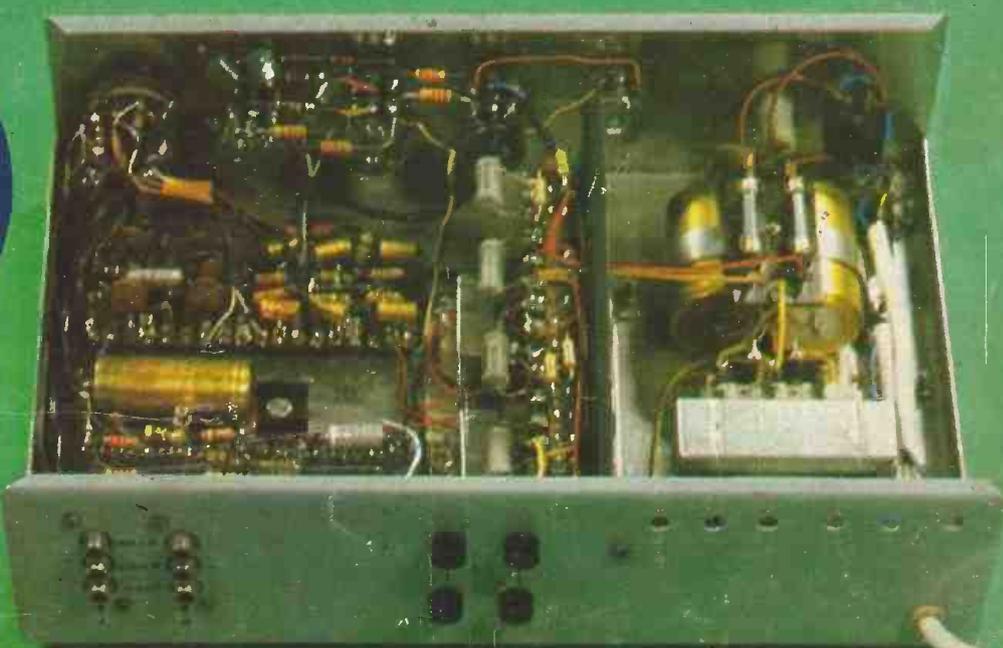


PRACTICAL WIRELESS

JANUARY
1973

20p

**FREE
COMPETITION
INSIDE**



STEREO

10+10 WATT AMPLIFIER



FINAL ENTRY FORM

**10 SCOPES TO
BE WON!**

ALSO:

**LINEAR CAPACITANCE METER
CONVERTER FOR 1.7-30MHz**

R.S.C. STEREO PACKAGE OFFERS



PACKAGE PRICE FOR ILLUSTRATED UNITS

ONLY **£39-95** Carr. £1-00

Or deposit **£8-95** and 9 monthly payments **£4-22** (Total **£44-98**)

Individual Rec. Retail Prices:

LINEAR 505 5 + 5 Watt Amplifier	£17-50
GARRARD 2025 Autochanger + K840A Cartridge	£13-68
Teak Veneer Plinth with Transparent Plastic Cover	£ 6-10
Pair A55 LOUDSPEAKERS (Inc 8" x 5" 10,000 Gauss)	£11-50
TOTAL	£48-68

SEND S.A.E. FOR FREE COLOUR BROCHURE

SAVE £31-60 ON HIGH FIDELITY UNITS

PACKAGE PRICE FOR ILLUSTRATED UNITS

ONLY **£99-95** Carr. £1-75

Or deposit **£15-00** and 12 monthly payments **£8-00** (Total **£111-00**)

Individual Rec. Retail Prices:

GOLDRING GL72 Transcription Turntable + P.U.	£31-89
GOLDRING G800 Magnetic Cartridge	£12-21
DE-LUXE PLINTH with 'Roll-over' Cover	£10-50
Pair R.S.C. MONARCH LOUDSPEAKERS	£38-70
R.S.C. SUPER 30 Mk III AMPLIFIER	£38-70
TOTAL	£131-65



'SUPER 30' AMP

'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

★ Moderate size only 25x14x10in. approx.
★ Response 30-20,000 c.p.s. **COMPLETE KIT £23** Carr. 65p

★ Performance comparable with units costing considerably more.
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) 8x5in. high flux middle range speaker. (4) High efficiency tweeter. (5) Appropriate quantity acoustic damping material. (6) Handsome Teak veneered cabinet. (7) Circuit and full instructions. Terms: Dep. **£4-60** and 9 monthly payments **£2-47** (Total **£28-83**).

DEMONSTRATIONS AT ALL BRANCHES

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 x 11 x 9in. appr. Range 45-15,000 c.p.s. Rating 8-10 watts. Fitted High Flux 13 x 8in. **£9-45** Carr. 40p.

MONARCH Size 19 x 10 x 9in. approx. Rating 10 watts. Inc. 13 x 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**

RSC G66 MkII 6+6 WATT high quality STEREO AMPLIFIER

Individual Ganged Controls: Bass, Treble, Volume and Balance. Printed circuit construction employing 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Bass Control ± 12db.



Treble Control ± 13db. Selector switch for P.U. or Tape/Radio. For loudspeaker output impedances of 3 to 15 ohms. For standard 200-250v. A.C. mains operation.

Attractive Black and Silver finished metal fascia plate and matching control knobs. **COMPLETE KIT OF PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT and COMPREHENSIVE WIRING DIAGRAMS & INSTRUCTIONS £11-50** Carr. 40p

Or **FACTORY BUILT IN TEAK VENEERED CABINET** as illustrated **£14-99** or dep. **£2-20** and 9 monthly payments **£1-70** (Total **£17-50**).

R.S.C. TA12 MKIII 6-5 + 6-5 WATT STEREO AMPLIFIER

FULLY TRANSISTORISED, SOLID STATE CONSTRUCTION

HIGH FIDELITY OUTPUT OF 6-5 WATTS PER CHANNEL

Designed for optimum performance with any crystal or ceramic Gram. P.U. cartridge, Radio tuner, Tape recorder etc. ★ 3 separate switched input sockets on each channel ★ Separate Bass and Treble controls

★ Slide Switch for mono use ★ Speaker Output 3-15 ohms ★ For 200-250v. A.C. mains ★ Frequency Response 20-20,000 c.p.s. -2dB ★ Harmonic Distortion 0-3% at 1,000 c.p.s. Hum and Noise -70dB ★ Sensitivities (1) 50mV (2) 400mV (3) 100mV. Output rating I.H.F.M. ★ Handsome finish Facia plate & Knobs.

COMPLETE KIT OF PARTS WITH FULL WIRING DIAGRAMS & INSTRUCTIONS. £15-50 Carr. 40p. 12 mths. guarantee **£19-50**

Deposit **£3** and 9 mthly pymts **£2-15** (Total **£25-95**). Or in Teak veneer housing Dep. **£3** & 9 mthly payments **£2-55** (Total **£25-95**). Send S.A.E. for leaflet. **£23**



AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£5-95** Carr. 30p

OR SENIOR 15 WATT INCLUDING HF126 15,000 LINE SPEAKER **£6-95** Carr. 35p

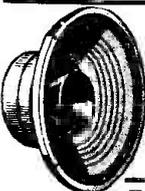


AUDIOTRINE HIGH FIDELITY SPEAKERS

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

Exceptional performance at low cost.

HF808T	8"	10W	£2-98	HF120D	12"	15W	£4-99
HF102D	10"	10W	£3-40	HF126	12"	15W	£5-75
HF120	12"	15W	£4-50	HF126D	12"	15W	£6-25



FANE 807T HIGH FIDELITY SPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. Cast chassis Roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 30 c.p.s. Tweeter cone is fitted to extend high tone response. Frequency range 25 Hz to 15 KHz. Gauss 10,000. Impedance 3 or 8-15 Ω. **£3-85**

PLEASE STATE IMPEDANCE WHEN ORDERING



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 x 2½ x 2½in.
250-0-250v. 60mA. 6-3v. 2a. **99p**
250-0-250v. 60mA 6-3v 2a **£1-05**

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

For Mullard 510 Amplifier **£2-65**
350-0-350v. 100mA. 6-3v. 4a. 0-5-6-3v. 3a. **£2-20**
350-0-350v. 150mA. 6-3v. 4a. 0-5-6-3v. 3a. **£2-65**
425-0-425v. 200mA. 6-3v. 4a. c.t. 5v. 3a. **£4-95**
425-0-425v. 200mA. 6-3v. 4a. 6-3v. 3a. 5v. 3a. **£5-10**
450-0-450v. 250mA. 6-3v. 4a. c.t. 5v. 3a. **£5-50**

TOP SHROUDED DROP-THRO' TYPE
250-0-250v. 70mA. 6-3v. 2a. 0-5-6-3v. 2a. **£1-35**
250-0-250v. 100mA. 6-3v. 3-5a. **£1-55**
250-0-250v. 100mA. 6-3v. 2a. 6-3v. 1a. **£1-60**
350-0-350v. 80mA. 6-3v. 2a. 0-5-6-3v. 2a. **£1-65**
250-0-250v. 100mA. 6-3v. 4a. 0-5-6-3v. 3a. **£2-20**
300-0-300v. 100mA. 6-3v. 4a. 0-5-6-3v. 3a. **£2-20**
300-0-300v. 130mA. 6-3v. 4a. c.t. 6-3v. 1a. **£2-60**
Suitable for Mullard 510 Amplifier **£2-60**
350-0-350v. 100mA. 6-3v. 4a. 0-5-6-3v. 3a. **£2-20**
350-0-350v. 150mA. 6-3v. 4a. 0-5-6-3v. 3a. **£2-60**

FILAMENT or TRANSISTOR POWER PACK
Type 6-3v. 1-5a. 49p; 6-3v. 2a. 54p; 6-3v. 3a. 76p;
6-3v. 6a. £1-30; 12v. 1a. 55p; 12v. 3a. or 24v. 1-5a **£1-35**; 0-9-15v 1½a **£1-10**; 0-12-25-42v 2a **£1-76**.

CHARGER TRANSFORMERS 0-9-15v. 1½a. 99p; 2½a. £1-10; 3a. £1-25; 5a. £1-45; 6a. £1-65; 8a. £2-00

AUTO (Step UP/step DOWN) TRANSFORMERS
0-110/120v. 200-250-250v. 50-80 watts **£1-10**
150 watts. £1-90 250 watts **£2-75**; 500 watts **£5-75**

OUTPUT TRANSFORMERS
Standard Pentode 5,000 Ω to 7,000 Ω to 3 Ω **50p**
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω **83p**
Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω **£1-37**
Push-Pull EL84 to 3 or 15 Ω 10-12 watts. **£1-35**
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Push-Pull 15-18 watts, sectionally wound **£1-99**
6L6, KT66, etc. for 3 or 15 Ω **£1-99**
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω **£3-30**

SELENIUM RECTIFIERS

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

SMOOTHING CHOKES

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

R.S.C. Mk III SUPER 30 HIGH FIDELITY STEREO AMPLIFIER

A completely new design further improved in both appearance and performance. Representing value far higher than the prices suggest.

Only high grade components by leading manufacturers. **£25** Carr. 65p

COMPLETE KIT OF PARTS
Or **FACTORY BUILT** with 12 months guarantee. Dep. **£5-75** and 9 monthly payments **£3-50** (Total **£37-25**).
Or **FACTORY BUILT** in cabinet as illustrated. Dep. **£7** and 9 monthly payments **£3-95** (Total **£42-91**)

TECHNICAL DETAILS (Applying to each channel where appropriate)
CONTROLS: PUSH-BUTTON SELECTOR (1) Disc (2) Radio (3) Tape (4) Mono L (5) Mono R (6) SPEAKER DIS. (7) Mains on/off. Bass, Treble and Balance. Plus Ceramic Mag P.U. Switch.



Printed Circuitry
Twenty Silicon Transistors, Four Diodes, Four Rectifiers

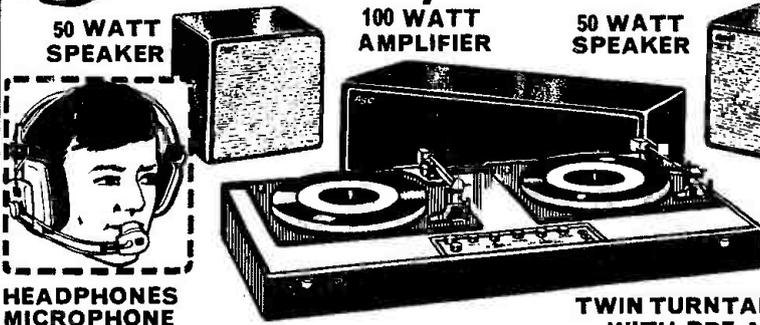
£33-75

£38-75

FREQ. RESPONSE: -3dB 7Hz to 70kHz **BASS CONTROL:** +17dB to -16dB at 40Hz
TREBLE CONTROL: +16dB to -12dB at 14kHz **CROSS TALK** -8dB
SENSITIVITIES: Disc Mag. 2-5 mV. Ceramic 35mV. Radio 120mV. Tape 120mV.
REAR PANEL SOCKETS FOR 3 PAIRS OF INPUTS (1) P.U. (2) Radio. (3) Tape Amp. Plus pair for tape recorder signal take off and 2 pairs for speaker connections.

RSC STEREO F.M. TUNER NOW AVAILABLE. Visually matches Super 30 MkIII ONLY £44-95

RSC GROUP/DISCO UNITS



50 WATT SPEAKER

100 WATT AMPLIFIER

50 WATT SPEAKER

HEADPHONES MICROPHONE

TWIN TURNTABLE WITH PRE-AMP.

PACKAGE OFFER

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

Size approx. 18" x 18" x 8" **£72-85**

Terms on Amps. Speakers and Head- phone/Mike. Deposit £15 and 18 monthly payments of £4-00 (Total £87-00).

RSC TDI DISCO CONSOLE

Incorporating twin Garrard SP25 Mk.III turntables and Sonotone or Acos Cartridges with diamond stylus. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control switch. Black Rexine covered Cabinet with lid. See illus. on left

Carr. £1-25
 Or Dep. £18-25 and 9 mthly pymts £8-88
 (Total £75-17) or Dep. £15 and 18 mthly payments £8-62 (Total £80-16).

£67-10

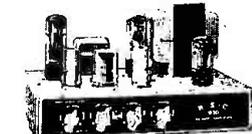
R.S.C. COLUMN SPEAKERS

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 C312 30-40 WATTS** Fitted two exceptionally efficient, low feedback howl characteristic high flux 13" x 8" 20 watt speakers. Terms: Dep. £8 and 9 m'thly payments £2-22 (Total £22-98) Carr. 50p. **£19-95**
- TYPE C412S 50 WATTS** Fitted four 12" 11,000 line 15 watt speakers: Overall size approx. 58 x 14 x 9in Terms: Dep. £4 and 9 monthly payments £3-37 (Total £34-33) Carr. 75p. **£31**
- TYPE C4100 100 WATTS** Inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx. 58 x 16 x 10" Acoustically filled and pressurised. Terms: Dep. £11 and 12 mthly. pyts. £5-18 (Total £78-16). **£65** Carr. £1

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

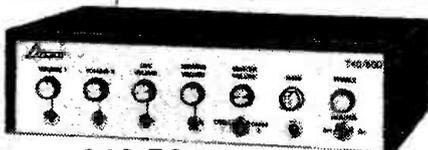
Highly sensitive. Push-Pull high output, Hum level -70dB. Response ±3dB 30-20,000 c/s. All high grade components. Valves EF86 EF86, ECC83, EL34, EL34, GZ34. Separate Bass and Treble Controls. Sensitivity 36 millivolts. For High Impedance microphones. For Clubs, Schools, Theatres, Dance Halls, Outdoor Functions, etc. For Electronic Organ, Guitar, Siring Bass, etc. Gram, Radio or Tape. Two separate inputs with vol. controls permit such as 'mike' and Pick-up etc. for mixing purposes. 200-250v. 50 c/s A.C. mains. For 3 and 16 ohm speakers. Twin-handled perforated cover £1-90. 12 MONTHS' GUARANTEE. Carr. 65p



TERMS: Deposit £4 and 9 monthly payments of £2-10 (Total £22-90). Send S.A.E. for leaflet. **£19-75**

LINEAR T40/60D 50W GROUP/DISCO AMPLIFIER

- ★ FULL MONITORING FACILITIES
 - ★ Individual Bass and Treble controls
 - ★ Twin jack output sockets for speakers
 - ★ Input sockets for medium or high impedance Microphones or Guitar P.U.s and Crystal or Ceramic Gram. P.U.s
 - ★ Frequency response 30-20,000 Hz.
 - ★ Output overload protection plus double fusing
- FRONT PANEL** (Jack inputs) Gram, Gram, Microphone/Guitar P.U.; plus monitoring socket.
- CONTROLS** Vol. (1) (2) (3) and (4). Bass, Treble, Master Vol., Monitor Selection Switch Gram (1) or (2), Mains Switch

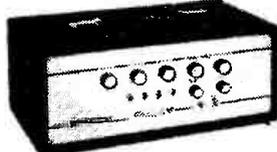


£49-50 Carr. free
 Or Deposit £7-50 and 9 monthly payments £5-37 (Total £55-83)

Simulated black rexine, plastic bonded metal case.
ALSO STOCKED LINEAR T80/100D £69-75

FAL PHASE 50 Mk.III AMPLIFIER 50 WATT.

Solid state. 4 Separately controlled inputs Plus master vol. control. Ind. Bass and Treble Controls. Protective circuit to guard against damage from accidental shorts. Output for Speaker/s 8 to 30 ohms. Size 17" x 7" x 7 1/4". 200-250v. A.C. mains. Output 50 watts music rating. Or deposit £7-25 & 9 monthly payments £3-55. Total £39-20. **£34-95** Carr. 75p.



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

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 **£6-75** or Dep. £1-25 and 9 monthly payments 75p (Total £8-00).

GROUP/DISCO EQUIPMENT PACKAGE OFFERS

- F.A.L. PHASE 50 MK.III AMPLIFIER** £34-95
PR. FANE POP 25/2 25W L/SPEAKERS £13-50
 Terms: Deposit £6.50 and 9 monthly payments of £4.92 (Total £50.78) **£45** carr. £1
- F.A.L. PHASE 50 MK.III AMPLIFIER** £34-95
PR. FANE POP 50 L/SPEAKERS £21-80
 Terms: Deposit £10 and 9 monthly payments of £5-87 (Total £58.83) **£52** carr. £1
- F.A.L. PHASE 50 MK.III AMPLIFIER** £34-95
PAIR L12/25 25W L/8 in cabinets £23-90
 Terms: Deposit £10 and 9 monthly payments of £5-88 (Total £68-92) **£56** carr. £1-25
- LINEAR T40/60D AMPLIFIER** £49-50
PAIR L12/25 L/8 in cabinets £23-90
 Terms: Deposit £9-95 and 9 monthly payments of £7-67 (Total £78-98) **£69-95** carr. £1-50
- F.A.L. PHASE 100 AMPLIFIER** £61-95
4 FANE POP 50 L/SPEAKERS £48-80
 Terms: Deposit £15-95 and 9 monthly payments of £10-73 (Total £112-52) **£99-95** carr. £2

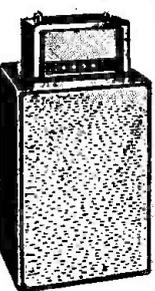
HIGH QUALITY LOUDSPEAKER UNITS

- ALL TWO TONE REXINE AND VYNAIR FINISH
L125 50 WATT Fitted pair of 12" 50 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Carr. £1-50 **£34-50**
- Or deposit £5-50 and 9 monthly payts. of £8-70. Total £38-80
- L12/25 12" 25 WATT** L13 13" x 8" 10 Watt 10,000 lines **£11-95**
- L15 15" 15 WATT** 10,000 lines 3 or 15 ohms. State impedance required. Carr 40p **£5-25**

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. L'speaker 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.

Credit Terms: Deposit £16 & 9 monthly pyts of £6-25 (Total £71-25) **£65** Carr. £2 for leaflet.



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

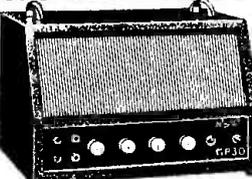
NOW FOUR NEW BRANCHES
 19/19A MARKET STREET
NOTTINGHAM
 5 MARKET SQUARE
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 8 LITTLE UNDERBANK
STOCKPORT
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RSC GP30 HI-FI AMPLIFIER

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/gold P.V.C. fascia.
 Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Terms: Deposit £4-40 and 9 monthly payments of £2-45 (Total £26-45). **£23-50** Carr. 65p



RSC HI-FI CENTRES LTD.
 MAIL ORDERS & EXPORT ENQUIRIES TO:—
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 Tel: Pudsey (09735) 77831.
 TERMS C.W.O. or C.O.D. under £1.
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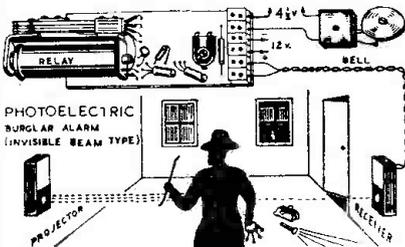
RADIO SOCIETY OF GREAT BRITAIN

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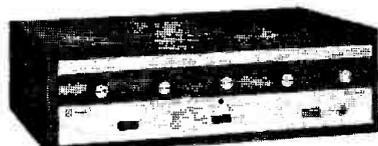
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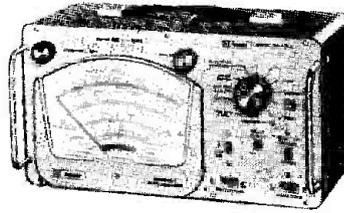
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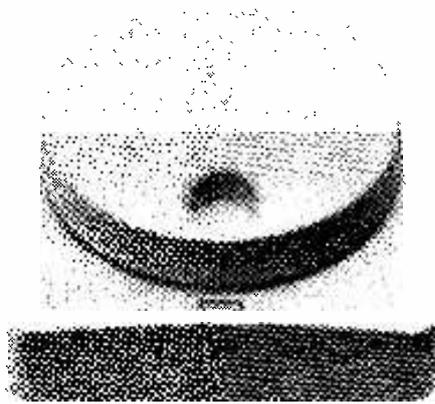
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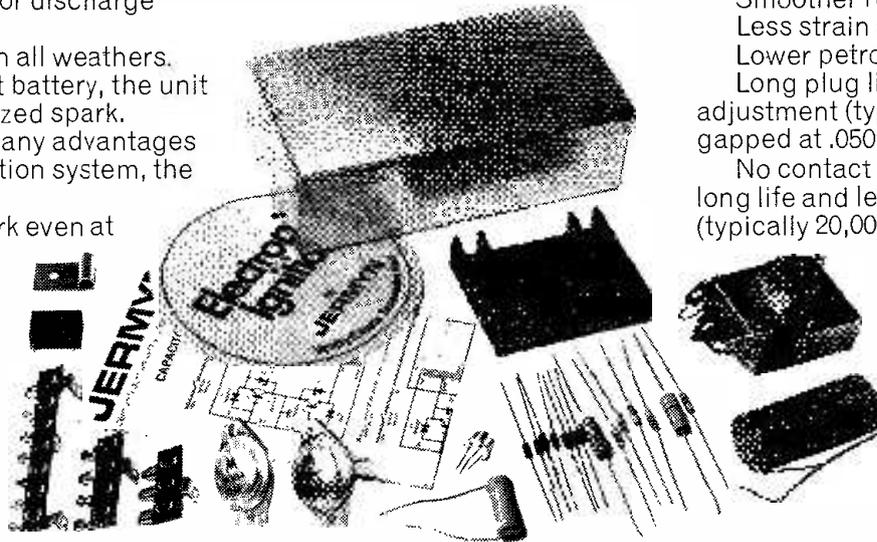
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SPEAKERS

Duo Type II Size approx. 17in. x 10 $\frac{1}{2}$ in. x 6 $\frac{1}{2}$ in. Drive unit 13in. x 8in. with parasitic tweeter. Max. power 10 watts, 8 ohms. Simulated Teak cabinet. £14 pair + £2 p&p.

Duo Type III Size approx. 23 $\frac{1}{2}$ in. x 11 $\frac{1}{2}$ in. x 9 $\frac{1}{2}$ in. Drive unit 13 $\frac{1}{2}$ in. x 8 $\frac{1}{2}$ in. with H.F. speaker. Max power 20 watts at 3 ohms. Freq. range 20Hz to 20kHz. Teak veneer cabinet. £32 pair + £3 p&p.

SPECIFICATION R101

14 watts per channel into 3 to 4 ohms. (suitable 3-15 ohms). Total distortion @ 10W @ 1kHz 0.1%. P.U.1. (for ceramic cartridges) 150mV into 3 Meg. P.U.2. (for magnetic cartridges) 4mV @ 1kHz into 47K equalised within $\pm 1\text{dB}$ R.I.A.A. Radio 150mV into 220K. (Sensitivities given at full power). Tape out facilities: headphone socket, power out 250mV per channel. **Tone controls and filter characteristics.** Bass: +12dB to -17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble +12dB to -12dB @ 15kHz. Treble filter: 12dB per octave. **Signal-to-noise ratio:** (all controls at max) -P.U.1. and radio -65dB, P.U.2 -58dB. **Cross talk** better than -35dB on all inputs. **Overload characteristics** better than 26dB on all inputs. Size approx. 13 $\frac{1}{2}$ x 9in. x 3 $\frac{1}{2}$ in.

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Garrard SP25 Mk. III with MAG. cartridge plinth and cover	£23.00+£1.50 p&p
Total	£59.00

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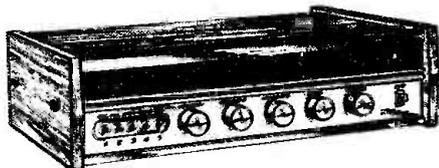
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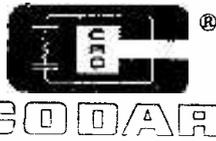
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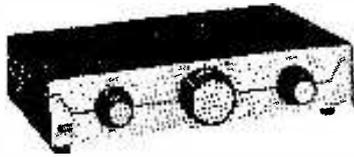
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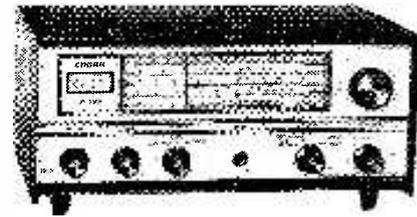
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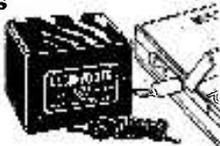
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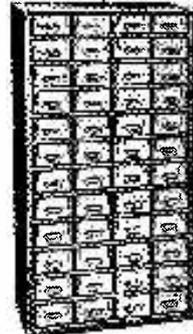
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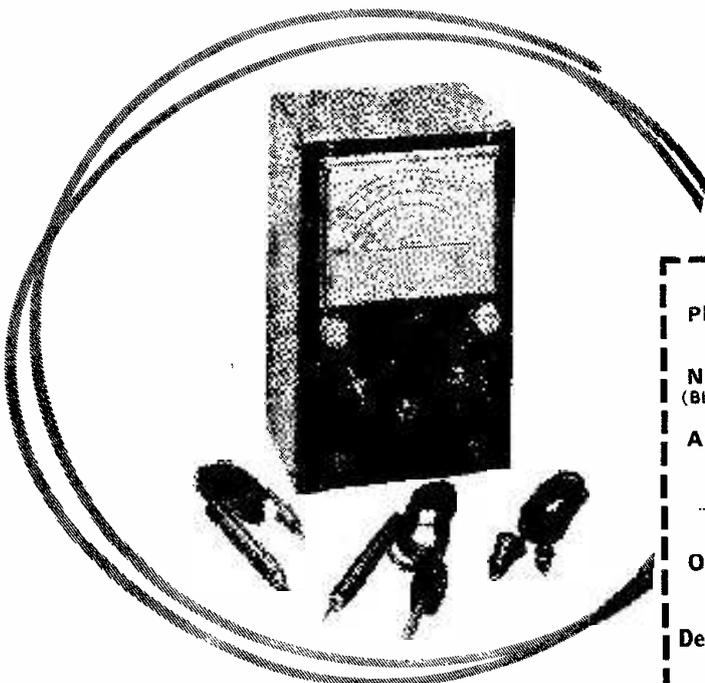
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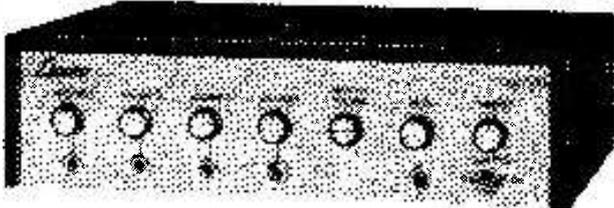


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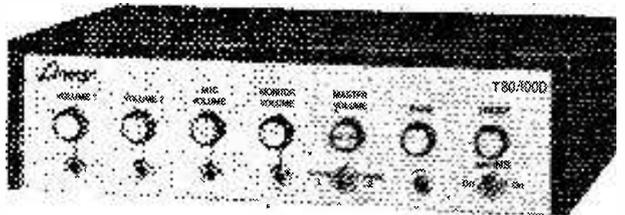
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AC117K	0-20		0-55	BC151	0-20	BD140	0-60	BF196	0-14	OC23	0-42	2G374	0-17	2N2222	0-20	2N3391A	0-16	2N4062	0-12
AC122	0-12	ADT140	0-50	BC152	0-17	BD155	0-80	BF197	0-14	OC24	0-56	2G377	0-30	2N2368	0-17	2N3392	0-14	2N4284	0-17
AC125	0-17	AF114	0-24	BC153	0-28	BD176	0-60	BF200	0-45	OC25	0-38	2G378	0-16	2N2369	0-14	2N3393	0-14	2N4285	0-17
AC126	0-17	AF115	0-24	BC154	0-30	BD177	0-60	BF222	0-95	OC26	0-25	2G381	0-16	2N2369A	0-14	2N3394	0-14	2N4286	0-17
AC127	0-17	AF116	0-24	BC157	0-18	BD178	0-65	BF257	0-45	OC28	0-50	2G382	0-16	2N2411	0-24	2N3395	0-17	2N4287	0-17
AC128	0-17	AF117	0-24	BC158	0-12	BD178	0-65	BF258	0-60	OC29	0-50	2G401	0-30	2N2412	0-24	2N3402	0-21	2N4288	0-17
AC132	0-14	AF118	0-24	BC159	0-12	BD179	0-70	BF259	0-85	OC35	0-42	2G414	0-30	2N2646	0-47	2N3403	0-21	2N4289	0-17
AC134	0-14	AF124	0-30	BC160	0-45	BD180	0-70	BF262	0-55	OC36	0-50	2G417	0-25	2N2711	0-21	2N3404	0-23	2N4290	0-17
AC137	0-14	AF125	0-25	BC161	0-50	BD185	0-65	BF263	0-55	OC41	0-20	2N388	0-35	2N2712	0-21	2N3405	0-42	2N4291	0-17
AC141	0-14	AF126	0-28	BC167	0-12	BD186	0-65	BF270	0-35	OC42	0-24	2N388A	0-55	2N2714	0-21	2N3414	0-15	2N4292	0-17
AC141K	0-17	AF127	0-28	BC188	0-12	BD187	0-70	BF271	0-30	OC44	0-15	2N404	0-20	2N2804	0-17	2N3415	0-15	2N4293	0-17
AC142	0-14	AF129	0-30	BC189	0-12	BD188	0-70	BF272	0-80	OC45	0-12	2N404A	0-28	2N2904A	0-21	2N3416	0-28	2N5172	0-12
AC142K	0-17	AF178	0-50	BC170	0-12	BD189	0-75	BF273	0-35	OC70	0-10	2N524	0-42	2N2905	0-21	2N3417	0-28	2N5457	0-32
AC144	0-15	AF179	0-50	BC171	0-14	BD190	0-75	BF274	0-35	OC71	0-10	2N527	0-49	2N2905A	0-21	2N3525	0-75	2N5458	0-32
AC154	0-20	AF180	0-50	BC172	0-14	BD195	0-85	BFW10	0-60	OC72	0-14	2N598	0-42	2N2906	0-15	2N3646	0-09	2N5459	0-50
AC155	0-20	AF181	0-45	BC173	0-14	BD196	0-85	BFX29	0-27	OC74	0-14	2N599	0-45	2N2906A	0-18	2N3702	0-10	2S301	0-50
AC156	0-20	AF186	0-45	BC174	0-14	BD197	0-90	BFX84	0-22	OC75	0-15	2N696	0-12	2N2907	0-20	2N3703	0-10	2S302A	0-42
AC157	0-24	AF239	0-37	BC175	0-22	BD198	0-90	BFX85	0-30	OC76	0-15	2N697	0-13	2N2907A	0-22	2N3704	0-11	2S302	0-42
AC165	0-20	AL102	0-65	BC177	0-19	BD199	0-95	BFX86	0-22	OC77	0-25	2N698	0-24	2N2925	0-14	2N3705	0-10	2S303	0-55
AC166	0-20	AL103	0-65	BC178	0-19	BD200	0-95	BFX87	0-24	OC81	0-15	2N699	0-35	2N2924	0-14	2N3706	0-09	2S304	0-70
AC167	0-20	ASY26	0-25	BC179	0-19	BD205	0-80	BFY88	0-22	OC81D	0-15	2N706	0-08	2N2925	0-14	2N3707	0-11	2S305	0-84
AC168	0-24	ASY27	0-30	BC180	0-24	BD206	0-80	BFY50	0-20	OC82	0-15	2N706A	0-09	2N2926 (G)		2N3708	0-07	2S306	0-84
AC169	0-14	ASY28	0-25	BC181	0-24	BD207	0-95	BFY51	0-20	OC82D	0-15	2N707	0-12	2N2926 (Y)	0-12	2N3709	0-09	2S307	0-84
AC176	0-20	ASY29	0-25	BC182	0-10	BD208	0-95	BFY52	0-20	OC83	0-20	2N711	0-30	2N2926 (O)	0-11	2N3710	0-09	2S321	0-56
AC177	0-24	ASY50	0-25	BC182L	0-10	BDY20	1-00	BFY53	0-17	OC84	0-20	2N717	0-35	2N2926 (R)	0-10	2N3711	0-09	2S322	0-42
AC178	0-28	ASY51	0-25	BC183	0-10	BF115	0-24	BFX25	0-85	OC139	0-20	2N718	0-24	2N2926 (B)	0-10	2N3712	0-09	2S322A	0-42
AC179	0-28	ASY52	0-25	BC183L	0-10	BF117	0-45	B8X19	0-15	OC140	0-20	2N718A	0-50		0-10	2N3820	0-60	2S323	0-56
AC180	0-17	ASY54	0-25	BC184	0-12	BF118	0-70	B8X20	0-15	OC169	0-25	2N726	0-28	2N2926 (R)	0-10	2N3821	0-85	2S324	0-70
AC180K	0-20	ASY55	0-25	BC184L	0-12	BF119	0-70	B8Y25	0-15	OC170	0-25	2N727	0-28		0-10	2N3822	0-85	2S325	0-70
AC181	0-17	ASY56	0-25	BC186	0-28	BF121	0-45	B8Y26	0-15	OC171	0-25	2N743	0-20	2N2926 (B)	0-10	2N3903	0-28	2S326	0-70
AC181K	0-20	ASY57	0-25	BC187	0-28	BF123	0-50	B8Y27	0-15	OC200	0-25	2N744	0-20		0-10	2N3904	0-30	2S327	0-70
AC187	0-22	ASY58	0-25	BC207	0-11	BF125	0-45	B8Y28	0-15	OC201	0-28	2N914	0-14	2N3010	0-70	2N3905	0-28	2S701	0-42
AC187K	0-20	ASZ21	0-40	BC208	0-11	BF127	0-50	B8Y29	0-15	OC202	0-28	2N918	0-30	2N3011	0-14	2N3906	0-27	40361	0-40
AC188	0-22	BC107	0-09	BC209	0-12	BF152	0-55	B8Y38	0-18	OC203	0-25	2N929	0-21	2N3053	0-17	2N4058	0-12	40362	0-45
AC188K	0-20	BC108	0-09	BC212L	0-11	BF153	0-45	B8Y39	0-18	OC204	0-25	2N930	0-21						
ACY17	0-25	BC109	0-10	BC213L	0-11	BF154	0-45	B8Y40	0-28	OC205	0-35	2N1131	0-20						
ACY18	0-20	BC113	0-10	BC214L	0-14	BF156	0-70	B8Y41	0-28	OC309	0-40	2N1132	0-22						
ACY19	0-20	BC114	0-15	BC225	0-25	BF156	0-48	B8Y95	0-12	P346A	0-20	2N1302	0-14						
ACY20	0-20	BC115	0-15	BC226	0-35	BF157	0-55	B8Y95A	0-12	P397	0-42	2N1303	0-14	AA119	0-08	BY133	0-21	OA10	0-35
ACY21	0-20	BC116	0-15	BCY30	0-24	BF158	0-55	Bu105	2-00	OCP71	0-48	2N1304	0-17	AA120	0-08	BY164	0-50	OA47	0-07
ACY22	0-16	BC117	0-15	BCY31	0-26	BF159	0-60	CI11E	0-50	ORP12	0-43	2N1305	0-17	AA129	0-08	BYX38/30		OA70	0-07
ACY27	0-18	BC118	0-10	BCY32	0-30	BF160	0-40	C400	0-30	ORP60	0-40	2N1306	0-21	AA Y30	0-09		0-42	OA79	0-07
ACY28	0-19	BC119	0-30	BCY33	0-22	BF162	0-40	C407	0-25	ORP61	0-40	3N1307	0-21	AA Z13	0-10	BYZ10	0-25	OA81	0-07
ACY29	0-35	BC120	0-80	BCY34	0-25	BF163	0-40	C424	0-20	ST140	0-12	2N1308	0-23	BA100	0-10	BYZ11	0-30	OA85	0-09
ACY30	0-28	BC125	0-12	BCY70	0-14	BF164	0-40	C425	0-50	ST141	0-17	2N1309	0-23	BA116	0-21	BYZ12	0-30	OA90	0-08
ACY31	0-28	BC126	0-18	BCY71	0-18	BF165	0-40	C426	0-35	T1843	0-30	2N1613	0-20	BA126	0-22	BYZ13	0-25	OA91	0-08
ACY34	0-21	BC132	0-12	BCY72	0-14	BF167	0-22	C428	0-20	UT46	0-27	2N1711	0-20	BA148	0-14	BYZ16	0-40	OA95	0-07
ACY35	0-21	BC134	0-18	BCZ10	0-20	BF173	0-32	C441	0-30	2G301	0-09	2N1889	0-32	BA154	0-12	BYZ17	0-35	OA200	0-08
ACY36	0-28	BC135	0-18	BCZ11	0-25	BF176	0-35	C442	0-30	2G302	0-19	2N1890	0-45	BA155	0-14	BYZ18	0-35	OA202	0-07
ACY40	0-17	BC136	0-15	BCZ12	0-25	BF177	0-35	C444	0-35	2G303	0-19	2N1893	0-37	BA156	0-13	BYZ19	0-28	SD10	0-05
ACY41	0-18	BC137	0-15	BD121	0-60	BF178	0-30	C460	0-22	2G304	0-24	2N2147	0-72	BY100	0-15	CG62		SD19	0-05
ACY44	0-35	BC139	0-40	BD123	0-65	BF179	0-30	MAT100	0-19	2G306	0-40	2N2148	0-60	BY101	0-12	(Eq) OA91		IN34	0-07
AD130	0-38	BC140	0-30	BD124	0-60	BF180	0-30	MAT101	0-20	2G308	0-35	2N2160	0-57	BY105	0-17		0-05	IN34A	0-07
AD140	0-48	BC141	0-30	BD131	0-50	BF181	0-30	MAT120	0-19	2G309	0-35	2N2192	0-35	BY114	0-12	CG651		IN914	0-06
AD142	0-48	BC142	0-30	BD132	0-60	BF182	0-40	MAT121	0-20	2G339	0-20	2N2193	0-35	BY126	0-14	(Eq) OA70-		IN916	0-06
AD143	0-38	BC143	0-30	BD133	0-65	BF183	0-40	MFP102	0-42	2G339A	0-16	2N2194	0-35	BY127	0-15	OA79	0-06	IN414B	0-06
AD149	0-50	BC145	0-45	BD135	0-40	BF184	0-25	MFP104	0-87	2G344	0-18	2N2217	0-26	BY128	0-15	OA5	0-35	IS021	0-10
AD161	0-38	BC147	0-10	BD136	0-40	BF185	0-30	MFP105	0-37	2G345	0-16	2N2218	0-20	BY130	0-16	OA5SL	0-21	IS951	0-06

DIODES AND RECTIFIERS

AA119	0-08	BY133	0-21	OA10	0-35
AA120	0-08	BY164	0-50	OA47	0-07
AA129	0-08	BYX38/30		OA70	0-07
AA Y30	0-09		0-42	OA79	0-07
AA Z13	0-10	BYZ10	0-25	OA81	0-07
BA100	0-10	BYZ11	0-30	OA85	0-09
BA116	0-21	BYZ12	0-30	OA90	0-08
BA126	0-22	BYZ13	0-25	OA91	0-08
BA148	0-14	BYZ16	0-40	OA95	0-07
BA154	0-12	BYZ17	0-35	OA200	0-08
BA155					

The largest selection

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

PIV 1A	3A	5A	5A	7A	10A	16A	30A
TO5	TO66	TO66	TO84	TO48	TO48	TO48	TO48
50 0-23	0-25	0-35	0-35	0-47	0-50	0-53	1-15
100 0-25	0-33	0-47	0-47	0-50	0-58	0-63	1-40
200 0-35	0-37	0-49	0-49	0-57	0-61	0-75	1-60
400 0-43	0-47	0-56	0-56	0-67	0-75	0-93	1-75
600 0-53	0-57	0-68	0-68	0-77	0-77	1-25	—
800 0-63	0-70	0-80	0-80	0-90	1-20	1-50	4-00

SIL. RECTS. TESTED

PIV 300mA	750mA	1A	1.5A	3A	10A	30A
50 0-04	0-05	0-05	0-07	0-14	0-21	0-60
100 0-04	0-06	0-05	0-13	0-16	0-23	0-75
200 0-05	0-09	0-06	0-14	0-20	0-24	1-00
400 0-06	0-13	0-07	0-20	0-27	0-37	1-25
600 0-07	0-16	0-10	0-25	0-34	0-45	1-86
800 0-10	0-17	0-11	0-25	0-37	0-55	2-00
1000 0-11	0-25	0-14	0-30	0-46	0-63	2-50
1200 —	0-33	—	0-38	0-57	0-75	—

TRIACS

VBOM 2A	6A	10A
TO-1 TO-66	TO-88	
\$p	\$p	\$p
100 30	50	76
200 50	60	90
400 70	75	1-10

DIACS

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

BRAND NEW TEXAS GERM. TRANSISTORS

Coded and Guaranteed

Pak No.	EQVT
T1	8 2G3713 OC71
T2	8 D1374 OC75
T3	8 D1216 OC81D
T4	8 2G381T OC81
T5	8 2G382T OC82
T6	8 2G344B OC44
T7	8 2G345B OC45
T8	8 2G378 OC78
T9	8 2G399A 2N1302
T10	8 2G417 AP117

All 50p each pak

2N2060 NPN SIL. DUAL TRANS. CODE D1689 TEXAS. Our price 25p each.

180 VCB MIXIE DRIVER TRANSISTOR. Sim. B5X21 & C407, 2N1893 FULLY TESTED AND CODED ND 120. 1-24 17p each. TO-5 N.P.N. 25 up 15p each.

Sil. trans. suitable for P.E. Organ. Metal TO-18 Eqvt. ZTX300 5p each. Any Qty.

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GENERAL PURPOSE GERM. PNP Coded GP100. BRAND NEW TO-3 CASE. POSS. REPLACE.—OC25-28-29-30-35-36. NKT 401-403-404-405-406-430-451-462-453. TI3027-3028, 2N250A, 2N456A-457A-458A, 2N511 A & B. 2G220-222. ETC. VCEO 80V VCEO 50V IC 10A PT. 30 WATTS Hfe 30-170.

PRICE	1-24	25-99	100 up
	43p each	40p each	38p each

SILICON High Voltage 250V NPN TO-3 case. G.P. Switching & Amplifier Applications. Brand new Coded R 2400 VCEO 250V VCEO 100V IC 5A/30 Watts. HFE type 20/IT 5MHZ. OUR PRICE EACH:

1-24	25-99	100 up
50p	45p	40p

2N3055
115 WATT SIL POWER NPN 50p EACH

AD161/162 PNP
M/P COMP GERM TRANS. OUR LOWEST PRICE OF 55p PER PAIR

FULL RANGE OF ZENER DIODES RANGE

2-33V. 400mV (DO-7 Case) 13p ea. 1 1/2W (Top-Hat) 18p ea. 10W (BO-10 Stud) 25p ea. All fully tested 6% tol. and marked. State voltage required.

10 amp POTTED BRIDGE RECTIFIER on heat sink. 100PIV. 90p each

NEW LINE Plastic Encapsulated 2 Amp. BRIDGE RECTS.

50 v RMS 32p each
100 v RMS 37p
400 v RMS 46p
Size 15 mm x 6 mm.

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ORP12 43p
ORP60, ORP61 40p each

GENERAL PURPOSE NPN SILICON SWITCHING TRANS. TO-18 SIM. TO 2N706/8. BSY-27/28/95A. All usable devices no open or short circuits. ALSO AVAILABLE in PNP Sim. to 2N2906, BCY70. When ordering please state preference NPN or PNP.

20	For	0-50
50	For	1-00
100	For	1-75
500	For	7-50
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SIL. G.P. DIODES 4p

300mW 30. 0-50
40PIV(Min.) 100. 1-50
Sub-Min. 500. 5-00
Full Tested 1,000. 9-00
Ideal for Organ Builders.

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Pak No.	Description	Price
U 1	120 Glass Sub-Min. General Purpose Germanium Diodes	0-50
U 2	60 Mixed Germanium Transistors AF/RF	0-50
U 3	75 Germanium Gold Bonded Sub-Min. like OA5, OA47	0-50
U 4	40 Germanium Transistors like OC81, AC128	0-50
U 5	60 200mA Sub-Min. Silicon Diodes	0-50
U 6	30 Sil. Planar Trans. NPN like BSY95A, 2N706	0-50
U 7	16 Sil. Rectifiers TOP-HAT 750mA VLTG. RANGE up to 1000 0-50	
U 8	50 Sil. Planar Diodes DO-7 Glass 250mA like OA200/202	0-50
U 9	20 Mixed Voltages, 1 Watt Zener Diodes	0-50
U10	20 BAY50 charge storage Diodes DO-7 Glass	0-50
U11	25 PNP Sil. Planar Trans. TO-5 like 2N1152, 2N2904	0-50
U12	12 Silicon Rectifiers Epoxy 500mA up to 800 PIV	0-50
U13	30 PNP-NPN Sil. Transistors OC200 & 2S 104	0-50
U14	150 Mixed Silicon and Germanium Diodes	0-50
U15	25 NPN Sil. Planar Trans. TO-5 like BSY51, 2N697	0-50
U16	10 3 Amp Silicon Rectifiers Stud Type up to 1000PIV	0-50
U17	30 Germanium PNP AF Transistors TO-5 like ACY 17-22	0-50
U18	8 6 Amp Silicon Rectifiers BY213 Type up to 600 PIV	0-50
U19	25 Silicon NPN Transistors like BC108	0-50
U20	12 1-5 Amp Silicon Rectifiers Top Hat up to 1000 PIV	0-50
U21	30 AF. Germanium Alloy Transistors 2G300 Series & OC71	0-50
U22	30 MADT's like MHz Series PNP Transistors	0-50
U23	20 Germanium 1 Amp Rectifiers GJM Series up to 300 PIV	0-50
U24	25 300 MHz NPN Silicon Transistors 2N708, BSY27	0-50
U25	30 Fast Switching Silicon Diodes like IN914 Micro-Min.	0-50
U26	12 NPN Germanium AF Transistors TO-1 like AC127	0-50
U27	10 1 Amo SCR's TO-5 can, up to 600 PIV CR81/25-600	1-00
U28	15 Plastic Silicon Planar Trans. NPN 2N2926	0-50
U29	20 Silicon Planar Plastic NPN Trans. Low Noise Amp 2N3707	0-50
U30	25 Zener Diodes 400mW DO-7 case 3-18 vpts mixed	0-50
U31	15 Plastic Case 1 Amp Silicon Rectifiers IN4000 Series	0-50
U32	30 Silicon PNP Alloy Trans. TO-5 BCY26 28302/4	0-50
U33	25 Silicon Planar Transistors PNP TO-18 2N2906	0-50
U34	25 Silicon Planar NPN Transistors TO-5 BFY50/51/52	0-50
U35	30 Silicon Alloy Transistors SO-2 PNP OC200, 2S322	0-50
U36	20 Fast Switching Silicon Trans. NPN 400 MHz 2N3011	0-50
U37	30 RF. Germ. PNP Transistors 2N1303/5 TO-5	0-50
U38	10 Dual Transistors 6 lead TO-5 2N2060	0-50
U39	25 RF Germanium Transistors TO-5, OC45, NKT72	0-50
U40	10 VHF Germanium PNP Transistors TO-1 NKT667, AF117	0-50
U41	25 Sil. Trans. Plastic TO-18 A.F. BC113/114	0-50
U42	20 Sil. Trans. Plastic TO-5 BC115/NPN	0-50
U43	7 3A SCR. TO66 up to 600PIV	1-00

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

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Q2	16 White spot R.F. transistors PNP	0-50
Q3	4 OC 77 type transistors	0-50
Q4	6 Matched transistors OC44/45/81/81D	0-50
Q5	4 OC 75 transistors	0-50
Q6	5 OC 72 transistors	0-50
Q7	4 AC 128 transistors PNP high gain	0-50
Q8	4 AC 126 transistors PNP	0-50
Q9	7 OC 81 type transistors	0-50
Q10	7 OC 71 type transistors	0-50
Q11	2 AC 127/128 Complementary pairs PNP/NPN	0-50
Q12	3 AF 116 type transistors	0-50
Q13	3 AF 117 type transistors	0-50
Q14	3 OC 171 H.F. type transistors	0-50
Q15	7 2N2926 Sil. Epoxy transistors mixed colours	0-50
Q16	2 GET880 low noise Germanium transistors	0-50
Q17	5 NPN 2 x ST.141 & 3 x ST.140	0-50
Q18	4 MADT's 2 x MAT 100 & 2 x MAT 120	0-50
Q19	3 MADT's 2 x MAT 101 & 1 x MAT 121	0-50
Q20	4 OC 44 Germanium transistors A.F.	0-50
Q21	4 AC 127 NPN Germanium transistors	0-50
Q22	20 NKT transistors A.F. R.F. coded	0-50
Q23	10 OA 202 Silicon diodes sub-min.	0-50
Q24	8 OA 51 diodes	0-50
Q25	15 IN914 Silicon diodes 75 PIV 75mA	0-50
Q26	8 OA95 Germanium diodes sub-min IN89	0-50
Q27	2 10A PIV Silicon rectifiers IS425H	0-50
Q28	2 Silicon power rectifiers BYZ 13	0-50
Q29	4 Silicon transistors 2 x 2N696, 1 x 2N697, 1 x 2N698	0-50
Q30	7 Silicon switch transistors 2N706 NPN	0-50
Q31	6 Silicon switch transistors 2N708 NPN	0-50
Q32	3 PNP Silicon transistors 2 x 2N1131, 1 x 2N1132	0-50
Q33	3 Silicon NPN transistors 2N1711	0-50
Q34	7 Silicon NPN transistors 2N2369, 500MHz (code P397)	0-50
Q35	3 Silicon PNP TO-5. 2 x 2N2904 & 1 x 2N2905	0-50
Q36	7 2N3646 TO-18 plastic 300 MHz NPN	0-50
Q37	3 2N3053 NPN Silicon transistors	0-50
Q38	7 NPN transistors 4 x 2N3703, 3 x 2N3702	0-50

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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 x 7400	0-50	UIC46	= 5 x 7446	0-50	UIC86	= 5 x 7486	0-50
UIC01	= 12 x 7401	0-50	UIC47	= 5 x 7447	0-50	UIC90	= 5 x 7490	0-50
UIC02	= 12 x 7402	0-50	UIC48	= 5 x 7448	0-50	UIC91	= 5 x 7491	0-50
UIC03	= 12 x 7403	0-50	UIC50	= 12 x 7450	0-50	UIC92	= 5 x 7492	0-50
UIC04	= 12 x 7404	0-50	UIC51	= 12 x 7451	0-50	UIC93	= 5 x 7493	0-50
UIC05	= 12 x 7405	0-50	UIC53	= 12 x 7453	0-50	UIC94	= 5 x 7494	0-50
UIC06	= 8 x 7406	0-50	UIC54	= 12 x 7454	0-50	UIC95	= 5 x 7495	0-50
UIC07	= 8 x 7407	0-50	UIC60	= 12 x 7460	0-50	UIC96	= 5 x 7496	0-50
UIC10	= 12 x 7410	0-50	UIC70	= 8 x 7470	0-50	UIC100	= 5 x 74100	0-50
UIC13	= 8 x 7413	0-50	UIC72	= 8 x 7472	0-50	UIC121	= 5 x 74121	0-50
UIC20	= 12 x 7420	0-50	UIC73	= 8 x 7473	0-50	UIC141	= 5 x 74141	0-50
UIC30	= 12 x 7430	0-50	UIC74	= 8 x 7474	0-50	UIC151	= 5 x 74151	0-50
UIC40	= 12 x 7440	0-50	UIC75	= 8 x 7475	0-50	UIC154	= 5 x 74154	0-50
UIC41	= 5 x 7441	0-50	UIC76	= 8 x 7476	0-50	UIC193	= 5 x 74193	0-50
UIC42	= 5 x 7442	0-50	UIC80	= 5 x 7480	0-50	UIC199	= 5 x 74199	0-50
UIC43	= 5 x 7443	0-50	UIC81	= 5 x 7481	0-50			
UIC44	= 5 x 7444	0-50	UIC82	= 5 x 7482	0-50			
UIC45	= 5 x 7445	0-50	UIC83	= 5 x 7483	0-50			

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SN7400	0.15	0.14	0.12	SN7450	0.15	0.14	0.12	SN74123	£2.80	£2.70	£2.60	SN74123	£2.80	£2.70	£2.60	SN74123	£2.80	£2.70
SN7401	0.15	0.14	0.12	SN7451	0.15	0.14	0.12	SN74141	0.67	0.64	0.58	SN74141	0.67	0.64	0.58	SN74141	0.67	0.64
SN7402	0.15	0.14	0.12	SN7453	0.15	0.14	0.12	SN74145	£1.50	£1.40	£1.30	SN74145	£1.50	£1.40	£1.30	SN74145	£1.50	£1.40
SN7403	0.15	0.14	0.12	SN7454	0.15	0.14	0.12	SN74130	£2.00	£2.70	£2.50	SN74130	£2.00	£2.70	£2.50	SN74130	£2.00	£2.70
SN7404	0.15	0.14	0.12	SN7460	0.15	0.14	0.12	SN74151	£1.00	0.95	0.90	SN74151	£1.00	0.95	0.90	SN74151	£1.00	0.95
SN7405	0.15	0.14	0.12	SN7470	0.28	0.28	0.24	SN74153	£1.20	£1.10	0.95	SN74153	£1.20	£1.10	0.95	SN74153	£1.20	£1.10
SN7406	0.35	0.31	0.28	SN7472	0.29	0.28	0.24	SN74154	£1.80	£1.70	£1.60	SN74154	£1.80	£1.70	£1.60	SN74154	£1.80	£1.70
SN7407	0.35	0.31	0.28	SN7473	0.37	0.35	0.32	SN74155	£1.40	£1.30	£1.20	SN74155	£1.40	£1.30	£1.20	SN74155	£1.40	£1.30
SN7408	0.18	0.17	0.16	SN7474	0.37	0.35	0.32	SN74156	£1.40	£1.30	£1.20	SN74156	£1.40	£1.30	£1.20	SN74156	£1.40	£1.30
SN7409	0.18	0.17	0.16	SN7475	0.45	0.43	0.42	SN74157	£1.90	£1.80	£1.70	SN74157	£1.90	£1.80	£1.70	SN74157	£1.90	£1.80
SN7410	0.15	0.14	0.12	SN7476	0.40	0.39	0.38	SN74160	£1.80	£1.70	£1.60	SN74160	£1.80	£1.70	£1.60	SN74160	£1.80	£1.70
SN7411	0.25	0.24	0.23	SN7480	0.67	0.64	0.53	SN74161	£1.80	£1.70	£1.60	SN74161	£1.80	£1.70	£1.60	SN74161	£1.80	£1.70
SN7412	0.35	0.31	0.28	SN7481	£1.20	£1.15	£1.10	SN74175	£1.80	£1.50	£1.40	SN74175	£1.80	£1.50	£1.40	SN74175	£1.80	£1.50
SN7413	0.29	0.26	0.24	SN7482	0.37	0.37	0.34	SN74176	£2.00	£2.40	£2.30	SN74176	£2.00	£2.40	£2.30	SN74176	£2.00	£2.40
SN7416	0.45	0.43	0.40	SN7483	£1.10	£1.05	0.95	SN74164	£2.20	£2.15	£2.10	SN74164	£2.20	£2.15	£2.10	SN74164	£2.20	£2.15
SN7417	0.43	0.40	0.33	SN7484	£1.00	0.95	0.90	SN74165	£2.25	£2.20	£2.15	SN74165	£2.25	£2.20	£2.15	SN74165	£2.25	£2.20
SN7420	0.15	0.14	0.12	SN7485	£3.00	£3.50	£3.40	SN74166	£3.00	£3.25	£3.00	SN74166	£3.00	£3.25	£3.00	SN74166	£3.00	£3.25
SN7422	0.50	0.48	0.45	SN7486	0.32	0.31	0.30	SN74174	£2.30	£2.20	£2.10	SN74174	£2.30	£2.20	£2.10	SN74174	£2.30	£2.20
SN7423	0.50	0.48	0.45	SN7489	£5.50	£5.25	£5.00	SN74175	£1.80	£1.50	£1.40	SN74175	£1.80	£1.50	£1.40	SN74175	£1.80	£1.50
SN7425	0.50	0.48	0.45	SN7490	0.67	0.64	0.58	SN74176	£2.00	£2.40	£2.30	SN74176	£2.00	£2.40	£2.30	SN74176	£2.00	£2.40
SN7427	0.70	0.65	0.60	SN7491	£1.00	0.95	0.90	SN74177	£2.50	£2.40	£2.30	SN74177	£2.50	£2.40	£2.30	SN74177	£2.50	£2.40
SN7428	0.70	0.65	0.60	SN7492	0.67	0.64	0.58	SN74180	£2.00	£1.60	£1.40	SN74180	£2.00	£1.60	£1.40	SN74180	£2.00	£1.60
SN7430	0.15	0.14	0.12	SN7493	0.67	0.64	0.58	SN74181	£5.50	£5.00	£4.75	SN74181	£5.50	£5.00	£4.75	SN74181	£5.50	£5.00
SN7432	0.45	0.42	0.40	SN7494	0.77	0.74	0.68	SN74182	£2.00	£1.80	£1.60	SN74182	£2.00	£1.80	£1.60	SN74182	£2.00	£1.80
SN7433	0.80	0.75	0.70	SN7495	0.77	0.74	0.68	SN74184	£3.50	£3.25	£3.00	SN74184	£3.50	£3.25	£3.00	SN74184	£3.50	£3.25
SN7437	0.84	0.82	0.80	SN7496	0.67	0.64	0.58	SN74190	£1.95	£1.80	£1.85	SN74190	£1.95	£1.80	£1.85	SN74190	£1.95	£1.80
SN7438	0.84	0.82	0.80	SN74100	£1.85	£1.80	£1.55	SN74191	£1.90	£1.85	£1.90	SN74191	£1.90	£1.85	£1.90	SN74191	£1.90	£1.85
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SN7442	0.67	0.64	0.58	SN74107	0.40	0.38	0.36	SN74194	£2.00	£2.60	£2.50	SN74194	£2.00	£2.60	£2.50	SN74194	£2.00	£2.60
SN7443	£1.30	£1.25	£1.20	SN74110	0.55	0.53	0.50	SN74195	£2.00	£1.90	£1.80	SN74195	£2.00	£1.90	£1.80	SN74195	£2.00	£1.90
SN7444	£1.30	£1.25	£1.20	SN74111	£1.25	£1.15	£1.10	SN74196	£1.80	£1.70	£1.60	SN74196	£1.80	£1.70	£1.60	SN74196	£1.80	£1.70
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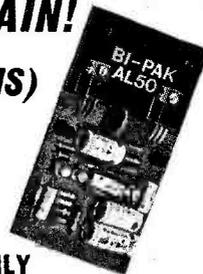


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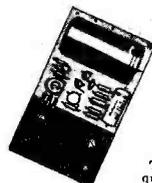
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Built to a specification and NOT a price, and yet still the greatest value on the market. The PA100 stereo pre-amplifier has been conceived from the latest circuit techniques. Designed for use with the AL50 power amplifier system, this quality made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

SPECIFICATION

Frequency Response 20Hz - 20KHz ± 1dB
Harmonic Distortion better than 0.1%
Inputs : 1. Tape Head 1-25 mV into 50K Ω
2. Radio, Tuner 35 mV into 50K Ω
3. Magnetic P.U. 1-5 mV into 50K Ω
All input voltages are for an output of 250mV. Tape and P.U. inputs equalised to RIAA curve within ± 1dB. from 20Hz to 20KHz.
Bass Control ± 15dB at 20Hz
Treble Control ± 15dB at 20KHz
Filters : Rumble (High Pass) 100Hz
Scratch (Low Pass) 8KHz
Signal/Noise Ratio better than - 65dB
Input overload + 26dB
Supply + 35 volts at 20mA
Dimensions 292mm x 82mm x 35mm
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BP 709P—μA709C	36p	34p	30p
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BP 711—μA711	45p	43p	40p
BP 741—72741	75p	80p	50p
μA703C—μA703C	63p	26p	24p
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TAA 350	170p	168p	150p

S.G.S. EA1000 2-63

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

Type No.	1-24	25-99	100 up
BP930	12p	11p	10p
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BP933	13p	12p	11p
BP935	13p	12p	11p
BP936	13p	12p	11p
BP940	13p	12p	11p
BP944	25p	24p	22p
BP946	12p	11p	10p
BP948	25p	24p	22p
BP951	65p	60p	55p
BP962	12p	11p	10p
BP909	40p	38p	35p
BP909A	40p	38p	35p
BP909B	40p	38p	35p
BP909C	40p	38p	35p

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

NUMERICAL INDICATOR TUBES



MODEL	CD66	GB116	3015F Minitron
Anode voltage (Vdc)	170min	175min	5
Cathode Current (mA)	2-3	14	8
Numerical Height (mm)	16	13	9
Tube Height (mm)	47	52	22
Tube Diameter (mm)	19	13	12 wide
I.C. Driver Rec.	BP41 or 141	BP41 or 141	BP47
PRICE EACH	£1.70	£1.55	£1.90

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POWER AMPLIFIER MODULES

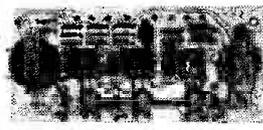


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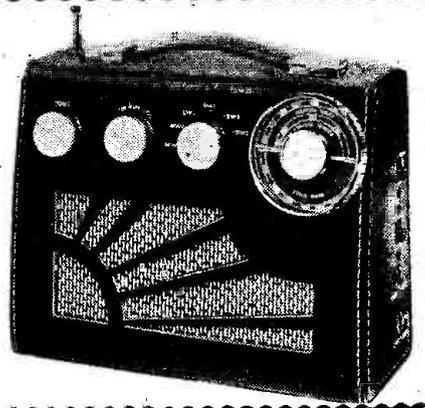
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(Overseas P. & P. £1)



ROAMER EIGHT Mk I

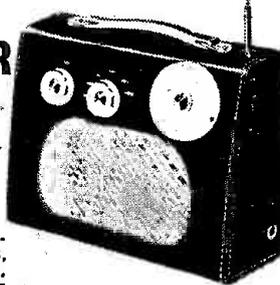
NOW WITH VARIABLE TONE CONTROL



7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Retractable chrome plated Telescopic aerial for Short Waves. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams. Parts Price List and Easy Build Plans 25p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

Total building cost **£6-98** P. P. & (Overseas P. & P. £1) Ins. 45p.

ROAMER SEVEN MK IV



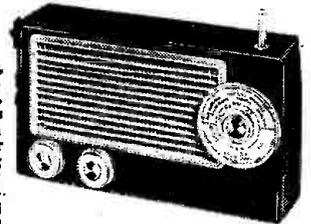
7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for MW and LW. Retractable 4 section 24in. chrome plated telescopic aerial for SW. Socket for Car Aerial. Powerful push-pull output. 7 transistors and 2 diodes, fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with carrying handle Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams. Parts price list and 'easy build plans 15p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

Total building costs **£5-98** P. P. & (Overseas P. & P. £1) Ins. 45p.

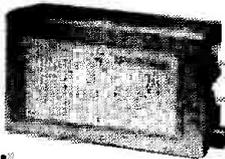
ROAMER SIX

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3, Trawler band plus an extra Medium waveband for easier tuning of Luxembourg etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 5½ x 2½in. approx. Easy build plans and parts price list 15p (FREE with parts).

Total building costs **£3-98** P. P. & (Overseas P. & P. £1) Ins. 30p



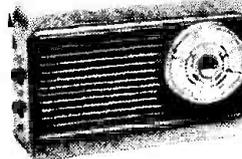
POCKET FIVE



3 Tunable Wavebands: MW, LW, Trawler Band with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5½ x 1½ x 3¼in. Easy build plans and parts price list 10p (FREE with parts).

Total building costs **£2-29** P. P. & (Overseas P. & P. 63p) Ins. 23p

TRANSONA FIVE



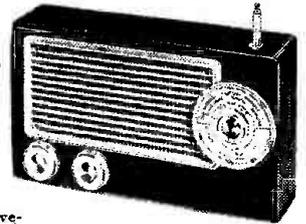
5 TRANSISTORS AND 2 DIODES

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

Total building costs **£2-50** P. P. & (Overseas P. & P. 63p) Ins. 24p

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 x 5½ x 2½in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 25p (FREE with parts).

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POCKET FIVE	<input type="checkbox"/>	EDU-KIT	<input type="checkbox"/>

Parts price list and plans for

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PW49

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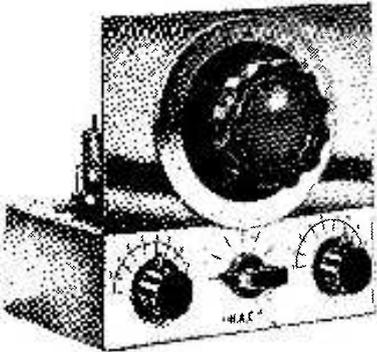


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PHILIPS 308 transcription unit complete with base and cover	36-55	28-50
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	Rec. Retail Price	Comet Price
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PIONEER PL61 with base and cover	176-83	119-95
THORENS TX25 cover	8-85	6-95
THORENS TD125	76-73	52-95
THORENS TD125 Mk. II	82-63	66-50
THORENS TD125AB	115-69	79-95
THORENS TD 125AB Mk. II with TP 16 arm	124-54	99-95
THORENS TD 160/c Including base and cover	69-80	56-95
THORENSTD150 Mk. II	36-30	28-95
THORENS TD150A Mk. II	46-33	35-95
THORENS TD150AB Mk. II	50-17	39-95
THORENS TX11 Cover	4-49	3-60
WHARFEDALE Linton	37-50	26-95
PICK UP ARMS AND HEADS		
AUDIO Technica AT1005 Mk. II	18-78	14-25
AUDIO Technica L2 IIlfts.	2-61	1-95
GOLDRING Lenco 75	13-96	9-25
GOLDRING Lenco L69	10-46	6-50
GOLDRING PH6 Head Shell	2-97	1-99
SME 3009 with S2 Shell	32-34	23-95
SME 3009 HE with S2 Shell	33-71	24-95
SME 3012 with S2 Shell	34-44	25-50
SME 3012 HE with S2 Shell	35-81	26-50
SME S2 Headshell	2-59	1-95
SPEAKERS		
AMSTRAD 138 (pair) teak	26-00	13-95
AKAI SW 155	64-50	44-95
B & W Model 70	169-50	109-95
B & W DM2	60-76	48-95
B & W DM1 (pair)	75-20	53-95
CELESTION COUNTY (pair)	47-94	35-95
CELESTION Ditton 120 (pair)	56-40	40-50
CELESTION Ditton 15	37-40	27-95
CELESTION Ditton 25	55-00	43-50
CELESTION Ditton 44	54-00	37-95
CELESTION Ditton 66	99-00	70-95
FERROGRAPH S1 inc. stand	95-00	69-95
GOODMANS Minister (pair)	49-20	35-95
GOODMANS Havant (pair)	57-12	39-95
GOODMANS Magister	65-63	44-50
GOODMANS Double Maxim	67-40	48-50
GOODMANS Mezzo 3	35-70	23-95
GOODMANS Magnum K2	46-20	30-95
GOODMANS Goodwood	55-00	23-95
GOODMANS Dimension 8	72-44	47-95
GOODMANS DIN 20NT kit	12-19	8-50
KELETRON KN400 2-speaker System (pair)	15-86	11-95
KN600 3-speaker System (pair)	26-46	16-95
KN800 3-speaker System (pair)	31-80	18-95
KN1100 4-speaker System (pair)	40-80	23-95
KN1600 3-speaker System	25-20	14-95
KN2100 3-speaker System	30-60	18-95
LEAK 150 (pair)	50-00	37-50
LEAK 250 (pair)	63-00	47-95
LEAK 600	49-50	34-50
LINEAR 10 watt teak (pair)	Sp. Price	13-50
MARSDEN HALL Annexe 100 Walnut (pair)	30-00	17-95
METRO SOUND HFS 103 (pair)	29-21	20-95
METRO SOUND 202	21-50	14-75
METRO SOUND Duplex 15	32-00	21-95
METRO SOUND Duplex 25	56-00	37-95
PIONEER CS53	46-72	29-95
SINCLAIR Q16	8-98	6-50
STE-MA 450	25-00	16-95
TANDBERG Tan 7	29-50	23-60
TANDBERG Tan 11 (pair)	40-00	31-95
TANDBERG T 12 teak (pair)	55-50	44-50
TANDBERG T 25 teak (pair)	71-50	56-95
TANDBERG T 50 teak	68-00	50-95
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TG 200 (pair)	41-95	24-95
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Linton Mark II (pair)	52-00	37-50
Triton III (pair)	65-00	46-95
Melton Mark II	35-00	23-75
Dovedale 3 Mark II	47-50	32-25
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Unit 3 Speaker Kit	12-50	8-95
Unit 4 Speaker Kit	19-00	12-95
Unit 5 Speaker Kit	27-50	18-75
CHASSIS SPEAKERS		
GOODMANS Twin-Axiom 8	9-12	6-95
Twin Axiom 10	10-06	7-50
Axiom 401	17-88	11-95
Audiom 8P	5-49	4-15
Audiom 10P	5-97	4-50
Audiom 12P	13-00	9-15
Audiom 15P	21-00	14-60
Audiom 18P	35-70	24-45
Audiom 100 40 watts DIN	12-00	8-35
ARU 172	4-50	3-20
Axent 100	6-90	4-80
Midax 650	13-59	9-50
Attenuator	3-73	2-60
Crossover Network XO/950	7-77	5-45
WHARFEDALE 8in. Bronze/RS/DD	4-75	3-30
Super 8/RS/DD	8-50	6-25
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AMSTRAD 900C	4-95	3-40
AMSTRAD 900D	7-50	5-40
AMSTRAD 900 EX	11-00	8-50
AUDIO TECHNICA AT66	6-47	3-45
GOLDRING G850	6-10	3-10
GOLDRING G800	12-21	4-50
GOLDRING G800E	17-67	7-00
GOLDRING G800 Super E	24-41	15-25
*GOLDRING CS90 Stereo	4-88	3-95
*GOLDRING CS91/E	7-33	5-50
EMPIRE 1000ZE/X	62-22	39-95
EMPIRE 999VE/X	44-44	28-95
EMPIRE 999TE/X	26-13	18-95
EMPIRE 999SE/X	21-11	13-95
EMPIRE 999E/X	16-36	10-95
EMPIRE 909E/X	12-79	8-50
EMPIRE 909E/X	9-94	6-95
ORTOFON M15E	27-60	22-75
SHURE M3DM	6-10	3-75
SHURE M31E	11-63	6-95
SHURE M32E	10-73	6-50
SHURE M44-G	8-30	4-95
SHURE M44-7	7-90	4-90
SHURE M-44C	7-90	4-90
SHURE M44E	8-60	4-75
SHURE M55E	9-70	5-60
SHURE M75G	14-70	8-40
SHURE M75-6 (S)	8-36	5-45
SHURE M75-6	13-60	7-60
SHURE M75EJ	15-40	8-95
SHURE M75E	19-00	10-75
SHURE M75 ED	19-00	10-75
SHURE M75E/95G	20-80	12-95
SHURE M91ED	18-45	9-95
SHURE V15-11	39-40	24-95
*SONOTONE 9TAHC Diam/Saph.	3-75	1-45

Starrd cartridges above are ceramic. All others are magnetic.

BASES AND COVERS	Rec. Retail Price	Comet Price
GARRARD WB1 Base	3-78	2-95
WB4 Base	5-60	4-25
SPC1 Cover	3-68	2-75
SPC4 Cover	4-38	3-25
Special offer of Base and Cover to fit SP25, SL55, SL65B and 3500 and Zero 100S	6-55	4-80
WB4 base Mk IIZ to fit Zero 100 and Zero 100S	9-77	6-75
GOLDRING Plinth 75	9-42	6-50
GOLDRING Plinth 72	4-71	3-25
GOLDRING Covers for 72P	5-23	3-60
Cover for 75P De Luxe	6-98	4-95
Cover for 85P	8-85	6-95
THORENS TX25 (for TD125AB)	4-49	3-60
THORENS TX11 Cover	46-20	35-95
SME Plinth System 2000 with motor-board	5-85	4-45
MOTORBOARDS only	0-98	0-75
SME P1 Spacer		

BLANK TAPES	Rec. Retail Price	Comet Price
SCOTCH DYNARANGE CASSETTES		
C80	0-71	0-40
C90	0-99	0-50
C120	1-49	0-75
SCOTCH HIGH ENERGY COBALT CASSETTES		
C80	1-10	0-65
C90	1-45	0-85
SCOTCH Low Noise 8-TRACK BLANK CARTRIDGES		
40 mins	1-50	0-90
80 mins	1-80	1-10
SCOTCH LONG LIFE SPOOLED TAPES		
5 1/2" L.P. 900	1-41	0-85
5 1/2" L.P. 1200	1-76	1-10
7" L.P. 1800	2-52	1-50
SCOTCH HI-FI DYNARANGE SPOOLED TAPES		
5" L.P. 900	1-88	1-10
5 1/2" L.P. 1200	2-20	1-30
7" L.P. 1800	2-95	1-80

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AMSTRAD HPS5A	6-95	3-95
HPS6A with volume control	9-95	6-75
HPS7A bass and treble controls	12-95	9-95
AKAI ASE9	7-25	4-25
AKAI ASE22	11-90	7-25

HEADPHONES—continued	Rec. Retail Price	Comet Price
AKG K180	28-00	16-95
AKG K60	15-00	8-95
AKG 100	8-00	4-95
AKG 120	10-00	4-50
KOSS HV1	20-00	15-95
KOSS ESP-9 Electrostatic	69-00	52-95
KOSS ESP-6 Electrostatic	45-00	34-95
KOSS PRO 5L/C	30-00	23-95
KOSS PRO-4AA	28-00	21-90
KOSS KO-727B	16-50	12-45
KOSS 747	20-00	15-90
KOSS K-711	10-00	7-90
KOSS K6	12-50	9-90
KOSS K6/LC (with volume control)	14-00	11-10
PIONEER SE50	21-90	14-20
PIONEER SE30A	12-60	8-50
PIONEER SE20A	7-88	5-15
PIONEER SEL20	10-53	6-80
PIONEER SEL40	17-43	11-30
ROTEL RH630	6-50	4-50
ROTEL RH700	9-95	6-75
SOUND MD806	6-40	2-70
WHARFDALE DD1	12-50	8-75

HI-FI STEREO SYSTEMS—COMPLETE	Rec. Retail Price	Comet Price
ALBA UA552	47-75	29-95
BUSH A1005	69-89	53-25
DANSETTE Consort Stereo	34-43	23-95
DANSETTE 4005	71-45	52-95
DANSETTE 4020	47-99	31-95
DECCA Sound 613	Special Price	46-95
DECCA Sound 614	Special Price	52-95
DECCA Sound 1204	Special Price	70-95
DECCA Compact 2	Special Price	78-95
DECCA Compact 3	Special Price	98-95
DECCA 403	Special Price	44-95
EKCO ZU4	152-00	114-00
FERGUSON 3425	136-35	102-75
FERGUSON 3450 with Radio	74-20	55-95
FERGUSON 3451 with Radio	101-70	79-95
FERGUSON 3454	41-50	32-95
FIDELITY UA1 Music Master with Radio	100-00	69-95
FIDELITY UA2 Music Master	43-50	30-95
FIDELITY UA3 Music Master	63-00	45-95
FIDELITY Stereo Nine	38-50	22-95
GOODMANS Module 89 compact (Less L/S)	165-00	125-75
HMV 2450 with Stereo Radio	138-00	104-95
HMV 2451	122-00	95-95
HMV 2452	66-00	49-95
HMV 2453	66-00	49-95
KB1025 with 657 speakers	48-25	37-95
KB 1250 with KS 653 Speakers	71-00	53-95
KB 2010 with 658 speakers	101-50	77-95
KB 2250 with 658 speakers	124-00	95-95
MURPHY 902 Studio 1, AM/VHF Radio	84-50	64-95
MURPHY 903	84-42	64-95
PHILIPS 808	105-00	76-95
PHILIPS G824	65-30	49-65
PHILIPS 825	49-50	38-95
PHILIPS 826	75-00	52-95
PHILIPS 835	69-50	49-55
PHILIPS 836	95-00	69-95
PYE Black Box unit stereo 1022	90-93	68-95
RIGONDA Party Time	28-50	20-95
STEEPLETONE stereo system	41-75	25-95
ULTRA 6028	59-95	45-95
ULTRA 6450	74-20	57-95
ULTRA 6451	79-50	61-50
ULTRA 6454	38-85	29-95
ULTRA 6455	41-35	31-95

TAPE RECORDERS AND TAPE DECKS	Rec. Retail Price	Comet Price
AKAI 1720L 4-track stereo	87-36	58-75
AKAI 1721L 4-track stereo	99-90	73-95
AKAI 4000D 4-track stereo deck	93-65	64-50
AKAI 4000DS 4-track stereo deck	99-50	73-95
AKAI CR80D 8-track stereo tape deck	85-02	55-95
AKAI CR80 8-track stereo recorder	106-39	69-95
AKAI CR80T 8-track stereo recorder and tuner/amplifier	149-84	89-95

TAPE RECORDERS—continued	Rec. Retail Price	Comet Price
AKAI CR81D	89-90	65-95
AKAI CR81	109-50	80-95
AKAI X200D	157-93	99-95
AKAI GX220D	229-00	168-95
AKAI 1800SD	162-79	99-95
FERGUSON 3258 4-track	70-45	51-95
FERROGRAPH 702/704 Dolby	264-38	224-50
FERROGRAPH 702H Dolby	274-95	233-50
FERROGRAPH 702/724 Dolby	301-98	255-95
FERROGRAPH 702/704	224-43	170-65
FERROGRAPH 722/724	2 62-03	190-15
FIDELITY BRAEMAR 4-track	34-75	19-95
GRUNDIG TK 121 twin track	56-25	38-95
GRUNDIG TK 141 4-track	62-10	44-95
GRUNDIG TK 146 4-track Auto	66-95	48-95
GRUNDIG TK 147 4-track Auto	98-65	74-95
GRUNDIG TK 148 (4-track auto 2 speed)	74-10	56-95
GRUNDIG TK 246 4-track Stereo Deck	131-85	99-95
GRUNDIG TK 3200 Hi-Fi (Battery)	141-10	105-95
PHILIPS 4303 Twin-track	39-46	24-95
4404 4-track stereo recorder	89-23	65-95
4418 4-track stereo	200-00	145-95
4450 4-track stereo	295-00	214-95
TANDBERG 2041 4-track (Stereo)	130-50	108-50
TANDBERG 1841 4-track stereo deck	66-00	49-95
TANDBERG 3021X twin track stereo	113-00	89-95
TANDBERG 3041X 4-track stereo	113-00	89-95
TANDBERG 4021X twin track stereo	179-00	145-95
TANDBERG 4041X 4-track stereo	179-00	145-95
TANDBERG 6041X 4-track stereo	199-30	159-95
TANDBERG 6021X twin track stereo	199-30	159-95

TAPE RECORDERS (CASSETTE)	Rec. Retail Price	Comet Price
AKAI CS 50 recorder	125-83	92-95
AKAI CS 50D Deck	104-46	77-50
AKAI CS35D Tape Deck	79-95	59-50
AKAI CS35 Stereo including L/S	112-50	82-95
AKAI GXC 40D Tape Deck	95-50	67-95
AKAI GXC 40	112-50	82-95
AKAI GXC 40T Cassette Recorder, Tuner/Amplifier	167-50	123-95
AKAI GXC 45D Tape Deck	129-50	95-95
AKAI GXC 46D Tape Deck	139-50	103-50
AKAI GXC 65D Dolby auto reverse Tape Deck	154-50	110-25
APCO Batt./Mains with AM/FM Radio	35-00	22-95
BUSH Discassette DCT0	20-62	15-95
BUSH TP60	27-62	19-95
BUSH TP 66 Batt./Mains	28-18	21-50
BUSH TP 70 battery/mains	28-13	19-95
CARLTON LCR500	Sp. Price	11-95
DANSETTE DCT105	20-62	12-95
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EKCO 351 Battery/Mains	24-23	19-50
FERGUSON 3240 with case	24-90	15-95
FERGUSON 3253	42-40	31-95
FERGUSON 3257	56-45	41-95
FERGUSON 3257/7 speakers for above	16-00	12-00
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GRUNDIG C200 De Luxe	37-55	26-95
GRUNDIG C210 batt./mains	48-75	36-95
HARVARD Elite with AM/FM radio batt./mains	44-75	23-95
JVC Nivico 9420 L/S with AM/FM radio batt./mains	61-45	45-95
JVC Nivico 1710 Radio/Cassette, AM/FM	61-00	42-95
PHILIPS 322 Radio/Cassette Recorder	45-75	32-95
2202/2203	22-85	17-95
2204 battery/mains	29-10	24-95
2400 stereo less L/S	66-10	52-95
PHILIPS 2405 Stereo with 2 RH401 L/S	72-00	54-95
3302	21-50	15-95
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PYE 9116 Stereo	69-90	49-95
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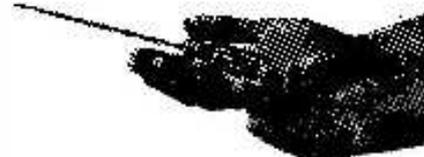
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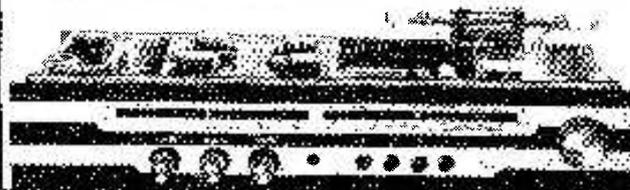
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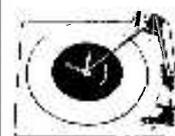
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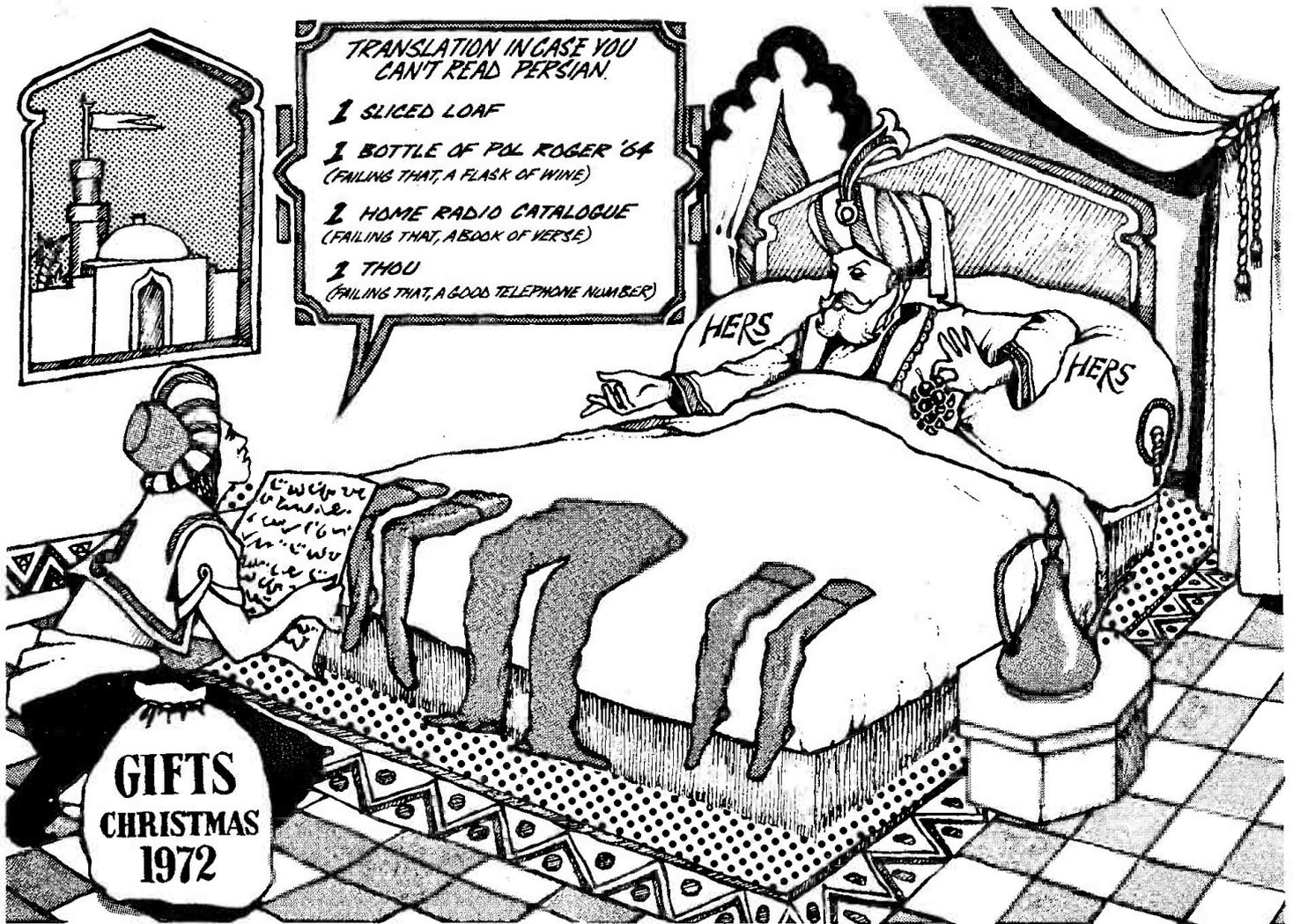
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For the benefit of those who have a scientific rather than a literary bent, may we explain? Omar Khayyam was a Persian Tent Maker who lived in the 11th Century. He was also a Poet, Philosopher and Astronomer. Thanks to the fine translation by Edward Fitzgerald, his best known work is the exquisite "Rubaiyat". It was first produced in England as a pamphlet and offered at sixpence. It didn't sell and was reduced to twopence. As there are only three known copies left in existence you may imagine what they are worth today!

One of the best known verses runs as follows:
*Here with a loaf of Bread beneath the Bough,
 A Flask of Wine, a Book of Verse and Thou
 Beside me singing in the Wilderness
 And Wilderness is Paradise enow.*

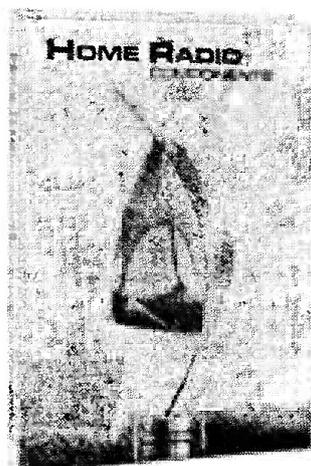
I hope that throws some light on our cartoon. If you read the poem you are bound to come to the conclusion that O.K. liked his tippie—obviously a thoroughly "good type".

What's all this to do with Electronics? You may well ask!!!

Nothing really, but after all, this is the Christmas Number, so we should be able to let our hair down. In any case we are sure you must already know that we produce an excellent Components Catalogue which will make interesting holiday reading for you, listing as it does some 8,000 items (over 1500 illustrated) and costing only 75p including postage and packing (only 55p if you collect it). It also contains 10 vouchers (each worth 5p when used as directed). Are you convinced? No? Well you'd better go out and buy Omar's "Rubaiyat" instead!

Our "new look" catalogue is hot off the press! Larger pages, many new items and pictures. Now, more than ever, it is a "must" for every keen constructor. Full details of our popular Credit Account Service are given in the catalogue.

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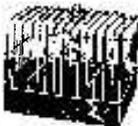
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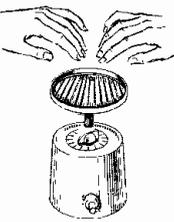
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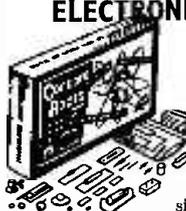
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SOOTHE YOUR NERVES RELAX WITH THIS AMAZING RELAXATRON

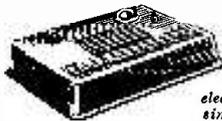
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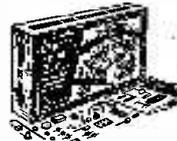
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Tune in your favourite programmes or the news, or sports in the Office or in your bedroom. Uses sensitive, germanium diode originally evolved from Wartime radar. Never buy a battery. Never use electricity. Never replace. Covers all medium waves. Clear beautiful tone. Size 4 1/2" x 2 1/2" x 1 1/2" in beautiful case. **ONLY 7 CONNECTIONS AND IT'S MINUTES!** Ideal for absolute beginner from 8 years of age upwards. **SPECIAL PRICE TO CLEAR STOCKS OF COMPONENTS. ONLY £1.70 + 20p. P. & P.** for all parts including beautiful case. (Germanium semi-conductor, tuning condenser, personal phone, wire, nuts screws. **SIMPLE AS A.B.C. INSTRUCTIONS** (Parts available separately).

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With this "Brain-box" you will be able to perform mind-boggling feats. THE MIND READING DEVICE will make people swear you have "telepathic" powers. THE AMAZING CARD TRICK UNIT completely mystifies and baffles from one to six people. You correctly "guess" the two cards each person has selected at random from a pack they themselves shuffled. THE ELECTRONICS NERVES TESTER puts your friends to a very lively test. It gives out fail and finish signals (the winner is the person with lowest number of fail signals.) Can be adjusted from the weakest to strongest person. THE ELECTRONIC MAZE tests the mental ability of the player because it uses psychology with an electronic twist to it. You can change the maze pathways in seconds to prevent the maze becoming too stale after lots of use. Completely safe and foolproof. Size 18" x 12" x 6" (Max.). You can play all these games and more beside after building the "Brain box". No soldering, you get pictorial, easy as a.b.c. step-by-step simple instructions. **ONLY £2.87 + 33p. p. & p.** for all parts including chassis, switches, stylus, signalling lights, wire, nuts, screws, etc. etc. Uses standard battery. Presentation Box 35p. extra as illus. if read. (PARTS AVAILABLE SEPARATELY) FULL OPERATING DIRECTIONS WITH EACH OF THE PROJECTS.



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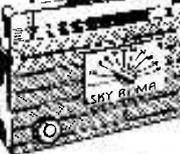
FIND BURIED TREASURE! Transistorised Treasure Locator

This fully portable transistorised metal locator detects and tracks down buried metal objects—it signals exact location with loud audible sound (no phones used)—uses any transistor radio which fits inside—no connections needed. FINDS GOLD, SILVER, COINS, JEWELLERY, ARCHAEOLOGICAL PIECES ETC. ETC. Extremely sensitive will signal presence of certain objects buried several feet below ground. No knowledge of radio or electronics required. Can be built with ease in one short evening by anybody from nine years of age upwards. With the clear, easy to follow, step-by-step, fully illustrated instructions—Uses standard PP3 battery. No soldering necessary. Kit includes nuts, screws, wire, etc. **ONLY £2.85 + 25p. p. & p.** (Sectional handle as illustrated 95p. extra). Parts available separately. Made up looks worth £15.

ONLY £2.85

SHORTWAVE TRANSISTOR RADIO

ONLY £2.75



Anyone from 9 year up can follow the step-by-step, easy as ABC, fully illustrated instructions. No soldering necessary. 76 stations logged on rod aerial in 30 mins.—RUSSIA, AFRICA, USA, SWITZERLAND, ETC. Experience thrills of world wide news, sport, music, etc. Eavesdrop on unusual broadcasts. Uses PP3 battery. Size only 3" x 4 1/2" x 1 1/2" **ONLY £2.75 + 20p p. & p.** Kit includes cabinet, screws, instructions, etc. (Parts available separately).

INGENIOUS ELECTRONIC SLEEP INDUCER

ONLY £3.25



Do you wake up in the night and can't get off to sleep again? Would you like to be gently soothed off to satisfying sleep every night? Then build this ingenious electronic sleep inducer. It even stops by itself so you don't have to worry about it being on all night! The loudspeaker produces soothing audio-frequency sounds, continuously repeated—but as time goes on the sound gradually becomes less and less—until they eventually cease altogether, the effect it has on people is amazing. All transistor. No knowledge of electronics or radio needed. Step-by-step instructions included. **No soldering necessary.** Kit includes case, nuts, wire, screws, etc. SEND **£3.25 + 25p p. & p.** (Parts available separately).

now YOU can CATCH SHOALS OF BIG FISH with new electronic miracle special introductory offer £2.50

First time marketed in England, this exciting electronic instrument the "Decoytronic" is the one responsible for starting the electronic fish-lure rage in the U.S.A. just recently. Uses ingenious double-action method of attracting all kinds of fish from hundreds and hundreds of feet away... saltwater or freshwater. Why this device is so fantastically successful is because it actually imitates the sound of wet insects milling about the surface. These sound waves spread out hundreds of feet in all directions. Although this peculiar sonic frequency won't sound like much to you—to all the fish in the area it's their dinner bell! But that's not all... electroluminescence neon tubes cunningly flicker intermittently, penetrating the area for hundreds of feet around, at a frequency fish are unable to resist. The fish mistake this flickering glimmer for the soft phosphorescence glow given off by Plankton... a favourite delicacy of most fish!!! All you do is switch on, lower into the water (it's completely water resistant) allow around 5 minutes—then start reeling 'em in. We'll bet you won't be able to reel 'em in fast enough. Self-contained batteries last ages—cost pence. Kit of all parts including special easy as a.b.c. directions only **£2.50 + 25p. P. & P.** (Parts available separately).



ONLY £4.50

the amazing "Phototron" SOUND OPERATED FLASH

Take flash pictures at the exact instant of the bursting of a balloon. A champagne cork leaving the bottle. The split second a hammer strikes a light bulb. The mind boggles at the possibilities of the "Phototron"... the only limit is your imagination. Now that inexpensive flash guns are on the market in quantity, it has made possible, with the help of electronics the production of a wide variety of exciting photography effects, once strictly limited to the professionals. The duration of an electronically produced flash is extremely brief and normally measured in Milliseconds. Now, providing the camera shutter is left open in a dark or subdued light, it is the timing of the flash that determines what is imprinted on the film—not necessarily anything done by the camera. As electronic flash guns are fired by making a switched connection then it becomes obvious that one of the latest Silicon Controlled Relay's can be used. If we make this S.C.R. operate by sound (with variable sensitivity control for soft/loud sounds) some real "way out" photography effects can be captured forever on film. Easily built in a couple of hours or so, the "Phototron" is fully solid state, uses self contained PP3 battery. No soldering necessary using our special terminal board (Pat. Applied For). All parts including special pictorial step-by-step plans, transistors, microphone, S.C.R., potentiometers, switches, test lamp, case, nuts, screws, etc. **ONLY £4.50 + 25p P. & P.** Made up must be worth at least £10 (parts available separately).

CONCORD ELECTRONICS LTD. (P.W.1) 8, Westbourne Grove, London, W.2. Callers welcome 9 a.m.—5.30 p.m.

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

TRANSISTORS

Table of transistor components including part numbers (e.g., 2G301, 2G302), types (e.g., PNP, NPN), and prices.

TTL LOGIC I.C. NEW PRICES

Table of TTL Logic ICs with columns for part numbers (e.g., SN7400, SN7401), prices, and availability.

SUB-MIN ELECTROLYTIC

Values: (µF/V); 6-64/64; 1/40; 1-6/25; 2-5/16; 2-2/63; 4-7/16; 4-7/25; 6-4/8-4; 6-4/25; 10/16; 10/25; 10/64; 12-5/25; 16/40; 20/64; 25/6-4; 25/25; 32/10; 32/40; 40/16; 50/6-4; 50/25; 50/40; 64/10; 80/16; 80/25; 100/6-4; 125/10; 125/16; 200/10.

SILICON RECTIFIERS

Table of silicon rectifiers with columns for PIV, current ratings (50, 100, 200, 400, 600, 1000, 1200), and prices.

DIODES & RECTIFIERS

Table of diodes and rectifiers with columns for part numbers (e.g., IN34A, IN914), prices, and types.

OPTOELECTRONICS

MINITRON 3015F 7-SEGMENT INDICATOR (16 PIN DIL) £2.00 May be driven by SN7447

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

B9900 PHOTORESISTOR 38p

VEROBOARD

Table of Vero Board sizes and prices: 2 1/2 x 3 1/2 in Matrix 17p, 2 1/2 x 5 in Matrix 25p, 3 1/2 x 3 1/2 in Matrix 25p, 3 1/2 x 5 in Matrix 30p.

SLIDE POTENTIOMETERS

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

MULLARD C280 M/FOIL CAPACITORS

0-01, 0-022, 0-033, 0-047 3p each 0-068, 0-10 4p each 0-15, 0-22, 0-33 5p each 0-47 9p 0-68 11p 1µF 14p 1.5µF 21p 2.2µF 25p

WIRE-WOUND RESISTORS

2-5 watt 5% (up to 270 ohms only). 7p 5 watt 5% (up to 8-2kΩ only). 9p 10 watt 5% (up to 26kΩ only). 10p

POTENTIOMETERS

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

PRESETS (CARBON)

0-1 Watt 6p VERTICAL 0-2 Watt 8p OR 0-3 Watt 7p HORIZONTAL

SPECIAL OFFER

TOSHIBA TH9013P 20 WATT AMP £3.50 TH9014P PRE-AMP £1.25

Advertisement for 'SCORPIO' CAP DISCHARGE IGNITION SYSTEM. (As published in P.E. November 1971) Complete kit £10.00 P. & P. 50p.

RETURN OF POST SERVICE

Post & Packing 13p per order. Europe 25p. Commonwealth (Air) 65p (MIN.) Matching charge (audio transistors only) 15p. extra per pair. Prices subject to alteration without prior notice.

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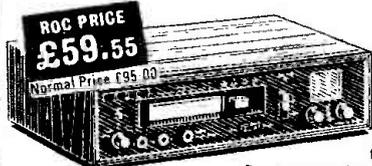
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ROC PRICE
£59.55
Normal Price £95.00

8-TRACK STEREO CARTRIDGE TAPE DECK MODEL RP-1000ST

The popular Lear-Jet type recording unit is the heart of the fantastic RP-1000ST, which has full record and playback facilities. Automatic track change with manual over-ride.

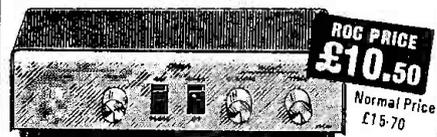
Press to start button. Stereo headphone and Left and Right Mic sockets on front panel. Dual recording level meter, and Left and Right volume controls. Built-in pre-amp. Tape speed 3 1/2 ips (9.5 cms). Frequency response: playback 30-10,000 Hz; recording/playback 30-8,000 Hz. Line output: fully variable 0-500mV. The RP-1000ST incorporates all the features you'd expect on a top quality Cartridge Tape Deck. Size 16" wide, 4" high, 9" deep. Cabinet in walnut. Including connecting leads.



ROC PRICE
£28.00
Normal Price £35.70

A-3000 36-WATT SOLID STATE STEREO AMPLIFIER

The A-3000 looks as good as it sounds! Giving you a big performance this superb audio amplifier has a full range of facilities on the front and rear panels. On the front - all the controls you're ever likely to need plus a headphone socket. On the rear - signal inputs, speaker outputs and a line fuse for circuit protection. Specifications: 18 watts rms per channel into 8 ohms. Frequency response 20-35,000 Hz (± 2 db) Inputs Magnetic, Ceramic, Tuner, Tape, Aux. Tape Play. Size: 345mm x 300mm x 130mm.



ROC PRICE
£10.50
Normal Price £15.70

OLSON AM-400 4 WATT STEREO AMPLIFIER

Here's marvellous value for someone just starting to set themselves up in audio! At only £10.50, you get a fine amplifier in a scratch resistant metal cabinet, with a smart brushed aluminium front panel. It incorporates separate tone and volume controls for each channel. Inputs are provided for turntable (ceramic cartridge), tuner and tape deck or recorder. Frequency response: 70-20,000 Hz ± 3 db. Output: 2 watts r.m.s. per channel into 8 ohms. Inputs: phono 80mV; tuner/aux 80mV. Size 8" wide, 2 1/2" high, 4 1/2" wide.



25-WATT 3-WAY 'LIVING AUDIO' SPEAKER CE-5b

This high quality speaker has its own built-in 3-way sound response switch, giving you the ideal frequency response for hi-fi, natural or mood music listening. Its beautiful, heavy, oiled walnut cabinet incorporates two separate speaker units an 8" woofer, and a 5" mid-range with 2" concentric tweeter. Power handling capacity: 25 watts r.m.s. into 8 ohms. Overall frequency response: 35-20,000 Hz. Cabinet size: 10 1/2" x 7 1/2" x 8 1/2". Exactly right for matching the most modern decor.

ROC PRICE
£27.25
Normal Price £39.95 each.

REALISTIC 30 WATT STEREO AMPLIFIER MODEL SA-500

A superb hi-fi amplifier with all the features you've ever wanted - for under £46.00. Saving over £10.00 on the normal retail value. Up-to-the-minute slider controls for bass and treble. Separate volume and balance controls. Headphone socket on front panel. Push-button input controls - magnetic phono (high/low) tuner, aux. mono, monitor. Loudness push-button control for perfect sound at low output levels. Left and right push-button on/off switches for speakers. Noise filtering and tape monitoring facilities. Two auxiliary AC outlets. Frequency response 20-20,000 Hz ± 1 db at full power. 15 watts rms per channel. Walnut cabinet with satin aluminium trims. Inputs: phono 2.5mV and 5mV RIAA; tuner/aux 250mV. Hum and noise: phono - 50db; tuner/aux - 65db. How's that for a specification! Size 14 1/2" wide, 3 1/2" high, 10 1/2" deep.



As reviewed in "POPULAR HI-FI" February 1972

ROC PRICE
£35.20
Normal Price £55.50



OLSON RA-310 AM/FM/MPX STEREO TUNER

This ROC Tuner is especially designed to match the Olson AM-395 Stereo Amplifier. In price and value, as well as its good looking design! But of course it's also ideal for use with any other amplifier. The RA-310 costs £10.00 less than the normal retail value, and yet it is a highly sophisticated unit, incorporating the latest solid state techniques. Operation is drift free for supreme station-holding capability. You can connect this Tuner to a stereo amplifier, to a tape deck or a tape recorder. And of course it covers all the stations in the AM and FM bands. FM: 87-108 MHz; AM: 525-1605 kHz. FM Sensitivities: FM, 3uV; AM, 250uV. Stereo separation 30dB at 1kHz, image rejection 60dB. Size: 11 1/2" wide, 4" high, 7 1/2" deep.

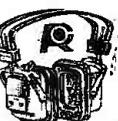
ROC PRICE
£31.20
Normal Price £50.00



REALISTIC SA-100B 8-WATT STEREO AMPLIFIER

Here's fabulous, exciting value in miniature! This high quality stereo amplifier measures only 9" wide x 3" high x 5 1/2" deep. And yet it has separate ganged volume, balance and tone controls. Plus speaker in/out, mono/stereo, phono/tuner and power on/off slide switches. The ends are oiled/walnut, with matching enamelled metal top. The front panel is satin aluminium and walnut-brown enamel. Frequency response is 50 to 10,000 Hz ± 3 db. Output 3 watts r.m.s. per channel into 8 ohms. Inputs are 100mV for both phono and tuner.

ROC PRICE
£12.45
Normal Price £21.00



TEC HR-007 HEAD-PHONE RADIO

When you want to listen to the radio all by yourself. Then this will solve the problem. Separate volume and tuning controls with easy-to-use knobs. Frequency range is 535 to 1605 kHz medium wave band. Maximum output is 300 mW. Normal Price £7.50 ROC PRICE £5.80

EAGLE LC.07 STEREO MOVING-MAGNET CARTRIDGE

Here's your opportunity to own a transcription cartridge for the price of a ceramic! Is specially designed to match top quality tone arms, and to get the very best from your hi-fi amplifier. 0.7 mil diamond stylus. Output: 7mV per channel. Frequency range: 20-21,000 Hz. Channel balance: ± 1 db. Channel separation: 28db. Compliance: 12 x 10⁻⁶ cm/dyne. ROC PRICE £6.37



CONSTRUCTORS KITS

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£1.50

TWO TRANSISTOR RADIO KIT

Complete with solar cell
£2.50

10 PROJECT INTEGRATED CIRCUIT KIT

Build a radio, morse key etc.
£3.50

SOLAR ELECTRONIC KIT

20 ways of harnessing the sun's energy
£4.50

TWO OCTAVE ELECTRONIC ORGAN KIT

Make your own music. Complete with speaker.
£4.50

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BUY NOW FOR XMAS!



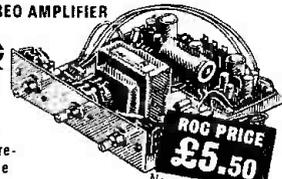
ROC PRICE
£27.55
Normal Price £42.00

PALCE AM/FM/MPX STEREO TUNER AMPLIFIER SSA-16

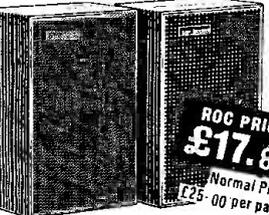
This is one of the lowest priced stereo tuner amplifiers on the market. It covers the full range of both AM and FM broadcast frequencies. And when you're switched to FM, an indicator lights up when a stereo signal is received - that's the time to switch to 'Stereo'! The SSA-16 has all the facilities you'd expect to find on tuners costing twice as much - separate volume, bass, treble, balance and tuning controls. Selector switch for tape, phono, AM, FM, stereo. Jack socket on front panel for stereo headphones. Frequency range: FM 88-108 MHz. AM 535-1605 kHz. Frequency response: 50-10,000 Hz ± 3 db. Power output: 4 watts total music power into two 8 ohm speakers. Size: 16" wide, 4 1/2" high, 8" deep.

ROC 7-WATT STEREO AMPLIFIER CHASSIS SK-317

This exclusive ROC Stereo Chassis is completely self-contained, and it costs £2.25 less than the normal retail value! The SK-317 is a really compact unit measuring only 5 1/2" wide, 1 1/2" high and 6 1/2" deep. It contains its own mains power supply, and has a ganged volume control and separate treble controls for each channel. Specification: frequency response 40-17,000 Hz ± 3 db; output 3.5 watts music power per channel into 8 ohms; input, phono, 600mV; signal-to-noise ratio better than 45dB.



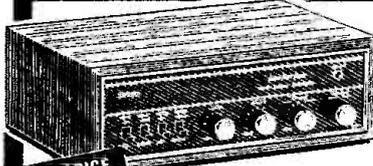
ROC PRICE
£5.50
Normal Price £7.75



ROC PRICE
£17.80
Normal Price £25.00 per pair.

R.446 3-WAY MATCHED SPEAKERS

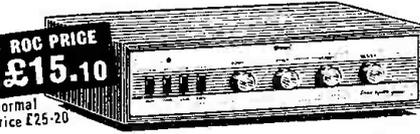
These will do justice to your amplifier - and to your pocket. At only £16.40 a pair, they are real value-for-money. Each cabinet is heavily lagged and teak finished. They handle 16 watts rms (8 watts rms each). Each loudspeaker contains a large dual cone base unit, plus a separate tweeter. Frequency range: 40 to 19,000 Hz. Size 14" high, 9" wide, 6 1/2" deep.



ROC PRICE
£24.10
Normal Price £39.50

OLSON AM-395 40-WATT STEREO AMPLIFIER

An ideal unit for your new stereo separate system. It is more than £10.00 below the normal retail price! Making the AM-395 one of Britain's best hi-fi buys. It takes in signals from magnetic or ceramic pick-ups, tuners (see Olson RA-310) and tape decks. And it's got outputs for taping and for headphones. There are separate bass and treble controls, separate Left and Right channel volume controls. And a loudness switch for boosting the bass and treble notes when listening at low output levels. Frequency response: 20-20,000 Hz ± 3 db. Output: 20 watts r.m.s. per channel into 8 ohms. Inputs: magnetic phono 3.0mV RIAA, crystal phono 100mV; tape 180mV; tuner 160mV. Size 11 1/2" wide, 4 1/2" high, 7 1/2" deep. The specification reads well - sounds even better!



ROC PRICE
£15.10
Normal Price £25.20

OLSON AM-372 16-WATT STEREO AMPLIFIER

Here's a really good amplifier at a really down-to-earth price - nearly £7 less than the normal retail value! Just look at what the AM-372 will do for you - reproduce signals from ceramic or crystal cartridges, AM and FM tuners, and tape recorders. And it gives you outputs for two sets of speakers, headphones and tape recorders. Frequency response is 30 to 20,000 Hz ± 3 db. Output 8 watts r.m.s. per channel music power into 8 ohm speakers. Phono input 200mV. Tuner input 200mV. Size: 12 1/2" wide, 3 1/2" high, 7 1/2" deep.

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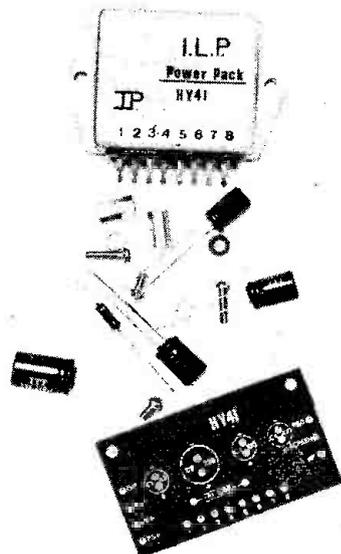


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I.L.P. (Electronics) Ltd

THE HY41



The HY41 supersedes the popular HY40 introduced by ILP last year. This highly improved module achieves true High Fidelity with a dramatic reduction in distortion (typically 0.05% at 1KHz into 8 ohms!) and is electronically and mechanically compatible with the HY40.

With this important improvement the HY41 retains all of the quality characteristics found in the earlier version and P.C. board, Resistor, Capacitors, Hardware Mountings and comprehensive manual are included in the basic kit. No further components are required to construct a complete power amplifier of extremely high performance sufficiently versatile to provide power not merely for Hi-Fi but also for public address systems and industry.

The free manual gives a full circuit diagram of the HY41 and its various applications including a complete stereo amplifier.

Like its predecessor the HY41 is based on conventional and proven circuit techniques developed over recent years.

OUTPUT POWER: British Rating 40 WATTS PEAK, 20 watts R.M.S. continuous.

LOAD IMPEDANCE: 4-16 ohms.

INPUT IMPEDANCE: 30K ohms at 1KHz.

VOLTAGE GAIN: 30db at 1KHz

TOTAL HARMONIC DISTORTION: less than 0.15% (typical 0.05%) at 1KHz.

FREQUENCY RESPONSE: 5Hz-50KHz \pm 1db.

SUPPLY VOLTAGE: + 22.5volts D.C.

SUPPLY CURRENT: 0.8 amps maximum.

PRICE: inc. comprehensive manual, P.C. board, five extra components and P. & P.:—
MONO: £4.90 **STEREO: £9.80**

UNIQUE HYBRID PRE-AMPLIFIER

The HY5 has rapidly established a position in the WORLD as the sole hybrid pre-amplifier to contain all feedback and equalization networks within an integrated pre-amplifier circuit.

Supplied with the HY5 are two stabilizing capacitors and by the addition of volume, treble and bass potentiometers it is ready for use.

Internally the HY5 provides equalization for almost every conceivable input, the desired function is achieved by use of a multi-way switch or by direct interconnection.

Two distinctive features of the HY5 are its inbuilt stabilization circuit, allowing it to be run off any unregulated power supply from 16-25 Volts and a balance circuit which, when linked by a balance control to a second HY5, forms a complete stereo pre-amplifier.

Specifically and critically designed to meet exacting Hi-Fi standards, the HY5 combines extremely low noise with a high overload capability. When used in conjunction with the HY41 and PSU45 forms a completely intergrated system.

INPUTS

Magnetic Pick-up (within \pm 1db RIAA curve) 2mV. 47K Ω

Tape Replay (external components to suit head). 4mV. 47K Ω

Microphone (flat) 10mV. 47K Ω

Ceramic Pick-up (equalized and compensatable) 20-2000mV. variable.

Tuner (flat) 250mV. 100K Ω

Auxiliary 1 250mV. 47K Ω

Auxiliary 2 2-20mV. 100K Ω

OUTPUTS

Main Pre-amp output 500mV.

Direct tape output 120mV.

ACTIVE TONE CONTROLS (Baxendall)

Treble \pm 12db.

Bass \pm 12db.

INTERNAL STABILIZATION

Enables the HY5 to share an unregulated supply with the Power Amplifier.

SUPPLY VOLTAGE

16-25 volts

PRICE: MONO: £3.60

STEREO: £7.20

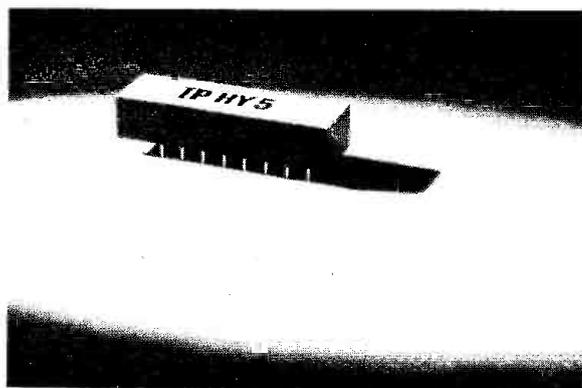
SUPPLY CURRENT

6mA approx.

OVERLOAD CAPABILITY

better than 26db on most sensitive input infinite on tuner and auxl.

OUTPUT NOISE VOLTAGE: 0.5mV.



POWER SUPPLY PSU45

The versatile P.S.U.45 is designed to supply your HY41's +HY5's in stereo or mono format.

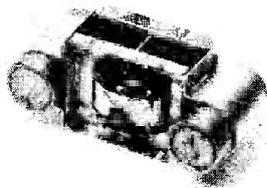
Specification

Input: 200-240 Volts.

Output: \pm 22.5 Volts at 2 amps.

Overall Dimensions: L. 7"; D. 3.8"; H. 3.1"

PRICE: £4.50 inc. P. & P.



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PRACTICAL WIRELESS

VOL 48 NO 9

Issue 791

JANUARY 1973

1932-1972

ALMOST unnoticed amidst the fanfare of the BBC's 50th Anniversary, we too at *Practical Wireless* have something to celebrate. On the 24th September 1932, 40 years ago, the first issue of this magazine was published under the editorship of the late F. J. Camm. We are justifiably proud of the many "firsts" that we have published in those glittering editorial decades and we wish to thank our many readers, contributors and advertisers for their continuing support.

Our basic policy laid down in issue No. 1 has remained almost unchanged to this day. Editorial content has been broadened to cover the changing scene in the world of wireless and electronics. We have a number of projected constructional features that will introduce our readers to new fields in the coming year. Our emphasis, as always, is to keep our readers abreast of new advances in the ever-changing world of technological advancement and to cater for readers at all levels.

We attempt to cater for all the desires of our readers which is of course our objective. We are here to help and educate and we feel that in this we are making a worthwhile contribution.

To commemorate our 40th birthday we feel that many of our readers would wish to voice their thoughts on the early years and therefore we invite those of you who have been with us since issue No. 1 to write to us.

LIONEL E. HOWES—Assistant Editor.

Norman Stevens, Editor of *Practical Wireless* and *Television* since September 1962 has left these lofty portals for other spheres. We all wish Norman bon voyage.

To all our readers
**A Merry Christmas
and a Happy New Year**

from

Lionel E. Howes, G3AYA (Assistant Editor)
Eric Dowdeswell, G4AR Halvor Moorshead
Colin Riches
Peter Metalli (Art Editor)
Jenny Phelps and Jill Alflatt (Secretarial)

**THE FEBRUARY ISSUE WILL BE
PUBLISHED ON JANUARY 5th**

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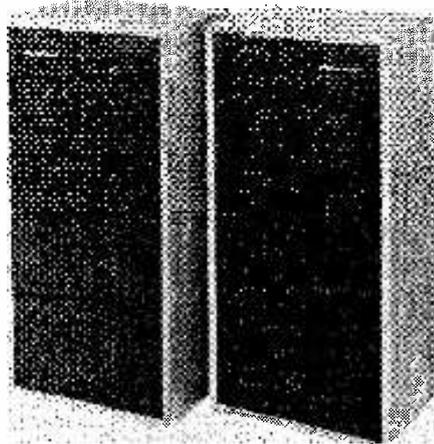
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Eagle speakers

Eagle International have just announced the model AA20 speaker. It has a power handling capacity of 15W r.m.s. and uses a high-compliance dual-cone combined bass and mid-range speaker with a 3in. tweeter.

Frequency range is 35Hz-20kHz and cabinet size 23½in. × 12in. × 9in. Recommended retail price is £28.

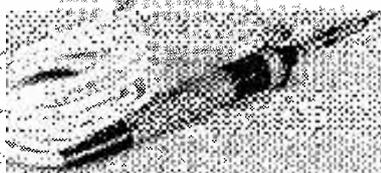


Antex "X25"

The picture shows the Antex "X25" soldering iron. It's rated at 25W and has a leakage current of only a few μ A so the makers claim it cannot harm the most delicate equipment—even when soldered 'live'.

It comes fitted with a long-life ⅛in. iron-coated bit and is priced at £1.75.

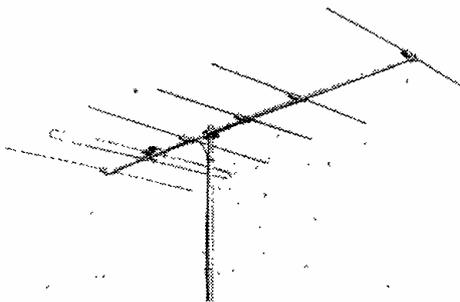
If you would like a copy of the free Antex colour catalogue, write to Antex Limited, Freepost, Plymouth, PL1 1BR.



The "mush killers"

As a follow-on to the BBC's statement of plans for extending the f.m. stereo broadcasts, Antiference have announced their new "mush-killer" aerials for f.m. stereo.

They are specially tuned for optimum performance in the U.K. f.m. band 2 (88-100 MHz) and the model priced at £6.95 shown in photograph comprises a 6-element folded dipole array. A surface-mounting dipole priced at £2.20 is also available. *Antiference Limited, Bicester Road, Aylesbury, Bucks.*



Dolby B unit

Kellar Electronics have introduced their KDB3 simplified Dolby B Noise Reduction unit. It has two line inputs controlled by a master record control lever and two line outputs with 10dB switched attenuator. There are complete metering facilities in record/replay, together with a built-in 400Hz oscillator.

The record section input sensitivity is 25mV for Dolby level at 20k Ω . A 19 and 38 kHz notch filter is provided to prevent beating of f.m. multiplex tones with a tape recorder bias oscillator. Frequency response is 20Hz to 15kHz \pm 1dB, 19kHz—36dB and output to tape recorder inputs (adjustable by record/calibrate controls) is 580mV for 25mV input with a minimum load of 5k Ω .

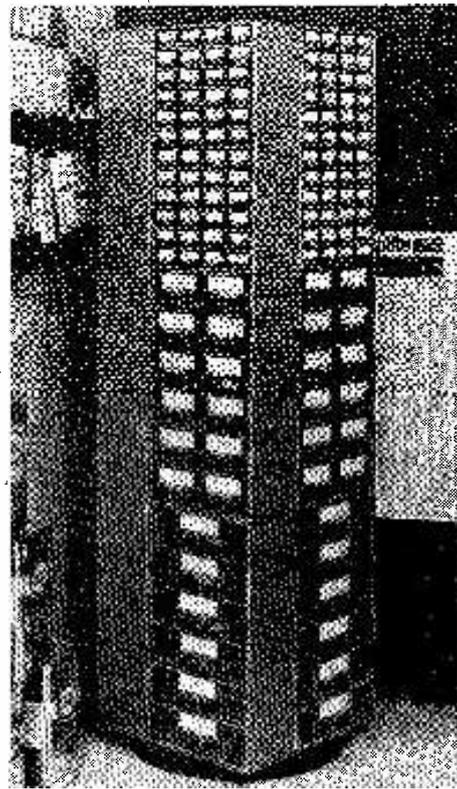
Price of the 15½in. × 8in. × 3¼in. unit is £39. *Kellar Electronics Ltd., Lopen Works, R/o 78 Lopen Road, London N18.*

Multiple drawers

Did you know that with a Link MK Space Mizer you can get 21 sq. ft. of storage space totaling 12 cu. ft. of drawers in a floor area of only 18¼in. × 18¼in. These cabinets are fixed firmly to a heavy-duty ball-bearing turntable enabling the units to be easily rotated.

Link MK cabinets from the 120, 250 or 500 ranges can be combined in multiples of four to build a complete Space Mizer. There are 16 basic drawers, each of which can be sub-divided in at least six different ways.

If you want a free brochure on these units, write to *Link-Hampson Ltd., 5 Bone Lane, Newbury, Berkshire.*



The Cornish Link

The other morning a copy of "The Cornish Link" magazine came in with the post. It's the official magazine of the Cornish Radio Amateur Club and contains the club's future programme and some interesting little articles together with "sales and wanted" columns, etc.

The club is affiliated to the R.S.G.B. and holds regular monthly meetings.

The November meeting was held at the S.W.E.B. Club Room, Pool, Cambourne, on November 2nd. The business of the Club was followed by films, one of which was "The Radio Sky".

The December 7th meeting includes closed-circuit TV and video tape recording demonstrations.

The magazine has a lively editorial and is full of interesting "goodies", and the Assistant Editor is Sheila Locke, to whom all "contributions" should be sent at "Hillside" Kehelland, Cambourne. Sheila's OM is Bill Locke, G3NKE, who is the public relations officer of the club.

Visitors to Cornwall who are interested in the Club's activities are asked to write or telephone Bill, G3NKE, at Cambourne 2419.

Annual subscription to The Cornish Link is £1.25.

Applications handbook

SGS/ATES has published an applications handbook setting out numerous suggestions for the use of its high level logic family, the H100 series.

Aimed at the general reader, and including an introduction to the logic and a presentation of the range and operation of the elements, the handbook will also interest the specialist, detailing as it does some fifty applications under the general headings of digital and computing, wave forming and pulse circuit, interface and miscellaneous.

Copies are available at a price of £1.20 from Mr. R. Burnip, SGS (United Kingdom) Ltd., Planar House, Walton Street, Aylesbury, Bucks.

Richard Mann

Author and designer Richard Mann of "TEXAN" fame has, after a period of five years moved from the Applications Laboratory of Texas Instruments Limited to become Market Communications Manager for Northern Europe. He is responsible for technical publications, advertising and P.R.

He previously specialised in the uses of TTL and Operational Amplifiers and has been one of the principle speakers at Technical Seminars which Texas Instruments hold regularly in London, Edinburgh and the Scandinavian countries.



Adcola kit

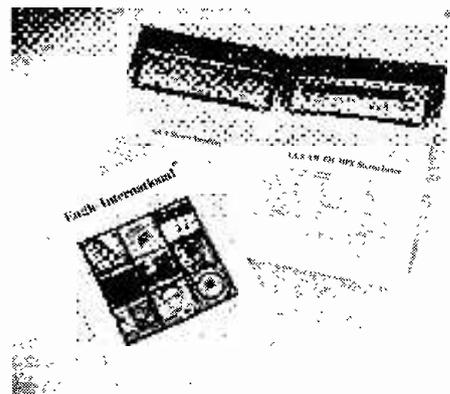
Adcola Products have produced a new soldering kit, containing an Invader iron, a stand, solder, two spare bits and an instruction card giving hints and tips on soldering. Price is £3.99. Adcola Products Ltd., Adcola House, Gauden Road, London, S.W.4.



Eagle brochure

Eagle International, of Wembley, Middlesex, have just released their latest 28-page colour brochure, containing over 60 of their audio products.

Sections cover stereo amplifiers, tuners, speakers and speaker systems, tweeters, cartridges, stereo headphones, accessories, microphones and mixers.



The new brochure which is free, is available from retailers or direct from Eagle International, Precision Centre, Heather Park Drive, Wembley HA0 1SU.

Top Band Transatlantic Tests 1972-73

Stewart Perry, W1BB, reports almost 100% support for the continuation of these tests, held since 1932, during the coming DX season. The dates are Sundays December 24, January 14 and February 11 from 0500 to 0700 GMT with the W/VE's on 1800-1807kHz and the Europeans on 1825-1830kHz, better known as the "DX Window". W/VE's will call "CQ DX TEST" for the first 2½ minutes of the first 5-minute period and then listen for replies for 2½ minutes. Europeans will call similarly for 2½ minutes at the beginning of the second period and then listen for replies for 2½ minutes, and so on. W1BB emphasises the importance of accurate time-keeping unless in QSO. Reports to W1BB or your favourite DX column.

MANY P.W. readers must have seen 'Tomorrow's World' on BBC-1 at the beginning of November which included a demonstration of a remarkable new radio i.c. Realising that many of you will want to experiment with this, we have pulled all the stops out to bring you the 'Mighty Midget' which makes use of the hot-off-the-production-line ZN414, a remarkable little i.c. of which we are bound to hear more.

Already we are preparing further projects which use this device, including an ultra simple bed-side radio which, in conjunction with another i.c. for the

Smaller & smaller...



THE **Mighty Midget!**

HALVOR MOORSHEAD

audio amplifier, will make an excellent push-button receiver with loudspeaker output using less than 20 components.

The ZN414 is a complete a.m. radio circuit containing 10 transistors, 4 capacitors and 15 resistors. It is a t.r.f. but overcomes many of the disadvantages of this type of circuit. It does not have the performance of a superhet but it is nearer this than the conventional type of t.r.f.

For miniaturisation the ZN414 is ideal; it operates beautifully using a tiny mercury cell and the photographs show just how tiny we have made our prototype. We hesitate to make the claim that this is the "smallest radio in the world" simply because we haven't seen all the contenders! What we can say is that the 'Mighty Midget' is smaller than either of the two rival commercial claimants for this title!

Miniaturisation is fun—and novel—but usually problems are encountered in making or obtaining the 'bits'; this does not apply to the 'Mighty Midget' for, apart from the i.c. (suppliers are given in the components list), all the components are widely available and little difficulty should be experienced in obtaining them.

USING THE
ZN414 AS
FEATURED ON BBC 1's
**Tomorrow's
World**

Construction is relatively simple; all you need is a file, a couple of drills, a screwdriver, fine-nosed pliers and a soldering iron. The total cost will depend on what you already have available or where you buy your components but assuming that all-new components are used, the cost will be about £2, £1.25 of which is for the i.c.

It must be emphasised that although we are using the ZN414 here in a 'gimmick' circuit, this is by no means its main application. Ferranti, the British makers, have released few details of this device—no internal circuit has yet been made available to the public—but it offers several attractive features. The input impedance is very high—typically 1.5MΩ—and this allows for a simple tuned circuit to be connected to it without the device damping it; this accounts for the good selectivity.

There is also an excellent a.g.c. circuit built into the device; this is a feature difficult to obtain with normal t.r.f. design.

The output from the unit can be as high as 30mV but the tiny aerial used here means that the output of our unit is somewhat less. The current drain measured on the prototype was a tiny 70μA but the makers say that a more typical figure would be 400μA. Even so, the mercury cell will give over 400 hours of operation for about 16p (the cost of the battery).

Our circuit here is for medium waves only but the i.c. will operate (at lower efficiency) on the long waves and up to 5MHz. In a quick lash-up during development of the prototype, our sample even worked well on the 49 metre-band—rather above the maker's claim, though this may be a characteristic of our sample.

The selectivity of the prototype is reasonable but takes an unusual form. Although the tuning of the more powerful stations is very broad, as soon as another station of sufficient strength is tuned in, even though fairly close to the main one, there is no trace of the well-spread, powerful one. Radio 4, pretty strong in the author's area, appears across most of the dial but is not present when the receiver is tuned to other stations. This is hard to describe but those building this project will notice the effect.

The author, living in the London area, picked up over a dozen stations at one o'clock in the morning but Radio Luxembourg was not amongst these as BBC Radio London on 206 metres completely swamped it. When the latter went off the air one hour later, Luxembourg was as clear as crystal, so readers outside London and Birmingham (which also uses 206 metres) should have no problems in getting it. The weaker the station, the better the selectivity; there is definitely swamping of the front end from powerful stations and the makers admit this in their spec. sheet.

Our use of the ZN414 is obviously not the best way of demonstrating audio quality but the distortion from this unit is somewhat less than that from an ordinary superhet due to very low intermodulation distortion.

CIRCUIT

The complete circuit is given in Fig. 1. The ZN414 comes in a TO-18 can (the same as a BC109) and there are only three connections: input, negative-chassis and output-positive.

The radio signals are induced into the tiny coil, L1,

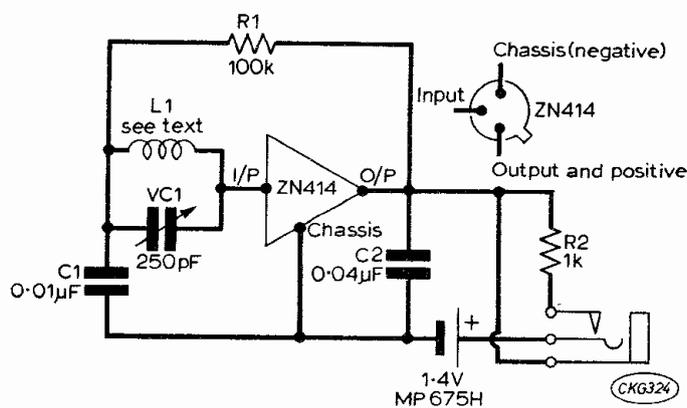


Fig. 1: The complete circuit, beautifully simple as far as the constructor is concerned yet the i.c. contains 10 transistors, 4 capacitors and 15 resistors—all on a 30 thousandths of an inch square chip.

★ components list

- | | |
|-------------------|---|
| R1 | 100kΩ, $\frac{1}{8}$ W, 5% |
| R2 | 1kΩ, $\frac{1}{8}$ W, 5% — see text |
| C1 | 0.01μF tubular ceramic |
| C2 | 0.04μF disc ceramic—see text |
| VC1 | 250pF compression trimmer (R.S. Components) |
| L1 | 90 turns of 32 s.w.g. enamelled copper wire on $\frac{1}{2}$ in. length of $\frac{1}{16}$ in. diameter ferrite rod. |
| IC1 | ZN414 (Ferranti). Available from Bywood Electronics, 181 Ebbw Road, Hemel Hempstead, Herts or Henry's Radio Ltd., 303 Edgware Road, London W.2 or Davian Electronics, P.O. Box 38, Oldham Lancs. Price (same from all suppliers) £1.25 including postage. |
| Battery | Mercury cell, 1.4V, type MP675H (available from most chemists). |
| Jack socket | 2.5mm type with switch, modified as shown. |
| Crystal earpiece | with 2.5mm jack plug; see text. |
| Case | Snuff box; see text. |
| Tuning knob | 6BA screw, $\frac{3}{16}$ in long. |
| Total cost | about £2 |

which is tuned by the variable capacitor VC1. One side of the tuned circuit connects directly to the input while the other is at chassis potential (as far as a.c. is concerned) by having C1 in line.

As the internal circuit is not available and details are at present a closely guarded secret, we can only guess at the function of R1—presumably it applies bias to the input but it may also affect the a.g.c. Experimentally it was found that lower values caused regeneration and instability but such experiments cannot be recommended as the device may be harmed.

The output is an audio signal but a small smoothing capacitor is required. The makers suggest a 0.01μF component for C2 but this was found barely sufficient and a 0.04μF (or 0.05μF) was found better. This higher value was not found to affect the audio signal. This component has been left accessible in the layout if readers wish to experiment with this value.

The reason why a higher value is better is because we are closing things up a bit tighter than is recommended; ideally the output lead of the i.c. should be at least an inch from the coil but if extra smoothing is used there is less danger of instability resulting from r.f. finding its way back to the coil. The load resistor, across which the a.f. signal is developed, is R2. The value here affects the a.g.c. and once again

there is room for experiment. As with C2, this component is left accessible for changes if necessary. The makers recommend a 470Ω here as a typical value but in the prototype the 1kΩ was found a bit better.

For efficiency and economy a crystal earpiece is used. This has a high impedance and will not affect the circuit operation. The author also tried 250Ω and 2000Ω impedance magnetic types; both worked well, although the d.c. conditions are affected and changes may be necessary in both R2 and C2 if these are used. Low impedance magnetic types which are provided with many transistor radios are *not* suitable and should not be used.

THE COIL

Commercial coils of the size that we need are not available and so it is necessary to wind one's own but this is not difficult. You need to buy a length of 1/4 in. diameter rod, this is available in 5 in. or 6 in. lengths from Henry's Radio or Home Radio but of course this has to be cut to a 1 1/2 in. length. The way to do this is to file a V-shaped groove and smartly snap the rod—it is no good trying to cut it with a hacksaw. When this is done check that it will fit inside the case before winding the coil.

A narrow band of plastic, self-adhesive tape should be wound around one end, trapping the wire in it. 90 turns of 32 s.w.g. wire should then be made, the final turn being trapped in a second band of tape. Thinner gauge wire may be used if available, but thicker gauges will not fit on, the length of the rod is not sufficient.

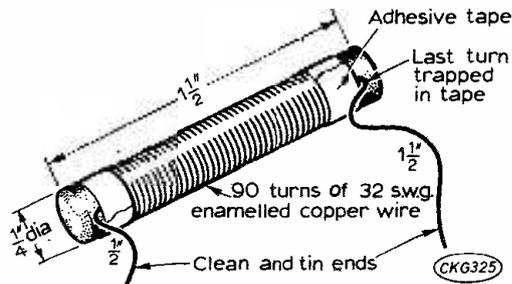


Fig. 2: The aerial is wound on a short length of ferrite rod as shown.

A drawing of the ferrite rod aerial is shown in Fig. 2 and, as will be seen, short lengths of wire should be left at both ends, stripped of the insulation and tinned.

CONSTRUCTION

The case can be obtained from nearly any tobacconist—it is the container used for Wilson's S.P. No. 1 Snuff, the most widely available brand. The cost of this—including the snuff of course—is only 8p and the little plastic box is an ideal size for our needs and quite strong. The metal lid fits tightly and no additional fixing for this is necessary. Incidentally if you haven't tried snuff, this is your chance (your author is partial to the occasional pinch).

Two holes have to be drilled in the box, these are shown in Fig. 3. The siting of the hole for VC1 has to be quite accurate and it may be best to take this from the actual component. At this end of the box there is very little room for the ferrite rod and VC1 and careful siting is essential.

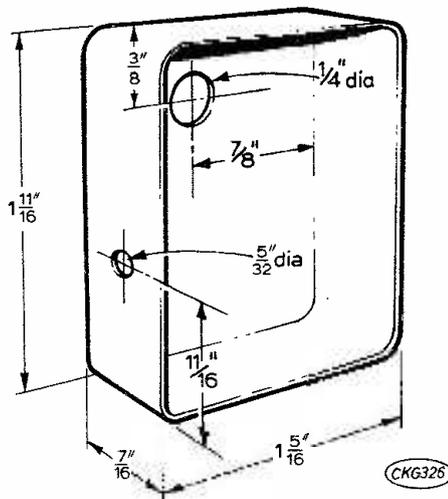


Fig. 3: The holes necessary in the plastic snuff box which is used for the case.

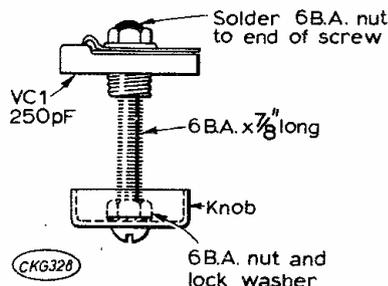


Fig. 4: The modification to the compression trimmer to make it into a variable capacitor.

The tuning capacitor is small 250pF compression trimmer which has to be modified as shown in Fig. 4. The screw supplied should be removed and replaced by a 7/8 in. 6BA screw fitted from the other end. The knob should be held near the head as shown and, after assembly in the box, this should be secured by soldering a nut to the end, ensuring that the special washer is fitted. This trimmer capacitor has rather long solder tags and these should be cut off, leaving just enough to solder to.

The earpiece socket is a 2.5mm type and this has to be adapted as shown in Fig. 5. It must be fitted with a switch but this will be of the break type. For our purposes we need the switch to *make* when the earpiece is inserted and the contact should be modified as shown using fine-nosed pliers.

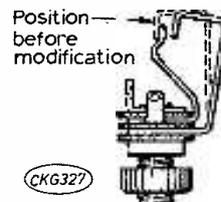


Fig. 5: The 2.5mm jack socket has to be modified to make it switch on when the plug is inserted.

The component layout is shown in Fig. 6. The easiest method is first to mount the wires and R2 directly onto the small socket and then fit this into the case. The components are 'floating' and this will provide an anchoring point. The output lead of the i.c. should be soldered to R2 and the input lead should be run to one connector of VC1. Lengths of wire should be left for the final connection to the mercury cell. These should be soldered directly to it;

To underside
of cell

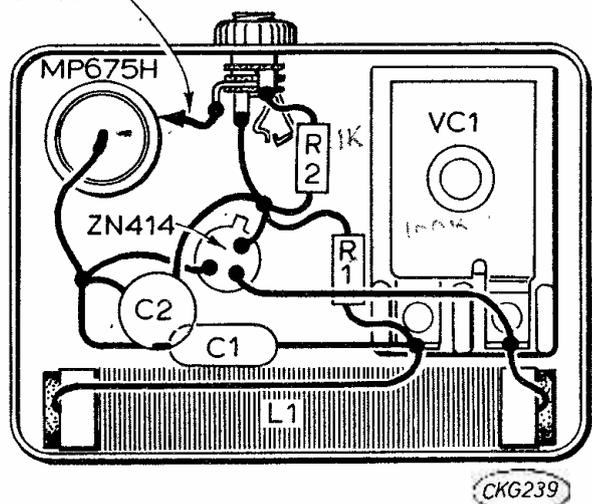
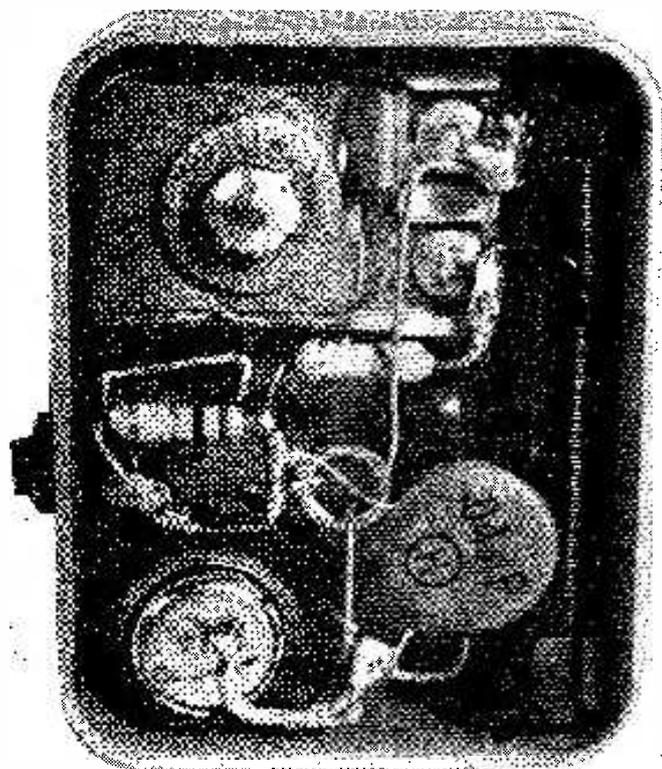
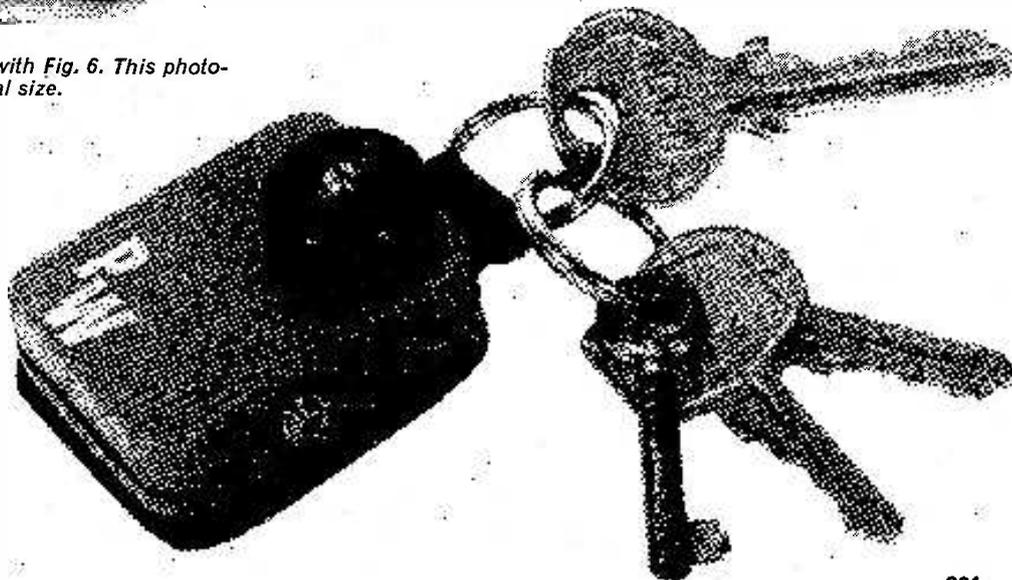


Fig. 6: The components layout. Note that C2 and R2 are left accessible to allow for later experimentation.



An inside shot of the prototype, compare this with Fig. 6. This photograph is of course much larger than actual size.

Being so small, the Mighty Midget lends itself to several types of gimmick. One idea is shown on the right, that of gluing the finished radio to the fob of a key ring.



The Mighty Midget shown full size. We don't claim that this is the smallest radio ever described, but it must be a contender being under one cubic inch in volume!



note that the positive connection is the main body.

Great care should be taken when making this joint as mercury cells can quickly be destroyed if they are overheated. The solder joint must be made as fast as possible and, after it has solidified, the cell should be cooled as quickly as possible—wrapping it in a damp cloth is one way. The author has never destroyed a transistor by soldering but several mercury cells have been ruined, this is only mentioned to emphasise the great care that is needed in this operation.

Ideally a metal lid should not be used but in practice it hardly affects the circuit and, since it forms a neat back, may be used. It should not be connected electrically to any part of the circuit. A small 'nick' will be needed in the lid to prevent it interfering with the earpiece holding nut.

There is of course no lining up and the radio should work immediately upon switching on. It is worthwhile having a look to see that the earpiece on-off switch is operating properly in situ.

The radio is not as directional as most t.r.f.'s and is similar to a superhet; this is on account of the very efficient a.g.c. action; it can certainly be operated from a breast pocket.

The small size, of course, enables lots of gimmicks to be tried. One photograph shows that it can be mounted on a key ring fob.

Few problems should be experienced with this circuit but remember that the i.c. is a delicate device and should be treated carefully—especially while soldering. ■

CHARLES MOLLOY

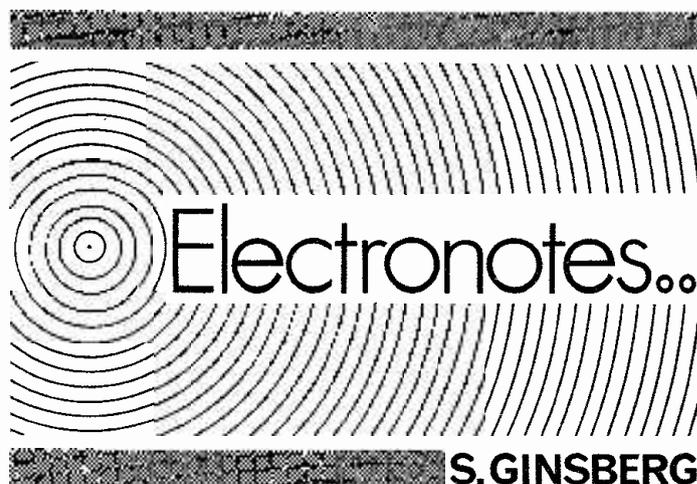
THE Medium Wave Column

PHILIP J. WHARMBY who lives in Manchester has been DXing on the medium waves with his HMV 2170 receiver. He reports reception of WBT Charlotte, North Carolina, on 1110kHz at 0300hrs with some interference from AFN Munich; The Voice of America, Kavalla, Greece, on 791kHz in English at 2302hrs after Limoges, France, had closed down; Athens (Armed Forces outlet) on 1320kHz at 2230hrs with Leipzig off the air. Philip asks for a list of the new BBC Local Radio Stations on the medium waves. Radio Blackburn is on 854kHz; Solent on 998kHz; Sheffield and Medway on 1034kHz; Leeds on 1105kHz; London, Birmingham, Manchester and Newcastle on 1457kHz; Brighton and Humberside on 1484kHz; Stoke on 1502kHz; Bristol and Teesside 1546kHz; Leicester 1594kHz. Radio Merseyside is not yet on the medium waves but is expected to appear on 1484kHz early in 1973.

Although these local broadcasters are on the air until 0100hrs, it is during the daytime, when continental interference is at a minimum, that the DXer has his best chance of hearing a few of the more distant ones. **Dr. H. S. Brodribb** who lives at St Leonards-on-Sea, Sussex, has had daylight reception of London, Medway and Solent. His receiver is a 1938 vintage Philips superhet connected to an outdoor aerial via a Joymatch aerial tuning unit. He remarks "It is interesting (and reminds me of about 1925) to receive low power stations at a distance". **George East** of Solihull has heard Manx Radio 1295kHz on his car radio while driving near Whitchurch in Shropshire. This station transmits on 1295kHz and 1594kHz during daylight hours, each with a power of 1kW. At dusk the 1295kHz transmission closes down while on 1594kHz the power is reduced to 200 watts.

Mid-winter is the season for Asiatics on the medium waves. They are usually audible in the afternoon during the closing hours of daylight, before they become swamped by interference from Europeans. Listen from 1500hrs onwards for China, India and Japan. The 1000kW outlet of All India Radio in Calcutta is a regular on 1130kHz and has been heard with news and identification in English at 1600hrs. It is subject to slow fading so it is worth remaining on the channel for a minute or two if it cannot be heard. Chinese stations are often conspicuous. Search for Lanchow on 860kHz; Sinkiang 910kHz; Hofei 940kHz; Peking 1000kHz, 1190kHz and 1200kHz; Chanso 1230kHz. From Taipeh in Taiwan BED2 on 750kHz and BED50 on 1250kHz are sometimes audible with programmes of westernised Chinese music. Japanese stations are less conspicuous but listen for JOBB in Osaka on 830kHz and JOLB in Fukuoka on 870kHz. Two regulars from the Near East are Baghdad 760kHz and Kabul, Afghanistan 1280kHz, while the new high power Radio Iraq at Ovazim on 841kHz is usually a strong signal for most of the evening.

Please send logs and information about medium wave to the author at 132 Segars Lane, Southport.



S. GINSBERG

Many months back I wrote of the application of a laser to write and then read a holographic memory. The idea was simple. Since the flat photographic plate could be made to produce a 3D photograph, then a similar idea could be employed as a form of data recording. One "layer" of data could be stored and then, because the 3D effect gave depth, a second "layer" of data could be recorded behind the first, and so on.

News now comes from Japan that this is not a theoretical idea anymore. The Central Research Laboratory at Hitachi has developed a system in which, it is claimed, the maximum limit of storage density is approaching that predicted by optical theory. Some 10,000 symbols can be accommodated or stored in a spot only 1 millimetre in diameter (about 1/25 of an inch). Reading time is of the order of 1 μ S (one millionth of a second). Wonder if this will bring that 3D colour telly any closer? It will certainly be interesting to see what may be developed over the next few years.

I hear that Chrysler, the U.S. automobile manufacturer, has ordered 3 million transistors from RAC. These are for electronic ignition systems and bring this form of ignition a step nearer becoming a standard. It is acclaimed by some as a "major step" in helping to combat pollution problems due to exhaust emission. As you all know, this pollution question is a big thing in the States and it is something that will have to be seriously thought about here!

For those making their own Printed Circuits—good news. A company called Decon Laboratories is to market a special pen in small quantities down to a one-off. The pen is "special" because it contains an acid resistant ink! This is applied via a nylon "nib". It is thus only necessary to take a piece of copper-clad laminate, and literally draw the circuit connection pattern required. The laminate is then etched in ferric chloride in the usual way to remove unwanted copper.

A problem with some memory systems is that when power is cut, the memory "forgets" and clears itself. A fairly new device introduced by Siemens boasts a storage time of many months even with power removed. The device works on the principle of charge carriers being stored between a silicon oxide layer and a nitride layer. Although the charges shift the threshold voltage of the transistor, they do not alter the physical semiconductor structure. Thus information may be repeatedly written and erased. Pulses of between 50 and 100 μ S duration at $\pm 35V$ are required to write/erase information.

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Price together	£6-50

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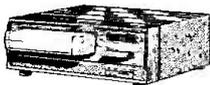
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MP-60 TPD2 Styrene base			17-50	21-00	
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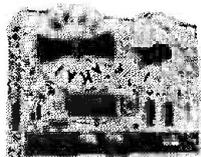
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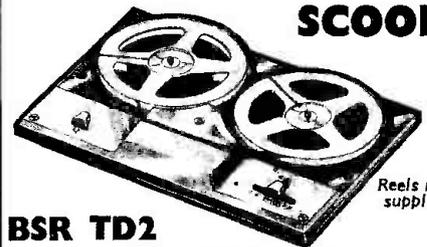
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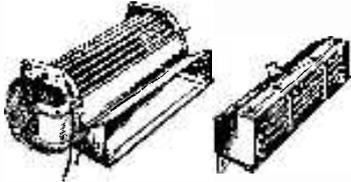
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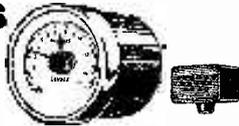
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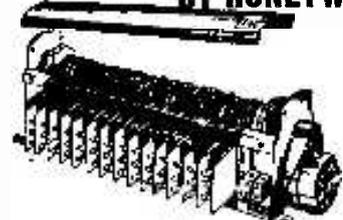
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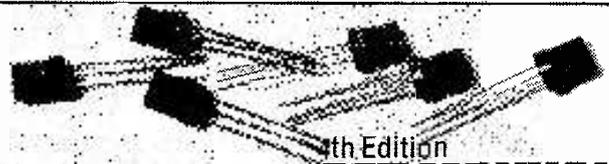
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ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz ● Times in GMT

THE collecting of QSL cards, as mentioned last month, gives the hobby of shortwave listening a new dimension. The cards, once received, can be made into an attractive and interesting collection and put into albums for display. Alternatively, those listeners lucky enough to have their own shack can decorate the walls with QSL cards.

Most of the DX and radio clubs issue attractive certificates to members who have collected certain numbers of cards. There is usually one award for number of countries verified, 50, 100 etc. Other certificates are more specialised, for hearing a certain number of countries on a certain band; for hearing, say, ten stations in each of the continents etc. These certificates can be added to the collection.

Some DX clubs also organise listening competitions in which the listener is restricted to certain bands and certain times. The competitor then submits his log for the competition which is then checked against the transmission schedules of all the stations. Points are then awarded according to the difficulty of reception. The winner is the person with the most points at the end of the day.

DX News

Bolivia: Radio Juan XXIII, San Ignacio has been heard with a poor signal at 0125 on 4967kHz, the programme consisted of music and advertisements.

Fiji: The Fiji Broadcasting Commission has closed its short-wave transmitters and the two 10kW units are being converted for medium-wave broadcasts.

Gabon: Franceville has been noted at 0500 on the new frequency of 4830kHz. The programme was in French and reception was poor.

Papua: R. Milne Bay, VL8AS, is now in operation on the new frequency of 3360kHz with a power of 10kW. The station advises that the reception is world-wide and they are rated as the best signal from Papua.

The above items of news are from Sweden Calling DXers and my own listening efforts.

The first log this month comes from **Michael Berry** of Dewsbury, Yorkshire who heard the following stations:

- 3210 R. *Clube Mozambique*, Portuguese at 1810.
- 11805 R. *Globo*, Brazil in Portuguese at 2020.
- 11835 R. *El Espectador*, Uruguay, Spanish at 2135.
- 11865 R. *Clube Pernambuco*, Brazil at 2050.
- 11920 *Ivory Coast* in English at 1935.
- 11950 R. *Min. Educacao*, Brazil, Portuguese at 2245.
- 15105 *Windward Islands* B.S. in English at 2120.

Richard Witney of Braintree, Essex, used his Binatone Air Marshall portable receiver and 35 foot telescopic antenna to hear the following stations:

- 9670 *Trans Europa Radio*, Greece 1250.
- 9750 *Radio Kuwait* in English at 1710.

- 9913 *All India Radio*, News in English at 2100.
- 11721 *Radio Nacional de Brazilia* at 0700.
- 11955 *FEBA*, *Seychelles* in English at 1600.

Richard Keen of Hayes in Middlesex has just installed an a.f. processing unit to improve reception and was rewarded by hearing:

- 4550 R. *Nacional Columbia* at 2100.
- 5960 *HCJB*, *Quito*, Ecuador in English at 2040.
- 11724 R. *Nacional Brazilia* noted at 2020.
- 11795 R. *Nacional*, *Rio de Janeiro* at 2015.
- 11805 *Radio Globo*, Brazil noted at 2115.
- 11830 *VOA*, *Okinawa* at 1635.
- 15105 R. *Rural Brazil* noted at 2040.

John W. Smith of Cellardyke, Anstruther, Fife returns after a long absence with the following list received on his Eddystone 840C and 60 metre half-wave dipole.

- 4860 *All India Radio* at 1920.
- 4890 R. *Dif. Venezuela* at 0250.
- 4910 *Conakry*, Guinea at 2215.
- 4940 R. *Yaracuy*, Venezuela noted at 0223.
- 4965 *South African B.C.*, Internal Sce. at 2130.
- 4980 *Ecos del Torbes*, Venezuela at 0235.
- 4990 R. *Barquisimeto*, Venezuela at 0355.
- 5035 *Radiodif. Nationale Centrafricaine*, 2230.
- 5047 *Radiodif. du Togo* noted at 2245.
- 15155 R. *Dif. de Sao Paulo*, Brazil at 2005.
- 15180 R. *Cultura de Bahia*, Brazil at 2030.
- 15450 R. *Nacional de Brazil* at 1930.

Simon Fordham sent the following log from his home in Auckland, New Zealand, his equipment consists of a 5-valve domestic receiver and a 15 foot vertical aerial:

- 5970 *CBC*, Radio Canada at 0840.
- 9680 *ABC*, *Radio Australia* at 0815.
- 9715 *Radio Nederland*, Bonaire at 0815.
- 9745 *HCJB*, *Quito*, Ecuador at 0830.
- 11730 *Radio Moscow* at 0430.
- 11730 *Radio Nederland*, Bonaire at 0700.
- 11765 *ABC*, *Radio Australia* at 0800.
- 11765 *HCJB*, *Quito*, Ecuador at 0835.
- 15405 *ABC*, *Radio Australia* at 0800.

Mohammed Huq of London, E.2. is a newcomer to the column, his equipment consists of a Skywood CX203 receiver and a 45 foot long-wire antenna, this enabled him to hear:

- 9460 R. *Pakistan* with music at 2025.
- 9570 *Radio Australia*, newsreel at 0730.
- 9912 *All India Radio*, music at 2240.
- 11650 *Radio Bangladesh* with songs at 1740.
- 15520 *Radio Bangladesh* with news in Bengali at 1500.
- 17825 *NHK*, *Tokyo*, Japan in Japanese at 0820.

Reports should arrive by the 15th. of the month and be addressed to me at 59 Windrush, Highworth, Swindon, Wiltshire, SN6 7DT.

SHORT WAVES

THE AMATEUR BANDS

David Gibson, G3JDG

Frequencies in kHz ● Times in GMT

IT'S the very last month of the year, Time for Santa to come sliding down your antenna with a big bag crammed with goodies. All the best wishes from G3JDG will not guarantee a nice new hunk of equipment, but a very happy Christmas to all slaves of the ether, anyway.

Speaking of Christmas; for the benefit of the many newcomers plus those who forgot (confess!), remember the large number of nets on Christmas morning. Topband is a firm favourite with two metres a close second.

Did you know that you can "grade" an Amateur Radio station by listening to the Christmas nets? Well, you can, and here's how. At 0600hrs the fanatics come on. They've been up all night on the air. Note their callsigns. These are the ones to listen for next year. They'll be working the DX even if it kills them.

This group is joined at 0800hrs on Christmas morning by a very large number. These are the family types who were awakened at 0600hrs by their harmonics (children). They have already received (0601hrs) their annual quota of gloves (wrong size), socks (wrong colour) and aftershave (wrong pong) and are killing time until breakfast.

At 0930hrs—the elite—the guy who doesn't have to get up early. His 1kW transmitter at the bedside feeds a well-hidden 5 Megawatt linear in the garage and from thence to a tri-band quad at 200feet. He doesn't have to get up early for DX, they can hear him everywhere, anywhere, anytime.

At about 1030hrs, the last batch arrives on the bands. These are just plain lazy and the group will almost certainly harbour G3JDG. See how many you can log in each group and let me know.

Time to look at our Potty Prefix list. It seems that there are more changes than the consumption of proverbial hot dinners. Gozo has changed from 9H1 to 9H4 followed by two letters. Indian Amateurs are using a VU25 prefix to celebrate the 25th anniversary of the country's independence.

Scalp hunters will be pleased to note that Mellish Reef has been added to the Countries List by the ARRL (American Radio Relay League). Wonder how they'd reckon on G3JDG working /A from the duck sanctuary in the middle of the Serpentine.

If you get fed up listening to crowded bands with 40 stations separated by 3Hz—have a rest, tune into the wide open r.f. pastures of the four metre cemetery. Think of it; just you, your receiver and the noise level—Haaa . . .! But things have changed. Real signals have been heard with people unashamedly giving callsigns quite openly.

Kevin Gibson (no, I'm not his sister!) of Buckingham backs up my findings with a 70MHz log filled in with the aid of a solid state homebrew converter (r.f., mixer) feeding the precious QSO's into an Eddy-

stone 750. Antenna is a 4-element Yagi at 25ft. Heard on 70MHz and not forgotten; G3—CDG/P, GGH, GJW/A, HBG, NVI, RML, RSB, SLI/M, TIR, UHH, UPK, UPS/P, WIR, YCN, YNX/M, YQW, ZHA/M, ZQX, ZRF, ZRH, ZYS/P, G4—AAW, ADM (using indoor dipole), BDQ, BEG. Kevin also reports hearing "meteor pings" from Eastern European f.m. broadcast stations. (Not the dreaded Peking Pings?). Anyone else hear anything on 70MHz? Be pleased to hear from you.

Richard Osborne (Weaverham, Cheshire) asks, "Why are there so few logs for 10 metres? When the band is open, the DX comes rolling in". Proof of the Christmas Pudding etc., so Richard sent a list which reads; CE3AOS/P/O, CR6TP, CX2CN, EL8YE, FL8OM, HClJB, KV4GV, MPHMBQ (Masira Island), MP4TEE, PW1EMM (Editor on holiday on Lundy?), PY2RZ, PZ5CW, TU2DO, VP9GE, fifteen W's, ZE4JW, seven ZS's, 4X4IX, 4Z4LS, 5T5TY, 9JZDT.

Same guy, same gear bagged these on 21MHz; CR6QA, DUICM, FB8XX, FP8CT, many JA's, KL7HDY, KV4AD, MP4MBP, MP4TDM, TN8AU, VS9MB (on Gan Island), VU25DK, YB3AAAY, ZD3D, 5H3MT, 5N2AAN, 9M2DW, 9Q5NB, 9X5VA. Kevin uses an "all PW" station which includes the PW General receiver, G3TYJ preselector and PW DXer's audio processing unit. Ten metre antenna is 30 metres long end-fed.

Robert Iball (is that pronounced "Eyeball" or am I being too Eyebrow?) is back in the saddle of his Trio JR500SE. Antenna is 75ft endfed and the cream of hearings on three bands are as follows. Twenty metres: UA1KAE (Antarctica), VK3MO, VK5UC, VK6BC, WA1QOX/VE8, all on s.s.b. with VE8RCS and CO1IB/FP8 on c.w. Fifteen metre s.s.b. from WA60YU/KG6 and G3MUL/CE3 while VK2CX put in an appearance on c.w. Ten metre c.w.; UM8MAH: s.s.b. signals from FL8OM, HClLG, HClXX, JY9DR and VK6NI. Robert's QTH is Worksop, Notts.

Anyone started some serious Topband listening yet? David Sharred (South Yardley, Birmingham) managed to hear HB9ANW plus GI3GRD and GW3XHG. Receiver is a three valve regen. from PW; about 1965 (a good year for regens!) Antenna is a "folded" 140ft. endfed.

Only two "happenings" in my diary for the immediate future. December 9 and 10, topband c.w. contest; January 27-28, C.Q. World Wide DX 160 contest—now there's an opportunity.

Logs, in alphabetical order please, to arrive not later than the 15th of the month at:
12 Cross Way, Harpenden, Herts.

ALMOST UNBELIEVABLE! Think of the year 1984 and what might be produced then—now get the fantastic **ASTRAD 17** and **SEE** for yourself that the incredible Russians have done it all **NOW!** It's the radio perfectionist's dream come true! **THIS ONE SUPERSEDES ALL EARLIER MODELS!** It will probably make your present radio seem like a "crystal set"! Complete with optional battery eliminator for both battery and mains use! We're almost giving them away at only £20.75—a mere fraction of even today's Russian miracle price! We challenge you to compare performance and value with that of £80 radios! *Test 7 days—we'll refund instantly if you are not absolutely astounded, **Elegant black and chrome finish facia, set in fabulous Cabinet built case—constructed of fine Russian hardwood in beautiful Teak Veneer finish—prevents vibration, ensures purer and sweeter tone than ever!** Volume controlled from a whisper to a roar that would fill a hall! Much wider band spread, for absolute "pin-point" station selection! Plus "MAGIC EYE" tuning level indicator for ultra perfect tuning sensitivity! Yes, the Russians have surpassed themselves, proving again their fantastic ability in the field of electronics and brilliantly reflecting their advanced micro-circuitry techniques in the field of spaceship and satellite communications. **Yes, EVERY WAVEBAND** instantly at your fingertips including Standard Long, Medium, Short and Ultra Short Waves to cover the four corners of the earth 24 hours a day, including all normal transmissions, VHF, AM, FM, MW, LW, USW, plus local and new stations not yet operational and messages from all over the world! Expensive **TURRET TUNER** side control waveband selection unit (as used on expensive T.V.'s!). Every waveband clicks into position giving incredible ease of station tuning! Genuine push-pull output! ON/OFF volume and separate Treble and Bass tone controls for utter perfection of reproduction and tone! Press-button dial illumination! Take it anywhere—runs economically on standard batteries (obtainable everywhere) or direct through battery eliminator from 220/240v AC mains supply. Internal ferrite rod aerial plus built-in "rotatable" telescopic aerial extending to 39ins approx. It's also a fabulous **CAR RADIO**. Can also be used through extension amplifier, tape recorder or public address system. **SIZE 14ins x 10½ins x 4½ins overall approx.** Magnificently designed, made to give years of perfect service. (U.K. service facilities and spares available for years and years to come, if ever necessary!). With **WRITTEN GUARANTEE**, manual with simple operating instructions and circuit diagram. **ONLY £20.75** (with mains/battery eliminator £1.48 extra) **BOX, POST, ETC. 50p.** ***BUT WAIT**, for only 55p extra you get the sensational "**COMPUTERISED**" **WORLD TUNING GUIDE** (It enables you to time, pinpoint and get transmissions the whole world over—even a child can do it in a flash—it even lets you know when to tune into the U.K. when abroad. **NO GUESSING! NO MESSING!**) **PLUS** Standard 'longlife' batteries **PLUS** ultra sensitive earphone for personal listening. (Sorry—We cannot change these new radios for any earlier model purchased.) **HURRY!** Send today or call at either store. It's a chance of a lifetime that nobody can afford to miss. **SHOPERTUNITIES FOR BARGAINS!**

JUST ARRIVED! THIS YEAR'S NEW * **COMPUTERISED?**
RUSSIAN MIRACLE!

BRAND NEW 'SPACE AGE' model—SO FAR AHEAD OF ITS TIME IT WILL STILL BE MAKING MANY LOOK OUT OF DATE IN 1984!

THE FABULOUS ASTRAD 17

THIS OFFER ONLY FROM US!

WORLD WIDE RECEPTION
THOUSANDS OF TRANSMISSIONS & STATIONS POUR IN FROM THE FOUR CORNERS OF THE EARTH!

PORTABLE RADIO & COMMUNICATIONS RECEIVER



28 TRANSISTORS AND DIODES!
WAVEBANDS:
STANDARD LONG and MEDIUM
Plus 5 SHORT WAVEBANDS
Plus ULTRA SHORT WAVES
(V.H.F. AM, FM, MW, LW, USW.)

***COMPARE ITS PERFORMANCE with £80 RADIOS!**

BATTERY MODEL £20.75
BOX POST ETC. 50p
MAINS/BATTERY ELIMINATOR £1.48 extra

FIRST TIME EVER!
***NOW AVAILABLE WITH fabulous "COMPUTERISED" WORLD TUNING GUIDE!**
NO MORE GUESSWORK—INSTANT DATA at your fingertips—enables you to TUNE IN A FLASH to transmissions the world over!

THIS FANTASTIC OFFER ONLY FROM US! Fabulous BRAND NEW **SOLID STATE** This equipment's got EVERYTHING!

BATTERY/MAINS AC Combined V.H.F. AM/FM RADIO and CASSETTE TAPE RECORDER & PLAYER

WITH REMOTE CONTROL MICROPHONE

RECOMMENDED RETAIL PRICE £44

OUR PRICE £23.75 CARR. ETC. 35p

Shopertunities 'thunder' ahead with an offer that's **FANTASTIC** (even by our standards!) We've snapped up 500 magnificent machines. Latest sensation in the world of sound! First-class makers! Fabulous **VHF, AM/FM Radio AND Cassette Tape Recorder & Player** combined and it also runs off standard batteries or mains. (Simply plug in the 220/240V. AC line cord.) Record and play back anything, anywhere! Even tape direct from the radio as you listen! **RECOMMENDED RETAIL PRICE GENUINELY £44!** **WE OFFER AT ALMOST HALF PRICE!** Wonderful features: * **Press-button Keyboard Control Panel** or latest **MASTER SWITCH CONTROL!** * **"MAGIC EYE"** Visual Battery check/recording level indicator or built-in automatic Leveller! * **Separate ON/OFF and HI-LO volume controls!** * **Heavy duty built-in speaker!** * **Earphone** (for personal listening or "monitoring") and extension speaker sockets! * **Remote control microphone!** * **Built-in swivel telescopic extension aerial (24in. approx.)!** Magnificently made case with carry handle. (**DESIGNS VARY SLIGHTLY.**) Takes standard 30, 60, 90 or 120-minute Cassette Tapes obtainable everywhere. **AND** the amazing built-in full circuit **VHF, AM/FM Radio** gives you superb clarity of tone, incredible station selection. Unique rotating Station Selector Dial—get all local city and regional stations in every part of the country plus B.B.C. National, VHF. Picks up dozens of foreign stations. **Fabulous in your car!** You could pay £££'s more for a Car Radio or Car Cassette player **ALONE!** £23.75, **CARR. ETC. 35p.** Complete with simple instructions, remote control microphone with on/off switch and microphone stand. **WITH WRITTEN GUARANTEE.** send today to Uxbridge Rd. and test 7 days—refund if not absolutely delighted. Or call at either store. **BONUS OFFER:** Batteries and Cassette Tape 25p extra if required.

FIRST TIME EVER! SAVE £14.48!
BRAND NEW AC/DC BATTERY/MAINS

Cassette TAPE RECORDER & PLAYER

FIRST CLASS MAKERS

With remote control microphone.

WE COULD CHARGE UP TO £26.97!
OUR PRICE £12.49 POST ETC. 31p

THE ONE STEP FORWARD EVERYONE HAS WAITED FOR! NOW a superb de-luxe portable **BATTERY/MAINS** tape recorder and player—and incredible Shopertunities bring it to you for **ONLY £12.49!** Due to our cut price we cannot name first-class makers—but rest assured you're getting one of the **BEST!** Expensive "**PIANO KEYBOARD**" **CONTROL PANEL** (or latest **MASTER SWITCH** control) and **AUTOMATIC LEVEL CONTROL.** No fiddling with awkward tape and reels, just "slap-in" a cassette and off you go! (Takes 30, 60 or 90 minute standard cassette tapes obtainable everywhere.) Amazing performance ensures perfect tapings and superb reproduction! Remote control microphone. Rapid rewind! Fast forward! Beautiful tone from a whisper to a roar. Completely self contained—record anywhere, indoors or out! **Runs on standard batteries AND 220/240v. AC mains.** Separate jacks for remote control microphone, etc. Size 9½in. x 5in. x 2½in. approx. Design can vary slightly. With carry handle. **WRITTEN GUARANTEE** and full instructions. **ONLY 12.49, post etc. 31p.** *Refund if you don't agree we could charge up to £26.97!
BONUS OFFER (strictly rationed one per customer):—Cassette tape, set of standard batteries **AND** microphone stand all for 50p extra if required.
ALSO super de-luxe model fitted with **V.H.F. AM/FM Radio, ONLY £23.75 carr. etc. 35p** (standard batteries & cassette tape 25p extra, if required).
Send today & test 7 days, refund if not delighted, or call at either store.

Dept. WP/26, 164 UXBRIDGE ROAD (facing Shepherds Bush Green), LONDON, W12 8AQ (Thurs. 1, Fri. 7). Also at 37/39 HIGH HOLBORN (opp. Chancery Lane), LONDON, W.C.1 (Thurs 7) **BOTH OPEN MON TO SAT 9 A.M. UNTIL 6 P.M.**

SHOPERTUNITIES LTD.



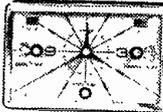
MAINS MOTOR

Precision made—as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at 65p. Postage 20p for first one then 10p for each one ordered.



MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at 20p each, £1.80 for ten, your assortment.



ISA ELECTRICAL PROGRAMMER

Learn in your sleep! Have radio playing and kettle boiling as you awake—switch on lights to ward off intruders—have a warm house to come home to. All these many other things you can do if you invest in an electrical programmer. Clock by famous maker with 15 amp. on/off switch. Switch on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price £1.95 + 20p p & p or with glass front chrome bezel 75p extra.



RESETTABLE FUSE

How long does it take you to renew a fuse? Time yourself when next one blows. Then reckoning your time at £1 per hour see how quickly our resettable fuse (auto circuit breaker) will pay for itself. Price only £1 each or £11 per dozen, specify 5, 10 or 15 amp—simply fit in place of switch.

FLUORESCENT CONTROL KIT

Each kit comprises seven items—Choke, 2 tube ends, starter, holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A—15-20 w. £1. Kit B—30-40 w. £1. Kit C—80 w. £1.20. Kit E—65 w. £1.20. Kit F for 8ft. 125 w. tube £1.75. Kit MF1 is for 6in., 9in. and 12in. miniature tubes £1. Kit MF2 for 21in. 13 w. miniature tube £1. Postage on Kits A and B 23p for one or two kits then 23p for each two kits ordered. Kits C, D and E 23p on first kit then 18p for each kit ordered. Kit F 33p then 23p for each kit ordered. Kit MF1 18p on first kit then 15p on each two kits ordered.

SOLDER GUN

A must for every busy man, gives almost instant heat also illuminated job. 100 watt £2.25 plus post and ins. 20p. RIG JOB 250 watt model £2.75 plus post and ins. 40p.

WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. 50p post free.

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: P1, P3, P4, P6, P7, P9 and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only 85p, plus 20p postage.

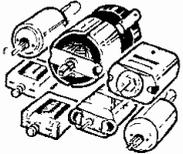
THERMOSTATS

Type "A" 15 amp. for controlling room heaters, greenhouses, airing cupboards Has spindle for pointer knobs. Quickly adjustable from 30-38 deg. F. Suitable box for wall mounting 45p. Type "B" 10 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 50-550 deg. F. Internal screw alters the setting so this could be adjustable over 30 deg to 1000 deg. F. Suitable for controlling furnace, oven, kiln, immersion heater or to make flame-stat or fire alarm, 50p plus 12p post and insurance. Type "C" Simply clamp to tank. Pipe, heatsink, casing. Break temperature adjustable by calibrated knob 75p. Type "D". We call this the Ice-stat as it cuts in and out at around freezing point, 2/3 amps. Has many uses, one of which would be to keep the loft pipes from freezing, if a length of our blanket wire (26 yd.) 50p is wound round the pipes 28p P & P 5p. Type "E". This is standard refrigerator thermostat. Spindle adjustments cover normal refrigerator temperature. 50p. plus 5p post.

SPARTAN Portable RADIO

Long and medium wave, 7 transistor, size 6" x 4" x 1 1/2" with larger than usual speaker giving very good tone. Built-in ferrite aerial and telescopic aerial for distant stations. A real bargain complete with leather case, carrying sling, ear-plug and case £3.75 plus 25p post and ins.

The Remitone transistor medium wave pocket loud speaker radio. Loud and with good tone will make wonderful Christmas present. Buy while stocks last. Full money back guarantee. £1.99 Only



BATTERY MOTORS

A bargain parcel of 7 motors for £1. Some not as large as a postage stamp and only 3/4" thick. Largest is 1 1/2" x 1 1/2" dia. Some work off 1 1/2 v some as high as 18v. These motors are used in racing cars, power toys etc. The largest is so powerful that it will drive a Mini drill, model lathe, or similar. This is a 4 pole motor, optimum working 16.5 v but very powerful even as low as 4 1/2 v. Don't miss this wonderful snip.

COMPUTER TAPE

2,400ft of the Best Magnetic Tape machine can buy—users claim good results with Video and sound. 1in wide £1.00 plus 33p post and insurance with cassette. 1/2in wide £1.00 plus 30p post and insurance with cassette. Spare spools and cassettes—1in 75p, 1/2in 75p each plus 20p post and insurance.

TANGENTIAL HEATER UNITS

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing £15 and more. We have a few only. Comprises motor, impeller, 2kW. element and 1kW. element allowing switching 1, 2 and 3kW. and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only need control switch. £3.50. 2kW. Model as above except 2 kilowatts £2.50. Don't miss this. Control Switch 35p. P. & P. 40p



TIMAC 24 hour 15 amp Clock Switch. Self-contained unit for flex connection to the mains. Clock switches 2 on/off's per 24 hours. Operates a 15 amp switch. All neatly made up in an ivory moulded case with outlet socket. The only snag is that the outlet socket is the continental type. Plugs for these can be bought in this country alternatively you could fit a connector strip in place of the outlet socket. Overall size of this unit is approx. 4" x 2 1/2" x 3" and the clock has a clear perspex cover which is easily removable for reprogramming. Ideal for blanket controller etc. Price £2.75 each.

THYRISTOR LIGHT DIMMER

For any lamp up to 1kw. Mounted on switch plate to fit in place of standard switch. Virtually no radio interference. Price £2.85, plus 20p post and insurance.

HORSTMANN "TIME AND SET" SWITCH

(A 30 amp Switch). Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fires, etc., up to 14 hours from setting time or you can use the switch to give a boost on period of up to 3 hours. Equally suitable to control processing. Regular price probably around £5. Special snip price £1.50, p. & ins. 23p.

THIS MONTH'S SNIP

Miniature mains driven blower centrifugal type blower unit by Woods, powerful but specially built for quiet running—driven by cushioned induction motor with specially built low noise bearings. Overall size of blower is approx. 4 1/2" x 4 1/2" x 4". When mounted by its flange air is blown into the equipment but to suck air out mount it from the centre using a clamp, ideal for cooling electrical equipment, or fitting into a cooker hood, film drying cabinet or for removing flux smoke when soldering etc. etc. A real bargain at £1.85.

MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied. Model 1153 500m watt power output 65p. Model 1172 750m watt power output 85p. Model EP9000 4 watt power output £1.45. EP9001 Twin channel pre amp for stereo £1.80. 10% discount if 10 or more ordered.

MULLARD THYRISTOR TRIGGER MODULE

This produces pulses for phase control triggering, it has two isolated out-puts, so one thyristor or two thyristors (in separate arms of bridge) may be controlled by one module. The timing circuit is synchronised to the mains frequency and control is by an external variable resistor or from a voltage or current source. Provision is made for feedback where automatic control is required. Price £4.50 each or 10 for £40.00.

MULLARD UNILEX

This D.I.Y. Stereo Amplifier is still available complete at £7.00 for the four Mullard Modules, or Modules can be bought separately as follows:—4 watt amplifier module (2 required) Mullard Ref. No. E.P.9000—£1.45 each. Pre amp module Mullard Ref. No. E.P.9001—£1.80 each. Power module—Mullard Ref. No. E.P. 9002—£2.30 each. In addition and made to Mullard Specification we offer:—Standard Control Unit with escutcheon—£2.50. Knobs—Set of 4—50p. De-luxe Control Unit—£3.50 with escutcheon. Set of 6 Knobs—75p. Mullard Unilex Handbook—25p.

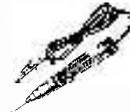
MULLARD I.F. MODULE

This is a fully screened intermediate frequency module for amplification and detection of f.m. signals at 10.7MHz and a.m. signals at 470kHz. The first stage is used as an i.f. amplifier for f.m. and a self oscillating mixer for a.m. operation, in conjunction with an external oscillator coil. 85p each. 10 for £7.85. 100 for £62.50p. With connection dig.

Where postage is not stated then orders over £5 are post free. Below £5 add 20p. Semi-conductors add 5p post. Over £1 post free. S.A.E. with enquiries please.

POCKET CIRCUIT TESTER

Test continuity of any low resistance circuit, house wiring, car electric. Tests polarity of diodes and rectifiers. Also ideal size for conversion to signal injector (circuit supplied). 30p or 2 for 50p post paid.



AMPLIFIER IN CASE WITH SPEAKER

Marketed by British Relay under the name Luxitor. This is in a very neat looking cabinet and is ideal around the home or in the workshop for trouble shooting or for testing out a quick lash up. Size approx. 9 1/2" x 6 1/2" x 3 1/2" deep. Input is via a matching transformer and volume control and amplifier may be powered by an internal 9v battery or an external 110v source. Speaker is an R-A elliptical 6" x 3 1/4" 10,000 gauss. The amplifier proper is a Newmarket model ref. P.C.4. Price £3.50 each, 10 for £31.50. Post and insurance 20p.

BAKELITE INSTRUMENT CASE

Size approx. 6 1/2" x 3 1/2" x 2" deep with brass inserts in four corners and bakelite panel. This is a very strong case suitable to house instruments and special rigs, etc. Price 45p each.

TELEPHONES

Complete as illustrated. Save your legs, time and temper, simply by putting in some telephones. Ex. G.P.O. not new—but guaranteed in good condition and serviceable. Supplied with diagram and instructions showing how to connect. Price £1 each + 50p post or 2 for £2.50 post paid. Also available separately, dials and handsets 50p each + 20p post.



ROCKER SWITCH

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

SLIDE SWITCHES

Slide Switch, 2-pole changeover panel mounting by two G.B.A. screws. Size approx. 1in x 3/4in rated 250V lamp. 6p each, 10 for 54p, 100 for £5.10, 500 for £24. Ditto as above but for printed circuit 5p each 10 for 45p, 100 for £4.25. Sub Miniature Slide Switch, DPDT 19mm (3in approx.) between fixing centres. 18p. each or 10 for £1.08. SP Change over spring return 250v 1 amp. 10p.

EDUCATIONAL KITS—all with pictorial instructions

THIS BALANCE KIT FREE
Eagle educational kits. Japanese made these are excellent value for money. We do not expect



to be able to repeat this offer once stocks are sold. Brief description of each kit is given below and with 3 kits or more we give FREE an accurate 11 piece balance kit. Price of kits 40p each post paid. Special price for all 8 kits £3.00 with free balance kit.

KA2 Lens Kit. Eleven parts, including candle, one concave lens, one convex lens, stage and slit frame, etc. Watch light rays bend as they pass through different lenses.

KA3 Water Pump Kit. Thirteen parts. Top of pump is transparent so that operating parts may be observed. Small parts are brightly coloured to be seen easily while working. Three types of pump may be made: Lift pump, Force Pump and Force Pump with reservoir and nozzle.

KA4 Buzzer Kit. Eleven parts. Transparent covers allow the operation of buzzer to be seen. Illustrates and teaches how electromagnetism with an automatic switch results in an operating buzzer.

KA6—2-Pole Motor Kit. Twenty-four parts including enamel wire, armature and pole piece, etc. Motor operates from 1 1/2 volt battery. Illustrates and teaches how electro-magnetism operates a motor.

KA7 Electro-Magnet Kit. Fifteen parts, includes compass. Makes two electro-magnets, one with one layer of wire and one with several layers of wire. Picks up tacks, nails and any small parts showing how magnetism works.

KA8 Current and Resistance Kit. Twenty-nine parts, including bench and light bulb. Conduct interesting and educational projects to learn the application of "OHMS LAW" and see the difference in current and resistance with different types and lengths of wire.

KA9 Bell Kit. Eight parts, including bell and push button switch. Build a complete electric bell and see how the hammer is triggered to make the bell ring.

KA10 Morse Key buzzer and bell kit. 25 part kit easy to construct, simple to operate.

J. BULL (ELECTRICAL) LTD.

(Dept. P.W.) 7 Park Street, Croydon CRO 1YD

Callers to: 102/3 Tamworth Road, CROYDON

Short Wave Converter

R. H. LONGDEN

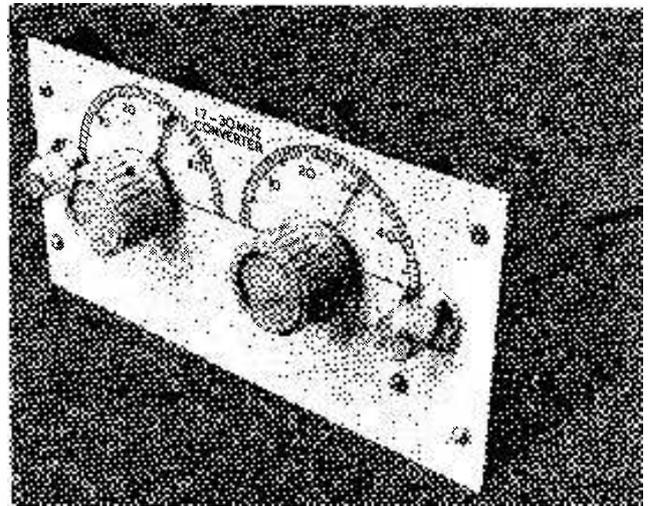
WHEN used in conjunction with a receiver able to tune between about 1.4 and 1.6MHz, at the high frequency end of the medium wave band, this converter provides continuous coverage from 1.7 to 30MHz. This includes the 160, 80, 40, 20, 15 and 10 metre Amateur bands as well as the general short wave broadcasts and many other transmissions.

CIRCUIT

Fig. 1 shows the circuit, having Tr1, an AF117 as r.f. amplifier with VR1 as the r.f. gain control, necessary to prevent overloading with strong signals. Tr3, another AF117, is the tunable oscillator. The output from the MPF105 f.e.t. mixer Tr2 goes to a co-axial lead feeding the receiver.

L1 and L2 are tuned to the signal frequency by the ganged capacitor VC1/2 but L1 can be peaked for maximum efficiency on any range by the panel trimmer VC3. A separate capacitor, VC4, is the oscillator tuning.

The coils L1, L2 and L3 are designed for use in circuits which employ a 1.6 MHz i.f. amplifier. By using a separate capacitor for VC4 and an untuned output circuit at Tr2 the need to set the receiver to precisely 1.6MHz is avoided. The receiver may in fact be tuned to some convenient frequency which avoids any breakthrough of m.w. signals or it may be tuned over a narrow segment to bandspread a part of the converter range. The combination of converter and receiver works as a double-superhet. Initial conversion is to the frequency to which the receiver is tuned followed by the usual conversion to 470kHz or a similar frequency in the receiver.



1.7-30 MHz

Plug-in coils are used having the advantage of allowing three ranges without complicated switching. The listed coverage for the coils is as follows:

Range 3	1.67-5.3MHz	(180-57 metres)
Range 4	5-15MHz	(60-20 metres)
Range 5	10.5-31.5MHz	(28.9-5 metres)

“Blue” coils are used in the aerial circuit with “Yellow” coils for the mixer and “White” coils for the oscillator. One set of three coils is required for each band.

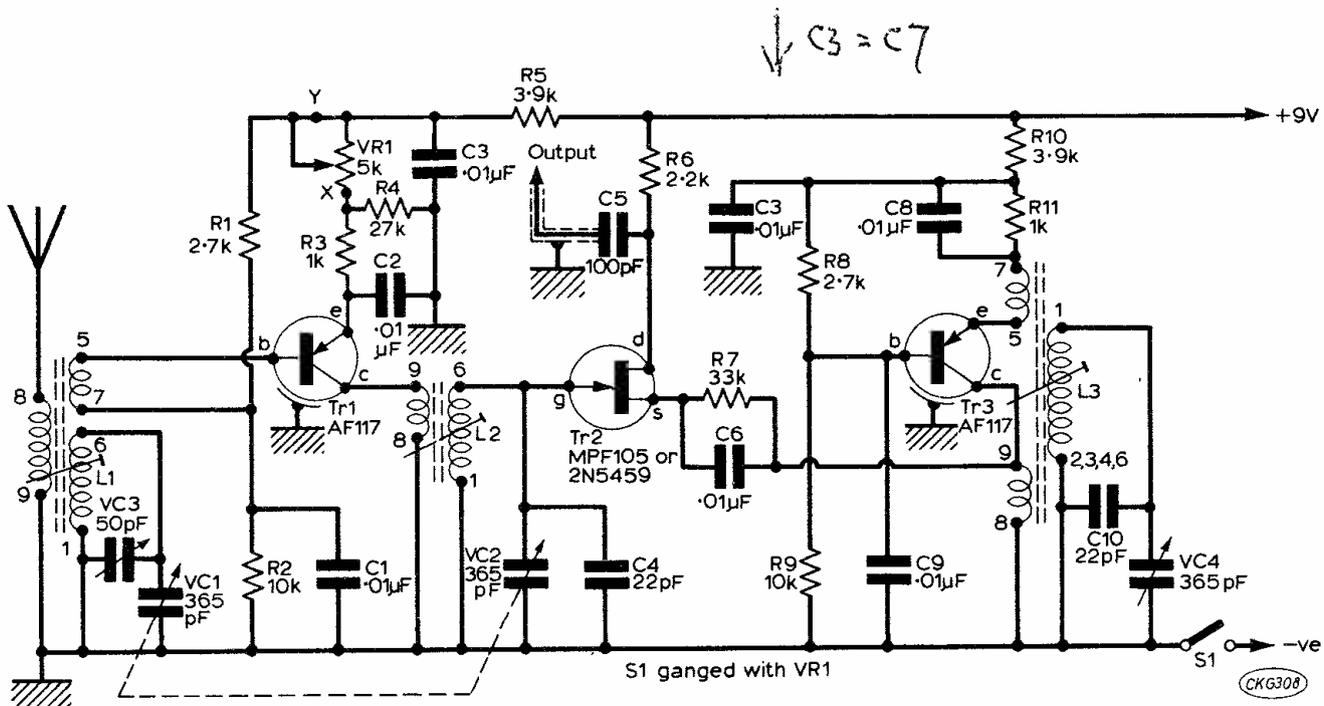


Fig. 1: Complete circuit of the short wave converter. Leadout connections for the transistors are shown in Fig. 3.

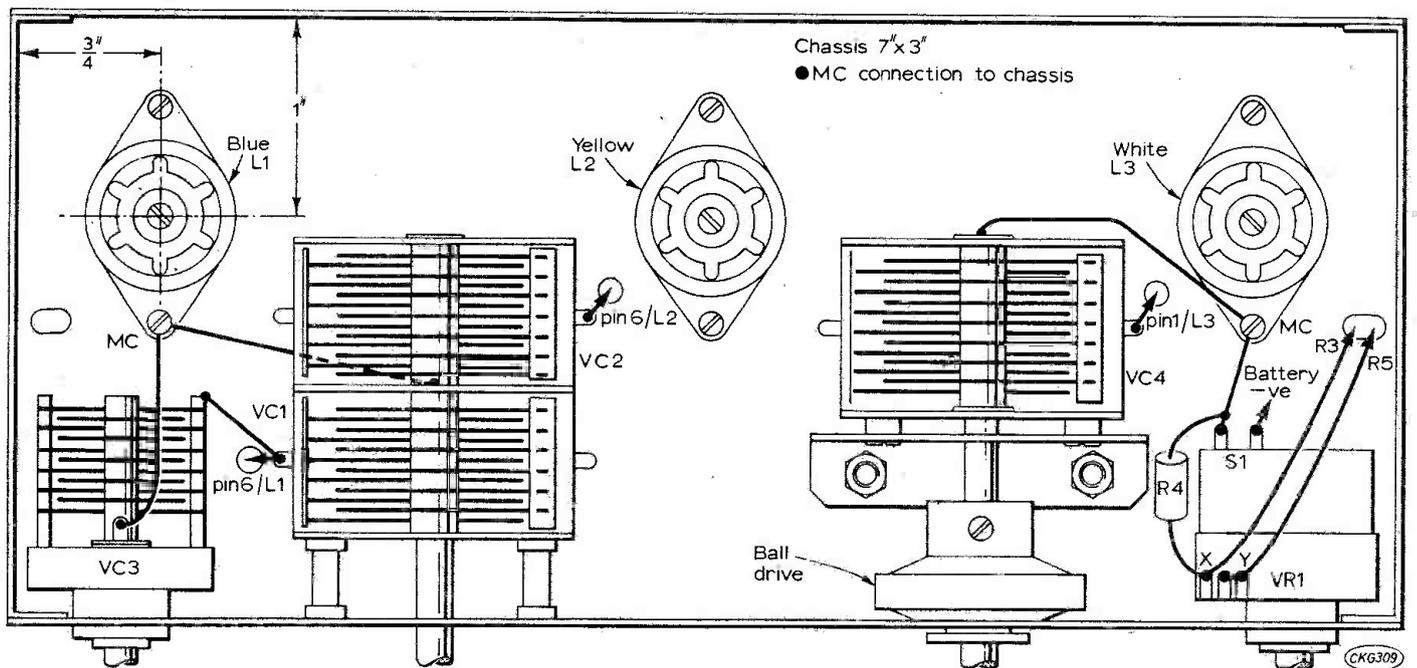


Fig. 2: Component layout on top of the chassis, which is only 7 x 3 in.

CONSTRUCTION

Construction is greatly simplified by using flanged 'universal chassis' members. A 7 x 3 in. member forms the chassis, carrying the coil holders, VC4 and an insulated circuit board.

The panel is a 7 $\frac{1}{4}$ x 3 $\frac{1}{2}$ in. flat piece of aluminium, carrying VC1/2, VC3, VR1 and the ball drive for VC4.

Each side is 3 $\frac{1}{2}$ x 3 in. cut from a single 7 x 3 in. flanged member, the back corners being cut off at 45°. It would be in order to close the back of the converter by leaving the sides intact and bolting a 7 x 3 $\frac{1}{2}$ in. plate on to the back. A top would have to be hinged, or removable, to permit changing the coils,

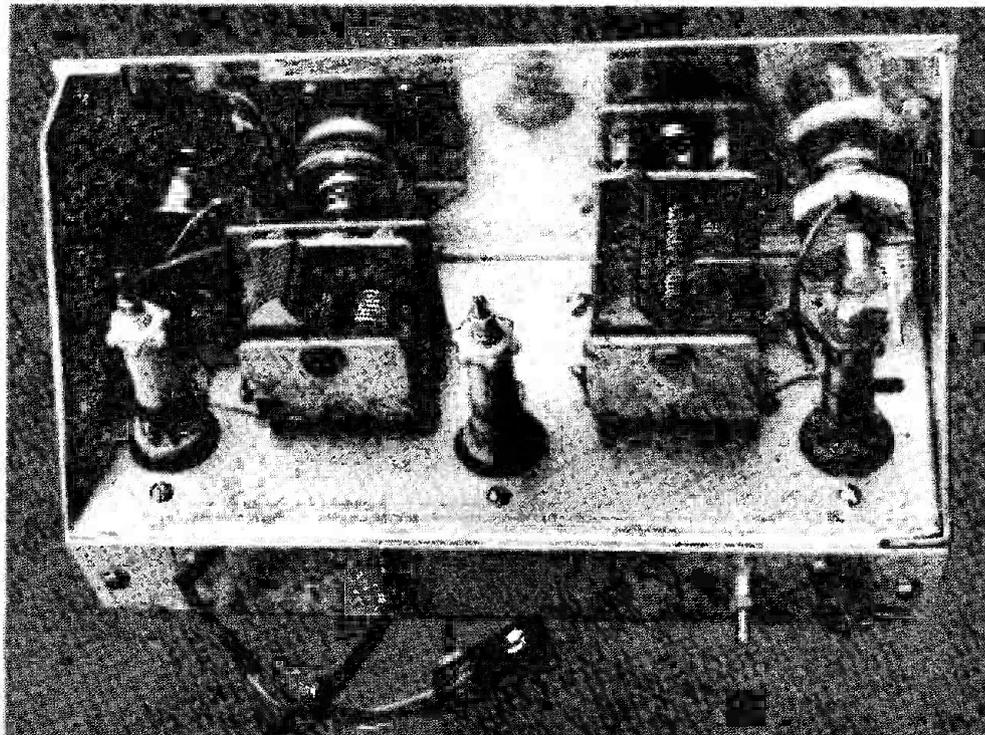
unless interest is confined to one particular range.

Fig. 2 shows the top of the chassis the holes for the 9-pin holders being punched before assembling any parts. The flanges are cut away for about $\frac{3}{8}$ in. to $\frac{1}{2}$ in. at the ends so that this part fits inside the flanges of the sides.

Clearance holes are required for the ball drive and spindle of VC1/2. VC4 is positioned to match up with the drive and is fixed to a bracket cut from scrap metal or a spare flanged member.

A lead is soldered to the rotor tag of VC1/2 and runs to a tag bolted to the chassis. This is also done with VC4. Insulated leads from VC1, VC2, VC4 and VR1 pass down through holes in the chassis.

Fig. 3 shows components and connections under the chassis. Tr1 and Tr3 are soldered directly to the



This view of the completed converter may help when positioning components.

The BIG discount house!

AMPLIFIERS

Amstrad Integra 4000	£22 70
Amstrad 8000	£13 95
Amstrad 8000 MK II	£15 95
Amstrad IC 2000	£27 00
Cambridge P50	£68 00
Cambridge P100	£115 00
Dulc! & Eagle—Full range available	
Ferroglyph F307	
MK II Wood Case	£45-95
Leak Delta 30	£48 00
Leak Delta 70	£58 75
Linear 606	£17 25
Linear LT66	£16 75
Linear 505	£13 75
Metrosound ST 20E	£24 25
Metrosound ST.60	£45 75
Phillips RH 580	£19 99
Phillips RH 590	£39 00
Phillips RH 591	£59 00
Pioneer—Full range available	
Rogers R/Brook CH	£36 00
Rogers R/Brook Cased	£40 00
Rogers R/Bourn CH	£41 95
Rogers R/Bourn Cased	£48 50
Rotel RA 210	£23 00
Rotel RA 310	£30 50
Rotel RA 610	£48 00
Revox A 78	£104 00
Sansui Full range In Stock.	
Sinclair, Wharfedale Linton & Quad—Full range available	
(Carriage and packing 50p.)	

TUNER AMPLIFIERS

AKAI AA 8500	£167 95
AKAI AA 6600	£104 00
AKAI AA 6300	£92 00
AKAI AA 6200	£71 95
Wharfedale 100.1	£89 00
SONAB R4000	£130 00
Sansui full range in stock	
Phillips RH 702	£69 00
Phillips RH 901 with SPKS	£74 00
Goodmans Module 80	£68 95
Goodmans One Ten	£99 00
Leak Delta 75	£124 00
Rogers R/Brk Cased	£78 50
Rotel Fax 331A	£64 95
Rotel Fax 550A	£76 95
Rotel Fax 660A	£83 75
Rotel RX 150	£52 95
Rotel RX 200	£67 00
Rotel RX 400	£76 95
Sharp STA 32L	£89 95
Carriage and packing 50p	

TUNERS

Amstrad MLX 3000	£28 70
Leak Delta FM	£55 95
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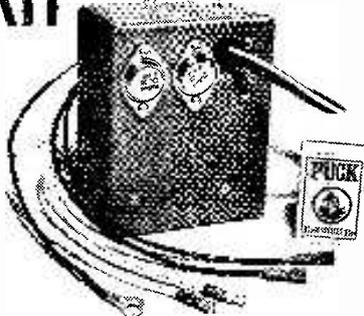
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0B2	.30	6BR8	.63	6SA7GT	.35	19A05	.74	807	.50	EBC80	.30	KTW61	.63	PL505	1.30	UY85	.23	AC157	.25	BCY34	.23	OA85	.08
0Z4	.25	6BS7	1.25	6SA7M	.35	19G6	.50	6702	.50	EBC83	.38	KTW62	.63	PL508	.90	U10	.45	AC165	.25	BCY38	.23	OA90	.13
1A3	.25	6BW6	.72	6SC7GT	.33	20D4	1.05	5763	.50	EBC82	.38	KTW63	.50	PL509	1.30	U12/14	.33	AC166	.25	BCY39	.25	OA91	.09
1A7GT	.32	6BW7	.50	6SG7GT	.33	20P2	.85	7193	.53	EBC81	.26	MHLD6	.75	PL609	1.30	U19	1.73	AC168	.38	BCZ11	.38	OA95	.09
1B3GT	.35	6BZ6	.31	6SH7	.53	20L1	.98	7475	.70	EBC86	.59	F61	.44	PL802	1.70	U22	.39	AC176	.55	BF158	.29	OA200	.09
1HG5GT	.33	6CB6A	.28	6S7	.35	20P1	.50	AC/PEN	.98	EBC88	.59	FAB30	.32	PM84	.31	U25	.62	AC177	.28	BF159	.25	OA202	.10
1L4	.13	6C4	.28	6SK7GT	.23	20P3	.76	AC2/PEN	.98	EBC92	.34	EL37	.74	PC88	.44	U26	.53	AC179	.25	BF163	.20	OC22	.38
1N5GT	.37	6C9	.73	6S7GT	.33	20F4	.89	DD	.98	ECC32	1.50	EL41	.53	PC88	.44	U191	.56	AC189	.20	BF173	.38	OC23	.38
1R5	.26	6CD6G	1.06	6U4GT	.60	20F5	1.00	AC6PEN	.38	ECC33	1.50	EL42	.53	PC97	.53	U251	.62	AC199	.19	BF180	.30	OC24	.38
1R4	.22	6CG8A	.50	6V8G	.17	25A6G	.29	AC/TH1	.58	ECC35	.95	EL81	.50	PC97	.36	U301	.40	AC199	.19	BF181	.40	OC25	.38
1U4	.29	6CH6	.38	6V6GT	.27	25L6G	.20	AC/TF	.98	ECC40	.60	EL83	.38	PC900	.29	U403	.33	AC199	.19	BF185	.40	OC28	.60
1U5	.48	6CL6	.48	6X4	.20	25Y3G	.43	AL60	.78	ECC81	.16	EL84	.21	PC884	.27	U404	.38	AC199	.19	BF194	.15	OC29	.63
2D21	.35	6CM7	.50	6X5GT	.25	25Z4G	.28	ATP4	.12	ECC82	.19	EL85	.40	PC885	.24	U500	.95	U801	.78	BF195	.23	OC35	.32
2GK5	.50	6CU5	.30	7B6	.53	25Z5	.40	AZ1	.40	ECC83	.21	EL86	.38	PC888	.39	U500	.95	U801	.78	BF195	.23	OC35	.32
3A4	.25	6CW4	.03	7B7	.32	25Z6G	.43	AZ31	.46	ECC84	.28	EL87	.38	PC889	.42	U500	.95	U801	.78	BF195	.23	OC35	.32
3D6	.19	6DE7	.50	7H7	.28	30A5	.44	AZ41	.46	ECC85	.32	EL88	.38	PC889	.42	U500	.95	U801	.78	BF195	.23	OC35	.32
3Q4	.38	6DT6A	.50	7R7	.65	30C15	.55	CL33	.50	ECC88	.35	EL89	.38	PC889	.42	U500	.95	U801	.78	BF195	.23	OC35	.32
3Q5GT	.35	6EWA6	.55	7Y4	.60	30C17	.74	CV63	.53	ECC89	.48	EL91	.38	PC889	.42	U500	.95	U801	.78	BF195	.23	OC35	.32
3R4	.23	6F1	.59	7Z4	.50	30C18	.58	CY1C	.53	ECC87	.67	EL92	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
4CB6	.50	6F6	.63	9BW6	.50	30F8	.61	CY31	.59	EY87/6	.27	EL93	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
5CG8	.50	6F13	.33	9D7	.78	30FL1	.58	DAF91	.20	ECF80	.27	EL94	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
5T4	.30	6F14	.40	10C2	.49	30FL2	.58	DAF96	.33	ECF82	.25	EL95	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
5U4G	.30	6F18	.45	10D87	.50	30FL12	.67	DF91	.14	ECF86	.64	EL96	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
5V4G	.33	6F23	.65	10F1	.75	30FL14	.68	DF96	.14	ECF84	.42	EL97	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
5Y3GT	.25	6F24	.68	10F9P	.45	30L15	.55	DH76	.28	ECH21	.63	EL98	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6Z4G	.35	6F25	.51	10P18	.35	30L17	.65	DK40	.58	ECH35	.50	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6Z4GT	.38	6F28	.60	10L1D1	.53	30P4MR	.95	DK92	.35	ECH42	.57	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6/30L2	.53	6F32	.15	10P13	.54	30P12	.69	DK96	.35	ECH81	.25	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6A8G	.33	6GH8A	.50	10P14	1.08	30P19/	.69	DL96	.35	ECH83	.38	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AX4	.15	6GK5	.50	12A6	.63	30P4	.55	DM70	.30	ECH84	.34	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AG5	.25	6GU7	.50	12AC6	.40	30PL1	.57	DM71	.38	ECH84	.34	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AK5	.25	6H6GT	.15	12AD6	.40	30PL13	.75	DY87/6	.22	ECL80	.28	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AK6	.30	6J5G	.19	12AE6	.48	30PL14	.62	DY802	.29	ECL82	.28	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AM8A	.50	6J5GT	.29	12AT6	.23	30PL15	.87	E80CC	1.65	ECL83	.52	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AN8	.49	6J6	.18	12AUV	.21	35A3	.48	E80F	1.20	ECL84	.54	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AQ5	.21	6J7G	.24	12AUV6	.28	35A5	.70	E83F	1.20	ECL85	.54	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AR5	.30	6J7(M)	.33	12BA6	.30	35L6GT	.42	E88CC	.60	ECL86	.38	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AT6	.18	6JU8A	.50	12BE6	.30	35W4	.28	E92CC	.40	ECF22	.63	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AU6	.19	6K7G	.10	12BH7	.27	35Z4GT	.24	E180F	.90	EF40	.49	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AV6	.28	6K8G	.16	12J7GT	.33	35Z5GT	.30	E182CC1	.00	EF41	.58	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AW8A	.54	6L1	.98	12K5	.50	50C5	.32	E1148	.53	EF42	.33	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6AX4	.39	6L7	.38	12K7GT	.34	50C6G	.69	E1476	.58	EF73	.75	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6B8G	.13	6L8	.44	12SC7	.35	217	.55	EABC80	.29	EF80	.21	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6BA6	.19	6L9	1.38	12SG7	.23	50EH5	.55	EAC91	.38	EF83	.54	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6DC8	.50	6LD20	.48	12SH7	.15	50L6GT	.45	EAF42	.48	EF85	.25	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6BE6	.20	6N7GT	.40	12SJ7	.23	85A2	.43	EAF801	.50	EF86	.27	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6BH6	.43	6Q7GT	.43	12SK7	.24	85A3	.40	EB34	.20	EF89	.23	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6BJ6	.39	6Q7(M)	.43	12SK7	.50	90C1	.59	EB91	.10	EF91	.17	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32
6BQ7A	.38	6R7G	.35	14H7	.48	190CG	1.70	EBC41	.48	EF92	.28	EL99	.34	EL95	.32	U500	.95	U801	.78	BF195	.23	OC35	.32

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PW JUNE 71

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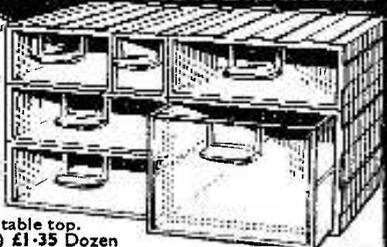
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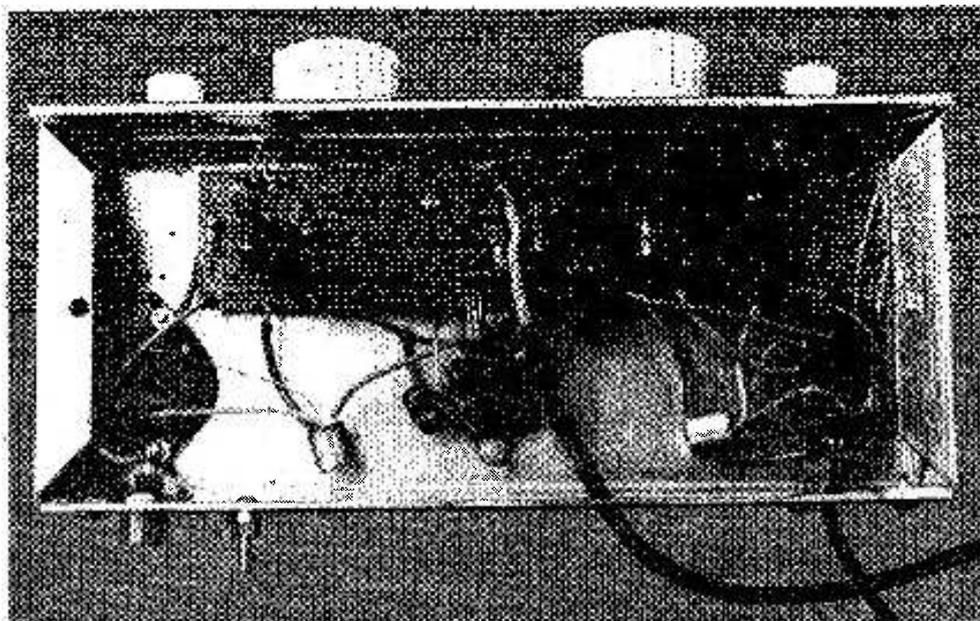
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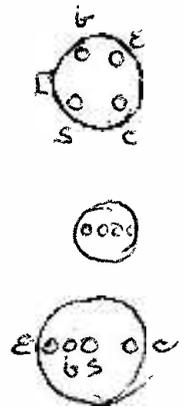
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Under the chassis. The coaxial cable at the centre takes the output of the converter to the receiver.



coil holders to avoid unnecessarily long leads. Put insulated sleeving on these wires, and any other connections which may touch each other or chassis.

The insulated board is about 5 x 1 $\frac{1}{4}$ in. Two $\frac{1}{2}$ in. 6BA bolts hold tags which form a chassis return for components on the board. After the board is wired, these bolts pass through matching holes in the chassis. Extra nuts hold the board clear of the metal. Take care that joints or leads here do not touch the bolts holding the bracket fitted for VC4. These bolts can have their heads below the chassis. The board is completely wired, with a number of projecting leads or Veropins for external connections. It is then fitted in the manner described and the connections shown made to other points.

A 3-lead holder was used for Tr2 so that different transistors could be tried here. If preferred, Tr2 can be wired permanently on to the board. The usual care should be taken to prevent undue and lengthy heating of the transistor leads. Be sure drain, source and gate wires are correctly connected, as in Fig 3.

CONVERTER ADJUSTMENT

Range 3 is probably most easily dealt with but each range is adjusted in the same way. The coil cores are unscrewed somewhat from the fully-in position. A signal is tuned in with VC4 about 80% closed and VC1/2 tuned for best results. With VC3 about half closed adjust the cores of L1 and L2 for best volume. If the tuning position of VC1/2 is very different from that of VC4 adjust the cores of L1 and L2 to correct this, keeping the signal in tune by rotating VC1/2.

Subsequently tune in a signal with VC1/2 and VC4 nearly fully open and peak VC3 for best reception. Tune to the l.f. end of the band, leaving VC3 untouched, and adjust the core of L1 for maximum volume.

Maximum efficiency will be obtained provided VC1/2 is tuned for best volume and VC3 peaked for best results while not fully open or fully closed. However, adjusting the coils in the way described

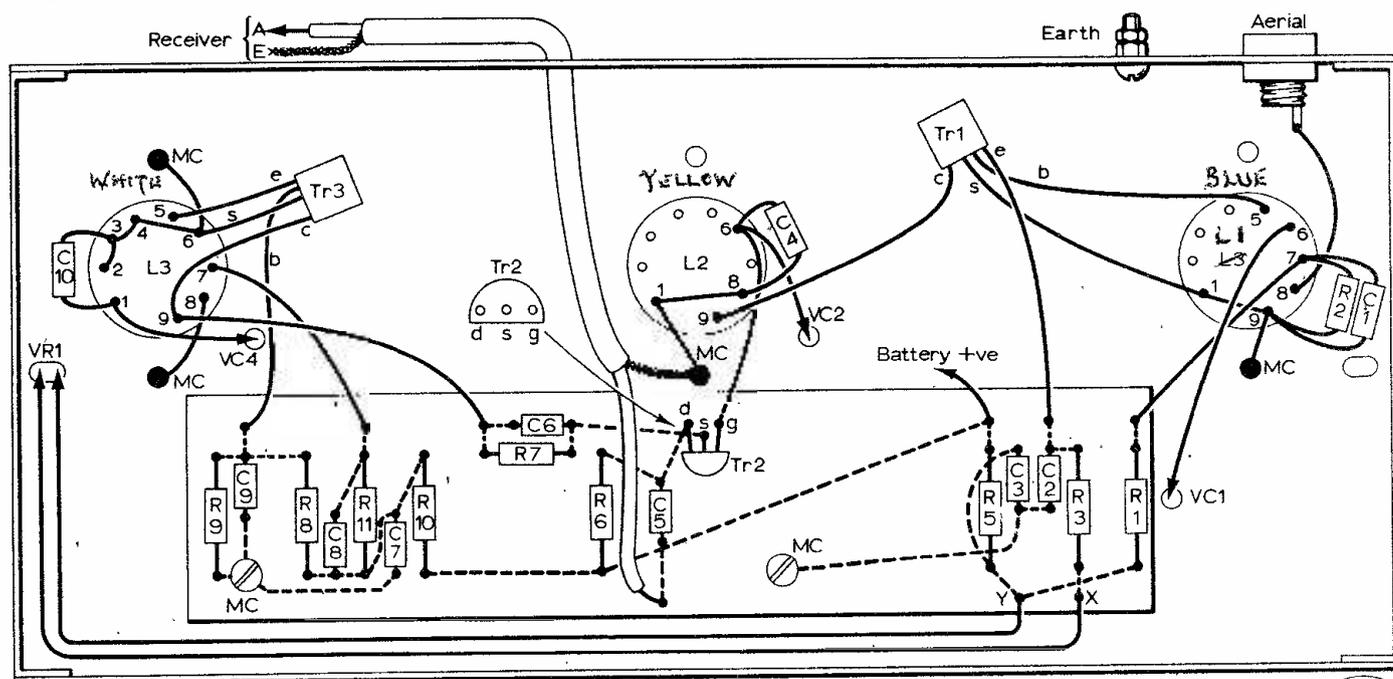


Fig. 3: Details of the component board and wiring under the chassis.

will reduce the need for frequent adjustment of VC3 throughout the range.

On range 5 the mixer utilises the oscillator second harmonic, with the coils listed, and more care is required to adjust the coils. At high frequencies it is also possible to tune VC1/2 to the second channel frequency which arises at about 3MHz from the correct channel. On all frequencies the latter is selected when the oscillator is h.f. of the signal frequency.

A card panel was drawn with scales for the pointers. Suitable ready-made dials calibrated 0-100 can be obtained and may be used if preferred. There is also sufficient space for VR1 and VC3 to be placed under the chassis, if this is required to clear the dials.

As the oscillator circuit is tuned separately, padders are not essential and there is no loss of efficiency without them. The addition of padders will allow the settings of VC1/2 and VC4 to agree more closely, especially on the lower frequencies, and this may be felt to be an advantage. If so, the padder is 350pF for Range 3, 1000pF for Range 4 and 2000pF for Range 5. Range 3 padder is connected from chassis to pin 3 of L3, Range 4 padder from chassis to pin 4, and Range 5 padder from chassis to pin 6.

NOTES

Many transmissions can be received with a short indoor aerial and no earth but for weak signals a better aerial will bring about a great improvement. Unless a specially designed aerial is to be used this

can be 25ft. to 100ft. or so of wire, out-of-doors, placed as high and clear of earthed objects as is practicable. A reasonably long aerial will give much better results on the low frequencies than a short wire.

With weak signals an earth connection will improve results. A good earth can consist of a reasonably short, stout lead to a copper spike driven into the ground.

An unnecessarily long screened lead from the converter to the receiver will reduce signal strength. This lead must be screened to reduce pick up of m.w. signals. The outer braid of the screened output lead is taken to earth on the receiver.

No direct connections must be made to an a.c./d.c. type receiver or to any receiver deriving h.t. directly from the mains in such a way that the receiver chassis is connected to the mains. The converter is not intended for use with such receivers.

For general short wave reception the receiver can be left tuned to some point near the h.f. end of the m.w. band where no m.w. signals are received. All tuning is then carried out on the converter. To search a narrow band of frequencies the receiver can be employed as a tunable i.f. In this case, VC4 is set to the wanted range of frequencies and tuning carried out on the receiver, VC1/2 and VC3 being peaked for best reception. ■

★ components list

RESISTORS

R1 2.7kΩ	R5 3.9kΩ	R9 10kΩ
R2 10kΩ	R6 2.2kΩ	R10 3.9kΩ
R3 1kΩ	R7 33kΩ	R11 1kΩ
R4 27kΩ	R8 2.7kΩ	VR1 5kΩ linear with switch, S1

All resistors 1/4W 10%

Capacitors

C1 0.01μF	C6 0.01μF
C2 0.01μF	C7 0.01μF
C3 0.01μF	C8 0.01μF
C4 22pF SM	C9 0.01μF
C5 100pF	C10 22pF SM
VC1/2 2 x 365pF with slow motion drive (Jackson 02)	
VC3 50pF (Jackson C804)	
VC4 365pF (Jackson 01)	

Inductors

L1 "Blue" ranges 3T, 4T and 5T
L2 "Yellow" ranges 3T, 4T and 5T
L3 "White" ranges 3T, 4T and 5T
All Denco, miniature, transistor type.

Semiconductors

Tr1 AF117	Tr2 MPF105 or 2N5459	Tr3 AF117
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Miscellaneous

Ball drive (Home Radio DL50A). Valveholders B9A(3). Veroboard, plain, 5 x 1½in. Knobs. Universal chassis flanged members 7 x 3in. (2), chassis back 7 x 1in., panel 7¼ x 3½in. (Home Radio).

TELEVISION

JANUARY ISSUE

RECONDITIONED TV SETS

With the growth of colour vast numbers of monochrome sets are coming on the second-hand market. Most of these are capable of a long useful life, maybe as second sets, if knowledgeably reconditioned—in fact with care they can be offered with a good guarantee. What then constitutes reliable TV set overhaul? This month we provide a general guide as to what to look for and the minimum action necessary. The article is based on the author's practical experience of this type of work over a number of years.

BUILDING A COLOUR SET

You don't have to follow the TELEVISION colour receiver design. In fact many readers have gone their own way, using surplus panels and so on. It's likely to take you rather longer but can work out cheaper. Barrie Spink describes his experiences in assembling a go-it-alone colour receiver.

COLOUR RECEIVER PROJECT

This month the final module, the power supply circuits. Details also of the tuner and its connections. This will leave you ready for final assembly of the various units, testing, setting up, etc.

PLUS ALL THE REGULAR FEATURES

ON SALE DECEMBER 18th

IN NEXT MONTH'S

PRACTICAL WIRELESS

POWER for EVER!

Using batteries costs roughly 2,000 times as much as operating via a mains power supply! This article describes a battery eliminator for the popular PP9 type; not only are the voltage and available current characteristics the same, but the unit is housed inside an old battery case, making it a direct replacement. The total cost is only about £1 but this will rapidly be recovered in savings on batteries.

3-RANGE CRYSTAL MARKER

A simple "box" providing r.f. signals on known frequencies is probably one of the most useful bits of equipment that one can have around the radio workshop. Besides its basic role of providing accurate calibration points it gives a range of signals that are invaluable when testing and aligning receivers. Self-contained and battery operated, this is a "must" for the experimenter.

GENERAL COVERAGE RECEIVER

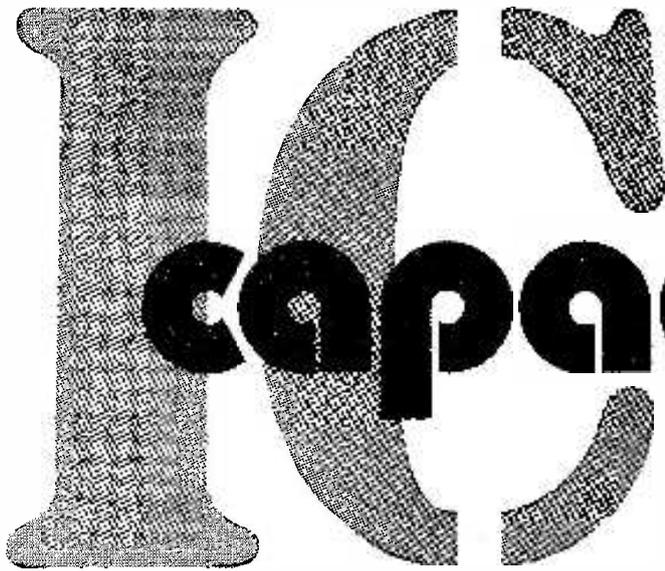
GENERAL COVERAGE RECEIVER

Another project by popular author F. G. Rayer—this time a battery operated 8-transistor radio receiver covering the long, medium and short wave bands. Each stage is built on a separate board and, with the detailed information given in the article, construction is simplicity itself. Testing and alignment instructions, not involving expensive test gear, will be appreciated by the newcomer to this type of project.



MANY OTHER CONSTRUCTIONAL ARTICLES PLUS ALL THE REGULAR FEATURES PRICE 45p

ALL IN THE FEBRUARY ISSUE ON SALE 5th JANUARY



linear capacitance meter

THIS project makes use of readily available digital integrated circuits to produce a direct reading meter that will measure capacitance between 1pF and 10 μ F. The meter is simple to construct, calibrate and use.

Many capacitors, in their life, either change in value, become leaky, or lose their markings. Such capacitors should not be used in construction as it is highly probable that they will cause a fault. It is also possible that even new capacitors are faulty or wrongly marked. Because of this, it is desirable that capacitors can be checked before use.

For low voltage capacitors, leakage can be assessed with a good multimeter, but high voltage capacitors are best checked by using a medium voltage supply (about 100V). Capacitance values can be measured by a number of means, the most common of these being the RC bridge. The main difficulty in constructing an RC bridge is producing a neat and accurate scale. It is also common practice to use a 50Hz sine-wave derived from the mains supply which leads to inaccurate balancing of the bridge for low capacities.

The meter described here does not require calibration—the only adjustments being a preset resistor for each range.

Principle of operation

A block diagram of the circuit is shown in Fig 1.

An oscillator triggers the monostable multivibrator at regular intervals. This gives a square-wave output at A, which is at a constant frequency with a mark period directly proportional to the unknown capacitance, C, which is used as the timing element in the monostable. These pulses are then clamped to a fixed potential, V, so that the output at B is a

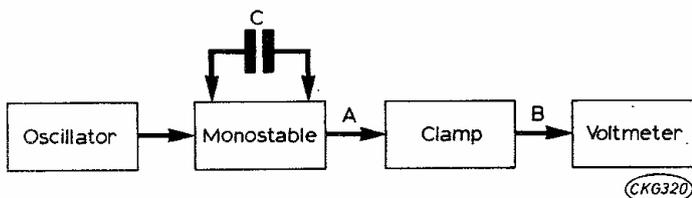


Fig. 1: Block diagram showing the principle of operation. The text explains the function of each section.

square-wave oscillating between negative and the reference potential V. The average d.c. voltage at B is measured by a voltmeter, and is directly proportional to the mark period, and therefore to C.

The circuit is built around two i.c.'s, the first being a BP-13 or an SN7413 which is used as the oscillator; the second a BP-121 or an SN74121 which is the monostable multivibrator.

★ components list

Resistors:

R1	330 Ω	R3	33k Ω 5.1
R2	1k Ω 270	R4	330 Ω

All $\frac{1}{4}$ W, 5 per cent types

VR1-3 47k Ω skeleton preset types

VR4-6 4.7k Ω skeleton preset types

Capacitors:

C1	6,800pF	C4	6.8 μ F 12V min.
C2	0.068 μ F	C5	68 μ F 12V min.
C3	0.68 μ F		

See text regarding capacitors required for calibration. As C4 and C5 may be hard to obtain, a 6.4 μ F and 64 μ F may be used instead.

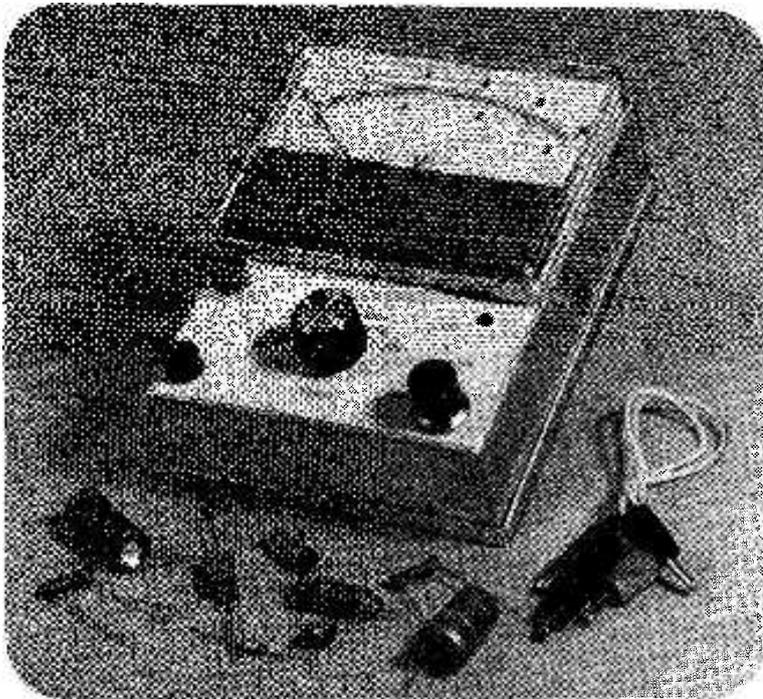
Semiconductors:

IC1	BP-13 or SN7413
IC2	BP-121 or SN74121
Tr1	BC107
D1	BZY88 C3V3 (3.3V zener diode)
D2	OA200
D3	BZY88 C3V3 (3.3V zener diode) 5.1V
LED1	TIL209, Light emitting diode

Arrangements have been made with Bi-Pak, P.O. Box 6, Ware, Herts, for the supply of all the above semiconductors to P.W. readers at the special price of £1.30 plus 10p postage.

Miscellaneous

M1	50 μ A meter (10cm x 8cm) Radiospares—see text
SW1	2-pole, 6-way rotary switch
SW2	Single pole, biased on-off push-button switch
	Veroboard, 2 $\frac{1}{2}$ in x 1 $\frac{1}{2}$ in., 0.1in. matrix
	Case, 5 $\frac{1}{2}$ in. x 4in. x 1 $\frac{1}{2}$ in., Type AB10 (Henry's Radio)
	Wander sockets, PP6 battery and battery clip



D.J. DENTON B.Sc.

battery a simple voltage stabiliser (D3, R4, and Tr1) is used to reduce the supply to the 5V required by the i.c.'s.

The light emitting diode, LED1, is used as a battery level indicator. When the battery is at 9V, the current through the diode is about 9mA but at 6V falls to nothing so no light shows.

The meter is switched on by means of a push on—release off switch, SW2. Since the meter consumes 40mA the use of a biased switch is strongly recommended, so reducing the likelihood of leaving the unit left on.

The prototype meter uses a 50µA movement. Other movements can be used by substituting suitable values of R2 and R3. Suitable values are shown in Table 1.

TABLE 1

Movement	R2	R3	Battery current
50µA	1kΩ	33kΩ	40mA
100µA	470Ω	18kΩ	43mA
200µA	270Ω	9·1kΩ	50mA
500µA	120Ω	3·3kΩ	74mA

Circuit

The complete circuit is shown in Fig 2. R1, the capacitor selected by SW1a and half of IC1 form the oscillator. The frequency is increased in decades, from about 45Hz to 450kHz, by SW1a. The other half of IC1 is not really required, but is used to ensure a good square wave for triggering the monostable.

IC2 is the monostable, in which the time of the output pulse is determined by Cx and one of VR1 to VR6. A separate preset resistor is used for each range for calibration.

R2, D1, and D2 ensure the pulses from the monostable oscillate between 0V and approximately 3·3V. The average d.c. potential is measured by the voltmeter formed from R3 and M1.

Since the meter is powered by a PP3 or PP6

Construction

The size of the box used to house the meter will depend on the size of meter movement employed. The prototype was built in a small aluminium box measuring 5¼in x 4in x 1½in which is available from the suppliers mentioned in the components list.

The front panel is drilled to hold the meter, wander sockets, on-off switch, range switch and the light emitting diode (which is glued in place).

The majority of the components are soldered on a piece of 0·1in Veroboard (2½in x 1½in) as shown in Fig. 3. Sockets were used for the i.c.'s in the prototype. Due to the small size of this board, only one mounting hole is needed, the board being fixed behind the meter. The head of the screw for holding

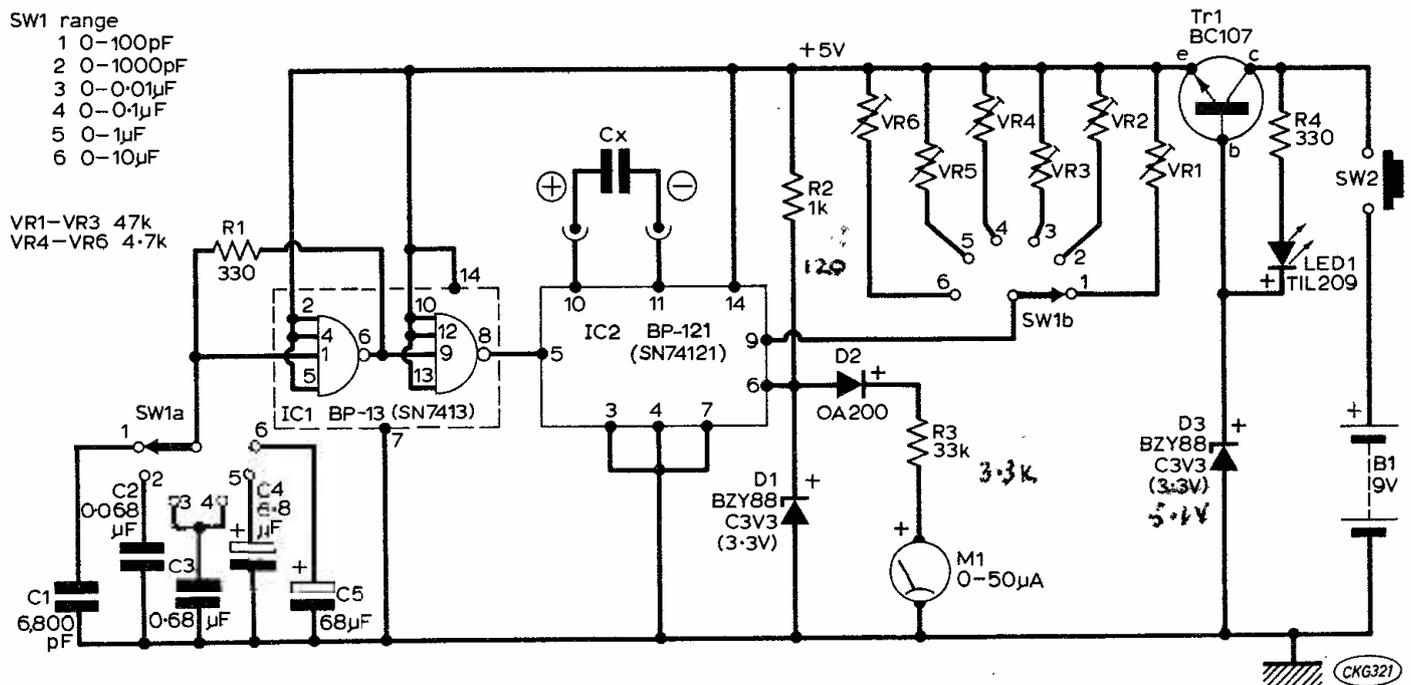


Fig. 2: Complete circuit of the Linear Capacitance Meter.

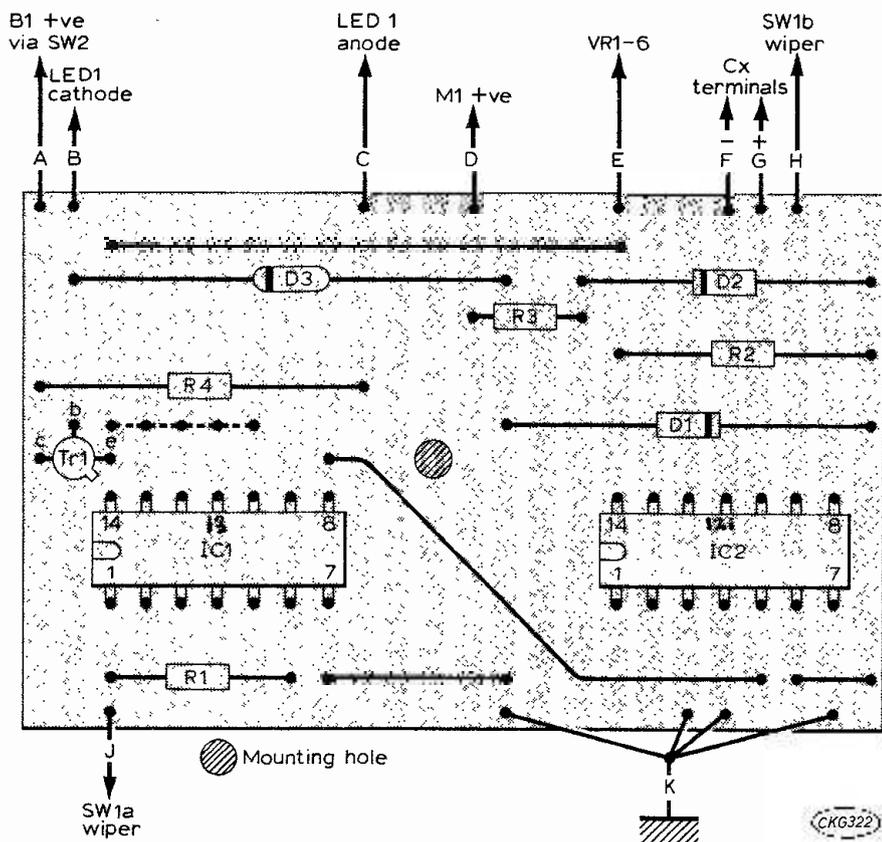
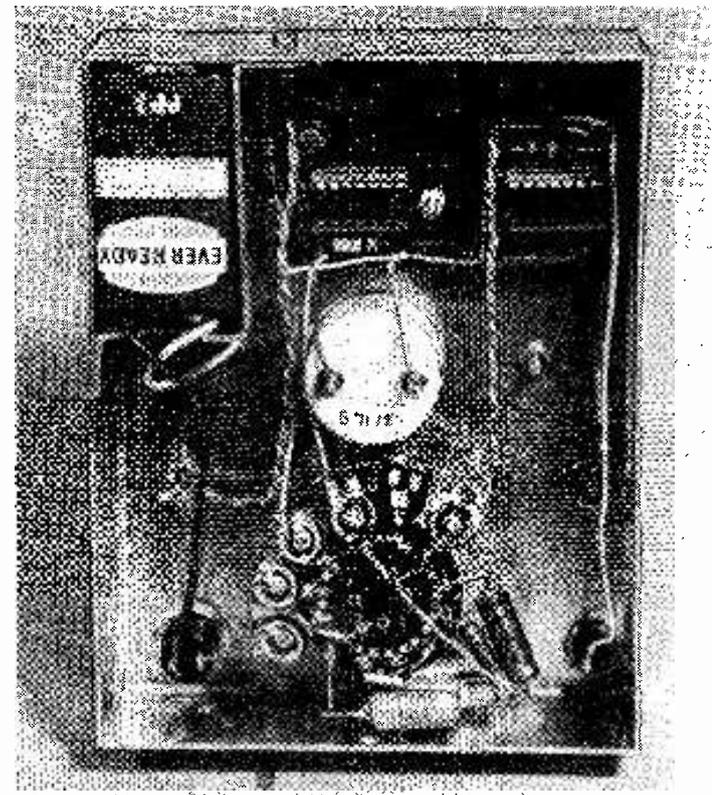


Fig. 3 (above): The main component board layout on 0.1in matrix Veroboard. Five of the conductor strips should be connected together by a wire soldered on the under side, This is shown dotted.

Some changes have been made since the photograph below was taken but it does illustrate the general layout employed.



the board fits into a recess on the under side of the meter used in the prototype. With many movements this may not be possible and the board will have to be mounted on the side of the box. The main wiring is shown in Fig 4.

Two short test leads were made using wander plugs and crocodile clips.

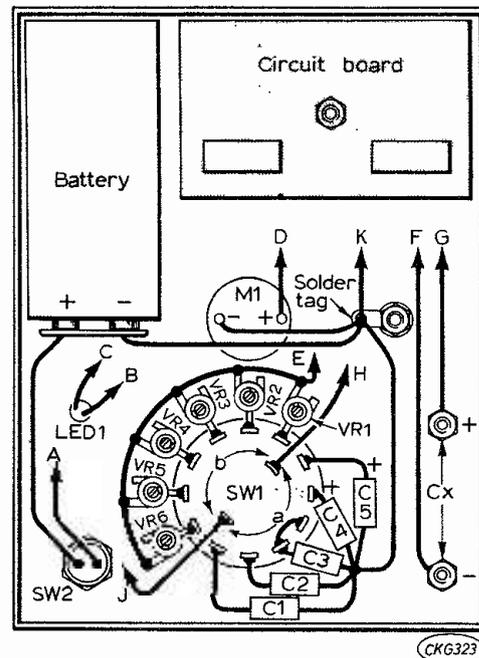
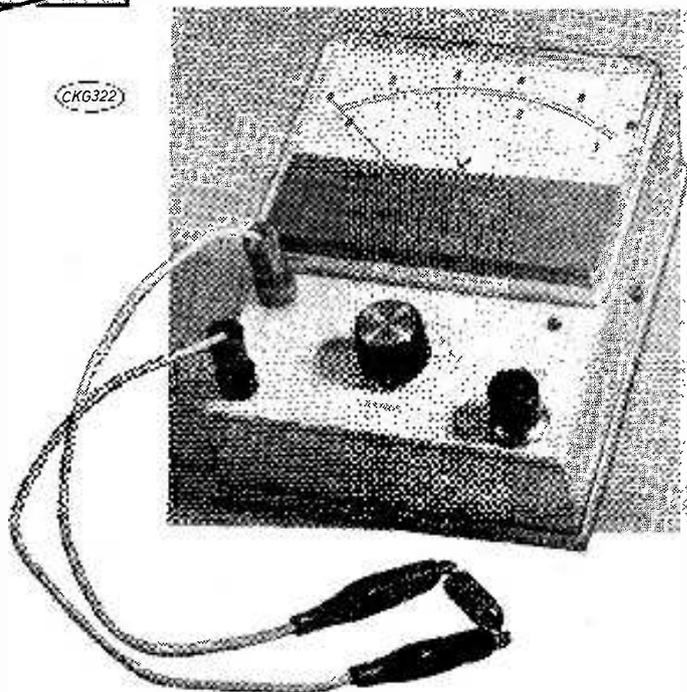


Fig. 4: The wiring from the various controls etc. to the component board. The letters correspond with those in Fig. 3.



Capacitors used for calibration should be of known quality and better than ± 2 per cent tolerance. The values of capacitors required are 100pF, 1000pF, 0.01 μ F, 0.1 μ F, 1 μ F, and 10 μ F. Each capacitor is used with its respective range and the associated calibration resistor (VR1-6) is adjusted to give full scale deflection on the meter.

To test an unknown capacity, connect the capacitance across the test terminals and, starting with the highest range (10 μ F), switch on and reduce the range until the meter indicates between 0.1 and 1.0 of full scale deflection. This will then be the correct range for measuring that capacitor.

If the indicator does not light up when the meter is switched on, the battery is in need of replacement. Polarised capacitors (electrolytics or tantalums) should be connected the correct way. The meter is not damaged by short circuited capacitors.

Assuming a meter movement can be acquired for about £2, the total cost of the meter will be about £6.

FREE COMPETITION

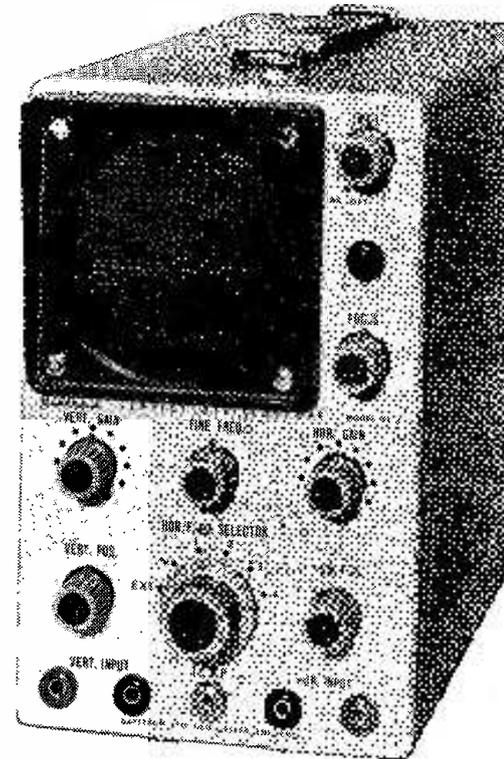
Organised by Practical Wireless and Heath (Gloucester) Ltd.

We're repeating the competition from last month's Practical Wireless so that anyone who missed that issue can still take part. Regular readers who have kept the first coupon can send it with this month's coupon.

The Heathkit General Purpose Oscilloscope Kit K/OS-2 is a dependable, well-rated design, ideal for the hobby constructor. The small size and light weight make it ideal for the 'shack' while the wide range of facilities make it extremely versatile.

The low price of £29.50 for the kit plus 80p postage and packing (when ordered direct from the Gloucester factory) is an added attraction and of course, coming from Heathkit, the instructions for both assembly and operation are clear and precise, leaving nothing to chance. Even if you already own a 'scope, the OS-2 makes an excellent portable, back-up unit. Just consider the specification: Y Bandwidth from 2Hz to 3MHz; Time base 20Hz-200kHz Automatic sync; P.C. board construction; small size, 12in x 7³/₈in x 5in; Switched ext/int Y plate connections; Sensitivity 250mV peak-to-peak per cm.

10 'Scopes to be Won!



HOW TO ENTER:

Listed below are eight important features of the Heathkit OS-2 oscilloscope. All you have to do is place them in what you consider to be their order of importance to the average Practical Wireless reader. For example, if you think *Portability* is most important of all, write D in the box marked 1st on your entry coupon. The key letter of your second choice goes into the box marked 2nd, and so on for all eight. Complete the coupon, all in ink or ball-point pen, with your full name and address, then post in a sealed envelope to: PRACTICAL WIRELESS 'SCOPE COMPETITION, 16 GARRICK STREET, LONDON WC2E 9PR to arrive not later than Wednesday, February 14th, 1973, the closing date. If you still have the coupon from the December issue you can, if you wish, send it with this month's coupon, for an extra attempt.

RULES

There is no entry fee, but each attempt must be fully completed in ink on the proper printed coupon cut from Practical Wireless, and bear the entrant's own full name and address.

Every accepted entry will be examined and the prizes, as described, will be awarded to the ten entrants who, in the opinion of an expert panel of judges, and in any one attempt, have shown the most skill and judgment in listing the eight features in order of importance.

In the event of a tie or ties for any of the prizes, a further eliminat-ing test will be conducted by post between the tying competitors to determine such winners.

Any entry which does not comply with the printed instructions or is received after the closing date will be disqualified, as will any received mutilated or illegible, incomplete, bearing alterations, or with more than one key letter in each space. No responsibility will be accepted for entries lost or delayed in the post or otherwise.

The judges' decision, and that of the Editor of Practical Wireless in all other matters affecting the competition, is final and legally binding. No correspondence can be entered into.

The competition is open to all readers in Great Britain, Northern Ireland, and the Channel Isles except employees (and their families) of IPC Magazines, the printers of Practical Wireless, and Heath (Gloucester) Ltd., all of whom are ineligible.

The winners will be notified, and the result announced in the earliest possible issue of this magazine.



- A Good frequency response.
- B Simple controls.
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- D Portability.
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FREE ENTRY COUPON

PRACTICAL WIRELESS
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2

My order of importance for the eight points is given on the left. I agree to the rules as final and legally binding.

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Full Address

Post to: PRACTICAL WIRELESS 'Scope Competition,
16 Garrick Street, London WC2E 9PR.

Closing date: February 14, 1973

please cut out along this line

PW AT THE AUDIO FAIR



PW staff on both sides of the stand have fun with the Reverberation Unit.



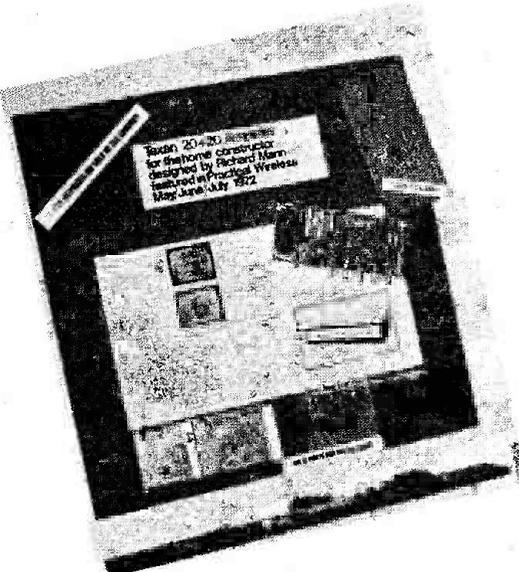
The Buzz-Bar, never stopped buzzing! Probably the most popular project on the stand.



The stand was enhanced by an excellent wall display dealing with the Texan stereo amplifier.



Two enthusiasts give the Reverberation Unit a thorough check-out.

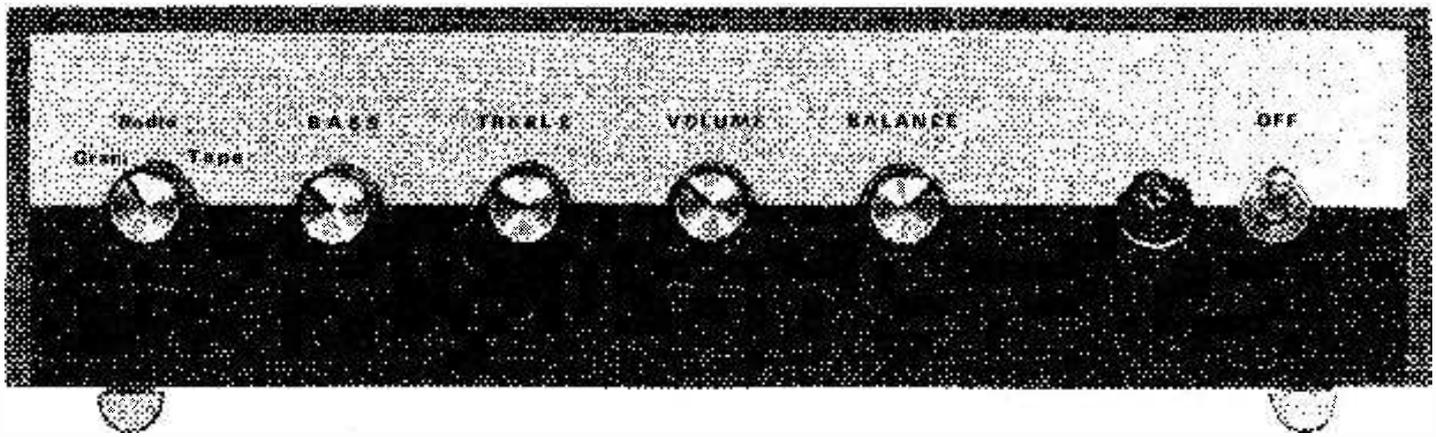


Close-up of the Texan display which featured a typical kit of components as well as a finished amplifier.

Visitors could buy reprints of the Texan series of articles as well as the current issue of PW.



A busy moment with every project under the closest scrutiny!



10+10 WATT stereo amplifier

W. CAMERON

PART ONE

THIS project is a development of the author's "Low Cost Hi-Fi" published in the December 1967-March 1968 issues of *Practical Wireless*.

It is an ideal design for those who have had little success previously with transistor projects and for those who consider themselves perhaps too biased towards valve equipment to change. This is because it uses familiar methods of construction, with wired rather than printed circuits, making servicing and replacement of components easier, and lending itself to modification if one wishes to add refinements.

A stereo f.m. tuner is currently being developed for use with this amplifier and it is hoped that this will be published in a future issue of *Practical Wireless*.

The amplifier has a maximum output of 15 watts r.m.s. per channel into 15Ω, a class A driver amplifier and preamplifier with RIAA equalisation for

magnetic or ceramic pick-up cartridges, input facilities for P.U., radio and tape, and bass and treble controls, each with a range of 15dB above and below flat response.

Main considerations in the design must be to produce a true Hi-Fi amplifier of excellent frequency and transient response, with very low harmonic and intermodulation distortion. Equally important, especially if it is to be built by relatively inexperienced constructors, is that construction should be straightforward. For this reason the amplifier is divided into three units, each built up as a module, namely, power amplifier, driver amplifier and preamplifier.

For simplicity, the driver and preamp modules are constructed on group boards. The power amplifier is built on an aluminium sub-chassis which serves as a heat sink for the power transistors and also as a partition screen between power supply and amplifier.

The design is such as to avoid complicated circuit configurations in which wiring mistakes might easily be made, resulting in the destruction of transistors. This latter possibility is considerably reduced in this amplifier as the bias for the output transistors is not dependent on the operating conditions of the driver stages, due to the use of a driver transformer rather than phase-splitting transistors. This arrangement also gives perfect drive balance to each half of the push-pull output stage, and much greater reliability due to the independence of the output pair.

The general disadvantages of transformer coupling are avoided in this design. Leakage inductance is overcome by using very close coupling between windings by winding primary and secondaries together (trifiler wound). Magnetisation is avoided by using capacitor coupling to provide d.c. isolation, so because there are no magnetising currents in the windings and because the driving power is relatively low, the transformer can be quite small. A minimum of 3/8in. square centre core section is sufficient, provided the core material is of Radiometal or Unisil.

Winding details are given but as many constructors will prefer to purchase ready-made transformers, arrangements have been made with C. & D. Electronics, St. Lukes Cross, Sunderland, for the supply of these; see components list.

Specification

Sensitivity	Magnetic P.U.: 5mV Ceramic P.U.: 100mV (see text)
Input Impedance	Radio: 250mV Tape: 250mV Magnetic P.U.: 47kΩ Radio/Tape: 120kΩ
Tone Controls	Treble: ±15dB Bass: ±15dB
Power Output	Into 15Ω: 15W r.m.s. max (same for 8Ω) 10W continuous sine wave
Crosstalk	At 1kHz: Better than 80dB
Hum and Noise	Better than 70dB
Distortion	Less than 0.1 per cent at 10W, less than 0.05 per cent at 2W
Frequency Response	±1dB: 20Hz to 20kHz ±3dB: 10Hz to 40kHz
Transient Response	Rise time less than 4μS

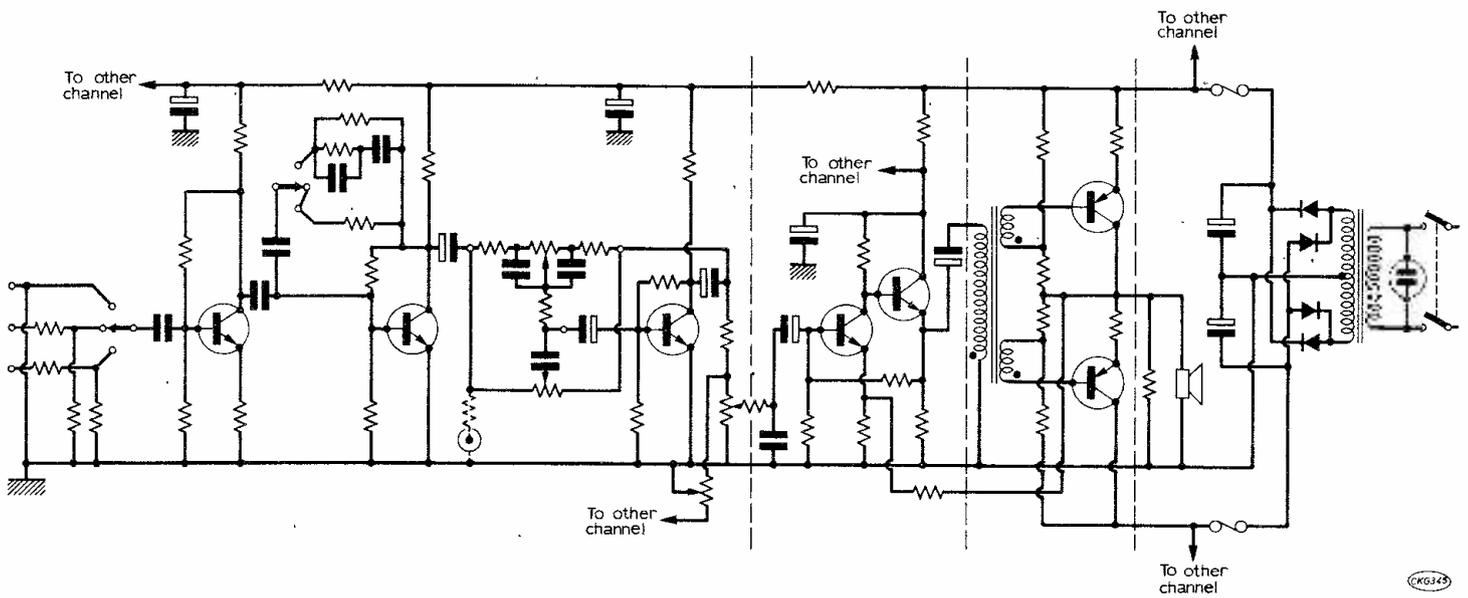


Fig. 1: The skeleton circuit of one channel. The component values and voltages of the individual sections are given under the various headings although the components list is complete.

CONSTRUCTION

The logical order of construction is first to complete the metal work, then build up the modules in the order: power amplifier, driver amplifier and pre-amplifier, which are then installed in the chassis together with the controls and power supply. The following notes will therefore be in that order.

CHASSIS AND METALWORK

The chassis is of 18 s.w.g. aluminium, size 14in. x 12in. The front and rear 3in. are turned up to provide the front and rear panels, giving a basic chassis size of 12in. x 8in. x 3in. A stronger job will result if sufficient material is left to give a 1/4in turnover along the front and rear panels (aluminium size 14 1/2in. x 12in. will be required for this).

It is best to complete the main drilling before bending. The mounting and ventilation holes for the heat sink are drilled after bending, when their positions can be marked directly from the heat sink. Drilling and bending details are shown in Fig. 2a.

The front and rear panels of the chassis can be painted, using an aerosol spray, and then lettered as required.

The controls can now be fitted and also the speaker and input sockets. Two pairs of single sockets are used for the speakers, and two 3-way phono sockets for inputs. These were used simply because they are easiest to work with, although D.I.N types may be used if desired.

The heat sink on which the power amplifier section is to be built is also of 18 s.w.g. aluminium, size 7in.

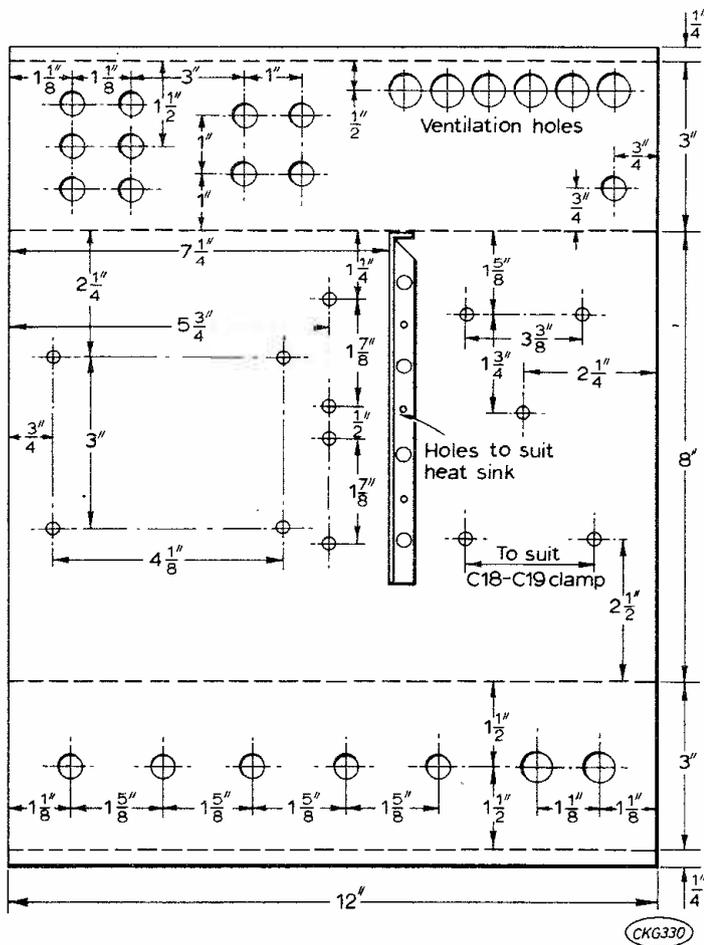


Fig. 2a: The main chassis metalwork dimensions. The size of the holes shown should correspond to the components used.

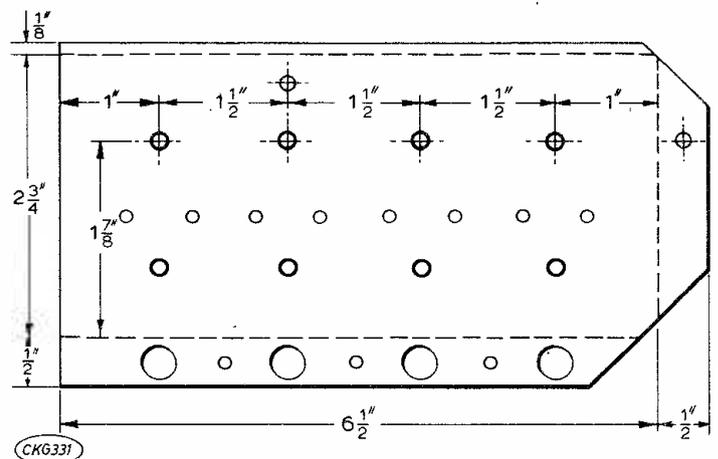
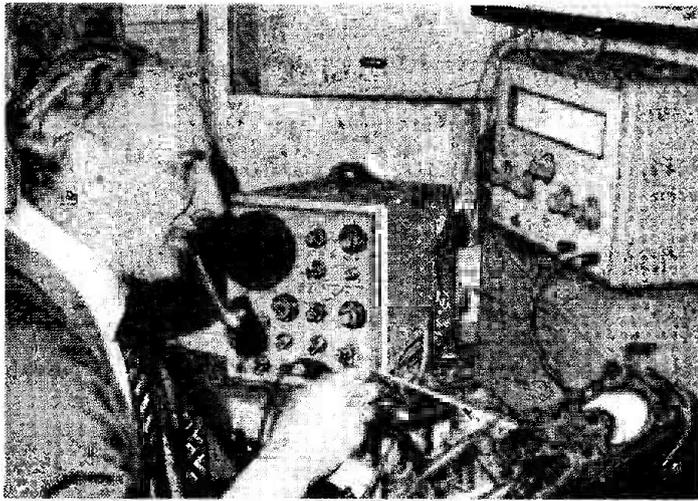


Fig. 2b: Metalwork details of the heatsink sub-chassis on which the power output section is built.



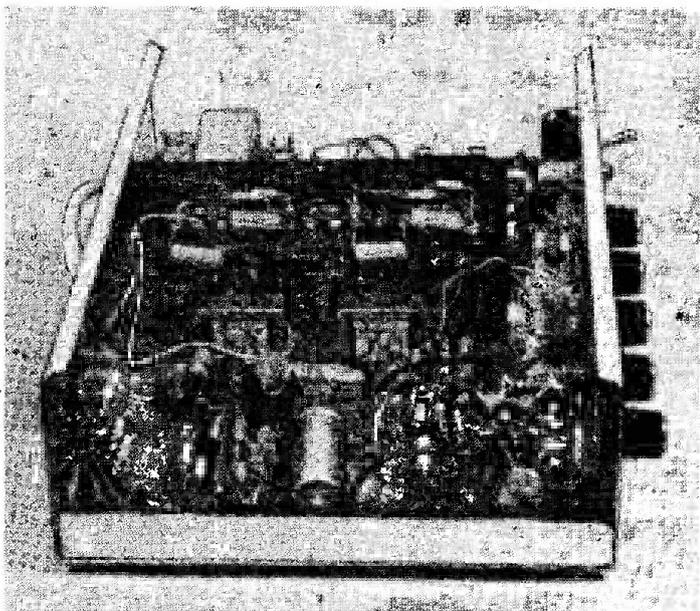
The author taking voltage readings from the prototype. Note the elaborate test gear that was used to prove the design.

x 3¹/₂ in. drilled and bent as shown in Fig. 2b. The mica used for insulating the power transistors from the chassis are used here as templates for marking the positions of the transistor holes. It is essential that no burrs remain on these holes, which could later puncture the mica to cause a short between transistor and panel. It is desirable to rub these areas with very fine emery paper.

Choice of a covering case is left to the constructor. Two angle pieces along the ends of the chassis will facilitate the fitting of a neat and simple "top and two sides" type of cover, while if countersunk screws are used to secure chassis components, the "sleeve" type of case can be used. The case can be of wood or metal. The ventilation holes in the bottom of the chassis must not be obstructed and feet should be fitted to aid ventilation as well as for effect.

POWER AMPLIFIER

This is assembled on the heat sink panel as shown in Fig. 3a. Mica insulators and bushes insulate the power transistors and mounting bolts from the chassis. If the transistors are types with a thin mount-



A view of the prototype illustrating the general constructional method employed.

★ components list

Resistors

R1	56kΩ	R21	100kΩ
R2	220kΩ	R22	10kΩ
R3	4.7kΩ	R23	2.2kΩ
R4	100kΩ	R24	1.5kΩ*
R5	4.7kΩ	R25*	2.2kΩ
R6	1MΩ	R26	100kΩ
R7	470kΩ	R27	3.9kΩ
R8	56kΩ	R28	27Ω
R9	390Ω	R29	390kΩ
R10	56kΩ*	R30	56Ω 1W*
R11	220kΩ	R31	120Ω 1W
R12	12kΩ	R32	2.7kΩ
R13	15kΩ	R33	4.7Ω
R14	330kΩ	R34	500Ω 5W WW
R15	56kΩ	R35	4.7Ω
R16	4.7kΩ	R36	500Ω 5W WW
R17	3.3kΩ	R37	0.47Ω 2W
R18	3.3kΩ	R38	0.47Ω 2W
R19	4.7kΩ	R39	390Ω
R20	560kΩ		

Two of each are required except those marked * which are common to both and one only is required. All resistors carbon type, 1W, 5 per cent tolerance except where stated. R1-R24 are in the preamplifier, R25-R32 are in the driver and R33-R39 are in the power amplifier.

Controls

VR1	25 + 25kΩ linear ganged pot.
VR2	50 + 50kΩ linear ganged pot.
VR3	25 + 25kΩ log. ganged pot
VR4	25kΩ linear.

Capacitors

C1	0.47μF*	C11	8μF 12V min.
C2	64μF 10V min*	C12	100μF 12V min*
C3	0.47μF	C13	8μF 12V min.
C4	0.47μF	C14	1000pF
C5	0.02μF	C15	8μF 12V min.
C6	4000pF (or 3900pF)	C16	2000μF 18V min.*
C7	8μF 12V min.	C17	200μF 6.4V min.
C8	0.1μF	C18	5000μF 25V min.*
C9	0.1μF	C19	5000μF 25V min.*
C10	0.01μF		

Two of each required except those marked * which are common to both channels and only one is required. C1-C13 are in the preamplifier, C14-C17 are in the driver stage and C18 and C19 are in the power supply. The 8μF capacitors may be 10μF, non-electrolytics may be ceramic or polyester.

Semiconductors

Tr1	BC109	Tr5	3FY01
Tr2	BC109	Tr6	OC28
Tr3	BC109	Tr7	OC28
Tr4	BC108	D1-D4	D4 100V, 1A silicon rectifiers, (e.g. 1N4002)—see text.

Two of each are required except D1-D4

Transformers

Driver transformer (two off required)—see text.
Mains transformer, 15-0-15V secondary, 2A.
The transformers are available from C and D Electronics, St. Lukes Cross, Sunderland. The complete set costs £5.50 plus 20p postage.

Miscellaneous

Neon indicator
Mains switch, two-pole on-off
Fuse holders and 1.5A fuses
Group boards (R.S. Components), 18-way
Tag strip
Screened lead
Selector switch, 4-pole, 3-way

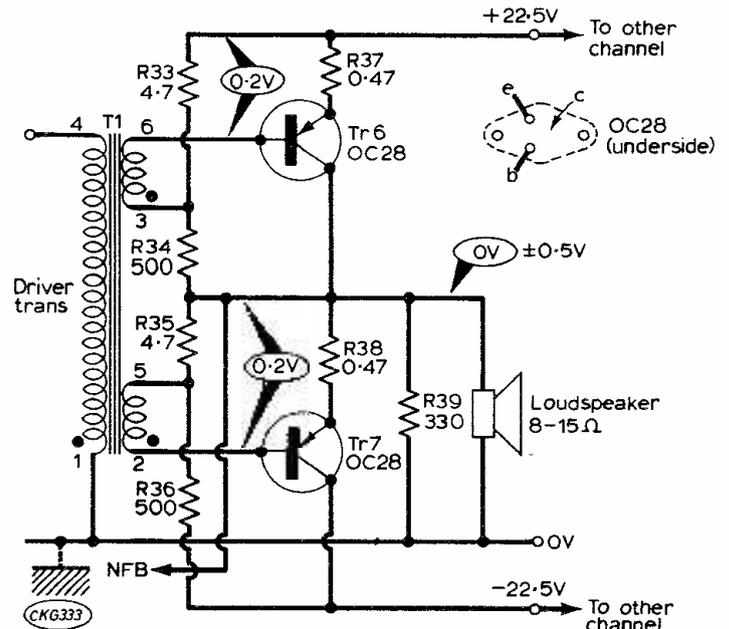
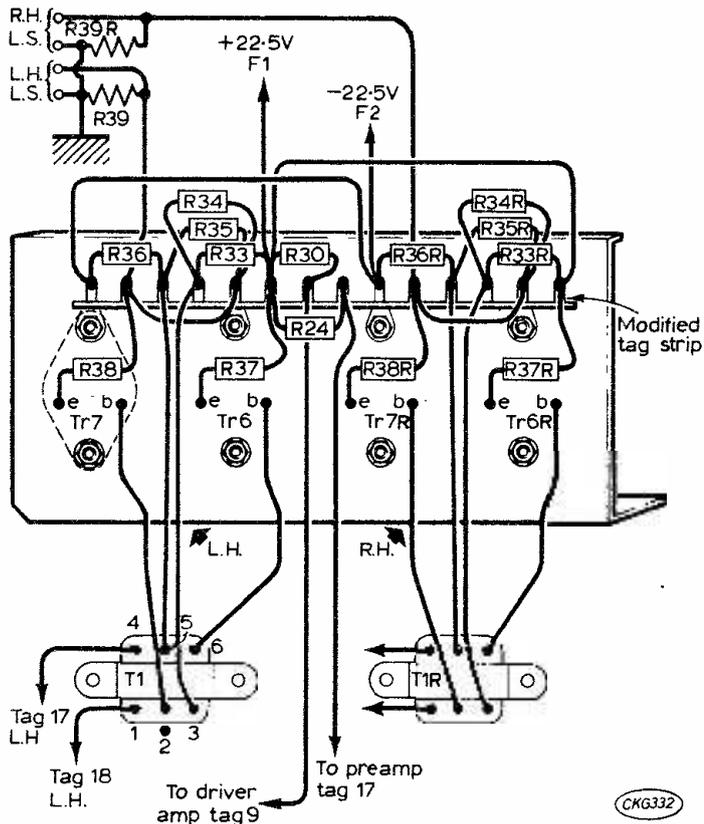


Fig. 3a (left) and Fig. 3b (above): The circuit and wiring of the output stages. Note that the tag-strip has to be modified to fit directly onto the collector connections, this is described in the text. The components for both channels are shown in the layout, those applicable to the R.H. channel are marked with the suffix R.

ing flange, the bushes may be too long, and must be carefully filed flush with the panel.

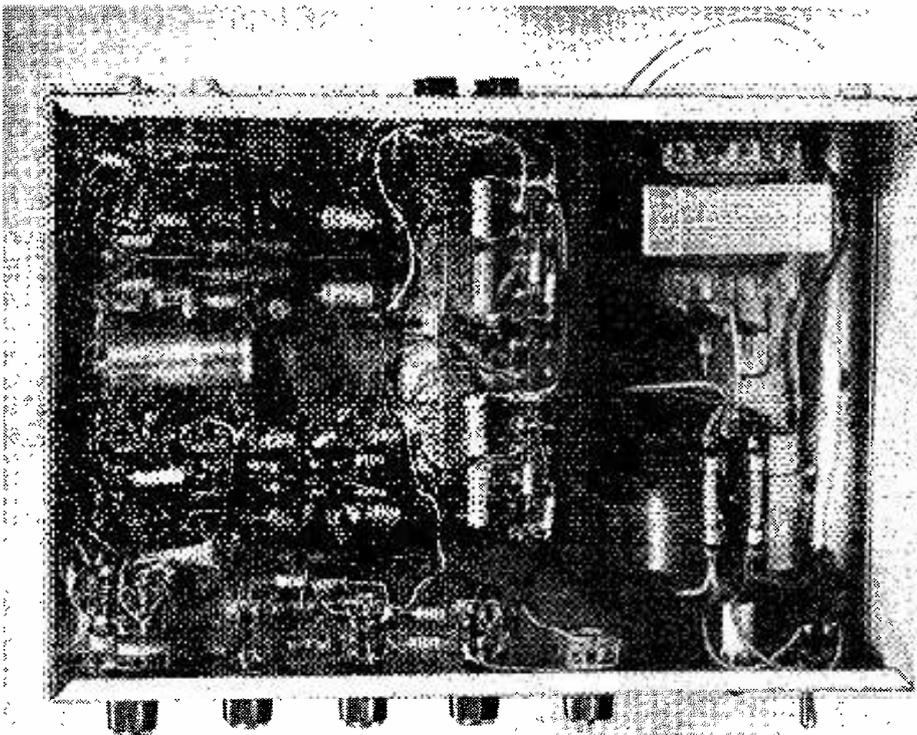
The transistors are secured on the flanged side of the panel, with 6BA nuts and bolts through the insulating bushes. These same bolts hold the 14-tagged mounting strip, modified so that the mounting lugs are spaced wider by one tag, to make their spacing to suit the transistor screws. The lugs therefore become the transistor collector connections. Make a check with an ohmmeter to ensure that the transistors are completely insulated from the panel.

Fig. 3b is the power amplifier circuit diagram.

The following details will assist those who may wish to wind their own driver transformers. The transformer core with clamp measures approximately 1½ in. x 1 in. x ½ in. The actual core section is ¾ in. square. The windings are 180 turns of 32 s.w.g. enamelled wire, trifler wound, that is, the three windings are wound together so that the turns of each winding lie side by side.

The three "starts" are brought out on one side of the bobbin. The three "finishes" are identified with an ohmmeter and brought out on the opposite side, corresponding with the "starts". After completion the "starts" side can be marked with an identifying spot, although this is not strictly necessary, as it will make no difference which way round the transformer is mounted.

The core laminations should be interleaved, that is, the E sections built up alternatively from each side, with the I sections inserted in the spaces. The C & D transformer mentioned previously is supplied not interleaved, but it is an easy matter to remove the core and reassemble it in this manner. Results are quite acceptable even if the core is not interleaved, but the low frequency response will suffer below 50Hz.



An overall view of the amplifier. The pre-amp and driver stages are on the left, the output stage in the middle with the power supply on the right.

A rear view showing the input and output sockets. The holes at the top left are for ventilation.

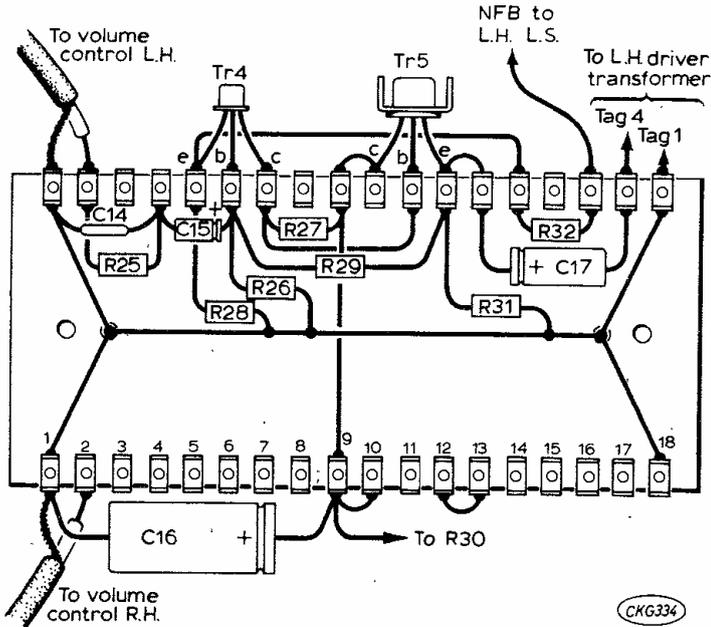
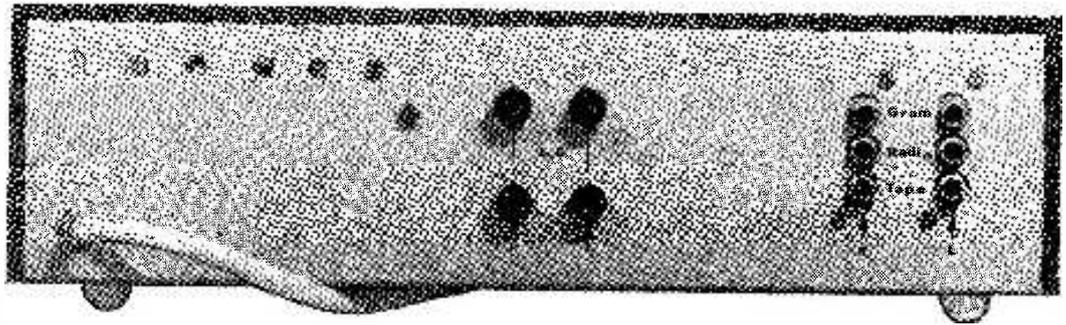


Fig. 4a: The layout of the driver amplifier section. Only the components for the L.H. channel are shown. Those for the other are mounted as a mirror image on the other side of the tag board.

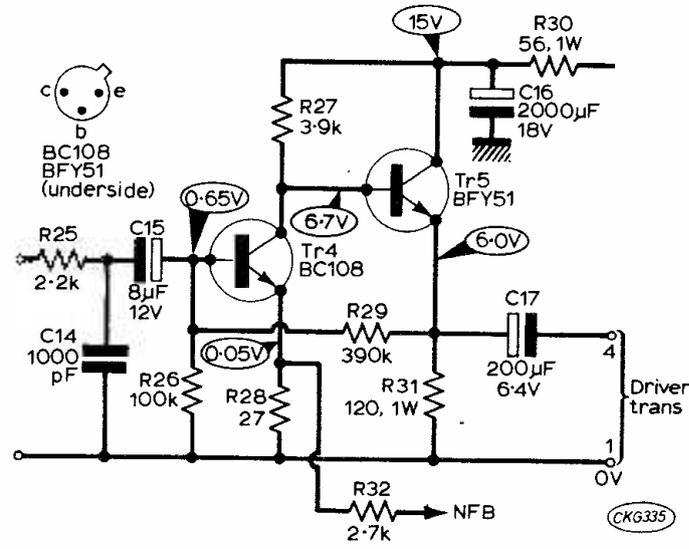


Fig. 4b: The circuit of the driver amplifier.

DRIVER AMPLIFIER

The driver amplifiers for both channels are assembled on a single group panel size 4½in. x 1½in. A single common earth bus-bar of 20 s.w.g. tinned wire runs down the length of the board and some ⅜in. above it, held in place by passing through the holes in each end of the board (next to last) and bent

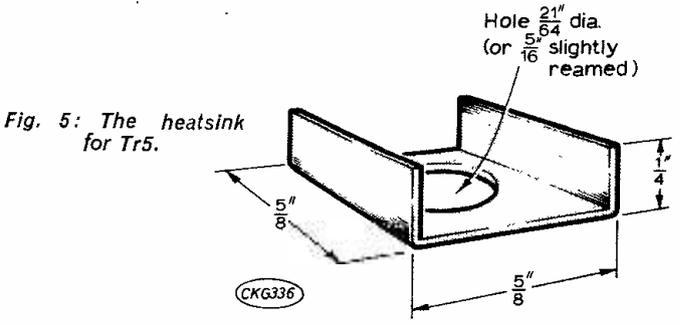
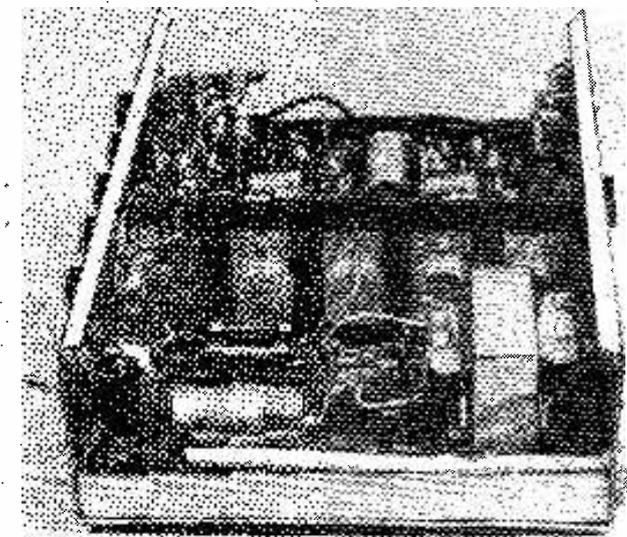


Fig. 5: The heatsink for Tr5.



An internal shot of the amplifier showing the power supply. The output transistors can also be seen on their sub-chassis.

back through the preceding hole. The end holes are left for mounting. Assembly is as shown in Fig. 4a which illustrates one channel only for clarity. The other channel is a "mirror image" of the first except for the decoupling components C16 and R30 which are common to both channels.

Heat sinks for the BFY51 transistors are made from 18 s.w.g. aluminium 1½in. x 5⁄8in. bent and drilled as shown in Fig. 5 and painted matt black. These are pushed on to the transistors and must be a tight fit to be effective. Commercial heat sinks for this type are available but are difficult to find.

The completed board is secured to the chassis with two 6BA screws and nuts. Additional nuts between board and chassis act as distance pieces to hold the board clear of the chassis. Fig. 4b shows the circuit of the driver amplifier.

The input required by the driver, for full drive to the power amplifier, is 180mV r.m.s.

TO BE CONTINUED

choosing that battery!

A.G. BLEWETT

At the design stage of portable electronic equipment the choice of a battery usually presents problems for the amateur constructor. Various factors dictate final choice and, ideally, the matter should be settled before the physical construction stage reaches the drawing board. It is hoped this article will provide an alternative to the 'suck it and see' approach many constructors have to employ through lack of information.

Although many different types and sizes of dry batteries are available only ten of these are discussed,

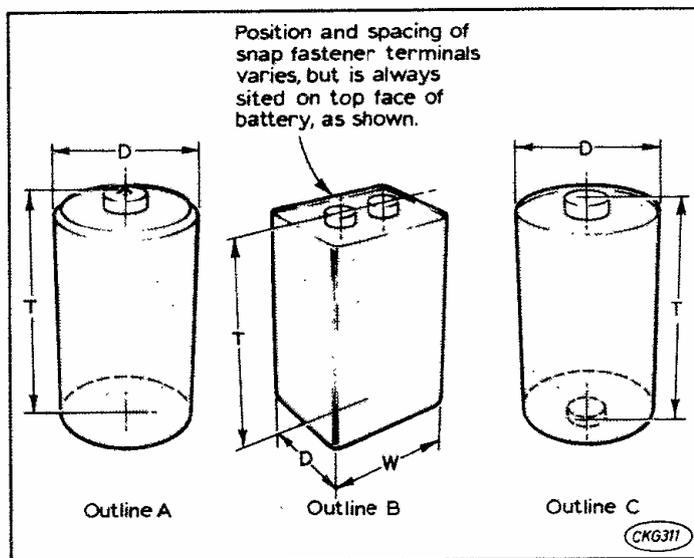


TABLE 1
DIMENSIONS AND WEIGHTS OF BATTERIES

Battery	Outline	T mm	D mm	W mm	Weight gms
HP2	A	61	34	—	90
HP11	A	50	26	—	45
HP7	A	51	14	—	17
PP8	B	201	52	65	1100
PP1	B	56	65	56	283
PP9	B	81	52	66	425
PP7	B	61	46	46	198
PP6	B	70	35	36	142
PP4	C	50	25	—	51
PP3	B	48	18	27	38

Outlines of the three principal types of battery with table of overall dimensions.

the more common types, but it is believed that this small selection will probably satisfy the needs of most amateur projects as far as output and size are concerned.

Battery life

Initial load. Obviously, the more current taken from the battery, the shorter will be its life. The current taken into a fixed load will fall as the terminal voltage falls, but for the purpose of this article it can be taken as the average load current.

End point voltage. The terminal voltage of the battery will fall as discharge progresses. The lowest permissible voltage that can be tolerated for any particular application must be considered, as it will determine when the battery is of no further use and consequently the expected life.

Periods of use. Generally speaking, a battery will give a greater service life if used over short periods rather than long ones. The 'Hours Per Day' figure must therefore be taken into consideration.

Temperature. A battery will temporarily lose its efficiency at low temperatures. As we are only concerned with amateur applications, implying operation at room temperatures, this factor can be ignored.

Storage time. The service life of a battery is shortened after a long period of storage without use. It is therefore desirable to obtain batteries from a source known to have a frequent turnover of stock. Partly used batteries should never be left in equipment if this equipment is not to be used for a considerable period.

Battery sizes

Table 1 details the physical sizes of the batteries listed so that these factors can be cross-referred to the data in Table 2 in choosing the best battery for the job. The rectangular shaped battery packages lend themselves particularly well to battery compartments in equipment cases, but the cylindrical cells can present a bit of a problem when it comes to stowing them. Home Radio (Mitcham) Ltd. can offer various alternatives to this problem by supplying S.R.B.P. tubing that can be tailored to take one or more cells. Specially shaped plastic holders for 2, 4 or 6 units are available as well as a range of holders made by Bulgin Ltd.

Service life

Table 2 details estimated service life as a function of battery type, hours of use per day and average discharge current. These figures are based on an end-point voltage of around 75% of nominal, e.g. a 9V battery having dropped to 6.6V. Where it is permissible for the terminal voltage to fall further, greater life expectancies result.

It will be noted that the data for the 6V PP1 and the 9V PP9 is the same. This is because each package contains the same type of individual series connected cells, there being two extra in the PP9.

Similar batteries can of course be connected in series to obtain desired voltages; this does not affect the service life, which will be the same as if only a single battery is used, providing the current drawn remains the same.

Finally, the author would like to express his thanks to the Ever Ready Co. (GB) Ltd., for help in obtaining information used in this short article.

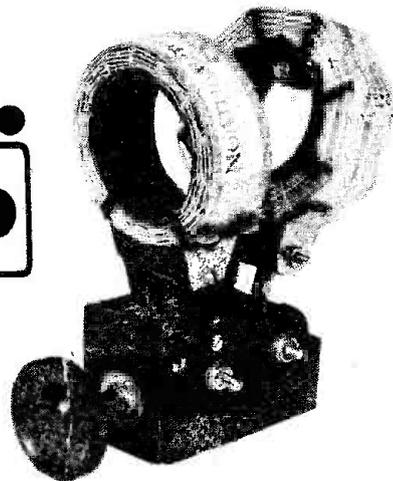
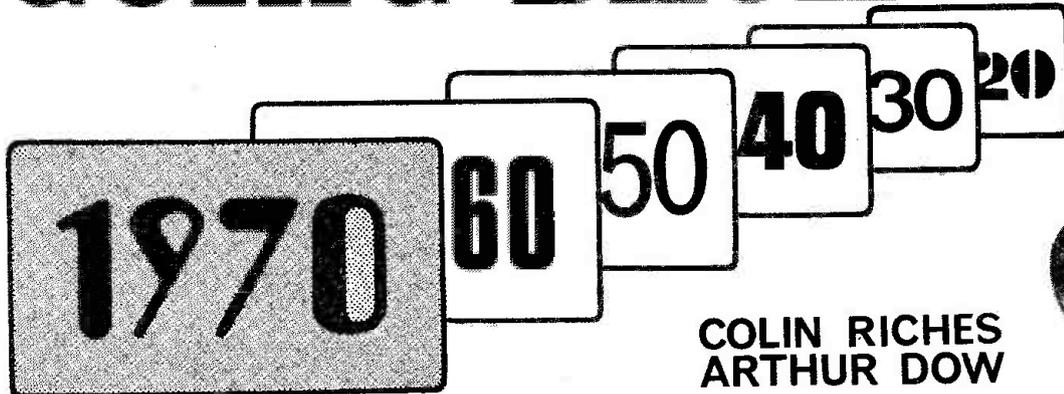
DISCHARGE mA	ESTIMATED SERVICE LIFE (HOURS) FOR ENDPOINT VOLTAGE 75% OF NOMINAL																			
	HP2 1.5V				HP11 1.5V				HP7 1.5V				PP8 6V				PP1/PP9 6/9V			
	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY
0.5																				
1											1500									
5						570	680			280	250									1100
10			455	795		320	330		138	130	97							505	450	
15			330	480		185	205	200	84	80	52			1570			330	260		
25		225	205	270		110	115	105	43	37	22			810			175	115		
50		120	105	100		46	52	37	22	14	10			400	330		74	48	28	
75		81	80	73	28	26	30		13	7	4			250	185		35	19		
100		60	58	50	22	19	19		8					175	115		16	9		
150		38	36	25	14	8.5	8.5		3.7					120	86	52	16			
250	19	20	16		7.5				1.4					50	30	15	1.3			
500	7.5				1.5									24	7.7					

DISCHARGE mA	ESTIMATED SERVICE LIFE (HOURS) FOR ENDPOINT VOLTAGE 75% OF NOMINAL															
	PP7 9V				PP6 9V				PP4 9V				PP3 9V			
	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY	30 MIN DAY	2 HR DAY	4 HR DAY	12 HR DAY
0.5											1050				720	
1				2000				1550			510			335	380	
5			560	470			240	210		95	90	56		58	67	47
10			225	160		115	90	75		40	38	26	28	24	18	
15		135	130	81		68	49	38	24	23	21		18	12.5	10	
25		68	59	33		32	23		11	13	7		9.5			
50		21	12.5		16.5	9			3.5				2.4			
75	20	8.3			7.3											
100	11				2.8											
150	1.8															
250																
500																

Example :—A PP6 battery used in a circuit taking 5mA on a basis of 4 hours per day will have a service life of 240/4 or 60 days.

Table 2 :—FROM WHICH THE AVERAGE SERVICE LIFE OF NINE POPULAR TYPES OF DRY BATTERY CAN BE ESTIMATED

GOING BACK...



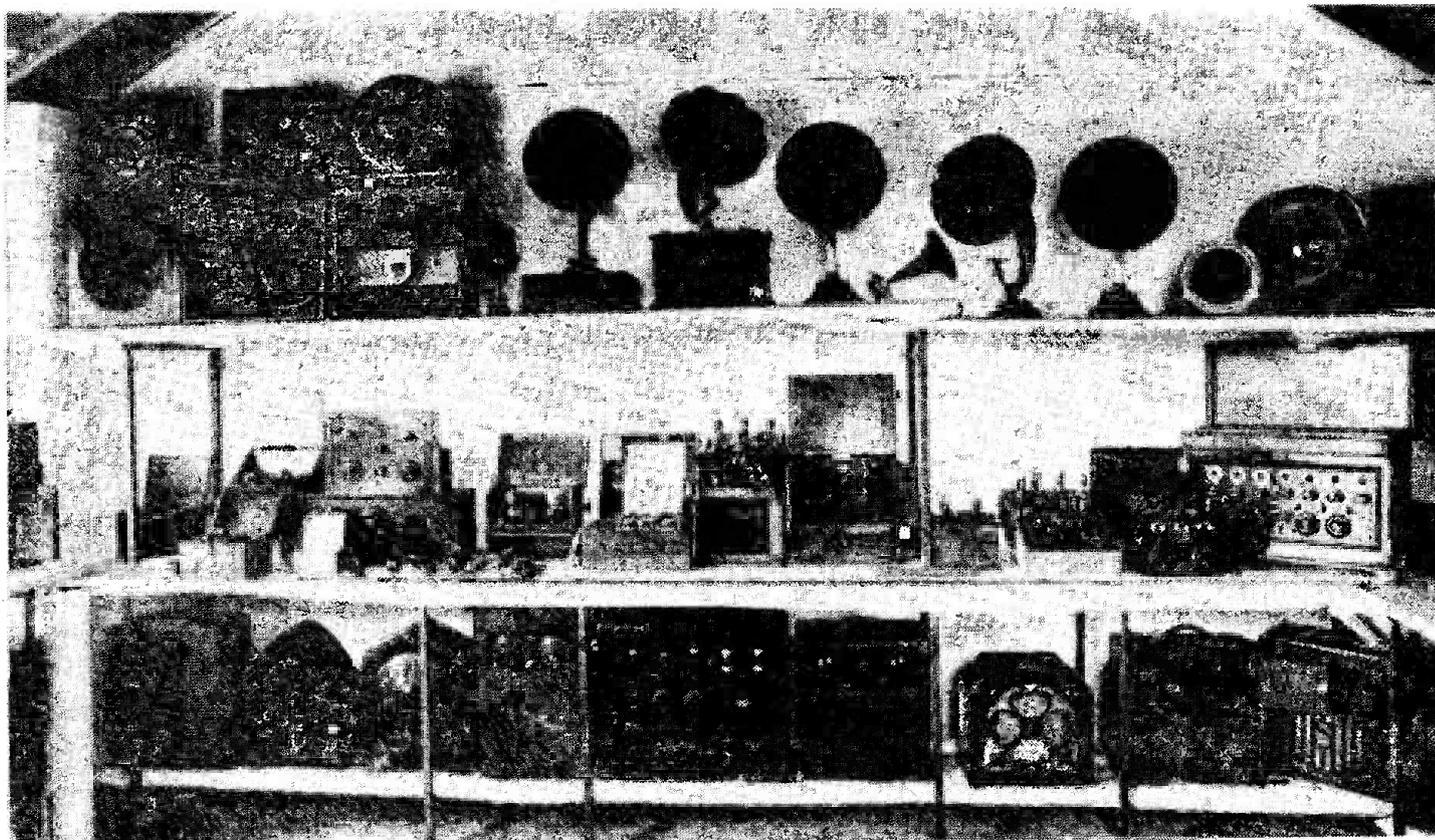
COLIN RICHES
ARTHUR DOW

AT the risk of wearying our readers with further chatter on the subject of collecting and preserving vintage radio equipment and our periodical suggestions for the formation of a vintage radio society to further this aim we are very happy indeed to learn that such a society is now in existence. Over the years we have met quite a few of those responsible for the formation of this group and we know that their aim of collecting, refurbishing and preserving old radio equipment is a true labour of love.

The Wireless Preservation Society is "exclusively devoted to the collection, preservation and restoration of wireless and electronic equipment (including sound reproduction, gramophone and television gear) for purely cultural, educational and historical purposes".

The Society is entirely non-profit making and all its Officers are honorary. These include the *President*, W. K. E. Geddes of the Science Museum, *Vice-President* F. C. Ward G2CVV, Immediate Past President of the RSGB, while the *Secretary and Museum Curator* is Douglas Byrne G3KPO, an Area Representative of the RSGB. Among the Founder Life Members are included Mrs. B. Hance who is an Historian with the Marconi Company, and a number of well known radio amateurs including G2UK, G2UV, G2VS, G3VA, G4AR, G5BV, G5LP, G5UL, G5UM, G5VS, G6GH and G6NZ, Historian for the RSGB.

A WIRELESS MUSEUM has now been established, containing many receivers dating right back to the first days of broadcasting in this country, the 50th.



Just one corner of the museum that has been established by the Wireless Preservation Society.

anniversary of which is currently being celebrated by the BBC and other organisations. Receivers with bright-emitter valves and plug-in coils as well as crystal sets have been brought into working condition by local radio amateurs. Other treasures include a 1916 trench set and an early superhet with frame aerial.

The Museum may be viewed at any mutually convenient time by arrangement with the Curator who may be contacted at Gosberton 485 (STD 077-584485). Viewing is free of charge and there is no objection to the exhibits being handled by visitors, quite a pleasant change!

The Society would be very grateful for the donation of additional items and equipment as well as any old radio books, magazines and catalogues, which can prove so very useful in dating exhibits. Contact the Curator, Mr. D. Byrne, at Homa House, Quadring Watergate, Spalding, Lincolnshire.

Letters

One of the joys of conducting Going Back is the continual stream of letters that we receive, many containing anecdotes and reminiscences of the early days of radio. These, when published, often bring together, perhaps only by correspondence, a pair of old friends who have almost forgotten each other. Unfortunately, shortage of space does not allow us to print as many letters as we would wish. The following letter is slightly different but full of interest nevertheless.

I have just received the August PW and have read your article on John Scott-Taggart with great interest. I am a Boltonian myself and used to live quite near to the Scott-Taggart's house at the "Crofters". Indirectly, John Scott-Taggart helped to save my father's life! It was in the early 20's and my father was very ill, and although his doctor allowed him to continue to go to business, the rest of the time had to be spent indoors. The doctor insisted that father should not lose interest in life and should take up some hobby, which he did . . . radio! . . . and started by buying "More Practical Valve Circuits" by J. S-T published in 1923. I still have that book with me. The first circuit in it is the ST68 and the last the ST151 which was a three valve job with a little drawing of a horn type speaker. We became so interested that long after father recovered we continued with radio, specialising in S-T sets. I think it was the ST300 which first offered coils for the "short waves" and it was with this that I first heard American broadcasting stations and then, of course, the amateurs, but not always on short waves. I still have a lapel badge issued by the British Broadcasting Company from the Manchester station 2ZY which entitles me to have my birthday greetings read out on the appropriate day!

*All of which makes me happy to sign,
Yours sincerely,*

*Eric Lomax 5N2ABG, Hon. Sec.,
Nigerian Amateur Radio Society.*

GOING BACK—continued on page 842

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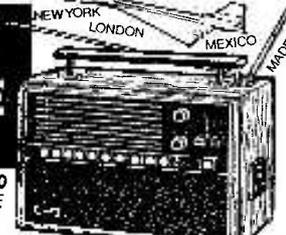
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TAKE 20

JULIAN ANDERSON

THE Wheatstone Bridge is an excellent arrangement for comparing the value of capacitors, resistors and inductors. Although it will measure all of these types, by far the most useful of these is that for capacitors; resistors can usually be measured on a test-meter while the facility for finding out inductances is rarely required. If we only want to measure and compare capacitors, a very simple circuit can be employed and the total cost falls within our budget.

If we take a look at Fig. 1 and ignore all the components except for VR1, Cr, Cx and the crystal earpiece, we are looking at the basic Wheatstone Bridge. If an audio signal is developed across VR1, which the remainder of the circuit provides, our Bridge operates as follows:

Let us assume that Cr and Cx are the same value, they will then have the same reactance as each other and therefore the audio signal, which is applied across them as well as across the variable resistor will be equally distributed. Half the applied signal will appear at terminals B and C, which is the common point for both. If the slider of the potentiometer is also at the centre of the track, half the signal will be at this point. Since the signal at both sides of the crystal earpiece is the same, nothing will be heard in it. If the slider is anywhere but at the centre, there will be a voltage difference and a note will be heard in the earpiece.

If Cx is half the value of Cr, it will have twice the reactance and a balance will only be achieved if section 'b' of the track is twice the value of 'a'. Once again this will be the only setting of the slider at which nothing is heard in the earpiece. If we have a series of reference capacitors, say 100pF, 0.01μF, 1μF and 100μF we shall be able to find out the value of any capacitor with a value from 10pF to 1,000μF without having to rely on ratios of 'a' to 'b' of greater than 10:1.

The value of 'a' and 'b' will of course be proportional to the angle of rotation of the spindle and it will obviously be necessary to use a pointer knob with a calibrated scale. This should be marked with ratios; the mid-position will correspond to 1:1, of course. Then, if the reference capacitor is known it will be a simple matter to apply the ratio which is given on the VR1 scale to give the value of the unknown component.

The circuit given in Fig. 1 is only suitable for capacitors; if resistors were substituted these would affect the collector load of Tr2. A crystal earpiece is ideal with this type of circuit. The impedance is very high and so it does not affect the bridge and the cost is low. Crystal earpieces are also quite sensitive and so will enable a really accurate null to be identified.

The circuit providing the audio note is made up from Tr1, Tr2 and the associated components; it is a conventional multivibrator and the operation of this has been explained before in this series. The transistors can be replaced by a wide variety of other types if these are handy, in fact almost any small signal,

No. 44 CAPACITANCE BRIDGE

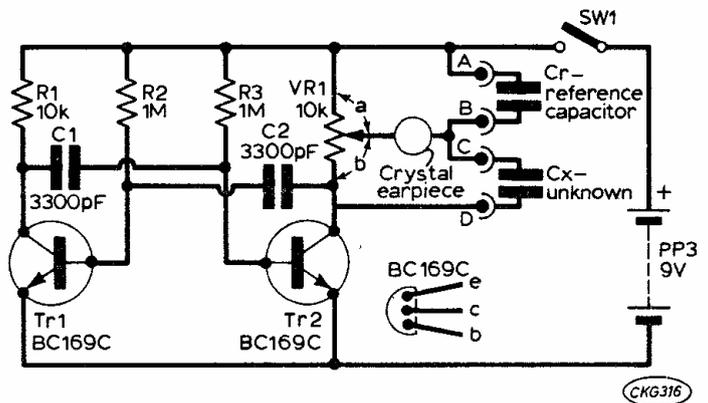


Fig. 1: The circuit of the capacitance bridge. See the text for an explanation of how it works.

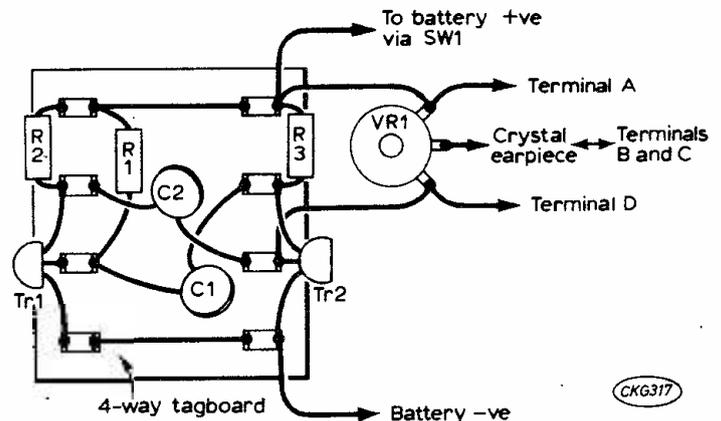


Fig. 2: A suggested component layout.

★ components list

R1	10kΩ, 5%, 1/4W	1p
R2	1MΩ, 5%, 1/4W	1p
R3	1MΩ, 5%, 1/4W	1p
C1	3,300pF disc ceramic	3p
C2	3,300pF disc ceramic	3p
Tr1	BC169C	12p
Tr2	BC169C	12p
VR1	10kΩ linear pot.	12p
SW1	On-off toggle switch	5p
Crystal earpiece		25p
Four-way tag board		10p
		<hr/> 85p

Prices are those recently advertised and may have changed. No allowance is made for minimum order costs or for postage and packing and these points should be checked carefully before ordering.

silicon, NPN transistor can be used with no modifications.

The current taken by the circuit is quite small and a PP3 battery is perfectly adequate.

A suggested component layout is shown in Fig. 2; this is on a small tag board but of course some form of face plate will be necessary to which VR1 must be fixed with the calibrated ratio scale and also for the terminals A-D.

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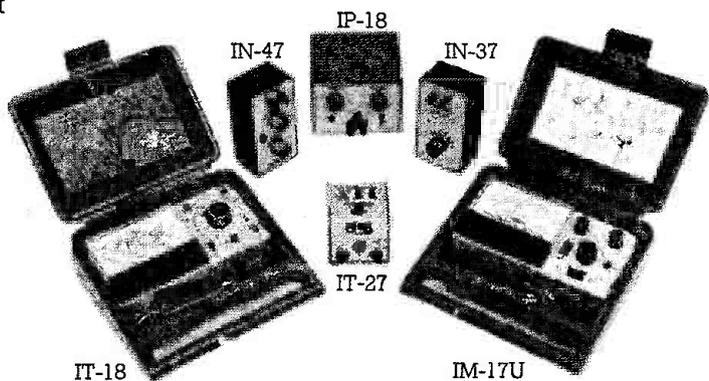
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6/30L2	80	6P11	40	6SL7GT	35	12BE6	40	20P18	£1-20	78	45	DF96	45	ECC88	40	EM81	60	PC97	50	PL806	£2-50	U4F80	40
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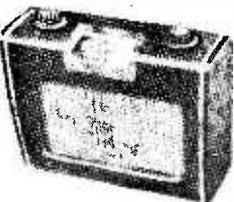
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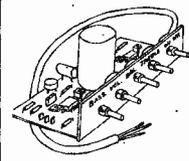


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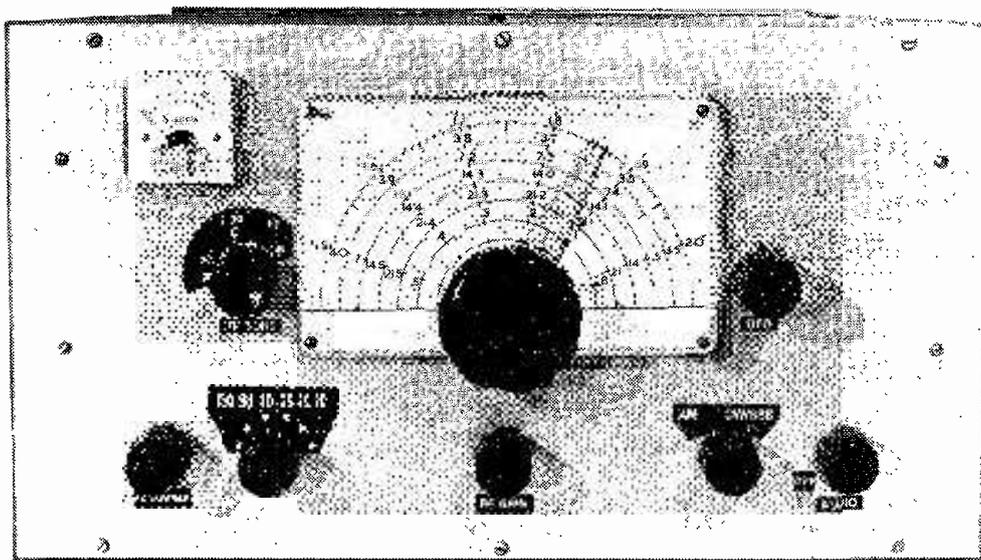
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PART 2

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TUNABLE IF AMPLIFIER (Cont)

Fig. 3 shows the underside of the box. The "Blue" coil L1 is placed inside the screening can supplied with it, holes being drilled in advance through the can sides, for the leads shown. L2 is the "Yellow" coil, and L3 the "Red" type.

The ganged capacitor is attached to the front of the box by three bolts. Solder a lead to the frame or rotor tag near the back, and run this to MC (chassis).

Trimmers TC1, TC2 and TC3 are of the ceramic type, each mounted with two 8BA bolts a little clear of the box top, so that they may be adjusted through holes in the box. Jackson air-spaced trimmers Type C801 (3-8-50pF) or concentric trimmers are also suitable.

Construction and wiring should be rigid. For easy identification of circuits, coloured leads are soldered on to pass down through the chassis. Solder a length of 75 ohm co-ax to L1 as in Fig. 3, and the white lead from pin 8. These run through a single hole immediately under L1.

Yellow (VR1), Brown (a.g.c.), Grey (150V), Blue (heaters) and Red (h.t. positive) leads run together through a single hole. R7 is actually on the voltage regulator holder, V2 of Fig. 2D.

The co-axial lead from V2 runs inside the box towards the first 455kHz i.f. transformer, and through the chassis. It is screened because stray coupling round the band-pass crystal filter will cause a reduction in selectivity.

All leads are left long enough for the box to be turned at right angles to the main chassis should any tests be needed. The box is mounted by self-tapping screws passing up through the chassis and into the flanges of the box sides, front and back.

TUNABLE IF ADJUSTMENT

When the 455kHz, a.f. and power circuits are completed, the tunable i.f. can be aligned, and its coverage adjusted. This is the only calibration work re-

quired, as other receiver ranges are automatically obtained on the same scale, as explained.

With the ganged capacitor almost fully closed, adjust the core of L3 for 3.5MHz, and roughly peak the cores of L1 and L2 for best results. The ganged capacitor is then set nearly fully open, and TC3 is adjusted for 4MHz. Trimmers TC1 and TC2 are set for best results. Adjusting TC3 at the h.f. end of the band will to some extent change the core setting of L3 at the l.f. end of the band, so L3 and TC3 are checked several times. Remember to adjust L3 at the l.f. band end, and TC3 at the h.f. band end. In this way coverage is eventually brought to the desired range.

The cores of L1 and L2 can then be adjusted at about 3.55MHz, and the trimmers at about 3.9MHz, until no further improvement is possible, and the cores are locked with 6BA nuts.

For these adjustments, the signal is taken to the co-axial lead to L1. A harmonic crystal marker using a 100kHz crystal and giving calibration points at 3.5, 3.6, 3.7, 3.8, 3.9 and 4MHz is most suitable. A tunable signal generator should if possible be checked with a crystal or other reference source. Output indication can at this stage be estimated by ear. When construction is finished, cores and trimmers can if necessary be touched up while observing the receiver S-meter, to secure the best reading.

CHASSIS

Fig. 4 shows the top of the chassis and drilling dimensions. It is best to complete as much drilling and other metal work as possible before fixing any components, and to clear away metal fragments. Tags are bolted on tightly for chassis connections. Metal fragments between the i.f.t. pins and chassis can cause h.t. or other shorts, so sleeving can be put on the pins in advance. Each i.f.t. needs a central hole to reach the lower core.

The panel is supported by two brackets, bolted to chassis and panel. Fit the panel so that it projects about $\frac{1}{2}$ in. below the edge of the chassis, as the

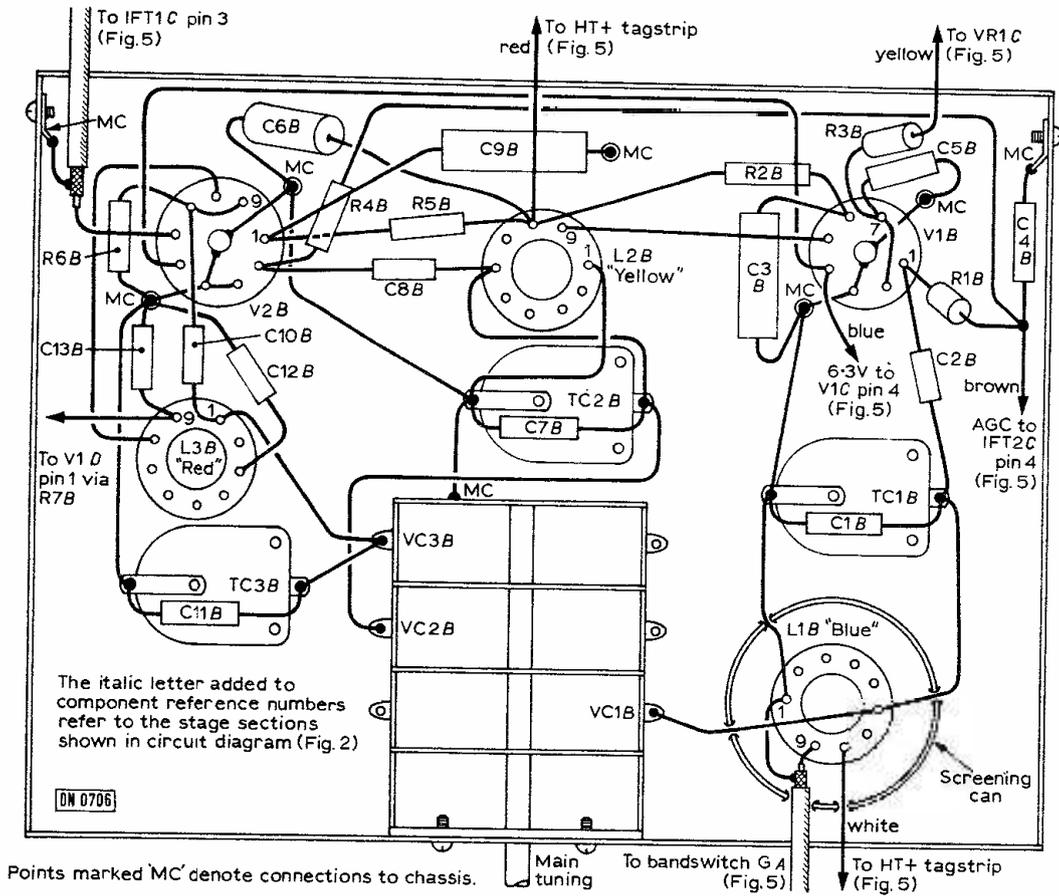


Fig. 3: Component placement and constructional details of the tunable i.f. amplifier unit.

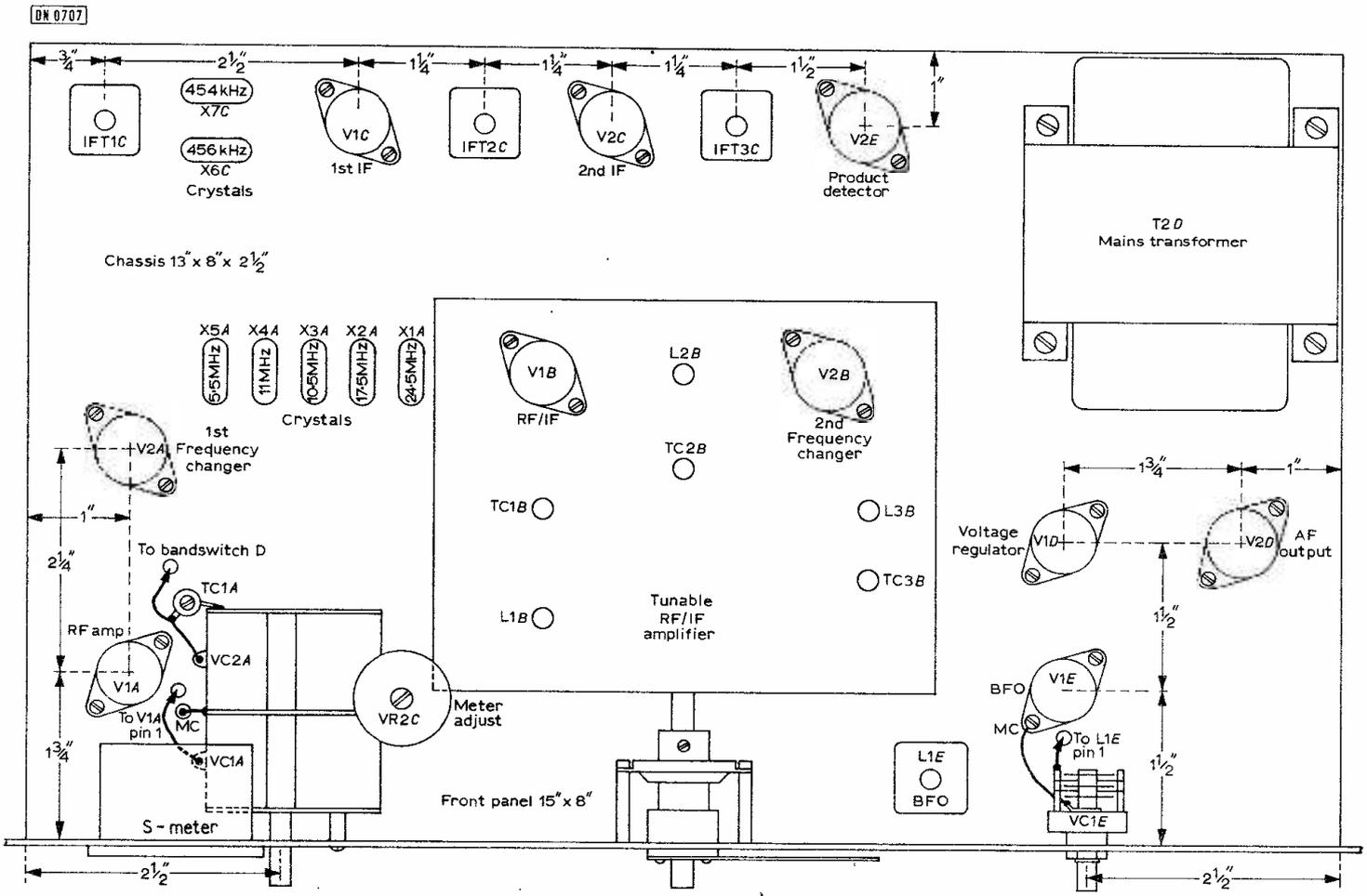
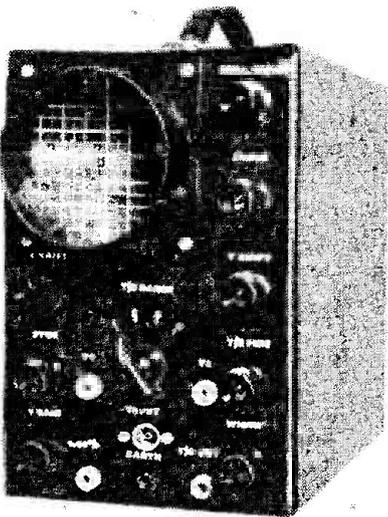
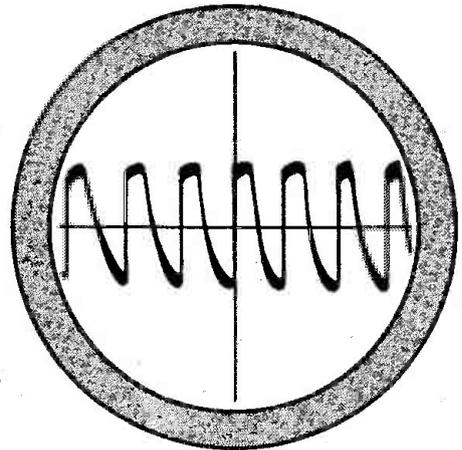


Fig. 4: Top of the chassis with drilling information. The photograph on p. 695, Part 1, will assist in identifying components.

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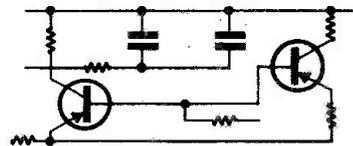
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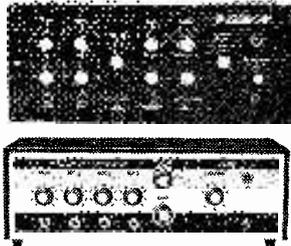
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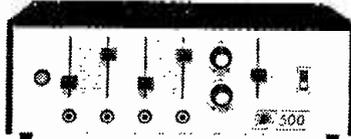
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Speaker Impedance	8-16 ohms.
Inputs: Mic 1 & 2	5mV at 50K ohms (50 or 600 ohm to order)
Aux 3 & 4	100mV at 1 meg ohm.
Size (all models)	15 1/2" x 5" x 6".
Power Output:	Model D.J.500 — 50 watts R.M.S.
(at 8 ohms)	Model D.J.700 — 70 watts R.M.S.
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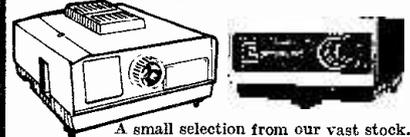
DISCO MINI

Hardly larger than a suitcase yet contains all the necessary features for a high quality mobile unit. The pre-amp has separate tone controls for both mic. and decks, and each input has its own individual volume controls and inputs, plus the addition of a cross fade for deck to deck sound transfer. A built in P.F.L. system for cueing, together with mic-over-ride facility are standard on all units. Response 20-20,000 Hz. Mic. input 5mV, 50K. Output 1 volt.

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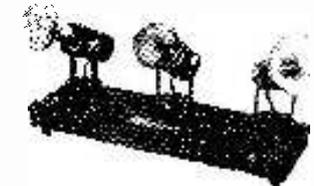
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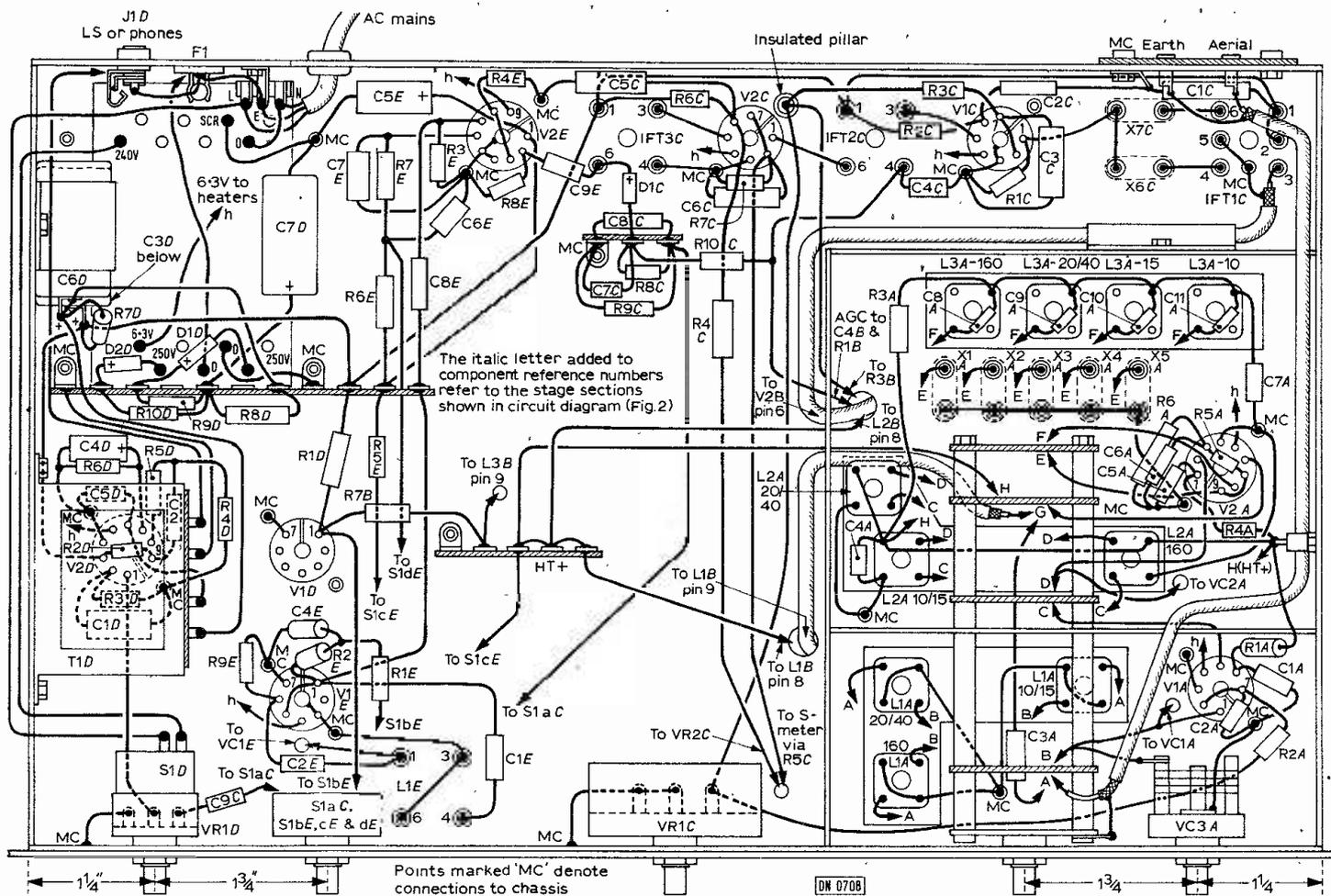


Fig. 5: Location of components underneath the chassis. Note that the wiring of the ECL86 output stage should be completed before fitting the output transformer.

cabinet requires this. Mark through the chassis control bush holes on to the panel, and drill or punch the latter to match.

The panel is marked centrally, level with the ganged capacitor spindle, then drilled and punched to take the ball drive. The dial can then be fitted and holes marked for it.

The b.f.o. pitch capacitor and ganged first r.f. and mixer tuning capacitor are also above the chassis and operated directly by knobs.

Fig. 5 shows the underside of the main chassis and where needed components can be identified by reference to the circuit diagrams.

The mains cord is anchored to a tag strip. The mains transformer tags project through the chassis and a long tag strip near this supports the h.t. rectifiers and other components.

The a.f. and output stage is wired complete and then the speaker transformer T1 is bolted to the side runner and thus lies over this valveholder. The audio section can be tested as described by feeding a signal in at VR1.

The a.m. diode D1 and associated resistors and capacitors are mounted on a tag strip as shown.

Fig. 5 shows all wiring to the crystal filter and following i.f. stage. It is easy to check that this section operates, by temporarily taking D1 positive to pin 6 of the 2nd i.f.t., or by wiring the i.f. amplifier anode to pin 3 of the last i.f.t. The signal is taken by the screened lead to pin 3 of the i.f.t., either from the tunable i.f. described, or from a signal generator. The i.f.t.'s may then be aligned in the way described. The few extra connections etc, for the second i.f. amplifier can then be added, to complete

the circuit, the meter being included or omitted as wished.

This completes construction up to the point where the receiver can be used for a.m. reception in the 3.5-4MHz range.

BFO

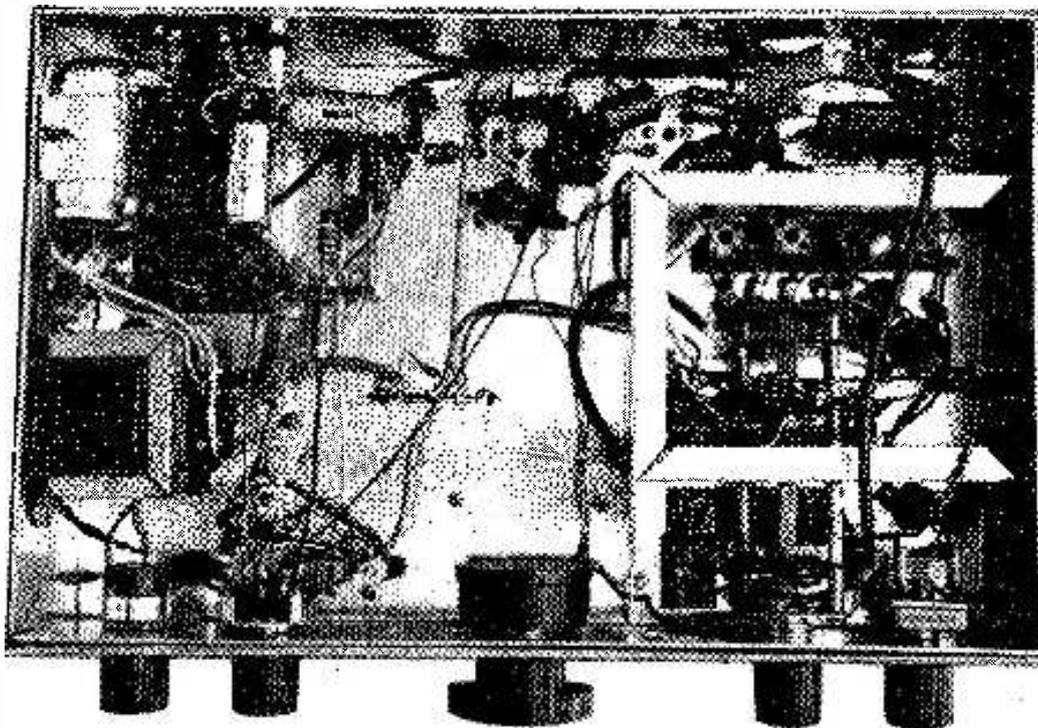
V1 in Fig. 2E is the beat frequency oscillator for c.w. and "carrier oscillator" for s.s.b., and receives h.t. from the regulated supply when section S1b of the 3-way switch is in the CW/SSB position.

The voltage regulated supply is not absolutely essential, but will be found to give a worthwhile improvement in frequency stability. It is possible to use a switched crystal controlled oscillator for selection of upper and lower sidebands but the tunable oscillator is simpler and gives satisfactory results.

PRODUCT DETECTOR

This is V2 in Fig. 2E and it operates on both c.w. and s.s.b., giving an audio output which is selected by section S1a of the 3-way switch. Section S1c applies h.t. to V2, when in the c.w./s.s.b. position. This double-triode circuit is very reliable and trouble-free, and capable of very good results on s.s.b.

In some designs a.g.c. is removed for c.w. and s.s.b. reception and an extra pole on the 3-way switch could accomplish this. However, for strong signals the r.f. gain control has to be turned back anyway, which greatly reduces a.g.c. action so it was decided to leave the a.g.c. circuit in operation at all times.



This view of the chassis will be useful when wiring up the receiver from Fig. 5.

ADJUSTMENT OF BFO

Initially VC1 is half closed and a steady a.m. transmission is tuned in as precisely as possible. The function switch is then turned to "c.w./s.s.b.", and the core of the b.f.o. coil adjusted with a trimming tool for zero beat. If the core is adjusted a little either side of this setting, a strong heterodyne note will be heard, which rises in pitch as the core is moved from its correct position. Opening or closing VC1 from its central or zero position has the same result.

To receive CW, set VC1 above or below the central position, as required to produce the most suitable tone.

For s.s.b. reception, slowly rotate VC1 one way or the other, as required, to produce intelligible speech. Lower sideband is generally used on 1.8, 3.5MHz and 7MHz bands and upper sideband on 14MHz and above, but the effect of adjusting VC1 will soon become clear. Speech cannot be resolved if VC1 is the wrong side of the s.s.b. signal. When VC1 is set for s.s.b. reception, it need not be further adjusted, unless the receiver is switched from l.f. to h.f. bands or vice versa.

Many very strong s.s.b. signals are often heard so for general s.s.b. reception it is better to keep the a.f. gain fairly high, and turn back the r.f. gain as necessary.

The centre pole of the 3-way switch takes h.t. off all but the tunable oscillator and output stages, muting the receiver transmission.

FIRST RF/MIXER OSCILLATOR

This part of the receiver operates on 10, 15, 20, 40 and 160m bands, and the circuit is shown in Fig. 2A. V1 is the r.f. amplifier while the triode section of V2 functions as a crystal controlled oscillator and the heptode section as a mixer.

The 6-way bandswitch has eight poles. For 80m sections A and G take the aerial circuit directly to

the 3.5-4MHz tunable i.f., which operates as r.f. and mixer on this band. For all other bands, section A takes the aerial to the primaries of the aerial coils L1, while section G takes output of the mixer to the tunable i.f.

Section B selects the appropriate coils L1 but three coils only are required for the five bands covered by this section: one coil for 10m and 15m, a second for 20m and 40m, and the third coil for 160m. This reduces the number of coils needed while giving a satisfactory L/C ratio. Switch sections C and D select similar coils L2, for the mixer grid circuit.

Coils L1 and L2 are tuned by the ganged capacitor VC1/VC2. In use, this capacitor is peaked up in the selected band and need only be re-adjusted slightly when receiving weak signals, or when moving well across the band, except in the case of 160m, where it requires more frequent adjustment. The panel aerial trimmer VC3 allows further alignment with almost any aerial. AGC is not applied to either of these stages, but the gain of V1 is controlled by VR1, which also adjusts the cathode bias of some later stages.

The r.f. coils L1 are wound to give an input impedance of around 75Ω. Transmitting equipment will often be operated into a dipole or other aerial with a matching device to provide about this load, so the same system can generally be used for reception. For reception only, any simple end-connected wire may be taken to the aerial socket, with good results. For maximum signal strength with weak signals it is customary to employ some improved form of aerial, such as an end-connected wire with matching unit, or a single-band or multi-band dipole with 75Ω co-axial feeder.

Switch section E selects the appropriate crystal and section F the triode anode oscillator coils. The crystal frequencies are chosen so that incoming signals on the wanted band are converted into the 3.5-4MHz range. The latter thus covers a 500kHz band which includes the wanted h.f. band, or 160m.

It will be seen that it is not essential to use the crystal frequencies listed, though these allow dial

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AC128	PNP	
AC178	NPN	
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*AD181	PNP	
*AD182	PNP	
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BC108	PNP	
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C	1/4W
C	1/2W
C	1W
MO	1W
WW	1W

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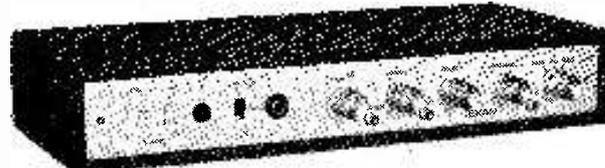
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markings to match up easily. For example, the 11MHz crystal for 40m results in a range of 7.0-7.5MHz being tuned. If the band 7.0-7.1MHz only is required, as permitted for transmission in this country, any crystal which converts 7.0-7.1MHz to a part of the 3.5-4MHz range can be used. In the same way, the 5.5MHz Top band crystal results in coverage of 1.5-2.0MHz but any crystal which results in 1.8-2MHz being covered would do. "Round number" crystals will give dial readings which match up with the 3.5-4MHz range at 100kHz points, such as an actual range of 1.6-2.1MHz, for example, for 160m.

Crystal frequencies which are not "rounded off" to 100kHz will result in the band being off-set one way or the other, according to the actual crystal frequency. The listed crystals can be easily obtained, but it will be seen that it may be possible to use surplus or other crystals to hand, provided band calibration is adjusted to suit.

A crystal should not put its own harmonic in the wanted band. A 3.5MHz crystal would, for example, give 3.5MHz from V2 with the receiver tuned to 7MHz, but the 3.5MHz 2nd harmonic and fundamental pick-up at 3.5MHz by the tunable i.f. would block reception.

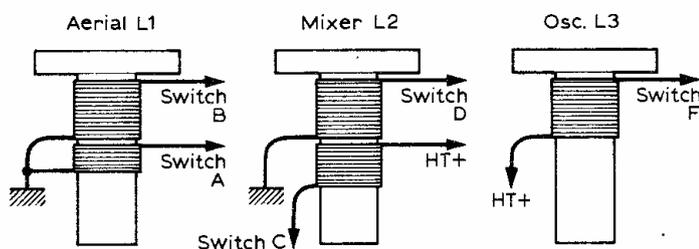
Only four anode coils L3 are necessary for the five crystals because 40m uses a 11MHz crystal and 20m a 10.5MHz crystal so a single coil is satisfactory for both ranges.

Should there be no interest in Top band, L1, L2, L3 and the crystal for this band can be omitted.

One crystal provides coverage of one 500kHz sector of 10m, any additional 500kHz sector requiring another crystal. If 160m is omitted, the 6th position could introduce a 25MHz crystal, for 28.5-29MHz. Alternatively, 8 and 9-way switches are available, so that coverage of 10m may be extended that way. Another method is to extend section E to a 3-way rotary switch for the 10m crystals.

RF/MIXER COILS

Each coil is begun right against the tagged end, as in Fig. 6, no space being left between the tuned section and the primary. The wire ends can be



All formers $\frac{9}{32}$ " dia. x 1" long with iron dust cores. DW 0709

Band MHz	RF		Mixer		Wire
	Pri.	Sec.	Pri.	Sec.	
1.8	10	*	40	*	32g. enam.
7/14	4	24	12	24	32g. enam.
21/28	2	10	10	7	26g. enam.

* MW coil (Osmor Range 5) with 20 turns removed. All windings close wound. No space between windings.

Fig. 6: Showing the method of constructing the r.f./mixer coils.

soldered to tags, taken through small holes, or run directly to wiring points, the ends of the windings being held with a touch of polystyrene adhesive.

A strip of $\frac{3}{16}$ in. plywood or similar material is drilled to be a push fit for the ends of r.f. coils, with a similar strip for the mixer coils. The strips are bolted to the chassis.

CRYSTAL OSCILLATOR COILS

The four coils, see table, are a push fit in holes in a strip of plywood, which is bolted to the chassis near the switch.

Crystal (MHz)	Turns	Wire	Parallel C
5.5	30	32g. enam.	100pF
10.5	24	32g. enam.	22pF
17.5	19	32g. enam.	10pF
24.5	16	26g. enam.	5pF

Close wound at end of former as in Fig. 6.

Winding information for the crystal oscillator stage coils.

If a meter is clipped from chassis to the h.t. end of the coils, oscillation is shown by a rise in voltage. Adjust each core for maximum voltage then, if necessary, set it slightly off this peak so that each crystal starts reliably. One setting is suitable for both 10.5 and 11MHz crystals. Readings were approximately 50V when not oscillating, rising to about 100V with oscillation, but a little lower on the highest frequency range.

SWITCH AND COILS

The bandswitch is positioned as in Fig. 5, and arranged so that the 10/15m coil L1 can be placed as shown to allow short wiring to the wafers. A 5x2in. flanged universal chassis member is placed inside the chassis, and marked to agree with the switch bush hole. This hole is punched, and holes are drilled for the switch screwed rods. The rear wafers and spacers are taken off, and the switch re-assembled with the flanged member, which gives extra support and also provides a screen between r.f. and mixer sections. Holes are drilled in the flanged member in advance, so that a lead can run directly through from r.f. anode (pin 5) to section C, and so that the heater circuit can be wired. C3 (used to isolate h.t. on 80m) is near section A and a lead runs through to section G.

Leads from sections B and D run up through the chassis to VC1 and VC2. Short, direct chassis returns are necessary, especially for the h.f. bands coils. Connections to the 10/15m coils and leads to the crystals are kept very short.

To avoid possible errors in wiring the switch, first check that normal results are obtained on 80m. The coils and crystal for 40m may then be added and the circuit tested. The other ranges can then be fitted in turn.

The remaining flanged members listed can be bolted to the chassis to enclose this section of the receiver.

ALIGNMENT

With TC1 and VC3 nearly fully open and with the band switch on 10m, check that 29.5MHz can be tuned with VC1/2 fully open. If not, screw the cores of L1 and L2 further out of the windings (towards the chassis) VC3 should also peak signals but if it is fully open, screw down TC1 a little.

Switch to 15m and peak signals by closing VC1/2. If VC3 now needs considerable adjustment move the core of L1 or L2 (10/15m range) to correct this.

Switch to 20m, and with VC1/2 fully open, set the cores of L1 and L2 for 14.5MHz. Check that 7MHz can be reached with VC1/2 nearly fully closed, after switching to this range. If not, adjust the cores until this is possible to minimise the need for re-adjustment of VC3.

On 160m, adjust L1 and L2 (160m range) to allow peaking with VC1/2 and to minimise the need for altering the setting of VC3 when tuning from the h.f. end of the band towards the l.f. end.

The crystal oscillator coils are adjusted as previously described. No reception is possible on a range where the crystal is not oscillating. VC1/2 should peak quite sharply on each amateur band, but should not be too critical. The dial or control knob should be marked with approximate band positions and with frequencies for 1.8, 1.9 and 2MHz.

With an i.f. of 3.5 to 4MHz a second channel signal arises at 7 to 8MHz from the wanted amateur band so that in normal use, interference is unlikely. But on the highest frequency bands the wide coverage of VC1/2 allows these circuits to be tuned accidentally to the second channel frequency. This tuning position must not be used for amateur band reception.

With the tunable i.f. of 3.5-4MHz the oscillator covers 3955-4455kHz the 5th harmonic of which falls in the 15m band and is heard as a weak carrier. This is unavoidable with this type of circuit and similar considerations apply to 10m.

Should the S-meter potentiometer be at the limit of its adjustment without the meter being at zero, add a resistor of some 100 to 330Ω or so between potentiometer and chassis. This value depends on individual valves, h.t. voltage, etc.

CABINET

Holes or slots are required in the back of the cabinet for the mains lead, aerial, etc. Slots can be made by drilling holes and sawing between them or by sawing between holes made with a chassis punch. For additional ventilation six $\frac{1}{2}$ in. holes were punched in the bottom and a row of similar holes in the back near the top. The case is raised on four $\frac{3}{4}$ in. rubber feet.

An opening lid is made to reach the S-meter potentiometer, etc. Lines are drawn about $1\frac{1}{2}$ in. from front, back and sides, to make a lid about 12x6in. Sufficient $\frac{1}{8}$ in. holes are drilled at the corners to start a small metal saw. The 12x6in. piece is cut out, and edges smoothed with a file. Strips of metal about 7x1in. are bolted inside the cabinet for the lid to rest upon when closed. ■

Note: Part 1. Fig. 2A, bottom of L1(160m) primary should go to chassis, 40 and 20m switch sections (B) should be linked. In Fig. 2E, C3 is a fixed capacitor.

GOING BACK—continued from page 829

Arthur L. Kongshaug, Schouterrassen 22, Oslo 5, Norway has some more information on Dr. Loewe and his Loewe receiver mentioned in a previous Going Back article.

This type of receiver was based on a patent by Dr. Sigmund Loewe, and was manufactured in his own factory, Radiofrequenz G.m.b.H., in Berlin, starting in 1926.

The receiver was made in two versions, a two-valver and a three-valver. Both versions were intended to operate a vibrating reed type of loud-speaker—a type which was very popular at the time (before the Dane, Mr. Jensen, came along with the dynamic types).

The basic idea behind the “Loewe” receivers, was that all resistors, all capacitors and the elements of the valves, in fact everything outside the tuning arrangement, were enclosed in one big glass tube under vacuum. Resistors and capacitors not being as stable as they are today, this was a real improvement.

One may also assume that this first attempt to make an “integrated” receiver, made them cheaper to manufacture than the standard versions of the time. The sets were very popular, and are said to be the first sets to pass the million-mark in Europe. Who assembled the British version, I do not know. The brand is still one of the best known in Germany, today under the name “Loewe Opta”, with works in Berlin, Kronach and Düsseldorf.

Jim F. Rowland, hailing from Kauhajoki KK, Suomi, Finland, says . . . “I am the proud possessor of a Philips Radio Type 2531 serial number 016824N1 complete with its original loudspeaker.

Valve line up is: 506—E442—E443—E424. Bands: 200—450, 400—950, 900—2100 meters. The speaker line out plug is also a three position switch.

I was rather lucky to get this set, I was in fact in the process of moving from my house near Vaasa when my next door neighbour came to ask me if I could help him with an old radio he had found in his loft. Well I helped him with a small token of my appreciation with a fiver!!

The wireless is to the best of my knowledge in perfect condition, that is to say that with a little bit of howl, wow and whistle. We manage to listen to the immaculate BBC in the evenings around 2300hrs local time (ours).

Well now, if you find this interesting and would like photos of the object, let me know. Should you be able to enlighten me as to its year of origin and perhaps country I should be very much obliged.”

Yes, we would like to see photos of your receiver Mr. Rowland. Sorry, we don't know year of manufacture, but it was probably made in Holland.

Mr. D. M. Findlay, 2a St. George's Drive, Carpenders Park, Watford, Herts, writes in to say . . .

“I found an old radio in the loft of my last house. As a computer engineer with an appreciation of the ‘oldies’ in the wireless world, I am looking for any info. on this piece of equipment.

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So if anyone has any ideas, will they drop Mr. Findlay a line?

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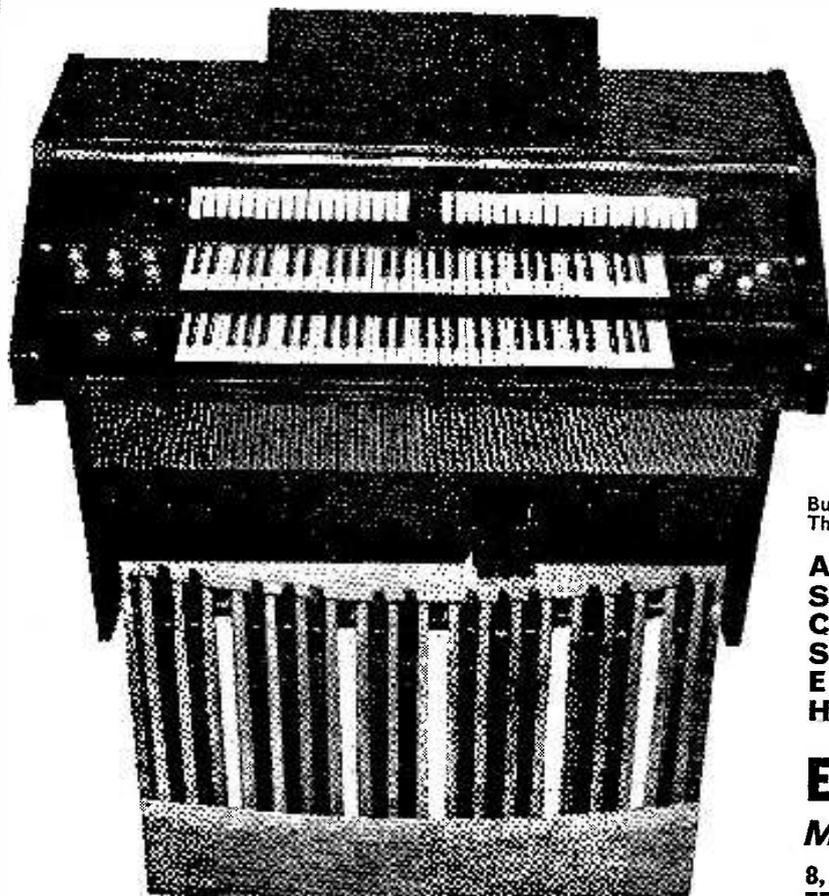
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6BW7 .48	DK91 .25	ECH42 .59	EY86 .27	PCL83 .58	UBF89 .28
6F1 .57	DK96 .43	ECH81 .28	EZ80 .19	PCL84 .31	UCH85 .38
6F23 .64	DL92 .24	ECL80 .35	EZ81 .21	PCL85 .86	UCH42 .56
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12AU7 .18	DY86 .21	EF39 .36	N78 .85	PL36 .45	UF41 .49
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30C15 .56	DY802 .28	EF80 .22	PC88 .44	PL82 .29	UL41 .52
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Electrolytic capacitors µF/V 2000/35, 8,000/30, 10,000/15 10,000/25, 10,000/35, 12,500/35, 1,000 + 1,000/40 all at 35p each post free. 2,000/50, 2,500/50, 5,000/50, 10,000/50, 12,500/50 all at 50p each post free.

16 + 16/350, 32 + 16/350, 32 + 32/350, 40 + 40/250 50 + 50/300, 80 + 80/450, 100 + 100/385. All at 25p each post free.

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practically wireless

commentary by **HENRY**

HAVE you been watching this space? From time to time, Henry appraises his forbearing readers with news of the sort of innovations that are likely to revolutionise the world of wireless. Even Dr. Strabismus, whom God preserve, of Utrecht, has had no more near-misses. But this time Henry feels sure he is on a winner. Here is the communications breakthrough for which all frustrated hams and nail-biting telephonists have been waiting. Here is the answer to sunspots, a heavier-than-Heaviside layer and the incessant whirring of the power drill next door.

Here, in short, is the OIC—pronounced, I have it on the authority of Jim McDermott, who is Eastern Editor of *Electronic Design*, as OYK, which I shall Anglicise to Oyck.

There is a two to ten year development timelag, and, to quote J. McD again: "... the major researchers tend to be close-mouthed about what the big hang-ups are."

Henry could tell him! Hang-ups inevitably occur while big companies eye each other and such bodies as Standards Committees, waiting for the word from Olympus giving them what they hope is a monopolistic *carte blanche*.



Nail-biting telephonists ...

Astute readers will have deduced that OIC stands for Optical Integrated Circuit but idiots like Henry will still be floundering with the information that light-emitting diodes are non-lasing, producing a relatively broad spectrum of energy which, transmitted along optical fibres is limited to a few hundred feet, with maximum response in the 100MHz region.

Henry could have told Corning that his development of an optical, single-mode fibre with losses of only 20dB/km would have found applications for making dial lamps shine in impossible places, and that their incorporation in the one or two enterprising radio sets that have dared use them has been more trouble than it was worth.

The answer to the short-range, narrow-band optical system is—hadn't you guessed?—laser light.

This is where the integrated circuitry comes in: there are two ways of attacking the problem; with passive or active devices. Bell Telephone Laboratories (I seem to have heard of them somewhere before) are putting a lot of work into micron-sized thin-film, dielectric waveguides on transparent substrates. The methods of producing integrated circuits that have given us such things as perfectly pretuned FM IF strips and some audio amplifiers with noisier front-ends than some of us managed to make with war-surplus VR65's, allow what J. E. Goell describes as a deposited glass film. Oxygen is used for sputtering and a thin film of a glass with a higher index of refraction is deposited on another, when masking and etching processes are then carried out.

There is a bit of bother with the edges of the waveguides so made. Goell tells us that a loss of about 1dB/cm results from an edge with a 500 Angstrom rms deviation, for a refractive index difference of 1% between the



A chance to tell your grandchildren ...

waveguide and its surrounding media at a wavelength of 1 micrometre.

Next problem is putting laser energy into the device. One way is to use prisms, the other an etched grating—and here we are, back to the Oyck again. At this stage of the proceedings, developers are more insistent than G8DSH's monkey, Maxwell.‡

We have Professor Bertoni of Brooklyn Polytechnic on the one hand, Prof. Jay H. Harris of the U of Washington claiming near 100% efficiency with his own tapered prisms and IBM using dense flint glass as well as the quartz crystal device by their Lawrence Kuhn, struggling to beat the Bragg angle.

No, I refuse to explain further. I've read the article seven times now and still wonder why R. G. Hunperger of Hughes Research Laboratories had to use ion (proton) implantation in gallium arsenide material. No doubt Faraday had the same bother when he discovered that the resistance of silver sulphide went down sharply with heating, dating the first known negative temperature coefficient thermistor as 1833. It took the Henrys of this world a long time to get around to using it, so I just thought I'd give you, Joe, a chance to say to your grandchildren when the communal wired TV is changed over to OIC linkage: "Ah, yes, I remember reading about that in *Practical Wireless*."

‡ See page 342, August 1972 PW.

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Type SW.100 100 x 80 mm.

50μA	...	\$3-80
50-0-50μA	...	\$3-80
100μA	...	\$3-80
100-0-100μA	...	\$3-70
500μA	...	\$3-50
1mA	...	\$3-40
20V. D.C.	...	\$3-40
50V. D.C.	...	\$3-40
300V. D.C.	...	\$3-40
1 amp. D.C.	...	\$3-40



Type MR.85P. 4 1/2in. x 4 1/2in. fronts

50μA	...	\$3-10
100μA	...	\$3-10
500μA	...	\$3-10
1 amp.	...	\$3-10
5 amp.	...	\$3-10
15 amp.	...	\$3-10
30 amp.	...	\$3-20
20V. D.C.	...	\$3-10
50V. D.C.	...	\$3-10
150V. D.C.	...	\$3-10
300V. D.C.	...	\$3-10
15V. A.C.	...	\$3-10
300V. A.C.	...	\$3-10
S Meter 1mA	...	\$3-15
VU Meter	...	\$3-95

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

200μA	...	\$1-75
300μA	...	\$1-75
500μA	...	\$1-75
750μA	...	\$1-75
1 amp.	...	\$1-75
2 amp.	...	\$1-75
5 amp.	...	\$1-75
10 amp.	...	\$1-75
3V. D.C.	...	\$1-75
10V. D.C.	...	\$1-75
15V. D.C.	...	\$1-75
20V. D.C.	...	\$1-75
50V. D.C.	...	\$1-75
100V. D.C.	...	\$1-95
200V. D.C.	...	\$1-95
300V. D.C.	...	\$1-95
500μA	...	\$1-80
500-0-500μA	...	\$1-75
1mA	...	\$1-75
1-0-1mA	...	\$1-75
2mA	...	\$1-75
5mA	...	\$1-75
10mA	...	\$1-75
20mA	...	\$1-75
50mA	...	\$1-75
100mA	...	\$1-75
150mA	...	\$1-75



Type MR.65. 3 1/2in. square fronts

1 amp.	...	\$2-15
5 amp.	...	\$2-15
15 amp.	...	\$2-15
30 amp.	...	\$2-15
50 amp.	...	\$2-15
5V. D.C.	...	\$2-15
10V. D.C.	...	\$2-15
20V. D.C.	...	\$2-15
50V. D.C.	...	\$2-15
150V. D.C.	...	\$2-15
300V. D.C.	...	\$2-15
50mV. D.C.	...	\$2-40
100mV. D.C.	...	\$2-40
300V. A.C.*	...	\$2-20
50V. A.C.*	...	\$2-20
150V. A.C.*	...	\$2-20
300V. A.C.*	...	\$2-20
500mA A.C.*	...	\$2-15
1 amp. A.C.*	...	\$2-15
5 amp. A.C.*	...	\$2-15
10 amp. A.C.*	...	\$2-15
20 amp. A.C.*	...	\$2-15
30 amp. A.C.*	...	\$2-15
50 amp. A.C.*	...	\$2-15
VU Meter	...	\$3-40

Type SD.830 82.5mm x 110mm Fronts

10mA	...	\$2-50
50mA	...	\$2-50
100mA	...	\$2-50
500mA	...	\$2-50
1 amp.	...	\$2-50
5 amp.	...	\$2-50
10 amp.	...	\$2-50
5V. D.C.	...	\$2-50
10V. D.C.	...	\$2-50
20V. D.C.	...	\$2-50
50V. D.C.	...	\$2-50
300V. D.C.	...	\$2-50
50V. D.C.	...	\$2-75
300V. D.C.	...	\$2-75
300V. A.C.	...	\$2-75
VU Meter	...	\$3-00

Type MR.52P. 2 1/2in. square fronts

50μA	...	\$3-40
50-0-50μA	...	\$2-85
100μA	...	\$2-85
100-0-100μA	...	\$2-75
500μA	...	\$2-55
1mA	...	\$2-20
5mA	...	\$2-20
10mA	...	\$2-20
50mA	...	\$2-20
100mA	...	\$2-20
500μA	...	\$2-20
1 amp.	...	\$2-20
5 amp.	...	\$2-20

Type MR.45P. 2in. square fronts

50μA	...	\$2-50
50-0-50μA	...	\$2-30
100μA	...	\$2-30
100-0-100μA	...	\$2-05
200μA	...	\$2-05
500μA	...	\$1-95
500-0-500μA	...	\$1-85
1mA	...	\$1-85
5mA	...	\$1-85
10mA	...	\$1-85
60mA	...	\$1-85
100mA	...	\$1-85
500mA	...	\$1-85
1 amp.	...	\$1-85

Type S-80 80 mm. square fronts

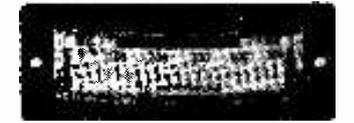
50μA	...	\$3-50
50-0-50μA	...	\$3-40
100μA	...	\$3-40
100-0-100μA	...	\$3-30
500μA	...	\$3-05
1mA	...	\$2-85
20V. D.C.	...	\$2-85
50V. D.C.	...	\$2-85
300V. D.C.	...	\$2-85
1 amp. D.C.	...	\$2-85
5 amp. D.C.	...	\$2-85
300V. A.C.	...	\$2-85
VU Meter	...	\$3-70

Type SD.640 63.5mm x 85mm Fronts

50μA	...	\$2-60
50-0-50μA	...	\$2-55
100μA	...	\$2-55
100-0-100μA	...	\$2-55
200μA	...	\$2-55
500μA	...	\$2-55
1mA	...	\$2-35
5mA	...	\$2-35
10mA	...	\$2-35
50mA	...	\$2-35
100mA	...	\$2-35
500mA	...	\$2-35
1 amp.	...	\$2-35
5 amp.	...	\$2-35
10 amp.	...	\$2-35
5V. D.C.	...	\$2-35
10V. D.C.	...	\$2-35
20V. D.C.	...	\$2-35
50V. D.C.	...	\$2-35
300V. D.C.	...	\$2-35
15V. A.C.	...	\$2-40
300V. A.C.	...	\$2-40
VU Meter	...	\$2-70

Type MR.65P. 3 1/2in. x 3 1/2in. fronts

50μA	...	\$3-70
50-0-50μA	...	\$3-00
100μA	...	\$3-00
100-0-100μA	...	\$2-90
200μA	...	\$2-90
500μA	...	\$2-65
500-0-500μA	...	\$2-40
1mA	...	\$2-40
5mA	...	\$2-40
10mA	...	\$2-40
50mA	...	\$2-40
100mA	...	\$2-40
500μA	...	\$2-40
1 amp.	...	\$2-40
5 amp.	...	\$2-40
10 amp.	...	\$2-40
15 amp.	...	\$2-40
20 amp.	...	\$2-40
30 amp.	...	\$2-40
50 amp.	...	\$2-75
5V. D.C.	...	\$2-40



"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. The 3° mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

50μA	...	\$5-50
100μA	...	\$5-10
1mA	...	\$4-85
50-0-50μA	...	\$5-10
1-0-1mA	...	\$4-85
1A d.c.	...	\$4-85
5A d.c.	...	\$4-85
10V. d.c.	...	\$2-85
50V. d.c.	...	\$4-85
300V. d.c.	...	\$4-85
Dual range	...	
500mA/5A d.c.	...	\$5-10
5V/50V d.c.	...	\$5-10

Type SD.460 46mm x 59.5mm Fronts

50μA	...	\$2-40
50-0-50μA	...	\$2-35
100μA	...	\$2-35
100-0-100μA	...	\$2-35
200μA	...	\$2-35
500μA	...	\$2-20
1mA	...	\$2-15
5mA	...	\$2-15
10mA	...	\$2-15
50mA	...	\$2-15
100mA	...	\$2-15
500mA	...	\$2-15
1 amp.	...	\$2-15
5 amp.	...	\$2-15
10 amp.	...	\$2-15
5V. D.C.	...	\$2-15
10V. D.C.	...	\$2-15
20V. D.C.	...	\$2-15
50V. D.C.	...	\$2-15
300V. D.C.	...	\$2-15
15V. A.C.	...	\$2-30
300V. A.C.	...	\$2-30
VU Meter	...	\$2-55

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"SEW" EDGWISE METERS

Type PE.70. 3 1/7 3/2in. x 1 1/5 3/2in. x 2 1/2in. deep

50μA	...	\$3-40
50-0-50μA	...	\$3-30
100μA	...	\$3-30
100-0-100μA	...	\$3-20
200μA	...	\$3-20
500μA	...	\$3-05
1mA	...	\$2-70
300V. A.C.	...	\$2-70
VU Meter	...	\$3-75

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High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range ex-stock. Single hole fixing, 3/16 in. dia. shafts. Bulk quantities available.

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100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms. \$1-65 P. & P. 7 1/2p.

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8 Amp	...	\$15-90
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12 Amp	...	\$23-80
20 Amp	...	\$49-00
25 Amp	...	\$58-00
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2-5 Amp	...	\$5-05

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150 W	...	\$2-70
300 W	...	\$3-60
500 W	...	\$5-25
1000 W	...	\$7-50
1500 W	...	\$10-20
2500 W	...	\$17-25
5000 W	...	\$35-00

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Input 88 125 VAC or 176 250VAC. Output 120V AC, or 240 VAC. 200 VA rating. \$11-97, carr. 50p.

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P. & P. extra

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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 x 85 x 103mm. \$28-97 P. & P. 25p.

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4 Station \$8-62, P. & P. 17p.

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

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MULTIMETERS for EVERY purpose!



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High-precision at low-cost. Ranges: D.C. 15V, 150V, 1,000V (10,000 opv). A.C. 15V, 150V, 100V (1,000 opv). D.C. Current 150mA. Resistance 100k ohms. £1-85. Post 15p.

ROUND SCALE TYPE PENCIL TESTER MODEL T.S.68
Completely portable, simple to use pocket sized tester. Ranges 0/3/30/300V AC and DC at 2,000 ohms. Resistance 0-20K ohms. ONLY £1-97 P. & P. 13p.

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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. £3-57. Post 20p.

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20,000 o.p.v. Overload protection. Slide switch selector 0 / 25 / 2.5 / 10 / 50 / 250 / 1000V. D.C. 0 / 10 / 50 / 250 / 1000V. A.C. 0 / 50µA / 25 / 250mA. D.C. 0 / 3K / 30K / 300K / 3 meg -20 to +50db £4-97. Post 15p.

MODEL TE-300
30,000 O.P.V. Mirror scale. overload protection 0/6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30µA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm -20 to +63 db. £5-97. P. & P. 15p.

MODEL PL436
20k Ω/Volt D.C. 8k Ω/Volt A.C. 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. £6-97½. P. & P. 12½p.

TMK MODEL TW-50K
46 ranges, mirror scale, 50K/Vol. D.C. 5K/Volt A.C. D.C.: Volts 125, 25, 1.25, 2.5, 5, 10, 25, 50, 125, 250, 500, 1000V, A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50µA, 2.5, 5, 25, 50, 250, 500mA, 5, 10 amp. Resistance: 10K, 100K, 1 MEG, 10 MEG Ω. Decibels: -20 to +81.5db £8-50. P. & P. 17½p.

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HIKO MODEL 700X
100,000 O.P.V. Overload protection. Mirror scale. 3/6/12/15/30/60/120/300/600/1200V D.C. 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 / 5000µA / 1 / 10 / 100 / 500mA / 10 amp. D.C. 0 / 2K / 200K / 20 meg -20 to +50 db. £13-95. Post 35p.

U4312 MULTIMETER
Extremely sturdy instrument for general electrical use. 667 o.p.v. 0/3/1.5/7.5/30/60/150/300/600/900 VDC and 75mV. 0/3/1.5/7.5/30/60/150/300/600/900 VAC. 0/300µA/1.5/6/15/60/150/600mA/1.5/6 AMP. D.C. 0/1.5/6/15/60/150/600MA/1.5/6 AMP. AC. 0/200 Ω/3K/30K Ω. Accuracy DC 1%, AC 1-5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. £9-50 plus P. & P. 25p.

MODEL 1092 TESTMETER
5,000 O.P.V. 0/3/15/150/300/1200 V. D.C. 0/6/30/300/600 V. A.C. 0/300µA/300 MA 0/10K/1 meg Ω Decibels -10 to +16db £2-75 each +15p P. & P.

HIKO MODEL 720X
20,000 O.P.V. Overload protection 5/25/100/500/1000 VDC. 10/50/250/1000 VAC. 50µA/250mA. 20K/2 meg ohm. -5 to +62db. £4-97. P. & P. 15p.

HIKO MODEL 730X
30,000 O.P.V. Overload protection. 6/30/60/300/600/1200 VDC. 12/60/120/600/1200 VAC. 60µA/30 mA/300 mA. 2K/200K/2 megohm. -10 to +63db. £6-50. P. & P. 15p.

MODEL TE-12
20,000 O.P.V. 0/0-6/6/30/120/600/1,200/3,000/8,000V. D.C. 0/6/30/120/600/1,200V. A.C. 0/60µA/6/60/600mA. 0/6K/600K/6Meg/60 Meg. Ω 50pF-0.2mFd. £5-97½. P. & P. 17½p.

MODEL TE-200
20,000 O.P.V. Mirror scale. overload protection. 0/5/25/125/1,000V. D.C. 0/10/50/250/1,000V. A.C. 0/50 µA/250 mA. 0/60K/6 meg Ω. -20 to +62db. £8-95. P. & P. 15p.

MODEL 500
30,000 O.P.V. with overload protection mirror scale 0/5/2.5/10/25/100/250/500/1,000V. D.C. 0/2.5/10/25/100/250/500/1,000V. A.C. 0/50µA/5/50/500mA. 12 amp. D.C. 0/60K/6 Meg/60 Meg Ω £8-87½. Post paid.

HIKO MODEL 750X
50,000 o.p.v. 43 ranges 0-0.3 to 1,200V D.C. 0-3 to 1,200V A.C. 0-30µA/300mA. 0-3K/30 meg ohms. -10 to +17db. £8-97. Post 20p.

HT100B4 MULTI-METER
Features A.C. current ranges. 100,000 o.p.v. Mirror Scale. Overload protection. 0/1/2.5/10/50/250/500/1000 V D.C. 0/2.5/10/50/250/1000 V. A.C. 0/10/250µA/2.5/25/250 MA/10 Amp. D.C. 10 Amp A.C. 0/20K/200K/2 MEG/20 MEG. -20 +62db. £12-50. P. & P. 25p.

370 WTR MULTI-METER
Features A.C. current ranges. 20,000 o.p.v. 0/5/2.5/10/50/250/500 1000 V. D.C. 0/2.5/10/50/250/500/1000V AC 0/50µA/1/10/100mA/1/10 Amp D.C. 0/100mA/1/10 Amp AC 0/5K/50K/500K/5 MEG/ 50 MEG. -20 +62db. £15. P. & P. 25p.

RUSSIAN 22 RANGE MULTIMETER
Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2.5/10/50/250/500/1000V D.C. 2.5/10/50/250/500/1000V A.C. DC Current 100mA/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

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Full capabilities for measuring A, B and IGO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. £7-50. Post 20p.

TE-16A TRANSISTORISED SIGNAL GENERATOR
5 ranges 400KHz-30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800KHz modulation. 5½ x 5½ x 3½ in. Complete with instructions and leads. £7-97. Post 25p.

Model S-100TR MULTIMETER TRANSISTOR TESTER
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TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE
A new, portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1 Ω 11-1 meg Ω 6 Ranges ±1% L. 1 µ H - 111 HENRYS 6 Ranges 2 = % C. 10pF ±1110nF/d 6 Ranges ±2%. TURNS RATIO 1 : 1/1000-1 : 1/100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100µA. Meter indication. Attractive 2 tone metal case. Size 7½ x 5 x 2in. £20. P. & P. 25p.

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

MODEL TE.15 GRID DIP METER
Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440Kc/s-280Mc/s in 6 coils. 500µA Meter. 9V battery operation. Size 180 x 80 x 40mm. £12-50. Post 20p.

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Accurate wide range signal generator covering 120 Kc/s 500 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator, audio output. 220/240V. A.C. Brand new with instructions £15. Carr. 37½p. Size 140 x 215 x 170 mm.

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Sine 18 x 200,000 Hz. Square 18 x 50,000 Hz Output max. +10 dB. (10 K ohms) Operation internal batteries Attractive 2-tone case 7½ x 5" x 2". Price £17-50. Carr. 17½p.

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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 Ω / 100 meg ohms £15-97. Post 15p.

MODEL MG-100 SINE SQUARE WAVE AUDIO GENERATOR
Range 19-220,000Hz Sine Wave 19-100,000 Hz Square Wave. Output Sine or Square wave 10V. P. to P. Size 180 x 90 x 90mm. Operation 220/240V. A.C. £17-50. Post 37p.

CI-5 PULSE OSCILLOSCOPE
For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/ 5mm. 1-25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz. V RMS/mm. 3-25; Preset triggered sweep 1-3,000µsec.; free running 20-200,000Hz in nine ranges. Calibrator pips. 220 x 360 x 430mm. 115-230V. AC operation. £39-00. Carr. paid.

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

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 x 215 x 330 mm. Weight 15½lb. 220/240V. A.C. Supplied brand new with handbook. £40-00. Carr. 50p.

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.

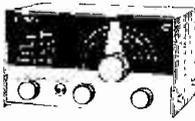
RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPE
5 mc/s Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 5in. x 4in. C.R.T. Calibrated triggered sweep from 2 u/sec. to 100 milli-sec. per cm. Free running time base 50 c/s-1 mc/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with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

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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 0/3/7.5/15/30/75/150/300/750V DC 0/750mV/1.5/3/7.5/15/30/75/150/300/750V AC. Automatic cut out. Supplied complete with test leads, manual and test certificates. £49-00. Post 50p.

G. W. SMITH & CO (RADIO) LTD.
Also see opposite page and next two pages

UNR-30 RECEIVER

4 Bands covering 550Kc/s - 30Mc/s. B.F.O. Built-in Speaker 220/240v A.C. Brand new with instructions. £15-75. Carr. 37½p.



UR-1A SOLID STATE COMMUNICATION RECEIVER

4 Bands covering 550Kc/s-30Mc/s. FET 8 Meter. Variable BFO for SSB, Built-in Speaker, Bandsread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12½" x 4¾" x 7" Brand new with instructions. £25. Carr. 37½p.

SKYWOOD CX203 COMMUNICATION RECEIVER

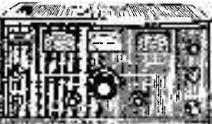


Solid state. Coverage on 5 bands 200-420 KHz and -55 to 30 MHz. Illuminated slide rule dial. Bandsread. Aerial tuning BFO. AVC, ANL, 'S' meter. AM/CW/SSB. Integrated speaker and phone socket. Operation 220/240v AC or 12v DC. Size 325 x 266 x 150 mm. Complete with instructions and circuit. £28-50. Carr. 50p.

LAFAYETTE HA-600 SOLID STATE RECEIVER



General coverage 150-400Kc/s. 550 Kc/s-30Mc/s. FET front end. 2 mech. filters. product detector, variable B.F.O., noise limiter. S. Meter, Bandsread, RF Gain. 15" x 9¾" x 8¾". 18 lbs. 220/240v. A.C. or 12v. D.C. Brand new with instructions. £50. Carr. 50p.



TRIO 9R59DS COMMUNICATION RECEIVER

4 band covering 550Kc/s to 30 Mc/s. continuous and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW. ANL. Variable BFO. S meter. Sep. bandsread dial. IF frequency 455 Kc/s. audio output 1-5w. Variable RF and AF gain controls 115/250v. A.C. Size: 7" x 13" x 10" with instruction manual. £40-50. Carr. Paid.

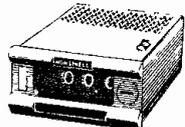


EMI LOUDSPEAKERS

Model 350. 13" x 8" with single tweeter/crossover. 20-20,000 Hz. 15 watt RMS. Available 8 or 15 ohms. £7-25 each P. & P. 37p.
Model 450. 13" x 8" with twin tweeter/crossover. 55-13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. £8-62 each. P. & P. 25p.

HONEYWELL DIGITAL VOLTMETER VT.100

Can be panel or bench mounted. Basic meter measures 1 volt D.C. but can be used to measure a wide range of AC and DC volt. current and ohms with optional plug in cards. Specification: Accuracy: ± 0.2, ± 1 digit. Resolution: 1mV. Number of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1-999). Input impedance: 1000 Meg ohm. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100v. D.C. Input: Fully floating (3 poles). Input power. 110-230v. A.C. 50/60 cycles. Overall size: 5½in. x 2 13/16in. x 8 3/16in. AVAILABLE BRAND NEW AND FULLY GUARANTEED. £35-50. Carr. 50p.



SINCLAIR EQUIPMENT

Project 60 Package offers. 2 x 230 amplifier, stereo 60 pre-amp, P25 power supply. £15-95 Carr. 37½p. Or with P26 power supply £18-00 Carr. 37½p. 2 x 250 amplifier, stereo 60 pre-amp, P28 power supply. £20-25. Carr. 37½p.
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2000 Amp £21-95 Carr. 37½p.; 3000 Amp £28-50 Carr. 37½p.; Neoteric Amp £43-95. Carr. 37½p IC12 £1-80 p. & p. 10p.
NEW PROJECT 605 - £20-97, Carr. 37p.

WHARFEDALE MID-RANGE HI-FI UNITS

As used in world famous system. 5" dia. Impedance 4/8 ohms. High flux ceramic magnet, 20 watts rms. Brand new £1-50. Carr. 37p.

SPECIAL OFFER! GOODMANS AXIOM 301

Hi Fi 12" 20 watt twin cone full range speaker. 30-16,000 Hz. 16,500 gauss. 8 ohm impedance. Brand new and boxed. (List price £21.72) OUR PRICE £12-50 each. Carr. 50p.

EA-41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, guitar, etc., and output into your amplifier. Volume control, depth of reverberation control. Beautiful walnut cabinet. 7¼ x 3 x 4½ in. £5-97. P. & P. 15p.

SPECIAL OFFER! ROTEL RH700 STEREO HEADPHONES

20-20,000Hz. 8-16 ohm. (List £9-95). OUR PRICE £6-75. P. & P. 25p.

SPECIAL OFFER! STEREO SPEAKERS

Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size 14½" x 9" x 7¼". 8 ohms. 8 watt RMS. 16 watt peak. Complete with DIN lead. £12-95 pr. Carr. 50p.

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 60MW. £5-97. P. & P. 15p.

SPECIAL PURCHASE! NEAT G30J STATIC BALANCE PICK-UP ARMS



Identical specification to NEAT G30 arm but with two-tone chrome and black finish. Complete with head shell, pick up rest and plug in phono leads.
BRAND NEW—FULLY GUARANTEED ONLY £8-95. P. & P. 25p.

AKAI BARGAINS

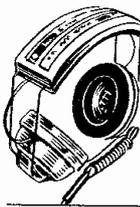
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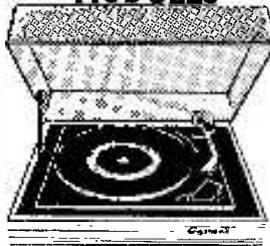
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Low cost high performance stereo headphones. Foam rubber ear cups. Adjustable head-band. 8 ohm impedance 25-18,000 Hz. With lead and stereo jack plug. ONLY £1-97½. P. & P. 12½p.

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Popular range of Garrard decks with Shure cartridge fitted in deluxe plinth with hinged lid.

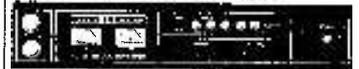
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| SP25 III Module/M75-6 | Our Price £23-50 |
| AP76 Module/M75-6 | £33-80 |
| AP96 Module/M75-6 | £38-75 |
| Zero 100S Module/M98E | £52-60 |
- Carr. 50p extra any item.

HOSIDEN DH-085 DE-LUXE STEREO HEADPHONES



Features unique mechanical 2 way units and fitted adjustable level, controls. 8 ohm impedance 20-20,000cps. Complete with spring lead & stereo jack plug £7-97½. P. & P. 12½p.

DOLBY SYSTEM NOISE REDUCTION UNIT



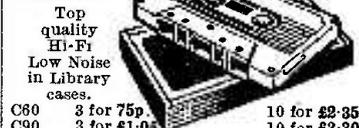
Improves the performance of cassette and semi-professional recorders. Reduces tape hiss by 3dB at 600Hz, 6dB at 1200Hz and 10dB for all frequencies above 3000Hz. Controls for input levels and noise reduction on record and replay. 2 meters for Dolby level. Off tape monitoring. Frequency response: 20Hz to 15k Hz ± 1dB 19kHz - 35dB. Size 15¾" x 9" x 3¼". AC 200/250V. OUR PRICE £32-50 Carr. 50p.

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Top quality Hi-Fi Low Noise in Library cases.
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Tape Head Cleaner 30p each. P. & P. 10p extra.

SPECIAL PURCHASE! LEAK MINI-SANDWICH SPEAKERS

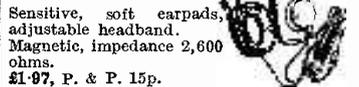
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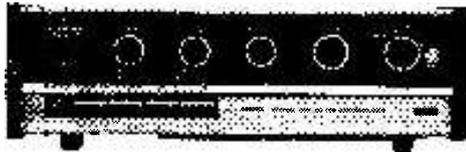


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Also see opposite page and next two pages

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17 + 17 watts rms stereo amplifier with inputs for Magnetic and Crystal phono, Tuner, Tape, Aux and Tape Monitor. Outputs for two pairs of stereo speakers and Tape. Stereo headphone socket. Full range of controls including loudness control, scratch filter, etc. Size 13" x 9 1/2" x 3 1/2". Unrepeatable offer—limited stocks!

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OUR PRICE

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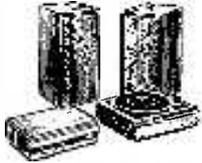
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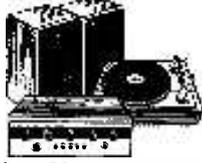
WHARFEDALE LINTON SYSTEM



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OUR PRICE **£105.00** Carr. and Ins. £1.25

LEAK DELTA 30 SYSTEM



Leak Delta 30 stereo amplifier, Goldring GL75, plinth, cover and G800 cartridge. Pair of Leak 150 speakers and all leads.

OUR PRICE **£121.50** Carr. and Ins. £1.50

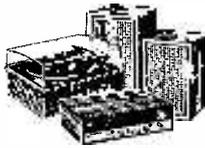
TELETON CRI0T/RG42 SYSTEM



Teleton AM/FM 4 + 4 watt stereo tuner amplifier, Garrard 2025 T/C, plinth and cover, stereo cartridge, pair of matching speakers and all leads.

OUR PRICE **£35.50** Carr. £1.00

TELETON F2300 SYSTEM



Teleton F2300 AM/FM. 7 + 7 watt stereo tuner amplifier, Garrard SP25 III or BSR MP60, plinth and cover, 9TAHCD cartridge, pair of Stereosound Deluxe speakers and all leads.

OUR PRICE **£59.95** Carr. and Ins. £1.50

AMSTRAD 8000 II SYSTEM



Amstrad 8000 II 7 + 7 watt amplifier, Garrard SP25 III or BSR MP60, plinth and cover, Goldring G800 cartridge, pair of Apollo speakers and all leads.

OUR PRICE **£47.25** Carr. £1.00

Amplifier only, £14.50. Carr. 50p.

TELETON SAQ206B SYSTEM

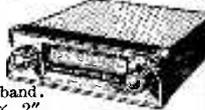


Teleton SAQ306B 8 + 8 watt Amplifier, Garrard SP25 III or BSR MP60, plinth and cover, Goldring G800 cartridge, pair of Apollo speakers and all leads.

OUR PRICE **£54.95** Carr. £1.50

Amplifier only, £22.95. Carr. 50p.

MW/LW CAR RADIO

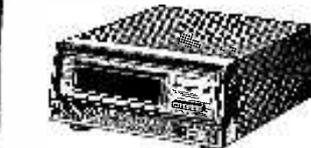


Fully transistorised, dual waveband. Size 6 1/2" x 4 1/2" x 2". 12v. D.C. Neg. or Pos. earth. Complete with fixing kit, speaker and leads. ONLY £7.50. Post 20p.

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Tone, volume and balance controls. Track selector. Complete with matched pair of stereo speakers, connections and fittings. ONLY £18.95. Post 30p.



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Integrated preamps (output 125 mV) to feed into any stereo amplifier. Automatic and manual programme selector. 4 pole synchronous motor. 210/240 V. A.C.

OUR PRICE **£16.25** Carr. 37p

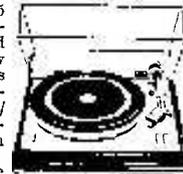
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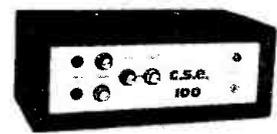
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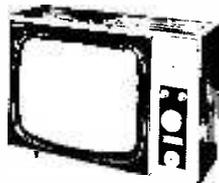
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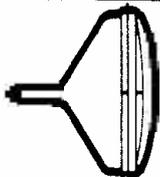
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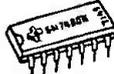
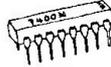
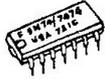
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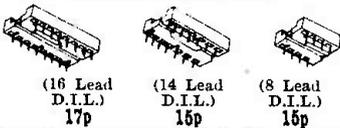
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SN7407	0.30	0.27	0.25	SN7473	0.40	0.37	0.35	SN74167	1.80	1.70	1.50
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SN7409	0.45	0.42	0.38	SN7475	0.65	0.62	0.60	SN74169	2.60	2.40	2.25
SN7410	0.20	0.18	0.16	SN7476	0.45	0.42	0.39	SN74182	3.40	3.25	2.70
SN7411	0.23	0.22	0.20	SN7480	0.80	0.75	0.67	SN74183	3.40	3.25	2.70
SN7412	0.42	0.40	0.36	SN7481	1.25	1.15	1.10	SN74184	2.75	2.30	2.10
SN7413	0.30	0.27	0.25	SN7482	0.87	0.80	0.70	SN74185	4.00	3.50	3.00
SN7416	0.30	0.27	0.25	SN7483	1.00	0.90	0.86	SN74186	4.00	3.50	3.00
SN7417	0.30	0.27	0.25	SN7484	0.90	0.85	0.80	SN74187	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	1.50
SN7423	0.48	0.44	0.40	SN7491AN	1.00	0.95	0.90	SN74175	1.35	1.27	1.15
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SN7438	0.85	0.80	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	1.85	1.85	1.75
SN7441AN	0.75	0.72	0.70	SN74107	0.50	0.45	0.40	SN74192	2.00	1.80	1.80
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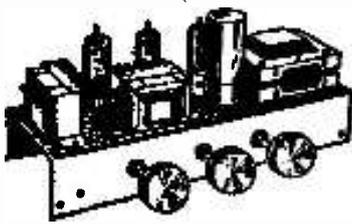


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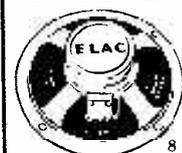
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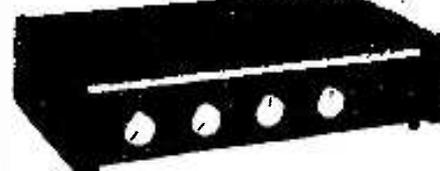
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Fully detailed 7 page construction manual and parts list free with kit or send 15p plus large S.A.E.

AMPLIFIER KIT ... £10.50 P. & P. 15p
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(Post Free if all units purchased at same time)
Full after sales service

Also available ready built and tested £21.00. Post Free.
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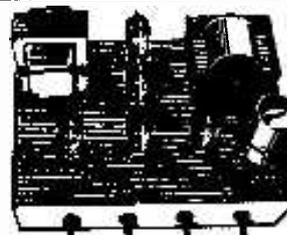
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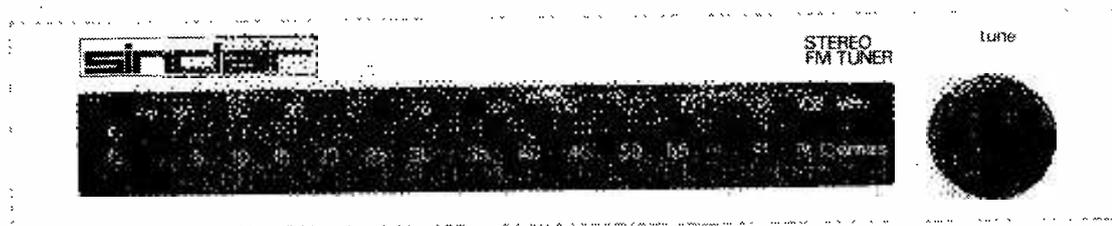
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Sinclair Project 60

Project 60 Stereo FM Tuner



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with phase lock-loop principle

Amongst the many advanced electronic features to be found in this remarkable stereo tuner, use of the phase lock loop principle ensures standards of audio quality better than from any other method of detection yet used. Varicap diode tuning, accurately formed printed circuit coils, an I.C. in the special stereo decoder section and switchable squelch circuit for silent tuning between stations contribute to the unsurpassed performance of this tuner, irrespective of price consideration. But the Project 60 FM Stereo Tuner is far from expensive – indeed, it offers fantastic value for money and will bring the thrill of stereo radio to many who previously may not have been able to afford it. The tuner may be used with any good system as well as Project 60, but if you use it with other Project 60 modules, you will find the matching front panels particularly impressive in appearance as well as function.

SPECIFICATIONS

Number of transistors: 16 plus 20 in I.C.
Tuning range: 87.5 to 108MHz.
Sensitivity: 7µV for lock-in over full deviation.
Squelch level: typically 20µV.
Signal to noise ratio: - 65dB.
Audio frequency response: 10Hz–15Khz (- 1dB).
Total harmonic distortion: 0.15% for 30% modulation.
Stereo decoder operating level: 2µV.
Cross talk: 40dB
Output voltage: 2 150mV R.M.S. max. (typically 2 50mV, stereo)
Operating voltage: 25–30V DC at 100mA.
Indicators: Stereo on + tuning
Size: 93 · 40 · 207mm.

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 tran-

sistor circuit contained within a 16 lead DIL package, and the finned heat sink is sufficient for all requirements. The Super IC.12 is compatible with Project 60 modules which would be used with the Z.50 and Z.30 amplifiers. Complete with free manual and printed circuit board.

SPECIFICATIONS

Output power: 6 watts RMS continuous (12 watts peak), 6–8Ω. **Frequency Response:** 5Hz to 100KHz - 1dB. **Total Harmonic Distortion:** Less than 1%. (Typical 0.1%) at all output powers and frequencies in the audio band (28V). **Load Impedance:** 3 to 15 ohms. **Input Impedance:** 250 Kohms nominal. **Power Gain:** 90dB (1,000,000,000 times) after feedback. **Supply Voltage:** 6 to 28V. **Quiescent current:** 8mA at 28V. **Size:** 22 · 45 · 28mm including pins and heat sink.

Manual available separately 15p post free.

With FREE printed circuit board and 40 page manual.

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Project 605



The easy way to buy and build Project 60

Project 605 is one pack containing: one P25, two Z30's, one Stereo 60 and one Masterlink. This new module contains all the input sockets and output components needed together with all necessary leads cut to length and fitted with neat little clips to plug straight on to the modules. Thus all soldering and hunting for the odd part is eliminated. You will be able to add further Project 60 modules as they become available adapted to the Project 605 method of connecting.

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Z.30 & Z.50 power amplifiers

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The Z.30 and Z.50 are of advanced design using silicon epitaxial planar transistors to provide unsurpassed standards of performance. Total harmonic distortion is an incredibly low 0.02% at 15w (8Ω) and all lower outputs. Whether you use Z.30 or Z.50 amplifiers in your Project 60 system will depend on personal preference, but they are the same size and are intended for use principally with other units in the Project 60 range. Their performance and design are such, however, that Z.50s and Z.30 may be used in a far wider range of applications.

SPECIFICATIONS (Z.50 units are interchangeable with Z.30s in all applications).— Power Outputs:
Z.30 15 watts R.M.S. into 8 ohms using 35 volts · 20 watts R.M.S. into 3 ohms using 30 volts
Z.50 40 watts R.M.S. into 3 ohms using 40 volts · 30 watts R.M.S. into 8 ohms using 50 volts.
Frequency response: 30 to 300,000Hz : 1dB. **Distortion:** 0.02% into 8 ohms. **Signal to noise ratio:** better than 70dB unweighted. **Input sensitivity:** 250mV into 100 Kohms (for 15w into 8Ω). For speakers from 3 to 15 ohms impedance. **Size:** 14 x 80 x 57mm

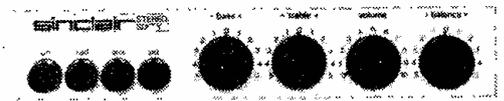


Stereo 60 Pre-amp/control unit

Built, tested and guaranteed. **£9.98**

Designed specifically for use on Project 60 systems, the Stereo 60 is equally suitable for use with any high quality power amplifier. Since silicon epitaxial planar transistors are used throughout, a really high signal-to-noise ratio and excellent tracking between channels is achieved. Input selection is by means of press buttons, with accurate equalisation on all input channels. The Stereo 60 is particularly easy to mount.

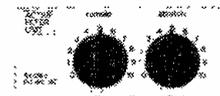
SPECIFICATIONS—Input sensitivities: Radio — up to 3mV. Mag. p.u. 3mV. correct to R.I.A.A. curve
 — 1dB: 20 to 25,000 Hz. Ceramic p.u. — up to 3mV · Aux — up to 3mV. **Output:** 250mV. **Signal to noise ratio:**
 better than 70dB. **Channel matching:** within 1dB. **Tone controls:** TREBLE—12 to —12dB at 10KHz · BASS
 · 12 to —12dB at 100Hz. **Front panel:** brushed aluminium with black knobs and controls. **Size:** 66 x 40 x 207mm.



A.F.U. High & Low Pass Filter Unit

Built, tested and guaranteed **£5.98**

For use between Stereo 60 unit and two Z.30s or Z.50s. The unit is very easily mounted and is unique in that the cut-off frequencies are continuously variable. As attenuation in the rejected band is rapid (12dB/octave), there is less loss of the wanted signal than has previously been possible. Amplitude and phase distortion are negligible. The A.F.U. is suitable for use with any other amplifier system. There are two filter sections — rumble (high pass) and scratch (low pass). H.F. cut-off (—3dB) variable from 28KHz to 5KHz. L.F. cut-off (—3dB) variable from 25Hz to 100Hz. Distortion at 1KHz (35V. supply) 0.02% at rated output. Operating voltage from 15 to 35V. Current 3mA. **Size:** 66 x 40 x 90mm.



Power Supply Units

Designed specifically for use with the Project 60 system of your choice. Use PZ.5 for normal Z.30 assemblies and PZ.6 or PZ.8 where a stabilised supply is essential.

PZ.5 30 volts un stabilised £4.98
PZ.6 35 volts stabilised £7.98
PZ.8 45 volts stabilised
 (less mains transformer) **£7.98**
PZ.8 mains transformer £5.98



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 deluxe stereo amplifier. (60W. RMS into 8 ohms)	2 x Z.50s, Stereo 60; PZ.8, mains transformer	As above	£34.88
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F.M. Stereo Tuner (£25) & A.F.U. (£5.98) may be added as required.

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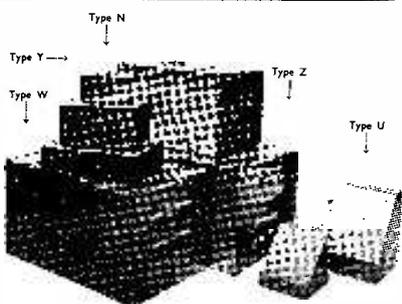
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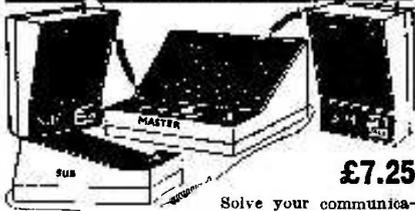
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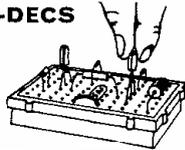
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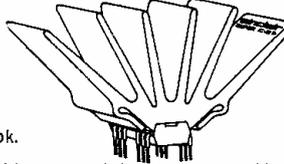
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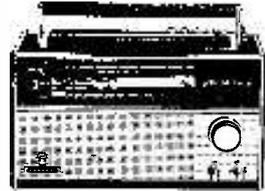
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0A2	0.40	6AR5	0.55	6F1	0.75	6X8	0.85
0A3	0.48	6AR6	0.85	6F5	0.75	6Y6G	0.80
0B2	0.40	6AR11	1.25	6FR6G	0.45	7Y4	0.75
0B3	0.70	6AS5	0.50	6F11	0.50	9BW6	0.70
0C3	0.40	6AS7G	0.85	6F13	0.50	10C2	0.60
0D3	0.40	6AT6	0.38	6F14	0.70	10D1	0.65
1B3GT	0.45	6AU6	0.30	6F15	0.65	10D2	0.55
1L4	0.25	6AV6	0.40	6F18	0.50	10F1	0.75
1R4	0.50	6AW8A	0.65	6F23	0.90	10F9	0.65
1R5	0.45	6BA6	0.28	6F24	0.80	10F18	0.60
1R4	0.30	6BE6	0.32	6F25	1.00	10L1	0.60
1R5	0.30	6BF6	0.55	6F26	0.85	10LD11	0.70
1T4	0.30	6BH6	0.78	6F28	0.70	10L13	0.75
1U4	0.40	6BJ6	0.55	6GK6	0.60	12AB5	0.70
1U5	0.75	6BK7A	0.75	6J4	0.80	12AC6	0.60
1V2	0.55	6BN5	0.43	6J5GT	0.40	12AD6	0.60
1X2B	0.55	6BN6	0.60	6J6	0.30	12AE6	0.60
2CW4	0.75	6BQ5	0.25	6J7	0.45	12AL5	0.55
2D21	0.40	6BR8	0.75	6K4I7	0.60	12AQ5	0.60
3A4	0.45	6BR7	1.35	6K6GT	0.75	12AT6	0.40
3A5	0.75	6BW6	0.90	6K7	0.43	12AT7	0.40
3BP1	3.50	6BW7	0.90	6K8G	0.45	12AU6	0.45
3S4	0.40	6BX6	0.25	6K25	0.75	12AU7	0.33
3V4	0.65	6BZ6	0.45	6L6GT	0.55	12AV6	0.45
6H4GY	0.75	6C4	0.35	6L7	0.45	12AV7	0.70
6U4G	0.40	6C5GT	0.55	6L18	0.50	12AX7	0.33
6V4G	0.60	6CB6	0.40	6LD20	0.50	12AY7	0.75
6Y3GT	0.45	6CD6GA		6N7GT	0.55	12B4A	0.65
6Z3	0.75		1.30	6P25	1.50	12BA6	0.45
5Z4G	0.45	6CG7	0.60	6P28	0.85	12BA7	0.50
6/30L2	0.90	6CH6	0.60	6Q7	0.50	12BE6	0.50
6AB4	0.45	6CL6	0.60	6R7A	0.45	12BH7	0.50
6AF4A	0.60	6CU6	0.80	6S7	0.45	12BY7	0.65
6AG5	0.25	6CW4	0.70	6K7	0.50	12K5	1.00
6AG7	0.45	6CY6	0.50	6SL7GT	0.45	12K7GT	0.50
6AH6	0.80	6CY7	0.75	6SN7GT	0.45	12Q7GT	0.45
6AJ8	0.30	6D3	0.55	6S7	0.50	12SR7	0.50
6AK5	0.40	6DC6	0.80	6SR7	0.50	20D1	0.80
6AK6	0.80	6DK6	0.60	6T8	0.38	20L1	1.10
6AL3	0.43	6DQ6B	0.75	6U4GT	0.70	20P1	0.50
6AL5	0.22	6DS4	1.25	6U5G	0.75	20P4	1.10
6AM5	0.40	6EA8	0.65	6R8A	0.48	20P5	1.20
6AM6	0.37	6EH7	0.30	6V8GT	0.45	26C5	0.60
6AQ5	0.42	6EJ7	0.35	6X4	0.40	25L6GT	0.50
6AQ6	0.70	6EW6	0.70	6X5GT	0.45	25Z4G	0.35

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30FL1	0.80	90CV	2.40	E180F	1.00	ECF80A1	0.85
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30P19	0.95	6146B	2.50	EBF90	0.40	ECL82	0.35
30PL1	0.95	6560	1.25	EBF83	0.40	ECL83	0.70
30PL13	1.10	6939	2.25	EBF89	0.32	ECL84	0.55
30PL14	1.25	7199	0.85	EBL31	1.50	ECL85	0.55
35A3	0.80	7360	2.20	EC53	0.50	ECL86	0.40
35A5	0.75	7588	1.50	EC86	0.60	ECL800	
35B5	0.65	7895	1.50	EC88	0.60		2-20
35C5	0.80	A2293	2-20	EC90	0.35	EF37A	1.00
35D5	0.75	AZ1	0.60	EC92	0.45	EF40	0.50
35L6GT	0.75	AZ1	0.55	EC93	0.60	EF41	0.85
35W4	0.40	CB1	0.90	ECC35	1.00	EF42	0.70
35Z3	0.75	CB131	1.00	ECG40	0.70	EF80	0.30
35Z4G	0.40	CY31	0.50	ECC81	0.40	EF85	0.35
36Z5GT	0.70	DAF96	0.50	ECC82	0.32	EF86	0.30
50A5	0.80	DF95	0.50	ECC83	0.32	EF89	0.32
50B5	0.70	DK92	0.70	ECC84	0.30	EP91	0.37
50C5	0.60						
50C6G	1.20						
50EH5	0.65						
59L6GT	0.80						
59A2	0.55						
90A9	2.40						
90AV	2.50						
90C1	2.75						
90CV	2.40						
807	0.50						
813	4.00						
866A	0.85						
8642	0.70						
8080	1.75						
6146	1.80						
6146B	2.50						
6560	1.25						
6939	2.25						
7199	0.85						
7360	2.20						
7588	1.50						
7895	1.50						
A2293	2-20						
AZ1	0.60						
AZ1	0.55						
CB1	0.90						
CB131	1.00						
CY31	0.50						
DAF96	0.50						
DF95	0.50						
DK92	0.70						
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PCF80	0.30						
PCF82	0.35						
PCF84	0.60						
PCF86	0.60						
PCF87	1.10						
PCF801	0.50						
PCF802	0.50						
PCF805	0.90						
PCF806	0.75						
PCF808	0.90						
PCH200	0.70						
PCL81	0.50						
PCL82	0.35						
PCL83	0.65						
PCL84	0.45						
PCL86	0.45						
PCL88	1.25						
PCL800	1.10						
PCL801	0.95						
PCL805	0.50						
PD500	1.30						
PF86	0.70						
PF818	1.00						
PFL200	0.65						
PL36	0.40						
PL36	0.55						
PL81	0.50						
PL82	0.45						
PL83	0.45						
PL84	0.40						
PL302	0.95						
PL504	0.75						
PL508	0.90						
PL509	1.10						
PL801	1.00						
PL802	0.95						
PM84	0.60						
PM84	0.33						
PY33	0.65						
PY80	0.40						
PY81	0.30						
PY82	0.35						
PY83	0.38						
PY88	0.40						
PY800	0.47						
PY801	0.50						
PZ30	0.68						
QV02-6							
QV03-10							
QV03-20							
QV03-30							
QV03-40							
QV03-50							
QV03-60							
QV03-70							
QV03-80							
QV03-90							
QV03-100							
QV03-110							
QV03-120							
QV03-130							
QV03-140							
QV03-150							
QV03-160							
QV03-170							
QV03-180							
QV03-190							
QV03-200							
QV03-210							
QV03-220							
QV03-230							
QV03-240							
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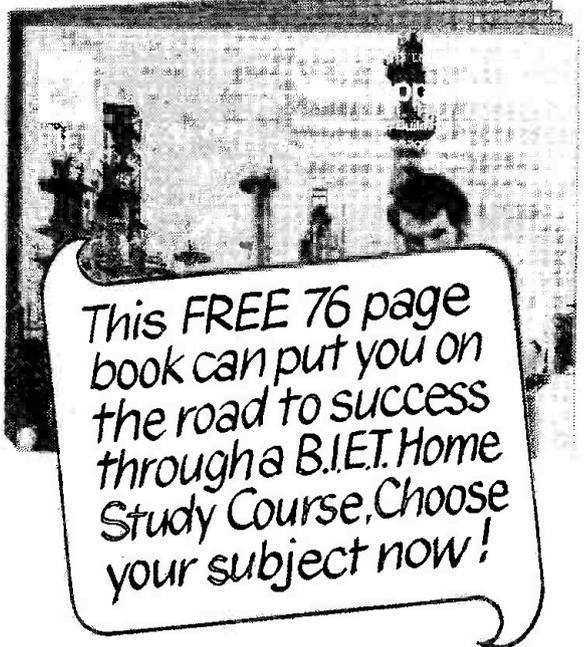
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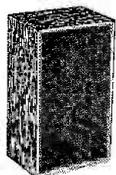
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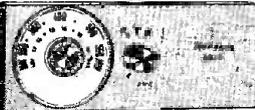


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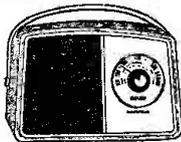
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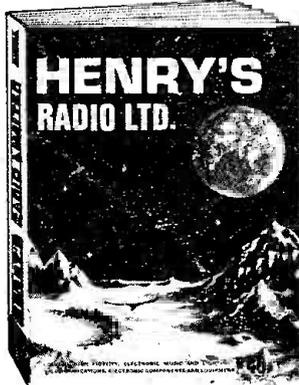
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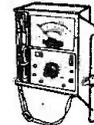
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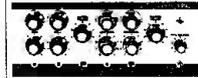
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