PRACTICAL WIRELESS

NOVEMBER 1974

25p

SPECIAL audio ISSUE

ADD-ON STEREO HI-FI UNITS

SCRATCH & RUMBLE FILTER

TONE CONTROL UNIT

ALSO:-

Section 2 of the P.W. BUYERS' GUIDE

AND

CONCLUDING THE PW TELE-TENNIS - FINAL ADJUSTMENTS

NEW EDU-KIT MAJOR

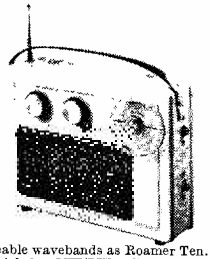
Completely Solderless Electronic Construction Kit
Build these projects without soldering iron or solder

- ★ 4 Transistor Earpiece Radio.
- ★ Signal Tracer.
- ★ Signal Injector.
- ★ Transistor Tester NPN-PNP.
- ★ 4 Transistor Push Pull Amplifier.
- ★ 5 Transistor Push Pull Amplifier.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ 5 Transistor Short Wave Radio.
- ★ Electronic Metronome.
- ★ Electronic Noise Generator
- ★ Batteryless Crystal Radio.
- ★ One Transistor Radio.
- ★ 2 Transistor Regenerative Radio.
- ★ 3 Transistor Regenerative Radio.
- ★ Audible Continuity Tester.
- ★ Sensitive Pre-Amplifier.

Total Building Costs £7·23 P P & Ins. 44p (Overseas P & P £1·85) (+ 8% VAT 57p)

Components Include: 24 Resistors ● 21 Capacitors ● 10 Transistors ● 3¼" Loudspeaker ● Earpiece ● Mica Baseboard ● 3 12-way connectors ● 2 Volume controls ● 2 Slider Switches ● 1 Tuning Condenser ● 3 Knobs ● Ready Wound MW/LW/SW Coils ● Ferrite Rod ● 6½ yards of wire ● 1 Yard of sleeving etc. ● Parts Price List and Plans 50p. (Free with parts).

NEW ROAMER NINE

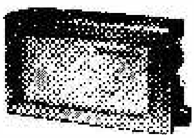


WITH V.H.F. INCLUDING AIRCRAFT

Nine Transistors, 9 Tuneable wavebands as Roamer Ten. Built in ferrite rod aerial for MW/LW. Retractable chrome-plated telescopic aerial for VHF and SW. Push Pull output using 600 mW transistors. 9 Transistors and 3 diodes, tuning condenser with V.H.F. section, separate coil for aircraft, moving coil loudspeaker, volume ON/OFF and wavechange controls. Attractive all white case with red grille and carrying strap. Size 9½" × 7" × 2¾" approx. Parts Price List and Plans 30p (Free with parts).

Total Building Costs £6·95 P P & Ins. 44p (Overseas P & P £1·85) (+ 8% VAT 55p)

POCKET FIVE

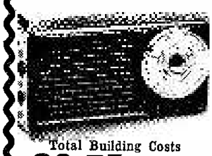


NOW WITH 3" LOUDSPEAKER

3 Tunable wavebands. M.W. L.W. and Trawler Band, 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, attractive black and gold case. Size 5½" × 1½" × 3½" approx. Plans and Parts Price List 15p (Free with parts).

Total Building Costs £2·50 P P & Ins. 26p (+8% VAT 20p) (Overseas P & P £1·25)

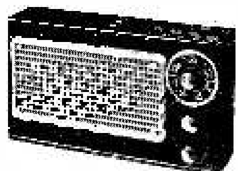
TRANSONA FIVE NOW WITH 3" LOUDSPEAKER



Wavebands, transistors and speaker as Pocket Five. Larger Case with Red Speaker Grille and Tuning Dial. Plans and Parts Price List 15p (Free with parts).

Total Building Costs £2·75 P P & Ins. 26p (+8% VAT 21p) (Overseas P & P £1·25)

NEW Everyday Series



Build this exciting New series of designs

E.V.5. 5 Transistors and 2 diodes. MW/LW. Powered by 4½ volt Battery. Ferrite rod aerial, tuning condenser, volume control, **and now with 3" loudspeaker.** Attractive case with red speaker grille. Size 9" × 5¼" × 2½" approx. Parts Price List and Plans 15p. Free with parts.

Total Building costs £2·95 P P & Ins. 30p (+ 8% VAT 23p) (Overseas P & P £1·25)

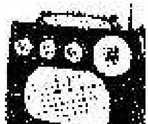
E.V.6. Case and looks as above. 6 Transistors and 3 diodes. Powered by 9 volt battery. Ferrite rod aerial, 3" loudspeaker, etc., MW/LW coverage. Push Pull output. Parts Price List and Plans 15p. Free with parts.

Total Building Costs £3·60 P P & Ins. 30p (+ 8% VAT 29p) (Overseas P & P £1·25)

E.V.7. Case and looks as above. 7 Transistors and 3 diodes. Six wavebands. MW/LW, Trawler Band, SW1, SW2, SW3, powered by 9 volt battery. Push Pull output. Telescopic aerial for short waves. 3" Loudspeaker. Parts Price List and Easy Build Plans 20p. Free with parts. Overseas P & P £1·05.

Total Building Costs £4·08 P P & Ins. 31p Overseas P & P £1·85 (+ 8% VAT 32p)

ROAMER EIGHT Mk I

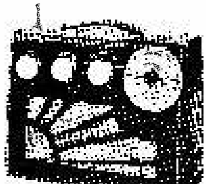


NOW WITH VARIABLE TONE CONTROL

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Chrome plated Telescopic aerial can be angled and rotated for peak short wave listening. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Latest 4" 2 watt ferrite magnet loudspeaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts price list and plans 25p (FREE with parts).

Total building costs £6·98 P P & Ins. 47p (+ 8% VAT 56p) Overseas P & P £1·85)

ROAMER TEN



WITH VHF INCLUDING AIRCRAFT

10 Transistors. Latest 4" 2 watt Ferrite Magnet Loudspeakers. 9 Tunable Wavebands, MW1, MW2, LW, SW1, SW2, SW3, Trawler Band, VHF and Local Stations also Aircraft Band.

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

Total building costs £8·50 P P & Ins. 52p (Overseas P & P £1·85) (+ 8% VAT 68p)

"EDU-KIT"

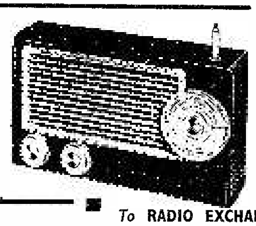
Build Radios, Amplifiers, etc., from easy stage diagrams.

Five units including master unit to construct.

Components include:
Tuning Condenser: 2 Volume Controls: 2 Slider Switches: Fine Tone 3" Moving Coil Speaker: Terminal Strip: Ferrite Rod Ariel: Battery Clips: 4 Tag Boards: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ½" Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction.
Parts price list and plans 25p (FREE with parts).

Total building costs £5·50 P P & Ins. 33p (Overseas P & P £1·85) (+ 8% VAT 44p)

TRANS EIGHT 8 TRANSISTORS and 3 DIODES



6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2¾in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and plans 25p (FREE with parts).

Total building costs £4·48 P P & Ins. 33p (+ 8% VAT 36p) (Overseas P & P £1·25)

ROAMER SIX CASE AND LOOKS AS TRANS-EIGHT

6 Tunable Wavebands: MW, LW, SW1, SW2. Trawler band plus an extra Medium waveband for easier tuning of Luxembourg, *etc.* Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2¾in. approx. Plans and parts price list 25p (FREE with parts).

Total building costs £3·98 P P & Ins. 31p (Overseas P & P £1·85) (+ 8% VAT 32p)

RADIO EXCHANGE LTD

★ Callers side entrance "Lavells" shop.
★ Open 10–1, 2.30–4.30, Mon.–Fri. 9–12 Sat.

To RADIO EXCHANGE CO., 61a HIGH STREET, BEDFORD, MK40 1SA
Tel.: 0234 52367. Reg. No. 788372.

I enclose £.................... for ....

Name ....

Address ....

(Dept. PW11.)

PRACTICAL WIRELESS

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NOVEMBER 1974

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

EDITOR
Lionel E. Howes, G3AYA

ASSISTANT EDITOR
Eric Dowdeswell, G4AR

ART EDITOR Peter Metalli

PRODUCTION & NEWS EDITOR Colin R. Riches

PROJECTS SUB-EDITOR
Geoffrey C. Arnold

TECHNICAL ARTIST
Alan Martin

SECRETARIAL Susan King
01-634 4292

ADVERTS. MANAGER
01-634 4293 Roy Smith

CLASSIFIED ADVERTS.
01-634 4301 Colin R. Brown

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

NEWS & COMMENT

CONSTRUCTIONAL

OTHER FEATURES

PLUS BUYERS' GUIDE to Radio and Electronic Components—PART 2

STAFF CHANGES

Lionel Howes has been appointed Editor of Practical Wireless and of our associate magazine Television. Eric Dowdeswell has been appointed Assistant Editor of Practical Wireless.

HUGE DISCOUNTS

ON LEADING BRAND HI-FI

ALL RSC PRICES INCLUDE VAT
LOW DEPOSIT CREDIT TERMS

*Full labour and material guarantees for 12 months

	List Price	RSC Price
WHARFEDALE DENTON	£42·31 Pr.	£29·95
WHARFEDALE LINTON	£52·39 Pr.	£38·95
LEAK 250 SPEAKERS	£65·48 Pr.	£42·00
LINEAR 202 AMPLIFIER	£39·23	£24·95
ROTEL RT222 AM/FM Tuner	£50·57	£36·95
ROTEL RT322	£73·16	£53·50
ROTEL RX150 A Tuner/Amp	£77·09	£54·95
LEAK 2000 Tuner/Amp	£165·70	£134·95
Wharfedale Denton Tun/Amp	£93·28	£59·95
RANK 150a Stereo System	£139·90	£79·95

Also Shure Cartridges, Basf Tape, Koss H/Phones, etc.
Prices of above correct at Sept 25 1974

AKAI TAPE UNITS

All £1 carr.

	Rec. Price	
GXC 36D	£110·72	£72·50
GXC 38	£147·19	£104·95
GXC 38D	£137·38	£97·95
GXC 46D	£157·59	£109·95
GXC 40T	£186·09	£135·95
GXC 75D	£199·90	£142·95
GXC 510D	£189·90	£135·95
GXR 82D	£122·65	£89·95
4000 DS	£130·12	£94·95
4000 DB(Dolby)	£196·27	£139·95
1721 L	£118·58	£84·95
CR 81D	£98·10	£69·95
CS33D	£105·81	£75·95

GOLDRING GL72 T/Table & G800 **£29·95** (Approx. value £46) Carr. 75p

GOLDRING GL75 T/Table & G800 **£34·95** (Approx. value £65) Carr. 85p

PIONEER PL12D T/Table on plinth & cover **£41·75** List £61·90

BSR TD8S 8 track player. Special price £14·95

T/TABLES with MAGNETIC CARTRIDGE/PLINTH & COVER

GARRARD SP25 MK IV with G850 **Special Price £19·95** (Carr. £1)

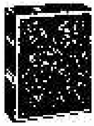
McDONALD MP60 with G800 or G850 „ „ **£19·95** (Carr. £1)

RANK BD2000 Rec. Price £67·27 **£48·95** (Carr. £1)

FANE HI-FI LOUDSPEAKERS AT APPROXIMATELY HALF-PRICE

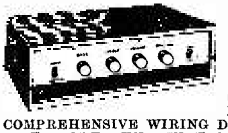
UNREPEATABLE OFFER · BRAND NEW · BOXED · FULLY GUARANTEED for High-Fidelity NOT Group Disco use
Available by Mail Order only due to small quantities of some models. SAE for leaflets. Please state impedance required.

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
505	£2·73	806	£2·56	121/10	£3·17	138/10LR	£2·50	138/15TLR	£4·96	122/10TLR	£6·36	122/14ALR	£9·52	152/12A	£11·33
506	£2·61	1001	£4·37	121/10T	£3·37	138/10TLR	£2·63	101/10A	£4·27	122/12	£6·75	122/17	£10·26	152/14	£12·49
507	£1·08	1002	£4·19	121/11	£3·58	138/11	£3·55	101/14	£6·64	122/12A	£7·08	122/17A	£10·59	152/17	£14·96
508	·96	1005	£3·65	121/11T	£3·78	138/11LR	£3·87	101/14A	£6·74	122/12D	£6·88	122/17T	£10·59	153	£17·48
801	£3·93	1006	£3·50	121/15	£4·61	138/13	£3·83	122/10	£5·16	122/12T	£7·08	122/17LR	£10·98		
802	£3·69	1008	£2·93	121/15LR	£5·33	138/13LR	£4·15	122/10A	£5·49	122/14	£8·47	122/17ALR	£11·31		
802T	£3·82	1001LR	£5·09	138/10	£2·18	138/15	£4·51	122/10LR	£6·03	122/14A	£8·80	152/10	£9·26		
805	£3·25	1005LR	£4·37	138/10T	£2·31	138/15LR	£4·83	122/10T	£5·49	122/14LR	£9·19	152/12	£10·84		



RSC G66 MkII 6+6 WATT high quality STEREO AMPLIFIER

Controls: Bass, Treble, Vol. and Bal. 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Bass Control ± 12db. Treble Control ± 13db. Selector switch for Crystal P.U. or Tape/Radio. For speaker output impedances of 3 — 15 ohms. For standard 200-250v. A.C. mains operation. Attractive Black and Silver finished metal fascia plate and matching control knobs.

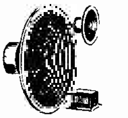


COMPLETE KIT OF PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT and COMPREHENSIVE WIRING DIAGRAMS & INSTRUCTIONS **£12·95** Carr. 40p
Or FACTORY BUILT IN TEAK VENEERED CABINET as illustrated £16·95 or dep. £2·12 and 8 monthly payments £2·12 (Total £19·08).

HI-FI SPEAKER ENCLOSURES

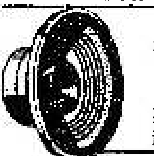
Teak veneer Sizes approx. Carr. 50p. per enc.

JE8	16 × 11 × 9in.	Cut for 8in. spkr.	£5·95
SE10	25 × 16 × 9in.	Cut for 10in. and Tweeter	£8·95
SE12	25 × 16 × 9in.	Cut for 12in. and Tweeter	£8·95



AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 11,000 Gauss 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£7·50** Carr. 45p
OR SENIOR 15 WATT INCLUDING HF126 15,000 GAUSS SPEAKER **£7·95** Carr. 50p



AUDIOTRINE HIGH FIDELITY SPEAKERS

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

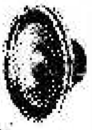
HF808T	8"	10W	£2·55	HF120D	12"	15W	£6·50
HF102D	10"	10W	£3·50	HF126	12"	15W	£7·95
HF120	12"	15W	£5·95	HF126D	12"	15W	£8·50

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

200-250v. AC mains operated. Response 30-20,000 c.p.s. —2dB. 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. O/P rating I.H.F.M. Enclosed enamelled case 9¼ × 2¾ × 5¼in. Silver finish facia 10¼ × 3¼in. Complete kit, wiring diagrams and instructions. **£7·95** Carr. 40p. FACTORY BUILT **£10·95**

FANE 807T HIGH FIDELITY SPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. Cast chassis Roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 30 c.p.s. Tweeter cone is fitted to extend high note response. Frequency range 25 Hz to 15 KHz. Gauss 10,000. Impedance 3 or 8-15 Ω.
PLEASE STATE IMPEDANCE REQUIRED List £4·42 **£3·99**
MODEL 803T 8" 15w. with parasitic Tweeter. Response 25 Hz to 15 KHz. Gauss 13,000 Imp 3 or 8-15 Ω. **£5·50** List £6·38



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

Fully Transistorised. Hi-Fi o/p of 6·5 watts per channel. Optimum performance with any crystal or ceramic P.U. Cartridge, Radio Tuner, Tape Rec. etc. Input Sel. Switch, Bass, Treble, Vol. & Bal. Controls. COMPLETE KIT OF PARTS WITH FULL WIRING DIAGRAMS & INSTRUCTIONS **£12·95** Carr. 40p.
Factory built with 12 mths guarantee **£16·61** Or in Teak Veneer housing **£19·55** Dep. £2·50 & 8 mthly pymts £2·50 (Total £22·50).

AUDIO FIDELITY FR1 SPEAKER KIT

Response 30Hz-15KHz. Rating 15 watts in sealed cabinet. Imp. 8-15 ohms. 8" Bass Unit with P.V.C. Cone surround for ultra low resonance. Pressure Tweeter. Printed Circuit. Inductive/Capacitive Cross-over. Damping Material, Screws, Terminal Panels. **£10·78** each, Carr. Free.
SPECIAL OFFER **£14·99** Pair Carr. 50p

HI-FI 8" x 5" 7 watt SPEAKERS

with parasitic Tweeter 8 ohm imp. P.p. 20p **£1·25**

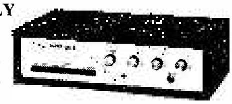
R.S.C. MkIII SUPER 30 HIGH FIDELITY STEREO AMPLIFIER

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

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

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

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



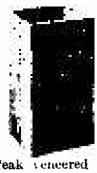
COMPLETE KIT (less cabinet). Carr. 70p. Cabinet if req. £4·90 extra. **£22·50**
Assembled unit in cabinet £42·50

'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

★ Moderate size only 25 × 14 × 10in. approx.
★ Response 30-20,000 c.p.s. Impedance 15 ohms
Performance comparable with units at twice the cost

COMPLETE KIT **£25·95** Carr. 75p

Deposit £4·71 and 8 monthly payments £3·12 (Total £29·67)
Consists of (1) 12in. 15w Bass unit with cast chassis. Roll rubber cone surround for ultra low resonance. (2) 3-way quarter section series cross-over system. (3) 8 x 5in. high flux middle range speaker. (4) Dome Pressure Tweeter. (5) Quantity acoustic damping material. (6) Handsome Teak veneered cabinet. (7) Circuit and full instructions.



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

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

MIDGET CLAMPED TYPE 2⅝ × 2⅝ × 2¼in.
250v., 60mA, 6·3v. 2a .... £1·50
250-0-250v., 60mA 6·3v 2a .... £1·60

FULLY SHROUDED UPRIGHT MOUNTING
250-0-250v. 60mA, 6·3v. 2a., 0-5-6·3v. 2a. £2·25
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
300-0-300v. 130mA, 6·3v. 4a. c.t., 6·3v. 1a.
For Mullard 510 Amplifier .... £4·50
350-0-350v. 100mA, 6·3v. 4a., 0 5-6·3v. 3a. £3·75
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a. £4·50
425-0-425v. 200mA, 6·3v. 4a., c.t., 5v. 3a. £8·50
425-0-425v. 200mA, 6·3v. 4a., Twice 5v. 3a. £8·70
450-0-450v. 250mA, 6·3v. 4a., c.t., 5v. 3a. £9·00

TOP SHROUDED DROP-THRO' TYPE
250-0-250v. 70mA, 6·3v. 2a., 0-5-6 3v. 2a. £2·25
250-0-250v. 100mA, 6·3v. 3·5a. .... £2·50
250-0-250v. 100mA, 6·3v. 2a., 6·3v. 1a. .. £2·75
350-0-350v. 80mA, 6·3v. 2a., 0-5-6·3v. 2a. £2·75
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
300-0-300v. 130mA, 6·3v. 4a., c.t. 6·3v. 1a.
Suitable for Mullard 510 Amplifier...... £4·50
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a. £4·50

FILAMENT or TRANSISTOR POWER PACK
Types 6·3v. 1·5a. 77p; 6·3v. 2a. 80p; 6·3v. 3a. £1·45p; 6·3v. 6a. £2 25; 12v. 1a. 80p; 12v. 3a. or 24v. 1·5a £2·25; 0·9-18v 1½a £1·95; 0-12-25-42v 2a £2·75.

CHARGER TRANSFORMERS 0-9-15v. 1½a. £1·75, 2½a. £1·95; 3a. £2·00; 5a. £2·45; 6a. £2·75; 8a. £3·00

AUTO (Step UP/step DOWN) TRANSFORMERS
0-110/120v. 200-230-250v. 50-80 watts £2·50, 150 watts, £4·50 250 watts £5·50; 500 watts £8·50

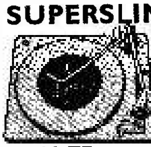
OUTPUT TRANSFORMERS
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω .. £1·45
Push-Pull 10 watts 6V6, 3-5-8-15 Ω .. £2·25
Push-Pull EL84 to 3 or 15 Ω 10-12 watts.. £2·25
Push-Pull Ultra Linear for Mullard 510, etc. £3·75
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω .... £3·20
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω £5·50

SELENIUM RECTIFIERS F. W. (Bridged)
All 6/12v. D.C. output. Max. A.C. input 18v.
1a, 38p. 2a, 49p. 3a, 65p. 4a, 81p. 6a, 97p.

L.F. CHOKES
150mA, 7-10H, 250 Ω £1·10; 100mA, 10H, 200 Ω 95p; 60mA, 10H, 400 Ω 35p.

ALL OUR PRICES INCLUDE V.A.T.

BSR LATEST SUPERSLIM



STEREO AND MONO

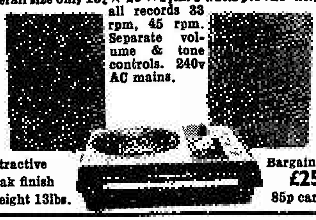
Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. AC 200/250v.. Size 13¼ × 11½in. Above motor board 3⅛in. Below motor board 2½in. With STEREO and MONO XTAL **£6·75** Post 45p.

PORTABLE PLAYER CABINET

Modern design. Black rexine covered Silver front grille. Chrome fittings. Motor board cut for BSR deck. **£4·50** Post 45p.

COMPACT PORTABLE STEREO HI-FI

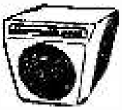
Two full size loudspeakers 13½ × 10 × 3⅛in. Player unit clips to loudspeakers making it extremely compact. Overall size only 13½ × 10 × 8⅛in. 3 watts per channel, plays all records 33 rpm, 45 rpm. Separate volume & tone controls. 240v AC mains.



Attractive Teak finish Weight 13lbs.

Bargain Price **£25** 85p carriage

SPECIAL OFFER



SMITH'S CLOCKWORK 15 AMP TIME SWITCH 0-60 MINUTES

Single pole two-way. Surface mounting with fixing screws. Will replace existing wall switch to give light for return home, garage, automatic anti-burgular lights, etc. Variable knob. Turn on or off at full or intermediate settings. Makers last list price £4·50. Brand new and fully guaranteed. Fully insulated. OUR PRICE £1·95 Post 25p

WEYRAD P50—TRANSISTOR COILS

RA2W Ferrite Aerial..85p	Printed Circuit. PCA1..65p
I.F. P50/2CC 470 kc/s..40p	J.B. Tuning Gang ..£1·20
3rd I.F. P50/3CC......40p	Weyrad Booklet 10p
Spare Cores 3p	OPT1 ....65p
P50/IAC 60p	Driver Trans. LFDT4..65p

Ferrite Rod 8 × ⅜in. 20p 6 × $\frac{5}{16}$in. 20p 3 × ⅜in. 10p

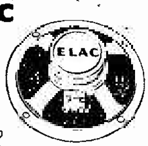
VOLUME CONTROLS

5 K. ohms to 2 Meg. LOG or LIN. L/S 20p. D.P. 35p. STEREO L/S 55p. D.P. 75p. Edge 5K.S.P. Transistor 25p

80 Ohm Coax 5p. yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £2; 60 yd. £3. FRINGE LOW LOSS Ideal 625 & colour **10p yd.**

8in & 10 x 6in ELAC HI-FI SPEAKER



Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 c/s. Bass resonance 55 c/s. 8 ohm 10 watt. **£3·75** Each Post 52p

10 inch 12 watt Twin Cone, 8 ohm £4·50

E.M.I. 13½ × 8in. SPEAKER SALE!

With twin tweeters and crossover, 10 watt. State 3 or 8 or 15 ohm. (As illustrated) **£4·50** Post 25p

With flared tweeter cone and ceramic magnet. 10 watt. Bass res. 45-60 c/s. Flux 10,000 gauss. State 3 or 8 or 15 ohm. Post 25p **£2·75**

BOOKSHELF CABINET Size 16 × 10 × 9 in. teak finish **£6·60** Post 25p

E.M.I. 13 × 8 in. BASS WOOFER. 20 WATTS 15Ω RUBBER CONE SURROUND. £5·50 Post 25p.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides 6 × 4in. 45p; 8 × 6in. 53p; 10 × 7in. 65p; 12 × 8in. 85p; 14 × 9in. 90p; 16 × 6in. 90p; 12 × 3in. 50p; 16 × 10in. £1. ALUMINIUM BOXES 3 × 3 × 3in. 60p; 4 × 4 × 4in. 70; 6 × 4 × 4in. 80p; 9 × 4 × 4in. £1; 12 × 4 × 4in. £1·80. ALUMINIUM PANELS 18 s.w.g. 6 × 4in. 12p; 8 × 5in. 19p; 14 × 3in. 20p; 10 × 7in. 24p; 12 × 5in. 25p; 12 × 8in. 34p; 16 × 6in. 34p; 14 × 9in. 40p; 12 × 12in. 47p; 16 × 10in. 60p PAXOLIN PANEL 10 × 8in. 30p.

SPECIAL OFFER

100 ohm 20W Rheostat 2½in. diam. Ceramic Former, screw terminals, ¼in. diam. spindle. 95p, post 25p.

ANOTHER RCS BARGAIN!

ELAC 9 × 5in. HI-FI SPEAKER. TYPE 59RM. THIS FAMOUS AND WIDELY USED UNIT NOW AVAILABLE AT BARGAIN PRICE 10 WATT. 8 OHM. CERAMIC MAGNET. **£2.95**

R.C.S. STABILISED POWER PACK KITS

All parts and instructions with Zener Diode, Printed Circuit, Bridge Rectifiers and Double Wound Mains Transformer. Input 200/240V a.c. Output voltages available 6 or 9 or 12 or 15 or 18 or 20V d.c. at 100mA or less. PLEASE STATE VOLTAGE REQUIRED. Details S.A.E. Size 3½ × 1½ × 1½in. **£2·20** Post 20p

R.C.S. GENERAL PURPOSE TRANSISTOR PRE-AMPLIFIER BRITISH MADE

Ideal for Mike, Tape, P.U., Guitar, etc. Can be used with Battery 9-12v. or H.T. line 200-300V. d.c. operation. Size 1¾" × 1¾" × ½". Response 25 c/s. to 25 Kc/s, 26 dB gain. For use with valve or transistor equipment. Full instructions supplied. Details S.A.E. **99p** Post 20p

TEAKWOOD LOUDSPEAKER GRILLS. Will easily fit to baffle board. Size 18½ × 10½in—75p. 10½ × 7⅞in- 45p.

E.M.I. WOOFER AND TWEETER KIT

Woofer 10½ × 6½in. Ceramic Magnet, 44oz. 13,000 lines. Tweeter 3½in. square, 10,000 lines. Crossover condenser full instructions supplied. Impedance 8 ohms. Power 12 watts. **£5·75** Post 45p.

BRITISH FM/VHF TUNING HEART

88 to 108 M/CS British made. 2 Transistors ready aligned requires 10·7 M/CS I.F. Complete with tuning gang. Connections supplied but some technical experience essential Post 20p. **Our price £3·95** 10·7 M/Cs IF Strip £4·95

MAINS TRANSFORMERS

All post 25p each

Eagle MT12 12-0-12V 50mA 99p
250-0-250 80 mA. 6·3V 3·5A 6·3V 1A or 5V 2A......£2·50
350-0-350 80 mA 6·3V 3·5A, 6·3V 1A or 5V 2A....£3·00
300-0-300V 120mA, 6·3V 4A C.T.; 6·3V 2A........£4·25
MINIATURE 200V 20mA, 6·3V 1A £1
MIDGET 220V 45mA, 6·3V 2A £1.10
HEATER TRANS. 6·3V ½ amp 85p. 3 amp £1·20
GENERAL PURPOSE LOW VOLTAGE. Trapped outputs at 2 amp, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30V £3·00
1 amp, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £3·00
2 amp, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £4·00
3 amp. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £6·00
5 amp. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £9·75
5, 8 and 13V 5 amp £1·20. 3 amp, 3, 5, 8, 10, 13 and 5-0-5V £1·30, Ditto 5 amp. £1·50; 6-0-6V 500mA 90p 9V 1 amp 95p 12V 300mA 75p 12V 500mA 85p 12V 750mA 95p. 12, 36, 48V 2 amp £2. 20V 3 amp £2.
AUTO TRANSFORMERS, 115V to 230V or 230V to 115V 150W £2·95; 600W £7·50; 750W £10; 1000W £15
CHARGER TRANSFORMERS. Input 200/250V. for 6 or 12V, 1½ amp £1·50; 2 amp £1·80; 4 amp £3·50
BATTERY CHARGERS. Ready built with leads and clips 1½ amp £2; 4 amp £4; 5 amp. £4·50.
FULL WAVE BRIDGE CHARGER RECTIFIERS; 6 or 12V outputs. 1½ amp 40p; 2 amp 55p; 4 amp 85p.

MAINS ISOLATING TRANSFORMER

Primary 0-110-240V. Secondary 0-240V. 3A. 720W. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. Famous make. (Value £19) OUR PRICE **£12** Carr. 95p

Can be used as 800W auto transformers 240-110V. IDEAL FOR COLOUR T.V. OR GARDEN TOOLS.

NEW ELECTROLYTIC CONDENSERS

2/350V ..	14p	100/25V ..	10p	50+50/300V ..	50p
4/350V ..	14p	250/25V	14p	350+50/325 ..	85p
8/350V ..	22p	500/25V	20p	32+32/350V ..	40p
16/450V	25p	1000/25V ..	35p	32+32/450V ..	60p
32/450V	35p	1000/50V ..	47p	32+32+32/350V	65p
32/500V	50p	8+8/450V ..	22p	32+32+32/450V	85p
25/25V ..	10p	8+16/450V	25p	900/350V ..	95p
50/50V ..	10p	16+16/450V	40p	4700/63V ..	95p

LOW VOLTAGE ELECTROLYTICS

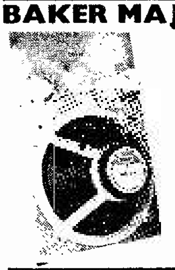
1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF. 15V. 10p. 500mF. 12V. 15p; 25V. 20p; 50V. 30p. 1000mF. 12V. 20p; 25V. 35p; 50V. 47p; 100V. 70p. 2000mF. 6V. 25p; 25V. 42p; 50V. 57p. 2500mF. 50V. 62p; 3000mF. 25V. 47p; 50V. 65p. 5000mF. 6V. 25p; 12V. 42p; 25V. 75p; 35V. 85p; 50V. 95p.

MICRO SWITCH. Single Pole Change Over. 20p. Sub Min 25p.

CERAMIC 1pF to 0·01mF, 4p. Silver Mica 2 to 5000pF, 4p. PAPER 350V-0·1 4p. 0·5 13p; 1mF 15p; 2mF 150V 15p. 500V-0·001 to 0·05 4p; 0·1 5p; 0·25 8p; 0·47 25p. TWIN GANG. "0-0" 208pF+176pF, £1·20; 500pF standard 75p; 365+365 with 25+25pF Slow motion drive 50p. SHORT WAVE, SINGLE. 10pF 30p; 25pF 55p; 50pF 55p. NEON PANEL INDICATORS. 250V AC/DC Amber 25p. RESISTORS. ¼W, ½W, 1W, 20% 1p; 2W, 5p. 10 Ω to 10M. HIGH STABILITY. ½ w. 2% 10 ohms to 6 meg., 10p. Ditto 5% Preferred values 10 ohms to 10 meg., 4p. WIRE-WOUND RESISTORS. 5 watt, 10 watt, 15 watt 10 ohms to 100K 10p each. TAPE OSCILLATOR COIL. Valve Type 35p.

NEW MODEL "BAKER LOUDSPEAKER" 12in. 50 watt GROUP 50/12 8 or 15 ohm high power full range. Professional quality. **£12·95**

BAKER MAJOR 12" £8·50



Post free

30-14,500 c/s. 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s Rated 20 watts. NOTE: 3 or 8 or 15 ohms must be stated.

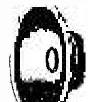
Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. Post free **£10·95** Please state 3 or 8 or 15 ohms.

BAKER "BIG-SOUND" SPEAKERS Post free

'Group 25'	'Group 35'	'Group 50'
12 inch 25 watt **£7·75**	12 inch 35 watt **£8·50**	15" 50 w **£17·80**
3 or 8 or 15 ohm	3 or 8 or 15 ohm	8 or 15 ohm

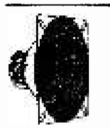
TEAK VENEERED HI-FI SPEAKER CABINETS
For 12in. or 10in. dia. speaker 20 × 13 × 9" £10·50 Post 25p
For 13 × 8in. or 8in. speaker 16 × 10 × 9" £6·60 Post 25p
For 8 × 5in. speaker 16 × 8 × 6" £4·95 Post 25p
For 6in. and tweeter 12 × 8 × 6" £4·00 Post 25p
LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft

EMI 6½in. HI-FI WOOFER



8 ohm, 10 watt. Large ceramic magnet. Special Rubber cone surround. Frequency response 30-12,000 c/s. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. Suitable cabinet 12 × 8 × 6 £4·00. Suitable Tweeter £2·00. **£4**

ELAC CONE TWEETER



The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 c/s to 18,000 c/s. Size 3½ × 3½ × 2in. deep. Rating 10 watt, 3 ohm Suitable Crossover £1·30 **£1·90** Post 20p

SPEAKER COVERING MATERIALS. Samples Large S.A.E. Horn Tweeters 2-16kc/s, 10W 8 ohm or 15 ohm £1·95. CROSSOVERS TWO-WAY 3000cps 3 or 8 or 15 ohm £1·30 LOUDSPEAKERS 3 OHMS. 7 × 4in. £1·25; 6½in. £1·50. 8 × 5in. £1·60 8in. £1·75; 10 × 6in. £1·90; 10in. £2·00. SPECIAL OFFER: 80 ohm, 2¼in.; 2¾in. 35 ohm. 2in., 3in., 25 ohm. 2½in. dia., 5in. dia, 6" × 4" 15 ohm, 3½in. dia.; 6 × 4in.; 7 × 4in.; 8 × 5in. 3 ohm, 2½in.; 2¾in.; 3½in.; 5in. dia. (6 × 4in. 8 ohm £1·50) **£1** EACH TYPE
RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8 in. diameter 4 watt £2·50. 10in. diameter 5 watt £2·50; 12 in. diameter. 6 watt £2·95.
VALVE OUTPUT TRANS. 40p; MIKE TRANS. 50:1 40p. Mike trans. mu metal 100:1 £1·25.

MAJOR 100 WATT ALL PURPOSE GROUP OR DISCO AMPLIFIER

All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 4 way mixing. Output 8/15 ohm. a.c. Mains. Separate treble and bass controls. **£49** Carr. £1·00

MAJOR 50 WATT 4 INPUTS. 2-WAY MIXING £39

3-WAY CROSSOVER 950 CPS and 3000 CPS with leads ready assembled **£1·95**

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt. **£4·50**

TWO CHANNEL STEREO VERSION **£5·95**

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume, treble and bass controls 18v. DC operation. **£3·95**

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p COAXIAL OUTLET BOXES, surface, 35p. BALANCED TWIN FEEDER 300 ohms 7p yard. JACK SOCKET Std. open-circuit 15p. closed-circuit 23p. Chrome Lead Socket 45p. Phono Plugs 8p. Phono Socket 8p. JACK PLUGS Std. Chrome 20p; 3·5mm Chrome 12p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 25p. DIN PLUGS 3-pin 18p; 5-pin 25p. VALVE HOLDERS. 5p; CERAMIC 10p; CANS 5p.

REVERSIBLE 4 POLE MOTOR £2·25

1,400 r.p.m. Reversible 42 Watt. Post 25p spindle 1¼" × 7/32", size 3½" × 3". As illustrated. With Cooling Fan 240V A.C.

E.M.I. GRAM MOTOR £1·00

120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2¾ × 2½ × 2½ in. Post 25p.

RADIO COMPONENT SPECIALISTS

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Open 9—6 Wed. 9—1 Sat. 9—5 (Closed for lunch 1.15—2.30)
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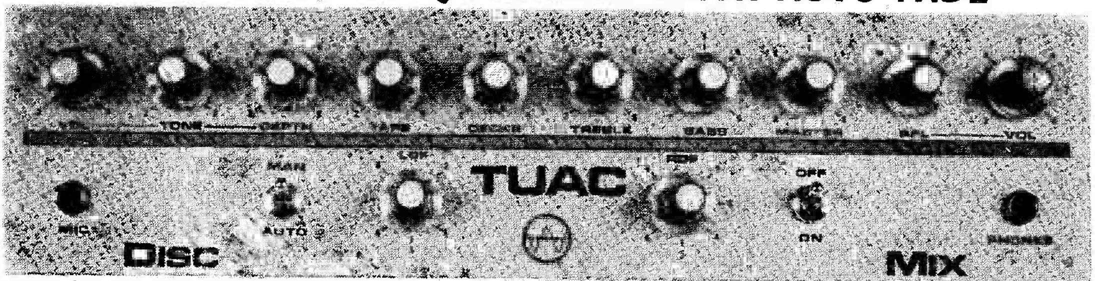
TUAC

TRANSISTOR UNIVERSAL AMPLIFICATION CO.LTD.
163 MITCHAM RD·LONDON SW17 9PG 01·672 3137/9080

TUAC DISCOTHEQUE MIXER WITH AUTO FADE



Designed for the discerning D.J. of professional standard Offering a vast variety of functions. Controls; Mic Vol; Tone, over-ride depth; auto/Manual Sw; Tape Vol; L & R Deck Faders; Deck Volume; Treble and Bass; H. Phon Vol Selector; Master Vol On/Off Sw. Max output 1V RMS.

Specification. Deck Inputs—50mV into 1mΩ; Deck Tone Controls—Treble +28 – 15dB at 12kHz. Bass +22 – 15dB at 40Hz; Mic input—200 ohms upwards. 2mV into 10kΩ; Mic Tone Control—Total Variation Treble 15dB. Total Variation Bass 10dB; Tape input —30mV into 47kΩ; Power Requirements—30–45 volts at 100mA.

£26·50

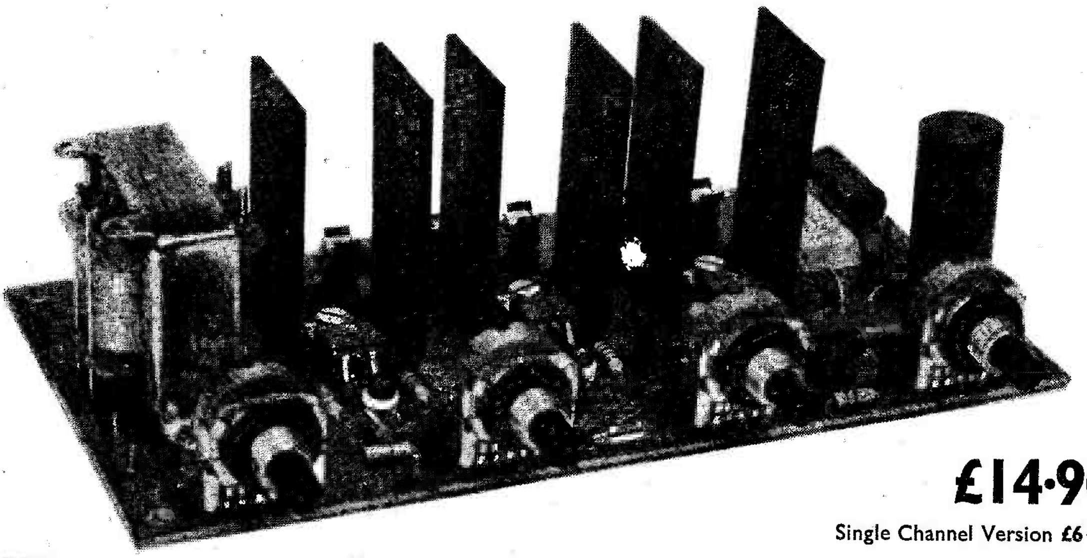
PANEL SIZE
18 × 4½ in.
DEPTH 3in.

TUAC MAIN DEALERS

BRISTOL DISCO CENTRE, 86 Stokes Croft, Bristol 1. Tel. Bristol 41666.
CALBARRIE AUDIO, 38 Cromwell Road, Luton Beds. Tel. Luton 411733.
SOCODI, 9 The Friars, Canterbury, Kent. Tel. Canterbury 60948.
WEC LIGHTING, 35 Northam Road, Southampton, Hants. Tel. Southampton 28102.
CALLERS ONLY

NEW! 3 CHANNEL LIGHT MODULATOR

- R.C.A. 8 Amp Triacs
- 1000W per channel
- Each channel fully suppressed and fused
- Master control to operate from 1W to 100W
- Full wave control—12 easy connections



£14·90

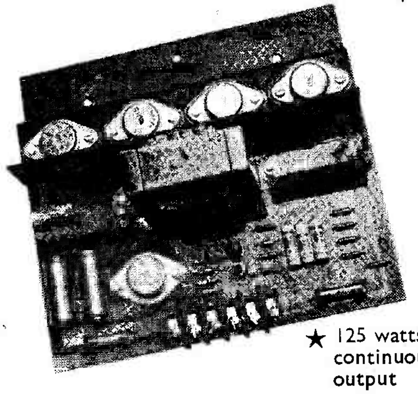
Single Channel Version **£6·60**

MANUFACTURERS OF ELECTRONIC AND AMPLIFICATION EQUIPMENT
SPECIALISTS IN QUALITY TRANSISTOR EQUIPMENT·OPEN 6 DAYS A WEEK 9·30am-6.00pm

TUAC

TRANSISTOR UNIVERSAL AMPLIFICATION CO. LTD.
163 MITCHAM RD · LONDON SW17 9PG 01-672 3137/9080

NEW TUAC POWER MODULES offering more power and quality than ever before.



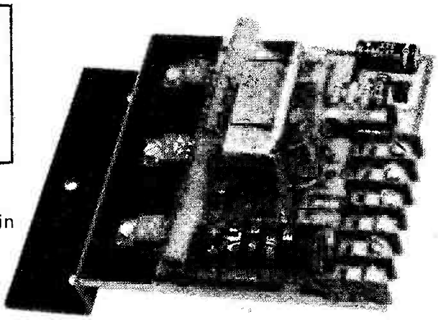
Specification on all power, modules: All output power ratings ± 0·5dB; Output impedance 8-15 ohms; THD at full power 2% typically 1%; Input sensitivity 60mV into 10kΩ; Frequency response 20Hz–20kHz ±2dB; Hum and noise better than —70dB.

TP125
7 x 6½ x 3in

£17·00

★ 125 watts RMS continuous sine wave output

★ 4 R.C.A. 150 watt 15 amp output transistors



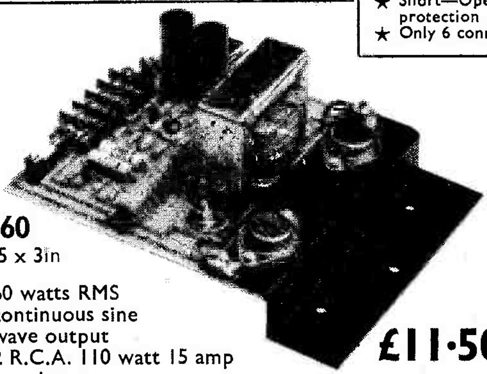
TL30
4 x 5¼ x 2½in

£9·30

★ 30 watts RMS continuous sine wave output

★ 2 R.C.A. 40 watt output transistor

★ Rugged layer wound driver transformer.
★ Short—Open—and Thermal overload protection
★ Only 6 connections



TL60
5 x 5 x 3in

★ 60 watts RMS continuous sine wave output

★ 2 R.C.A. 110 watt 15 amp transistors

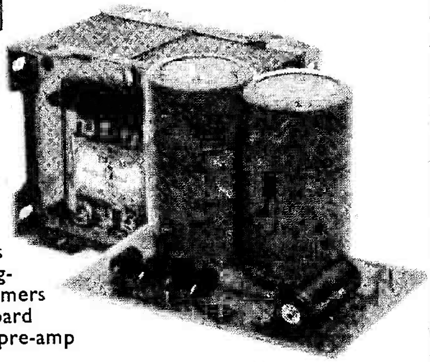
£11·50

TL100
5 x 5 x 3in

★ 100 watts R.M.S. continuous sine wave output

★ 2 R.C.A. 150 watt 15 amp transistors

£13·20



Power supplies vacuum impregnated Transformers with supply board incorporating pre-amp supply:

PS 125 ± 50 volts for one TP125	**£11·50**
PS 100 ± 45 volts for one TL100	**£10·50**
PS 60 ± 40 volts for one TL60	**£9·30**
PS 30 + 50 volts for one TL30	**£6·85**
PSU 2 for supplying disco mixer	**£4·65**

PREAMPLIFERS

All TUAC audio modules are constructed on glass fibre P.C. board, are ready assembled and fully tested. Low noise silicon and FET transistors together with H.S. carbon film resistors are used throughout. Extensive research has gone into various wide range tone control circuits producing superb sound quality from any signal.

VAO8 Vol. Treble, Mid and Bass controls. HI, IMP, FET, I/P, suitable Mid, Guitar, Radio, Crystal/Ceramic P.U. Sensitivity 4mV. Treble +35dB at 16kHz. Mid +20—15dB at 1kHz. Bass +20—10dB at 40Hz. **£4·90**

VAO6 Vol. Treble and Bass controls. Sensitivity 8mV. Treble +28—15dB at 12kHz. Bass ±18dB at 40Hz. **£4·15**

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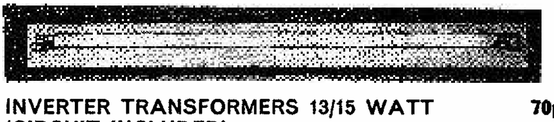

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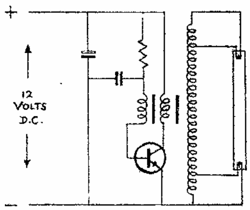

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H8/8A	16μF	16V	4p
H8/9A	20μF	70V	4p
H8/10	22μF	50V	4p
H8/11	25μF	12V	4p
H8/12A	30μF	10V	4p
H8/13A	32μF	50V	4p
H8/14	40μF	25V	5p
H8/14A	40μF	16V	4p
H8/15A	40μF	35V	4p
H7/1A	50μF	10V	4p
H7/2A	64μF	2·5V	2p
H7/4	64μF	15V	4p
H7/9A	125μF	4V	4p
H7/10A	160μF	2·5V	3p
H7/11	160μF	25V	6p
H7/11A	150μF	16V	5p
H7/14	220μF	50V	10p
H7/14A	220μF	16V	6p
H7/15	220μF	25V	5p
H7/15A	220μF	35V	10p
H6/1A	250μF	4V	3p
H6/3A	320μF	2·5V	3p
H6/4	320μF	10V	4p
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6·5AMP ISOLATED TAB

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NAS0651X	100V	·44
NAS0652W	200V	·58
NAS0652X	200V	·56
NAS0654W	400V	·84
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NAS1001X	100V	·80
NAS1002W	200V	·78
NAS1002X	200V	·74
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NAS1006W	600V	1·34
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NAS0302X	200V	·34
NAS0304W	400V	·52
NAS0304X	400V	·50
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8·5AMP ISOLATED TAB

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4 AMP ISOLATED TAB

NAS106P	50PIV	·26
NAS106Q	100PIV	·30
NAS106R	200PIV	·36
NAS106S	400PIV	·57

6 AMP ISOLATED TAB

NAS206P	50PIV	·37
NAS206Q	100PIV	·42
NAS206R	100PIV	·50
NAS206S	100PIV	·77

8 AMP ISOLATED TAB

NAS306P	50PIV	·41
NAS306Q	100PIV	·47
NAS306R	200PIV	·59
NAS306S	400PIV	·85

16 AMP ISOLATED TAB

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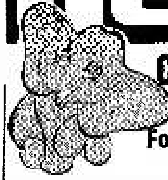

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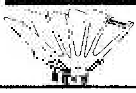

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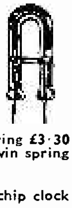

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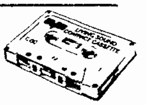

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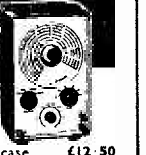

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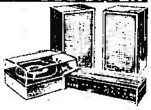

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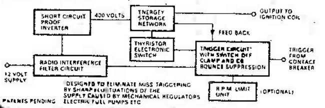

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Code	*Watts*	*Ohms*	*1 to 9*	*10 to 99*	*100 up* (see note below)
C	1/3	4·7–470K	1·3	1·1	0·9 nett
C	1/2	4·7–10M	1·3	1·1	0·9 nett
C	3/4	4·7–10M	1·5	1·2	0·97 nett
C	1	4·7–10M	3·2	2·5	1·92 nett
MO	1/2	10–1M	4	3·3	2·3 nett
WW	1	0·22–3·9Ω	11	10	8
WW	3	1–10K	9	8	6
WW	7	1–10K	11	10	8

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

Values: All E12 except C $\frac{1}{3}$W, C $\frac{3}{4}$W and MO $\frac{1}{2}$W.
E12: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
E24: as E12 plus 11, 13, 16. 20, 24, 30, 36, 43, 51, 62, 75, 91 and their decades.

Tolerances:
5% except WW 10% ± 0·05Ω below 10Ω and MO $\frac{1}{2}$W 2%.

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1·0	—	—	—	—	—	11p	—	8p
2·2	—	—	—	—	11p	—	8p	9p
4·7	—	—	—	11p	—	8p	9p	8p
10	—	—	—	—	8p	9p	8p	8p
22	—	—	8p	—	9p	8p	8p	10p
47	8p	—	9p	8p	8p	8p	10p	13p
100	9p	8p	8p	8p	9p	10p	12p	19p
220	8p	8p	9p	10p	10p	11p	17p	28p
470	9p	10p	10p	11p	13p	17p	24p	45p
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2,200	15p	18p	23p	26p	37p	41p	—	—
4,700	26p	30p	39p	44p	58p	—	—	—
10,000	42p	46p	—	—	—	—	—	—

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1000mF/25V **28p** 2200/100 **£1·56**
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5000/50 **£1·18**

POLYESTER TYPE C.280. *Radial leads for P.C.B. mounting. Working voltage 250V d.c.*
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0·068, 0·1, 0·15 ea. **4p**
0·22 **5p**; 0·33 **7p**; 0·47 **8p**; 0·68 **11p**; 1·0 **14p**; 1·5 **21p**; 2·2 **24p**

SILVERED MICA. *Working voltage 500V d.c.*
Values in pFs—2·2 to 820 in 32 stages ea. **6p**
1000, 1500 **7p**; 1800 **8p**; 2200 **10p**; 2700, 3600 **12p**; 4700, 5000 **15p**; 6800 **20p**; 8200, 10,000 **25p**

TANTALUM BEAD
0·1, 0·22, 0·47, 1·0 mF/35V, 1·5/20V, 3·5/16V ea. **14p**
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4·7/35V, 10/16V, 22/6·3V ea. **18p**
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Type B42540 Working Voltage—250V
Values in mF:
0·0047; 0·0068; 0·0082; 0·01; 0·012; 0·015 ea. **3p**
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6 ft strip **66p**

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Other sizes available

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	Socket	Plug
1 way loudspeaker	10p	12p
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5 way audio 180	12p	15p
5 way audio 240	12p	15p
6 way audio	13p	15p

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EXHIBITIONS ? !

WHAT is happening to the R.S.G.B. National Mobile Rally? This annual event, as many readers will be aware, took place in the grounds of Woburn Abbey during the month of August.

It was not the day of continuous rain that made the exhibition part of the rally a wash-out—attendance was good despite the climatic conditions. Apathy on the part of the organisers and many exhibitors resulted in dismal displays on nameless stalls.

Who were these nameless exhibitors? These people were, in effect, representatives of one of our greatest national activities—Amateur radio and the amateur electronics constructor. The question being asked was, "surely this is not the R.S.G.B. National Mobile Rally? I must have taken the wrong turning!"

Exhibitors displaying new equipment and those displaying 'surplus' gear were intermixed. Yours truly spent a considerable amount of time trying to find the whereabouts of various exhibitors, without avail. Little information was forthcoming—even from the R.S.G.B. stand itself! Well-established and respected manufacturers and distributors were conspicuous—by their absence. Who can blame them?

Someone had better pull up their socks or we may see the rapid demise of what should be, as the title implies, our *National Mobile Rally.*

Do you remember the Radio Communications or Hobbies Exhibitions sponsored by the Radio Society of Great Britain? They were held annually in the London area and were extremely popular. What happened to them.

Practical Wireless and other major organisations, gave their support on numerous occasions and we are justly proud of the part that we contributed by showing our flag, on behalf of the radio and electronic constructor.

This hobby of ours encompasses an exceedingly wide sphere in the field of electronics and it is the responsibility of the Editor and his staff—as a team—to balance the editorial contents of each issue—to cater for many tastes. The satisfaction that the constructor derives from 'switching it on' is extremely gratifying and indeed therapeutic. We are indeed fortunate in that we live in an era of component plethora. Of course, there are shortages in many areas, but we suggest that the pessimists cast a careful eye over the pages of our *1974/5 PW Buyers' Guide to Radio and Electronic Components.*

Many new items are included, each month by advertisers in their respective columns. Take a good look at the small print, you could be pleasantly surprised!

We shall be exhibiting at the 1974 International Audio Festival and Fair, Olympia, London. Many *PW* constructional projects will be on show, including unique constructional designs not yet published in this country. A further exciting development in the *PW Tele-Tennis* constructional project will also be unveiled.

Members of the editorial and advertising departments will be in attendance to deal with enquiries. We shall also have a limited number of free 'give-aways' to visitors.

Don't forget the *PW* slogan—*Stay tuned to PW* for full coverage of the finest and up-to-the minute constructional projects.

A date for your diary—*Practical Wireless*, Stand B12, International Audio Festival & Fair, Olympia, 28th October—3rd November inclusive.

LIONEL E. HOWES—Editor.

NEWS...

Crofton move

CROFTON ELECTRONICS have moved. Their new address is: 124 Colne Road, Twickenham, Middlesex. (Tel: 898 1569).

A foolproof Electric Lock

SOME quite clever ideas have appeared in journals for electronic locks. But our vote goes to a professional approach recently announced which, as far as we can see, is almost fool-proof. The code for this lock is carefully stored in a CMOS shift register memory. When the "electronic" key is inserted, the code in the key is interrogated by the lock which compares it with the code in its memory. If the two codes are identical the lock will open. The key itself contains another shift register with the identical code in its memory banks. Even a small 32-bit memory would provide a possible four million combinations.

When the key is inserted into the lock it activates a micro-switch. This causes the lock to transmit a series of pulses which in turn make the "key" enter its code into the lock for comparison.

Because the key does not emit signals (i.e. magnetic or sonic or anything else) it is impossible to "read" the code from the key. Again, any exploratory signals sent into the lock would immediately alter or destroy its memory (fail safe).

One last cunning asset. The speed of operation of the memory circuits in the lock is fast when opening the door with the correct. key. But slow by "logic" standards. If you were to permutate all combinations possible by plugging some sort of pulsing device into the lock instead of the key—it would take well over a year to run through all the possible combinations. Sorry—not available on the market yet and that's all the information we can get at present.

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

Not to be missed –

THE LATEST Heathkit Catalogue is now available free from: Heath (Gloucester) Limited, Bristol Road, Gloucester, GL2 6EE. Write, or phone Gloucester 29451, for a copy. Or if you happen to be in London or Gloucester, call in and collect one. The London Heathkit Centre is at 233 Tottenham Court Road. and the Gloucester showroom is next to the factory in Bristol Road.

The catalogue contains details of the very large range of electronic kits, many available for the first time in this country.

It talks in detail about kit building "The Heathkit Way" and shows how easy it is to build a Heathkit. Even a complete novice need have no worries as the instruction manual, with the aid of large pictorials and step-by-step instructions, leads you every step of the way.

Its 64 pages give details of many exciting models for home construction, ranging from a large selection of audio and Hi-Fi equipment through electronic calculators, digital electronic clocks, electronic thermometers, an ultrasonic burglar alarm, to test instruments for the electronic hobbyist and home car servicer. Even a 12 inch black and white portable television kit is available.

Heathkit's Catalogue

New kit models include an f.m. tuner with digital readout and computer tuner, a 4 channel SQ amplifier, a battery powered electronic thermometer and a de-luxe digital electronic clock with alarm. All models are available for cash or on extended credit terms through the very popular Heath Money Budget Plan. A free technical consultation service is in operation both before and after purchase.

You have been warned! Don't forget to order your copy of the December issue of *Practical Wireless* . . . look for your Free PW Miniature Screwdriver.

Start building the PW Kempton with our December issue. This is a quality stereo cassette player for your car; build yourself an inexpensive capacitance bridge that really works, and the third section of our 1974/5 PW Buyers Guide to Radio and Electronic Components will also be included in our December issue.

In the January 1975 issue of PW, we start the New Year with constructional series on radio control. Don't forget to place a permanent order with your newsagent, or write to our subscription department.

Further details of the December issue on page 609.

Hi-Fi Accessories by Bib

BIB HI-FI Accessories Limited announce the publication of a comprehensive 16-page full colour catalogue, which illustrates and describes their very large range of hi-fi accessories which now comprises more than 70 products.

The catalogue has been designed so that it can be easily reprinted in foreign languages and arrangements are already in hand to print it in French, German and Italian.

For the UK market a single sheet retail price list is inserted in the catalogue.

Bib Hi-Fi Accessories Ltd., PO Box 78, Hemel Hempstead, Herts, HP2 7EP.

Wolsey's Colour King at sea

WOLSEY ELECTRONICS equipment is now being increasingly used on marine installations and the most recent of these, through Aerialwork Limited of Southampton, their agents for Southern England, has been the installation of a communal TV and radio system to the officers and crews quarters on the car ferry "Eagle". In order to receive various transmitters whilst at sea, a Wolsey Broad Band "Colour King" u.h.f. aerial and FM411 array were erected with a rotator motor and remote control unit. The aerials and mast were specially treated to withstand exposed sea conditions. The well-proved Wolsey "Mercury" amplifier was fitted and provision was made for a monochrome video cassette recorder and additional outlet points to public rooms should this be required at some future date.

The 11,500 ton "Eagle" which is controlled by one of the P & O Group of Companies—Southern Ferries—is the largest on/off car ferry to use the port of Southampton and operates a regular service to Lisbon, Algeciras and Tangier.

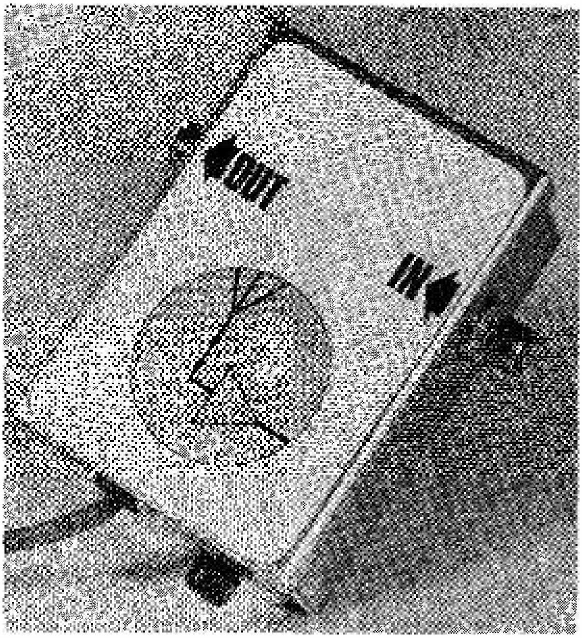
FM AERIAL pre-amplifier

KEITH CUMMINS

LONG-DISTANCE reception of weak FM signals is possible provided that a high gain aerial is used and that the receiver has high sensitivity. Some older types of receiver lack the sensitivity of their modern counterparts and the use of an aerial amplifier can improve reception considerably.

We have to be careful in the use of such an amplifier however, since high gain is not the only pre-requisite. If the amplifier adds as much noise as it increases the signal, then we are no better off. The amplifier must have a good noise factor, that is, it increases the signal by a much greater amount than it increases the noise.

Another aspect we have to consider is the type of reception we expect, having provided the amplifier. If the incoming signal is very weak indeed than we may be able to improve it, but if it fades away to nothing, no amount of amplification will bring it back again. This situation can exist during fading conditions, when total cancellation of the signal at the aerial occurs because of multipath reception. An amplifier can be useful, however, since it shortens the time during which the signal is unusable. Imagine a threshold level below which the signal must not fall if a satisfactory signal-to-noise ratio is to be maintained; if the amplifier lifts the entire incoming signal, this can fall to a lower level before becoming unsatisfactory.

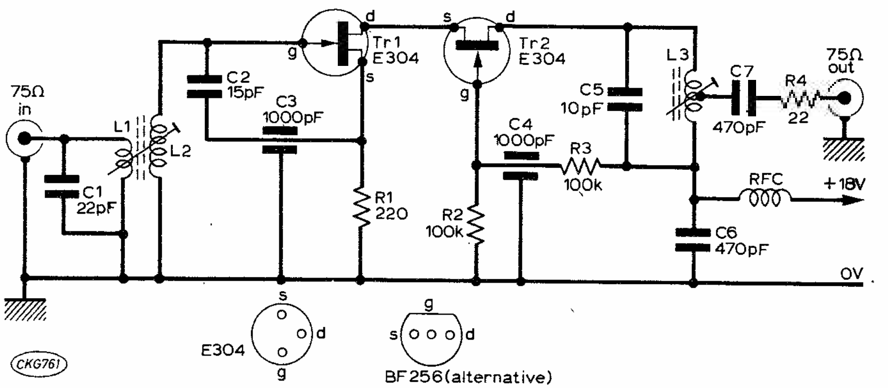


CROSS MODULATION

The VHF FM band is becoming quite crowded and the weak signals we wish to amplify may be situated very close to a strong local transmission. Unless our amplifier is correctly designed, a strong possibility exists that cross-modulation will occur between the various signals present, due to the high amplitude of the local signals. The signals we wish to receive may then become completely lost in the mess which results. Once this has happened, it is impossible to separate the signals again, so we must prevent such a thing happening in the first place.

Cross-modulation can not only occur in the amplifier but also in the input stages of the receiver. A valve receiver is far more tolerant of high input levels than its transistor counterpart. Too much amplification before the receiver's RF stage can therefore cause intermodulation and it will be seen that excessive gain can be a real disadvantage. Any aerial amplifier used for FM work should therefore not have so much gain that the local signals will cause cross modulation, have enough gain to substantially improve weak signals, and, itself, have

Fig. 1: The two FETs are connected in a cascode circuit, the first being an amplifier while the second is a buffer or isolating stage.



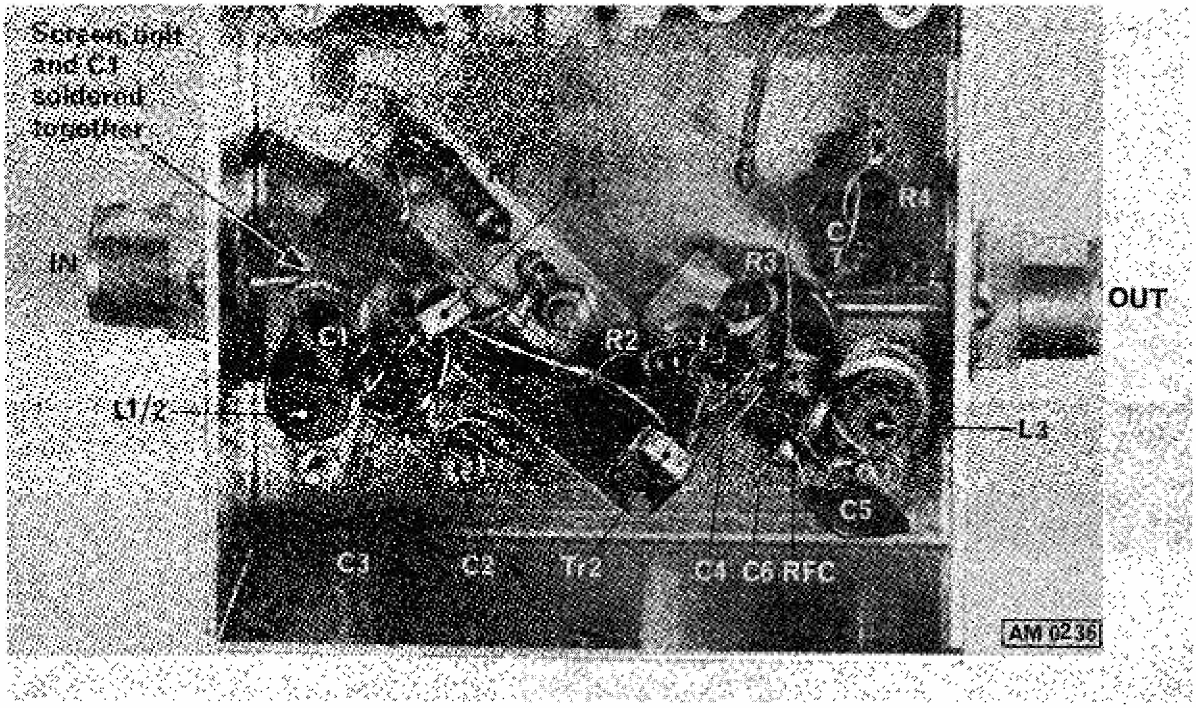


Fig. 2: This view of the amplifier shows all the components of Fig. 1. Most are mounted on either side of a metal screen to which earth returns can be soldered.

good cross-modulation characteristics. Above all, its signal-to-noise ratio should be as high as possible.

The cross-modulation requirements basically rule out the use of ordinary bipolar transistors. A very simple amplifier made up to prove the point produced a total jumble of signals which could not be separated. The use of field-effect transistors is much to be preferred, since they have a square law characteristic which helps prevent cross modulation from occurring.

A PRACTICAL DESIGN

The circuit of Fig. 1 shows a very successful aerial amplifier using FETs in a cascode configuration. The 75 ohm aerial signal is fed to the aerial coil L1, which is tightly coupled to L2. C1 is included to improve the aerial matching resulting in a useful improvement in signal-to-noise ratio. The input circuit to the FET gate is tuned by C2 connected from gate to source of the FET, the source being decoupled to earth by the feed-through capacitor C3. This input configuration has been found to provide the optimum energy transfer from the aerial to the FET.

As in all cascode configurations, the first stage provides the gain while the second provides isolation from input to output, so preventing feedback and instability. It is possible to provide neutralisation over just one FET stage, but because of the bandwidth requirements of our amplifier, the neutralisation could not be optimised and so the gain would not be constant over the band.

The arrangement shown is a satisfactory compromise between gain and bandwidth so that a useful gain of 12 to 15dB is obtained over the range 88-98 MHz. The output tuned circuit consisting of C5 and L3 has a tapping for the output, which is taken to the socket via C7 and R4. The input circuit required additional capacitive reactance to optimise the matching and it was found that the output circuit needed R4 to improve matching and prevent spurious instability. This could be the result of coupling the amplifier to the receiver by a coaxial cable less than half a wavelength long. The receiver's input impedance need not be entirely resistive.

CONSTRUCTION

A suggested layout is shown in Fig. 2. Great care should be taken when handling and connecting the FETs. The unit should not be attached to any other apparatus while undergoing construction and the soldering iron should be earthed. This will ensure that the devices are not subjected to voltages which might damage them. Information on the coils is given in Fig. 3.

Tuning is quite simple. An attenuator should be fitted in the aerial feed so that with the amplifier connected, a weak signal is received. The cores of

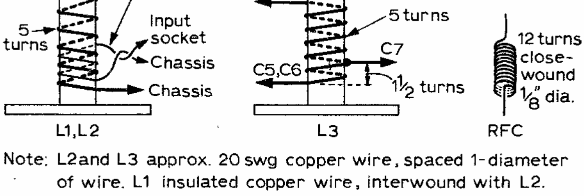


Fig. 3: Details of the coils and the RFC. Follow information carefully to ensure coils will tune inside the FM band, using the adjustable cores.

★ components list

Resistors

R1	220Ω	R3	100kΩ	R5	390Ω
R2	100kΩ	R4	22Ω		

All $\frac{1}{8}$ or $\frac{1}{4}$W 5 or 10%

Capacitors

C1	22pF SM	C5	10pF SM
C2	15pF SM	C6	470pF SM
C3	1000pF Feedthrough	C7	470pF SM
C4	1000pF Feedthrough	C8	1000μF 30V

Semiconductors

Tr1	E304* or BF256*	D1	1N4002
Tr2	E304* or BF256*	D2	ZF18 (zener 18V)

* see text

Miscellaneous

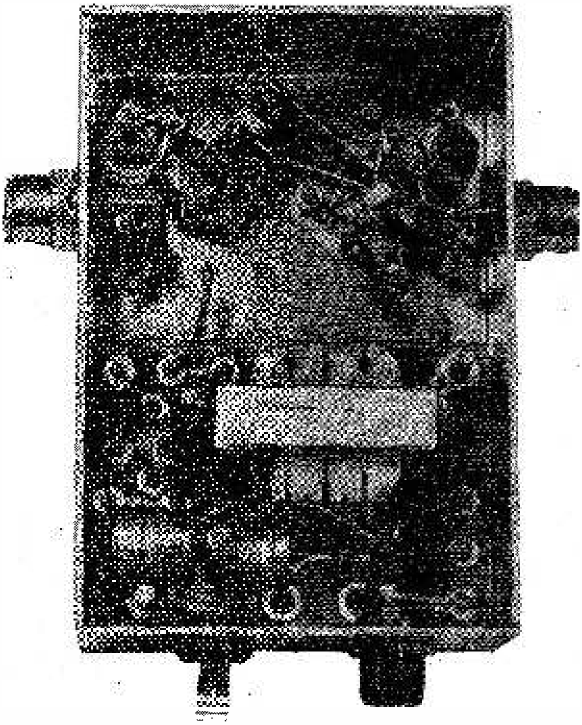
T1, transformer 240V/12+12V. F1, fuse 100mA and holder. Aluminium box (Type AB9) 4 x 2$\frac{3}{4}$ x 1$\frac{1}{2}$in. Coaxial sockets (2). Coil formers, polystyrene $\frac{1}{4}$in. dia. with cores.

the coils can then be adjusted for optimum performance. They should be set to approximately half way out of the windings as a starting position.

RESULTS

Results using the prototype are most encouraging. A Wolsey FM4 aerial is fitted to a 12ft mast attached to a chimney. Low-loss coaxial cable links the aerial to the amplifier, which is then connected to the Quad FM1 tuner. The receiving site is in Southern Hampshire and the aerial is beamed half way between London and Wrotham. There is virtually no difference between the reception of local signals from the Isle of Wight and those from Wrotham, including these stations' "local" transmissions, Radio Solent and Radio London. Capital Radio can be received, even though it is adjacent to Radio Solent. Mono reception of Capital is satisfactory 90% of the time; stereo about 50% at the time of writing. Other signals received are Radio Bristol, Radio Oxford and LBC which seems very consistent.

It should be pointed out that all long-range reception is vulnerable to interference from electrical apparatus such as vacuum cleaners and drills. The hash from a vacuum cleaner nearby may completely obliterate the distant signal despite all our efforts to receive it. The local oscillators of TV receivers operating on Band 1 may also radiate and



The finished pre-amplifier. The power supply board shown here was taken from a commercial pre-amplifier.

cause interference. This problem, however, is becoming less troublesome as more and more viewers move to UHF.

Reflected signals from aircraft appear in and out of phase with the main signal so cancelling at the aerial in a cyclic manner. This gives rise to drop-out of the signal accompanied by a "chuff-chuff" noise, something like a steam train. Despite these problems, however, worthwhile reception of distant signals is possible for a high proportion of the time, provided a good aerial is available.

Power for the amplifier can be obtained from a simple power pack as shown in Fig. 4 or, alternatively, two PP9 batteries may be used. The current drain is only 4mA, so battery life would be long.

The Siliconix FETs have been chosen for their excellent signal-to-noise ratio and they can be obtained from Atlantic Semiconductors, 143 Loughborough Rd, Leicester LE4 5LR. The alternative BF256 can be obtained from Ambit International, 37 High St., Brentwood, Essex CM14 4RH. ■

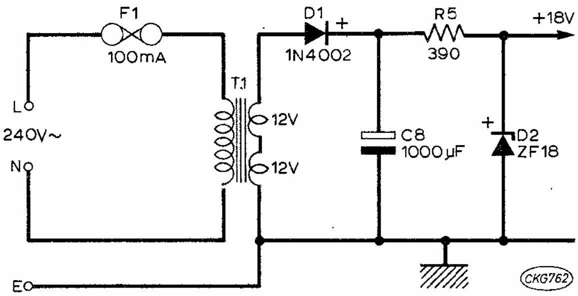


Fig. 4: Circuit of a suitable power supply for the pre-amplifier.

**PW 'DERBY'
STEREO HEADPHONE AMPLIFIER
AUGUST 1974**

Fig. 1: Bottom, right. "To R123/Tr103 base" should read 'collector'.

Fig. 1: In the symbol for Tr5 the collector should be the emitter, with arrowhead inwards (PNP). The emitter should be the collector, to base Tr6, C16 and D2. The diagram of the component layout, Fig. 8, is correct and not affected.

Fig. 9: On the DISC/RADIO switch S1, pole connection S1d should be marked R106, not R116.

PW SANDOWN PART 3

J. R. W. AMES B Sc
&
M. J. CAREY B Sc

f.m. stereo tuner

CONSTRUCTIONAL DETAILS

Construction of the tuner is very simple but it should not be undertaken by someone who has not had some previous experience in miniature electronic circuitry. The components are closely packed and may be damaged easily if overheated by a soldering iron.

Because of the high gain in parts of the circuit and the high frequencies involved, careful attention to the layout of the circuit is very important if instability is to be avoided and best performance obtained. Great care must be taken to ensure that no undesirable stray coupling can exist between sensitive parts of the circuit.

Fig. 4 shows the underside of a printed wiring board which has been designed to ensure stable operation and Fig. 5 shows the component side of the same board. This consists of a sheet of copper, or ground plane, broken only by bare patches where component leads pass through. The narrowness and close proximity of some of the conductors on this board, however, make it difficult to produce by normal 'kitchen table' techniques. Those readers who prefer to purchase a ready-made board may do so from the firm mentioned in the components list.

SCREENING

Liberal use has been made of screening between circuits and it is with these screens that construction should begin. They consist of strips of double-sided copper-clad board 1" high with lengths as shown in Fig. 6.

Start with the screen marked AB and put a small blob of solder on the bottom corner at both sides at point B and, on the side facing the printed wiring board only, at point A. Then hold the screen in position and run solder between it and the board to tack it into place at the points at which the solder blobs were applied. When you are sure that the screen is vertical and in the correct position it may be finally fixed by producing a fillet of solder between both sides and the board. This can be done by running the soldering iron along in contact with board and screen whilst feeding in solder.

Repeat this process for screens CD, DE and FG but leave HJ until later to allow access to the IF compartment. Where two screens meet they should be joined by a fillet of solder in the same manner. Small marks are provided on the underside of the board to indicate the correct positions of the screens.

TUNER HOUSING

Fig. 6 shows the completed tuner mounted in an $8\frac{3}{4}$in x $5\frac{3}{4}$in die-cast box with all component positions marked. Start by placing the board and transformer in the box where shown and centre-punching through the mounting holes. Drill and countersink 6BA holes for the board mounting bolts and 4BA holes for the transformer.

Holes should be drilled in the side of the box for the sockets for aerial input and audio output and for the 17 leadthrough insulators carrying connections to the front panel as listed in Table 1. Two further holes are required in the end of the box for the mains input grommet and fuseholder. The positions for these components are shown in Fig. 6 and the photograph of the tuner box which appeared in Part 1.

Mount all the components except the board, remembering to fix a couple of solder tags under one of the transformer mounting bolts. Connect two separate insulated wires to one of these earthing tags and route them close to the sides of the box to leadthrough terminals 14 and 17. Next connect wires to the two 12V terminals on the transformer and attach them to terminals 15 and 16. These wires carry current for the scale illuminating lamps on the control panel. Where a number of wires run together in close proximity it is convenient and tidy to make them up into a cable form.

TABLE 1

Leadthrough insulator No.	Connect to PCB point
1	X
2	M
3	SW M
4	SW
5	SS
6	SD OUT
7	SD IN
8	SQ OUT
9	SQ IN
10	LAMP
11	V
12	L
13	H
14	EARTH TAG
15	12 VAC (T301)
16	12 VAC (T301)
17	EARTH TAG

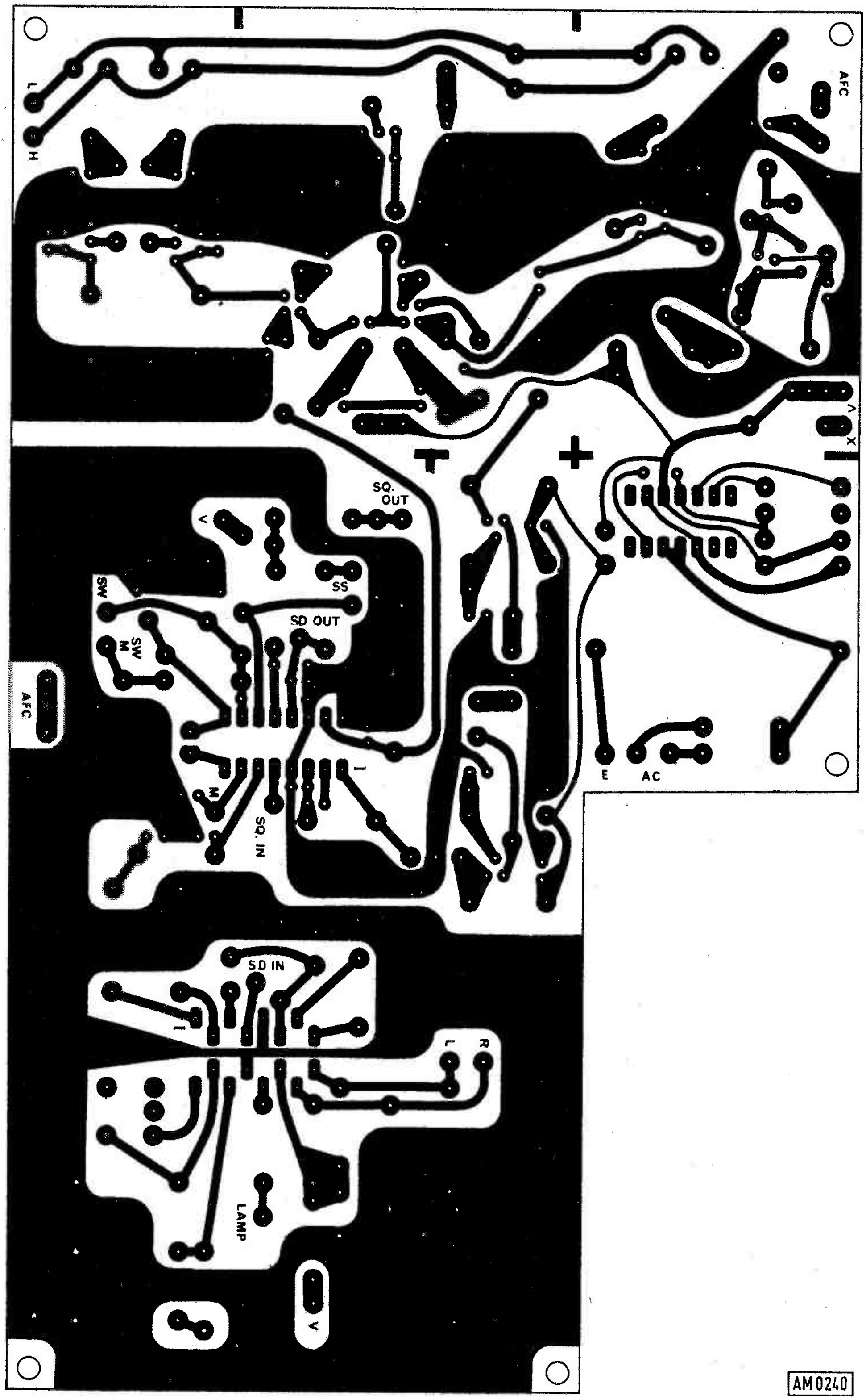


Fig. 4 Underside of printed circuit board, shown actual size.

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PW 'KEMPTON' PART 1
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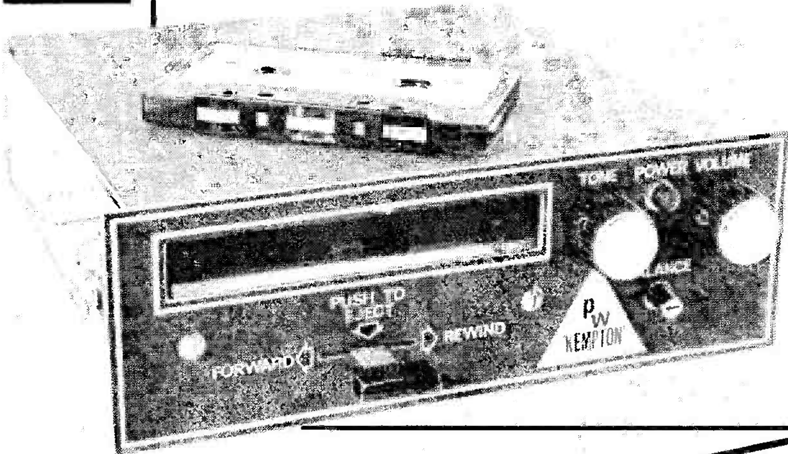

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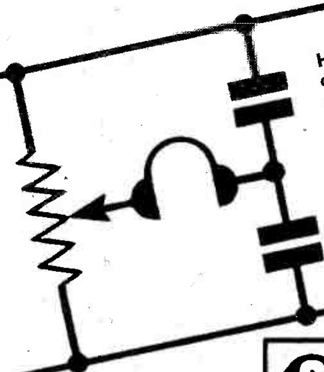

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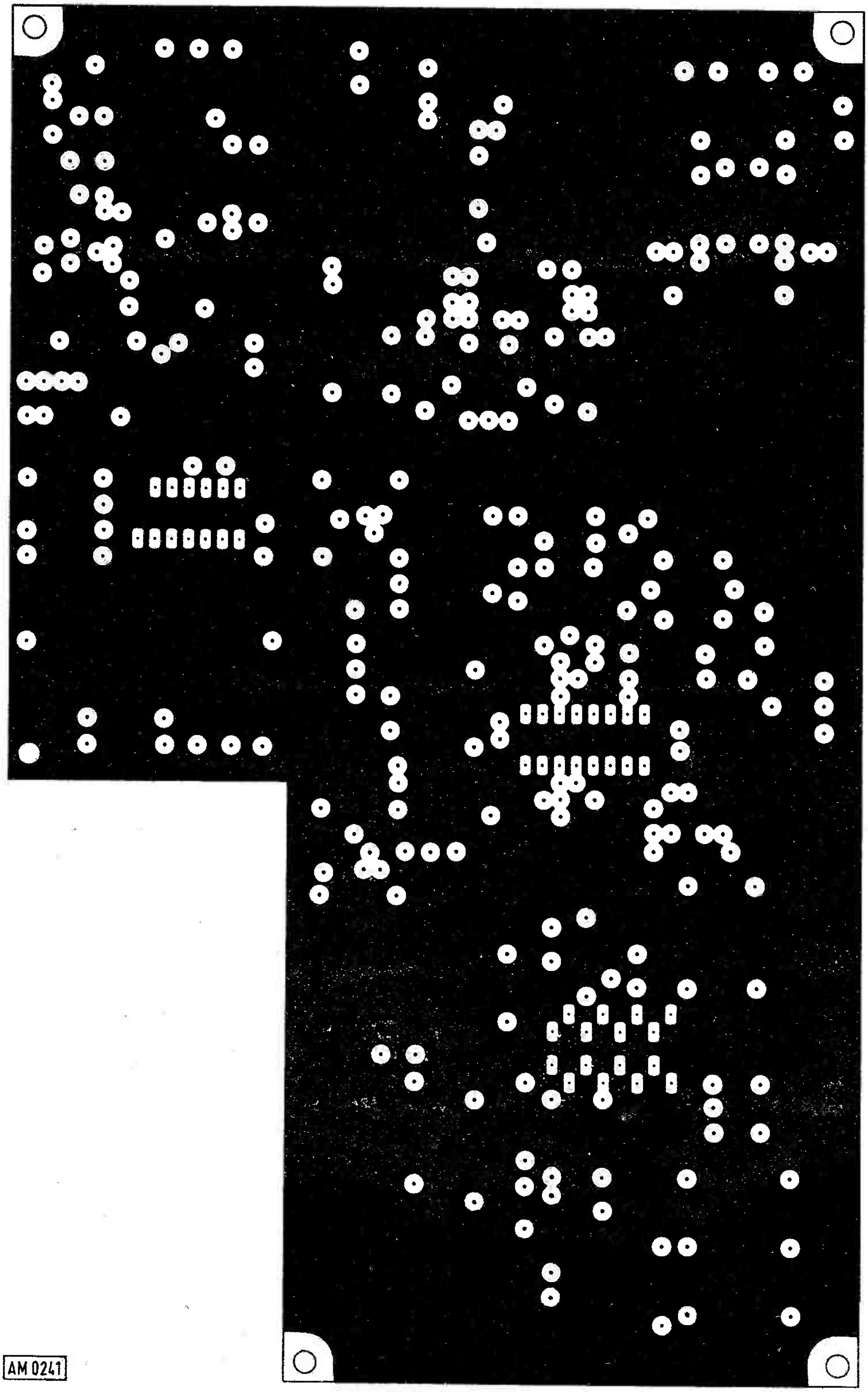

Fig. 6 : Ground-plane side (top) of printed circuit board, drawn actual size.

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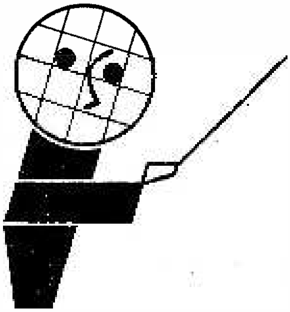

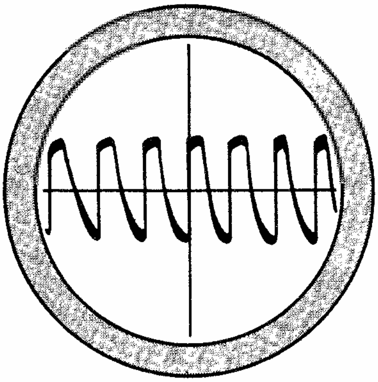

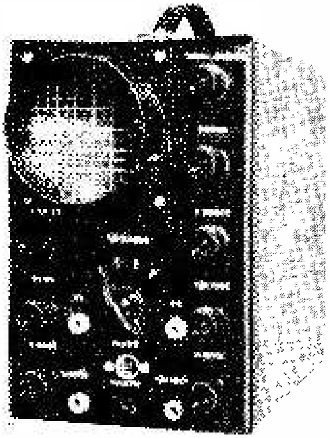

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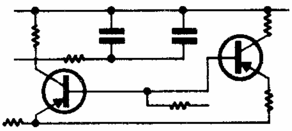

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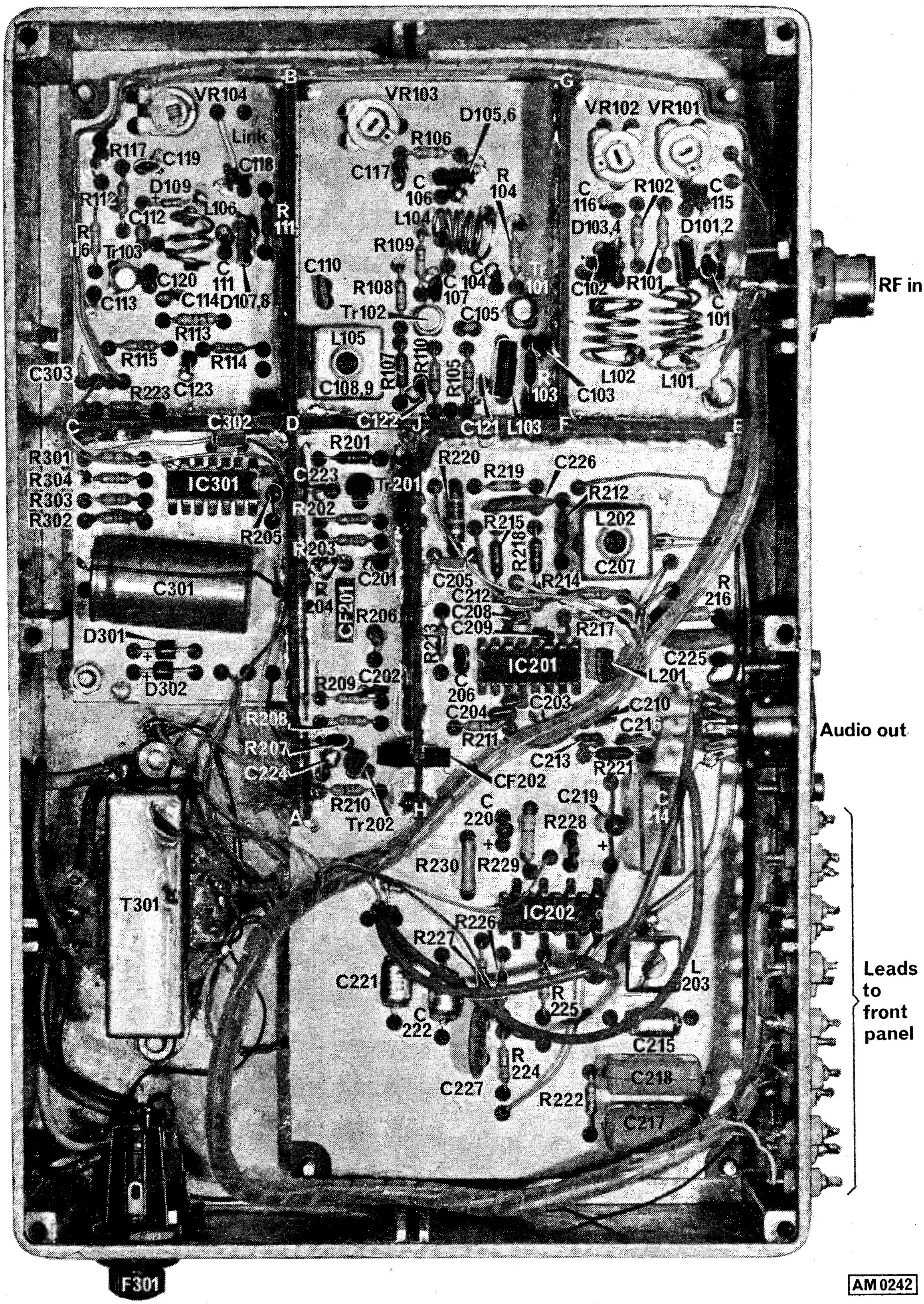


Fig. 6: Layout of components and Screens in the receiver.
NOTE—To correspond with the layout shown here, two alterations should be made to the circuit diagram, Fig. 2: (a) C216 should be connected between earth and the junction of R221/C214, not to pin 1 of IC202. (b) The top ends of R226 and R227 should be returned to the junction of R224/C227 and not direct to the +13V line.

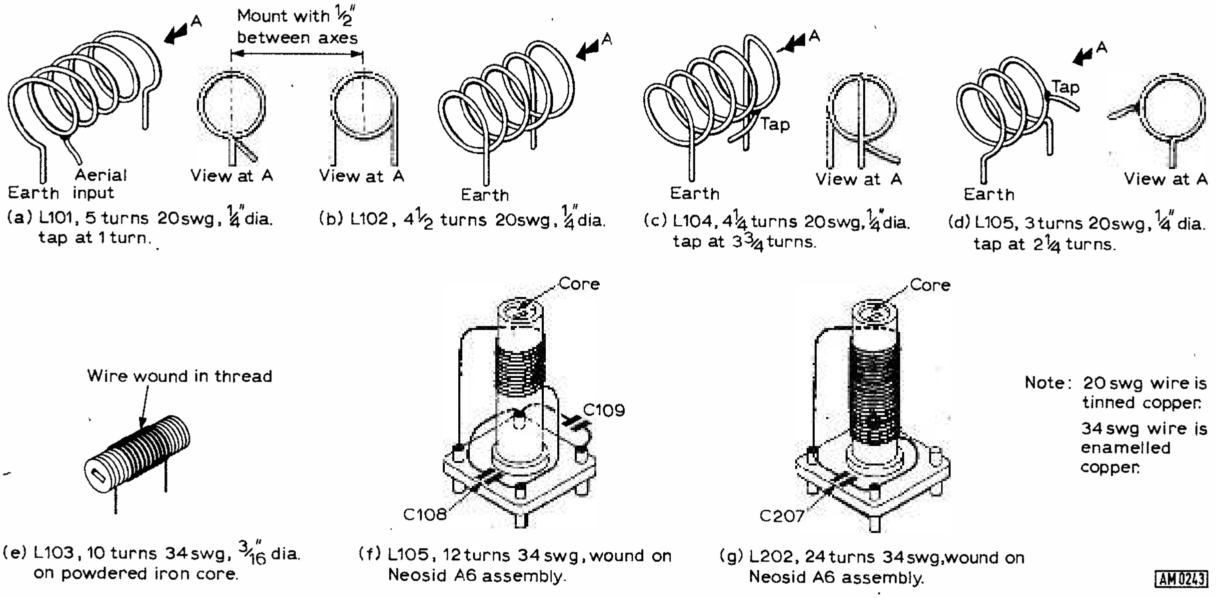


Fig. 7: Winding information for all coils.

POWER SUPPLY

There are few components in the power supply section, but care must be taken to ensure that diodes D301, D302 and capacitor C301 are correctly connected. Mount and solder the power supply components shown on Fig. 6, but omit IC301 and R205 at this stage.

Now connect up the mains lead, fuseholder and transformer as indicated in the circuit diagram. Connect to the other earthed solder tag the mains earth, the transformer centre tap, the transformer screen and the pad marked 'E' on the underside of the board. The earth return for the rest of the circuit is via the board mounting bolt in the power supply section. For testing the board out of the box, a temporary earth link can be provided by a wire soldered to the ground plane and connected to a transformer earth tag. It is important that this earthing arrangement is adhered to as other arrangements may result in the appearance of 50Hz or 100Hz hum at the outputs of the tuner.

TESTING

As an initial test connect a voltmeter across C301 and switch on. The meter reading should rise immediately to about +18V. If not, switch off and check the wiring and the polarity of D301, D302 and C301.

When this test is satisfactory switch off and insert IC301, ensuring that it is the correct way round. Solder the pins to the pads on the underside of the board using as little heat as possible. Pin 7 should also be soldered to the ground plane to complete the power supply earth return. Now connect the voltmeter to the junction of R302, R303 and switch on: the voltage will rise to about 13V. This completes the construction of the power supply.

Assembly of the remainder of the pcb is easier if the earth and AC leads from T301 are now disconnected, allowing the board to be completely removed from the box.

FRONT END AND OSCILLATOR

Winding data for all of the coils is given in Fig. 7 and it is worth spending a little time in ensuring that they are made correctly so that the receiver is easy to align when construction is complete.

Mount the components in the positions indicated in Fig. 6 taking care that the coils are correctly positioned and that the active devices are soldered in correctly. All components should be positioned as close to the board as possible except for Tr103, which must be at least ¼in from the ground plane, and the coils which should stand about 0·1 in clear of the board and all other components. Wires which are connected to earth should be soldered both above and below the board in the RF sections.

IF SECTION

Earthed leads in this section are also soldered to both sides of the board, except for the centre pins of the ceramic filters which are only soldered to the underside. Treat the ceramic filters as you would active devices and apply as little heat as possible to their leads whilst soldering. Omit R205, located in the power supply section.

When the IF section is complete solder in the final screening partition HJ as described earlier.

DEMODULATOR AND DECODER

It is most important that the integrated circuits in this section are inserted the right way round or an expensive failure may result when power is first applied. Fig. 6 shows the correct orientation. When soldering the pins of the integrated circuits, treat them as you would transistors and apply as little heat as possible whilst ensuring that the solder wets both of the surfaces to be joined.

Omit the power supply resistors R212, R224 so that initial testing may be carried out systematically from the front end. Finally make a connection

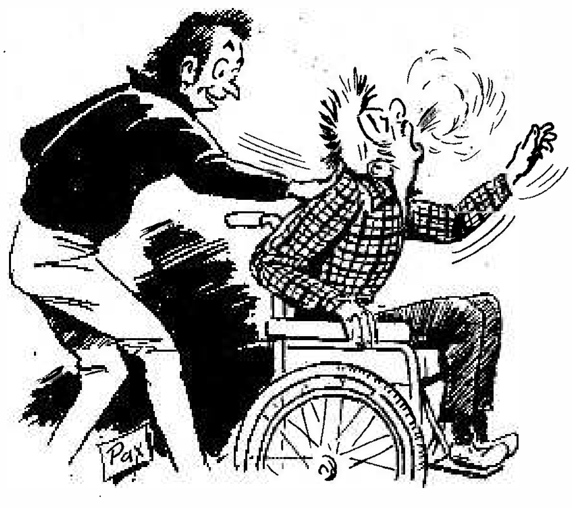
—continued on page 641

SWITCH ON SOMEBODY!

Geoffrey Smith

I'D better come clean at the start. I'm not a radio expert. I suppose I could say "Well, it's not my fault—I've got no sight and I'm a wheel-chair case with multiple sclerosis" but that would only be an excuse. In this country alone there are many severely disabled people who are capable and very knowledgeable radio amateurs.

Take Paddy, for instance, who's a Londoner. He's got a 45ft tower with a high gain 3-element rotary aerial, whatever all that is. He's also got a KW2000 transceiver, a KW1000 linear and a fistful of achievement certificates. He's totally blind, yet operationally he's as efficient as any sighted person. If this wasn't so, he wouldn't be a member of the First-Class Operators Club. This exclusive body limits its members to 500 top-notch morse code operators throughout the world. Paddy finds morse relaxing, after talking all day in his job as a bank telephonist.



. . . a friend who'll nudge me . . . .

Whilst operating he's also often using his tape recorder to make copies of a comprehensive course in radio. It's a voluntary job. He does it to help beginners in a national radio club for the disabled to study for their exams to get a transmitting licence. Actually, this is the course I've been floundering through but I find tape study tough going. What happens is that I come to a spot on the tape where I'm not sure what's meant, so I solve the problem by applying my own particular brand of logic. Usually I coast along through the next mile or so of tape before I gradually begin to realise that, way back, I came to some wrong conclusions, because nothing is making sense any more. What I really need is a friend locally who'll nudge me back on to the right road.

I have to be honest, though, and admit that I have another difficulty. I'm a radio romantic. I marvel each time I'm reminded that there, dancing amongst the petunias in my garden, is music and speech from all over the world. Radiophonically speaking, the wonder of it clouds my thinking and makes the next process even less credible. That's the bit where these inaudible signals are channelled along a piece of copper wire, fed into a box, dissected and then rendered capable of being amplified to an ear-bursting loudness, in stereo if desired.

. . . . music dancing in my garden . . . .

It's difficult to think of a better hobby than amateur radio for those who are on their own a good deal. At the flick of a switch a friend from the next street or the other side of the world can come into the room. Thanks to non-visual radio waves, the guest is certain not to feel awkward or embarrassed. I can't always say the same about people I meet in the High Street when I'm being pushed along in my wheel-chair in real live 3D colour.

Bye Bye, Mr. Smith

When I'm around, people often become ill-at-ease and behave unnaturally. Conversations tend to go on above my head and the breeze wafts down to me such remarks as "Can he dress himself?" or "How does he pass the time?" Knowing I'm blind they're quite likely, on parting, to bend down, cup their hands round my ear and bellow "Bye Bye, Mr. Smith, pleased to see you looking so well!" If this action makes them feel particularly foolish then they may cap it by tapping me lightly on the head as we move away.

Well, of course, you don't get these problems with amateur radio, so I decided to look out for a short wave receiver. A fellow I contacted said he had one to sell and would bring it round. In this transistor age I was expecting something small so I was very surprised to find it took two strong men all their time to huff and puff it into my den. After heaving it on to the top of a chest-of-drawers, one of them had to make a second trip to fetch the separate speaker unit. It was the owner who stayed behind and passed the time by telling me how sad he was to be losing his set. He'd gone and brought one of these new-fangled Japanese transceivers which slipped into one of his bureau drawers but the receiver part wasn't half as good as the one he was offering me, a pre-war Hallicrafters Super Skyrider SX-28. Its age, in fact, seemed to be its main selling feature. He assured me that the instruction manual, if not the set itself, was of considerable antique value!

. . . . how sad to be losing his set . . . .

After the speaker had been hoisted into place on top of the set, and a temporary aerial erected, I was invited to move over and inspect the instrument. It certainly seemed impressive. It bristled with knobs, had a couple of capstan-like wheels and three little glass windows which, apparently, lit up like a doll's house. The main structure was built of metal, including the slotted lid which reminded me of an Edwardian pavement grating. The matching speaker was finished off in the same style with what felt like a metal footscraper bolted across its front! Still, it sounded good and the price seemed reasonable, so I bought it.

Conversation piece

Right from the start it's been an interesting conversation piece. Strangers immediately find that their eyes are drawn to the corner where it stands. 'What's that?' they ask. When I explain that it's a Super Skyrider short wave radio made in Chicago when Al Capone was a lad, I never fail to get one of those drawn-in whistles. All in all it's been a good friend. When in good health its oscillations rose to the heights and plunged to the depths in grand style, vibrating everything vibrateable in the room. Yes, it's certainly been a lively period-piece but sadly the breath's gone out of it now.

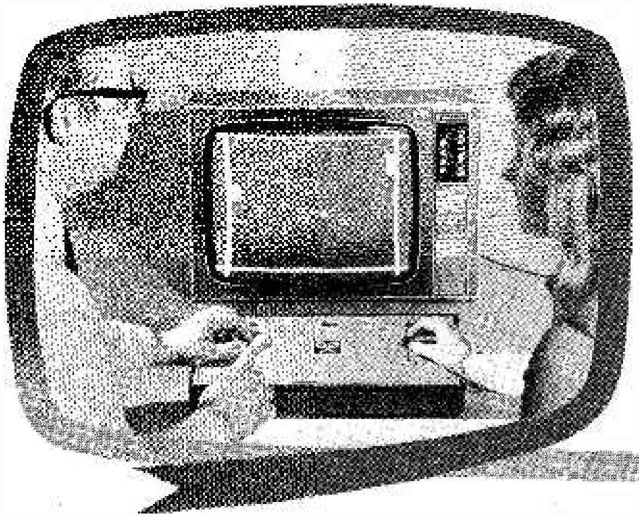
What happened was that a ham came from the town to these country parts for a few day's fresh air. On learning that there was a short wave listener in the area, he looked me up for a chat. He also tuned my set and got it going well on all pistons. It made his day to hear his pals back home having a local chat across the town. After he'd gone I carried on listening to them until it was time to make lunch and tune in to "The World at One" on my domestic set. At two o'clock, though, my curiosity drew me back to the Hallicrafter. I wanted to know if they were still at it, but all I got when it warmed up on the frequency where I'd left them, was a spluttering, spitting noise. I mused to think that they were perhaps frying up a couple of transformers in oil for a light lunch. It was only as the smell, thick enough to taste, wafted across to me that I began to realise the seriousness of the situation. Hurriedly I snatched the mains plug out of its socket and then waited nervously by in my wheel-chair, hoping the set wouldn't burst into flames. Thankfully, it didn't. After a series of pings, twangs and cracks it gradually cooled off.

Disposing of a Skyrider

My set is now something of a problem. There's no one in the house strong enough to move it but we don't want it to become a permanent fixture. My wife suggested that we should gradually disembowel it by taking bits out weekly and putting them in the dustbin until we're left with an empty shell. Personally I prefer to search for a couple of men who could take it down to the garden as it stands and bury it. It would be a more fitting end, I feel, for it to rest in a quiet corner where the radio waves could blow freely over it. What we really need, of course, is a little practical help and advice from a local radio enthusiast. Disabled people like to be independent but with the best will in the world there are some jobs they just can't do.

. . . . the smell wafted across to me . . . .

This is why the radio club for the disabled, which I mentioned earlier, is always very pleased to welcome helpers who are fit and active enough to lend a hand occasionally. If you feel that you could give a little help at times to invalid radio enthusiasts who have struck a bad patch, write to Evelyn Boakes secretary of the Radio Amateur Invalid and Bedfast Club at RAIBC, Bristol Road, Cambridge, Glos. GL2 7BQ. It could be that someone disabled in your area is anxiously waiting now to have a chat with a knowledgeable, good-hearted chap like you! ■



THE POPULAR NEW ELECTRONIC GAME

TELE-TENNIS

PLAYED ON THE TELEVISION SCREEN

PART 5

M. J. HUGHES MA

Testing Board D

Build the circuit for Board D and install it on the sub frame with all the necessary interconnections (including those to the front panel) EXCEPT for the lead from the blanked ball output to Board E. Instead connect a temporary link between the last diode input of Board E and the BALL signal input to Board D. This will by-pass the ball-blanking and allow you to see the ball at all times to check that the ramps are working.

Set VR11 and VR12 to maximum resistance and switch on. You should immediately see the ball moving about the screen, but do not worry if it is stationary near one of the corners of the tennis court. You are bound to have to carry out a bit of lining up and you must follow the procedure to be described very carefully. It is not difficult but needs a little patience.

Final Adjustments

Press the Ballboy button and the ball should jump to an approximately central position on the screen. Use VR3 and VR4 of Board A to get the ball as near to the centre as possible and then take your finger off the button. The ball will move obliquely across the screen and should rebound as it hits each base line.

It may be that the ball rises to the top left hand corner and stops before it reaches a base line; this means that the voltage control is not having sufficient effect on the ball's position. In this event use VR3 to move the ball from its stationary position until it just touches the top base. The ball will immediately start to move down the screen but will not move sideways. Now adjust VR4 so that the ball is in contact with the left base. All being well the ball should now move freely across the screen rebounding from all the bases.

If there are problems in getting the ball to reach both extremes of its vertical and horizontal travel you might have to bring the base lines in a little. Once this has been done check that the Ballboy freezes the ball's movement somewhere within the "court".

Now remove the temporary link from board E and connect the Blanked Ball output of Board D permanently to the last diode input to the mixer stage. Switch on and press Ballboy—almost certainly the ball will not be visible because it will be blanked off. Press the Service button on one side and hold it down for a few seconds. The ball should appear from that end's base after a brief delay. As soon as it appears try playing a brief game and check that the ball disappears when it hits an end base. Finally test the other end's service and then adjust the ball's speed with VR11 and VR12 to suit the standard of your play. When doing setting up adjustments it is always advisable to have the ball moving at its lowest speed.

Installation

Now that the game is complete it only remains to finish off the installation within the case, using self tapping screws to secure the subframe. Make sure that the mains input lead is suitably clamped and that the earth wire goes to the case. Use two short lengths of 16 swg enamelled copper wire twisted together once or twice over three-quarters of an inch to provide the uhf output coupling capacitor. Using the centre core only of coaxial plug, connect one end of this capacitive lead to the output of the modulator. The other end goes direct to the output

—*continued on page 641*

★ components list

FRONT PANEL & CASE

Potentiometers
VR13, VR14 5kΩ linear sliders

Switches (all push-button type)
S1, S2, S3 DP changeover, non-locking
S4 DP Push-ON/Push-OFF, 250 VAC rating

Miscellaneous
SK1 75Ω panel mounting coax socket
SK2 50Ω panel mounting coax socket (for video output if required)
Case including front panel; hinge for panel; mains-cable grommet and clamp; earthing tags; plastic feet.

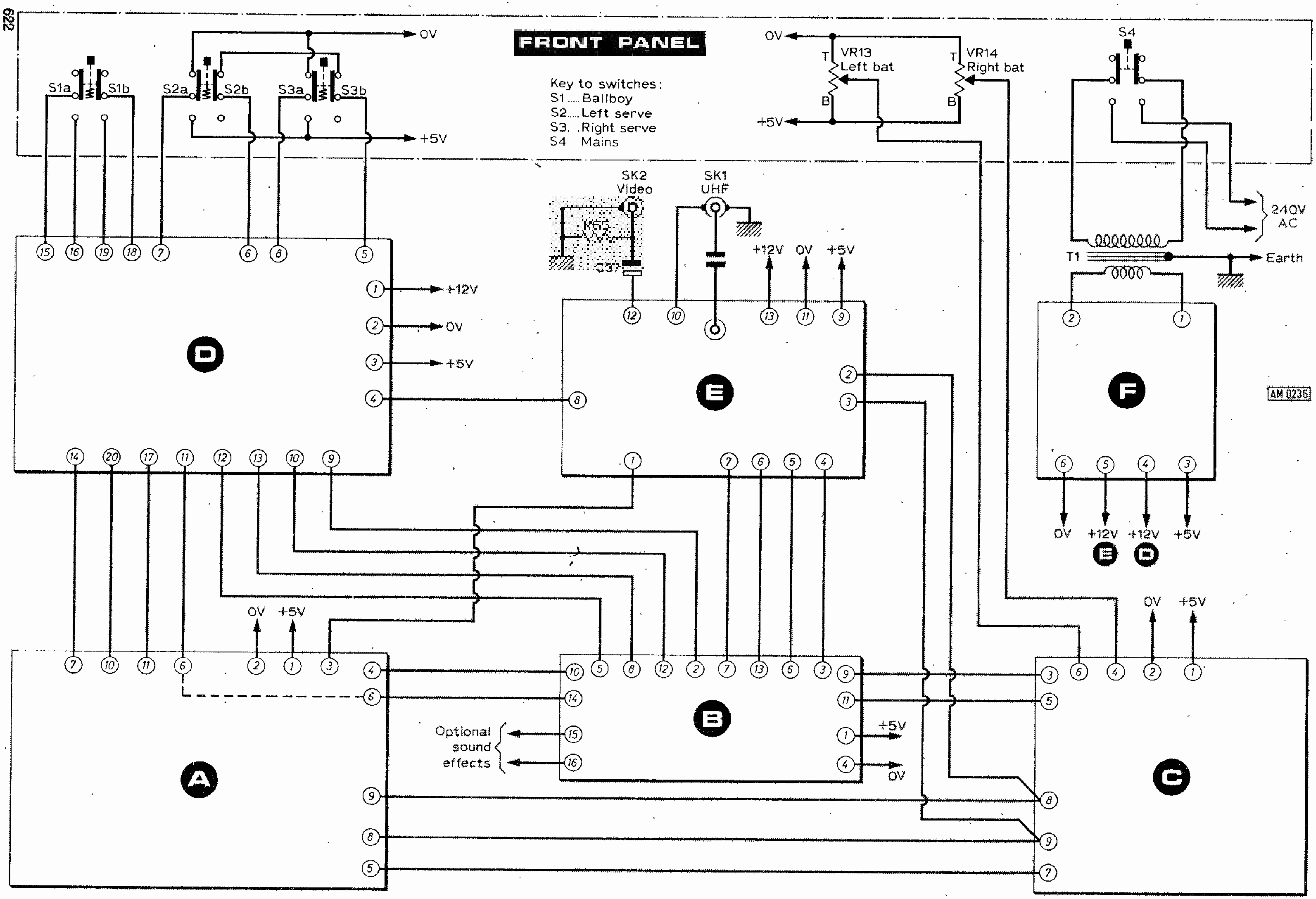


Fig. 20: Inter-board wiring diagram and Front Panel circuit for the completed game.

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AC188K	23p
AC187/188K	40p
ACY17	27p
ACY18	20p
ACY19	20p
ACY20	20p
ACY21	19p
ACY22	10p
AD140	60p
AD149	60p
AD161	44p
AD162	44p
AD161/162	88p
AF106	32p
AF114	27p
AF115	27p
AF116	25p
AF117	25p
AF118	44p
AF124	25p
AF125	24p
AF126	24p
AF139	47p
AF186	40p
AF239	52p
AF279	58p
ASY26	25p
ASY27	30p
ASY28	22p
ASY29	30p
BA138	15p
BB103	20p
BB104	34p
BB105	28p
BC107	16p
BC107/BC177	36p
BC108	16p
BC108/BC178	32p
BC109	16p
BC109/BC179	36p
BC109C	18p
BC117	15p
BC140	30p
BC147	12p
BC148	11p
BC149	12p
BC157	13p
BC158	12p
BC159	13p
BC147/157	25p
BC148/158	23p
BC149/159	25p
BC167	11p
BC168	10p
BC169	11p
BC169C	12p
BC177	20p
BC178	16p
BC179	20p
BC182	14p
BC182L	14p
BC183	13p
BC183L	14p
BC184	17p
BC184L	16p
BC212	16p
BC212L	16p
BC238	10p
BC238/308	20p
BC257	11p
BC258	10p
BC259	12p
BC307	12p
BC308	10p
BCY30	25p
BCY31	48p
BCY32	50p
BCY33	20p
BCY34	25p
BCY38	30p
BCY58	18p
BCY70	15p
BCY71	26p
BCY72	14p
BD124	75p
BD131	40p
BD132	40p
BD131/132	80p
BDY20	91p
BF115	23p
BF163	35p
BF167	25p
BF173	29p
BF177	25p
BF178	31p
BF180	35p
BF194	15p
BF195	15p
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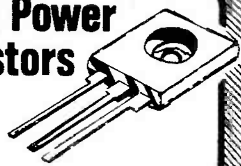

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TAKE 20

DAVID ANDREWS

No. 65 ELECTRONIC PUSHBUTTON SWITCH

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

THERE are often occasions when it is desirable to control a circuit, or a piece of machinery, with push buttons. The classic case is the two button system for starting and stopping a lathe; when the green button is pressed the lathe starts running and continues to do so until the red button is pressed. These high power push button contactors are usually of an electro-mechanical design and rely on a relay tripping and latching itself "in" when the start button is pressed; pressing the stop button breaks the current through the relay coil and the relay drops out.

We can produce a simple circuit that will perform the same function for small currents and its applications are numerous. For remote switching of radios, burglar alarm trips, starting and stopping logic circuits or possibly in a domestic lighting system for switching lights on and off from different locations.

Practical Circuit

The circuit is shown in Fig. 1 and to make the application general we are carrying out the switching of the external circuit via a relay, RL1. All the control circuitry is at low voltage but there is no reason why the relay should not control low power mains circuits if desired. To show how the system will respond to signals from more than one station we have built in two extra push buttons, S2 and S4, but for single station control these can be omitted. For more than two stations it is only necessary to parallel other push buttons with S1 and S2 for the "Start" function and an equivalent number of buttons with S3 and S4 for the "Stop" operation.

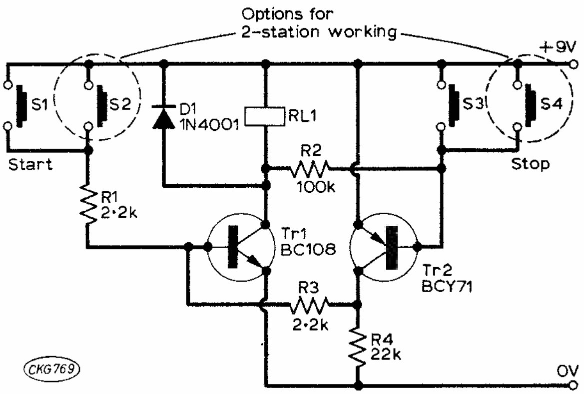


Fig. 1: Circuit of the switch with provision for additional stations.

The circuit is basically a bistable using complementary transistors; when one of the start buttons is pressed base current flows into Tr1 and the relay pulls in switching on the external circuit. Simultaneously the voltage at the collector of Tr1 falls to nearly zero and current then flows from the emitter of Tr2, through its base and via R2. Because of this base current through Tr2 the latter transistor turns on and its collector voltage is pulled up to the positive rail. This action provides an alternative source of base current for Tr1 through R3 and when the finger is removed from the start button the relay is held in by this positive feedback loop. This switching action is very fast and once initiated cannot be reversed, hence the action is "once and for all" which means that very positive switching is produced so there is no possibility of contact bounce in the electronics (although this may not necessarily be the case with the relay contacts).

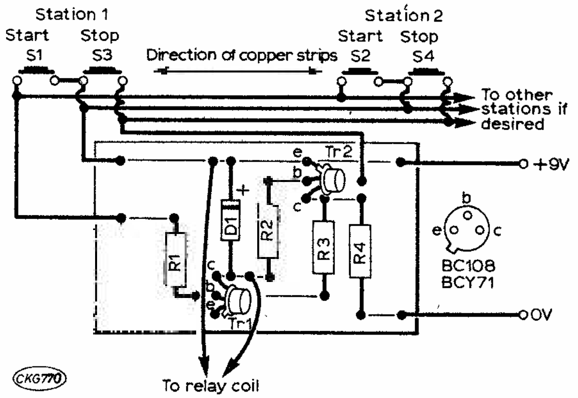


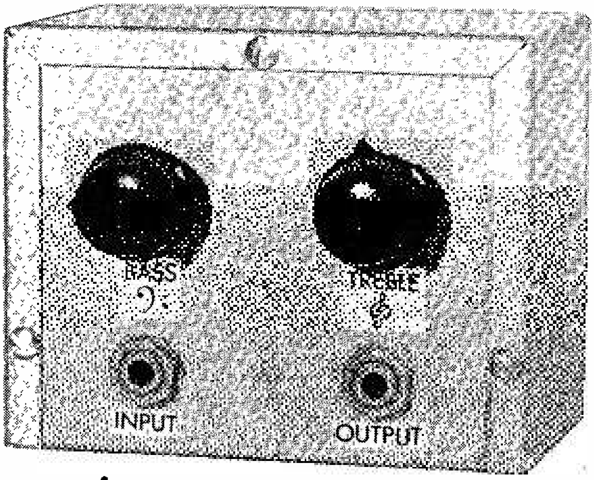
Fig. 2: Layout for 2-station switching, using Veroboard. No breaks are required in copper rails.

To get the relay to drop out it is only necessary to stop the base current flowing through Tr2 and this is done with the stop button(s) which shorts its base to +9V diverting any base current. D1 is present to protect the base/collector junction of Tr1 from the high reverse voltages that are produced by the inductance of RL1.

The relay can be of any type designed for low voltage (6 to 9 volts) operation but should have a coil resistance greater than 100 ohms. Conventional or reed relays can be used. Alternatively the relay and D1 can be replaced by a resistor in the range of 150 to 1000 ohms if all that is required is a logic signal, which can be extracted from the collector of Tr1. Another option is to replace it with a 6V 0·04A bulb or an LED, with a suitable limiting resistor if the circuit is to be used for visual indicating. ■

★ components list

R1	2·2kΩ	¼ or ½W 10%	Tr1	BC108
R2	100kΩ		Tr2	BCY71
R3	2·2kΩ		S1 etc.	Push buttons normally open.
R4	22kΩ		RL1	See text
D1	1N4001			



ADD-ON STE

*TONE CONTROL UNIT

A. FOORD

THE tone control unit was designed for experimental audio application where tone controls may be required for signal equalisation. Two identical printed circuit boards are used but a single channel may be constructed if desired. For maximum flexibility volume and balance controls were not added to the unit, but these may be incorporated if required.

PERFORMANCE

Input Resistance	15kΩ
Output Resistance	Low
Midband Gain	Unity
Bass Control Range	±20dB at 20Hz
Treble Control Range	±11dB at 20kHz

Supply voltage nominally 18V but 12 to 24 V may be used

CIRCUIT

The circuit for one channel is shown in Fig. 1. An emitter follower Tr1 gives a medium input resistance with a low output resistance driving a Baxandall type tone control circuit. This uses negative feedback around an integrated circuit to give well defined tone control characteristics. The DC bias for the integrated circuit is derived from the supply via R9 and R10. Capacitors C7 and C9 are decoupling components.

CONSTRUCTION

The construction is straightforward, as shown in Fig. 2, with a separate board, Fig. 3, for each channel. Jack sockets Sk1 and Sk2 are common to both channels. Components for the second channel are listed as C101, etc, as is normal practice. Although a printed circuit was used in the prototype, a similar

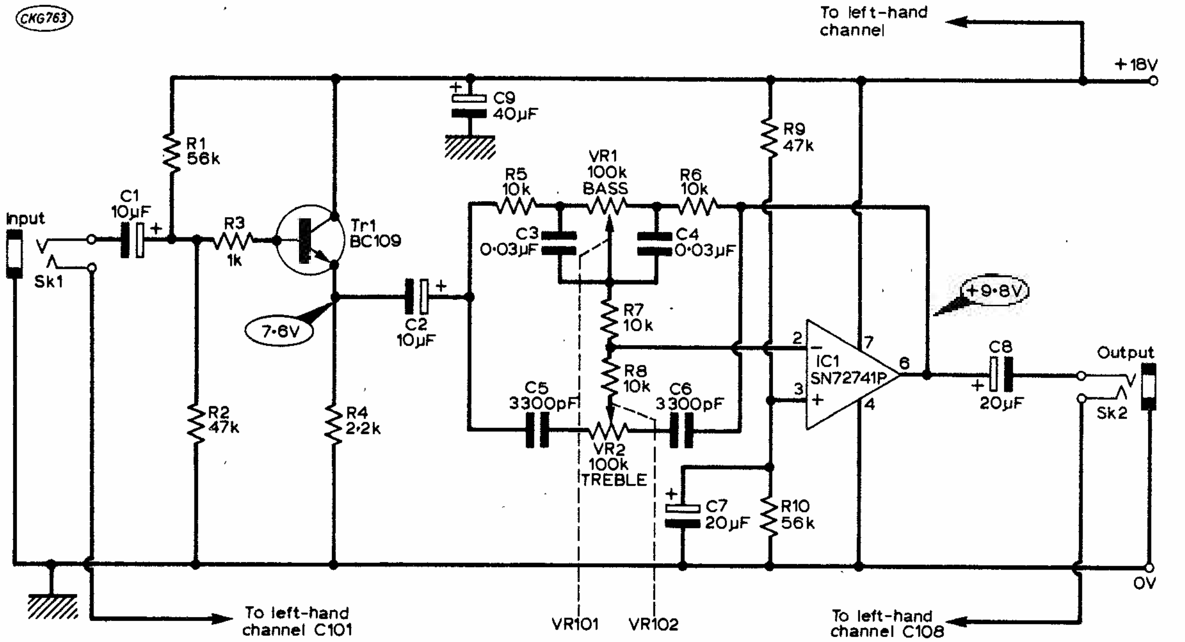


Fig. 1: Circuit of the Tone Control Unit with test voltages indicated. The right-hand channel is shown, the left-hand channel being similar.

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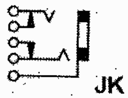
continued on page 38.

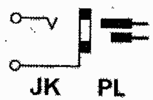
JACKS AND PLUGS

Jack with two lines and common.
Top-tip contact
Centre-ring
Bottom-sleeve

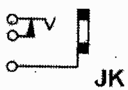
Jack as above but with break contacts



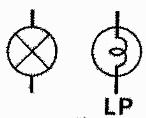
Jack with one line and common



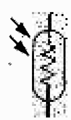
Jack as above but with one break contact



INCANDESCENT LAMPS INDICATING (left) AND ILLUMINATING (right)



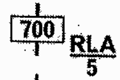
LIGHT DEPENDENT VARIABLE RESISTANCE



LOUDSPEAKER

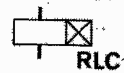
ELECTROMAGNETIC RELAYS

Relay coil with resistance value shown



Coil of slow-release relay

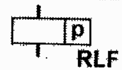
Coil of slow-to-operate relay



Coil of a.c. relay

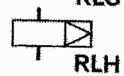
Coil of remanent relay

Coil of polarised relay



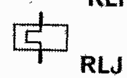
Coil of d.c. operated magnetic counter with cyclometer action

Coil of latching relay



Coil of reed relay

Coil of thermal relay

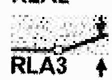


RELAY CONTACTS (SHOWN IN NEUTRAL POSITION)

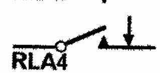
Single make contacts

Single break contacts

Single changeover contacts



Make before break



Break before make

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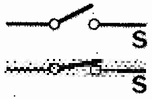
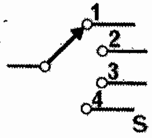
Single-pole single throw on-off

(a) normally open

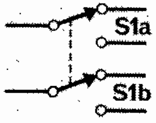
(b) normally closed



Single-pole multi-way rotary switch with knob control and four paths

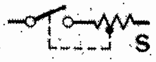


Double-pole changeover with rotary control knob or single toggle operating ganged moving arms

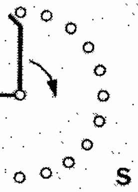


Single-pole slide switch with changeover operated by slider knob

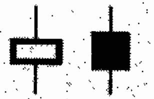
Thermal switch with resistive sensing element



Multi-way electro-magnetic coil operated rotary switch. Arrow shows direction of wiper motion (uniselector)



Coil of above switch



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SCREEN AROUND A PART OF A CIRCUIT

SOLAR CELL

SUPPRESSOR

SWITCHES (SHOWN IN NEUTRAL POSITION)

Single pole on-off push button (normally off)

Single pole on-off push button (normally closed)

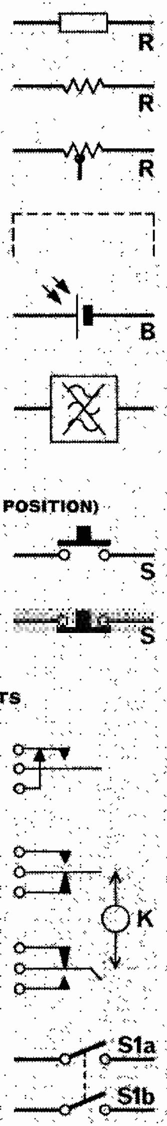
LEVER OPERATED KEYSWITCH CONTACTS

Make before break, non-locking

Changeover, non-locking Lever arm

Changeover locking

Double-pole single throw on-off switch (ganged moving arms or single toggle)



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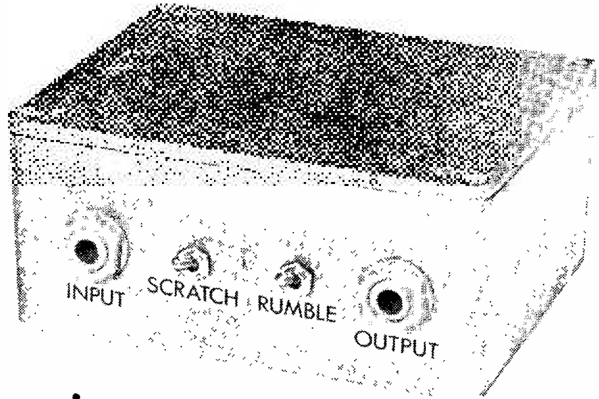
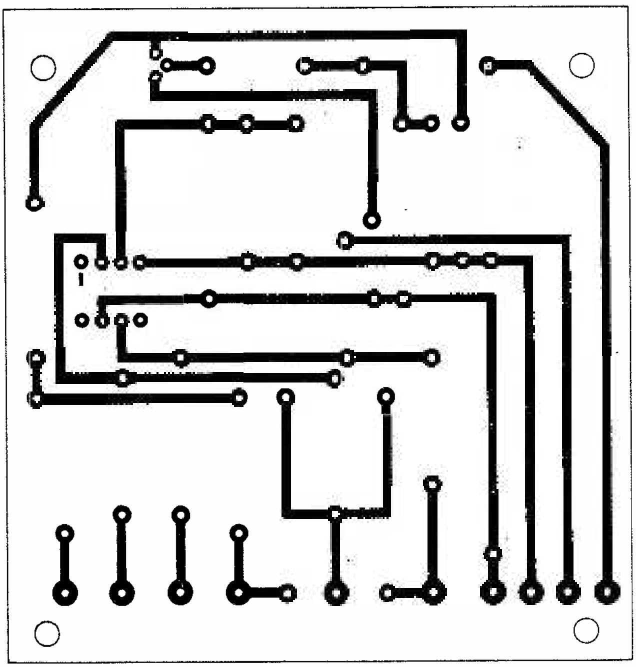


*SCRATCH AND RUMBLE FILTER



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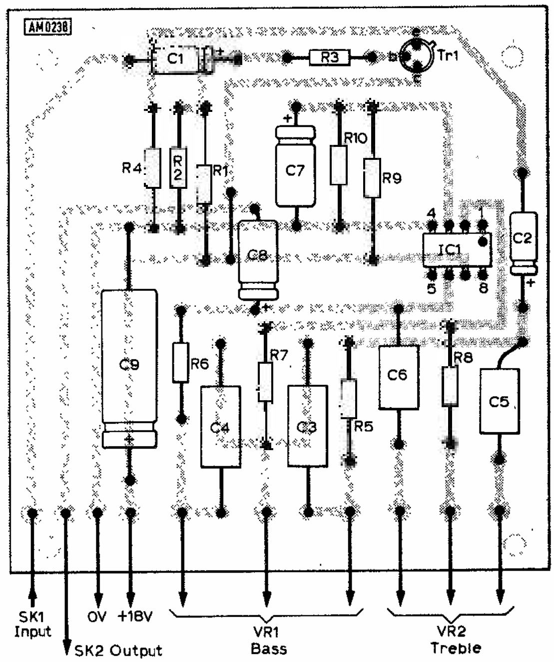
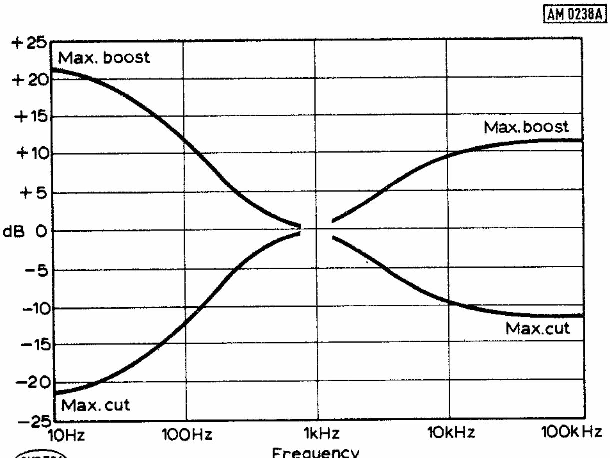
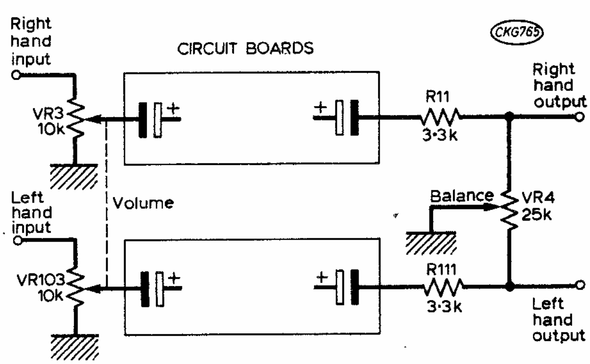
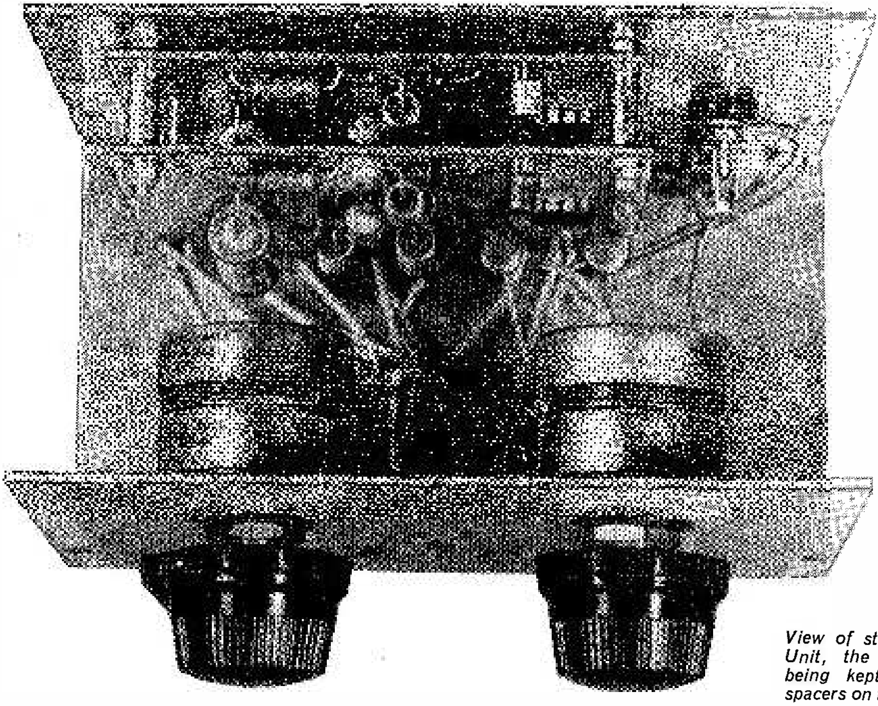




Figs. 2 & 3; above, show the PCB actual size and layout of components on the PCB. Two such PCB's are required for a stereo unit. Fig. 4: left, indicates the performance of the tone controls. Fig. 5: below, shows how volume and balance controls can be added, if required.





View of stereo Tone Control Unit, the identical boards being kept well apart with spacers on the fixing bolts.

layout using LEKTROKIT could be used if required. No detailed dimensions are given since this will depend on the constructor's individual requirements and the layout is not critical.

The DC voltages shown on the circuit diagram may be measured for the nominal supply voltage shown.

★ components list

Resistors

R1	R101	56kΩ	R7	R107	10kΩ
R2	R102	47kΩ	R8	R108	10kΩ
R3	R103	1kΩ	R9	R109	47kΩ
R4	R104	2·2kΩ	R10	R110	56kΩ
R5	R105	10kΩ	R11	R111	3·3kΩ
R6	R106	10kΩ			

All ½ or ¼W 5%

VR1/VR101 100kΩ linear dual gang
VR2/VR102 100kΩ linear dual gang
VR3/VR103 10kΩ log. dual gang
VR4 25kΩ linear

Capacitors

C1	C101	10μF 16V
C2	C102	10μF 16V
C3	C103	0·03μF* 5% polycarbonate
C4	C104	0·03μF* 5% ,,
C5	C105	3300pF 5% polystyrene
C6	C106	3300pF 5% ,,
C7	C107	20μF 16V
C8	C108	20μF 16V
C9	C109	40μF 25V

(* 0·033μF 'preferred' value)

Semiconductors

Tr1 Tr101 BC109 IC1 IC101 SN72741P (or 741 or similar)

Miscellaneous

Terminals (2). Case 5 x 4 x 3 in. or similar. Knobs (2). Jack sockets, stereo (2). PCB's (2).

If these DC conditions are correct then an AC signal may be applied to the unit and the overall performance checked. If no test equipment is available then a listening test must suffice. The tone control characteristics are shown in Fig. 4.

VOLUME AND BALANCE CONTROLS

If required, volume and balance controls may be added as shown in Fig. 5. This will however depend on the application and the existing system. For maximum flexibility in experimental work it might be better to have completely separate controls for bass, treble and volume rather than have them ganged.

The balance control shown reduces the gain for each channel to 0·8 times the central value. However this should not present a problem because tone controls are usually inserted into a system at a point where adequate signals are available.

SCRATCH & RUMBLE FILTER

This unit was developed for experimental audio applications where scratch and rumble filtering may be required to improve the results obtained from a record player or tape recorder. It was originally built as an "add on" stereo unit, although it could equally well be incorporated into a permanent system. The unit was designed on two identical printed circuit boards so that a single channel can be constructed if desired.

THEORY

The basic scratch and rumble filters used here are shown in Fig. 6a and 6b respectively. The theoretical design of such circuits is complex and many variations are possible. The unity voltage gain amplifier shown will have a power gain because it has a high

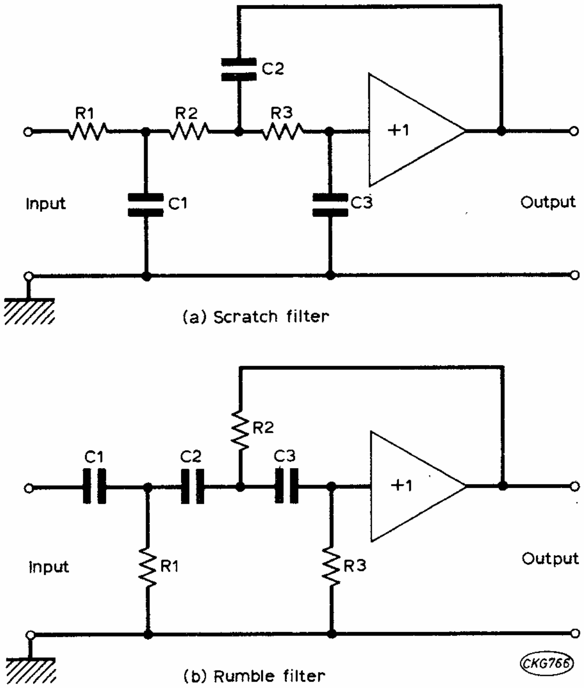
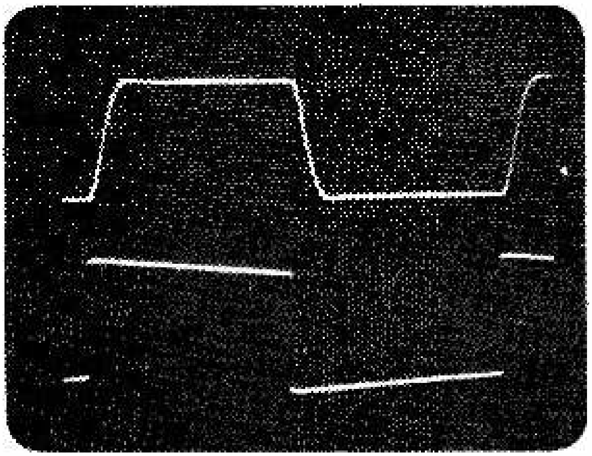


Fig. 6: (a) Basic circuit of a scratch filter. (b) shows the arrangement required for a rumble filter.



These traces show the response of the filters to a 1kHz square wave input. Top, scratch filter only. Bottom, rumble filter only.

input impedance but a low output impedance. An emitter follower is sometimes used but an integrated circuit allows the unity gain to be more closely defined.

For the scratch filter the capacitors have no effect at mid frequencies and the overall gain is unity. As the input frequency is increased C1 and C3 bypass the signal to earth and there is feedback from the output of the amplifier through C2 back to the input circuit. This arrangement gives a sharper 'turn-over' of the frequency response than would be possible using only passive components. Similarly, for the rumble filter, at mid frequencies the capacitors have a low impedance and the overall gain in unity. As the input frequency is decreased the capacitors increase in impedance and the output is reduced.

CIRCUIT

In the practical circuit of Fig. 7 the amplifiers are formed by 741 integrated circuits. The output terminal pin 6 is connected directly to the inverting input pin 2. This gives the required non-inverting buffer with a high input impedance and a low output impedance. The right hand channel only is shown in Fig. 7 and the left hand channel is identical. Tr1 forms an emitter follower which drives the scratch filter and also provides the correct DC bias for the integrated circuit. The rumble filter can be

—continued on page 633

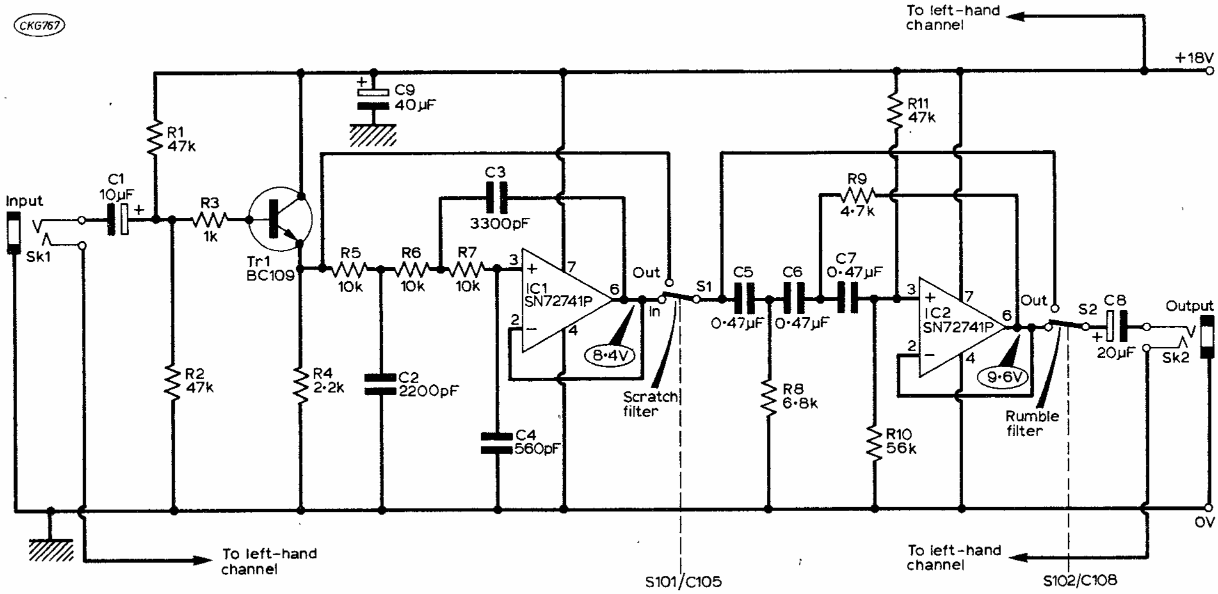


Fig. 7: Circuit of the right-hand channel of the complete Scratch and Rumble Filter for stereo.

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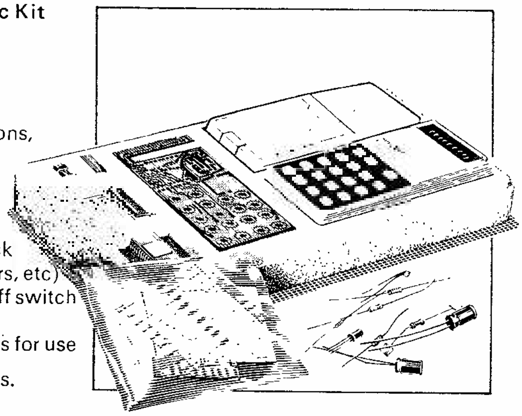

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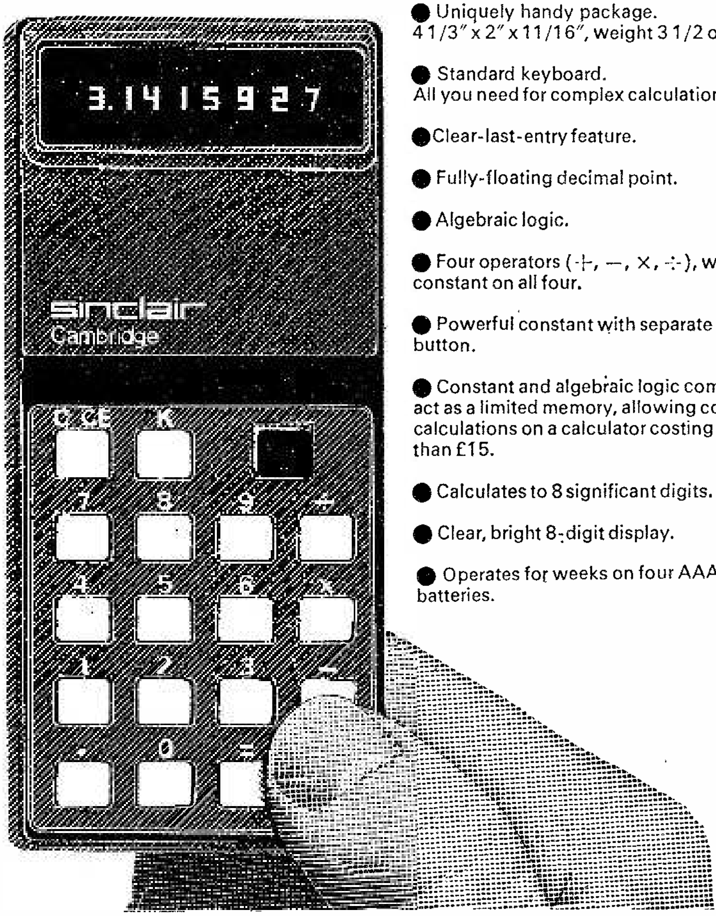

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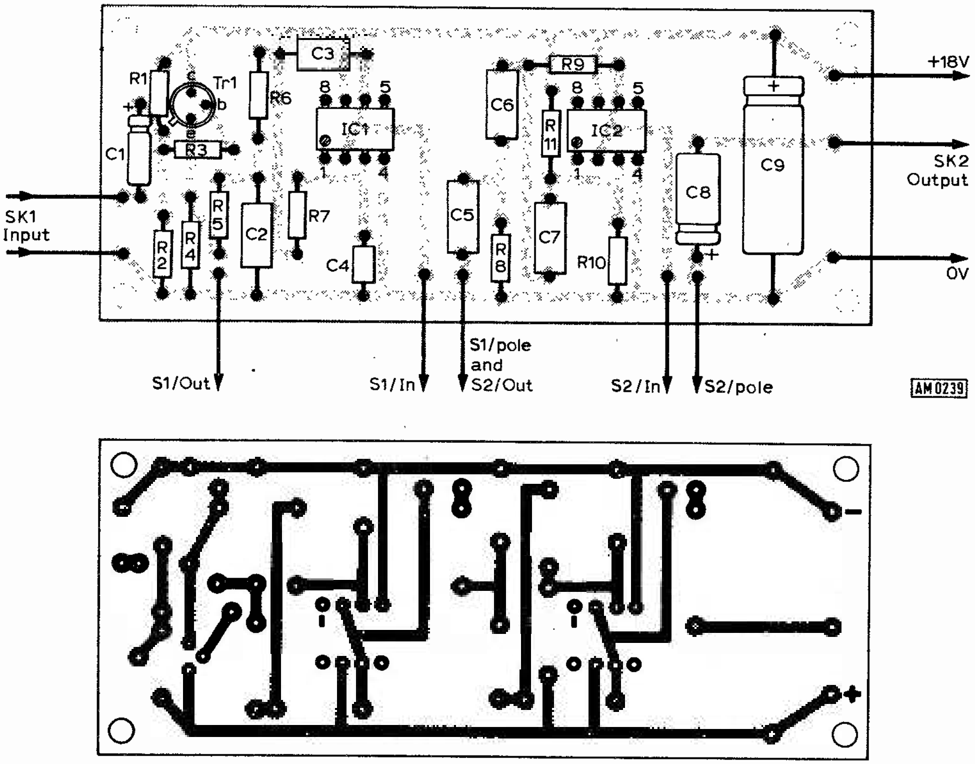


Figs. 8 and 9: Full size diagram of the PCB with component layout. Again, two PCB's are required for a stereo amplifier.

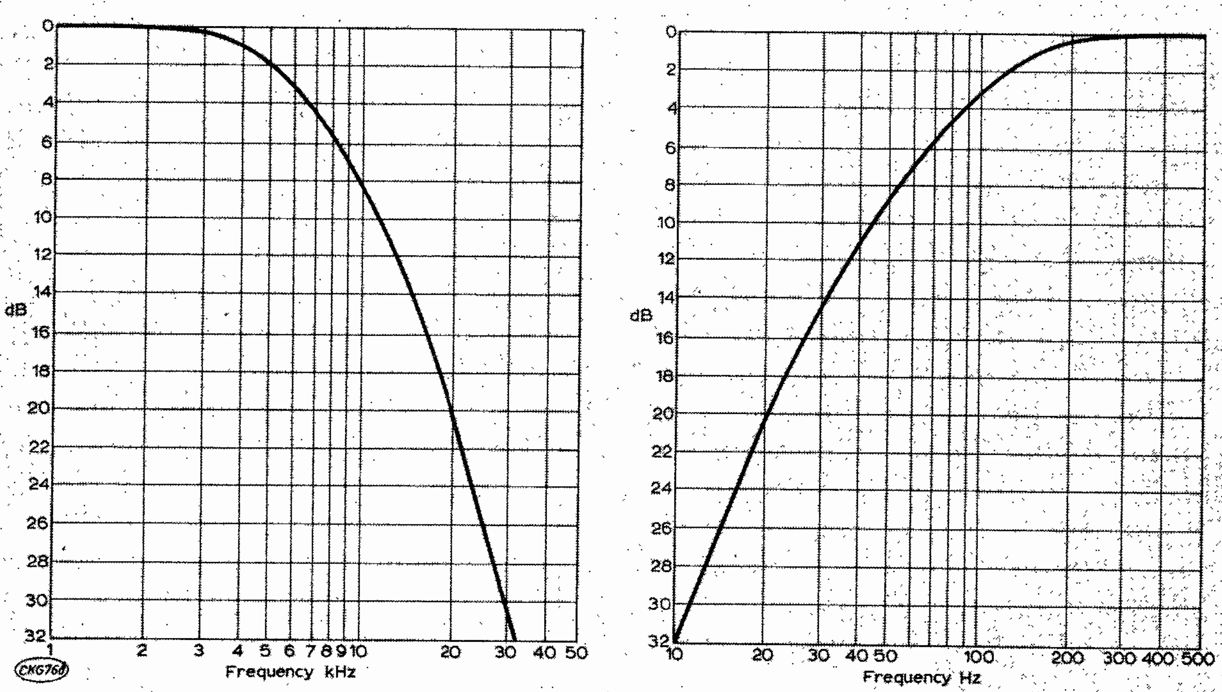
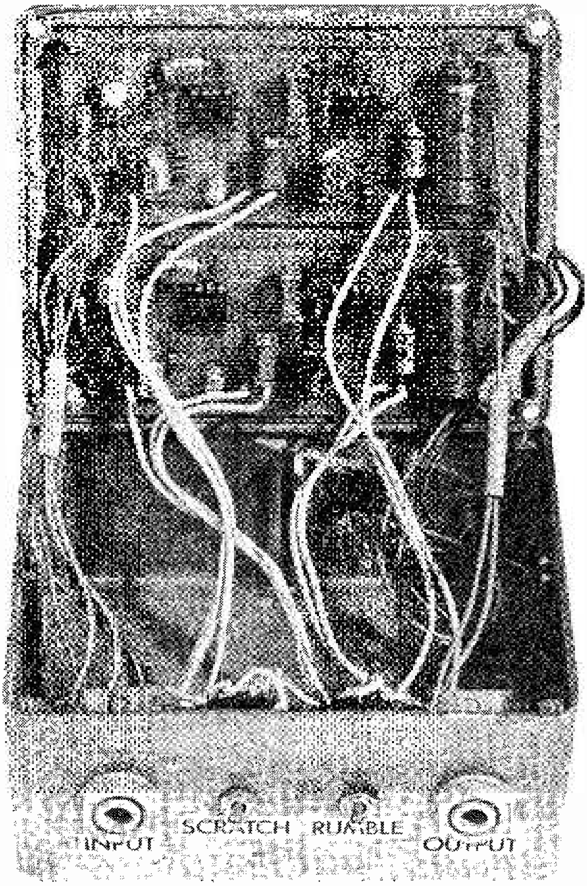


Fig. 10: left, frequency response of the scratch filter. The response of the rumble filter is shown on the right.



The finished Scratch and Rumble filter for a stereo set-up. The input impedance is 15kΩ and the output impedance low.

★ components list

Resistors

R1	R101 47kΩ	R7	R107 10kΩ
R2	R102 47kΩ	R8	R108 6·8kΩ
R3	R103 1kΩ	R9	R109 4·7kΩ
R4	R104 2·2kΩ	R10	R110 56kΩ
R5	R105 10kΩ	R11	R111 47kΩ
R6	R106 10kΩ		

All ½ or ¼W 5%

Capacitors

C1	C101 10μF 16V	C6	C106 0·47μF 5% PC
C2	C102 2200pF 5% PS	C7	C107 0·47μF 5% PC
C3	C103 3300pF 5% PS	C8	C108 20μF
C4	C104 560pF 5% PS	C9	C109 40μF
C5	C105 0·47μF 5% PC		

PS polystyrene PC polycarbonate

Semiconductors

Tr1 Tr101 BC109 IC1 IC101 SN72741P or similar
IC2 IC102 SN72741P or similar

Miscellaneous

S1/S101 and S2/S102, each 2 pole 2 way toggle switch. Sk1/2 stereo jack socket (2). Printed circuit boards. Die cast aluminium box 4½ x 3½ x 2in. or similar. Terminals (2).

—continued from page 629

driven from the scratch filter or directly from Tr1. In the rumble filter R10 and R11 maintain the correct DC conditions for the circuit and their parallel resistance gives the R3 of Fig. 6b. Capacitors C9 and C109 are decoupling components.

CONSTRUCTION

Construction is straightforward, as shown in Fig. 8 with a separate board, Fig. 9, for each channel. Sockets Sk1 and Sk2 are common to both channels. Components for the second channel are listed as C101, etc, as in normal practice. Although a printed circuit was used in the prototype, a similar layout using LEKTROKIT could be used if required. It is advisable to purchase the filter components before the layout is finalised as capacitor sizes vary and the types used were among the smallest available.

Although the 8 pin DIL versions of the 741 are specified in the article, it is worthwhile noting that the round package versions have the same pin connections and the leads can be spread to fit the printed circuit board if required. No detailed dimensions are given because this will depend on the box used, the size of which is not important.

TESTING

The DC voltages shown on the circuit diagram should be measured for the nominal supply voltage shown. If these DC conditions are correct then an AC signal may be applied to the unit and the overall performance checked. If no test equipment is available for this purpose then a listening test must suffice. The characteristics of the filters are shown in Fig. 10. ■

SPECIAL PRODUCT REPORT

HEATHKIT SW-717G

MEDIUM AND SHORT WAVEBANDS RECEIVER

THIS report applies to the Heathkit SW-717G, the latest model from the SW-717 range of receivers. The SW-717G shortwave receiver covers the medium waveband and three short wavebands. The receiver tunes continuously from 550kHz (550 metres) to 30MHz (10 metres) in four overlapping bands and will receive a.m., c.w. morse code or single sideband (s.s.b.) signals.

The Heathkit SW-717G is an all-semiconductor design with a selected 40673 dual gate MOSFET functioning both as r.f. amplifier-mixer in the front end of the receiver. The 40673 has wide signal handling capabilities together with lower noise. A separate local oscillator stage reduces 'pulling' and improves stability.

Ceramic filters are utilised in the i.f. stages, thus simplifying alignment. The i.f. response and therefore selectivity is optimised by the use of these filters.

Amplified a.g.c. is incorporated, thus yielding excellent control over the gain of the r.f./mixer and i.f. stages. Regeneration is utilised to improve selectivity in the c.w. s.s.b. mode and to a limited extent in the a.m. mode.

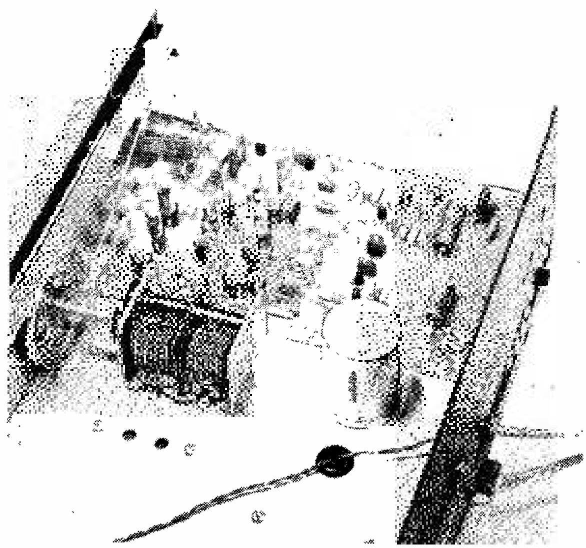
The degree of regeneration (and therefore selectivity) may be adjusted by a front panel control. This was found to be extremely useful when receiving 80 metre s.s.b. and c.w. signals.

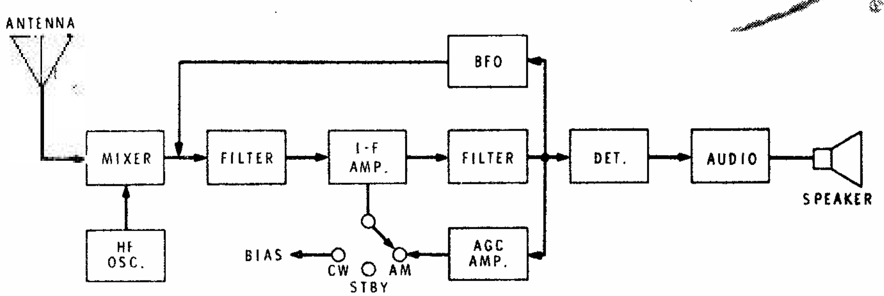
An automatic noise limiter circuit affords a reduction in the levels of impulse noise interference. The audio stages consist of audio preamplifier and driver, followed by a complementary push-pull output stage (pnp-npn silicon devices) which in turn feeds either an internal loudspeaker or a socket for headphones/external speaker.

A ferrite rod aerial is utilised for medium waveband reception and is automatically selected by the wavechange switch. On short waves there is provision for connecting an external aerial for optimum performance.

Bandspread tuning on all wavebands is an extremely useful tuning aid, especially when searching for those weak DX signals. A tuning meter indicates relative signal strength.

The assembly manual for the Heathkit SW-717G is an excellent and informative work. The assembly instructions are clear and concise and the accompanying sketches





The block diagram, left, indicates the function of each stage of the SW-717G. The photograph, above, shows the completed printed circuit board fitted to the chassis.

MANUFACTURER'S SPECIFICATION

Frequency coverage:
Band A—550kHz to 1500kHz,
Band B—1·5MHz to 4·0HMz,
Band C—4·0MHz to 10·0MHz,
Band D—10·0MHz to 30·0MHz.

Sensitivity:
Band A—10μV (ferrite rod aerial)

S/N + N for 3μV input	**Image average**
Band B 30dB average (h.f to i.f.)	30dB down
Band C 25dB average (h.f to i.f.)	24dB down
Band D 15dB average (h.f. to i.f.)	15dB down

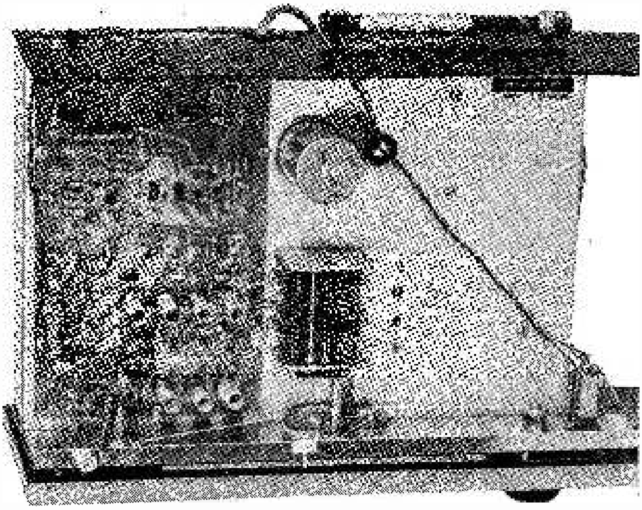
Selectivity:
4kHz at 3dB down
12kHz at 30dB down.

Meter:
Indicates relative signal strength. **Headphone socket:** low impedance headphones or external loudspeaker (25Ω). **Loudspeaker:** built-in. **Controls:** Volume with on/off switch. **Mode:** (a.m., Standby, c.w./s.s.b.). **BFO, Main Tuning. Band-spread Tuning. ANL (on/off).**

Transistor complement:
40673 r.f. amplifier and mixer, MP105 local oscillator, 2N5308 i.f. amplifier, 2N5232A i.f. amplifier and a.g.c. amplifier, 2N3393 audio pre-amplifier, X29A829 audio driver, S2090/S2091 audio output stage (complementary pair).

Power requirements:
Transformer operated, full wave bridge rectifier 120V a.c. or 240V a.c. 50/60Hz.

Dimensions:
14·5in. wide, 5·75in. high, 10in deep. Weight 7lbs.



The ferrite rod aerial for the medium wave band is fitted to the outside of the back of the cabinet, at the top in the photograph.

detailing step-by-step assembly cannot be faulted. Everything that the newcomer or beginner requires for assembly in easy-to-read stages is there. Alignment, often the bogey of the beginner constructor, is covered in a straightforward manner. Details are given for alignment both *with* and *without* test instruments. As a matter of interest, the reviewers' young son used the '*without instrument*' alignment procedure and on checking with instruments—no extra adjustment was required. Quite remarkable, but after all Heathkit Ltd., have been in this business for a very long time.

A technical consultancy service is operated by Heathkit—queries are answered either by telephone or letter—what more could you ask?

Performance figures do not really convey much to many beginners or newcomers to shortwave listening. What he really wants to know is, how well it works. Well, judge for yourself. In conjunction with a wire aerial (132ft. trap dipole fed with 75Ω coax) the following amateur s.s.b. stations were heard at good strength on the 80M amateur band during July this year, (The reviewers' favourite band). ZL3GS, PY2FOA, ZL4KF, PY2FUS, all at good signal strengths. In addition many stations from the USA and Canada were logged over a week of early morning listening. On the 20M band, most parts of the world were logged including VP8. If one remembers that the majority of amateur band signals emanate from low power transmitters (compared with BC stations) the performance of the SW-717G is indeed impressive.

No problems were encountered during assembly (assembled by the reviewers' young son) and the receiver, after initial tests, worked immediately upon switching on—in fact, before alignment.

The main tuning drive utilises a spring-loaded reduction system. Tuning is positive and there is negligible backlash. Tuning the shortwave bands was a pleasure, especially when using the bandspread control.

The Heathkit SW-717G kit is well engineered, the chassis and other metalwork is first class. A printed circuit board facilitates assembly.

In addition to the assembly manual, a kit builders' guide is included which, amongst many other things, gives comprehensive illustrative details on how to solder!

At £33·50 (including VAT and carriage) the Heathkit SW-717G is extremely good value for money. Its excellent performance and sensitivity surprised your reviewer, who incidentally has been both swl and licensed amateur for a total of 35 years!

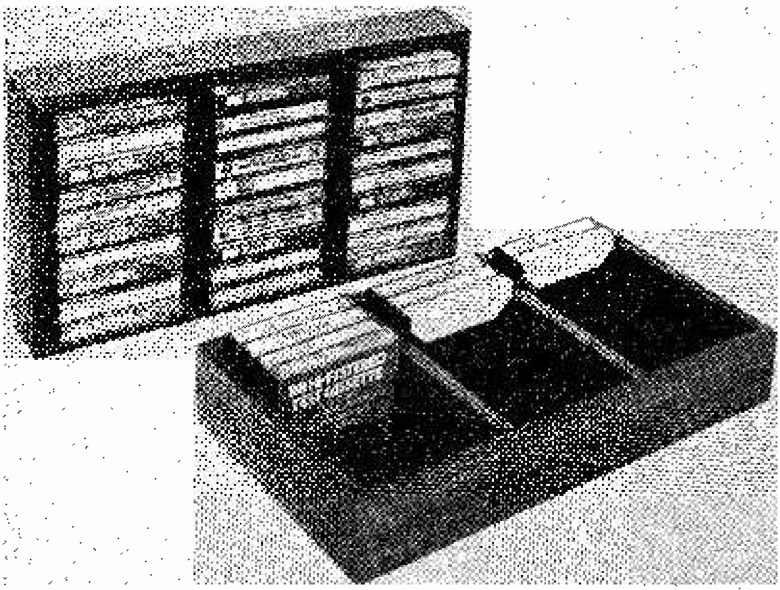
An illustrated brochure with complete circuit details is available—upon request from Heathkit. The complete assembly manual is also available. The cost is 50p which is deductible when purchasing the kit.

HEATHKIT (GLOUCESTER) LTD, GLOUCESTER, GL2 6EE, ENGLAND.

PRODUCTION LINES

colin riches

CASSETTE STORAGE UNIT



THIS jolly useful piece of furniture—for that is what my wife, Margaret, called it when she saw the lovely teak finish—is something that's been wanted for a long time.

It holds 30 compact cassettes which fit into plastic inserts—thus enabling them to be removed quickly and easily wihout touching each other.

The rack, made by Bib Limited, measures $15\frac{3}{4}$in wide, 9in high and $2\frac{1}{2}$in. deep. It can be used either standing up or laying flat (as the picture shows) and comes complete with four self-adhesive protective base feet.

The price, excluding VAT, is £4·26 and you should see them in most hifi and record shops.

If you would like further information on this, or any other accessories, write to Bib for their full-colour catalogue. The address is: *Bib HiFi Accessories Limited, P.O. Box 78, Hemel Hempstead, Herts HP2 7EP.*

RECHARGEABLE CELLS

THE Ever Ready Co. market a good selection of rechargeable cells. They are nickel cadmium devices and come in a range of sizes and capacities which makes them ideal for driving transistor tape recorders, battery shavers and such like.

The main features of the nickel cadmium electrochemical system are (1) flat voltage curve—the cell voltage being substantially constant throughout the discharge cycle; (2) high rate discharge—the cells are capable of and specially suited to this type of use; (3) overcharge capability—the cells can accept long-term overcharging at prescribed rates; (4) wide temperature range—the cells will operate from −30°C to +50°C.

If you would like some more gen and a price list contact *Mr. K. G. Banks, The Ever Ready Co. (Great Britain) Limited, Spa Road, Hockley, Essex SS5 4AH.*

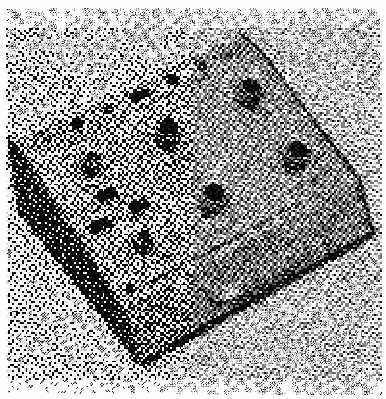
CURVE TRACER

WITH this device you can check operating parameters of any discrete semiconductor with your oscilloscope.

The IT-1121 curve tracer from Heath is just connected to any 'scope with a horizontal sensitivity of 0·5V/div and vertical sensitivity of 1V/div.

Devices such as bipolar transistors, diodes, SCR's, triacs and FET's can be inspected or tested. Extra leads are supplied for in-circuit testing or checking large devices.

With the IT-1121, you can display fundamental parameters like gain (beta) leakage, breakdown voltage, saturation, forward conduction voltage, output admittance, linearity, capacitive effects, temperature effects, etc.



In kit form, the unit costs £52·95 (this includes 8% VAT and delivery). Assembled price is £127·45.

Further gen and free catalogue from *Heath (Gloucester) Ltd., Gloucester GL2 6EE.*

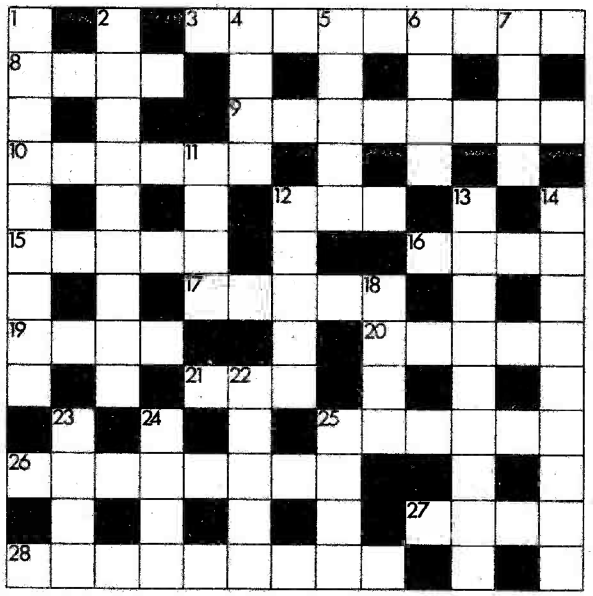
GRUNDIG CUT PRICES

GRUNDIG have cut the prices of two of their most popular car radios. The WK2503 l.w./m.w. push button receiver with tone control now costs £29·16 (rec. retail price including VAT).

The 3-band model WK3001 with manual tuning and push-button tone control now retails at £20.

Grundig tell us that in spite of these price reductions, there are no changes to the two receivers.

PW TECHNICROSS PUZZLE No. 7



ACROSS

3 A brief farewell to this band? (5, 4)
8 Plans to correct Pam's distortion? (4)
9 Disc-jockeys in bowlers? (8)
10 Has no longer got it taped? (6)
12 Group receiver fixed (3)
15 Bewilder with a complicated circuit? (5)
16 The spiral of electricity charges (4)
17 Beams over the television? (5)
19 Much of a rectifier from a friend? (4)
20 Marine ultrasonics, like Richard said (5)
21 Often an extreme state of modulation (Abbrev.)
25 One in the eye for the TV screen? (6)
26 Manufacturer for BBC's American sound? (8)
27 Chief part of a main conductor? (4)
28 Singular example of personal reception (9)

DOWN

1 It seems to resist more after induction (9)
2 Is it a receiver or some other mechanism? (9)
4 Disapproval expressed of surface noise (4)
5 It has current for hi-network induction (5)
6 Bit of a blow to prepare for 16 Across? (4)
7 Love radio shows when she's in them? (4)
11 Woolly sound from their ramshackle designs! (4)
12 Extra volume instruction finishes employees (5)
13 Milkman in electricity storage business? (9)
14 Valve charges passed by this device? (9)
18 Glass shutter mechanism (4)
22 Intuition about hunting a switch? (5)
23 Large networks contain hereditary element (4)
24 Speed up for such jazz? (4)
25 An indication of call-up? (4)

FOR AMUSEMENT ONLY
ANSWERS NEXT MONTH

EXPERIMENTAL WORKSHOP

M. J. HUGHES M.A.

LEARNING BY PRACTICAL PROJECT STEPS

PART 12—R C FILTERS

CAPACITORS behave, to some extent, like resistors in a.c. circuits in that they exhibit a form of resistance to current flow. Unlike a straightforward resistance the effect produced by a capacitor depends on the frequency of the current trying to flow through it. To distinguish between this special sort of resistance and the conventional type—with which we are all very familiar—we call the capacitor's resistance **reactance.** Strictly speaking it should be called **capacitive reactance.**

A capacitor allows high frequency signals to flow through it more easily than low frequency signals therefore we can say that the reactance of a capacitor decreases as frequency increases. The actual value of the capacitor (microfarads or picofarads) also controls the reactance. The higher the capacitance the lower the reactance. The effect of frequencies is superimposed on the relationship between capacitance and reactance hence we can derive a simple formula for calculating the reactance of any capacitor at any frequency.

$$Xc \text{ (capacitive reactance)} = \frac{1}{2\pi fC}$$

where the reactance is in Ohms, f is in Hz and C in Farads

Although reactance has units of ohms just like resistors we cannot simply add the reactance of a capacitor to the value of a resistor when they are connected in series because a phenomena known as **phase shift** occurs in such a circuit when a.c. signals flow—we shall be saying more about this next month—therefore we have, again, another simple formula for calculating the nett value of the two in series.

$$Z = \sqrt{R^2 + Xc^2}$$

Z is called **impedance** and again is measured in ohms

So long as we deal with the effective resistance to a.c. of the circuit as a whole in terms of **impedance** we can use values of d.c. resistance or capacitive reactance in voltage divide calculations just as if we were dealing with resistors in d.c. circuits. The only thing to remember is that one set of calculations is only valid for one particular frequency.

The frequency dependence of reactance is very useful to us because it enables us to tailor the frequency response of circuits—we can design and build filters which will pass, or block, signals having preselected frequency ranges. In this part we shall look at just one area where this application is well known—tone controls in audio amplifiers.

If we feed a set of a.c. signals of different frequencies into the circuit of Fig. 82 the reactance of the capacitor decreases as frequencies increase; if this is combined with the total circuit impedance for each frequency we care to consider we can work out what the output voltage would be as a fraction of the input voltage by a simple potential divide calculation.

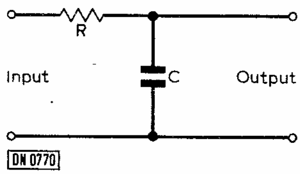
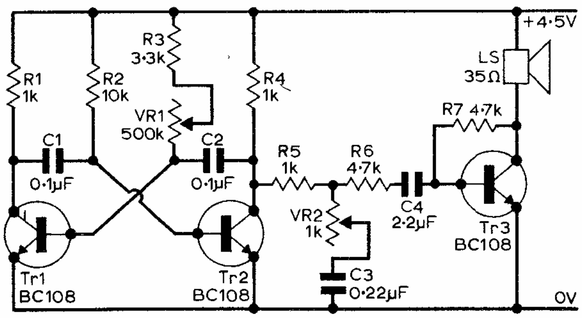


Fig. 82: Basic circuit for a top cut filter.

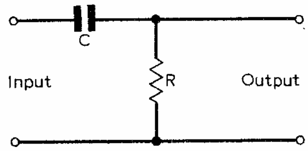
We would find that for a fixed amplitude input signal the output voltage would fall as the frequency of the signal increased. If you have the inclination you could work this out by taking any pair of values for C and R and using the equations we have just mentioned. If you were to do this you would find that a doubling in frequency would halve the output voltage thus we arrive at the statement that an RC filter stage of this type has a falling response to frequency with a factor of 2 (or 6dB) per octave. Because the circuit attenuates high frequencies we call this a **top cut filter** and it is very often used as a "mellowing" circuit for low price record players and radios.

You can see—or rather, listen to—the effect of a circuit based on this principle by making up the project shown in Fig. 83. In this circuit we have an oscillator in the shape of a multivibrator (Tr1 and Tr2) the frequency of which can be adjusted



DN0771

Fig. 83: left, demonstration circuit of a top cut filter. R7 should be selected to produce a quiescent voltage of 2V at the collector of Tr3. Fig. 85: below, shows basic bottom cut network.



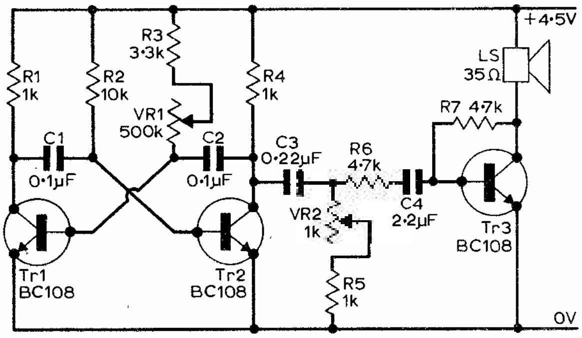
DN0772

by VR1. We have designed it to run at quite low frequencies but the square wave output is very rich in harmonic content. If this were listened to in its raw state the wave produced would sound rich and throaty—rather like a clarinet. If we remove some of the high frequency harmonics with a filter the sound becomes more mellow with flutelike qualities.

R5 in conjunction with VR2 and C3 form the top cut filter (R6 and C4 are only there to give us effective coupling to the loudspeaker driver stage). VR2 allows us to change the total circuit impedance and thus alter the potential divide effect of C3—this effectively shifts the frequency at which the filter starts to take effect. A high value for VR2 will reduce the top cut action (in simple terms you could imagine it as divorcing the capacitor from the rest of the circuit!). Reducing the value of VR2 to zero gives maximum top cut effect.

Make up the circuit on T Dec as shown in the layout; be careful that the collector of Tr3 is approximately mid rail—to do this you might have to vary the value of R7 slightly. With VR2 set to maximum resistance you should hear the clarinet type of sound already described and reducing it should mellow the signal considerably. Ideally you need as large a loudspeaker as possible to get the best effect. Try different frequency settings of the oscillator and at the same time substitute different values for C3 in the range of 0·01µF to 1·0µF.

While you have the circuit built you can easily investigate the properties of a bottom cut (or bass cut) filter. The basic circuit is shown in Fig. 85. Note that the capacitor and resistor have changed places; at high frequencies the capacitor provides very little series reactance hence attenuation of these frequencies is small but for low frequencies the capacitor increases the circuit's impedance and the potential divide action between the resistor and the impedance is quite significant—hence the low frequencies are attenuated.



DN0773

Fig. 86: This circuit of the bottom cut filter is similar to Fig. 83 except that the positions of the components C3 and R5 are interchanged.

By reducing the low frequencies of the square wave we effectively draw more attention to the high harmonics and the sound becomes very raspy or harsh. Control over the degree of filtering is provided by VR2 which is now, effectively, divorcing R5 from the rest of the circuit; the lower the value of VR2 the greater the filtering effect.

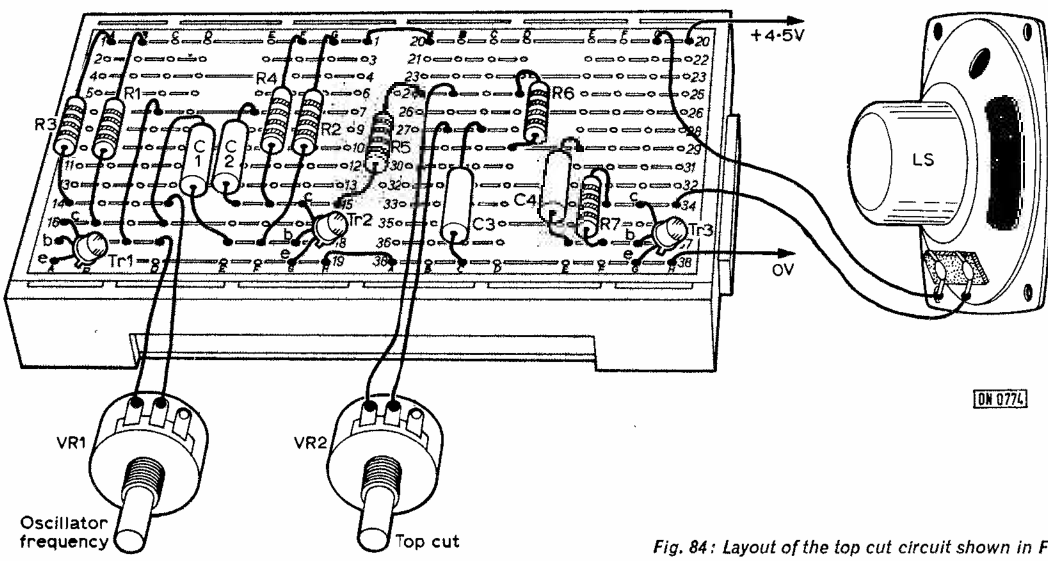


Fig. 84: Layout of the top cut circuit shown in Fig. 83.

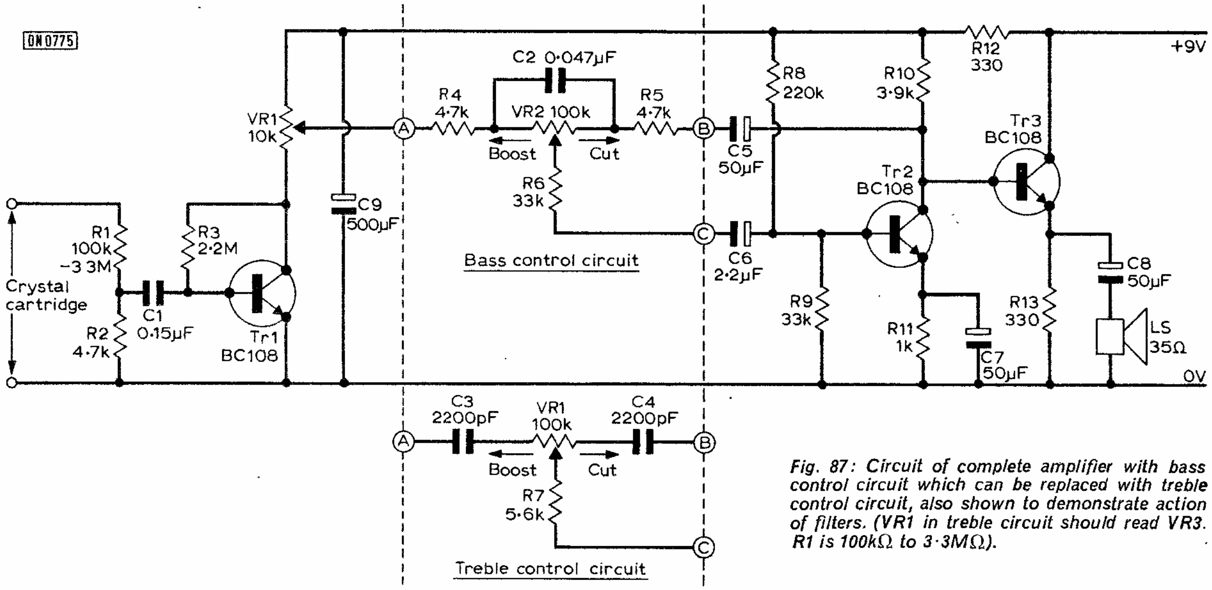


Fig. 87: Circuit of complete amplifier with bass control circuit which can be replaced with treble control circuit, also shown to demonstrate action of filters. (VR1 in treble circuit should read VR3. R1 is 100kΩ to 3·3MΩ).

Both these types of circuit are used in simple tone control applications and they frequently form part of the tone forming circuits of electronic organs as the experiment should make very clear. There is a fundamental problem with this type of circuit; it operates by *removing* part of the signal and the signal that is left is always of lower energy than that which went into the filter. Such a filter cannot by any stretch of the imagination be considered as one which, for example, "improves" the bass of an amplifier. In practice, of course, one can cut the treble and then turn up the volume control of the amplifier; this will enhance the bass frequencies but the enhancement is caused mainly by the extra gain from the amplifier. The filters we have just described come into the category of **passive filters.**

In most high-fidelity amplifiers we like to be able to cut or enhance each end of the audio frequency range with single controls. This means that our filter must be somewhat more complex—we need to turn to **active filters.** These are circuits which will range from giving preferential amplification to certain frequencies through a central "neutral" condition—in which the input signal is unaltered—to a condition which reduces the signal from the range of frequencies in question.

A demonstration circuit incorporating such a bass filter is shown in Fig. 87. This circuit is for a very simple record player amplifier; the circuitry around Tr1 and Tr3 has already been described earlier in the series. The active filter is centred on Tr2. The values of R4, R5, C2 and VR2 have been carefully selected so that when VR2 is set in its mid position the gain of Tr2 stage is approximately unity at a frequency of 1 kHz.

The wiper of VR2 receives two signals; one is the direct input signal coming through R4 and the other is a negative feedback signal from R5. When the

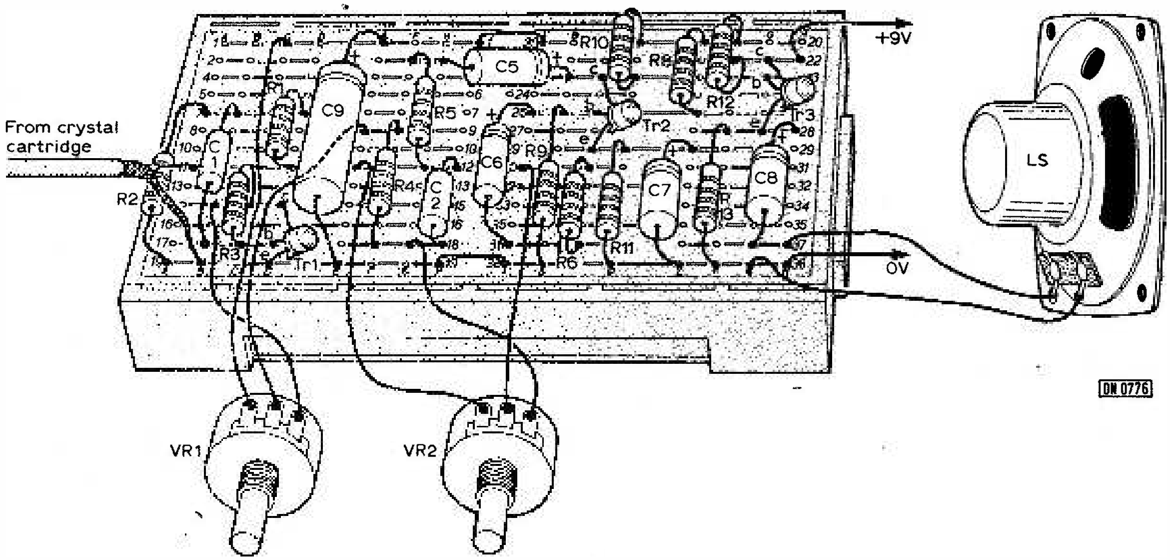


Fig. 88: Layout of the amplifier shown in Fig. 87 with the bass control circuit components inserted.

wiper is at the left hand end of its track (in the boost position) the wiper sees the input signal unmodified by any reactive elements but C2 feeds back high frequency signals from the collector of Tr2. These signals are out of phase with the input and effectively reduce the amplitude of high frequency signals at the wiper. Because we have removed the series effect of VR2 to the input signal its overall amplitude will be larger and this fact in conjunction with the attenuation of high frequencies provides a bass boost. When the wiper is at the right hand end of its track C2 provides a reactive path for the input signal and will, of course, pass high frequency signals preferentially. By cutting out the effect of VR2 on the feedback signal the overall negative feedback is considerably increased and the nett effect is a lowering of the stage gain to low frequencies—in other words the bass will be cut.

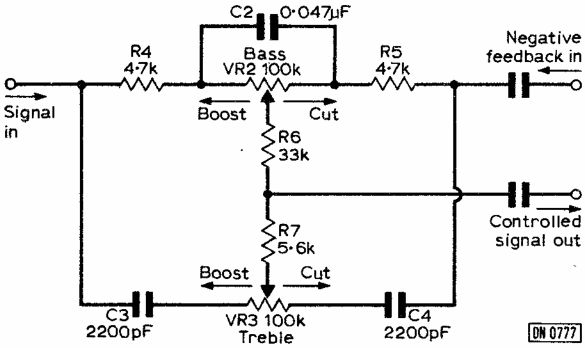


Fig. 89: A combined feedback tone control circuit designed by Baxendall, frequently found in audio amplifiers.

By connecting a crystal cartridge to the input (selecting R1 to prevent overload distortion) you should be able to hear the effect of this circuit quite clearly if a reasonably good loudspeaker is used.

You can, at the same time, experiment with a treble boost/cut circuit—also shown in Fig. 87. The extra network simply substitutes for the circuit between the dotted lines at connections A B and C. Again the gain of the stage at 1kHz will be about unity when VR3 is set mid way. When the wiper is at the left hand end C3 passes high frequencies and the negative feedback, overall, is low thus giving a boost to high frequencies; when it is at the right hand end the extra series resistance of VR3 reduces the input signal and the negative feedback of high frequencies through C4 is also increased. This gives rise to treble cut.

In practice these two circuits would be combined as we have shown in Fig. 89 providing the amplifier user with virtually independent control of both the low and high frequency ends of the audio spectrum with the centre frequency (1kHz) unaffected. Such a network is sometimes named after its original designer—Baxandall. You might like to try building the complete network on a piece of Veroboard together with Tr2 and its bias components; the complete stage should be capable of insertion in almost any type of amplifier at the volume control stage, if you wish to improve the tone control arrangements.

To be continued

continued from page 621

socket on the back of the case. When this is done use Araldite to hold the twisted wires together.

Now connect a short lead between the case and the 0V rail of Board E, as shown in Part 2. This must be the **only** link to chassis in the whole system. Under **no circumstances** should the metal case of the modulator be allowed to come into electrical contact with the main system's chassis—this will put a dead short across the power supply.

The prototype has proved to be quite robust, having stood up to a lot of travelling and to use at an exhibition. Little adjustment has been needed apart from the initial setting up described in the above paragraphs. However, should it be necessary to carry out adjustments the design allows easy access to all the preset potentiometers. When doing this be careful not to catch the back of your hand on the pins of the mains switch which will, of course, be live. ■

Corrections to Overall components list
(page 235 of July issue)

1. Polystyrene capacitor quantities:
   1000pF should read 2.
   2200pF should read 5.

   Diode types:
2. 1N4004 should read 1N4001, although either type is satisfactory in this circuit.

SANDOWN PART 2—continued from page 614

between the earth planes on the top and bottom of the board by passing a piece of wire through the hole near to the connecting pad marked 'SW' and soldering it to both sides of the board.

WIRING UP

Connect wires to the leadthrough insulators on the side of the box and route them in a cable form as shown in Fig. 6. Table 1 shows the point on the board to which each wire should be connected. Leave enough wire to allow the board to be removed from the box without disconnecting the cable. If any meters or switched facilities are omitted the appropriate wires may be left out and the necessary connections made directly on the board. Re-connect the wires from the transformer, including the temporary earth lead from the ground plane to the earth tag, in readiness for testing.

Next month we will give constructional details for the front panel, together with final test and alignment procedures.

EDITORIAL VACANCY ON PW

PW invites applications, in writing, for the position of Technical Sub-Editor on the magazine. Previous experience of editing technical material, correcting proofs and article make-up highly desirable. A general knowledge of electronics should be coupled with an interest in the problems of the home-constructor. Applications should be addressed to the Editor.

HOTLINES ON RECENT DEVELOPMENTS

VERY FISHY

MANY moons ago (1972 to be precise) RCA announced details of an improved type of TV camera tube—a silicon intensifier type. Having wondered ever since about the applications (other than military) I checked. Would you believe it, one application is the detection of fish from a flying aircraft and at night time too!

Apparently sea plankton glows very slightly and this is detectable by the silicon intensifier. The fish disturb the plankton when they swim near it and thus the fish can be seen from an aircraft flying at some thousands of feet. Before anyone thinks this a little crude, I should add that, so sensitive are these tubes, the observers can even tell the actual species of fish involved.

SO SARIE!

But it's not only American companies which design and manufacture interesting devices. An example of something from England is Sarie—the brain child of EMI Electronics Ltd. This simple name hides a most ingenious semi-automatic radar identification equipment.

Think of a foreign ship, steaming along and watching British naval exercises. The foreign ship will be using it's radar to keep an eye on the whole operation. But such an observer can be disguised and so can it's radar equipment. Such disguises don't fool Sarie. She is a passive receiving system which looks round for any signals. Once she spots a radar signal she immediately displays this on a digital/alpha numeric LED readout. Radars are known and classified by characteristics—size of the pulse, width of pulse, duration, frequency etc etc.

The previous approach was to first pick up the radar signal, then examine it on an oscilloscope and try to measure the characteristics. Having eventually done all that, it was necessary to hunt through a huge list of radars trying to match up the characteristics and thus, finally, identify the radar.

This can now be done by Sarie—in a few seconds. The signal received (on standard receiving equipment) is simply fed into Sarie. She immediately shows all radars in her memory which have characteristics like those being received. These signals are arranged in order of likelihood. Further information is then derived from the signal and Sarie will eliminate the "probables" leaving the identified radar on the screen plus all the information about its characteristics. The significance of this can be appreciated already. However, whereas at sea during an exercise, the identification of a foreign radar can be a casual affair, think of a missile. To spend several minutes hunting through lists could be the last hunt you ever did! Sarie holds a unique place in U.K. electronics—she allows the listener to be listened to.

MORE CCDS

Charge coupled devices (CCDS) showed great promise as solid state television camera tubes. Some systems have already been marketed which employ CCD sensors. Fairchild, for example, have a television camera about the size of a packet of 20 cigarettes. Versatility of the CCD technique is now being realised in other areas and perhaps the most prominent is that of using it in a computer memory. Various systems already exist—tape, magnetic disc and drums etc. Drums are popular and can store large amounts of information. Now, the memory scene is being upset, because the CCD memory seems to offer a quite fantastic edge on anything else—so far! Comparing CCD memories with drums illustrates the point. An American company is currently working on a CCD memory which can store some eight million bits of information. To store the same amount of information a drum would need to be bigger and heavier. The CCD device weighs only one eighth, measures only one tenth and consumes only one sixtieth of the power which a comparable drum system would use. Remember too that the CCD device is solid state, no moving parts, no maintenance. The desk top computer will soon be old hat and we will end up with wrist watch computers if things carry on at this pace. Perhaps those 007 gimmicks aren't so far fetched after all.

SNAP

The photographic fraternity among us may be heading for an era where no film exists—no negatives. The hint is that amateur photographers of the future will sport a video camera recording direct on to magnetic tape. The age of hand-held consumer video cameras is about to dawn and already the electronics companies are gearing up to provide all the necessary equipment. The latest item of interest comes from BASF who has developed a cassette system using magnetic tapes with a playback time of 90 minutes. The tape has 28 tracks and reverses automatically in a fraction of a second when the end of one track is reached. Rumours tell of a two-hour tape under development. The interesting thing about the BASF approach is that it is a major departure from the conventional rotating heads along angled tracks. The BASF system uses the reverse; longtitudinal tracks and fixed head.

The electronics for the consumer video camera is an expensive affair and has to be very much cheaper before it becomes a marketable proposition. However, with the development of CCDs (those devices again) a solid-state cine camera could well be just round the corner.

Ginsberg

I.C. OF THE MONTH

Number 48 — National Semicon LM1820N AM Superhet

INTEGRATED circuits are becoming much more widely used in all types of radio receiver. As experience is gained by the collaboration of the semiconductor and receiver manufacturers, the devices produced become more and more complex internally as it becomes possible to incorporate more functions into a single device. At first sight one might expect that such ICs would be of use mainly to the receiver manufacturer rather than to the amateur enthusiast. However, the complex internal circuitry allows the use of simplified external circuits, which is very suitable for the amateur constructor!

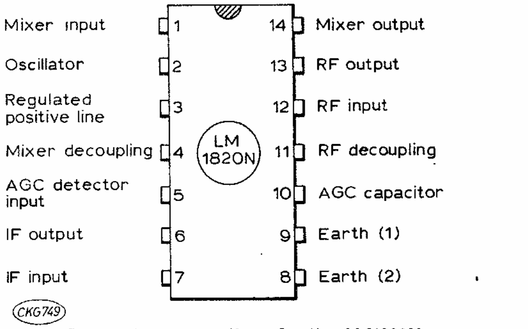


Fig. 1: Pin connections for the LM1820N.
Fig. 2: below, circuit for receiver using ganged permeability tuning.

Manufacturers design devices primarily for the high volume user but it is very pleasing to note that the devices are now being made available to the amateur constructor almost as soon as they reach the large manufacturer.

This month's device is the National Semiconductor's LM1820N superhet AM radio receiver which incorporates all the active devices required between the aerial and the audio detector diode. It can be used in receivers up to about 30MHz.

The 14 pin dual-in-line device contains two amplifiers, one as an RF stage and one as an IF amplifier, a mixer-oscillator, an AGC detector and a zener diode voltage regulator. Most of the external components used consist of tuned circuits, the selectivity depending entirely on these circuits and not on the IC itself. In addition, a detector circuit and an audio amplifier are required; an IC audio amplifier will normally be employed so that the whole receiver is as compact as possible.

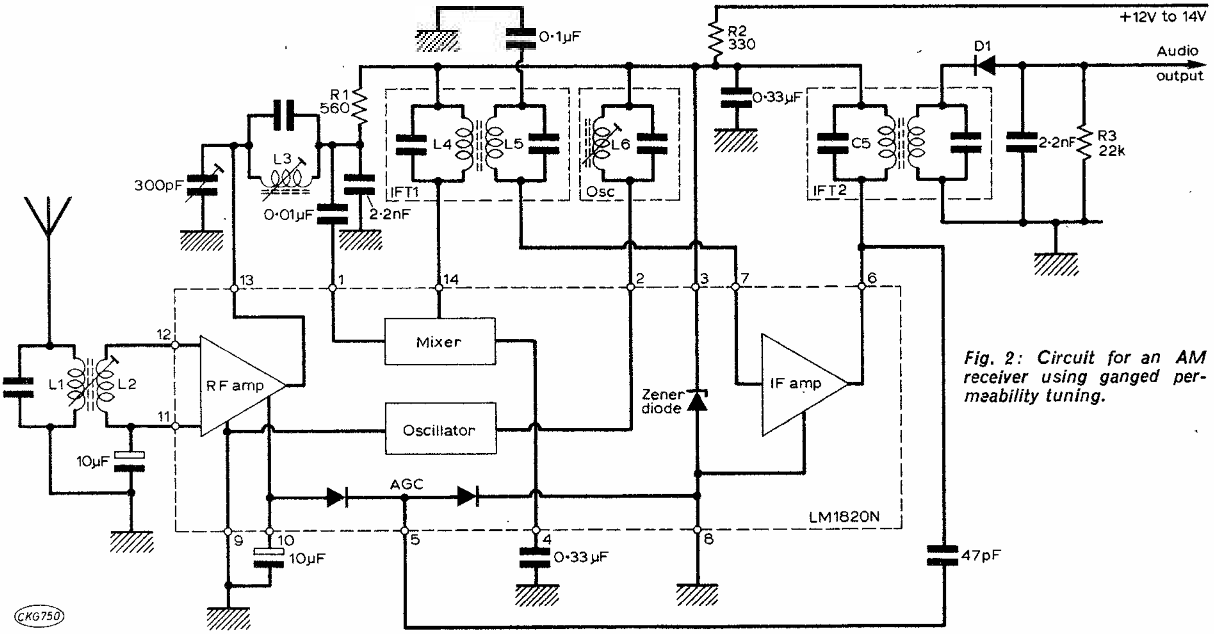


Fig. 2: Circuit for an AM receiver using ganged permeability tuning.

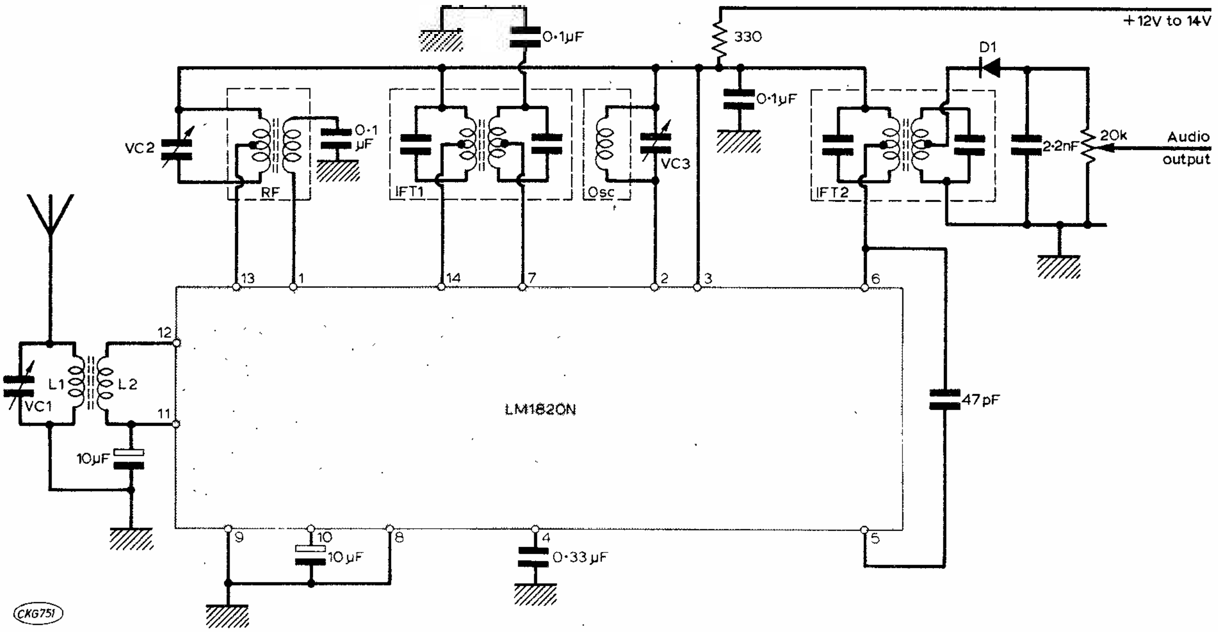


Fig. 3: Receiver with variable capacity tuning, VC1/2/3 being ganged.

CIRCUITS

The pin connections of the LM1820N are shown in Fig. 1. A typical receiver circuit (excluding the audio amplifier) is shown in Fig. 2 together with the internal circuitry of the LM1820N in the form of a block diagram. It can be seen that the inputs and outputs of the RF and IF amplifier stages are brought out to separate pins. This improves the versatility of the device, since one could, for example, omit the receiver RF stage and use the amplifier for another purpose.

The circuit of Fig. 2 is designed for permeability tuning. That is, the iron dust cores of the aerial tuned circuit L1, the RF tuned circuit L3 and the oscillator tuned circuit L6 move simultaneously into or out of the three coils to tune the receiver.

The component values shown are the ones tried by the writer, since no values are shown on the receiver circuit in the manufacturer's data sheet. For simplicity only one waveband is shown in Fig. 2, but it is not difficult to employ a number of switched coils for L1, L2, L3 and L6 to provide a number of switched wave bands.

POWER SUPPLY

The absolute maximum supply line voltage is 16V, but it is wise to regard the circuit design maximum voltage as 14V so as to allow a reasonable margin of safety. An internal zener diode is connected between pins 3 and 8 so it is important to note that a resistor must be connected between the positive supply line and pin 3 or the supply voltage will be connected directly across the zener. Unlike most ICs there is no direct connection between the receiver positive line and any pin of the LM1820N.

The zener diode stabilises the pin 3 voltage at about 7·1V. The total supply current required is about 18mA and it follows that a resistor R2 of about 330Ω should be connected between pin 3 and the receiver positive supply line for typical supply voltages of about 12 to 14V. The device will, in fact, function when the supply voltage is below the zener voltage. The maximum permissible current into pin 3 is 35mA and the maximum dissipation at temperatures up to 25°C is 850mW.

The output of the RF amplifier stage at pin 13 is connected internally to the collector of an npn transistor. The current required by this transistor passes through the resistor R1 and L3 in the circuit of Fig. 2. The mixer output (pin 14) is also connected to the collector of an internal npn transistor, obtaining its current through the primary of IFT1.

The steady component of the voltage at pin 2 should be equal to the potential at pin 3, accomplished by connecting a tuned circuit between the pins. This circuit resonates at the oscillator frequency.

The output of the mixer stage at pin 14 feeds IFT1 and the signal from this is fed into the IF amplifier through pin 7. The output from this amplifier at pin 6 is fed into IFT2. The secondary of the transformer feeds the detector diode D1 which provides the audio output. R3 may be replaced with a 20kΩ volume control.

The IF output from pin 6 is fed to the AGC input pin 5. The two internal diodes act as a peak-to-peak detector. The resulting AGC control voltage is smoothed at pin 10 and provides a suitable time constant in controlling the gain of the RF stage.

VARIABLE CAPACITY TUNING

The amateur constructor may find it easier to use the LM1820N in the type of circuit shown in Fig. 3 in which tuning is carried out by means of a three-gang variable capacitor, VC1, VC2 and VC3. The RF coil L3 is tapped which leads to a simpler and more efficient circuit. (The coil L3 of Fig. 2 was not tapped because this can cause problems with permeability tuning.) One could also consider the possibility of using semiconductor variable capacitance diodes for tuning purposes.

—continued on page 650

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ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

LOOK to your laurels, my lads! Pride of place this month goes to **Julie Rose** (Warley, West Midlands) who has sent in any excellent log. Her Dad handed over his version of the PW 'Progressive' receiver to Julie and she's spent most of her spare time in the last couple of years listening on the amateur bands, aided and abetted by a No. 19 set bought for 10p at a jumble sale! Clever Dad removed the TX and VHF bits and fitted up a power pack and output stage. A Yaesu FR50B is in the offing, if Santa gets the message in time!

And now-SSTV !

Paul Barker (Sunderland) made me sit up with his reception reports on SSTV (slow scan TV) stations he had 'seen'! Equipment includes a home-made electrostatic monitor and an MK Products electromagnetic monitor which has recording facilities. Receivers include an FRDX500, Trio JR310 and Sony TFM1600. The aerials are 15 and 20m dipoles and a six element Yagi on 2m. Paul is to be congratulated on getting away from the SSB/CW routine and it is to be hoped that others may follow his example and 'look' into the possibilities of SSTV. Sorry about that!

John Porter (Baslow, Derbys) queries the SQ prefix heard of late. Just another of those silly 'change for change's sake', I'm afraid. Some SP anniversary I understand. The habit is very common nowadays especially in contests, no doubt netting the user a few extra million points since the country/prefix chaser cannot afford not to work him 'just in case' he is a new one!

Tony Price BRS33946 (Brierly Hill, Staffs) will have to have another go at the RAE. Hard luck Tony, but I'm sure the exam experience will have been worthwhile. I'm glad to see you haven't given up amateur radio in favour of stamp collecting! Tony reports that WB4SPG is hoping to activate Saipan in the Pacific 10 to 15 October, mostly CW but some SSB on 80, 40 and 20m. Tony also logged TG9GI who was running just 5 watts of SSB. That's really QRP, although the call is always worth a couple of extra S points! By the way, Tony uses a Collins 75A4 (lucky him!) and a TA32 for 10, 15 and 20m.

Alan Rae (Glasgow) concentrated on 40m SSB this time. He and his fellow members of the West of Scotland ARS are very aggrieved on having the club's KW2000 stolen recently. **Stan Sharred** (B'ham) is still finding useful DX on 160m in the height of summer (I must be joking!) including ZB2AY for a new one. **Michael Crimes** (Exeter) was pleased to change his 9R59DS for a Yaesu FR50B but says 'no more VHF until the converter's IF is changed' so he was forced to listen on HF for a change.

Congratulations

Graham Nicholls (Banbury) is just 16 and really off to a flying start in amateur radio having just passed his RAE, and probably his code exam by now. He says 'can copy 20wpm in my head' so writing it down at 12wpm shouldn't present much of a problem. How wise of him to go for the Class A licence from the start and have the run of all the bands even though he is interested only in 70cm and 2m at the moment. Graham's version of the G3HBW 2m converter reached out to OE3QMD/P and his F3PH/F3FC converter caught DL3BSA which isn't bad with bedroom yagis! He can always hang his socks on them when conditions are duff! **Max France** (Warrington) sent in a very impressive first log of 80m SSB heard on his R107 with either a 60ft horizontal wire or a 30ft vertical and a home-made ATU.

SSB-the hard way

Tim Charles (Colchester) plucked up courage to tell me that he is only 15 but a dedicated listener to the amateurs. His Teleton 702 portable hasn't got a BFO so 'I resolve SSB and CW by superimposing a local carrier from another receiver'. He does the same with his modified Bush 90A covering the HF bands between them. Oh well! As Tim says 'one day I'll have to make up a simple BFO'. It would be easier!

Not much space for personal chat this month! Any 9R59DS experts out there??? Several readers complain of excessive hum when using headphones, perhaps not entirely unexpected since these low impedance headsets are probably intended for hi-fi stereo reception and respond well to the 100Hz ripple frequency! A capacitor, around 0·5/1μF in series with headset might help reduce the bass response.

Log Extracts

Julie Rose:- 80m CT2BN C31FO EL7F FP0YY (0530) VK3DN VP2LH ZL2AKK ZL2BT ZL3GS ZL4KS ZP5AL **40m** EA7PW 7X2AN **20m** HI8MOG 5X5NK.

BROADCAST BANDS

Short Wave and **VHF/FM** reports by the 15th of the month to The Editor, Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.

Medium Wave Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

AMATEUR BANDS

Logs covering any amateur band/s in band/alphabetical order by the middle of the month to **Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey, KT21 2TW.**

P. Barker:- 20m C31BL F0CH/FC HM1BK HZ1SH KC4AAC (Antarctica) KC6SX KV4BW R1A, R2C etc (Russian contest calls) VE8DC (Ellesmere Is.) VQ9BP XT2AA **15m** TR8SS ZE4JS ZS3TP **Seen on 20m SSTV:-** DL3DW DK2MH DK5EL F8KW G3VGU K1OKW YU2CDS YV1AQE.

J. Porter:- 20m CR4BS CX1JR FG7TD HC1WP KG4NY TU2DV VP2VS (Tortola) **15m** KZ5WA ZP5AN.

T. Price:- 20m CO2FA CR4BS DU1XKE HK0BKX KG4GO KH6IJ KL7MF KM6DZ KS6DH KW6HF TG9GI ZL4BX (2300) **15m** HI8EJH.

A. Rae:- 40m CM7EG CX3UE M1C PJ2CW ZS3PT.

S. Sharred:- 160m EP2BQ GD3WPS/P WA8IJI ZB2AY 80m 5Z4LW CE6EZ FY7YF ZS1MH **40m HC1XG TI2PZ VK3MR 20m** 5T5MG DU1NRS **FG7XC** FL8OM HR1JBS KL7BJW **15m CX2CA TR8CQ.**

M. Crimes:- 20m VU2DK **15m** LU9HG VQ9GP CE3AQW IS0SQF.

G. Nicholls:- 2m DC8CB DK6QK GD8EXI GM8AGU/P HB9QQ LX1DU OE2CAL/P OK1WSG/P OZ1OL **All SSB. 70cm** DL3SBA DL7SGN F9FT G3KMS G8BGU **All SSB.**

M. France:- 80m CE6EC CP8CX CR3WB EP2VJ FY7AU TJ1EZ TR8AI VP2SAF VP5KG VP8NP ZD9GD 4S7PB 8P6CX 9M2BX.

T. Charles:- 80m PY4TK ZL3FA ZL3PX ZL4KF **40m** TG9PW VK2WC YV4ZA **ZL3DR** ZL4BO ZL4CM.

CW stations in bold, remainder SSB.

MEDIUM WAVE BROADCASTS
by CHARLES MOLLOY

Christopher Owens (Stoke-on-Trent) has a Bush PB12 receiver and a 15ft outdoor aerial. His medium wave log includes Radio Carlisle on 755kHz; Radio Blackburn on 854kHz; Radio Derby on 1115kHz; Piccadilly Radio, Manchester on 1151kHz; IBA Birmingham also on 1151kHz and Radio Humberside on 1484kHz. Christopher asks for information about French and German broadcasts on the low frequency end of the medium wave band. Guide to Broadcasting Stations published by Butterworth is available in most bookshops. It lists the majority of European stations on the medium waves together with a few of the more distant ones that are heard regularly and it is a good guide for the newcomer to the band.

Christopher Hall of St Julians in Malta who has been trying to pick up the BBC on the medium waves with his Telefunken multiband receiver, asks for information about medium wave propagation. During the daytime reception is by the ground wave only and the range, even of high power stations is limited. After dark the radio waves are reflected by the ionosphere and they can travel quite a considerable distance provided there is a path of darkness between transmitter and receiver. Reception of the UK in Malta on the medium waves should be possible after dark provided a selective receiver and an outdoor aerial are used.

DXers in the UK often hear North America on the medium waves during the winter months when a path of darkness falls across the North Atlantic before midnight. The band becomes quieter after 2300hrs GMT when a number of European broadcasters close down for the night and this is the time to hunt for Canadians, which are the first to appear. Listen for CBN in St John's Newfoundland on 640kHz; CJON also in St John's on 930kHz; CHER Sydney, Nova Scotia on 950kHz and CBA in Moncton, New Brunswick on 1070kHz. These stations are heard regularly in the UK when conditions are favourable. Propagation is variable on this path so if nothing is heard at the first attempt then try again a few evenings later. As midnight approaches stations in the United States can be heard. Look for WOR in New York City on 710kHz; WNEW also in NYC on 1130kHz; WCAU Philadelphia on 1210kHz and WKWB Buffalo NY on 1020kHz. An outdoor aerial or a medium wave loop aerial should be used for this type of DXing as it is unlikely that North America will be heard at any strength with a portable receiver and internal aerial.

David Birch (Trowbridge, Wilts) has been busy on the medium waves with his VTO transistor radio. He reports hearing Vatican Radio on 1529kHz; Trans World Radio, Montecarlo on 1466kHz; and programmes in English from West Germany on 1268kHz, Warsaw on 1502kHz and the Voice of America on 1295kHz at 2100hrs GMT. Our regular reporter **Brendon McNamee** who lives in Portrush, Northern Ireland has been DXing with his Sharp BZ-23 receiver. His log includes Radio Tirana, Albania on 1394kHz; Radio Prague on 1286kHz and RTE Dublin on 1250kHz.

We wish to thank those readers who have sent in reports for the Short Wave Broadcast and VHF/FM bands, we hope to resume publication of these features as from next month.

IC OF THE MONTH—*continued from page 646*

PERFORMANCE

The RF input resistance at pin 12 is typically 1kΩ. The transconductance of the RF stage at 1MHz with a 100μV signal at pin 12 is about 120mmho, but decreases with the applied AGC and, at higher frequencies, with the frequency. The mixer input impedance is typically 1·4kΩ whilst the mixer transconductance is about 2·5mmho with a 1MHz 1mV input signal at pin 1. The oscillator voltage at pin 2 is about 1·7V RMS.

If the IFT between pins 14 and 7 is replaced by a suitable ceramic filter, a better response curve should be obtainable. Ceramic filters operating at the normal IF frequency of about 455kHz can provide a response curve with a flat, broad top for good quality reproduction, but with the steep sides required for the reception of a weak signal close to a much more powerful one. If such a ceramic filter is employed, a single tuned circuit may be used for IFT2.

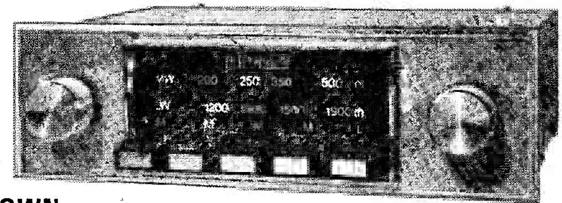
For broadcast band reception on the medium and long wave bands, a ferrite rod aerial could be employed instead of L1 and L2 of Figs. 2 and 3. However, the LM1820N is really intended for more critical applications. The Fairchild equivalent is the μA720DC while the NE546A is the equivalent in the Signetics range.

ICs and coils available from Ambit International, 37A High Street, Brentwood, Essex CM14 4RH. ■

R T V C FOR AUDIO ON A BUDGET

PUSH BUTTON CAR RADIO KIT

The Tourist II



NO SOLDERING REQUIRED!

NOW BUILD YOUR OWN PUSH BUTTON CAR RADIO

Easy to assemble construction kit comprising fully completed and tested printed circuit board on which no soldering is required. All connections are simple push fit type making for easy assembly.
Fine tuning push button mechanism is fully built and tested to mate with printed circuit board.

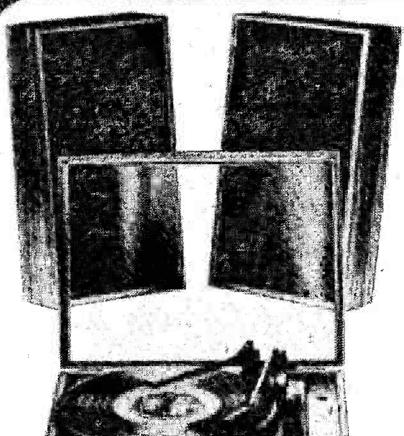
Car Radio Kit £7.70 + 55p p & p

Tourist Mk.1 kit still available-
price **£6.60+55p. p&p.**
See July issue for full specification

Technical specification:
(1) **Output** 4 watts R.M.S. output. For 12 volt operation on negative or positive earth.
(2) **Integrated circuit** output stage, pre-built three stage IF Module.

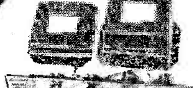
Controls volume manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands.
Size chassis 7″ wide, 2″ high and $4\frac{5}{16}$″ deep approx

Speaker including baffle and fixing strip **£1.65+23p. p&p.**
Car Aerial Recommended—fully retractable and locking **£1.37+20p. postage & packing**



*STEREO 21 QUALITY SOUND FOR LESS THAN £20·00

Stereo 21, easy to assemble audio system kit. No soldering required.
Includes:- **BSR 3 speed deck**, automatic, manual facilities together with ceramic cartridge.
Two speakers with cabinets.
Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.
Specifications: For the technically minded:—
Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel.
Output impedance 8–15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs – radio, tape, etc., and outputs for taping discs. **Overall Dimensions.** Speakers approx. 15½″ × 8″ × 4″. Complete deck and cover in closed position approx. 15½″ × 12″ × 6″.
Complete only **£19.95** + **£1.60 p & p. Extras if required.** Optional Diamond Styli **£1.37.**
Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance, **£3.85.**



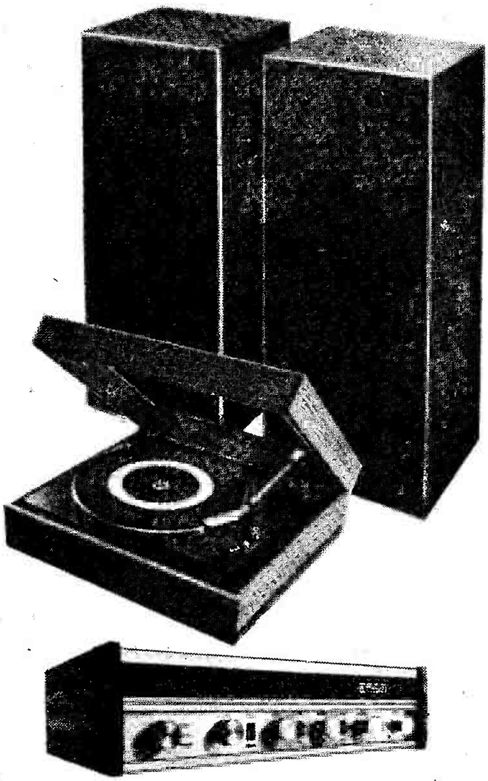
BUILD YOUR OWN STEREO AMPLIFIER*

For the man who wants to design his own stereo — here's your chance to start, with Unisound — pre-amp, power amplifier and control panel. No soldering — just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic power chips which ensure very low distortion over the audio spectrum.
240V. AC only. **£7·64 + 55p. p&p**

8 TRACK CARTRIDGE PLAYER*

Elegant self selector push button player for use with your stereo system. Compatible with Viscount III system, Unisound module and the Stereo 21. Technical specification Mains input, 240V, Output sensitivity 125mV
Comparable unit sold eleswhere at £24.00 approx. **Yours for only**
£10.95 + 90 p & p

COMPLETE* STEREO SYSTEM



System 1. £51·00

40 Watt Amplifier. Viscount III – R102 now 20 watts per channel.
System I includes:
Viscount III amplifier – volume, bass, treble and balance controls, plus switches for mono/stereo on/off function and bass and treble filters. Plus headphone socket.
Specification
20 watts per channel into 8 ohms. Total distortion @ 10W @ 1kHz 0·1%. *P.U.1* (for ceramic cartridges) 150mV into 3 Meg. *P.U.2* (for magnetic cartridges) 4mV @ 1kHz into 47K. equalised within ±1dB R.I.A.A. *Radio* 150mV into 220K. (Sensitivities given at full power). Tape out facilities: headphone socket, power out 250mW per channel. *Tone controls and filter characteristics.* Bass: +12dB to –17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble +12dB to –12dB @ 15kHz. Treble filter: 12dB per octave. *Signal to noise ratio:* (all controls at max.) – 58dB. Crosstalk better than 35dB on all inputs. Overload characteristics better than 26dB on all inputs. Size approx. 13¾″×9″×3¾″.
Garrard SP 25 Mk III deck with magnetic cartridge, de luxe plinth and hinged cover.
Two Duo Type II matched speakers – Enclosure size approx. 17½″×10¾″×6″ in simulated teak. Drive unit 13″×8″ with parasitic tweeter. 10 watts handling.

Complete System £51·00

System 2. £69·00

Viscount III amplifier (As System I)
Garrard SP 25 Mk III deck (As System I)
Two Duo Type IIIA matched speakers – Enclosure size approx. 31″×13″×11½″ Finished in teak veneer. Drive units approx. 13½″×8¼″ with 3¼″ HF speaker. Max. power 20 watts, 8 ohms. Freq. range 20Hz to 20kHz.

Complete System £69·00

PRICES: SYSTEM 1	
Viscount III R102 amplifier	£24.20 + £1 p & p
2 Duo Type II speakers	£14.00 + £2.20 p & p
Garrard SP 25 with Mag. cartridge de luxe plinth and hinged cover	£21.00 + £1.75 p & p
total: £59.20	

Available complete for only:
£51·00
+ £3.50 p & p

PRICES: SYSTEM 2	
Viscount III R102 amplifier	£24.20 + £1 p & p
2 Duo Type III A speakers	£39.00 + £4.00 p & p
Garrard SP 25 with Mag. cartridge de luxe plinth and hinged cover	£21.00 + £1.75 p & p
total: £84.20	

Available complete for only:
£69·00
+ £4.00 p & p

EMI SPEAKERS AT FANTASTIC REDUCTIONS

20 WATT SPEAKER SYSTEM

System consists of a 13″×8″ (approx) eliptical woofer unit with a 8″×5″ (approx.) mid range unit incorporating parasitic tweeter and crossover components.
Technical Specification:
Bass Unit
Flux density–100 K, speech coil–1½″, Cone, Triple laminated paper with P.V.C. surround.
Mid Range Unit
Flux density-33K, speech coil-1″ with parasitic tweeter.
Power Handling
20 watts R.M.S., impedance – 8 ohms, frequency response – 20 Hz to 18,000 Hz.

OUR PRICE £6.60. Complete +90p p & p.

15″ 14A/780 BASS UNIT

Bass unit on a rigid diecast chassis. Superior cone material handles up to 50 watts RMS, and is treated to give a smooth frequency response. Resonance 30 Hz. flux density 360,000 Maxwells. Impedance at 1 kHz is 8 ohms. 3″ voice coil.

Recommended retail price £40·80.
OUR PRICE £18·70 + £1·50 p&p

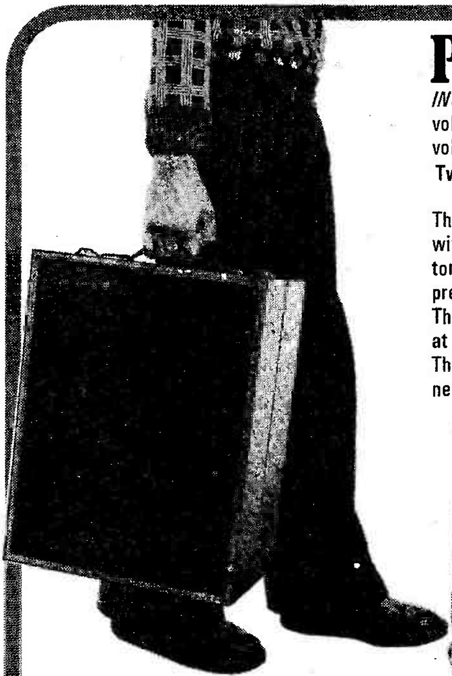
950 KIT

Five matched speakers and crossover unit for handling up to 45 watts, frequency response from 20 to 20,000 Hz.
Huge 19″ × 14″ (approx.) high efficiency Bass-Speaker with 16,500-gauss magnet built on a heavy diecast frame.
The four 10,000 gauss tweeters, each 3¼″ dia. approx., are fed by the crossover which critically adjusts signal for maximum fidelity. Impedance at 1 kHz is 8 ohms. Bass coil 2″, others 0·5″.
Recommended list price £44·00.

Special Offer
OUR PRICE £19.50 + £1·50 p&p

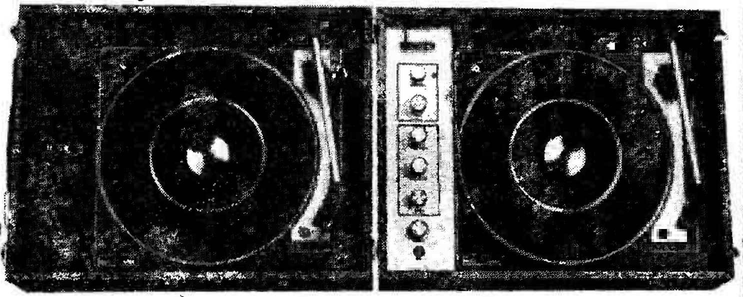
FOR DISCO PAGE AND DETAILS OF HOW TO ORDER – TURN OVER...

PORTABLE DISCO CONSOLE



INCORPORATES: Pre-Amp with full mixing facilities, including switched input for mic with volume control, switched input for auxiliary with volume control, bass and treble controls, volume control and blend control for turntables.
Two B.S.R. single play professional series decks, fitted with crystal cartridges.

The turntables are designed and precision engineered. They combine clean modern styling with superb reproduction. Their many special features include square section aluminium tonearms, (high precision low mass design fully counterbalanced, with calibrated stylus pressure control for perfect tracking), and conveniently grouped easy to read linear controls. The turntables have viscous cueing devices which allows the tonearms to be placed or lifted at any point on the record.
The two lightweight cartridge shells have slide-in-holders to facilitate easy inspection of needles and cartridges.

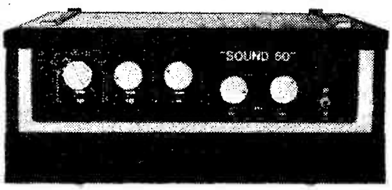


TECHNICAL SPECIFICATION:
Pre-amp – Output – 200mV. Auxiliary inputs – 200mV and 750mV into 1 meg. Mic input – 6mV into 100K. 240 volt operation.
Turntables capacity – 7″, 10″ or 12″ records.
Rumble, wow and flutter – Rumble – Better than –35dB. Wow – Better than 0.2%. Flutter – Better than 0.06% (Gaumont kalee meter).
Finish – Satin black mainplate with black turntable mat inlaid with brushed aluminium trim. Tonearm and controls in black and brushed aluminium.

Console size – Unit Closed – $17\frac{3}{4}'' \times 13\frac{3}{4}'' \times 8\frac{3}{4}''$ (approx.)
Unit Open – $35\frac{3}{4}'' \times 13\frac{3}{4}'' \times 4\frac{3}{4}''$ (approx.)
This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.
The unit is finished in black PVC with contrasting simulated teak edging diamond spun control knobs with matching control panel.

Yours for only £45.00 + £3.50 P. & P.

DISCO 50



45 WATT R.M.S. MONO DISCOTHEQUE AMPLIFIER
Ideal for Disco Work. Output Power: 45 watts R.M.S. Frequency Response 3dB points 30Hz and 18KHz. Total Distortion: less than 2% at rated output. Signal tp noise ratio: better than 60dB. Bass Control Range: 13dB at 60Hz. Treble Control Range: 12dB at 10KHz. Inputs: 4 inputs at 5mV into 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV into 470K. Size: $19\frac{1}{4}'' \times 10\frac{1}{2}'' \times 8''$ (approx.) Amplifier **£27.50 + £1.50 p. & p.**

Special Offer: Disco 50 plus two 15″ E.M.I. speakers type 14A/780 (as illustrated on previous page) **Complete £55.00 + £4.00 p&p.**

DISCO AMPLIFIER

Reliant Mk IV Mono Amplifier, ideal for the small disco or house parties.
Outputs 20 watts R.M.S. into 8 ohms (suitable for 15 ohms).
Inputs *4 electrically mixed inputs. *3 individual mixing controls.
*Separate bass and treble controls common to all 4 inputs.
*Mixer employing F.E.T. (Field Effect Transistors) *Solid State circuitry.
*Attractive styling.

INPUT SENSITIVITIES
–Input – 1.) Crystal mic. guitar or moving coil mic, 2 and 10mV.
(Selector switch for desired sensitivity).
–Inputs – 2), 3), 4). Medium output equipment – ceramic cartridge, tuner, tape recorder, organs, etc. – all 250mV sensitivity. AC Mains, 240V operation.
Size approx: $12\frac{1}{2}'' \times 6'' \times 3\frac{1}{2}''$.

£15.00 + 60p. post & pack.

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- **Leaflets available for all items listed thus * Send stamped addressed envelope.**

R T V C Radio and TV Components (Acton) Ltd.

21 High Street, Acton, London W3 6NG
323 Edgware Road, London W2

Personal Shoppers — Edgware Road: 9a.m.–5.30p.m. Half day Thurs.
Acton: 9.30a.m.–5p.m. Closed all day Wed.

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DEPT PW, ELSTOW STORAGE DEPOT
KEMPSTON HARDWICK
BEDFORD

C.W.O. PLEASE. POST AND PACKING PLEASE ADD 10p TO ORDERS UNDER £2.

Catalogue sent free on request, 10p stamp appreciated.

PLEASE ADD 8% VAT

RESISTORS

$\frac{1}{2}$W and $\frac{1}{4}$W PIHER.
$\frac{1}{2}$W 2% ELECTROSIL.

Power watts	Tolerance	Range	Values available	Price 1–99	Price 100+
$\frac{1}{2}$	5%	4·7 Ω–2·2M Ω	E24	1p	0·8p
$\frac{1}{2}$	10%	3·3M Ω–10M Ω	E12	1p	0·8p
$\frac{1}{2}$	2%	10 Ω–1M Ω	E24	3·5p	3p
$\frac{1}{4}$	10%	1 Ω–3·9 Ω	E12	1p	0·8p
$\frac{1}{4}$	5%	4·7 Ω–1M Ω	E12	1p	0·8p
4	10%	1 Ω–10 Ω	E12	6p	5·5p

Quantity price applies for any selection. Ignore fractions on total order.

DEVELOPMENT PACK

0·5 watt 5% Piher resistors 5 off each value 4·7Ω to 1MΩ.
E12 pack 325 resistors **£2·40**. E24 pack 650 resistors **£4·70.**

POTENTIOMETERS

Carbon track 5k Ω to **2M** Ω, log or linear (log $\frac{1}{4}$W, lin $\frac{1}{2}$W).
Single, **14p.** Dual gang (stereo), **49p.** Single D.P. switch, **29p.**

SKELETON PRESET POTENTIOMETERS

Linear: 100, 250, 500Ω and decades to 5MΩ. Horizontal or vertical P.C. mounting (0·1 matrix).
Sub-miniature 0·1W. **6p** each. Miniature 0·25W, **7p** each.

TRANSISTORS

AC107	16p	BC109	14p	BD115	75p	BF337	46p	ZTX300	18p
AC126	18p	BC115	16p	BD116	60p	BFY50	22p	ZTX302	20p
AC127	18p	BC116	15p	BD124	81p	BFY51	22p	ZTX341	18p
AC128	18p	BC117	23p	BD131	60p	BFY52	22p	ZTX500	18p
AC141K	22p	BC125	15p	BD132	64p	BRY39	41p	ZTX503	25p
AC142	25p	BC142	24p	BD140	66p	MJE340	47p	2N2646	60p
AC165	20p	BC143	21p	BDY32	57p	MJE370	68p	2N2904	28p
AC176	18p	BC147	12p	BF115	32p	OC26	90p	2N2905	32p
AC187	22p	BC148	12p	BF158	22p	OC28	90p	2N2926	12p
AC188	22p	BC149	12p	BF159	22p	OC35	90p	2N3053	31p
AC193K	28p	BC153	18p	BF160	23p	OC42	16p	2N3054	60p
AD140	53p	BC154	18p	BF161	26p	OC44	12p	2N3055	60p
AD143	73p	BC157	15p	BF164	22p	OC45	12p	2N3702	15p
AD149	70p	BC158	15p	BF173	28p	OC70	12p	2N3703	14p
AD161	42p	BC159	14p	BF177	29p	OC71	12p	2N3704	20p
AD162	42p	BC169	15p	BF178	43p	OC72	12p	2N3705	20p
AF114	25p	BC171	13p	BF179	41p	OC75	12p	2N3706	19p
AF115	25p	BC172	22p	BF180	42p	OC81	12p	2N3707	20p
AF116	25p	BC177	20p	BF181	32p	OC82	12p	2N3708	20p
AF117	25p	BC182	15p	BF182	41p	OCP71	35p	2N3709	19p
AF118	50p	BC182L	16p	BF183	43p	ORP12	65p	2N3710	19p
AF121	50p	BC183	15p	BF184	32p	TIP29A	49p	2N3711	19p
AF126	50p	BC183L	16p	BF185	32p	TIP30A	58p	2N3819	32p
AF127	50p	BC184	18p	BF194	14p	TIP31A	62p	2N4062	25p
AF139	53p	BC186	25p	BF195	17p	TIP32A	74p	40360	46p
AF178	48p	BC187	25p	BF196	15p	TIP33A	98p	40361	43p
AF180	50p	BC212	13p	BF197	16p	TIP34A	148p	40362	45p
AF186	39p	BC212L	15p	BF200	40p	TIP41A	79p	40363	88p
AF239	48p	BC214L	19p	BF259	25p	TIP42A	90p	40406	44p
BC107	13p	BCY70	21p	BF262	26p	TIP43	35p	40486	90p
BC108	13p	BD112	52p	BF263	26p	ZTX108	18p		

ZENER DIODES

400mW 5% 3·3V to 30V, **12p.**

WIRE WOUND POTS.

3W, 10, 25, 50Ω and decades to 100kΩ, **50p.**

DIODES

RECTIFIER

BY127	1250V	1A	12p
IN4001	50V	1A	7p
IN4002	100V	1A	8p
IN4004	400V	1A	8p
IN4006	800V	1A	10p
IN4007	1000V	1A	10p

SIGNAL

OA85	7p
OA90	5p
OA91	5p
OA202	7p
IN4148	5p
BA114	8p

SLIDER POTENTIOMETERS

86mm x 9mm x 16mm, length of track 59mm.
SINGLE 10K, 25K, 100K log. or lin. **50p.**
DUAL GANG, 10K + 10K etc. log. or lin. **60p.**
KNOB FOR ABOVE, **12p.**
FRONT PANEL, **90p.**

18 Guage panel 12in x 4in with slots cut for use with slider pots. Grey or matt black finish complete with fixings for 4 pots.

BRUSHED ALUMINIUM PANELS

12in x 6in. **37p.**
12 in x $2\frac{1}{2}$in. **14p.**
9in x 2in, **12p.**

THYRISTORS

2N5060	50V 0·8A	65p	
2N5064	200V 0·8A	80p	
106F	50V	5A	55p
106D	200V	5A	80p

HEATSINKS—REDPOINT

2W	24p	4W	45p	TO5 Clip	5p
3W	36p	6W	60p	TO18 Clip	5p
TO1 Single	5p				
TO1 Double	8p				

TRANSFORMERS

All have 240V primary

MT30/2	0–12–15–20–24–30V	2A	£3·85
MT50/$\frac{1}{2}$	0–19–25–33–40–50V	$\frac{1}{2}$A	£2·50
MT50/1	0–19–25–33–40–50V	1A	£3·15
MT50/2	0–19–25–33–40–50V	2A	£4·20
MT60/$\frac{1}{2}$	0–24–30–40–48–60V	$\frac{1}{2}$A	£3·30
MT60/1	0–24–30–40–48–60V	1A	£4·80
MT60/2	0–24–30–40–48–60V	2A	£6·50

MULLARD POLYESTER CAPACITORS C280 SERIES

250V P.C. Mounting: 0·01μF, 0·015μF, 0·022μF, 0·033μF, 0·047μF, $3\frac{1}{2}$**p.** 0·068μF **4p.** 0·1μF $4\frac{1}{2}$**p.** 0·15μF **5p.** 0·22μF $5\frac{1}{2}$**p.** 0·33μF **7p.** 0·47μF **9p.** 0·68μF **12p.** 1·0μF $14\frac{1}{2}$**p.** 1·5μF **22p.** 2·2μF **26p.**

MYLAR FILM CAPACITORS 100V

0·001μF, 0·002μF, 0·005μF, 0·01μF, 0·02μF, **3p.** 0·04μF, 0·05μF, 0·068μF, 0·1μF, **6p.**

CERAMIC DISC CAPACITORS

100pF to 10,000pF, **2p** each.

ELECTROLYTIC CAPACITORS

(μF/v) 1/63, 1·5/63, 2·2/63, 3·3/63, 4·7/63, 6·8/40, 6·8/63, 10/25, 10/63, 15/16, 15/40, 15/63, 22/10, 22/25, 22/63, 33/6·3, 33/16, 33/40, 47/4, 47/10, 47/25, 47/40, 68/6·3, 68/16, 100/4, 100/10, 100/25, 150/6·3, 150/16, 220/4, 220/6·3, 220/16, 330/4, **6p.** 47/63, 100/40, 150/25, 220/25, 330/10, 470/6·3, **7p.** 68/63, 150/40, 220/40, 330/16, 1000/4, **10p.** 470/10, 680/6·3, **11p.** 100/63, 150/63, 220/63, 1000/10, **12p.** 470/25, 680/16, 1500/6·3, **13p.** 470/40, 680/25, 1000/16, 1500/10, 2200/6·3, **18p.** 330/63, 680/40, 1000/25, 1500/16, 2200/10, 3300/6·3, 4700/4, **21p.**

SOLID TANTALUM BEAD CAPACITORS — 12p

0·1μF	35V	2·2μF	35V	22μF	16V
0·22μF	35V	4·7μF	35V	33μF	10V
0·47μF	35V	6·8μF	25V	47μF	6·3V
1·0μF	35V	10μF	25V	100μF	3V

VEROBOARD

	0·1	0·15
$2\frac{1}{2}$ x $3\frac{3}{4}$	26p	28p
$2\frac{1}{2}$ x 5	28p	28p
$3\frac{3}{4}$ x $3\frac{3}{4}$	28p	28p
$3\frac{3}{4}$ x 5	34p	34p
17 x $2\frac{1}{2}$	95p	77p
17 x $3\frac{3}{4}$	130p	108p
17 x $3\frac{3}{4}$ (plain)	86	72p
17 x $2\frac{1}{2}$ (plain)	—	51p
$2\frac{1}{2}$ x 5 (plain)	—	18p
$2\frac{1}{2}$ x $3\frac{3}{4}$ (plain)	—	15p
Pin insertion tool	62p	62p
Spot face cutter	52p	52p
Pkt. 50 pins	20p	20p

JACK PLUGS AND SOCKETS

Standard screened	32p	2·5mm insulated	13p
Standard insulated	18p	3·5mm insulated	13p
Stereo screened	44p	3·5mm screened	22p
Standard socket	15p	2·5mm socket	14p
Stereo socket	22p	3·5mm socket	14p

D.I.N. PLUGS AND SOCKETS

2 pin, 3 pin, 5 pin 180°, 5 pin 240°, 6 pin
Plug **12p.** Socket **8p.**
4 way screened cable, **26p**/metre.
6 way screened cable, **32p**/metre.

BATTERY ELIMINATOR — £1·70

9V mains power supply. Same size as PP9 battery.

HIGH VOLTAGE TUBULAR CAPACITORS—1,000 VOLT

0·01μF	12p	0·047μF	16p	0·22μF	25p
0·022μF	14p	0·1μF	20p	0·47μF	36p

POLYSTYRENE CAPACITORS 160V $2\frac{1}{2}$%

10pF to 1,000pF E12 Series Values, **4p** each.

SMOKE AND COMBUSTIBLE GAS DETECTOR—GD1

The GD1 is the world's first semiconductor that can convert a concentration of gas or smoke into an electrical signal. The sensor decreases its electrical resistance when it absorbs deoxidizing or combustible gases such as hydrogen, carbon monoxide, methane, propane, alcohol, North Sea gas, as well as cabron-dust containing air or smoke. This decrease is usually large enough to be utilized without amplification. Full details and circuits are supplied with each detector. Detector GD1 **£2.** Smoke and Gas Detector Kits, mains operated with audible alarm **£5·60.** Mains operated Meter Indicator **£7·90.** Mains/Battery Gas Leak Detector **£12·60.** 12/24V Battery operated **£8·40.** 12V Battery operated Two Remote Sensors **£12·80.** NOTE. The battery operated kits incorporate our patented circuit to minimise battery drain. Typically 120mA for 12V. These kits contain all parts required with the exception of case. Suitable case mains operated kit **£1·60.** Battery operated kits **£5.**

PRINTED BOARD MARKER — 97p

Draw the planned circuit onto a copper laminate board with the P.C. Pen, allow to dry, and immerse the board in the etchant. On removal the circuit remains in high relief.

METERS

2″ Scale-500μA, 1mA, 10mA, 100mA — **£3·30**

BULGIN MAINS CONNECTORS

3 Pin	$1\frac{1}{2}$A	Chassis Plug	18p	3 Pin	$1\frac{1}{2}$A	Chassis Socket	30p
		Line Socket	22p			Line Plug	24p
3 Pin	3A	Chassis Plug	24p	3 Pin	3A	Chassis Socket	34p
		Line Socket	28p			Line Plug	40p
3 Pin	5A	Chassis Plug	24p				
		Line Socket	32p	2 Pin	5A	Line Plug	20p

THERMISTORS

VA1005	15p
VA1026	15p
VA1033	15p
VA1055S	15p
VA1066S	15p
VA1077	15p
R53	£1·25

WAVECHANGE SWITCH 33p

1p 12W, 3p 4W, 2p 2W, 2p 6W, 4p 3W

ROTARY MAINS SWITCH

D.P. 2A **35p**

LINEAR IC's

709	14 pin DIL	40p
741	8 pin DIL	40p
741	14 pin DIL	38p
723	14 pin DIL	95p
747	14 pin DIL	85p
748	8 pin DIL	45p

DIL Sockets 14 pin and 16 pin **16p**

The largest selection

BRAND NEW FULLY GUARANTEED DEVICES

Type	Price
AC107	0·22
AC113	0·20
AC115	0·22
AC117K	0·32
AC122	0·13
AC125	0·19
AC126	0·19
AC127	0·20
AC128	0·20
AC132	0·16
AC134	0·16
AC137	0·16
AC141	0·20
AC141K	0·32
AC142	0·20
AC142K	0·28
AC151	0·17
AC154	0·22
AC155	0·22
AC156	0·22
AC157	0·27
AC165	0·22
AC166	0·22
AC167	0·22
AC168	0·27
AC169	0·16
AC176	0·22
AC177	0·27
AC178	0·31
AC179	0·31
AC180	0·22
AC180K	0·32
AC181	0·22
AC181K	0·32
AC187	0·24
AC187K	0·25
AC188	0·24
AC188K	0·25
ACY17	0·28
ACY18	0·22
ACY19	0·22
ACY20	0·22
ACY21	0·22
ACY22	0·18
ACY27	0·20
ACY28	0·21
ACY29	0·39
ACY30	0·31
ACY31	0·31
ACY34	0·23
ACY35	0·23
ACY36	0·31
ACY40	0·19
ACY41	0·20
ACY44	0·39
AD130	0·42
AD140	0·53
AD142	0·53
AD143	0·42
AD149	0·55
AD161	0·39

Type	Price
AD162	0·39
AD161 &	
AD162(MP)	75
ADT140	0·55
AF114	0·27
AF115	0·27
AF116	0·27
AF117	0·27
AF118	0·39
AF124	0·33
AF125	0·33
AF126	0·31
AF127	0·31
AF139	0·33
AF178	0·55
AF179	0·55
AF180	0·55
AF181	0·55
AF186	0·55
AF239	0·41
AL102	0·72
AL103	0·72
ASY26	0·28
ASY27	0·33
ASY28	0·28
ASY29	0·28
ASY50	0·28
ASY51	0·28
ASY52	0·28
ASY54	0·28
ASY55	0·28
ASY56	0·28
ASY57	0·28
ASY58	0·28
ASY73	0·28
ASZ21	0·44
BC107	0·14
BC108	0·14
BC109	0·15
BC113	0·11
BC114	0·17
BC115	0·17
BC116	0·17
BC117	0·20
BC118	0·11
BC119	0·33
BC120	0·88
BC125	0·13
BC126	0·20
BC132	0·13
BC134	0·20
BC135	0·13
BC136	0·17
BC137	0·17
BC139	0·44
BC140	0·33
BC141	0·33
BC142	0·33
BC143	0·33
BC145	0·50
BC147	0·11
BC148	0·11

Type	Price
BC149	0·13
BC150	0·20
BC151	0·22
BC152	0·19
BC153	0·31
BC154	0·33
BC157	0·20
BC158	0·13
BC159	0·13
BC160	0·50
BC161	0·55
BC167	0·13
BC168	0·13
BC169	0·13
BC170	0·13
BC171	0·16
BC172	0·16
BC173	0·16
BC174	0·16
BC175	0·24
BC177	0·21
BC178	0·21
BC179	0·21
BC180	0·27
BC181	0·27
BC182	0·16
BC182L	0·16
BC183	0·16
BC183L	0·16
BC184	0·22
BC184L	0·22
BC186	0·31
BC187	0·31
BC207	0·12
BC208	0·12
BC209	0·13
BC212L	0·14
BC213L	0·14
BC214L	0·18
BC225	0·28
BC226	0·39
BC301	0·30
BC302	0·27
BC303	0·35
BC304	0·40
BC440	0·34
BC460	0·40
BCY30	0·27
BCY31	0·29
BCY32	0·33
BCY33	0·24
BCY34	0·28
BCY70	0·16
BCY71	0·22
BCY72	0·16
BCZ10	0·22
BCZ11	0·28
BCZ12	0·28
BD115	0·68
BD116	0·88
BD121	0·66
BD123	0·72

Type	Price
BD124	0·76
BD131	0·55
BD132	0·66
BD133	0·72
BD135	0·44
BD136	0·44
BD137	0·50
BD138	0·55
BD139	0·61
BD140	0·66
BD155	0·88
BD175	0·66
BD176	0·66
BD177	0·72
BD178	0·72
BD179	0·77
BD180	0·77
BD185	0·72
BD186	0·72
BD187	0·77
BD188	0·77
BD189	0·83
BD190	0·83
BD195	0·94
BD196	0·94
BD197	0·99
BD198	0·99
BD199	£1·05
BD200	£1·05
BD205	0·88
BD206	0·88
BD207	£1·05
BD208	£1·05
BDY20	£1·10
BF115	0·27
BF117	0·50
BF118	0·77
BF119	0·77
BF121	0·50
BF123	0·55
BF125	0·50
BF127	0·55
BF152	0·61
BF153	0·50
BF154	0·50
BF155	0·77
BF156	0·53
BF157	0·61
BF158	0·61
BF159	0·66
BF160	0·44
BF162	0·44
BF163	0·44
BF164	0·44
BF165	0·44
BF167	0·24
BF173	0·24
BF176	0·39
BF177	0·39
BF178	0·33
BF179	0·33
BF180	0·33

Type	Price
BF181	0·33
BF182	0·44
BF183	0·44
BF184	0·28
BF185	0·33
BF187	0·30
BF188	0·44
BF194	0·13
BF195	0·13
BF196	0·16
BF197	0·16
BF200	0·50
BF222	£1·05
BF257	0·50
BF258	0·66
BF259	0·94
BF262	0·61
BF263	0·61
BF270	0·39
BF271	0·33
BF272	0·88
BF273	0·39
BF274	0·39
BFW10	0·66
BFX29	0·30
BFX84	0·24
BFX85	0·33
BFX86	0·24
BFX87	0·27
BFX88	0·24
BFY50	0·22
BFY51	0·22
BFY52	0·22
BFY53	0·19
BSX19	0·17
BSX20	0·17
BSY25	0·17
BSY26	0·17
BSY27	0·17
BSY28	0·17
BSY29	0·17
BSY38	0·20
BSY39	0·20
BSY40	0·31
BSY41	0·31
BSY95	0·14
BSY95A	0·14
Bu105	£2·20
C111E	0·55
C400	0·33
C407	0·28
C424	0·28
C425	0·55
C426	0·39
C428	0·22
C441	0·33
C442	0·33
C444	0·39
C450	0·24
MAT100	0·21
MAT101	0·22
MAT120	0·21

Type	Price
MAT121	0·22
MJE2955	0·95
MJE3055	0·62
MJE3440	0·55
MPF102	0·46
MPF104	0·41
MPF105	0·41
OC19	0·39
OC20	0·70
OC22	0·52
OC23	0·54
OC24	0·62
OC25	0·42
OC26	0·32
OC28	0·55
OC29	0·55
OC35	0·46
OC36	0·55
OC41	0·22
OC42	0·27
OC44	0·17
OC45	0·14
OC70	0·11
OC71	0·11
OC72	0·16
OC74	0·16
OC75	9·17
OC76	0·17
OC77	0·28
OC81	0·17
OC81D	0·17
OC82	0·17
OC82D	0·17
OC83	0·22
OC139	0·22
OC140	0·22
OC169	0·28
OC170	0·28
OC171	0·28
OC200	0·28
OC201	0·31
OC202	0·31
OC203	0·28
OC204	0·28
OC205	0·39
OC309	0·44
OCP71	0·48
ORP12	0·48
ORP60	0·44
ORP61	0·44
P20	0·55
P346A	0·22
P397	0·46
ST140	0·14
ST141	0·19
TIS43	0·34
UT46	0·30
ZN414	£1·20
2G301	0·21
2G302	0·21
2G303	0·21
2G304	0·27

Type	Price
2G306	0·44
2G308	0·39
2G309	0·39
2G339	0·22
2G339A	0·18
2G344	0·20
2G345	0·18
2G371	0·18
2G371B	0·13
2G373	0·19
2G374	0·19
2G377	0·33
2G378	0·18
2G381	0·18
2G382	0·18
2G401	0·33
2G414	0·33
2G417	0·28
2N388	0·39
2N388A	0·61
2N404	0·22
2N404A	0·31
2N524	0·46
2N527	0·54
2N598	0·46
2N599	0·50
2N696	0·14
2N697	0·15
2N698	0·27
2N699	0·39
2N706	0·09
2N706A	0·10
2N708	0·13
2N711	0·33
2N717	0·39
2N718	0·27
2N718A	0·55
2N726	0·31
2N727	0·31
2N743	0·22
2N744	0·22
2N914	0·16
2N918	0·33
2N929	0·23
2N930	0·23
2N1131	0·22
2N1132	0·24
2N1302	0·16
2N1303	0·16
2N1304	0·19
2N1305	0·19
2N1306	0·23
2N1307	0·23
2N1308	0·26
SN1309	0·26
2N1613	0·22
2N1711	0·22
2N1889	0·35
2N1890	0·50
2N1893	0·41
2N2147	0·79
2N2148	0·63

Type	Price
2N2160	0·66
2N2192	0·39
2N2193	0·39
2N2194	0·39
2N2217	0·24
2N2218	0·22
2N2219	0·22
2N2220	0·24
2N2221	0·22
2N2222	0·22
2N2368	0·19
2N2369	0·16
2N2369A	0·16
2N2411	0·27
2N2412	0·27
2N2646	0·52
2N2711	0·23
2N2712	0·23
2N2714	0·23
2N2904	0·19
2N2904A	0·23
2N2905	0·23
2N2905A	0·23
2N2906	0·17
2N2906A	0·20
2N2907	0·22
2N2907A	0·24
2N2923	0·16
2N2924	0·16
2N2925	0·16
2N2926(G)	14
2N2926(Y)	12
2N2926(O)	11
2N2926(R)	11
2N2926(B)	11
2N3010	0·77
2N3011	0·16
2N3053	0·19
2N3054	0·51

Type	Price
2N3055	0·55
2N3391	0·16
2N3391A	0·18
2N3392	0·16
2N3393	0·16
2N3394	0·16
2N3395	0·19
2N3402	0·23
2N3403	0·23
2N3404	0·31
2N3405	0·46
2N3414	0·17
2N3415	0·17
2N3416	0·31
2N3417	0·31
2N3525	0·83
2N3614	0·74
2N3615	0·82
2N3616	0·82
2N3646	0·10
2N3702	0·13
2N3703	0·13
2N3704	0·14
2N3705	0·13
2N3706	0·13
2N3707	0·14
2N3708	0·09
2N3709	0·10
2N3710	0·10
2N3711	0·10
2N3819	0·31
2N3820	0·55
2N3821	0·39
2N3823	0·31
2N3903	0·31
2N3904	0·33
2N3905	0·31
2N3906	0·30
2N4058	0·13

Type	Price
2N4059	0·11
2N1060	0·13
2N4061	0·13
2N4062	0·13
2N4284	0·19
2N4285	0·19
2N4286	0·19
2N4287	0·19
2N4288	0·19
2N4289	0·19
2N4290	0·19
2N4291	0·19
2N4292	0·19
2N4293	0·19
2N5172	0·13
2N5294	0·60
2N5457	0·35
2N5458	0·35
2N5459	0·44
2N6221	0·75
2S301	0·55
2S302A	0·46
2S302	0·46
2S303	0·61
2S304	0·77
2S305	0·86
2S306	0·86
2S307	0·86
2S321	0·62
2S322	0·46
2S322A	0·46
2S325	0·62
2S324	0·77
2S325	0·77
2S326	0·77
2S327	0·77
2S701	0·46
40361	0·44
40362	0·50

DIODES AND RECTIFIERS

Type	Price	Type	Price	Type	Price
AA119	0·09	BY128	0·17	OA10	0·15
AA120	0·09	BY130	0·18	OA47	0·08
AA129	0·09	BY133	0·23	OA70	0·08
AAY30	0·10	BY164	0·55	OA79	0·08
AAZ13	0·11	BYX38/300	0·46	OA81	0·08
BA100	0·11	BYZ10	0·39	OA85	0·10
BA116	0·23	BYZ11	0·33	OA90	0·07
BA126	0·24	BYZ12	0·33	OA91	0·07
BA148	0·16	BYZ13	0·28	OA95	0·08
BA154	0·13	BYZ16	0·44	OA200	0·07
BA155	0·16	BYZ17	0·39	OA202	0·08
BA156	0·15	BYZ18	0·39	SD10	0·06
BA173	0·16	BYZ19	0·31	SD19	0·06
BY100	0·17	CG62		1N34	0·08
BY101	0·13	(OA91 Eq)	0·06	1N34A	0·08
BY105	0·19	CG651—		1N914	0·06
BY114	0·13	(OA70-79)	0·07	1N916	0·06
BY124	0·13	OA5	0·39	1N4148	0·06
BY126	0·16	OA5 short		IS021	0·11
BY127	0·17	leads	0·23	IS951	0·07

LINEAR I.C's—FULL SPEC.

Type No.	Price 1	25	100+
72702	50p	48p	45p
72709	35p	33p	30p
72709P	33p	31p	29p
72710	45p	43p	40p
72741	40p	38p	35p
72741C	45p	43p	40p
72741P	38p	36p	34p
72748P	38p	36p	34p
SL201C	59p	45p	40p
SL701C	50p	45p	40p
SL702C	50p	45p	40p
TAA263	80p	70p	60p
TAA293	£1·00	95p	90p
TAA350A	£1·85	£1·80	£1·70
µA703C	28p	26p	24p
µA709C	35p	33p	30p
µA711	45p	43p	40p
TBA800	£1·50	—	—

NUMERICAL INDICATOR TUBES

CD66 .. .. £1·87
GR116 .. .. .. £1·70
3015F Minitron .. .. £1·50
MAN 3M. L.E.D. 7-segment 0·127" £1·90
All indicators 0·9 + Decimal point. All side viewing. Full data for all types available on request.

ZN414 .. .. .. £1·20 each
I.C. Radio Rec. incl. full cir. data.

DTL 930 SERIES LOGIC I.C's

Type	Price 1	25	100+
BP930	15p	14p	13p
BP932	16p	15p	14p
BP933	16p	15p	14p
BP935	16p	15p	14p
BP936	16p	15p	14p
BP944	16p	15p	14p
BP945	30p	28p	25p
BP946	15p	14p	13p
BP948	30p	28p	25p
BP951	70p	65p	60p
BP962	15p	14p	13p
BP9093	45p	43p	40p
BP9094	45p	43p	40p
BP9097	45p	43p	40p
BP9099	45p	43p	40p

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

VOLTAGE REGULATORS

TO.3 Plastic 1·5 Amps
µA.7805/L129 5V (Equiv. to MVR5V) £1·76
µA.7812/L130 12V (Equiv. to MVR12V) £1·76
µA.7815/L131 15V (Equiv. to MVR15V) £1·76

TRIPLE 66-bit DYNAMIC SHIFT REGISTER EDSR 3166

Comprises three 66-bit 2 0 dynamic shift registers with independent inputs and outputs. TTL compatibility and buffered clock lines to reduce the capacitive load presented at the clock pins. A bootstrapped buffer ensures a full logic swing at the output.
£2·50 each

DUAL-IN-LINE SOCKETS.

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

PROF. TYPE No.	1–24	25–99	100up.
TSO 14 pin type	33p	30p	27p
TSO 16 ,, ,,	38p	35p	32p
LOW COST No.			
BPS 14	16p	14p	12p
BPS 16	17p	15p	13p
BPS 8 spin type	15p	13p	11p

ALL PRICES INCLUDE VAT.

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

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

Type	Quantities 1 £ p	25 £ p	100+ £ p
7400	0·18	0·17	0·16
7401	0·18	0·17	0·16
7402	0·18	0·17	0·16
7403	0·18	0·17	0·16
7404	0·18	0·17	0·16
7405	0·18	0·17	0·16
7406	0·39	0·34	0·31
7407	0·39	0·34	0·31
7408	0·25	0·24	0·23
7409	0·25	0·24	0·23
7410	0·18	0·17	0·16
7411	0·28	0·27	0·26
7412	0·30	0·29	0·28
7413	0·32	0·31	9·30
7416	0·40	0·39	0·38
7417	0·40	0·39	0·38
7420	0·18	0·17	0·16
7422	0·30	0·29	0·28
7423	0·40	0·39	0·38
7425	0·40	0·39	0·38
7426	0·40	0·38	0·36
7427	0·40	0·38	0·36
7428	0·45	0·42	0·40
7430	0·18	0·17	0·16
7432	0·40	0·38	0·36
7433	0·42	0·40	0·38
7437	0·45	0·42	0·40
7438	0·45	0·42	0·40
7440	0·18	0·17	0·16
7441	0·74	0·71	0·64
7442	0·74	0·71	0·64
7443	1·20	1·15	1·10
7444	1·20	1·15	1·10
7445	1·98	1·95	1·90
7446	1·20	1·15	1·10
7447	1·10	1·07	1·05

Type	Quantities 1 £ p	25 £ p	100+ £ p
7448	1·10	1·07	1·05
7450	0·18	0·17	0·16
7451	0·18	0·17	0·16
7453	0·18	0·17	0·16
7454	0·18	0·17	0·16
7460	0·18	0·17	0·16
7470	0·32	0·29	0·27
7472	0·32	0·29	0·27
7473	0·41	0·39	0·35
7474	0·41	0·39	0·35
7475	0·60	0·58	0·56
7476	0·44	0·43	0·42
7480	0·74	0·71	0·64
7481	1·30	1·25	1·20
7482	0·90	0·85	0·80
7483	1·20	1·15	1·05
7184	1·10	1·05	1·00
7485	2·00	1·90	1·80
7486	0·35	0·34	0·33
7489	4·00	3·75	3·50
7490	0·74	0·71	0·64
7491	1·10	1·05	1·00
7492	0·74	0·71	0·64
7493	0·74	0·71	0·64
7494	0·85	0·82	0·75
7495	0·85	0·82	0·75
7496	0·96	0·93	0·86
74100	1·50	1·45	1·40
74104	0·70	0·68	0·66
74105	0·70	0·68	0·66
74107	0·44	0·42	0·40
74110	0·60	0·55	0·50
74111	0·95	0·92	0·90
74118	1·10	1·05	1·00
74119	1·50	1·40	1·30
74121	0·50	0·48	0·45

Type	Quantities 1 £ p	25 £ p	100+ £ p
74122	0·88	0·86	0·84
74123	1·58	1·54	1·50
74141	0·85	0·82	0·79
74145	1·58	1·54	1·50
74150	2·50	2·40	2·30
74151	1·10	1·05	1·00
74153	1·20	1·10	1·00
74154	1·98	1·90	1·75
74155	1·20	1·15	1·10
74156	1·20	1·15	1·10
74157	1·20	1·15	1·10
74160	1·73	1·70	1·65
74161	1·73	1·70	1·65
74162	1·73	1·70	1·65
74163	1·73	1·70	1·65
74164	2·20	2·10	2·00
74165	2·20	2·10	2·00
74166	2·35	2·30	2·25
74174	2·00	1·95	1·90
74175	1·40	1·35	1·30
74176	1·60	1·55	1·50
74177	1·60	1·55	1·50
74180	1·60	1·55	1·50
74181	5·00	4·50	4·00
74182	1·50	1·45	1·40
74184	2·40	2·30	2·20
74190	2·15	2·10	2·00
74191	2·15	2·10	2·00
74192	2·15	2·10	2·00
74193	2·15	2·10	2·00
74194	1·90	1·80	1·70
74195	1·60	1·50	1·40
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200	0·06	0·10	1N4003	0·07	0·12	0·22	0·25	1·00
400	0·08	0·15	1N4004	0·08	0·15	0·30	0·38	1·35
600	0·09	0·17	1N4005	0·10	0·18	0·36	0·45	1·90
800	0·12	0·19	1N4006	0·11	0·20	0·38	0·55	2·10
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30FL1	.75
30FL2	.75
30FL12	.90
30FL13	.55
30FL14	.78
30L15	.75
30L17	.70
30P4MR	1.00
30P12	.80
30P19/30P4	.75
30PL1	.85
30PL13	.95
30PL14	1.10
30PL15	.90
35A3	.65
35D5	.75
35L6GT	.75
35W4	.50
35Z3	.75
35Z4GT	.70
35Z5GT	.75
43	1.00
50B5	.85
50C5	.45
50CD6G	1.25
50EH5	.55
50L6GT	.65
85A2	.60
85A3	1.00
90AG	2.50
90C1	.75
90CG	2.40
150B2	.75
215SG	.50
807	.59
4033X	6.00
5702	.80
6057	1.00
6060	1.00
6067	1.00
7475	1.00
9002	.50
9006	.30
AC/PEN	.93
AC2/PEN/DD	.98
AC6PEN	.60
AC/TH1	£1
AL60	1.00
ATP4	.50
AZ1	.60
AZ31	.60
AZ41	.65
BL63	2.00
CL33	1.60
CY1C	1.00
CY31	.50
DAF91	.30
DAF96	.50
DF91	.30
DF96	.50
DK40	.70
DK92	.70
DK96	.60
DL96	.55
DM70	.60
DM71	1.00
DY87/6	.35
DY802	.33
E80CC	2.20
E80F	1.20
E83F	1.20
E88CC	75
E92CC	1.00
E180F	1.00
E182CC	1.00
E1148	.53
EA50	.27
EA76	1.00
EABC80	.33
EAC91	.75
EAF42	.75
EAF801	.75
EB34	.25
EB91	.20
EBC41	.75
EBC81	.35
EBF80	.39
EBF83	.43
EBF89	.30
EBL21	2.00
EC86	.70
EC88	.70
EC92	.45
ECC33	1.50
ECC35	.95
ECC40	1.00
ECC81	.34
ECC82	.33
ECC83	.33
ECC84	.30
ECC85	.40
ECC86	.85
ECC88	.44
ECC189	.65
ECC807	1.20
ECF80	.34
ECF82	.38
ECF86	.75
ECF804	2.10
ECH21	2.00
ECH35	1.25
ECH42	1.00
ECH81	.33
ECH83	.44
ECH84	.44
ECL80	.55
ECL82	.34
ECL83	.70
ECL84	.60
ECL85	.60
ECL86	.40
EF22	1.50
EF40	.75
EF41	.70
EF42	.70
EF73	1.50
EF80	.26
EF83	1.00
EF85	.34
EF86	.30
EF89	.27
EF91	.37
EF92	.50
EF97	.80
EF98	.80
EF183	.30
EF184	.35
EF804	1.25
EH90	.55
EL32	.50
EL34	.66
EL35	2.50
EL37	2.50
EL41	.90
EL81	.60
EL83	.55
EL84	.31
EL85	.44
EL86	.38
EL91	.50
EL360	1.20
EL506	.85
ELL80	1.25
EM80	.45
EM81	.65
EM83	.55
EM84	.40
EM85	1.00
EM87	.70
EMM803	£2
EY51	.40
EY81	.40
EY83	.54
EY84	.70
EY87/6	.85
EY88	.40
EY91	.58
EZ40	.70
EZ41	.75
EZ80	.28
EZ81	.29
GY501	.75
GZ32	.54
GZ33	1.25
GZ34	.65
GZ37	1.00
HABC80	.60
HL23	.60
HL23DD	.75
HL41DD	£2
HL42DD	.70
HN309	1.50
HVR2	1.00
HVR2A	1.00
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KT41	.98
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KT66	2.50
KT81	2.00
KTW61	1.50
KTW62	1.50
KTW63	1.00
MHLD6	£1
M8162	1.00
P61	.50
PABC80	.38
PC86	.60
PC88	.60
PC95	.60
PC97	.38
PC900	.48
PCC84	.40
PCC85	.44
PCC88	.60
PCC89	.50
PCC189	.60
PCF80	.40
PCF82	.35
PCF84	.59
PCF86	.60
PCF200	.75
PCF801	.50
PCF802	.48
PCF806	.55
PCH200	.80
PCL82	.35
PCL83	.66
PCL84	.49
PCL86	.47
PCL805	.60
PEN45	.80
PEN45DD	.80
PEN46	.50
PEN453DD	2.00
PENDD-4020	2.00
PL33	.50
PL36	.60
PL81	.50
PL81A	.55
PL82	.45
PL83	.45
PL84	.40
PL504/500	.75
PL505	1.45
PL508	.90
PL509	1.45
PL802	.95
PY33/2	.50
PY81	.35
PY82	.35
PY83	.38
PY88	.38
PY500	.95
PY500A	.95
PY800	.40
PY801	.40
PZ30	.48
QQV03/10	1.75
QS75/20	1.00
QS95/10	1.00
QV04/7	1.00
R19	.55
TH233	.98
TP2620	.98
UABC80	.40
UAF42	.60
UBC41	.60
UBC81	.45
UBF80	.40
UBF89	.40
UBL21	.77
UC92	.45
UCC84	.75
UCC85	.45
UCF80	.70
UCH21	2.00
UCH42	.75
UCH81	.40
UCL82	.38
UCL83	.65
UF41	.70
UF42	.70
UF80	.35
UF85	.44
UF86	1.00
UF89	.40
UL41	.75
UL84	.42
UM80	.44
UY41	.49
UY85	.40
U10	1.00
U12/14	1.00
U19	2.50
U25	.85
U26	.75
U33	1.50
U35	1.50
U81	.80
U191	75
U251	.80
U281	.90
U301	.65
U403	.75
U404	70
U801	.85
U4020	.80
VP23	.75
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2N404	·20
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2N2297	·25
2N2369	·15
2N2613	·43
2N3053	·36
2N3121	2·75
2N3703	·21
2N3709	22
AA119	·17
AA120	·17
AA129	·17
AAZ13	·20
AC107	·17
AC113	·28
AC126	·14
AC127	·19
AC128	·22
AC132	·22
AC154	·28
AC156	·22
AC157	·28
AC165	·28
AC166	·28
AC168	·42
AC176	·61
AC177	·31
ACY17	·28
ACY18	·22
ACY19	·21
ACY20	·20
ACY21	·21
ACY22	·17
ACY28	·20
AD140	·40
AD149	·55
AD161	·50
AD162	·50
AF114	·28
AF115	·17
AF117	·21
AF121	.33
AF124	·28
AF125	·19
AF126	·20
AF180	·53
AF186	·61
BA115	·15
BA116	·20
BA129	·14
BA130	·11
BA153	·17
BC107	·14
BC108	·14
BC109	·11
BC113	·28
BC115	·17
BC116	·28
BC118	·25
BCY10	·50
BCY12	·55
BCY33	·22
BCY34	·25
BCY38	·25
BCY39	·28
BCZ11	·42
BF158	·20
BF159	·28
BF163	·22
BF173	·42
BF180	·33
BF181	·44
BF185	·44
BF194	·17
BFY50	·25
BFY51	·21
BFY52	·22
BY100	·20
BY114	·20
BY126	·17
BY127	·20
BYZ10	·28
BYZ11	·28
BYZ12	·28
BYZ13	·28
OA5	·31
OA9	·14
OA10	·47
OA47	·11
OA70	·17
OA73	·17
OA79	·10
OA81	·10
OA85	·09
OA90	·14
OA91	·10
OA95	·10
OA200	·10
OA202	·11
OC44	·11
OC45	·12
OC46	·17
OC70	·14
OC71	·12
OC72	·12
OC74	·25
OC75	·12
OC76	·17
OC77	·30
OC78	·17
OC78D	·17
OC81	·12
OC81D	·12
OC82	·12
OC82D	·12
OC83	·22
OC84	·26
OC123	·25
OC139	·25
OC169	·25
OC172	·39
OC200	·24
OC201	·42
OC202	·47
OC203	·33
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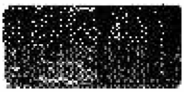

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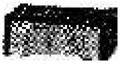

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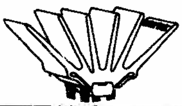

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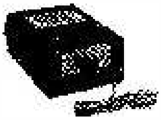

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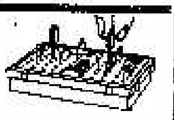

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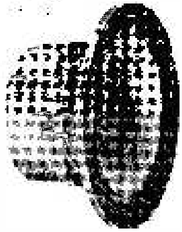

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Kef T15	£6·00
Kef B110	£7·00
Kef B200	£8·00
Kef B139	£12·75
Kef DN8	£2·00
Kef DN12	£4·50
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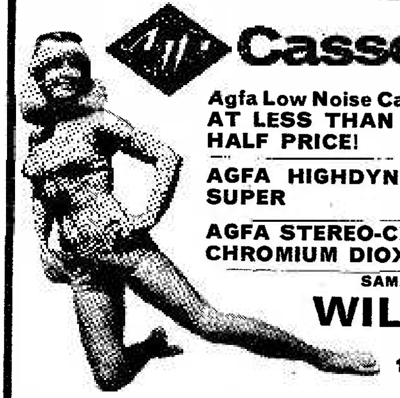

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Due to current world shortages, resistor kits may contain some wattage and value substitutions.

MULLARD POLYESTER CAPACITORS C280 SERIES
250V P.C. Mounting: 0·01μF, 0·015μF, 0·022μF, 0·033μF, 0·047μF, 3½p. 0·068μF 0·1μF, 4½p. 0·15μF, 4½p. 0·22μF, 5½p. 0·33μF, 8p. 0·47μF, 9p. 0·68μF, 12p 1μF, 15p. 1·5μF, 23p. 2·2μF, 26p.

MULLARD POLYESTER CAPACITORS C296 SERIES
400V: 0·001μF, 0·0015μF, 0·0022μF, 0·0033μF, 0·0047μF, 2½p. 0·0068μF, 0·01μF, 0·015μF, 0·022μF, 0·033μF, 3½p. 0·047μF, 0·068μF, 0·1μF, 4½p. 0·15μF, 6½p 0·22μF, 8½p. 0·33μF, 12p. 0·47μF, 14p.
160V: 0·01μF, 0·15μF, 0·022μF 3p. 0·047μF, 0·068μF, 3½p. 0·1μF, 4½p. 0·15μF, 5p. 0·22μF. 5½p. 0·33μF, 6½p. 0·47μF, 8½p. 0·68μF, 12p. 1μF, 14p.

MINIATURE CERAMIC PLATE CAPACITORS
50V: (pF) 22, 27, 33, 39, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 820, 1K, 1K5, 2K2, 3K3, 4K7, 6K8, (μF) 0·01, 0·015, 0·022, 0·033, 0·047, 2½p. each. 0·1, 30V, 5p.

POLYSTYRENE CAPACITORS 160V 5%
(pF) 10, 15, 22, 33, 47, 68, 100, 150, 220, 330, 470, 680, 1000, 1500, 2200, 3300, 4700, 6800, 10,000, 4½p.

RESISTORS
CF—High Stab Carbon Film, 5% MF—High Stab Metal Film, 5%.

W.	Type	Range	1–99	100–499	500–999	1000+	Size mm
¼	CF	22–1M	1	0·75	0·60	0·55	2·4x7·5
¼	CF	22–2M2	1	0·75	0·60	0·55	3·9x10·5
½	CF	22–1M	1	0·75	0·60	0·55	5·5x16
¼	MF	10–2M7	2	1·54	1·32	1·1	3x7
½	MF	10–2M2	2	1·43	1·21	0·99	4·2x10·8
1	MF	10–10M	3	1·98	1·81	1·65	6·6x13
2	MF	10–10M	4·5	3·52	3·08	2·75	8x17·5

For value mixing prices, please refer to our catalogue. (price in pence each).
VALUES AVAILABLE—E12 Series only. (Net prices above 100.)

PRESET SKELETON POTENTIOMETERS
MINIATURE 0·25W Vertical or horizontal 6p each 1K, 2K2, 4K7, 10K, etc. up to 1M Ω
SUB-MIN 0·05W Vertical, 100 Ω to 220K Ω 5p each.

B. H. COMPONENT FACTORS LTD.

(P.W.) 61 CHEDDINGTON ROAD, PITSTONE
NR. LEIGHTON BUZZARD, BEDS, LU7 9AQ
Tel.: Cheddington 668446 (Std. Code 0296)
CATALOGUE No. 3 20p

Miniature Mullard Electrolytics

1·0μF	63V	6½p	68μF	16V	6½p
1·5μF	63V	6½p	68μF	63V	12p
2·2μF	63V	6½p	100μF	10V	6½p
3·3μF	63V	6½p	100μF	25V	6½p
4·0μF	40V	6½p	100μF	63V	14p
4·7μF	63V	6½p	150μF	16V	6½p
6·8μF	63V	6½p	150μF	63V	15p
8·0μF	40V	6½p	220μF	6·4V	6½p
10μF	16V	6½p	220μF	10V	6½p
10μF	25V	6½p	220μF	16V	8p
10μF	63V	6½p	220μF	63V	21p
15μF	16V	6½p	330μF	16V	12p
15μF	63V	6½p	330μF	63V	25p
16μF	40V	6½p	470μF	6·4	9p
22μF	25V	6½p	470μF	40V	20p
22μF	63V	6½p	680μF	16V	15p
32μF	10V	6½p	680μF	40V	25p
33μF	16V	6½p	1000μF	16V	20p
33μF	40V	6½p	1000μF	25V	25p
32μF	63V	6½p	1500μF	6·4V	15p
47μF	10V	6½p	1500μF	16V	25p
47μF	25V	6½p	2200μF	10V	25p
47μF	63V	8p	3300μF	6·4V	26p

VEROBOARD	0·1	0·15
2½ x 5"	36p	36p
2½ x 3¾"	33p	25p
3¾ x 5"	42p	46p
3¾ x 3¾"	36p	36p
2½ x 1"	9p	9p
2½ x 5" (Plain)	—	19p
2½ x 3¾" (Plain)	—	16p
5 x 3¾" (Plain)	—	29p
Insertion tool	73p	73p
Track Cutter	56p	56p
Pins, Pkt. 25	22p	22p

TRANSISTORS

AC127	16½p	BC212L	12p
AC128	22p	BC213L	12p
BC107	11p	BC214L	17p
BC108	12p	OC44	18p
BC109	13p	OC71	13p
BC148	12p	OC81	16p
BC149	12p	OC170	23p
BC182L	12p	TIS43	33p
BC183L	12p	2N2926	11p
BC184L	13p	2N3702	11p

POTENTIOMETERS
Carbon Track 5K Ω to 2M Ω, log or lin (and 1K lin). Single, 16½p Dual Gang 46p. Log single with switch 26p. Slider Pots. 10K, 100K, 500K, semi log 30mm, 34p. 45mm, 47p. 60mm, 55p.

DIODES	
1N4001	6½p
1N4002	7½p
1N4003	9p
1N4004	90p
1N4005	12p
1N4006	14p
1N914	7p
1N916	7p
BA100	10p
OA5	42p
OA47	9p
OA81	11p
OA200	8p

PLUGS	
DIN 2 Pin	12p
3 Pin	13p
5 Pin 180°	16p
Std. Jack	20p
2.5mm jack	13p
Phono	6p
SOCKETS	
DIN 2 Pin	10p
3 Pin	10p
5 Pin 180°	12p
Std. Jack	15p
2.5mm Jack	13p
Phono	6p

ELECTROLYTIC CAPACITORS. Tubular & Large Cans (uF/V): 1/25, 2/25, 4/25, 4·7/10, 5/25, 8/25, 10/10, 10/50, 16/25, 22/63, 25/25, 25/50, 32/25, 50/25, 100/10, 100/25, 6½p. 50/50, 8p. 100/50, 200/25, 11p. 250/50, 18p. 500/10. 11p. 500/25, 15p. 500/50, 18p. 1000/10, 15p. 1000/25, 22p. 1000/50, 40p. 2000/10, 20p. 1000/100, 88p. 2000/25, 30p. 2000/100, 93p. 2500/25, 38p. 2500/50, 61p. 5000/25, 65p. 5000/50, £1·08.

HI-VOLT: 4/350, 14p. 8/350, 19p. 100/100 20p. 16/350, 22p. 16/450, 23p. 32/350, 33p. 50/250, 20p. 100/250, 30p.

METALLISED PAPER CAPACITORS
250V: 0·05μF, 0·1μF, 6p. 0·25, 6p. 0·5μF, 7½p. 1μF, 9p. 500V: 0·025, 0·05, 6p. 0·1, 6p. 0·25, 7½p. 0·5, 9p. 1000V: 0·01, 11p. 0·022, 13p. 0·047, 0·1, 15p. 0·22, 23p. 0·47, 34p.

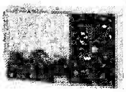
Integrated Circuits	
μA709C	49p
μA741C	50p
μA723C	98p
ZN414	£1·30

Screened Wire, Metre	6½p
Twin Screened Wire, Metre	12p
Stereo Screened Wire, Metre	12p
Connecting Wire. All colours, Metre	2½p
Neon Bulb, 90V Wire Ended	5 for 24p
Panel Neon. 240V Red, Amber, Clear	20p

ZENER DIODES
Low cost 400mW Tol ±7%
All values E24 series 3V-30V

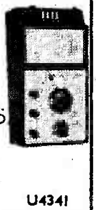
1-24	25-99	100-499	1000—
9p	7½p	6½p	5½p

MULTIMETER U4323
22 Ranges plus AF/IF Oscillator 20,000Ω/Volt.
Vdc—0·5—1000V in 7 ranges
Vac—2·5—1000V in 6 ranges
Idc—0·05—500mA in 5 ranges
Resistance—5Ω—1MΩ in 4 ranges.
Accuracy—5% of F.S.D.
OSCILLATOR—1 KHz and 465 KHz (A, M.) at approx. 1 Volt.
Size—160 x 97 x 40mm.
Supplied complete with carrying case, test leads and battery.
PRICE £8·30 net p & p 25p.



U4323

MULTIMETER U4341
27 Ranges plus Transistor Tester.
16,700Ω/Volt. Overload protected.
Vdc—0·3—900V in 8 ranges.
Vac—1·5—750V in 6 ranges.
Idc—0·06—600mA in 5 ranges.
Iac—0·3—300mA in 4 ranges.
Resistance—2KΩ—2MΩ in 4 ranges.
Accuracy—dc—2½%, ac—4% of F.S.D
hfe—10—350 in 2 ranges.
Size—115 x 215 x 90mm.
Complete with steel carrying case, test leads, and battery.
PRICE £11·30 net p & p 30p.



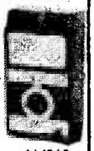
U4341

NEW CAPACITOR KITS
C280 Kit—PC. Mounting polyester 250V. 5 of each value: 0·01 0·022, 0·047, 0·1, 0·22μF. 2 of 0·47, 1μF. £1·30 net.
C296 Kit—Tubular polyester, 400V. 5 of each value: 0·01, 0·022, 0·047, 0·1, 0·22μF. 2 of 0·47μF. £1·30 net.
Ceramic Kit—square plaquette 50V. 5 each value: 22, 33, 47, 100, 220, 330, 470, 1000pF, 2200, 4700pF, 0·01μF. £1·30 net.
250V Paper kit—Tubular metal case. 3 of each value: 0·05, 0·1, 0·25, 0·5, 1μF. 90p net.
500V Paper Kit—Tubular metal case. 3 of each value: 0·025, 0·05, 0·1, 0·25, 0·5μF. 90p net.
1000V Paper Kit—Tubular metal case. 3 each value: 0·01, 0·025, 0·05, 0·1μF. £1·10 net.

MULTIMETER U4324
34 Ranges. High sensitivity.
20,000Ω/Volt. Overload protected.
Vdc—0·6—1200V in 9 ranges.
Vac—3—900V in 8 ranges.
Idc—0·06—3A in 6 ranges.
Iac—0·3—3A in 5 ranges.
Resistance—25Ω—5MΩ in 5 ranges.
Accuracy—dc and R—2½% of F.S.D. ac and db—4% of F.S.D.
Size—167 x 98 x 63mm.
Supplied complete with storage case, test leads, spare diode, and battery.
PRICE £9·95 net p & p 25p.

U4324

MULTIMETER U4313
33 ranges. Knife edge with mirror scale.
20,000Ω/Volt. High accuracy. mVdc—75mV.
Vdc—1·5—600V in 9 ranges.
Vac—1·5—600V in 9 ranges.
Idc—60—120 microamps in 2
Idc—0·6—1500mA in 6 ranges.
Iac—0·6—1500mA in 6 ranges.
Resistance—1KΩ—1MΩ in 4 ranges.
db scale—10 to + 12db.
Accuracy—dc—1½%, ac—2½%
Size—115 x 215 x 90mm.
Complete with steel carrying case, test leads, and battery.
PRICE £13·40 net p & p 30p.



U4313

S-DeC	
S-DeC	£2·14
T-DeC	£3·92
μDeC "A"	£4·30
μDeC "B"	£7·53
ANTEX	
CCN240	£2·43
CN240	£2·01
X25	£2·01

PANEL METERS
2" scale
100μA
500μA
1mA
5mA
10mA
50mA
100mA
500mA
1A
All at £3·75

Dalo Pen	98p
"expert" solder gun	£6·56
Wire pack 5 x 5mtrs.	27p
Diode pack (Ge) 50 for	25p
Jackson "00" 365pF	98p
C804, 5pF, 10pF, 15pF	83p
20pF, 25pF, 50pF	89p
60pF, 75pF, 100pF	98p
Dilecon 100, 300, 500pF	70p
LED. TIL 209	5 for £1
Panel l/holder 4 colours	22p
R'ry Sw'chs, 1P12W, 2P6W, 3P4W, 4P3W, 6P2W	30p

FELSTEAD ELECTRONICS (PW84), LONGLEY LANE, GATLEY, CHEADLE, CHESHIRE SK8 4EE

STYLI Replacements for virtually all ACOS, BSR, COLLARO, GARRARD, PHILIPS, RONETTE, SONOTONE. Single Tip: Sapphire **19p**, Diamond **37p**. **Double Tip:** Can be Stereo/LP+78 or ST/LP+ST/LP Sapphire **37p**. **Double Tip:** Diamond ST/LP+Sapphire 78 **65p**. Diamond ST/LP+Diamond ST/LP **£1·25**. For **GOLDRING** Diamond G800, G800H and G850 at **£2·10** each. G800E at **£4·10**. FREE LIST (FOR SAE) FULL DETAILS STYLI AND CARTRIDGE EQUIVALENTS including SHURE, PICKERING, AUDIO-TECH, B. & O., AND MANY MORE STYLI FOR MAGNETIC AND CRYSTAL PICK-UPS. Charges **10p** any quantity.

CARTRIDGES. All with styli and fittings. Replacements for ACOS GP/91 SC (Stereo-mono compatible series) at **£1·05**. GP93 Stereo at **£1·45**. GP94 Stereo Ceramic at **£1·98**: for RONETTE DC/400SCM (Speed change switch at front for GP67. TC8 & c.) at **£1·25**. for BSR X3H, X5H and X5M at **£1·35** each. SX5H and SX5M at **£1·70** each. TC8H at **£1·50**, TC8 Stereo, 3 pins. **£2·15**; charges **10p** any quantity.

RECORDING TAPE. ALL FINEST BRITISH MYLAR: 5" 600 ft. **40p**; 5" 900 ft. **55p**; 5¾" 1200 ft. **75p**; 7" 1800 ft. **£1·05**. Charges for 5" and 5¾", 1–4, **13p** each; 5 and over, **33p** the lot. Charges for 7", 1-3 **15p** each. 4-5 **35p** the lot, 6 and over **40p** the lot.

SPEAKERS 2½", 3, 8 or 64 ohms (state which) **55p**. Charges **10p** each.

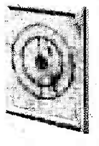
CONNECTING WIRE. Pkts. of 5 coils, asstd. cols., each 5 yds. Solid core **19p** (**10p** charges). Flexible **21p** (**10p** charges).

EARPIECES. Magnetic. 2·5 or 3·5mm plug (state which) **15p**. CRYSTAL (3·5mm only) **35p** (all **10p** up to 6).

VIBRATORS. 7 pin SYNCH. (12SR7 type) **75p**. 4-pin NON-synch (121HD4) **45p** (all **10p** each).

Send SAE for free styli, cartridge and components list. All prices include VAT.
(Some delay possible in dealing with orders, &c. between Oct. 23rd and Nov. 8th)

poly-planar



20-Watt Full Range Speaker

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

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

£7·50 each Stereo pair £14·50
INCLUSIVE OF VAT AND POSTAGE

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P.O. Box 162, Watford WD1 1AA

Project 80

The slim modules for building stereo hi-fi with FM

Project 805

Project 80 made even easier to build

Project 805SQ

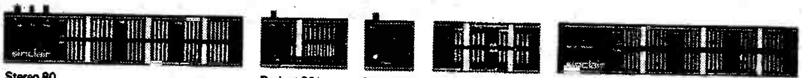
The add-on assembly that gives you quadraphony

Q16 Loudspeakers

The square speakers for 4 channel listening

Four channel listening has arrived!

Thanks to Project 80 versatility and marvellous compactness, adding two more channels is easy, efficient and economical – you simply add on Project 805SQ, or select the necessary modules from the Project 80 range detailed on the fourth page of this advertisement. Another way is to start with the new Project 805 (which is Project 80 complete in one pack) and add 805SQ to it. Our technicians have adopted the CBS SQ matrix principle to carry the rear left and right channels since it is already clearly the most widely used method in quadraphonic recordings. The decoder, however, can be modified to discrete systems without difficultly. Sinclair suitability for quadraphonics by no means stops with Project 805SQ. The Q.16 always a superb loudspeaker in its own right becomes one of the best ways of creating effective ambience without taking up too much space or money. Project 80 quadraphonic modules are ready now for you to enjoy both stereo and true quadraphonics right away with better reproduction from mono records as well.



Stereo 80 pre-amp/control unit — Project 80 F.M. tuner — Project 80 stereo decoder — Project 80 active filter unit — Project 80SQ quadrophonic decoder

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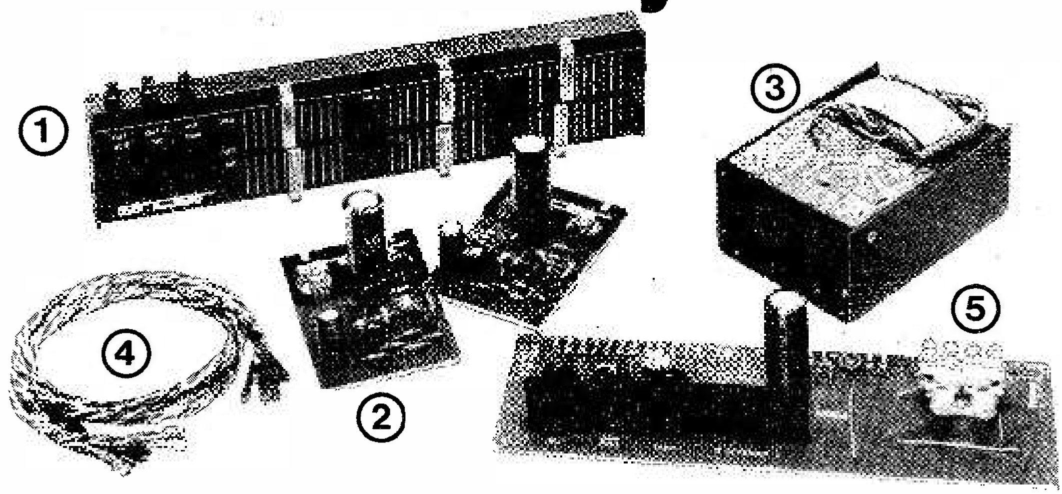
Forward with Project 80 into



Everything you want in one pack to build the world's most advanced modular hi-fi WITHOUT SOLDERING

1 Stereo 80 Control Unit
For mag. and ceramic cartridges, radio and tape.

2 Project 80 power amplifiers
Two Z.40s to give 8/8 watts R.M.S. output per channel.

3 Power supply unit
One PZ.5.

4 Connecting wires
All wires plus nuts, bolts, screws etc.

5 Project 805 Masterlink
For input and output connections.

6 Mains switch block and instructions manual (not illustrated).

This is Project 80 made even easier to build

You have seen how the marvellously compact Project 80 modules (only 2″ high × ¾″ deep) are so adaptable and easy to install. Now, with Project 805, this wonderful system is made easier still to put together. In this, you have not only all the Project 80 modules in one pack for building a 8/8 watt R.M.S. hi-fi amplifier – there is also a loom of colour coded wires cut to length and tagged for clipping on so that you don't even have to solder! Input and output connections go via the 805 Masterlink panel. With the explicit stage-by-stage large 32 page instructions manual included, it becomes easy for anyone, no matter how inexperienced to install an ultra-modern assembly so advanced in appearance and design that it sets brand new concepts in domestic hi-fi – and of course, you can convert to quadraphony just whenever you wish by adding 805SQ. Only Sinclair know-how and manufacturing facilities could hope to bring you such quality and versatility.

TAGGED WIRES CUT TO LENGTH·NO SOLDERING

Project 805

the complete ready·to·build hi·fi STEREO AMPLIFIER

Project 805 comprises a Stereo 80 Pre-amp/Control Unit with input for both magnetic and ceramic cartridges, radio, tape; separate bass and treble cut/lift, and volume controls 2 × Z.40 power amplifiers, PZ.5 power unit, 805 Masterlink, wire loom, instructions manual, etc. down to nuts, bolts and washers. For technical specifications, see fourth page of this advertisement.

£39.95
+£3.20 VAT (R.R.P.)

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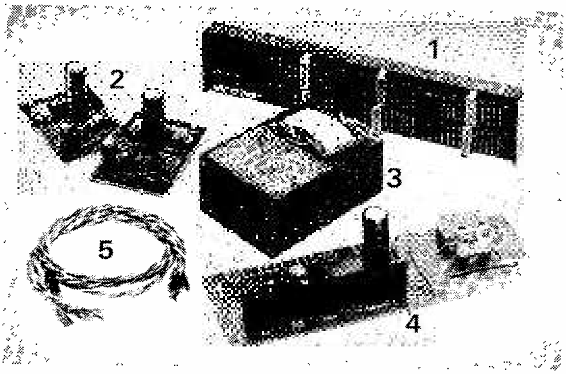
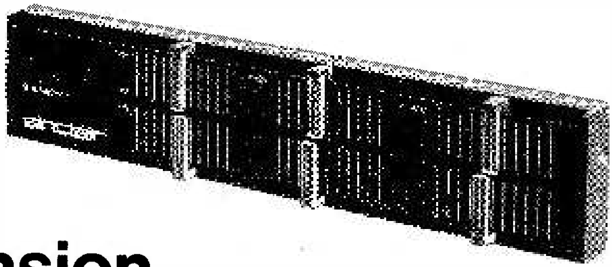
SINCLAIR RADIONICS LTD.
London Rd, St. Ives, Huntingdon PE17 4HJ
Telephone St. Ives (0480) 64646

true quadraphonics... NOW!



The most effective and economical way to enjoy this spectacular break-through in hi-fi listening

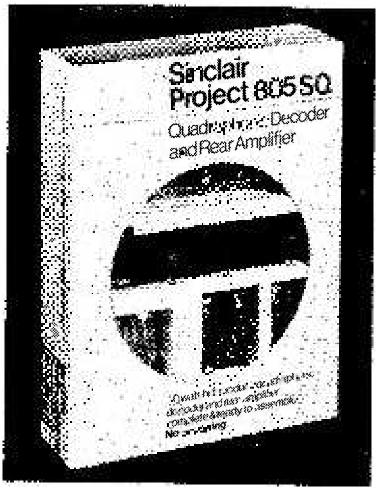


1. Project 80SQ decoder with controls.
2. Two Z.40 power amplifiers.
3. PZ.5 power pack.
4. Project 80Q Masterlink unit.
5. Wire loom, with clip-on tags – NO SOLDERING!
6. (Not illustrated) Instructions manual, nuts bolts, washers, etc.

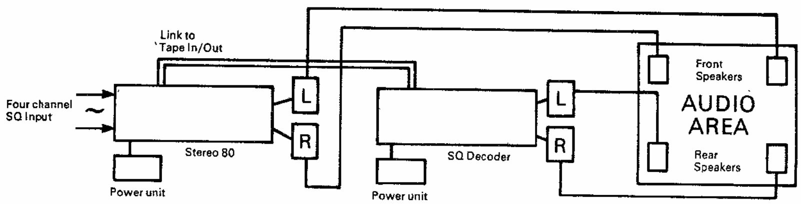
Add a fourth dimension to your stereo sound

It's so simple to convert to quadraphonics when you already have Project 80, or are about to start with Project 805. Project 805SQ is a complete add-on system at the heart of which is the Project 80SQ decoder. It uses the CBS.SQ matrix principle, by now the widest used method of containing four sound channels within the groove of the record. Project 805SQ includes two power amplifiers, power supply unit, connecting wire loom, 805Q Master-link, switch block and instructions manual. The 80SQ decoder (also obtainable separately) has independent tone and volume slider controls on the two rear channels for matching true four channel sound to domestic environment. Project 805SQ is money saving too since you do not have to scrap existing Project 80 equipment to enjoy the newest and most exciting form of home listening in the entire history of sound, and your Project 80 quad-raphonic assembly is compatible with stereo and mono records.

- Frequency response ±3db 15 Hz-25kHz
- Rated output 100mV
- S/N ratio 58dB
- Distortion 0·1%
- Power requirements 22-35 volts
- Phase shift network 90° ±10° 100 Hz-10kHz
- Adaptable to discrete (CD4) use



Project 805SQ



The output from any good stereo cartridge feeds into Stereo 80 and passes via the tape outlet to the 80SQ decoder. Here the signal is separated into its constituent 4 channels, those for the front being accepted by the Stereo 80, those for the rear going from the decoder to the two additional power amplifiers and speakers.

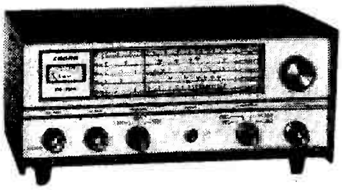
£44.95
+£3.60 VAT (R.R.P.)

Guarantee If, within 3 months of purchasing any product direct from us, you are dissatisfied with it, your money will be refunded on production of receipt of payment. Many Sinclair Appointed Stockists also offer this guarantee. Should any defect arise in normal use within 2 years, we will service it without charge. For damage arising from mis-use a nominal charge will be made.

Project 80 quadraphonic modules may be purchased separately if required. The Project 80SQ decoder may be used with any other amplifier having tape and monitoring facilities. Z40 or Z60 power amps can be used as required.

LISTEN TO **CODAR**® THE WORLD!

★CR70A



★MADE TO ORDER!

COMMUNICATION RECEIVER

£34·14!
VAT PAID
CARR. 87p

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

★ IMPORTANT NOTE

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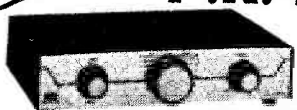

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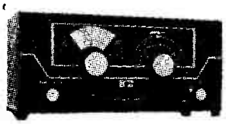

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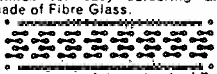

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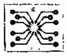

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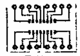

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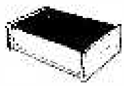

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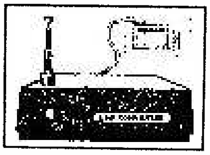

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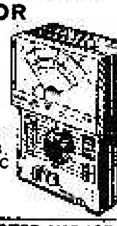

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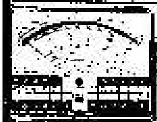

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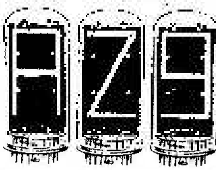

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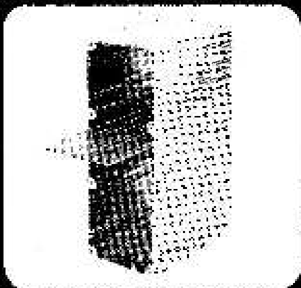

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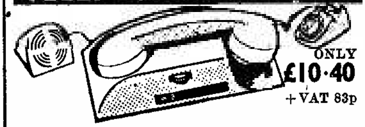

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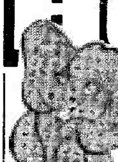

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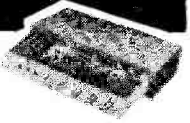

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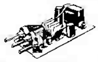

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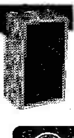

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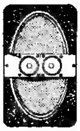

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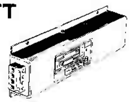

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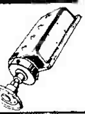

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