

PRACTICAL WIRELESS

MARCH 1973

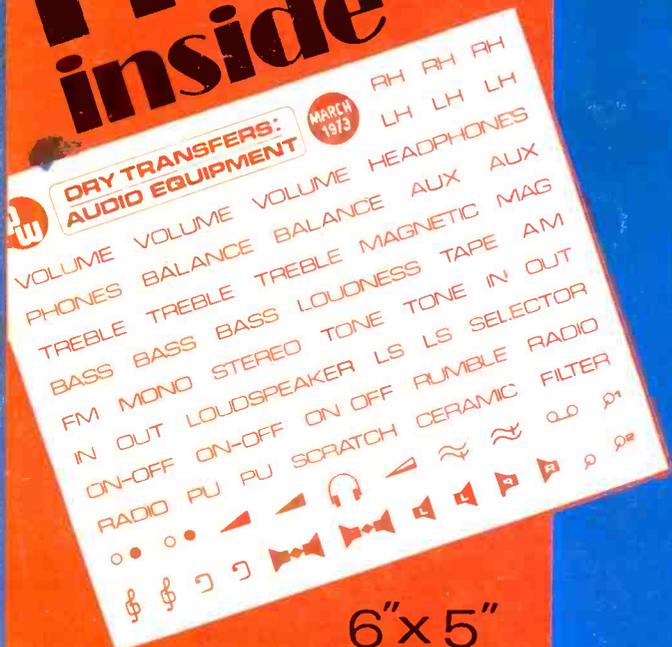
20p

FREE inside

FREE TRANSFERS: AUDIO EQUIPMENT MARCH 1973

RH RH RH
LH LH LH

VOLUME VOLUME VOLUME HEADPHONES
PHONES BALANCE BALANCE AUX AUX
TREBLE TREBLE TREBLE MAGNETIC MAG
BASS BASS BASS LOUDNESS TAPE AM
FM MONO STEREO TONE IN OUT
IN OUT LOUDSPEAKER LS LS SELECTOR
ON-OFF ON-OFF ON OFF RUMBLE RADIO
RADIO PU PU SCRATCH CERAMIC FILTER

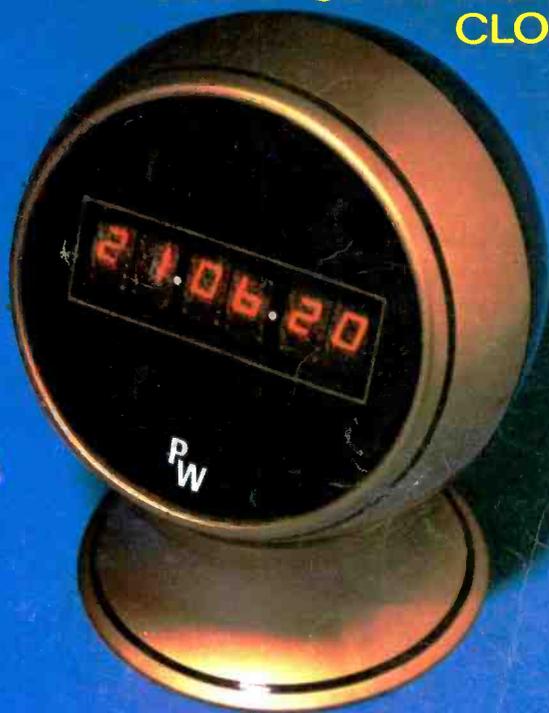


6" x 5"

TRANSFER SHEET

THE 'digitronic'

SOLID-STATE DIGITAL CLOCK



ELECTRONIC MAZE



PACKAGE PRICE R.S.C. STEREO PACKAGE OFFERS

FOR ILLUSTRATED UNITS

ONLY £39.59

Carr. £1.00
Or deposit £8.95
and 9 monthly
payments £4.22
(Total £44.93)



GARRARD 2025

R.S.C. A55
LOUDSPEAKERS



LINEAR 505 AMP



Individual Rec. Retail Prices:
LINEAR 505 6 + 8 Watt Amplifier £17.60
GARRARD 2025 Autochanger + KR40A Cartridge £13.58
Teak Veneer Plinth with Transparent Plastic Cover £8.10
Pair A55 LOUDSPEAKERS (Inc 8" x 8" 10,000 Gauss) £11.50
TOTAL £48.88

SEND S.A.E. FOR
FREE COLOUR
BROCHURE

SAVE £31.60

MONARCH
SPEAKERS

GOLDRING
GL72



'SUPER 30' AMP

HIGH FIDELITY UNITS

PACKAGE PRICE **£99.95** Carr. £1.76

FOR ILLUSTRATED UNITS

Or deposit £18.00 and
12 monthly payments £8.00
(Total £111.00)
Individual Rec. Retail Prices:
GOLDRING GL72
Transcription
Turntable + P.U. £81.89
GOLDRING G800
Magnetic Cartridge £12.21
DE-LUXE PLINTH
with Roll-over Cover £10.60
Pair R.S.C. MONARCH
LOUDSPEAKERS £88.70
R.S.C. SUPER 30
Mk III AMPLIFIER £88.76
TOTAL £181.55

FANE 'MODE ONE' HIGH FIDELITY SPEAKER KIT



Incorporating a model 803 8" 13,000 Gauss Bass Speaker with ultra low resonance. P.V.C. surround cone. Printed circuit cross-over assembly with ferrite cored coils. Model 303 Pressure Tweeter, Acoustic damping material, Screws, Panels etc., and instructive diagrams, Frequency **£9.95** post free
Impedance 8-15 ohms. Or Dep. £2.25 and 9 monthly payments, £1 (Tot. £11.25)

RSC G66 Mk II 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 1 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 **£14.99** or dep. £2.20 and 9 monthly payments £1.70 (Total £17.60).

AUDIOTRINE HIGH FIDELITY SPEAKERS

Heavy construction. Latest high efficiency ceramic magnets. Plasticised Cone surround. "D" indicates Tweeter Cone providing extended frequency range up to 16,000 c.p.s. Impedance 3 or 8-15 ohms. PLEASE STATE CHOICE.



Exceptional performance at low cost.
HF808T 8" 10W £2.88 HF120D 12" 15W £4.99
HF102D 10" 10W £8.40 HF128 12" 15W £5.75
HF120 12" 15W £4.60 HF128 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 note response. Frequency range 25 Hz to 15 KHz. Gauss 10,000. Impedance 3 or 8-15 Ω. **£3.85**
PLEASE STATE IMPEDANCE WHEN ORDERING
MODEL 803T 8" 15W with parasitic Tweeter. **£4.95**
Response 25 Hz to 15 KHz. Gauss 13,000 Imp 3 or 8-15.



R.S.C. BATTERY/MAINS CONVERSION UNITS



TYPE BMI. An all-dry battery eliminator. Size 5 1/4 x 4 1/2 x 2in. approx. Completely replaces batteries supplying 1.5v and 90v. to battery radio where A.C. mains 200/250v. 60c/s is available. COMPLETE KIT WITH DIAGRAM **£3.25** ASSEMBLED READY FOR USE **£3.75**

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

MIDGET CLAMPED TYPE 2 1/2 x 2 1/2 x 2 1/2 in.
250v. 60mA. 6.3v. 2a. 99p
250-0-250v. 60mA 6.3v. 2a. 91.05

FULLY SHROUDED UPRIGHT MOUNTING
250-0-250v. 60mA. 6.3v. 2a., 0-5-6.3v. 2a. £1.40
250-0-250v. 100mA. 6.3v. 4a., 0-5-6.3v. 3a. £2.20
300-0-300v. 100mA. 6.3v. 4a., 0-5-6.3v. 3a. £2.20
300-0-300v. 130mA. 6.3v. 4a. c.t., 6.3v. 1a. £2.20
For Mullard 610 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-THERO TYPE
250-0-250v. 70mA. 6.3v. 2a., 0-5-6.3v. 2a. £1.85
250-0-250v. 100mA. 6.3v. 3a., 0-5-6.3v. 2a. £1.85
250-0-250v. 100mA. 6.3v. 2a., 6.3v. 1a. £1.80
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 610 Amplifier. £2.60
350-0-350v. 100mA. 6.3v. 4a., 0-5-6.3v. 3a. £2.90
350-0-350v. 160mA. 6.3v. 4a., 0-5-6.3v. 3a. £2.80

FILAMENT or TRANSISTOR POWER PACK
Types 6.3v. 1.5a. 49p; 6.3v. 2a. 54p; 6.3v. 3a. 76p;
350-0-350v. 100mA. 6.3v. 4a., 0-5-6.3v. 3a. £2.90
6.3v. 6a. £1.80; 12v. 1a. 56p; 12v. 3a. or 24v. 1.5a. £1.35; 9-18v. 1 1/2a. £1.10; 0-12-25-42v. 2a. £1.78.

CHARGER TRANSFORMERS 0-9-15v. 1 1/2a. 99p
2 1/2a. £1.10; 3a. £1.25; 6a. £1.45; 6a. £1.65; 8a. £2.00
AUTO (Step UP/step DOWN) TRANSFORMERS
0-110/120v. 200-250-250v. 60-80 watts £1.10.
150 watts, £1.90; 250 watts £2.75; 500 watts £5.75

OUTPUT TRANSFORMERS
Standard Pentode 6,000 Ω or 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
Push-Pull Ultra Linear for Mullard 510, etc. £2.20
Push-Pull 15-18 watts, sectionally wound 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 1/2v. D.C. output. Max. A.C. input 18v.
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.

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.
Dual Cone speaker. Imp. 3 or 15 ohms.
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. **£19.35** Carr. 60p

HI-FI SPEAKER ENCLOSURES MODERN DESIGN

Teak veneer finish. Acoustically lined. Sizes approx. Carr. 35p. per enc.
JEB Size 16 x 11 x 9in. **SE8** For optimum performance with any 8in. Hi-Fi spkr. Size 22 **£6.47** x 15 x 9in.
SE12 For excellent performance with 12in. Hi-Fi speaker and tweeter. Size 24 x 15 x 10in. **£7.87**
x 10in. P.t'd.

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 **£6.95** Carr. 35p
HF126 15,000 LINE SPEAKER

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

200-250v. AC mains operated. Frequency Response 30-20,000 c.p.s. ±2dB. Harmonic Distortion 0.2% at 1,000 c.p.s. Separate Bass and Treble 'lift and cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3-15 ohm spkrs. Max. sensitivity 5mV Output rating 1 I.H.F.M. Fully enclosed enamelled case. 9 1/2 x 2 1/2 x 5 1/2 in. Attractive brushed silver finish fascia plate 10 1/2 x 3 1/2 in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£7.75** Carr. 40p.
OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE **£10.95**

NOW IN STOCK! FANE 'CRESCENDO' SUPER EFFICIENT GROUP/DISCO LOUDSPEAKERS

Send S.A.E. for leaflet on this range of extraordinarily efficient units including the very latest BASS CRESCENDO '12' 100 Watts. FULL DISCOUNT to Genuine Trade Customers. CARR. FREE.

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

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

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

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

R.S.C. STEREO FM TUNER.
Visually matches Super 30 Mk. III **£44.95**



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

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

FACTORY BUILT UNIT INC. CABINET with 12 months' guarantee. Or Dep. £7 and 9 monthly payments £3.99 (Total £42.91). **£38.75**

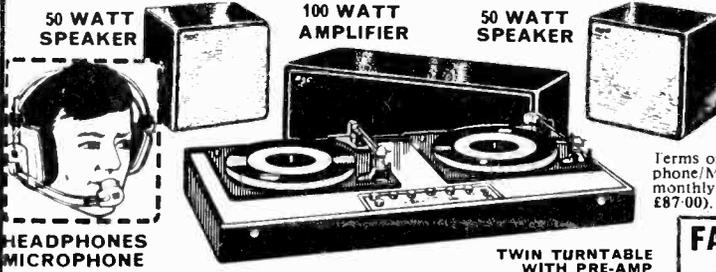
'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

★ Moderate size only 25 x 14 x 10in. approx.
★ Response 30-20,000 c.p.s. Impedance 15 ohms **£23**
★ Performance comparable with units costing considerably more Carr. 65p

Consists of (1) 12in. 15 watt Bass unit with cast chassis, Roll rubber cone surround for ultra low resonance, and ceramic magnet.
(2) 3-way quarter section series cross-over system.
(3) 8 x 5in. high flux middle range speaker.
(4) High efficiency tweeter. (5) Appropriate quantity acoustic damping material. (6) Handsome Teak veneered cabinet.
(7) Circuit and full instructions. Terms: Dep. £4.60 and 9 monthly payments £2.47 (Total £26.83).



GROUP/DISCO UNITS



HEADPHONES
MICROPHONE

TWIN TURNTABLE
WITH PRE-AMP

R.S.C. COLUMN SPEAKERS

IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

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

TYPE C312 30-40 WATTS Fitted two exceptionally efficient, low feedback howl char- acteristic high flux 13" x 8" 30 watt speakers. Terms: Dep. £3 and 9 m'thly payments £2.22 (Total £22.98) Carr. 50p.

TYPE C412S 50 WATTS Fitted four 12" 11,000 line 15 watt speakers. Overall size approx. 56 x 14 x 8in. Terms: Dep. £4 and 9 monthly pay- ments £3.37 (Total £34.33) Carr. 75p. £31

TYPE C4100 100 WATTS Inc. four 12" 50 watt speakers for conserva- tive rating. Extra heavy construction. Size approx. 58 x 15 x 10". Acoustically filled and pressurised. Terms: Dep. £11 and 12 m'thly. pmts. £5.18 (Total £73.16). Carr. £1 £65

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, EL54, GZ34. Separate Bass and Treble Controls. Sensitivity 36 millivolts. For High Impedance micro- phones. For Clubs, Schools, Theatres, Dance Halls, Outdoor Func- tions, etc. For Electronic Organ, Guitar, String Bass, etc. Gram, and Pick-up etc. for mixing purposes, 200-250v. 50 c/s A.C. mains. For 3 and 15 ohm speakers. Twin-handled perforated cover £1.90. 12 MONTHS' GUARANTEE. Carr. 60p

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 accident al shorts. Output for Speaker's 3 to 30 ohms. Size 17" x 7" x 7 3/4". 200-250v. A.C. mains. Output 50 watts music rating. Or deposit £7.25 & 9 monthly pay- ments £3.56. Total £38.20.

£34.95 Carr. 75p.



RSC PHANTOM '50'

Combined 50w Amplifier and 12in. Loud- speaker. For Lead Guitar, mtc., Gram, Radio, Tape (Not for use with Bass instruments). Inc. 3 inputs and 2 vol. controls plus Treble, Bass and Presence. Output Jack for additional 15 ohm Speaker. Attractively finished in black with silver-finished fascia and trimmings. Compact size. Fitted carrying handle. Terms: Deposit £8.95 and 9 monthly payments £8 (Total £82.95). Carr. £1.50

£55.95

RSC BASS-REGENT 50 WATT AMPLIFIER

A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape. Peak Output rating. Loudspeaker unit either horizontal or vertical mounting.
* Two extra heavy duty 12in. 50w Loudspeakers.
* Four Jack inputs and two Volume Controls for instant use of up to four pick-ups or "mikes". Bass and Treble controls. Send S.A.E. for leaflet.
Credit Terms: Deposit £15 & 9 monthly payments of £8.25. (Total £71.25). Carr. £2

£65



RSC GP30 HI-FI AMPLIFIER

For Guitar, Vocal or Instrumental Group
A 4 input, 2 vol. control Hi-Fi 30 watt unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/silver P.V.C. fascia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Terms: Deposit £4.40 and 9 monthly payments of £2.45 (Total £26.45).

£23.50 Carr. 65p



NOW FOUR NEW BRANCHES

NOTTINGHAM 19/19A MARKET STREET
SUNDERLAND 5 MARKET SQUARE
STOCKPORT 8 LITTLE UNDERBANK
COVENTRY 17 SHELTON SQUARE
NEW LARGER PREMISES AT HULL, DARLINGTON & NEWCASTLE See Addresses



HI-FI CENTRES LTD.
MAIL ORDERS & EXPORT ENQUIRIES TO:—
AUDIO HOUSE, HENCONNER LANE, LEEDS, 13. Tel: Pudsey (09735) 77831.
TERMS C.W.O. or C.O.D. No C.O.D. under £1. POSTAGE 25p EXTRA UNDER £2. 30p EXTRA OVER £2 OR AS QUOTED. TRADE SUPPLIED. S.A.E. PLEASE WITH ENQUIRIES.
SUPPLIERS TO GOVT. DEPTS. H.M. FORCES. EDUCATION AUTHORITIES & HOSPITALS. Etc.
MAIL ORDERS MUST NOT BE SENT TO SHOPS

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"
(a)(b)(c)&(d) £72.85 Carr. £1.25

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. £13.25 and 9 m'thly pmts £8.88 (Total £75.17) or Dep. £15 and 18 m'thly payments £3.62 (Total £80.16).

£67.10

FANE ULTRA HIGH POWER LOUDSPEAKERS

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

| 'POP' 100 | 'POP' 60 | 'POP' 50 |
|--|---|--|
| 18" 100 Watt 14,000 gauss 8/15Ω | 15" 60 Watt 14,000 gauss 8/15Ω | 12" 50 Watt 13,000 gauss 15Ω |
| £22.95 | £12.90 | £10.90 |
| Dep. £6 and 9 m'thly payments £2.20 (Total £25.80) | Dep. £3.30 and 9 m'thly payments £1.30 (Total £15). | Dep. £2 and 9 m'thly payments £1.20 (Total £12.90) |

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 m'thly payments 75p (Total £8.00).

GROUP/DISCO EQUIPMENT PACKAGE OFFERS

| | | | |
|--|--------|---------------|--------------------|
| F.A.L. PHASE 50 MK.III AMPLIFIER | £34.95 | PACKAGE PRICE | £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) | | £48.45 | £45 carr. £1 |
| F.A.L. PHASE 50 MK.III AMPLIFIER | £34.95 | PACKAGE PRICE | £34.95 |
| PR. FANE POP 50 L/SPEAKERS | £21.80 | | |
| Terms: Deposit £10 and 9 monthly payments of £5.37 (Total £58.33) | | £56.75 | £52 carr. £1 |
| F.A.L. PHASE 50 MK.III AMPLIFIER | £34.95 | PACKAGE PRICE | £34.95 |
| PAIR L12/25 25W L/S in cabinets | £23.90 | | |
| Terms: Deposit £10 and 9 monthly payments of £5.98 (Total £62.92) | | £58.85 | £56 carr. £1.25 |
| LINEAR T40/60D AMPLIFIER | £49.50 | PACKAGE PRICE | £49.50 |
| PAIR L12/20 L/S in cabinets | £23.90 | | |
| Terms: Deposit £9.95 and 9 monthly payments of £7.67 (Total £78.98) | | £73.40 | £69.95 carr. £1.50 |
| F.A.L. PHASE 100 AMPLIFIER | £41.95 | PACKAGE PRICE | £41.95 |
| 4 FANE POP 50 L/SPEAKERS | £43.80 | | |
| Terms: Deposit £15.95 and 9 monthly payments of £10.73 (Total £112.52) | | £106.55 | £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
Or deposit £5.50 and 9 monthly pmts. of £3.70. Total £38.80

L12/20 12" 20-25 WATT L13 13" x 8" 10 WATT
13,000 lines 10,000 lines 3 or 15 15 ohms. State imped- ance required. Carr 40p

£34.50
£11.95

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

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

BRADFORD 10 North Parade (Closed Wed.). Tel. 25349
BLACKPOOL (Agent) O & C Electronics 227 Church Street
BIRMINGHAM 30/31 Great Western Arcade. Tel. 021-236 1279 (Closed Wed.).
COVENTRY 17 Shelton Square
DERBY 25 Osmaston Rd., The Spot (Closed Wed.). Tel. 41361
DARLINGTON 19 Northgate (Closed Wed) Tel 68043
EDINBURGH 101 Lothian Rd. (Closed Wed.). Tel. 229 9501
GLASGOW 326 Argyle St. (Closed Tues.). Tel. 248 4158
HULL 7 Whitefriargate Tel. 20505
LEICESTER 32 High Street (Closed Thurs.). Tel. 56420
LEEDS 5-7 County (Mecca) Arcade, Briggate (Closed Wed.). Tel. 28252
LIVERPOOL 73 Dale St. (Closed Wed.). Tel. 236 3573
LONDON 238 Edgware Road, W.2. (Closed Thurs.). Tel. 723 1629
MANCHESTER 60A Oldham Street, (Closed Wed.). Tel. 236 2778
MIDDLESBROUGH 106 Newport Rd. (Closed Wed.). Tel. 47096
NEWCASTLE UPON TYNE 24 Newgate Shopping Centre (Closed Wed.) Tel. 21469
NOTTINGHAM 19/19A Market Street (Closed Thurs.). Tel: 48068
SHEFFIELD 13 Exchange Street (Castle Marke' Blds. (Closed Thurs.). Tel. 20716
STOCKPORT 8 Little Underbank. Tel. 480-0777.
SUNDERLAND 5 Market Sq. (Closed Wed.) Tel. 70573

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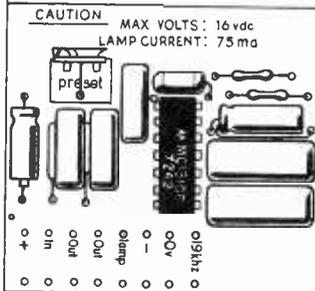
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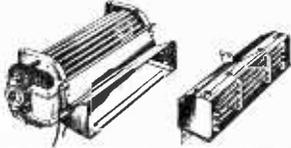
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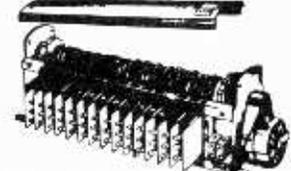
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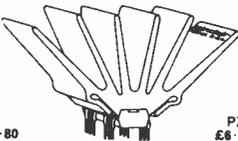
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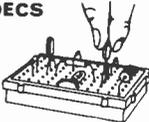
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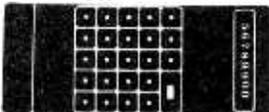
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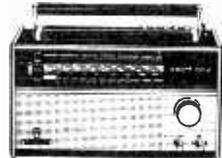
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| AC107 | 0-20 | AD162 | 0-35 | BC148 | 0-10 | BD137 | 0-45 | BF188 | 0-40 | CC19 | 0-35 | 2G371 | 0-16 | 2N2219 | 0-20 | 2N3054 | 0-46 | 2N4059 | 0-10 |
| AC113 | 0-20 | AD161 & AD162 (MS) | 0-35 | BC149 | 0-12 | BD138 | 0-50 | BF194 | 0-12 | CC20 | 0-63 | 2G371B | 0-12 | 2N2220 | 0-22 | 2N3055 | 0-50 | 2N4060 | 0-12 |
| AC116 | 0-25 | AD162 (MS) | 0-35 | BC150 | 0-18 | BD139 | 0-55 | BF195 | 0-12 | CC22 | 0-38 | 2G373 | 0-17 | 2N2221 | 0-22 | 2N3056 | 0-14 | 2N4061 | 0-12 |
| AC117K | 0-20 | AD162 (MS) | 0-35 | BC151 | 0-20 | BD140 | 0-60 | BF196 | 0-12 | CC23 | 0-42 | 2G374 | 0-17 | 2N2222 | 0-20 | 2N3057 | 0-16 | 2N4062 | 0-12 |
| AC122 | 0-12 | ADT140 | 0-50 | BC152 | 0-17 | BD155 | 0-80 | BF197 | 0-14 | CC24 | 0-56 | 2G377 | 0-20 | 2N2268 | 0-17 | 2N3058 | 0-14 | 2N4063 | 0-12 |
| AC125 | 0-17 | AF114 | 0-24 | BC153 | 0-28 | BD175 | 0-60 | BF200 | 0-45 | CC25 | 0-38 | 2G378 | 0-16 | 2N2369 | 0-14 | 2N3059 | 0-14 | 2N4285 | 0-17 |
| AC126 | 0-17 | AF115 | 0-24 | BC154 | 0-30 | BD176 | 0-60 | BF222 | 0-95 | CC26 | 0-25 | 2G381 | 0-16 | 2N2369A | 0-14 | 2N3059A | 0-14 | 2N4286 | 0-17 |
| AC127 | 0-17 | AF116 | 0-24 | BC157 | 0-18 | BD177 | 0-65 | BF257 | 0-45 | CC28 | 0-50 | 2G382 | 0-16 | 2N2411 | 0-24 | 2N3059 | 0-17 | 2N4287 | 0-17 |
| AC128 | 0-17 | AF117 | 0-24 | BC158 | 0-12 | BD178 | 0-65 | BF258 | 0-60 | CC29 | 0-50 | 2G401 | 0-20 | 2N2412 | 0-24 | 2N3402 | 0-21 | 2N4288 | 0-17 |
| AC132 | 0-14 | AF118 | 0-25 | BC159 | 0-12 | BD179 | 0-70 | BF259 | 0-85 | CC35 | 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 | CC36 | 0-50 | 2G417 | 0-25 | 2N2711 | 0-24 | 2N3404 | 0-25 | 2N4290 | 0-17 |
| AC137 | 0-14 | AF125 | 0-25 | BC161 | 0-50 | BD185 | 0-65 | BF263 | 0-55 | CC41 | 0-20 | 2N388 | 0-35 | 2N2712 | 0-21 | 2N3405 | 0-45 | 2N4291 | 0-17 |
| AC141 | 0-14 | AF126 | 0-28 | BC167 | 0-12 | BD186 | 0-65 | BF270 | 0-85 | CC42 | 0-24 | 2N388A | 0-55 | 2N2714 | 0-21 | 2N3414 | 0-15 | 2N4292 | 0-17 |
| AC141K | 0-17 | AF127 | 0-28 | BC168 | 0-12 | BD187 | 0-70 | BF271 | 0-80 | CC44 | 0-15 | 2N404 | 0-20 | 2N2904 | 0-17 | 2N3415 | 0-15 | 2N4293 | 0-17 |
| AC142 | 0-14 | AF139 | 0-30 | BC169 | 0-12 | BD188 | 0-70 | BF272 | 0-80 | CC45 | 0-12 | 2N404A | 0-28 | 2N2904A | 0-21 | 2N3416 | 0-28 | 2N5172 | 0-12 |
| AC143 | 0-17 | AF178 | 0-50 | BC170 | 0-12 | BD189 | 0-75 | BF273 | 0-85 | CC70 | 0-10 | 2N624 | 0-42 | 2N2905 | 0-21 | 2N3417 | 0-28 | 2N6457 | 0-32 |
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| AC154 | 0-20 | AF180 | 0-50 | BC172 | 0-14 | BD193 | 0-80 | BFW10 | 0-60 | CC81D | 0-15 | 2N706 | 0-45 | 2N2906 | 0-15 | 2N3446 | 0-08 | 2N6459 | 0-40 |
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| AC178 | 0-28 | AS761 | 0-25 | BC183 | 0-10 | BF116 | 0-24 | BFX25 | 0-85 | CC139 | 0-20 | 2N718 | 0-24 | 2N2926 (D) | 0-10 | 2N3819 | 0-28 | 2B322A | 0-42 |
| AC179 | 0-28 | AS762 | 0-25 | BC183 | 0-10 | BF117 | 0-45 | BFX19 | 0-18 | CC140 | 0-20 | 2N718A | 0-50 | 2N2926 (D) | 0-10 | 2N3820 | 0-50 | 2B323 | 0-56 |
| AC180 | 0-17 | AS764 | 0-25 | BC184 | 0-12 | BF118 | 0-25 | BFX20 | 0-15 | CC189 | 0-25 | 2N727 | 0-28 | 2N2926 (R) | 0-10 | 2N3821 | 0-25 | 2B324 | 0-70 |
| AC180K | 0-20 | AS766 | 0-25 | BC184L | 0-12 | BF119 | 0-70 | BFX25 | 0-15 | CC190 | 0-25 | 2N727 | 0-28 | 2N2926 (R) | 0-10 | 2N3822 | 0-25 | 2B325 | 0-70 |
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| AC181K | 0-20 | AS767 | 0-25 | BC187 | 0-28 | BF123 | 0-50 | BFY27 | 0-15 | CC200 | 0-25 | 2N744 | 0-20 | 2N2926 (B) | 0-10 | 2N3904 | 0-25 | 2B327 | 0-70 |
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| AC187K | 0-20 | AS721 | 0-40 | BC208 | 0-11 | BF127 | 0-50 | BFY29 | 0-15 | CC202 | 0-28 | 2N918 | 0-20 | 2N3011 | 0-14 | 2N3906 | 0-27 | 4O381 | 0-40 |
| AC188 | 0-22 | BC107 | 0-09 | BC209 | 0-12 | BF129 | 0-55 | BFY30 | 0-18 | CC203 | 0-25 | 2N929 | 0-21 | 2N3053 | 0-17 | 2N4058 | 0-12 | 4O382 | 0-45 |
| AC188K | 0-20 | BC108 | 0-09 | BC212L | 0-11 | BF143 | 0-45 | BFY39 | 0-18 | CC204 | 0-25 | 2N950 | 0-21 | | | | | | |
| ACY17 | 0-25 | BC109 | 0-10 | BC213L | 0-11 | BF154 | 0-45 | BFY40 | 0-28 | CC205 | 0-35 | 2N1131 | 0-20 | | | | | | |
| ACY19 | 0-20 | BC113 | 0-10 | BC214L | 0-14 | BF155 | 0-70 | BFY41 | 0-28 | CC309 | 0-40 | 2N1132 | 0-22 | | | | | | |
| ACY19 | 0-20 | BC114 | 0-15 | BC225 | 0-25 | BF156 | 0-48 | BFY95 | 0-12 | P346A | 0-20 | 2N1302 | 0-14 | | | | | | |
| ACY20 | 0-20 | BC116 | 0-15 | BC226 | 0-35 | BF157 | 0-55 | BFY96A | 0-12 | P367 | 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 | Bul05 | 2-00 | CCP71 | 0-43 | 2N1304 | 0-17 | AA120 | 0-08 | BY164 | 0-50 | OA47 | 0-07 |
| ACY22 | 0-16 | BC117 | 0-15 | BCY31 | 0-28 | BF159 | 0-60 | CI11E | 0-60 | ORP12 | 0-43 | 2N1305 | 0-17 | AA129 | 0-08 | BYX39/30 | 0-08 | OA70 | 0-07 |
| ACY27 | 0-18 | BC118 | 0-10 | BCY32 | 0-30 | BF160 | 0-40 | C400 | 0-30 | ORP60 | 0-40 | 2N1306 | 0-21 | AA30 | 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 | 2N1307 | 0-21 | AA713 | 0-10 | BZ210 | 0-35 | OA81 | 0-07 |
| ACY29 | 0-25 | BC120 | 0-80 | BCY34 | 0-25 | BF163 | 0-40 | C424 | 0-20 | BT140 | 0-17 | 2N1308 | 0-23 | BA100 | 0-10 | BZ211 | 0-30 | OA85 | 0-09 |
| ACY30 | 0-28 | BC125 | 0-12 | UCY70 | 0-14 | BF164 | 0-40 | C425 | 0-50 | BT141 | 0-17 | 2N1309 | 0-23 | BA116 | 0-21 | BZ212 | 0-30 | OA90 | 0-08 |
| ACY31 | 0-28 | BC126 | 0-18 | UCY71 | 0-18 | BF165 | 0-40 | C426 | 0-35 | BT143 | 0-20 | 2N1613 | 0-20 | BA126 | 0-22 | BZ213 | 0-25 | OA91 | 0-08 |
| ACY34 | 0-21 | BC132 | 0-12 | UCY82 | 0-14 | BF167 | 0-22 | C428 | 0-22 | UT45 | 0-27 | 2N1711 | 0-20 | BA148 | 0-14 | BZ216 | 0-40 | OA95 | 0-07 |
| ACY35 | 0-21 | BC134 | 0-18 | UCY10 | 0-10 | BF173 | 0-22 | C441 | 0-30 | 2G301 | 0-09 | 2N1889 | 0-32 | BA154 | 0-12 | BZ217 | 0-35 | OA200 | 0-06 |
| ACY36 | 0-28 | BC135 | 0-12 | UCZ11 | 0-25 | BF176 | 0-35 | C442 | 0-30 | 2G302 | 0-19 | 2N1890 | 0-45 | BA155 | 0-14 | BZ218 | 0-35 | OA202 | 0-07 |
| ACY40 | 0-17 | BC136 | 0-15 | UCZ12 | 0-25 | BF177 | 0-35 | C444 | 0-35 | 2G303 | 0-19 | 2N1893 | 0-37 | BA156 | 0-13 | BZ219 | 0-28 | SD10 | 0-05 |
| ACY41 | 0-18 | BC137 | 0-15 | BD121 | 0-60 | BF178 | 0-30 | C450 | 0-22 | 2G304 | 0-24 | 2N2147 | 0-72 | BY100 | 0-15 | CG62 | 0-08 | SD19 | 0-05 |
| ACY44 | 0-35 | BC138 | 0-40 | BD123 | 0-65 | BF179 | 0-30 | MAT100 | 0-19 | 2G306 | 0-40 | 2N2148 | 0-57 | BY101 | 0-12 | (Eq) OA91 | 0-05 | IN34 | 0-07 |
| AD100 | 0-35 | BC140 | 0-30 | BD124 | 0-60 | BF180 | 0-30 | MAT101 | 0-20 | 2G308 | 0-35 | 2N2160 | 0-80 | BX106 | 0-17 | 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 | 0-14 | IN194 | 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 | 0-06 | IN196 | 0-06 |
| AD143 | 0-38 | BC143 | 0-30 | BD133 | 0-65 | BF183 | 0-40 | MPP102 | 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 | MPP104 | 0-37 | 2G344 | 0-18 | 2N2217 | 0-22 | BY128 | 0-15 | OA5 | 0-35 | IN8021 | 0-10 |
| AD161 | 0-33 | BC147 | 0-10 | BD136 | 0-40 | BF185 | 0-30 | MPP105 | 0-37 | 2G345 | 0-16 | 2N2218 | 0-20 | BY130 | 0-16 | OA58L | 0-21 | IN891 | 0-08 |

DIODES AND RECTIFIERS

| | | | |
|----------|------|-------|------|
| BY133 | 0-21 | OA10 | 0-35 |
| BY164 | 0-50 | OA47 | 0-07 |
| BYX39/30 | 0-08 | OA70 | 0-07 |
| 0-42 | OA79 | 0-07 | |
| BZ210 | 0-35 | OA81 | 0-07 |
| BZ211 | 0-30 | OA85 | 0-09 |
| BZ212 | 0-30 | OA90 | 0-08 |
| BZ213 | 0-25 | OA91 | 0-08 |
| BZ216 | 0-40 | OA95 | 0-07 |
| BZ217 | 0-35 | OA200 | 0-06 |
| BZ218 | 0-35 | OA202 | 0-07 |
| BZ219 | 0-28 | SD10 | 0-05 |
| CG62 | | | |

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| TO5 | TO86 | TO6 | TO84 | TO48 | TO48 | TO48 | TO48 |
| 50 | 0-23 | 0-25 | 0-35 | 0-33 | 0-47 | 0-50 | 0-53 |
| 100 | 0-25 | 0-33 | 0-44 | 0-47 | 0-50 | 0-58 | 0-63 |
| 200 | 0-34 | 0-41 | 0-49 | 0-49 | 0-57 | 0-61 | 0-75 |
| 400 | 0-44 | 0-47 | 0-56 | 0-56 | 0-67 | 0-75 | 0-93 |
| 600 | 0-53 | 0-57 | 0-68 | 0-68 | 0-77 | 0-97 | 1-25 |
| 800 | 0-63 | 0-70 | 0-80 | 0-80 | 0-90 | 1-20 | 1-50 |

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| 50 | 0-04 | 0-05 | 0-05 | 0-07 | 0-14 | 0-21 |
| 100 | 0-04 | 0-06 | 0-06 | 0-10 | 0-16 | 0-23 |
| 200 | 0-05 | 0-09 | 0-08 | 0-14 | 0-20 | 0-24 |
| 400 | 0-05 | 0-13 | 0-07 | 0-20 | 0-27 | 0-37 |
| 600 | 0-07 | 0-16 | 0-10 | 0-20 | 0-24 | 0-45 |
| 800 | 0-10 | 0-17 | 0-11 | 0-25 | 0-37 | 0-55 |
| 1000 | 0-11 | 0-25 | 0-14 | 0-30 | 0-46 | 0-63 |
| 1200 | 0-11 | 0-33 | 0-38 | 0-57 | 0-75 | - |

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| SN7440 | 0.15 | 0.14 | 0.12 | SN74104 | 0.87 | 0.84 | 0.88 | SN74192 | 0.20 |
| SN7441 | 0.67 | 0.64 | 0.58 | SN74105 | 0.97 | 0.94 | 0.88 | SN74193 | 0.20 |
| SN7442 | 0.67 | 0.64 | 0.58 | SN74107 | 0.40 | 0.38 | 0.38 | SN74194 | 0.20 |
| SN7443 | 1.30 | 1.25 | 1.20 | SN74110 | 0.55 | 0.53 | 0.50 | SN74195 | 0.20 |
| SN7444 | 1.30 | 1.25 | 1.20 | SN74111 | 0.25 | 0.15 | 0.10 | SN74196 | 0.20 |
| SN7445 | 1.30 | 1.25 | 1.20 | SN74118 | 0.10 | 0.05 | 0.05 | SN74197 | 0.20 |
| SN7446 | 0.97 | 0.94 | 0.88 | SN74119 | 0.35 | 0.25 | 0.25 | SN74198 | 0.20 |
| SN7447 | 2.10 | 0.97 | 0.95 | SN74121 | 0.40 | 0.37 | 0.34 | SN74199 | 0.20 |
| SN7448 | 0.10 | 0.07 | 0.05 | SN74122 | 0.40 | 0.30 | 0.10 | SN74199 | 0.20 |

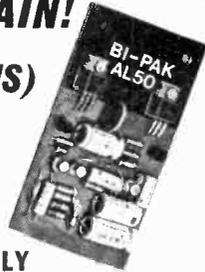


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SPECIFICATION

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. input 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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S.G.S. EA1000 2-63

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

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| Tube Height (mm) | 47 | 32 | 22 |
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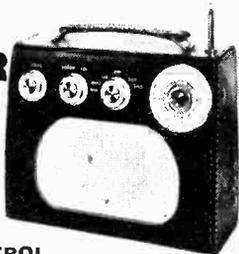
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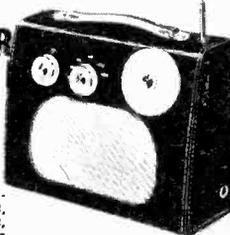
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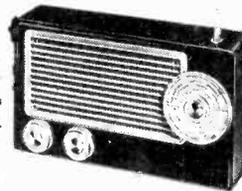
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POCKET FIVE

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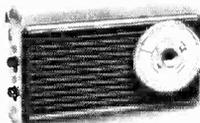


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5 TRANSISTORS AND 2 DIODES

3 Tunable Wavebands: MW, LW and Trawler Band. 7 stages—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser volume control, fine tone moving coil speaker. Attractive case with red speaker grille. Size 6 1/2 x 4 1/2 x 1 1/2in. Easy build plans and parts price list 10p (FREE with parts).

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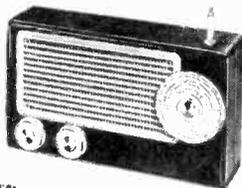


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6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 x 5 1/2 x 2 1/2in. 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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| STEREO AMPLIFIERS | | |
| ALBA UA 700 | 37-93 | 25-25 |
| ALPHA 212 by Highgate | 37-75 | 23-95 |
| AMSTRAD IC 2000 | 46-25 | 27-50 |
| AMSTRAD Integra 4000 | 35-50 | 21-50 |
| ARMSTRONG 521 | 59-00 | 43-75 |
| DULCI 207M | 32-00 | 19-25 |
| FERROGRAPH F307 Mk. II (cased) | 68-00 | 43-50 |
| GOODWIN RH 25 25 | 59-95 | 47-95 |
| GLIXOR MW3000, 15 watts RMS per channel | 49-50 | 23-95 |
| JVC NIVICO VN 300 | 58-00 | 48-95 |
| MCA 104Z | 85-00 | 70-95 |
| MCA 105E | 130-50 | 109-95 |
| MCA VSE VN550 Quadraphonic | 89-00 | 74-95 |
| MCA VSE VN890 Quadraphonic | 148-00 | 124-95 |
| KELETRON KSA 700 | 29-00 | 17-95 |
| KELETRON KSA 1500 | 39-00 | 23-95 |
| LEAK Delta 90 (cased) | 69-90 | 46-95 |
| LEAK Delta 70 (cased) | 85-90 | 57-95 |
| METROSOUND ST60 | 39-50 | 24-20 |
| METROSOUND ST80 | 70-00 | 45-45 |
| PHILIPS RH521 | 109-00 | 89-95 |
| PHILIPS RH 580 | 30-50 | 21-50 |
| PIONEER SA500A | 47-10 | 32-95 |
| SA600 | 95-48 | 57-95 |
| SA800 | 126-55 | 75-95 |
| SA1000 | 155-82 | 94-95 |
| QL600A Quadraphonic Converter | 118-95 | 78-95 |
| QD 210 Quadraphonic decoder | 42-85 | 29-95 |
| QA 800 Quadraphonic | 188-60 | 122-95 |
| Reverberation 202w | 54-95 | 35-95 |
| RANK ROTEL 210 | 34-80 | 22-95 |
| RANK ROTEL 310 | 52-00 | 34-95 |
| RANK ROTEL 610 | 78-50 | 51-95 |
| RANK ROTEL RA 810 | 105-50 | 72-95 |
| RANK ROTEL RA 1210 | 129-00 | 89-95 |
| ROGERS Ravensbourne | 64-50 | 49-25 |
| Ravensbourne (cased) | 69-50 | 53-95 |
| Ravensbrook Mk. II | 50-50 | 38-95 |
| Ravensbrook (cased) Mk. II | 55-50 | 41-95 |
| SINCLAIR 2000 | 35-00 | 22-95 |
| 3000 | 45-00 | 28-95 |
| PROJECT 605 | 29-95 | 18-90 |
| SOLARVOX 20, 10 watts, RMS per channel | 39-95 | 24-95 |
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| SOLARVOX AM108 2 x 8 watts, RMS plus MATRIX 4 channel | 28-45 | 19-95 |
| SOLARVOX AM318 2 x 18 watts, plus MATRIX 4 channel | 41-38 | 28-95 |
| TANDBERG TA300 | 69-90 | 54-95 |
| WHARFEDALE Linton amplifier | 65-00 | 41-95 |
| All take both ceramic and magnetic cartridges. | | |

| | Rec. Retail Price | Comet Price |
|--|-------------------|-------------|
| TUNERS | | |
| AMSTRAD Multiplex 3000 FM | 39-95 | 28-95 |
| *ARMSTRONG 523 AM/FM | 52-68 | 40-95 |
| *ARMSTRONG 524 FM | 40-97 | 31-95 |
| ARMSTRONG M8 Decoder | 9-50 | 5-95 |
| *DULCI FMT 7 FM | 24-43 | 14-95 |
| GOODMANS Stereoamax | 75-74 | 35-95 |
| JVC NIVICO VT500 | | |
| MCT VSE AM/FM | 86-00 | 69-95 |
| MCT VSE AM/FM | 122-42 | 93-95 |
| LEAK Delta FM | 79-50 | 57-95 |
| LEAK Delta AM/FM | 89-50 | 69-95 |
| METROSOUND FMS 20 | 54-92 | 38-75 |
| PHILIPS RH 690 | 48-50 | 31-95 |
| PHILIPS RH 621 | 109-00 | 89-95 |
| PIONEER TX500A AM/FM | 75-92 | 56-95 |
| PIONEER TX600 AM/FM | 104-57 | 73-95 |
| RANK ROTEL 320 | 59-50 | 42-95 |
| RANK ROTEL 620 | 93-50 | 67-95 |
| ROGERS Ravensbourne Chassis | 57-95 | 43-95 |
| Ravensbourne in Teak Case | 62-63 | 47-95 |
| Ravensbrook Chassis | 42-14 | 31-95 |
| Ravensbrook (cased) | 48-00 | 36-95 |
| SINCLAIR 2000 | 45-00 | 29-95 |
| 3001 | 45-00 | 29-95 |
| Project 60 Tuner (stereo) | 25-00 | 17-50 |
| All above Tuners are complete with MPX Stereo Decoder except where starred | | |

| | Rec. Retail Price | Comet Price |
|--|-------------------|-------------|
| TUNER/AMPLIFIERS | | |
| AKAI CR80T FM/AM Tuner Amplifier with built in Eight Track Tape Recorder | 149-84 | 89-95 |
| AKAI AA8500 | 249-00 | 179-85 |
| AKAI 6200 | 105-00 | 75-95 |
| AKAI 6300 | 137-50 | 79-95 |
| AKAI 6800 | 199-95 | 109-95 |
| ARENA 2600 | 111-30 | 90-95 |
| ARMSTRONG M8 Decoder | 9-50 | 6-95 |
| ARMSTRONG 525 | 90-14 | 69-95 |
| ARMSTRONG 526 | 102-72 | 77-95 |
| GOODMANS Module 80, 35w. RMS Module 80 Compact | 93-00 | 69-95 |
| Module 90 | 168-00 | 127-95 |
| Module 90 | 119-00 | 91-95 |
| Module 110 FM/MW/LW/SW/100w. RMS | 139-00 | 105-95 |
| GOODMANS Module 110, Compact | 245-00 | 187-50 |
| JVC NIVICO 4MM 1000 Quadraphonic | 159-50 | 134-95 |

| | Rec. Retail Price | Comet Price |
|---|-------------------|-------------|
| TUNER/AMPLIFIERS—continued | | |
| JVC Nivico VR 5500/5501 AM/FM... VR 5521 AM/FM and SEA | 96-96 | 81-95 |
| 4VR 5414 Quadraphonic | 175-00 | 148-95 |
| 212-00 | 179-95 | |
| KYOTO 1000 AM/FM Tuner/Amplifier with built in Stereo Cassette Recorder. Complete with two speakers and two microphones | 85-00 | 61-95 |
| LEAK Delta 75 | 175-00 | 129-95 |
| PHILIPS RH 7025 | 215-00 | 179-95 |
| PIONEER SX525 | 192-49 | 134-35 |
| SX626 | 192-49 | 134-35 |
| SX727 | 231-74 | 162-95 |
| SX828 | 297-20 | 208-95 |
| QX 4000 Quadraphonic | 225-93 | 164-95 |
| QX 8000 Quadraphonic | 286-24 | 199-95 |
| ROGERS Ravensbrook Chassis | 96-57 | 73-95 |
| ROGERS Ravensbrook (cased) | 140-53 | 78-45 |
| ROTEL RX 150A | 69-90 | 50-95 |
| ROTEL RX200A | 89-50 | 65-95 |
| ROTEL RX 400A | 107-50 | 78-95 |
| ROTEL RX 600A | 149-00 | 109-95 |
| ROTEL RX 800A | 189-50 | 139-95 |
| ROTEL RX 154 Quadraphonic | 129-50 | 94-95 |
| SOLARVOX TAM 1105 2 x 5 watts RMS AM/FM Multiplex comp. with 2 speakers and featuring Matrix 4 channel | 38-50 | 29-95 |
| TANDBERG 1171 MPX | 103-03 | 84-95 |
| TANDBERG TR200 MPX | 106-00 | 85-95 |
| TANDBERG TR1000 FM MPX (teak) | 156-00 | 129-60 |
| TANDBERG TR 1010 AM/FM MPX | 169-00 | 139-95 |
| WHARFEDALE Linton WE400 | 115-00 | 85-95 |
| TELETON CR55 | 125-26 | 88-50 |
| TELETON R6000 AM/FM | 42-16 | 21-95 |
| GARRARD 403 Quadraphonic | 105-33 | 85-95 |
| Teleton R6000, Kyoto 1000 which take ceramic only. | | |
| All include MPX Stereo Decoder with the exception of Armstrong where M8 decoder is extra. | | |
| TURNABLES | | |
| CONNOISSEUR BD1 kit | 13-34 | 10-95 |
| CONNOISSEUR BD2 Chassis | 32-71 | 25-95 |
| CONNOISSEUR BD2 P/C/SAU2 | 41-29 | 33-95 |
| GARRARD SP25 Mk. III | 16-17 | 10-50 |
| GARRARD SL65B | 13-63 | 10-95 |
| GARRARD SL65B | 20-93 | 13-75 |
| GARRARD SL95B | 49-21 | 32-25 |
| GARRARD 401 | 39-04 | 25-95 |
| GARRARD SL72B | 32-60 | 21-95 |
| GARRARD AP76 | 28-44 | 17-25 |
| GARRARD Zero 100A | 57-42 | 38-95 |
| GARRARD Zero 100S | 52-83 | 38-95 |
| GARRARD WB4 Base Mk. 11Z to fit Zero 100 and Zero 100S | 6-55 | 4-95 |

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GARRARD SP25 Mk. 111 Special Price £18-50

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McDONALD MP60 Special Price £17-50

McDONALD MP60 with SHURE M 44/7 Special Price £18-95

McDONALD MP60 with Goldring G800 Special Price £19-95

McDONALD HT70 with Goldring G800 Special Price £25-50

GARRARD AP76 with Goldring G800 Special Price £26-50

GARRARD AP76 with Shure M55E Special Price £30-50

GARRARD AP76 with Shure M75EJ Special Price £32-50

GARRARD 2025 with Sonotone 9TAMC Special Price £12-75

GOLDRING GL75 with G800 Special Price £39-50

THORENS 156 AB complete with T2 cartridge, Shure M55E cartridge £60-35 £49-95

| Base and cover to fit GARRARD | Sp. Price | 3-60 |
|---|-----------|-------|
| SP25, SL55, SL65B | 75-00 | 51-95 |
| GOODMANS TD100 with G800E | 29-64 | 20-50 |
| GOLDRING G101P/C | 31-39 | 20-95 |
| GOLDRING GL72 Chassis | 40-81 | 27-50 |
| GOLDRING GL72P | 48-86 | 28-95 |
| GOLDRING GL75P | 51-82 | 35-25 |
| GOLDRING GL85P/Cover | 87-19 | 56-95 |
| Covers for 72P | 4-71 | 3-25 |
| Cover for 75P (de Luxe) | 5-23 | 3-50 |
| Cover for 85P | 6-98 | 4-95 |
| C99-plinth and cover for G99 | 15-35 | 11-95 |
| GOLDRING G99 | 29-64 | 19-25 |
| LEAK Delta | 69-50 | 52-50 |
| JVC Nivico SRP 473 Quadraphonic, including plinth and cover | 69-50 | 58-95 |
| McDONALD MP60 | 14-78 | 9-50 |
| McDONALD 610 | 18-75 | 12-95 |
| McDONALD HT100 | 29-64 | 14-60 |
| Base and cover for MP60 and 610 | Sp. Price | 3-95 |
| PHILIPS GA212 Electronic | 69-00 | 57-50 |
| PIONEER PL12D with base and cover | 49-18 | 34-50 |

| | Rec. Retail Price | Comet Price |
|--|-------------------|-------------|
| TURNABLES—continued | | |
| PIONEER PL61 with base and cover | 176-83 | 119-95 |
| THORENS TX25 cover | 8-85 | 6-50 |
| THORENS TD125A Mk. II | 82-63 | 66-50 |
| THORENS TD125AB | 115-69 | 79-95 |
| THORENS TD125AB Mk. II with TP 16 arm | 124-54 | 99-95 |
| THORENS TD160/c including base and cover | 69-80 | 56-95 |
| THORENS TD150 Mk. II | 36-30 | 28-95 |
| THORENS TD150A Mk. II | 46-33 | 35-95 |
| THORENS TD150AB Mk. II | 50-17 | 38-95 |
| THORENS TX11 cover | 4-49 | 3-60 |
| WHARFEDALE Linton | 37-50 | 28-95 |

| | Rec. Retail Price | Comet Price |
|-------------------------------|-------------------|-------------|
| PICK UP ARMS AND HEADS | | |
| AUDIO Technica AT 1005 Mk. 11 | 18-78 | 14-25 |
| AKN50 Technica L2 lifts | 2-61 | 1-95 |
| CONNOISSEUR SAU2 | 14-61 | 11-95 |
| 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 3012 HE with S2 Shell | 33-71 | 24-95 |
| SME 3012 with S2 Shell | 34-57 | 25-95 |
| SME 3012 HE with S2 Shell | 35-81 | 26-50 |
| SME S2 Headshell | 2-59 | 1-95 |

| | Rec. Retail Price | Comet Price |
|--------------------------|-------------------|-------------|
| SPEAKERS | | |
| AMSTRAD 138 (pair) Teak | 26-00 | 13-95 |
| AKAI SW 155 | 64-50 | 44-95 |
| B and W Model 70 | 159-50 | 109-95 |
| B and W DM2 | 69-99 | 47-50 |
| B and W DM4 | 49-66 | 37-95 |
| B and W DM5 (pair) | 59-48 | 43-95 |
| CELESTION COUNTY (pair) | 47-94 | 35-95 |
| Ditton 120 (pair) | 56-40 | 38-50 |
| Ditton 15 | 37-40 | 26-00 |
| Ditton 25 | 65-00 | 42-50 |
| Ditton 44 | 54-00 | 35-00 |
| Ditton 66 | 99-00 | 70-95 |
| FERROGRAPH S1 inc. stand | 95-00 | 67-95 |
| GOODMANS Minister Pair | 49-20 | 35-95 |
| Havant (pair) | 57-12 | 39-40 |
| Magister | 65-63 | 42-50 |
| Double Maxim (pair) | 67-40 | 47-95 |
| Mezzo 3 | 35-70 | 23-45 |
| Magnum K2 | 46-20 | 32-95 |
| Goodwood | 55-00 | 38-95 |
| Dimension 8 | 72-44 | 45-95 |
| DIN 20 NT KIT | 12-19 | 8-50 |

| | Rec. Retail Price | Comet Price |
|--|-------------------|-------------|
| KELETRON KN 400 2-speaker system (pair) | | |
| KN500 3-speaker system (pair) | 15-44 | 11-95 |
| KN800 3-speaker system (pair) | 25-82 | 18-95 |
| KN100 4-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 | 45-95 |
| LEAK 600 | 49-50 | 34-50 |
| LINEAR 10 watt Teak (Pair) | Sp. Price | 12-95 |
| METROSOUND HFS 103 (pair) | 29-21 | 20-95 |
| 202 | 21-50 | 14-75 |
| Duplex 15 | 32-00 | 21-95 |
| Duplex 25 | 56-00 | 37-50 |
| PIONEER CS5 | 46-72 | 29-95 |
| SINCLAIR Q16 | 8-98 | 6-50 |
| TANDBERG Tan 7 | 29-50 | 23-60 |
| Tan 11 (pair) | 40-00 | 31-95 |
| TL 12 Teak (pair) | 55-50 | 44-50 |
| TL 25 Teak (pair) | 71-50 | 58-95 |
| TL 50 Teak | 68-00 | 50-95 |
| TELETON 8000 (pair) | 21-08 | 11-95 |
| THORPE GRENVILLE TG100 (pair) | 28-95 | 16-95 |
| TG200 (pair) | 41-95 | 24-95 |
| TG300 (pair) | 55-95 | 29-95 |
| WHARFEDALE Denton Mark II (pair) | 42-00 | 28-95 |
| Linton Mark II (pair) | 52-00 | 37-50 |
| Linton 111 (pair) | 65-00 | 46-95 |
| Melton Mark II | 35-00 | 23-75 |
| Dovedale 3 Mark II | 47-50 | 32-25 |
| Rosedale | 69-00 | 44-95 |
| Unit 3 speaker kit | 12-50 | 8-95 |
| Unit 4 speaker kit | 19-00 | 12-95 |
| Unit 5 speaker kit | 27-50 | 18-75 |

| | Rec. Retail Price | Comet Price |
|-------------------------------|-------------------|-------------|
| CHASSIS SPEAKERS | | |
| GOODMANS Twin-axiom 8 | 9-12 | 6-95 |
| Twin Axium 10 | 10-06 | 7-50 |
| Axiom 401 | 17-68 | 11-95 |
| Axiom 8P | 5-49 | 4-15 |
| Axiom 10P | 5-97 | 4-50 |
| Axiom 12P | 13-00 | 9-15 |
| Axiom 15P | 21-00 | 14-60 |
| Axiom 18P | 35-70 | 24-45 |
| Axiom 100 40 watts din. | 12-00 | 8-35 |
| ARU 172 | 4-50 | 3-20 |
| Axiom 100 | 6-90 | 4-80 |
| Melton 650 | 13-59 | 9-50 |
| Axiom 8P | 3-73 | 2-95 |
| Crossover network XO/850 | 7-77 | 5-45 |
| WHARFEDALE 8 in. Bronze/RS/DD | 4-75 | 3-60 |
| Super 8/RS/DD | 8-50 | 6-25 |
| Super 10/RS/DD | 14-00 | 9- |

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| CARTRIDGES | | | |
| AMSTRAD 900C | 5.32 | 3.40 | |
| AMSTRAD 900D | 8.10 | 5.40 | |
| AMSTRAD 900 EX | 11.90 | 8.50 | |
| AUDIO TECHNICA AT 66 | 6.47 | 3.45 | |
| CONNOISSEUR Ceramic SCUI | 6.09 | 4.95 | |
| GOLDRING G850 | 12.21 | 4.50 | |
| GOLDRING G800 | 17.67 | 7.00 | |
| GOLDRING G800E | 11.62 | 8.25 | |
| GOLDRING G820 | 17.44 | 12.25 | |
| GOLDRING G820 Super E | 23.25 | 16.25 | |
| GOLDRING G800 Super E | 24.41 | 15.25 | |
| EMPIRE 1002E/X | 6.22 | 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 | 9.50 | |
| EMPIRE 90EE/X | 6.10 | 3.75 | |
| SHURE M31M | 11.63 | 6.95 | |
| SHURE M31E | 10.73 | 6.50 | |
| SHURE M32E | 8.30 | 4.95 | |
| SHURE M44-G | 7.90 | 4.50 | |
| SHURE M44-7 | 7.90 | 4.50 | |
| SHURE M-44C | 7.90 | 4.50 | |
| SHURE M44E | 6.60 | 4.75 | |
| SHURE M55E | 9.70 | 5.60 | |
| SHURE M75G | 14.70 | 8.35 | |
| SHURE M75-6 (S) | 8.36 | 5.45 | |
| SHURE M75-6 | 13.60 | 7.60 | |
| SHURE M75EJ | 15.40 | 8.75 | |
| SHURE M75ED | 19.00 | 10.15 | |
| SHURE M75E 95G | 20.80 | 12.95 | |
| SHURE M91E | 18.45 | 9.95 | |
| SHURE V15-11 | 39.40 | 24.95 | |
| *SONOTONE 9TAHC Diam/Saph | 3.75 | 1.45 | |

Starred cartridges above are ceramic. All others are magnetic.

| | Rec. Price | Retail Price | Comet Price |
|---|------------|--------------|-------------|
| BLANK TAPES | | | |
| SCOTCH DYNARANGE CASSETTES | | | |
| C60 | 0.71 | 0.40 | |
| C90 | 0.99 | 0.50 | |
| C120 | 1.49 | 0.75 | |
| SCOTCH HIGH ENERGY COBALT CASSETTES | | | |
| C60 | 1.10 | 0.65 | |
| C90 | 1.45 | 0.85 | |
| SCOTCH Low Noise 8-TRACK | | | |
| BLANK CARTRIDGES | | | |
| 40 mins. | 1.50 | 0.90 | |
| 90 mins. | 1.80 | 1.10 | |
| SCOTCH HI-FI DYNARANGE SPOOLED TAPES | | | |
| 5" L.P. 900 | 1.88 | 1.10 | |
| 5" L.P. 1200 | 2.20 | 1.30 | |
| 7" L.P. 1800 | 2.95 | 1.80 | |
| SCOTCH HI-FI DYNARANGE DOUBLE PLAY | | | |
| 5" D.P. 1200 | 2.31 | 1.40 | |
| 5" D.P. 1800 | 3.15 | 1.95 | |
| 7" D.P. 2400 | 4.03 | 2.50 | |

Postage—Tape, cassettes and 8T cartridges 1-9 Items 5p per order. Packs of ten post free.

| | Rec. Price | Retail Price | Comet Price |
|--|------------|----------------|-------------|
| BASES AND COVERS | | | |
| CONNOISSEUR P11th BD1 | 5.57 | 4.50 | |
| CONNOISSEUR Cover | 4.17 | 3.40 | |
| CONNOISSEUR P.U. Mount Board | 0.95 | 0.75 | |
| GARRARD WB1 Base | 3.78 | 2.95 | |
| GARRARD WB4 Base | 5.60 | 4.25 | |
| GARRARD SP1 Cover | 3.68 | 2.75 | |
| GARRARD SP4 Cover | 4.38 | 3.25 | |
| Special Offer of Base and Cover for fit GARRARD SP25, SL55, SL65B and 3500 | | Sp. Price 3.60 | |
| GARRARD WB4 base MK 11z to fit Zero 100 and Zero 100S | 6.55 | 4.80 | |
| GOLDRING P11th 75 | 9.77 | 6.75 | |
| GOLDRING P11th 72 | 9.42 | 5.50 | |
| GOLDRING Covers 72P | 4.71 | 3.25 | |
| Cover for 75P De Luxe | 5.23 | 3.60 | |
| Cover for 85P | 6.98 | 4.95 | |
| THORENS TX 25 (for TD125AB) | 8.85 | 6.50 | |
| THORENS TX11 Cover | 4.49 | 3.60 | |
| SME P11th System 2000 with motorboard | 46.20 | 35.95 | |
| MOTORBOARDS only | 5.85 | 4.45 | |
| SME P1 Spacer | 0.98 | 0.75 | |

| | Rec. Price | Retail Price | Comet Price |
|-------------------------------|------------|--------------|-------------|
| HEADPHONES | | | |
| AMSTRAD HPSSA | 7.50 | 3.90 | |
| HPSSA with volume control | 10.70 | 6.70 | |
| HPSA bass and treble controls | 13.95 | 9.90 | |

| | Rec. Price | Retail Price | Comet Price |
|----------------------------------|------------|--------------|-------------|
| HEADPHONES—continued | | | |
| AKAI ASE9 | 7.25 | 4.25 | |
| AKAI ASE22 | 11.90 | 7.25 | |
| AKG K60 | 28.00 | 16.95 | |
| AKG K80 | 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 K6 plus 2 Quadrafone | 45.00 | 35.95 | |
| KOSS PRO 5 LIC | 30.00 | 23.95 | |
| KOSS PRO-4AA | 28.00 | 20.95 | |
| KOSS K-727B | 16.50 | 12.45 | |
| KOSS 747 | 20.00 | 14.95 | |
| KOSS K-711 | 10.00 | 7.75 | |
| KOSS K6 | 12.50 | 9.50 | |
| KOSS K6/LC (with volume control) | 14.00 | 10.50 | |
| KOSS K6/LCQ Quadrafone | 20.00 | 16.95 | |
| PIONEER SE 50 | 21.90 | 13.25 | |
| PIONEER SE 30A | 12.60 | 8.25 | |
| PIONEER SE 20A | 7.88 | 4.95 | |
| PIONEER SEL 20 | 10.53 | 6.80 | |
| PIONEER SEL 40 | 17.43 | 11.30 | |
| ROTEL RH 330 | 6.50 | 4.50 | |
| ROTEL RH 700 | 9.95 | 6.75 | |
| SOUND MD806 | 6.40 | 2.70 | |
| WHARFEDALE DD1 | 12.50 | 8.75 | |
| WHARFEDALE 150 DYNAMIC | 19.95 | 14.95 | |

| | Rec. Price | Retail Price | Comet Price |
|---|------------|--------------|-------------|
| MANUFACTURERS' HI-FI STEREO SYSTEMS—COMPLETE | | | |
| ALBA 552 | 47.75 | 29.95 | |
| BUSH A1005 | 69.89 | 51.95 | |
| DANSETTE Consort Stereo | 34.43 | 23.95 | |
| DANSETTE 4005 | 71.45 | 49.95 | |
| DANSETTE 4020 | 47.99 | 31.95 | |
| DECCA SOUND 813 | Sp. Price | 46.50 | |
| DECCA SOUND 614 | Sp. Price | 52.95 | |
| DECCA COMPACT 2 with Radio | Sp. Price | 78.95 | |
| DECCA COMPACT 3 with Radio | Sp. Price | 98.95 | |
| DECCA 403 | Sp. Price | 44.95 | |
| FERGUSON 3450 B with Radio (new model) | 79.50 | 61.95 | |
| FERGUSON 3451 B with Radio (new model) | 107.00 | 82.95 | |
| 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 Stereo Nine | 38.50 | 22.95 | |
| G.E.C. 2810 | 79.00 | 59.95 | |
| GROSVENOR MPX 8400 AM/FM MPX Tuner/Amplifier, magnetic input with built-in 8-track cartridge player with speakers | 67.50 | 39.95 | |
| HMV 2452 | 66.00 | 49.95 | |
| HMV 2453 | 66.00 | 49.95 | |
| KB 1025 with 662 speakers | 48.25 | 37.95 | |
| KB 1250 with KS 653 Speakers | 71.00 | 53.95 | |
| KB 2010 with 658 speakers | 101.00 | 77.95 | |
| KB 2250 with 658 speakers | 124.00 | 95.95 | |
| MURPHY 902 Studio 1, AM/VHF Radio | 84.50 | 64.95 | |
| MURPHY 940 | 69.89 | 52.95 | |
| PHILIPS 808 | 105.00 | 76.95 | |
| PHILIPS GF 824 | 65.30 | 49.95 | |
| PHILIPS 825 | 49.50 | 38.95 | |
| PHILIPS 826 | 75.00 | 52.95 | |
| PHILIPS 835 with Radio | 69.50 | 49.55 | |
| PHILIPS 836 with Radio | 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 | 22.95 | |
| ULTRA 6028 | 59.95 | 45.95 | |
| ULTRA 6450B (new model) with Radio | 79.50 | 61.95 | |
| ULTRA 6455 | 41.35 | 31.95 | |
| ULTRA 6454 | 38.85 | 29.95 | |

| | Rec. Price | Retail Price | Comet Price |
|-----------------------|------------|--------------|-------------|
| TAPE RECORDERS | | | |
| AKAI 1721L | 99.90 | 73.95 | |
| AKAI 4000 DS | 99.50 | 73.95 | |
| AKAI X201D | 179.00 | 132.95 | |

| | Rec. Price | Retail Price | Comet Price |
|--|------------|--------------|-------------|
| TAPE RECORDERS—continued | | | |
| AKAI X1810 | 229.00 | 169.95 | |
| AKAI GX221D | 229.00 | 169.95 | |
| AKAI GX1900D | 239.00 | 177.95 | |
| AKAI GX370D | 350.00 | 259.95 | |
| AKAI CR80D 8-track stereo 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 | |
| AKAI CR81 | 89.50 | 80.95 | |
| AKAI CR81D | 89.50 | 85.95 | |
| FERGUSON 3258 4-track FERROGRAPH 702/704 Dolby | 285.53 | 241.95 | |
| FERROGRAPH 702H Dolby | 297.28 | 251.95 | |
| FERROGRAPH 723/724 Dolby | 326.65 | 278.95 | |
| FERROGRAPH 723H Dolby | 338.40 | 286.95 | |
| FERROGRAPH 702/704 | 235.00 | 172.95 | |
| FERROGRAPH 722/724 | 276.13 | 188.95 | |
| FIDELITY Braemar 4-track GROSVENOR MPX 8400 AM/FM MPX Tuner/Amplifier, magnetic input with built-in 8-track cartridge player with speakers | 34.75 | 19.95 | |
| GRUNDIG TK 121 (twin-track) | 67.50 | 39.95 | |
| GRUNDIG TK 141 (4-track) | 56.25 | 39.95 | |
| GRUNDIG TK 146 (4-track auto) | 62.10 | 45.95 | |
| GRUNDIG TK 146 (4-track auto) | 66.95 | 49.95 | |
| GRUNDIG TK 147 (4-track auto) | 98.65 | 76.95 | |
| GRUNDIG TK 148 (4-tr. auto 2 spd) | 74.10 | 57.95 | |
| GRUNDIG TK 246 4-track Stereo Deck | 131.85 | 101.95 | |
| GRUNDIG TK 3200 Hi-Fi (Battery) | 141.10 | 105.95 | |
| MARCONI 4248 4-track, 2 speed | 52.30 | 39.95 | |
| PHILIPS 4303 Twin-track | 39.48 | 24.95 | |
| PHILIPS 4307 4-track | 50.00 | 35.95 | |
| PHILIPS 4308 De Luxe 4-track | 59.00 | 42.95 | |
| PHILIPS 4418 4-track stereo | 200.00 | 145.95 | |
| TANDBERG 1841 4-tr. stereo deck | 66.00 | 49.95 | |
| TANDBERG 4021X 2-track stereo | 179.00 | 145.95 | |
| TANDBERG 6021X twin-track stereo | 199.30 | 159.95 | |
| TANDBERG 6041X 4-track stereo | 199.30 | 159.95 | |

| | Rec. Price | Retail Price | Comet Price |
|---|------------|--------------|-------------|
| TAPE RECORDERS (CASSETTE) | | | |
| AKAI CS35D tape deck | 79.95 | 59.50 | |
| AKAI CS35 Stereo inc. Speakers | 112.50 | 82.95 | |
| AKAI GXC 40D tape deck | 95.50 | 67.95 | |
| AKAI GXC 40 | 112.50 | 82.95 | |
| AKAI GXC 40T recorder, tuner/amp. | 167.50 | 123.95 | |
| AKAI GXC 45D tape deck | 129.50 | 95.95 | |
| AKAI GXC 46D Dolby tape deck | 139.50 | 103.50 | |
| AKAI GXC 65D Dolby auto-reverse tape deck | 154.50 | 110.25 | |
| APCO Battery/Mains AM/FM Radio | 35.00 | 22.95 | |
| BROWN Radio/cassette recorder | 45.00 | 19.95 | |
| BUSH Discassette DC70 | 20.62 | 15.95 | |
| BUSH TP 60 | 27.62 | 15.95 | |
| BUSH TP 66 Battery/Mains | 28.18 | 21.50 | |
| CARLTON LCR 500 | Sp. Price | 11.95 | |
| DANSETTE DCT 105 | 20.62 | 14.95 | |
| FERGUSON 3240 with case | 24.90 | 15.95 | |
| FERGUSON 3253 | 42.40 | 31.95 | |
| FERGUSON 3257 | 56.45 | 41.95 | |
| FERGUSON 3257/7 spkrs. for above | 16.00 | 12.00 | |
| GEC CR200 AM/FM Cassette/Radio, Battery/Mains with slide controls | Sp. Price | 35.95 | |
| GRUNDIG C210 Batt./mains | 48.75 | 36.95 | |
| HARVARD Elite Cassette/AM/FM Radio (battery/mains) | 44.75 | 23.95 | |
| JVC Nivico 9420 LS with AM/FM radio, battery/mains | 61.45 | 45.95 | |
| JVC Nivico 1710 Radio/Cassette, AM/FM | 61.00 | 42.95 | |
| PHILIPS 2202/2203 | 24.00 | 17.95 | |
| PHILIPS 2204 battery/mains | 29.10 | 24.95 | |
| PHILIPS 2405 Stereo with 2 RH40 | 72.00 | 54.95 | |
| PHILIPS 3302 | 21.50 | 15.95 | |
| PIONEER CT 4141 Dolby Deck | 150.02 | 104.95 | |
| PYE 9116 Stereo | 69.90 | 49.95 | |
| WHARFEDALE Dolby DC9 Mk. II. | 119.00 | 85.95 | |

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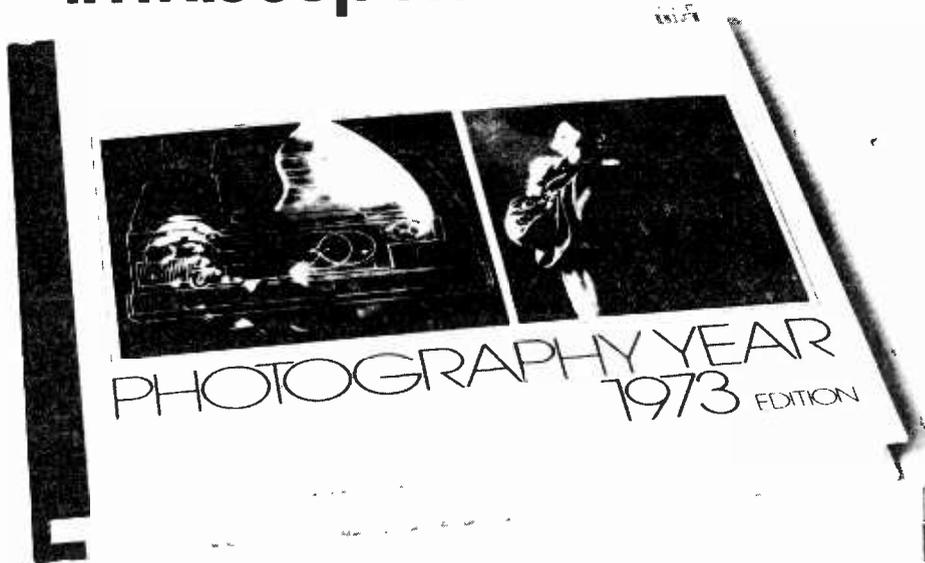
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| 2355 | | 2365 | | 2375 | | 2385 | | 2395 | | 2405 | | 2415 | | 2425 | | 2435 | | 2445 | | 2455 | | 2465 | | 2475 | | 2485 | | 2495 | | 2505 | | 2515 | | 2525 | | 2535 | | 2545 | | 2555 | | 2565 | | 2575 | | 2585 | | 2595 | | 2605 | | 2615 | | 2625 | | 2635 | | 2645 | | 2655 | | 2665 | | 2675 | | 2685 | | 2695 | | 2705 | | 2715 | | 2725 | | 2735 | | 2745 | | 2755 | | 2765 | | 2775 | | 2785 | | 2795 | | 2805 | | 2815 | | 2825 | | 2835 | | 2845 | | 2855 | | 2865 | | 2875 | | 2885 | | 2895 | | 2905 | | 2915 | | 2925 | | 2935 | | 2945 | | 2955 | | 2965 | | 2975 | | 2985 | | 2995 | | 3005 | | 3015 | | 3025 | | 3035 | | 3045 | | 3055 | | 3065 | | 3075 | | 3085 | | 3095 | | 3105 | | 3115 | | 3125 | | 3135 | | 3145 | | 3155 | | 3165 | | 3175 | | 3185 | | 3195 | | 3205 | | 3215 | | 3225 | | 3235 | | 3245 | | 3255 | | 3265 | | 3275 | | 3285 | | 3295 | | 3305 | | 3315 | | 3325 | | 3335 | | 3345 | | 3355 | | 3365 | | 3375 | | 3385 | | 3395 | | 3405 | | 3415 | | 3425 | | 3435 | | 3445 | | 3455 | | 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4575 | | 4585 | | 4595 | | 4605 | | 4615 | | 4625 | | 4635 | | 4645 | | 4655 | | 4665 | | 4675 | | 4685 | | 4695 | | 4705 | | 4715 | | 4725 | | 4735 | | 4745 | | 4755 | | 4765 | | 4775 | | 4785 | | 4795 | | 4805 | | 4815 | | 4825 | | 4835 | | 4845 | | 4855 | | 4865 | | 4875 | | 4885 | | 4895 | | 4905 | | 4915 | | 4925 | | 4935 | | 4945 | | 4955 | | 4965 | | 4975 | | 4985 | | 4995 | | 5005 | | 5015 | | 5025 | | 5035 | | 5045 | | 5055 | | 5065 | | 5075 | | 5085 | | 5095 | | 5105 | | 5115 | | 5125 | | 5135 | | 5145 | | 5155 | | 5165 | | 5175 | | 5185 | | 5195 | | 5205 | | 5215 | | 5225 | | 5235 | | 5245 | | 5255 | | 5265 | | 5275 | | 5285 | | 5295 | | 5305 | | 5315 | | 5325 | | 5335 | | 5345 | | 5355 | | 5365 | | 5375 | | 5385 | | 5395 | | 5405 | | 5415 | | 5425 | | 5435 | | 5445 | | 5455 | | 5465 | | 5475 | | 5485 | | 5495 | | 5505 | | 5515 | | 5525 | | 5535 | | 5545 | | 5555 | | 5565 | | 5575 | | 5585 | | 5595 | | 5605 | | 5615 | | 5625 | | 5635 | | 5645 | | 5655 | | 5665 | | 5675 | | 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6795 | | 6805 | | 6815 | | 6825 | | 6835 | | 6845 | | 6855 | | 6865 | | 6875 | | 6885 | | 6895 | | 6905 | | 6915 | | 6925 | | 6935 | | 6945 | | 6955 | | 6965 | | 6975 | | 6985 | | 6995 | | 7005 | | 7015 | | 7025 | | 7035 | | 7045 | | 7055 | | 7065 | | 7075 | | 7085 | | 7095 | | 7105 | | 7115 | | 7125 | | 7135 | | 7145 | | 7155 | | 7165 | | 7175 | | 7185 | | 7195 | | 7205 | | 7215 | | 7225 | | 7235 | | 7245 | | 7255 | | 7265 | | 7275 | | 7285 | | 7295 | | 7305 | | 7315 | | 7325 | | 7335 | | 7345 | | 7355 | | 7365 | | 7375 | | 7385 | | 7395 | | 7405 | | 7415 | | 7425 | | 7435 | | 7445 | | 7455 | | 7465 | | 7475 | | 7485 | | 7495 | | 7505 | | 7515 | | 7525 | | 7535 | | 7545 | | 7555 | | 7565 | | 7575 | | 7585 | | 7595 | | 7605 | | 7615 | | 7625 | | 7635 | | 7645 | | 7655 | | 7665 | | 7675 | | 7685 | | 7695 | | 7705 | | 7715 | | 7725 | | 7735 | | 7745 | | 7755 | | 7765 | | 7775 | | 7785 | | 7795 | | 7805 | | 7815 | | 7825 | | 7833 | | 7845 | | 7855 | | 7865 | | 7875 | | 7885 | | 7895 | | 7905 | | 7915 | | 7925 | | 7935 | | 7945 | | 7955 | | 7965 | | 7975 | | 7985 | | 7995 | | 8005 | | 8015 | | 8025 | | 8035 | | 8045 | | 8055 | | 8065 | | 8075 | | 8085 | | 8095 | | 8105 | | 8115 | | 8125 | | 8135 | | 8145 | | 8155 | | 8165 | | 8175 | | 8185 | | 8195 | | 8205 | | 8215 | | 8225 | | 8233 | | 8245 | | 8255 | | 8265 | | 8275 | | 8285 | | 8295 | | 8305 | | 8315 | | 8325 | | 8335 | | 8345 | | 8355 | | 8365 | | 8375 | | 8385 | | 8395 | | 8405 | | 8415 | | 8425 | | 8435 | | 8445 | | 8455 | | 8465 | | 8475 | | 8485 | | 8495 | | 8505 | | 8515 | | 8525 | | 8535 | | 8545 | | 8555 | | 8565 | | 8575 | | 8585 | | 8595 | | 8605 | | 8615 | | 8625 | | 8635 | | 8645 | | 8655 | | 8665 | | 8675 | | 8685 | | 8695 | | 8705 | | 8715 | | 8725 | | 8735 | | 8745 | | 8755 | | 8765 | | 8775 | | 8785 | | 8795 | | 8805 | | 8815 | | 8825 | | 8833 | | 8845 | | 8855 | | 8865 | | 8875 | | 8885 | | 8895 | | 8905 | | 8915 | | 8925 | | 8933 | | 8945 | | 8955 | | 8965 | | 8975 | | 8985 | | 8995 | | 9005 | | 9015 | | 9025 | | 9033 | | 9045 | | 9055 | | 9065 | | 9075 | | 9085 | | 9095 | | 9105 | | 9115 | | 9125 | | 9133 | | 9145 | | 9155 | | 9165 | | 9175 | | 9185 | | 9195 | | 9205 | | 9215 | | 9225 | | 9233 | | 9245 | | 9255 | | 9265 | | 9275 | | 9285 | | 9295 | | 9305 | | 9315 | | 9325 | | 9333 | | 9345 | | 9355 | | 9365 | | 9375 | | 9385 | | 9395 | | 9405 | | 9415 | | 9425 | | 9433 | | 9445 | | 9455 | | 9465 | | 9475 | | 9485 | | 9495 | | 9505 | | 9515 | | 9525 | | 9533 | | 9545 | | 9555 | | 9565 | |
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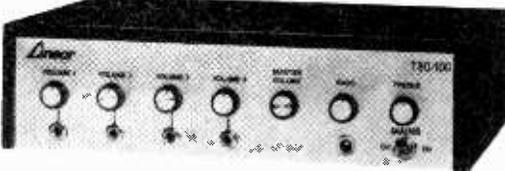
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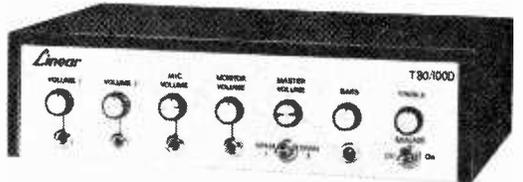
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| 12V x 2 2A x 2 | MT 18 AT† | £2-06 30p |
| 12V x 2 3A x 2 | MT 70 AT† | £2-59 32p |
| 12V x 2 4A x 2 | MT 109 AT† | £2-92 34p |
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30 volts. All tapped at 0-12-15-20-24-30V
Out-Ref. No. Price P.P. Out-Ref. No. Price P.P.

| Amps. | Ref. No. | Amps. | Ref. No. | Price P.P. |
|--------|------------|----------|-------------|------------|
| 500 mA | MT 112 CT† | 1-12 16p | 3A MT 20 AT | 2-64 32p |
| 1A | MT 79 AT† | 1-55 29p | 4A MT 21 AT | 3-10 40p |
| 2A | MT 3 AT | 2-23 30p | 5A MT 51 AT | 4-31 42p |

50 volts. All tapped at 0-19-25-33-40-50V
500 mA MT 102 AT† 1-45 24p 3A MT 105 AT 3-91 41p

| | | | | |
|----|-----------|----------|--------------|----------|
| 1A | MT 103 AT | 2-00 32p | 4A MT 106 AT | 5-06 41p |
| 2A | MT 104 AT | 3-10 32p | 6A MT 107 AT | 7-47 50p |

80 Volts. All tapped at 0-24-30-40-48-60V
500 mA MT 124 AT† 1-46 30p 2A MT 127 AT 3-16 41p

| | | | | |
|----|-----------|----------|--------------|----------|
| 1A | MT 126 AT | 2-24 32p | 3A MT 125 AT | 4-69 41p |
|----|-----------|----------|--------------|----------|

AUTO-WOUND RANGE
Winding tapped at Ref. No. Price P. & P.

| | | | |
|--------------|-------------------|-----------|---------------|
| Power output | Winding tapped at | Ref. No. | Price P. & P. |
| 20 VA | 0-115-210-240 | MT 113 CT | £0-89 14p |
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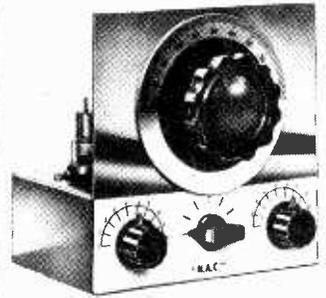
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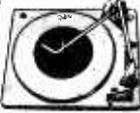
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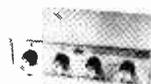
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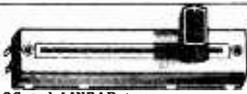
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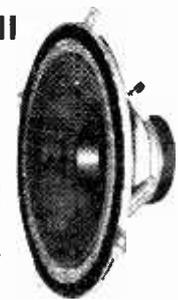
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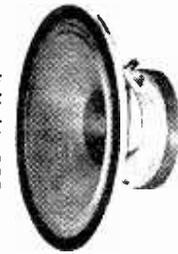
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PRACTICAL WIRELESS

VOL 48 NO 11

Issue 793

MARCH 1973

Quiet Revolution

If you wanted to purchase components, who would you go to? You might think this a silly question, deserving a silly answer, but it is not really. Behind the scenes there is a massive quiet revolution going on which could be the last nail in the wholesaler's coffin and the first for the retailer. The common factor is the distributor, the firm which specialises in highly efficient marketing operations, backed by computerised accounting, on behalf of specified manufacturers.

Franchised distributors have been around for a few years, but only recently is the sophisticated organisation supported by its own AFDEC (Association of Franchised Distributors of Electronic Components) really becoming a powerful force. There are now ten times the number of distributors than there were 10 years ago, and the trends show that the current £40 million worth of business will be doubled in the next eight years, based on today's prices.

The franchised distributor usually, but not always, operates by bulk purchase at reduced prices, and sells at manufacturers' recommended prices. His profit for running costs is derived from the difference between 1-off prices and bulk prices. In most cases this margin is not very great, but several distributors find it sufficient to secure franchise agreements. The competition is high, demanding supreme efficiency and fast service. This means substantial capital tied up in stock at the risk of slow turnover, which also costs money.

Of the 100 or so of these firms now well established, some are looking to alternative outlets for their stock, and this is where the retailer may start to feel the pinch. At least two, SDS Components and GDS Sales, have set up off-shoot companies to supply components to the small consumer, including the man-in-street hobbyist. The latter company, through Best Electronics (Slough) Ltd, go a stage further and specialise in supplying replacements and alternatives for the bench serviceman. RS Components (formerly Radiospares) have been operating on this basis for a long time, but they will not, as yet, supply direct to the hobbyist.

We see these developments as a welcome sign that the industrial suppliers are, at long last, recognising the potential market worth millions of pounds in the constructor and hobbyist field. At the same time the effects of this, combined with price increases due to VAT, will be a severe blow to the high street shop and small mail order business. What is also implied is that the shop can purchase from the distributor, but there does not appear to be any margin for overheads and profit for the shopkeeper. So if your local shop is reluctant to order small quantities from a series of distributors, the reason is obvious.

M. A. COLWELL—Editor.

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THE APRIL ISSUE WILL BE
PUBLISHED ON MARCH 2nd

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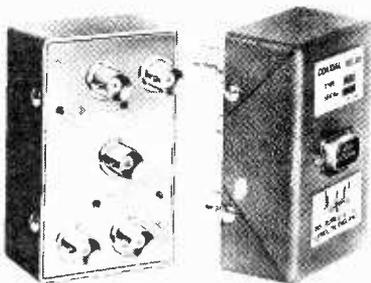
by
Colin Riches

Amtron kits

Some months ago, an Italian firm of electronic kit manufacturers called Amtron took some advertising space in this magazine. In these advertisements they asked for application for sole UK distributorship.

A company called "The Trading Post" has now been appointed sole UK importer for Amtron and set up the marketing company under the title "Amtron UK". Their address is 4 & 7 Castle Street, Hastings, Sussex.

Coax relays



Hatfield Instruments announce a range of 2, 4 and 6-way, single-pole relays. The spec. quotes a minimum life expectancy of 1 million operations.

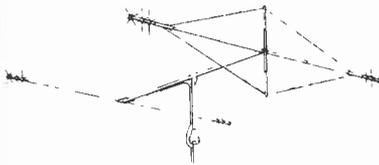
The relays are for 12 or 24V use and all internal contacts are hard gold plated.

Further gen from Hatfield Instruments Ltd., Burnington Way, Plymouth, PL5 3LZ, Devon.

Vice catalogue

If you would like a copy of the free catalogue which contains vices like the one illustrated together with many other useful tools, write to Special Products Distributors Ltd. 81 Piccadilly, London, W1.

Ham aeriels



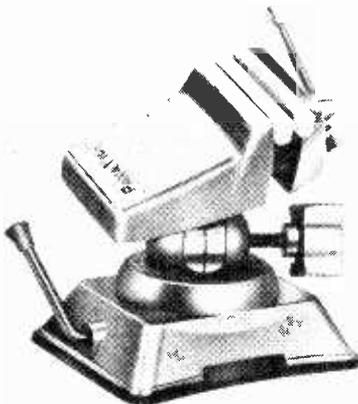
Waters Electronics inform us that they have been appointed European Distributors for Mini-Products Inc. P.A., U.S.A.

Mini-Products make a range of compact beam and vertical aeriels for the Amateur bands, which should be of particular interest to those of you who have mini-sized gardens or don't want to spend their money on heavy-duty rotators or large towers.

Unlike most beam aeriels, planning permission with the 2-element models B24 and HQ-1 (illustrated) should be no problem.

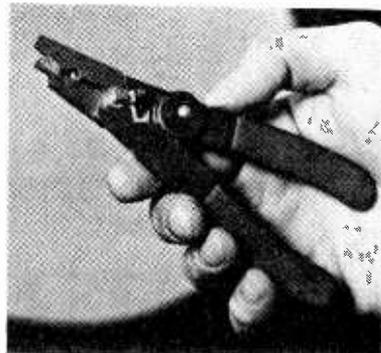
The HQ-1 is a 4-band 2-element aerial incorporating the Mini-Products "multiple hat" loading principle. This principle considerably reduces the aerial length. Operating bands are 6, 10, 15 and 20 metres. Forward gain is 5.6dB average. SWR at resonance is less than 1.5 to 1. Front to back ratio is 12 to 17dB, power rating 1,200W p.e.p. and input impedance 50Ω. Price is £42.95.

If any readers would like more "blurb" on the HQ-1 and the rest of the range of aeriels, drop a line to P. W. Waters, G3OJV, Waters Electronics, 8 Gay Bowers, Hockley, Essex. Tel. Hockley 4930.



A wire stripper

This is a device marketed by Spiralux (Hollands and Blair) Ltd. It is a wire stripper, wire looper, cutter and screwdriver. Price is 40p. Hollands and Blair Ltd., Bensham Grove, Thornton Heath, Surrey.



The Spiralux wire stripper.

Mullard films

Mullard Ltd. announce six new colour 35mm films which are also available as slide sets. They are "The Transistor" which shows the basics of transistor operations; "Magnetism-Part 1" which deals with magnetic fields and their effect on current carrying conductors; "Magnetism—Part 2" which explains amongst other things the principles of moving-coil instruments.

The fourth filmstrip "Semiconductor Photocells" explains the theory of the photo-diode and photo-transistor and their various applications. "Conduction in Solids" tells how the lattice structure of a solid effects its conductivity and explains the function of electrons and film number six "Conduction in Gases" shows molecular movements in gases and their energies illustrates how glow and arc discharges differ in high and low pressure columns.

For further details and prices, please don't contact Mullard. All information can be received from The Slide Centre Limited, Portman House, 17 Broderick Road, London, SW17 7DZ.

NEWS...

NEWS...

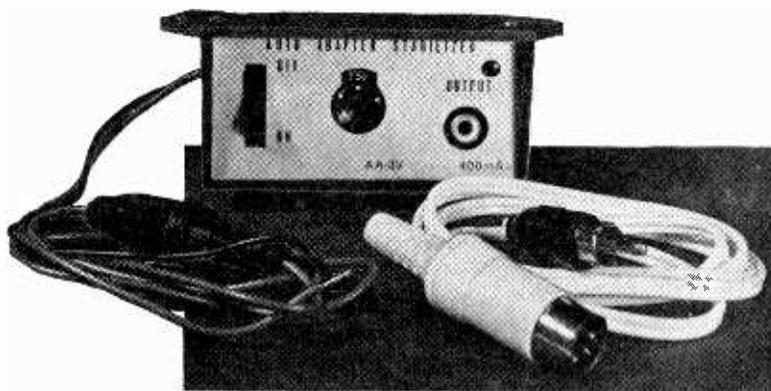
NEWS...

Auto adaptor

Omnia Products market a useful little unit that enables stabilised voltages of 6, 7.5 and 9V to be obtained from a 12V car battery.

The required voltage can be set by the adjustment on the front of the unit (see photograph). An on/off switch and a pilot lamp are provided together with a phono socket for the output. The unit is fused and the lead supplied with our unit was fitted with a DIN plug for our EL3302 cassette recorder.

The Auto Adaptors can either be obtained from local dealers or direct from Omnia for £3.50. *Omnia Products, 25 Wilbury Gardens, Hove, Sussex. BN3 6HQ.*



"Electrokits"

Electrokit have supplied us with their latest list of kit prices. As examples, the 8W Amplifier, published in P.W. November 1972, costs £8.20. The IC Power Supply in the same issue costs £4.00. The Reverberation Unit kit, including only the resistor pack, capacitor pack and semiconductor pack, costs £10.70.

All prices include post and packing. Further information may be obtained from *Electrokit, 12 Lauderdale Road, London, W.9.*

Stylus patent

Re: British Patent 1160839 (Application 16619/67).

At the request of our clients Moviecol Enterprises Ltd., we are writing to draw your attention to the above British patent which covers a stylus operated miniature electric organ. We believe you will find this patent of interest in relation to the "Music Maker" described in the December issue of Practical Wireless on page 716. We suggest that you may also wish to notify Mr. D. Smith and Messrs. Servitronix Ltd., of the existence of our clients' British patent 1160839. Baron & Warren, Chartered Patent Agents (16 Kensington Square, London, W8 5HL).

Audio fidelity

RSC Hi-Fi Centres Ltd., the retail and mail order part of the Audio Fidelity Group has recently opened branches in Coventry and Stockport, making a total of 19 branches in England and Scotland.

De-solder kit



Elekon Enterprises recently sent us a "Soksol De-soldering Kit". It comes complete with 20ft. of special copper braid, chemical solution and full instructions.

After the braid has been processed in the de-solder solution, it should be left to dry for about 48 hours. It will then, with the aid of a soldering iron, desolder joints. The kit, as illustrated, is available for £1 plus 15p post from *Elekon Enterprises, 224a St. Paul's Road, Highbury Corner, London N.1.*

World Radio Club

World Radio Club, the BBC World Service programme for radio enthusiasts and DXers, now has 11,000 members.

World Radio Club is broadcast in the BBC World Service on Thursdays at 1245 GMT, Fridays at 2345 and Sundays at 0815 GMT. Membership is free and all listeners have to do to join is write to World Radio Club, BBC, Bush House, London.

The BBC World Service is on the air twenty-four hours a day, with News and a full range of programmes, broadcast on both short and medium waves, to be heard in all parts of the world at convenient listening times. World Radio Club is one of its programmes. The club caters for short-wave enthusiasts of all ages and for all listeners who want to get the best results from their radio equipment. It uses ordinary, uncomplicated English, whether talking about a simple aerial, or the latest space communication achievement.

DX News is a regular item each week, and with all the resources of the BBC at the disposal of the World Radio Club, it really is newsworthy. Members who write for help with practical listening problems will be answered by post or over the air.

Full details of BBC World Service programmes can be obtained from the *BBC, Bush House, P.O. Box 76, Strand, London WC2B 4PH.*

Simple

4-METRE

TRANSMITTER

F.G.RAYER G30GR

DUE to the fact that the limitations of crystal control are quite acceptable on the 4 metre band, a transmitter running some 10 to 15W on 70MHz can be a very straightforward piece of equipment. The transmitter shown here consists of the r.f. section only as an existing power supply and modulator was used in conjunction with it.

Maximum input to the p.a. is 50mA at 300V, or 15W, but the power actually run may depend somewhat on the available h.t. supply and modulator. It would be in order to operate the r.f. section from its own h.t. pack but this is scarcely necessary with low power, though it can be a solution if current cannot be drawn from existing equipment. HT requirements are up to a maximum of about 90mA at 300V for the whole r.f. section, plus 1.8A at 6.3V for the heaters.

Adequate grid drive was obtained with a 250V supply for the crystal oscillator and doubler but efficiency begins to fall off if less than 300V is provided for the p.a. It is useful to have a combined modulator/power-pack incorporating at least a 150mA 300V h.t. supply so that some 70 to 80mA will be available for the modulator itself and a similar current for an r.f. unit, or other equipment, which may be plugged in.

CIRCUIT

This is shown in Fig. 1 and uses a 6AM6 as the crystal oscillator. This type of circuit does not depend

on the tuning of L1 for oscillation; L1 is actually tuned to select the wanted harmonic.

Crystals are chosen so that multiplication by 8 gives a frequency in the 70MHz band. They will thus be in the vicinity of 8.8MHz. (This is quoted only as an example, and comes out at $8.8 \times 8 = 70.4\text{MHz}$).

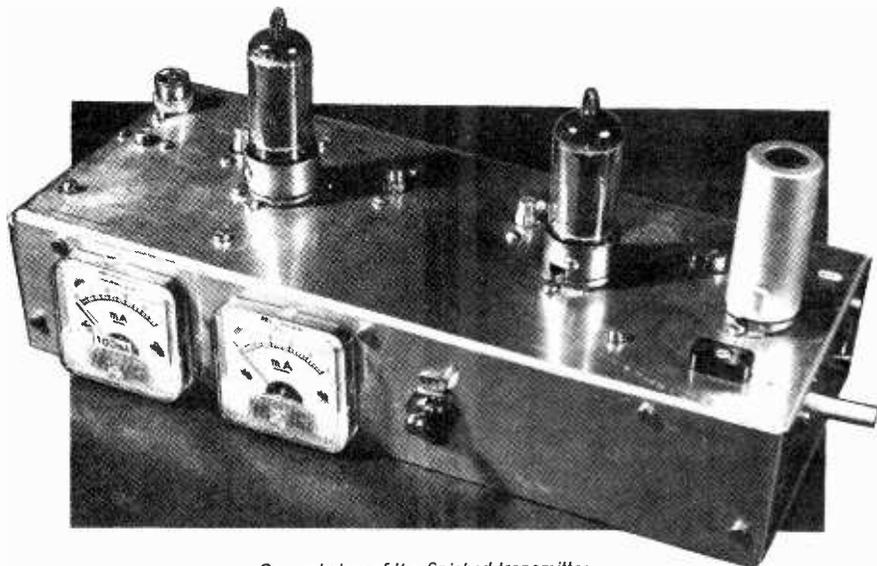
L1 is tuned to the 4th harmonic, or approx. 35.2MHz the following 5763 acting as a doubler. When first testing the circuit it can be useful to check the doubler grid current so a meter can be clipped across R6 for this purpose.

L2 and L3 are both tuned to the output frequency. Grid current in the p.a. develops bias across R8, which is 22k Ω , so 2 to 3mA grid current will provide some 44 to 66V bias. For ease in setting up and checking operation a 5mA meter M1 is permanently connected to show grid current.

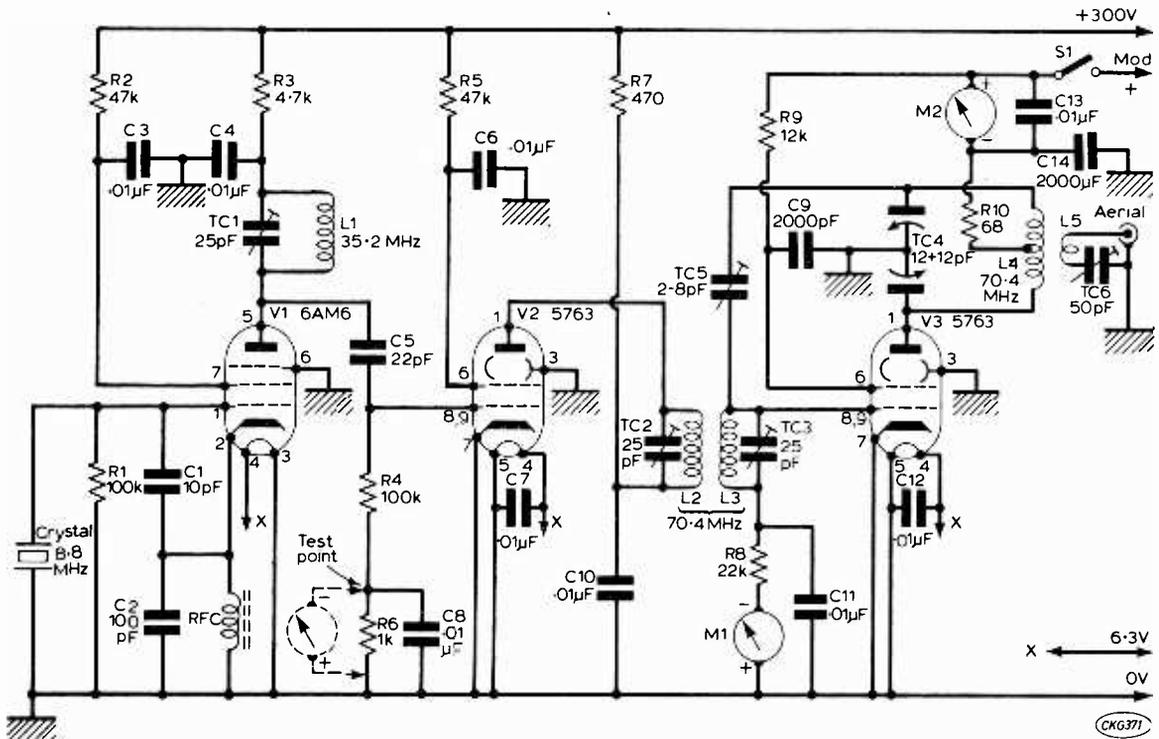
The 5763 p.a. is listed as suitable for use up to 175MHz and was found to give very good efficiency. Meter M2 indicates anode current. A 1mA meter, shunted to read 0-100mA, was used here.

TC4 and L4 is a balanced centre-tapped arrangement so that TC5 can be employed for neutralising. It was found that the p.a. was stable without neutralising but tuning TC4 brought about quite noticeable changes in grid current, shown by M1. With neutralising this effect is almost absent and better efficiency is obtained.

Switch S1 removes h.t. from the p.a. mainly for tune-up purposes when checking grid current shown by M1 and also allows the transmitter frequency to be located on the receiver.

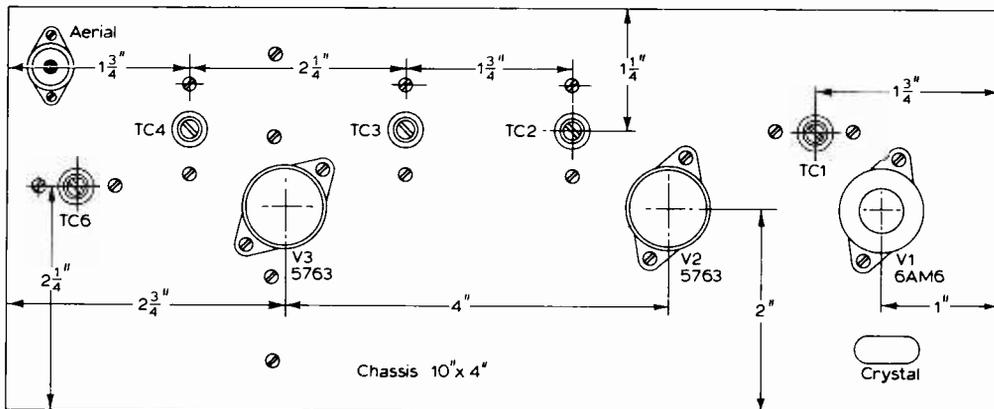


General view of the finished transmitter.



▲ Fig. 1: Schematic diagram of the complete transmitter.

Fig. 2: Drilling details on top of the chassis. ▼



CKG373

CONSTRUCTION

Fig. 2 shows dimensions on top of the chassis for which 10 x 4in. flanged "universal chassis" member was used with flanged 4 x 2in. ends and 10 x 2in. plates for the front and back. It is convenient to leave off these side plates until most of the wiring is completed.

All the trimmers TC1-TC4 are of the type having isolated bushes for 6BA bolts so that the rotors are insulated from the chassis. TC1 could be a small air-spaced variable capacitor of the usual type with its bush insulated from the chassis with washers. TC2 and TC3 are not used in a balanced circuit, but are "butterfly" types mainly to provide an easy means of mounting L2 and L3. TC4 must be a butterfly

type. Ensure that there is ample clearance for the spindles of TC1-TC3, to avoid h.t. or p.a. bias shorts.

The fixing holes for the p.a. valveholder are left until a check has been made that the pins will come in such a position that pins 7, 8 and 9 are on one side of the screen below the chassis and the remaining pins the other side.

A 4 x 2in. flanged member forms the screen which is filed or cut away to give only essential clearance to the valveholder. A hole is drilled in advance for the heater lead. Only two other leads pass through here and these use the holes already punched in the member near the flanges. The latter have to be cut away for about 1/2in. so that the member fits inside the 10 x 4in. part. These are bolted together as in Fig. 3. To obtain enough clearance for pins 1, 6 and 9, pin 7 may be in contact with the screen.

WIRING

Components and wiring are shown in Fig. 3. All leads are as short as reasonably possible, especially those for earth returns and by-pass capacitors. Heater leads for earth returns and by-pass capacitors. Heater leads to pins X run against the chassis. Insulated stand-offs are used to support some points in the h.t. circuit.

L1 stands vertically near TC1. L2 and L3 are about $\frac{1}{8}$ in. apart, but can be moved to obtain suitable grid current. If these are wound with bare wire take care that they do not touch each other. L4 is centre tapped for supply resistor R10. L5 is of well insulated wire and can be moved into L4 to increase coupling.

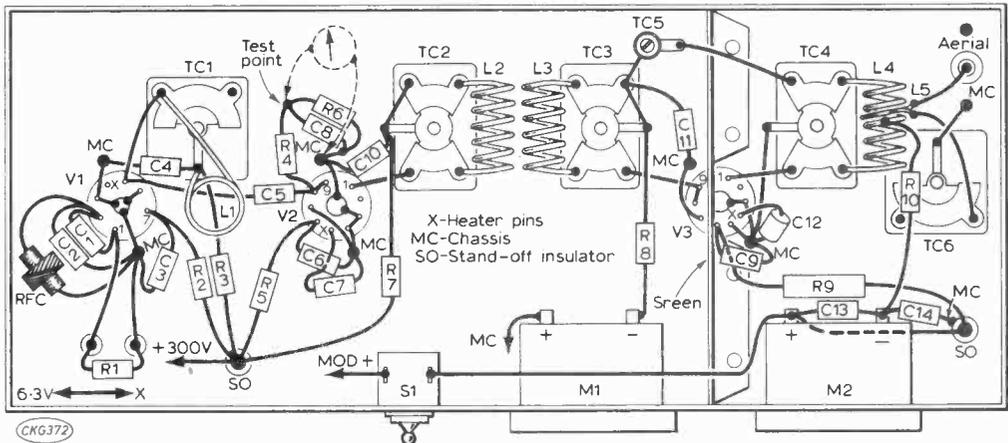
A 4-core flexible cord is made up and equipped with a multi-pin plug or other means of connecting to the modulator/power-supply. A screen is placed on the 6AM6, but not on the 5763's, in view of the heat produced here. A reduced h.t. supply could be used for a first test, though no damage will be done provided grid current is obtained in the way described. But failing this, cathode current in the 5763 stages may be high and anode dissipation above the rated maximum.

CO ADJUSTMENT

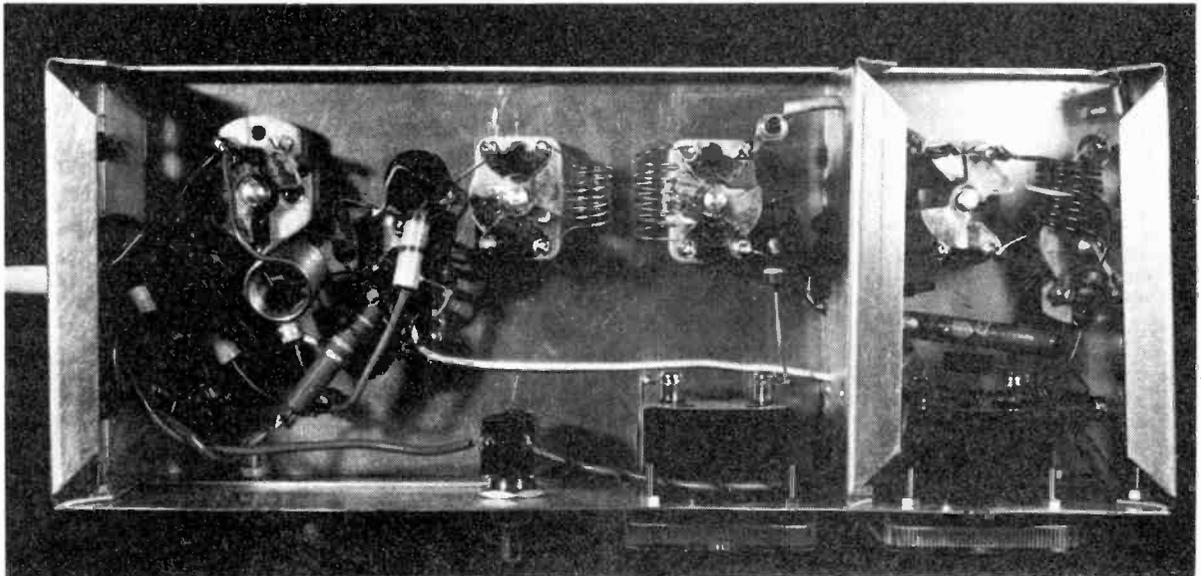
Resistors R5 and R7 can be temporarily disconnected from the h.t. line and S1 should be open. A meter is clipped across R6 (positive to chassis). L1 is then tuned by TC1 to secure maximum grid current in this stage, which is likely to be around 0.2mA or more.

It is as well to make a check to see that L1 is tuned to the 4th harmonic. If the crystal frequency is about 8.8MHz, this will be 35.2MHz. Wrong tuning positions would be the 3rd harmonic (26.4MHz) and 5th harmonic (44MHz). Due to variations in the exact dimensions of L1 and stray circuit capacitances it might in some cases be possible to reach the 3rd or 5th harmonics near the extreme settings of TC1.

When output is obtained from L1 on 35MHz it is impossible to tune L2, L3 or L4 to the wrong harmonic, so incorrect operation of the p.a. should not arise. Once L1 is tuned to 4x the crystal frequency this is followed by 2x in the doubler, resulting in 8x, or around 70.4MHz, from a crystal with a fundamental frequency of about 8.8MHz. This is mentioned



▲ Fig. 3. Under-chassis wiring guide. This view will be useful in conjunction with Fig. 3 ▼



in detail to point out that if L1 is tuned to the 3rd harmonic, or 26.4MHz, the following stage might also, in error, be used as a tripler resulting in 3x3 or 9x or 79.2MHz. With variations in home-made coils, it might be possible to tune L4 to this frequency. This will be avoided by a wavemeter check of L1 or by noting that the doubler gives an output at the expected frequency on the receiver.

★ components list

Resistors

| | | |
|--------------------------|-------------------------|-------------------------|
| R1 100kΩ $\frac{1}{2}$ W | R5 47kΩ 1W | R9 12kΩ 1W |
| R2 47kΩ $\frac{1}{2}$ W | R6 1kΩ $\frac{1}{4}$ W | R10 68Ω $\frac{1}{4}$ W |
| R3 4.7kΩ $\frac{1}{2}$ W | R7 470Ω $\frac{1}{2}$ W | |
| R4 100kΩ $\frac{1}{2}$ W | R8 22kΩ $\frac{1}{2}$ W | |

Capacitors

| | |
|---------------------|----------------------|
| C1 10pF SM | C8 0.01μF Disc cer. |
| C2 100pF SM | C9 2000pF 600VW |
| C3 0.01μF Disc cer. | C10 0.01μF Disc cer. |
| C4 0.01μF Disc cer. | C11 0.01μF Disc cer. |
| C5 22pF SM | C12 0.01μF Disc cer. |
| C6 0.01μF Disc cer. | C13 0.01μF Disc cer. |
| C7 0.01μF Disc cer. | C14 2000pF 600 VV |

| |
|--|
| TC1 25pF air-spaced trimmer (Jackson C801) |
| TC2/3 25pF+25pF butterfly trimmer (Jackson C713) |
| TC4 12pF+12pF butterfly trimmer (Jackson C713) |
| TC5 2.8pF tubular trimmer |
| TC6 50pF air spaced trimmer (Jackson C801) |

Valves

| | | |
|---------|---------|---------|
| V1 6AM6 | V2 5763 | V3 5763 |
|---------|---------|---------|

Inductors

| |
|--|
| L1 10 turns 18 swg $\frac{1}{2}$ in. i.d., spaced to $\frac{3}{8}$ in. long. |
| L2 7 turns 20 swg $\frac{3}{8}$ in. i.d., spaced to $\frac{3}{8}$ in. long. |
| L3 As L2 |
| L4 9 turns 18 swg $\frac{1}{2}$ in. i.d., spaced to $\frac{3}{8}$ in. long. |
| L5 1 turn insulated wire in centre of L4. |

Miscellaneous

M1, 5mA miniature meter. M2, 100mA miniature meter. S1, on-off toggle switch. Valveholders, B7G with screen (1), B9A (2). Chassis, universal chassis flanged members, 10 x 4in., 4 x 2in. (3 off), flat sheet 10 x 2in. (2 off) (Home Radio). Co-axial socket. RFC, dust-cored choke. Stand-offs. Crystal, 8.8 MHz (see text) Type HC6U and holder (Senator Crystals, 36 Valleyfield Rd, London, SW16).

DOUBLER ADJUSTMENT

TC2 and TC3 are tuned for maximum grid current on M1 with S1 open but R5 and R7 connected normally. If either trimmer is seen to be fully open for maximum grid current, stretch the associated coil a little. Conversely, should either trimmer be fully closed, the associated coil should be compressed.

With a 300V supply well over 4mA was obtained on M1, but the p.a. is normally operated with around 3mA. Should less than 2mA be obtained move L2 and L3 closer together. Insufficient grid current will considerably reduce r.f. output. Ancient or defective crystals cannot be expected to have the necessary activity and a crystal of the type listed is recommended, the exact frequency in this range being a personal choice of course.

Excess grid current can be avoided by slightly staggering the tuning of TC2 and TC3, or by moving L2 and L3 apart, or increasing the value of R5 to reduce the h.t. on V2.

PA TUNING

An initial test can be made using a 12V bulb as an r.f. load connected to the aerial outlet, or to a one or two turn loop placed over L4. TC5 is initially fully unscrewed. If necessary, stretch or compress L4 to bring tuning within the range of TC4.

With S1 open, grid current shown by M1 will dip slightly as TC4 is tuned through resonance. Screw down TC5 slightly, checking meanwhile until no change in grid current can be observed when TC4 is tuned through resonance. If TC5 is screwed down too far changes in grid current will again become apparent as TC4 is adjusted. Neutralising is not touchy or difficult. It is correct when, with S1 closed, resonance obtained with TC4 coincides with maximum lamp brilliance, minimum current on M2, and adjusting TC4 causes no significant change in grid current.

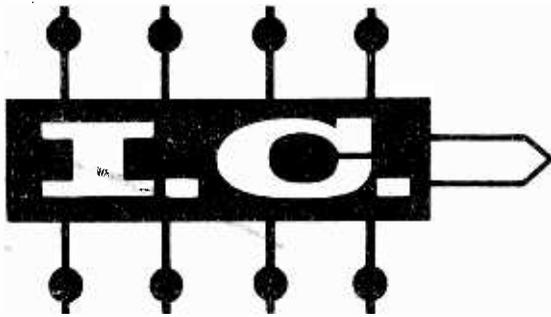
AERIAL

The enthusiastic 4m operator is likely to end up with some multi-element array which can be purchased or constructed from information in the various handbooks.

Here, it is proposed to point out that one can get started on 4m with nothing more than a dipole, around 79 $\frac{1}{2}$ in. overall length. This is conveniently made from $\frac{1}{4}$ in. or $\frac{3}{8}$ in. alloy tubing the inner ends being secured in a TV type junction box, or in an electrician's insulated junction box or bolted to a piece of insulating material. A 75Ω co-axial feeder is connected to the inner ends and the whole unit raised on a light pole or situated as circumstances allow. A little directivity will be found but there is not much real need to make provision to rotate the aerial.

Trimmer TC6 gives some control over loading, without moving L5, and allows adjustment to compensate for the reactance of L5, if necessary. There should be little difficulty in finding a setting for TC6, and a position for L5, which results in M2 showing the wanted input current, when TC4 is tuned to the dip, in the usual way.

If a test is made with a lamp load or some form of r.f. indicator, it will be seen that a worthwhile increase in output power may be achieved by very slight adjustments of TC4, and that the dip on M2 has its limitations as an indication of the exact tuning position for TC4. For this reason, it is a good plan to use some form of r.f. output indicator. One such indicator is a loop, crystal diode and sensitive d.c. meter (say, 100μA to 1mA full-scale). The loop is put in position to pick up some of the r.f. in L4/L5, taking care to avoid having it too near, until it is seen what meter reading is likely. Tuning is then directed towards obtaining the best reading on the meter, corresponding to maximum r.f. in L4. Other means, such as the use of an s.w.r. meter showing forward power in the aerial feeder, would be just as suitable, or even better, if suitable for the frequency. ■



OF THE MONTH

L.A.J. IRELAND

Number 36

ITT SAK110 Tachometer Driver

SPECULATION on the impact of electronics on motor vehicle design has been current for so long, and with such little results, that it retains little credibility among engineers involved in either specialty. Granted that a few models have been produced with electronic fuel injectors rather than carburetors, and that the occasional Volkswagen carries a sticker about computer servicing methods, but in general electronics is classified with fuel cells among the "Advanced ideas for the 1980's". The difficulty seems to be that whereas electronic systems substituting for many of the devices in the car could be designed and produced, the mechanical versions, for example of the signal light flasher, have been so widely applied and are so familiar, that there is little incentive for replacement. It is therefore rather pleasing to be able to present this month an integrated circuit specifically designed for the car, the ITT SAK110 tachometer driver, for electronic rev. counters.

It is basically a variation of the multivibrator oscillator, with one stable state. An input pulse switches off the transistor which is conducting and the device produces an output current. This conducting state is, however, unstable, and after a time determined by an external capacitor and resistor the device reverts to the original state. The period of the output pulse is independent of input waveform, as long as it is of sufficient amplitude to trigger the transition to the conducting stage. The total charge passed by the device per second is therefore determined solely by the number of input pulses applied in that time, and can be displayed on an appropriate meter. If the pulses are derived from the contact breaker of a car the meter reading will indicate the number of sparks delivered to the engine per second and therefore the number of revolutions per minute, when suitably calibrated.

Since the device is expected to respond to pulses delivered to it by the contact breaker, high sensitivity is not required. In fact, it would be quite useless in close proximity to a car engine, an environment of high electrical noise. In such a location, a highly sensitive device would record a large number of spurious events. The integrated circuit will be unresponsive to input pulses of less than eight volts, thereby guaranteeing noise immunity while securing definite triggering at the operating voltage of the car battery and the circuit breaker. The unit is designed for negative earth operation, and the input is diode protected against any negative-going input, whether accidentally applied or resulting from

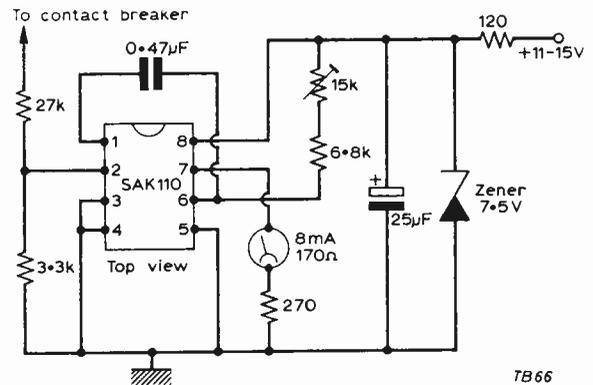


Fig. 1: Circuit using the SAK110, for a nominal battery voltage of 12V.

ambient noise. The meter is driven by a push-pull output pair of transistors fabricated on the integrated circuit substrate; such an arrangement permits the use of moving coil meters, despite their high inductance, and independent of the frequency of the output pulses required by the engine speed.

As is clear from Fig. 1, the unit operates from a zener stabilised power supply derived from the car battery, so that reliable operation is guaranteed despite the state of the battery charge. The other external components required are the timing resistor and capacitor, which determine the duration of the conducting period following receipt of a given triggering pulse.

If the conducting period is too short, the device will revert to the stable state during the period of the triggering pulse, and will be retriggered. Alternatively, if the period is too long, a second triggering pulse will arrive during the conduction state induced by its predecessor, and will be ignored. The first situation will be evident in that the rev. counter will not indicate an accelerating engine as speed is increased from tick-over; with long time-constants the lack of response will be evident at the high end of the speed range. A variable resistor is therefore indicated in Fig. 1 for adjustment of this parameter. The circuit illustrated gives an application of the SAK110 to a four cylinder four stroke engine, with a maximum speed of 6000 rpm.

The device is marketed in the U.K. by:—ITT Electronic Services, Edinburgh Way, Harlow, Essex at 77p plus postage.

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BRAND NEW SEMICONDUCTORS & COMPONENTS GUARANTEED

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TRANSISTORS

| | | | | | | | | | | | |
|--------|------|---------|------|--------|------|--------|------|---------|------|--------|------|
| 20301 | 0-15 | 2N2924 | 0-12 | 2N5172 | 0-08 | AF116 | 0-25 | BC307 | 0-10 | BF271 | 0-21 |
| 20302 | 0-15 | 2N2925 | 0-12 | 2N5173 | 0-08 | AF117 | 0-20 | BC307A | 0-10 | BF272 | 0-21 |
| 20303 | 0-15 | 2N2925 | 0-12 | 2N5174 | 0-08 | AF118 | 0-50 | BC307VI | 0-10 | BF273 | 0-25 |
| 20306 | 0-20 | Green | 0-10 | 2N5176 | 0-26 | AF121 | 0-22 | BC308 | 0-09 | BF274 | 0-28 |
| 20309 | 0-30 | Orange | 0-10 | 2N5177 | 0-26 | AF122 | 0-24 | BC308A | 0-09 | BF275 | 0-46 |
| 20344A | 0-25 | Orange | 0-10 | 2N5191 | 0-96 | AF127 | 0-20 | BC308B | 0-09 | BF458 | 0-57 |
| 20345B | 0-25 | 2N3053 | 0-22 | 2N5192 | 1-24 | AF129 | 0-19 | BC309 | 0-10 | BF459 | 0-57 |
| 20371 | 0-15 | 2N3054 | 0-47 | 2N5193 | 1-01 | AF130 | 0-25 | BC309B | 0-10 | BF821A | 2-30 |
| 20374 | 0-15 | 2N3054 | 0-46 | 2N5194 | 1-10 | AF132 | 0-25 | BC310 | 0-30 | BF828 | 0-92 |
| 20381 | 0-22 | 2N3055 | 0-50 | 2N5195 | 1-46 | AF178 | 0-55 | BC328 | 0-22 | BF861 | 0-27 |
| 20417 | 0-20 | 2N3390 | 0-20 | 2N5245 | 0-43 | AF179 | 0-65 | BC337 | 0-19 | BF898 | 0-28 |
| 2N109 | 0-40 | 2N3391 | 0-20 | 2N5457 | 0-30 | AF180 | 0-50 | BC338 | 0-19 | BFW11 | 0-41 |
| 2N174 | 0-40 | 2N3391A | 0-22 | 2N5458 | 0-38 | AF186 | 0-40 | BCY30 | 0-25 | BFW15 | 0-35 |
| 2N176 | 0-75 | 2N3392 | 0-13 | 2N6459 | 0-83 | AF200 | 0-35 | BCY31 | 0-40 | BFX13 | 0-23 |
| 2N274 | 0-75 | 2N3393 | 0-12 | 3N128 | 0-63 | AF239 | 0-41 | BCY32 | 0-60 | BFX29 | 0-25 |
| 2N336 | 0-75 | 2N3394 | 0-12 | 3N138 | 1-37 | AF240 | 0-72 | BCY32 | 0-75 | BFX30 | 0-25 |
| 2N351 | 0-85 | 2N3402 | 0-17 | 3N139 | 1-36 | AF278 | 0-54 | BCY33 | 0-34 | BFX37 | 0-30 |
| 2N456A | 0-75 | 2N3403 | 0-19 | 3N140 | 0-78 | AF284 | 0-36 | BCY34 | 0-35 | BFX44 | 0-23 |
| 2N384 | 0-93 | 2N3404 | 0-24 | 3N141 | 0-69 | AFY42 | 0-74 | BCY38 | 0-40 | BFX63 | 2-48 |
| 2N388A | 0-40 | 2N3405 | 0-27 | 3N142 | 0-54 | AFY21 | 0-55 | BCY39 | 1-05 | BFX68 | 0-30 |
| 2N404 | 0-28 | 2N3414 | 0-10 | 3N143 | 0-64 | AL102 | 0-75 | BCY40 | 0-50 | BFX84 | 0-24 |
| 2N404 | 0-28 | 2N3415 | 0-10 | 3N152 | 0-79 | AL103 | 0-70 | BCY42 | 0-15 | BFX85 | 0-29 |
| 2N456 | 0-75 | 2N3416 | 0-15 | 3N153 | 0-74 | ABY26 | 0-30 | BCY43 | 0-15 | BFX86 | 0-24 |
| 2N456A | 0-75 | 2N3417 | 0-15 | 3N154 | 0-74 | ABY27 | 0-30 | BCY44 | 0-15 | BFX87 | 0-24 |
| 2N457A | 0-80 | 2N3420 | 0-15 | 3N159 | 1-00 | ABY28 | 0-28 | BCY59 | 0-22 | BFX88 | 0-22 |
| 2N491 | 3-25 | 2N3671 | 1-12 | 3N187 | 1-30 | ABY29 | 0-30 | BCY66 | 0-66 | BFX89 | 0-45 |
| 2N584 | 0-28 | 2N3572 | 0-07 | 3N200 | 2-07 | ABY50 | 0-20 | BCY67 | 0-94 | BFY10 | 0-35 |
| 2N581 | 0-84 | 2N3703 | 0-10 | 3N201 | 1-05 | ABY56 | 0-85 | BCY70 | 0-12 | BFY11 | 0-45 |
| 2N699 | 0-15 | 2N3703 | 0-10 | 40050 | 0-78 | ABZ21 | 0-55 | BCY71 | 0-22 | BFY17 | 0-80 |
| 2N697 | 0-15 | 2N3704 | 0-10 | 40051 | 0-81 | RC107 | 0-18 | BCY72 | 0-25 | BFY18 | 0-25 |
| 2N698 | 0-25 | 2N3705 | 0-10 | 40052 | 0-81 | RC108 | 0-18 | BCY88 | 2-40 | BFY19 | 0-25 |
| 2N699 | 0-25 | 2N3706 | 0-90 | 40039 | 0-83 | RC109 | 0-14 | BCY89 | 0-80 | BFY29 | 0-40 |
| 2N705 | 0-10 | 2N3707 | 0-10 | 40310 | 0-82 | RC110 | 0-13 | BCY90 | 0-35 | BFY37 | 0-20 |
| 2N706A | 0-12 | 2N3708 | 0-70 | 40313 | 0-83 | RC113 | 0-13 | BCY91 | 0-50 | BFY41 | 0-43 |
| 2N709 | 0-38 | 2N3709 | 0-80 | 40316 | 0-50 | RC114 | 0-12 | BCY92 | 0-15 | BFY43 | 0-62 |
| 2N709 | 0-38 | 2N3710 | 0-80 | 40318 | 0-92 | RC116 | 0-15 | BD116 | 0-75 | BFY50 | 0-20 |
| 2N711 | 0-80 | 2N3711 | 0-90 | 40322 | 0-92 | RC116A | 0-18 | BD121 | 0-75 | BFY61 | 0-10 |
| 2N718 | 0-21 | 2N3712 | 0-95 | 40326 | 0-46 | BC117 | 0-21 | BD123 | 0-82 | BFY62 | 0-26 |
| 2N720 | 0-50 | 2N3714 | 1-15 | 40362 | 0-44 | BC118 | 0-11 | BD124 | 0-87 | BFY63 | 0-15 |
| 2N721 | 0-55 | 2N3715 | 1-23 | 40363 | 0-88 | BC119 | 0-27 | BD130 | 0-67 | BFY66 | 0-24 |
| 2N714 | 0-15 | 2N3716 | 1-30 | 40389 | 0-46 | BC123 | 0-29 | BD132 | 0-50 | BFY64 | 0-41 |
| 2N718 | 0-21 | 2N3717 | 1-08 | 40394 | 0-56 | BC125 | 0-15 | BD135 | 0-43 | BFY75 | 0-22 |
| 2N720 | 0-50 | 2N3718 | 1-15 | 40395 | 0-50 | BC126 | 0-20 | BD136 | 0-40 | BFY77 | 0-24 |
| 2N721 | 0-55 | 2N3719 | 1-23 | 40406 | 0-44 | BC132 | 0-80 | BD137 | 0-55 | BFY78 | 0-86 |
| 2N714 | 0-15 | 2N3720 | 1-30 | 40408 | 0-50 | BC134 | 0-11 | BD138 | 0-68 | BFY90 | 0-60 |
| 2N718 | 0-21 | 2N3721 | 1-08 | 40409 | 0-52 | BC136 | 0-15 | BD139 | 0-71 | BFY93 | 0-30 |
| 2N720 | 0-50 | 2N3722 | 1-15 | 40410 | 0-58 | BC137 | 0-15 | BDY10 | 1-25 | BSX20 | 0-14 |
| 2N721 | 0-55 | 2N3723 | 1-23 | 40411 | 2-00 | BC138 | 0-20 | BDY11 | 1-50 | BSX21 | 0-20 |
| 2N714 | 0-15 | 2N3724 | 1-30 | 40414 | 3-55 | BC140 | 0-84 | BDY17 | 1-50 | BSX26 | 0-34 |
| 2N718 | 0-21 | 2N3725 | 1-08 | 40428 | 1-44 | BC141 | 0-89 | BDY18 | 1-75 | BSX27 | 0-84 |
| 2N720 | 0-50 | 2N3726 | 1-15 | 40464 | 0-88 | BC142 | 0-24 | BDY19 | 1-87 | BSX28 | 0-25 |
| 2N721 | 0-55 | 2N3727 | 1-23 | 40465 | 0-88 | BC143 | 0-24 | BDY20 | 1-87 | BSX29 | 0-25 |
| 2N714 | 0-15 | 2N3728 | 1-30 | 40600 | 0-80 | BC144 | 0-24 | BDY28 | 0-65 | BSX30 | 0-68 |
| 2N718 | 0-21 | 2N3729 | 1-08 | 40601 | 0-87 | BC145 | 0-21 | BDY60 | 0-90 | BSX59 | 0-78 |
| 2N720 | 0-50 | 2N3730 | 1-15 | 40602 | 0-48 | BC147 | 0-11 | BDY61 | 0-85 | BSX60 | 0-54 |
| 2N721 | 0-55 | 2N3731 | 1-23 | 40603 | 0-66 | BC148 | 0-10 | BDY62 | 0-82 | BSX61 | 0-42 |
| 2N714 | 0-15 | 2N3732 | 1-30 | 40636 | 1-16 | BC149 | 0-13 | BF115 | 0-25 | BSX76 | 0-15 |
| 2N718 | 0-21 | 2N3733 | 1-08 | 40673 | 0-58 | BC153 | 0-18 | BF117 | 0-25 | BSX77 | 0-20 |
| 2N720 | 0-50 | 2N3734 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF119 | 0-58 | BSX78 | 0-25 |
| 2N721 | 0-55 | 2N3735 | 1-23 | 40673 | 0-58 | BC154 | 0-18 | BF121 | 0-25 | BSX79 | 0-28 |
| 2N714 | 0-15 | 2N3736 | 1-30 | 40673 | 0-58 | BC154 | 0-18 | BF122 | 0-25 | BSX79 | 0-28 |
| 2N718 | 0-21 | 2N3737 | 1-08 | 40673 | 0-58 | BC154 | 0-18 | BF123 | 0-27 | BSY24 | 0-20 |
| 2N720 | 0-50 | 2N3738 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF125 | 0-25 | BSY25 | 0-15 |
| 2N721 | 0-55 | 2N3739 | 1-23 | 40673 | 0-58 | BC154 | 0-18 | BF126 | 0-27 | BSY26 | 0-20 |
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| 2N720 | 0-50 | 2N3746 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF133 | 0-27 | BSY26 | 0-20 |
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| 2N720 | 0-50 | 2N3750 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF137 | 0-27 | BSY26 | 0-20 |
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| 2N720 | 0-50 | 2N3754 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF141 | 0-27 | BSY26 | 0-20 |
| 2N721 | 0-55 | 2N3755 | 1-23 | 40673 | 0-58 | BC154 | 0-18 | BF142 | 0-27 | BSY26 | 0-20 |
| 2N714 | 0-15 | 2N3756 | 1-30 | 40673 | 0-58 | BC154 | 0-18 | BF143 | 0-27 | BSY26 | 0-20 |
| 2N718 | 0-21 | 2N3757 | 1-08 | 40673 | 0-58 | BC154 | 0-18 | BF144 | 0-27 | BSY26 | 0-20 |
| 2N720 | 0-50 | 2N3758 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF145 | 0-27 | BSY26 | 0-20 |
| 2N721 | 0-55 | 2N3759 | 1-23 | 40673 | 0-58 | BC154 | 0-18 | BF146 | 0-27 | BSY26 | 0-20 |
| 2N714 | 0-15 | 2N3760 | 1-30 | 40673 | 0-58 | BC154 | 0-18 | BF147 | 0-27 | BSY26 | 0-20 |
| 2N718 | 0-21 | 2N3761 | 1-08 | 40673 | 0-58 | BC154 | 0-18 | BF148 | 0-27 | BSY26 | 0-20 |
| 2N720 | 0-50 | 2N3762 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF149 | 0-27 | BSY26 | 0-20 |
| 2N721 | 0-55 | 2N3763 | 1-23 | 40673 | 0-58 | BC154 | 0-18 | BF150 | 0-27 | BSY26 | 0-20 |
| 2N714 | 0-15 | 2N3764 | 1-30 | 40673 | 0-58 | BC154 | 0-18 | BF151 | 0-27 | BSY26 | 0-20 |
| 2N718 | 0-21 | 2N3765 | 1-08 | 40673 | 0-58 | BC154 | 0-18 | BF152 | 0-27 | BSY26 | 0-20 |
| 2N720 | 0-50 | 2N3766 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF153 | 0-27 | BSY26 | 0-20 |
| 2N721 | 0-55 | 2N3767 | 1-23 | 40673 | 0-58 | BC154 | 0-18 | BF154 | 0-27 | BSY26 | 0-20 |
| 2N714 | 0-15 | 2N3768 | 1-30 | 40673 | 0-58 | BC154 | 0-18 | BF155 | 0-27 | BSY26 | 0-20 |
| 2N718 | 0-21 | 2N3769 | 1-08 | 40673 | 0-58 | BC154 | 0-18 | BF156 | 0-27 | BSY26 | 0-20 |
| 2N720 | 0-50 | 2N3770 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF157 | 0-27 | BSY26 | 0-20 |
| 2N721 | 0-55 | 2N3771 | 1-23 | 40673 | 0-58 | BC154 | 0-18 | BF158 | 0-27 | BSY26 | 0-20 |
| 2N714 | 0-15 | 2N3772 | 1-30 | 40673 | 0-58 | BC154 | 0-18 | BF159 | 0-27 | BSY26 | 0-20 |
| 2N718 | 0-21 | 2N3773 | 1-08 | 40673 | 0-58 | BC154 | 0-18 | BF160 | 0-27 | BSY26 | 0-20 |
| 2N720 | 0-50 | 2N3774 | 1-15 | 40673 | 0-58 | BC154 | 0-18 | BF161 | 0-27 | BSY26 | 0-20 |
| 2N721 | 0-55 | 2N3775 | 1-23 | 40673 | 0-58 | BC154 | 0-18 | BF162 | 0-27 | BSY26 | 0-20 |
| 2N714 | 0-15 | 2N3776 | 1-30 | 40673 | 0-58 | BC154 | 0-18 | BF163 | 0-27 | BSY26 | 0-20 |
| 2N718 | 0-21 | 2N3777 | 1-08 | 40673 | | | | | | | |

BACK in 1948 Bell Telephone Laboratories announced the "Transistor". They described it as a small germanium crystal unit that could amplify signals and so be made to oscillate.

Before the birth of the transistor, the technology of electronics was based on the valve, which had, in effect made modern communications possible. The valve was, however, chemically and mechanically fragile, used large amounts of power and developed a great deal of heat thus making the cost of operating and maintaining electronic systems high. Indeed, the research and development effort that led to the transistor was set in motion because people in the Bell Company were aware that the valve would not be reliable or economical enough to provide the high quality of telephone service that would soon be required.

John Bardeen and Walter Brattain were instrumental in the development of the transistor which gained its name from TRANSfer resISTOR. Together with Dr. William Shockley they shared the 1956 Nobel prize for Physics as a result of their discovery.

Dr. Shockley was one of the first people to realise the significance of the discovery. He also realised the limitations of the device—high noise factor, relatively high cost of production and difficulty of manufacture together with lack of durability. Shockley did much more research on the junction device and finally came up with a "junction transistor" this being the basis of most semiconductor devices available today. He was also the only man at the time who attempted to exploit the transistor commercially.

The original commercial device was housed in a little metal tube less than an inch in length. When connected as an amplifier with a positive bias of less than 1V on the emitter and the output circuit consisting of a negative bias of 20V to 30V and a suitable load, the input impedance was only about 100Ω while the output impedance ran at about 10kΩ.

Bell Telephone Laboratories demonstrated complete broadcast band superhet receivers using only transistors in the oscillator and amplifier sections. An audio output of 25mW could be obtained using two transistors in push-pull but in 1948 it was thought that the only use for transistors would be in telephone amplifiers and possibly large-scale computers.

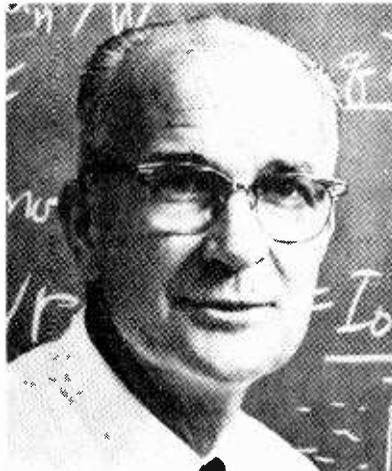
It was thought at that time that much use of transistors could be



by R. COLLINS

made by amateurs. The noise figures were poor compared with those obtained from valves and it was thought that this would be a major limiting factor in whatever application the device was used.

In 1955 Shockley left Bell so that he could start up a semiconductor laboratory at Beckman Instruments. His company, in 1958, became known as the Shockley Transistor Corporation. This company never succeeded in making a success even though Shockley had brilliant men like Gordon Moore and Robert Noyce working with him.



Dr William Shockley, Poniatoff Professor of Engineering Science and Executive Consultant Bell Telephone Laboratories, Murray Hill, the inventor of the junction transistor and a winner of the Nobel Prize in Physics in 1956 is to lecture at the Institution of Electrical Engineers on 14th February 1973.

Noyce, together with a team of scientists broke away from the Shockley Transistor Corporation to form Fairchild Semiconductors, which since that time has made great strides in transistor development.

Beckman Instruments sold Shockley to Clevite in 1960 who in turn sold out to ITT in 1965. Also in 1965, Shockley went back to Bell, becoming an executive consultant—a post he still holds.

Walter Brattain retired from Bell in 1967 after being a research physicist there for 38 years. John Bardeen is professor of physics and electrical engineering at Illinois University—a post he has held since 1951.

When one thinks of the fantastic developments that have taken place since 1948, one cannot begin to guess what the next 25 years hold. As the IEE states "Today's fantasy is tomorrow's reality!"

Events

To mark the 25th anniversary of the birth of the transistor, the Institution of Electrical Engineers, is holding the following events.

Full details are available from The Secretary, I.E.E., Savoy Place, London WC2R 0BL.

12th-16th February 1973

An exhibition at the Institution of Electrical Engineers demonstrating the evolution from the point-contract transistor to complex integrated circuits.

13th February 1973 10.00 a.m.

A colloquium "The 25th anniversary of the Transistor" at the Royal Society.

14th February 1973 5.30 p.m.

A lecture by Dr. William Shockley "The invention of the transistor: an example of creative-failure methodology" at the IEE.

15th February 1973 10.30 a.m.

A half-day discussion meeting "What next in semiconductors?" at the IEE.

Date to be announced 3.00 p.m.

A lecture by Dr. W. E. J. Farvis "The influence of the transistor in our society and economy" at the IEE.

The Institution of Electronic and Radio Engineers, is marking the anniversary by devoting an enlarged issue of its journal, "The Radio and Electronic Engineer" to a collection of 20 pages on semiconductor subjects. Copies of this can be obtained for £2 each post free from the Publications Sales Department, IERE, 9 Bedford Square, WC1B 3RG.

LETTERS

The Editor does not necessarily endorse the views expressed by correspondents

"BEEB" replies

If Mr. Miller's advice to his customers in Uttoxeter is as muddled as his views expressed in your correspondence column (November 72), no wonder his sales are so low. In view of the serious overcrowding on Medium Wave that already existed by the mid-1950s, no-one who wanted quality listening could have quarrelled with the BBC's decision that making network services available on v.h.f. should be the first call on the Corporation's limited resources. However, our first application to utilise v.h.f. local radio was made as early as 1960: it took six years to obtain Government permission. It was the commercial broadcasters who lacked faith in v.h.f. and who insisted on Medium Wave for their transmissions. It was the BBC which, far from frustrating them, demolished their regional structure to make Medium frequencies available. The 'Pirates' were pirates of course, because the programmes they offered could not have been broadcast by the BBC, or a legitimate commercial station in Britain within the legal restrictions of the day.

After two years on the air, it is disheartening to learn that Mr. Manners thinks we only relay Radios 1 and 2 at night. We originate our own programmes until 10 o'clock in the evening and on Friday nights until much later. If either of your correspondents thinks that local radio output is simply a carbon copy of existing programmes, they can simply not have bothered to listen.—**Peter Redhouse** (Manager), Radio London.

DX reception

I need help. I intend to set up a receiving station for DX reception. I would like to build my own receiver and I would be glad to answer any correspondence and delighted to refund postage to any reader who could give me advice and a suitable circuit for a receiver and aerial details etc.—**Paul Castle** (324 Pietermaritz St., Pietermaritzburg Natal, South Africa).

Treasure traced

My son found a rare coin with the aid of the P.W. Treasure Tracer. Since then I have built the newer version published in your journal and this seems to be an even better instrument.

An item published in the *Leicester Mercury* describes my son's find and reads: "A rare American dime possibly worth £90, is the latest discovery of coin collector Ken McMillan (19) of 26 Tuckett Road, Woodhouse Eaves.

Ken refuses to say where he found the coin, but has staked a claim in case others are found. The dime is one of a comparatively small number minted in Denver, Colorado.

Ken, a coin collector since he was eight, uses a metal detector fitted with a radio transmitter to search for coins.—**H. McMillan** (Loughborough, Leicestershire).

Hyreg modules

Referring to the "IC of the Month" number 34 (December 1972 issue) I would like to comment on the statement made by Mr. Ireland in the last paragraph of his article.

Whilst, as Mr. Ireland states, the Westinghouse Hyreg ARI power regulator is not generally suitable for induction and squirrel cage motor control (since this requires variable frequency as well as variable voltage), it is ideally suitable for a.c. synchronous fan applications. Here, because of the constant load factor and inertia provided by the fan blades, they work very well. For example with Expelair and Vent-Axia domestic fans.—**A. M. Smith** Sales Manager (Best Electronics).

Calibrator wanted

I was moved to write this letter after my discovery of a rather ludicrous situation. Namely that, up to the time of writing, I have been unable to find any firm that will undertake the calibration of audio signal generators.

Surely someone must have realised that, to calibrate a home-built generator to an accuracy of $\pm 5\%$, one must be in possession of a generator of similar performance. Goodness knows what one would do if the accuracy required is in the order of $\pm 1\%$.

This is a problem which I feel should have been solved long ago. Somewhere there must be an enterprising firm who could offer a calibration service to the home constructor. I only hope that they make their voice heard.—**G. Clarke** (Sunderland, Co. Durham).

Heard this one?

I recently had a "turn-out" of my shack the other week and came across the following which I thought may amuse your readers:

1 μ Fd Reward
for
Hoppalong Capacity
of

The Delta Star Network—
who escaped from a primary cell armed with a carbon rod and sal ammoniac.

Characteristics—Tall, long phase, with Leydon jar complexion, cats whiskers moustache, crystal blue eyes, and an air gap between his teeth.

Wanted for—The induction of an 18-year-old coil and stealing of her joules. He will be charged with a salt and battery. He was last seen riding over Wheatstone's Bridge on a megacycle, heading for his ohm town. EMF's in search coils have been ferrite-ing for him in neighbouring magnetic fields. Capacity is dangerous and will offer a high resistance to arrest.

Signed—Die Electric (Sheriff)
Eddy Current (Chief Copper Loss)
—**R. T. Standing** (Weybridge, Surrey).

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| B81 | 10 | Reed Switches, mixed types large and small | 50p |
| B99 | 200 | Mixed Capacitors. Approx. quantity, counted by weight | 50p |
| H4 | 250 | Mixed Resistors. Approx. quantity counted by weight | 50p |
| H7 | 40 | Wirewound Resistors. Mixed types and values. | 50p |
| H9 | 2 | OC771 Light Sensitive Photo Transistor | 50p |
| H28 | 20 | OC200/1/2/3 PNP Silicon uncodded TO-5 can | 50p |
| H30 | 20 | 1 Watt Zener Diodes, Mixed Voltages 6.8 - 43V. | 50p |
| H35 | 100 | Mixed Diodes, Germ. Gold bonded, etc. Marked and Unmarked. | 50p |
| H38 | 30 | Short Lead Transistors, NPN Silicon Planar types. | 50p |
| H39 | 10 | Integrated Circuits: 6 Gates BMC 962, 4 Flip Flops BMC 945 | 50p |
| H40 | 20 | BFY50/2, 2N696, 2N1613 NPN Silicon uncodded TO-5 | 50p |

UNMARKED UNTESTED PAKS

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| B66 | 150 | Germanium Diodes Min. glass type | 50p |
| B83 | 200 | Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ. | 50p |
| B84 | 100 | Silicon Diodes DO-7 glass equiv. to OA200, OA202 | 50p |
| B86 | 100 | Sil. Diodes sub. min. IN914 and IN916 types | 50p |
| B88 | 50 | Sil. Trans. NPN, PNP equiv. to OC200/1, 2N706A, BSY95A, etc. | 50p |
| B1 | 50 | Germanium Transistors PNP, AF and RF | 50p |
| H6 | 40 | 250mW. Zener Diodes DO-7 Min. Glass Type | 50p |
| H17 | 20 | 3 amp. Silicon Stud Rectifiers, mixed volts | 50p |
| H15 | 30 | Top Hat Silicon Rectifiers, 750mA, Mixed volts | 50p |
| H16 | 15 | Experimenters' Pak of Integrated Circuits. Data supplied. | 50p |
| H20 | 20 | BY126/7 Type Silicon Rectifiers 1 amp plastic. Mixed volts. | 50p |
| H34 | 15 | Power Transistors, PNP, Germ. NPN Silicon TO-3 Can. | 50p |

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90W + 90W 60p 58p 56p



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| Hex. Inverter | BMC934 | 12p | 11p | 10p |
| Hex. Inverter | BMC935 | 12p | 11p | 10p |
| Hex. Inverter | BMC936 | 12p | 11p | 10p |
| Hex. Inverter | BMC937 | 12p | 11p | 10p |
| Decade Counter | BMC938 | 25p | 23p | 21p |
| Div. by 16 Counter | BMC939 | 25p | 23p | 21p |
| Hex. Inverter | BMC940 | 12p | 11p | 10p |
| Hex. Inverter | BMC941 | 12p | 11p | 10p |
| Type D Flip Flop | BMC942 | 20p | 18p | 16p |
| Ex. 2/4-input Power | BMC944 | 12p | 11p | 10p |
| Clocked Flip Flop | BMC945 | 20p | 18p | 16p |
| 4/2 Input NAND Gate | BMC946 | 11p | 10p | 9p |
| Clocked Flip Flop | BMC948 | 20p | 18p | 16p |
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| Pulsed Trig. Binary | BMC950 | 20p | 18p | 16p |
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| Dual J/K Flip Flop | BMC955 | 20p | 18p | 16p |
| Dual J/K Flip Flop | BMC956 | 20p | 18p | 16p |
| Quad. 2-input Power | BMC958 | 12p | 11p | 10p |
| 2/4-input Gate | BMC961 | 12p | 11p | 10p |
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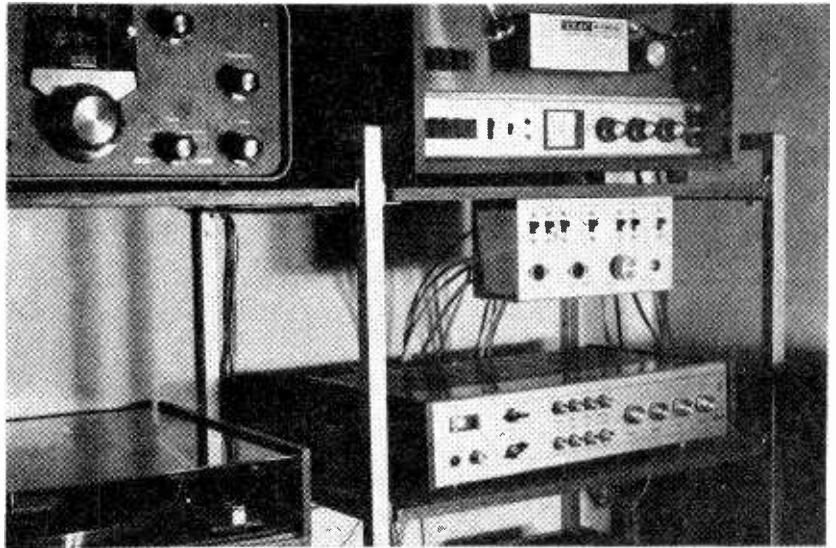
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DESIGN FOR AN AUDIO- CENTRE

G.A.J. FOORT



FOR the more serious audiophiles occupied with sound recording for slide or cine projection and even the listener who occasionally feels the need for tape recording, the Audio-Centre described here will prove to be a boon. It has always been a tiresome business to connect equipment together and then afterwards find it necessary to exchange cables for another set-up. This Audio-Centre is an exchange for temporary but fixed line connections with a mixing-unit providing for the fading in or out of sound effects.

Most hi-fi amplifiers these days have a choice of input channels but it is important to note that the choice is fixed in either one or another channel. With the Audio-Centre there is more freedom to make other arrangements or to play from more than one channel.

APPLICATIONS

Combinations in the use of equipment are numerous and a choice has to be made from the start. Assume the equipment to comprise: hi-fi amplifier, pickup, tuner (radio receiver) and tape deck with a cassette recorder being used for dubbing tape.

The Audio-Centre described here then has the following possibilities:—

- Pickup to Amplifier.
- Pickup to Tapedeck, monitored over amplifier.
- Pickup to Cassette recorder, monitored over amplifier.
- Tuner to Amplifier.
- Tuner to Tapedeck, monitored over amplifier.
- Tuner to Cassette recorder, monitored over amplifier.
- Tapedeck to Amplifier.
- Recorder to Amplifier.
- Tapedeck to Cassette recorder, monitored over amplifier.
- Recorder to Tapedeck, monitored over amplifier.
- Mixing microphone output with music from pickup or tape.
- Possibility to play or record mono or stereo systems.

The simplest application is playback from any source, tape, radio or pickup through the amplifier. In Fig. 1 the No. 1 Line Out, is the tapedeck unit. It is possible to play from track 1-4 or 2-3 in the case of a mono (single) track recording depending on how the track switch is placed. For stereo recording place track switch in position 1-4 and the stereo-mono switch in the stereo position. The tape-play switch should be in position I. To add commentary, music or sound effects to a slide or cine projection the tape-deck is used. The pickup-record switch should be in position I and the mono-stereo switch on mono. The mixer control knob is turned to pu. and a microphone plugged into the front panel jack.

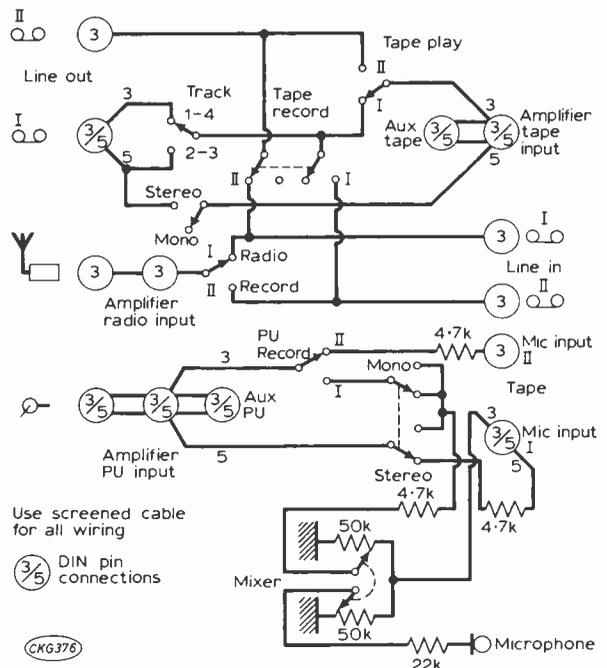
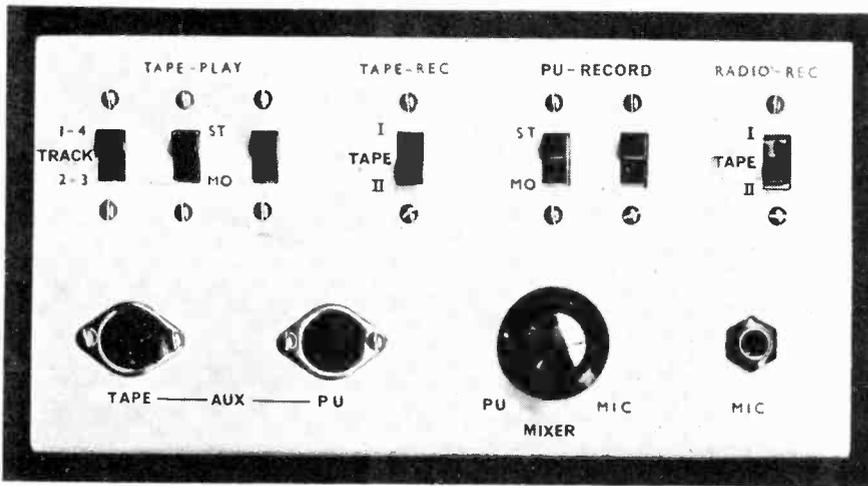
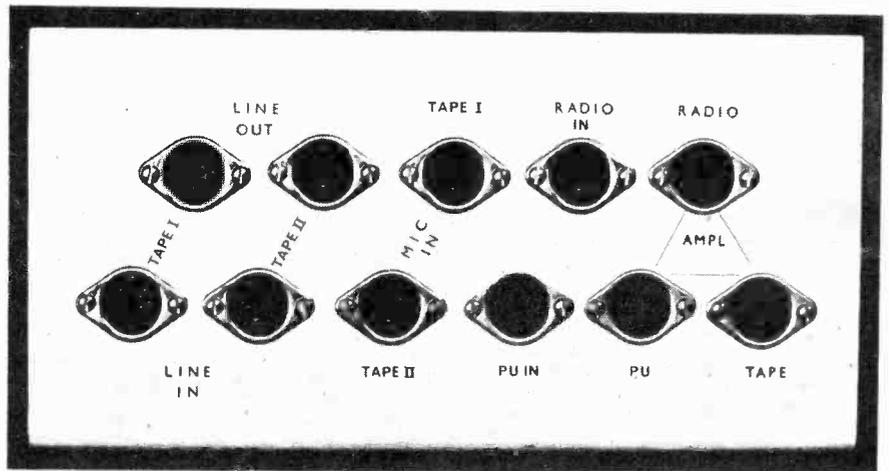


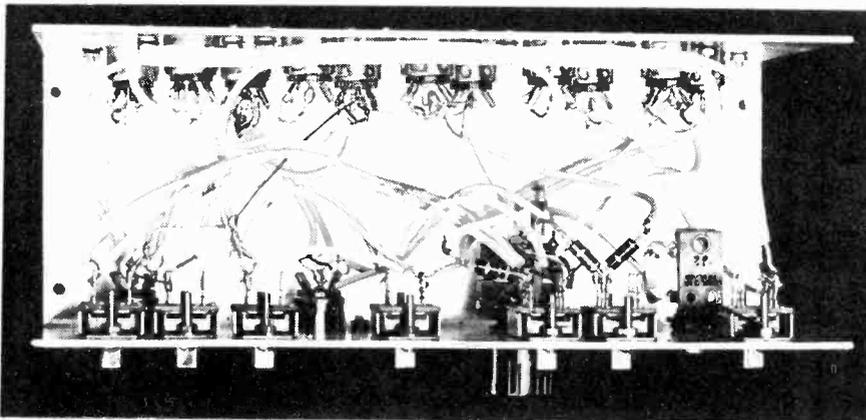
Fig. 1: Circuit of the author's prototype Audio-Centre.



Front panel layout. The heading photograph shows the finished unit in a practical set-up.



Rear apron of the cabinet carrying eleven DIN sockets.



Interior view of the Audio-Centre which may be compared with the wiring diagram of Fig. 4.

Start the programme music while watching a projection of the film or slides, begin the commentary and turn the mixer towards mic. Music may remain in the background at a very low level if the knob is not turned fully towards mic. Because it is a mono-recording one channel (pin 5) is free on the mic. inputs of the tapedeck unit. This could be used for the recording of the pulse from an automatic slide projector to advance the slide. Remember that recording levels should be set in advance so that they

do not overload the tape recorder pre-amplifiers. This is done with the recording controls on the tape deck itself.

It may be that sound effects or commentary have been recorded previously on the cassette recorder, No. II in Fig. 1. These can be copied or dubbed on the tapedeck unit. Place tape record switch in position II and tape play switch in position II. Monitor the output via the amplifier. The recording from the cassette recorder is now transferred to Line Input of

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FULL RANGE OF MICROPHONES, STANDS, ETC. ALWAYS IN STOCK



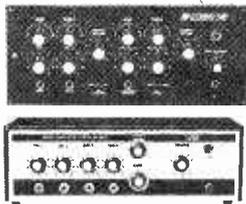
SOUND CONTROLLED AND SOUND TO LIGHT UNITS

- Mid, Treble and Bass Channels. up to 1kw of lamps per channel plus override switching.
- DJ30L.** Sound to light. Takes output from most amplifiers. Adjustable levels.
- DJ40L.** Sound controlled version. Built in microphone, no connections required.

ASSEMBLED DISCOTHEQUES

- DISCO-PLINTH.** Consists of 2 turntables fitted with high quality ceramic cartridges. The unit has a built in cross-fade rotary control for transferring the sound from left to right decks. The unit has no amplification built in and must be used with amplifiers such as the D.J. 100S or D.J. 70S. Size 32" x 14 1/2" x 7" (incl. lid).
- DISCO-IMP.** The latest addition to the Disco-sound Range of discotheques. Even smaller and more compact than the Disco-Mini, it contains all the necessary features for the smooth running of a mobile unit. Size 29" x 18 1/2" x 7".
- DISCO-MINI.** Complete portable Disco with built-in full function preamplifier/mixer. For use with any power amplifier such as "Disc-master". Size 30" x 20" x 8".
- DISCO-STANDARD.** Has all the facilities of the Disco-Mini with the addition of a built-in 100 watt power amplifier making it a completely self contained disco unit. A V.U. meter gives visual indication of output levels. Size 32" x 27" x 7 1/2".
- DISCO-SUPER.** A slightly larger version of the Disco-Standard. Fitted individual controls for both mic. and deck inputs plus a cross-fade for deck to deck transfer. A built in P.F.L. cueing system, mic. over-ride, also a V.U. meter gives visual indication of output levels.
- DJ. 30L (3000w)** 3-channel psychedelic light unit is a standard fitting. Deck cut out switches are also featured for ease of cueing. Size 38" x 27" x 10".
- DISCO-SUPREME.** All facilities of the Disco-Super plus a third turntable which can be used for Jingles or other effects without using the main deck system. Flexi lights are also fitted. Size 50" x 27" x 10".

PA-DISCO AMPLIFIERS



DISCO-AMP. 100 watt rms. output for 8-16 ohms, 4 channel inputs, 2-mic, 2 decks. Separate volume control plus masters. Response 30Hz -30KHz, distortion less than 1%. Treble/Bass/PFL/Mic over-ride etc. Panel size 16 1/2" x 7".

DJ.70S MIXER/AMPLIFIER. 70 watt rms. output for 8-16 ohms. 2-mic, 2-aux/decks. Master volume/Bass/Treble. Size 15 1/2" x 5" x 6".

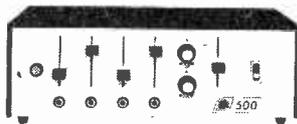
DJ.105S. 30 watt rms. version. Size 11 1/2" x 5" x 6".

DISCMASTER SLAVE AMPLIFIER. 100 watt rms. for 8-16 ohms.

NEW D.J. 500 SERIES P.A. AMPLIFIERS 50 WATT, 70 WATT & 100 WATT MODELS

This new range incorporates many features that make them ideal for the professional user, clubs, discotheques, factories etc. Fibre glass P.C. Boards are used throughout with low noise silicon transistors, high stability resistors, generously rated components and hand wired assembly to ensure reliability and quality.

- ★ Exclusive "Fail Safe" Electronic Protection circuit.
- ★ Fault Condition warning lamp.
- ★ Built in bass boost below 30 Hz.
- ★ 4 channel mixer with slider controls.



All three amplifiers have a built in emitter follower output socket for connecting a slave amplifier to enable the power output to be increased up to 1000 watts or more if required. A matching range of slave power amplifiers and a separate matching 100v line transformer is available

SPECIFICATION

| | |
|-----------------------------|---|
| Frequency Response | 50-20,000 Hz ± 3db (10dB Bass Boost at 10 Hz) |
| Signal/Noise Ratio | better than =50db. |
| Harmonic Distortion | less than 1% |
| 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. |
| Model D.J.1000 | 100 watts R.M.S. |

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.

McDonald M.P.60 Turntables are used with high quality ceramic cartridges, and each deck has its own individual cut out switch fitted. This unit is suitable for Discos or Clubs having a power amplifier, or for use with the Discmaster 100 watt power amplifier as above. Size 32" x 20" x 8".



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A small selection from our vast stock

- DISCO COLT.** 150 watt.
- LIQUIMATIC MINI.** 50 watt Q1 with 6" wheel
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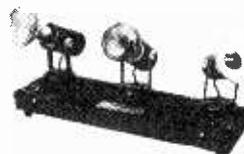
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- 12" 25 watt rms. 15 ohm Mid-Treble.
- 15" 50 watt rms. 15 ohm. Full range.
- 15" 100 watt rms. 15 ohm. Bass.
- 18" 100 watt rms. 15 ohm. Bass.

DISCO SPOT BANK



Designed to take three E/S Type spot or colour bulbs up to 150 watts each. The unit is of all metal construction and has one 3-pin mains input socket plus one 3-pin mains output socket for connecting more than one bank together if required. The unit can be left free-standing or wall mounted if needed. Black crackle finish gives the unit a very professional appearance.

Size 18" x 6" x 7" (excluding bulbs)

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MIXER UNITS

DJ.101. Battery powered, 6-channel, variable levels, 3 x 50k mic., 1 x 100mV aux., 2 x 100mV p.u. Output 250mV.

DJ.102. Mains operated, 4-channel, variable levels. 2 x 50k mic., 2 x 100mV p.u. PFL control, master volume, mic. over-ride, output variable 0-500mV.

DISCO 40. Pre amp part of Disco amp (see above). All facilities. Output will drive up to ten 100 watt amplifiers.

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the tape deck. Monitor the recording level not forgetting to turn up the volume of the cassette recorder, which very often is forgotten. By connecting Aux. Tape socket directly to the mic. jack on the front panel, with a separate adaptor cable, it is possible to mix in the output of the pu. In that case turn down Line Input, Tape II or switch tape record switch to position I.

In the adaptor cable plugs always use pin 2 for earth and pin 3 for the signal line. In the circuit diagram, Fig. 1, for simplicity, only single circuit lines are drawn, but it should be remembered that

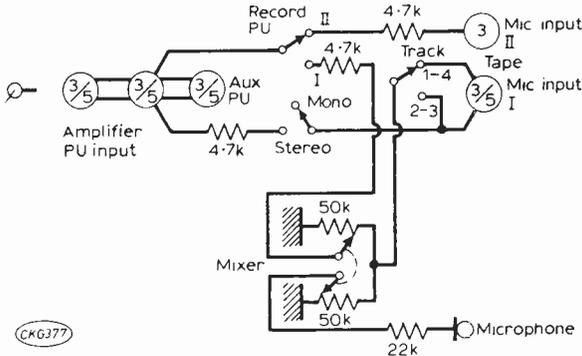


Fig. 2: An amendment to the circuit of Fig. 1 to improve the method of recording from a pickup.

screened cable is used everywhere and should be as short as possible between components. With DIN sockets and plugs, the No. 2 pin is earth and the screen of the cable should be connected to it. For the "left" channel in stereo the No. 3 pin is used and the "right" channel is No. 5. Where only one channel is in use, as for the radio tuner or cassette recorder, use pin 3.

Magnetic cartridges usually give only a very small output voltage, in the range of 3mV into 50kΩ. So for ceramic cartridges giving a higher output voltage change the circuit by connecting to Line Inputs of the

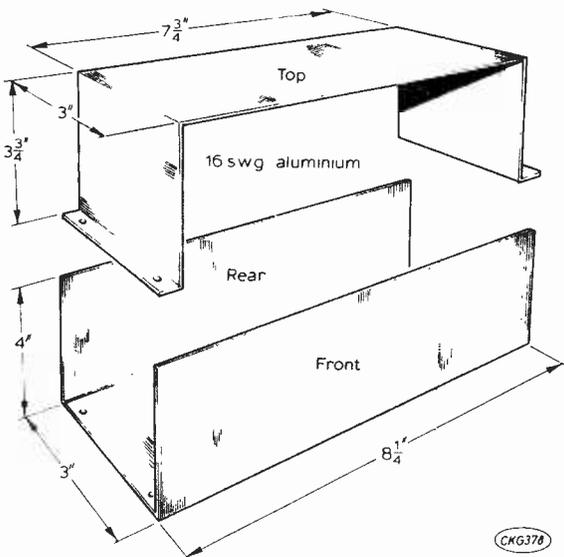


Fig. 3: Cabinet details. Dimensions are in no way critical.

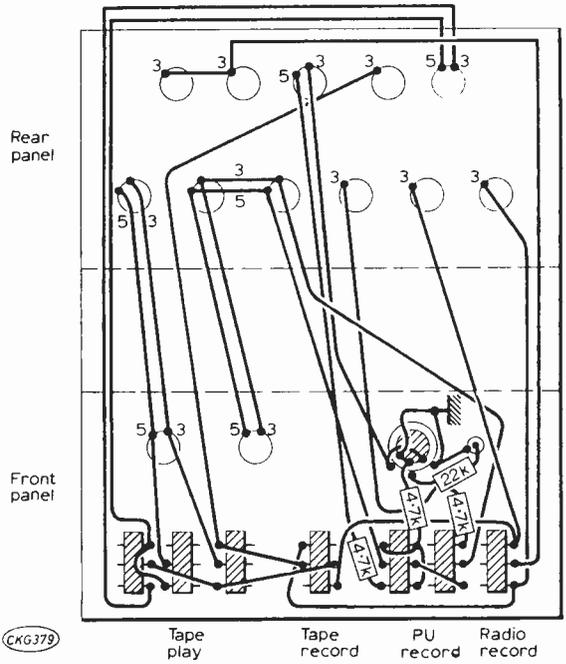


Fig. 4: Wiring diagram of the unit. All leads must be in screened cable.

tape recorders but leave the 4.7kΩ resistors in series with the pickup leads.

These resistors are necessary to match the impedances and also to prevent the monitoring amplifier from going dead when the microphone is turned full on. The 22kΩ resistor in series with the microphone was inserted to adjust the level of speech to that of the pickup output. These values might need altering with different equipment and should be tried by experiment.

An improvement in the method of recording from a pickup is given in Fig. 2. Changing the circuit in this way allows immediate recording on track 1-4 or 2-3 which is sometimes an advantage. It is then possible to mix the microphone into channels 3 and 5 instead of only channel 3. There is no need to use an extra track switch as the open contacts on the original d.p.d.t. switch may be used.

CONSTRUCTION

A box was constructed as shown in Fig. 3 and seven d.p.d.t. switches, toggle or slide type, placed on the front panel. The rear panel contains eleven socket outlets, preferably DIN type. If the microphone mixing facility is incorporated, add a twin ganged potentiometer of the log-antilog type and a microphone jack in the front panel. To connect an auxiliary tape recorder and pickup, two DIN type sockets are placed on the front panel. A guide for wiring is given in Fig. 4.

The front panel, after being drilled and filed out, should be sandpapered and then finished with fine emery cloth to remove any scratches. A bath in caustic soda solution will give a matt silver appearance to the panel. Wash off with clean water at the end of the process.

Lettering is done with transfers. A thin and even layer of transparent varnish from an aerosol spray will complete the job.

practically wireless commentary by HENRY

No. 97

Let's
be Frank

WELL, yes, I wish I could be Frank. Not that Henry is consumed by envy, or other such base emotions. Simply that Frank is one of those rare birds, the enthusiast able to indulge his fancies. Unlike Henry and other working technicians, he can afford to buy and build all the



An ungainly-looking parcel arrives.

enticing designs he sees described. Along the way, Frank has learned more tricks of the trade than Smithy ever imparted to Dick.

There was a time when Frank took notice of the advertised virtues of his purchases. He followed, meticulously, the recommendations of the article writers, buying this transformer from that firm, these capacitors (sorry, condensers then) from the other.

Now and again, like all of us, Frank burned his fingers. From a wealth of constructional detail, explaining the hooking and testing, the principles and production of the world-shaking project Frank duly enthused, sent off his postal order for the bits.

Old campaigners—i.e., regular Henry readers—will by now be *au fait* with the rigmarole. First there comes the lip-licking expectancy, then the anxious waiting while the postal authorities deal in their devious ways with our order. When it arrives, an ungainly parcel, looking like a mid-stream junior's

attempt to wrap Mother Hubbard's boot in brown paper, there are more moments of trepidation.

The inexperienced constructor, at this stage, plunges in, soldering iron at the 'high port' and screwdriver, pliers, at the 'ready'.

Frank, and others of us with a few barnacles around the belt, know better. We count the bits, tick them off with the precise assiduity of a maiden aunt cataloguing her trousseau, and align them ready for construction.

The secret of good set-building lies in the preparation. Let no-one kid you, gentle reader, constructing electronic equipment that works first time is an art unto itself.

Like all art, it begins with the planning and laying out. If you are following a published design, you have every right to expect this basic chore to have been done for you. Take a toddle around Frank's den, where the derelicts of a couple of generations gather dust on his shelves, and he will point out 'this one, obviously designed on the drawing board—couldn't ever have worked', or that one: 'never completed—the suppliers ran out of the special transformer before the print on the drawing was dry.'

Many constructors apply the 'three-month errata lag' theory before sending off their precious lolly for the list of bits. In the month after publication, they argue, the author will have noted the mess made of his circuit by subs and printers, and had his squeals reproduced in some corner of the month-after-next issue.

Henry goes one better than this. He studies the correspondence columns, remembering the famous 'scope design from which, eventually, a beautiful series of television timebase circuits evolved; simply because the author was challenged on one or two points and then—only then—gave a column or two of his fundamental reasoning

Frank has a 'thing' about this. He never builds blindly. He wants to know why the author chose that particular value of component, and if the unfortunate chap hasn't said so, Frank persists in asking. So often, unfortunately, the only real reason is 'because it was there'.

But there is another, more sinister trend that Henry has noted, and the start of '73 is as good a time as any to denounce it. This is the practice of using someone else's circuit section with neither acknowledgement nor explanation. How many commercial amplifier designs can you think of that have chucked in the basic Baxandall tone control network without adjustment or rejigging to allow for mismatching? No prize for your answer—nor for the guess of the percentage distortion (THD and IM) of such amplifiers if measurements are made anywhere away from the straight and narrow.



Frank persists in asking.

Among my correspondence is a chilling number of letters from constructors who have failed through no fault of their own. We can't all be Frank, so how about you chaps dropping a line to Henry with observations on your constructional experiences? A guinea (that dates me, doesn't it? I mean £1.05, of course) for the most horrific letter published.

As Frank would tell us, if it is really outrageous, it is almost certainly true.

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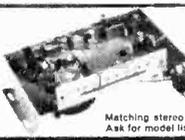
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½ watt 5% Carbon Film - low noise Hi-Stabs
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1 W 10% Carbon Composition 3p each
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2 ½ W 5% Wire wound 9p each
5 W Wire wound 9p each
10 W Wire wound 10p each
plus p. & p. 7p for up to 25 resistors plus 1p for each additional 25.



SGS EA1000

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Our Price inc. handbook £2.49
10+ less 15%
25+ less 25%
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Potentiometers



| | | |
|-------|--------|--------|
| 5K Ω | 50K Ω | 500K Ω |
| 10K Ω | 100K Ω | 1M Ω |
| 25K Ω | 250K Ω | 2M Ω |

log or lin less switch (& 1K Ω lin) 12p
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250 2.5K Ω 25K Ω 250K Ω 2.5M Ω
500 5K Ω 50K Ω 500K Ω 5M Ω

Capacitors

| disa ceramic | low voltage |
|-------------------|--------------|
| 0.1µF 18v 5p | 0.1µF 30v 5p |
| 0.22µF 18v 5p | 0.22µF 6v 5p |
| 0.47µF 12v 5p | 0.47µF 3v 5p |
| ceramic plate 30V | |
| 1000pf 10p | 4700pf 10p |
| 2200pf 10p | 10,000pf 10p |

Capacitors

Ceramic - plate 63V (C333)
1.9pf 33p 120pf
2.2pf 10pf 33pf 150pf
3.3pf 12pf 47pf 180pf
3.9pf 15pf 56pf 220pf
4.7pf 18pf 68pf 270pf
5.6pf 22pf 82pf 330pf
6.8pf 27pf 100pf
all 5p. each

mylar film 100V
1000pf 2p 0.1µF 3p 0.68µF 4p
2000pf 2p 0.2µF 3p 1µF 4p
5000pf 2p 0.4µF 3p 2µF 5p
0.5µF 3p

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

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0.22µF 3p 1.5µF 4p 1µF 13p
0.33µF 3p 2.2µF 5p 1.5µF 20p
0.47µF 3p 3.3µF 6p 2.2µF 24p

metallised polyester 400V (C281)
0.1µF 4p 0.47µF 6p 22µF 10p
0.15µF 4p 0.68µF 6p 33µF 14p
0.22µF 4p 1µF 7p 4.7µF 15p
0.33µF 5p 1.5µF 8p

silvered mica 1% (>50pF) 500V
2.2pF-820pF 7p 4.7nF-5600pF 19p
1nF-2.2nF 9p 6800pF-0.1µF 29p
2.7nF-3.6nF 18p

mixed dielectric 600V
0.1µF 7p 0.47µF 7p 22µF 16p
0.22µF 7p 0.68µF 8p 4.7µF 24p
0.33µF 7p 1µF 8p 1µF 33p

CHROMASONIC electronics

Heat Sinks



TO5 TO18 5p
TO66 TO3 14p
Power Tab 13p
DIP10/2 for SL403D 15p
10D 50p

Transistors & Integrated Circuits

| | | | | | |
|------------|--------------|----------------|-----------|------------|--------------|
| AC107 10p | BC147 10p | BF196 15p | OC81 19p | 2N1304 22p | 2N5172 15p |
| AC126 17p | BC148 10p | BF197 15p | OC140 20p | 2N1711 25p | LO05T1 £1 50 |
| AC127 15p | BC149 10p | BF272 53p | OC170 23p | 2N1893 30p | LO36T1 £1 50 |
| AC128 15p | BC157 12p | BFY50 24p | OC171 30p | 2N2926 10p | LO37T1 £1 50 |
| AC176 15p | BC158 10p | BFY51 21p | ZX107 15p | 2N3053 25p | MC1303 £1 75 |
| AC187 25p | BC159 12p | BRV39 36p | ZX108 12p | 2N3054 50p | MC1330 80p |
| AC187K 25p | BC169 15p | BS321 29p | ZX109 12p | 2N3055 49p | MC1350 75p |
| AC188 25p | BC266 15p | BSY64 14p | ZX300 12p | 2N3792 25p | MC1351 £1 00 |
| AC188K 25p | BD115 87p | BU105/02 £1.75 | ZX301 15p | 2N3703 12p | MC1352 £1 00 |
| ACV20 20p | BD131 76p | MJE340 57p | ZX302 20p | 2N3704 18p | MFC0000B 49p |
| AD140 40p | BD132 70p | MPE192 40p | ZX303 20p | 2N3705 16p | MFC0101A 55p |
| AD149 40p | BD131/2M 70p | MPF103 37p | ZX304 25p | 2N3706 10p | LM380 £1 45 |
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| AF114 18p | BF167 20p | MPF106 45p | ZX501 15p | 2N3709 12p | TAD100 £1 50 |
| AF115 18p | BF173 20p | OC28 40p | ZX502 20p | 2N3710 12p | FL117 £1 90 |
| AF116 14p | BF180 25p | OC35 40p | ZX503 17p | 2N3711 12p | JA796C 34p |
| AF117 15p | BF181 30p | OC44 15p | ZX504 50p | 2N3719 35p | JA710 45p |
| AF139 28p | BF184 25p | OC45 15p | ZX505 25p | 2N3803 15p | JA722C 95p |
| BC107 10p | BF185 25p | OC71 11p | 2N697 18p | 2N3904 17p | JA741C 47p |
| BC108 10p | BF194 15p | OC72 17p | 2N706 12p | 2N3905 21p | JA748C 60p |
| BC109 10p | BF195 15p | OC76 15p | 2N708 15p | 2N3906 12p | |

Mixed dielectric

| | | |
|-----------|------------|----------|
| 1000pf 6p | 6800pf 9p | 1µF 12p |
| 2200pf 6p | 0.1µF 9p | 22µF 22p |
| 3300pf 6p | 0.22µF 9p | 47µF 30p |
| 4700pf 6p | 0.47µF 12p | |

Ceramic 12KV d.c. 8KV d.c. Hi-K 750V.
10pf 9p 200pf 9p 1000pf 5p
15pf 9p 220pf 9p 1500pf 5p
22pf 9p 250pf 9p 2000pf 5p
68pf 9p 270pf 9p 3000pf 5p
82pf 9p 330pf 9p 5000pf 5p
1000pf 9p 750V DISC 10,000pf 5p
1200pf 9p 470pf 5p feed-through
140pf 9p 1000pf 5p
150pf 9p 5000pf 5p
180pf 9p 10,000pf 5p 1000pf 5p

Veroboard

| Copperclad | Plain |
|---------------|--------------|
| 0.1" 0.15" | 0.15" |
| 2½" x 1" 6p | 6p |
| 2½" x 3½" 20p | 16p (9) 10p |
| 2½" x 5" 24p | 21p (7) 12p |
| 3½" x 3½" 24p | 21p (8) - |
| 3½" x 5" 27p | 27p (10) 17p |
| 17" x 2½" 67p | 50p 37p |
| 17" x 3½" 90p | 70p 52p |
| 17" x 5" - | - 75p |

Spot-face Cutter 36p
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NEW LIST'S

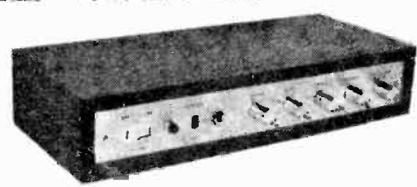
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| (9) | 4" | x 2½" | x 1½" | 35p | 8p |
| (10) | 4" | x 5¼" | x 1½" | 40p | 8p |
| (11) | 4" | x 2½" | x 2" | 35p | 8p |
| (12) | 3" | x 2" | x 1" | 32p | 9p |
| (13) | 6" | x 4" | x 2" | 50p | 12p |
| (14) | 7" | x 5" | x 2½" | 58p | 12p |
| (15) | 8" | x 6" | x 3" | 75p | 18p |
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The construction of this kit was featured in 'Practical Wireless' May - Aug. 1972.

Complete Kit (inc. Teak Case) £28.50 P&P Ltd

Mullard & Siemens Electrolytics

| CAP µF | VOLTAGE | 4 | 6.3 | 10 | 16 | 25 | 40 | 63 |
|--------|---------|---|-----|----|----|----|----|-----|
| 1.5 | - | - | - | - | - | - | - | 6p |
| 2.2 | - | - | - | - | - | - | - | 8p |
| 3.3 | - | - | - | - | - | - | - | 8p |
| 4.7 | - | - | - | - | - | - | - | 8p |
| 6.8 | - | - | - | - | - | - | - | 6p |
| 10 | - | - | - | - | - | - | - | 6p |
| 15 | - | - | - | - | - | - | - | 6p |
| 22 | - | - | - | - | - | - | - | 6p |
| 33 | - | - | - | - | - | - | - | 6p |
| 47 | 6p | - | - | - | - | - | - | 6p |
| 68 | 6p | - | - | - | - | - | - | 10p |
| 100 | 6p | - | - | - | - | - | - | 10p |
| 150 | 6p | - | - | - | - | - | - | 10p |
| 220 | 6p | - | - | - | - | - | - | 10p |
| 330 | 6p | - | - | - | - | - | - | 10p |
| 470 | 6p | - | - | - | - | - | - | 10p |
| 680 | 10p | - | - | - | - | - | - | 10p |
| 1000 | 10p | - | - | - | - | - | - | 10p |
| 1500 | 10p | - | - | - | - | - | - | 10p |
| 2200 | 10p | - | - | - | - | - | - | 10p |
| 3300 | 10p | - | - | - | - | - | - | 10p |
| 4700 | 10p | - | - | - | - | - | - | 10p |

Quantity Prices on application.

Hi-Volt Electrolytics

| | | | | | | | |
|-------|------|---------|------|------|------|---------|-----|
| 1.2 | 4 | 8µF | 450V | 14p | 32µF | 450V | 28p |
| 1.6µF | 450V | 15p | 50µF | 450V | 25p | 20µF | 25p |
| 8 | 8µF | 450 V W | 18p | 32 | 32µF | 350 V W | 25p |
| 8 | 15µF | 450 V W | 20p | 32 | 32µF | 450 V W | 43p |
| 16 | 16µF | 450 V W | 25p | 50 | 50µF | 350 V W | 35p |

by COLIN RICHES

carriers and 33 received carriers.

Goonhilly 3 will operate with an Intelsat IV satellite sited in geostationary orbit 22,300 miles above the Atlantic Ocean. This satellite, like those in orbit over the Indian and Pacific Oceans can provide up to 5,000 speech circuits, using 12 transponders. Each earth terminal can then communicate with all other terminals in the satellite coverage area.

It is for this reason that each terminal using the satellite must have one or more separate transmitters and receivers. Each one of these must be capable of handling a group of telephone channels multiplexed to occupy a section of the frequency spectrum of the satellite. Some of these groups are beamed by the satellite's aerials towards specific destinations while others are received by all the terminal stations.

An important design feature of Goonhilly 3 is the use of "microstrip receivers" providing increased reliability and eliminating the use of bulky waveguide units. These microstrip techniques are used for channel branching circuits and for the frequency down-converters which bring each of the received carriers to the i.f. of 70MHz. Each carrier is then demodulated to recover the multiplexed group of speech channels using conventional solid-state techniques.

The first stages in these receivers employ cryogenically-cooled parametric amplifiers mounted in a cabin behind the aerial dish and connected to the



GOONHILLY 3

It is a well-known fact that satellites now carry almost half of this country's telephone calls to places beyond Europe. Things have come a long way since the first telephone call in the world by satellite was relayed across the Atlantic by Telstar ten or so years ago.

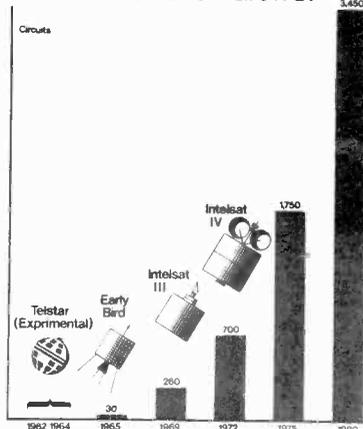
Satellites are now closely rivalling submerged cables as the principle form of telecommunication over long distances, and as there is an ever-increasing demand for the telephone services, the Post Office faces a great challenge.

The United Kingdom handled an annual total of 20 million international telephone calls five years ago. Now the figure is nearly 60 million and five years from now, the estimated number of calls per year to be handled will be in the region of 130 million.

Speaking at the opening ceremony for Goonhilly 3, Mr. Keith Hannant, Director of the Post Office's International and Maritime Services, said that since 1962, when Telstar first came into use, the Post Office had contributed about £9m towards the purchase and launching of satellites by Intelsat and £10m for the development of the earth station at Goonhilly.

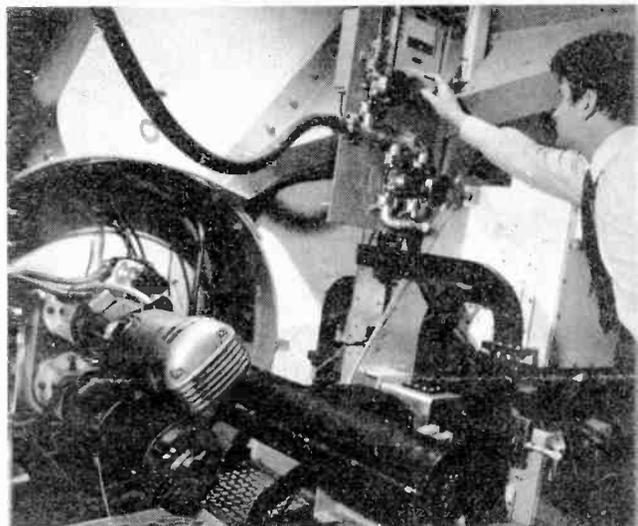
The third earth station at Goonhilly Downs in Cornwall was recently handed over to the Post Office by Marconi Communication Systems. This new £2¼m station has a 97ft diameter dish aerial and its four transmitters are rated at a peak output of 10kW. Each is capable of multi-carrier operation and will initially cater for 213 telephone circuits from 11 different earth stations. The eventual capacity will be 1800 circuits using 7 transmitted

UK Satellite Circuit Growth





Section of the main control panel



Aerial feed and parametric amplifiers

Shift controller's desk with visual display unit



feed horn by means of a short flexible waveguide coupling. This is a standard technique in Marconi earth stations and enables the parametric receiver to be kept level whatever the elevation of the aerial dish, providing better accessibility for maintenance.

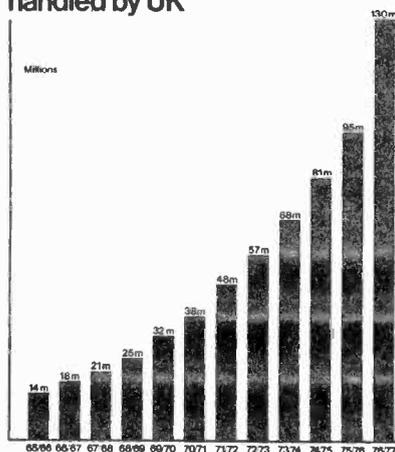
Four P2000 wideband transmitters have been utilised, each having a peak output power of 10kW in the 6,000MHz band. Two transmitters are used for telephone channels, the third for TV transmissions and the fourth as a standby. A fifth transmitter has been provided so that the telephone channel capacity can be increased when the need arises. The output from all these transmitters is combined in a waveguide "combining unit" which delivers the final high power output through a flexible waveguide to the transmitting horn.

The 97ft diameter dish aerial is built from aluminium petals on a steel backing structure rather like a photographer's flashgun and the Cassegrain sub-reflector is mounted on three steel lattice supports.

The complete aerial structure, with its elevation bearing assembly is housed inside the 60ft high reinforced concrete tower under the actual aerial.

Automatic satellite tracking is provided by an auxiliary mode feed system, providing error signals at the satellite beacon frequency, enabling a servo control system to drive the aerial in both elevation and azimuth until

International telephone calls handled by UK



TV channel monitors and control unit

the error signals have been reduced to zero. Then the aerial is aligned accurately with the satellite.

The control panel for Aerial 3 comprises four separate consoles. The left-hand one giving an indication of the receive-path equipment and the right-hand one giving control of outgoing carriers and transmitters.

The two central panels monitor servo systems for tracking and display the aerial pointing angles together with azimuth and elevation tracking errors.

Also included are controls for steering the aerial manually.

Except for the manual steering, operational changes can be made by just pressing buttons which become illuminated when the change is complete.

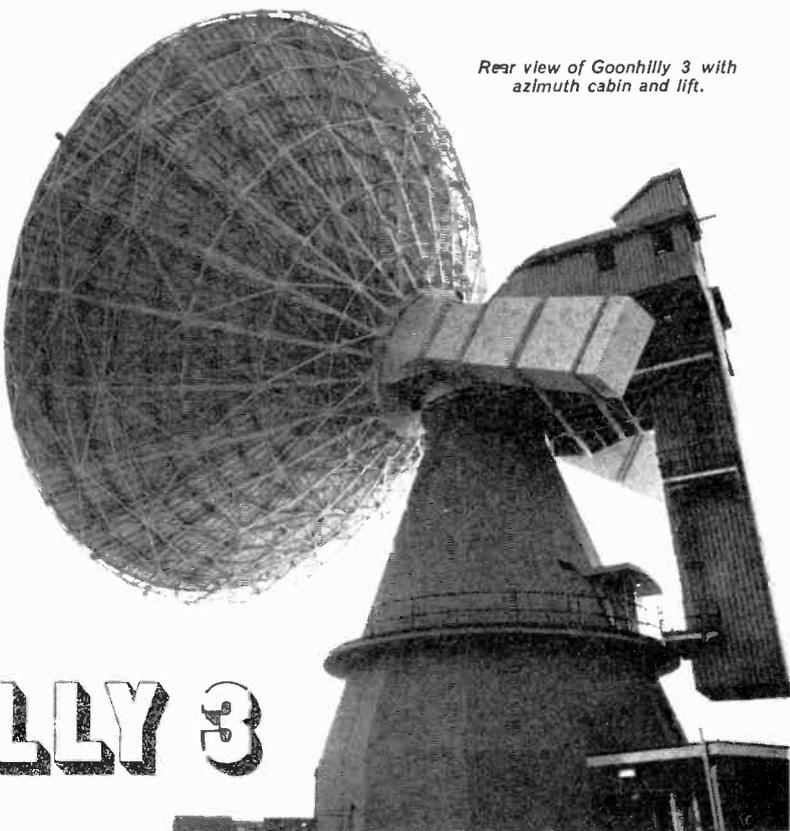
Looking into the future, the Post Office is planning an aerial system to replace "Goonhilly I" which they will probably "pension off" about 1978.

Intelsat V should then have taken over from Intelsat IV and this will probably feature time-

division multiple access systems which should greatly improve the traffic-carrying capabilities of the satellite links.

Incidentally, as a point to note, when the Post Office first started their trans-Atlantic telephone services 46 years ago, the minimum charge for a one-minute call was £15. Now, a call to the U.S. or Canada can be made by S.T.D. for as little as 50p per minute.

| | |
|--|-------------------------------------|
| Net aerial gain at 4.165GHz | 60.3dB |
| Net aerial gain at 6.055GHz | 63.0dB |
| System figure of merit (G/T) at 4.165GHz | 41.3 |
| Overall efficiency of aerial | 72% |
| Tracking accuracy (wind speed 45mph, gusting to 63mph) | within 1 minute of arc |
| Maximum operational wind speed | 47mph mean hourly, gusting to 66mph |
| Survival wind speed | 200mph |
| Slew velocities (azimuth and elevation) | 15°/minute |
| Tracking velocities (azimuth and elevation) | 1°/minute |
| Radiated power capability | 96dBW |
| Actual transmitted power (approximate) | 2kW |



Rear view of Goonhilly 3 with azimuth cabin and lift.

GOONHILLY 3

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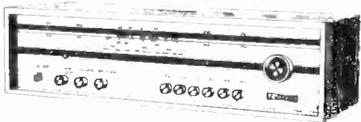
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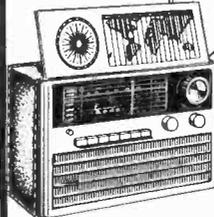


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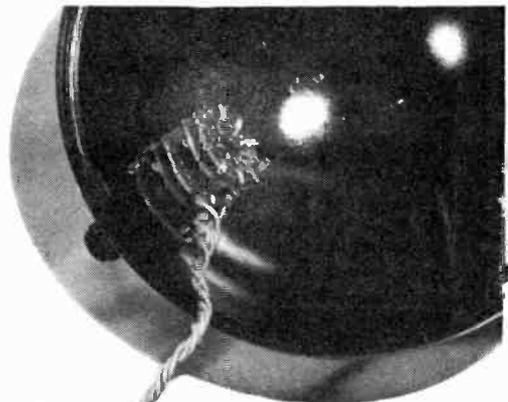
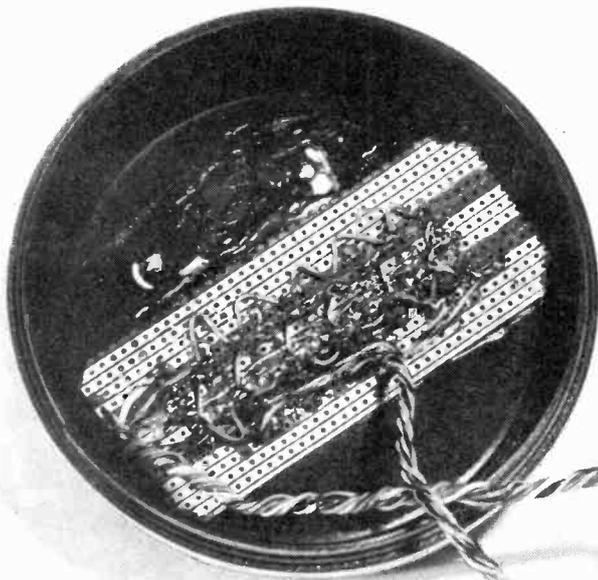


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THE DIGITAC



SOL

This article describes the construction of a 6 digit 24 hour digital clock utilising 7 segment LED's for the display. Brief details are also included for those who prefer a simplified version for 12 hour function and 4 digit display.

MOST electronic calculators today use an LSI (Large Scale Integration) chip which may contain upwards of 7000 transistors in a small IC package. This LSI technology has now produced a digital clock chip, several chips are rumoured to be in design or production but the first to become generally available is the MM5311 by National Semiconductors. This chip contains all the normal requirements of a digital clock with 7 segment or inverted BCD outputs and 4 or 6 digit drive lines. Rather than produce a fixed clock function, the manufacturers have provided on this chip the options for 4 or 6 digit display, operation from 50 or 60Hz mains frequency, 12 or 24 hour read-out and compatibility with TTL gates.

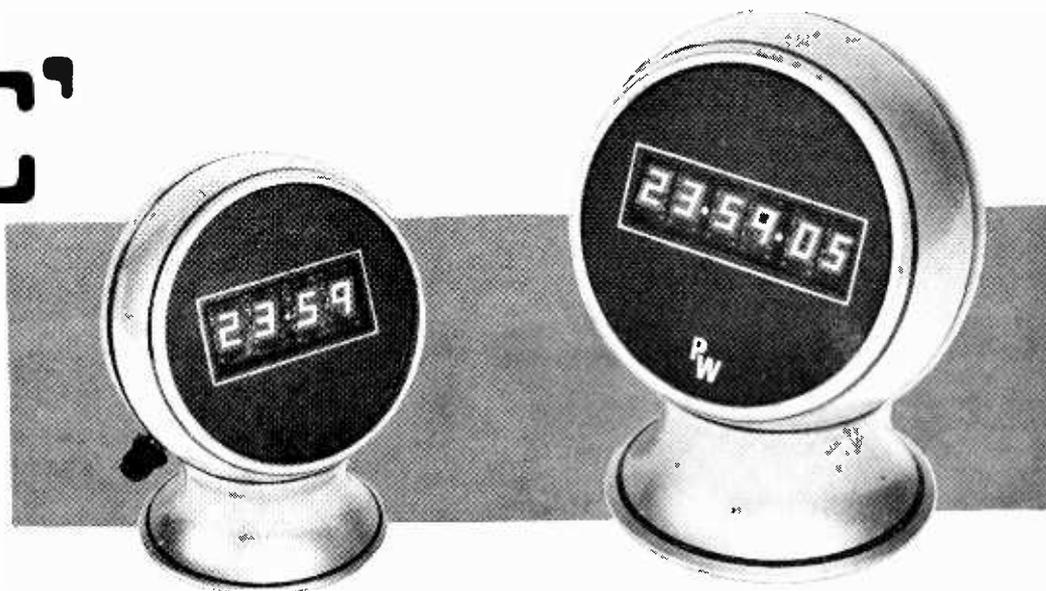
JOHN MILLER-KIRKPATRICK

The MM5311

The block diagram of the chip is shown in Fig. 1. The half wave 50 or 60Hz input is squared by a shaping circuit and then divided by 50 or 60 to give 1 pulse per second. Three other counter stages complete the division to 12 or 24 hours depending on the 12 or 24 hour select input. Logic gates between the counters allow time setting at the rate of one hour digit per second or one minute digit per second, a hold enable allows the stopping of the entire counting



IC



D-STATE DIGITAL CLOCK

chain. The multiplexer samples the outputs from these counters routing the data to a ROM (read only memory) which is programmed to provide the BCD and 7 segment outputs. The multiplexer is also used to provide the six (or four) digit select outputs, each one indicates in succession the digits' information being presented at the BCD and 7 segment outputs.

The equivalent circuit using TTL would require 8 7490's, 5 7492's, 3 7400's, 4 74151's, 7442, 7447, plus discrete components, the cost would be about £20 and the resulting clock would be about seven times as large as the LSI clock.

Display

This project uses LED 7 segment units for the displays, this is because although the unit cost of these devices is higher than filament equivalents, the LED requires much less in the way of external driving components and thus the result is a smaller package, more reliable and at an equivalent cost per digit displayed. There is no need to be scared of using LEDs, their encapsulated packaging makes them virtually indestructible and the only real way to harm a LED is to pass too high a voltage through it (most LEDs work on only 1 or 2 volts).

Construction (general)

We shall deal in this project with the construction of a six digit read-out, 24 hour clock, a four digit

clock requires that only four digits be wired on the display, four driver transistors be used and one pin of the chip not wired to negative. A 12 hour version instead of a 24 hour version requires that one pin of the chip is wired to negative (in fact a small switch could be used to switch from 12 to 24 hour display as required).

The case used was chosen to give a professional finish to the project. As most electronic casings are nothing more than metal or plastic boxes which do not lend themselves to a good finish, a commercially made case was required, this was found cleverly disguised as a table mirror stand in a local shop. The case is available in three sizes and several colours, the middle sized case was used for the six digit clock but a four digit version can be packed (and I mean packed) into the small sized case. Perhaps these or similar cases would lend themselves to other project cases (e.g. radios, etc.).

Construction (display)

The whole clock is built onto the inside of the front half of the case (which unscrews from the back half). The first thing to do is to remove the mirror, it is held on by three pieces of double sided sticky tape and can be levered off but to protect the case it is probably best to cover the mirror with a cloth and smash it by tapping (!) with a small hammer. Decide what sort of display you are going to use and cut an aperture for it in the face of the case. A word of warning at this point, some of the facings are made of thick plastic and some of thin, in the latter

case it may be best to melt the plastic using a soldering iron with an old bit rather than drilling out the hole.

The display is to be mounted in 0.1in matrix Veroboard and mounted through the aperture. Because of this the board should be cut with a border of about half an inch all round the display unit. If you are using TIL302 displays a board 15 strips by 36 holes will be required. Remove copper strips E, F, L & M altogether. This should leave three complete strips along the centre, then two blanks and four strips on either side. Now solder low-profile 14 pin sockets so that the pin 4s of the sockets are in positions J31, J27, J18, J13, and J9, this will give three pairs of sockets to give spacing between hours, minutes and seconds. The layout of the LED (and thus the sockets) as seen from the soldering side is shown in Fig. 2. As the three centre lines are used only once per device these may be used as anchor points by soldering all of pins 3, 4, 5 and 10, 11, 12 to the respective copper rails, however breaks have

ing 3 volts d.c. (1.5 volt in the case of other than TIL302 displays) between the first digit lead and the first segment lead, if no segment lights connect the supply the other way round (some types of LED are common cathode, others common anode, TIL302 are common anode). Check that each segment of each digit lights, and that only one lights at each test, if more than one segment lights, there is a short somewhere. When the check is OK your display unit is complete. Use of a TIXL360 display (one six digit package) would replace the above instructions if a smaller sized digit is acceptable. Check that the display fits into the front of the case and screw or 'Araldite' into position.

Construction (clock)

The main clock board is built onto a piece of 0.1in matrix Veroboard 24 strips by 26 holes cut as in Fig. 4. The transformer used was soldered

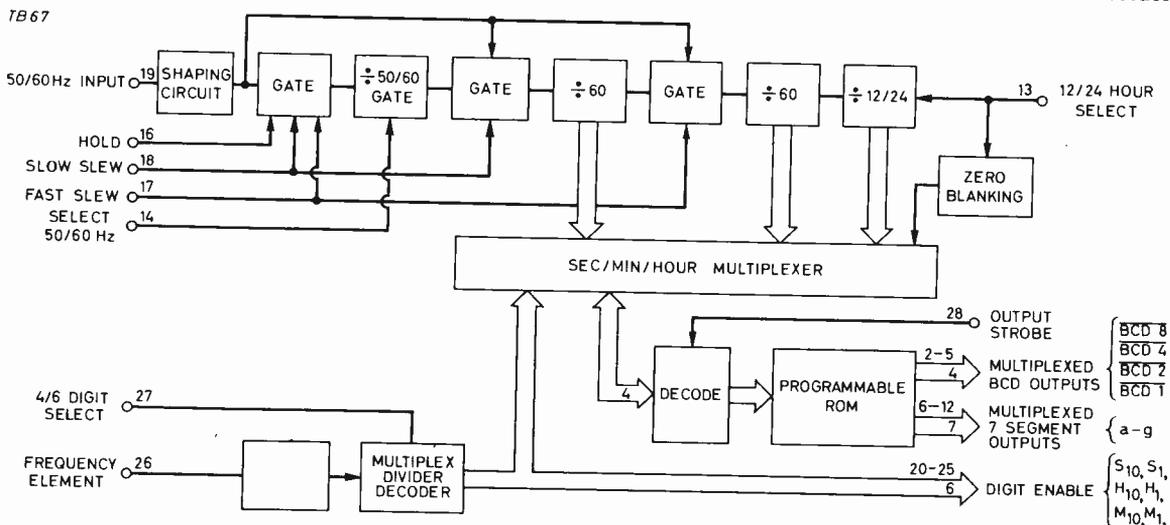


Fig. 1: Block diagram of the National Semiconductors MM5311 chip. This represents the "heart" or "brain" of the clock.

to be made in strip K as shown in Fig. 3a to keep the X's (common) at pin 3's separate from each other. Also cut track N at the same points.

Taking each socket at a time connect pins 3, 9, and 14 (X's) to each other and to the appropriate section of track N, then connect a lead (6in) to the track N section, these leads will eventually go to the digit select transistors. When all six sockets have been wired up check that there is no connection between any pair of them. Solder each pin 7 to track D below thus paralleling the E segments. Solder pin 1's to each other, leaving about 4 inches of flying lead at one end. Similarly, but using a different coloured wire if possible, connect all pin 2's to each other, all pin 13's to each other and pin 8's to each other leaving flying leads in each case. Solder flying leads to the ends of tracks D, H and J, this should result in a new set of seven leads (the segment drives) which should be anchored to the board by tying with a small piece of wire so as to give no strain on the solder joints. Insert the LED's into the sockets, the two indentations in the top of the package denote the top, the pins nearest to these are pins 1 and 14. Test connections by connect-

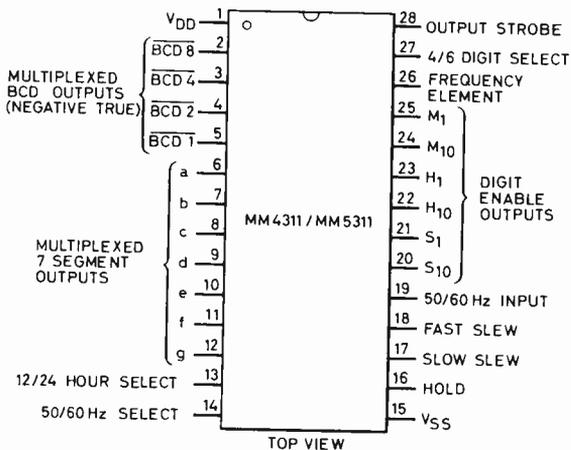


Fig. 1(a): Connections for the MM5311 chip.

directly to the board by the tags, thus anchoring it to the board and leaving the feet of the transformer as an anchor point for the whole board. Check that the mains connections are isolated from each other and from the rest of the board. Solder the rectifier into holes AB2 (-), Y2 (+), and AA2 and Z2 (input from transformer) connect the 0 and one of the 12V outputs of the transformer to the appropriate inputs to the rectifier. The power supply reservoir/smoothing capacitor (C1) is soldered between AB4 (-) and AB13 (+) and check that strip AB is broken between these points. Connect the rectifier output (Y2) to the positive end of the capacitor C1 and check that all connections from the power supply are isolated from the rest of the board except for strip AB10-26 which becomes the positive supply line. Mount the 28 pin socket for IC1 with pins 14 and 15 in positions AA17 and AA23 and solder all 28 pins in place, checking that the

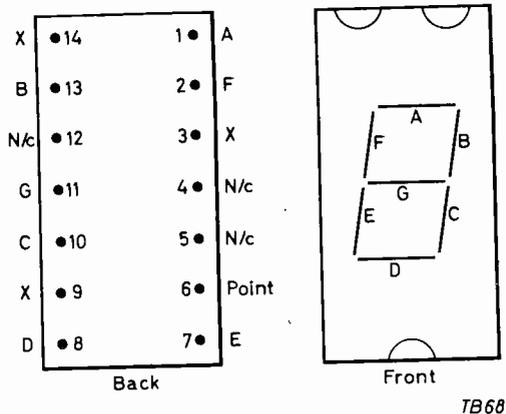


Fig. 2: View of the LED socket (rear) and the LED display (front). This is the Texas TI1302 display.

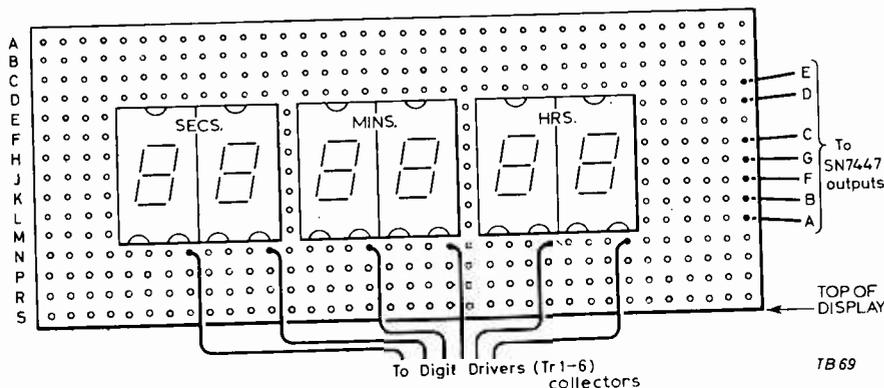


Fig. 3: The display board showing connections to the SN7447 outputs and digit drivers.

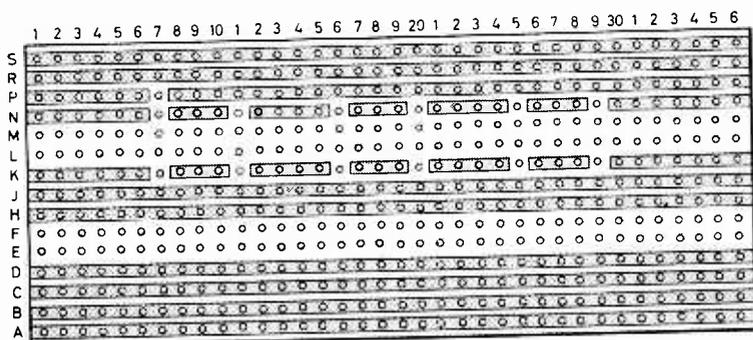


Fig. 3 (a): The display board, copper side.

copper strips between the pins has been cut. Connect a wire from the negative end of C1 to K14 thus making strip K the main negative line. Connect a 100kΩ resistor between negative (K24) and pin 26 (N24) and a 0.02μF capacitor between positive (AB25) and pin 26 (N25). Add positive at pin 15 by connecting AB24 and AA24, and negative to pin 1 by connecting L17 and K17. Connect diode D2 to pin 19 (W26) and pin 15 (AA26) with positive end of diode at pin 15. The 0.01μF capacitor C2 is connected to pin 19 at W25 and negative at K26. Solder the other 100kΩ resistor R2 between one of the transformer outputs (N13) and a spare piece of strip (W13), break strip W at W14 to isolate from IC1. Now connect a wire from pin 19 (W24) to the resistor at W12, this has connected the 50Hz input to pin 19.

Switch SW1

Connect the wiper of the one pole four way switch to negative at K25 and the outputs of the switch as follows—

- 1st position to pin 18 (X25) for FAST SLEW setting,
- 2nd position to pin 17 (Y25) for SLOW SLEW setting,

- 3rd position to pin 16 (Z25) for HOLD,
- 4th position open circuit for NORMAL.

Solder a 14 pin socket (for IC2) into position with pin 1 at A14 and pin 8 at H17, and break the copper

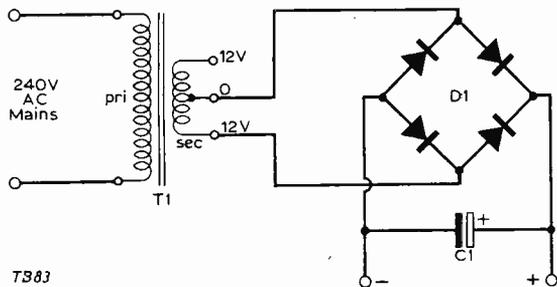


Fig. 6: Clock mains power supply theoretical circuit.

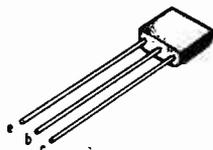


Fig. 7. Lead connections for the ZXT500 transistors.

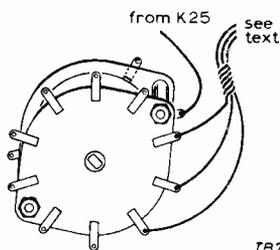


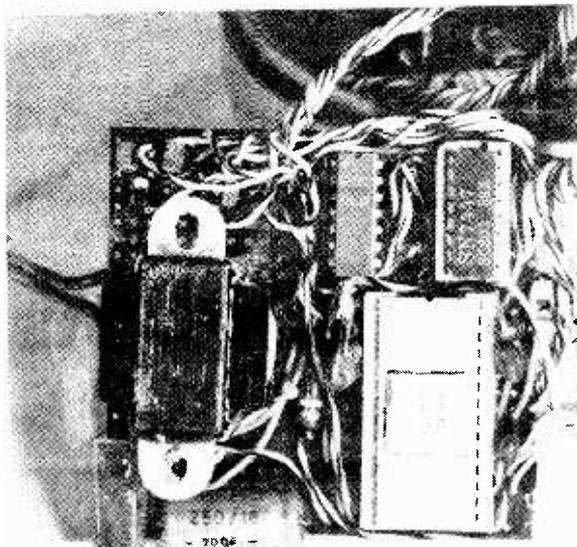
Fig. 8: Connections to SW1—see text for further details. K25 is the switch pole and the adjacent tag (below) goes to X25 on the clock board.

The last area of the board A-H, 1-10 is used for the digit driver transistors. Connect the digit select output from IC1 for seconds (pin 21) to the base of a ZTX500, the collector to the positive supply and the emitter to the flying lead to the seconds digit (if you are using a four digit display use the minutes output and lead, but make sure that the speed setting is at SLOW). To enable the six digit output connect IC1 pin 26 to negative (K14-26).

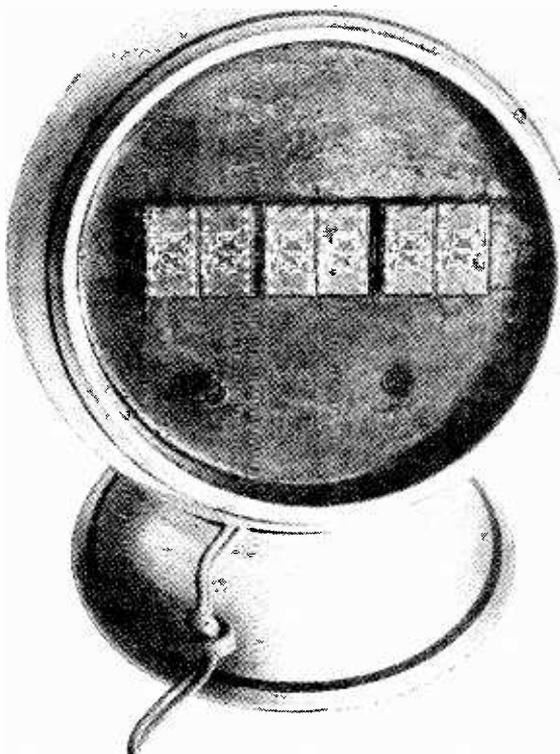
Testing

The unit is now ready for initial testing, place a 7400 in the IC2 socket and a 7447 in the IC3 socket, do not insert IC1 at this stage. Plug the clock into the mains and check that the voltage across IC2 pins 7 and 14 is between 4.5 and 5.5 volts, if not then the value of the 68 ohm resistor should be changed.

Make a temporary connection from the hours digit to positive, the result should be that the display shows a zero, this is because the inputs to the 7400 are at logical '1' and thus the outputs are at logical '0' and thus the inputs to the 7447 are also at logical '0'. If necessary check for shorts, etc until a zero display is the result. Next short pins 1, then 4, then 10 and 13 to IC2 pin 7 (do not use the main negative supply as this is about 7 volts negative to the ground of IC2 and IC3). If these pins are shorted one at a time the resulting displays should be 8, 4, 2 and 1. If this is so



Photograph shows the main clock board. Mains transformer T1 can be clearly seen on the left hand side of the board.



View showing the LED display mounted in the case.

then the 7400 and 7447 would appear to be working, disconnect the temporary connection to the hours digit and also disconnect the mains.

Before touching IC1 it should be noted that it is possible to ruin the IC by shorting the pins with metal or even with the fingers, the black plastic cloth covering the pins is to stop the build up of any static during

★ components list

Resistors:

| | | | |
|----|-------|----|-------|
| R1 | 100kΩ | R5 | 3-3kΩ |
| R2 | 100kΩ | R6 | 3-3kΩ |
| R3 | 3-3kΩ | R7 | 68Ω |
| R4 | 3-3kΩ | | |

All 10% 1/2W miniature.

Capacitors:

| | | |
|----|--------|---------------------------------------|
| C1 | 250μF | 16 volt miniature electrolytic |
| C2 | 0.01μF | 100 volt miniature paper or polyester |
| C3 | 0.02μF | 100 volt miniature paper or polyester |

Integrated Circuits

& Semiconductors:

| | | |
|--------|--------|--|
| IC1 | MM5311 | National Semiconductors |
| IC2 | SN7400 | Texas |
| IC3 | SN7447 | Texas |
| Tr1-6 | ZTX500 | Ferranti |
| D1 | REC65 | Silicon bridge rectifier printed circuit type, R.S. Components |
| D2 | IN914 | Silicon rectifier |
| LED1-6 | TIL302 | 7 segment displays, Texas |

Miscellaneous:

T1, Subminiature mains transformer, type 12V, 12-0-12V r.m.s. 50mA, R.S. Components; SW1, 1 pole, 4 way miniature water switch; 16 pin DIL socket; 1 off 14 pin DIL socket for SN7400; 1-6 14 pin DIL sockets for TIL302's; 0.1in matrix Vero-board.

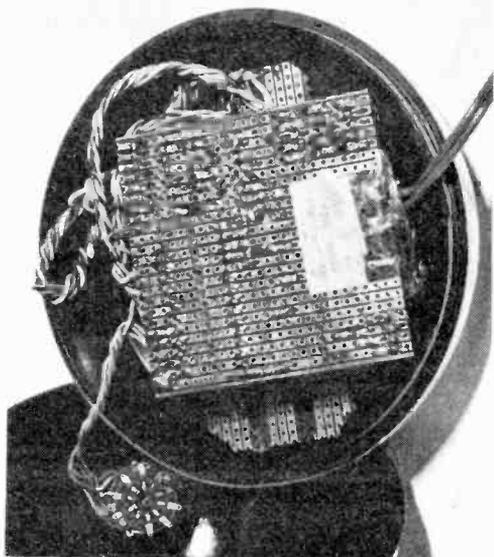
Note that R.S. Components Ltd *only* supply components to the trade. Readers will have to order via their local component shop.

The cases are available from—GARLAND, The Marlowes, Hemel Hempstead, Herts or many large chemists shops.

Prices (including P & P) Small £1.20, Medium £1.70. Colours—Gold & Brown, Green & Silver, Silver & Blue, White & Black, Red & Orange, Orange & Brown.

The MM5311, LEDs and sockets are available from—BYWOOD ELECTRONICS, 181 Ebbens Rd, Hemel Hempstead, Herts.

Prices (Including P & P) MM5311 £11.62, 28 pin socket £1.15, TIL302 4 for £10, 6 for £14.



Internal view of the completed six digit clock. Note the position of SW1.

storage. First orient the IC to the socket, pin 1 of the IC (identified by a dot) goes to the negative supply (i.e. at the end of the socket nearest to IC2) be very sure before you continue. Remove the black cloth and insert the IC in the socket holding the IC by the ends—carefully.

Switch on the mains supply, the seconds (or minutes) display connected earlier should now be alight and counting at one per second. It not check the following:

| | |
|--------------|---|
| Not alight | ZTX500 connections |
| „ | 12 volt supply to IC1 |
| Not counting | speed switch at normal (SLOW for 4 digit) |
| „ | pin 26 is at negative (6 digit only) |
| Flickering 8 | speed switch or ZTX500. |

Check the circuitry and correct if necessary to get the digit counting at one per second. Now disconnect the mains and connect the other ZTX500's to the digits and the digit select pins, connect back to the mains. The complete display should now be on, check the functions of the speed select switch, fast, slow, hold and normal. At this point if you are using a 60Hz input, connect IC1 pin 14 to negative, and if you require a 12 hour read-out connect IC1 pin 13 to negative. The display can be switched on and off by connecting pin 28 to negative (for OFF).

Completion

The clock circuitry is now complete and ready to go into the case. Screw or glue the transformer base to the back of the clock face, this should leave a clearance between the clock components board and the display board. The speed switch SW1 is set into the back or the base of the case and the main lead is fed through the back and base of the case. Screw the two halves of the case together and your clock is completed.



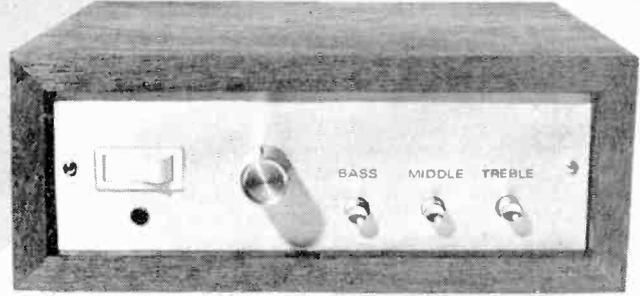
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PART ONE NEXT MONTH

Mood Lighting System

DARKROOM EXPOSURE METER

This simple and straightforward project was designed to determine the exposure required for any particular monochrome print. It has a range of up to 40 seconds, and will be most useful for making enlargements.



I.C. Power Amplifier

The use of an integrated circuit with two Darlington-pair transistors provides an easy means of equipping the workshop with a general purpose amplifier for testing audio equipment. This one was designed to deliver more than 10 watts r.m.s. into an 8 ohm load.



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SPECIAL PRODUCT REPORT

DIGITAL MULTIMETER-



SINCLAIR DM1

THE digital multimeter has become established in industrial circles as an accurate device capable of a much higher performance than an alternative moving coil analogue instrument. Indeed, the accuracies obtained speak for themselves, and the easy readability of measurements on numerical display tubes lends this type of meter to assembly line testing and fault-finding by semi-skilled personnel.

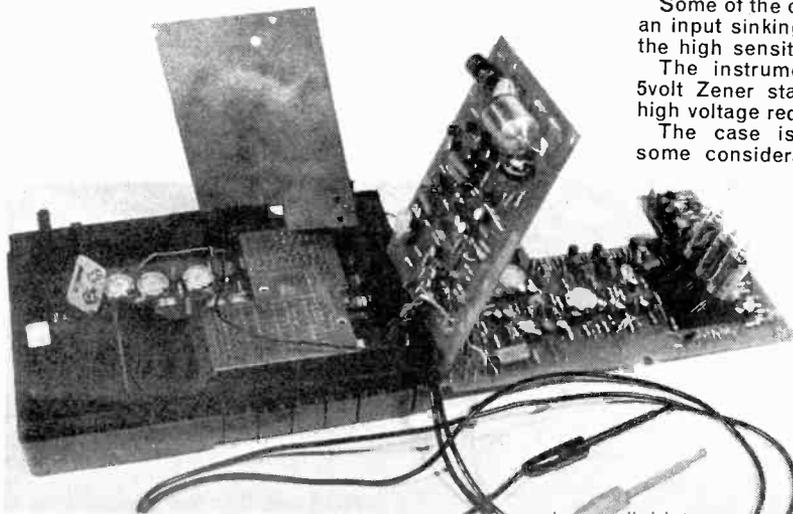
For average work that requires accuracies of up to 0.5%, then the Advance DDM2 and the Avo DA114 will cost in the region of £100 or more. The usual accuracies expected from conventional analogue meters are unlikely to be better than about 1%, and in many cases much worse, at up to about £40.

To obtain a digital performance at an analogue price some economies are inevitable. But there may be frequent cases where accuracies of one or two per cent are acceptable, in which case the moving coil meter is excellent.

One digital multimeter now being produced merits a special mention in that it combines performance competitive with that of analogue alternatives. The price is £49, and they are to be sold direct by mail order to any customer with a 12 month guarantee. In the time available to us we were unable to subject this new instrument, the DM1 from Sinclair Radionics Ltd., to rigorous laboratory measurements, but our sample does indicate that it will undoubtedly provide engineers and experimenters with most of the facilities that are commonly required of a multimeter.

The construction of this instrument is based on a sandwich of two printed circuit board assemblies with a screen between them. Three miniature "Nixie" type tubes with integral decimal point provide the display, with a small number 1 first significant digit indicated when required by a neon with a diffracting plastic lens. It is surprising that

Interior view of the DM1 showing the "layered" P.C. boards.



Manufacturers' Specification

| | VOLTAGE | | F.S.D. | MAX RES | Typical accuracy |
|--------------------------------------|----------|-------|--------|---------|------------------------|
| | min. | max | | | |
| D.C. | 1V | 1000V | | 1mV | 0.4% ind. 0.2% fsd. |
| A.C. | 1V | 1000V | | 1mV | 1.0% ind. 0.2% fsd. |
| CURRENT | | | | | |
| D.C. | 1μA | 1A | | 1nA | 0.5% ind. 0.2% fsd. |
| A.C. | 1mA | 1A | | 1μA | 1.0% ind. 0.2% fsd. |
| RESISTANCE | | | | | |
| | 0 to 1MΩ | | | | 0.6% ind. 0.2% fsd. |
| INPUT RESISTANCE Up to 1000MΩ | | | | | |

no integrated circuits have been used and on questioning this with the Sinclair engineer it was done as part of the exercise to keep the price down. Also typical of this policy is the 1 indicator mentioned above.

The method of achieving the performance at low cost is, naturally, a Sinclair trade secret, but they do let it be known that all parameters are interpreted by the instrument in terms of a common 0.1 volt scale. A ramp generator switches on a 100kHz oscillator until the ramp reaches the same voltage as that coming into the circuit. A cascaded analogue-to-digital converter changes this information into a series of square topped pulses which drive a counter and the output is fed to the readout tubes.

Some of the other features not given in the table include an input sinking current of only 50pA which provides for the high sensitivity quoted.

The instrument is battery powered and employs a 5volt Zener stabilised blocking oscillator to obtain the high voltage required for the display.

The case is moulded in blue polypropylene and some considerable thought has gone into its design.

The ranges are selected by pressing hinged segments such as are now successfully used for other box applications in this material. The test leads and clips are permanently soldered in and anchored so that they can be tidily stowed in the central recess around the edges. The size of the complete instrument is 190 x 130 x 58mm making it light and comfortable to hold in the hand while working. Supplied by Sinclair Radionics Ltd., St. Ives, Hunts., PE17 4HJ

SOMETIMES we seem to take our hobby of radio and electronic construction a bit too seriously. Modern components and techniques have opened up new realms to the amateur and highly sophisticated circuits are now possible but a lot of fun can still be had from simple projects such as that featured here.

Like most simple projects it is a variation on a theme, in this case those 'mazes' printed in children's books and on the back of cornflake packets . . . "How can the bear find his way to the jar of honey?" . . . you know the sort of thing. These 'mazes' may be fun for the very young but to say the least they lack

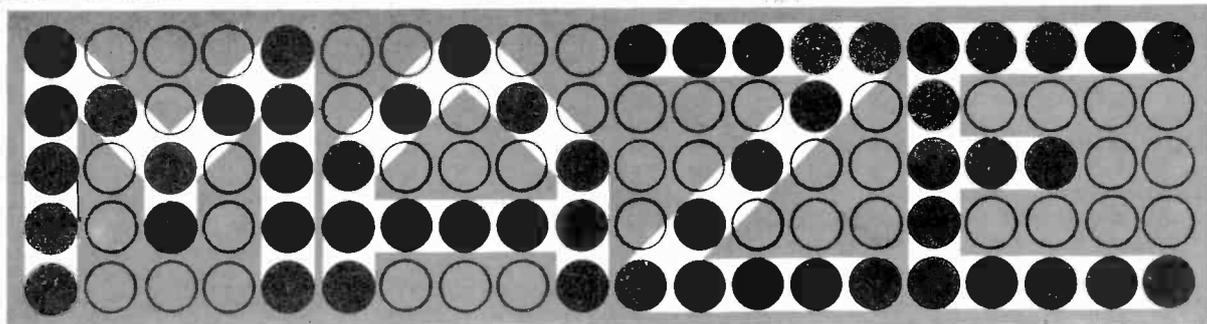
The reason for this is that no identification of the route is visible from the front; you are working almost blind.

OPERATION

The method of play is as follows: The probe is touched on to the *Start* point (at the top left) and the unit is switched on. The probe has then got to be moved from one point to another (up and down or left and right but *not* diagonally) eventually ending up at the *Finish* button at the bottom right.

ELECTRONIC

HALVOR MOORSHEAD

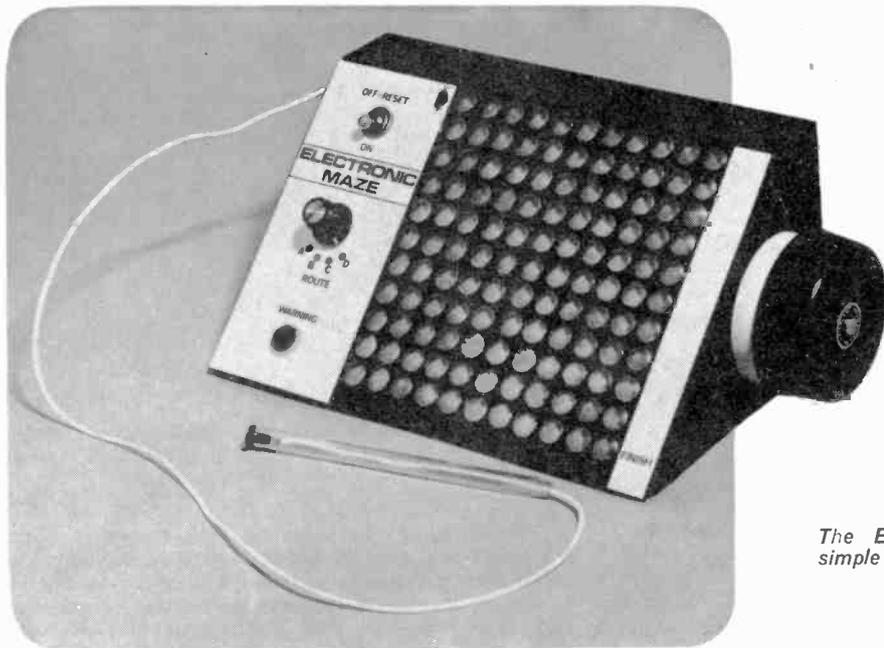


the sophistication required for adults. Our version not only increases the sophistication but turns the game into one of skill.

Despite the simplicity of the arrangement, completing the maze without an error is very difficult indeed, requiring a considerable degree of skill. In addition four different configurations of the route can be selected by a switch and since the route will be built as a mirror image of the front view, even the builder will take some time to master all the routes.

However, if you stray off the route a warning bulb will light up and if you don't get back very quickly to the point you have just moved from, a bell will ring, indicating a failure. The delay between the warning bulb coming on and the bell ringing is about 0.75 second using the components specified, which is pretty quick, especially when you bear in mind that your reactions at their best will take 0.1 second and that's just for the thinking time; you have still to move the probe back physically.

With a well designed maze there will be a large number of false trails. If one of these is followed a point will eventually be reached where you can go no further without the light coming on. In this case you will have to back-track along the route you took until you find another branch of the maze. When played seriously, one can take several minutes to complete the course as it is very difficult to remember the route you took and which are false trails.



The Electronic Maze, although very simple and cheap to build, will provide hours of fun.

One attractive feature of this design is that children over about six are just as good as adults. They may lack the reasoning powers of an adult but their memory appears to be very much better and this evens up matters.

Experience has shown that people pick up the game very quickly and a lengthy explanation of the rules is not needed.

The building cost is low; even if you have to buy all new components including the bell, it should set you back between £2.00 and £2.50.

THE CIRCUIT

The electronics part is very simple and the complete circuit is shown in Fig. 1. The maze route is connected to the positive line and the probe to the base of Tr1. For the moment SW2 can be ignored, this is the switch which governs the choice of route.

While the probe is touching the maze route, the base of Tr1 is shorted to the positive line which also connects to the emitter of the transistor. When the probe is off route (i.e. on a dummy point) R1 will apply bias to Tr1 and it will conduct. A light bulb is in the collector circuit of Tr1 and this will immediately light up. At the same time the voltage at the collector will move towards that of the positive line and C1 starts to charge up through R2. The voltage at the junction of these two components will initially start at the full negative potential but will become more and more positive as the capacitor charges. This governs the time delay.

When this point is sufficiently positive, the gate of the SCR will trigger the device into conduction and the battery potential will be applied across the bell, causing it to ring.

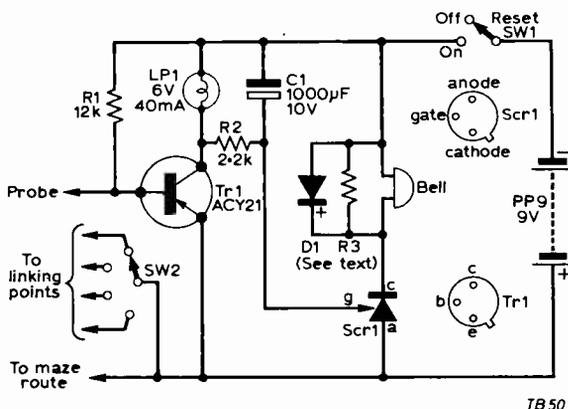


Fig. 1: The complete circuit of the Electronic Maze.

The SCR will remain conducting until the gate voltage drops and the supply is disconnected but, of course, electric bells, when operated from d.c. include a make-and-break circuit. Normally C1 will hold its charge for some seconds and keep the bell ringing, even if the probe is brought back onto the route but if you want the bell to ring continually (so that it can only be stopped by switching off) a resistor should be wired in parallel to keep the SCR on so it continues to draw current. A 330Ω resistor should therefore be wired in parallel. This will mean that, when on, the SCR will be passing at least 27mA,

holding it on while the break circuit is open. This component was not fitted to the final version as it was not found necessary but readers may wish to do so.

In any make-and-break inductive circuit, very high back e.m.f. voltages are generated (several hundred volts) and if you want to be sure that no damage will befall the SCR, especially if it is a 'minimum rated' component as in the components list, then a diode should be included in the circuit to protect it, this will short circuit these high voltages. The 330Ω resistor, if fitted, will considerably damp this and the diode will not be necessary. It is a matter of fitting one or the other, both are not necessary. The diode can be of almost any type, an 0A81, 0A91, 1N914, 1N4001 etc.

As with the holding resistor, this can be fitted between the terminals inside the bell housing.

THE CASE

The maze itself is made up from a matrix of brass drawing pins pushed through a panel of 3/16in. plywood. Before making the maze itself, the woodwork should be completed though the front panel, which holds the maze, should not be fitted at this stage.

The drawing pins have to be accurately sited and the spacing will depend on their size. Those used by the author (pretty standard types) were just under 1/2in. diameter and a 1/2in. matrix was used. The pins must not touch each other of course but the gap between them should not be too large; 1/16in. is about right but it should not be more than 1/8in.

Once the spacing has been settled, a matrix should be drawn in pencil on to the plywood—11 lines horizontally and the same number vertically with the correct spacing. Where the lines cross is the point where the drawing pins are pushed through. Fair pressure is needed but once all the pins are in place they can be hammered home.

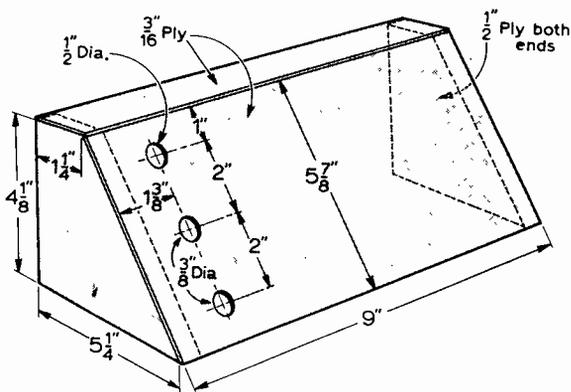


Fig. 2: The woodwork dimensions used on the prototype. Those readers who are accomplished at carpentry may well be able to improve on this.

The remainder of the case is as shown in Fig. 2. This part of the project is far from critical and those more accomplished at woodwork than the author will no doubt be able to improve on it. The construction shown in Fig. 2 is nice and simple and the maze pattern is presented at a convenient angle.

THE MAZE

The back of the main panel should consist of 132 drawing pin ends and it is the way in which these are wired that determines the pattern. Working out this pattern is good fun but it must be carefully planned if the best use is to be made of the matrix. There is no need to follow the plan used in the prototype but Fig. 3 shows the one used and it will be described as an example of how to proceed.

As we are viewing from the back the "Start" point will be at the top right. A route should then be designed to end up at the bottom left. All kinds of false trails can be incorporated in this pattern and certain pins—four in the case of the prototype—can be taken to a switch which will select one route and cut off the other three.

Each pin on the route must have 'guard' or dummy pins around it except where the route runs. Where a false trail ends the pin must be surrounded on three sides by dummies.

If the route switching means that there is more than one basic route (as in the prototype) these will have to be linked. Fig. 3 shows the pattern on the one described here and the top and bottom sections are separate and are only joined by the switched pins. To join these a link wire is included (on the right hand row, about halfway down).

The linking pins are connected to SW2 and these are incorporated in the maze. The dotted lines show the routes formed when these are switched in, but remember that only one of these dotted routes will apply at any one time.

CONSTRUCTION NOTES

The majority of the components can be mounted on a small tagboard as shown in Fig. 4. When this is completed it is screwed on to one of the side panels,

★ components list

| | |
|----------------------------|---|
| R1 12kΩ, 1W, 5% | SCR1 CRS1/05 (1A, 50V) |
| R2 2.2kΩ, 1W, 5% | SW1 On-off toggle switch |
| C1 1000µF 10V— see text | SW2 One-pole, four-way rotary switch |
| Tr1 ACY21 | LP1 6V, 40mA bulb, MES type |

Doorbell, suitable for operating from 9V d.c. Battery, PP9 or similar and battery clip. Bulb holder with red lens. Six way tag-board, miniature type. Gross of brass drawing pins. Discarded ball-point pen. Plywood as in drawing ($\frac{1}{2}$ in and $\frac{3}{8}$ in)

Total cost: about £2.25

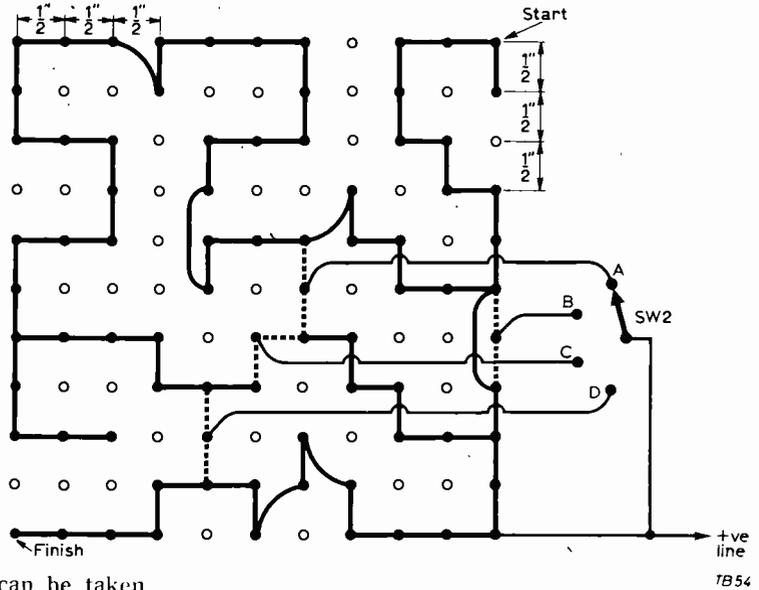


Fig. 3: The "route" used on the prototype. This need not be copied but the route should be carefully planned before wiring.

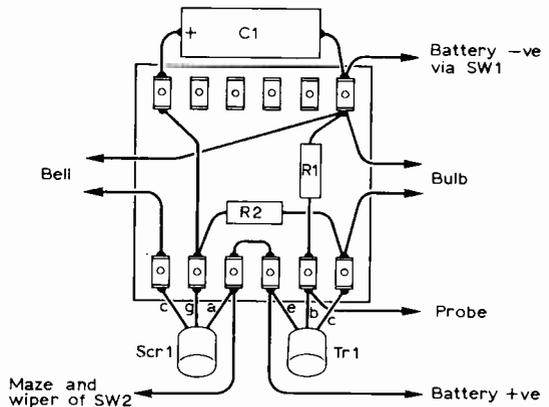


Fig. 4: The electronic components are mounted on a small piece of tag board as shown.

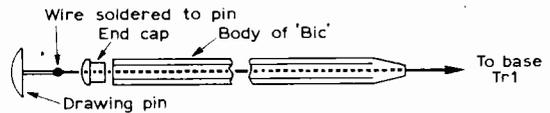


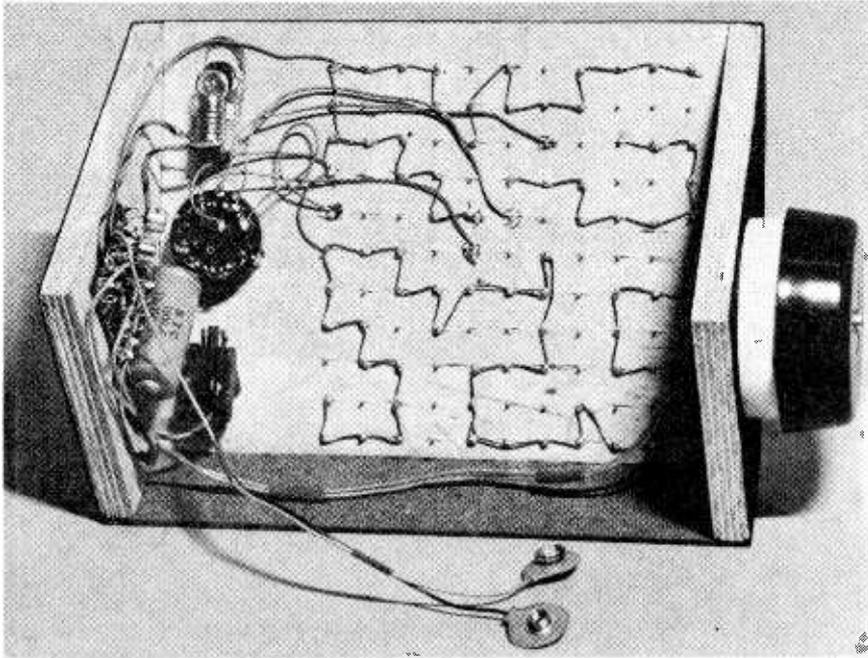
Fig. 5: The construction of the probe.

inside of course. The bell fits on the outside of the other side panel.

The siting of the bulb, SW1 and SW2 can be seen from the photographs and wires run from these to the circuit board and the maze. The battery, a PP9 type, will easily fit into the space available.

The probe is made up from a discarded ballpoint pen and a drawing pin—the construction of this is shown in Fig. 5 and is fairly obvious. The drawing pin at the end of the probe will thus bridge across adjacent points making it possible to go from one to the next without the bulb lighting.

The time delay between the warning bulb and the



An inside view of the prototype showing the wiring of the pins and the switched points running to SW2.

bell ringing is governed by the time constant formed by R2 and C1. It is not practical to increase the value of R2 or the SCR will fail to trigger. (In fact if the SCR fails to trigger the value of R2 may have to be reduced to say 1.5kΩ or even lower but the 2.2kΩ used was sufficient with several samples of SCR so it should be sufficient.)

Since R2 cannot be increased to extend the time delay, the value of C1 must be changed. A delay of less than 0.75 second (as used in the prototype) will make the game too difficult but the delay may be increased by increasing the value of C1. Generally speaking if you double the value of the capacitor, you will double the time delay. ■

All about your



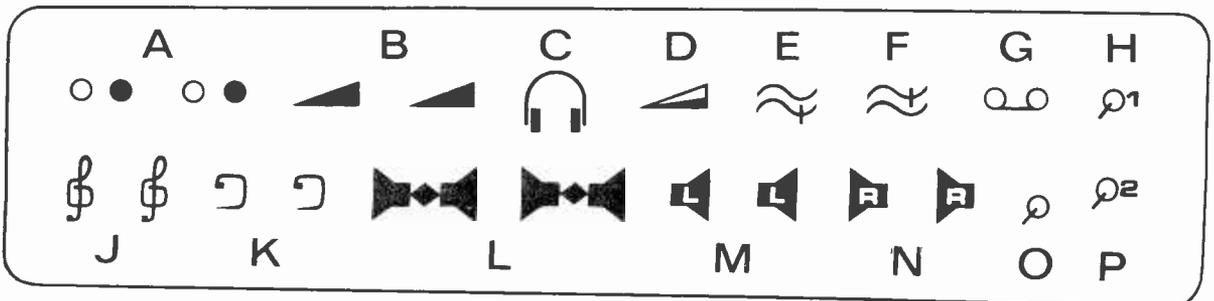
DRY TRANSFERS:
AUDIO EQUIPMENT

MARCH
1973

sheet

Your transfer sheet given with this month's issue has been designed especially for the home constructor who wants to finish off his audio equipment to a professional standard. The colour, red, will show up well on nearly all surfaces and the adhesive has been specially formulated to adhere to aluminium or paint; it will stick to paper but results may not be quite as successful. Most of the lettering is straightforward and needs no explanation. The modern international symbols shown below may not be familiar, so their meanings are given below.

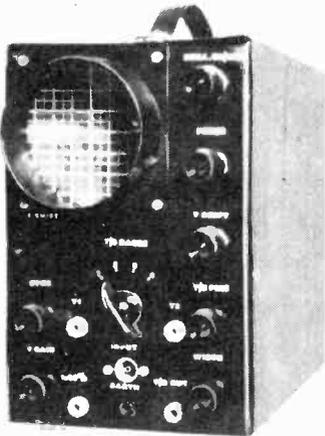
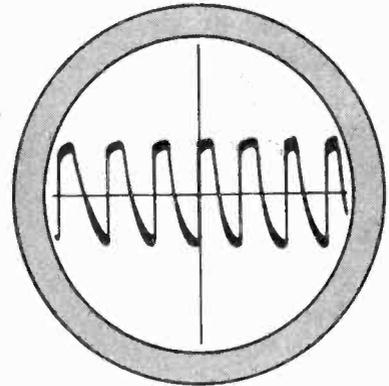
- | | | |
|---------------------|-------------------------|---------------------------|
| A On-Off | F Treble Cut | L Balance |
| B Volume | G Tape | M Speaker—left |
| C Headphones | H Ceramic Pickup | N Speaker—right |
| D Loudness | J Treble | O Pickup (general) |
| E Bass Cut | K Bass | P Magnetic Pickup |



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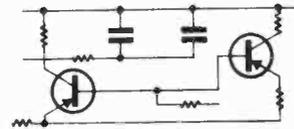
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| 8x4x2" | 38p | 19p | 13x8x2½" | 76p | 38p |
| 8½x5½x2" | 44p | 21p | 14x7x3" | 80p | 36p |
| 9x7x2" | 50p | 26p | 14x10x2½" | 88p | 47p |
| 10x4x2½" | 50p | 21p | 15x10x2½" | 92p | 50p |
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| U | 9½x7½x3½" | £1-55 | Z | 17x10x9" | £4-15 |
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| W | 8x6x6" | £1-90 | | | |

Type N has removable bottom. Type U removable bottom or back. Type W removable front. Type Y all screwed construction. Type Z removable back and front. Plus p. & p.

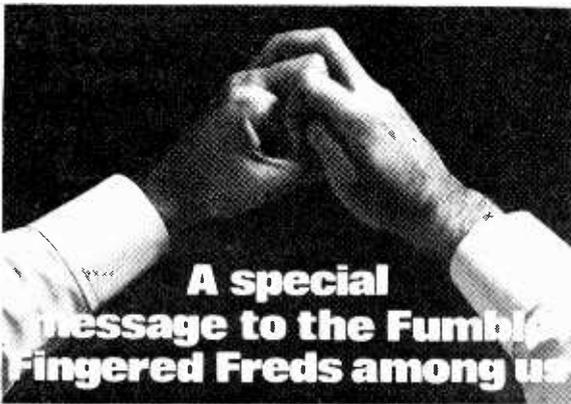


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|-----------|-----|-----|------------|-------|-----|
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| 7x5x2" | 43p | 21p | 14x8½x2" | 74p | 44p |
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| | | | | | | | | | | | |
|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|-------------|-----|
| 1R5 | -28 | 30C17 | -76 | EAF42 | -50 | EM80 | -86 | PCF808 | -68 | U801 | -75 |
| 1R5 | -28 | 30C18 | -72 | EB91 | -12 | EM81 | -86 | PCL82 | -80 | UABC80 | -81 |
| 1T4 | -18 | 30F6 | -64 | EB33 | -40 | EM84 | -82 | PCL83 | -65 | UAF42 | -65 |
| 3R4 | -28 | 30F11 | -65 | EB34 | -48 | EM87 | -60 | PCL84 | -83 | UBC41 | -60 |
| 3V4 | -47 | 30F112 | -69 | EB38 | -30 | ET61 | -88 | PCL86 | -88 | UBF80 | -84 |
| 5U4G | -31 | 30F114 | -68 | EB39 | -32 | EY71 | -89 | PCL88 | -87 | UBF89 | -84 |
| 5V4G | -36 | 30L1 | -29 | EBF80 | -32 | EY87 | -29 | PCL89 | -80 | UCB4 | -80 |
| 5Y3GT | -30 | 30L15 | -70 | EBF83 | -39 | EZ40 | -39 | PCL80 | -89 | UCB85 | -88 |
| 6Z4G | -38 | 30L17 | -70 | EBF89 | -29 | EZ41 | -39 | PCL805 | -88 | UCF80 | -80 |
| 6Z0L2 | -64 | 30P4 | -65 | ECC81 | -17 | EZ80 | -21 | PEN4A | -77 | UCH42 | -68 |
| 6AM6 | -18 | 30P12 | -69 | ECC82 | -20 | EZ81 | -22 | PEN36C | -70 | UCH81 | -80 |
| 6AQ5 | -22 | 30P19 | -65 | ECC93 | -85 | EZ90 | -25 | PFL200 | -61 | UCL82 | -88 |
| 6AT6 | -20 | 30PL1 | -80 | ECC85 | -54 | GZ30 | -84 | PL38 | -48 | UCL83 | -88 |
| 6AU6 | -20 | 30PL13 | -89 | ECC804 | -54 | GZ32 | -40 | PL81 | -43 | UF41 | -59 |
| 6BA6 | -20 | 30PL14 | -80 | ECC80 | -30 | GZ34 | -50 | PL81A | -47 | UF89 | -80 |
| 6BE6 | -21 | 35L6GT | -45 | ECF82 | -26 | KT41 | -77 | PL82 | -81 | UL41 | -68 |
| 6BJ6 | -41 | 35W4 | -25 | ECH35 | -55 | KT61 | -55 | PL83 | -83 | UL64 | -80 |
| 6BW7 | -50 | 3Z4GT | -25 | ECH42 | -69 | KT69 | -78 | PL84 | -80 | UM84 | -88 |
| 6F14 | -35 | 50CD6G | -68 | ECH81 | -29 | LN319 | -68 | PL500 | -63 | UY41 | -89 |
| 6F23 | -68 | 807 | -49 | ECH83 | -38 | LN329 | -80 | PL50 | -65 | UY85 | -85 |
| 6F25 | -50 | AC/VP2 | -77 | ECH84 | -35 | LN389 | -65 | PM84 | -80 | VF4B | -77 |
| 6J7G | -24 | R349 | -70 | ECL80 | -30 | N78 | -87 | PX25 | -95 | W77 | -63 |
| 6K7G | -12 | B729 | -54 | ECL82 | -29 | P61 | -40 | PY32 | -52 | Z77 | -82 |
| 6L6G | -38 | CC35 | -67 | ECL96 | -35 | PABC80 | -81 | PY33 | -62 | Transistors | -17 |
| 6Q7G | -35 | CY31 | -28 | EP39 | -38 | PC86 | -47 | PY81 | -25 | AC127 | -18 |
| 6SL7GT | -32 | DAF91 | -22 | EP41 | -57 | PC88 | -47 | PY82 | -25 | AD140 | -37 |
| 6SN7GT | -32 | DAF96 | -36 | EP80 | -23 | PC98 | -42 | PY83 | -25 | AF115 | -20 |
| 6V6G | -28 | DF91 | -18 | EP85 | -28 | PC97 | -88 | PY88 | -33 | AF116 | -20 |
| 6V6GT | -28 | DF96 | -36 | EP86 | -30 | PC900 | -29 | PY80 | -81 | AF116 | -20 |
| 6X4 | -23 | DH77 | -20 | EP89 | -26 | PC84 | -29 | PY801 | -81 | AF117 | -20 |
| 6X6GT | -28 | DK32 | -33 | EP81 | -13 | PC85 | -23 | R19 | -30 | AF125 | -17 |
| 10P13 | -53 | DK91 | -28 | EP92 | -27 | PC88 | -88 | R20 | -70 | AF127 | -17 |
| 12AT7 | -17 | LK93 | -50 | EP98 | -65 | PC89 | -43 | U95 | -73 | OC28 | -25 |
| 12AU7 | -20 | DK96 | -45 | EP183 | -27 | PCC189 | -48 | U96 | -65 | OC44 | -18 |
| 12AX7 | -22 | DL35 | -40 | EP184 | -29 | PCC805 | -70 | U47 | -73 | OC45 | -12 |
| 19BG6G | -75 | DL92 | -28 | EH90 | -38 | PCF80 | -28 | U49 | -70 | OC71 | -12 |
| 20F2 | -67 | DL94 | -47 | EL33 | -55 | PCF82 | -33 | U62 | -31 | OC72 | -12 |
| 20F3 | -75 | DL96 | -38 | EL34 | -48 | PCF88 | -46 | U78 | -24 | OC75 | -12 |
| 25L6GT | -19 | DY86 | -24 | EL41 | -54 | PCF90 | -58 | U91 | -88 | OC81 | -12 |
| 25U4GT | -26 | DY87 | -24 | EL84 | -23 | PCF801 | -28 | U95 | -31 | OC81D | -12 |
| 30C1 | -58 | DY802 | -33 | EL95 | -33 | PCF802 | -39 | U251 | -31 | OC82 | -12 |
| 30C15 | -58 | EABC80 | -82 | EL500 | -62 | PCF806 | -56 | U329 | -68 | OC82D | -12 |

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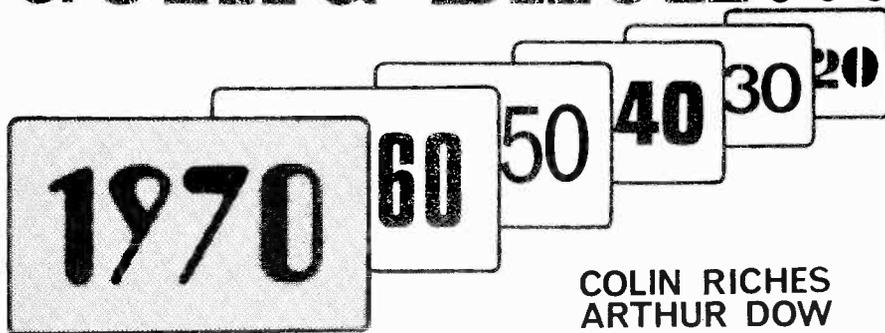
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GOING BACK...



COLIN RICHES
ARTHUR DOW

Happy Days!

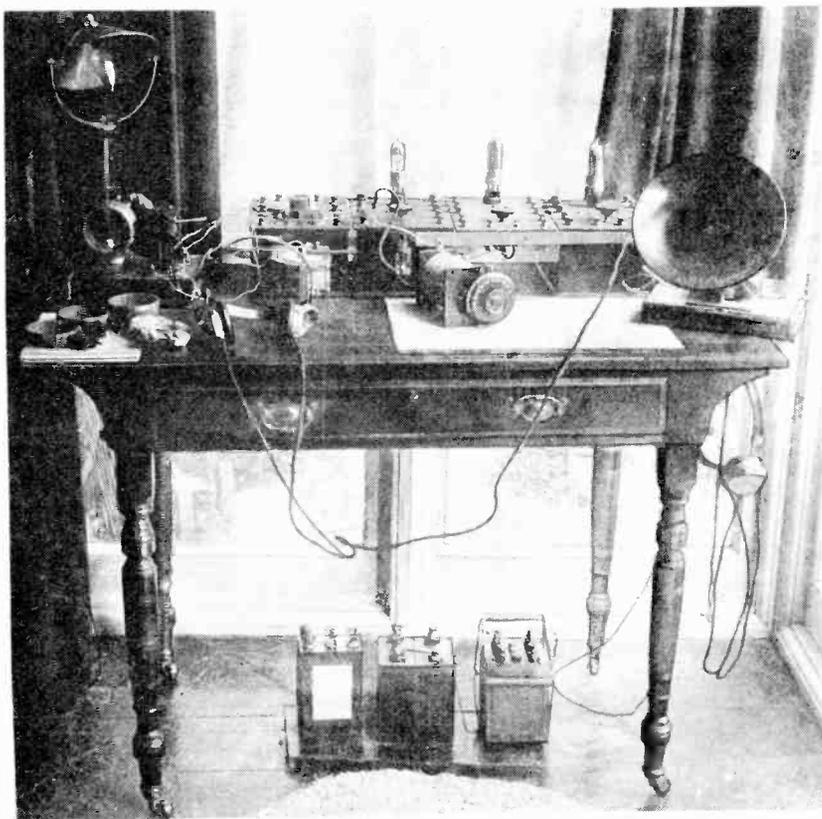
Reader H. E. Grafton Watts of Uxbridge, Middlesex, recently came across this photograph of his receiving set-up of 1925, when he was just 15 years of age and still at school. He recalls putting shields round the valves because the filaments were so bright only to find they expired from the excessive heat!

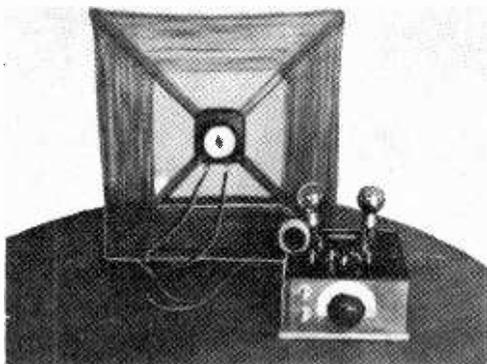
The horn of the Amplion loudspeaker was driven from a diaphragm mounted in the cast aluminium box below the horn. The "box" on the left-hand side of the table would appear to be a variometer tuning unit followed by a detector unit, since a catswhisker

crystal detector can be seen mounted vertically on the front of the unit. The remaining two units were presumably audio amplifier stages.

The loose coils at the front of the table bring back memories of nails in cotton reels used to wind coils in the early do-it-yourself days. The large accumulators on the floor are a far cry from the small dry batteries that are used today for powering solid-state receivers!

At the end of his most interesting letter Mr. Grafton Watts recalls the elderly lady appealing to him to slow down the dance music of the Savoy Orpheans coming from the loudspeaker!



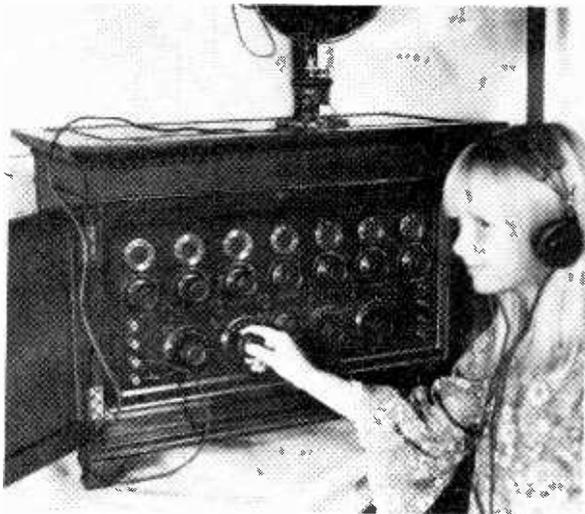


Regular reader Chris Petsikopoulos of Athens has renovated this 1922 French receiver which uses two R5 valves by La Radiotechnique. The bandswitched frame aerial was made by Thomson Houston.

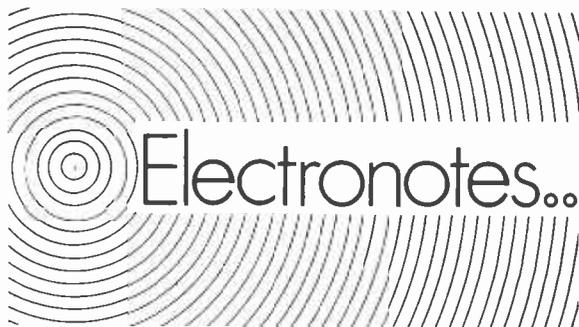
Mighty Monster

Douglas Byrne, curator of the museum organised by the Wireless Preservation Society, has sent a delightful photograph of a young visitor at the controls of a mighty receiver of 1926 vintage. Just a bit bigger than the multitransistor receiver that she normally totes around!

The line of "portholes" seen in the photograph enabled the operator to see the individual valve filaments when adjusting the rheostats, next line down. The seven bright-emitter valves comprised two radio-frequency amplifying stages, a detector and four audio stages of amplification. In the jargon of the day the receiver was known as a 2-V-4 contrasting with the more popular 0-V-1 and 1-V-1 of that time.



Apart from the usual aerial and anode tuning condensers the 2-V-4 included a special control for varying the bias voltage on the detector valve. Five plug-in coils were needed for each band covered so it can be imagined that a change of bands was not indulged in too frequently! A hefty 6V accumulator fed the valve filaments while the HT supply was around 60 to 100V.



S. GINSBERG

DIODES come in assorted types and sizes. These humble creatures have only two connections and many might consider them the unglamorous relatives of the more exotic types of semiconductor.

One cousin in this family is the light emitting diode or l.e.d. now beginning to find its way increasingly into solid state readout devices. These devices offer the great advantage over the nixie type tube in that they will work happily off of low voltages which are already present to power the other solid state circuitry within the particular equipment. Nixie tubes require high voltages (180V typical).

But the l.e.d. is far from being fully developed as yet and is only an infant on the semiconductor scene. A recent order from the U.S. Armed Services has been for a huge array of l.e.d.s measuring some 6x4 feet. This area will contain approximately two million diodes. The colour which these diodes will radiate will be dependent upon the current passing through them and will offer a choice of either red or green. Further details are restricted for obvious reasons. However, it is interesting to note that the supplying Company already manufactures a 2,240 element array. This is used for marking film and is described as a "replacement cathode ray tube" in this particular application. Look out Shadow Mask and Trinitron?

When the l.e.d. first rose to fame the "in" colour was red. Then, someone produced a green emitting version. Now comes news that workers are concentrating on a range of colours and there seems no theoretical reason why white should not be included. The fabrication of these new multi-colour capability devices is complex, but it would be a safe bet to watch out for some information on them at the Physics Exhibition. We might even see a sample or two which will cause an endearing glow in the hearts of many workers in this field.

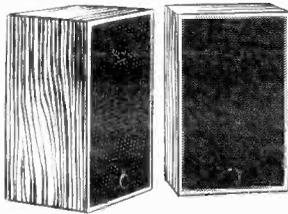
While the l.e.d. forges ahead, the liquid crystal still remains a tantalising vision for many. One Company at the Electronica exhibition offered a liquid crystal readout with four digits. These, note, were offered in production quantities so it looks as though another device has passed quietly from the realms of research and into the pages of practice.

Liquid crystals take very little power: C-m.o.s. takes very little power. Put them together and you have the basis of a digital wrist watch which will run for a year from a single battery and with truly remarkable accuracy. The c-m.o.s. technique uses complimentary m.o.s. devices on a single chip. It combines both p-channel and n-channel devices coupled together.



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R 088 MATCHED STEREO LOUD SPEAKERS Here's real value in stereo speakers! Each unit comes complete with 10-foot lead and phono plug, and look really smart. Power handling per speaker: 4 watts rms, 8 watts peak. Frequency range: 40-16,000 Hz. Flux density: 8,500 gauss. Impedance: 8 ohms. Dimensions: 9" high, 5 1/2" wide, 4 1/2" deep. Finish: oiled walnut. **ROC PRICE £9 50 pair.** Normal Price £10 75

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 trim. Inputs: phono 2.5mV and 5mV RIAA, tuner aux 250mV. Hum and noise: phono - 50db, tuner/aux - 85db. How's that for a specification? Size 14" high, 10" wide, 3 1/2" deep.



As reviewed in **POPULAR HI-FI** February 1972

ROC PRICE £35.20
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OLSON RA-310 AM FM MPX STEREO TUNER

This ROC Tuner is especially designed to match the Olson AM-395 Stereo Amplifier. Its 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 3µV, AM 250µV. Stereo separation 30db at 1kHz. Image rejection 60db. Size 11 1/2" high, 4" wide, 7 1/2" deep.



REALISTIC SA-1008 6 WATT STEREO AMPLIFIER

Here's fabulous, exciting value in miniature! This high quality stereo amplifier measures only 9" wide, 3 1/2" high, 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. -3db. Output 3 watts r.m.s. per channel into 8 ohms. Inputs are 100mV for both phono and tuner.



TEC HR-007 HEADPHONE 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 £11.00 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! It 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. 1db Channel separation. 28db Compliance. 12-10.6 cm/dyne. **ROC PRICE £6 37**



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 (±2db) Inputs: Magnetic, Ceramic, Tuner, Tape, Aux. Tape Play. Size: 345mm x 300mm x 130mm.

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R 446 3-WAY MATCHED SPEAKERS

These will do justice to your amplifier - and to your pocket. At only £20.00 a pair, they are real value for money. Each cabinet is heavily lagged and teak finished. They handle 16 watts rms, 18 watts rms each. Each loudspeaker contains a 6" base unit plus tweeter. Frequency range: 40 to 19,000 Hz. Size 14" high, 9" wide, 6 1/2" deep.

ROC PRICE £20.00
Normal Price £27.00 per pair



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. -3db. 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 CRYSLER "LIVING AUDIO" SPEAKER CE-56



ROC PRICE £27.25

Normal Price £39.95 each

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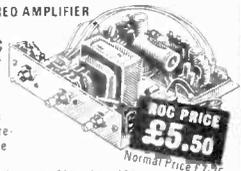
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This is one of the lowest priced stereo tuner amplifiers on the market. It covers the full range of both AM and FM broadcast frequencies. And when you're switched to FM, an indicator lights up when a stereo signal is received - that's the time to switch 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. ±3db. Power output: 4 watts total music power into two 8 ohm speakers. Size: 16" wide, 4 1/2" high, 8" deep.

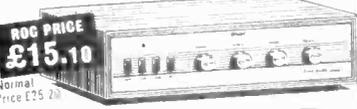
ROC 7-WATT STEREO AMPLIFIER CHASSIS SK-317

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. -3db. output 3.5 watts music power per channel into 8 ohms. input, phono, 800mV, signal-to-noise ratio better than 45dB.



ROC PRICE £5.50

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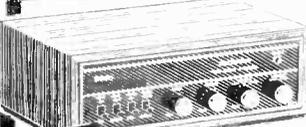


ROC PRICE £15.10

Normal Price £25.20

OLSON AM-372 16-WATT STEREO AMPLIFIER

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ROC PRICE £24.10

Normal Price £39.50

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SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

DURING the past few months we have been examining the ways and means of gaining extra pleasure and interest from the hobby of DX Listening. One of our readers, **Mr. G. E. W. Hewlett** of Torquay, has suggested yet another method of achieving this aim.

Mr. Hewlett has made an intensive study of all the broadcasts from Radio Australia. He has logged their transmissions at all hours of the day and night and has heard their broadcasts on many different bands. Every time a broadcast is heard he notes the signal strength (on the SINPO scale), the transmitter power and the beam of the transmitting aerial.

All this information provides a good overall picture of the station's Service. During November 1972 Mr. Hewlett logged Radio Australia on no fewer than 305 occasions. He chose Radio Australia as his subject because the station can be received via two different propagation paths. There is the obvious direct route and also the longer route round the other side of the earth.

This method can be applied to any station, or alternatively to a particular area of the world. If the information collected is made into a fully comprehensive report and forwarded to the station it will be very useful to the station engineers. The reason for this is that all the receptions were made by the same person on the same receiver at the same location. This enables the station to draw direct comparisons between the various broadcasts that they have made.

The following table is an extract from Mr. Hewlett's log and gives some idea of the extent of his research into the station:

| Freq. | Time | Transmitter Details | Language |
|---|------|--------------------------|------------|
| <i>South & South-East Asia Service</i> | | | |
| 7145 | 1500 | Darwin, 250 kW, Beam 301 | English |
| 7235 | 1500 | Shepp., 100 kW, Beam 308 | English |
| 9535 | 2130 | Shepp., 100 kW, Beam 308 | Vietnamese |
| 9550 | 1700 | Shepp., 100 kW, Beam 320 | English |
| 9680 | 1700 | Shepp., 100 kW, Beam 308 | English |
| 9740 | 2100 | Shepp., 100 kW, Beam 308 | English |
| 11765 | 1330 | Shepp., 50 kW, Beam 320 | Thai |
| 11765 | 1430 | Shepp., 50 kW, Beam 320 | English |
| 11790 | 2130 | Shepp., 100 kW, Beam 320 | Vietnamese |
| 11790 | 2230 | Shepp., 100 kW, Beam 320 | Indonesian |
| 15320 | 2300 | Shepp., 100 kW, Beam 320 | English |
| 15405 | 2230 | Shepp., 100 kW, Beam 308 | Indonesian |
| 17715 | 0500 | Darwin, 250 kW, Beam 301 | English |
| 17715 | 2230 | Shepp., 100 kW, Beam 320 | Indonesian |
| 17870 | 0300 | Shepp., 50 kW, Beam 308 | English |
| 21550 | 0200 | Shepp., 50 kW, Beam 320 | English |
| <i>East Asia & North-West Pacific Service</i> | | | |
| 15240 | 2100 | Shepp., 50 kW, Beam 342 | English |
| 17715 | 2100 | Shepp., 50 kW, Beam 342 | English |
| <i>Pacific Islands Service</i> | | | |
| 9570 | 0700 | Shepp., 50 kW, Beam 128 | English |

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz ● Times in GMT

9580 1900 *Shepp.*, 100 kW, Beam 118 English
 11765 0700 *Shepp.*, 100 kW, Beam 128 English
 15240 0130 *Lyndh.*, 10 kW, Beam 110 English
British Isles & European Service

9570 & 11765 kHz as in Pacific Isles Service
African Service

17820 0330 *Shepp.*, 50 kW, Beam 243 English and French

Receiver: KOYO KTR 1770+CODAR PR40 pre-selector.

Aerial: 32 foot, centre-fed long-wire.

The first log for this month comes from Rendcomb College in Cirencester, Gloucestershire. It was sent in by **Simon Wormleighton** and **J. P. Fletcher**. The equipment consisted of an HRO receiver with 8 metre folded dipole and an Astrad-Altair receiver with a forty foot long-wire. The stations logged included:

6130 R. *Norway* in English at 1230
 7135 T.W.R., *Monte Carlo* in English at 1930
 9745 R. *Baghdad, Iraq* in English at 1940
 11755 R. *Finland* in English at 1825
 11955 FEBA, *Seychelles* in English at 1755
 15250 RSA, *South Africa* in English at 1600
 17815 HCJB, *Quito, Ecuador* in English at 2030
 17820 R. *Canada International*, English at 1250
 25790 RSA, *South Africa* in English at 1510.

Rex Cooper of Foulton in Norfolk has sent in another interesting report of stations heard on his 6-valve Domestic Receiver. The log includes the first mention on this page of the Madagascar relay of Radio Nederland.

9605 R. *Dif. de Sao Paulo, Portuguese* at 2310
 9610 R. *Damascus, Syria* in English at 2145
 11650 RAE, *Argentina* in English at 2325
 11650 R. *Nederland, Madagascar relay* with sign-off in English at 1830
 11720 R. *Nacional de Brasilia, Portuguese* at 2200
 11720 *Saudi-Arabian BC, English* at 1810
 11890 R. *Lebanon with News* in English at 1835
 17800 NHK, *Japan, News* in English at 0905

Richard Witney of Braintree in Essex received a Skywood SX-203 receiver for Christmas which he used to hear the following stations:

7100 R. *Tirana, Albania* in English at 2220
 7245 R. *Austria* in English at 0902
 9545 R. *Ghana* in English at 2100
 9655 R. *Damascus, Syria* in English at 2030
 9675 *Radio Ceylon* in English at 0200
 11815 T.W.R., *Bonaire* in English at 0100
 15185 *Radio Nigeria* in English at 1620
 15245 RSA, *South Africa* in English at 1600

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

NOW that we are well into 1973, how about getting down to some Amateur Radio resolutions? Hopefully, these will last longer than the ones you all made on January 1 and have all now been broken! One possibility might be to attempt to contribute something really worthwhile this year. For example, there are three beacon stations all happily radiating in the ten metre band. At present we are on the downward trend of the sunspot cycle and conditions on 28MHz should (in theory) get progressively worse—or more interesting? If you can standardise on a receiver, the settings of the controls on the receiver, and a “standard” antenna, you could monitor these beacons at regular intervals and collect some useful data. Frequencies and locations for the beacons are as follows: GB3SX, 28·185MHz, Crowborough in Sussex; DL0IGI, 28·195MHz and 28·200MHz, near Salzburg in Germany; 3B8MS, 28·190MHz, Signal Mount in Mauritius. If it will help, or encourage anyone, I will be happy to publish the sunspot count each month, although these will be a bit behind since they will come from a professional laboratory who don't exist for the purpose of sending of' 3JDG sunspot counts. Incidentally, there are other beacon stations radiating. Two metres is another band which has these in evidence.

D. Warmer (Sittingbourne) is a keen 3·5MHz listener and spends about 80 per cent of his time on that band. He mentions that VE7AGJ is looking for G contacts on 80 at around 0430hrs. Early birds might try the top end of eighty, from 3·790MHz to 3·800MHz.

Listeners on the h.f. bands will have to mind their manners. This is very pertinent if they hear ZD8AW who is an XYL and operates from Ascension Island. (Now what's a nice girl like you . . . etc?)

Another eagle-eared s.w.l. is **J. Birrell** (Nottingham) who gives word that VK9RY is on from Papua. Apparently this station is on every day on 21MHz and 28MHz. John also notes that ZD9GC is active from Gough Island. Worth a listen in the afternoons on 28MHz for a ZD9 callsign.

Two events are not too far away and might be of interest to many readers. The first is mainly for the v.h.f. types. This is the RSGB v.h.f./u.h.f. Convention which takes place at the Winning Post Hotel, Whitton, Middlesex on April 7. Full details from the RSGB—usually a very interesting affair and well worth going to if your interests lie in the higher frequencies. Second event is the first Mobile Rally which should stir up quite a bit of activity on top band. This is the White Rose Rally at Lawnswood Girls' High School, Ring Road, West Park, Leeds 16 on April 1.

A very high activity in February for contest types. My little black book lists the following: February 3-4, ARRL DX (phone); 10-11, topband contest; 17-18, ARRL DX (c.w.); 18, 70MHz open contest; 24-25, REF contest (phone); March 3-4 Two metres

and seventy centimetres contest; March 3-4, ARRL DX (phone); March 4, two metre fixed. Speaking of future events, did anyone log EIOYSE. This was a special callsign for a station operating at the Royal Dublin Society showgrounds.

For those not familiar with contests they are very good fun and can bump up your “Countries heard” score (and your ego too) quite a bit. If you haven't listened in on a contest before, now is the time to try. Start with a phone one and see how many stations you can log. You can also give your aerial a good try out too and see how your rig compares with other peoples' equipment.

Those, like '3JDG, who have a miniscule garden will weep openly when they hear of **Graham Armstrong's** 550ft. long wire. This r.f. clothes line is some 50ft. up and feeds a 9R-59DS receiver. Top-band goodies bagged are DL5XF, EP2BQ, HB9CM, PA0HLA, PA0PN, W1GL all on s.s.b. On c.w.; KV4FZ, KV4UE, OK1ATP, OK1FCW, W1BB, W1HGT, W8FFT.

People with the super-doooper b.f.o. swishing, a.v.c.—controlling everything receivers should try a regen claims **Stanley Sharred** (Birmingham). Topband on his three-valve receiver sounded like; GW3UCB, OK1FCW, OK1ATP, W1HGT, W1VS and a K7 which got away (all these on c.w.). Meanwhile, in another part of the house lurks an R1155, 140ft antenna and a brother, one David Sharred. Log for eighty from the udder brudder reads; YA1DT, YO3AN, XP2CA, ZC4HC, ZL2MI, ZS3GH.

Neil Marshall (Old Coulsdon) has 128ft. of wire in the loft. This, plus a 19 set got him the following on 80 metres; K4CIA, OH0NJ, PY1CAD, VE1BB, VE1IE, VE2XB, VE3UA, VK2AVA, VU25BX, WA2EAH, WA90TH, W1DL, W2GO, W4AP, ZL4KF, ZS1MH, ZS3GH, 4Z4DX, 9H1C.

Eighty metres is my favourite band confesses **Peter Reed** (Brighton). Receiver is an R1155N and a Joystick antenna. Cream of those received are; CE8AA, VK2AVA and ZL4KE.

Roger Dixon (Skipton) pointed his CX 203 receiver in the direction of twenty metres this last month. This, together with a PR30 and 100ft. end fed brought the following log on s.s.b.; CR6A, CT1XY, CT3AP, EA5LC, EA8BW, F6AOE, F9LC/MM, FY7AE, G3KGF/P/VP9, H5SAFJ, IT9LPP, JA3FD, JA4BLY, JA8MWU, K1SLL, K2ISP, LU4ECO, OH0NI, VE0MAB/MM, VE1ASJ, VE3CNE, VE5CJ, VE7ATP, VK2AZO, VK3IPI, VK3LB, VK4GD, VG6RG, VO1CO, W1AA, W2JQV, W3CRA, W6CWN/MM, W6DL/CT1, W6ZJA, XT2AG, ZB2A, ZC4DJ, ZD3D, ZD5EL, ZD8KO, ZL1ABO, ZL2AAW, ZM1ASY, ZS4NJ, 4X4BL, 5T5DA, 9H4H, 9H5D, 9J2SS, 9K2BQ, 9V1QT.

Logs, in alphabetical order please, to arrive by the fifteenth of the month to:

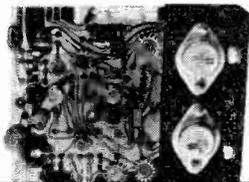
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|-------------------|--|
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| Noise | Better than -75 dB |
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SPECIFICATION

| | |
|-------------------|----------------------------------|
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| Freq. response | 20-20,000 Hz \pm 2dB |
| Input sensitivity | 200 mV into 10K |
| Construction | Fibreglass board |
| Size | 8" x 4" x 4" (5" with supply) |
| Low distortion | parallel push-pull output stage. |

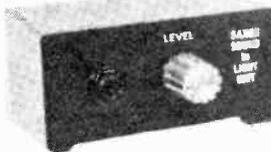


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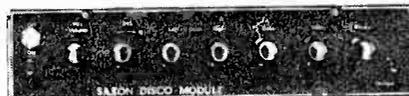


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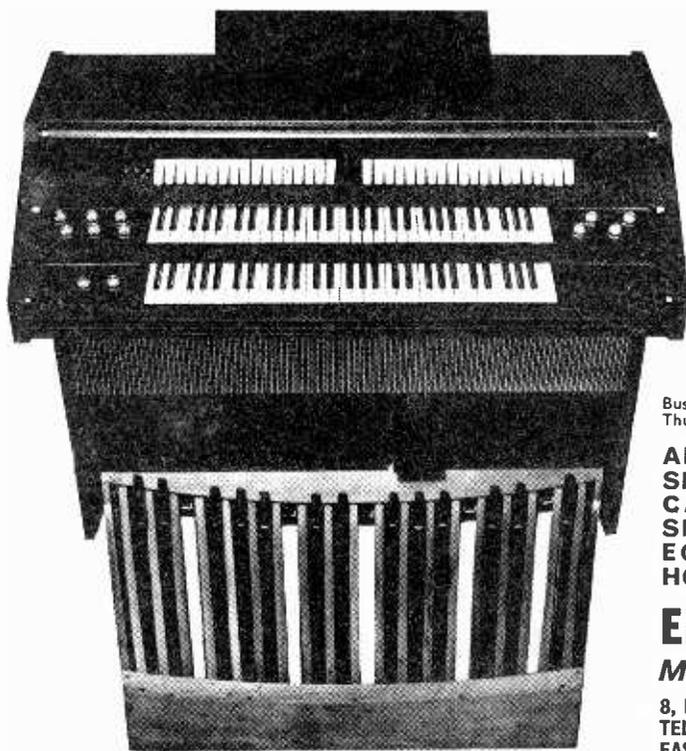
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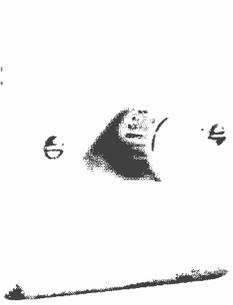
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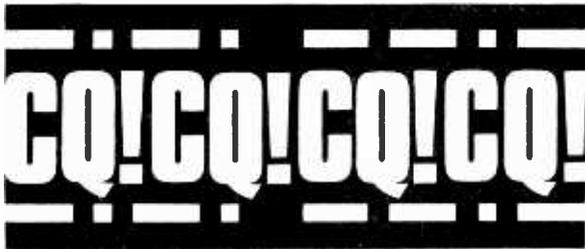


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 —R. H. Wike, 8 Orford Road, Padgate Lane, Warrington, Lancs.
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INFORMATION WANTED

...information on converting a Sobell TPS147 TV set into an oscilloscope.—J. Mlehm, 86 Forest Road, London, N9 8RX
 ...wanted to buy or borrow instructions manual or any gen for Eddystone communication receiver 5840 (all valves missing). Will pay postage etc.—E. J. Mannix, 2 Blacquiere Villas, Phibsboroigt, Dublin 7, Eire.
 ...any info on a Pys PTC 3004 high band base receiver for use on 2 metres.—B. Dunn 17 Duke St., Clayton le Moors, Accrington, Lancs.
 ...instruction book or circuit for R-2A/ARR-3 receiver—R. W. Appleby, 34 Furze Avenue, St. Albans, Herts.
 ...any info re circuitry for an infra red closed circuit alarm design using an OCP. 71 or similar.—H. Bye, 110 Burnt Oak Lane, Sidcup, Kent.
 ...service sheet for a Rotokup tape recorder type RK4 (or even a circuit diagram).—R. Carter, 41 Manston Crescent, Crossgates, Leeds, LS15 8QZ
 ...any info on the Marconi 'Oceanic' receiver type 975A, Serial No. S11.—B. Taylor The Green, Goose Green, Pulborough, Sussex.
 ...any info on valve line up in the TRUVOICE TREBLE-N-BASS FIFTY, 50 watt valve amplifier.—G. Parkin, 2 Westfield Cott, Westmelton, Rotherham, Yorks.
 ...numbers of transistors and info on their connections into circuit 'for output stage of Sinclair system 2000 35watt stereo ampl.—R. Greene, 14 Cremore Road, Glaslerrin, Dublin 11, Eire.
 ...any info circuit or manual for the CR100 (B.28) communications receiver.—A. G. Jones, 6 Gower View, Llanelli, Carm. S. Wales.
 ...meter, frequency deviation (test gear 3227)—FR5001/V. Function/operation/conversion information please.—E. Withers, 146, Winchester Road, Basingstoke, Hants.
 ...construction data wanted for Oscilloscope with ACR13 C.R.T.—G. Hetherington, Ballinamore, Co. Leitrim, Ireland.
 ...information wanted on VCR138A and VCR139A scope tube, especially on details and operating voltages—plus any scope circuits using these tubes.—P. Seddon, 48 Cymbeline Way, Rugby.
 ...info on frequency modulation converters.—J. F. Diaz Prieto, Medico Psiquiatra, Apartado 9, 055, Madrid-9.
 ...info on constructing a fixed speed, mains stroboscope and a light sound synchronizer to run off of a 50 watt amp.—R. Hornby, 4 Liddymore Road, Watchet, Somerset.
 ...info on how I could get a volume control for a Loewe opto stereo tuner receiver.—J. Joyce, Grove, Wantage, Berks.
 ...a circuit for a sweep generator.—K. W. Capewell, 168, Burnbridge Road, Old Whittington, Chesterfield, Derbyshire.
 ...a service manual for a Jaseon JTV2 Mk. 2.—B. P. Barker, Weybridge, Surrey.
 ...a circuit for a diode noise limiter, using a EB91 valve, suitable for use in a communications receiver. A Kettlewell, 3 Portland Road, Oxford, OX2 7EZ.
 ...info on attaching a signal strength and centre channel meter for an f.m. tuner.—D. S. De Silva, London, S.W.17. (St. Benedict's Hospital).
 ...info for the assembling of a power supply for 24V. E. de Oliverira, Apartado 20 Carcavelos, Portugal.
 ...details of Valve Voltmeter Battery operated Radio Constructor 1967? Also Jan 1969.—D. G. Biddle, 28 Rockbourne Road, S.E.23.
 ...circuit diagram for a 100 watt power amplifier mentioned by Mr. Rostgard in his letter published in April '72 or another good quality valve amplifier, as I am also one of the dying breed.—R. H. Harper, 7 Brookend Road, Sidcup, Kent. A15 8BE.
 ...info on very old blue-prints. Such as Reflects Circuits and also Crystal sets.—C. Lynch, 26 Henley Avenue, Connahs Quay, Deeside, Flintshire, W. Wales
 ...a device which consisted of Thermopiles which were heated by gas and provided H.F. output and a supply of changing 2V ac. used to be used for power. The writer wishes to know whether thermopiles are available which could be used to charge 12V acc for use in a caravan.—J. Robb (Electronics) Ltd., 29 Sciennes Road, Edinburgh EH9 1NX.
 ...info where I can obtain the wafer switches, for a Perdio Town and Country receiver —M. A. Wood, 45 Rivermead, Cotgrave, Nottingham, NG12 3LP.
 ...any info on a model railway train speed control circuit.—M. Robson, 8 Withipoll St. Ipswich, Suffolk.
 ...any info (especially circuit diagram) on a R1155A receiver. I have no information at all.—J. Thomson, 32 Sunnyside Avenue, Port Glasgow, Renfrewshire, PA14 6QQ
 ...Service info required on the following EMI oscilloscope Model QD/101 and Home-lab signal generator AF, RF type 10.—B. Thomas, 8 Whitehill Road, Barton le Clay, Bedford.
 ...Service info for "Eddystone" RX type B40A—Manual or any info loan or purchase. Also circuit or modification for use as a radio receiver, Television converter.—F. Payne, 15, Wood Crescent, Holts Estate, Oldham, Lancs.
 ...wanted, I.C. data sheets, any type, state price.—J. Rowley, 18, Old Park Road, Shirehampton, Bristol, BS11 9PW.
 ...wanted manual or handbook for R209 Rx.—I. Simpson, 107 Derryhale Road, Portadown, Co. Armagh, N.I.
 ...any info or a diagram to build a transmitter receiver for use underwater at a depth averaging from 300ft to 1000ft.—B. A. Conyers, 6 London Road, Observatory, Cape Town, Rep. South Africa.
 ...Loan of circuit diagrams for the old 17 set and R209 Mk II, what frequencies does the 17 set cover and has anyone modified the R209 from 12 volts d.c. to mains operation does this eliminate the "Buzzing interference" on the range one on Top band 1-8 to 2 meg.—K. F. Best, 17 Chestpost Close, Croes-Y-Ceillog, Cwmbran, Mon. S. Wales.
 ...Your price for blueprint and construction details for P.W. 35W Guitar amp. May 64 issue.—P. Kingsley, 89 Main Road, Crynant, Neath, Glam.
 ...I need a 15kv supply any ideas.—P. Martin, Windrush, Boileau Ave., Tacolneston, Norwich, NOR 87W.
 ...circuit diagram, service sheet or manual, in fact any literature relating to the Cosor, Oscillograph Model 1035 scope.—L. A. Hall, 18 Heather Road, Fawley, Southampton, Hants.
 ...instruction manual and/or any gen regarding a 1946, Marconi CR100-B29, A.P. (ednaily pattern) W2698.—J. Baker, 16 St. Christophers Road, Haslemere, Surrey.
 ...Circuit diagram and/or manual for Solatron Scope type C.D. 513-C. Newbury, 4 Sunningfield Road, Hendon, London, N.W.4.
 ...a copy of a battery valve voltmeter in Radio Constructor about five years ago.—D. Biddy, 2B, Rockbourne Road, Forest Hill, London, S.E.23.

R. M. BEYLEMANS of Brussels, Belgium reports bearing Radio Algiers 251kHz on the long-waves relaying the French Network of R.T. Algerienne. Reception reports should go to 21 Boulevard des Martyres, Algiers. Azilal, Morocco on 209kHz is another North African that uses this band and is usually heard with programming in Arabic and some interference from Kiev, USSR. **Geoffrey Driver** (Woodham, Surrey) has been active on the medium waves and his log includes Tenerife, Canary Islands on 620kHz; Bissau, Portuguese Guinea 1070kHz; Novi Sad, Yugoslavia 1268kHz in English at 2200hrs; Radio Tirana, Albania 1394kHz; Trans World Radio, Monaco 1466kHz at 2130hrs; Manx Radio on 1594kHz.

Kenneth Turner (Edinburgh) has heard the 10kW Radio London 1457kHz which he reports as being strong during the afternoon. **Dr. H. S. Brodribb** (St. Leonards-on-Sea) points out that Radio Brighton 1484kHz is on an international common frequency and consequently it is inaudible along the south coast of England because of interference from Ostend. Radio Merseyside is now on 1484kHz as well as v.h.f. but at the time of writing there is still no reliable news about Radio Nottingham or Radio Derby.

Brian Walsh (Romford Essex) has heard CKGO Ottawa on 1440kHz at 0230hrs GMT. CKGO is not a new station but is the new callsign for CKPM, which is listed on that channel. Readers who have not yet heard North America on the medium waves should listen on 930kHz after 2330hrs for CJON St John's, Newfoundland. Look for the AFN station on 935kHz and then tune slightly to the low frequency side of it. CJON has been a consistent signal recently and has been logged several times when no other North American could be heard. On the high frequency side of AFN there is CBM Montreal on 940kHz, which is a key station of the Canadian Broadcasting Corporation and is being heard well at present. WINS 1010kHz in New York City is often strong and sometimes causes a heterodyne with Lopik, Holland on 1007kHz before the latter closes down at midnight. WOR 710kHz, also in NYC, has been logged a number of times recently by the writer after 2330hrs with interference from CJOX Grand Bank, Newfoundland on the same frequency.

The Voice of Free Asia is the name of the 1000kW Voice of America outlet on 1580kHz, located at Ban Pachi Thailand. It is on the air nightly from 2200hrs until 2230hrs with news in Cambodian, but the identification at the start and finish of the transmission is in English. Tune between the European channels on 1578kHz (Italy) and 1586kHz (West Germany). Ban Pachi has been heard in Europe several times this winter and it verifies. Reception reports should be sent to the VOA, Washington DC 20547, USA.

Please send logs and information about the medium waves to the author at 132 Segars Lane, Southport PR8 3JG.

TAKE 20

JULIAN ANDERSON

WHEN we think about audio amplifiers we almost always think in terms of high fidelity and high output power. There are many occasions, however, where distortion is of minor importance and other factors come into play. Most audio amplifiers have a quiescent current drain of at least 25mA, for battery operation this is a little severe. For a baby alarm such a current consumption would be very expensive. An amplifier on the other hand may not always be required for ordinary speech and music; frequently we want pulses or tone to be fed to the speaker, for this we want high output for a low quiescent current. The amplifier that we are describing here is designed for these functions rather than for good quality. It can be used with almost any speaker impedance and all-in-all is a pretty versatile little circuit. It is possible to obtain pretty fair quality by adjusting a preset pot incorporated in the circuit, but this is not the prime purpose of our project this month.

The Circuit

The amplifier takes a pretty conventional form. The input signal is fed to the base of Tr1 via the d.c. blocking capacitor C1. The input sensitivity for full output is about 30mV and the input impedance a little under 10kΩ. Tr1 is the driver for the complementary output pair. In the no-signal state the voltage at the collector of Tr1 should be roughly half that of the supply voltage, as will be the common point of Tr2 and Tr3. When a positive going signal is applied to Tr1 this transistor conducts more, thus increasing the bias current for Tr3, but turning off Tr2. When the signal swings negative the reverse happens. The common point of both these changes is at the emitter junctions of Tr2 and Tr3 and this signal is applied to the loudspeaker via the d.c. blocking capacitor C2.

Circuits of this type require some form of d.c. stabilisation and so the base bias supply for the driver transistor is taken from the output. This also applies a.c. feedback, so improving the quality slightly. R3 serves the function of applying a certain amount of base bias between the bases of Tr2 and Tr3. If the output quality is of no importance at all, then this resistor may be omitted, connecting the two bases together. The quiescent current is then extremely low, only about 1mA, but for any sort of quality the resistor is really needed.

VR1 can almost be regarded as a quality control preset. If the value is at maximum the quiescent is low and so is the quality. By reducing the value, the quality will improve dramatically but so will the quiescent current. Fair to good quality will be obtained when this reaches a little over 20mA. When setting this component a meter should be inserted in the supply line to ensure that the current drain is not much over this.

C2 need not be quite so high a value if the amplifier is not required to handle low frequencies, in fact it can be as low as 10μF if pulses are being handled.

No. 46 AUDIO AMPLIFIER

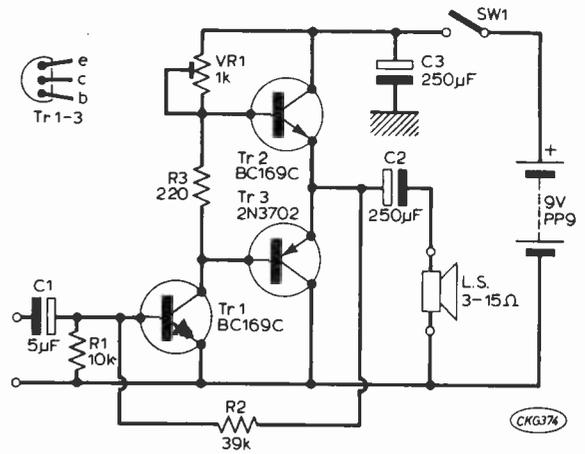


Fig. 1: The complete circuit; see the text regarding VR1 and R3.

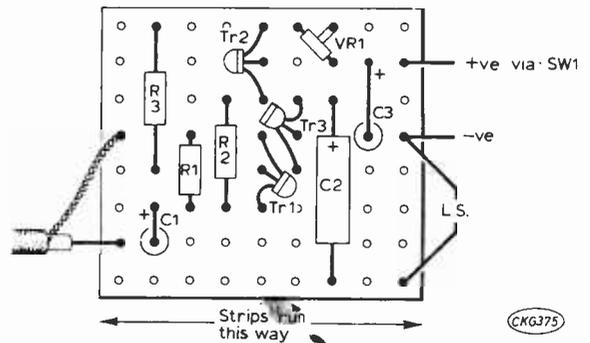


Fig. 2: A suggested component layout on Veroboard.

★ components list

| | | |
|-----|-----------------------|-----|
| R1 | 10kΩ 1/4W, 5 per cent | 1p |
| R2 | 39kΩ | 1p |
| R3 | 220Ω | 1p |
| VR1 | 1kΩ skeleton preset | 5p |
| C1 | 5μF 10V min. | 4p |
| C2 | 250μF 10V min. | 5p |
| C3 | 250μF 10V min. | 5p |
| Tr1 | BC169C | 11p |
| Tr2 | BC169C | 11p |
| Tr3 | 2N3702 | 10p |
| SW1 | On-off toggle switch | 5p |
| | | 59p |

Prices are those 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.

The layout is not critical and all the components will mount onto a small piece of Veroboard as shown in Fig. 2. The skeleton preset may well fit at an angle as shown, so avoiding bending the pins.

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| 2N2646 | NPN UJT | |
| 2N2926 | NPN | |
| 2N3055 | NPN | |
| 2N3702 | PNP | |
| 2N3704 | NPN | |
| AC128 | Ger. | |
| AC128 | Ger. | |
| AC176 | Ger. | |
| AD149 | Ger. | |
| *AD181 | Ger. | |
| *AD181 | Ger. | |
| BC107 | PNP | |

RESISTORS

| Code | Power |
|------|-------|
| C | 1/8W |
| C | 1/4W |
| C | 1/2W |
| C | 1W |
| MO | 1W |
| WW | 1W |
| WW | 2W |
| WW | 3W |
| WW | 5W |
| WW | 10W |
| WW | 20W |
| WW | 30W |
| WW | 50W |
| WW | 100W |

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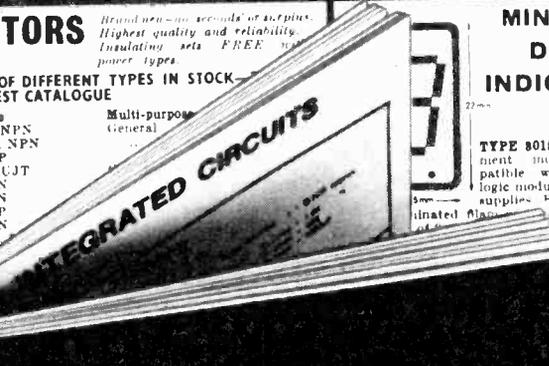
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| 1A7GT .13 | 6BR7 .75 | 6S7A7M .35 | 19A05 .24 | 150B2 .58 | E8C41 .48 | EF183 .25 | KTW62 .63 | PL505 1.30 | UY85 .23 | AC157 .25 | BC134 .23 | OA85 .08 | |
| 1B3GT .35 | 6BW6 .72 | 6S7GT .35 | 19A66 .50 | 807 .59 | E8C81 .28 | EF184 .27 | KTW63 .50 | PL508 .90 | U10 .45 | AC165 .25 | BC135 .23 | OA90 .13 | |
| 1HG5T .18 | 6BW7 .50 | 6S8G7 .35 | 20P4 .105 | 5702 .80 | EBF80 .30 | EH90 .34 | MHL.D6 .75 | PL509 1.30 | U12/14 .38 | AC166 .25 | BC139 .25 | OA91 .09 | |
| LL4 .18 | 6BZ6 .31 | 6H7 .53 | 20P2 .85 | 5703 .50 | EBF83 .28 | EL32 .18 | P61 .44 | PL509 1.30 | U19 .78 | AC168 .38 | BC211 .38 | OA95 .09 | |
| 1NSGT .37 | 6CB6A .28 | 6H7 .53 | 20P1 .50 | AC/PEN .98 | EBF89 .26 | EL34 .44 | PAC80 .32 | PL509 1.30 | U22 .38 | AC172 .28 | BC219 .38 | OA200 .09 | |
| 1R5 .25 | 6C4 .28 | 6H8GT .38 | 20P1 .50 | AC/PEN .98 | EBL21 .60 | EL35 1.00 | PC86 .44 | PL509 1.30 | U25 .62 | AC177 .25 | BC220 .38 | OA209 .10 | |
| 184 .22 | 6C9 .73 | 6H9GT .38 | 20P3 .78 | DD .38 | EC88 .58 | EL37 .53 | PC88 .44 | PL509 1.30 | U26 .62 | AC177 .25 | BC221 .38 | OA210 .10 | |
| 1U4 .29 | 6CD6G 1.00 | 6U4GT .60 | 20P4 .89 | DD .38 | EC88 .58 | EL41 .74 | PC88 .44 | PL509 1.30 | U26 .62 | AC177 .25 | BC222 .38 | OA211 .10 | |
| 1U5 .48 | 6CG8A .50 | 6V6G .17 | 20P5 1.00 | ACSPEN .38 | EC92 .34 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC223 .38 | OA212 .10 | |
| 2D21 .35 | 6C6E .38 | 6V6GT .27 | 25A60 .29 | AC/TH1 .50 | EC93 1.50 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC224 .38 | OA213 .10 | |
| 2GK6 .50 | 6C6L .48 | 6X3 .20 | 25L60 .20 | AC/TP .98 | EC93 1.50 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC225 .38 | OA214 .10 | |
| 3A4 .25 | 6C6M .50 | 6X5GT .25 | 25Y60 .43 | A160 .78 | EC94 .60 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC226 .38 | OA215 .10 | |
| 3D6 .19 | 6C6S .30 | 7B6 .58 | 25Z40 .28 | ATP4 .12 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC227 .38 | OA216 .10 | |
| 3Q4 .38 | 6C7 .63 | 7B7 .32 | 25Z55 .40 | AZ1 .40 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC228 .38 | OA217 .10 | |
| 3Q8GT .35 | 6D67 .50 | 7H7 .28 | 25Z68 .43 | AZ31 .44 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC229 .38 | OA218 .10 | |
| 384 .25 | 6DT6A .50 | 7R7 .65 | 30A5 .44 | AZ41 .53 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC230 .38 | OA219 .10 | |
| 4CB6 .50 | 6E6W .55 | 7Y4 .60 | 30C15 .55 | CL33 .40 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC231 .38 | OA220 .10 | |
| 5C9 .50 | 6E6S .55 | 7Z4 .50 | 30C17 .74 | CV63 .53 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC232 .38 | OA221 .10 | |
| 5T4 .30 | 6F1 .58 | 8B6W .50 | 30C18 .58 | CV1C .53 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC233 .38 | OA222 .10 | |
| 5U4G .30 | 6F6 .78 | 8B7 .58 | 30C19 .61 | CV31 .29 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC234 .38 | OA223 .10 | |
| 5V4G .33 | 6F14 .40 | 10C2 .49 | 30FL1 .68 | DAF91 .20 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC235 .38 | OA224 .10 | |
| 5Y3GT .25 | 6F18 .45 | 10D67 .50 | 30FL2 .58 | DAF96 .33 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC236 .38 | OA225 .10 | |
| 5Z4G .25 | 6F23 .65 | 10F1 .75 | 30FL3 .67 | DC90 .60 | EC98 .21 | EL41 .74 | PC95 .53 | PL509 1.30 | U26 .62 | AC177 .25 | BC237 .38 | OA226 .10 | |
| 60L2 .38 | 6F24 .68 | 10P9 .45 | 30FL13 .47 | DP91 .14 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L3 .38 | 6F25 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L4 .38 | 6F26 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L5 .38 | 6F27 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L6 .38 | 6F28 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L7 .38 | 6F29 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L8 .38 | 6F30 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L9 .38 | 6F31 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L10 .38 | 6F32 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L11 .38 | 6F33 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L12 .38 | 6F34 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L13 .38 | 6F35 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L14 .38 | 6F36 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L15 .38 | 6F37 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L16 .38 | 6F38 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L17 .38 | 6F39 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L18 .38 | 6F40 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L19 .38 | 6F41 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L20 .38 | 6F42 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L21 .38 | 6F43 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L22 .38 | 6F44 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L23 .38 | 6F45 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L24 .38 | 6F46 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L25 .38 | 6F47 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L26 .38 | 6F48 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L27 .38 | 6F49 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L28 .38 | 6F50 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L29 .38 | 6F51 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L30 .38 | 6F52 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L31 .38 | 6F53 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L32 .38 | 6F54 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L33 .38 | 6F55 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L34 .38 | 6F56 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L35 .38 | 6F57 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L36 .38 | 6F58 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L37 .38 | 6F59 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L38 .38 | 6F60 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L39 .38 | 6F61 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L40 .38 | 6F62 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N2813 .30 | BA115 .14 | GET87 .43 | OC123 .23 |
| 60L41 .38 | 6F63 .51 | 10F18 .35 | 30FL14 .66 | DP96 .34 | ECF86 .64 | GY501 .76 | GZ32 .38 | PEN45 .1.38 | UC92 .35 | 2N | | | |

A bash at "Auntie"

I am amazed at all the fuss that is being made over the 50th anniversary of the BBC. All the celebrations on BBC radio and television are just another method that the 'Beeb' uses to try to tell us how marvellous it is.

For the past 50 years, contrary to what it makes out, the BBC has not been the only broadcasting service in this country. ITV has played a large part in broadcasting for 18 of those years, and the so-called 'pirate' stations of the 1960's proved far more popular than the BBC, which lost many millions of listeners, during this time. There has also been Radio Luxembourg, which has provided a great deal of competition for the BBC for many years.

The Editorial in the December *PW* called the BBC 'the best broadcasting service in the world.' It so happens that the BBC transmitters at Shoreham are very bad quality, and cause countless harmonics all the way down the medium wave band. It is also quite possible to cover the whole country with a few kilowatts on MW, and yet the BBC is so inefficient that it has to use one kilowatt from Shoreham to cover a small part of the south coast. This also applies to most other BBC transmitters. Most of the BBC's programmes are good, but the Corporation as a whole cannot be worthy of praise until it decides to build some decent medium wave transmitters.—**P. Woodward** (*Lancing, Sussex*).

Car Radios

On reading Mr. Capel's article again on Car Radio Installation, I was reminded of my own experience this year.

It would seem that the Mark III Cortina with metallic paint must be the worst ever offender for ignition interference, this was confirmed by the radio specialist of a very large Ford dealer nearby.

Having put my aerial on the wing near the screen on the near side, opposite the distributor, my

troubles began. For most radio listeners who only listen to strong local stations, no problem, but I also listen to foreigners and the interference was terrible.

By having a wire attached to the chassis and dabbing the other end around the front end of the car, I was surprised but pleased, to find a very noticeable drop in the interference when touching the hub cap. This led me to find that the whole steering yoke and also the bottom end of the steering mechanism are insulated from the main chassis.

I have now connected both these units, plus the fan motor chassis and the hood, by individual connecting wires to the main chassis. Also it is very important to keep the spark plug gap down to its given figure

One learns by experience, the hard way.—**A. B. Sammons** (*Solihull, Warwickshire*).

VAT

Under one of my 'hats', I have to advise clients of my accountancy practice on all the aspects of Value Added Tax. It was only recently that I realised that I had forgotten to deal with the problem of this business which is predominantly a Mail Order concern. I think it fair to say that the problems we will be faced with that are special to the nature of trade will be the same for our rivals, and if your readers, who are our customers, are not advised as to what they will be faced with, there will be chaos after 31st March 1973.

To put the problem in a nutshell:

a) Components etc. will be standard-rated. This means that orders placed after 31st March 1973 will have to be accompanied by 10% for the VAT over and above list prices.

b) If orders are received without the tax, the component house can either send goods equivalent to 10/11 in value of the cash received or hold the order and write to the customer. Either way will be tedious, expensive and lead to colossal delays.

c) Trade customers who are registered for VAT should state that their goods, when dispatched, must be accompanied by a 'Tax Invoice' which will enable them to obtain relief for the tax they have to pay.

If you decide to present the above to your readers, which in my view would provide advertisers and readers alike with an invaluable service, it might be worthwhile to recommend that they always write their names and addresses somewhere on their correspondence in capital letters.—**Alan Secker, A.C.A.** (*Chromasonic Electronics, London, N.10.*)

We would like to hear of any other views or problems in connection with VAT. Please write to The Editor and mark your letters "VAT".—*Editor.*

Pitfalls?

May I warn your readers of certain unpublicised pitfalls of Stereo—in view of the new Radio 2 service?

When fitting a 'Stereo Decoder', look very closely at the v.h.f. receiver. The fact that it has a socket marked 'Multiplex' or 'Stereo Decoder' doesn't necessarily mean a coded signal is available. Many of these receivers, on examination, prove to have a capacitor of around 0.02 μ F shunted across them. This cap. must be removed before stereo can be obtained.

Having got stereo from such a decoder, check the level of the 38kHz signal at the output with an a.c. voltmeter (in series with a 0.1 μ F cap.) If it is too high, it can lead to burnt out output transistors. The cure is, of course, a pair of r.c. filters.

When setting up, note particularly that the fact that a programme is marked 'Stereo' in the programme page doesn't necessarily mean that all of it is in stereo! Much worry can be caused at the 'failure' of the decoder, when all it is, is a mono recording being transmitted. (This happens all too often.)—**R. G. Young** (*Peacehaven, Sussex*).

Low Reading OHMMETER

N. WILKINSON

ONLY the most sophisticated and expensive meters are able to read resistance values below about 10Ω. However it is fairly simple to construct a suitable device which will check such low resistances as the windings of an i.f. transformer, the contacts of a switch or even a loud-speaker speech coil.

The circuit

A suitable circuit for taking such readings is shown in Fig. 1. The meter is a 500μA f.s.d. meter with a coil resistance of 75Ω. This was used by the author as it was handy but similar types can be used if modifications are made. The circuit is so arranged that when VR1 is adjusted to give an f.s.d. reading, 25mA is being drawn from the battery. If VR1 is left in the maximum current position, the meter will only be overloaded by about 25 per cent and will not be damaged.

The shunt resistance R2 (1.5Ω in the case of the prototype) can be found for any meter as follows:

$$R_s = \frac{R_m}{N-1}$$

where R_s is the value of R2, R_m is the coil resistance of the particular meter used and N is the number of times the scale is multiplied. In our case we want a 500μA meter to read 25mA and so N is 50. By calculation we shall find that R_s is very nearly 1.5Ω.

As the shunt resistance is high compared to that of the meter it is convenient to ignore in later calculations and simply now regard our meter as being a 500μA meter having a 1.5Ω coil resistance.

If VR1 is set so that the meter is reading f.s.d. and we connect 1.5Ω across the test probes, this will reduce the current through the coil to half or 250μA and the meter will register this. If 6Ω is connected, this will reduce the reading by a factor of 1 to 4 or 20 per cent. The table shows a full range of values and the meter reading. In this way readings between 0.05Ω and about 12Ω can be read quite easily.

Construction

Care should be taken in the construction so that all leads have low resistances in themselves—especially the probes. If the meter scale is left as it is, a graph of the readings against the resistance can be drawn, alternatively the face of the meter can be calibrated.

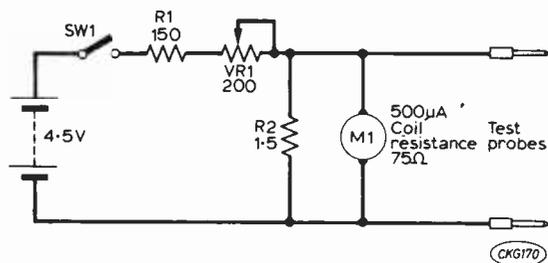


Fig. 1: The circuit used for measuring low resistance.

TABLE 1

| Scale reading (μA) | Resistance (Ω) | Scale reading (μA) | Resistance (Ω) |
|--------------------|----------------|--------------------|----------------|
| 16 | 0.05 | 330 | 3.0 |
| 31 | 0.1 | 365 | 4.0 |
| 125 | 0.5 | 385 | 5.0 |
| 166 | 0.75 | 400 | 6.0 |
| 200 | 1.0 | 420 | 8.0 |
| 250 | 1.5 | 435 | 10.0 |
| 285 | 2.0 | 445 | 12.0 |
| 310 | 2.5 | | |

The shunt can be a reasonably high tolerance fixed resistor though these are not always easy to come by. A six yard length of 29 s.w.g. enamelled copper wire will have a resistance of 1.5Ω.

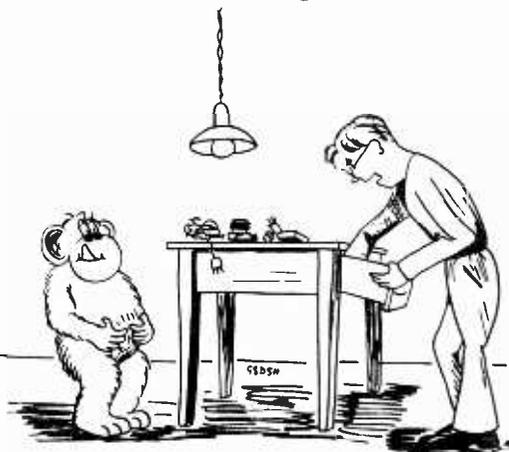
Setting up

Switch on SW1 and adjust VR1 until full scale deflection is registered. Now short together the probes and only a tiny reading should be shown. Adjust the mechanical zero to bring the pointer back to read zero on the scale. The low reading ohmmeter will now be ready for use.

The circuit is only really good for readings below about 10Ω but values above this can usually be taken quite easily from a normal multimeter. ■

MAXWELL

by G8DSH



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|-----------|------|-------|-------|--------|------|-------|-------|---------|------|-------|-------|
| SN7400 | 0-20 | 0-18 | 0-16 | SN7450 | 0-20 | 0-18 | 0-16 | SN74145 | 1-50 | 1-40 | 1-30 |
| SN7401 | 0-20 | 0-18 | 0-16 | SN7451 | 0-20 | 0-18 | 0-16 | SN74150 | 8-35 | 8-25 | 8-15 |
| SN7402 | 0-20 | 0-18 | 0-16 | SN7452 | 0-20 | 0-18 | 0-16 | SN74151 | 1-10 | 0-95 | 0-90 |
| SN7403 | 0-20 | 0-18 | 0-16 | SN7453 | 0-20 | 0-18 | 0-16 | SN74152 | 1-35 | 1-27 | 1-20 |
| SN7404 | 0-20 | 0-18 | 0-16 | SN7454 | 0-20 | 0-18 | 0-16 | SN74153 | 2-35 | 1-27 | 1-20 |
| SN7405 | 0-20 | 0-18 | 0-16 | SN7455 | 0-20 | 0-18 | 0-16 | SN74154 | 2-00 | 1-17 | 1-15 |
| SN7406 | 0-30 | 0-27 | 0-25 | SN7456 | 0-30 | 0-27 | 0-25 | SN74155 | 1-55 | 1-47 | 1-35 |
| SN7407 | 0-30 | 0-27 | 0-25 | SN7457 | 0-30 | 0-27 | 0-25 | SN74156 | 1-55 | 1-47 | 1-35 |
| SN7408 | 0-30 | 0-27 | 0-25 | SN7458 | 0-40 | 0-37 | 0-35 | SN74157 | 1-80 | 1-70 | 1-60 |
| SN7409 | 0-45 | 0-42 | 0-35 | SN7459 | 0-40 | 0-37 | 0-35 | SN74160 | 2-60 | 2-40 | 2-25 |
| SN7410 | 0-20 | 0-18 | 0-16 | SN7460 | 0-55 | 0-52 | 0-50 | SN74161 | 2-60 | 2-40 | 2-25 |
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| SN7425 | 0-42 | 0-39 | 0-35 | SN7469 | 0-80 | 0-75 | 0-70 | SN74172 | 1-35 | 1-27 | 1-15 |
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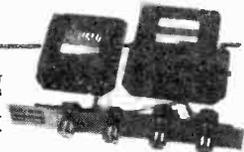
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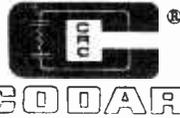


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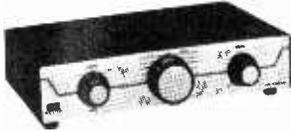
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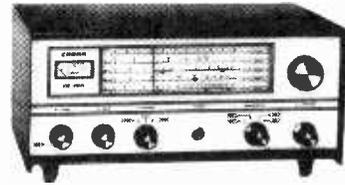
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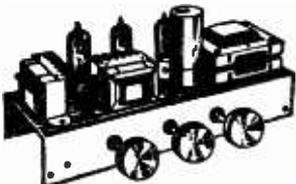
SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts

r.m.s. into 8 ohm. Frequency response 12Hz-30KHz \pm 3db. Fully integrated pre-amplifier stage with separate Volume, Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high x 6" wide x 7 1/2" deep. AC 200/250V. PRICE £10.50. P. & P. 25p.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. U.I. 1 in 6 heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. 1 x E2280

Valve line up:—2 x ECL86 Triode Pentodes. 1 x ECC83 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11" w x 4" d. Overall height including valves 5". Ready built & tested to a high standard. PRICE £32.92 P. & P. 45p.

POWER SUPPLY UNIT 200/240v. A.C. Input. Four switched fully smoothed D.C. outputs giving 6v. and 7 1/2v. and 9v. and 12v. at 1 amp continuous (1 1/2 amp intermittent). Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" x 3 1/2" x 2 1/2". Suitable for Transistor Radios, Tape Recorders, Amplifiers etc. etc. Ready built & tested. PRICE £4.50 P. & P. 35p.

BLACK ANODISED 16g. ALUMINIUM HEAT SINKS. For T03, complete with mica's and bushes. Size 2 1/2" x 3" approx. 25p pair. P. & P. 5p.

COILED SPRING BACK TELEPHONE CABLE. Closed approx. 10" extends to 36". 4 core or 6 core 25p each P. & P. 5p. 5 or more post free. LIMITED NUMBER!

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0-210-240v. Secondary combinations 0-5-10-15-20-25-30-35-40-50-60v. half wave at 1 amp. or 10-0-10, 20-0-20, 30-0-30v. at 2 amps full wave. Size 3in. long x 3 1/2in. wide x 3in. deep. Price £1.85 P. & P. 30p.

MAINS TRANSFORMER. For transistor power supplies. Pri 200/240v. Sec. 9-0-9 at 500mA. 85p. P. & P. 13p. Pri. 200/240v. Sec. 12-0-12 at 1 amp. 95p. P. & P. 13p. Pri. 200/240v. Sec. 10-0-10 at 2 amp. £1.45. P. & P. 30p.

SPECIAL OFFER MAINS TRANSFORMER 200/240v. A.C. Input 35v at 1 1/2 amp A.C. output overall size 2 1/2" x 2 1/2" x 3" approx. Suitable drop through or vertical mounting 90p. P. & P. 30p.

CENTRE ZERO MINIATURE MOVING COIL METER. 100uA. For balance or tuning. Approx. size 1" x 1" x 1" deep. Limited number. 75p. P. & P. 10p.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER

For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-15v. battery or from H.T. line 200/200v. Frequency response 15Hz-25KHz. Gain 26dB. Solid encapsulation size 1 1/2" x 1 1/2" x 1". Brand new complete with instructions. Price 88p. P. & P. 13p.

HANDBOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES

A must for servicemen and home constructors. Including many 1000's of British, U.S.A. European and Japanese transistors. ONLY 40p. Post 5p.

4-SPEED RECORD PLAYER BARGAINS
Mains models. All brand new in maker's packing.
LATEST B.S.R. C109/C129 4-SPEED AUTOCHANGER.
With latest mono compatible cartridge £6-97 Carr. 50p.
With stereo cartridge £7-97 Carr. 50p.

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PRECISION ENGINEERED PLINTHS
Beautifully constructed in heavy gauge "Colorcoat" plastic coated steel. Resonance free. Designed to take Garrard 1025, 2000, 2025TC, 2500, 3000, 3500, 5100, SP25 II and III, EL56B, AT60 etc. or B.S.R. C109, C129, A21 etc. Black leatherette finish. Size 12 1/2" x 14 1/2" x 3 1/2" (approx. 7 1/2" high, including rigid smoked acrylic cover).
NOW ONLY £4.50. P. & P. 35p.

LATEST ACOS GP91/130 mono compatible cartridge with T/O stylus for LP/EP/78. Universal mounting bracket. £1-50 P. & P. 8p.

SONOTONE STAIHC COMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78. ONLY £2-50 P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. £3. P. & P. 10p.

LATEST RONETTE T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. £1-63 P. & P. 10p.
LATEST RONETTE T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only £1-50 P. & P. 10p.

QUALITY RECORD PLAYER AMPLIFIER MK II
A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide x 3in. deep x 6in. high. Ready built and tested. PRICE £32.95 P. & P. 40p.
ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE £25-25 P. & P. 50p.

DELUXE QUALITY PORTABLE R/P CABINET MK II. Uncut motor board size 14 1/2 x 12in. clearance 2in. below, 5 1/2in. above. Will take above amplifier and any B.S.R. or GAREARD changer or Single Player (except AT60 and SP25). Size 18 x 15 x 8in. PRICE £4-75. P. & P. 60p.

SPECIAL OFFER ! HI-FI LOUDSPEAKER SYSTEMS

Beautifully made teak finish enclosure with most attractive Tygan-Vynair front. Size 16 1/2" high x 10 1/2" wide x 5 1/2" deep. Fitted with E.M.I. Ceramic Magnet 13" x 8" bass unit, two H.F. tweeter units and crossover. Power handling 10 watts. Available 3 or 8 or 15 ohms impedance.

OUR PRICE £8.40 Carr. 65p

Cabinet Available Separately £4-50 Carr 60p
Also available in 8 ohms with EMI 13" x 8" bass speaker with parasitic tweeter £8-50 Carr. 65p

LOUDSPEAKER BARGAINS

5in. 3 ohm £1-05, P. & P. 15p. 7 x 4in. 3 ohm £1-15, P. & P. 20p. 10 x 6in. 3 or 15 ohm £1-90, P. & P. 30p. E.M.I. 8 x 5in. 3 ohm with high flux magnet £1-62, P. & P. 20p. E.M.I. 13 1/2 x 8in. with high flux ceramic magnet 3, 8 or 15 ohm £2-20, P. & P. 30p. E.M.I. 13 x 8in. 3, 8 or 15 ohm with two inbuilt tweeters and crossover network £4-50, P. & P. 30p. 13 x 8in. twin cone (parasitic tweeter) 8 ohm £2-25, P. & P. 30p.

BRAND NEW 12in. 15w. H/D Speakers, 3 or 15 ohms. Current production by well-known British maker. Now with Hifux ceramic ferrobar magnet assembly £6-75. Guitar models: 25w. £6-75, 35w. £8-50. P. & P. 38p



SPECIAL OFFER!

LIMITED NUMBER OF BRAND NEW ELAC 10" TWIN CONE LOUDSPEAKERS
With large ceramic magnet and plasticised cone surround. 8 ohm impedance. £2-75. P. & P. 25p.

12in. "RA" TWIN CONE LOUDSPEAKER. 10 watts peak handling. 3, 8 or 15 ohm £2-20, P. & P. 30p. 35 ohm SPEAKERS 3in. only 68p. P. & P. 13p.

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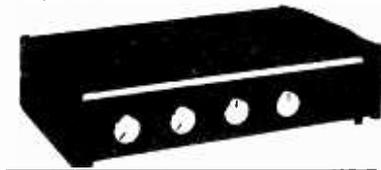
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app. 54 in. wide. Usual: £1-75 yd., our price 75p yd. length. P. & P. 15p per yd (min 1 yd.). S.A.E. for samples.

HI-FI STEREO HEADPHONES

Adjustable headband with comfortable flexifoam ear-muffs. Wired and fitted with standard stereo 1in jack plug. Frequency response 30-15,000Hz. Matching impedance 8-16 ohms. Easily converted for Mono. PRICE £2-95. P. & P. 15p.

HIGH IMPEDANCE CRYSTAL STICK MIKES.
OUR PRICE £1-05. P. & P. 8p

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



NEW FURTHER IMPROVED MODEL WITH HIGHER OUTPUT AND INCORPORATING HIGH QUALITY READY DRILLED FIBRE GLASS PRINTED CIRCUIT BOARD WITH COMPONENT IDENTIFICATION CLEARLY MARKED FOR EASY EASIER CONSTRUCTION

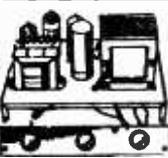
A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal Cartridges. Very simple to modify to suit magnetic cartridge—Instructions included. Output stage for any speakers from 5 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled fibreglass printed circuit board, smart brushed anodised aluminium front panel with matching knob, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification: Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response \pm 3dB 12-20,000 Hz Sensitivity: better than 80mV into 1M Ω . Full power bandwidth: \pm 3dB 12-15,000 Hz. Bass boost approx. to \pm 12dB. Treble cut approx. to -16dB. Negative feedback 16dB over main amp. Power requirements 35v. at 1.0 amp.

Kit Size 12" w x 8 1/2" d x 2 1/2" h. Fully detailed 7 page construction manual and parts list free with kit or send 18p plus large S.A.E.

AMPLIFIER KIT £10-50 P. & P. 15p
(Magnetic input components 30p extra)
POWER PACK KIT £3-00 P. & P. 30p
CABINET £3-00 P. & P. 30p

(Post Free if all units purchased at same time)
Full after sales service

Also available ready built and tested £21-00. Post Free.
Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi-Fi Diatheque use, etc.



3-VALVE AUDIO AMPLIFIER HA34 MK II.

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7 1/2" w x 4" d x 4 1/2" h. Incorporates ECC83, EL84, E2280 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm stage. Impedance 3 ohms. Output approx. 3.5 watts. Volume and tone controls. Chassis size only 7in. wide x 3in. deep x 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer. £2.95

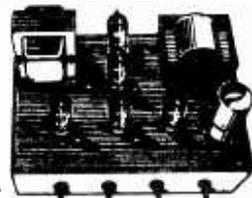
HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 but employs entirely different and advanced circuitry. Complete set of parts, etc. £4-10. P. & P. 40p.

HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3.5 watts. Volume and tone controls. Chassis size only 7in. wide x 3in. deep x 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer. £2.95 P. & P. 35p BARGAIN PRICE

10/14 TWIN HI-FI AMPLIFIER KIT

A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records 13p (Free with parts). All parts sold separately. ONLY £7-97 P. & P. 55p. Also available ready built and tested £10-97 P. & P. 60p.



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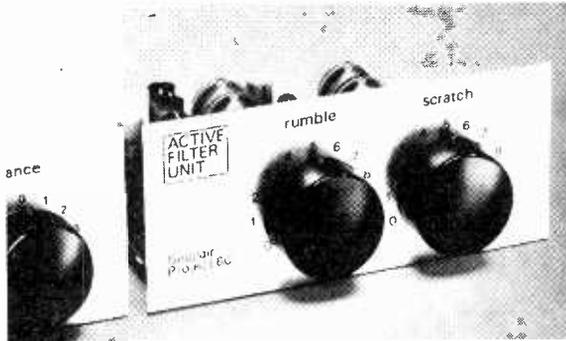
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Sinclair Project 60



Active Filter Unit (A.F.U.)

Built and tested post free
£5.98

The value of an efficient filtering system cannot be over emphasized in these days of very high quality reproduction since there are so often occasions where its use can mean the difference between comfortable and uncomfortable listening. On the low pass side the Sinclair A.F.U. will effectively reduce hiss from radio or tape, cut out heterodyne whistles on A.M. reception, greatly reduce record surface noise and other imperfections; on the high-pass side it will cut out motor rumble and other spurious low frequency intrusion. The unit is for use between pre-amp (including tape pre-amps) and power amplifiers, and operates in two sections, both stereo. The cut-off frequencies are continuously variable, and since attenuation in the rejection 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 as easy to mount as the stereo 60 pre-amp/control unit which it matches in styling, along with the Stereo FM Tuner.

SPECIFICATIONS

The A.F.U. employs two Sallen and Key type active filter stages, one rumble (high pass) and one scratch (low pass). The two stages use complementary transistors to minimise distortion.

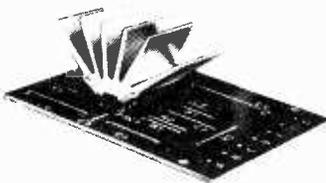
Supply voltage: 15 to 35 volts Current 3mA maximum

Gain at 1kHz: Filters flat 0.98 (-0.2 dB)
HF cut off: (-3dB) variable from 28 kHz to 5 kHz at 12 dB/octave.

LF cut off: (-3dB) variable from 25Hz to 100Hz at 12dB/octave.

Distortion: at 1kHz (35 volt supply) 0.02% at rated output.

Super IC.12 Integrated circuit high fidelity amplifier



istor 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 x 45 x 28mm including pins and heat sink.

Manual available separately 15p post free.

With FREE printed circuit board and 40 page manual

£2.98 Post free

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 trans-

Project 605



The easy way to buy and build Project 60

Project 605 is one pack containing one PZ5 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.

Complete Project 605 pack with comprehensive manual, post free

£29.95

Everything you need to assemble a superb 30 watt high fidelity stereo amplifier without having to solder.

sinclair

Sinclair Radionics Ltd, London Road, St. Ives, Huntingdonshire PE17 4HJ. Tel: St. Ives 64311

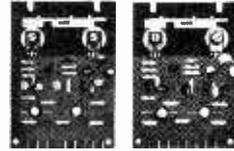
the world's most advanced high fidelity modules

Z.30 & Z.50 power amplifiers

Built, tested and guaranteed with circuits and instructions manual Z.30 £4.48 Z.50 £5.48

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

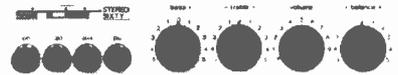


Stereo 60 Pre-amp/control unit

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



Project 60 Stereo F.M. Tuner

Built and tested. Post free. £25

The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. tuner with fantastically good results. Other advanced features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stereo decoder and switchable squelch circuit for silent tuning between stations. In terms of high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with most other high fidelity systems.

SPECIFICATIONS—Number of transistors: 16 plus 20 in I.C. **Tuning range:** 87.5 to 108MHz. **Sensitivity:** 7μV for lock in over full deviation. **Squelch level:** Typically 20μV. **Signal to noise ratio:** > 65dB. **Audio frequency response:** 10Hz – 15KHz (± 1dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2μV. **Cross talk:** 40dB. **Output voltage:** 2 x 150mV R.M.S. maximum. **Operating voltage:** 25–30VDC. **Indicators:** Stereo on, tuning. **Size:** 93 x 40 x 207mm



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 unstabilised £4.98
 PZ.6 35 volts stabilised £7.98
 PZ.8 45 volts stabilised £7.98
 (less mains transformer)
 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 |
| Indoor P.A. | Z.50, PZ.8, mains transformer | Mic., guitar, speakers, etc., controls | £19.43 |

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

Guarantee

If, within 3 months of purchasing any product direct from Sinclair Radionics Ltd., you are dissatisfied with it, your money will be refunded at once. Many Sinclair appointed Stockists also offer this same guarantee in co-operation with Sinclair Radionics Ltd.

Each Project 60 module is tested before leaving our factory and is guaranteed to work perfectly. Should any defect arise in normal use, we will service it at once and without any charge to you, if it is returned within two years from the date of purchase. Outside this period of guarantee a small charge (typically £1.00) will be made. No charge is made for postage by surface mail. Air Mail is charged at cost.

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| BD121 | 50p | OC45 | 13p |
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| BD131 | 59p | OC72 | 12p |
| BF194 | 15p | OC81 | 13p |
| BFY60 | 15p | OC81D | 13p |
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| ME4401 | 10p | OC25 | 25p |
| ME4102 | 12p | OC28 | 30p |
| ME8002 | 14p | OC29 | 35p |
| ME8101 | 14p | OC35 | 25p |
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| OC41 | 13p | TIP32A | 69p |

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| OC44 | 13p | TIP33A | 95p |
| OC45 | 13p | TIP34A | £1.80 |
| OC71 | 12p | 2N697 | 18p |
| OC72 | 12p | 2N1171 | 24p |
| OC81 | 13p | 2N1304 | 25p |
| OC81D | 13p | 2N1305 | 25p |
| OC83 | 20p | 2N2846 | 47p |
| OC170 | 24p | 2N2926 | 10p |
| OC200 | 25p | 2N3053 | 20p |
| OC201 | 25p | 2N3055 | 49p |
| OC25 | 25p | 2N3702 | 12p |
| OC28 | 30p | 2N3703 | 12p |
| OC29 | 35p | 2N3704 | 15p |
| OC35 | 25p | 2N3705 | 15p |
| OC36 | 35p | 2N3706 | 10p |
| TIP29A | 48p | 2N3707 | 10p |
| TIP30A | 55p | 2N3708 | 9p |
| TIP31A | 58p | 2N3709 | 10p |
| TIP32A | 69p | 2N3710 | 10p |

| | | | |
|--------|-----|--------|----|
| 2N3711 | 10p | IN4001 | 4p |
| 40251 | 49p | IN4002 | 4p |
| 40836 | 55p | IN4003 | 5p |
| | | IN4004 | 7p |
| | | IN4005 | 6p |
| | | IN4006 | 7p |
| | | IN4007 | 8p |
| | | IN4008 | 8p |
| | | IN4009 | 8p |
| | | IN4010 | 8p |
| | | IN4011 | 8p |
| | | IN4012 | 8p |
| | | IN4013 | 8p |
| | | IN4014 | 8p |
| | | IN4015 | 8p |
| | | IN4016 | 8p |
| | | IN4017 | 8p |
| | | IN4018 | 8p |
| | | IN4019 | 8p |
| | | IN4020 | 8p |
| | | IN4021 | 8p |
| | | IN4022 | 8p |
| | | IN4023 | 8p |
| | | IN4024 | 8p |
| | | IN4025 | 8p |
| | | IN4026 | 8p |
| | | IN4027 | 8p |
| | | IN4028 | 8p |
| | | IN4029 | 8p |
| | | IN4030 | 8p |
| | | IN4031 | 8p |
| | | IN4032 | 8p |
| | | IN4033 | 8p |
| | | IN4034 | 8p |
| | | IN4035 | 8p |
| | | IN4036 | 8p |
| | | IN4037 | 8p |
| | | IN4038 | 8p |
| | | IN4039 | 8p |
| | | IN4040 | 8p |

MINITRON DIGITAL INDICATOR TYPE 3015F

Reads 0-9 and decimals
(Data Sheet on request)

ONLY £1-50

TIL 208 LIGHT EMITTING DIODE
Made by TEXAS INST. (Red) 85p.

VEROBOARD

| | |
|---|------------|
| 0-15 Matrix | 0-1 Matrix |
| 2 1/2 x 3 1/2 in | 17p |
| 2 1/2 x 5 in | 25p |
| 3 1/2 x 3 1/2 in | 25p |
| 3 1/2 x 5 in | 30p |
| Vero Pins (Bag of 30) | 20p |
| Vero Cutter 45p | |
| Pin Insertion Tools (-1 and -15 matrix) | |
| at 55p. | |

SLIDE POTENTIOMETERS

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

SUPER PACKS

| | |
|---|--|
| Pack of 10 BC189 (unmarked) but tested | Pack of 25 IN4148 50p |
| 2N2646 (unmarked) 30p each | Pack of 10 BC108 BC107 (Plastic can) 50p 60p |
| AC127 & AC128 1-9 13p | AD161, AD162 M/P 44p |
| 10 plus 11p | 10 plus 58p |
| 100 plus 8p | BC107-BC108 BC109 8p 7p 6p |
| Pack of 10 2N2926G (unbranded but tested) | BC182L-3.4-212-4-9 8p 7p 8p |
| Unmarked but fully tested | Pack of 10 Plastic BC109 50p |
| 2N3055 1-9 30p | |
| 10 plus 25p | |

CAPACITORS

MULLARD POLYESTER CAPACITORS C280 SERIES
250V P.C. mounting, 0.01µF, 0.015µF, 0.022µF, 0.033µF, 0.047µF, 0.068µF, 0.1µF, 0.15µF, 0.22µF, 0.33µF, 0.47µF, 0.68µF, 1.0µF, 1.5µF, 2.2µF, 3.3µF, 4.7µF, 6.8µF, 10µF, 15µF, 22µF, 33µF, 47µF, 68µF, 100µF, 150µF, 220µF, 330µF, 470µF, 680µF, 1000µF, 1500µF, 2200µF, 3300µF, 4700µF, 6800µF, 10000µF, 15000µF, 22000µF, 33000µF, 47000µF, 68000µF, 100000µF, 150000µF, 220000µF, 330000µF, 470000µF, 680000µF, 1000000µF, 1500000µF, 2200000µF, 3300000µF, 4700000µF, 6800000µF, 10000000µF, 15000000µF, 22000000µF, 33000000µF, 47000000µF, 68000000µF, 100000000µF, 150000000µF, 220000000µF, 330000000µF, 470000000µF, 680000000µF, 1000000000µF, 1500000000µF, 2200000000µF, 3300000000µF, 4700000000µF, 6800000000µF, 10000000000µF, 15000000000µF, 22000000000µF, 33000000000µF, 47000000000µF, 68000000000µF, 100000000000µF, 150000000000µF, 220000000000µF, 330000000000µF, 470000000000µF, 680000000000µF, 1000000000000µF, 1500000000000µF, 2200000000000µF, 3300000000000µF, 4700000000000µF, 6800000000000µF, 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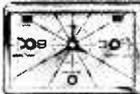
MAINS MOTOR

Precision made—as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at 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 this 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 end, 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-sized, mostly resin filled. Kit A—15-20 w. £1. Kit B—30-40 w. £1. Kit C—40 w. £1.20. Kit D—65 w. £1.20. Kit E for 8ft. 125 w. £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 8p then 23p for each kit ordered. Kit MF1 18p on first kit then 16p 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 £4.75 plus post and ins. 40p.

WATERPROOF HEATING ELEMENT

24 grams length 70W. Self-regulating temperature control. 60p post free.

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 8v., 9v., 12 volts for up to 800mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: mains transformer rectifier, smoothing and reservoir capacitors and instructions. Real snip at only £1.00, plus 20p postage.

THERMOSTATS

Type "A" 15 amp, for controlling room heaters, greenhouses, airing cupboards. Has standard pointer knob, adjustable from 30-38 deg. F. Suitable box with lift mounting 45p. Type "B" 10 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 60-550 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-stay or fire alarm, 50p plus 12p postage 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 25p p & p. Type "E". This is standard refrigerator thermostat. Spindle adjustments cover normal refrigerator temperature. 50p, plus 6p post.

SPARTAN Portable RADIO

Long and medium wave, 7 transistor, size 6" x 4" x 11" with slator, 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-phones 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 1/4" thick. Largest is 1 1/2" x 1 1/2" dia. Some work off 1 1/2v 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 circular saw. This is a 4 pole motor, optimum working 16.5 v but very powerful even as low as 4 1/2v. Don't miss this wonderful snip.

COMPUTER TAPE

2,400ft of the Best Magnetic Tape money can buy—users claim good results with Video and sound. 1in wide £1.00 plus 33p post and insurance with cassette. 1in wide 1/2 plus 30p post and insurance with cassette. 1in wide 85p plus 25p post and insurance with cassette. Spare spools and cassettes—1in 75p, 1in 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. Complies 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 lined case or cabinet. Only need control switch. £2.50. 2kW Model as above except 2 kilowatts, £2.50. Don't miss this. Control Switch, 45p. P. & P. 45p.

THIS MONTH'S SNIP

5 AMP VARIAC for £3 This heating is not quite accurate because it is not a variable transformer that we are offering but a solid state device which serves the same purpose in almost all applications and, of course, much smaller. Made by Ultra Electronics, can be fitted into ordinary switch box. Engrave a circle on the front plate, mark this off in divisions. Fit a pointer knob, calibrate with your voltmeter (you will find the scale almost linear) you now have a power controller equal to a 5 amp variac costing £12 or more.

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.

MULLARD UNILEX

This D.I.Y. Stereo Amplifier is still available complete at £7.00 for the four Mullard Modules, or bought separately as follows:— 4 watt amp. module (2 required) Mullard Ref. No. E.P.9000—£1.80 each. Pre-amp module Mullard Ref. No. E.P.9001—£1.80 each. Power module—Mullard Ref. No. E.P.9002—£2.10 each. In addition and made to Mullard Specification we offer:— Standard Control Unit with cutoutchen—£2.50. Knobs—Set of 4—50p.

MULLARD I.F. MODULE

This is a fully screened intermediate frequency module for amplification and detection of fm signals at 10.7MHz and a.m. signals at 470kHz. The first stage is used as an i.f. amplifier for fm, and a self oscillating mixer for a.m. operation. In conjunction with an external oscillator coil. 85p each. 10 for £7.85. 100 for £68.50p. With connection dig.

ATLAS TWENTYLITE

Fluorescent lighting units with polyester choke and finished white enamel. 2ft model, ideal kitchen, bedroom, hallway, porch, loft etc. With tube assembled ready to install. £1.99. + 30p postage & ins.

STANDARD WAFER SWITCHES

Standard size 1 1/2" wafer—silver-plated 5-amp contact standard 1/2" spindle 2" long—with locking washer and nut.

| No. of Poles | 2 way | 3 way | 4 way | 5 way | 6 way | 8 way | 9 way | 10 way | 12 way |
|--------------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| 1 pole | 40p | 40p |
| 2 poles | 40p | 40p |
| 3 poles | 40p | 40p |
| 4 poles | 40p | 40p |
| 6 poles | 40p | 40p |
| 7 poles | 40p | 40p |
| 8 poles | 40p | 40p |
| 9 poles | 40p | 40p |
| 10 poles | 40p | 40p |
| 11 poles | 40p | 40p |
| 12 poles | 40p | 40p |

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 synchronous 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 auto-control is required. Price £4.50 each or 10 for £40.00.

HONEYWELL PROGRAMMER

This is a drum type timing device, the drum being calibrated in equal divisions for switch setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control, Boiler firing, Dispensing and Vending machines, Display lighting, automated and signs, Signalling, etc. Price from makers. Includes lighting instructions. Probably over £10 each. Special snip price £5.75 plus 25p post and insurance. Don't miss this terrific bargain.

Where postage is not stated then orders over £5 are post free. Below £5 add 20p. Semi-conductors add 6p post. Over £10 post free. S.A.E. with enquiries please.

POCKET CIRCUIT TESTER

Test continuity of any low resistance circuit, house wiring, car electricals. Tests polarity of diodes and rectifiers. Also ideal size for conversion to signal injector (circuit supplied). 30p or 2 for 60p 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". 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 H-A elliptical 6 1/2" x 3 1/2" 100 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 1/2" deep with brass inserts in four corners. This is a very strong case suitable to house instruments and special rigs, etc. Price 45p each. Fax lid 10p extra.

TELEPHONES

Complete as illustrated. Save your legs, 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 handset 60p each + 20p post.

ROCKER SWITCH

13 amp self-fixing into an oblong hole. Size approximately 1" x 1" 8p each, 10 for 75p.

SLIDE SWITCHES

Slide Switch, 2-pole changeover panel mounting by two 6H.A. screws. Size approx. 1in x 1/2in rated 250V lamp. 6p each, 10 for 54p, 100 for £5.10, 500 for £24. Ditto as above but for printed circuit 6p each 10 for 45p, 100 for £4.25. Sub Miniature Slide Switch, DPDT 19mm (1in 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.
- KA5 2-Pole Motor Kit. Twenty-four parts including enamel wire, armature and pole pins, etc. Motor operates from 1.5 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

SEW PANEL METERS

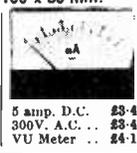
USED EXTENSIVELY BY INDUSTRY, GOVERNMENT DEPARTMENTS, EDUCATIONAL AUTHORITIES, ETC.

- LOW COST
- QUICK DELIVERY
- OTHER RANGES TO ORDER
- OVER 200 RANGES IN STOCK

CLEAR PLASTIC PANEL METERS

Type SW.100 100 x 80 mm.

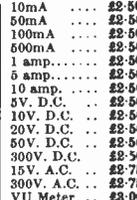
| | |
|-------------|--------|
| 50µA | \$2-80 |
| 50-0-50µA | \$2-80 |
| 100µA | \$2-80 |
| 100-0-100µA | \$2-70 |
| 500µA | \$2-50 |
| 1mA | \$2-40 |
| 20V. D.C. | \$2-40 |
| 50V. D.C. | \$2-40 |
| 300V. D.C. | \$2-40 |
| 1 amp. D.C. | \$2-40 |



5 amp. D.C. \$2-40
300V. A.C. \$2-40
VU Meter \$2-15

Type SD.830 82.5mm x 110mm Fronts

| | |
|-------------|--------|
| 10mA | \$2-50 |
| 50mA | \$2-50 |
| 100mA | \$2-50 |
| 100µA | \$2-50 |
| 500µA | \$2-50 |
| 1mA | \$2-50 |
| 1 amp. D.C. | \$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 |
| 15V. A.C. | \$2-75 |
| 300V. A.C. | \$2-75 |
| 5mA | \$2-50 |
| VU Meter | \$2-80 |



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 | \$2-55 |
| 5mA | \$2-55 |
| 10mA | \$2-55 |
| 50mA | \$2-55 |
| 100mA | \$2-55 |

| | |
|--------------|--------|
| 500mA | \$2-85 |
| 1 amp. D.C. | \$2-85 |
| 5 amp. D.C. | \$2-85 |
| 10 amp. D.C. | \$2-85 |
| 50V. D.C. | \$2-85 |
| 300V. D.C. | \$2-85 |
| 15V. A.C. | \$2-40 |
| 300V. A.C. | \$2-40 |
| VU Meter | \$2-70 |

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 | \$2-35 |
| 1mA | \$2-35 |
| 5mA | \$2-35 |
| 10mA | \$2-35 |
| 50mA | \$2-35 |
| 100mA | \$2-35 |
| 500mA | \$2-35 |

| | |
|--------------|--------|
| 1 amp. D.C. | \$2-15 |
| 5 amp. D.C. | \$2-15 |
| 10 amp. D.C. | \$2-15 |
| 50V. D.C. | \$2-15 |
| 300V. D.C. | \$2-15 |
| 15V. A.C. | \$2-80 |
| 300V. A.C. | \$2-80 |
| VU Meter | \$2-55 |

***MOVING IRON—**
ALL OTHERS MOVING COIL
Please add postage

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

| | |
|-------------|--------|
| 50µA | \$2-95 |
| 50-0-50µA | \$2-40 |
| 100µA | \$2-40 |
| 100-0-100µA | \$2-30 |
| 200µA | \$2-30 |
| 500µA | \$2-30 |
| 500-0-500µA | \$2-10 |
| 1mA | \$2-10 |
| 1-0-1mA | \$2-10 |
| 5mA | \$2-10 |
| 10mA | \$2-10 |

| | |
|---------------|--------|
| 50mA | \$2-10 |
| 100mA | \$2-10 |
| 500mA | \$2-10 |
| 1 amp. D.C. | \$2-10 |
| 5 amp. D.C. | \$2-10 |
| 30 amp. D.C. | \$2-10 |
| 20V. D.C. | \$2-10 |
| 50V. D.C. | \$2-10 |
| 150V. D.C. | \$2-10 |
| 300V. D.C. | \$2-10 |
| 15V. A.C. | \$2-10 |
| 300V. A.C. | \$2-10 |
| 8 Meter 1mA | \$2-15 |
| VU Meter | \$2-95 |
| 1 amp. A.C.* | \$2-10 |
| 5 amp. A.C.* | \$2-10 |
| 10 amp. A.C.* | \$2-10 |
| 20 amp. A.C.* | \$2-10 |
| 30 amp. A.C.* | \$2-10 |

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

| | |
|-------------|--------|
| 50µA | \$2-40 |
| 50-0-50µA | \$2-35 |
| 100µA | \$2-35 |
| 100-0-100µA | \$2-25 |
| 200µA | \$2-25 |
| 500µA | \$2-25 |
| 1mA | \$2-20 |
| 5mA | \$2-20 |
| 10mA | \$2-20 |
| 50mA | \$2-20 |
| 100mA | \$2-20 |
| 500µA | \$2-25 |
| 1mA | \$2-20 |
| 5mA | \$2-20 |
| 10mA | \$2-20 |
| 50mA | \$2-20 |
| 100mA | \$2-20 |

| | |
|--------------|--------|
| 10V. D.C. | \$2-20 |
| 20V. D.C. | \$2-20 |
| 50V. D.C. | \$2-20 |
| 300V. D.C. | \$2-20 |
| 15V. A.C. | \$2-80 |
| 300V. A.C. | \$2-80 |
| 8 Meter 1mA | \$2-80 |
| VU Meter | \$2-50 |
| 1 amp. A.C. | \$2-20 |
| 5 amp. A.C. | \$2-20 |
| 10 amp. A.C. | \$2-20 |
| 20 amp. A.C. | \$2-20 |
| 30 amp. A.C. | \$2-20 |

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

| | |
|-------------|--------|
| 50µA | \$2-70 |
| 50-0-50µA | \$2-60 |
| 100µA | \$2-60 |
| 100-0-100µA | \$2-50 |
| 200µA | \$2-50 |
| 500µA | \$2-50 |
| 500-0-500µA | \$2-40 |
| 1mA | \$2-40 |
| 5mA | \$2-40 |
| 10mA | \$2-40 |
| 50mA | \$2-40 |
| 100mA | \$2-40 |
| 500µA | \$2-40 |
| 1mA | \$2-40 |
| 5mA | \$2-40 |
| 10mA | \$2-40 |
| 50mA | \$2-40 |
| 100mA | \$2-40 |

| | |
|---------------|--------|
| 10V. D.C. | \$2-40 |
| 20V. D.C. | \$2-40 |
| 50V. D.C. | \$2-40 |
| 150V. D.C. | \$2-40 |
| 300V. D.C. | \$2-40 |
| 15V. A.C. | \$2-55 |
| 300V. A.C. | \$2-55 |
| 8 Meter 1mA | \$2-60 |
| VU Meter | \$2-70 |
| 50mA A.C.* | \$2-40 |
| 100mA A.C.* | \$2-40 |
| 200mA A.C.* | \$2-40 |
| 500mA A.C.* | \$2-40 |
| 1 amp. A.C.* | \$2-40 |
| 5 amp. A.C.* | \$2-40 |
| 10 amp. A.C.* | \$2-40 |
| 20 amp. A.C.* | \$2-40 |
| 30 amp. A.C.* | \$2-40 |

Send for illustrated brochure on SEW Panel Meters—discounts for quantities.

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

| | |
|-------------|--------|
| 50µA | \$2-80 |
| 50-0-50µA | \$2-10 |
| 100µA | \$2-10 |
| 100-0-100µA | \$1-85 |
| 200µA | \$1-85 |
| 500µA | \$1-85 |
| 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 |

| | |
|--------------|--------|
| 200mA | \$1-75 |
| 300mA | \$1-75 |
| 500mA | \$1-75 |
| 750mA | \$1-75 |
| 1 amp. D.C. | \$1-75 |
| 2 amp. D.C. | \$1-75 |
| 5 amp. D.C. | \$1-75 |
| 10 amp. D.C. | \$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. | \$1-75 |
| 150V. D.C. | \$1-75 |
| 300V. D.C. | \$1-75 |
| 750V. D.C. | \$1-75 |
| 15V. A.C. | \$1-85 |
| 50V. A.C. | \$1-85 |
| 150V. A.C. | \$1-85 |
| 300V. A.C. | \$1-85 |
| 600V. A.C. | \$1-85 |
| 8 Meter 1mA | \$1-85 |
| VU Meter | \$2-80 |

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 |
| 50mA | \$1-85 |
| 100mA | \$1-85 |
| 1 amp. D.C. | \$1-85 |

| | |
|--------------|--------|
| 5 amp. D.C. | \$1-85 |
| 10V. D.C. | \$1-85 |
| 20V. D.C. | \$1-85 |
| 50V. D.C. | \$1-85 |
| 300V. D.C. | \$1-85 |
| 15V. A.C. | \$2-00 |
| 300V. A.C. | \$2-00 |
| 8 Meter 1mA | \$2-05 |
| VU Meter | \$2-60 |
| 1 amp. A.C. | \$1-85 |
| 5 amp. A.C. | \$1-85 |
| 10 amp. A.C. | \$1-85 |
| 20 amp. A.C. | \$1-85 |
| 30 amp. A.C. | \$1-85 |

"SEW" EDGWISE METERS

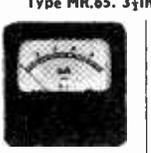
Type PE.70. 3 1/7/32in. x 1 15/32in. x 2 1/2in. deep

| | |
|-------------|--------|
| 50µA | \$2-40 |
| 50-0-50µA | \$2-30 |
| 100µA | \$2-30 |
| 100-0-100µA | \$2-20 |
| 200µA | \$2-20 |

| | |
|------------|--------|
| 600µA | \$2-05 |
| 1mA | \$2-70 |
| 300V. A.C. | \$2-70 |
| VU Meter | \$2-75 |

"SEW" BAKELITE PANEL METERS

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

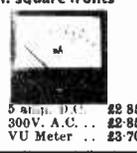


| | |
|-------------|--------|
| 25µA | \$2-85 |
| 50µA | \$2-80 |
| 50-0-50µA | \$2-60 |
| 100µA | \$2-60 |
| 100-0-100µA | \$2-50 |
| 500µA | \$2-45 |
| 500-0-500µA | \$2-15 |
| 1mA | \$2-15 |
| 1-0-1mA | \$2-15 |
| 5mA | \$2-15 |
| 10mA | \$2-15 |
| 50mA | \$2-15 |
| 100mA | \$2-15 |
| 500mA | \$2-15 |

| | |
|---------------|--------|
| 1 amp. D.C. | \$2-15 |
| 5 amp. D.C. | \$2-15 |
| 15 amp. D.C. | \$2-15 |
| 30 amp. D.C. | \$2-15 |
| 50 amp. D.C. | \$2-15 |
| 6V. D.C. | \$2-15 |
| 10V. D.C. | \$2-15 |
| 20V. D.C. | \$2-15 |
| 30V. D.C. | \$2-15 |
| 150V. D.C. | \$2-15 |
| 300V. D.C. | \$2-15 |
| 50mV. D.C. | \$2-40 |
| 100mV. D.C. | \$2-40 |
| 30V. 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 | \$2-40 |

Type S-80 80 mm. square fronts

| | |
|-------------|--------|
| 50µA | \$2-50 |
| 50-0-50µA | \$2-40 |
| 100µA | \$2-40 |
| 100-0-100µA | \$2-30 |
| 500µA | \$2-35 |
| 1mA | \$2-35 |
| 50V. 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 \$2-70

"SEW" EDUCATIONAL METERS



Type ED.107. Size overall 107mm x 90mm x 108mm
A new range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

| | |
|-----------|--------|
| 50µA | \$2-50 |
| 100µA | \$2-10 |
| 1mA | \$2-85 |
| 50-0-50µA | \$2-10 |
| 1-0-1mA | \$2-85 |
| 1A d.c. | \$2-85 |
| 5A d.c. | \$2-85 |
| 10V d.c. | \$2-85 |

| | |
|---------------|--------|
| 20V. d.c. | \$2-85 |
| 50V. d.c. | \$2-85 |
| 300V. d.c. | \$2-85 |
| Dual range | |
| 500mA/5A d.c. | \$2-10 |
| 5V/50V d.c. | \$2-10 |

POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range ex-stock. Single hole fixing, 1/2in. dia. shafts. Bulk quantities available.
25 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. 90p. P. & P. 71p.
60 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. \$1-15 P. & P. 71p.
100 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms. \$1-65 P. & P. 71p.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

Excellent quality · Low price · Immediate delivery

S-280 General Purpose Bench Mounting

| | |
|---------|---------|
| 1 Amp | \$7-00 |
| 2-5 Amp | \$8-05 |
| 5 Amp | \$11-75 |
| 8 Amp | \$15-90 |
| 10 Amp | \$22-50 |
| 12 Amp | \$25-60 |
| 20 Amp | \$48-00 |
| 25 Amp | \$58-00 |
| 40 Amp | \$82-50 |



S-280B Panel Mounting

| | |
|---------|--------|
| 1 amp | \$7-00 |
| 2-5 amp | \$8-05 |

Please add postage
ALL MODELS
INPUT 230 V 50/60 CYCLES
OUTPUT VARIABLE 0-260 VOLTS
Special discounts for quantity

AUTO TRANSFORMERS

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

| | | |
|--------|---------|-------------|
| 80 W | \$2-10 | P. & P. 18p |
| 150 W | \$2-70 | P. & P. 18p |
| 300 W | \$3-60 | P. & P. 23p |
| 500 W | \$5-25 | P. & P. 33p |
| 1000 W | \$7-50 | P. & P. 38p |
| 1800 W | \$10-90 | P. & P. 43p |
| 2250 W | \$12-75 | P. & P. 50p |
| 5000 W | \$25-00 | P. & P. 51 |

MCA.220 AUTOMATIC VOLTAGE STABILISER

Input 85 125 VAC or 175 250VAC. Output 120V AC. or 240 VAC. 200 VA rating. \$11-97. carr. 50p.



230 VOLT A.C. 50 CYCLES RELAYS

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

BH.001 HEAD SET AND BOOM MICROPHONE

Moving Coil. Ideal for language teaching, communications. Headphone imp. 18 ohms. Microphone imp. 200 ohms. \$4-62. P. & P. 15p.



240° Wide Angle 1mA Meters

MW 1-6 60mm square \$2-97
MW 1-8 80mm square \$4-97
P. & P. extra

RP214 REGULATED POWER SUPPLY

Solid state. Variable output 0-24V DC up to 1 amp. Dual scale meter to monitor voltage and current. Input 220/240V A.C. Size 185 x 85 x 105mm. \$8-97 P. & P. 25p.

PS.200 REGULATED P.S.U.

Solid state. Variable output 5-20 volt D.C. up to 2 amp. Independent meters to monitor voltage and current. Output 220/240 V. A.C. Size 7 1/4" x 5 1/4" x 3 1/4". \$14-97. P. & P. 25p.

PS.1000B REGULATED POWER SUPPLY

Solid state. Output 6, 9 or 12 volt DC up to 3 amps. Meter to monitor current. Input 220/240V A.C. Size 4" x 3 1/4" x 6 1/4". \$11-97. P. & P. 25p.

230V/240V SMITHS SYNCHRONOUS GEARED MOTORS

Built in gearbox. All brand new and boxed. 30 RPH CW; 2 RPH CW; 2

MULTIMETERS for EVERY purpose!

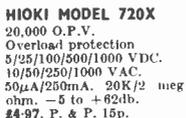


TS60 POCKET MULTIMETER
High-precision at low cost. Ranges: D.C. 15V, 150V, 1,000V (10,000 opv). A.C. 15V, 150V, 100V (1,000 opv). D.C. Current 150mA. Resistance 100K ohms. \$1.85. Post 15p.

MODEL 1092 TESTMETER
5,000 O.P.V.
0/3/15/150/300/1200 V.
D.C. 0/6/30/300/600 A.
A.C. 0/300A/300 MA
0/10K/1 meg Ω
Decibels -10 to +16db.
\$2.75 each +15p P. & P.



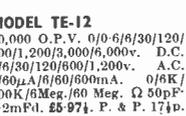
HIKOI MODEL 720X
20,000 O.P.V.
Overload protection
5/25/100/500/1000 VDC.
10/50/250/1000 VAC.
50μA/250mA. 20K/2 meg ohm. -5 to +62db.
\$4.97. P. & P. 15p.



HIKOI 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.



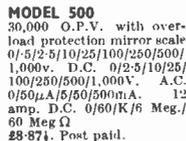
MODEL TE-12
20,000 O.P.V. 0/0-6/6/30/120/600/1,200/5,000/6,000V. D.C. 0/6/30/120/600/1,200V. A.C. 0/6/30/120/600/1,200V. 0/6K/600K/6Meg./60 Meg. Ω 50pF-0.2mF. \$5.97. P. & P. 17p.



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



MODEL 500
30,000 O.P.V. with overload protection mirror scale 0/1/2-5/10/25/100/250/500/1,000V. D.C. 0/2-5/10/25/100/250/500/1,000V. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60/K/6 Meg./60 Meg Ω
\$8.97. Post paid.



HIKOI 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 ohm. -10 to +17db.
\$8.97. Post 20p.



HT100B4 MULTI-METER
Features A.C. current ranges. 100,000 o.p.v. Mirror Scale. Overload protection. 0/5/12-5/10/50/250/500/1000 V D.C. 0/2-5/10/50/250/1000 V A.C. 0/10/250μA/2-5/25/250 MA/10 Amp. D.C. 0/20K/200K/2 MEG/20 MEG. -20 +62db.
\$12.50. 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 A.C. 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.

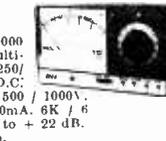


RUSSIAN 22 RANGE MULTIMETER
Model U-437 10,000 O.P.V.
A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2-5/10/50/250/500/1000V D.C. 2-5/10/50/250/500/1000V A.C. DC Current 100mA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3m Ω. Complete with batteries. Test leads, instructions and sturdy steel carrying case.
OUB PRICE \$5.97. P. & P. 25p

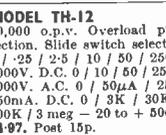


ROUND SCALE TYPE PENCIL TESTER MODEL T.S.68
Completely portable, simple to use pocket sized tester. Ranges 0/3/30/300V AC and DC at 2,000 o.p.v. Resistance 0-20K ohms. ONLY \$1.97 P. & P. 15p.

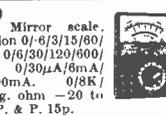
LT601 MULTIMETER
New style 20,000 o.p.v. pocket multi-meter. 5/25/50/250/500/1200 V. D.C. 10/50/100/500/1000V. A.C. 50μA/250mA. 6K/6 meg ohms. -20 to +22 db.
\$3.87. Post 20p.



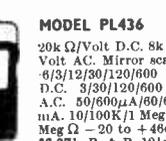
MODEL TH-12
20,000 o.p.v. Overload protection. Slide switch selector 0/25/125/5/10/50/250/1000V. D.C. 0/10/50/250/1000V. A.C. 0/50μA/25/250mA. D.C. 0/3K/30K/300K/3 meg -20 to +60db
\$4.97. Post 15p.



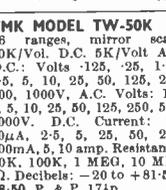
MODEL TE-300
30,000 O.P.V. Mirror scale. overload protection 0/6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30μA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm -20 to +63 db. \$5.97. P. & P. 15p.



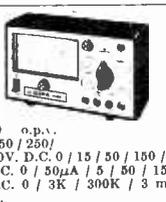
MODEL PL436
20k Ω/Volt D.C. 8k Ω/Volt A.C. Mirror scale. 6/3/12/30/120/600 V D.C. 3/30/120/600 V A.C. 50/600μA/60/600 mA. 10/100K/1 Meg/10 Meg Ω -20 to +46db.
\$5.97. P. & P. 12p.



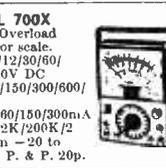
THK MODEL TW-50K
46 ranges, mirror scale. 50K/Vol. D.C. 5K/Volt A.C. D.C.: Volts -125, -25, 1-25, 2-5, 5, 10, 25, 50, 125, 250, 500, 1000V. A.C. Volts: 1-5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50μA, 2-5, 5, 25, 50, 250, 500mA, 5, 10 amp. Resistance: 10K, 100K, 1 MEG, 10 MEG Ω. Decibels: -20 to +81-5db
\$8.50. P. & P. 17p.



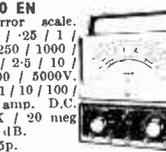
MODEL K228A
Taut band suspension. Overload protection. Polarity reversing switch. 30,000 o.p.v. 0/1-5/2-5/10/50/250/500/1000/2500V. D.C. 0/15/50/150/500/1000V. A.C. 0/50μA/5/50/150/500mA/5A. D.C. 0/3K/300K/3 meg. \$8.95. Post 20p.



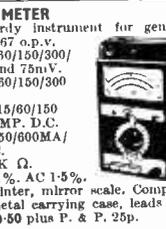
HIKOI MODEL 700X
100,000 O.P.V. Overload protection. Mirror scale. 3/6/12-2/1-5/3/6/12/30/60/120/300/600/1200V DC 1-5/3/6/12/30/60/150/300/600/1200 V A.C. 15/30μA/3/6/30/60/150/300mA 0/12 AMP. DC. 2K/200K/2 Meg/20 Meg ohm -20 to +63db. \$13.50. P. & P. 20p.



MODEL C-7080 EN
Giant 8" mirror scale. 20,000 o.p.v. 0/25/1/1-2-5/10/50/250/1000/5000V. D.C. 0/1-2-5/10/50/250/1000/5000V. A.C. 0/250/1000/5000V. A.C. 0/150μA/1/1/10/100/500mA/10 amp. D.C. 0/2K/200K/20 meg -20 to +50 db.
\$13.95. Post 35p.



U4312 MULTIMETER
Extremely sturdy instrument for general electrical use. 667 o.p.v. 0/3/1-5/7-5/30/60/150/300/600/900 VDC and 75mV. 0/3/1-5/7-5/30/60/150/300/600/900 VAC. 0/300μA/1-5/6/15/60/150/600mA/1-5/6 AMP. D.C. 0/1-5/6/15/60/150/600mA/1-5/6 AMP. AC. 0/200 Ω/3K/30K Ω. Accuracy DC 1%. AC 1-5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. \$9.50 plus P. & P. 25p.



Selected TEST EQUIPMENT

FTC-401 TRANSISTOR TESTER
Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads.
\$7.50. Post 20p.



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. 5 1/2 x 5 1/2 x 3 1/2 in. Complete with instructions and leads. \$7.97. Post 25p.



Model S-100TR MULTIMETER TRANSISTOR TESTER
100,000 o.p.v. mirror scale/overload protection. 0/12/6/3/12/30/120/600 V D.C. 0/6/30/120/600 V AC. 0/12/600μA/12/300mA/12 AMP DC. 0/10 K/1 MEG/100MEG. -20 to +60db. 0-01-2 MFD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. \$18.50. P/P 25p.



MODEL 449A IN CIRCUIT TRANSISTOR TESTER
Checks true A.C. beta in / out. Checks Ico. Checks diodes in / out. Checks SCR, etc. Beta. HI 10 - 500. LO 2 - 50. Ico 0-5000μA. 220/240 V A.C. operation.
\$17.50. Post 25p.



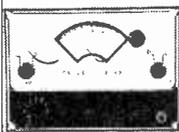
TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE
A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1 Ω 11 meg Ω. 6 Ranges ±1%. L. 1 μH - 111 HENRY. 6 Ranges ±2%. C. 10pF - 1110mF. 6 Ranges ±2%. TURNS RATIO 1:1/1000-1:1/100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 5 x 2 in. \$20. P. & P. 25p.



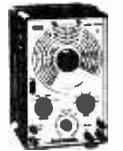
MODEL TE.15 GRID DIP METER
Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440Kcs-280Mc/s in 6 coils. 500μA Meter. 9V battery operation. Size 180 x 80 x 40mm.
\$18.50. Post 20p.



BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR
Sine 18 x 200,000 Hz. Square 18 x 50,000 Hz. Output max. +10 db. Bridge K (ohms) Operation Internal batteries Attractive 2-tone case 7 1/2 x 5 x 2 in. Price \$17.50. Carr. 17p.



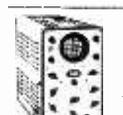
TE-20D RF SIGNAL GENERATOR
Accurate wide range signal generator covering 120 Kcs 500 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator, audio output. Xtal socket for calibration. 220/240V. A.C. Brand new with instructions \$15. Carr. 37p. Size 140 x 215 x 170 mm.



MODEL L-55 FET V.O.M.
Input impedance 10 meg ohms. 0/3-1/2/8/30/120/600V. D.C. 0/3/12/60/120/600V. A.C. 0/120μA/120mA D.C. 0/1K/100K/10 meg/100 meg ohms
\$15.97. Post 15p.



CI-5 PULSE OSCILLOSCOPE
For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/μm. -1-25. HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz, V RMS/μm. -3-25. Pre-set triggered sweep 1-3,000μsec.; free running 20-200,000Hz in nine ranges. Calibrator pipe. 220 x 360 x 430mm. 115-230V. C.C. operation. \$89.00. Carr. paid.



TO-3 PORTABLE OSCILLOSCOPE
3in. tube. Y amp. Sensitivity 0.1v p-p/CM. Bandwidth 1-5 cps-1.5 MHz. Input imp. 2 meg Ω. 25pF. X amp. sensitivity 0.9v. p-p/CM. Bandwidth 1.5cps-800KHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps 300 kHz. Synchronization. Internal/external. Illuminated scale 140 x 215 x 320 mm. Weight 15lb. 220/240V. A.C. Supplied brand new with handbook. \$40.00. Carr. 50p.



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 usec. to 100 mill-sec. per cm. Free running time base 50 c/s-1 mc/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with all accessories and instruction manual \$87. Carr. Paid.



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



MODEL AT201 DECADE ATTENUATOR
Frequency range 0-200KHz. Attenuator 0-111db. 0.1db step. Impedance 600 ohms. Max. input power 30lbm. Size 180 x 90 x 55mm.
\$12.50. Post 37p.



TE-65 VALVE VOLTMETER
28 ranges. D.C. volts 1-5-1,500V. A.C. volts 1-5-1,500V. Resistance up to 1,000 megohms. 200/240V. A.C. operation. Complete with probe and instructions. \$17.50. P. & P. 30p. Additional probes available. R.P. \$2-12; H.V. \$2-50.



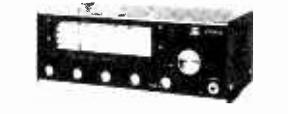
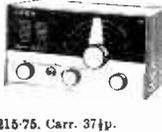
MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER
Sensitivity 330 ohms/Volt AC and DC. Accuracy 5% D.C. 1% AC. Scale length 165mm. 0/300/750μA/1/5/3/7-5/15/30/75/150/300/750mA/1-5/3/7-5AMP DC 0/3/7-5/15/30/75/150/300/750mA/1-5/3/7-5AMP AC 0/75/150/300/750V DC 0/750mV/1-5/3/7-5/15/30/75/150/300/750V AC. 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. 37/1p.



UR-1A SOLID STATE COMMUNICATION RECEIVER

4 Bands covering 550Kc/s-30Mc/s. FET 8 Meter. Variable BFO for RSB, Built-in Speaker, Bandspread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12 1/2" x 4 1/2" x 7 1/2" Brand new with instructions. £25. Carr. 37/1p.

SKYWOOD CX203 COMMUNICATION RECEIVER



Solid state. Coverage on 5 bands 200-420 KHz and -65 to 30 MHz. Illuminated slide rule dial. Bandspread. Aerial tuning BFO, AVC, ANL, 'S' meter. AM/CW/SSB. Integrated speaker and phone socket. Operation 220/240v AC or 12v DC. Size 325 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. PET front end. 2 mesh. filters, product detector, variable B.F.O., noise limiter. 8 Meter. Bandspread, RF Gain. 15" x 9 1/2" x 8 1/2". 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 10, 15, 20, 40 and 80 meters. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW. ANL. Variable BFO. 8 meter. Sep. bandspread dial. 1F 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 LOUSPEAKERS

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: InV. 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, automatic internal reference voltage. Overload: to 100v. D.C. Input: Fully floating (3 poles). Input power: 110-230v. A.C. 50/60 cycles. Overall size: 6 1/2" x 2 1/2" x 1 1/2". AVAILABLE BRAND NEW AND FULLY GUARANTEED. £35-50. Carr. 50p.



SINCLAIR IC-12

List Price £2-98
OUR PRICE £1-80
P. & P. 10p

SINCLAIR EQUIPMENT
Project 60 Package offers:
2 x Z30 amplifier, stereo 60 pre-amp, P25 power supply. £15-95 Carr. 37/1p. Or with P26 power supply £18-00 Carr. 37/1p. 2 x Z50 amplifier, stereo 60 pre-amp, P28 power supply. £20-25. Carr. 37/1p.
Transformer for P28. £2-97/1 extra.
Add to any of the above £4-45 for active filter unit and £13-00 for pair of Q16 speakers.
All other Sinclair products in stock.
2000 Amp £21-95 Carr. 37/1p.: 3000 Amp £28-50 Carr. 37/1p.: Neoteric Amp £48-95. Carr. 37/1p. ICI £1-80 p. & p. 10p.
NEW PROJECT 605 - £20-97. Carr. 37/1p.

SPECIAL OFFER! GOODMANS AXIOM 301
Hi Fi 12" 20 watt twin control range speaker. 30-16,000 Hz. 16,500 gauss. 8 ohm impedance. Brand new and boxed.
(List price £21.72) **OUR PRICE £18-50** 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. 7 1/2 x 8 x 4 1/2 in. £5-97. P. & P. 15p.



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



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 500V/1000V. 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.

ARF-300 AF/RF Signal Generator

All transistorised, compact, fully portable. AF sine wave 18 Hz to 220 KHz. AF square wave 18 Hz to 100 KHz. Output sine/square 10v. P.P. RF 100KHz to 200 MHz. Output 1v. maximum. Operation 220/240v. AC. Complete with instructions and leads. £23-95. Post 5 0p.



AKAI BARGAINS

SUPER MONEY SAVING OFFERS—BUY NOW WHILE STOCKS LAST! BRAND NEW AND FULLY GUARANTEED

172J Tape Rec. £73-95
X2000 Tape Rec. £99-95
GX370 Tape Deck £285-95
4000D Tape Deck £81-50
4000D8 Tape Deck £73-95
X201D Tape Deck £128-95
X221D Tape Deck £109-95
GX220D Tape Deck £148-50
GX260D Tape Deck £249-40
X1510D Tape/8 track Deck £169-95
GX1900D Tape/Cass Deck £177-95
X2000SD Tape/Cas/8 Track Rec. £283-30
CR81 8 track Rec. £80-95
CR81D 8 track Rec. £65-95
CR81T 8 track/Receiver £118-90
CR808S 8 track system £145-00

GXC40 Cassette Rec. £88-25
GXC40D Cassette Deck £66-95
GXC40T Cassette/Receiver £123-95
GXC45D Cassette Deck £95-95
GXC46D Cassette Deck £103-50
GX C50D Cassette Deck £111-25
GX C55D Cassette Deck £110-25
CS85D Cassette Deck £59-50
AA6200 Receiver £74-95
AA6300 Receiver £88-50
AA6600 Receiver £109-00
AA8500 Receiver £175-00
ADM11 Microphones (Pair) £7-50

Carriage 50p extra. (Recorders & Decks 75p)

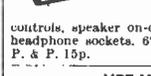


DOLBY SYSTEM NOISE REDUCTION UNIT



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 15kHz ± 1dB 19kHz -35dB. Size 15 1/2" x 9" x 3 1/2". AC 200/250V. **OUR PRICE £32-50** Carr. 50p.

1021 STEREO LISTENING STATION
For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 8" x 4" x 2 1/2". £25-25. P. & P. 15p.



MP7 MIXER PREAMPLIFIER
6 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9 1/2" x 5" x 3" Inputs Mics: 3 x 3mV 50K; 2 x 3mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K. £8-97. P. & P. 20p.



TE-1035 STEREO HEADPHONES
Low cost high performance stereo headphones. Foam rubber earcups. Adjustable head-band. 8 ohm impedance 25-18,000 Hz. With lead and stereo jack plug. **ONLY £1-97/1**. P. & P. 12/1p.



NEW GARRARD MODULES



Popular range of Garrard decks with Shure cartridge fitted in deluxe plinth with hinged lid.
SP25 IIII Module/M75-6 £28-50
AP76 Module/M75-6 £33-80
AP96 Module/M75-6 £38-75
Zero 1008 Module/M93E £52-60
Carr. 50p extra any item.

HOSIDEN DH-085 DE-LUXE STEREO HEADPHONES

Features unique mechanical 2 way units and fitted adjustable lever, controls. 8 ohm impedance 20-20,000cps. Complete with spring lead & stereo jack plug £7-97/1. P. & P. 12/1p.

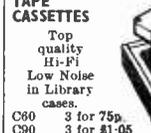


GENUINE BARGAIN! KOSS SP.3XC STEREO HEADPHONES



Response 10-15,000Hz. Impedance 4-6 ohms. Brand new. Boxed & fully guaranteed. (List £9.50). **OUR PRICE £6-50**. P. & P. 25p.

HOSIDEN DH-025 STEREO HEADPHONES



Wonderful value and excellent performance combined. Adjustable head-band. 8 ohm impedance. 20-12,000 cps. Complete with lead and plug. **ONLY £8-37/1**. P. & P. 12/1p.

TAPE CASSETTES



Top quality Hi-Fi Low Noise in Library cases.
C80 3 for 75p 10 for £28-25
C90 3 for £1-05 10 for £23-80
C120 3 for £1-85 10 for £42-80
Tape Head Cleaner 30p each. P. & P. 10p extra.

SPECIAL OFFER! ROTEL RH700 STEREO HEADPHONES



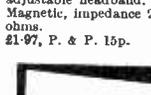
20-20,000Hz. 8-16 ohm. (List £9-95). **OUR PRICE £8-75**. P. & P. 25p.

SPECIAL PURCHASE! LEAK MINI-SANDWICH SPEAKERS



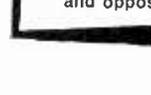
Brand new and fully guaranteed. 8 watt, 8 ohm. Teak finish. (Rec. list £59-50 pr.) **OUR PRICE £39-50** pair Carr. £1-00.

TRANSISTORISED FM TUNER



6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6 1/2 x 4 1/2 in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88-108Mc/s. Ready built ready for use. Fantastic value for money. £8-97/1. P. & P. 12/1p. Stereo multiplex adaptors £4-97/1.

TE 1018 DE-LUXE MONO HIGH IMPEDANCE HEADSET

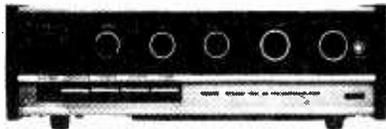


Sensitive soft earpads, adjustable headband. Magnetic, impedance 2,600 ohms. £1-97. P. & P. 15p.

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

FANTASTIC OFFER!

NIKKO TRM 50 STEREO AMPLIFIER



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

List price £59.50
OUR PRICE

£39.95

Carrage 50p

HI-FI EQUIPMENT SAVE UP TO 33 1/3% OR MORE

SEND S.A.E. FOR
FULL DISCOUNT
PRICE LISTS AND
PACKAGE OFFERS!



NIKKO TRM.50 SYSTEM



NIKKO TRM50 17 + 17 watt rms. stereo amplifier, BSR MP60, plinth & cover, Goldring G800 cartridge, pair of Linton 2 speakers and all leads.

OUR PRICE **£104.90**

Carr. and Ins. £1.50

WHARFEDALE LINTON SYSTEM



Wharfedale Linton Amplifier, Linton Turntable, pair of Linton 2 speakers and all leads.

OUR PRICE **£104.00**

Carr. and Ins. £1.25

LEAK DELTA 30 SYSTEM



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

OUR PRICE **£122.50**

Carr. and Ins. £1.50

TELETON SAQ206B SYSTEM



Teleton SAQ206B 8 + 8 watt Amplifier, BSR MP60, plinth & cover, Goldring G800 cartridge, pair of Apollo speakers and all leads.

OUR PRICE **£54.40**

Carr. £1.50

Amplifier only, £22.95. Carr. 50p.

MW/LW CAR RADIO



Fully transistorised, dual waveband. Size 9 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.

SUPER BARGAIN! 8-TRACK CAR STEREO TAPE PLAYER



Tone, volume and balance controls. Track selector. Complete with matched pair of stereo speakers, connections and fittings. ONLY £15.95. Post 30p.

BH.001 HEAD SET AND BOOM MICROPHONE

Moving Coil. Ideal for language teaching, communications. Headphone imp. 15 ohms. Microphone imp. 200 ohms. £4.82. P. & P. 15p.



AMSTRAD 8000 II SYSTEM



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

OUR PRICE **£47.50**

Carr. £1.00

Amplifier only, £14.50. Carr. 50p.



B.S.R. TD8S 8-TRACK STEREO TAPE PLAYER DECK

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

OUR PRICE **£16.25** Post 50p

SPECIAL PURCHASE!

FERGUSON 3414 STEREO TUNER AMPLIFIER TURNTABLE UNIT



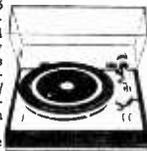
10+10 watts rms. Five push buttons with separate scales for pre-tuning to desired FM station. Housed in a handsome walnut finished cabinet with BSR P128/MP60 record deck with Goldring G800H stereo magnetic cartridge. Offered complete with cover and a pair of matching Medway Speakers, size 18" x 11" x 8". TODAY'S VALUE AT LEAST £125!

OUR PRICE **£75.00**

Carr. & Ins. £1.50.

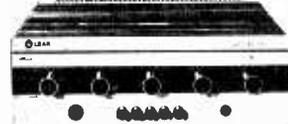
SAVE £££'s PHILIPS GA308 TRANSCRIPTION TURNTABLE

2 speeds 33 1/3 and 45 rpm. Lightweight tubular counterbalanced arm. Belt driven low speed synchronous motor. Viscous damped pick up lift/lower device. Complete with teak plinth and hinged cover. (GA308 less cartridge (List £36.55)). OUR PRICE £24.50. P. & P. 50p. GA308 PU with GP400 stereo magnetic cartridge (List £47.85). OUR PRICE £29.95. P. & P. 50p. LIMITED NUMBER ONLY!



LEAK BARGAINS!

LIMITED OFFER!
ALL STOCKS BRAND NEW AND GUARANTEED



Delta 30 ... £46.95
Delta 70 ... £57.95
Delta FM ... £55.95
Delta AM/FM ... £67.95
Delta 75 ... £127.50
Leak 150 pair ... £37.50
Leak 250 pair ... £47.95
Leak 600 each ... £33.95
P. & P. 50p extra each item.

ROTEL BARGAINS!

All brand new and guaranteed



RA210 Amp ... £22.50
RA310 Amp ... £35.95
RA610 Amp ... £48.25
RX150 Receiver ... £45.95
RX200 Receiver ... £57.50
RX400 Receiver ... £70.95
P. & P. 50p extra any item.

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.

HOMER INTERCOMS

Ideal for home office, stores, factories, etc. Supplied complete with batteries, cable and free instructions.

2 Station £2.97, 3 Station £5.25, P. & P. 15p;
4 Station £6.02, P. & P. 17p.

CREDIT TERMS AVAILABLE FOR CALLERS. ACCESS & BARCLAYCARD WELCOME.

RECORD DECKS (P. & P. 50p)

B.S.R. McDONALD
C114 Mini £4.97
C129 Mono £8.50
C137 £8.85
MP60 £9.75
610 £12.85
810 £31.25
MP60/TPD3 £25.75
MP60/G800 £12.95
MP60/TPD1 £11.05
MP60/TPD1/G800 £19.50
MP60/TPD2 £14.85
610/TPD1 £18.95
610/TPD1 £17.85
HT70 £18.99
HT70/G800 £17.25
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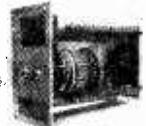
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| ECP801 82p | EZ81 27p | US91 80p | OA81 10p | OC85 25p | ZG431 51p | 40G96 12p | BFY52 20p | SD928 25p | 6K8GT 40p | 30C18 80p | 9006 15p |
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| CR85G | 1W | 0.1-1 |
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| CR87 | 1W | 0.1-1 |
| CR88 | 1W | 0.1-1 |
| CR89 | 1W | 0.1-1 |
| CR90 | 1W | 0.1-1 |
| CR91 | 1W | 0.1-1 |
| CR92 | 1W | 0.1-1 |
| CR93 | 1W | 0.1-1 |
| CR94 | 1W | 0.1-1 |
| CR95 | 1W | 0.1-1 |
| CR96 | 1W | 0.1-1 |
| CR97 | 1W | 0.1-1 |
| CR98 | 1W | 0.1-1 |
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| 6AK6 | 32p | 6B06G | 55p | 6C30L2 | 80p | 6D6 | 80p | 6E8 | 80p | 6F6 | 80p |
| 6AL5 | 15p | 6B36 | 45p | 6Z4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AL6 | 40p | 6B7A | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AM6 | 30p | 6B7B | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AN8 | 50p | 6B7C | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AQ5 | 35p | 6B7D | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AQ5W | 50p | 6B7E | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6 | 35p | 6B7F | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6G | 35p | 6B7G | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6H | 35p | 6B7H | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6J | 35p | 6B7I | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6K | 35p | 6B7J | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6L | 35p | 6B7K | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6M | 35p | 6B7L | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6N | 35p | 6B7M | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6O | 35p | 6B7N | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6P | 35p | 6B7O | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6Q | 35p | 6B7P | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6R | 35p | 6B7Q | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6S | 35p | 6B7R | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6T | 35p | 6B7S | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6U | 35p | 6B7T | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6V | 35p | 6B7U | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6W | 35p | 6B7V | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6X | 35p | 6B7W | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
| 6AV6Y | 35p | 6B7X | 85p | 6Y4 | 35p | 6X4 | 35p | 6Y4 | 35p | 6Z4 | 35p |
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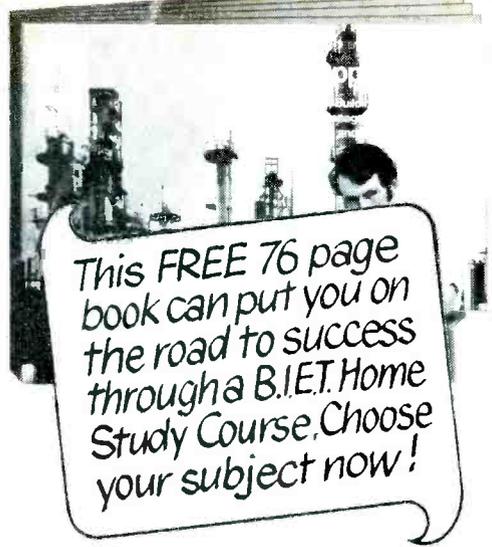
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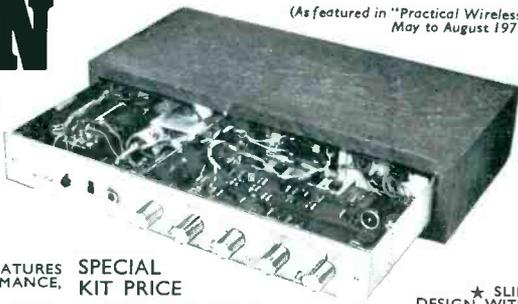
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(As featured in "Practical Wireless" May to August 1972)

SPECIAL KIT PRICE
£28.50 P & P
45p

★ **SLIM DESIGN WITH SILVER TRIM**
Overall chassis size 14 1/2" x 6" x 2 1/2" high

COMPLETE WITH FREE TEAK CABINET
Designer approved kits distributed by Henrys!

RECORD DECKS

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| CHASSIS (POST 50p) | |
| SP25/3 £10.25 HT70 | £14.50 |
| MP60 | £9.95 MP610 £12.95 |
| AP76 | £17.95 GL75 £28.30 |
| PLINTH/COVERS | |
| (State Model) | |
| SP25/MP60/610 £3.30 post 40p | |
| AP76 £4.50 post 40p | |
| CART/PLINTH/COVER (Post 70p) | |
| (HL) MP60/G800H/PC | £18.50 |
| MP610/SC5MD/TPD2/PC | £19.95 |
| AP76/M756SM/PC | £32.50 |
| AP96/M756SM/PC | £39.95 |
| (HL) AP76/G800H/PC | £28.95 |
| (HL) SP25/G800H/PC | £18.95 |
| HT70/G800/TPD1/PC | £24.50 |
| (HL) 2025/9TAHCD/PC | £13.95 |
| MP60/SC5MD/PC | £17.25 |
| (HL) GL75/G800E/PC | £41.95 |
| (HL) GL75/G800/PC | £38.95 |

ULTRASONIC TRANSDUCERS
Operate at 40kc/s up to 100 yds. Ideal remote switching and signalling. Complete with data and circuits. £5.90 per pair. Post 10p

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4 TRACK MONO or 2 TRACK STEREO
'17' High Impedance £2.00
'18' Med. Impedance £2.00
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Erase Heads for above 75p
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TH9013P—20 watt Power Amp Module £4.57.
TH9014P—IC Preamp £1.50. Data/Circuits for above No. 42 10p

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(Post 15p per 1 to 6)
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GNP-7, GNP-8 0-9 side view with decimal points and data, 95p.
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12 and 24 hour clock circuits Ref. No. 31 15p.

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Quality Slider Controls
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Hi-Fi & Tape Equipment
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Transistors - IC's - SCR's - Rectifiers - Triacs, etc. LATEST BROCHURE Ref. No. 36 on request, or see our earlier page

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Uses Mullard Module. Slow motion tuning. Built in battery. Ferrite aerial. Overall size 7" x 2 1/2" x 3 1/2". **TOTAL COST TO BUILD** £4.85. Post 15p. All parts sold separately. Leaflet No. 6

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Printed circuit all transistor design using Mullard RF/IF Module. Medium and Long Wave bands plus Medium Wave Bandspread for extra selectivity. Also slow motion geared tuning, 800 mW push-pull output, fibre glass PVC covered cabinet, car aerial. Attractive appearance and performance. **TOTAL COST TO BUILD** £7.96. p.p. 32p. (Battery 22p). All parts sold separately—Leaflet No. 2.

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| SE500 | Pocket Pencil Signal Tracer | £1.50 |
| THL33D | Robust 2K/Volt | £4.55 with case £4.95 |
| TE15 | Grid Dip Meter 440 KHz-280 mHz | £13.45 |
| 500 | 30 K/V Multimeter | £9.25 |
| | With leather case | £10.50 |
| 200H | 20K/V Multimeter | £4.20. With case £4.95 |
| AF105 | 50K/V Multimeter | £8.50. With case £9.50 |
| U4341 | AC/DC Multimeter with transistor tester with steel case | £10.50 |
| TE20D | RF Generator 120KHz-500MHz | £15.95. Carr. 35p |
| TE22D | Audio Generator 20Hz-200KHz | £17.50. Carr. 35p |
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ALL NOMBREX MODELS IN STOCK

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UK's Largest Range—Write phone or call in. Details and demonstrations on request.

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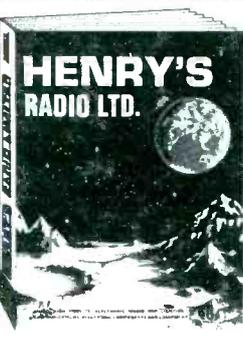
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