first version introduced in 1970 contained monochrome programme material and a year later the TriPAL-D System was sucessfully recorded using this medium. Production of disc players is now at an advanced stage and will undoubtedly attract a large market at the exhibition.

The TED System is claimed to be the cheapest of all known video recording systems but, of course, the domestic unit will not have "record" facilities, only playback.

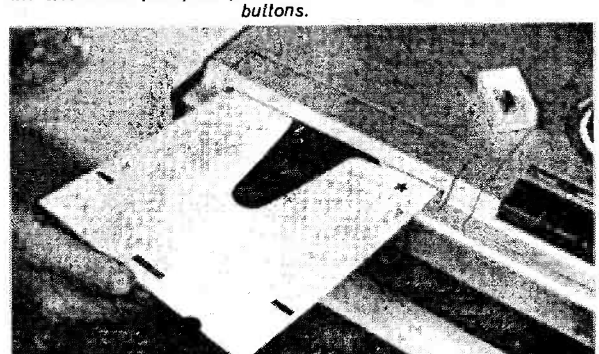
Other Recording Techniques

Of the five video recording techniques previously known, the only three to become the subject of further development in West Germany are magnetic tape cassettes, which are now enjoying a boom in demand, disc, and the "Super-8" film scanner, although the latter is only being developed by one company for production early next year.

The connection of a video recorder to the television receiver presents two main problems: mains isolation and time base stability. By connecting through the aerial socket the mains isolation problem is solved but this is only suitable for playback

The automatic studio equipment control console in the SFB. Instruction data is displayed on the screen in the background from the computer operated by the central push button panel.

Exclusive P.W. picture of the production version of TED, the Telefunken video disc player. The pickup head is seen in its box on the top. The disc is inserted, complete with sleeve into the slot in the front, the function controls being simple push buttons.



The Philips 401 dynamic stereo pickup head manufactured in West Berlin.

A P.W. photograph of the East Berlin television transmitting tower near Checkpoint Charlie.

machines. Video signal recording machines need an adaptor for use with a.c./d.c. sets but these are expensive and a cheaper solution is still being sought.

Timebase stability can be a problem with flywheel sync circuits and result in severe nonlinearity in the horizontal deflection. This problem can be overcome to a large extent by reducing the time constant in the phase comparator circuit. This facility will be incorporated in some sets by adding an "AV" switch, the "AV" designating Audio-Visual. Some sets have already reduced the time constant without the need for a switch. Permissible maximum time deviations that a receiver should accept or a video recorder should produce is the subject of a German Standards Committee dealing with this aspect.

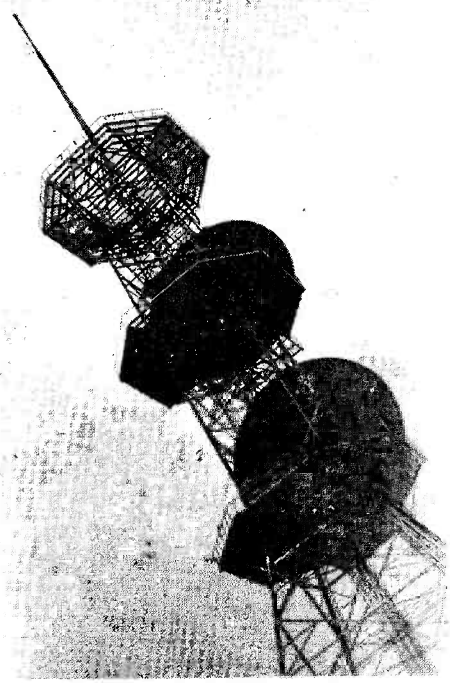
Seven German companies have now adopted the video cassette system and they are manufacturing cassette recorders on a large scale. All have built-in television tuners and timers, and stereo can be provided although up to now is not built-in. Over 40,000 VCR sets have been built and sold in Europe and manufacturers are having to work hard to satisfy a growing demand. The trend is to omit the u.h.f. tuner and connect to the video signal direct. Some domestic receivers are already being fitted with a video socket for this purpose specially for cassette recorders.

The German Post Office will be showing likely future developments in communications and to emphasise the theme they will give light and sound displays for visitors. Their exhibits include work in laser communications via glass fibres using pulse code modulation, which is particularly suitable for stereo broadcasting for sound only and television channels. Part of the work of the German Post Office is in monitoring the "air waves", particularly

as stringent control must be exercised in Berlin because of its geographical position.

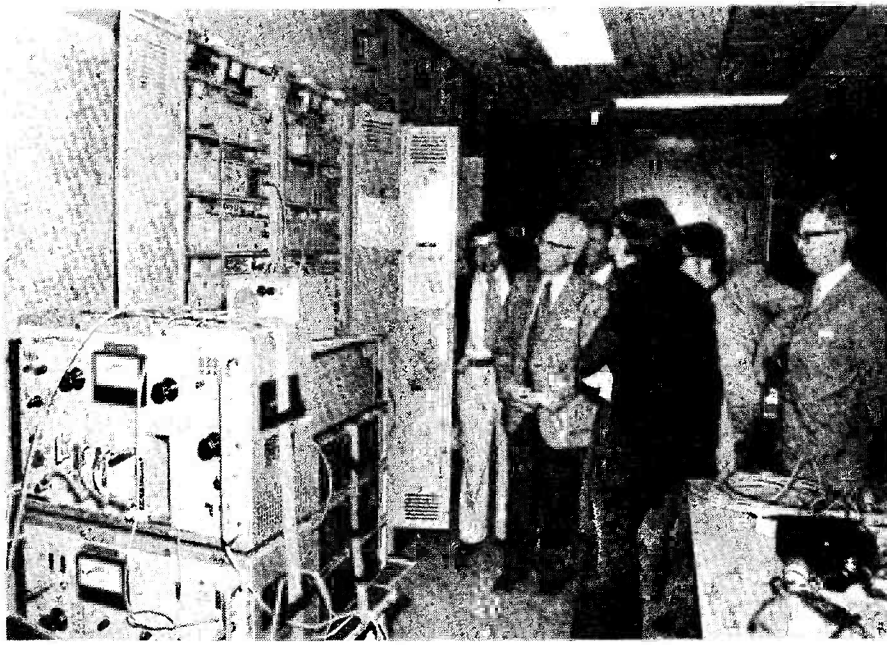
The Post Office is extending its transmission service capability by bringing into service its new "twin-dish" f.m. transmitter at Frohnau, Berlin. This station will handle telephone, telegraph, telex, gentex, and data traffic in two directions with a similar station in Lower Saxony, so extending communications from West Berlin without interference to East German transmissions. A fully automatic public land mobile service will also transmit via Frohnau.

The exhibition organisers, AMK Berlin, are to be congratulated on the magnificent organisation behind the exhibition programme. In turn they have received full co-operation from several Berlin organisations in promoting the 50 years anniversary celebrations including Philips, Telefunken, German Post Office, and broadcasting companies. We would hope that British exhibition organisers will visit Berlin to take notes. ■



The new Post Office scatter systems aerials at Frohnau. The highest section is used for mobile radio transmissions.

F.M. modulator/demodulator equipment in the new transmitting station at Frohnau.



I.C. OF THE MONTH

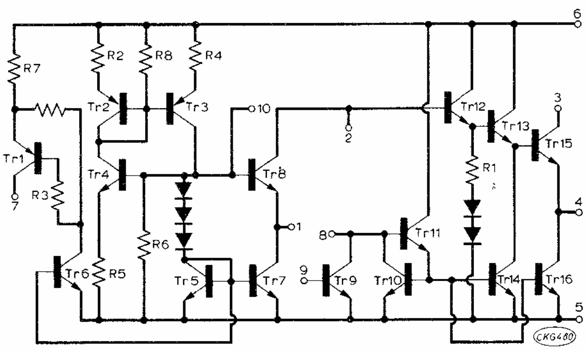
L.A.J. IRELAND

Number 41

LP2000 MICROTRANSMITTER

A few years ago the letters column of Practical Wireless bristled with a controversy regarding the pros and cons as to whether the authorities should allow low level radio communication on a specified band analagous to the citizens band in America, without the requirements of having to pass the morse code test and radio theory examination. Allied to this was the profusion of American and Japanese equipment particularly walkie-talkies, available over the counter from many radio and electrical shops giving rise to the rather curious anomaly whereby a person could legally purchase such equipment and yet find himself in the position of using it illegally.

The sale of such equipment even here is quite high and as each specific market for a particular transistorised unit is identified, it is inevitable that the IC manufacturers should turn their attention to fulfilling this need, in integrated form, if at all possible.



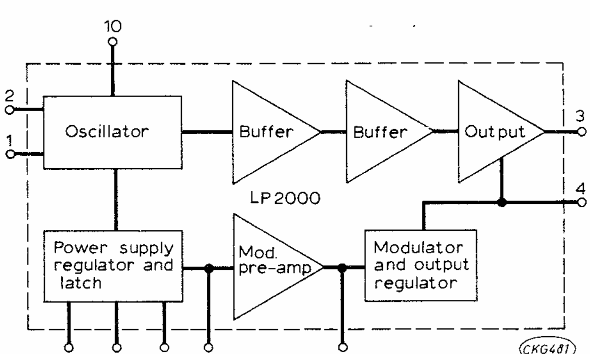


Fig. 1a, top, is the complete circuit of the LP2000. Fig. 1b, below, shows the circuit by functions.

Lithic Systems Inc. have now produced the first monolithic microtransmitter, designated the LP2000, the operating frequency being set by external tuning elements so that the device can operate at any frequency up to 150MHz with a power output in the region of 100mW.

Circuit

The complete circuit diagram of the LP2000 together with a functional block diagram is illustrated in Fig. 1. All the active components of the transmitter are incorporated in the IC with the operating frequency set by an external overtone type crystal and a tuned LC tank circuit picking out the required overtone frequency. Tr8 acts as the transistor oscillator operating with AC grounded base and having its DC bias controlled by the internal regulator. Further stability is ensured by having its emitter current controlled by the constant current source Tr7.

Two emitter follower buffer stages Tr12 and Tr13 directly couple the oscillator to the power output stage Tr15 and this rather unique design does away with the more conventional LC or RC interstage coupling networks. The modulator and output regulator form an integral part of the output stage and this is achieved by inserting Tr14 and Tr16 as the emitter loads with their currents controlled by the modulating preamplifier Tr9 and Tr10. In conjunction

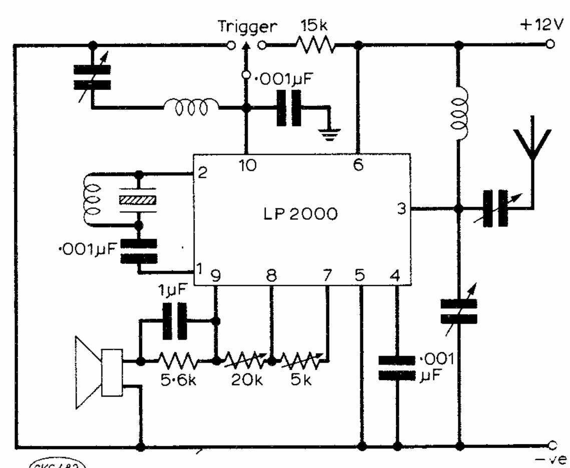
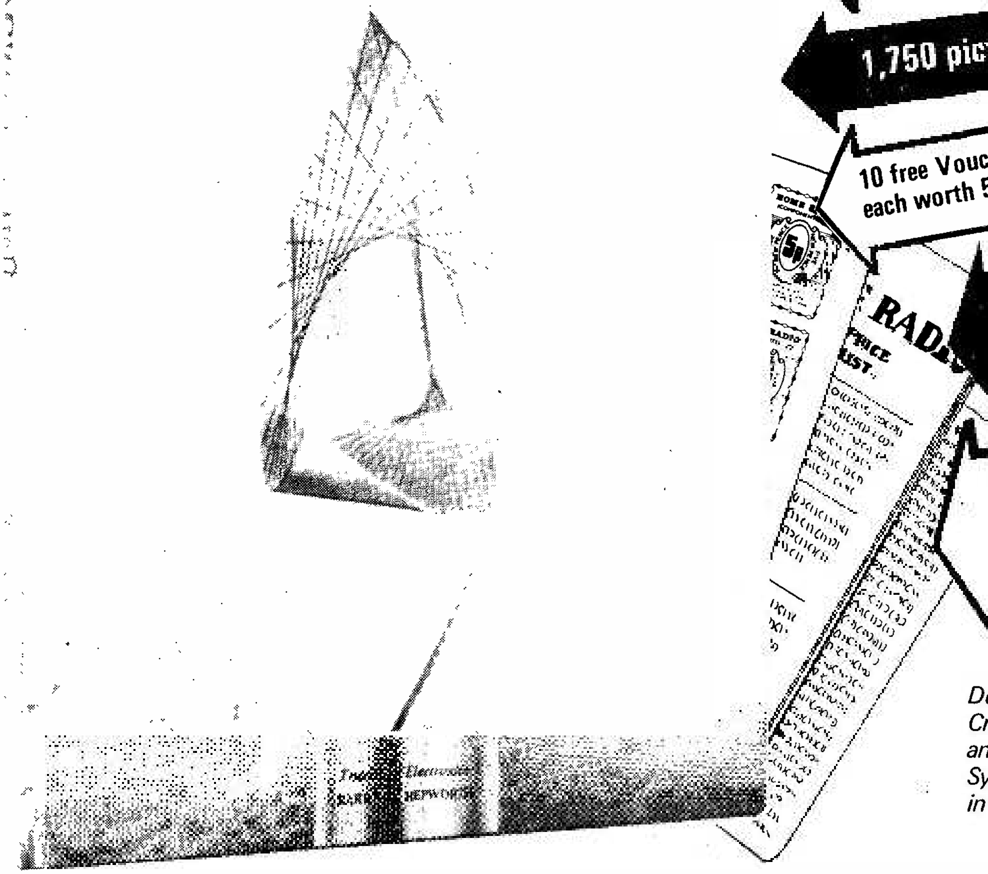


Fig. 2. Circuit for a complete transmitter, based on the LP2000.



parts for PRACTICAL WIRELESS projects

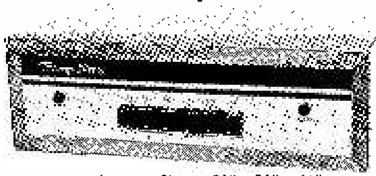
After many requests, Electro Spares are now supplying lists of components for ALL the projects featured in "Practical Wireless" commencing July 1973 issue. Just forward an S.A.E. (preferably 9" x 4" minimum) stating which project is of interest to you—we will forward an individually priced list of components required. No need to buy a full kit—you need only purchase the parts you require at any one time.

All Electro Spares supplied components are new, branded products of reputable manufacturers and carry full makers guarantee.

We regret we cannot supply lists for projects published **before** July 1973 issue.

"ONE SOURCE" BUYING MAKES SENSE—IT CAN SAVE YOU TIME, MONEY AND POSTAGE.

"p.e." f.m. varicap stereo tuner



Approx. Size :- 8½" x 2½" x 6½"

Features include push button "Spot On" tuning, with up to 5 pre-set stations (no difficult tuning dial and drive cord). Easy "no problem" construction, requiring only a few simple setting up adjustaments with a D.C. Voltmeter. Uses NEW pre-set modules for R.F. and I.F. Circuits—no circuit alignment. High efficiency Integrated Circuit Phase Lock Loop Decoder for perfect stereo reception, with stereo lamp indicator.

Total Kit price only £28·50 including VAT and postage

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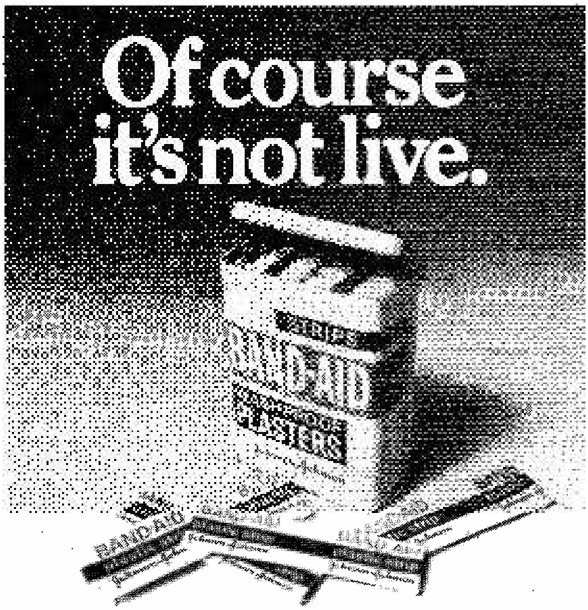

Sorry about that, Roger.

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* TRADE MARK

BROADWAY ELECTRONICS

92 MITCHAM ROAD, TOOTING BROADWAY, LONDON S.W.17 01-672 3984

CARTRIDGES—Stereo Sonotone 9TA H/C Diamond **£2·47**, Ronette S105 Medium Output **£1·40**, S106 High Output **£1·40**, Acos GP93/1 Sapphire **£1·95**, GP94/1 Sapphire **£1·95**, Japanese equivalent to B.S.R. TC8s **£1·80**.

CARTRIDGES—Mono GP91 Stereo Compatible **£1·29**. B.S.R. TC8H Jap. equivalent **£1·29**.

HI-FI STEREO HEADPHONES Padded ear cushions seal out room noise. Perfect coupling between reproducer and ears assure full response impedance 8 ohms, frequency range 20–20,000 Hz 6ft. cord and standard stereo plug. Only **£3·57**.

STEREO HEADPHONE JUNCTION BOX Simple unit connects direct to amplifier and speakers to give attenuated headphone output has 3 position switch to give headphones only, speakers only, speakers and headphones. Only **£1·74**.

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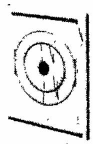
poly-planar

20-Watt Full Range Speaker



Completely replaces the conventional cone speaker Super-thin construction permits new installation ideas.

Power capability: 40 watts peak. **Frequency range:** 40 Hz–20 KHz **Sensitivity:** 85 dB/M for 1 watt electrical input. **Input impedance:** 8 ohms. **Operating temperature range:** —20°F to +175°F. **Size (WxDxL):** 1·7/16" x 11·3/4" x 14·11/16". **Weight:** 19 ounces.

£7·50 each Stereo pair £14·50
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with an ordinary dynamic loudspeaker used as a microphone sufficient drive is obtained to allow up to 100% modulation of the output stage.

When the transmitter is used as a portable, a latching mechanism allows the IC to be permanently connected across the power supply drawing little or no current until actuated. A positive going trigger pulse applied to pin 10 causes Tr4 to conduct and the resulting voltage drop across R8 causes Tr2 and Tr3 to conduct thereby providing regulated bias voltages for the oscillator and output stages. This quasi-stable state remains as long as the base of Tr4 is not grounded. Application of a negative going pulse or momentarily earthing pin 10 causes a reversal of the latch to the 'off' state.

A Practical Transmitter

A complete radio transmitter circuit, incorporating the LP2000, is shown in Fig. 2. The two pre-set resistors control the idling current and output modulation. One rather curious feature of the design is the DC short through the tank circuit between the base and collector of Tr8 but monolithic transistors still show a current gain even when operated in this mode. The tank coils and variable capacitors will have to be chosen to suit the operating frequency set by the particular crystal used, and while this IC can operate as a complete transmitter in its own right, it can also provide sufficient drive to operate a more powerful PA stage for amateur transmissions.

Also available is the LP2001, electrically interchangeable with the LP2000 but producing a minimum continuous output power of 250mW.

The suppliers, in this country, are Europartners Ltd., Shirley Lodge, 470 London Road, Slough, Bucks. The LP2000 costs £8·80 and the LP2001 £13·20 to which should be added VAT and postal and packing charges.

PRACTICAL WIRELESS MULTIMETER COMPETITION

THE WINNERS OF THE FOUR DIGITAL MULTIMETERS WILL BE ANNOUNCED NEXT MONTH

TUT! TUT!!

August 1973
Light Operated Switches
The diode D1 in Figs. 1-4 is shown reversed. Positive side of diode should go to positive supply line.

PRODUCTION LINES

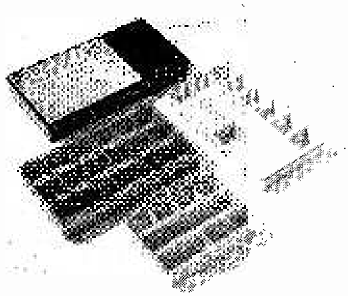
colin riches

STORAGE BOXES

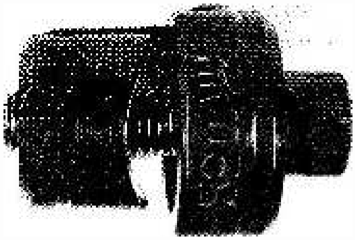
Kabi (Electrical & Plastics) Limited of Potters Bar, Herts. have introduced an entirely new series of compartment trays. The range comprises four sizes from 5¼in x 7in x 1½in to 6¼in x 12in x 2in.

The largest model has moveable compartment modules, each module being capable of sub-division, so that compartments of virtually any size up to the total dimensions of the tray can be formed.

Most are available in a range of colours at prices ranging from 45p to £1·50 each according to size. *Kabi Ltd. Cranborne Road, Potters Bar, Herts., EN6 3JP.*



METRIC CUTTERS



Q-Max (Electronics) Ltd., now supply their chassis cutters in metric sizes and linear sizes.

We have illustrated the 25mm size which is priced at £1·05. An Allen key to fit costs 9p.

To use these punches, a hole must be drilled ensuring that the Allen screw will fit through easily. The screw is then passed through the die (see picture) then passed through the ready-drilled hole. The punch is then screwed onto the projecting Allen screw until it makes contact with the metal to be punched. The screw is then turned by means of an Allen key and the punch cuts cleanly through the metal.
Q-Max (Electronics) Ltd., 44 Penton Street, London, N1 9QA.

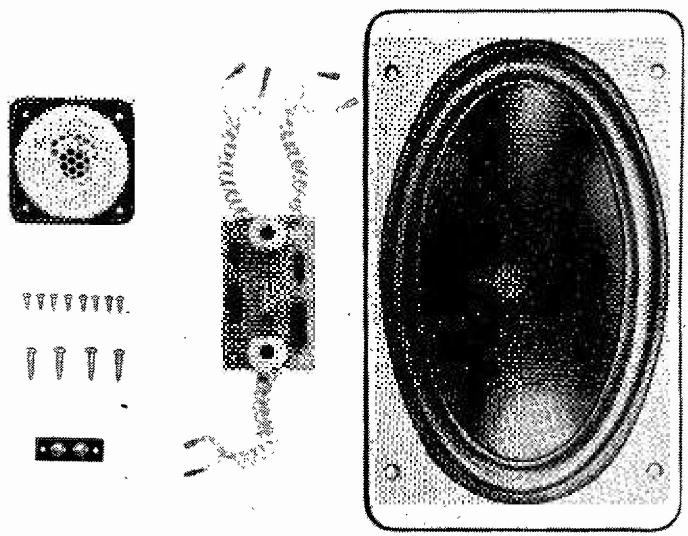
SOLDERING ALUMINIUM

In recent months Multicore Solders Limited have introduced to industry their new flux cored solder for soldering aluminium.

Multicore now believe that they have made a significant breakthrough and are announcing the release of ALU-SOL Multicore Solder which readily solders aluminium and many aluminium alloys, does not require any extra flux, and seems to provide joints having significantly better resistance to subsequent electrolytic corrosion than any other soft solder/flux combination considered previously for aluminium soldering.

Now a new pack (ref: Size 4) for Servicemen and Handymen is announced which comprises approximately ¼Kg, 16 swg ALU-SOL Multicore Solder wound on a plastic reel and packed in an attractive carton with full instructions, which will be available from electrical, hardware and do-it-yourself shops.

The recommended retail price is £1·50 per reel, excluding VAT. In case of difficulty please contact the manufacturers direct. *Multicore Solders Ltd., Hemel Hempstead, Herts, HP2 7EP, England.*



XLK50

LOUDSPEAKER KITS

Helme Audio Products Ltd. announce the introduction of two new hi-fi loudspeaker kits, the XLK-25 and XLK-50. Ready made versions and matching cabinet kits are also available. Kit XLK-25 comprises an 8in. low resonance woofer and 3in. square tweeter with aluminium cone. Kit XLK-50 uses the same high grade tweeter but takes advantage of a 13 x 8in. woofer with Bextrene cone. Both kits offer very good value for money and include a half-section, parallel cross-over network and all leads, terminal panel etc. NO soldering is necessary for their assembly. The kits are also supplied with protective built-in fuse against accidental overload. Prices (incl.VAT):

XLK-25 @ £23·17 per pair.
XLK-50 @ £42·18 per pair.

Helme Audio Products Ltd., Summerbridge, Harrogate, HG3 4DR.

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EBF83	0·62
EBF89	0·58
EC86	0·75
EC88	0·77
ECC81	0·45
ECC82	0·43
ECC83	0·45
ECC84	0·55
ECC85	0·53
ECC88	0·75
ECC189	0·71
ECF80	0·56
ECF82	0·73
ECF86	0·71
ECH81	1·00
ECH83	1·00
ECH84	0·78
ECL80	0·53
ECL82	0·61
ECL83	0·68
ECL86	0·63

EF80	0·46
EF83	1·03
EF85	0·43
EF86	0·90
EF89	0·81
EF91	1·30
EF92	1·40
EF95	1·35
EF183	0·80
EF184	0·80
EH90	0·58
EL34	0·95
EL36	1·05
EL81	0·90
EL84	0·47
EL85	0·55
EL86	0·95
EL95	0·70
EL91	1·31
ELL80	1·30
EM84	1·18
EM87	1·18
EY51	0·83
EY86/87	0·42
EY88	0·64
EZ80	0·51
EZ81	0·40
GY501	0·90
GZ34	0·78

PC86	0·75
PC88	0·75
PC97	0·45
PC900	0·56
PCC84	0·52
PCC88	0·80
PCC89	0·65
PCC189	0·65
PCF80	0·51
PCF82	1·30
PCF86	0·65
PCF200	0·85
PCF201	0·87
PCF801	0·65
PCF802	0·71
PCF806	0·66
PCH200	0·88
PCL82	0·54
PCL83	0·66
PCL84	0·59
PCL85	0·63
PCL86	0·63
PCL805/85	0·63
PD500	1·55
PFL200	0·80
PL36	0·88
PL81	0·75
PL81A	0·88
PL82	0·50
PL83	0·96

PL84	0·66
PL504	0·88
PL508	1·05
PL509	1·55
PL802	0·96
PY33	0·66
PY81/800	0·50
PY82	0·55
PY88	0·60
PY500A	1·05
PY800	0·50
PY801	0·50
U26	1·00
U191	1·00
U193	0·50
UABC80	0·90
UBC81	0·70
UBF89	0·60
UCC85	0·60
UCH81	1·00
UCL82	0·70
UCL83	0·70
UF89	0·80
UL84	0·95
UL85	0·50
6/30L2/ ECC804	1·00
6F23/EF812	1·05
30C1/PCF80	0·51

30C15/ PCF800	1·05
30C17	1·00
30C18/ PCF805	0·90
30F5/PF818	1·10
30FL1/ PCE800	0·75
30FL2	0·75
30FL12	1·05
30FL14	0·85
30L1/PCC84	0·52
30L15/PCC805	1·05
30L17	0·90
30P4MR	1·30
30P12/PC801	1·05
30P19/PC802	1·00
30PL1/PCL801	0·95
30PL13/ PCL800	1·20
30PL14/ PCL88	1·25
30PL15	1·05

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Individually boxed and guaranteed but of European or other origin at greatly reduced prices. Quotations for any valve not listed. Send SAE for lists.

AZ1	0·60
AZ31	0·55
CBL31	1·00
CL33	1·50
CY31	0·50
DAF91	0·30
DAF96	0·50
DCC90	1·35
DF91	0·30
DF96	0·50
DK91	0·45
DK92	0·70
DK96	0·60
DL92	0·40
DL94	0·48
DL96	0·55
DY86/87	0·37
DY802	0·37
EABC80	0·38
EAF42	0·75
EB91	0·22
EBC33	1·00
EBC41	0·75
EBC81	0·33
EBF80	0·40
EBF83	0·40
EBF89	0·32
EBL31	1·50
ECC81	0·40
ECC82	0·33
ECC83	0·33
ECC84	0·30
ECC85	0·40
ECC88	0·40
ECH35	1·25
ECH42	1·00
ECH81	0'30
ECH83	0·45
ECL80	0·45
ECL82	0·35
ECL83	0·68
ECL86	0·40
ECLL800	2·25
EF37A	1·20
EF39	1 20

EF80	0·25
EF85	0·35
EF86	0·30
EF89	0·28
EF91	0·37
EF92	0·35
EF95	0·40
EF98	0·75
EF183	0·30
EF184	0·35
EL32	0·60
EL33	1·75
EL34	0·50
EC36	0·50
EL37	2·35
EL41	0·90
EL42	0·90
EL84	0·25
EL95	0·35
ELL80	1·00
EM80	0·45
EM81	0·60
EM84	0·35
EM85	1·00
EY51	0·40
EY86	0·40
EZ40	0·75
EZ41	0·75
EZ80	0·29
EZ81	0·29
GY501	0·80
GZ30	0·45
GZ32	0·50
GZ34	0·60
GZ37	1·25
HN309	1·50
KT61	1·75
KT66	2·35
KT81 (7C5)	1·18
KT81	1·75
KT88	2·25
KTW61	1·00
MU14	1·00
N78	1·60

PC86	0·60
PC88	0·60
PC97	0·45
PC900	0·48
PCC84	0·40
PCC88	0·55
PCC89	0·50
PCC189	0·60
PCF80	0·30
PCF82	0·35
PCF86	0·60
PCF801	0·50
PCF802	0·50
PCF805	0 80
PCF806	0·75
PCF808	0·85
PCL82	0·35
PCL83	0·66
PCL84	0·45
PCL85	0·50
PCL86	0·45
PCL805/85	0·50
PD500	1·30
PEN45	0·75
PL36	0·55
PL81	0·50
PL82	0·45
PL83	0·45
PL84	0·40
PL500	0·75
PL504	0·75
PL508	0·90
PL509	1·55
PL802	0·95
PX4	2·50
PX25	2·50
PY33	0·63
PY81	0·30
PY82	0·35
PY83	0·38
PY88	0·40
PY500	0·47
PY81/800	0·50
PY801	0·50

SP41	3·00
SP61	0·75
T41	1·00
U14	1·00
U25	0·85
U26	0·85
U191	0·75
UABC80	0·40
UAF42	0·75
UBC41	0·75
UBC81	0·45
UBF80	0·40
UBF89	0·40
UCC85	0·45
UCH42	0·75
UCH81	0·40
UCL82	0·35
UCL83	0·70
UF41	0·75
UF89	0·40
UL41	0·85
UL84	0·43
UY41	0·48
UY85	0·40
VR105-30	0·40
VR150-30	0·40
OA2	0·40
OB2	0·40
1R5	0·45
1S5	0·30
1T4	0·30
3S4	0·40
3V4	0·48
5R4GY	0·75
5U4G	0·40
5V4G	0·50
5Y3GT	0·45
5Z4G	0·45
6/30L2	0·80
6AK5	0·40
6AM5	0·90
6AQ5	0·42
6AS7G	0·85
6AT6	0·38
6AU6	0·30
6BA6	0·28
6BE6	0·32
6BH6	0·75
6BJ6	0·55
6BQ7A	0·55
6BR7	0·90
6BS7	1·35
6BW6	0·90
6BW7	0·90
6C4	0·35
6CD6G	1·30
6CH6	0·60
6CW4	0·70
6F23	1·05
6F25	1·00
6F28	0·70
6J5M	0·80
6J5G	0·45

6J6	0·30
6J7M	0·45
6J7G	0·40
6K6GT	0·75
6K7M	0·43
6K7G	0·30
6K8M	0·60
6K8G	0·45
6K25	0·75
6L6G	0·55
6Q7M	0·50
6Q7G	0·50
6SL7GT	0·45
6SN7GT	0·45
6SQ7GT	0·50
6U5G	0·75
6V6G	0·40
6V6GT	0·45
6X4	0·40
6X5G	0·40
6X5GT	0·45
7B6	0·75
7B7	0·70
7C5	1·00
7C6	0·75
7H7	0·70
7R7	0·75
7S7	2·25
7Y4	0·75
12AT6	0·40
12AT7	0·40
12AU6	0·45
12AU7	0·33
12AX7	0·33
12BA6	0·45
12BE6	0·50
30C1	0·80
30C15	1·05
30C17	1·10
30C18	0·80
30F5	1·10
30FL1	0·75
30FL2	0·75
30FL14	0·85
30L15	1·05
30L17	0·90
30P4MR	1·30
30P12	1·05
30P19	1·00
30PL1	0·95
30PL13	1·20
30PL14	1·25
35W4	0·40
35Z4GT	0·70
50CD6G	1·20
807	0·50
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813 USSR	£5·75
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AAZ13	0.10
AAZ15	0·10
AC107	0·35
AC126	0·25
AC127	0·25
AC128	0·25
AC176	0·25
AC187	0·25
AC188	0·25
ACY21	0·20
ACY39	0·55
AD140	0·50
AD149	0·50
AD161	0·35
AD162	0·35
AF115	0·24
AF116	0·25
AF117	0·20
AF186	0·40
AF239	0·40
ASY27	0·30
ASY28	0·25
BA102	0·30
BA115	0·7
BC107	0·10
BC108	0·10
BC109	0·10
BC113	0·15
BC117	0·20
BC143	0·35
BC147	0·12
BC148	0·10
BC169C	0·12
BC182	0·10
BC182L	0·12
BC184L	0·11
BCY32	0·60
BCY33	0·34
BCY34	0·35
BCY70	0·15
BCY71	9·20
BCY72	0·15
BCZ11	0·50
BD121	0·75
BD124	0·80
BD131	0·75

BD132	0·80
BF115	0·25
BF167	0·25
BF173	0·25
BF179	0·30
BF180	0·30
BF181	0·32
BF194	0·15
BF195	0·15
BF197	0·15
BF200	0·35
BFS61	0·25
BFS98	0·25
BFX29	0·25
BFX88	0·20
BFY50	0·20
BFY51	0·20
BFY52	0·20
BFW10	0·61
BY100	0·15
BY126	0·15
BY127	0·15
BZX61 series	0·12
BZY88 series	0·10
CRS1-05	0·25
CRS1-40	0·35
CRS3-05	0·30
CRS3-40	0·45
MJE340	0·50
MJE370	0·70
MJE520	0·75
MJE2955	1·10
MJE3055	0·75
MPF102	0·42
MPF103	0·35
MPF104	0·37
MPF105	0·40
NKT404	0·50
OA5	0·50
OA10	0·35
OA79	0·7
OA81	0·10
OA91	0·7
OA200	0·7
OA202	0·10

OC16	0·75
OC20	0·95
OC23	0·85
OC25	0·40
OC28	0·65
OC35	0·50
OC36	0·65
OC42	0·40
OC44	0·15
OC45	0·15
OC71	0·15
OC72	0·25
OC76	0·40
OC77	0·45
OC81	0·25
OC81D	0·25
OC81Z	0·55
OC83	0·25
OC140	0·55
OC170	0·25
OC171	0·30
OC200	0·45
OC201	0·75
OC202	0·80
OC203	0·50
OCP71	1·25
ORP12	0·50
ORP60	0·40
T1005	0·30
TIC44	0·35
TIC226D	1·50
TIL209	0·30
TIS43	0·35
ZTX107	0·15
ZTX108	0·12
ZTX300	0·12
ZTX301	0·15
ZTX302	0·18
ZTX304	0·25

ZTX500	0·15
ZTX501	0·16
ZTX503	0·17
ZTX531	0·20
ZTX550	0·20
IN914	0·7
IN4001	0·6
IN4002	0·7
IN4003	0·8
IN4004	0·8
IN4005	0·10
IN4006	0·12
IN4007	0·15
IN4009	0·5
IN4148	0·8
IS921	0·10
IS2033	0·20
IS2051A	0·20
IS2100A	0·20
IS3010	0·25
2N696	0·15
2N697	0·15
2N706	0·10
2N706A	0·12
2N1131	0·25
2N1132	0·25
2N1302	0·18
2N1303	0·16
2N1304	0·22
2N1305	0·22
2N1306	0·22
2N1307	0·25
2N1308	0·25
2N1309	0·37
2N1613	0·20
2N1614	0·20
2N2147	0·75
2N2160	0·59
2N2369A	0·15

2N2646	0·50
2N2904	0·18
2N2904A	0·25
2N2905	0·26
2N2905A	0·23
2N2906	0·20
2N2926	0·10
2N3053	0·20
2N3055	0·55
2N3525	0·75
2N3614	0·59
2N3615	0·75
2N3702	0·10
2N3703	0·10
2N3704	0·10
2N3705	0·10
2N3706	0·10
2N3707	0·10
2N3708	0·10
2N3709	0·10
2N3710	0·10
2N3711	0·10
2N3819	0·35
2N3820	0·50
2N3823	0·62
2N3903	0·15
2N3904	0·17
2N3905	0·21
2N3906	0·12
2N4058	0·16
2N4059	0·9
2N4060	0·12
2N4061	0·12
2N4062	0·12
3N141	0·81
40360	0·40
40361	0·40
40362	0·50
40430	1·00

SN7400	0·20
SN7401	0·20
SN7402	0·20
SN7403	0·20
SN7404	0·20
SN7405	0·20
SN7406	0·30
SN7407	0·30
SN7408	0·20
SN7409	0·45
SN7410	0·20
SN7411	0·23
SN7412	0·42
SN7413	0·30
SN7416	0·30
SN7417	0·30
SN7420	0·20
SN7422	0·48
SN7423	0·48

SN7425	0·48
SN7427	0·42
SN7428	0·50
SN7430	0·20
SN7432	0·42
SN7433	0·70
SN7437	0·65
SN7438	0·65
SN7440	0·20
SN7441AN	0·75
SN7442	0·75
SN7450	0·20
SN7451	0·20
SN7453	0·20
SN7454	0·20
SN7460	0·20
SN7470	0·30
SN7472	0·30

SN7473	0·40
SN7474	0·40
SN7475	0·55
SN7476	0·45
SN7480	0·80
SN7482	0·87
SN7483	1·00
SN7484	0·90
SN7486	0·45
SN7490	0·75
SN7491AN	1·00
SN7492	0·75
SN7493	0·75
SN7494	0·80
SN7495	0·80
SN7496	1·00
SN7497	6·25
SN74100	2·50

SN74107	0·50
SN74110	0·80
SN74111	1·45
SN74118	1·00
SN74119	1·90
SN74121	0·60
SN74122	1·35
SN74123	2·70
SN74141	1·00
SN74145	1·50
SN74150	3·35
SN74151	1·10
SN74154	2·00
SN74155	1·55
SN74156	1·55

SN74157	1·80
SN74170	4·10
SN74174	2·00
SN74175	1·35
SN74176	1·60
SN74190	1·95
SN74191	1·95
SN74192	2·00
SN74193	2·00
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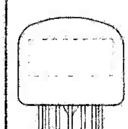

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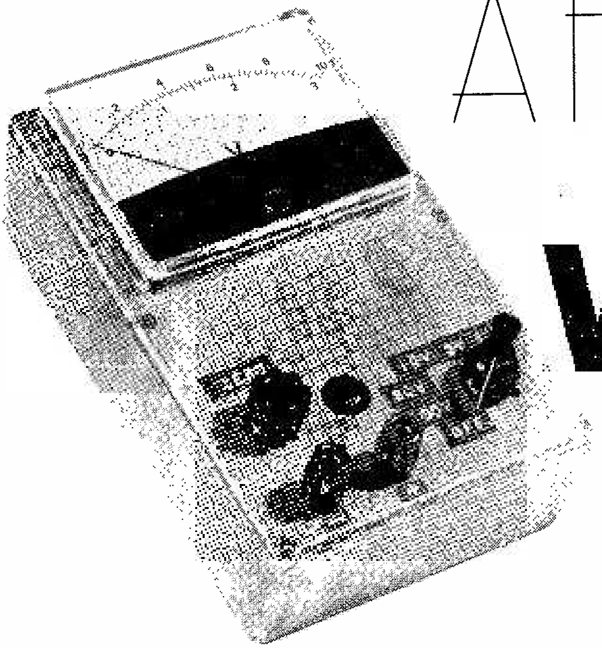


A High Sensitivity DC Voltmeter

D. J. SILVESTER

OF ALL of the basic measurements that can be made with a normal multimeter, the determination of voltage is probably the one most commonly attempted and the measurement that is most likely to give rise to erroneous results.

MEASUREMENT ERRORS

Consider for a moment the circuit of a low power audio amplifying stage in any piece of equipment, Fig. 1. The current through R3 will, with no input signal, be of constant value determined by the values of R1, R2 and R4, and will not be altered if the value of R3 is altered providing that the voltage at the collector of the transistor exceeds that at its base by 2 volts or more.

Let us suppose we wish to measure the voltage across R3, and given that the transistor delivers a current of 100μA and the value of R3 is 100kΩ, the voltage across the resistor will be 10V.

If we measure the voltage across R3 with a normal multimeter of 20kΩ/volt sensitivity then, on the 10V range, the meter will appear as a 200kΩ resistor. If a 200kΩ resistor is shunted across the 100kΩ resistor the apparent resistance drops to 66·7kΩ, and consequently the voltage across the combination drops to 6·67V, vastly different from the 10V correct value.

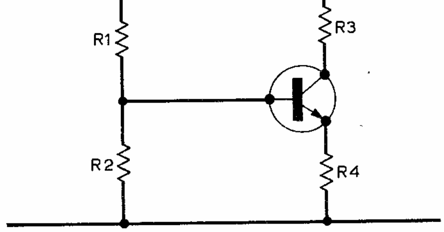


Fig. 1: Basic transistor circuit to demonstrate errors possible when using low sensitivity meters.

It is obvious therefore that a meter with a higher sensitivity would give much less error, but although valve and FET voltmeters can be built by the home constructor, difficulties can occur due to thermal drifts as the components in the circuit warm up. The circuit to be described uses a μA741C integrated circuit as the amplifying element of the circuit hence eliminating drift problems. Since it is difficult for the amateur to obtain high value, high tolerance resistors the sensitivity of the circuit has to be made 100kΩ/volt although 1MΩ/volt would be preferable.

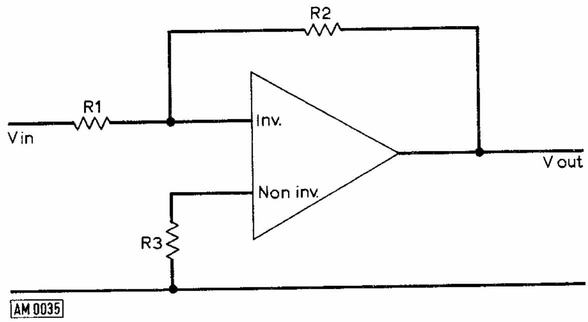


Fig. 2: Use of the μA741C integrated circuit as an amplifier.

★ components list

Resistors

R1	100kΩ	¼W 1%	R6	10kΩ	¼W 5%
R2	300kΩ		R7	10kΩ	
R3	1MΩ		R8	10kΩ	
R4	3MΩ		R9	820Ω	
R5	10MΩ				

(R4 is 2 x 1·5MΩ)

VR1 10kΩ linear potentiometer
VR2 500Ω miniature preset pot

Miscellaneous

IC1, μA741C (TO5 or DIL). S1, 4-pole 6-way, (from 2 x 2-pole 6 way wafers). M1, 100μA FSD, scaled 0-3 and 0-10 (RS-MR31). Case, approx 7" x 4" x 2". Terminals (2). Knobs (2). Battery clips (2 pairs). Terry spring clips (2). Batteries, PP4 (9V-2 off). Veroboard.

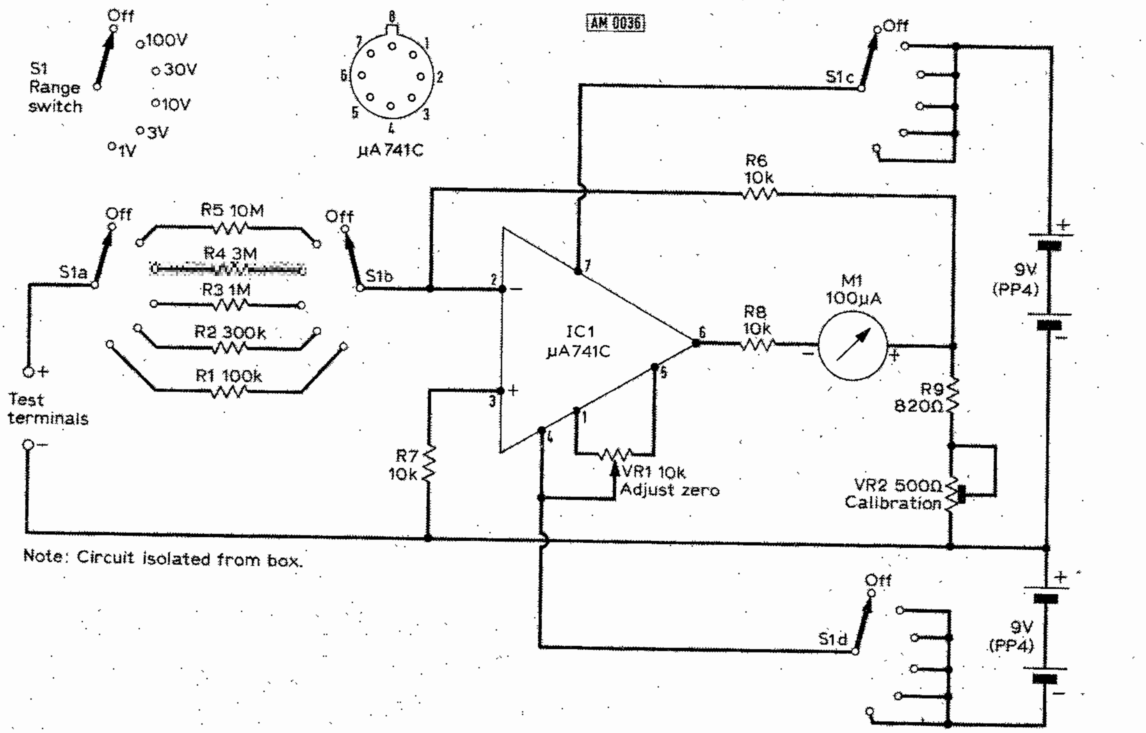
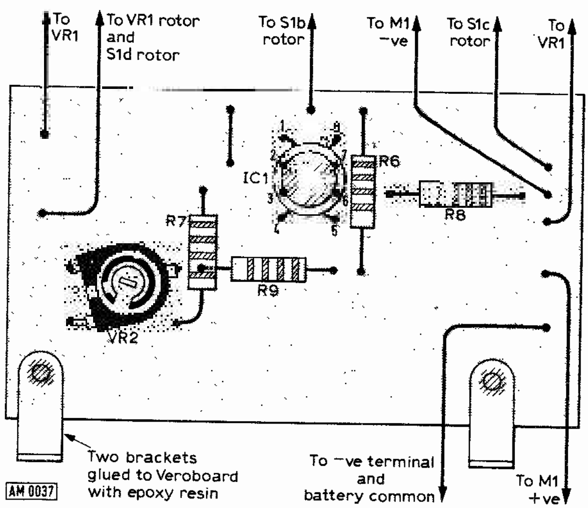


Fig. 3: Full circuit of the high sensitivity voltmeter. If difficulty is experienced in obtaining a suitable wafer switch, S1c and S1d could be replaced by a separate double pole toggle switch.

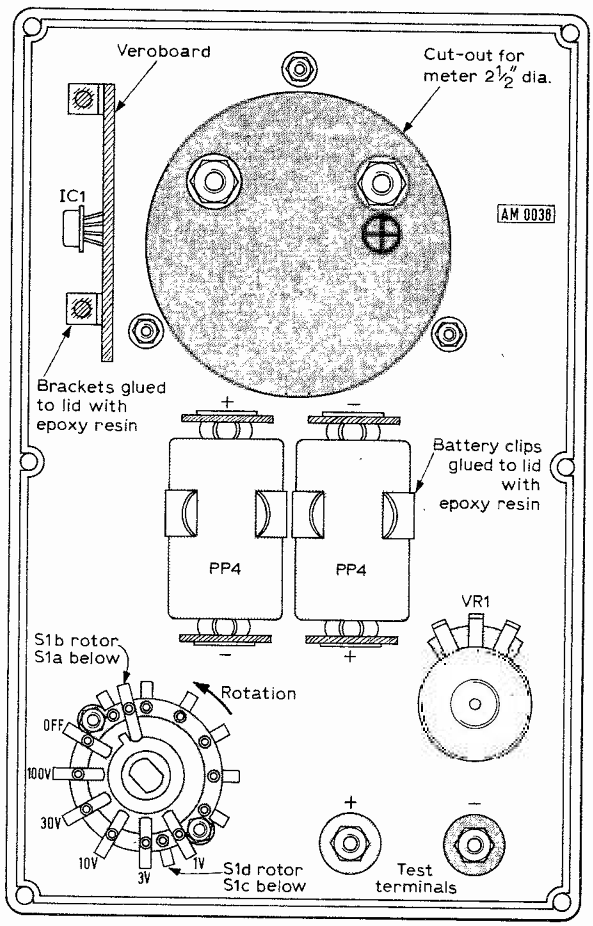


▲*Fig. 4: Layout of the small veroboard carrying the IC Supporting brackets are cemented to the box lid.*

Fig. 5: General layout of components on box lid with connections to range switch. ▶

Fig. 2 shows the basic inverting amplifier used in the meter. If we assume that the IC is perfectly matched (it would give no output if both inputs were earthed), we can prove that if R2 and R3 are not the same value the output voltage will not be zero, due to the currents being drawn through these resistors.

The IC has two terminals for offsetting small differences due to mismatch of components in the IC and the tolerance of the external resistors, as well as frequency compensating components to prevent



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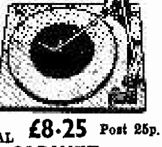

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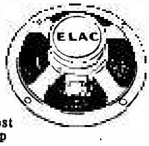

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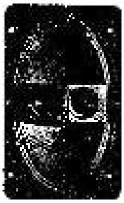

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25/25V ..	10p	8+16/450V	25p	32+32+32/350V	55p
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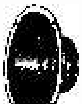

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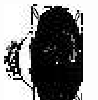

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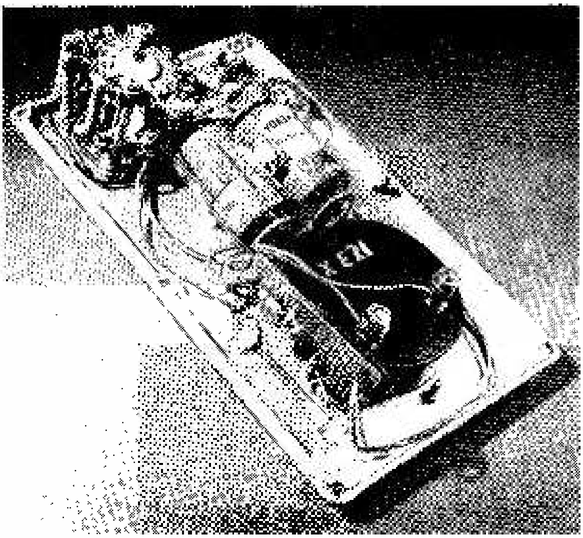
oscillation. The final circuit, Fig. 3, is very simple to construct and is an excellent project for a beginner, as well as being a very useful instrument.

CONSTRUCTION

The entire circuit is built on the lid of a 7″×4″× 2″ diecast aluminium box using the base as a cover. The switch should be assembled so that the two wafers are separated by 6BA spacers, 1″ long. The switch should only move through six positions, the "off" position being with the switch turned fully anti-clockwise, when viewed from the front panel.

The resistors R1 to R5 are mounted on the switch so that as the switch is turned clockwise the value is reduced. The remaining switch positions are connected so that when the resistors are in circuit the batteries will be connected to the board.

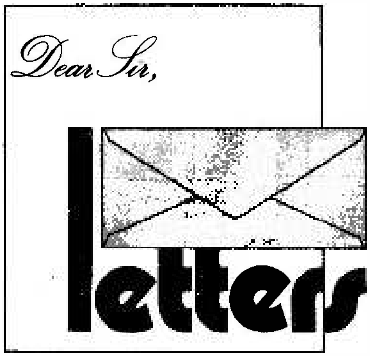
The circuit board, Fig. 4, should present no constructional problems provided that reasonable care is taken and that the copper strips which are supposed to be cut are completely severed. Fig. 5 shows the details of the switch wiring. The remaining work consists of attaching the assembled parts to the lid. The circuit board is stuck to the case, two pieces of bent metal supporting the board, the Terry battery clips being attached in the same way, after which final wiring can take place.



Photograph of completed voltmeter, which can be compared with the layout shown in Fig. 5.

CALIBRATION

The meter should now be in working order and can be switched on. By turning the offset potentiometers VR1 it should be possible to zero the meter. If the direction of rotation of the potentiometer and the movement of the needle do not coincide the wires to the ends of the potentiometer can be interchanged. The meter is calibrated by using either a known voltage source or a 1·35V mercury battery. This voltage is connected to the instrument and by rotating the present VR2 the meter can be set to the correct voltage. ■



Ideal resist

In recent months there appears to have been increasing use made of Printed circuit boards in projects published in P.W. The commonly used resist mentioned enamel paint suffers from two major disadvantages.

(1) It may take up to six hours for the paint to dry. This increases the chance of smudging and having to start all over again.

(2) It is difficult to remove the enamel while it is wet. This means that any mistakes made when painting on the resist cannot be easily corrected.

After spending many hours sweating over an artist's brush and hot copper laminate, I decided to try using women's nail varnish on the laminate. This has proved far better than enamel paint and dries within minutes. Mistakes can be corrected when dry by just scraping with a modelling knife.—**D. K. Baruth** (*Northumberland*).

Improving VHF radio

Further to my article in the April issue of PW, readers in areas of poor reception may obtain higher gain with the FET amplifier, Fig. 2, by shorting out R4 or reducing the value to 82 ohms. Experimentally, a 250 ohm pre-set potentiometer could be fitted and the optimum value found for a particular location.

Alan C. Ainslie
(Worksop, Notts.)

Power supplies

Correspondents have pointed out to me that in "Regulated Power Supplies for your Transistor Radio", *PW* June 1973, there is a minor error.

It is not, of course, true to say that the output voltage is higher than the zener voltage, it is *lower*. This hardly affects the operation of a transistor radio, which is designed to function at low voltages, as supplied by a partly exhausted battery.

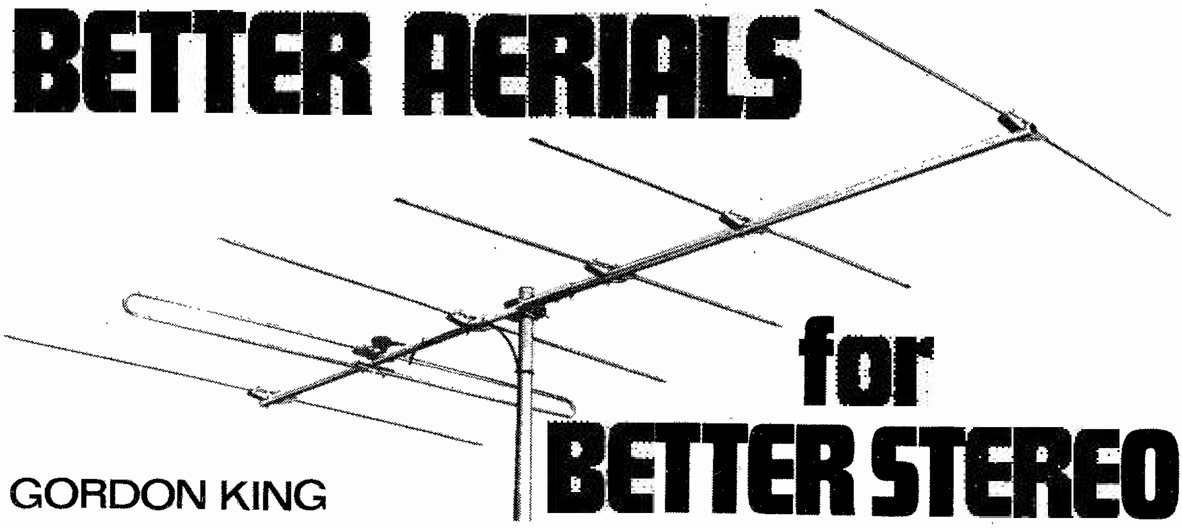
The mistake crept into the article due to my misreading a hastily written workshop note.
J. N. Watt (*Surrey*).

Play the game Lads!

Would it be possible to enlist your aid in bringing to the notice of "CQ!" Column participants that some of them are just bad-mannered opportunists.

I am no eccentric old buffer but admit to having had your magazine every month for years. My grouse relates to having, time after time, sending free copies of P.W. P.E. TV etc. to various people who do not even acknowledge receipt—let alone refund any postage. The last time this happened was in response to a "CQ!" published in the February issue. I'll not mention any names or addresses but hope the recipients' consciences will bother them.—**R. Williams** *(Gloucestershire)*.

BETTER AERIALS for BETTER STEREO



GORDON KING

PART 1

THE BBC is currently adopting a new approach with regard to the linking of studio centres to transmitters, notably for mono and stereo VHF radio programmes on the FM system of broadcasting. This is facilitating the introduction of stereo to FM transmitters which have hitherto been too remote from studio centres for equalised and balanced linking via the earlier radio and line analogue circuits.

Stereo demands high performance links capable of conveying two audio signals in isolation over hundreds of miles without quality impairment, imbalance or variation in transit time. Unless these requirements are adequately satisfied degradation of the stereo effect at the receiving points is bound to follow. On mono, of course, the requirements are significantly less critical; for a start there is only a single circuit to bother with, and phase distortion (i.e., transit time variation) on this is of minor consequence.

PULSE-CODE MODULATION

The new approach is based on translating the analogue signal (i.e., the type of signal yielded by a microphone or gramophone pickup, for example) to digital form, linking the signal in this form and translating it back to the original analogue for modulating the transmitter. The **series** of digits so produced corresponds to amplitude samples of the audio analogue. The digits are of simple zero/one form (i.e., binary) and the nature of the series (i.e., 011, 101, 111, etc.) reflects the instantaneous amplitude and polarity of the real audio signal.

In other words, the manner in which the digit series is coded is a direct function of the audio signal at that instant. It is thus a relatively simple matter to decode the pulse chain to reform the original audio analogue.

A major advantage of this scheme is that it is far less worried by noise and repeater non-linearity than direct analogue linking. Indeed, any noise on the digits or pulses can be sliced off without impairing quality of the ultimately decoded signal.

The system, which is not new—the BBC has been experimenting for ten years with digital techniques applied to audio signals, is known as pulse code modulation (pcm). A high quality pcm system requires more than a mere three digits to secure the necessary number of sampling levels. The number of levels sampled is related to the number of digits n in terms of 2^n. Thus only eight audio amplitude levels can be sampled with a three-digit binary code. The BBC uses a thirteen-digit binary code which corresponds to the sampling of 8192 levels—but the system also employs a parity 'bit' for error correction—and the sampling rate is 32kHz.

13-CHANNEL CAPACITY

The system carries thirteen high-quality audio signals in a single wideband circuit. The sending equipment is located at the London Control Room and the thirteen-channel multiplexed output is communicated by coaxial cable to the microwave system which directs the pcm signals to the transmitters. The thirteen-channel capacity provides the necessary scope for any future activities, since any one circuit can be used either as a mono channel or one of a stereo pair, and it would be possible to utilise four channels for quadraphony. Thus the future is well looked after!

It is noteworthy that the thirteen, high-quality circuits of 15kHz bandwidth and each of thirteen-digit binary code can be accommodated by any link capable of handling a single 625-line television signal. Each channel has a signal/noise ratio of 70dB (peak signal to peak weighted noise).

The pcm linking thus means that listeners will obtain improved quality signals from their FM tuners, even when the programme source is remote from the transmitter, and that transmitters which have hitherto been out of range of an equalised two-channel link of the earlier kind will be able to pick up high-quality signal pairs from the pcm system.

The six element beam aerial shown in the heading is the Antiference Ltd. "Mushkiller", type FM264.

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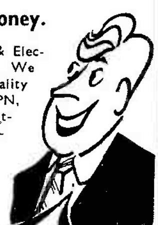

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Moreover, the capacity of the pcm system allows the transmission of more than one programme in stereo. Already a number of the main FM transmitters are radiating in stereo on several programmes and plans are in hand to extend the coverage with the least delay.

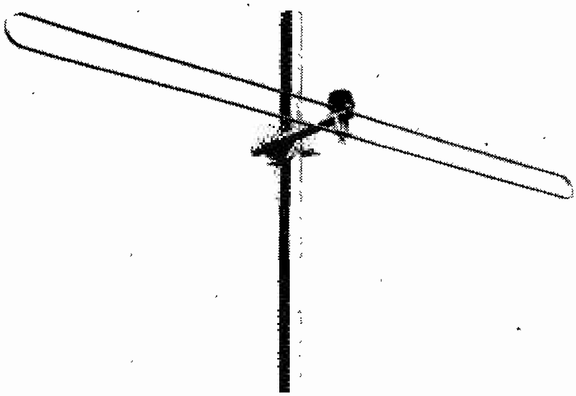
IMPORTANCE OF RECEIVING AERIAL

From the actual receiving point of view the conditions are unchanged. That is, there is no change in the transmission system. It is still FM from the transmitters and the same tuners and FM receivers will work just the same as before the introduction of pcm.

However, since stereo will be available to an increasing number of listeners the receiving aerial will assume a greater importance than for mono-only reception. The reason for this is that for a given mono signal/noise ratio threshold, the aerial input required for a similar ratio on stereo can be up to ten times that required for mono. Thus, while a tuner might require, say 50μV for a 50dB mono signal/noise, up to 500μV could be required for the same ratio on a stereo signal.

There are some hi-fi tuners significantly more sensitive than implied by this example, of course, where for an acceptable ratio about 10μV (or less) might be required on mono and 100μV (or less) on stereo, but the fact remains that whatever the tuner or receiver a greater aerial signal at the threshold signal/noise ratio is required for stereo than for mono. If a receiver or tuner is receiving just about enough aerial signal for an acceptable mono signal/noise ratio, the same station switching to stereo would almost certainly give rise to an unacceptable signal/noise ratio (obtrusive background hiss) on the same installation working in the stereo mode.

When a station goes stereo and the receiver is not equipped with a stereo decoder, the reproduction, of course, will be in mono. This results from the compatible design of the stereo system. That is, the mono information is carried by it in the usual manner, with the stereo information on a subcarrier, so a receiver devoid of a decoder responds merely to the mono information and takes no account at all of the stereo information. Since the stereo information is contained in sidebands centred on a 38kHz subcarrier frequency, the normal after-detector de-emphasis of a mono receiver or tuner eliminates or filters out this information. A 19kHz pilot tone signal is also transmitted on stereo for synchronising the stereo decoder in the receiver or tuner, and this too is rolled-off by the de-emphasis.



The J-Beam Ltd. SBM1 folded dipole is just about the simplest aerial possible, suitable only for local service areas

Thus a listener using a mono-only receiver or tuner is not aware that the station is transmitting a stereo signal. The signal/noise ratio is barely changed. There is a mild intrinsic impairment to the ratio under this condition owing to the pilot tone accommodating just under 10% of the total deviation of the system and leaving 90% (not 100%) deviation (i.e., modulation depth) for the mono components, but this is rarely detected subjectively by the average mono installation in receipt of a reasonable aerial signal.

SENSITIVITY AND S/N RATIO

A signal/noise ratio much below about 40dB is generally unacceptable by critical listeners. Indeed,

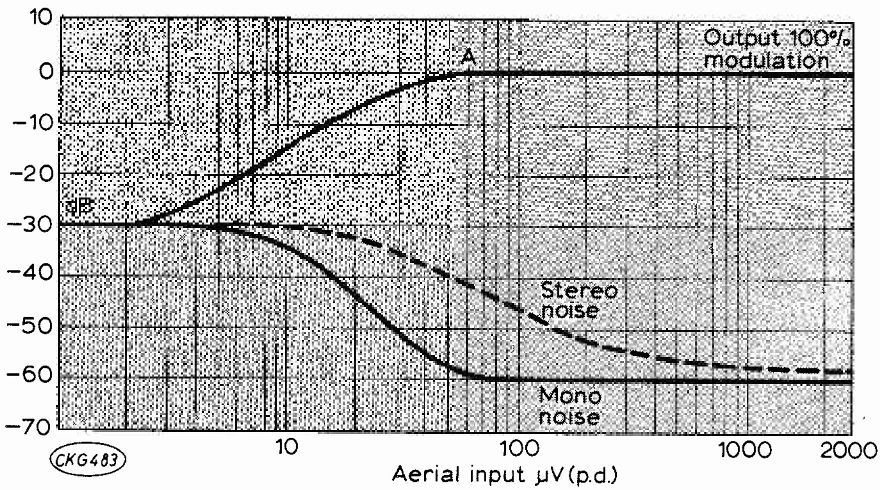


Fig. 1. Curves expressing signal/noise ratio and limiting performance.

for true hi-fi results the ratio should approach 60dB referred to 100% modulation (i.e., $\pm$75kHz deviation on the British system). The top curve in Fig. 1 shows how the audio output gradually increases with rise in aerial signal strength from the very low level. At point A on the curve, corresponding to an aerial input about 60μV, the output stabilises due to the FM limiting action of the receiver or tuner. This represents the 'limited' output and is referred to 0dB.

The noise on this signal is very low, but at aerial inputs below the limiting level shown the noise constitutes a greater proportion of total output. At zero signal input there is no real signal, of course, just noise, and in the example this corresponds to an output 30dB below the limited output.

The full-line mono noise curve shows how the noise contribution falls as the aerial signal is increased. At 30μV input, for example, the noise curve is at $-$50dB. Now, the signal/noise ratio is the dB difference between the noise and output curves, the ratio thus increasing as the signal strength increases. At 10μV input the ratio is just under 20dB, while at 20μV it is up to about 38dB. At 100μV it has maximised to about 60dB (the ultimate signal/noise ratio of the receiver or tuner), the noise then being so small as to be totally inaudible. This is on mono, but what about stereo?

S/N RATIO AND STEREO

The broken-line stereo noise curve shows this action. At 10μV input the ratio is a mere 15dB, and even at 20μV it is not much better than about 24dB. Thus noise on stereo at the input would be very troublesome though possibly acceptable on mono. At 60μV input there is almost a 20dB difference between the mono and the stereo signal/noise ratios, and on stereo the ultimate signal/noise ratio rarely reaches the mono ultimate. Nevertheless, the ratio of almost 60dB for stereo at highish aerial inputs is perfectly acceptable.

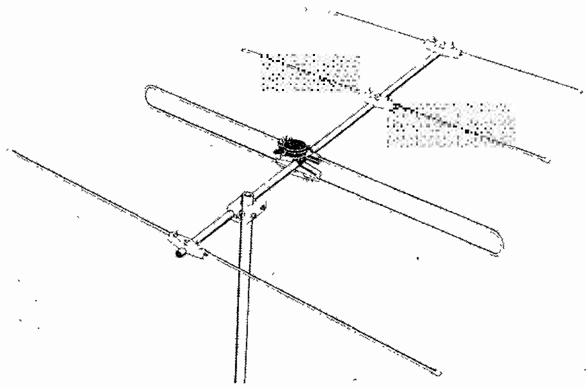
It must be stressed that these curves are not typical of any particular receiver or tuner. The overall design greatly influences the nature of the curves, and the greater the sensitivity of the receiver or tuner the lower the aerial signal required for full limiting and for an acceptable signal/noise ratio, and this applies both to mono and stereo, but with stereo always requiring more signal for a given signal/noise ratio, particularly at the low signal input end of the scale.

RECEIVER REQUIREMENTS

Clearly, then, the type of aerial required for the best stereo reception depends not only on the strength of the prevailing signal field but also on the sensitivity of the receiver or tuner. Some hi-fi tuners are capable of providing a mono signal/noise ratio of 40dB or more from an aerial input as low as 2 or 3μV and a similar stereo ratio from 20 or 30μV, with the ultimate ratio occurring at 10 or 100μV respectively. On the other hand, relatively inexpensive receivers might require up to 1mV signal (or more) for an acceptable stereo signal/noise ratio.

It is a fair indication that the aerial signal strength is insufficient should a tuner or receiver exhibit undue background noise on stereo, while producing an acceptable signal/noise ratio on mono. It is sometimes necessary to have a decoder fitted into a tuner or receiver to take advantage of the stereo signals when the 'local' FM transmitter goes over to stereo. On the other hand, the tuner or receiver may be 'stereo-ready', meaning that the stereo decoder is already incorporated. Most hi-fi tuners are of this kind.

Working with a stereo signal, a stereo tuner delivers signals in the left and right channels for application to the left and right channels of the amplifier, these two channels then feeding the stereo loudspeaker pair. A fully-fledged stereo receiver contains not only the stereo decoder but also the two amplifier channels, two loudspeakers then being required for stereo reproduction in the normal way.



The Antiference FM244 has the usual folded dipole, with two directors and one reflector element.

To glean some idea as to whether the aerial which is feeding a mono receiver is delivering sufficient signal for reasonably noise-free stereo, a 20dB attenuator can be connected in series with the aerial (coaxial plug-in types of various attenuation values can be obtained from dealers). If the mono reception is then still noise-free, it can be basically assumed that the signal will be strong enough to operate a stereo receiver or the same receiver after a decoder has been installed.

SIGNAL FIELD

The strength of the signal field locally from the nearest stereo-encoded station will depend on how far away the site is from the station and on the site elevation, while the amount of signal induced into the receiving aerial will depend on its height above ground, on the degree of local screening (by hills, large buildings, etc.), on the gain of the aerial (how many elements it possesses), on the attenuation of the downlead or feeder and on how well the aerial is orientated with respect to the station (some high-gain aerials are very directional such that almost half the signal is lost by a mere 30deg. misbeaming).

NEXT MONTH, IN PART 2, GORDON KING DISCUSSES THE NATURE OF THE TRANSMISSION PATH AND GIVES PRACTICAL INFORMATION ON AERIAL DESIGN.

HOTLINES ON RECENT DEVELOPMENTS

"PAPER" I.C. TRANSISTORS

MANY people have watched and wondered where integrated circuit technology will go next. The amount of semiconductor terminology in current useage gives some idea of the path along which i.c. development has rushed headlong.

In America, development has been quietly proceeding over the past few years with some interesting thin film technology. Yes, it had to come—the paper transistor! Devices have been successfully produced on a variety of flexible materials which include metal foils plus numerous plastic films and paper.

These days one thinks of an i.c. as being very small with the latest ones either smaller still, or the same size but with more packed in them. It is surprising, therefore, to hear of a six-inch square i.c. with some 14,000 transistors on it. Such is the state-of-the-art with these flexible circuits. It is envisaged that when this art is perfected further, some half a million transistors will be put onto the same size i.c.

THIN FILM

The interesting thing about these flexible i.c.'s is that they are not hybrids—the only production method used is that of thin film.

Thin film transistors were announced by one researcher back in 1968. The devices were f.e.t. types with insulated gates and were successfully reproduced on paper. Both p-channel and n-channel devices were made.

At this point, gate voltages around 200V were possible and power dissipation was about 0·5W. Two years later this power dissipation capability had been doubled. These flexible beasties are not fragile, either. The active devices will function happily when bent round a radius of some 0·06in. Productionwise it would appear that the flexible substrate—film, paper or whatever, is simply wound onto a spool. From here, it is fed into a deposition "processor" and is subsequently wound onto a take-up spool much the same way in which a cine film travels through a projector.

Please note: these devices are not on the market and no further information is available to date.

ACTIVE FILTERS

Although the above application may indicate a rise in fame for thin film, there are other areas where this technology could have very stiff competition. Hybrid thin film devices may find this from some miniature active bandpass filters which have just appeared. These have pre-tuned centre frequencies from 3,500Hz down to 200Hz. Gains available range from 0 to 40dB with Q factors from 2 to 50. Twist in the tail of this story is the size. These active filters are only 0·25 x 0·25 x 0·25 inch.

S.H.F. — AND HOW!

Still with components but looking at high frequencies, I note that the quest for higher and higher frequency requirements is still very much an active field in every sense of the word. The r.f. enthusiasts were elated when news of the first 1GHz devices appeared. Goodness knows what realms of ecstacy my news will bring but I have just learnt of oscillators using Impatt diodes which give some 120mW at—wait for it—140GHz. Outputs at 200GHz are expected later this year with 100mW at 170GHz already being mentioned.

8192-BITS

Charge-coupled devices are fascinating creatures. Space does not permit a discussion on how they work. However, as a point of information, one company is currently developing an 8,192-bit shift register which should cause a few hiccups in the computer hardware circles. The result could be a system which is 20–30 times faster than comparable rotating discs.

TIME IS PRECIOUS

For those who like to be in contact with electronics all the time, electronic watches are catching on fast. My own wrist watch has an accuracy (written guarantee) of an error not greater than 60 seconds in any one calendar year which, I thought, was pretty fantastic. Unbelievers might care to work out the number of seconds in 365 days and then work out the percentage error*

Omega has gone one better. This Company's latest wrist time piece has an accuracy of one second a month or 12 seconds/year. Readers will be pleased to know that these electronic watches will be available next year; and not so pleased to know that prices start from £425. Truly, time is precious.

SPIN OFFS

Very often there is a useful spin off of products for the Amateur. Some professional industrial idea has, say, consumer applications. Tape recorders may benefit further from the design and development of tape heads for data applications. An example is the latest tape heads on the data market which are 0·4mil flying lead types. In practical terms this means a recording density on the record discs of 1,500 tracks per inch. A 600 tracks/inch density can allow storage of something like 60 million bits of information. If this ever spreads to tape recorders, then the cassette tape you get with your new recorder will last you for life. How you would locate a particular item on such a tape is quite another matter.

RED CURRENTS?

Radio waves are attenuated by a variety of things. Often the terrain over which they pass is an important factor although the frequency involved is a major consideration. Workers in Russia have been looking into the effects of forests on medium and long wave radio transmissions. The findings are as follows. A tree with a circulating sap was found to be a good current conductor (no, not a Red current bush). Thus an electric current is induced in the tree when it "interacts" with radio waves. The induced current creates an electrical field, albeit a small one, which is radiated into space and thus dissipated. Doubtless we will now have some ingenious Amateurs using centre-fed sycamores or root-loaded rowans.

* *Sixty parts in thirty one million, five hundred and thirty six thousand.*

Ginsberg

IN NEXT MONTH'S PRACTICAL WIRELESS

OCTOBER ISSUE No.800

ON SALE SEPTEMBER 7th

QUADRAPHONIC SOUND SYSTEM

PW Q4 PROJECT

*****

NOW YOU CAN HAVE QUADRAPHONIC SOUND AT LOW COST.

FOLLOW PW PROJECT Q4 FOR THE FIRST FULLY COMPREHENSIVE DO-IT-YOURSELF QUAD DECODING SOUND SYSTEM TO BE PUBLISHED WITH FULL CONSTRUCTIONAL DETAILS.

Part 1 in the October issue gets you started with "GOING QUADRAPHONIC", a broad outline of the various quad systems that are incorporated in the project. It gives you an understanding of the different principles involved so that you can choose the systems you need. Parts 2 and 3 present the exclusive PW practical design in detail. You can make up one, two or more of the systems as you like but the complete Q4 quad unit shown here is designed to give you decoding for all of them: CD-4 Victor-RCA discrete system. RM Regular matrix surround sound. QS Sansui system. SQ CBS system.

You can use this system with your own choice of amplifier. It will convert two-channel stereo to any four-channel quad system, so you can use it to play any quad or stereo recordings, as well as being ready for any of the quad broadcasting systems that may be adopted.

PLUS EXPERIMENTAL WORKSHOP

First of a new series offering a new approach to learning how circuits operate by making up simple working projects and experimenting with the components. Soldering is not necessary so components can be used repeatedly. This series is recommended for group and class instruction support in schools, colleges and training centres.

DON'T MISS ANY ISSUE OF PRACTICAL WIRELESS

FREE INSIDE

PRACTICAL WIRELESS DATACARD SYSTEM 1973 1 2

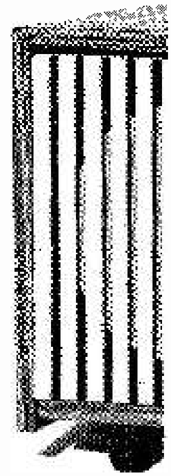
Don't miss out on this new exclusive scheme for readers of Practical Wireless. PW Datacards are designed attractively and clearly to give you at-a-glance technical information that you will be constantly referring to. They are printed in full colour so that you can identify each card easily. Collect the whole series for your workshop. PW Datacards will fit into the average jacket pocket, stand on the work bench, hang on the wall, or can be used as a place mat, or even a bookmark. The series will be presented in pairs in the October, November and December issues as follows:—

October issue	1. Standard Resistor values and colour code.
	2. Common Capacitor values and colour code.
November issue	3. DIN Plugs and Sockets. 4. Using decibels.
December issue	5. Combined resistance or capacitance calculator.
	6. D.C. Circuits and electrical relationships.

Don't miss the first pair in next month's issue. No other radio or electronics magazine has given such a comparable free service to its readers.

ZN414 Simple Two I.C.

PW POP STAR



F. G. RAYER

THIS is a neat portable table receiver covering medium waves and 200kHz on long waves and capable of a substantial loudspeaker output. It has an attractive but quite easily made case. Operation is from a 9V battery.

Fig. 1 is the circuit, using the ZN414 10 transistor network in the r.f. section, and SL403D as audio amplifier. The latter incorporates 16 transistors and 4 diodes. The following details will help clarify working of various parts of the receiver.

Tuning

A ready made Litz wound ferrite rod is used, and this will be found to have greater efficiency than a home made winding of ordinary enamel or cotton covered wire. For maximum efficiency the tuning capacitor VC1 is air-dieletric. The small Jackson 208/176pF type of capacitor, extensively used for aerial and oscillator tuning in superhets, is easily obtainable, and is fitted. As L1 is designed for a 208 pF capacitor, this provides correct band coverage, with the added advantage that an attractive ready-calibrated transparent dial is available for tuning.

C1 is fitted to limit h.f. coverage to about 1600kHz, the MW band being approximately 1600-550kHz. For reception of the BBC on 200kHz, S1 is closed. This places TC1 and C2 across L1, and the full swing of VC1 then covers about 195-250kHz. For full LW coverage it would be necessary to have a LW winding on the ferrite rod instead.

RF Section

The ZN414 radio receiver silicon network requires a reasonably stable supply in the 1·1 to 1·8V range. and this is obtained by the potential divider R3 and R4. It was found that best results were obtained with a supply of about 1·4V here.

The best possible supply voltage may depend somewhat on the exact layout of wiring, and in the receiver shown two Veropins were inserted so that R4 could easily be changed. This is scarcely necessary, but the importance of the voltage present here should not be overlooked. It must not exceed 1·8V (this can be checked by clipping a high resistance voltmeter across R3). If it is rather high (in the 1·6 to 1·7V range) instability is likely, and is shown by whistles accompanying the tuning-in of weak signals, though the whistles may disappear with strong transmissions. On the other hand, if the supply is rather low (1·1 to 1·2V or so) receiver sensitivity falls off considerably.

It is thus recommended that the values given are fitted, and R4 only need be change if instability, or very low sensitivity, is apparent when the receiver

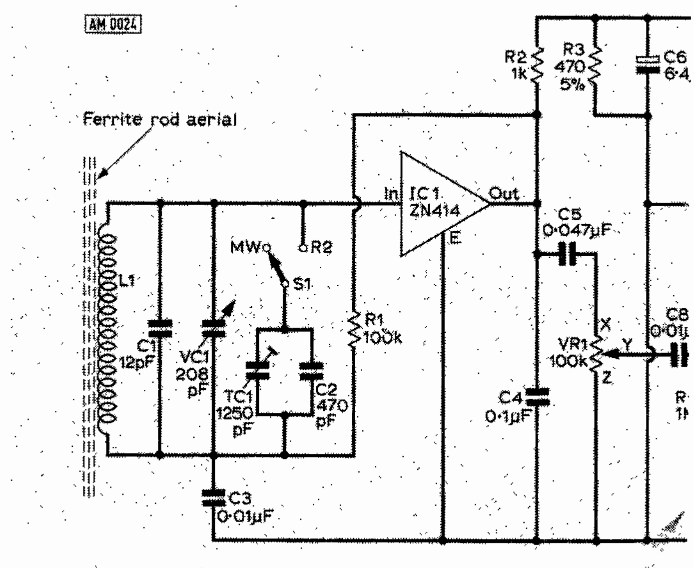


Fig. 1: Circuit of the

1·6 to 1·7V range) instability is likely, and is shown by whistles accompanying the tuning-in of weak signals, though the whistles may disappear with strong transmissions. On the other hand, if the supply is rather low (1·1 to 1·2V or so) receiver sensitivity falls off considerably.

It is thus recommended that the values given are fitted, and R4 only need be change if instability, or very low sensitivity, is apparent when the receiver is tested.

R2 is of somewhat higher value than recommended by the manufacturers, but was found best in this circuit. If experiments are afterwards made to secure the best possible results, the effect of reducing R2 to 680, 560 or 470 ohms can be tried.

Audio output is taken from C5 to the volume control, VR1. This control incorporates the on-off switch S2 in the usual way.

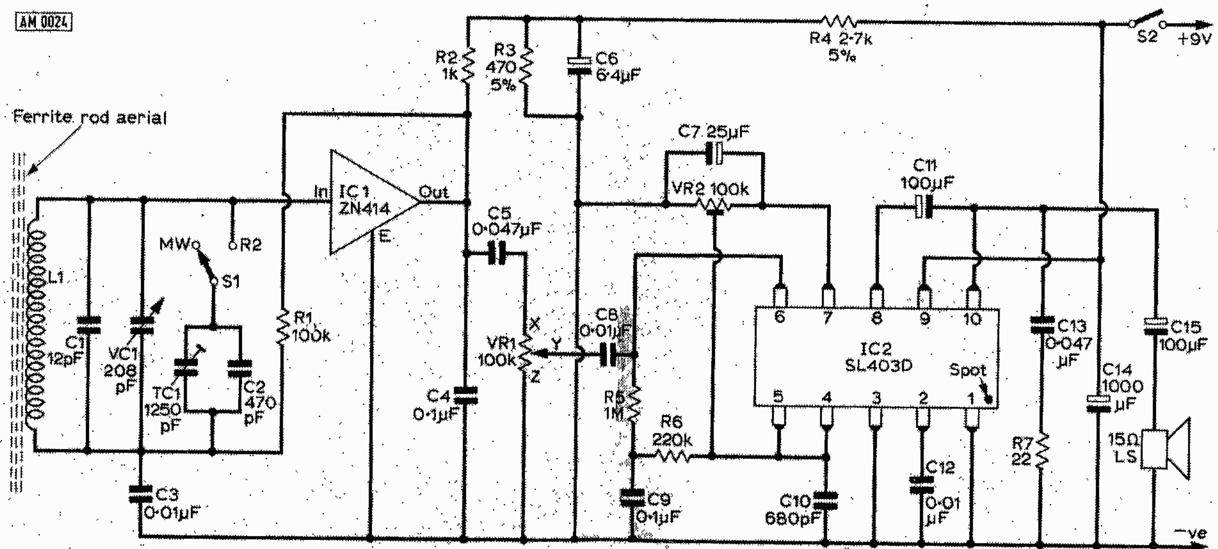
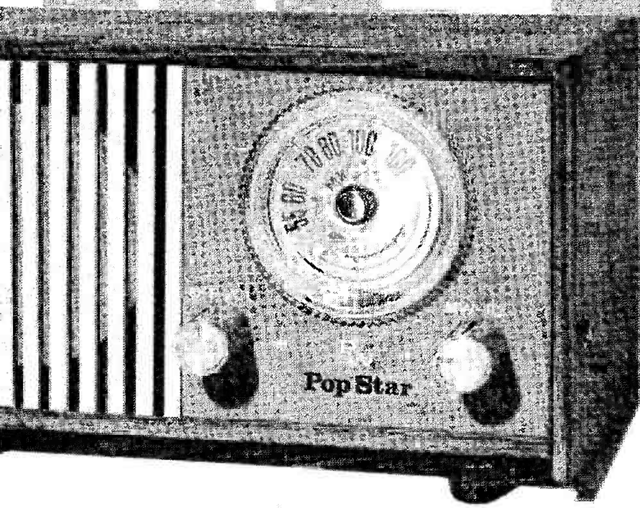


Fig. 1: Circuit of the PW POP STAR receiver.

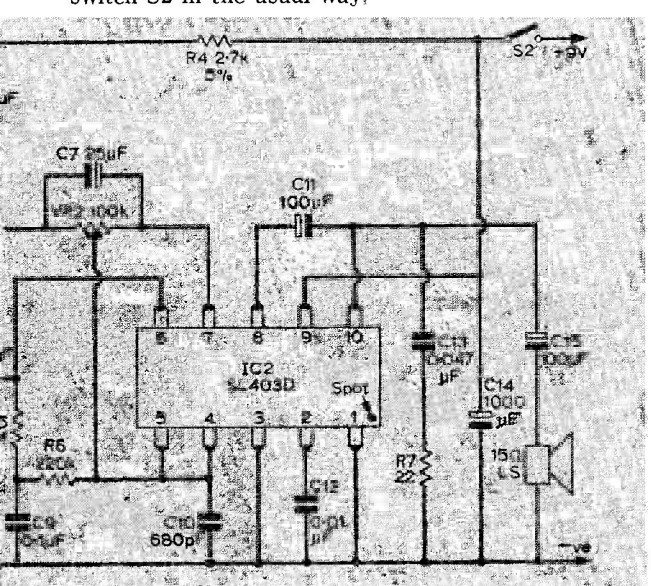
SL403D Two Band Radio



is tested.

R2 is of somewhat higher value than recommended by the manufacturers, but was found best in this circuit. If experiments are afterwards made to secure the best possible results, the effect of reducing R2 to 680, 560 or 470 ohms can be tried.

Audio output is taken from C5 to the volume control, VR1. This control incorporates the on-off switch S2 in the usual way.



PW POP STAR receiver.

★ components list

Resistors

R1	100kΩ	All $\frac{1}{4}$w 5%
R2	1kΩ	
R3	470Ω	
R4	2·7kΩ	
R5	1MΩ	
R6	220kΩ	
R7	22Ω	
VR1	100kΩ log pot with switch	
VR2	Miniature 100kΩ pre-set pot	

Capacitors

C1	12pF	C9	0·1µF
C2	470pF	C10	680pF
C3	0·01µF	C11	100µF, 10V
C4	0·1µF	C12	0·01µF
C5	0·047µF	C13	0·047µF
C6	6·4µF, 6·4V	C14	1000µF, 10V
C7	25µF, 10V	C15	100µF, 10V
C8	0·01µF		

Miscellaneous

VC1 Jackson 00, 208/176pF
TC1 1250pF compression type
L1 Denco FR5, medium wave ferrite rod
Transparent medium wave $2\frac{1}{2}$in. dial (Home Radio)
IC1 ZN414
IC2 SL403D
15Ω $3\frac{1}{2}$in. square speaker
Veroboard, Veropins
1-pole 2-way rotary switch
Two knobs
Case:
6mm. plywood: Top 8 x $4\frac{3}{8}$in.
Bottom 8 x $4\frac{3}{8}$in.
2 off $4\frac{3}{8}$ x $4\frac{3}{4}$in.
Back 8 x $3\frac{7}{8}$in.
Hardboard 8 x 4in. $\frac{1}{8}$in. thick
Panel: Universal chassis flanged member 8 x 4in.

Audio Section

To assist wiring, pins for the SL403D are shown in their actual positions in Fig. 1. Pin 6 is the pre-amplifier input, from the volume control VR1. This employs cascaded emitter followers and a common emitter stage. Output is at pin 5, which is directly connected to the main amplifier input at tag 4.

VR2 is a miniature pre-set potentiometer, provided to trim the bias operating point, and it requires no further adjustment, when once set.

The main amplifier has 13 transistors, with cascaded emitter followers between stages. Although up to 18V may be applied to the SL403D, the circuit here is intended for a 9V battery. Output is approximately just under 1 watt with a 9V supply, using a 7·5 ohm speaker. The speaker impedance actually selected is 15 ohms, this allowing approximately 400mW with the 9V supply, with additional current economy. This power output is considered easily adequate for a receiver of this kind.

C10 is a by-pass for the main amplifier input, and R7/C13 are for h.f. compensation, and should not be omitted.

Components

R3 and R4 are shown as 5 per cent, for the reason explained. This tolerance is so generally available that it can be used throughout. There is actually no reason why 10 per cent resistors should not be fitted, provided the voltage across R3 is checked as mentioned.

For the 9V supply, all capacitors could be of 10V rating. In numerous circuit positions a lower rating could be fitted. However, there seems little point selecting the lowest possible voltage ratings, as the usual small capacitors of up to 150V rating are of course perfectly suitable.

Circuit Board

This is 0·15in. matrix plain Veroboard approximately 5 x $1\frac{7}{8}$in., see Fig. 2. Brackets are bolted at holes D-D to support the ferrite rod. Holes B-B are to secure the finished board to the bottom of the receiver.

The a.f. amplifier is bolted with the spot (near pin 1) located as shown. Connecting wires then pass down through convenient holes in the board.

Wiring underneath is shown in Fig. 3. Insert a few components at a time as in Fig. 2, turn the board over, and solder as in Fig. 3, cutting the wire ends of components down as required. Insulated sleeving should be put on any leads which may touch other connections.

Veropins are inserted for external connections to L1, the loudspeaker, and battery circuits. The three thin flexible leads X, Y and Z are for connection to VR1.

Leads from the ZN414 are shown in Fig. 3. Position these so that lead E comes between the other wires, when they are in line as in Fig. 2. Stray feedback from output to input circuits may easily cause instability, so the lead is taken directly to C4, which in turn goes directly to the earth or negative line. The usual care to avoid lengthy heating is taken when soldering the two semiconductor devices.

Ferrite Aerial

The usual superhet type aerial has a small coupling winding, provided for base coupling to the mixer. This is not required here and is removed.

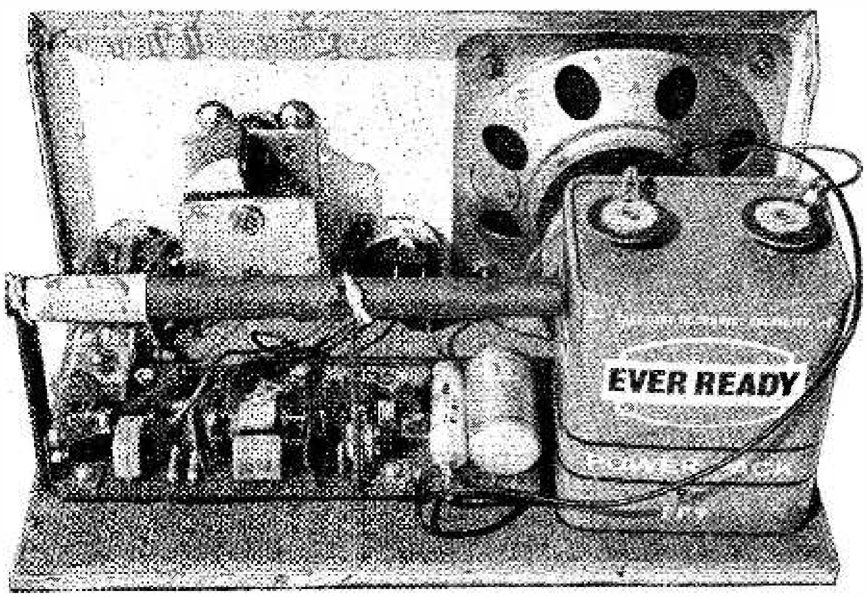
Two pieces of $\frac{1}{16}$in. thick paxolin or similar material are cut, about $\frac{1}{2}$in. wide and 2in. long. A "V" is cut in the top of each, a small hole being drilled just below this.

Small brackets are bolted to the strips, and secured in the holes D-D, Fig. 2. The rod, with winding, is then secured with string around it and through the holes in the paxolin strips. The ends of L1 are soldered to the pins provided on the board.

Front Panel

This is a 8 x 4in. flanged universal chassis side. An aperture is cut to match the speaker cone—this is most easily done with an adjustable tank or washer cutter. Also position holes for VR1 and S1, as in Fig. 4, and 1in. from the bottom edge.

VC1 has to be set back as in Fig. 4, to allow the



Photograph showing the inside of the completed receiver.

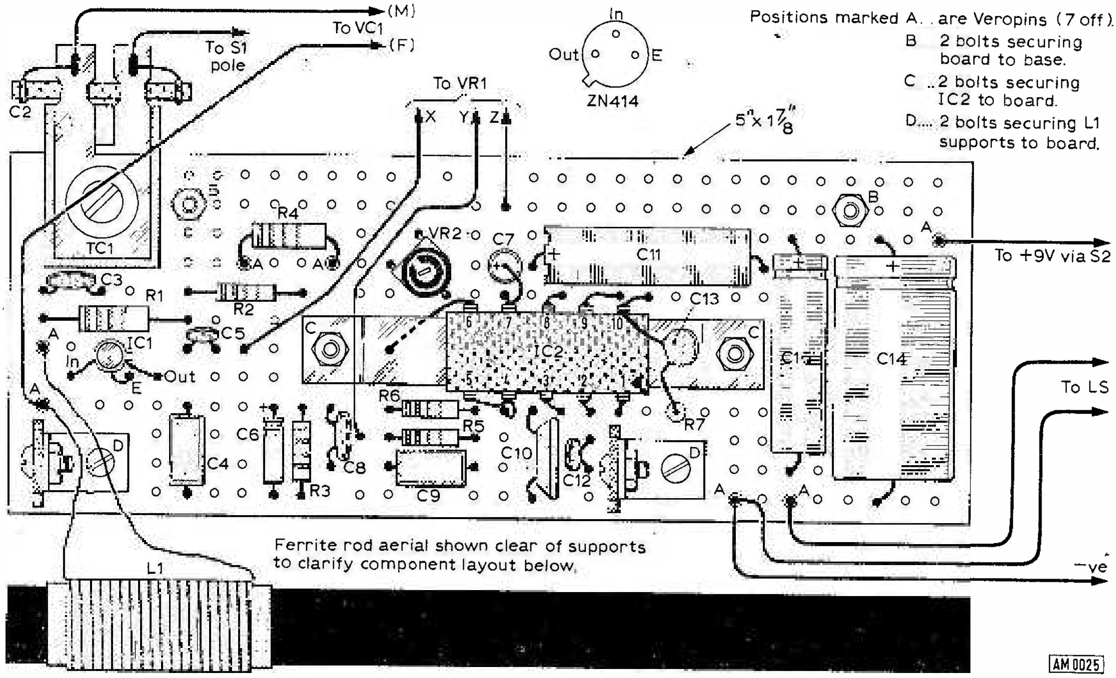


Fig. 2: Component layout on the Veroboard chassis.

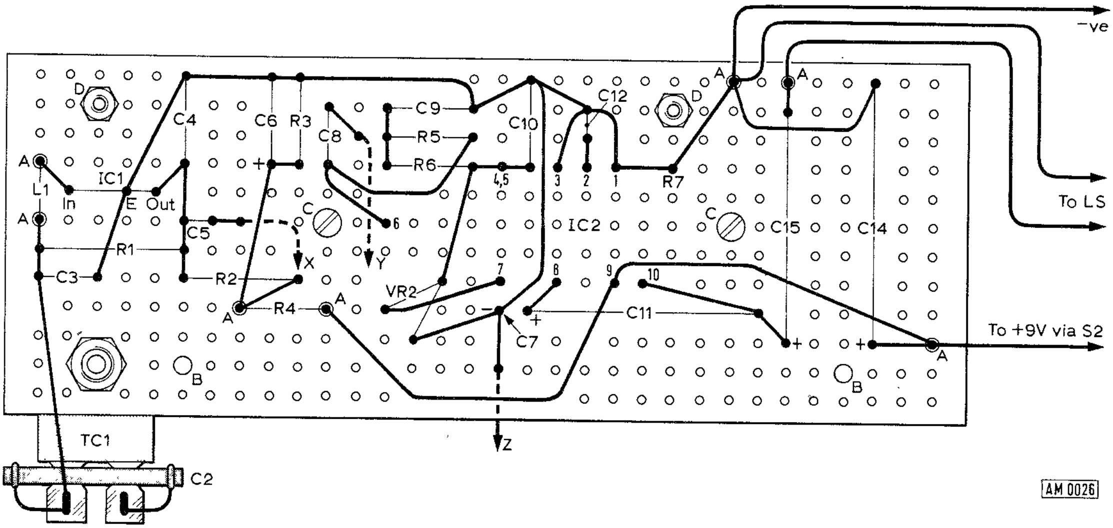


Fig. 3: Underside wiring. Insulated sleeving should be used where necessary.

transparent dial to be fitted, and the frame of VC1 must also be insulated from the aluminium panel. The spindle is $1\frac{1}{2}$in. from the top.

Three $\frac{3}{4}$in. 4BA bolts were used to secure the capacitor. A piece of paper with a hole for the spindle is pushed on to the front of the capacitor, so that the location of the fixing holes can be marked. This paper is then placed on the front and drilling positions are marked with a sharp tool. The central hole is $\frac{1}{2}$in. diameter and the three fixing holes are $\frac{1}{4}$in.

An insulated bush and washer is placed on each bolt, followed by a plain washer, and two nuts. The bolts pass into the threaded holes of the capacitor, and are adjusted so that it is square with the panel. The nuts are then locked against the frame, and front washers.

An alternative is to drill two pieces of thin paxolin, about $1\frac{1}{2}$ x 1in., to match the capacitor fixing holes. One piece can then be used each side the metal panel. Contact between the bolts and metal can be avoided by carefully locating the bolts before tightening the nuts, or by placing thin insulating washers on them, or using extremely short pieces of insulated sleeving.

The dial is a tight push fit on the spindle, and has a metal clip. A check should be made that this can be fitted. If not, the end of the capacitor spindle will have to be filed slightly, to produce a taper to get the push fit started. If necessary, the centre hole of the dial can be enlarged slightly with a ¼in. drill, using very light pressure indeed.

If an ordinary knob or dial is used instead, the capacitor should be insulated from the panel, but with its spindle projecting.

A piece of ⅛in. hardboard 8 x 4in. is fixed to the inside of the lower flange with 6BA bolts. The circuit board can then be fixed as in Fig. 4, using screws or bolts with extra nuts or spacers to give a little clearance to underside wiring.

Connections are then completed as in Fig. 4. Note that the metal panel is earthed to the negative line by the lead Z, from VR1. This was found necessary.

Adjustments

These are very few, as there is no alignment in the manner required with a superhet.

Band coverage is adjusted by the position of the winding on the ferrite rod. This can be placed nearly at one end. Or the dial can be set at 550kHz, with VC1 closed, and the winding moved along the rod to tune to this frequency.

VC1 is then set half open, S1 is closed, and TC1 is rotated to tune in the BBC on 200kHz. When this is done, VC1 merely acts as a fine tuner for this frequency. The position of L1 on the rod has considerable effect on the setting of TC1. Should TC1 be fully open without 200kHz being reached, L1 must be moved a little towards the end of the rod. On the other hand, if TC1 is fully compressed without 200kHz being reached, L1 must be pushed a little further on the rod. As there is considerable adjustment, and L1 is of suitable inductance, no difficulty should arise here.

VR2 has to be rotated with a small screwdriver, for best audio results. If VR2 is too far one way, reproduction is very distorted indeed. Moving VR2 too far the other way will cause a considerable increase in battery current, as shown by a meter in one battery lead. With normal adjustment, which is not at all critical, current should be about 20mA with low volume, peaking up to 40mA or more with considerable volume. If wrong adjustment of VR2 causes an extremely heavy current, this may persist. If so, momentarily break one battery connection (or switch off). This effect arises from the automatic s.c.r. protection integral in the module, and does not cause damage.

Finish

A piece of self-adhesive material, as used for shelves etc., and about 4½×5in., is placed on the control side of the front. It is better to cut this to clear the bushes before stripping the backing paper.

A piece of silk material about 4 x 5in. is stretched over the speaker, which is secured with countersunk bolts. This material is held at the edges only with Bostik 1 or similar adhesive. A vertical strip about ⅜in. wide and 4in. long covers the joint. This can be wood, metal, plastic, or as sold for shelf edgings etc.

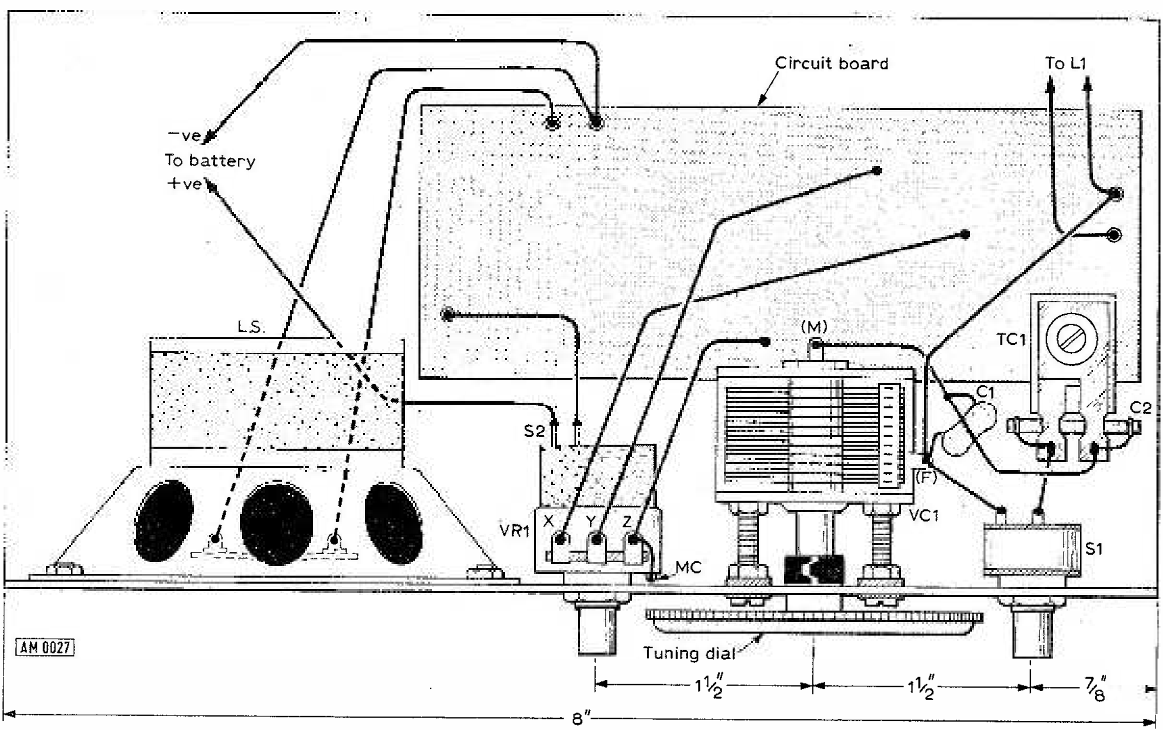
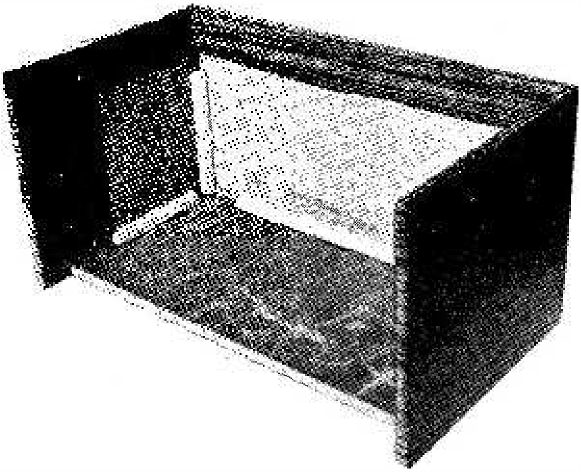


Fig. 4: Above chassis wiring and layout of panel components.



Photograph of the PW POP STAR cabinet. In this photograph the cabinet back is shown face downwards.

In some parts of the country there may be no point in providing 200kHz coverage. If so, TC1, C2 and S1 may be omitted.

Case Construction

This is made just to clear the receiver (see photograph) so really needs to be very slightly outside on the 8in. dimension to avoid a tight fit. The pieces were secured together by spreading adhesive on the meeting surfaces, and securing them with a few panel pins. Some ¼ x ¼in. strips were also cemented inside to strengthen the joints. When the adhesive is hard, the outside is glasspapered. Dust is blown or wiped away (this is essential) and the outside is covered with a wood-grained self-adhesive material.

The case fits over the receiver, and is held by two self-tapping screws, with washers under their heads, which run into the end flanges of the metal front.

At the bottom, strips about 1in. wide and 8in. long were fixed at the front and back, the front strip being covered with the wood-grained material first. Rubber feet at the front raise this a little.

An alternative is to make the case complete with bottom and back the full depth, so that the whole receiver can be slid in from the front. ■

CQ!CQ!CQ!CQ!

INFORMATION WANTED

...good cond. DX Data Chart (P.W. March 72 issue).—R. A. Haigh, 6 Park Road, Allington, Nr. Grantham, Lincs.

...buy or borrow March-May 1970 Sound Effects Synthesiser by Judd or any information on building synthe sisers.—R. J. Lewis, Wynnstay Hotel, Church Street, Oswestry Shropshire.

...circuit diagram or any information on "Murphy Lowband Mobile Unit". Loan or purchase.—R. McCormack, 44 Mountainview Park, Belfast 14.

...does any reader have any modification details for modifying the receiver drawer type 62E AP 67907.—R. S. Jarydon, 5 Princes Park Close, Hayes, Middlesex.

...Jason AG 10 audio signal generator. Borrow or purchase constructional plans. Expenses met.—G. E. Davies, 41 Dormington Drive, Tupsley, Hereford.

...coil data & circuit of "Simplex" T.V. receiver.—J. Bubez, 16 Penn Crescent, Haywards Heath, Sussex, RH16 3HN.

...a diagram of the R1155A of P. W. July, 1946.—J. Cerny, Turynskeho C80, Libochovice N/ohri, Czechoslovakia.

...any information on making a Cossor Oscilloscope type Mod. Ser. 1039, 10119, Mk.2 work.—Dr. M. T. Cooper, 608 Shelburne, Nova Scotia, Canada.

...power supply unit 8898 for Marconi Receiver CR300.—B. Rodriguez Oakleigh, Forest Road, Wokingham, Berks, Tele:—Bracknell 29680.

...a circuit diagram of a Truvoice Twin Selector Tone Amplifier, No. TC1566. —J. Challenge, 84 Stopford Road, Plaistow, London, E13 OLZ.

...technical details of, or the actual coil for the Mini Four, appearing in the March and April issues of P.W. for 1952. I have all the components except the coil type CT9 which was originally made by Stern Radio.—J. Cull, Sunnyside, 10 Ashdene Road, Southampton, Hants.

...an e.h.t. transformer rewound please? It is for an E.M.I. type WM2 oscilloscope.—D. Martin, The Bungalow, Marton, Near Rugby, Warwicks.

...operating instructions for Model RK3 tape recorder made by Robuk Electrical Industries Limited.—H. Edmonds, 4 Mount Pleasant, Ayr Lane, St. Ives, Cornwall.

...service sheets/handbooks for: Grampus Blue Peter superhet 40/100c/s 5V Pilot radio combined with Garrard RC110 16W record player and Westminster radiogram (ex-Belcher Electronics Services Ltd.) type WBST obtained from Curry's.—H. W. Clarke, 65 Beccles Road, Oulton Broad, Lowestoft, Suffolk.

...the address of a company which will mend loudspeaker cones.—R. V. Jenkin, Berry Cottage, Berry Lane, Bodmin, Cornwall.

...circuit for a 6-transistor pocket radio on a printed circuit board by Osmor. It was published in P.W. about 10 years ago and the case measures about 6 x 4in.—R. Harris, 8 Marine Parade, Penarth, Glamorgan.

...a copy of the DX Data Chart supplied the March issue of P.W.—K. Law, 17 Quickside Hill, Saffron Waldon, Essex.

...a service sheet or circuit diagram for my Philips EL3549 tape recorder —S. A. Fryatt, 20 Talbot Road, Accrington, Lancs.

...borrow instruction handbook for Cossor Oscilloscope No. 1039M.—J. Noreley, 16 Surrey Street, Latchford, Warrington, Lancs. WA4 IHE.

...loan copy or purchase of Practical Wireless April 1960 to copy modifications to the W.S.No. 19. or any other issues with extensive modification to this set (e.g. March 1966).—D. Collings c/o Glossop School, Glossop SK13, Derbyshire.

...circuit, valve equivs. & mods., etc. for ex-service crystal calibrator No. 10 with class "b" standard overhaul.—L. McGee. 6 Ripon Road, Newton Hall, Durham, Co. Durham.

...any gen on Elpico AC/54 valve amplifier at least 12 years old. Loan or buy if price reasonable.—C. White 38 Kittoe Road, Sutton Coldfield, Warks.

..circuit diagram and information on surplus oscilloscope 10SB/105, 'Buy or Borrow'.—E. P. Tozer, 21 Pen-yr-heol Dr., Sketty, Swansea, SA2 9J9.

...circuit diagram and instructions for No. "19" set aerial variometer. Wish to loan —P. Herber, 23 Church Road, Horley, Surrey.

...a service sheet for Practical Wireless Autocrat Set.—T. C. Vaughan, 13 Old Croft Road, Walton, Stafford.

EQUIPMENT REQUIRED

...wanted for new S.W.L., a Codar CR70A in good working order. Will pay around £10.—L. Paget, 50 Western Road, Kilmarnock, Ayrshire, KA3 ILB.

...correspond and exchange or buy any technical data with someone in U.K.—V. Jeevaratnam, 33 Main Street, Ettampitiya, Ceylon.

...wanted October P.W. 1971.—P. Smith, 68 Gatesden Road, Fetcham, Leatherhead, Surrey.

...two Electroniques i.f. transformers type D.F./85 series 11 plus electroniques Q-Multiplier coil type QLZ. please state price.—S. J. Dickey, 17 Maley Avenue, West Norwood, S.E.27.

...XG8 Novice G8 requires Pye "Cambridge" or similar rig to cut teeth on. Will collect in North East and Yorkshire.—J. McGee, 6 Ripon Road, Newton Hall, Durham, Co. Durham.

...a case for an Ultra Road Ranger Transistor portable model 6116 serial 25167.—R. Williams, 204 Dysart Road, Grantham, Lincs.

..a cheap X79 valve.—S. Taylor, 39 Openshaw Road, Abbey Wood, London, SE2 OTD.

...a cossor 2XP valve. I have tried equivalents but they all have a lower stage gain.—D. R. Goodwin, 3 Hamble House, Gardens, Hamble, Hampshire.

...Layfayette HA 600A required operating instructions circuit diagram alignment information.—B. Thomas, 8 Whitehall Road, Barton le Clay, Bedford.

...plastic tuning scale (black) for Pye valve car radio, Type No. 145311.—M. Stanley 9 Orminston Gardens, Belfats BT5 6JD.

...Rhythm type 3 speed morse record with books wanted. Reasonable price.—A. Forster, 14 Mandels Court, Norwich 12J.

...Coils wanted. Can anybody help me find two off, F243 formers, for transmitter coils. If you can sell me one (or two), please ring me at 01-598 5113.—G. L. Manning 63 The Drive, Edgware, Middlesex. HA8 8PS.

...RCA AR88D good condition, table or rack mounting.—N. Thompson, 5 Beechcroft, Ashtead, Surrey.

.. Chassis of a Murphy type U698. I require the Osc. coil for L.W. & M.W.—A. S. Holmwood 8 Dock Street, Pembroke Dock, Pembs.

ISSUES WANTED

...issues of P.W. Containing the Three Transistor Amplifier. Take Twenty Project or circuit....W. L. Brunsdon, 28 Meadfoot Road, Wallasey, Cheshire.

...issues of P.W. from Nov. 71—Mar 72 inclusive—C. Wright, 78 Swallow Road, Ipswich, Suffolk, IP2 0T3.

...February 1968 issue of Practical Wireless—T. T. Griffiths, 11 Berryfields Long Buckley, Nr. Rugby.

...January 1971 issue required giving details of the stereo tape recorder amplifier—A. Harbor, 204A High St., Brentford, Middlesex.

...P.W. May, June, 1972—C. S. Hyatt, Beech House, Beechway, Guildford, Surrey.

...P.T. February 1969, which had a Servicing Television Receivers No. 155. Defiant 9A61 U Series (Part 1) in it.—H. McBeath, 57 Castle Hill Road, Bearsden, G61 4DZ

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GOING BACK...

1970 60 50 40 30 20

COLIN RICHES
ARTHUR DOW

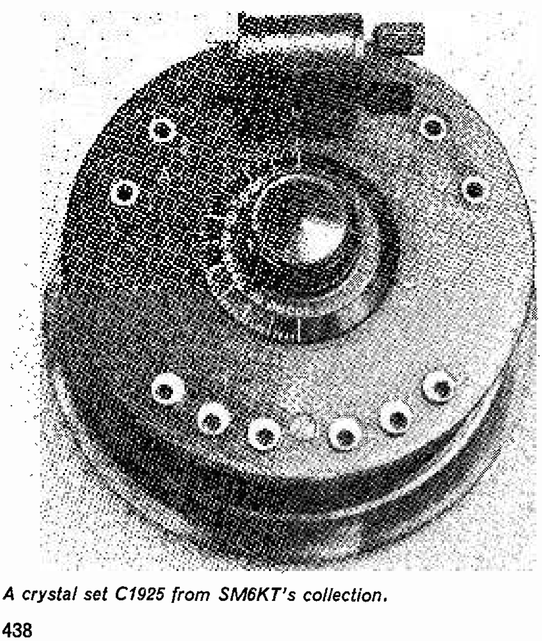
WHILE visiting Sweden recently, Colin Riches called on one of our Going Back readers—Gunnar Carlström, SM6KT who has a fine collection of Vintage radio equipment.

He told how, when broadcasting started in Sweden about 1925 he was a boy of twelve and became very interested in the new wonder of radio. His financial situation did not permit him to buy much equipment but he managed to build one or two crystal sets then progress to valved receivers. A simple receiver of that time consisted of a one-valve detector. Headphones would have to be used as there was not enough power to drive a speaker.

In some more advanced receivers Gunnar built, one or two valves were used as r.f. amplifiers with tuned circuits. After the detector, one or two stages of audio amplification were used.

A very common type of receiver used in Sweden in the early '20s was equipped with one valve as detector and two others for amplification. This set-up gave good volume over a loudspeaker when tuned to the local station and British and European stations could be picked up but at vastly reduced volume.

Feedback was frequently used in order to increase the amplification and selectivity of Gunnar's receivers. When he tried using it in some of his home-built sets which had no r.f. amplifier stages it often brought irate neighbours rushing in complaining of oscillations on their receivers!



A crystal set C1925 from SM6KT's collection.

In those days, the high tension batteries were very expensive and if a 90V supply was required, Gunnar said that poor boys like he had to wire a lot of torch batteries in series so that they could get the required voltage. Accumulators were used for the 4V supply.

Around 1930, receivers working from the mains supply were made available in Sweden and Gunnar told how he remembered his first experiment to build a unit so that he could work his battery receivers from the mains. The great difficulty was to eliminate the hum because only low capacity paper condensers were available at the time.

Gunnar explained that the experimenting of those earlier years really inspired him and made radio his hobby for life. In 1938 he gained his licence to transmit with the callsign SM6KT.

He has found the rapid development of radio very fascinating and he has realised that so many of the old pieces of equipment are very well worth saving.

Some items in his collection of Vintage gear have been in his possession for 40 years but most of the others have been collected quite recently. Gunnar explained how he took great delight in completely restoring old sets to their former glory.

A particular interest of Gunnar's is his collection of old valves. He describes them as his "Aladdin Lamps", and says that it was really them that made radio possible but now their rôle in ordinary receivers is almost terminated, and he feels that this is a great shame. He has a collection of receiving valves which covers 50 years of valve development. They are all put together in chronological order and although Gunnar has only valves dating from the early 1920s at the moment, he hopes to obtain some earlier types. He is also very interested in pre-1920 receivers and speakers.

Incidentally, Gunnar has asked if anyone can help him locate a mains transformer for the Philips 2514 receiver shown in the pictures. It must have an output of 200-0-200V and two 4V windings. The width must be 72mm. He has one 75mm wide transformer but this will not fit.

If anyone wishes to write to Gunnar on any aspect of Vintage radio, his address is: Gunnar Carlström, S-540 MOHOLM, Sweden.

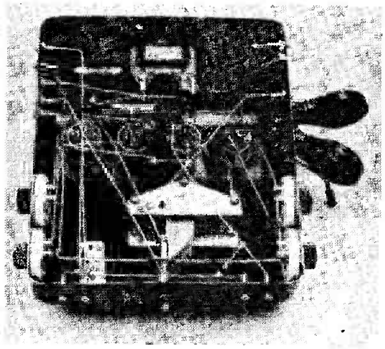
SWEDEN

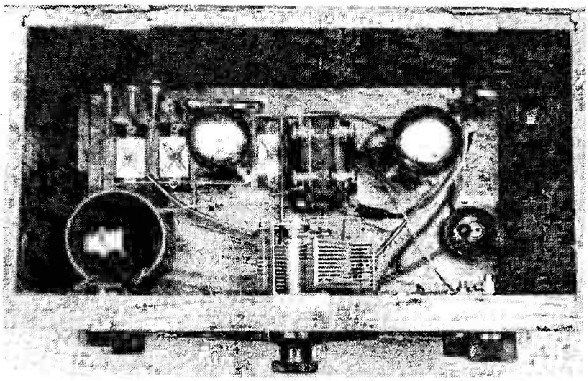
SM6KT

SINCE 1938

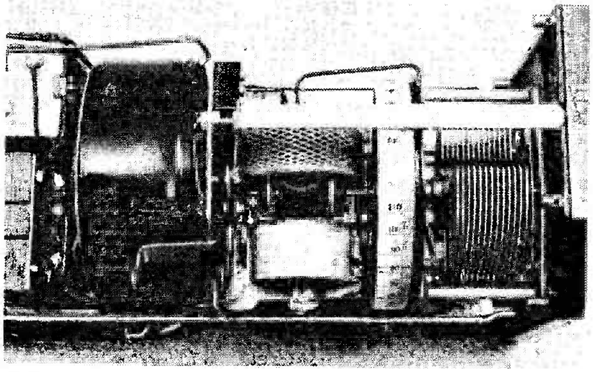
GUNNAR CARLSTRÖM
Granhem - Moholm

This receiver has four valves—1 detector and 3 audio. The feedback coil is shown on the right of the picture. The manufacturer is unknown but could possibly be VDFI. Date is about 1924 and the type number "E36" is printed on a small panel.

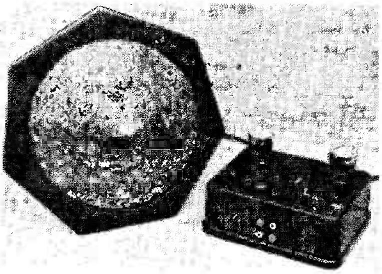




Interior view of a home-constructed receiver. It has a detector and audio valves and is dated about 1926. Power supplies are 4V and 60V.

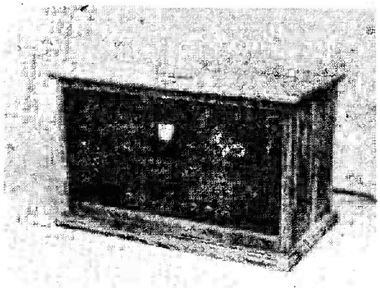


Philips 2514 for a.c. operation. Contains a universal supply unit for filament current, anode current and grid bias. Valves used are SV4, 154V and PM24. The a.f. side of this set could be used with a pickup to reproduce records. A popular design in the mid to late 20's, this set would be quite sensitive using only a short indoor aerial.

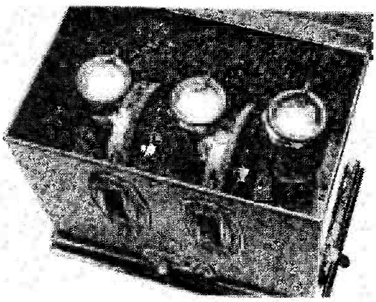


This receiver was bought from a local farmer in 1936 and is dated c1926. It is in good working condition and is made by Stern & Stern of Stockholm. Called the "Concerto II" it employs two valves and uses a wirewound pot for the filament supply. The speaker is a Philips type 2016 and was a common design in the 1930's. If anyone has more gen on this speaker, Gunnar would like to hear from you. Philips have not answered his letter to them asking for gen.

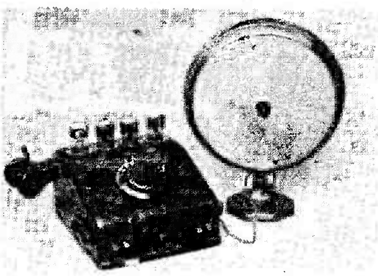
Telefunken receiver. The three valves are held in place by three sprung holders. This set was found in an attic in very bad condition but Gunnar Carlström has completely renovated it and built a new lid to the cabinet. Date is c1927. The speaker is a NORA type and more gen on this would be appreciated.



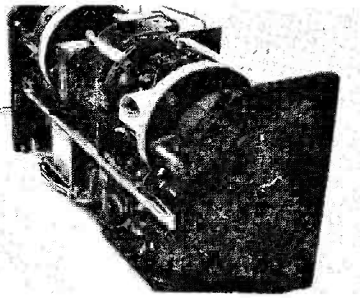
An external view of the above (left) receiver. The cabinet is in very fine condition and the control panel is of black Bakelite.



Interior view of the Telefunken receiver. Bandswitching for m.w./l.w. is on the front panel. Power supplies are 100V and 4V.



The "E36" shown with a "Tefag" loudspeaker. Manufacturer of the speaker is not known.



Another view of the Philips 2514 showing the tuning capacitors. This is the set that lacks a mains transformer (see opposite page).

Lusitania Messages

T. A. Ledward, 4 Haulfryn Terrace, Blaenau Ffestiniog, Merioneth writes . . . "In the year 1910 a school friend, living only a quarter of a mile away, suggested that we should make a transmitter and receiver. We did so and were licensed by the Post Office who allotted us a call sign and wavelength. The transmitter utilised a spark coil and the receiver a crystal, with coil and slider for tuning, and a single headphone. It worked well. I became so interested that after spending some time apprenticed to heavy engineering between the age of fifteen and eighteen, I took a course in Wireless at the Manchester School of Wireless Telegraphy. I quickly became proficient in morse and had quite a thrill when listening at home on my own crystal set I picked up messages passing between the Lusitania at Liverpool Landing Stage (I was only six miles away), and the Seaforth Station. I joined the Marconi Company, as a sea-going operator, and after serving on several merchant ships, I volunteered at the beginning of the first World War in 1914 for service on H.M.S. Victorian, an armed merchant cruiser, only just fitted with guns, etcetera. My sea-going career ended in 1917, when the ship on which I was serving was torpedoed and sunk. The German submarines had been having so much success that there were not enough armed merchant cruisers left to give employment to all the available operators, and I joined the R.A.F. (just re-named from the R.F.C.) and was appointed radio instructor in a home camp.

"Make Your Own Wireless Valves"

W. A. Field, 10 Thurlestone Gardens, Dartmouth, Devon says . . .

"I have been reading your article Going Back with very great interest. My practical experience goes back to 1916. I made my first radio set in 1917, then continued to complete the transmitter in early 1918. The entire equipment was made with the help of "The Boy Electrician", published in 1915 by A. P. Morgan (Duckworth & Co.), 3 Henrietta Street, Covent Garden W.C. (Little did I know that this subject was to be my career). This book was wonderful. It described each item, how to construct it, what it was for, then building the item into a complete circuit.

I constructed everything in this book from the crystal detector, tuning coils and condensers to the complete wireless station for amateurs, which I ran for many years. When the BBC started regular transmissions I constructed sets for the market. I had quite a lot of experience with the S T Manual. This was the first edition. I used the ST 200 as a basis for a radio set which could be used from a car, the audio side had to be altered and increased. Triode valves were coming in, and the famous Model Engineer came out with Make Your Own Wireless Valves. These were made of carbon filament motor car bulbs. The filament acted as the heater and a small ring or copper plating on the outside of the bulb as the anode. The deficiency here was the electrons had to pass through the glass first, later on we improved on these. All through my experiments I kept notes, and I have an old crystal set procured in 1917 and still working by my side now. (Is this a record?)

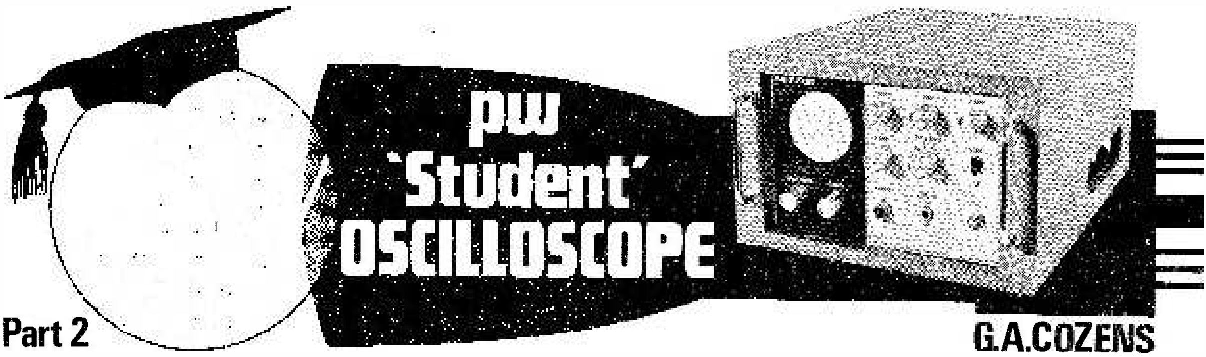
Amateur Radio Techniques (Fourth Edition)
By Pat Hawker G3VA
Published by the Radio Society of Great Britain
256 pages, 9½ x 7¼in. Price £1·60.

EVERY radio amateur has a few favourite reference manuals on his bookshelf and among these must surely be numbered Amateur Radio Techniques, published by the Radio Society of Great Britain. Their monthly magazine Radio Communication features "Technical Topics" and the reviewer knows that he is not alone in making this priority reading as each copy drops through the letter box. ART is a collection of choice items from TT since Pat Hawker G3VA began the series in 1958. If a quick recap on a particular circuit or idea is needed the chances are that it will be found in ART. It would be quite wrong to imagine that this book is just for the "ham" fraternity because it can be found on the desk of many professional electronics engineer, in Government departments and in the Services. This much enlarged edition contains over 600 diagrams with all necessary component values helping to illustrate and explain the plethora of practical ideas under such headings as Receiver Topics, Oscillator Topics, Transmitter Topics, Audio and Modulation, Aerial Topics and Fault-Finding and Test Units. Chapters on Semiconductors and Components and Construction fill in the gaps to provide an excellent publication. As the author points out, this is an "ideas" book rather than a conventional text book, the reader being left to use his own knowledge and experience in making up a particular circuit but it would be a poor experimenter who would not glory in doing just that. Altogether a fabulous book which can be picked up and read to advantage at any time but particularly useful when inspiration is needed.

AED

Guide to Broadcasting Stations—17th Edition
Published by The Butterworth Group—Iliffe Books
201 pages, 7¼ x 4⅝in. Price 75p (paper back).

THIS latest edition of a well established reference book lists broadcasting stations from information supplied by the BBC. It includes articles on various related topics for the listener and a listing of V.H.F. Sound Broadcasting Stations.



Part 2

G.A.COZENS

SIMPLE TO BUILD • INEXPENSIVE • ONE ASSEMBLY BOARD

Construction

Because of the length of the 3BP1 cathode ray tube, it is necessary to use a *deep* chassis. In fact the oscilloscope chassis is 14in. long (from back to front). The overall oscilloscope chassis dimensions are 14 x 9 x 2½in.

The front panel has to accommodate the c.r.t., seven variable controls, two input sockets, sync on/off switch, pilot lamp and an earth terminal. The main panel and chassis dimensions are given in Fig. 4. The drilling layout for the oscilloscope front panel is given in Fig. 5.

The astigmatism (VR7) X shift (VR6) and the X linearity (VR5) controls are mounted along the side of the chassis. The a.c. inputs from the mains transformer sub-chassis (containing T1, T2, and T3 etc) enter the oscilloscope chassis via the 10 way cable. This saves space on the front panel and simplifies the layout.

The Veroboard panel containing the main oscilloscope circuitry is mounted in a 12 x 3½in. cut-out in the oscilloscope chassis. Use the Veroboard panel as a template when drilling the fixing holes in the oscilloscope chassis.

The oscilloscope front panel also has an aperture covered by a piece of laminated plastic sheet. This is necessary because the brilliance control VR9 is approximately 720 volts negative with respect to the chassis and therefore needs to be well insulated. There is about 50 volts across the brilliance control. The focus control VR8 is also at a high negative potential with respect to the chassis and this has about 300 volts across it.

The laminated plastic sheet is extended to make a mask for the face.

The angle pieces holding the front panel to the chassis should be 16 or 18 s.w.g. aluminium and the bolts are 2BA with shake proof washers and firmly tightened nuts.

The method of supporting the c.r.t. is unconventional but it allows the tube to be adjusted to level the X axis (timebase) and at the same time the tube is held against a rubber ring glued to the back of the front panel.

The bracket which supports the back of the c.r.t. is secured to the chassis by four 4BA bolts which pass through grommets in the chassis and make the tube mounting more flexible. All the bolts have a full nut and a half nut for locking.

The main transformer sub-chassis carrying the three mains transformers, T1, T2 and T3 utilises a

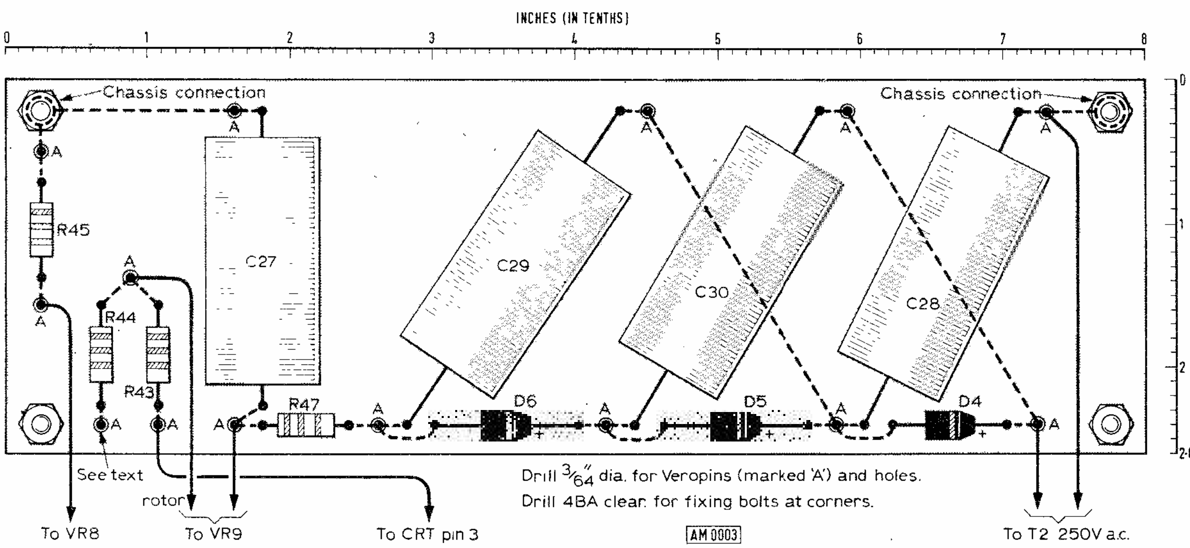


Fig. 3: Component layout and wiring on the EHT panel.

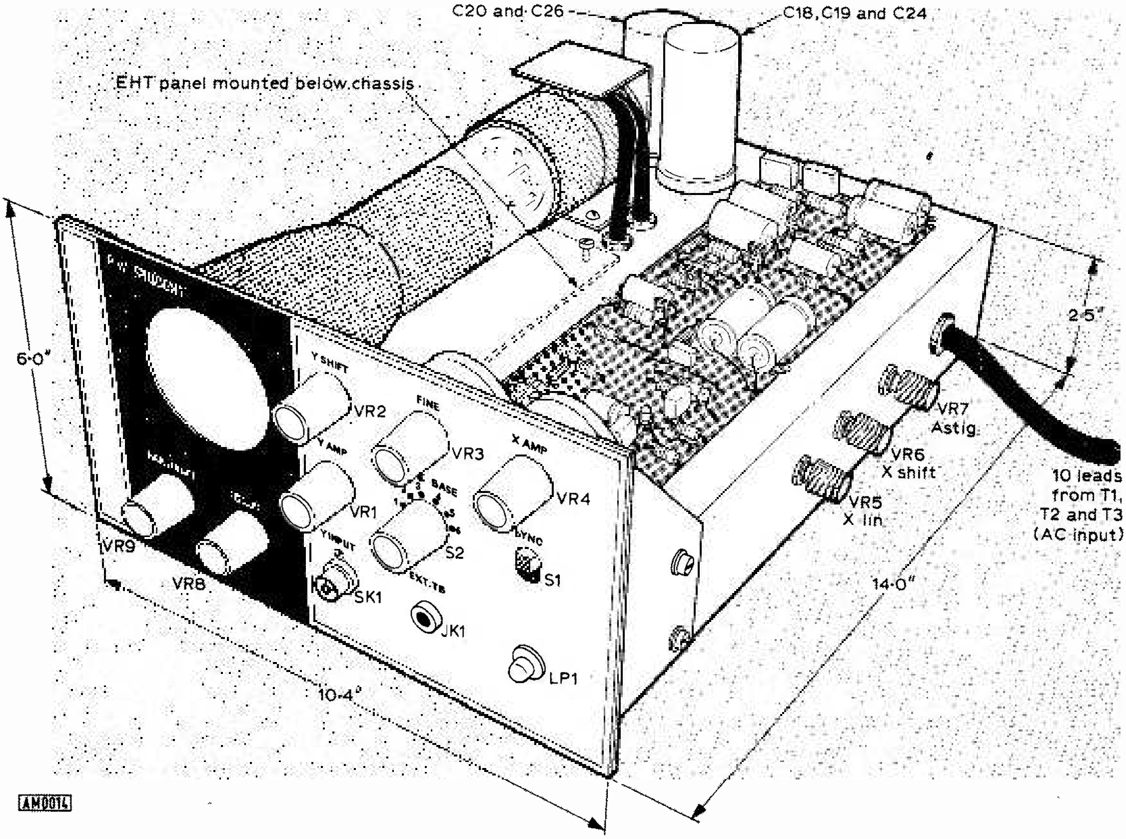


Fig. 4: General view of the PW 'Student' Oscilloscope, *showing the location of major components.*

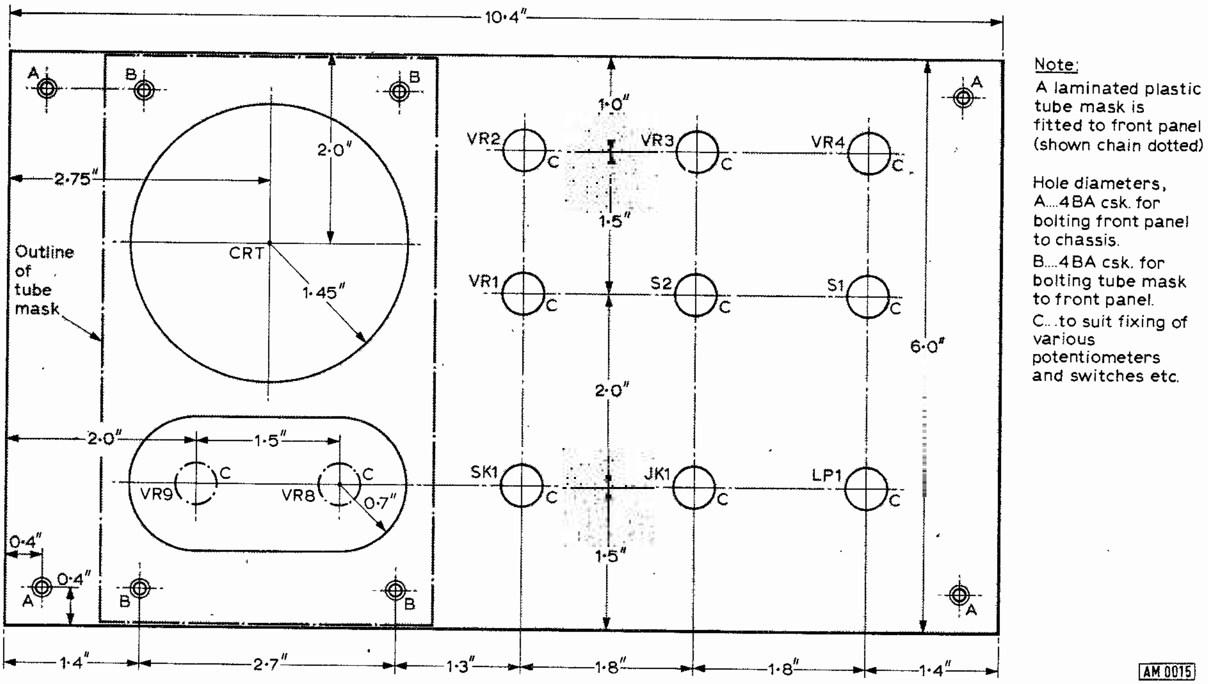


Fig. 5: Drilling layout for the front panel.

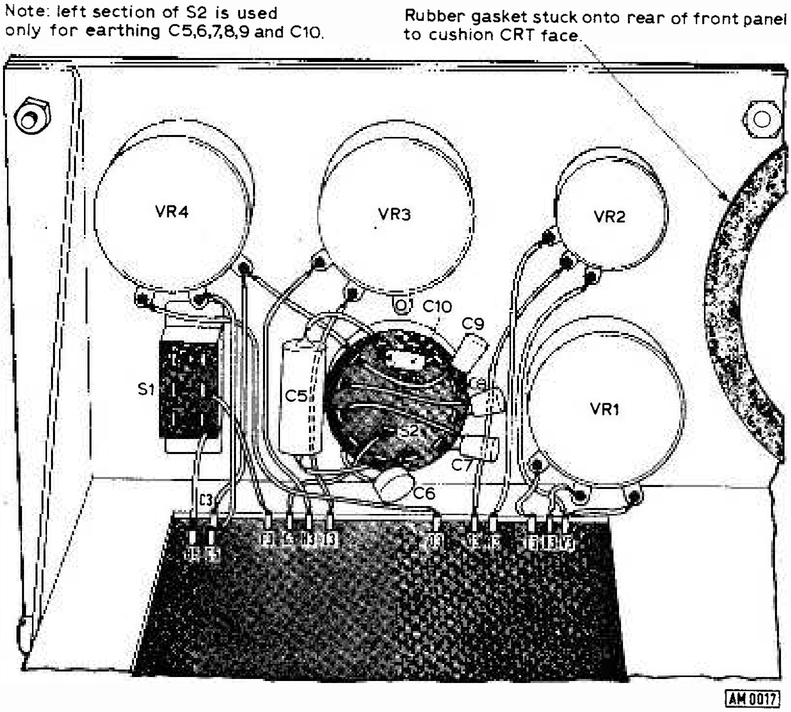


Fig. 6: Interconnection between Veroboard panel and front panel controls.

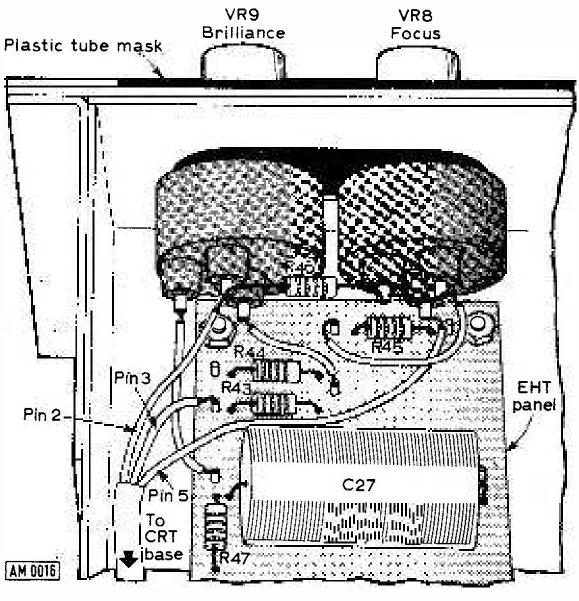


Fig. 7: Interconnection between the EHT panel and front panel controls.

wood base for mounting these components. The size of this base will depend upon the mains transformers used. Mains transformers usually have identifying tags for connection of leads. The arrangement behind the panel (from the 10 way socket to the mains transformer) will depend upon the transformers used, but should be quite straightforward once individual windings have been identified.

A suitable mains on/off switch, pilot lamp and a 2A mains fuse and holder may also be fitted to the sub-chassis front panel. It is recommended that the complete mains transformer sub-chassis is suitably enclosed to avoid accidents.

It is also possible to include a 100mV a.c. calibrating source from the 6·3V winding on T1 mains transformer. This is obtained from a 620Ω and a 10Ω resistor in series across the winding, and the junction is taken to a co-axial socket on the sub-chassis panel. The bottom of the 10Ω resistor goes to chassis. Because the 100mV signal will be fed into the Y input it is important to use a screened lead to avoid stray pick-ups. When wiring the 6·3V winding to the coax-socket, make sure that it is the earthy side of the socket that goes to the earthy side of the 6·3V winding (remember—one side of this winding is earthed on the oscilloscope chassis).

Other Facilities

The design as outlined is a compromise, being mainly concerned with the construction of a basic oscilloscope. For instance, no oscilloscope is complete without flyback suppression, but this requires further circuitry. The author so far has been unable to decide upon a suitable circuit.

Another area in which the instrument could be improved is the Y input, but the author believes that the best solution here would be to design a separate unit which can be plugged into the Y input, capable of accepting any signal from 10mV/cm to 50V/cm.

Beam slitting facilities and a mixer for two inputs could be added. However, such a unit would require complete screening which would be difficult to attain within the present design.

As the instrument is used for checking the performance of Hi-fi equipment as well as general laboratory work, it is housed in ½ in chipboard cases covered with imitation mahogany laminated plastic.

Both cabinets have aluminium instrument case handles, 4 ins centre to centre.

In part 1, last month, LP2 as shown in Fig. 1 would not function. The upper lead from LP2 should go to the top end of the 6·3V winding instead. Attention is drawn to the breaks in the Veroboard strips—especially between Tr3 base and Tr4 collector.

Caution

This instrument **should not** be used on TV or radio or any apparatus where the chassis is live to the mains supply. ■

TAKE 20

DAVID ANDREWS

No. 52
WAA-WAA UNIT

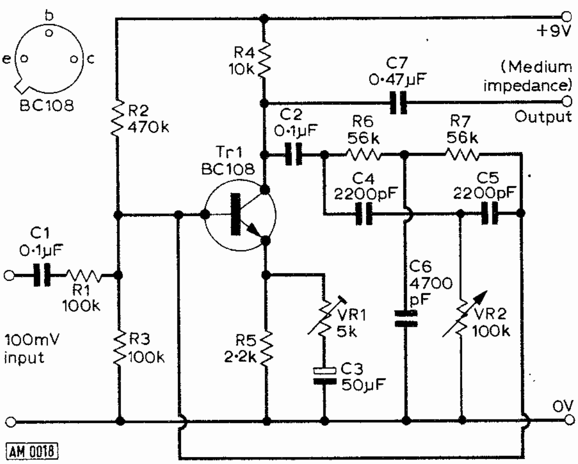
A series of simple transistor projects, using not more than twenty components.

WE'VE got very good value for the enthusiastic guitarist this month; a very simple Waa Waa unit that gives quite a dramatic effect with either guitars or electronic organs. There might need to be a little work done to the basic circuit to make it suitable for every application, but as there are so many different permutations on signal levels and input/output impedances we thought we would compromise with a circuit that can be inserted into the signal line where there is a typical level of between 50 and 100mV at medium to high impedance. Most equipment should have some point in it where this type of signal can be located.

Circuit

The circuit is basically a phase shift oscillator using the twin T bridge as the frequency selective element. C4, 5, 6 and R6 with R7 and VR2 form the bridge. Feedback is taken from the collector of Tr1 via C2 into the bridge and then back to Tr1's base. Negative feedback is also applied to Tr1 by means of VR1 in its emitter by-pass circuit; the level of the latter has to be adjusted so that the feedback is **just** insufficient for oscillation to be maintained.

The Waa-Waa effect is obtained by giving preferential amplification to certain frequencies within the musical note and then sweeping this frequency up and down. The chosen frequency is set by the component values of the twin T bridge and this can be varied over a useful range by adjustment of VR2. The gain of the circuit is greatest at the frequency when the level of positive feedback is greatest.



Circuit of the Waa-Waa unit which is essentially a phase-shift oscillator.

Chords or single notes will give the effect but in the case of the latter there should be a good range of harmonics present as well as the fundamental. A pure sine wave input, for example the flute stop of an organ, will give no effect whatsoever.

Almost any npn silicon transistor can be used for Tr1; the only feature of importance is that its h_{FE} should be in the order of 150 minimum (this is easily met by most BC108s). C4, 5 and 6 have been chosen to keep the Waa-Waa effect within the higher band of frequencies which adds more "sparkle" to the sound. If, however, a more mellow effect is required increase the values of these capacitors keeping the same ratio between them.

★ components list

R1	100kΩ	1p
R2	470kΩ	1p
R3	100kΩ	1p
R4	10kΩ	1p
R5	2·2kΩ	1p
R6	56kΩ	1p
R7	56kΩ	1p
VR1	5kΩ linear pre-set	8p
VR2	100kΩ linear	15p
C1	0·1μF	4p
C2	0·1μF	4p
C3	50μF 9VW min.	15p
C4	2200pF	4p
C5	2200pF	4p
C6	4700pF	4p
C7	0·47μF	5p
Tr1	BC108	10p
		80p

No allowance is made for minimum order costs or for postage and packing and these points should be checked carefully before ordering.

Adjustment

When wired up it is only necessary to adjust the value of the pre-set potentiometer VR1 to give the correct level of negative feedback. To do this start with VR1 at minimum resistance and then turn VR2 over its full range. At some point a loud howl will be heard from the amplifier; this is the unit oscillating. Leave VR2 in the position for loudest howl and then slowly increase the value of VR1 (increasing the negative feedback) until oscillation stops. Readjust VR2 over its full range; if oscillation occurs at another point carry out the same procedure until VR2 can be swept from one extreme to the other with no oscillation occurring. The unit is then ready

continued on next page

JOINING COAXIAL CABLE

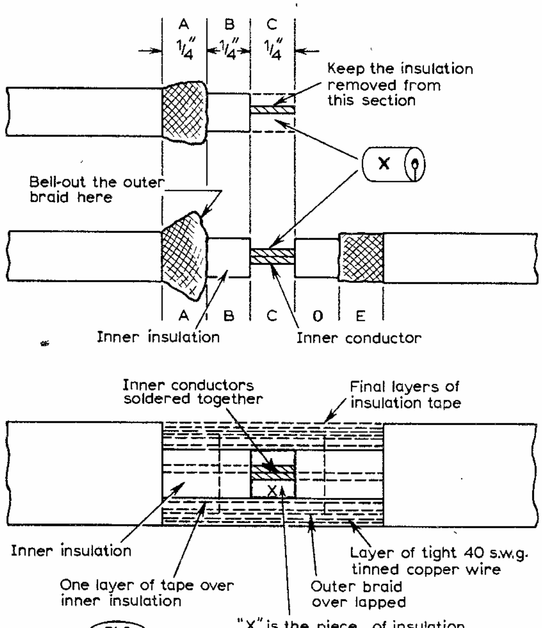
R.A.BUTTERWORTH

THE usual and accepted way of extending coaxial cable is to use the back-to-back coaxial connector. After a few months exposure to the elements it is not uncommon to find that the whole contraption has become oxidised, despite the fact that it was 'protected' by a generous layer of insulation tape of one kind or another. If, after you have managed to get the joint apart, close examination of the plugs and connector will usually reveal your so believed good electrical joint in an advanced state of corrosion.

The method to be described should appeal to those who like the writer, wish to join up these odd lengths of coaxial cable and forget about them.

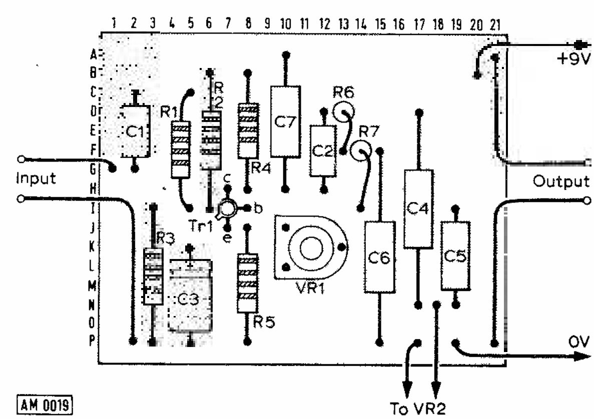
Proceed as follows referring to the sketches for any clarifications necessary:

1. Cut the ends of the coaxial cable to be joined to give clean ends. Carefully cut off $\frac{3}{4}$in. of the vynil covering at the end of each cable, taking care not to cut the outer braid.
2. Loosen and push back the braid like a concertina. Bell-out the outer braid of one cable.
3. Now carefully cut off $\frac{1}{4}$in. of the inner insulation, again taking great care not to cut any strands of the inner conductor, so that the insulation slides off the wire. Conserve one of these pieces of material, it will be required later.
4. Lay both cables down on the bench and clamp down in position so that the two inner copper conductors lay close together and parallel. Now solder the two inner conductors together.
5. Take one of the pieces of inner insulation and slit it length wise with a sharp razor blade. Slip it over the soldered inner conductors.
6. Cut a piece of aluminium cooking foil $\frac{3}{4}$in. wide and long enough to make a double thickness cylinder to cover the areas marked 'B', 'C', and 'D'. Heat this cylinder to about 100°C with a soldering iron when the insulation will be pliable enough to weld together. Discard the foil and leave the insulation to cool.
7. Now tightly wrap a single layer of $\frac{3}{4}$in. adhesive vinyl insulation tape over the section 'B.C.D.'. Now smooth section 'A' over section 'E'. Roll and smooth this overlap to make it even. Spot solder the edges where 'A' overlaps 'E'.
8. Starting at one end of the outer conductor braid close wind the whole areas of 'A.B.C.D.E.' with 40 s.w.g. tinned copper wire. Lightly solder several spots of this covering. Don't try to make it a solid soldered job, or you will ruin the inner insulation. ■



Joining two lengths of coaxial cable.

TAKE—20 WAA-WAA UNIT—*continued from previous page*



Suggested layout of components on a piece of 0·1" matrix Veroboard.

for operation. If the Waa Waa effect is too fierce increase the value of VR1 further.

It might be that no oscillation occurs with the above procedure. This means that the transistor has low gain but do not give up—you will probably find you still get a useful effect when signal is applied at the input. ■

SHORT WAVE DX
by MALCOLM CONNAH

BRITISH HONDURAS: Radio Belize has been noted with an extended schedule in Spanish. The frequency is 3300kHz and programmes have been heard up to 0730.

El Salvador: Radio Nacional de El Salvador has moved from 5980 to 6010kHz and has been heard at 0050 to 0055 with news, advertisements and music.

Malagasy Republic: RTVM Tananarive is using a new frequency of 6170 for the French Service. The transmissions have been noted in parallel with 7105 from 1400 to after 1900.

U.S.A.: According to 'DX Party Line' on HCJB, WNYW has now been taken over by Family Radio. Programming will, however, remain the same and the schedule for May-September is:

1700-2200 on 21525kHz	All transmissions in English to Europe
1700-1900 on 17845kHz	
1905-2130 on 17845kHz	
2135-2330 on 15440kHz	
2215-2400 on 11855kHz	

Vietnam: The Voice of Vietnam, 58 Quan-Su Street, Hanoi broadcasts in English at the following times: 0100-0130, 0200-0230, 1000-1030, 1300-1330, 1530-1600, 1800-1830 and 2230-2300. The frequencies announced are 10040 and 15105kHz but the later frequency has been noted at 15012kHz.

South Vietnam Liberation Radio, c/o Bureau d'Information du C.R.P. de la R.S.V.N., 39 Avenue Georges Mandel, Paris 16e, France. Broadcasts in English on 10010 and 7470kHz start at 1100, 1230, 1430 and 2330 respectively. The programme at 2030 uses 14990 and 12115kHz.

(The last two items came from **Adrian Pell** of Wareham in Dorset, other items courtesy of Sweden Calling DXers.)

Readers' Logs

Once again **Roy Patrick** of Derby kicks-off with the following log using his Trio 9R59DS and National 1400 receivers:

4854 *R. Clube de Mozambique,* Portuguese at 2130.
4940 *R. Abidjan, Ivory Coast,* in French at 2100.
4995 *R. Brazil Central* noted as early as 2230.
6030 *T.W.R., Monte Carlo* testing in Norwegian, 2030.
9023 *R. Tehran, Iran,* heard in English at 2000.
11650 *R. Bangladesh,* news in English at 1700.
15084 *R. Iran, Home Sce.* in Farsi at 2100.
15415 *R. Kuwait* heard in English at 1700.
15520 *R. Bangladesh* in English at 1700.

Fred Wall of Walthamstow returns to the page after a long absence having used his Plessey PR155 and 50 foot long-wire with A.T.U. to hear:

6065 *R. Vilnius, Lithuania* in English at 0045.
9540 *R. New Zealand* with news at 0800.
9655 *R. Damascus, Syria,* light music at 2045.
11780 *R. New Zealand* with news at 0800.
11855 *Saudi Arabia B.S.* news in English at 1700.
15125 *Voice of Free China,* Taiwan, English at 1800.
15265 *R. Afghanistan* noted in English at 1810.
21545 *R. Accra, Ghana,* with local music at 1730.

Ian Gordon of Birmingham has again been busy using his Codar CR70A receiver, 25 metre (Metrication no less!) long-wire and A.T.U. to hear:

7230 *T.W.R., Monaco* in German at 0905.
9560 *ORTF, France* in Russian.
9620 *R. Belgrade, Yugoslavia* noted at 2200.
9640 *Adventist World Radio* DX News at 0935.
9745 *R. Baghdad, Iraq* noted at 1955.
9912 *All India Radio,* Delhi at 2000.

Christopher Hodgson of Sunderland is a new reporter to this page, his equipment consists of a Codar Multiband-6 receiver with a 50 foot long-wire aerial and the PW A.T.U. His log included:

6100 *R. Belgrade, Yugoslavia* at 2200.
6130 *R. Norway* from Oslo at 1810.
7260 *R. Berlin International* at 1850.
9006 *R. Tehran,* Iran noted at 2000.
9525 *All India Radio,* Delhi at 2100.
9525 *R. Warsaw,* Poland at 1200.
9645 *Vatican Radio* noted at 1505.

The last report for this month comes from **Patrick Henderson** of Ledbury, Herefordshire who used a six transistor superhet with a 17 metre Windom aerial to hear the following stations:

6025 *Radio Portugal* with DX News at 2105.
6070 *Radio Sofia, Bulgaria,* Mailbag at 1930.
9570 *Radio Australia* noted at 0730.
15012 *Voice of Vietnam,* Hanoi at 1805.
15130 *R. New York Worldwide* at 2300.
15165 *Kol Israel* noted at 2030.
15175 *RSA, South Africa* in English at 1825.

During the next few months I hope to devote some space to the topic of ex-government Communication receivers which are now available at very reasonable cost compared with modern sets. I would be grateful if any readers with an interest in this topic would write to me with their opinions and any information that they may have.

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34 Lisle Street, W.C.2.
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AF30	Mono Transistor Pre-Amplifier	2·61	0·26	2·87
AF310	Mono Amplifier (for Stereo use two)	5·91	0·59	6·50
AT5	Automatic Light Control	2·58	0·26	2·84
AT30	Photo Cell Switching Unit	5·70	0·57	6·27
AT50	400W Triac Light Dimmer Speed Control	4·80	0·48	5·28
AT55	1,300W Triac Light Dimmer Speed Control	5·70	0·57	6·27
AT56	2,200W Triac Light Dimmer Speed Control	6·00	0·69	7·59
AT60	Psychedelic Light Control, Single Channel	7·80	0·78	8·58
AT65	Psychedelic Light Control, 3 Channel	14·55	1·45	16·00
HF61	Medium Wave Transistor Radio	3·33	0·33	3·66
HF65	F.M. Transistor Transmitter	2·70	0·27	2·97
HF75	F.M. Transistor Receiver	2·88	0·28	3·16
HF310	F.M. Tuner Unit	15·81	1·58	17·39
HF325	De-Luxe F.M. Tuner Unit	24·12	2·41	26·53
HF330	Stereo Decoder for use with HF310 or HF325	9·96	0·99	10·95
HF395	Aerial Amplifier for AM/FM Bands I, II and III	1·77	0·17	1·94
GP310	Stereo Pre-Amp to use with 2, AF310	21·27	2·12	23·39
GU330	Tremelo Unit for guitars, etc.	7·50	0·75	8·25
NT10	Power Supply 100m/a 9V Stabilised, 12V Unstabilised	6·15	0·61	6·76
NT300	Professional Stabilised Power Supply 2 x 30V, 2·2A	12·51	1·25	13·76
NT305	Transistor Converter 12/15V, a.c./d.c. to 6V, 7·5V, or 9V d.c.	4·50	0·45	4·95
NT310	Power Supply 240V a.c. to 2 x 18V d.c. at 2A	4·80	0·48	5·28
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ON THE AIR

MEDIUM WAVE BROADCASTS
by CHARLES MOLLOY

SEARCHING out BBC local radio stations is becoming popular and there are a number of reporters this month. **G. M. Christie** (N.L.S. Pole Star) used his Eagle Rx 60 while sailing off the east coast of Shetland to log BBC Radio Newcastle on 1457kHz. **Richard Ellis** (Ruscombe Glos.) has an Eddystone EC10 Mk2 and a 50m longwire feeding and aerial tuning unit. He reports reception of BBC Radio Blackburn on 854kHz; Solent on 998kHz; Sheffield 1034kHz; Birmingham 1457kHz; London 1457kHz; Oxford 1484kHz; Bristol 1546kHz; Leicester 1594kHz.

Martin Hall (Southsea) heard BBC Radio Teesside 1546kHz under Radio Bristol at 0502hrs while during the daytime he logged Radio Blackburn 854kHz and Radio Leeds 1106kHz. Martin has received a QSL card from Radio Blackburn and a QSL letter from Radio Leeds. Hunting out BBC local radios can be interesting at this time of year and all of these stations will confirm a correct reception report with either a letter or a QSL card.

Paul Petty (Canterbury) has been trying his Midland 9 transistor portable on the medium waves using its internal aerial and he has heard programmes in English from Trans World Radio, Montecarlo 1466kHz at 2130hrs; Radio Tirana, Albania 1394kHz at 2030hrs; Vatican Radio 1529kHz at 2100hrs; American Forces Network, Frankfurt 872kHz; Radio Berlin International 1511kHz at 2130hrs; Radio Prague, Czechoslovakia 1286kHz at 2200hrs, all times in GMT.

Jeff Driver (Woodham, Surrey) reports hearing Milan, Italy 899kHz which is on the air nightly from 2305hrs until 0500hrs GMT with news in English at 3 minutes past the hour. Jeff has also heard Radio Norway 1579kHz which broadcasts in English every Monday at 0200hrs and 0400hrs GMT. **John Thompson** (Gillingham) has heard the IBA on 719kHz. This transmission is in parallel with the tests on 557kHz which are on the air 24 hours a day.

Roger Thomas (Port Talbot) enquires about the possibility of using his AR88LF receiver on the medium waves. There is unfortunately no easy way of doing this as the intermediate frequency of this version of the popular AR88, lies well inside the medium waveband. The writer would be glad to hear from any reader who has successfully made this conversion.

Portugal is well represented on the medium waves. The international service of the Emissora Nacional de Radiodifusao is on the air every night in English at 2245hrs GMT from its transmitters at Lisbon on 755kHz and Norte on 1061kHz and these are easily heard in the UK. Among the commercial stations, look for CSB2 Porto on 1034kHz, which is on the air all night with pops; CSB3 Lisbon on 1286kHz; CSB4 Lisbon on 1594kHz and CSB5 Porto on 1578kHz. All these stations will QSL, the cards issued from the international service being particularly colourful.

Sp-E on VHF by SIMON DAVID

SINCE I last wrote to you, a number of outbursts of "foreign" noises has been taking place. That sporadic-E interference I mentioned has been having a field-day. Continental stations have been coming in all over the place, but in particular around the 65 to 75MHz region. This is outside the usual f.m. band, but it shows that f.m. stations turn up in odd places.

Hugh Cocks of Mayfield, Sussex, tells me that he has picked up several stations from Yugoslavia on 23rd May around midday. He also reports channel-5 television buzz from the vision signal on 93.25MHz. Other signals include Albania television sound on 87·75MHz and vision signal interference on 82·25MHz; a Dutch station on 98·6MHz; AFN Stuttgart, West Germany on 102·4MHz.

The eastern European f.m. stations have come in around 66 to 72 MHz using a four-element aerial and two BF180 pre-amps but Mr. Cocks has a problem. When his aerial is directed north or south he gets i.f. breakthrough which disappears when the aerial is due east or west. He thinks that this is largely due to burbles and interference from Radio Moscow in Austria. Any readers have a theory?

Peter Tyler of Whitton, West Middlesex, has sent in a long and detailed log. His home-made "curtain-rod" three-element Yagi is in his loft and drives an old valve Pye Fen Man I. His long list includes several French, Dutch, Belgian and German stations. The latter were NDR II Oldenburg 99·8MHz, Radio Bremen II 88·3MHz. Peter has also received an Italian station in 87·7MHz on 23rd May; signal strength was generally very good but subject to fading. On 24th June he received eight different Dutch stations and three German stations. He rightly complains of the effect of police transmissions on the band which spoil DXing. Further to his big bag was a bonanza of 10 Scandinavian stations, possibly Danish, on 16th June between 1400 and 1500 hours, between 87·7MHz and 99·5MHz. There was a high pressure area over the North Sea near Denmark at the time, which could be responsible for the good reception he obtained.

Recent information issued by the BBC includes a complete list of BBC local radio transmitting stations, revised reception area maps to cover BBC Radio Programmes in stereo from Wrotham and BBC Radios London, Brighton, Oxford, Teesside, Leicester, Birmingham, and Bristol. The BBC has also issued information sheet 1608 (1) which has some advice to help listeners to get the best they possibly can from BBC v.h.f. stereo broadcasts (see also Gordon King's article elsewhere in this issue).

Test tone transmissions on Radio 3 v.h.f. for stereo programmes are detailed on information sheet 1605 (9). These transmissions are usually broadcast on Mondays, Tuesdays and Thursdays to facilitate channel identification and adjustment of cross-talk, and on Wednesdays to assist in technical assessment and setting-up of stereo receivers. All such tests occur after close down in the late evening. Full details on these BBC Information Sheets from: Engineering Information Department, BBC Broadcasting House, London W1A 1AA. Please enclose a stamped envelope.

ON THE AIR

SHORT WAVES

by DAVID GIBSON, G3JDG

IT is a strange thing. Summertime is just the time for the DX-type listeners to flap their ever eager earholes all over 14MHz. What ever has happened? Far from multiple earhole flappings there is barely the twitch of a lonesome lobe. Just at the time when this band is the main one for most DX traffic, everyone is sending in logs for—you'll never guess—two metres. Nobody seems interested in hearing juicy jingles on 20 metres from people like SU1MA, XT2AK, KG6AAY and YB3CW to mention but a few who were about last month.

Equally strange is the marked lack of logs for 21MHz, too. On this band, African countries and most of South America were all happily squirting r.f. everywhere. Wait till I get my 700 element Yagi for 14MHz, I'll put you all to shame.

Twenty eight megacycles (or Hertz?) has apparently been abandoned by practically everyone. This is rather sad because this particular band is probably one of the most interesting now that the sunspot peak has passed.

One station who puts in an appearance is ZS4AA on 28·60MHz. Name is Basil and he also appears on 21·42MHz most weekdays from 1600 hours. Sundays finds Basil on 21·20MHz around 0900 hours. Location is Kroonstad.

Anyone living in the Torquay district and would like to join an Amateur Radio Club you're in luck. The Torbay Amateur Radio Society has its headquarters in Bath Lane (rear of 94 Belgrave Road) Torquay. Hon. Sec. is at 23, Waverley Road, Newton Abbot and the telephone number is Newton Abbot 3025. There is a Club magazine and quite a lot of activity. If you're in the area, give the Secretary a buzz.

Readers' reports

According to **Bill Yates** (Bedford) it is well worth listening for W6KNH on Tuesdays around 1700 hours. Frequency quoted is 14·24MHz and a sked is usually heard with ZK1MA. Another piece of information for DX types is that Andaman Island is due for a surge of extra activity. Twist is that it could mean yet another callsign change—listen for VU7.

Russell Corner sends in a log of G stations heard on topband and eighty metres. Russell's best from further afield on 3·5MHz includes: ZM1MH, 3A2AOO and 4XZSNJ. All these on a 9R59DE and 360ft. of wire in the loft at Walworth Grove in Middlesbrough.

Tony Mountifield (Gosport) claims to be a member of the RSGB and a passer of RAE. He also says, "I have read your column for a few years" (splendid fellow this Mountifield). Receiver is an R1155L (aren't those the ones you have to light with a match?) and among the best heard on twenty were: A6XF, CT1MA, EA8IX, LX1DU, SV5HH, TF3EB, VE3SR, W6UFG, ZD8RW, 4Z4GH, 9G1AR.

Bernard Hughes (Worcester) has sent in an updated portion of the Potty callsign changes list. In all seriousness, I do hope these will help those with computers to keep up to date with these callsigns. Bernard lists them as follows: HA25—25 years of post war Amateur Radio; HA100—Budapest Centenarium; OK5OR—celebrates 50 years of Amateur Radio; KW9WEZ—station operating from Indianapolis car races (now I've heard it all); VE3RCMP—Centenary of the Royal Canadian Mounted Police; IT57—Targa Florio award.

Just to show what's about on 14MHz, Bernard lists the following heard with the aid of his JR-310 and dipole; CR5AJ, HC2YL, JA4FAB, JA3LOJ/MM, JA6CNL, JY5HC, JX9XP, KW9WEZ, MP4BJR, PY9KC, PT2JB, VE8RCS, VP7ND, YA1DT, ZL1AUM, ZL2CE, ZL3FM, ZD7SD, ZD7SS, 7X2MD, 9K2CA.

Andrew May (Bromsgrove) got these on 28MHz with an HA-350 and 67ft. long wire (all s.s.b.); WA7CAE/P/YV5, YV5CWO, YV5DEO, 4X25HF, 4Z25MQ, 5U7BA, 6W8DY.

Lindsay Pennell is leaving Hong Kong and is due back in the UK. Perhaps we will see some UK-type logs (I was getting fed up with translating Chinese, anyway). Heard from Hong Kong on 28MHz; 9M2DQ, A4XFE, CR6SR, 9J2DT.

Two metre tweets heard from; DL7FQ, F1CCP, F6CKU, GI4AAT, GM3BA, GW3UUC/P, ON5NY/P, PA0FHV. These were bagged by **Paul Marks**, G8FVK, who lurks at Woodford Green with an 8-element beam, homebrew converter and Eddystone 730/1A.

Diary dates

The National Agricultural Centre at Stoneleigh, Kenilworth, Warwickshire is the place to be on the 25/26/27 of August. The Town and Country festival is to include a complete introduction to the world of Amateur Radio. This will include morse code demonstrations, display of radio equipment, homebrew demonstration, transmitters on the air, a radio rally and the Amateur Radio Emergency Service in action.

Other Mobile Rallies in August will take place at: Newton Abbot August 12; Derby 12; Bristol 19, Preston 19. Contests for August: WAE DX c.w. 11-13; 70MHz 12; 144MHz low power 18; 144MHz s.s.b. 19.

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/FM Reports to Simon David, c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 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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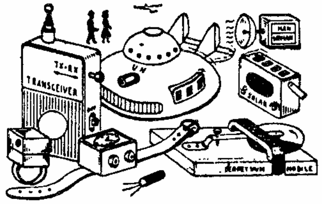

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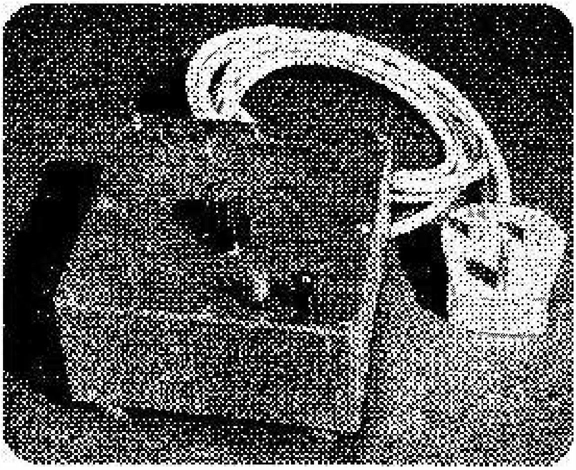


THE majority of circuits constructed by amateurs these days are transistorised and so their power supply requirements are quite modest compared with the valve sets of yesteryear. Most of these modern circuits can be driven either by batteries or by mains derived D.C. supplies. In some cases there is no real necessity to ensure that the power supply provides a constant voltage, this may vary without too much harm to the performance of the equipment. Others, though, may not be so tolerant, oscillators and integrated circuits are two that spring to mind. In these the output and the performance can be directly related to the stability of the supply voltage —especially if the voltage varies with the current drawn.

STABILISING CIRCUITS

To overcome these difficulties it has become common practice to use zener stabilised supplies or to add a transistor to that simple arrangement to give series or shunt stabilised supplies. Examples of these are shown in Figs. 1-3. Fig. 1 shows a simple zener circuit; the trouble here is that when no load is applied the zener has to be capable of dissipating all the power which should be consumed by the circuit, and due to zener spread and tolerance it is sometimes difficult to get an exact voltage. Fig. 2 shows a transistor-aided zener as a shunt regulator whilst Fig. 3 is a series regulator. Both these have the advantage that they can deal with higher currents and the output voltage can be varied continuously. The shunt circuit is also short-circuit proof though it does have a relatively high output resistance; the series circuit on the other hand has a low output resistance but it is not short-circuit proof. Short the output on this one and the transistor can easily blow.

The stabilisation offered by these simple circuits leaves a lot to be desired and some constructors have devised extra circuitry to add to them to give a feedback sensing of the output voltage. Fig. 4 shows this in block form. The idea is that as the output voltage changes this is sensed and the input to the base of the output transistor is varied to oppose the change. With the advent of cheap integrated operational amplifiers it became easy to replace the sensing circuit with, say, a 741 and this gave very satisfactory control. An outline of such a circuit is shown in Fig. 5.

As the shunt circuit had this high output resistance plus poor efficiency, as all the current flowed through it continuously, the practice was to use a series output transistor—but this suffered from the short circuit trouble. To overcome this a means was devised to sense a short across the output and then to limit the current flowing through it, achieved as shown in Fig. 6.

All these refinements meant that the power supply unit was becoming quite large and complex so the manufacturers started to produce integrated circuits which combined the functions of regulation and protection in one package. One of these is the Signetics 550 which is a precision voltage regulator designed for general purpose use. It will work from input voltages of 8·5 volts to 50 volts making it ideal for amateur use. On its own it can supply an output of up to 150mA and if an external power transistor is added the current output can be increased to a number of amperes. It also features current limiting and continuously variable output.

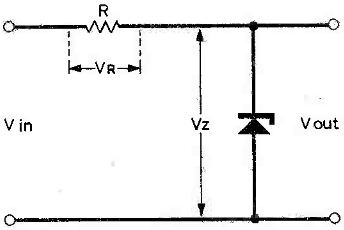
★ components list

BR1	Bridge rectifier [illegible] PIV (RS REC65)
C1	[illegible]µF 25V.W. electrolytic
C2	[illegible]pF polyester
IC1	NE550A (SCS Components)
N1	Mains neon indicator (RS)
R1	[illegible] 5% 3W
S1	2 pole mains on/off switch
T1	Transformer 240V/20V + 20V (RS)
Tr1	[illegible] (SCS Components)
VR1	10kΩ wire wound potentiometer
Verobox or similar, about 4½" x 4½" x 2".	
Veroboard 0·1" matrix, about 4⅛" x 1⅞", to fit box.	
Red and black output terminals.	

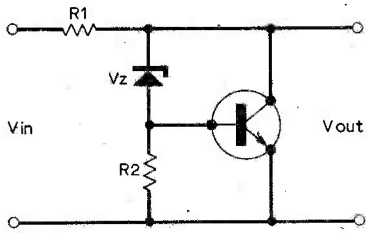
USING THE 550

The 550 is available either as a 14-pin DIL or a 10-lead 'transistor type' can. The actual internal circuitry is complex having some 15 transistors, 7 diodes and 8 resistors in it. To understand its operation it may be better to look at a block diagram of its internal functions, Fig. 7.

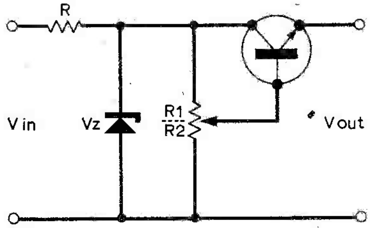
A reference voltage is produced of about 1·6 volts which is independent of supply variations, this being fed into the noninverting input of an operational



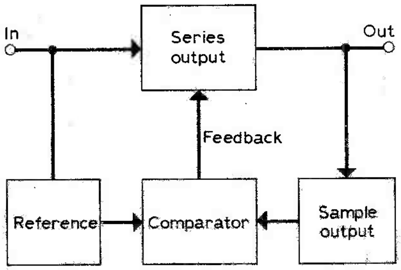
1 Zener supply



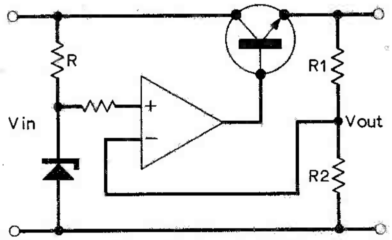
2 Shunt regulator



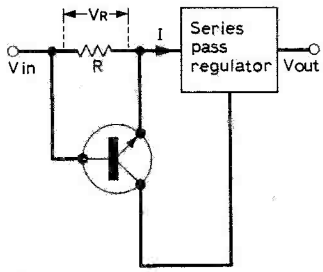
3 Series regulator



4 Feedback sensing

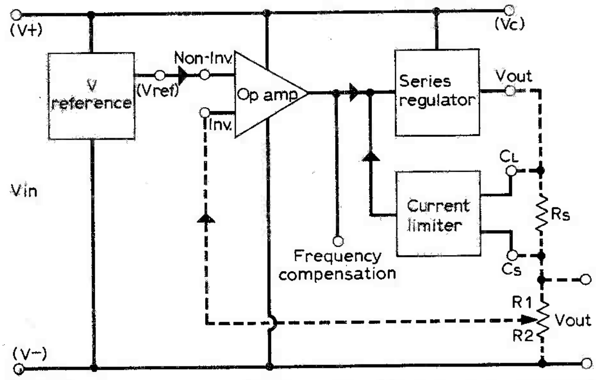


5 Op. amplifier stabiliser



6 Current limiting

AM 0028



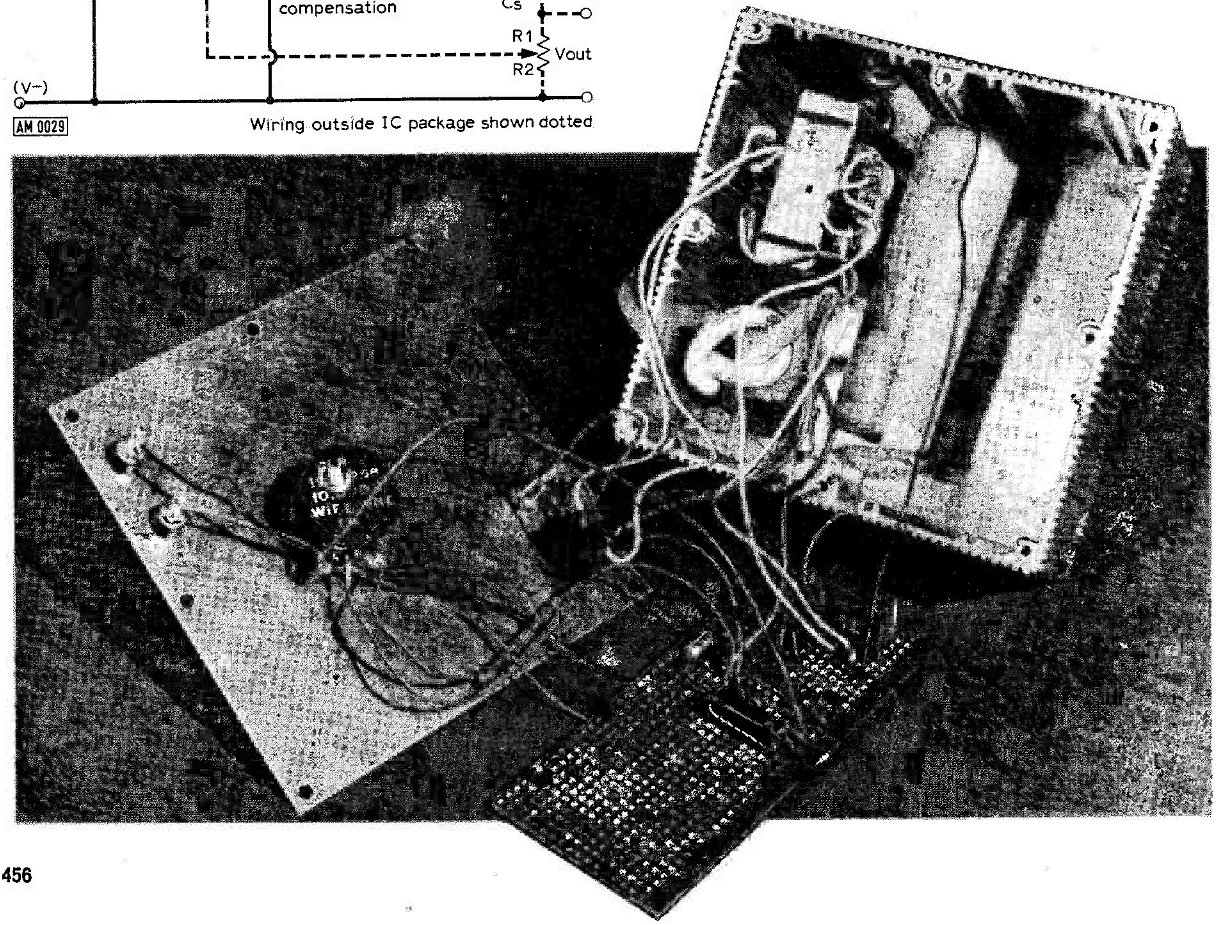
AM 0029

Wiring outside IC package shown dotted

Figs. 1 to 6, above, show the development of a simple zener circuit into one incorporating an IC operational amplifier providing greatly improved stabilisation and proof against short circuits by current limiting.

Fig. 7, left, is a block diagram of the functions performed by the 550 IC voltage regulator.

The photograph below is of the author's prototype dismantled to show the veroboard carrying the IC and other small components. The board fits into the slots at the right of the box. The output is variable between 1·5 and 20V, current limited to 300mA.



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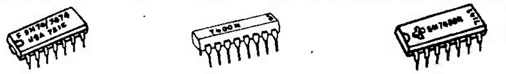

Type	1/11 p	12/24 p	25/99 p	Type	1/11 p	12/24 p	25/99 p	Type	1/11 p	12/24 p	25/99 p
SN7400	0·20	0·18	0·16	SN7450	0·20	0·18	0·16	SN74145	1·50	1·40	1·30
SN7401	0·20	0·18	0·16	SN7451	0·20	0·18	0·16	SN74150	3·35	2·95	2·15
SN7402	0·20	0·18	0·16	SN7453	0·20	0·18	0·16	SN74151	1·10	0·95	0·90
SN7403	0·20	0·18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

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AC126	25p	BCY32	75p	BYZ13	35p	OC72	25p	ZTX301	15p	2N3614	59p
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AC187	25p	BCY43	25p	GET880	45p	OC140	55p	ZTX503	17p	2N3705	10p
AC188	25p	BCY55	2·50	LM309K		OC170	25p	2G301	30p	2N3714	1·80
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AF186	40p	BF180	30p	NKT217	40p		55p	2N1307	25p	2N5457	30p
AF239	40p	BF194	15p	NKT403	70p	TAA263	75p	2N1308	25p	2N5777	55p
ASY27	30p	BF195	15p	NKT404	50p	TIL209	39p	2N1613	20p	2S001	1·00
ASY28	25p	BFS61	25p	OA5	50p	TIP29A	50p	2N1671	1·00	2S012	10·00
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BA115	7p	BFX13	25p	OA81	10p	TIP31A	60p	2N2160	59p	2S026	8·90
BA145	15p	BFX34	75p	OA91	7p	TIP32A	70p	2N2217	25p	2S301	50p
BAX13	5p	BFX37	30p	OA200	7p	TIP33A		2N2221	20p	2S303	65p
BAX16	7p	BFX88	20p	OA202	10p		1·00	2N2222A		2S324	95p
BC107	10p	BFY50	20p	OC16	75p	TIP34A			25p	40250	50p
BC108	10p	BFY51	20p	OC20	95p		1·50	2N2369A		40360	40p
BC109	10p	BFY52	20p	OC23	85p	TIP35A			15p	40361	40p
BC109C	12p	BFY64	50p	OC25	40p		2·50	2N2906	20p	40362	50p
BC113	15p	BFY90	59p	OC28	65p	TIP36A		2N2926 (all		40408	50p
BC117	20p	BLY36	8·00	OC35	50p		3·00	cols)	10p	40486	75p
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Any one type.

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

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

Any one type.

3 Watt Plastic
Wire Ends 5%
3EZ Range

All voltages
6·8 – 100 Volts
30p each.

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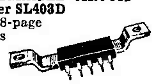

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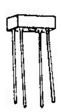

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CRS 3/10	100	30p
CRS 3/20	200	35p
CRS 3/40	400	45p
CRS 3/60	600	55p
FIVE AMP (TO66)		
CRS 5/400	400	60p
SEVEN AMP (TO48)		
CRS 7/100	100	60p
CRS 7/200	200	65p
CRS 7/400	400	70p
CRS 7/600	600	95p
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amplifier. The inverting input gets its voltage from a potentiometer across the output. The op. amp. senses any change between these two voltages and the output is controlled accordingly. There is also the current limiting part which monitors the voltage developed across an external resistor. When this voltage exceeds a specified value limiting starts, the output voltage starts to fall until the output transistor is switched off, the current remaining at a safe level which is within the capabilities of the IC.

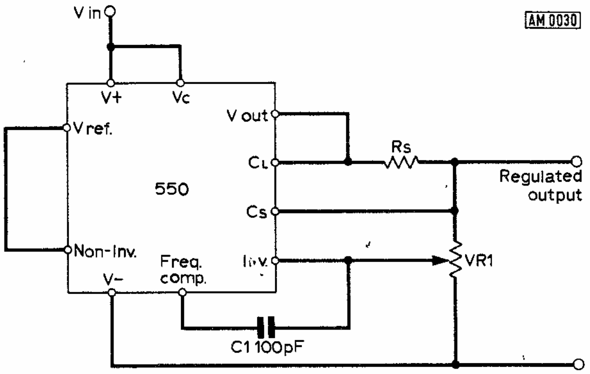


Fig. 8. External circuitry of the 550 to provide currents up to about 60mA from 2 to 20V.

Fig. 8 shows the IC connected for use as a power supply unit to give 2 to 20 volts at a maximum current of 60mA. R_s is chosen to be 10 ohms so that it will limit if the output current should exceed 60mA. If R_s is increased to say 20 ohms the limiting current now drops to about 30mA. If R_s is decreased to 5 ohms the current is increased to about 100mA. Care must be taken not to reduce the value too far or the short-circuit current could exceed 150mA. It is possible to replace R_s by a preset to give adjustable current limiting. The potentiometer VR1 is connected so that the output voltage can be adjusted. C1 is added to provide frequency compensation.

HIGHER CURRENTS

If more than 100mA or so is required all that need be added is a single NPN external power transistor as shown in Fig. 9, which is also the complete circuit of the practical unit.

The max current then available is given by:—

$$I_{max} = I_{limiting} \times h_{FE(min)}$$

For a 2N3055 whose $h_{FE(min)}$ is about 50 the maximum current which can be obtained is 3 amps assuming that one is keeping to an output current of 60mA from the IC. If this is uprated to 100mA then the current is 5 amps.

In order to calculate the value of R_s the following formula is used:—

$$R_s = \frac{0 \cdot 6}{I_L}$$

Where I_L is the current at which limiting is to start. The wattage rating for the resistor R_s is given by $W = 0 \cdot 6 \times I_L$.

Thus, in the prototype, the limiting current I_L was set at 300mA which meant that R_s had a calculated value of 2 ohms and a power rating of 0·18 watts. In point of fact the only available resistor of about this value was a 2·2 ohm 3 watt one, so this was used.

ALTERNATIVE TRANSISTORS

There is no need to use a 2N3055 if lower powers are anticipated. In fact almost any silicon NPN power transistor will do provided that its current rating is about twice the expected maximum. Its V_{CEO} should be about $1\frac{1}{2}$ times the maximum unregulated input voltage and the power rating is calculated by:—

$$W = (V_{in(unreg)} - V_{out(min)}) \times I_L$$

CONSTRUCTION

The IC is best mounted on 0·1″ matrix veroboard together with R_s and C1, and also VR1 if this is to be a preset. Should an external transistor be needed then this should go on a heat sink together with the rectifier. The case size will depend on the size of transformer used; a suitable case can be found from the

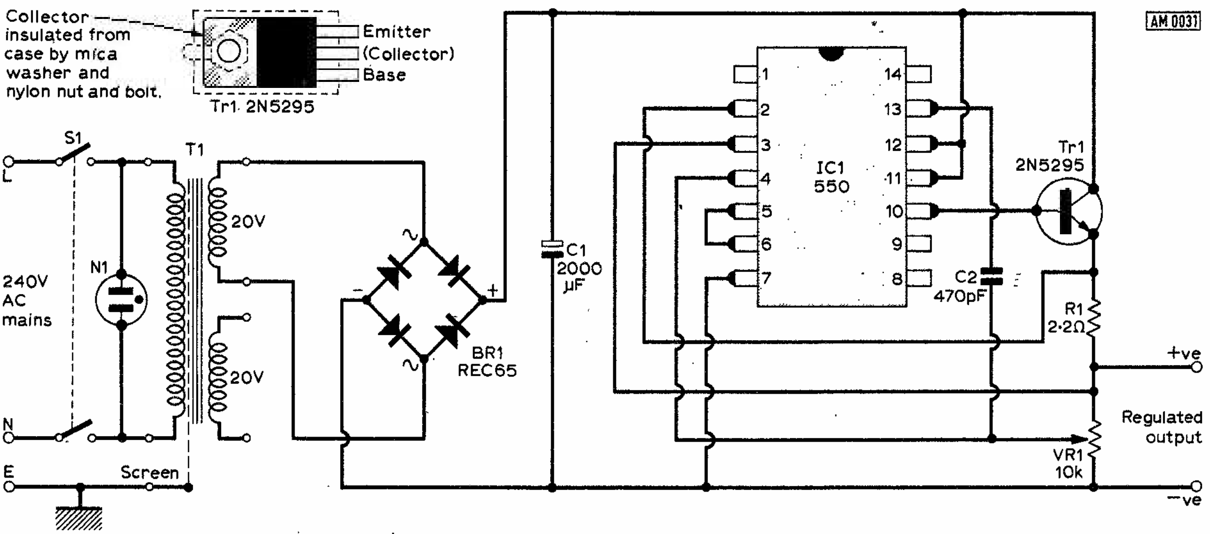


Fig. 9. Complete circuit of the prototype power supply module. The value of R1 for different output current ratings is discussed in the text.

Verobox range and this will make an elegant container. VR1 can be fitted with a suitable pointer and calibrated.

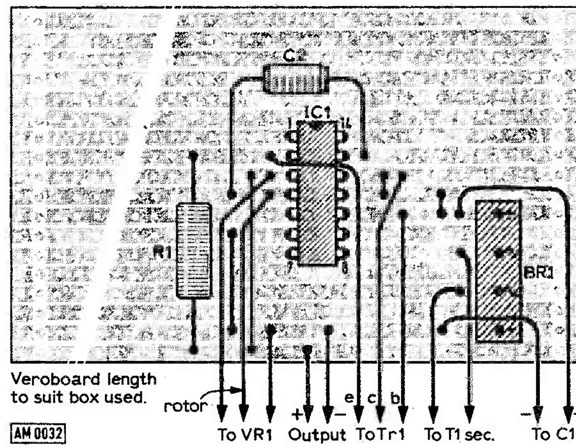
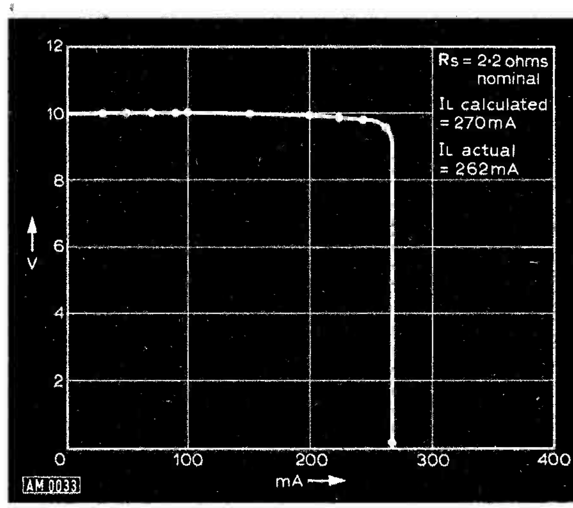


Fig. 10 Layout of components on the strip of veroboard.

It should be noted, with reference to the formulae previously given, that this is not a linear scale and tends to become cramped at the top end. This means that it is better to preset the value or use a voltmeter across the output terminals. The control can then be mounted on the top panel together with a mains switch, neon and output terminals. The corcuit of the completed unit is shown in Fig. 9, with the veroboard layout in Fig. 10.



On test the module's output voltage was set to 10V and the load current increased until limiting occurred, as shown by this graph.

It was found that a residual ripple on the output could be eliminated by adding a 100μF capacitor across the output terminals. This also helped to remove some RF noise that was present.

The 550A (DIL) costs 88p and the 550L (10-lead) is 93p inclusive of VAT and post and packing and can be obtained from SCS Components, POB 26, Wembley, Middx. The 2N5295 is also available from SCS at 68p inc. ■

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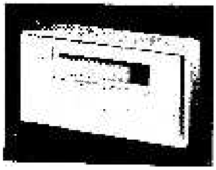
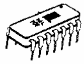


This 4 digit 24 hour clock is available to readers at this special price. Parts would normally cost over £25. Kit of parts includes twelve IC's, indicators, and a smart white plastic case.

74 Series TTL



	1	25		1	25		1	25		1	25
SN7400	16p	15p	SN7423	55p	50p	SN7450	16p	15p	SN7489	6·05p	5·85p
SN7401	16p	15p	SN7425	55p	50p	SN7451	16p	15p	SN7490	74p	72p
SN7402	16p	15p	SN7427	49p	46p	SN7453	16p	15p	SN7491	1·10p	1·04p
SN7403	16p	15p	SN7428	77p	72p	SN7454	16p	15p	SN7492	74p	72p
SN7404	16p	15p	SN7430	16p	15p	SN7460	16p	15p	SN7493	74p	72p
SN7405	16p	15p	SN7432	49p	46p	SN7470	33p	29p	SN7494	85p	72p
SN7406	38p	35p	SN7433	94p	82p	SN7472	33p	29p	SN7495	85p	72p
SN7407	38p	35p	SN7437	72p	69p	SN7473	41p	39p	SN7496	95p	92p
SN7408	20p	18p	SN7438	72p	69p	SN7474	41p	38p	SN74100	1·80p	1·75p
SN7409	20p	18p	SN7440	16p	15p	SN7475	50p	47p	SN74104	1·09p	1·06p
SN7410	17p	15p	SN7441	74p	70p	SN7476	44p	43p	SN74105	1·09p	1·06p
SN7411	27p	25p	SN7442	74p	70p	SN7480	73p	70p	SN74107	44p	42p
SN7412	38p	35p	SN7443	1·43p	1·37p	SN7481	1·32p	1·26p	SN74110	61p	59p
SN7413	32p	29p	SN7444	1·43p	1·37p	SN7482	97p	95p	SN74111	1·37p	1·27p
SN7416	47p	43p	SN7445	2·00p	1·92p	SN7403	1·20p	1·15p	SN74118	1·10p	1·05p
SN7417	47p	43p	SN7446	1·07p	1·02p	SN7484	1·10p	1·05p	SN74119	1·47p	1·37p
SN7420	16p	15p	SN7447	1·10p	1·03p	SN7485	3·96p	3·85p	SN74121	44p	41p
SN7422	55p	50p	SN7448	1·10p	1·03p	SN7486	36p	35p	SN74122	1·54p	1·43p

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307	DIL	69p	748c	DIL	39p
307	TO99	69p	748c	TO99	41p
307	8 PIN DIL	66p	1437	DIL	1·27p
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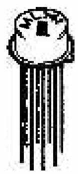
308A	TO99	6·40p	3046	DIL	84p
709c	DIL	35p	7503	DIL	1·27p
709c	TO99	31p			



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100µF	6½p
220µF	6½p
330µF	6½p
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4700µF	29p

6·3 VOLT

33µF	6½p
68µF	6½p
150µF	6½p
470µF	11p
680µF	13p
1500µF	18p
2200µF	18p
3300µF	26p

10 VOLT

22µF	6½p
47µF	6½p
100µF	6½p
220µF	8p
330µF	10p
470µF	10p
1000µF	11p
1500µF	20p
2200µF	24p

16 VOLT

15µF	6½p
33µF	6½p
68µF	6½p
150µF	8p
220µF	9p
680µF	17p
1000µF	17p
1500µF	25p
2000µF	43p

25 VOLT

10µF	6½p
22µF	6½p
47µF	6½p
100µF	8p
150µF	8p
220µF	10p
470µF	13p
680µF	20p
1000µF	22p
2200µF	39p
5000µF	68p

40 VOLT

6·8µF	6½p
15µF	6½p
33µF	6½p

40 VOLT

47µF	6½p
100µF	9p
150µF	10p
220µF	11p
470µF	19p
680µF	25p
1000µF	25p
2200µF	44p

63 VOLT

1µF	6½p
2·2µF	6½p
4·7µF	6½p
6·8µF	6½p
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BA145	22p
BA154	14p
BAX13	14p
BAX16	14p
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BY100	19p
BY126	16p
BY127	19p
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OA10	24p
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SINGLE GANGED, LOG or LIN 1k to 1M. 45p each
TWIN GANGED, LOG or LIN 1k to 500k. 66p each.

CARBON SKELETON PRESETS

Small high quality type (linear only).
All valves 100-5 meg ohms.
·1 watt 5½p each
·2·5 watt 6½p each

VEROBOARD

	0·15 Matrix	0·1 Matrix
2½in × 3¾in	19p	26p
2½in × 5in	28p	28p
3¾in × 3¾in	28p	28p
3¾in × 5in	33p	32p
5in × 17in (plain)	94p	—

Vero Pins (bag of 36), 22p
Vero cutter, 50p; Pin insertion Tools (0·1 and 0·15 matrix) at 61p.

SLIDE SWITCH

SPST 11p each. D.P.D.T. 13p each.

MINIATURE NEON LAMPS

240V or 110V 1–4 5p, 5 plus 4½p each.

MINITRON DIGITAL INDICATOR TYPE 3015F

Reads 0–9 and decimals
(Data Sheet on request)
ONLY £1·50
16 DIL Socket 33p
Driven by 7447 £1·05

RECTIFIERS

P.I.V.	1 AMP	1·5 AMP
50	IN4001 4½p	PL4001 8p
100	IN4002 4½p	PL4002 9p
200	IN4003 5½p	PL4003 10p
400	IN4004 6½p	PL4004 10p
600	IN4005 8p	PL4005 13p
800	IN4006 9p	PL4006 15p
1000	IN4007 10p	PL4007 20p

BRIDGE RECTIFIERS

P.I.V.	1 AMP	2 AMP	5 AMP	10 AMP
50	33p	53p	£1·76p	£2·20p
100	35p	57p	—	—
200	37p	60p	£1·98p	£2·31p
400	40p	64p	£2·15p	£2·42p
600	44p	66p	£2·42p	£2·75p
800	49p	—	—	—

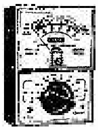
THYRISTORS

PIV	50	100	200	300	400
1 Amp	28	25	41	44	53
3 Amps	44	50	60	—	66
7 Amps	—	96	1·01	—	1·24

RESISTORS

¼ watt 5% carbon 1p each
¼ watt 10% carbon 1p each
1 watt 10% carbon 2½p each
Range 10 ohms to 4·7 meg.
¼ watt m/o 2% 3p each
Range 10 – 1 meg ohms

GWS G.W.SMITH & CO (RADIO) LTD

AUDIOTRONIC MODEL ATM.1

Top value 1000 o.p.v. pocket multimeter. Ranges: 0/10/50/250/1000v. AC and DC DC Current 0-1mA/100mA. Resistance 0/150k ohms. Decibels −10 to +22dB. Size 90 × 60 × 28mm. Complete with test leads. **£2·50.** Post 15p.

LT601 MULTIMETER

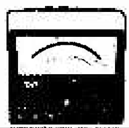
New style 20,000 o.p.v. pocket multimeter. 5/25/50/250/500 / 2500 V. D.C. 10 / 50 / 100 / 500 / 1000V. A.C. 50μA / 250mA. 6K / 6 meg ohms. −20 to + 22 dB. **£3·75.** Post 20p.

MODEL TH-12

20,000 o.p.v. Overload protection. Slide switch selector 0 / ·25 / 2·5 / 10 / 50 / 250 / 1000V. D.C. 0 / 10 / 50 / 250 / 1000V. A.C. 0 / 50μA / 25 / 250mA. D.C. 0 / 3K / 30K / 300K / 3 meg − 20 to + 50dB **£4·97.** Post 15p.

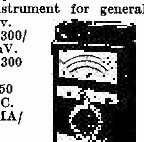
RUSSIAN 22 RANGE MULTIMETER

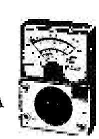
Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2·5/10/50/250/500/1000v D.C. 2·5/10/50/250/500/1000v A.C. DC Current 100wA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3m Ω. Complete with batteries, test leads, instructions and sturdy steel carrying case. OUR PRICE **£5·97.** P. & P. 25p

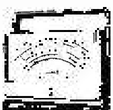
MODEL PL436

20k Ω/Volt D.C. 8k Ω/Volt AC. Mirror scale. ·6/3/12/30/120/600 V D.C. 3/30/120/600 V A.C. 50/600μA/60/600 mA. 10/100K/1 Meg/10 Meg Ω −20 to +46db. **£6·97.** P. & P. 12p.

MODEL 500

30,000 O.P.V. with overload protection mirror scale 0/·5/2·5/10/25/100/250/500/1,000v. D.C. 0/2·5/10/25/100/250/500/1,000V. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60/K/6 Meg./60 Meg Ω **£9·95.** Post paid. Leather Case **£1·75**

U4312 MULTIMETER
Extremely sturdy instrument for general electrical use. 667 o.p.v.

0/·3/1·5/7·5/30/60/150/300/600/900 VDC and 75mV. 0/·3/1·5/7·5/30/60/150/300 600/900 VAC. 0/300μA/1·5/6/15/60/150 600MA/1·5/6 AMP. D.C. 0/1·5/6/15/60/150/600MA/1·5/6 AMP. AC. 0/200 Ω/3K/30K Ω. Accuracy DC 1%. AC 1·5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. **£9·50.** P. & P. 25p.

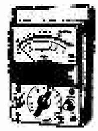
HIOKI MODEL 700X

100,000 O.P.V. Overload protection. Mirror scale. ·3/·6/1·2/1·5/3/6/12/30/60/120/300/600/1200V DC 1·5/3/6/12/30/60/150/300/600 1200 V. A.C. 15/30μA/3/6/30/60/150/300mA 6/12 AMP. DC. 2K/200K/2 Meg/20 Meg ohm −20 to +63dB. **£13·50.** P. & P. 20p

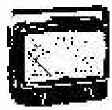
MODEL C-7080 EN

Giant 6″ mirror scale. 20,000 o.p.v. 0 / ·25 / 1 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. D.C. 0 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. A.C. 0 / 50μA / 1 / 10 / 100 / 500mA / 10 amp. D.C. 0 / 2K / 200K / 20 meg − 20 to + 50 dB. **£13·95.** Post 35p.

All prices are inclusive of 10% VAT

370 WTR MULTI-METER

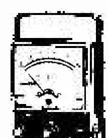
Features A.C. current ranges. 20,000 o.p.v. 0/·5/2·5/10/50/250/500 1000 V. D.C. 0/2·5/10/50/250/500/1000V AC 0/50uA/1/10/100mA/1/10 Amp D.C. 0/100mA/1/10 Amp AC 0/5K/50K/500K/5 MEG/ 50 MEG. −20 +62db. **£15.** P. & P. 25p.

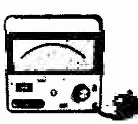
KAMODEN 72.200 MULTITESTER

High sensitivity tester. 200,000 o.p.v. Overload protection. Mirror scale. Ranges: 0 / ·06 / ·3 / 3 / 30 / 120 / 600 / 1200V. D.C. 0 / 3 / 12 / 60 / 300 / 11,200V. A.C. 0 / 6μA / 1·2mA / 120mA / 600mA / 12A. D.C. 0 / 12A. A.C. −20 to +63dB. 0 / 2K / 200K / 2 meg / 200 meg ohms. **£16·95.** Post 30p.

TMK LAB TESTER.

100,000 O.P.V. 6½in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K/Volt A.C. D.C. Volts: ·5, 2·5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 25, 50, 250, 500, 1,000V. D.C. Current: 10, 100μA, 10, 100, 500mA, 2·5, 10 amp. Resistance: 1K, 10K, 100K, 10MEG, 100MEG Ω. Decibels: −10 to +49 db. Plastic Case with Carrying Handle. Size: 7½in. × 6½in. × 3⅛in. **£18·95.** P. & P. 25p.

Model S-100TR MULTIMETER/ TRANSISTOR TESTER

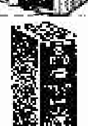
100,000 o.p.v. mirror scale/overload protection. 0/·12/·6/3/12/30/120/600 V DC. 0/6/30/120/600. V AC. 0/12/600μA/ 12/300mA/12 AMP DC. 0/10 K/1 MEG/100MEG. −20 to +50db. 0·01–2 MFD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. **£13·50.** P/P 25p.

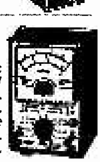
KAMODEN HM.350 TRANSISTOR TESTER

High quality instrument to test Reverse Leak current and DC current. Amplification factor of NPN, PNP, transistors, diodes, SCR's etc. 4″ × 4½″ clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. **£12·50.** Post 30p.

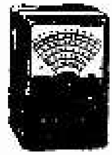
MODEL 449A IN CIRCUIT TRANSISTOR TESTER

Checks true A.C. beta in / out. Checks Icbo. Checks diodes in / out. Checks SCR, etc. Beta HI 10 − 500, LO 2 − 50. Icbo 0–5000μA. 220/240 V A.C. operation **£17·50.** Post 25p.

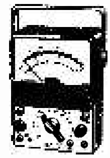
LB3 TRANSISTOR TESTER

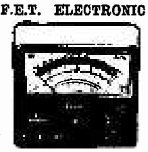
Tests ICO and B. PNP / NPN. Operates from 9v battery. Complete with all instructions, etc. **£3·95.** P. & P. 20p.

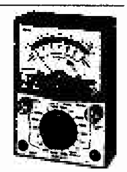
LB4 TRANSISTOR TESTER

Tests PNP or NPN transistors. Audio indication. Operates on two 1·5v batteries. Complete with all instructions, etc. **£4·50.** P. & P. 20p.

TE-40 HIGH SENSITIVITY A.C. VOLTMETER

10 meg. input 10 ranges: 01/·003/·1/·3/1/3/10/30/100/300V. R.M.S. 4cps.-1-2 Mc/s. Decibels −40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. **£17·50.** Carr. 25p.

TE-65 VALVE VOLTMETER

28 ranges. D.C. volts 1·5–1,500v. A.C. volts 1·5–1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. **£17·50.** P. & P. 30p. Additional probes available: R.F. **£2·12½**; H.V. **£2·50.**

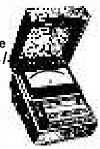
KAMODEN HM. 720B F.E.T. V.O.M.

Input impedance 10 meg ohms. Ranges: 0 / ·25 / 1 / 2·5 / 10 / 50/ 250 / 1000V. D.C. 0 / 2·5 / 10 / 50 / 250 1000V. A.C. 0 / 25μA / 2·5 / 25 / 250 MA D.C. − 20 to + 62dB 0 / 5K / 50K / 500K / 5meg 500meg ohms. **£14·95.** Post 30p

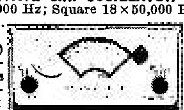
TMK MODEL 117 F.E.T. ELECTRONIC VOLTMETER

Battery operated, 11 meg input, 26 ranges. Large 4½″ mirror scale. Size 5⅞″ × 4⅞″ × 2⅛″. DC VOLTS 0·3–1200V AC VOLTS 3–300V RMS. 8·0–800V P-P. DC CURRENT ·12–12MA. Resistance up to 2000M ohm. Decibels −20 to + 51dB. Complete with leads/instructions. **£17·50.** P. & P. 20p.

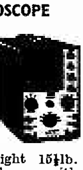
MODEL L-55 FET V.O.M.

Input impedance 10 meg ohms. 0 / ·3 / 1·2 / 6 / 30 / 120 / 600V. D.C. 0 / 3 / 12 / 60 / 120 / 600V. A.C. 0 / 120μA / 120mA D.C. 0 / 1K / 100K / 10 meg /100 meg ohms **£15·97.** Post 15p.

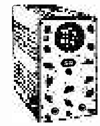
KAMODEN HMG-500 INSULATION RESISTANCE TESTER

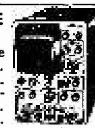
Range 0–1000 Megohms, 500 Volt. Battery operated. Wide range clear meter 4½″ × 4″. Complete with deluxe carrying case, batteries, instructions. **£19·95.** Post 30p

MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER

Sensitivity 330 ohms/Volt AC and DC. Accuracy 5% D.C. 1% AC. Scale length 165mm. 0/300/750μA/1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5AMP DC 0 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5 AMP AC 0 / 75 / 150 / 300 / 750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750V DC 0/750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 /750V AC. Automatic cut out. Supplied complete with test leads, manual and test certificates. **£49·00.** Post 50p.

BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR
Sine 18 × 200,000 Hz; Square 18 × 50,000 Hz

Output max. + 10 dB. (10 K ohms) Operation internal batteries. Attractive 2-tone case 7½″ × 5″ × 2″. Price **£17·50.** Carr. 17½p.

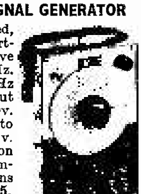
TO-3 PORTABLE OSCILLOSCOPE

3in. tube, Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps-1·5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0·9v. p-p/CM. Bandwidth 1·5cps–800kHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps 300 kHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½lb. 220/240V. A.C. Supplied brand new with handbook. **£47·50.** Carr. 50p.

CI-5 PULSE OSCILLOSCOPE

For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/mm. ·1-25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz, V RMS/mm. ·3-25; Preset triggered sweep 1-3,000usec.; free running 20-200,000Hz in nine ranges. Calibrator pips. 220 × 360 × 430mm. 115-230V. AC operation. **£39·00.** Carr. paid.

RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPE

5 mc/s Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 5in. × 4in. C.R.T. Calibrated triggered sweep from ·2 u/sec. to 100 milli-sec. per cm. Free running time base 50 c/s-1 mc/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with all accessories and instruction manual **£87.** Carr. Paid.

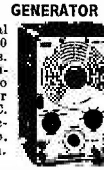
MODEL AT201 DECADE ATTENUATOR

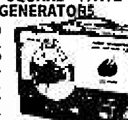
Frequency range 0–200KHz. Attenuator 0–111db, 0·1db step. Impedance 600 ohms. Max. input power 30dbm. Size 180 × 90 × 55mm. **£12·50.** Post 37p.

ARF-300 AF/RF SIGNAL GENERATOR

All transistorised, compact, fully portable. AF sine wave 18 Hz to 220 KHz. AF square wave 18 Hz to 100 KHz. Output sine / square 10v. P-P. RF 100 KHz to 200 MHz. Output 1v. maximum. Operation 220/240v. AC. Complete with instructions and leads. **£29·95.** Post 50p.

MODEL TE.15 GRID DIP METER

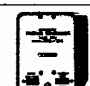
Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440Kc/s–280Mc/s in 6 coils. 500μA Meter. 9V battery operation. Size 180 × 80 × 40mm. **£15·00.** Post 20p.

TE-20D RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s 500 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator, audio output. Xtal socket for calibration. 220/240V. A.C. Brand new with instructions **£17·50.** Carr. 37p. Size 140 × 215 × 170 mm.

TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20cps to 200 kc/s on 4 bands. Square: 20cps to 30 kc/s. Output impedance 5,000 ohms, 200/250V. A.C. operation. Supplied brand new and guaranteed with instruction manual and leads. **£17·50.** Carr. 37½p.

AUTO TRANSFORMERS
0/115/250V. Step up or step down. Fully shrouded.

80 W	£2·10	P. & P. 18p
150 W	£2·70	P. & P. 18p
300 W	£3·60	P. & P. 23p
500 W	£5·25	P. & P. 33p
1000 W	£7·50	P. & P. 38p
1500 W	£10·20	P. & P. 43p
2250 W	£17·25	P. & P. 50p
5000 W	£35·00	P. & P. £1

MCA. 220 AUTOMATIC VOLTAGE STABILISER

Input 88 125 VAC or 176, 250VAC. Output 120VAC or 240VAC. 200VA rating. **£11·97.** Carr. 50p.

JOSTYKIT

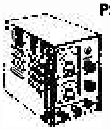
HIGH QUALITY CONSTRUCTION KITS
Appointed stockists at all branches
Complete with comprehensive, easy to follow instructions, and covered by full guarantee
Post and packing 15p per kit

AF20	Mono transistor amplifier	£4.80
AF30	Mono transistor pre-amplifier	£2.61
AF310	Mono amplifier (use two for stereo	£5.91
AT5	Automatic light control	£2.58
AT30	Photo cell switching unit	£5.70
AT50	400W Triac light dimmer/speed control	£4 80
AT55	1,300W Triac light dimmer/speed control	£5.70
AT56	2,200W Triac light dimmer/speed control	£6 90
AT60	Psychedelic light control, single channel	£7 80
AT65	Psychedelic light control, 3 channel	£14 55
HF61	Medium wave transistor radio	£3 33
HF65	FM transistor transmitter	£2.70
HF75	FM transistor receiver	£2.88
HF310	FM tuner unit	£15 81
HF325	De-luxe FM tuner unit	£24 12
HF330	Stereo decoder for HF310/HF325	£9 96
HF395	Aerial amplifier for AM/FM bands I, II, III	£1 77
GP310	Stereo pre-amp for use with 2x AF310	£21.27
GU330	Tremolo unit for guitars etc	£7 50
NT10	Power supply 100 m/a 9V stab 12V unstab	£6 15
NT300	Professional stabilized power supply 2x 30 Volt, 2 2 Amp	£12.51
NT305	Transistor converter 12/15V AC DC to 6V, 7 5V or 9V DC	£4.50
NT310	Power supply 240V AC to 2x 18V DC at 2 Amps	£4 80
NT315	Power supply 240V AC to 4.5-15V DC 500 m/a	£9.57

RP214 REGULATED POWER SUPPLY

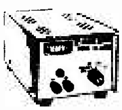
Solid state. Variable output 0–24V DC up to 1 amp. Dual scale meter to monitor voltage and current Input 220/240V AC. Size 185 × 85 × 105mm. **£8·97** P. & P. 25p.

PS.200 REGULATED P.S.U.



Solid state. Variable output 5·20 volt D.C. up to 2 amp. Independent meters to monitor voltage and current. Output 220/240 V. A.C. Size 7¾" × 5½" × 3½". **£19·95.** P. & P. 25p.

PS.1000B REGULATED POWER SUPPLY

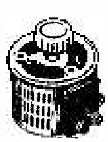


Solid state. Output 6, 9 or 12 volt DC up to 3 amps. Meter to monitor current. Input 220/240v AC. Size 4" × 3½" × 6¼". **£11·97.** P. & P. 25p.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

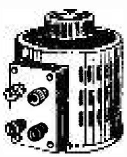
Excellent quality at low cost. All models—Input 230V. 50/60 c/s. Variable output 0–260V.

MODEL S-260 GENERAL PURPOSE BENCH MOUNTING



1 Amp	£7·00
2·5 Amp	£8·05
5 Amp	£11·75
8 Amp	£15·90
10 Amp	£22·50
12 Amp	£23·60
20 Amp	£49·00
25 Amp	£58·00
40 Amp	£82·50

MODEL S-260B

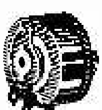


Panel Mounting.

1 Amp	£7·00
2·5 Amp	£8·05

Carriage and Packing Extra

POWER RHEOSTATS



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50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. £1·35. P. & P. 10p.

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50p each Post 12p.

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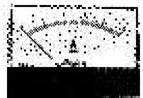
Type SW.100 100 x 80 mm.

50µA	£4·15	5 amp. D.C.	£3·80
50–0–50µA	£3·95	300V. A.C.	£3·70
100µA	£3·95	VU Meter	£4·30
100–0–100µA	£3·90		
500µA	£3·70		
1mA	£3·60		
20V. D.C.	£3·60		
50V. D.C.	£3·60		
300V. D.C.	£3·60		
1 amp. D.C.	£3·60		

Type SD.830 82.5mm x 110mm Fronts



50µA	£3·40	10mA	£3·10
50–0–50µA	£3·40	50mA	£3·10
100µA	£3·35	100mA	£3·10
100–0–100µA	£3·35	500mA	£3·10
200µA	£3·30	1 amp.	£3·10
500µA	£3·15	5 amp.	£3·10
1mA	£3·10	10 amp.	£3·10
5mA	£3·10	5V. D.C.	£3·10
		10V. D.C.	£3·10
		20V. D.C.	£3·10
		50V. D.C.	£3·10
		300V. D.C.	£3·10
		15V. A.C.	£3·30
		300V. A.C.	£3·30
		VU Meter	£3·50

Type SD.640 63.5mm x 85mm Fronts

50uA	£3·05	500mA	£2·90
50–0–50µA	£3·05	1 amp.	£2·90
100µA	£3·00	5 amp.	£2·90
100–0–100µA	£3·00	10 amp	£2·90
200µA	£3·00	5V. D.C.	£2·90
500µA	£2·95	20V. D.C.	£2·90
1mA	£2·90	50V. D.C.	£2·90
5mA	£2·90	300V. D.C.	£2·90
10mA	£2·90	15V. A.C.	£3·00
50mA	£2·90	300V. A.C.	£3·00
100mA	£2·90	VU Meter	£3·15

Type SD.460 46mm x 59.5mm Fronts

50µA	£2·80	1 amp.	£2·60
50–0–50µA	£2·80	5 amp.	£2·60
100µA	£2·75	10 amp.	£2·60
100–0–100µA	£2·75	5V. D.C.	£2·60
200µA	£2·70	10V. D.C.	£2·60
500µA	£2·55	20V. D.C.	£2·60
1mA	£2·60	50V. D.C.	£2·60
5mA	£2·80	300V. D.C.	£2·60
10mA	£2·60	15V. A.C.	£2·70
50mA	£2·60	300V. A.C.	£2·70
100mA	£2·60	VU Meter	£2·90
500mA	£2·60		

"SEW" EDGWISE METERS

Type PE.70. 3 17/32in. x 1 15/32in. x 2¼in. deep

50µA	£3·15	500µA	£3·20
50–0–50µA	£3·60	1mA	£3·20
100µA	£3·60	300V. A.C.	£3·25
100–0–100µA	£3·50	VU Meter	£3·35
200µA	£3·40		

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ALL OTHERS MOVING COIL**
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Type MR.85P. 4¼in. x 4¼in. fronts

50µA	£4·40	50mA	£3·90
50–0–50µA	£4·25	100mA	£3·90
100µA	£4·25	500mA	£3·90
100–0–100µA	£4·05	1 amp.	£3·90
200µA	£4·05	5 amp.	£3·90
500µA	£3·90	15 amp.	£3·90
500–0–500µA	£3·90	30 amp	£3·95
1mA	£3·90	20V. D.C.	£3·90
1–0–1mA	£3·90	50V. D.C.	£3·90
5mA	£3·90	150V. D.C.	£3·90
10mA	£3·90	300V. D.C.	£3·90
		15V. A.C.	£3·95
		300V. A.C.	£3·95
		S Meter 1mA	£3·90
		VU Meter	£4·55
		1 amp. A.C.*	£3·90
		5 amp A.C.*	£3·90
		10 amp. A.C.*	£3·90
		20 amp. A.C.*	£3·90
		30 amp. A.C.*	£3·90

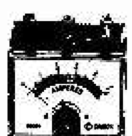
Type MR.52P. 2½in. square fronts

50µA	£3·50	10V. D.C.	£2·50
50–0–50µA	£3·05	20V. D.C.	£2·50
100µA	£3·00	50V. D.C.	£2·50
100–0–100µA	£2·95	300V. D.C.	£2·50
500µA	£2·65	15V. A.C.	£2·60
1mA	£2·50	300V. A.C.	£2·60
5mA	£2·50	S Meter 1mA	£2·60
10mA	£2·50	VU Meter	£3·60
50mA	£2·50	1 amp. A.C. *	£2·50
100mA	£2·50	5 amp. A.C. *	£2·50
500mA	£2·50	10 amp. A.C. *	£2·50
1 amp	£2·50	20 amp. A.C. *	£2·50
5 amp	£2·50	30 amp. A.C. *	£2·50

Type MR.65P. 3½in. x 3¼in. fronts

50µA	£3·70	10V. D.C.	£2·60
50–0–50µA	£3·15	20V. D.C.	£2·60
100µA	£3·15	50V. D.C.	£2·60
100–0–100µA	£3·10	150V. D.C.	£2·60
200µA	£3·05	300V. D.C.	£2·60
500µA	£2·75	15V. A.C.	£2·80
500–0–500µA	£2·60	50V. A.C.	£2·80
1mA	£2·60	150V. A.C.	£2·80
5mA	£2·60	300V. A.C.	£2·80
10mA	£2·60	500V. A.C.	£2·80
50mA	£2·60	S Meter 1mA	£2·85
100mA	£2·60	VU Meter	£3·70
500mA	£2·60	50mA A.C. *	£2·60
1 amp.	£2·60	100mA A.C. *	£2·60
5 amp.	£2·60	200mA A.C. *	£2·60
10 amp.	£2·60	500mA A.C. *	£2·60
15 amp.	£2·60	1 amp. A.C. *	£2·60
20 amp.	£2·60	5 amp. A.C. *	£2·60
30 amp.	£2·80	10 amp. A.C. *	£2·60
50 amp.	£2·90	20 amp. A.C. *	£2·60
5V. D.C.	£2·60	30 amp. A.C. *	£2·60

"SEW" EDUCATIONAL METERS

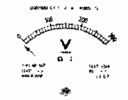


Type ED.107. Size overall 100mm x 90mm x 108mm

A new range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

50µA	£6·90	20V. d.c.	£5·95
100µA	£6·40	50V. d.c.	£5·95
1mA	£5·95	300V. d.c.	£5·95
50–0–50µA	£6·40		
1–0–1mA	£5·95	Dual range	
1A d.c.	£5·95	500mA/5A d.c.	£7·00
5A d.c.	£5·95	5V/50V d.c.	£7·00
10V d.c.	£5·95		

Type MR.38P. 1 21/32in. square fronts



50µA	£2·55	200mA	£2·25
50–0–50µA	£2·50	300mA	£2·25
100µA	£2·45	500mA	£2·25
100–0–100µA	£2·40	750mA	£2·25
200µA	£2·25	1 amp.	£2·25
500µA	£2·25	2 amp.	£2·25
500–0–500µA	£2·25	5 amp.	£2·25
1mA	£2·25	10 amp.	£2·25
1–0–1mA	£2·25	3V. D.C.	£2·25
2mA	£2·25	10V. D.C.	£2·25
5mA	£2·25	15V. D.C.	£2·25
10mA	£2·25	20V. D.C.	£2·25
20mA	£2·25	50V. D.C.	£2·25
50mA	£2·25	100V. D.C.	£2·25
100mA	£2·25	150V. D.C.	£2·25
150mA	£2·25	300V. D.C.	£2·25
		500V. D.C.	£2·25
		750V. D.C.	£2·25
		15V. A.C.	£2·30
		50V. A.C.	£2·30
		150V. A.C.	£2·30
		300V. A.C.	£2·30
		500V. A.C.	£2·30
		S Meter 1mA	£2·30
		VU Meter	£2·65

Type MR.45P. 2in. square fronts

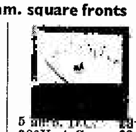
50µA	£2·70	5 amp.	£2·40
50–0–50µA	£2·65	10V. D.C.	£2·40
100µA	£2·60	20V. D.C.	£2·40
100–0–100µA	£2·50	50V. D.C.	£2·40
200µA	£2·50	300V. D.C.	£2·40
500µA	£2·45	15V. A.C.	£2·40
500–0–500µA	£2·40	300V. A.C.	£2·40
1mA	£2·40	S Meter 1mA	£2·50
5mA	£2·40	VU Meter	£2·70
10mA	£2·40	1 amp. A.C. *	£2·40
50mA	£2·40	5 amp. A.C. *	£2·40
100mA	£2·40	10 amp. A.C. *	£2·40
500mA	£2·40	20 amp. A.C. *	£2·40
1 amp.	£2·40	30 amp. A.C. *	£2·40

"SEW" BAKELITE PANEL METERS

Type MR.65. 3½in. square fronts

25µA	£4·60	1 amp.	£2·60
50µA	£3·55	5 amp.	£2·60
50–0–50µA	£3·05	15 amp.	£2·60
100µA	£3·00	30 amp.	£2·60
100–0–100µA	£3·00	50 amp.	£2·60
500µA	£2·70	5V. D.C.	£2·60
500–0–500µA	£2·70	10V. D.C.	£2·60
1mA	£2·60	20V. D.C.	£2·60
1–0–1mA	£2·80	50V. D.C.	£2·60
5mA	£2 60	150V. D.C.	£2·60
10mA	£2·30	300V. D.C.	£2·60
50mA	£2·60	50mV. D.C.	£2·90
100mA	£2·60	100mV. D.C.	£2·90
500mA	£2·60	30V. A.C. *	£2·65
		50V. A.C. *	£2·65
		150V. A.C. *	£2·65
		300V. A.C. *	£2·65
		500mA A.C. *	£2·60
		1 amp. A.C. *	£2·60
		5 amp. A.C. *	£2·60
		10 amp. A.C. *	£2·60
		20 amp. A.C. *	£2·60
		30 amp. A.C. *	£2·60
		50 amp. A.C. *	£2·60
		VU Meter	£3·65

Type S-80 80 mm. square fronts



50µA	£3·50	5 [illegible]	£3·00
50–0–50µA	£3·40	300V. A.C.	£3·00
100µA	£3·40	VU Meter	£3·70
100–0–100µA	£3·30		
500µA	£3·05		
1mA	£3·00		
20V. D.C.	£3·00		
50V. D.C.	£3·00		
300V. D.C.	£3·00		
1 amp. D.C.	£3·00		

HAND HELD 2-WAY WALKIE TALKIES

Battery operation. Volume and squelch controls. Call button and press to talk button. Telescopic aerial. Complete carrying cases.

100mW	**£24·95**	Pair. Post 50p.
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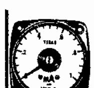
3 channel 2 watt	**£71·25**	Pair. Post 50p.

Licence required for operation in U.K.

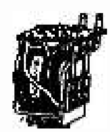
240° Wide Angle 1mA Meters



MW 1·6	60mm square	£3·97
MW 1·8	80mm square	£4·97

P. & P. extra

230 VOLT A.C. 50 CYCLES RELAYS



Brand new. 3 sets of changeover contacts at 5 amp rating. 50p each. P. & P. 10p (100 lots £40) Quantities available.

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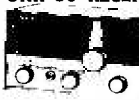
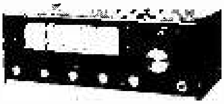
UNR 30 RECEIVER



4 Bands covering 550 kc/s-30 mc/s B.F.O. Built-in Speaker 220/240 v. A.C. Brand new with instructions.

Our Price **£15·75** Carr. 37p

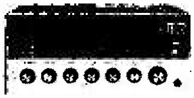
UR-1A RECEIVER



4 Bands covering 550 kc/s-30 mc/s. FET, S Meter. Variable BFO for SSB. Built-in Speaker, Bandspread, Sensitivity Control. 220/240 v. A.C. or 12 v. D.C. 12⅜in. × 4⅜in. × 7in. Brand new with instructions.

Our Price **£25·00** Carr. 37p

SKYWOOD CX203 RECEIVER



Solid state, 5 bands covering 200-420 KHz and ·55 to 30 MHz. Illuminated slide rule dial. Bandspread. Aerial tuning. BFO, AVC, ANL, "S" meter, AM/CW/SS B. Integrated speaker and phone socket. 220/240 v. A.C. or 12 v. D.C. Size 325 × 266 × 150 mm. Complete with instructions and circuit.

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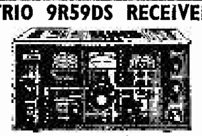
General coverage 150-400 kc/s, 550 kc/s-30 mc/s, FET front end, 2 mech. filters, product detector, variable B.F.O., noise limiter, S Meter Bandspread. RF Gain. 15in. × 9½in. × 8½in. 18 lb. 220/240 v. A.C. or 12 v. D.C. Brand new with instructions.

Our Price **£50·00** Carr. 50p

TRIO 9R59DS RECEIVER



4 bands covering 550 kc/s to 30 mc/s continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW, ANL, Variable BFO. S meter. Sep. bandspread dial. IF frequency 445 kc/s, audio output 1·5w. Variable RF and AF gain controls 115/250 v. A.C. Size: 7in. × 13in. × 10in. with instruction manual.

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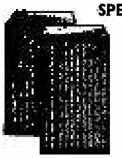
SPECIAL OFFER! STEREO SPEAKERS



Matched pair of stereo bookshelf speakers. Deluxe teak veneeredfinish. Size 14½" × 9" × 7½". 8 ohms. 8 watt RMS. 16 watt peak. Complete with DIN lead.

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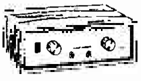
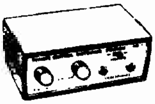
HA-10 STEREO HEADPHONE AMPLIFIER



All silicon transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9v battery. Inputs 5MU/100MU. Output 50MW.

Our Price **£6·97** P. & P. 15p

1021 STEREO LISTENING STATION



For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" × 4" × 2¼".

Our Price **£2·25** P. & P. 15p

MP7 MIXER PREAMPLIFIER

5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9½" × 5" × 3". Inputs Mics: 3×3mV 50K; 2× 3mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K.

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EA.41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, guitar, etc., and output into your amplifier. Volume control, depth of reverberation control. Beautiful walnut cabinet. 4½ × 3 × 4½in.

Our Price **£7·50** P. & P. 15p

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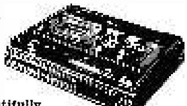
ACD.660 Stereo Cassette Deck



A beautifully styled 4 track stereo deck with an outstanding specification offered at a remarkably low price. Incorporates a host of features including switchable noise filter normal/chrome tape selector, twin VU meter, slider record/playback level controls, front panel headphone socket, recording indicator lamp, phono/Din line input sockets, 3.5mm mike input sockets etc. etc. Frequency response 100–8KHz (100–12KHz Cr02) S/N–45dB. Crosstalk 45dB. Separation–35dB. Noise limiter–6dB at 10KHz. Complete with phono connecting leads.

OUR PRICE **£39·50** Carr. & Ins.50p

AHP-8D 8 Track Stereo Tape Deck

Can be used with most hi fi amplifiers. Push button track selector and illuminated track indicators. Attractive cabinet with black and silver trim. Output level 750mV. AC 220/240v.

OUR PRICE **£11·95** P. & P. 50p.

AHP-8A 8 Track Stereo Tape Player

Incorporates built in amplifiers giving 2½ + 2½ watts rms output. Push button track selector, illuminated track indicators, slider controls for volume, balance and tone. Attractive cabinet with black and silver trim. Output impedance 8 ohms. AC 220/240v.

OUR PRICE **£17·25** P. & P. 50p.

Stereo Headphones

LSH.20 Individual volume controls Stereo mono switch. 8 ohms. 40–19,000 Hz. **£3·50** P & P 30p

LSH.30 Open back type. Individual tone and volume controls. 8 ohms. 30–20,000 Hz. **£5·50** P & P 30p

LSH.40 Two way speaker system. Individual volume controls. 8 ohms. 20–20,000 Hz. **£6·95** P & P 30p

LSH.60 3" speaker units. 8 ohms. 20–20,000 Hz. Complete with zipped carrying case. **£8·50** P. & P. 30p

LQH.400 4-channel dynamic headphones. Each earpiece has 4 drive units. 4-32 ohms. 20-20,000 Hz. **£9·95** P. & P. 30p

LSH.50 Electrostatic with self powered energiser and control unit with headphone/speaker selector. 4-32 ohms. 20-24,000 Hz. **£15·95** P. & P. 30p

AUDIOTRONIC DOLBY 'B' NOISE REDUCTION UNITS

Reduce tape hiss by 3dB at 600Hz, 6dB at 1200Hz and 10bB for all frequencies above 3000Hz. Size 16⅛" × 8" × 3⅛". AC 200/250v

PROCESS FOUR
For use with semi-professional tape recorders. Freq. res. 30Hz–20KHz ± 2dB. S/N better than 70dB. Full source tape monitoring. Record/Replay metering. Switchable multiplex filter. Supplied with test tape.

Our Price **£50·00** P & P 50p

PROCESS TWO
For use with cassette and tape recorders. Freq. res. 30Hz–20KHz ± 2dB. Off tape monitoring. Switchable multiplex filter. Two Dolby calibration meters. S/N better than 70dB. Supplied with test cassette or tape as required.

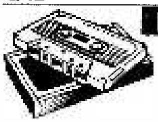
Our Price **£34·50** P & P 50p

ACR.14 Battery Mains Cassette Recorder

Portable twin track mono recorder with automatic recording level control. Built in speaker. Earpiece socket. Input for radio or record player. Fast forward and rewind. Output 500mW. AC 220/240v or 6v DC operation. Complete with remote control microphone, mains lead, earpiece and batteries.

OUR PRICE **£10·50** P. & P. 50p.

LOW NOISE TAPE CASSETTES



Top Hi-Fi quality in library cases

TYPE	5	10	25	
C60	£1·29	£2·53	£5·99	Cassette
C90	£1·85	£3·62	£8·59	Tape Head
C120	£2·29	£4·48	£10·63	Cleaner 30p

P. & P. 15p. post free

ACR 3500 CAR RADIO

Manual tuning of Medium and Long waves. 12v pos. or neg. earth. Complete with speaker, mounting brackets and instructions.

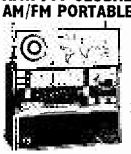
Our Price **£6·50** P & P 50p

ACP.8 8 TRACK CAR PLAYER

12v neg. earth. Slider controls for Volume, Tone and Balance. Channel selector button with red pilot lamp, with speakers, mounting brackets and instructions.

Our Price **£12·50** P & P 40p

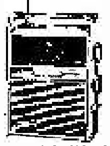
AMR-900 GLOBAL AM/FM PORTABLE RADIO



10 wavebands covering AM: 535–1605 kHz, LW: 150–380 kHz, MB 1·6–4·00 MHz, SW1: 4·0–8 MHz, SW2: 8·0–1·6 MHz, SW3: 16–24 MHz, PSB1: 30–50 MHz, PSB2: 148–174 MHz, FM 88–108 MHz, AIR: 108–136 MHz. Features time zone map and timing dial. Large clear scale. Telescopic aerial and built in aerial. AFC or FM. 6" × 4" speaker and personal earpiece. Battery/mains operation. Size: 345 × 133 × 305mm.

OUR PRICE **£36·00** P. & P. 50p.

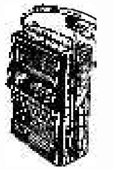
AR.1000 SPORTSMAN AM/FM PORTABLE RADIO



5 wavebands covering AM 535-1065KHz. FM 88–108MHz. AIR 108–135MHz. PB 147–174MHz. WB 162. 5MHz. Large horizontal slide dial with logging scale. Slider volume and squelch controls. 7 section telescopic aerial for FM and built in ferrite bar for AM. AFC. 3in. speaker. Earpiece socket. Green leatherette covered cabinet with metal side panels. Size 152 × 79 × 219mm. Battery/mains operation.

OUR PRICE **£11·50** P. & P 35p.

AUDIOTRONIC AMB.500 MULTIBAND RADIO



5 wavebands covering MW 535–1605KHz and FM 88–175MHz. All transistor. Battery or mains operation. Built in aerial and 8 section telescopic aerial. Complete with batteries, shoulder strap and earpiece.

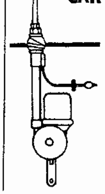
OUR PRICE **£6·95** P & P 35p

ACRI PUSHBUTTON CAR RADIO

Push button tuning of one LW and five MW stations of your choice. 12v pos. or neg. earth. Complete with speaker, mounting brackets and instructions.

Our Price **£8·95** P & P 50p

ACASSE ELECTRIC CAR AERIAL



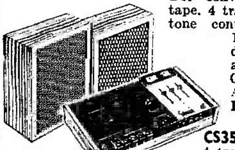
5 section. Fully automatic. 12v DC. Extends to approx. 40". Complete with switch, all leads and instructions.

Our Price **£5·95** P & P 50p

SAVE UP TO 33⅓% OR MORE! GWS

SUPER AKAI HIFI BARGAINS

CS35 STEREO CASSETTE RECORDER



For conventional or Chromium Dioxide tape. 4 track record/playback. Volume and tone controls. Frequency response 40–16kHz (using CrO2 tape), distortion better than 2%. wow and flutter better than 0·2% RMS. Complete with pair of matching Akai CS88 speakers.
Rec. Price £96·10. OUR PRICE **£56·50** P.&P. 50p

CS35D STEREO DECK

4 track record/playback deck. Accepts chrome/regular tape cassettes.
Rec. Price £68·30 GWS PRICE **£44·45** P. & P. 50p.

CASSETTE (P. & P. 50p)	
GXC40D Deck	£57·20
GXC40 Recorder	£67·20
GXC40T Deck/Receiver	£99·05
GXC45 Deck	£78·25
GXC46D Dolby Deck	£83·55
GXC46 Recorder	£89·95
GXC60D Deck	£87·65
GXC65D Dolby Deck	£92·65

CARTRIDGE (P. & P. 50p)	
CR81 Deck with amps.	£65·40
CR81D Deck	£53·60
CR81T Recorder/Receiver	£92·75
CR80SS 4 channel Recdr.	£114·25
CR80DSS 4 channel Recdr.	£93·65

TAPE (P. & P. 75p)	
4000DS Deck	£59·95
4000DS Dust Cover	£3·95
1721L Recorder	£60·35
X5000 Recorder	£82·50
X201D Deck	£108·20
GX220D Deck	£123·95
GX221D	£138·40
GX280D Deck	£196·50
GX370 Deck	£211·50

TAPE/CASSETTE (P. & P. 75p)	
GX1900D Deck	£144·50

MICROPHONES (P. & P. 50p)	
ADM Dynamic (pair)	£7·50

STEREO RECEIVERS (P. & P. 75p)	
AA6300 20+20 watt	£61·95
AA8030 25+25 watt	£92·50
AA8080 40+40 watt	£117·50
AA81008 2×36 or 4×18 w.	£175·00
AA8500 65+65 watt	£150·50

STEREO AMPLIFIERS (P. & P. 50p)	
AA5200 20+20 watt	£61·75
AA5500 30+30 watt	£78·50
AA5800 45+45 watt	£117·50

STEREO TUNERS (P. & P. 50p)	
AT550 AM/FM	£60·50
AT580 AM/FM	£94·50

4-CHANNEL UNIT (P. & P. 50p)	
SS1 Synthesiser	£39·95

SPEAKERS	
SW155 (each)	£51·00

STEREO HEADPHONES	
ASE11	£4·75
ASE20	£7·30
ASE22	£8·25

RECORD DECKS

Carriage and Packing 50p

B.S.R. McDONALD	
C114 Mini	£3·95
C129 Mono	£5·50
C137	£7·00
510/TPD1	£13·95
610	£10·55
610/TPD1	£15·45
710	£21·15
810	£26·30
MP60	£8·25
MP60/G800	£10·90
MP60/TPD1	£13·20
MP60/TPD2	£11·25
HT70	£11·60
HT70/G800	£14·25
HT70/TPD1	£16·55

CONNOISSEUR	
BD1 Kit	£9·10
BD1 Chassis	£11·35
BD1/SAU2/Plinth/Cover	£27·60
BD2/SAU2/Chassis	£22·70
BD2/SAU2/Plinth/Cover	£28·20

GARRARD	
2025 T/C Stereo	£6·35
SP25 III	£9·25
SP25 III Acos GP104C	£8·50
SP25111/9800	£10·95
SP25/M75-6	£13·90
AP76	£18·00
SL65B	£11·15
SL72B	£17·75
SL95B	£31·15
401	£24·35
ZERO 100A	£34·10
ZERO 100S	£31·40

GOLDRING	
G99	£18·99
G101P/C	£18·99
GL69/2	£15·75
GL72	£20·97
GL72/P	£27·80
GL75	£26·60
GL75P	£34·40
GL78P/C	£46·55
GL85P/C	£59·55

THORENS	
TD125/II	£56·60
TD125/AB/II	£85·65
TD160C	£48·40
TD165	£41·70

SPECIAL GARRARD OFFERS!

STEREO 1025T

4 speed autochanger unit fitted with stereo ceramic cartridge.
Our Price **£4·95** Carr. 50p

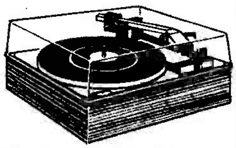
SP25 III WITH ACOS GP104

SP25 MK.II. 4 speed single record player fitted with Acos GP104 stereo ceramic cartridge.
Our Price **£8·50** Carr. 50p

SINCLAIR PROJECT 60 PACKAGE DEALS

2 × Z30 Stereo 60/P/Z5 £15·95. P. & P. 37p.
2 × Z30/Stereo 60/PZ6 £18·00. P. & P. 37p.
2 × Z50/Stereo 60/PZ8 £20·25. P. & P. 37p.
Transformer for PZ8 £3·65.
Active Filter Unit £4·45.
Pair of Q16 Speakers £10·70
Project 60 FM Tuner £14·95
Sinclair Project 605 £20·97. P. & P. 37p.
All other Sinclair Products in stock
2000 Amplifier £22·95
3000 Amplifier £28·95
2000/3000 Tuner £26·30
QS30 Speakers £29·98 pair
P. & P. 50p each of above items

RECORD DECK PACKAGES



Carriage and Packing 75p.
Complete units with Stereo cartridge ready wired in plinth cover.

GARRARD	
2025 TC/9TAHCD	£10·65
SP25 111/G800	£15·95
SP25 111/M44E	£16·45
SP25 111/M44-7	£16·10
SP25 111/M55E	£16·90
SP25 111 Module/M75-6	£19·45
AP76/G800	£23·50
AP76/G800E	£25·95
AP76/M44E	£24·95
AP76/M55E	£25·65
AP76/M75ED	£31·70
AP76/M75EJ	£27·85
AP76 Module M75-6	£29·10
AP96 Module M75-6	£33·20
ZERO 100S Module/M93E	£44·15

B.S.R. McDONALD	
210/SC7M	£7·40
MP60/G800	£15·00
MP60/TPD1/G800	£15·80
MP60/M44-7	£16·60
HT70/TPD1/G800	£19·20

GOLDRING	
GL72/G800	£31·50
GL75/G800	£36·65
GL75/G800E	£39·15

GOODMANS	
TD100/G800 Teak	£46·85
TD100/G800 White	£48·60

LEAK	
Delta/M75-6	£43·95

PHILIPS	
GA105/GP200	£13·80
GA160/GP200 Teak	£19·50
GA212/GP400	£45·25
GA308 (less cartridge)	£23·95
GA308 P.U.	£32·75

PIONEER	
PL12D (Less cartridge)	£29·60
PL15C (Less cartridge)	£41·25
PL41D (Less cartridge)	£95·25
PL50 (Less cartridge)	£89·90
PL61 (Less cartridge)	£102·75
PLA35 (Less cartridge)	£68·60

THORENS	
TD160C/Ortofon M15ES	£66·95
TD125 AB/11/Ortofon M15E Super	£104·25
TD165/Ortofon M15E Super	£59·60

WHARFEDALE	
Linton/M44-7 Teak	£23·70
Linton/M44-7 White	£23·90

HOMER INTERCOMS

Ideal for home, office, stores, factories, etc. complete with batteries, cable and instructions.
2 Station £2·97, P. & P. 15p.
3 Station £5·25, P. & P. 15p.
4 Station £6·62, P. & P. 17p.

SH628 STEREO HEADPHONES

Outstanding value. Soft ear-pads, adjustable headband. 8-16 ohms. 20-20,000 Hz. Complete with lead and stereo plug.
Our Price **£1·87** P. & P. 30p

LH02S STEREO HEADPHONES

Lightweight headphones with padded earpieces. 4-16 ohms. 20-20,000 Hz. Complete with 6 ft. cord and plug.
Our Price **£1·95** P. & P. 30p

TE1018 DE-LUXE MONO HIGH IMPEDANCE HEADSET

Sensitive magnetic headset with soft earpads. Impedance 2,600 ohms (d.c. 600 ohms). Frequency response 200–4,000 Hz.
Our Price **£2·25** P. & P. 30p

BH.001 HEAD SET AND BOOM MICROPHONE

Moving Coil. Ideal for language teaching, communications. Headphone imp. 16 ohms. Microphone imp. 200 ohms.
Our Price **£4·95** P. & P. 30p

FM TUNER CHASSIS

6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6 × 4 × 2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88–108Mc/s. Ready built ready for use. Fantastic value for money.
Our Price **£5·95** P. & P. 12p
Stereo multiplex adaptors £4·97.

SPECIAL PURCHASE!

FERGUSON EXPORT MODELS

FERGUSON 3408 STEREO TUNER AMPLIFIER

Covers FM 88-108 MHz. Five push button tuning scales. 8+8 watts rms. Inputs for stereo ceramic cartridge and tape etc. Separate bass treble, balance and volume controls.
Our Price **£31·50** P. & P. 50p

3416 STEREO TAPE DECK

4 track. 7½, 3¾, 1⅞ i.p.s. Stereo/mono record/play. 7" reels. Inputs for dynamic mikes, radio, gram. Complete with cover.
Our Price **£41·95** P. & P. 75p

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3, Lisle Street, W.C.2.	Tel: 01-437 8204
34, Lisle Street, W.C.2.	Tel: 01-437 9155
118, Edgware Road, W.2.	Tel: 01-723 9789
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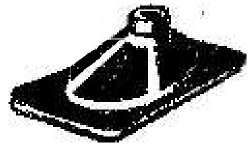

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THE Firm for speakers!

SPEAKERS

EMI 13 x 8, 3, 8 or 15 ohm	£2·03
EMI 13 x 8,150 d/c 3, 8 or 15 ohm	£2·25
EMI 13 x 8,450 t/tw 3, 8 or 15 ohm	£3·60
EMI 13 x 8 type 350 8 ohm	£8·25
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EMI 8 x 5, d /Cone Roll/s 8 ohm	£2·50
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Baker Group 35 3, 8 or 15 ohm	£7·50
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Kef T27	£4·67
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Kef B110	£6·16
Kef B200	£7·42
Kef B139	£10·72
Kef DN8	£1·92
Kef DN9	£1·37
Kef DN12	£4·12
Kef DN13	£2·75
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Fane Pop 60 watt 8/15 ohm	£12·26
Fane Pop 50 watt 8/15 ohm	£10·17
Fane Pop 25/2 25 watt 8/15 ohm	£5·94
Fane Pop 15 watt 8/15 ohm	£4·40
Fane Crescendo 15" 8 or 15 ohm	£27·50
Fane Crescendo 12A 100w 8 or 15ohm	£24·20
Fane Crescendo 12B 75w bass 8 or 15	£24·20
Fane 807T 8" d/c roll/s 8 or 15 ohm	£3·16
Fane 808T 8" d/cone 8 or 15 ohm	£2·64
Goodmans Axent 100 tweeter	£6·60
Goodmans 8P 8 or 15 ohm	£3·80
Goodmans 10P 8 or 15 ohm	£4·49
Goodmans 12P 8 or 15 ohm	£11·55
Goodmans 15P 8 or 15 ohm	£17·05
Goodmans 18P 8 or 15 ohm	£29·70
Goodmans Twinaxiom 8	£6·79
Goodmans Twinaxiom 10	£7·61
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Elac 6½" d/c roll/s 8 ohm	£3·22
Elac 6½" d/cone 8 ohm	£2·59
Elac 4" tweeter TW4	£1·21
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Wharfedale Super 8 RS/DD	£5·50
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10" x 6" 3, 8 or 15 ohm	£1·92
8" x 5" 3 or 8 ohm	£1·38
7" x 4" 3 or 8 ohm	£1·38
2½" 64 ohm or 70 mm 80 ohm	£0·65
Adastra Hiten 10" 10w 8 or 15 ohm	£2·80
Eagle DT33 dome tw.	£5·45
Eagle HT15 tweeter	£3·66
Eagle CT5 tweeter	£1·25
Eagle CT10 tweeter	£2·54
Eagle MHT10 tweeter	£3·74
Eagle FR4	£4·45
Eagle xover CN23, 28, 216	£1·15
Sp. matching transformer 3-15 ohm	£1·10
Celestion MF1000 25w horn 8 or 15 ohm	£10·45
Celestion PS8 (for Unilex)	£2·16
Celestion G12M 8 or 15 ohm	£12·00
Celestion G12H 8 or 15 ohm	£15·00
Celestion G15C 8 or 15 ohm	£24·00
Celestion G18C 8 or 15 ohm	£33·00

Car Stereo speakers—ask for leaflet.

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Wharfedale Unit 5	21·00
Richard Allan Twinkit	£7·33
Richard Allan Triple 8	£10·76
Richard Allan Triple Assem.	£16·20
Richard Allan Super Triple	£19·36
Goodmans DIN 20	£8·58
Fane Mode One	£9·00
Kefkit 2	£24·75
Kefkit 3	£35·50
Peerless 2-8	£5·50
Peerless 3-15	£10·45
Peerless 3-25	£16·00
Peerless 10-2	£8·47
Peerless 20-2	£10·41

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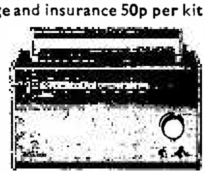

RADIOS/CASSETTES/AMPS.

Grundig Mariner TR865	£32·00
Grundig Party Boy 210	£20·00
Grundig Elite Boy 500	£24·00
Grundig Melody Boy 500	£24·00
Grundig Melody Boy 1000	£35·00
Grundig Yacht Boy 210	£31·00
Grundig RF430 mains	£23·75
Grundig RF310 mains	£21·00
Grundig Top Boy	£16·75
Grundig Satellit 1000	£116·00
Grundig C402 cassette	£27 00
Tandberg TP41	£37·75
Nordmende 7000	£87·00
BASF 9301 radio/cassette	£58·00
Bush RTP100 radio/cassette	£30·50
Trio KA2000A	£33·00
Trio KA2002	£41·00
Hitachi TRQ232S stereo cassette	£49·50
Hitachi TRQ257 cassette	£20·00
Hitachi KCT1210L radio/cassette	£37·50
Hitachi KH986	£18·70
ITT/KB Golf Preset	£21·25
ITT/KB Weekend Auto	£16·00
ITT/KB Europa	£18·00
ITT/KB SL53 cassette	£22·82
ITT/KB Studio 60M cassette	£29·32
ITT/KB Studio 73 stereo cassette	£44·00
Koyo KTR1664 8 waveband	£40·00
Koyo KRT 1770 11 waveband	£56·50

Prices include VAT.
Carriage and insurance 50p. FREE with each radio—"Guide to Broadcasting Stations" (160pp)

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Carriage and insurance £1·00.

Baker 100 Watt	£46·00
Linear 30/40	£25·00
Linear 40/60	£30·00
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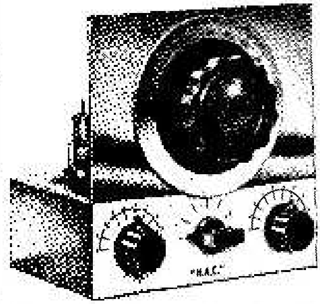
WILMSLOW AUDIO Dept. P.W.

Loudspeakers: Swan Works, Bank Square, Wilmslow, Cheshire SK9 1HF. Radios etc: 10 Swan St., Wilmslow, Cheshire SK9 1HF.

Telephone Wilmslow 29599

H.A.C. SHORT-WAVE KITS

WORLD-WIDE RECEPTION



Famous for over 35 years for Short-Wave Equipment of quality, "H.A.C." were the Original suppliers of Short-Wave Receiver Kits for the amateur constructor. Over 10,000 satisfied customers—including Technical Colleges, Hospitals, Public Schools, R.A.F., Army, Hams, etc.

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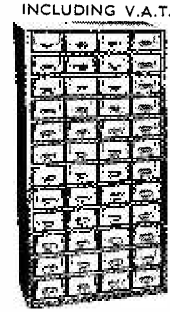
Complete kit—price £3·85 (incl. p. & p. & V.A.T.). Customer writes: "Australia, India and America at loud volume."—"I am 14 years of age and have logged over 130 stations, plus countless Amateurs from all over the world."!
This kit contains all genuine short-wave components, drilled chassis, valve, accessories and full instructions. Ready to assemble, and of course, as all our products—fully guaranteed. Full range of other S.W. kits, including the famous model "K" and "K plus" (illustrated above). All orders despatched by return. Send now for free descriptive catalogue, test report and order form. EXCITING COMPETITION for Short-Wave listeners. Send stamped envelope for details.

"H.A.C." SHORT-WAVE PRODUCTS
29 Old Bond Street, London W.1

SAVE TIME AND MONEY

LIST PRICE **£6·87** | OUR PRICE **£5·50**

INCLUDING V.A.T.



As supplied by us to **SCHOOLS, TECHNICAL COLLEGES, SHOPS, OFFICES AND INDUSTRY.** Silver grey stove enamelled steel cabinet with 48 transparent styrene drawers fitted with moulded handles and label slots. Dividers can be supplied at an extra charge to enable each drawer to be sub-divided into six compartments. Transparent drawers allow swift selection of components at a glance and eliminates duplication of stock. A really first class time saving unit. Size of cabinets 21¼" × 11¾" × 6½". Size of drawers 6¼" × 2¾" × 1½". Other sizes available. Callers welcome. NEW as illustrated **OUR RPICE ONLY £5·50** plus 44p carriage on orders less than £16·50. Money back guarantee. **SEND FOR FREE LISTS**

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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 (Quil). 14 and 16 pin
Our Price 1p per pin

VDR's & Thermistors

A15B	75p	E298 ED/A258	10p	VA1005	15p
CZ1	15p	E298 ZZ/06	10p	VA1026	13p
CZ4	13p			VA1033	10p
CZ13A	13p			VA1034	10p
CZ19	13p			VA1039	15p
GL16	£1·00			VA1040	10p
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R53	£1·32			VA1055S	10p
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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

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	10p	4700pf		10p
2200pf	10p	10,000pf		10p

Ceramic – plate		63V (C333)	
1·8pf	8·2pf	33pf	120pf
2·2pf	10pf	39pf	150pf
3·3pf	12pf	47pf	180pf
3·9pf	15pf	56pf	220pf
4·7pf	18pf	68pf	270pf
5·6pf	22pf	82pf	330pf
6·8pf	27pf	100pf	

all 5p. each

mylar film		100V			
1000pf 2p	·01μF	3p	·068μF	4p
2000pf 2p	·02μF	3p	·1μF	4p
5000pf 2p	·04μF	3p	·2μF	5p
	·05μF	3p		

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

metallised polyester		250V (C280)			
·01μF 3p	·068μF	3½p	·47μF	8p
·015μF 3p	·1μF	4p	·68μF	11p
·022μF 3p	·15μF	4p	1μF	13p
·033μF 3p	·22μF	5p	1·5μF	20p
·047μF 3p	·33μF	6½p	2·2μF	24p

metallised polyester		400V (C281)		
·01μF 4½p	·047μF	6p	·22μF	10p
·015μF 4½p	·068μF	6p	·33μF	14p
·022μF 4½p	·1μF	7p	·47μF	15p
·033μF 5½p	·15μF	8p		

silvered mica 1% (>50pf) 500V

2·2pf—820pf	7p	4·7nF—5600pf	19p
1nF—2·2nf	9p	6800pf—·01μF	29p
2·7nF—3·6nF	16p		

mixed dielectric		600V		
·01μF 7p	·047μF	7p	·22μF	16p
·022μF 7p	·068μF	8p	·47μF	24p
·033μF 7p	·1μF	8p	1μF	33p

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)

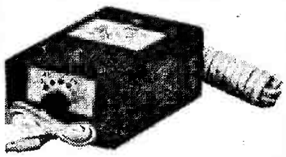
Resistors

½ watt 5% Carbon Film – low noise Hi-Stabs
All E24 values 1p each plus p. & p. 7p for up to 50 Resistors and a further 2p for each additional 50. Deduct 33⅓% for 100 of one type or 25% for mixed orders over £1 in value.

1 W	10% Carbon Composition	3p each
2 W	10% Carbon Composition	6p each
2½ W	5% Wire wound	9p each
5 W	Wire wound	9p each
10 W	Wire wound	10p each

plus p. & p. 7p for up to 25 resistors plus 1p for each additional 25.

Eliminators



6 volt @ 50mA	£1.50
9 volt @ 50mA	£1.50
6 + 6 volt, 50mA	£2.50
9 + 9 volt, 50mA	£2.50
7½ volt for cassette recorders	£2.00
6, 7½ or 9 volt	£3.00
3, 4½, 6, 7½, 9, 12 @ 500mA (illus.)	£3.99
Car Battery Converter fully stabilised to provide 6, 7½ or 9 volts	£4.99

(p. & p. 15p on all types)

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

BZY88 ZENER SERIES 10p each.

SGS

EA1000

3 Watt Audio Amplifier

Our Price inc. handbook £2·49

10+ less 15%
25+ less 25%
100+ less 33⅓%

5 Watt Audio Amplifier

Our Price £3·99
Less quantity discount.

FM TUNER chassis fully transistorised 9 volt operation OUR PRICE £6·25

Matching stereo decoder £4·97
Ask for model list No. 11.

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

CHROMASONIC electronics

PRICES DO NOT INCLUDE V.A.T.

MAIL ORDERS: Where no p. & p. charge is shown, a minimum of 7p applies, p. & p. on overseas orders is charged at cost.
ADDRESS TO: **Component Dept. 56, Fortis Green Road, London N10 3HN**
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Heat Sinks

TO5
TO18
5p

TO66	14p
TO3	15p
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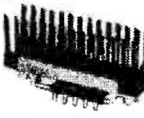
10D 50p



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	LO05T1	£1·50
AC127	15p	BC149	10p	BF272	53p	OC170	23p	2N1893	30p	LO36T1	£1·50
AC128	15p	BC157	12p	BFY50	24p	OC171	30p	2N2926 all	10p	LO37T1	£1·50
AC176	15p	BC158	10p	BFY51	21p	ZTX107	15p	2N3053	23p	MC1303L	£1·75
AC187	25p	BC159	12p	BRY39	36p	ZTX108	12p	2N3054	50p	MC1330	80p
AC187K	25p	BC169	15p	BSX21	26p	ZTX109	15p	2N3055	49p	MC1350	75p
AC188	25p	BC268	15p	BSY95A	14p	ZTX300	12p	2N3702	12p	MC1351	£1·00
AC188K	25p	BD115	67p	BU105/02	£1.75	ZTX301	15p	2N3703	12p	MC1352	£1·00
ACY20	20p	BD131	70p	MJE340	67p	ZTX302	20p	2N3704	10p	MFC4000B	49p
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 / AD162	60p		149p	MPF104	37p	ZTX341	20p	2N3707	15p	PA234	£1·99
		BF160	21p	MPF105	40p	ZTX500	15p	2N3708	12p	SL403D	£1·50
AF114	18p	BF167	20p	MPF106	45p	ZTX501	15p	2N3709	12p	TAD100	£1·50
AF115	18p	BF173	20p	OC28	40p	ZTX502	20p	2N3710	12p	FILTER LP1175	£1.50
AF116	18p	BF180	25p	OC35	40p	ZTX503	17p	2N3711	12p	μA709C	34p
AF117	18p	BF181	30p	OC44	15p	ZTX504	50p	2N3819	35p	μA710	45p
AF139	28p	BF184	25p	OC45	15p	ZTX531	25p	2N3903	15p	μA723C	95p
BC107	10p	BF185	25p	OC71	11p	2N697	18p	2N3904	17p	μA741C	47p
BC108	10p	BF194	15p	OC72	17p	2N706	12p	2N3905	21p	μA748C	60p
BC109	10p	BF195	15p	OC76	15p	2N708	15p	2N3906	12p		

mixed dielectric		1000V			
1000pf	6p	6800pf	9p	·1μF	12p
2200pf	6p	·01μF	9p	·22μF	22p
3300pf	6p	·022μF	9p	·47μF	30p
4700pf	6p	·047μF	12p		

Ceramic

12KV.d.c.		8KV.d.c.		HI-K 750V.	
10pf	9p	200pf	9p	1000pf	5p
15pf	9p	220pf	9p	1500pf	5p
22pf	9p	250pf	9p	2000pf	5p
68pf	9p	270pf	9p	3000pf	5p
82pf	9p	300pf	9p	5000pf	5p
100pf	9p	750V DISC		10,000pf	5p
120pf	9p	470pf	5p	feed-	
140pf	9p	1000pf	5p	through	
150pf	9p	5000pf	5p		
180pf	9p	10,000pf	5p	1000pf	5p

Veroboard

	Copperclad 0.1"	Copperclad 0.15"	Plain 0.15"
2½" x 1"	6p	6p	–
2½" x 3¾"	20p	16p (9)	10p
2½" x 5"	24p	21p (7)	12p
3¾" x 3¾"	24p	21p (8)	–
3¾" x 5"	27p	27p (10)	17p
17" x 2½"	67p	50p	37p
17" x 3¾"	90p	70p	52p
17" x 5"	–	–	75p

Spot-face Cutter	36p
Pin Insertion Tool	47p
Terminal Pins	18p per pack of 36

NEW LISTS

BOXES, CHASSIS, etc.	No. 7
TRANSISTORS, I.C.'s, etc.	(soon)

(postage 5p)

Mullard & Siemens Electrolytics

CAP μF	VOLTAGE 4	6.3	10	16	25	40	63
1	—	—	—	—	—	—	6p
1·5	—	—	—	—	—	—	6p
2·2	—	—	—	—	—	—	6p
3·3	—	—	—	—	—	—	6p
4·7	—	—	—	—	—	—	6p
6·8	—	—	—	—	—	6p	6p
10	—	—	—	—	6p	—	6p
15	—	—	—	6p	—	6p	6p
22	—	—	6p	—	6p	—	6p
33	—	6p	—	6p	—	6p	—
47	6p	—	6p	—	6p	6p	6p
68	—	6p	—	6p	—	—	10p
100	6p	—	6p	—	6p	6p	12p
150	—	6p	—	6p	6p	10p	12p
220	6p	—	6p	6p	10p	12p	18p
330	6p	—	6p	10p	—	—	21p
470	—	6p	10p	—	12p	18p	40p
680	—	10p	—	12p	18p	21p	—
1000	10p	—	12p	18p	21p	40p	60p
1500	—	12p	18p	21p	—	—	—
2200	—	18p	21p	40p	45p	55p	93p
3300	—	21p	—	—	—	—	—
4700	21p	—	—	60p	75p	93p	—

CAP μF	VOLTAGE 16	25	40	64
500			33p	40p
1250			50p	—
1600			—	75p
2000	40p	50p	—	—
2500	—	—	75p	93p
3200	50p		—	—
4000		75p	93p	—
6400	75p	93p	—	—

Quantity Prices on application.

Aluminium Boxes

Including baseplate and screws

No.	L.	W.	D.	Price	p. & p.
(7)	2¾"	x 5¼"	x 1½"	35p	8p
(8)	4"	x 4"	x 1½"	35p	8p
(9)	4"	x 2¾"	x 1½"	35p	8p
(10)	4"	x 5¼"	x 1½"	40p	8p
11	4"	x 2½"	x 2"	35p	8p
12	3"	x 2"	x 1"	32p	9p
13	6"	x 4"	x 2"	50p	10p
14	7"	x 5"	x 2½"	58p	12p
15	8"	x 6"	x 3"	75p	18p
16	10"	x 7"	x 3"	85p	20p

THE TEXAN

Complete Kit (inc. Teak Case) **£28.50** p&p 45p

20 Watts per channel integrated stereo amplifier developed by engineers of 'Texas Instruments Ltd. This designer approved kit, has a state-of-the-art specification, including distortion of only **0.09%** at **20 Watts** into **8 ohms** and a bandwidth of **5 – 35,000** at **–3db.** The semiconductor compliment of this superb kit includes no less than **6 integrated circuits**, 10 Silicon transistors, 4 rectifiers and 2 zeners. Controls include : bass; treble; volume; balance; on/off; 'on' indicator; headphone sockets; scratch filter; rumble filter; inputs for magnetic phono; tuner; aux or tape; tape head etc; input; selector; mono/stereo switch. The construction of this kit was featured in 'Practical Wireless' May - Aug. 1972.

Hi-Volt Electrolytics

1; 2; 4; 8μF 450V	14p	32μF 450V	20p
16μF 450V	15p	50μF 350V	20p
8 + 8μF; 450 V.W	18p	32 + 32μF; 350 V.W	25p
8 + 16μF; 450 V.W	20p	32 + 32μF; 450 V.W	43p
16 + 16μF; 450 V.W	25p	50 + 50μF; 350 V.W	35p

Sinclair Project 60

Now–the Z.50 Mk.2

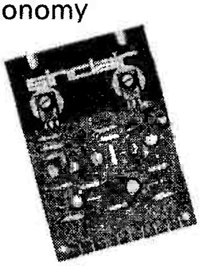
with built-in automatic transient overload protection

When originally introduced, the Sinclair Z.50 proved how it was possible to design and produce a popularly priced modular power amplifier having characteristics to challenge the world's costliest amplifiers. Many thousands of Z.50's are now giving excellent service day in, day out. But we have also learned that constructors do not always use their Z.50's ideally. That is why we have introduced modifications whereby risk of damage through mis-use is greatly reduced and performance further enhanced. The Z.50 Mk.2 has improved thermal stability, more accurately regulated D.C. limiting to ensure more symetrical output voltage swing and clipping and still less distortion at lower power. Z.50 Mk.2 is compatible with all other Project 60 modules, and may be incorporated to advantage in existing systems. Eleven silicon epitaxial planar transistors are now used, two more than in the original Z.50: circuitry has been re-designed, making this versatile high performance amplifier better than ever.

with free manual

£5.48

Z.30 the power amplifier for quality and economy



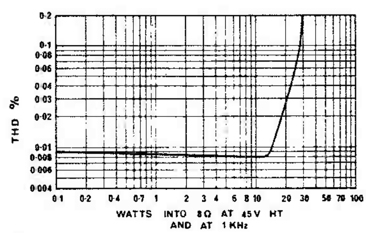
with free manual

£4.48

The Z.30 provides excellent facilities for the constructor requiring a high fidelity audio system of less power than that available from Z.50's. Using a power supply of 35 volts, Z.30 will deliver 15 watts RMS into 8 ohms, or 20 watts RMS into 3 ohms using 30 volts. Total harmonic distortion is a fantastically low 0.02% at 15 watts into 8 ohms with signal to noise ratio better than 70 dB unweighted. Input sensitivity 250mV into 100K ohms. Size 80 x 57 x 13 mm ($3\frac{1}{8}$ x $2\frac{1}{4}$ x $\frac{1}{2}$) Z.30, Z.50 and Z.50 MK.2 modules are compatible and interchangeable.

Brilliant new technical specifications

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



Typical Project 60 applications

System	The Units to use	together with	Units cost
Simple battery record player	**Z.30**	Crystal P.U., 12V battery volume control, etc.	**£4.48**
Mains powered record player	**Z.30, PZ.5**	Crystal or ceramic P.U. volume control, etc.	**£9.45**
12W. RMS continuous sine wave stereo amp. for average needs	**2 x Z.30s, Stereo 60; PZ.5**	Crystal, ceramic or mag. P.U., F.M. Tuner, etc.	**£23.90**
25W. RMS continuous sine wave stereo amp. using low efficiency (high performance) speakers	**2 x Z.30s, Stereo 60; PZ.6**	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc.	**£26.90**
80W. (3 ohms) RMS continuous sine wave de luxe stereo amplifier. (60W. RMS into 8 ohms)	**2 x Z.50s, Stereo 60; PZ.8, mains transformer**	As above	**£34.88**
Indoor P.A.	**Z.50, PZ.8, mains transformer**	Mic., guitar, speakers, etc., controls	**£19.43**

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

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.

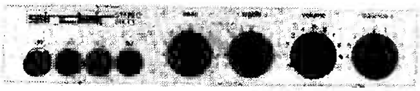
Each Project 60 module is tested before leaving our factory and is guaranteed to work perfectly. Should any defect arise in normal use, we will service it at once and without any charge to you, if it is returned within two years from the date of purchase. Outside this period of guarantee a small charge (typically £1.00) will be made. No charge is made for postage by surface mail. Air Mail is charged at cost.

sinclair

SINCLAIR RADIONICS LTD., R.O. London Road, St. Ives, Huntingdonshire, PE17 4HJ (Phone St. Ives 4311) Reg. No. 699483 England

the world's most advanced high fidelity modules

Stereo 60 Pre-amp/control unit

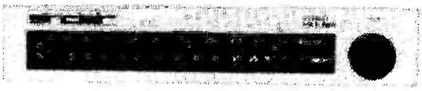


Designed specifically for use on Project 60 systems, the Stereo 60 is equally suitable for use with any high quality power amplifier. Since silicon epitaxial planar transistors are used throughout, a really high signal-to-noise ratio and excellent tracking between channels is achieved. Input selection is by means of press buttons, with accurate equalisation on all input channels. The Stereo 60 is particularly easy to mount.

SPECIFICATIONS—Input sensitivities: Radio – up to 3mV. Mag. p.u. 3mV: correct to R.I.A.A. curve $\pm$1dB :20 to 25,000 Hz. Ceramic p.u. – up to 3mV: Aux – up to 3mV. **Output:** 250mV. **Signal to noise ratio:** better than 70dB. **Channel matching:** within 1dB. **Tone controls:** TREBLE +12 to —12dB at 10KHz: BASS +12 to —12dB at 100Hz. **Front panel:** brushed aluminium with black knobs and controls. **Size:** 66 x 40 x 207mm.

Built, tested and guaranteed. **£9.98**

Project 60 Stereo F.M. Tuner



The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. tuner with fantastically good results. Other advanced features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stero decoder and switchable squelch circuit for silent tuning between stations. In terms of high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with most other high fidelity systems.

SPECIFICATIONS—Number of transistors: 16 plus 20 in I.C. **Tuning range:** 87.5 to 108MHz. **Sensitivity:** 7µV for lock-in over full deviation. **Squelch level:** Typically 20µV. **Signal to noise ratio:** >65dB. **Audio frequency response:** 10Hz – 15KHz ($\pm$1dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2µV. **Cross talk:** 40dB. **Output voltage:** 2 x 150mV R.M.S. maximum. **Operating voltage:** 25–30VDC. **Indicators:** Stereo on ; tuning. **Size:** 93 x 40 x 207mm.

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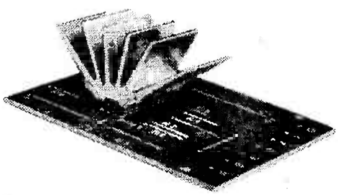
Super IC.12 Integrated circuit high fidelity amplifier



Having introduced Integrated Circuits to hi-fi constructors with the IC.10, the first time an IC had ever been made available for such purposes, we have followed it with an even more efficient version, the Super IC.12, a most exciting advance over our original unit. This needs very few external resistors and capacitors to make an astonishingly good high fidelity amplifier for use with pick-up, F.M. radio or small P.A. set up, etc. The free 40 page manual supplied, details many other applications which this remarkable IC. make possible. It is the equivalent of a 22 transistor circuit contained within a 16 lead DIL package, and the finned heat sink is sufficient for all requirements. The Super IC.12 is compatible with Project 60 modules which would be used with the Z.50 and Z.30 amplifiers. Complete with free manual and printed circuit board.

SPECIFICATIONS

Output power: 6 watts RMS continuous (12 watts peak). 6–8Ω. **Frequency Response:** 5Hz to 100KHz $\pm$1dB. **Total Harmonic Distortion:** Less than 1%. (Typical 0·1%) at all output powers and frequencies in the audio band (28V). **Load Impedance:** 3 to 15 ohms. **Input Impedance:** 250 Kohms nominal. **Power Gain:** 90dB (1,000,000,000 times) after feedback. **Supply Voltage:** 6 to 28V. **Quiescent current:** .8mA at 28V. **Size:** 22 x 45 x 28mm including pins and heat sink..

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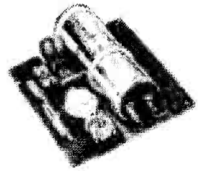

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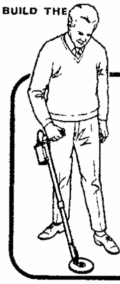

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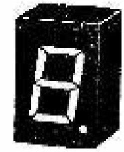

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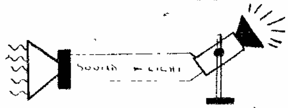

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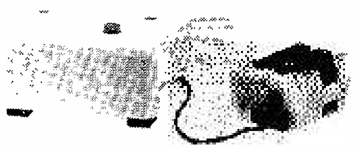

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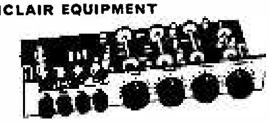

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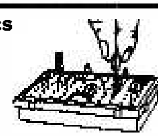

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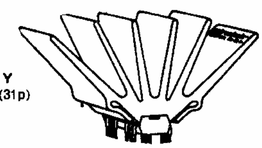

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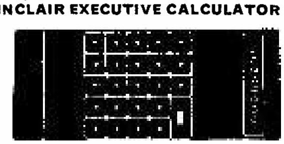

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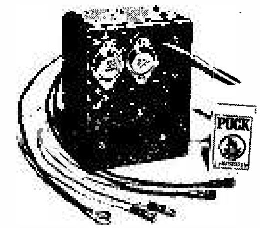

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EL81	0.55	PCC85	0.40	PL802	0.95	UBL21	0.70
EL83	0.50	PCC88	0.55	PM84	0.60	UC92	0.45
EL84	0.25	PCC89	0.55	PY31	0.35	UCC85	0.45
EL85	0.43	PCC189	0.60	PY33	0.63	UCF80	0.70
EL86	0.40	PCC805	0.95	PY80	0.40	UCH21	0.60
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EN91	0.40	PCF806	0.75	QQV03-10	1.25	UF43	0.65
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EY80	0.75	PCH200	0.70	TT22	4.00	UF85	0.40
EY81	0.40	PCL81	0.50	U18/20	0.75	UF89	0.40
EY83	0.55	PCL82	0.35	U25	0.85	UL41	0.65
EY86	0.40	PCL83	0.65	U26	0.85	UL84	0.43
EY87	0.43	PCL84	0.45	U31	0.70	UM84	0.30
EY88	0.43	PCL86	0.45	U37	6.50	UY1N	0.50
EZ40	0.50	PCL88	1.25	U52	0.40	UY11	1.00
EZ41	0.75	PCL200	0.75	U76	0.40	UY41	0.43
EZ80	0.28	PCL800	1.10	U78	0.40	UY82	0.50
EZ81	0.29	PCL801	0.95	U191	0.75	UY85	0.40
GT1C	3.00	PCL805	0.50	U201	0.50	W729	0.75
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GZ30	0.45	PF86	0.70	U282	0.55	Y63	0.75
GZ31	0.40	PF818	1.00	U301	0.55	Z759	3.60
GZ32	0.50			U403	0.70	Z5048	4.50
GZ34	0.60					Z5058	7.00
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2N697	0.15	AC132	0.35	BD123	0.80
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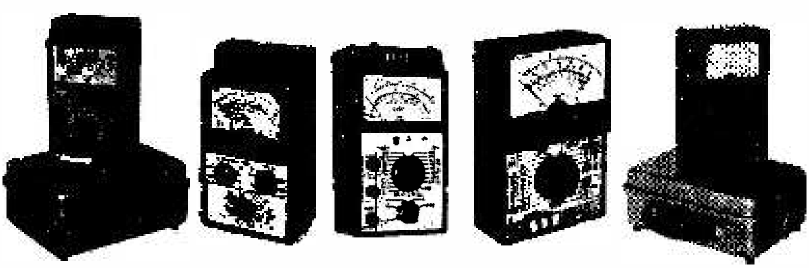
2N705	0.70	AC154	0.15	BD131	0.75
2N706	0.10	AC157	0.17	BD132	0.80
2N708	0.15	AC169	0.10	BF115	0.20
2N753	0.25	AC176	0.17	BF167	0.18
2N929	0.20	AC187	0.25	BF173	0.20
2N930	0.20	AC188	0.25	BF179	0.30
2N987	0.30	ACY17	0.25	BF180	0.30
2N1131	0.25	ACY18	0.20	BF181	0.30
2N1132	0.25	ACY19	0.25	BF184	0.20
2N1184	1.25	ACY20	0.20	BF185	0.20
2N1302	0.17	ACY21	0.20	BF194	0.14
2N1303	0.17	ACY22	0.10	BF195	0.14
2N1304	0.20	AD140	0.50	BF196	0.12
2N1305	0.20	AD149	0.45	BF197	0.12
2N1306	0.25	AD161	0.35	BF200	0.35
2N1307	0.25	AD162	0.35	BFW87	0.25
2N1308	0.25	ADZ11	1.25	BFW88	0.20
2N1309	0.25	ADZ12	1.25	BFW89	0.20
2N1613	0.17	AF114	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
2N2217	0.25	AF125	0.20	BFY51	0.20
2N2218	0.20	AF127	0.20	BFY52	0.20
2N2219	0.20	AF180	0.35	BSY26	0.17
2N2369A	0.15	AF181	0.35	BSY27	0.15
2N2477	0.65	AF186	0.40	BSY28	0.17
2N2646	0.40	AF239	0.36	BSY65	0.20
2N2905	0.25	AFZ11	0.45	BSY95A	0.12
2N2923	0.12	AFZ12	1.00	OC16	0.50
2N2924	0.13	ASY26	0.25	OC22	0.50
2N2926	0.10	ASY27	0.30	OC23	0.60
2N3053	0.20	ASY28	0.25	OC24	0.60
2N3054	0.50	ASY29	0.30	OC25	0.35
2N3055	0.60	ASY54	0.25	OC26	0.25
2N3133	0.25	ASZ15	0.70	OC29	0.60
2N3134	0.25	ASZ16	0.70	OC35	0.50
2N3391	0.17	ASZ17	0.75	OC36	0.45
2N3392	0.17	ASZ18	0.75	OC42	0.20
2N3393	0.15	ASZ20	0.25	OC44	0.15
2N3394	0.15	ASZ21	0.40	OC45	0.12
2N3395	0.20	BC107	0.10	OC70	0.10
2N3402	0.15	BC108	0.10	OC71	0.12
2N3403	0.15	BC109	0.10	OC72	0.12
2N3404	0.32	BC113	0.10	OC73	0.30
2N3414	0.20	BC118	0.20	OC75	0.15
2N3415	0.15	BC134	0.20	OC76	0.15
2N3417	0.25	BC147	0.10	OC78	0.25
2N3702	0.10	BC148	0.10	OC78D	0.20
2N3703	0.10	BC149	0.12	OC81	0.20
2N3704	0.12	BC152	0.15	OC81D	0.20
2N3707	0.12	BC158	0.15	OC83	0.20
2N3709	0.10	BC175	0.20	OC139	0.30
2N3710	0.10	BC186	0.25	OC140	0.35
2N3819	0.35	BCY30	0.25	OC141	0.60
2N3906	0.25	BCY31	0.30	OC170	0.25
2S702	0.50	BCY33	0.25	OC171	0.25
2S746	0.25	BCY34	0.30	OC200	0.30
AC113	0.15	BCY72	0.15	OC201	0.60
AC125	0.30	BCZ10	0.30	OC202	0.65
AC126	0.20	BCZ11	0.40	OC203	0.40
AC127	0.17			OC204	0.40



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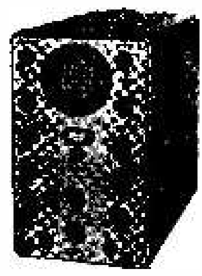

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BY101	450 p.i.v.	1·1A	0·15
BY105	800 p.i.v.	1·1A	0·15
BY127	1250 p.i.v.	1A	0·12
DD000	50 p.i.v.	500mA	0·15
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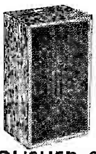

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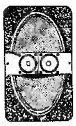

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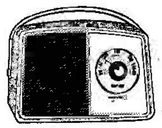

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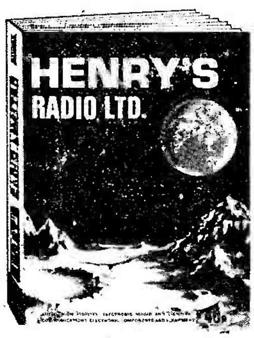

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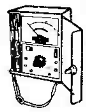

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200H	20K/V Multimeter £4·20. With case £4·95
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CI-5	3" Pulse Scope 10Hz–10mHz £39·00. Carr. 50p
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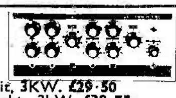

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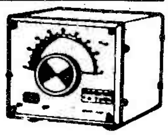

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