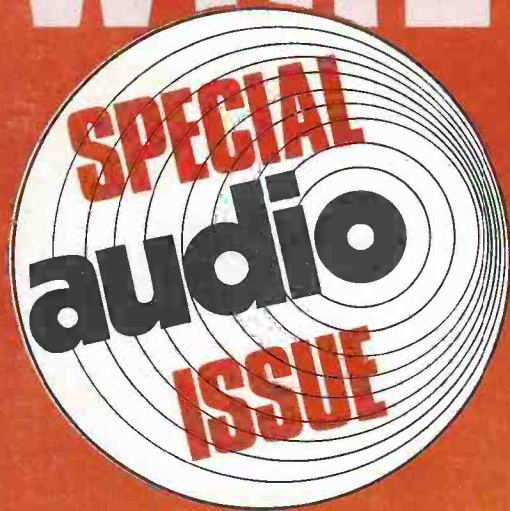


# PRACTICAL WIRELESS

NOVEMBER  
1974

25p



**ADD-ON STEREO  
HI-FI UNITS**

**ALSO:-**

**Section 2 of the  
P.W. BUYERS' GUIDE**

**AND**

**CONCLUDING THE**

**P.W. TELE-TENNIS**  
- FINAL ADJUSTMENTS



**SCRATCH & RUMBLE FILTER**



**TONE  
CONTROL UNIT**

# NEW EDU-KIT MAJOR

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

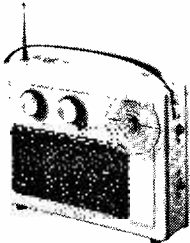
- ★ 4 Transistor Earpiece Radio.
- ★ Signal Tracer.
- ★ Signal Injector.
- ★ Transistor Tester NPN-PNP.
- ★ 4 Transistor Push Pull Amplifier.
- ★ 5 Transistor Push Pull Amplifier.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ 5 Transistor Short Wave Radio.
- ★ Electronic Metronome.
- ★ Electronic Noise 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 • 3 1/4" 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 • 6 1/2 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

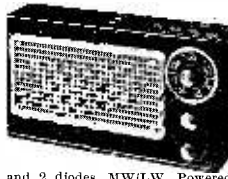


Nine Transistors, 9 Tunable wavebands as Roamer Ten. Built in ferrite rod aerial for MW/LW. Retractable chrome-plated telescopic aerial for VHF and SW. Push Pull output using 600mW transistors. 3 Transistors and 3 diodes, tuning condenser with V.H.F. section, separate coil for aircraft, moving coil loudspeaker, volume ON/OFF and wavechange controls. Attractive all white case with red grille and carrying strap. Size 9 1/2" x 7" x 2 1/4". 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)

## NEW Everyday Series

Build this exciting New series of designs



E.V.5. 5 Transistors and 2 diodes. MW/LW. Powered by 4 1/2 volt Battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" x 5 1/2" x 2 1/4" 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.

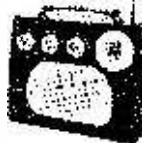
**Total Building Costs** **£3-60** P P & Ins. 30p  
(+ 8% VAT 29p)  
(Overseas P & P £1-25)

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

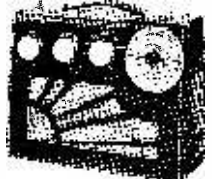


7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Chrome plated Telescopic aerial can be angled and rotated for peak short wave listening. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. 3 transistors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

**Total building costs** **£6-98** P P & Ins. 47p  
(Overseas P & P £1-85) (+ 8% VAT 36p)

## ROAMER TEN

WITH VHF INCLUDING AIRCRAFT



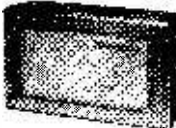
10 Transistors. Latest 4" 2 watt Ferrite Magnet Loudspeakers. 9 Tunable Wavebands. MW1, MW2, LW, SW1, SW2, SW3, Trawler Band, VHF and Local Stations also Aircraft Band.

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" x 7" x 4". Easy to follow instructions and diagrams. Parts price list and plans 30p (FREE with parts).

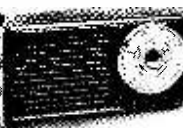
**Total building costs** **£8-50** P P & Ins. 62p  
(Overseas P & P £1-85) (+ 8% VAT 68p)

## POCKET FIVE

NOW WITH 3" LOUD-SPEAKER. 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 5 1/2" x 1 1/2" x 3 1/4" 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).

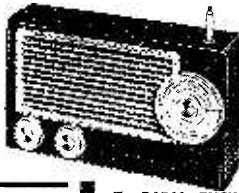
**Total Building Costs** **£2-75** P P & Ins. 26p  
(+ 8% VAT 21p) (Overseas P & P £1-25)

## TRANS EIGHT

8 TRANSISTORS and 3 DIODES

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 x 5 1/2 x 2 1/4in. 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 x 5 1/2 x 2 1/4in. approx. Plans and parts price list 25p (FREE with parts).

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

## "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 Aerial; Battery Clips; 4 Tag Boards; 10 Transistors; 4 Diodes; Resistors; Capacitors; Three 1" 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)

## RADIO EXCHANGE LTD

★ Callers side entrance "Lavelis" 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. 788972.

I enclose £..... for .....

Name .....

Address .....

(Dept. PW11.)

# PRACTICAL WIRELESS

VOL. 50 NO. 7  
ISSUE 813  
NOVEMBER 1974

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

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

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**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
WHARFEDAILE DENTON	£42.31 Pr.	£29.95
WHARFEDAILE 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

Model	Rec. Price	All £1 carr.
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

Model	Rec. Price	£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
505	£2.73	806	£2.56	121/10	£3.17	138/10LR	£2.50	138/15TLR	£4.96
506	£2.61	1001	£4.37	121/10T	£3.97	138/10TLR	£2.68	101/10A	£4.27
507	£1.08	1002	£4.19	121/11	£3.68	138/11	£3.65	101/11A	£3.64
508	£1.00	1005	£3.45	121/11T	£3.78	138/11LR	£3.97	101/11A	£3.74
801	£3.93	1006	£3.50	121/15	£4.61	138/13	£3.83	122/10	£3.17
802	£3.69	1008	£2.93	121/15LR	£5.33	138/13LR	£4.15	122/10A	£5.49
802T	£3.82	1001LR	£5.09	138/10	£2.18	138/15	£4.51	122/10LR	£6.08
805	£3.25	1005LR	£4.37	138/10T	£2.31	138/15LR	£4.83	122/10T	£5.49
								122/14LR	£9.19
								162/12	£10.94

## 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  $\pm$  12db. Treble Control  $\pm$  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. Or FACTORY BUILT IN TEAK VENEERED CABINET as illustrated £16.95 or dep. £2.12 and 8 monthly payments £2.12 (Total £19.08)

## 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	£3.65	HF120L	12"	15W	£7.95
HF120	12"	15W	£5.95	HF126D	12"	16W	£8.50

## 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  $\Omega$ . PLEASE STATE IMPEDANCE REQUIRED List £4.42 **£3.99**  
**MODEL 808T 8" 15w.** with parasitic Tweeter. Response 25 Hz to 15 KHz. Gauss 13,000 Imp 3 or 8-15  $\Omega$ . List £6.33 **£5.50**

## 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 8  $\Omega$ . Frequency Response 7 Hz to 70 KHz  $\pm$  1  $\frac{1}{2}$  dB.

COMPLETE KIT (less cabinet). Carr. 70p. Cabinet if req. £4.90 extra. Assembled unit in cabinet **£22.50**

## R.S.C. TRANSFORMERS, L.F. CHOKES & RECTIFIERS FULLY GUARANTEED.

MIDGET CLAMPED TYPE 2 1/2 x 2 1/2 in.	TOP SHROUDED DROP-THRO' TYPE
250v, 60mA, 6-3v, 2a	250-0-250v, 70mA, 6-3v, 2a, 0-5-6-3v, 2a
250-0-250v, 60mA, 6-3v, 2a	250-0-250v, 100mA, 6-3v, 3a
	250-0-250v, 100mA, 6-3v, 2a, 6-3v, 1a
	350-0-350v, 80mA, 6-3v, 2a, 0-5-6-3v, 2a
	250-0-250v, 100mA, 6-3v, 4a, 0-5-6-3v, 3a
	300-0-300v, 100mA, 6-3v, 4a, 0-5-6-3v, 3a
	300-0-300v, 130mA, 6-3v, 4a, c.t., 6-3v, 1a
	350-0-350v, 100mA, 6-3v, 4a, 0-5-6-3v, 3a
	300-0-300v, 100mA, 6-3v, 4a, 0-5-6-3v, 3a
	300-0-300v, 130mA, 6-3v, 4a, c.t., 6-3v, 1a
	Suitable for Mullard 610 Amplifier
	350-0-350v, 150mA, 6-3v, 4a, 0-5-6-3v, 3a
	WILMINGTON or TRANSISTOR POWER PACK
	6-3v, 1a, £7.75; 6-3v, 2a, £8.95; 6-3v, 3a, £1.45p;
	6-3v, 6a, £2.25; 12v, 1a, 80p; 12v, 3a, or 24v, 1a
	1-5a £2.25; 0-9-18v 1 1/2a £1.95; 0-12-25-42v 2a £2.75.

## HI-FI SPEAKER ENCLOSURES

TEAK VENEER Carr. 50p. Sizes approx. per enc. Cut for 8in. spkr. **£5.95**  
 SE10 25 x 16 x 9in. Cut for 10in. and Tweeter **£8.95**  
 SE12 25 x 16 x 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 **£7.50** Carr. 45p  
 OR SENIOR 15 WATT INCLUDING **£7.95** Carr. 50p  
 HF126 15,000 GAUSS SPEAKER

## 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 9 1/2 x 2 1/2 x 3 1/2 in. Silver finish fascia 10 1/2 x 3 1/2 in. COMPLETE KIT, wiring diagrams and instructions. **£7.95** Carr. 40p. FACTORY BUILT **£10.95**

## 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, Bass 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 **£22.50** (Total £28.50).

## AUDIO FIDELITY FRI SPEAKER KIT

Response 30Hz-15KHz. Rating 15 watts in sealed cabinet. Imp. 8-15 ohms. 8" Bass Unit with P.V.C. Cone surround (or ultra low resonance. Pressure Tweeter. Printed Circuit. Inductive/Capacitive Cross-over. Damping Material, Screws, Terminal Panels. Carr. each **£10.78**  
**SPECIAL OFFER £14.99** Pair 50p Carr. Free.

## 'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

★ Moderate size only 25 x 14 x 10in. approx.  
 ★ Response 30-20,000 c.p.s. Impedance 15 ohms  
 Performance comparable with COMPLETE KIT units at twice the cost **£25.95** Carr. 75p  
 Deposit £4.71 and 8 monthly payments £3.12 (Total £29.87)  
 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) 6L6, KT66, etc. for 3 or 15  $\Omega$ . (6) Handmade Teak veneered cabinet. (7) Circuit and full instructions.

## CHARGER TRANSFORMERS 0-9-15v, 1 1/2a £1.75

CHARGER TRANSFORMERS 0-9-15v, 1 1/2a £1.75	SELENIUM RECTIFIERS F.W. (Bridged)
2 1/2a. £1.95; 3a. £2.40; 5a. £2.45; 6a. £2.75; 8a. £3.40	All 6/12v. D.C. output. Max. A.C. input 18v.
AUTO (Step Up/step DOWN) TRANSFORMERS	1a, 39p, 2a, 49p, 3a, 65p, 4a, 81p, 6a, 97p.
0-110/120v. 200-230-250v. 50-80 watts £2.50, 150 watts, £4.50 250 watts £5.50; 500 watts £8.50	L.F. CHOKES
OUTPUT TRANSFORMERS	150mA, 7-10H, 250 $\Omega$ £1.10; 100mA, 10H, 200 $\Omega$ 85p
Push-Pull 8 watts EL84 to 3 or 15 $\Omega$ £1.45	60mA, 10H, 400 $\Omega$ 35p.
Push-Pull 10 watts 6V6, 3-5-8-15 $\Omega$ £2.25	
Push-Pull EL84 to 3 or 15 $\Omega$ 10-12 watts £2.25	
Push-Pull Ultra Linear for Mullard 610, etc. £2.75	
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc. for 3 or 15 $\Omega$ £3.20	
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 $\Omega$ £5.50	



# RSC 100 watt DISCO SYSTEM



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TWIN TURNTABLE WITH PRE-AMP and POWER AMPLIFIER

AT FANTASTIC LOW PRICES!

Complete with lid HEADPHONES MICROPHONE

Units listed below  
(a) DISCOMASTER TWIN TURNTABLE CONSOLE with integral 100W amplifier.  
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(d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18" x 18" x 8"  
(e) (b) (c) & (d) **£149-95**  
Carr. £3-00

**RSC TDI DISCO CONSOLE**  
Incorporating twin Garrard SP25 or BSR MP60 type turntables and Sonotone or Acos Cartridges with diamond stylus. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control switch. Black Vynide covered Cabinet with lid, see illustration on left.  
Or Dep. £6-00 and 18 fortnightly pymts. £4-22 (Total £54-96) Carr. £1-50  
**£75-00**

DEP. £19-95 & 19 fortnightly. payments of £7-87 (Total £169-48).

## DISCOMASTER TWIN TURNTABLE POWER CONSOLE

Garrard SP25 or McDonald MP60 turntables. Sonotone or Acos cartridges with diamond styl. Facilities as TDI Console but with built-in 100 watt Power Amplifier, complete with lid. Or Deposit **£11-48** and 18 fortnightly payments **£5-74** Carr. £2-50 (Total £114-80) **£99-95**

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All types 15 Ohms covered in Rexine and Vynair  
**TYPE C132 30-40 WATTS** Fitted two exceptionally efficient, low feedback howl characteristic high flux 12" x 8" x 20 watt speakers. Terms: Dep. **£3-95** and 8 m'thly payments **£2-67** (Total **£25-81**) Carr. 65p.  
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All power ratings are R.M.S. continuous. 2 YEARS' GUARANTEED High flux ceramic magnets. ALL CARRIAGE FREE.  
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Dep. **£2-12** and 8 m'thly payments **£2-17** (Total **£19-58**)  
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**FE. FANE POP 50'S ROW L/SPEAKERS** **£17-90** carr.  
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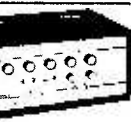
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A powerful high quality unit for lead, rhythm guitar, vocalists, gram, radio, tape. 50w Peak O/P rating. Not for Bass Guitar.  
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As featured in the May 1973 issue of 'Practical Electronics', Superb Hi-Fi tuner Kit now available from Electro Spares. Including cabinet and all components - pre-set Mullard modules for R.F. and I.F. circuits. Motorola I.C. Phase Lock Loop Decoder for perfect stereo reception. No alignment needed. Guaranteed first time results - or send it back, and we'll return it in perfect order (for a nominal handling charge). Electro Spares price only £28.50 inc. VAT and p & p.

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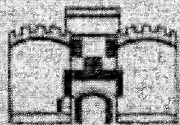
## The Castle 8.RS.DD.



A highly sensitive, full range eight inch unit designed for use in the recommended cabinet, or one of similar dimension.

Suitable for use with good quality stereo installations, tape recorders, car radios, public address and background music systems, it has a frequency range of 50 to 20,000 kHz - the lower limit variable with increases in cabinet volume. Recommended retail price is £9.00 excluding VAT.

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**PUSH-BUTTON VARICAP DIODE TUNING (6 Position)**

('WW' JUNE '73)

Exclusive Designer Approved Kits

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- MOSFET** front end for excellent cross modulation performance and low noise.
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- VARICAP** tuning diodes in back to back configuration for low distortion.
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- PHASE LOCKED** Stereo decoder with Stereo mute, see below
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- PUSH BUTTON** tuning (with AFC disable) over the FM band (88-104)
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The Nelson-Jones Tuner has all of these features and many more, and more importantly the design is fully proven not just with a few prototypes but with many thousands of working tuners spread across the world.

Typ. Specn: 20 dB quieting 0-75uV, Image rejection -70dB.I.F. Rejection -85 dB.

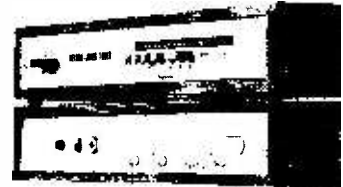
Basic tuner module prices start as low as **£12.31**, with complete kits starting at **£26.95** (mono) + P.P. 65p, and of course all components are available separately.

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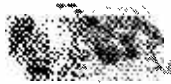
Price **£7.02** when bought with a complete N-J tuner kit or **£8.29** if bought separately (P.P. 21p). **PLEASE NOTE.** Existing tuners are readily convertible and kits/parts are available for this purpose.

**TEXAN AMPLIFIER.** We have designed the tuner case and metalwork to match the Texan amplifier (see photograph). Complete designer approved Texan kits are available at **£30.78** plus P.P. 65p including Teak Sleeve.



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Image rejection 40dB  
IF rejection 65dB

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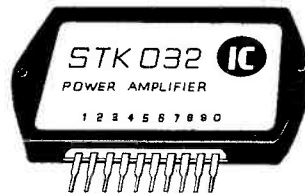
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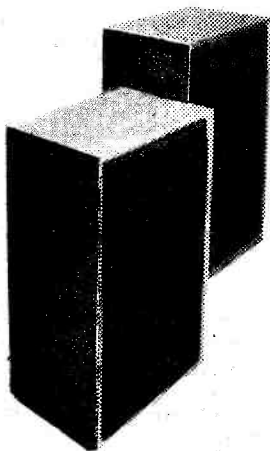
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All types 1" and less diameter

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21/A	12v	28mA	430	80p
12/A	6v	33mA	185	each

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All types are standard 240 volt primary. MT 102 ct. 0 = 19 = 25 = 33 = 40 = 50 at 500M/A

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2 1/2 x 3 1/2	32p	24p	15p
2 1/2 x 5	34p	34p	18p
3 1/2 x 3 1/2	34p	34p	
3 1/2 x 5	39p	45p	
17 x 2 1/2	1.48p	77p	60p
17 x 3 1/2	1.45p	1.16p	75p
17 x 5	1.85p		1.10p

**Pin insertion tool** 72p

**Spot face cutter** 52p

**Pkt. 38 pins (state -1 or -15)** 25p

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2 1/2" 8 ohm	50p
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\* Carr. on L/S over 18 x 8 and 12" 50p per L/S.

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Four-sided with corner plates. All are 2 1/2" deep.

	L	W	H	
6" x 3"	42p	12" x 5"		86p
6" x 4"	45p	12" x 8"		87p
8" x 3"	45p	14" x 3"		85p
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Metal project boxes give your work a professional finish

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AB8	4	4	1 1/2	40p
AB9	4	2 1/2	1 1/2	40p
AB10	4	5 1/2	1 1/2	45p
AB11	4	2 1/2	2	40p
AB12	3	2	1	35p
AB13	6	4	2	55p
AB14	7	5	2 1/2	68p
AB15	8	6	3	85p
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Handy boxes for construction projects. Moulded extrusion rails for P.C. or chassis panels. Fitted with 1mm front panels.

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1021 = 106mm x 74mm x 45mm (sloping front) = 50p

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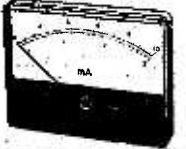
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ME11	=0 to 10 m/a Full Scale
ME12	=0 to 50 m/a Full Scale
ME13	=0 to 100 m/a Full Scale
ME14	=0 to 500 m/a Full Scale
ME15	=0 to 1 amp Full Scale
ME16	=0 to 50 volts A.C. Full Scale
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	1 1/8"	88p	
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		2 3/8"	25.25	"B"
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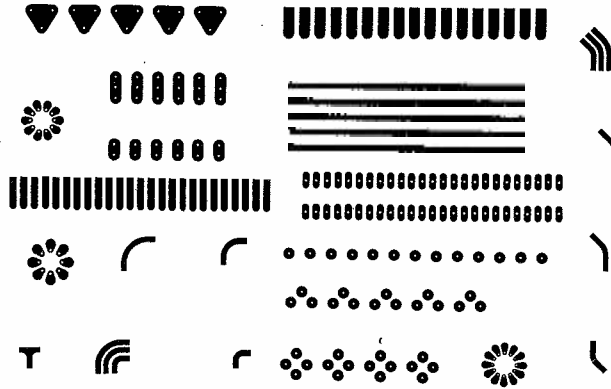
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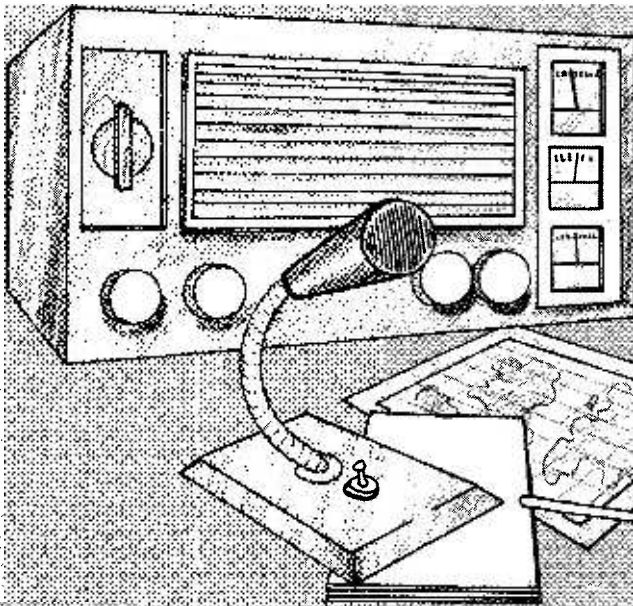
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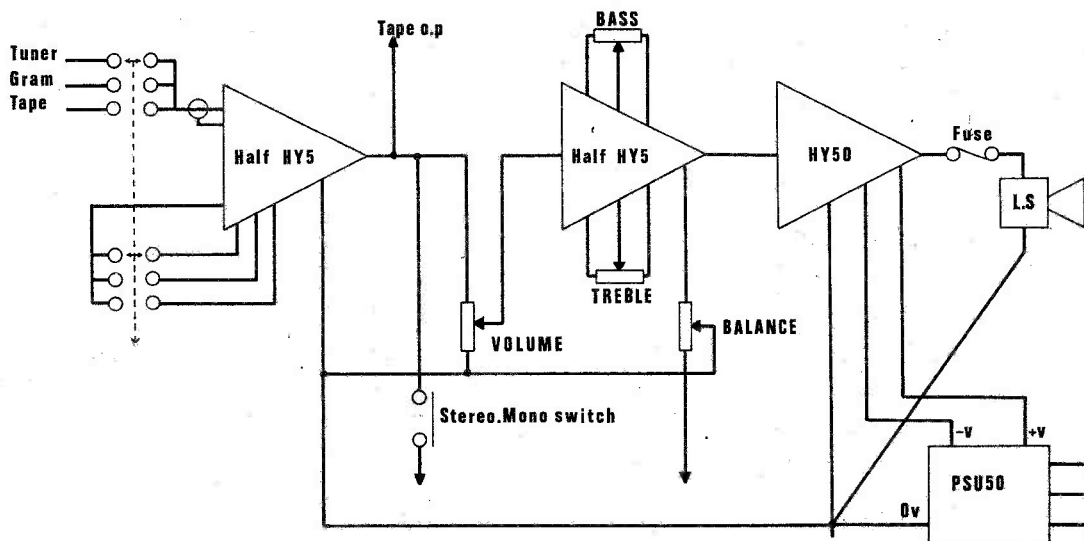
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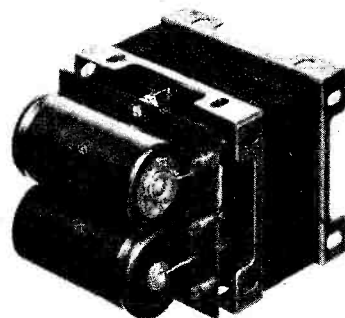
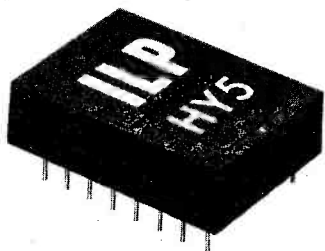


I.L.P. (Electronics) Ltd

# SHEER SIMPLICITY!



MONO ELECTRICAL CIRCUIT DIAGRAM WITH INTERCONNECTIONS FOR STEREO SHOWN



The HY5 is a complete mono hybrid preamplifier, ideally suited for both mono and stereo applications. Internally the device consists of two high quality amplifiers—the first contains frequency equalisation and gain correction, while the second caters for tone control and balance.

**TECHNICAL SPECIFICATION**

Inputs: Magnetic Pick-up 3mV RIAA; Ceramic Pick-up 30mV; Microphone 10mV; Tuner 100mV; Auxiliary 3-100mV; Input Impedance 47k $\Omega$  at 1kHz. Outputs: Tape 100mV; Main output 0db (0.775V RMS). Active Tone Controls: Treble  $\pm$  12db at 10kHz; Bass  $\pm$  12db at 100Hz. Distortion: 0.5% at 1kHz. Signal/Noise Ratio: 68db. Overload Capability: 40db on most sensitive input. Supply Voltage:  $\pm$  16-25V.

**PRICE £4.50**

- 36p VAT  
P. & P. free

The HY50 is a complete solid state hybrid Hi-Fi amplifier incorporating its own high conductivity heatsink hermetically sealed in black epoxy resin. Only five connections are provided, input, output, power lines and earth.

**TECHNICAL SPECIFICATION**

Output Power: 25W RMS into 8k $\Omega$ . Load Impedance: 4-16k $\Omega$ . Input Sensitivity 0db (0.775V RMS). Input Impedance: 47k $\Omega$ . Distortion: Less than 0.1% at 25W typically 0.05%. Signal/Noise Ratio: Better than 75db. Frequency Response: 10Hz-50kHz  $\pm$  3db. Supply Voltage:  $\pm$  25V. Size: 105 x 50 x 25mm.

**PRICE £5.98**

- 48p VAT  
P. & P. free

The PSU50 can be used for either mono or stereo systems.

**TECHNICAL SPECIFICATIONS**

Output voltage: 25V. Input voltage: 210-240V. Size: L. 70, D. 90, H. 60mm.

**PRICE £5**

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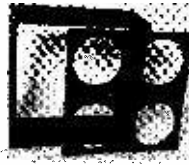
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**Speaker Cabinets in kit form represent HUGE SAVINGS**



2' x 12" Cabinet



4' x 12" Cabinet



Disco Console (includes lid not shown)  
Takes two slaves

For a long time now a large number of customers have asked us to produce cabinets in kit form, and above we show examples of cabinet styles and these are now available either fully built or in kit form ready for you to produce a professional finish in a very short time!

Kits are available in all specifications and all the kits contain everything you need as follows:-

- 1) 4 sides with handle cutouts, front edges rounded, 1 back with jack socket hole, and 1 baffleboard with speaker cutout
- 2) P.V.C. cut to size for frame and back, plus false front and back timbers, white front piping and speaker cloth
- 3) Recessed handles with fixing screws, jack socket, all fixing screws, corner plates, glue, and full instructions!

**PRICE & TYPE LIST**

Type	Size	Price manufactured	Kit price
2 x 12" (illustrated above)	36" x 18" x 13" x 3/4"	£19.50	£12.50
4 x 12" (illustrated above)	31" x 31" x 13" x 3/4"	£24.50	£17.50
4 x 12" P.A. Column	48" x 27" x 13" x 3/4"	£30.00	£21.50
1 x 18"	31" x 31" x 13" x 3/4"	£24.50	£17.50
1 x 15" with two top horn cutouts	36" x 20" x 13" x 3/4"	£21.00	£13.50
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Please ask for quotation on any other type or size of cabinet you may require.

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**PC ETCHING KIT**

Contains 1lb Ferric Chloride, 100 sq. ins. copper-clad board, DALO etch-resist pen, abrasive cleaner, etching dish & instructions, all for only £3.30

**RESISTORS & CAPACITORS**

500 assorted resistors £1.35. 2500 4x12, 150 poly. ceramic, mica etc capacitors 80p.

**VEROBOARD**

100 sq. ins. assorted sizes and pitches (no tiny pieces) £1.10.

**3W TAPE AMPLIFIERS**

Polished wooden cabinet 14 x 13 x 9" containing a sensitive (20uV) 4 valve amplifier with tone & volume controls. Gives 3 watts output to the 7 x 4" 3Ω speaker. Also a non-standard tape deck. Supplied in good working condition with circuit. Standard mains operation. £4.50. Suitable cassette £1.10. Spare head 33p. Tape (ex-computer) 75p. Amplifier chassis only, complete and tested (2x ECC83, EL84, EZ80) and speaker £3.

**VERSATILE POWER UNIT**

Contains mains transformer, 2A thermal cut-out and bridge rectifier. Will give 1.7-10.5V output with 2 extra capacitors (supplied) £1.20. Also available as model garage with switch, lamp, jack plug etc. (Used for 'Hot Wheels') £1.70.

**LEO III COMPUTER**

Arriving late-October. All parts available, including 3000 reels tape, 1/2" decks, power units, etc.

All prices shown include 8% VAT and postage (mainland only) SAE list, enquiries.

**GREENWELD ELECTRONICS (PW8)**

Mail order dept., wholesale/retail shop 51 SHIRLEY PARK ROAD, SOUTH-AMPTON. Tel 0703 772591. Other retail shops at 21 Deptford Broadway SE8, Tel 01-892 2009 and 38 Lower Addiscombe Road, Croydon. Callers Welcome.

**FERRIC CHLORIDE**

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**PO AMPLIFIER UNIT**

Contained in steel case 5 1/2 x 5 x 3 1/2" are 2xGET118 transistors on heat sinks, 3 pot cores, 2 30V zeners, 4 audio transformers, 1% resistors & caps. With circuit diagram £1.

**7lb BARGAIN PARCELS**

Hundreds of new components—Pots, resistors, capacitors, switches, + PC boards with transistors and diodes, and loads of odds and ends. Amazing value at only £2.30.

**COMPUTER PANELS**

3lbs asstd £1.40, 7lbs £2.65, 56lbs £15. Pack containing 500 components with at least 50 transistors 95p, 12 High quality panels with power transistors, trim pots, IC's etc £2.50. Thousands of boards at shops for callers from 5p.

**SLOT METER**

Ex-Pay TV, takes 10p pieces, has 3 digit mechanical counter, coin counter, Sangamo-Weston impulse movement, nylon gearing, switch, etc. Only £1.20.

**MISCELLANEOUS**

Transformer, Mains pri 16-0-16V with 9V tap sec 1 1/2A £2. Post office 4 digit counters 60p. Balanced armature earpieces, use as mic or spkr 20Ω impedance 30p. 2N3055 35p. 80 + 80 + 20uF 350V 15p. 10 for £1.15. Multimeters: good range in stock from £3.50.

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The kit is supplied with a ready-drilled roller-tinned printed-circuit board and fully machined die-cast case with AMP Electrical Spade Connector Block together with a custom wound transformer, first grade components and full constructional details.

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Ref. No.	VA (Watts)	Weight lb oz	Size cm.	P & P £
07	20	1 8	7.0 x 6.0 x 6.0	2.55 38
149	60	3 12	9.9 x 7.7 x 8.6	3.79 45
150	100	5 8	9.9 x 8.9 x 8.6	4.17 45
151	200	8 0	12.1 x 9.3 x 10.2	7.39 53
152	250	10 12	12.1 x 11.8 x 10.2	9.45 73
153	350	15 0	14.0 x 14.0 x 11.8	11.35 73
154	500	19 8	14.0 x 13.4 x 11.8	13.30 91
155	750	29 0	17.2 x 14.0 x 14.0	21.05 *
156	1000	38 0	17.2 x 16.6 x 14.0	27.20 *
158	2000	60 0	21.6 x 15.3 x 18.1	50.25 *

## AUTO TRANSFORMERS

Ref. No.	VA (Watts)	Weight lb oz	Size cm.	Auto Taps	P & P £
113	20	1 0	5.8 x 5.1 x 4.5	0-115-210-240	1.34 30
64	75	2 4	7.4 x 6.7 x 6.1	0-115-210-240	2.64 38
4	150	3 4	8.9 x 7.7 x 7.7	0-115-200-220-240	3.29 45
66	300	6 4	9.9 x 9.6 x 8.6	"	5.29 53
67	500	12 8	12.1 x 11.2 x 10.2	"	8.02 67
84	1000	19 8	14.0 x 13.4 x 14.3	"	13.50 91
93	1500	30 0	14.2 x 15.9 x 14.3	"	17.50 *
95	2000	32 0	17.2 x 16.6 x 14.0	"	25.35 *
73	3000	40 0	21.6 x 13.4 x 18.1	"	32.80 *

## CASED AUTO TRANSFORMERS

115V mains lead input and U.S.A. 2-pin outlets. 20VA £2.64 pp 38p  
500VA £9.50 pp 80p 1000VA £15.92 via B.R.S.

## TRANSFORMERS

### PRIMARY 240-250 VOLTS 12 AND OR 24 VOLT RANGE

Ref. No.	Amps.	Weight lb oz	Size cm.	Secondary Windings	P & P £
111	0.5	0.25	8 4.8 x 2.9 x 3.5	0-12V at 0-25A x 2	1.34 23
213	1.0	0.5	1 4 6.1 x 5.8 x 4.8	0-12V at 0-5A x 2	1.58 30
71	2	1 2	7.0 x 6.4 x 6.1	0-12V at 1A x 2	2.09 38
18	4	2 2	8.9 x 8.0 x 7.0	0-12V at 2A x 2	2.60 38
70	6	3 3	8.9 x 8.0 x 7.7	0-12V at 3A x 2	3.52 45
108	8	4 5	9.9 x 8.9 x 8.6	0-12V at 4A x 2	3.96 45
72	10	5 6	9.9 x 9.6 x 8.6	0-12V at 5A x 2	4.67 53
116	12	6 6	12.1 x 9.9 x 10.2	0-12V at 5A x 2	5.61 53
17	16	8 8	12.1 x 9.9 x 10.2	0-12V at 8A x 2	6.62 60
115	20	11 8	14.0 x 12.1 x 11.8	0-12V at 10A x 2	10.20 73
187	30	15 15	18.2 x 12.1 x 11.8	0-12V at 15A x 2	13.70 85
226	60	30 32	0 17.2 x 15.3 x 14.0	0-12V at 30A x 2	22.50 *

### 30 VOLT RANGE

Ref. No.	Amps.	Weight lb oz	Size cm.	Secondary Taps	P & P £
112	0.5	1 4	6.1 x 5.8 x 4.8	0-12-15-20-24-30V	1.58 30
79	1.0	2 4	7.0 x 6.7 x 6.1	"	2.18 38
3	2.0	3 4	8.9 x 8.3 x 8.6	"	3.18 38
20	3.0	4 8	9.9 x 9.3 x 8.6	"	4.12 45
21	4.0	6 4	9.9 x 9.6 x 8.6	"	4.67 53
51	5.0	6 12	12.1 x 8.6 x 10.2	"	5.83 53
117	6.0	8 0	12.1 x 9.3 x 10.2	"	6.94 60
88	8.0	12 0	12.1 x 11.8 x 10.2	"	9.00 67
89	10.0	13 12	14.0 x 10.2 x 11.8	"	9.80 73

### 50 VOLT RANGE

Ref. No.	Amps.	Weight lb oz	Size cm.	Secondary Taps	P & P £
102	0.5	1 12	7.0 x 6.4 x 6.1	0-19-25-33-40-50V	2.09 38
103	1.0	2 12	8.3 x 7.4 x 7.0	"	3.08 38
104	2.0	5 8	9.9 x 8.9 x 8.6	"	4.26 45
105	3.0	6 12	9.9 x 10.2 x 8.6	"	5.79 53
106	4.0	10 10	12.1 x 10.5 x 10.2	"	7.41 67
107	6.0	12 0	14.0 x 10.2 x 11.8	"	11.00 67
118	8.0	18 0	14.0 x 12.7 x 11.8	"	13.40 85
119	10.0	25 0	17.2 x 12.7 x 14.0	"	17.60 *

### 60 VOLT RANGE

Ref. No.	Amps.	Weight lb oz	Size cm.	Secondary Taps	P & P £
124	0.5	2 4	7.0 x 6.7 x 6.1	0-24-30-40-48-60	2.12 38
124	1.0	4 4	8.9 x 7.7 x 7.7	"	2.97 38
127	2.0	6 4	9.9 x 9.6 x 8.6	"	5.40 45
125	3.0	8 12	12.1 x 9.9 x 10.2	"	7.11 60
123	4.0	13 12	12.1 x 11.8 x 10.2	"	9.20 67
40	5.0	12 00	14.0 x 10.2 x 11.8	"	10.83 73
120	6.0	15 8	14.0 x 12.1 x 11.8	"	13.35 85
121	8.0	25 00	14.0 x 14.7 x 11.8	"	15.01 *
122	10.0	25 0	17.2 x 12.7 x 14.0	"	19.60 *
189	12.0	29 00	17.2 x 14.0 x 14.0	"	21.60 *

## MINIATURE TRANSFORMERS WITH SCREENS P & P

Ref. No.	MA	Weight lb oz	Size cm.	VOLTS	P & P £
238	200	2	2.8x2.6x2.0	3-0-3	1.40 10
212	1A, 1A	1	4 6.1x5.8x4.8	0-6-0-6	1.67 30
13	100	4	3.9x2.6x2.9	9-0-9	1.28 13
235	330, 330	4	4.8x2.9x3.5	0.9-0.9	1.42 19
207	500, 500	1	0 6.1x5.8x4.8	0-8-0, 0-8-9	2.23 30
208	1A, 1A	1	7.0x6.8x4.8	0.8-0.8-9	3.00 38
236	200, 200	4	4.8x2.9x3.5	0-15-0, 0-15	1.30 19
214	300, 300	1	4 6.1x5.8x4.8	0-20-0, 0-20	1.76 30
221	700 (D.C.)	1	8 7.0x6.1x6.1	20-12-0, 12-20	1.98 38
206	1A, 1A	2	12 8.3x7.7x7.0	0-15-20, 0-15-20	3.78 38
203	500, 500	4	8.3x7.0x7.0	0-15-27, 0-15-27	3.06 38
204	1A, 1A	3	4 8.9x7.7x7.7	0-15-27, 0-15-27	3.27 38

PLEASE ADD 8% FOR V.A.T. INCLUDING P. & P.

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Also 7BP7. All unused as new. Price £2 post paid.

**TRANSISTOR BOARDS**—consisting of transistors, diodes and resistors etc. Long leads. Good value 12 for £1.00 (min. order) P. & P. 30p. Quotations for quantity.

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**BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY**



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13 Master Frequencies on ONE tiny circuit board. **LOOK AT THESE AMAZING ADVANTAGES**

- ★ 13 frequencies from C8 to C9. ★ Each frequency digitally derived from a SINGLE h.f. master oscillator.
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SAJ110 7-stage frequency divider in one 14 pin DIL package. Sine or square wave input allows operation from almost any type of master oscillator including the DMO2 (when 97 notes are available). Square wave outputs may be modified to saw-tooth by the addition of a few components. SAJ110: £2.03 each OR special price for pack of 12: £25.00. S.a.e. please for data sheet.

Keyboards: High quality adjustable type.

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- Flat front 48-note F to E £14.35
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Two types of spring line available:

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- Long line £7.59

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### BASIC ORGAN CIRCUIT

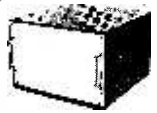
Leaflet MES 51 shows complete circuit for a basic fully polyphonic organ. Send only 15p for leaflet and start building now! **REMEMBER**—when you have built this organ you will later be able to use the same top quality component parts as the basis of a large sophisticated instrument with all the facilities you want. Watch our ads for details.

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Model 120 all aluminium two part construction. Top and sides, blue hammer finish, front, rear and base: white. Others: mild steel three part construction.

Top, base, sides and detachable rear panel, blue hammer. Detachable aluminium front panel finished in white.

Model	W	H	D	Price
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221	8	6	6	£4.07
320	12	8	12	£8.42

Chassis for model 320 £2.84 extra.

Please send s.a.e. for free illustrated leaflet.

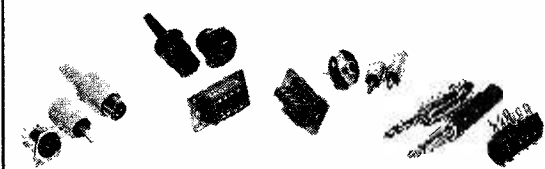
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Sub-miniature Axial lead electrolytic

Mfd V Price	Mfd V Price
1 63 6p 68 6-3 6p	Mfd V Price
1 5 63 6p 68 16 6p	470 6-3 6p
2-2 63 6p 68 63 14p	470 10 14p
3-3 63 6p 100 10 6p	470 25 16p
4-7 63 6p 100 10 6p	470 40 25p
6-8 40 6p 100 25 6p	470 40 25p
6-8 63 6p 100 40 6p	680 6-3 14p
10 25 6p 100 63 16p	680 16 16p
10 63 6p 150 6-3 6p	680 25 25p
15 16 6p 150 16 6p	1000 4 14p
15 40 6p 150 25 6p	1000 10 16p
15 63 6p 150 40 14p	1000 16 25p
22 10 6p 150 63 16p	1000 16 25p
22 25 6p 220 4 6p	1500 6-3 16p
22 63 6p 220 10 6p	1500 10 25p
33 6-3 6p 220 16 6p	1500 16 25p
33 16 6p 220 25 14p	1500 16 25p
33 40 6p 220 40 16p	2200 6-3 25p
47 4 6p 220 63 25p	2200 10 28p
47 10 6p 330 4 6p	2200 6-3 25p
47 25 6p 330 10 6p	3300 6-3 25p
47 40 6p 330 16 14p	4700 4 28p
47 63 6p 330 63 28p	



## PLUGS AND SOCKETS



- DIN PLUGS**
  - 2 pin (1 flat) 8p
  - 3 pin 9p
  - 4 pin, 5 pin A 9p
  - (180°), 5 pin B pair 28p
  - (240°), 6 pin 10p
- MAINS**
  - P360 3 pin 1-5A chassis plug with line socket. Per pair 28p
  - SA 2190 3 pin 5A chassis plug 26p
  - SA 1862 Line socket for above 28p
- DIN Sockets**
  - 2 pin 6p
  - 3 pin, 4 pin, 5 pin 6p
  - A (180°), 5 pin B 13p
  - (240°), 7p, 6 pin 8p
- McMURDO**
  - RP8 8 way chassis plug 52p
- R88 8 way chassis socket 68p**
- PHONO**
  - Plug plastic 5p
  - Plug screened 12p
  - Chassis socket 4p
- JACK**
  - Std. 1" mono plug Plastic 13p
  - Screened 21p
- Std. 1" stereo plug Plastic 18p**
- Screened 30p**
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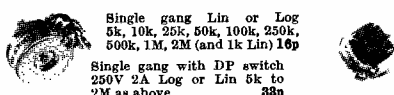
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- Silicone grease in special dispenser 20ml. 54p
- Red neon 240V panel mounting 23p
- Lacing Cord Strong rayon cored PVC 25m. 51p
- Panel fuse holders 20mm 20p; 1 1/2" 35p
- Transformers**
- LT700 min. output transformer Pri. 1-2k Ω Sec. 5 Ω 200mW 50p
- Sub-min. Mains Transformer 6-0-6V 100mA 95p
- 12-0-12V 50mA 85p
- Size: Both approx. 30 x 27 x 25mm.
- Min. Mains Transformer (Size: 46 x 31 x 38mm) 0-12V 250mA, 0-12V 250mA £1.36
- Mains transformer MT3AT Pri. 200-220-240V, Sec. 12-15-20-24-30V 2A £3.31
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## POTENTIOMETERS

Rotary miniature carbon track 1" spindle.



- Single gang Lin or Log 5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M, 2M (and 1k Lin) 16p
- Single gang with DP switch 250V 2A Log or Lin 5k to 2M as above 33p
- Dual gang (Stereo) without switch Log or Lin 5k to 2M as above 48p.
- PRESETS**
- Sub-miniature 0-1W Vert or Horiz. 100, 250, 500, 1k, 2.5k, 5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M 6p

**NE555V 8-pin DIL 69p**

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- Carbon Film 1W 5% 1Ω to 1M; 10% 1-2M to 10M E12 1p
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- Metal Oxide 1W 2% 10Ω to 1M E12 & E24 4p
- Wirewound 21W 10% 0-22ohms to 0-47ohms E12 14p
- Wirewound 21W 5% 1ohm to 270ohms E12 12p
- E12 values 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and decades
- E24 values 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and decades

## LINEARS

- CA3046 LH0042C, TO99 (TO5), FET 1/2p Op Amp 24.25p
  - LM301A. 8-pin DIL Op Amp 39p
  - MC1303L. 14-pin DIL Stereo Preamplifier £1.30p
  - MC1310P. 14-pin DIL FM Stereo Decoder (no coils needed) £3.15p
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  - µA723C. TO99 (TO5), 2 to 37V Voltage Regulator 75p
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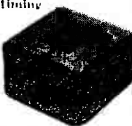
**2" 4"**  
SIZE: 60mm Wide x 45mm High x 40mm Deep. Movement I.R. Ohms  
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0-500 micro A. 170  
0-1 mA 170  
0-5 mA 170  
0-10 mA 170  
0-50 mA 170  
0-100 mA 0-5  
0-500 mA 0-5  
0-1 AMP 0-5  
0-2 AMP 0-5  
0-25 Volt 15K  
0-50 Volt 50K  
0-300 Volt 300K  
"g" Meter 170  
VU Meter 5250  
0-50 micro A. 1400  
0-100 micro A. 730  
0-500 micro A. 200  
0-1 mA 200  
0-5 mA 200  
0-10 mA 6  
0-50 mA 0-5  
0-100 mA 0-5  
0-500 mA 0-5  
0-1 AMP 0-5  
0-2 AMP 0-5  
15K  
50K  
300K  
200  
6250  
Ohms  
Ohms

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Price 2" £2.95 Post 10p. Price 4" £3.95 Post 10p. Lamps 55p per set.

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VA	Ref. No.	Price £	Price Plugs 2 Pin + 1 Earth	Price Open £	Post £
60	149	7.35	0.80	4.00	0.38
100	150	8.22	0.80	4.60	0.52
200	151	10.20	0.80	7.40	0.52
250	152	11.68	0.80	8.88	0.65
350	153	14.10	0.80	10.60	0.80
500	154	15.63	0.80	12.33	1.00
750	155	24.83	1.00	18.72	1.20
1000	156	32.19	1.00	26.50	1.20
1500	157	38.18	1.00	30.34	O.A.
2000	158	45.20	2.40	34.68	O.A.
3000	159	66.50	2.40	53.35	O.A.

**50 Volts**

Prim. 200-240V. Sec. 19, 25, 33, 40, 50V.	Amps	Ref. No.	Price £	Post £
0-5	102	2.33	0.30	
1	103	3.00	0.38	
2	104	4.57	0.42	
3	105	5.20	0.52	
4	106	6.89	0.52	
5	107	11.17	0.67	
8	118	14.19	0.87	
10	119	15.47	0.97	

**60 Volts**

Prim. 230-240V. Sec. 24, 30, 40, 48, 60V.	Amps	Ref. No.	Price £	Post £
0.5	124	4.00	0.38	
1	126	5.90	0.38	
2	127	6.83	0.42	
3	125	6.84	0.52	
4	125	7.94	0.67	
5	4	8.90	0.67	
6	130	10.16	0.82	
8	121	13.58	1.00	
10	122	18.16	1.00	
12	189	18.00	1.10	

**12 & 24 Volts Prim. 200-240V.**

Amps	Ref. No.	Price £	Post £
12V 24V			
0-3	0-15	2.49	1.34
0-5	0-25	1.11	1.88
1	0-5	2.13	1.88
2	1	71	3.09
4	2	18	6.58
6	3	70	8.90
8	4	108	9.52
10	5	79	4.80
12	6	110	6.01
16	8	17	6.22
20	10	116	9.47
30	15	187	11.95
40	20	222	13.88
50	30	226	15.30

**30 Volts**

Prim. 200-240V. Sec. 12, 15, 20, 24, 30V.	Amps	Ref. No.	Price £	Post £
0-5	1	112	1.72	0.22
1	2	79	2.81	0.38
2	3	3	2.26	0.38
3	3	20	4.10	0.42
4	4	21	4.88	0.52
5	5	21	6.80	0.52
6	6	117	8.60	0.67
8	8	88	8.50	0.67
10	8	89	9.27	0.67

**MINIATURE AND EQUIPMENT**

Prim. 240V with screen.	Sec. 1	Sec. 2	Milliamps	Ref. No.	Price £	Post £
3-0-3	—	—	200	238	1.28	0.10
0-6	—	—	500	334	1.30	0.10
0-6	0-6	—	1000	212	1.93	0.22
9-0-9	—	—	100	13	1.23	0.10
0-9	0-9	—	330	330	2.48	0.10
0-9	0-8-9	—	500	307	1.75	0.22
0-8-9	0-8-9	—	1000	208	2.82	0.22
15-0-15	—	—	40	240	1.23	0.10
0-15	0-15	—	200	236	1.80	0.10
20-0-20	—	—	30	241	1.23	0.10
0-20	0-20	—	160	150	2.37	0.10
0-15-20	0-15-20	—	500	500	2.47	0.38
0-20	0-20	—	360	300	2.14	0.22
0-20	—	—	3500	NO SCREEN	1116	3.90
20-12-0 12 20	—	—	700 (D/C)	—	221	2.31
0-15-20	0-15-20	—	1000	1000	2.06	0.38
0-15-27	0-15-27	—	500	500	2.03	0.38
0-15-27	0-15-27	—	1000	1000	2.04	0.38

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Cased versions are 240 Volt Mains to 115 Volts, smart steel cased units coated in tough resin with power lead, fuse and 115 Volt American type socket up to 500VA, above 500VA cable entry.

VA	Ref. No.	Price £	Price Plugs 2 & 3 pin	Price Open £	Post £
Tapped at 115, 220, 240 Volts					
20	118	3.00	0.15	1.55	0.30
150	4	5.30	0.15	3.98	0.39
200	65	5.40	0.15	4.50	0.40
300	66	7.27	0.15	5.28	0.52
500	67	9.99	0.15	8.29	0.67
750	83	12.58	0.75	9.76	0.82
1000	84	15.70	0.75	12.40	0.82
1500	93	19.85	0.75	18.58	1.50
2000	95	30.10	1.44	28.05	1.50
3000	73	43.58	1.90	38.00	1.90

**POWER UNIT Type CC 12-05**

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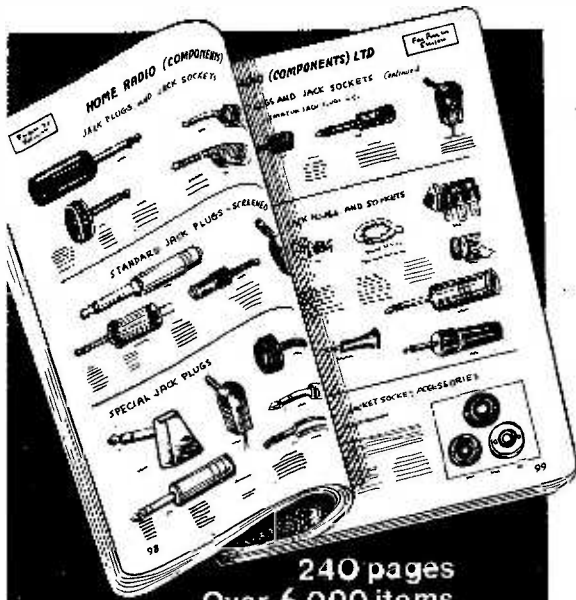
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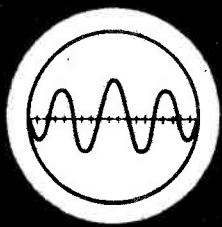
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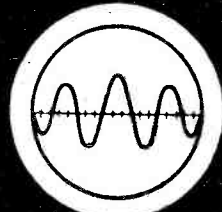
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**£26.50**

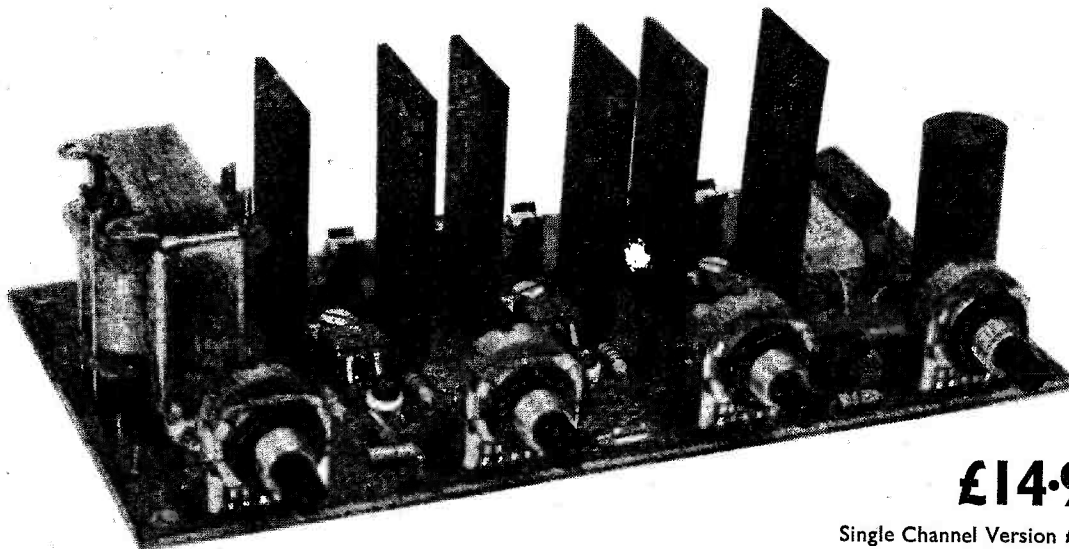
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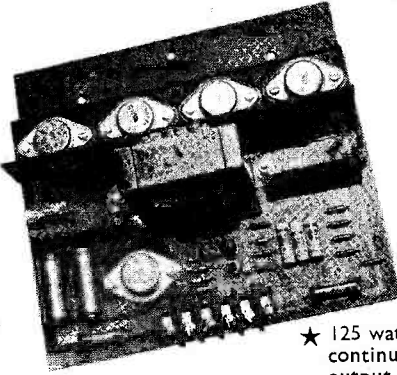
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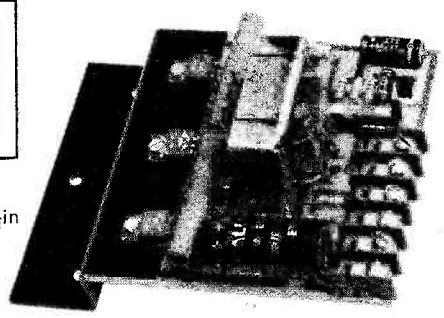


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Input sensitivity 60mV into 10k $\Omega$ ;  
Frequency response 20Hz-20kHz  $\pm 2$ dB; Hum and noise better than -70dB.

**TP125**  
7 x 6½ x 3in  
**£17.00**

- ★ 125 watts RMS continuous sine wave output

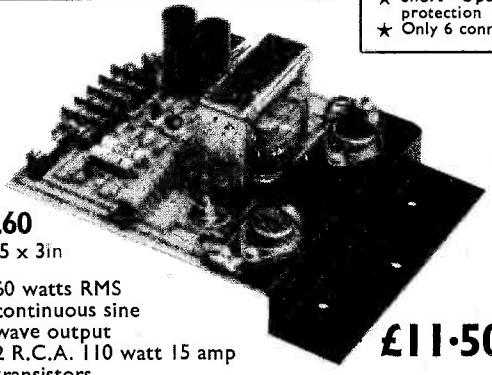
- ★ 4 R.C.A. 150 watt 15 amp output transistors



**TL30**  
4 x 5¼ x 2½in  
**£9.30**

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- ★ 2 R.C.A. 40 watt output transistor

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



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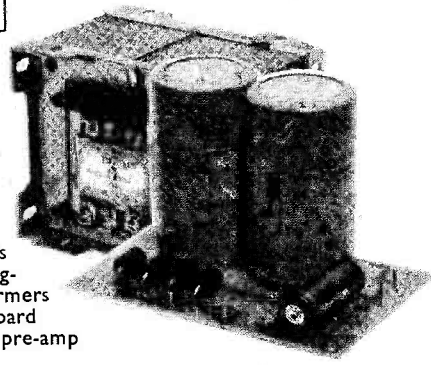
- ★ 60 watts RMS continuous sine wave output
- ★ 2 R.C.A. 110 watt 15 amp transistors

**£11.50**

**TL100**  
5 x 5 x 3in

- ★ 100 watts R.M.S. continuous sine wave output
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Power supplies vacuum impregnated Transformers with supply board incorporating pre-amp supply:

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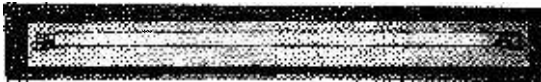


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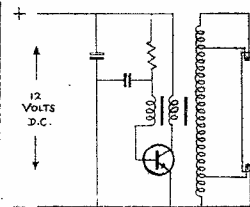
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H8/8A	16µF	16V	4p
H8/9A	20µF	70V	4p
H8/10	22µF	50V	4p
H8/11	25µF	12V	4p
H8/12A	30µF	10V	4p
H8/13A	32µF	50V	4p
H8/14	40µF	25V	5p
H8/14A	40µF	16V	4p
H8/15A	40µF	35V	4p
H7/1A	50µF	10V	4p
H7/2A	64µF	2.5V	2p
H7/4	64µF	15V	4p
H7/9A	125µF	4V	4p
H7/10A	160µF	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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NAS0162X 200V	-28	NAS0652X 200V	-56	NAS1002X 200V	-74
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NAS006R	200PIV -31	NAS106R	200PIV -36	NAS206R	100PIV -50
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**8 AMP ISOLATED TAB**  
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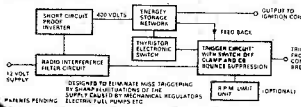
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(see note below)					
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C	3/4	4-7-10M	1-5	1-2	0-97 nett
C	1	4-7-10M	3-2	2-5	1-92 nett
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WW	3	1-10K	9	8	6
WW	7	1-10K	11	10	8

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10	—	—	—	—	—	—	8p	8p
22	—	—	—	—	—	—	8p	8p
47	8p	—	8p	8p	8p	8p	10p	13p
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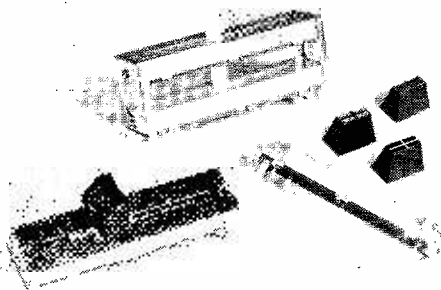
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Box 4	4"	9 1/2"	High	290p	
Box 4	4"	10 1/2"	High	320p	
Box 4	4"	11 1/2"	High	350p	
Box 4	4"	12 1/2"	High	380p	
Box 4	4"	13 1/2"	High	410p	
Box 4	4"	14 1/2"	High	440p	
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## VEROBORD

# EXHIBITIONS ?!

**W**HAT 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

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

## A foolproof Electric Lock

**S**OME 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.

**Not to be missed —**

**T**HE 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.

**Hi-Fi Accessories by Bib**

**B**IB 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**

**W**OLSEY 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, Algeiras and Tangier.

**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.**

# FM AERIAL pre-amplifier

KEITH CUMMINS

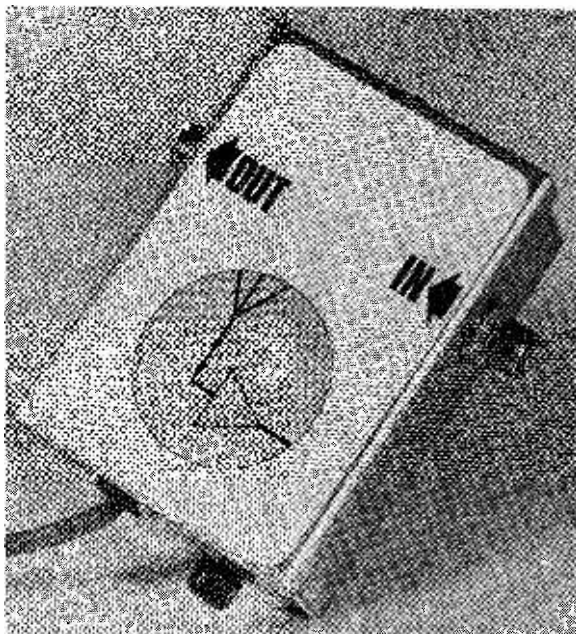
**L**ONG-DISTANCE reception of weak FM signals is possible provided that a high gain aerial is used and that the receiver has high sensitivity. Some older types of receiver lack the sensitivity of their modern counterparts and the use of an aerial amplifier can improve reception considerably.

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 then 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

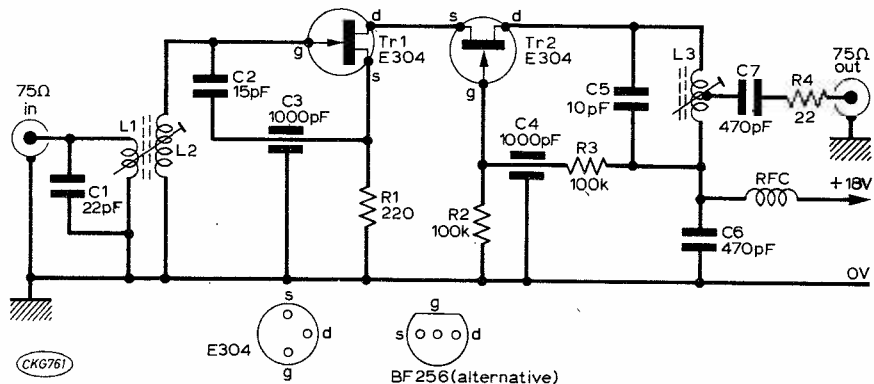
The VHF FM band is becoming quite crowded and the weak signals we wish to amplify may be situated very close to a strong local transmission. Unless our amplifier is correctly designed, a strong possibility exists that cross-modulation will occur between the various signals present, due to the high amplitude 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.





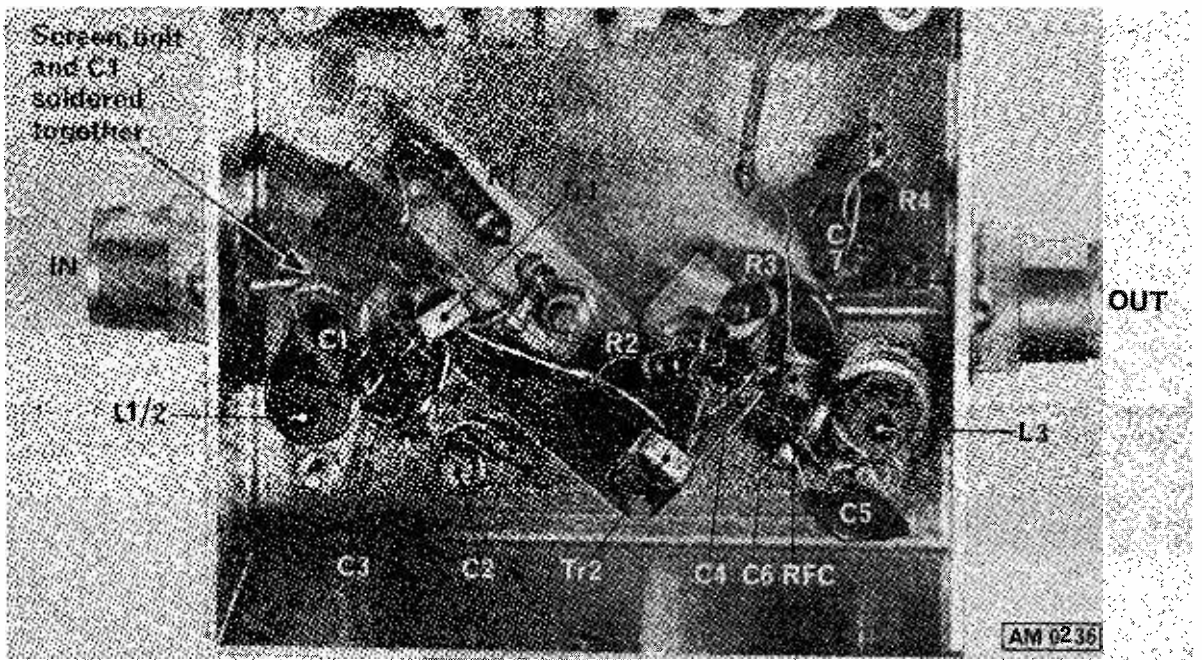


Fig. 2: This view of the amplifier shows all the components of Fig. 1. Most are mounted on either side of a metal screen to which earth returns can be soldered.

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.

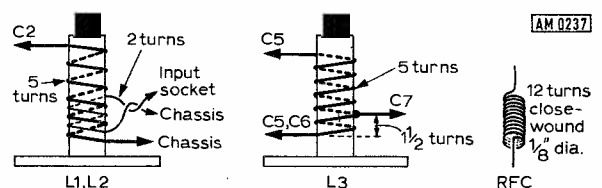
The arrangement shown is a satisfactory compromise between gain and bandwidth so that a useful gain of 12 to 15dB is obtained over the range 88-98 MHz. The output tuned circuit consisting of C5 and L3 has a tapping for the output, which is taken to

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

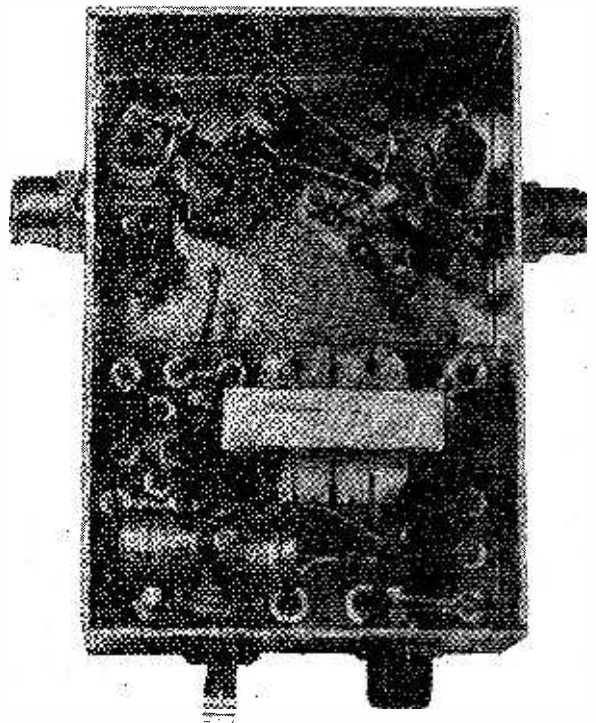


Note: L2 and L3 approx. 20 swg copper wire, spaced 1-diameter of wire. L1 insulated copper wire, interwound with L2.

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 $\frac{1}{2}$ 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 2½ x 1½ in. Coaxial sockets (2). Coil formers, polystyrene ¼ in. dia. with cores.		



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

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

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.

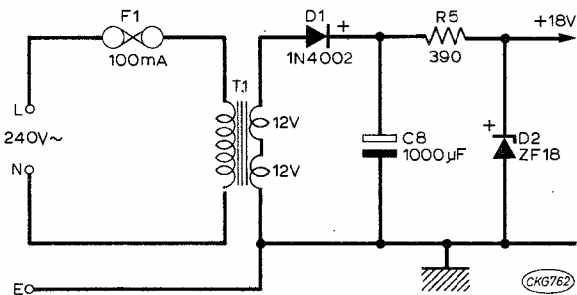


Fig. 4: Circuit of a suitable power supply for the pre-amplifier.

**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.

# 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

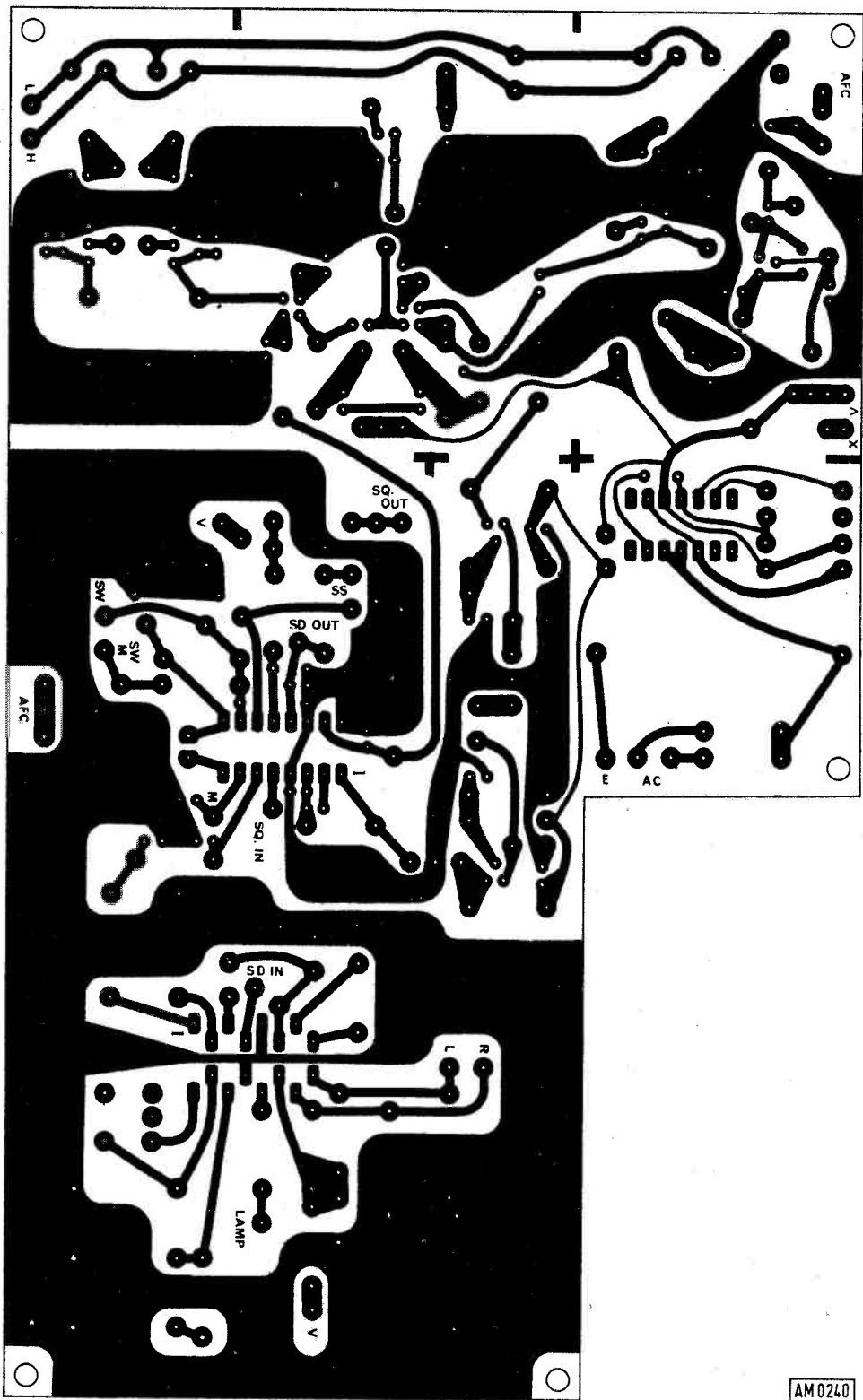


Fig. 4. Underside of printed circuit board, shown actual size.

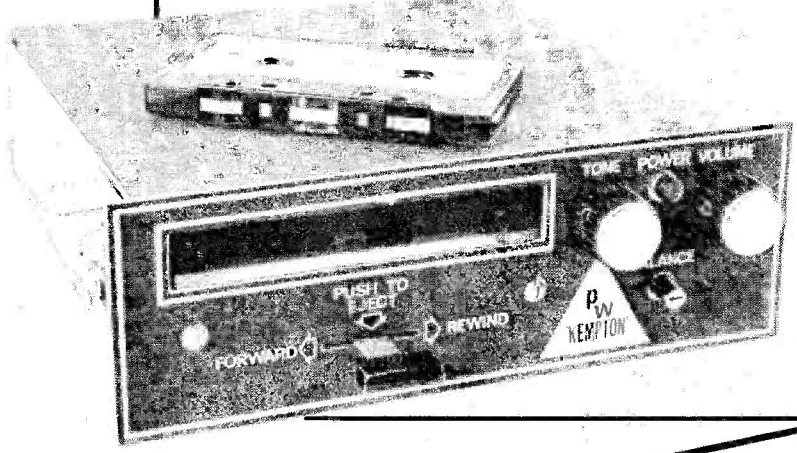


# FREE!

**YOU HAVE BEEN WARNED!** Don't forget to order your copy **NOW**. The December issue of PW will carry your Free Miniature Screwdriver, invaluable in the home and in the electronic enthusiasts' workshop for adjusting miniature potentiometers, etc.

# IN NEXT MONTH'S PRACTICAL WIRELESS

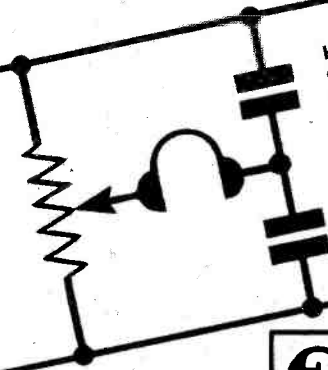
## PW 'KEMPTON' PART 1 CAR STEREO CASSETTE PLAYER



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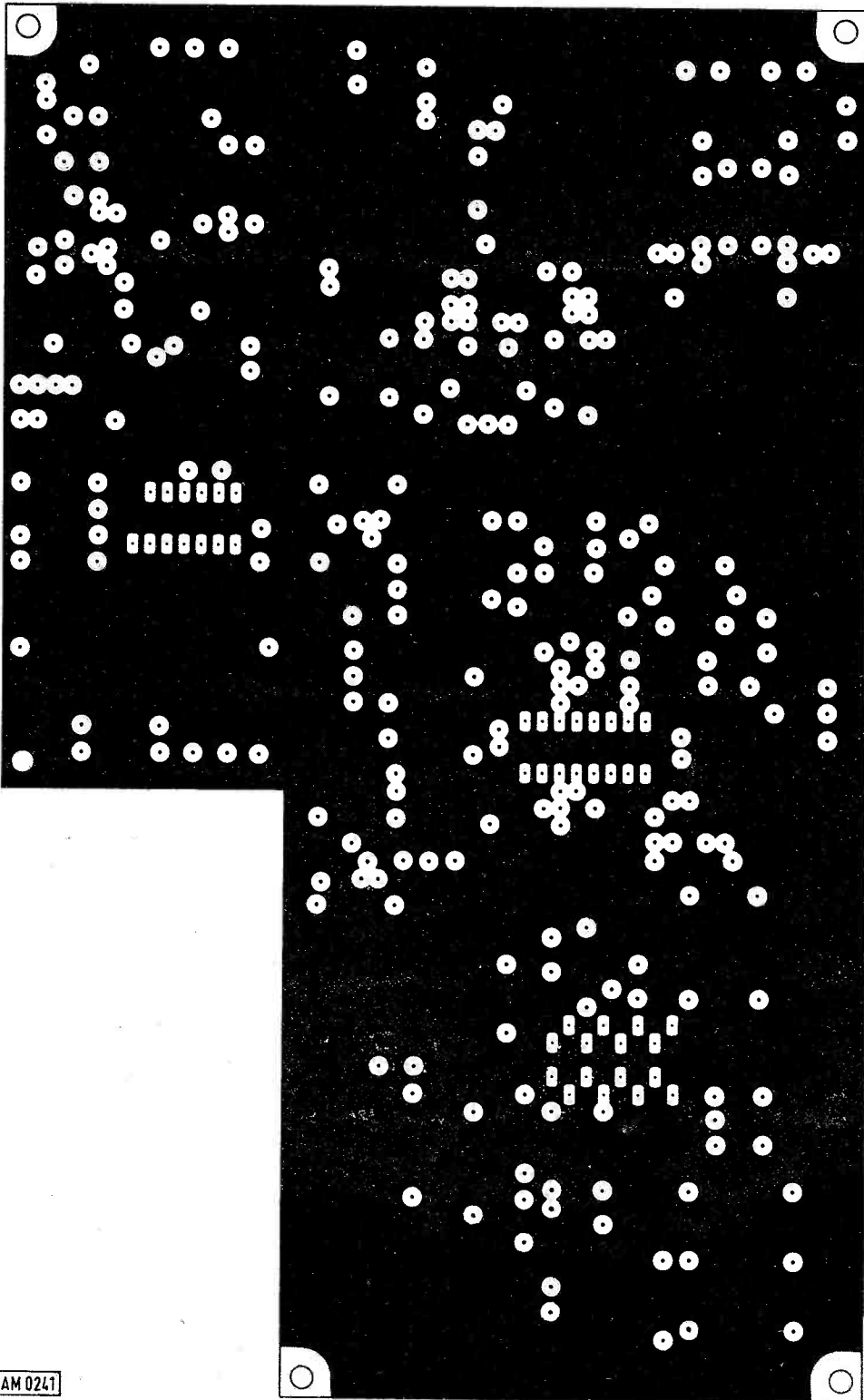


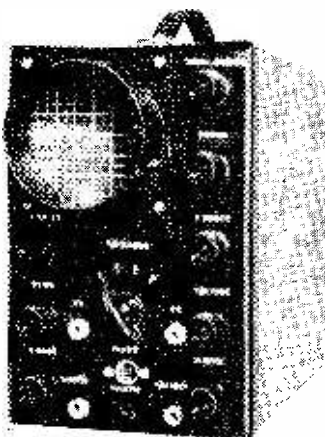
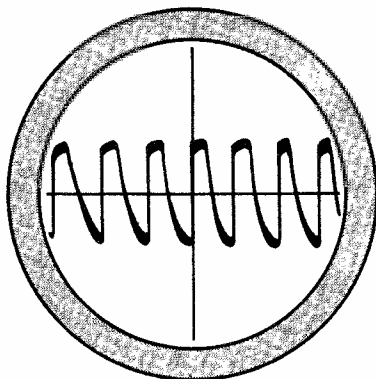
Fig. 6. Ground-plane side (top) of printed circuit board, drawn actual size.

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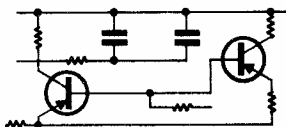
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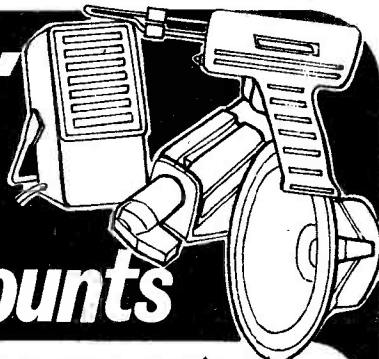
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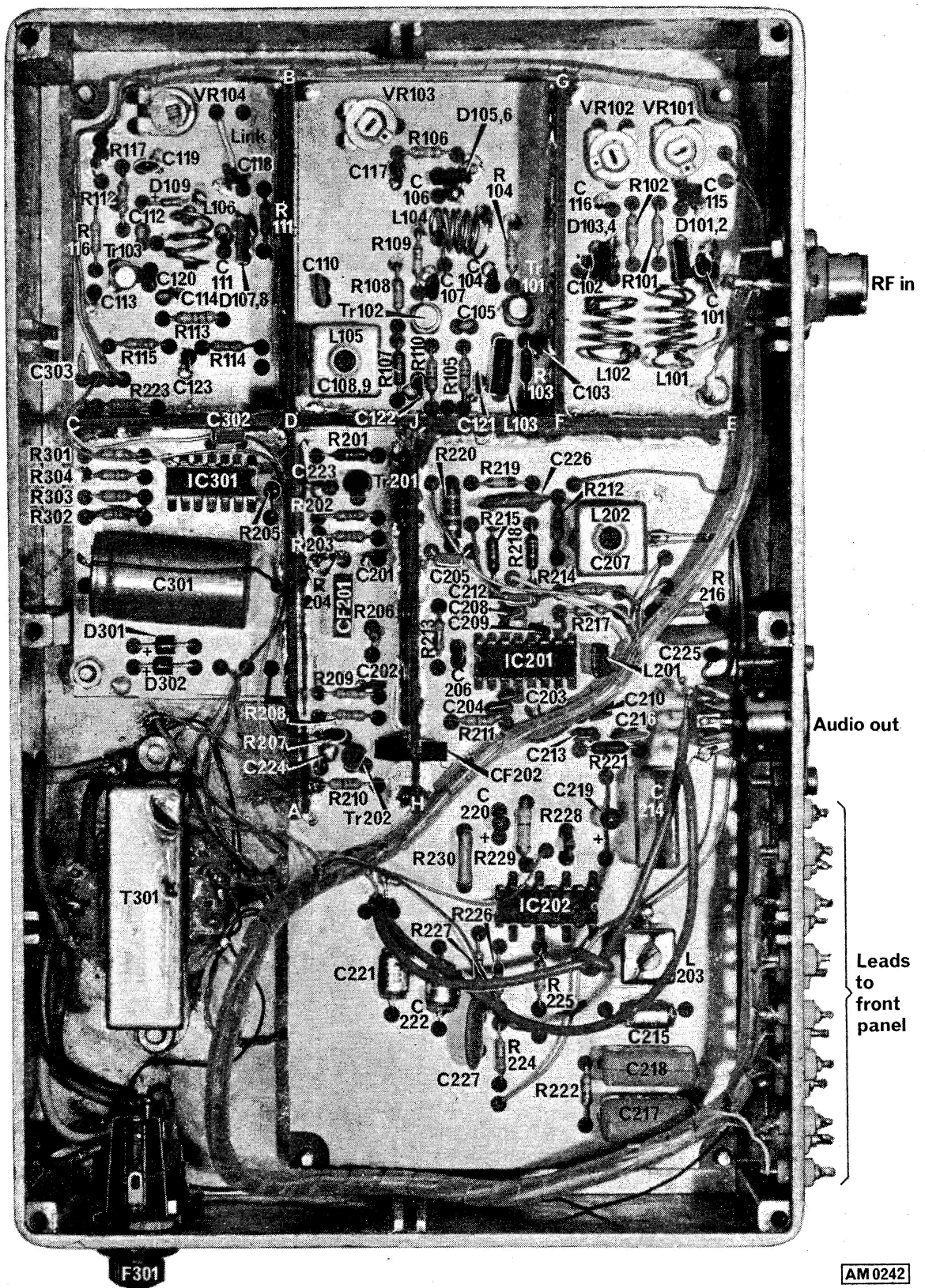


Fig. 6: Layout of components and Screens in the receiver.

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.

AM 0242

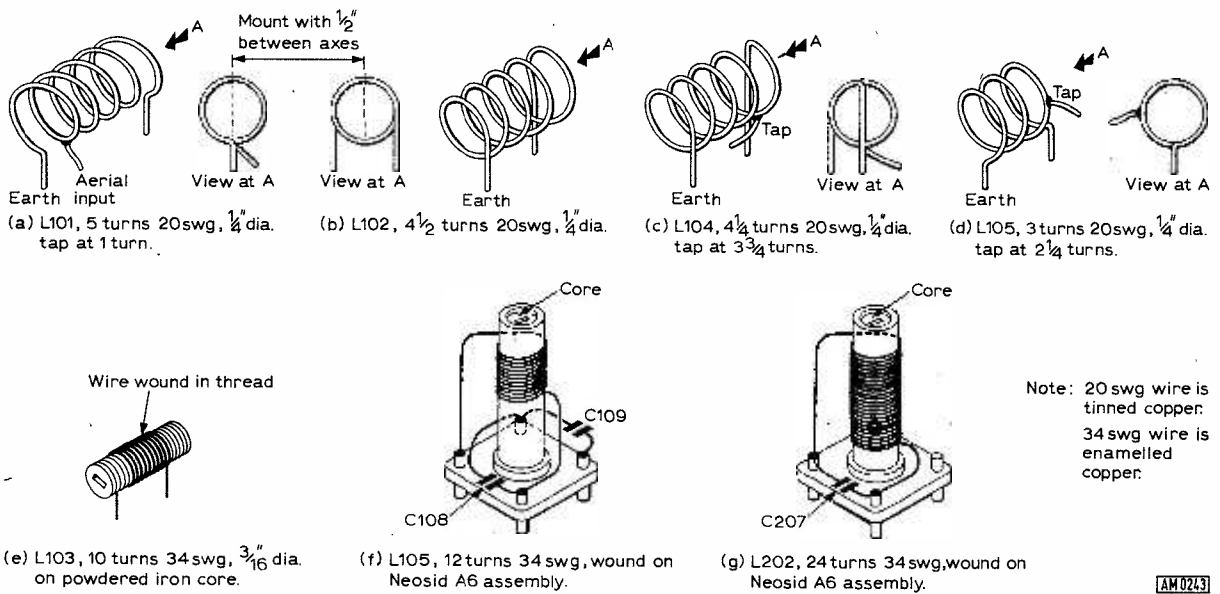


Fig. 7: Winding information for all coils.

## 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 1/4in 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

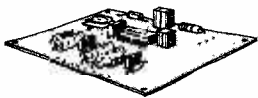
It is most important that the integrated circuits in this section are inserted the right way round or an expensive failure may result when power is first applied. Fig. 6 shows the correct orientation. When soldering the pins of the integrated circuits, treat them as you would transistors and apply as 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



# BI-PRE-PAK Audio Bargains



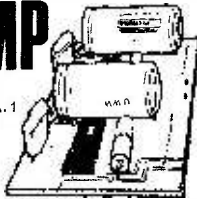
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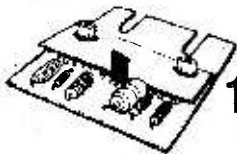
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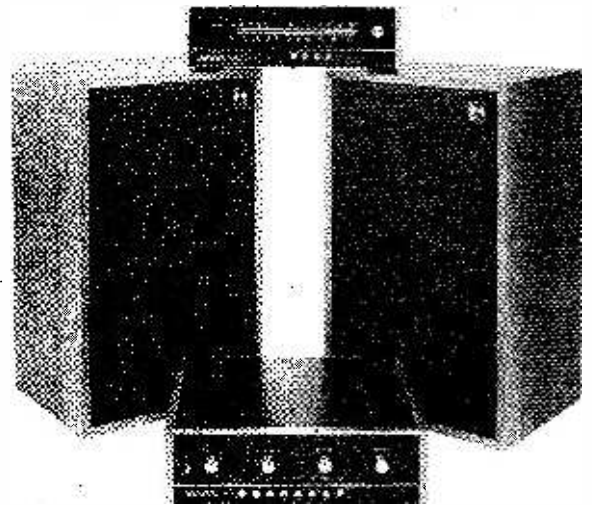
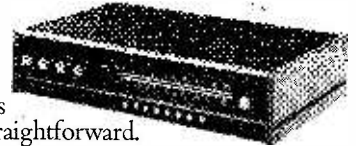
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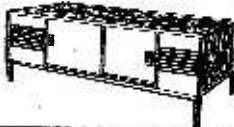
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(A 20 amp Switch). Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fires, etc., up to 14 hours from setting time or you can use the switch to give a boost on period of up to 3 hours. Equally suitable to control processing. Two models 15 amp £1.98, 30 amp £2.58. P. & P. 25p each.

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But, if you install SAGA (our smoke and gas alarm) your family will have the latest electronic protection against these killers. SAGA uses a fantastic electronic sensor which "smells" smoke and gas and sounds the alarm immediately. In a neat case measuring approx. 6" x 3 1/2" x 2 1/2". It has its own internal alarm, also a connector for additional bells. You just plug it in to the mains and hang it near the ceiling. SAGA uses so little electricity that it will hardly move the meter, leave it on always to give night and day protection. £6.99 plus 30p post.

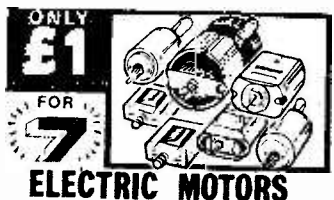
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Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19.25.31.39 & 49 metre bands—kit contains chassis front panel and all the parts. £1.25—crystal earphone 35p.

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Miniature mains driven blower centrifugal type blower unit by Woods. Powerful but specially built for quiet running—driven by cushioned induction motor with specially built low noise bearings. Overall size 4 1/2" x 4 1/2" x 4". When mounted by blange, air is blown into the equipment to be cooled, air out, mount it from centre using cable. Ideal for cooling electrical equipment or fitting into a cooker hood, film drying cabinet or for removing fume smoke when soldering etc., etc. A real bargain at £2.95.



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# 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 vibratable 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! ■

## SUPERSOUND 13 HI-FI MONO AMPLIFIER



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Something with negligible hum. Valve line up: 2  $\times$  ECL86 Triode Pentodes, 1  $\times$  EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"  $\times$  4". Overall height including valves 5". Ready built & tested to a high standard. **£10.22. P. & P. 50p.**

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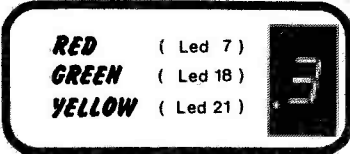
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PART 5

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 5k $\Omega$  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 75 $\Omega$  panel mounting coax socket

SK2 50 $\Omega$  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.



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AC153/176K	52p	BF178	31p	MC1303L	£1.75	PM7A6	£2.50	2N2219A	53p	7476	54p	
AC187K	17p	BF180	35p	MC1305P	£2.80	PN170	10p	2N2368	17p	7480	80p	
AC188K	23p	BF194	55p	MC1307P	£1.65	PN171	10p	2N2369	17p	7482	£1.04	
AC187/188K	40p	BF195	15p	MC1310P	£2.80	PN107	8p	2N2369A	17p	7483	£1.58	
ACY17	27p	BF196	15p	MC1330P	£2.00	PN108	8p	2N2484	42p	7486	39p	
ACY18	20p	BF200	35p	MC1352P	£2.00	PN109	8p	2N2646	45p	7490	34p	
ACY19	20p	BF254	14p	MC1466L	£4.20	PN3619 (2N3819)	20p	2N2904	44p	7491A	£1.54	
ACY20	20p	BF255	15p	MC1466L	£2.58		20p	2N2904A	49p	7492	£1.02	
ACY21	19p	BFX13	25p	MC4002P	£2.58	SL103A	50p	2N2905	65p	7493	90p	
ACY22	10p	BFX29	32p	MC4044P	£2.20	SL403A	50p	2N2905A	75p	7494	£1.36	
AD140	60p	BFX84	25p	MFC4000B	65p	(Rectifier)	60p	2N2924	18p	7495	96p	
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BC107	16p	to	MPF105 (2N5459)	W04	27p	2N3906	28p	2N4058	25p	40406	45p	
BC107/BC177	36p	BZX63CV0	10p	NE555V	78p	W08	41p	2N4060	13p	40407	40p	
BC108	16p	BZX61 C7V5	NE555V	78p	W08	41p	2N4060	13p	40408	54p		
BC108/BC178	36p	BZX61 C3V0	28p	NKT1033	66p	ZT107	12p	2N4061	13p	40409	62p	
BC109	32p	BZY93CV1	70p	NKT212	25p	ZT108	11p	2N4062	13p	40409	62p	
BC109/BC179	36p	BZY93CV12	70p	NKT213	25p	ZT300	13p	2N4441	70p	40410	62p	
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BCY31	48p	CD4049AE	99p	OC45	20p	2N930	28p	7425	26p			
BCY32	50p	CR1/051C	54p	OC71	20p	2N1131	24p	7430	24p			
BCY33	29p	CR1/401C	71p	OC72	20p	2N132	24p	7440	29p			
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### 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.

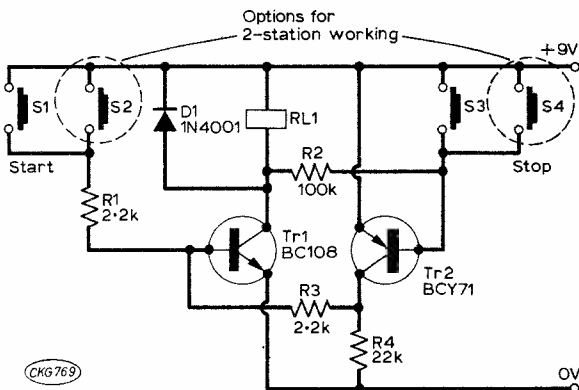


Fig. 1: Circuit of the switch with provision for additional stations.

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).

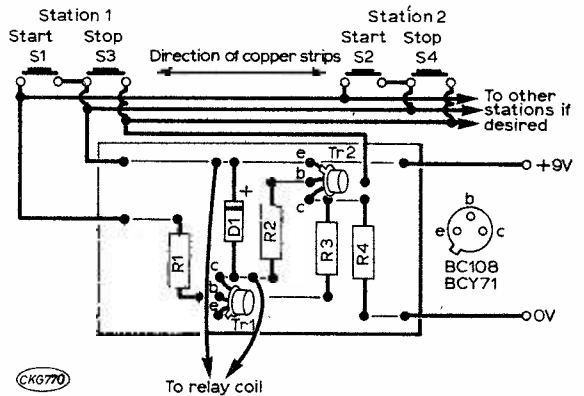


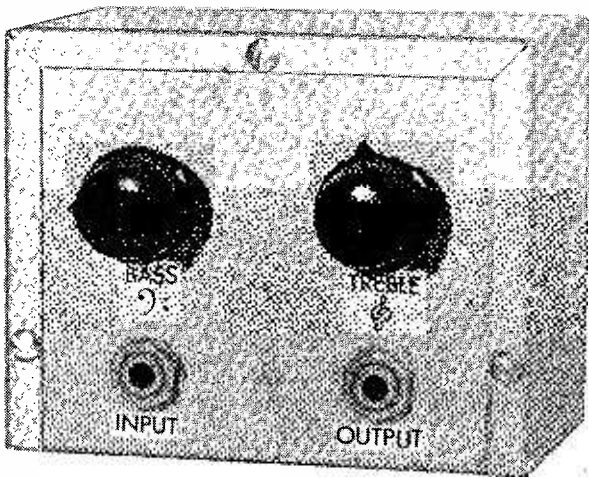
Fig. 2: Layout for 2-station switching, using Veroboard. No breaks are required in copper rails.

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	} or 1W 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	15k $\Omega$
Output Resistance	Low
Midband Gain	Unity
Bass Control Range	$\pm 20$ dB at 20Hz
Treble Control Range	$\pm 11$ dB 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

CMG763

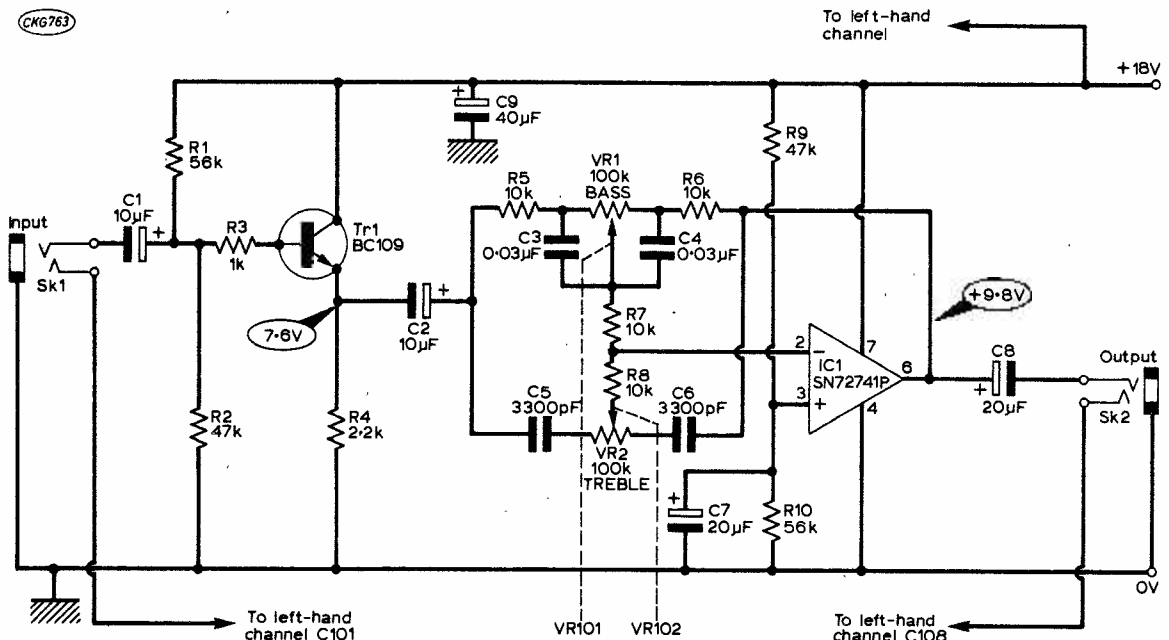


Fig. 1: Circuit of the Tone Control Unit with test voltages indicated. The right-hand channel is shown, the left-hand channel being similar.

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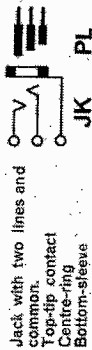
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continued on page 38.

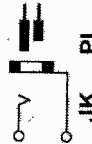
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Jack with two lines and common.  
Top-tip contact  
Centre-ring  
Bottom-sleeve



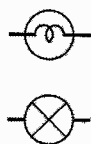
Jack as above but with break contacts



Jack with one line and common



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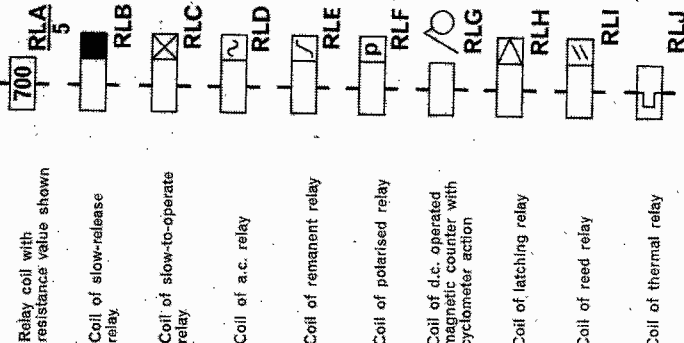


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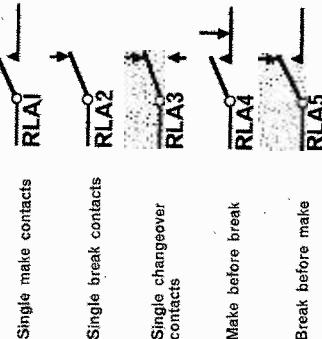
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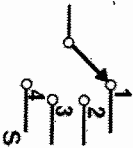
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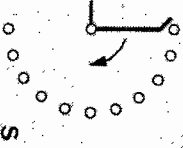
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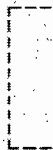
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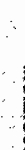
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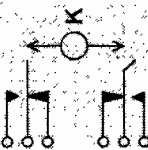


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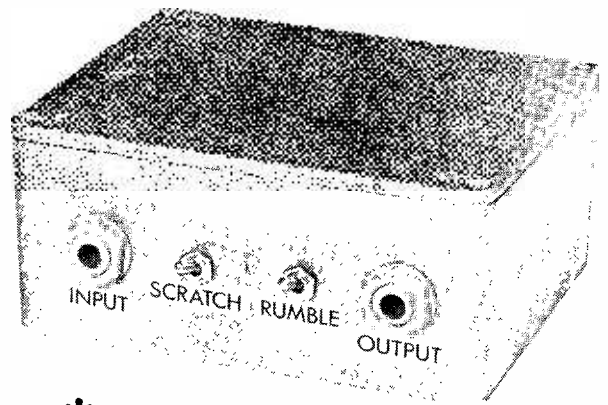
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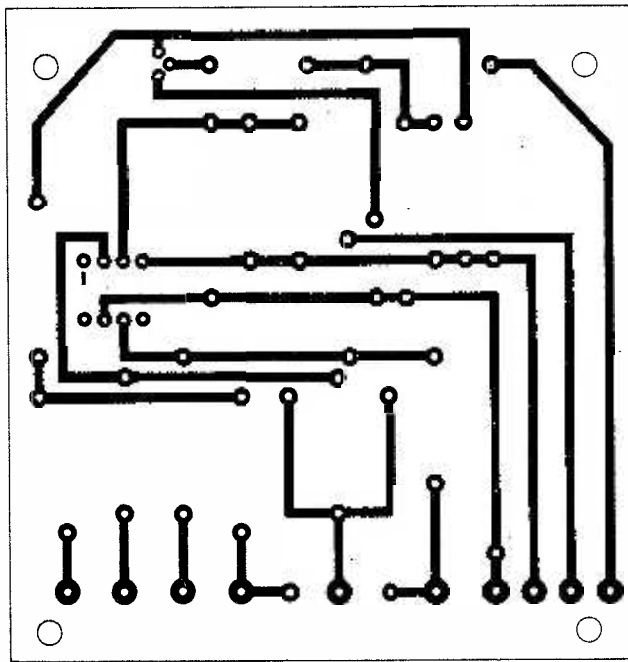
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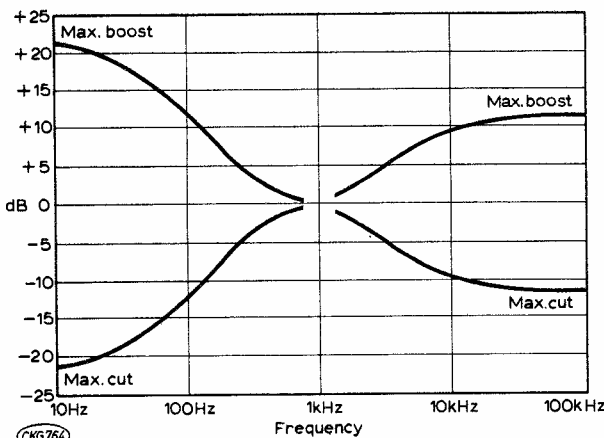
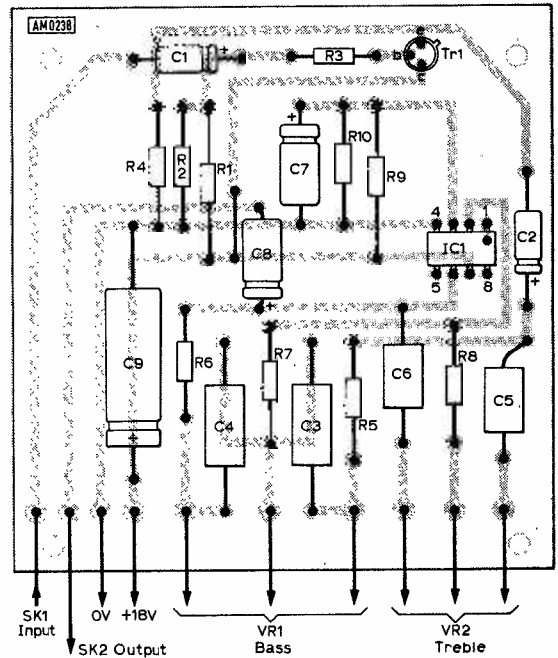
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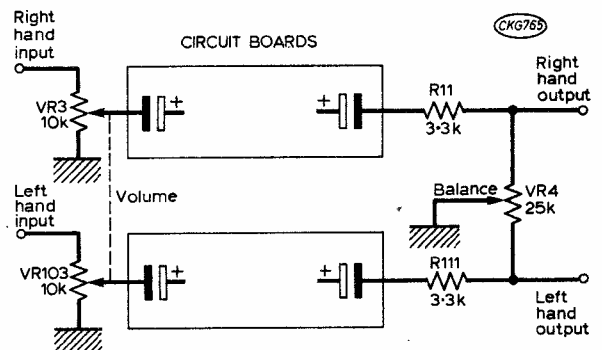
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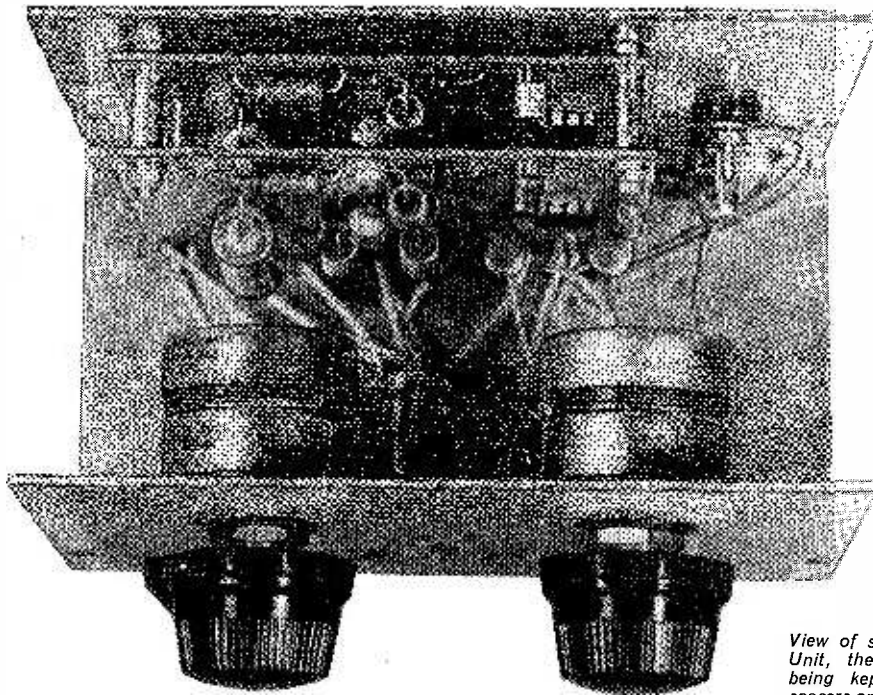


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Figs. 2 & 3; above, show the PCB actual size and layout of components on the PCB. Two such PCB's are required for a stereo unit. Fig. 4: left, indicates the performance of the tone controls. Fig. 5: below, shows how volume and balance controls can 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	56k $\Omega$	R7	R107	10k $\Omega$
R2	R102	47k $\Omega$	R8	R108	10k $\Omega$
R3	R103	1k $\Omega$	R9	R109	47k $\Omega$
R4	R104	2.2k $\Omega$	R10	R110	56k $\Omega$
R5	R105	10k $\Omega$	R11	R111	3.3k $\Omega$
R6	R106	10k $\Omega$			

All  $\frac{1}{4}$  or  $\frac{1}{2}$ W 5%

VR1/VR101 100k $\Omega$  linear dual gang

VR2/VR102 100k $\Omega$  linear dual gang

VR3/VR103 10k $\Omega$  log. dual gang

VR4 25k $\Omega$  linear

### Capacitors

C1	C101	10 $\mu$ F 16V
C2	C102	10 $\mu$ F 16V
C3	C103	0.03 $\mu$ F* 5% polycarbonate
C4	C104	0.03 $\mu$ F* 5% "
C5	C105	3300pF 5% polystyrene
C6	C106	3300pF 5% "
C7	C107	20 $\mu$ F 16V
C8	C108	20 $\mu$ F 16V
C9	C109	40 $\mu$ F 25V

(\* 0.033 $\mu$ F '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

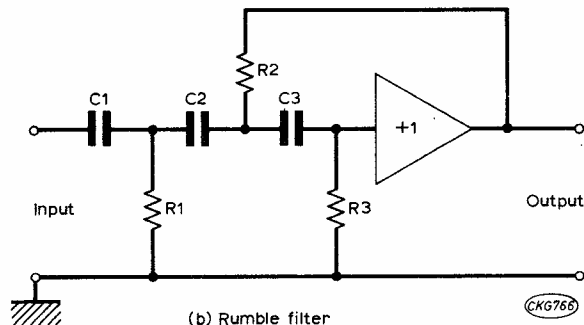
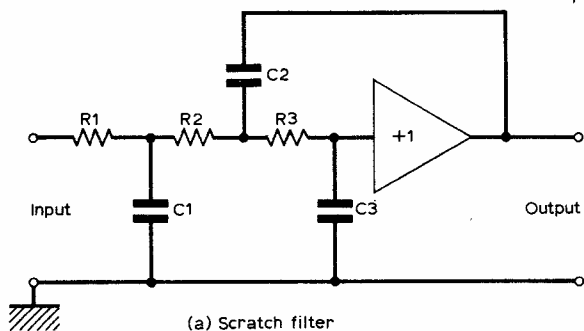
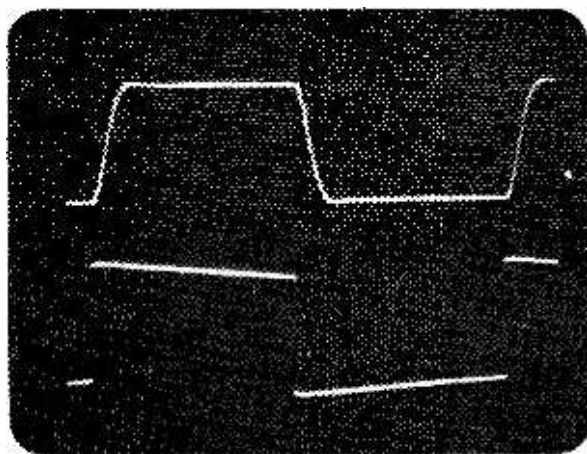


Fig. 6: (a) Basic circuit of a scratch filter. (b) shows the arrangement required for a rumble filter.

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'



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

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 corrects the DC bias for the integrated circuit. The rumble filter can be

—continued on page 633

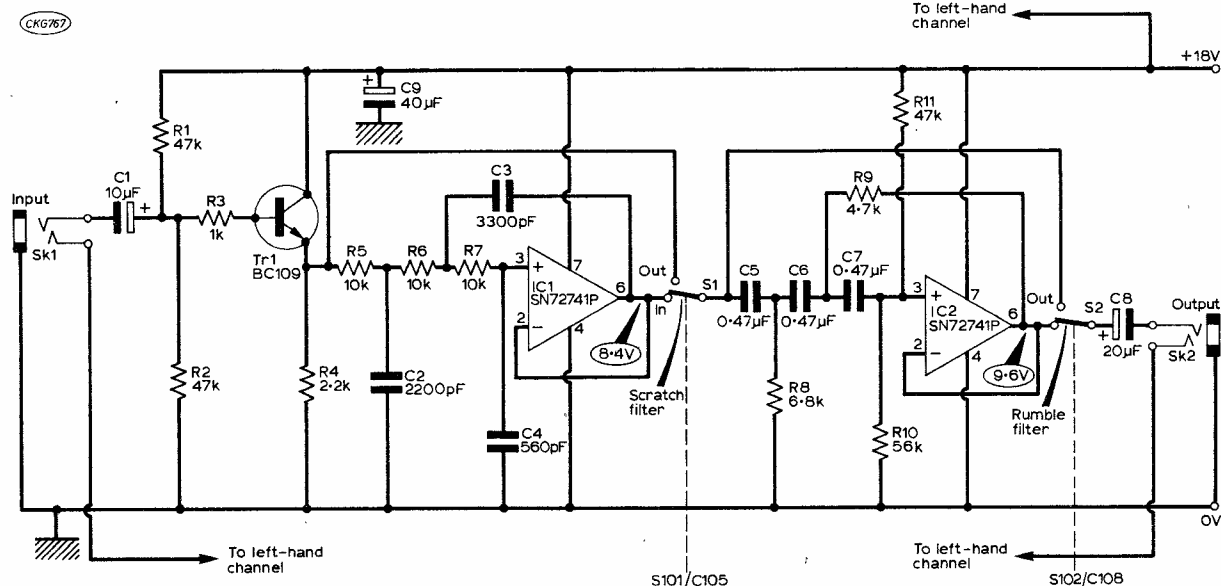


Fig. 7: Circuit of the right-hand channel of the complete Scratch and Rumble Filter for stereo.

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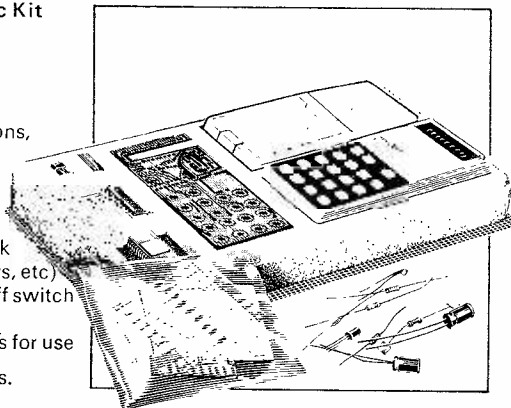
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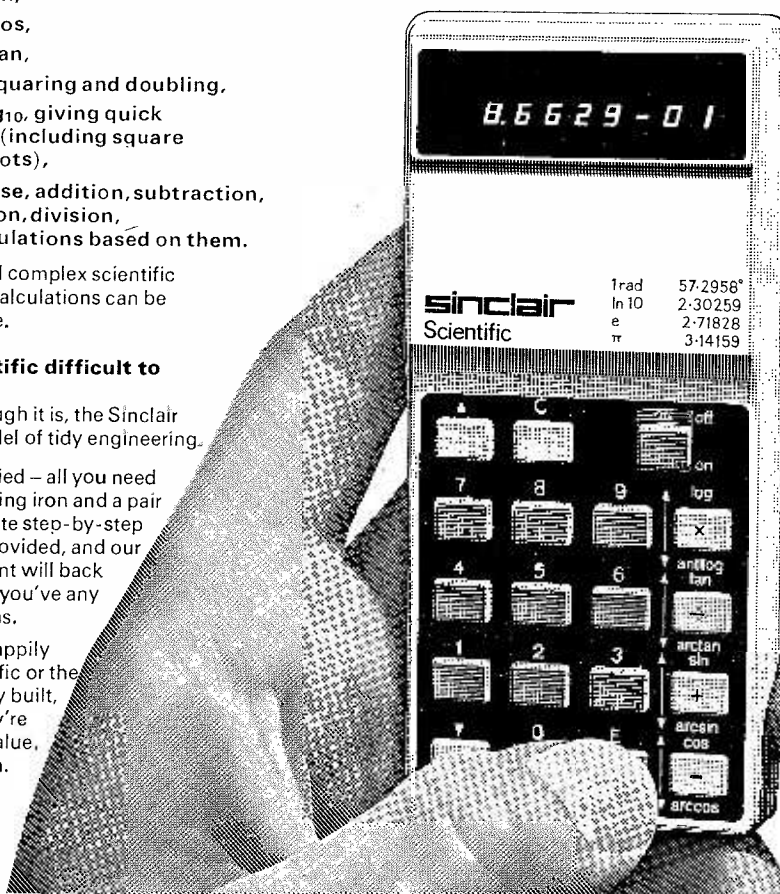
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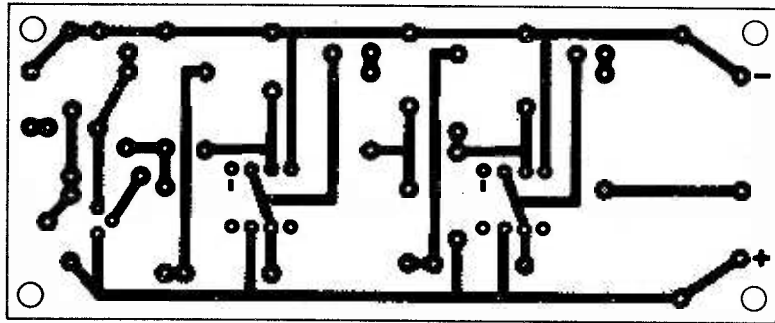
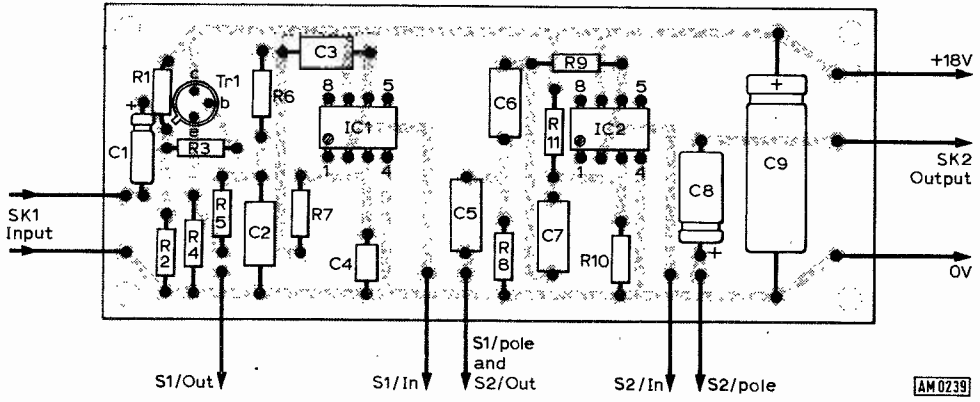
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Figs. 8 and 9 : Full size diagram of the PCB with component layout. Again, two PCB's are required for a stereo amplifier.

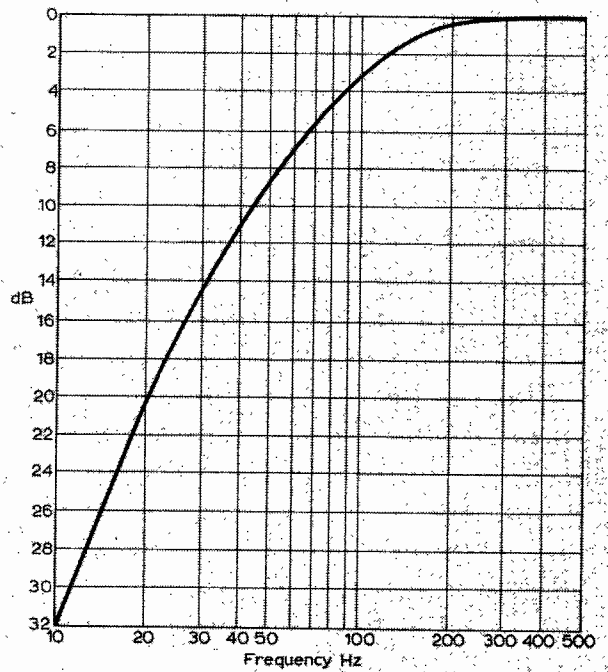
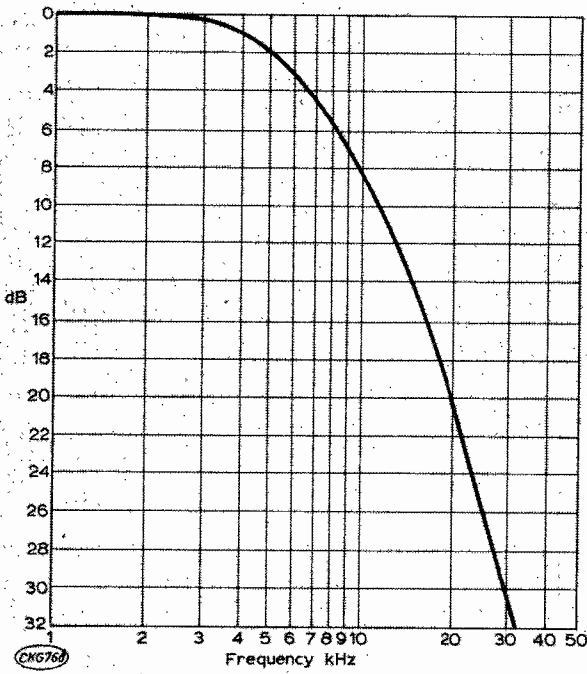


Fig. 10: left, frequency response of the scratch filter. The response of the rumble filter is shown on the right.

—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.

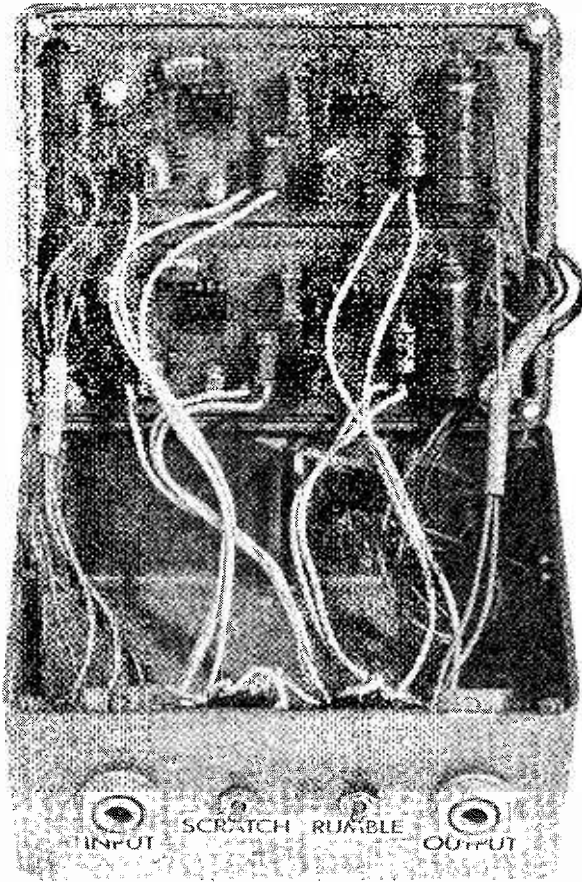
## CONSTRUCTION

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.



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  $\frac{1}{2}$  or  $\frac{1}{4}$ W 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 ICI 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).

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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.

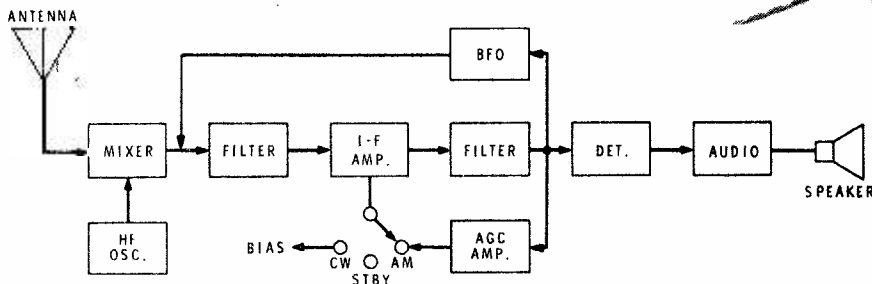
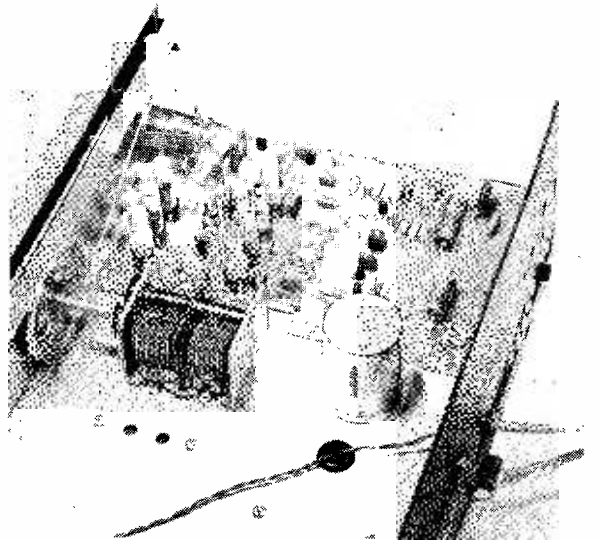
The degree of regeneration (and therefore selectivity) may be adjusted by a front panel control. This was found to be extremely useful when receiving 80 metre s.s.b. and c.w. signals.

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 4.0MHz,  
Band C—4.0MHz to 10.0MHz,  
Band D—10.0MHz to 30.0MHz.

### Sensitivity:

Band A—10 $\mu$ V (ferrite rod aerial)

### S/N + N for 3 $\mu$ V input

Band B 30dB average (h.f. to l.f.)	30dB down
Band C 25dB average (h.f. to l.f.)	24dB down
Band D 15dB average (h.f. to l.f.)	15dB down

### Image average

### Selectivity:

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

### Meter:

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

### Transistor complement:

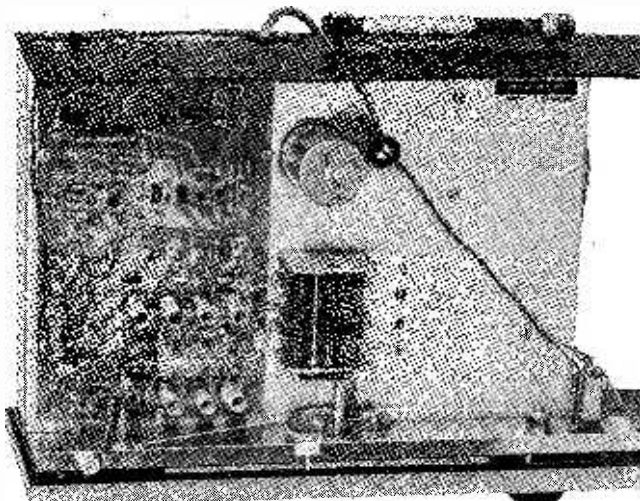
40673 r.f. amplifier and mixer, MP105 local oscillator, 2N5308 i.f. amplifier, 2N5232A i.f. amplifier and a.g.c. amplifier, 2N3393 audio pre-amplifier, X29A829 audio driver, S2090/S2091 audio output stage (complementary pair).

### 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.

fed with 75 $\Omega$  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.

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

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## 1974 INTERNATIONAL AUDIO FESTIVAL AND FAIR

Times:—Monday 28 Oct, 12 noon-9 p.m. Tuesday 29 Oct to Saturday 2 Nov, 10 a.m.-9 p.m.

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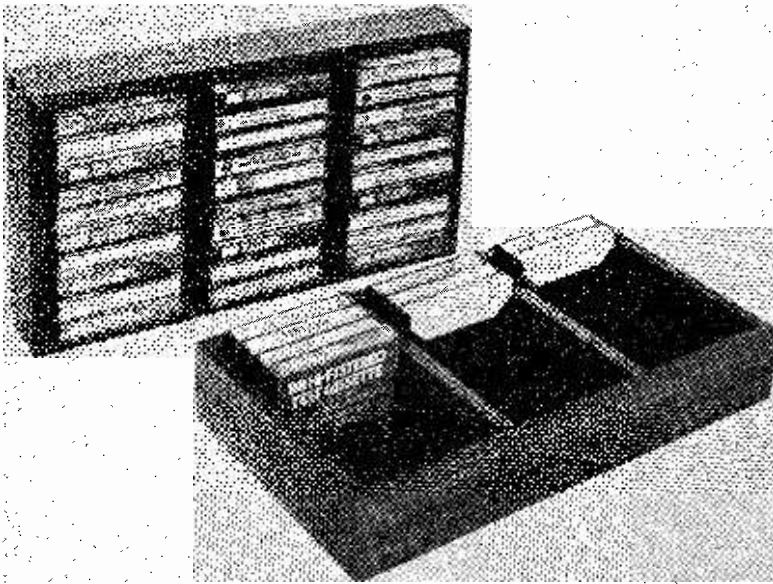
PW's STAND IS B12



# PRODUCTION LINES

colin riches

## CASSETTE STORAGE UNIT



**T**HIS 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 without 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 hi-fi 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

**T**HE 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  $-30^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ .

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.*

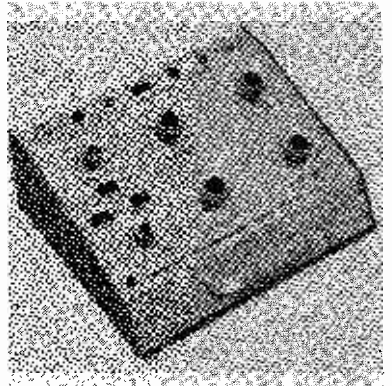
## CURVE TRACER

**W**ITH 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.*

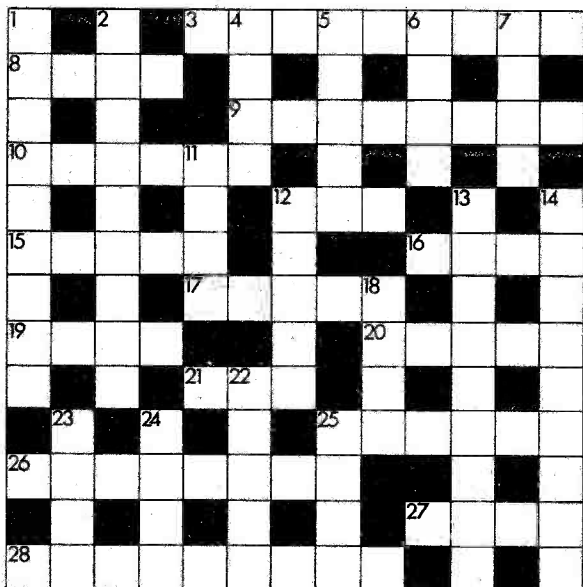
## GRUNDIG CUT PRICES

**G**RUNDIG 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 TECHNICAL CROSS 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

# TELEVISION

## IN THE NOVEMBER ISSUE

### BUILD A BLACK-LEVEL CLAMP

Most monochrome receivers use a.c. coupling at some point in the video circuits. The result of this is that the black level shifts as the average picture content changes. In consequence the contrast range is compressed as dark areas become lighter and dark detail is lost. D.C. Restoration can help but the best answer to the problem is to use a driven clamp. The circuit described—with full constructional details—was devised for use in the Thorn 950 Mk. II chassis but should work in almost any monochrome receiver using a valve video output stage. Accurately timed pulses derived from the line output stage are used to drive the clamp.

### RASTER CORRECTION IN 110° COLOUR RECEIVERS

New circuits have had to be devised for pin-cushion distortion correction in the new generation of 110° colour receivers. This means extra knobs for the devoted knob-twiddler to try out. As the methods of correction used are quite novel however it is important to know what the circuitry is doing. The message from Harold Peters in this issue is reassuring however: "don't panic, it's easy!"

### CHANNEL IDENTIFICATION WITH VARICAP TUNERS

One of the problems of the DX-TV enthusiast or those seeking extra channels with a varicap tuner is that no accurate indication of the channel selected is provided. Accurate channel identification in electronically tuned sets can be provided however by means of the simple and inexpensive meter circuit to be described this month.

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# EXPERIMENTAL WORKSHOP

M. J. HUGHES M.A.

## LEARNING BY PRACTICAL PROJECT STEPS

### PART 12—R C FILTERS

**C**APACITORS 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.

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

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.

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

$Z$  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.

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.

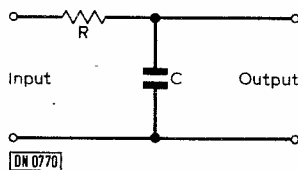


Fig. 82: Basic circuit for a top cut filter.

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

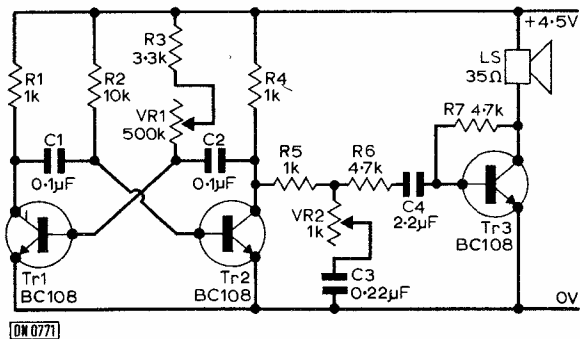
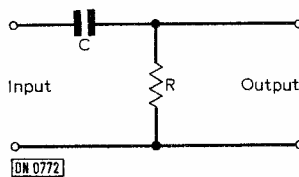


Fig. 83: left, demonstration circuit of a top cut filter. R7 should be selected to produce a quiescent voltage of 2V at the collector of Tr3. Fig. 85: below, shows basic bottom cut network.



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.

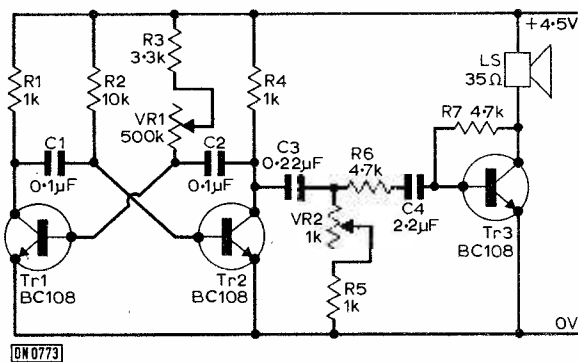


Fig. 86: This circuit of the bottom cut filter is similar to Fig. 83 except that the positions of the components C3 and R5 are interchanged.

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.

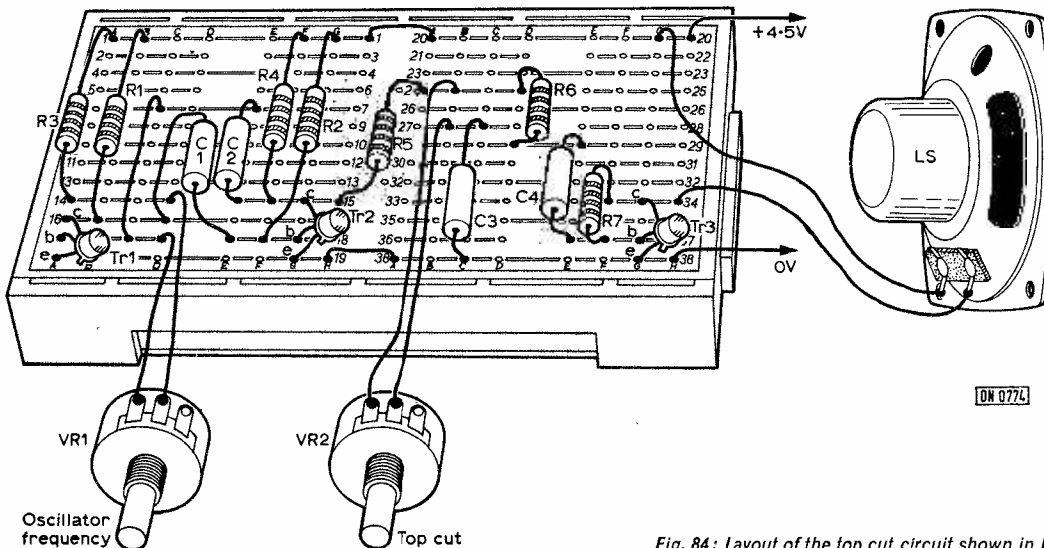


Fig. 84: Layout of the top cut circuit shown in Fig. 83.

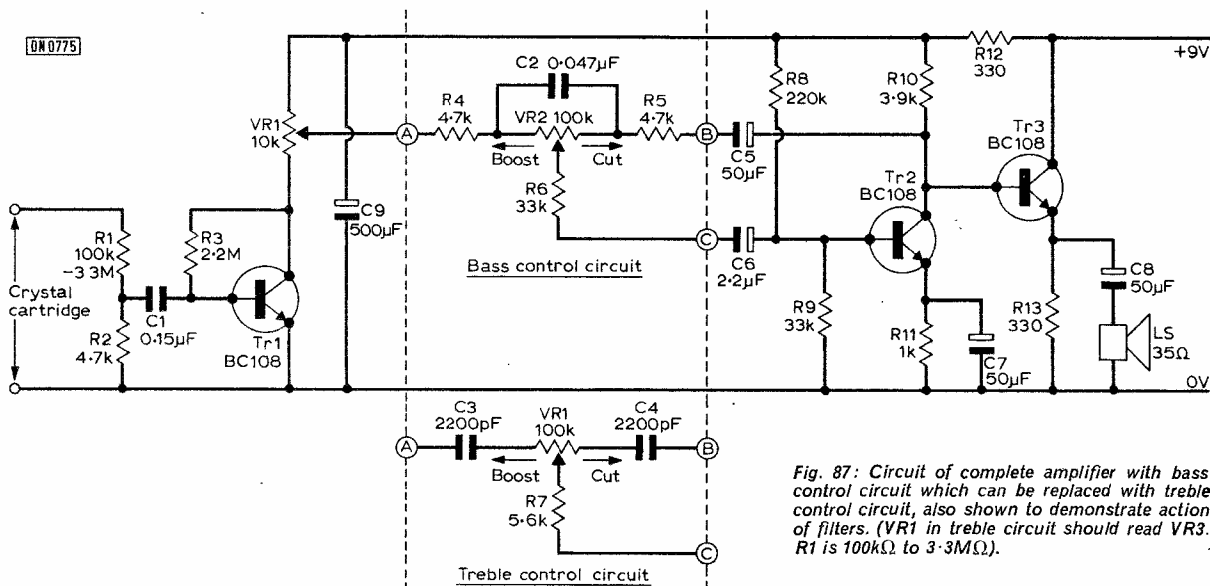


Fig. 87: Circuit of complete amplifier with bass control circuit which can be replaced with treble filter, also shown to demonstrate action of filters. (VR1 in treble circuit should read VR3. R1 is 100kΩ to 3.3MΩ).

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 experimenter 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

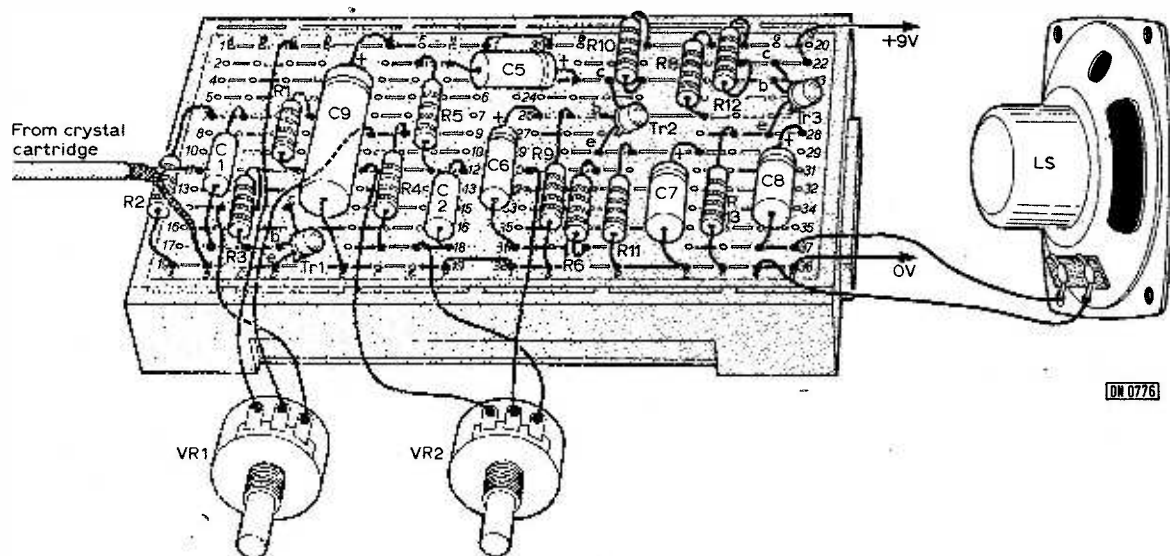


Fig. 88: Layout of the amplifier shown in Fig. 87 with the bass control circuit components inserted.



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.

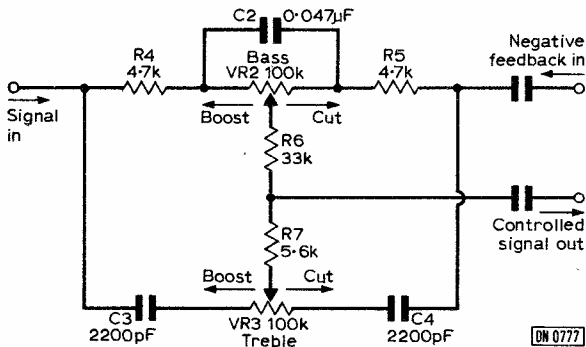


Fig. 89: A combined feedback tone control circuit designed by Baxendall, frequently found in audio amplifiers.

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—Baxendall. 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

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 its radar to keep an eye on the whole operation. But such an observer can be disguised and so can its 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; longitudinal 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*

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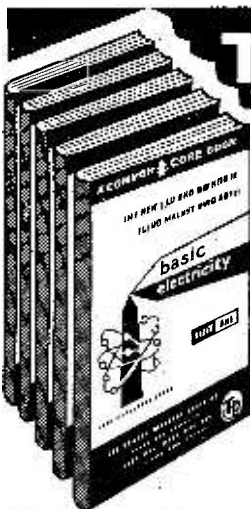
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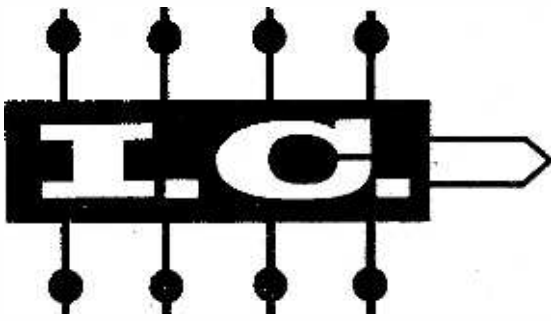
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# OF THE MONTH

## Number 48 National Semicon LM1820N AM Superhet

**I**NTEGRATED 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!

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.

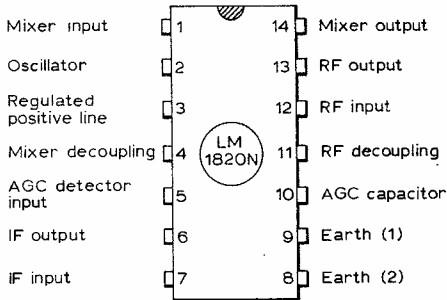


Fig. 1: Pin connections for the LM1820N.

Fig. 2: below, circuit for receiver using ganged permeability tuning.

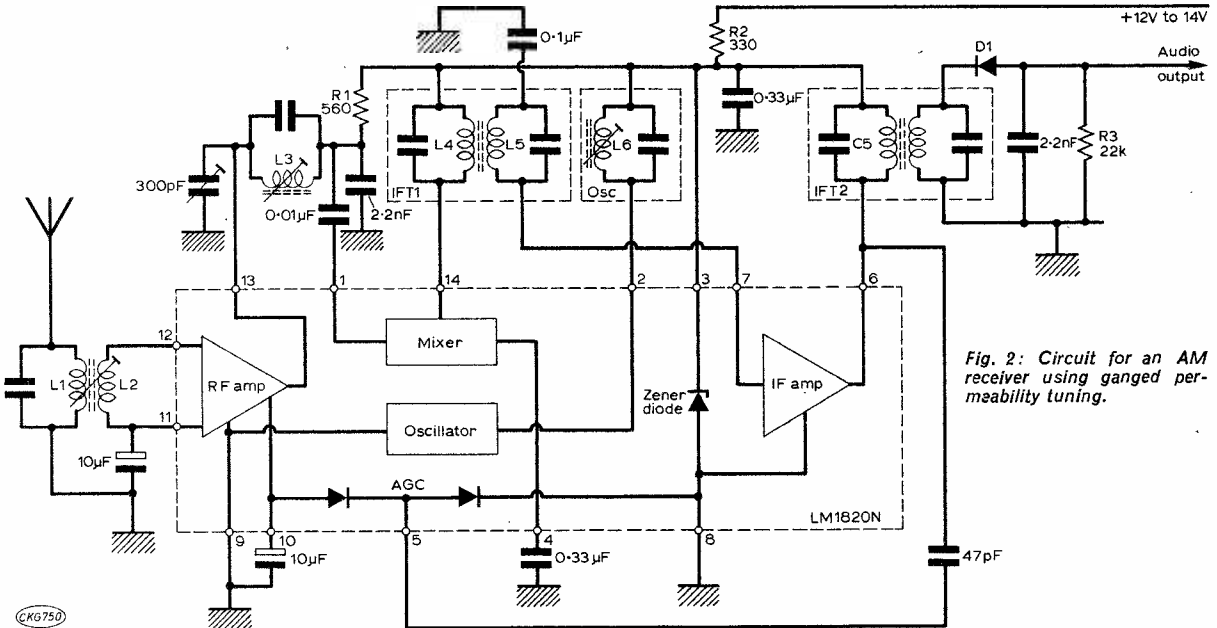


Fig. 2: Circuit for an AM receiver using ganged permeability tuning.



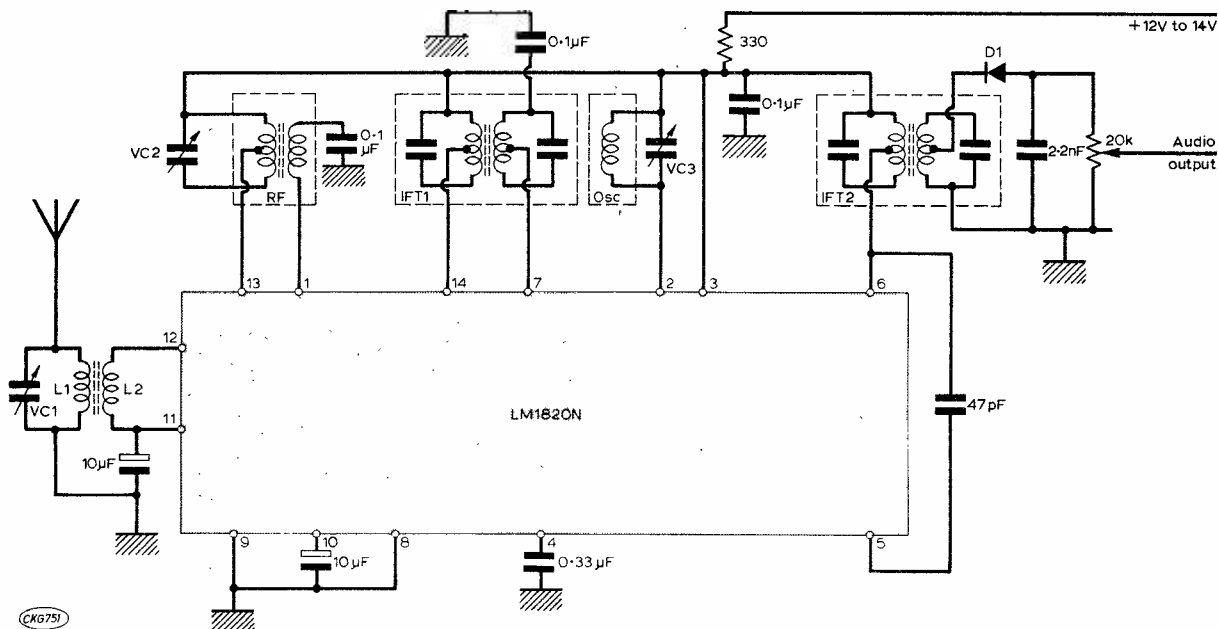


Fig. 3: Receiver with variable capacity tuning, VC1/2/3 being ganged.

## 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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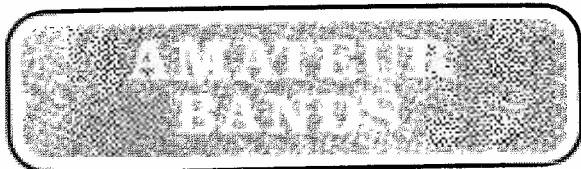
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by Eric Dowdeswell G4AR

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 bands in band/alphabetical order by the middle of the month to Eric Dowdeswell G4AR, Silver Fir, Leatherhead Road, Ash-lead, 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 C02FA CR4BS DUIXKE HK0BKX KG4GO KH6IJ KL7MF KM6DZ KS6DH KW6HF TG9GI ZL4BX (2300) 15m H18EJH.

**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 HRIJBS KL7BJW 15m CX2CA TR8CQ.

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

**G. Nicholls:-** 2m DC8CB DK6QK GD8EX1 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.

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.



## MEDIUM WAVE BROADCASTS by CHARLES MOLLOY

**C**hristopher 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.

## IC OF THE MONTH—continued from page 646 PERFORMANCE

The RF input resistance at pin 12 is typically 1k $\Omega$ . The transconductance of the RF stage at 1MHz with a 100 $\mu$ V 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 1.4k $\Omega$  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  $\mu$ A720DC while the NE546A is the equivalent in the Signetics range.

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

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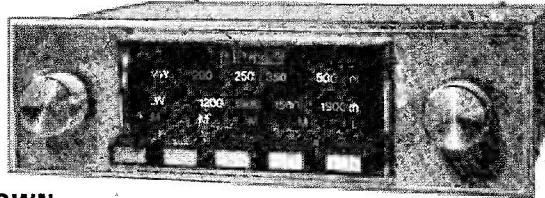
<b>Transistors</b>	BA145 24p	BCY30 58p	ME04075 34p	NKT773 34p	2N930 22p	<b>Ther-</b>	IN5407 28p	7437 77p	74154 22.20
AA119 7p	BA154 14p	BCY31 60p	ME0491 23p	NKT773 30p	2N1131 26p	<b>mistors</b>	IN5408 24p	7738 77p	74155 21.75
AC107 25p	BA156 18p	BCY70 17p	ME0492 23p	OA5(GH5001) 19p	2N3132 26p	VA10668 15p	400mW Zener	7440 22p	74156 21.75
AC126 22p	BAX16 8p	BCY71 27p	ME0493 21p	OA10 24p	2N3202 26p	VA10658 15p	Diodes	7441 81p	74157 21.84
AC127 18p	BC107 14p	BCY72 14p	ME1001 15p	OA10 24p	2N1303 30p	VA10656 15p	3.3v to 33v 15p	7442 81p	74160 22.18
AC128 13p	BC108 14p	BD124 14p	ME1002 17p	OA47 9p	2N1304 35p	VA10657 15p		7443 81p	74161 22.18
AC141 25p	BC109 14p	BD131 52p	ME1075 15p	OA90 6p	2N1305 38p	VA1089 14p	<b>Thyristors</b>	7444 81p	74162 22.18
AC141k 25p	BC113 18p	BD132 57p	ME1100 20p	OA91 6p	2N1306 47p	VA1040 14p	1 amp	7445 81p	74163 22.18
AC142 22p	BC114 19p	BD131 M/P	ME1120 20p	OA95 6p	2N1307 47p	VA1077 15p	50v	7446 81p	74164 22.18
AC142k 22p	BC115 19p	BD132 / 11.18	ME2001 15p	(HG1005) 7p	2N1308 23p	VA1100 14p	100v	7447 81p	74165 22.18
AC151 23p	BC117 26p	BDY20 91p	ME2002 18p	OA200 9p	2N1309 26p	<b>Bridge</b>	200v	7448 81p	74166 22.18
AC152 25p	BC125 17p	BF167 25p	ME2003 18p	OA202 9p	2N1310 26p	<b>Rectifiers</b>	400v	7449 81p	74167 22.18
AC153k 38p	BC126 17p	BF173 25p	ME2004 18p	OA19 55p	2N1613 24p	1 amp	50v	7450 81p	74168 22.18
AC153k M/P	BC128 19p	BF177 27p	ME2005 18p	OA19 55p	2N1711 25p	2 amp	50v	7451 81p	74169 22.18
AC176k 38p	BC137 18p	BF178 24p	ME2006 18p	OC25 45p	2N2218 48p	5 amp	50v	7452 81p	74170 22.18
AC176k 42p	BC140 35p	BF179 38p	ME2007 18p	OC28 45p	2N2219 48p	10 amp	50v	7453 81p	74171 22.18
AC176 24p	BC147 18p	BF194 18p	ME2008 18p	OC29 69p	2N2219a 48p	1 amp	100v	7454 81p	74172 22.18
AC187 22p	BC148 11p	BF195 18p	ME2009 18p	OC35 65p	2N2484 46p	2 amp	100v	7455 81p	74173 22.18
AC187k 22p	BC149 18p	BF244 27p	ME2010 18p	OC41 20p	2N2646 51p	5 amp	100v	7456 81p	74174 22.18
AC188 22p	BC157 17p	BF254 19p	ME2011 18p	OC44 20p	2N2904 25p	10 amp	100v	7457 81p	74175 22.18
AC188k 22p	BC158 18p	BF259 24p	ME2012 18p	OC44 20p	2N2904a 25p	5 amp	400v	7458 81p	74176 22.18
AC197 22p	BC159 18p	BF264 24p	ME2013 18p	OC70 23p	2N2904a 25p	10 amp	400v	7459 81p	74177 22.18
AC198 22p	BC167 18p	BF265 24p	ME2014 18p	OC71 18p	2N2905a 25p	5 amp	50v	7460 81p	74178 22.18
AC199 22p	BC168 18p	BF266 24p	ME2015 18p	OC72 18p	2N3053 28p	10 amp	50v	7461 81p	74179 22.18
AC200 22p	BC169 18p	BF267 27p	ME2016 18p	OC75 24p	2N3055 28p	5 amp	100v	7462 81p	74180 22.18
AC201 22p	BC177 23p	BF268 27p	ME2017 18p	OC81 28p	2N3702 11p	10 amp	100v	7463 81p	74181 22.18
AC202 19p	BC178 21p	BF269 27p	ME2018 18p	OC81 28p	2N3703 11p	5 amp	100v	7464 81p	74182 22.18
AD140 67p	AD142 67p	AD143 67p	ME2019 18p	OC82 28p	2N3704 11p	10 amp	100v	7465 81p	74183 22.18
AD142 67p	AD143 67p	AD144 67p	ME2020 21p	OC83 24p	2N3705 11p	5 amp	100v	7466 81p	74184 22.18
AD143 67p	AD144 67p	AD145 67p	ME2021 21p	OC84 28p	2N3706 11p	10 amp	100v	7467 81p	74185 22.18
AD149 65p	BC184 12p	BFY30 11.15	ME2022 18p	OC84 28p	2N3707 11p	5 amp	100v	7468 81p	74186 22.18
AD161 46p	BC212 18p	BY100 17p	ME2023 18p	TIP29a 64p	2N3708 11p	<b>Silicon</b>	7400 20p	7469 81p	74187 22.18
AD162 46p	BC213 15p	BY127 17p	ME2024 18p	TIP30a 64p	2N3709 11p	<b>Rectifiers</b>	7401 20p	7470 81p	74188 22.18
AD161 M/P	BC214 15p	BF210 39p	ME2025 18p	TIP31a 77p	2N3710 11p	IN4001 7p	7402 20p	7471 81p	74189 22.18
AD162 55p	BC215 15p	BF211 39p	ME2026 18p	TIP32a 77p	2N3711 11p	IN4002 7p	7403 20p	7472 81p	74190 22.18
AF114 25p	BC256 18p	BF212 38p	ME2027 18p	TIP33a 77p	2N3712 11p	IN4003 8p	7404 20p	7473 81p	74191 22.18
AF116 20p	BC259 15p	BY213 28p	ME2028 18p	TIP34a 77p	2N3713 11p	IN4004 8p	7405 20p	7474 81p	74192 22.18
AF116 20p	BC267 14p	CA07 19p	ME2029 18p	TIP35a 23.18p	2N3714 20p	IN4005 10p	7406 20p	7475 81p	74193 22.18
AF117 20p	BC268 18p	MA8001 36p	ME2030 18p	TIP36a 24.07p	2N3819 27p	IN4006 11p	7407 20p	7476 81p	74194 22.18
AF124 29p	BC269 14p	MA8002 40p	ME2031 18p	TIP41a 88p	2N4292 11p	IN4007 11p	7408 20p	7477 81p	74195 22.18
AF125 29p	BC270 15p	MA8003 40p	ME2032 18p	TIP42a 11.10p	2N4296 11p	IN4008 11p	7409 20p	7478 81p	74196 22.18
AF126 29p	BC271 15p	ME0401 33p	ME2033 18p	TIP43a 11.10p	2N4306 17p	IN4009 11p	7410 20p	7479 81p	74197 22.18
AF127 29p	BC272 15p	ME0402 33p	ME2034 18p	TIP44a 11.10p	2N4306 17p	IN4010 11p	7411 20p	7480 81p	74198 22.18
AF128 29p	BC273 15p	ME0403 33p	ME2035 18p	TIP45a 11.10p	2N4306 17p	IN4011 11p	7412 20p	7481 81p	74199 22.18
AF129 29p	BC274 15p	ME0404 33p	ME2036 18p	TIP46a 11.10p	2N4306 17p	IN4012 11p	7413 20p	7482 81p	74200 22.18
AF239 62p	BC298 24p	ME0404/1 19p	ME2037 18p	TIP47a 11.10p	2N4306 17p	IN4013 11p	7414 20p	7483 81p	74201 22.18
AF279 75p	BC300 41p	ME0404/2 19p	ME2038 18p	TIP48a 11.10p	2N4306 17p	IN4014 11p	7415 20p	7484 81p	74202 22.18
AY826 39p	BC301 40p	ME0411 22p	ME2039 18p	TIP49a 11.10p	2N4306 17p	IN4015 11p	7416 20p	7485 81p	74203 22.18
AY827 50p	BC302 36p	ME0412 21p	ME2040 18p	TIP50a 11.10p	2N4306 17p	IN4016 11p	7417 20p	7486 81p	74204 22.18
AY828 39p	BC303 49p	ME0413 19p	ME2041 18p	TIP51a 11.10p	2N4306 17p	IN4017 11p	7418 20p	7487 81p	74205 22.18
AY829 45p	BC304 39p	ME0414 19p	ME2042 18p	TIP52a 11.10p	2N4306 17p	IN4018 11p	7419 20p	7488 81p	74206 22.18
BA111 35p	BC341 39p	ME0422 25p	ME2043 18p	TIP53a 11.10p	2N4306 17p	IN4019 11p	7420 20p	7489 81p	74207 22.18
BA115 10p	BC461 45p	ME0463 23p	ME2044 18p	TIP54a 11.10p	2N4306 17p	IN4020 11p	7421 20p	7490 81p	74208 22.18
			ME2045 18p	TIP55a 11.10p	2N4306 17p	IN4021 11p	7422 20p	7491 81p	74209 22.18
			ME2046 18p	TIP56a 11.10p	2N4306 17p	IN4022 11p	7423 20p	7492 81p	74210 22.18
			ME2047 18p	TIP57a 11.10p	2N4306 17p	IN4023 11p	7424 20p	7493 81p	74211 22.18
			ME2048 18p	TIP58a 11.10p	2N4306 17p	IN4024 11p	7425 20p	7494 81p	74212 22.18
			ME2049 18p	TIP59a 11.10p	2N4306 17p	IN4025 11p	7426 20p	7495 81p	74213 22.18
			ME2050 18p	TIP60a 11.10p	2N4306 17p	IN4026 11p	7427 20p	7496 81p	74214 22.18
			ME2051 18p	TIP61a 11.10p	2N4306 17p	IN4027 11p	7428 20p	7497 81p	74215 22.18
			ME2052 18p	TIP62a 11.10p	2N4306 17p	IN4028 11p	7429 20p	7498 81p	74216 22.18
			ME2053 18p	TIP63a 11.10p	2N4306 17p	IN4029 11p	7430 20p	7499 81p	74217 22.18
			ME2054 18p	TIP64a 11.10p	2N4306 17p	IN4030 11p	7431 20p	7500 81p	74218 22.18
			ME2055 18p	TIP65a 11.10p	2N4306 17p	IN4031 11p	7432 20p	7501 81p	74219 22.18
			ME2056 18p	TIP66a 11.10p	2N4306 17p	IN4032 11p	7433 20p	7502 81p	74220 22.18
			ME2057 18p	TIP67a 11.10p	2N4306 17p	IN4033 11p	7434 20p	7503 81p	74221 22.18
			ME2058 18p	TIP68a 11.10p	2N4306 17p	IN4034 11p	7435 20p	7504 81p	74222 22.18
			ME2059 18p	TIP69a 11.10p	2N4306 17p	IN4035 11p	7436 20p	7505 81p	74223 22.18
			ME2060 18p	TIP70a 11.10p	2N4306 17p	IN4036 11p	7437 20p	7506 81p	74224 22.18
			ME2061 18p	TIP71a 11.10p	2N4306 17p	IN4037 11p	7438 20p	7507 81p	74225 22.18
			ME2062 18p	TIP72a 11.10p	2N4306 17p	IN4038 11p	7439 20p	7508 81p	74226 22.18
			ME2063 18p	TIP73a 11.10p	2N4306 17p	IN4039 11p	7440 20p	7509 81p	74227 22.18
			ME2064 18p	TIP74a 11.10p	2N4306 17p	IN4040 11p	7441 20p	7510 81p	74228 22.18
			ME2065 18p	TIP75a 11.10p	2N4306 17p	IN4041 11p	7442 20p	7511 81p	74229 22.18
			ME2066 18p	TIP76a 11.10p	2N4306 17p	IN4042 11p	7443 20p	7512 81p	74230 22.18
			ME2067 18p	TIP77a 11.10p	2N4306 17p	IN4043 11p	7444 20p	7513 81p	74231 22.18
			ME2068 18p	TIP78a 11.10p	2N4306 17p	IN4044 11p	7445 20p	7514 81p	74232 22.18
			ME2069 18p	TIP79a 11.10p	2N4306 17p	IN4045 11p	7446 20p	7515 81p	74233 22.18
			ME2070 18p	TIP80a 11.10p	2N4306 17p	IN4046 11p	7447 20p	7516 81p	74234 22.18
			ME2071 18p	TIP81a 11.10p	2N4306 17p	IN4047 11p	7448 20p	7517 81p	74235 22.18
			ME2072 18p	TIP82a 11.10p	2N4306 17p	IN4048 11p	7449 20p	7518 81p	74236 22.18
			ME2073 18p	TIP83a 11.10p	2N4306 17p	IN4049 11p	7450 20p	7519 81p	74237 22.18
			ME2074 18p	TIP84a 11.10p	2N4306 17p	IN4050 11p	7451 20p	7520 81p	74238 22.18
			ME2075 18p	TIP85a 11.10p	2N4306 17p	IN4051 11p	7452 20p	7521 81p	74239 22.18
			ME2076 18p	TIP86a 11.10p	2N4306 17p				



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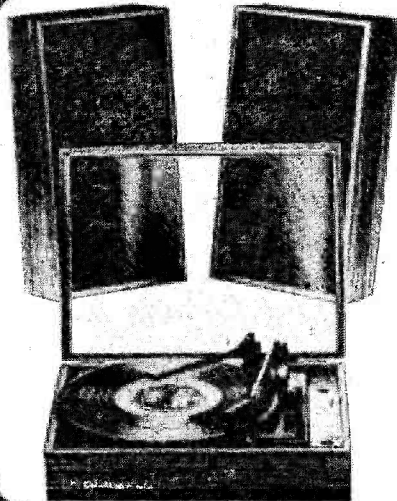
#### Technical specification :

- (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.**

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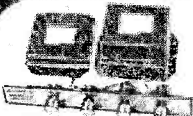
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Complete only **£19.95 + £1.60 p & p.** Extras if required. Optional Diamond Stylus **£1.37.**

Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance. **£3.85.**

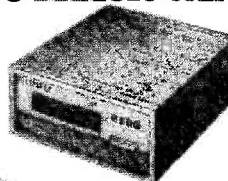


## BUILD YOUR OWN \* STEREO AMPLIFIER

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.

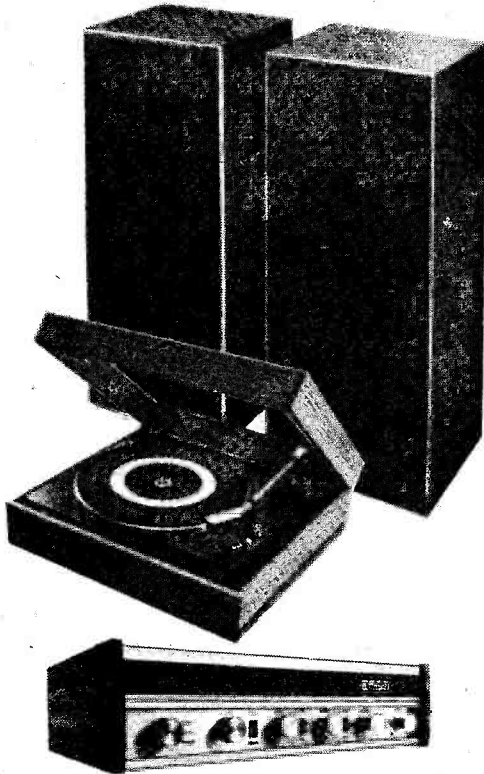
Compatible with Viscount III system, Unisound module and the Stereo 21.

Technical specification Mains input, 240V, Output sensitivity 125mV

Comparable unit sold elsewhere 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 1 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  $\pm 1$ dB R.I.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:  $+12$ dB to  $-17$ dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble  $+12$ dB to  $-12$ dB @ 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.  $13\frac{3}{4}'' \times 9'' \times 3\frac{3}{4}''$ .

Garrard SP 25 Mk III deck with magnetic cartridge, de luxe plinth and hinged cover.

Two Duo Type II matched speakers - Enclosure size approx.  $17\frac{1}{2}'' \times 10\frac{1}{2}'' \times 6''$  in simulated teak. Drive unit  $13'' \times 8''$  with parasitic tweeter. 10 watts handling.

Complete System £51.00

## System 2. £69.00

Viscount III amplifier (As System 1)

Garrard SP 25 Mk III deck (As System 1)

Two Duo Type IIIA matched speakers - Enclosure size approx.  $31'' \times 13'' \times 11\frac{1}{2}''$

Finished in teak veneer. Drive units approx.  $13\frac{1}{2}'' \times 8\frac{1}{2}''$  with  $3\frac{1}{4}''$  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
<b>total:</b>	<b>£59.20</b>

Available complete for only:

**£51.00**  
+ £3.50 p & p

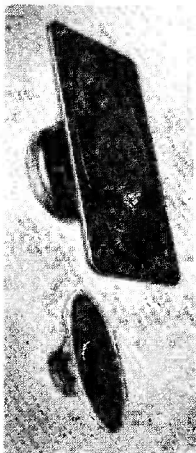
### PRICES: SYSTEM 2

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
<b>total:</b>	<b>£84.20</b>

Available complete for only:

**£69.00**  
+ £4.00 p & p

# EMI SPEAKERS AT FANTASTIC REDUCTIONS



### 20 WATT SPEAKER SYSTEM

System consists of a  $13'' \times 8''$  (approx) elliptical woofer unit with a  $8'' \times 5''$  (approx.) mid range unit incorporating parasitic tweeter and crossover components.

Technical Specification:

Bass Unit

Flux density-100 K, speech coil- $1\frac{1}{2}''$ , 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  $19'' \times 14''$  (approx.) high efficiency Bass-Speaker with 16,500-gauss magnet built on a heavy diecast frame. The four 10,000 gauss tweeters, each  $3\frac{1}{2}''$  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...

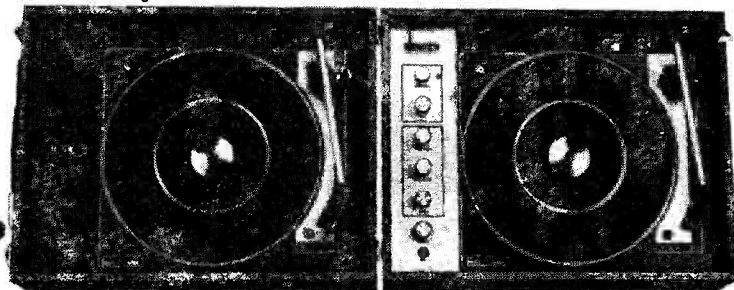
# PORTABLE DISCO CONSOLE

**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% (Gaugmont 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 3/4" x 13 3/4" x 8 3/4" (approx.)

Unit Open - 35 3/4" x 13 3/4" x 4 1/4" (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.**

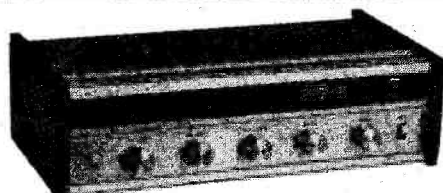
# DISCO 50



## 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 to 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 1/4" x 10 1/2" x 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 3/4" x 8" x 3 3/4".

**£15.00 + 60p. post & pack.**



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EP800/01	40p	EP91	45p	PC118	£1.10	QV06-40E	40p
EP92	50p	EP92	50p	PC120	40p	QV06-40F	40p
EP93	50p	EP95	40p	PC121	40p	QV06-40G	40p
EP94	50p	EP96	40p	PC122	40p	QV06-40H	40p
EP97	40p	EP98	35p	PC123	40p	QV06-40I	40p
EP99	40p	EP100	35p	PC124	40p	QV06-40J	40p
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EP105	40p	EP106	35p	PC127	40p	QV06-40M	40p
EP107	40p	EP108	35p	PC128	40p	QV06-40N	40p
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EP189	40p	EP190	35p	PC169	40p	QV06-40BC	40p
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EP249	40p	EP250	35p	PC199	40p	QV06-40CG	40p
EP251	40p	EP252	35p	PC200	40p	QV06-40CH	40p

AC 113	AF 139	BBY 27	OA 202	OC 200	2N 3033
AC 126	AF 178	BBY 38	OA 200	OC 206	2N 3034
AC 127	AF 186	BBY 39	OC 22	OC 206	2N 3034
AC 128	AF 187	BBY 39A	OC 22	OC 206	2N 3034
AC 176	AF 212	BYZ 16	OC 25	OC 25	2N 3390
AC 181	ASX 26	CRS 1/10	OC 26	OC 26	2N 3391
AC 187	ASX 27	CRS 1/20	OC 28	OC 28	1N 28A
AC 19	ASX 28	CRS 1/30	OC 29	OC 29	1N 25
AC 20	BC 108	CRS 1/40	OC 35	OC 35	1N 32A
AC 21	BC 118	CRS 1/10	OC 36	OC 36	1N 28A
AC 29	BC 119	CRS 3/20	OC 42	OC 42	1N 43
AC 30	BC 136	CRS 3/30	OC 44	OC 44	1N 70
AC 40	BC 137	CRS 3/40	OC 45	OC 45	1N 277
AD 149	BC 148	CRS 25/25	OC 70	OC 70	1N 4150
AD 161	BC 172	CRS 25/25	OC 73	OC 73	1N 4149
AD 162	BC 172A	CRS 25/25	OC 78	OC 78	1N 4149
AD 171	BC 212A	CRS 25/25	OC 81	OC 81	1N 4149
AD 172	BC 212A	CRS 25/25	OC 82	OC 82	1N 4149
AD 173	BC 212A	CRS 25/25	OC 82D	OC 82D	1N 4149
AD 174	BC 212A	CRS 25/25	OC 82DM	OC 82DM	1N 4149
AD 175	BC 212A	CRS 25/25	OC 83	OC 83	1N 4149
AD 176	BC 212A	CRS 25/25	OC 83A	OC 83A	1N 4149
AD 177	BC 212A	CRS 25/25	OC 83B	OC 83B	1N 4149
AD 178	BC 212A	CRS 25/25	OC 83C	OC 83C	1N 4149
AD 179	BC 212A	CRS 25/25	OC 83D	OC 83D	1N 4149
AD 180	BC 212A	CRS 25/25	OC 83E	OC 83E	1N 4149
AD 181	BC 212A	CRS 25/25	OC 83F	OC 83F	1N 4149
AD 182	BC 212A	CRS 25/25	OC 83G	OC 83G	1N 4149
AD 183	BC 212A	CRS 25/25	OC 83H	OC 83H	1N 4149
AD 184	BC 212A	CRS 25/25	OC 83I	OC 83I	1N 4149
AD 185	BC 212A	CRS 25/25	OC 83J	OC 83J	1N 4149
AD 186	BC 212A	CRS 25/25	OC 83K	OC 83K	1N 4149
AD 187	BC 212A	CRS 25/25	OC 83L	OC 83L	1N 4149
AD 188	BC 212A	CRS 25/25	OC 83M	OC 83M	1N 4149
AD 189	BC 212A	CRS 25/25	OC 83N	OC 83N	1N 4149
AD 190	BC 212A	CRS 25/25	OC 83O	OC 83O	1N 4149
AD 191	BC 212A	CRS 25/25	OC 83P	OC 83P	1N 4149
AD 192	BC 212A	CRS 25/25	OC 83Q	OC 83Q	1N 4149
AD 193	BC 212A	CRS 25/25	OC 83R	OC 83R	1N 4149
AD 194	BC 212A	CRS 25/25	OC 83S	OC 83S	1N 4149
AD 195	BC 212A	CRS 25/25	OC 83T	OC 83T	1N 4149
AD 196	BC 212A	CRS 25/25	OC 83U	OC 83U	1N 4149
AD 197	BC 212A	CRS 25/25	OC 83V	OC 83V	1N 4149
AD 198	BC 212A	CRS 25/25	OC 83W	OC 83W	1N 4149
AD 199	BC 212A	CRS 25/25	OC 83X	OC 83X	1N 4149
AD 200	BC 212A	CRS 25/25	OC 83Y	OC 83Y	1N 4149
AD 201	BC 212A	CRS 25/25	OC 83Z	OC 83Z	1N 4149



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68Q7	85p	30PL2	£1.00	9004	35p
68Q7	90p	30PL2	£1.00	9004	35p
68Q7	95p	30PL2	£1.00	9004	35p
68Q7	100p	30PL2	£1.00	9004	35p
68Q7	105p	30PL2	£1.00	9004	35p
68Q7	110p	30PL2	£1.00	9004	35p
68Q7	115p	30PL2	£1.00	9004	35p
68Q7	120p	30PL2	£1.00	9004	35p
68Q7	125p	30PL2	£1.00	9004	35p
68Q7	130p	30PL2	£1.00	9004	35p
68Q7	135p	30PL2	£1.00	9004	35p
68Q7	140p	30PL2	£1.00	9004	35p
68Q7	145p	30			

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THE TREND LEADER **QR666 TRIO** SOLID STATE GEN. COVERAGE RECEIVER £139.62 delivered **FREE** (our risk), with **FREE** matching headphones—OR—**COMPLETE STATION** on the air in seconds—delivered (our risk) for **£157.58** **THE SUPER PARTRIDGE PACKAGE** comprises:—

- **QR666** receiver, 170kHz–30MHz, all bands, all modes. AM, SSB, CW, (opt. FM) for Mains, batteries, DC ext., a truly beautiful receiver for all purposes.
- **FREE** matching headphones, lightweight, comfortable, hygienic.
- World Record All Band patented **VFA** aerial in gold stove enamel, hammer finish (7' 6" long when assembled!)
- Made to match the **QR666**—the **JOYMATCH 111B** A.T.U. in gold stove enamel hammer finish case.
- All necessary cables.

**JOYSTICK VFA + JOYMATCH 111B** (for Trio, Eddystone, Yaesu Musen etc. receivers & LP.TX. **£29.58 del.**

**JOYSTICK VFA + JOYMATCH LO-Z 500** (with RF meter. Transmitting 500W P.EP input) **£36.27 del.**

**JOYSTICK VFA + JOYMATCH LO-Z 500X** (No RF meter. Transmitting 500W P.EP input) **£33.59 del.**

**JOYMATCH** tuned **AERIAL SYSTEM** for ANY M.W. and S.W. communications or solid state receiver **£5.87 del.**

**JOYMATCH** Artificial Earth for M.W. and S.W., as used on North Sea Oil Rigs **£5.87 del.**

Communications Headphones 8 ohm (suitable most modern comm. receivers) **£3.39 del.**

**VALVES:** Complete replacement set for 9R59DS & 9R59DE **£4.75 del.**

**AERIAL WIRE,** heavy duty 16 SWG enamelled aluminium, per 10 metres **£0.59 del.**

Send 4½p stamp for complete brochure **PARTRIDGE** and **TRIO**.



BOX 5 **PARTRIDGE**  
BROADSTAIRS KENT ENGLAND  
**ELECTRONIC LTD**

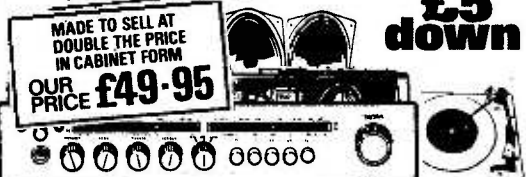
G3CED — G3VFA

FOR EXPERT ADVICE AND INFORMATION

Telephone: 0843 62535 or 62839  
evenings and weekends

## QUALITY STEREO SOUND.

ALMOST **½ PRICE OFFER!** SOLENT AUDIO SYSTEM



**MADE TO SELL AT DOUBLE THE PRICE IN CABINET FORM**  
**OUR PRICE £49.95**  
**£5 down**

\*Stereo Tuner Amplifier chassis with AM/FM radio covering long medium short and Stereo FM wavebands. Separate Base and Treble controls. Power output 7 watts R.M.S. per channel (frequency response 25-20,000 Hz) Tape record and playback facilities. Dimensions 18" x 8½" x 3¼". The very latest BSR automatic record deck with cue and pause control. Two matching elliptical speaker units.

Order early limited stocks available cash price £49.95. Credit Sale £5.00 deposit 9 monthly payments of £5.75 (Total Credit price £56.75). P. & P. £2.50. Send £7.50 today.

Chassis only available for cash at £35.00.  
Full 12 months Guarantee.  
CALLERS WELCOME.

Stereo headphones supplied with every order.

**LEWIS radio** PW 11/74 100 CHASE SIDE SOUTHGATE LONDON N14 5PL Telephones: 01-886 9666/3733

## MASSIVE CLEARANCE BARGAINS

Bargain component parcels contain Resistors, Capacitors, Potentiometers, Knobs, Rotary and Slide Switches, IP's, Tag Strips, Drive Drums, Coil Formers, Wire, Grommets, Relays, Pulley Wheels, Magnets, Transistor Panels, etc. Save yourself £'s on these well selected parcels, 6lb net weight £1.00, p.p 50p.

Brand New Wire-wound Resistors 1-7 watts, mostly Plessey GWS-1-3-5-7. Good selection. 100 for £1.00, p.p. 20p.

Mullard Ferrite Cores LA3 50p, LA4 75p, LA2100 50p.

SPECIAL OFFER. Metallised Polyester Capacitors by Erie, Mullard, etc. Values include -01/160V, -01/250V, -015/160V, -022/160, -033/160, -047/160V, -068/160V, -1/160-250V, -22/160V, etc. This is a bargain not to be missed. 100 for £1.50, p.p. 20p.

Assorted Capacitors, Silver Mica, Tubular and Disc Ceramics, Polystyrene, Tremendously good selection. 300 for £1, p.p. 20p. Please add 8% V.A.T.

Mail Order Only.

**XEROZA RADIO,**  
1, EAST STREET, BISHOPS TAWTON, DEVON.

## MODULAR POWER AMPLIFIERS

**50 WATTS RMS.**

Power Output .... 50 watts rms 4Ω **£6.95 INC.**  
25 watts rms 8Ω **VAT, P & P.**

**H.T. Requirements** 25 to 65 volts  
**Power Response** ..15 Hz to 40kHz ± 3dB  
**T.H.D.** ..... < 0.25% (typical 0.15%) @ 1kHz  
**Input Sensitivity** .... 500mV  
Stereo pre-amp with 4 inputs, slider controls & illuminated input selection available shortly.

## ELLIOTT BLUNT AUDIO LTD.

40 York Street, Twickenham, Middx. Tel: 01-891-1692



# YATES ELECTRONICS

(FLITWICK) LTD.

DEPT P.W., 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

±1W and ±1W PIHER.  
±1W 2% ELECTROSIL.

Power watts	Tolerance	Range	Values available	Price
1	5%	4.7 Ω - 2.2M Ω	E24	1p
1	10%	3.3M Ω - 10M Ω	E12	0.8p
1	2%	10 Ω - 1M Ω	E24	3.5p
1	10%	1 Ω - 1M Ω	E12	1p
1	5%	4.7 Ω - 1M Ω	E12	0.8p
1	10%	1 Ω - 10 Ω	E12	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 ±1W, lin ±1W).  
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 25p	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
AD161 42p	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	BF177 28p	OC70 12p	2N3703 14p
AD161 42p	BC159 15p	BF177 28p	OC71 12p	2N3704 20p
AD162 42p	BC169 15p	BF178 43p	OC72 12p	2N3705 20p
AF114 25p	BC171 13p	BF179 41p	OC85 12p	2N3706 19p
AF115 25p	BC172 22p	BF180 42p	OC87 12p	2N3707 20p
AF116 25p	BC177 20p	BF181 32p	OC88 12p	2N3708 20p
AF117 25p	BC182 15p	BF182 41p	OC72 12p	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 30p	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

DIODE	VOLTS	CURRENT	SIGNAL	PRICE
BY127	1250V	1A	OAS5	7p
IN4001	50V	1A	OAS9	5p
IN4002	100V	1A	OAS9	5p
IN4004	400V	1A	OAS20	7p
IN4006	800V	1A	IN4148	5p
IN4007	1000V	1A	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 Gauge 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.

12in x 2½in. 14p.

9in x 2in. 12p.

## THYRISTORS

2N5060	50V 0.8A	65p	106F	50V	5A	55p
2N5064	200V 0.8A	80p	106D	200V	5A	80p

## HEATSINKS—REDPOINT

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

## TRANSFORMERS All have 240V primary

MT30/2	0-12-15-20-24-30V	2A	£3.85
MT50/±	0-12-15-20-24-30V	±A	£2.50
MT50/±	0-19-25-33-40-50V	±A	£3.15
MT50/2	0-19-25-33-40-50V	2A	£4.20
MT60/±	0-24-30-40-48-60V	±A	£3.30
MT60/±	0-24-30-40-48-60V	±A	£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, 3½p. 0.068μF 4p. 0.1μF 4½p. 0.15μF 5p. 0.22μF 5½p. 0.33μF 7p. 0.47μF 9p. 0.68μF 12p. 1.0μF 14½p. 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

0.1μF	35V	2.2μF	35V	22μF	16V	12p
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

2½ x 3½	0.1	0.15	Standard screened	32p	2.5mm insulated	13p
2½ x 5	26p	28p	Standard insulated	18p	3.5mm insulated	13p
3½ x 3	28p	28p	Stereo screened	44p	3.5mm screened	22p
3½ x 5	28p	28p	Standard socket	15p	2.5mm socket	14p
3½ x 5	34p	34p	Stereo socket	22p	3.5mm socket	14p
17 x 2½	95p	77p				
17 x 3½	130p	108p				
17 x 3½ (plain)	86	72p				
17 x 2½ (plain)	—	51p				
2½ x 5 (plain)	—	18p				
2½ x 3½ (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

9V mains power supply. Same size as PP9 battery. £1.70

## HIGH VOLTAGE TUBULAR CAPACITORS—1,000 VOLT

0.01μF	16p	0.047μF	16p	0.22μF	25p
0.022μF	14p	0.1μF	20p	0.47μF	36p

## POLYSTYRENE CAPACITORS 160V 2½%

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

## SMOKE AND COMBUSTIBLE GAS DETECTOR—GDI

The GDI 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 oxidizing or combustible gases such as hydrogen, carbon monoxide, methane, propane, alcohol, North Sea gas, as well as carbon-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 GDI £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

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. 97p

## METERS

2" Scale-500μA, 1mA, 10mA, 100mA £3.30

## BULGIN MAINS CONNECTORS

3 Pin 1½A	Chassis Plug	18p	3 Pin 1½A	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
VA10555	15p
VA10665	15p
VA1077	15p
R53	£1.25

## 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

## WAVECHANGE SWITCH 33p

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

DIL Sockets 14 pin and 16 pin 16p



# The largest selection

## BRAND NEW FULLY GUARANTEED DEVICES

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AC107	0-20	AD162	0-39	BC149	0-18	BD124	0-76	BF181	0-33	MAT121	0-22	2G306	0-44	2N2180	0-66	2N3055	0-85	2N4059	0-11
AC113	0-20	AD161	0-20	BC150	0-20	BD131	0-85	BF182	0-44	MJE2065	0-95	2G309	0-35	2N2182	0-39	2N3059	0-18	2N4060	0-13
AC115	0-22	AD162(MP)	75	BC151	0-22	BD132	0-86	BF183	0-44	MJE3055	0-82	2G310	0-39	2N2183	0-39	2N3061	0-18	2N4061	0-13
AC117K	0-32	AD170	0-55	BC152	0-19	BD133	0-72	BF184	0-28	MJE3440	0-55	2G319	0-22	2N2194	0-39	2N3092	0-16	2N4062	0-13
AC122	0-18	AF114	0-27	BC153	0-31	BD135	0-44	BF185	0-33	MFF102	0-46	2G339A	0-18	2N2217	0-29	2N3393	0-16	2N4284	0-10
AC125	0-19	AF115	0-27	BC154	0-33	BD136	0-44	BF187	0-40	MFF104	0-41	2G344	0-20	2N2218	0-22	2N3394	0-16	2N4285	0-10
AC126	0-19	AF116	0-27	BC157	0-20	BD137	0-50	BF189	0-38	MFF105	0-41	2G345	0-18	2N2219	0-22	2N3395	0-16	2N4286	0-10
AC127	0-20	AF117	0-27	BC158	0-13	BD138	0-55	BF194	0-18	OC23	0-70	2G371B	0-16	2N2220	0-24	2N3402	0-23	2N4287	0-10
AC128	0-20	AF118	0-39	BC159	0-13	BD139	0-51	BF195	0-18	OC22	0-52	2G373	0-19	2N2222	0-22	2N3404	0-21	2N4288	0-10
AC132	0-16	AF124	0-33	BC160	0-50	BD140	0-66	BF196	0-16	OC23	0-54	2G374	0-19	2N2268	0-19	2N3405	0-46	2N4290	0-10
AC134	0-16	AF125	0-33	BC161	0-55	BD155	0-88	BF197	0-16	OC24	0-62	2G377	0-33	2N2369	0-16	2N3414	0-17	2N4291	0-10
AC137	0-16	AF126	0-31	BC167	0-13	BD175	0-66	BF200	0-50	OC25	0-42	2G378	0-18	2N2369A	0-16	2N3415	0-17	2N4292	0-10
AC141	0-20	AF127	0-31	BC168	0-18	BD176	0-66	BF222	\$1.05	OC26	0-42	2G381	0-18	2N2411	0-27	2N3416	0-31	2N4293	0-10
AC141K	0-32	AF139	0-33	BC169	0-18	BD177	0-72	BF257	0-60	OC28	0-55	2G382	0-18	2N2412	0-27	2N3417	0-31	2N4294	0-10
AC142	0-20	AF178	0-55	BC170	0-13	BD178	0-72	BF258	0-66	OC29	0-55	2G401	0-33	2N2846	0-23	2N3614	0-21	2N4295	0-10
AC142K	0-28	AF179	0-55	BC171	0-16	BD179	0-77	BF259	0-94	OC29	0-55	2G411	0-33	2N2847	0-23	2N3617	0-21	2N4296	0-10
AC151	0-17	AF180	0-55	BC172	0-16	BD180	0-77	BF262	0-61	OC35	0-45	2G414	0-33	2N2848	0-23	2N3618	0-21	2N4547	0-35
AC154	0-22	AF181	0-55	BC173	0-16	BD185	0-72	BF263	0-61	OC36	0-55	2G417	0-28	2N2712	0-23	2N3615	0-82	2N4548	0-35
AC155	0-22	AF186	0-55	BC174	0-16	BD186	0-72	BF270	0-89	OC41	0-22	2N388	0-39	2N2714	0-23	2N3616	0-82	2N4549	0-35
AC156	0-22	AF239	0-41	BC175	0-24	BD187	0-72	BF271	0-83	OC42	0-27	2N388A	0-61	2N2904	0-19	2N3644	0-10	2N6221	0-75
AC157	0-27	AL102	0-72	BC177	0-21	BD188	0-77	BF272	0-83	OC43	0-27	2N404	0-17	2N2905	0-23	2N3702	0-10	2N6222	0-75
AC165	0-22	AL103	0-72	BC178	0-21	BD189	0-83	BF273	0-89	OC45	0-14	2N404A	0-31	2N2905	0-23	2N3703	0-18	2N6223	0-75
AC166	0-22	ASV26	0-28	BC179	0-21	BD190	0-83	BF274	0-89	OC70	0-11	2N524	0-46	2N2905A	0-23	2N3704	0-14	2N6224	0-75
AC167	0-22	ASV27	0-28	BC180	0-27	BD195	0-94	BFW10	0-66	OC71	0-11	2N527	0-54	2N2906	0-17	2N3705	0-13	2N6225	0-75
AC168	0-27	ASV28	0-28	BC181	0-27	BD196	0-94	BFX29	0-80	OC72	0-16	2N598	0-46	2N2906A	0-20	2N3706	0-13	2N6226	0-77
AC169	0-18	ASV29	0-28	BC182	0-16	BD197	0-99	BFX24	0-24	OC74	0-16	2N599	0-50	2N2907	0-24	2N3707	0-14	2N6227	0-77
AC176	0-22	ASV50	0-28	BC182L	0-16	BD198	0-99	BFX25	0-24	OC76	0-17	2N696	0-14	2N2907A	0-24	2N3708	0-09	2N6228	0-77
AC177	0-27	ASV51	0-28	BC183	0-16	BD199	\$1.05	BFX26	0-24	OC77	0-17	2N697	0-17	2N2908	0-14	2N3709	0-10	2N6229	0-77
AC178	0-31	ASV52	0-28	BC183L	0-16	BD200	\$1.05	BFX27	0-27	OC78	0-22	2N698	0-27	2N2909	0-16	2N3710	0-10	2N6230	0-77
AC179	0-31	ASV54	0-28	BC184	0-22	BD205	0-88	BFX28	0-24	OC81	0-17	2N699	0-39	2N2926	0-16	2N3711	0-10	2N6232	0-46
AC180	0-22	ASV55	0-28	BC184L	0-22	BD206	0-88	BFY59	0-22	OC81D	0-17	2N706	0-09	2N2926(G)	14	2N3819	0-01	2N6232A	0-66
AC180K	0-32	ASV56	0-28	BC185	0-16	BD247	\$1.05	BFY51	0-22	OC82	0-17	2N706A	0-10	2N2926(Y)	12	2N3820	0-65	2N6232B	0-66
AC181	0-22	ASV57	0-28	BC187	0-31	BD208	\$1.05	BFY52	0-22	OC83	0-22	2N706B	0-13	2N2926(X)	11	2N3821	0-39	2N6232C	0-77
AC181K	0-32	ASV58	0-28	BC207	0-12	BDY20	\$1.10	BFY53	0-19	OC83	0-22	2N711	0-09	2N2926(Z)	11	2N3822	0-39	2N6232D	0-77
AC187	0-24	ASV73	0-28	BC208	0-12	BF115	0-27	BSX19	0-17	OC139	0-22	2N717	0-39	2N2926(B)	11	2N3903	0-31	2N6232E	0-77
AC187K	0-25	ASV71	0-44	BC209	0-13	BF117	0-50	BSX20	0-17	OC140	0-22	2N718	0-27	2N3010	0-77	2N3904	0-33	2N6232F	0-77
AC188	0-24	BC107	0-14	BC212L	0-14	BF118	0-77	BSY25	0-17	OC169	0-28	2N718A	0-55	2N3011	0-16	2N3905	0-31	2N6232G	0-77
AC188K	0-25	BC108	0-14	BC213L	0-14	BF119	0-77	BSY26	0-17	OC170	0-28	2N726	0-31	2N3058	0-19	2N3906	0-31	2N6232H	0-77
AC197	0-28	BC109	0-15	BC214L	0-18	BF121	0-50	BSY27	0-17	OC77	0-28	2N727	0-31	2N3064	0-07	2N4061	0-13	40362	0-50
AC198	0-22	BC113	0-11	BC225	0-28	BF123	0-55	BSY28	0-17	OC200	0-28	2N743	0-25						
AC199	0-22	BC114	0-17	BC226	0-39	BF125	0-50	BSY29	0-17	OC201	0-31	2N744	0-22						
AC200	0-22	BC115	0-17	BC301	0-30	BF127	0-55	BSY38	0-20	OC202	0-31	2N914	0-16						
AC201	0-22	BC116	0-17	BC302	0-27	BF128	0-61	BSY39	0-20	OC203	0-28	2N918	0-33	Type Price	Type Price	Type Price	Type Price	Type Price	Type Price
AC202	0-22	BC117	0-17	BC303	0-18	BF129	0-60	BSY40	0-20	OC204	0-28	2N929	0-23	AA119	0-09	BY128	0-17	OA10	0-15
AC203	0-22	BC118	0-11	BC304	0-40	BF154	0-50	BSY41	0-31	OC205	0-28	2N930	0-23	AA120	0-09	BY130	0-18	OA17	0-08
AC208	0-21	BC119	0-33	BC440	0-34	BF155	0-77	BSY95	0-14	OC206	0-44	2N930	0-23	AA129	0-09	BY133	0-28	OA70	0-08
AC209	0-39	BC120	0-38	BC460	0-40	BF156	0-53	BSY95A	0-14	OC209	0-44	2N131	0-44	AA131	0-09	BY140	0-45	OA71	0-08
AC230	0-31	BC125	0-18	BCY30	0-27	BF157	0-61	CI11E	\$2.20	OC211	0-48	2N132	0-24	AA132	0-11	BY139/300	0-45	OA81	0-08
AC231	0-31	BC126	0-20	BCY31	0-29	BF158	0-61	CI11E	0-55	OC212	0-48	2N132	0-16	AA133	0-11	BY140	0-39	OA85	0-10
AC232	0-31	BC127	0-20	BCY32	0-38	BF159	0-66	C400	0-33	OC213	0-48	2N1303	0-16	AA134	0-11	BY141	0-39	OA90	0-07
AC233	0-31	BC128	0-20	BCY33	0-40	BF160	0-44	C401	0-33	OC214	0-48	2N1304	0-19	AA135	0-11	BY142	0-39	OA91	0-07
AC234	0-31	BC129	0-20	BCY34	0-28	BF162	0-44	C424	0-33	OC215	0-48	2N1305	0-19	AA136	0-11	BY143	0-39	OA95	0-08
AC235	0-31	BC130	0-20	BCY35	0-18	BF163	0-44	C425	0-55	OC216	0-48	2N1307	0-23	AA137	0-11	BY144	0-39	OA96	0-08
AC236	0-31	BC131	0-13	BCY36	0-28	BF164	0-44	C426	0-39	OC217	0-48	2N1308	0-26	AA138	0-11	BY145	0-39	OA97	0-08
AC237	0-31	BC132	0-17	BCY71	0-22	BF165	0-44	C428	0-39	OC218	0-48	2N1309	0-26	AA139	0-11	BY146	0-39	OA98	0-08
AC238	0-31	BC133	0-17	BCY72	0-22	BF166	0-44	C428	0-39	OC219	0-48	2N1310	0-26	AA140	0-11	BY147	0-39	OA99	0-08
AC239	0-31	BC134	0-13	BCY73	0-22	BF167	0-44	C441	0-33	OC220	0-48	2N1311	0-22	AA141	0-11	BY148	0-39	OA100	0-08
AD130	0-42	BC140	0-33	BCZ10	0-28	BF170	0-39	C442	0-33	OC221	0-48	2N1312	0-22	AA142	0-11	BY149	0-39	OA101	0-08
AD140	0-53	BC141	0-33	BCZ11	0-28	BF171	0-39	C443	0-33	OC222	0-48	2N1313	0-22	AA143	0-11	BY150	0-39	OA102	0-08
AD142	0-53	BC142	0-33	BCZ12	0-28	BF172	0-39	C444	0-33	OC223	0-48	2N1314	0-22	AA144	0-11	BY151	0-39	OA103	0-08
AD143	0-42	BC143	0-33	BD115	0-68	BF177	0-39	C450	0-24	OC224	0-48	2N1315	0-22	AA145	0-11	BY152	0-39	OA104	0-08
AD145	0-55	BC145	0-30	BD116	0-68	BF178	0-33	C451	0-24	OC225	0-48	2N1316	0-22	AA146	0-11	BY153	0-39	OA105	0-08
AD149	0-55	BC147	0-11	BD121	0-66	BF179	0-33	C452	0-24	OC226	0-48	2N1317	0-22	AA147	0-11	BY154	0-39	OA106	0-08
AD161	0-39	BC148	0-11	BD123	0-72	BF180	0-33	MAT100	0-21	OC227</									

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100 0-28 0-37 0-52 0-62 0-55 0-64 0-70 1-54
200 0-39 0-41 0-54 0-54 0-63 0-67 0-83 1-76
400 0-48 0-52 0-62 0-62 0-74 0-83 1-03 1-93
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1L4	68	6C7	1-40	6Q7MT	55	1A37	85	80L46	85	E146	85	EF25	1-00	HZ81	25	PEN48	30	UCF82	38	2N2813	48	BA115	15	
1N6GT	45	6BW6	90	6R7G	80	1A57	80	85A2	80	E450	87	EF26	1-00	HZ82	80	PEN49	30	UCF83	65	2N3053	88	BA129	14	
1R5	45	6BW7	74	6R7M	75	19A4	50	85A3	1-00	E476	1-00	EF27	1-00	HZ83	80	PENDD	30	UCF84	70	2N3121	276	BA130	11	
1R4	38	6BZ6	49	6SA7	44	19G6	1-40	90A9	2-50	EABC80	38	EF28	1-00	HZ84	80	PEN49	30	UCF85	40	2N3703	21	BA131	17	
1U4	40	6CB6A	40	68C7GT	38	20D4	2-00	90C1	75	EAC91	75	EF29	37	HL1D	82	PEN50	40	UCF86	35	2N3709	22	BC107	14	
1U5	75	6C4	35	68G7	44	20P2	75	90C2	2-40	EAF42	75	EF30	37	HL42	70	PEN50	40	UCF87	50	2N3709	22	BC108	14	
1D1	40	6C6	40	68HT	44	20L1	88	10B32	75	EAF61	75	EF31	37	HL43	70	PEN50	40	UCF88	50	2N3709	22	BC109	11	
2GK5	55	6C8	1-50	68J7	55	20P3	80	10B37	80	EAF61	75	EF32	37	HL44	70	PEN50	40	UCF89	50	2N3709	22	BC110	11	
2X2	50	6CD6G	1-25	68K7GT	44	20P4	1-00	807	59	E81	20	EF33	1-00	HZ85	80	PEN50	40	UCF90	50	2N3709	22	BC111	28	
8A4	50	6CG8A	75	68Q7GT	45	20P5	1-80	4033X	6-00	EBC41	75	EF34	37	HL45	70	PEN50	40	UCF91	50	2N3709	22	BC112	28	
8D4	40	6CH6	1-18	6V6G	1-00	27A6G	60	6702	80	EBC1	85	EF35	37	HL46	70	PEN50	40	UCF92	50	2N3709	22	BC113	28	
8Q4	60	6CL6	1-15	6V8GT	45	27B6G	60	6087	1-00	E8F80	89	EF36	37	HL47	70	PEN50	40	UCF93	50	2N3709	22	BC114	28	
8Q4GT	55	6CL8A	80	6K4	40	20Y6G	70	6080	1-00	E8F83	48	EF37	37	HL48	70	PEN50	40	UCF94	50	2N3709	22	BC115	28	
8B6	45	6CM7	75	6X6GT	40	28Z4G	35	6087	1-00	E8F89	40	EF38	37	HL49	70	PEN50	40	UCF95	50	2N3709	22	BC116	28	
4QB6	55	6C8U5	75	7B6	75	28Z6	80	7475	1-00	E85	44	EF39	37	HL50	70	PEN50	40	UCF96	50	2N3709	22	BC117	28	
6C8S	55	6CW4	1-00	7B7	70	28Z6G	70	9002	50	E86	70	EF40	37	HL51	70	PEN50	40	UCF97	50	2N3709	22	BC118	28	
8R4GY	80	6DE7	75	7H7	75	28D7	1-00	9006	30	E88	70	EF41	37	HL52	70	PEN50	40	UCF98	50	2N3709	22	BC119	28	
5U4G	40	6DT6A	75	7R7	80	80A5	65	AC/PE9	93	E89	45	EF42	37	HL53	70	PEN50	40	UCF99	50	2N3709	22	BC120	28	
5V4G	54	6EW6	75	7Y4	75	30C15	50	AC/PE9	93	ECC33	1-50	EF43	37	HL54	70	PEN50	40	UCF100	50	2N3709	22	BC121	28	
5Y3GT	45	6E5	1-00	7A4	80	30C17	80	DD	95	ECC36	95	EF44	37	HL55	70	PEN50	40	UCF101	50	2N3709	22	BC122	28	
5Z3	40	6E1	70	9D7	85	AC/PE9	93	AC/PE9	93	ECC38	1-00	EF45	37	HL56	70	PEN50	40	UCF102	50	2N3709	22	BC123	28	
6Z4GT	45	6F6G	50	10C2	85	80F5	80	AC/TH1	41	ECC31	34	EF46	37	HL57	70	PEN50	40	UCF103	50	2N3709	22	BC124	28	
6Z4GT	45	6F13	55	10DR7	75	30FL1	75	A160	1-00	ECC82	33	EF47	37	HL58	70	PEN50	40	UCF104	50	2N3709	22	BC125	28	
6J80L2	80	6F14	75	10F1	75	30FL2	75	ATP4	50	ECC83	33	EF48	37	HL59	70	PEN50	40	UCF105	50	2N3709	22	BC126	28	
6A8G	1-25	6F18	55	10F9	85	30FL2	1-00	AZ1	80	ECC84	30	EF49	37	HL60	70	PEN50	40	UCF106	50	2N3709	22	BC127	28	
6AC7	49	6F23	80	10F15	55	30FL3	55	AZ31	60	ECC85	40	EF50	37	HL61	70	PEN50	40	UCF107	50	2N3709	22	BC128	28	
6AN8	27	6F24	35	10LD11	70	30P4	75	D91	85	ECC86	85	EF51	37	HL62	70	PEN50	40	UCF108	50	2N3709	22	BC129	28	
6AQ5	45	6E7	85	10C18	80	AC/PE9	93	AC/PE9	93	ECC87	85	EF52	37	HL63	70	PEN50	40	UCF109	50	2N3709	22	BC130	28	
6AR5	55	6H6GT	25	12A6	45	30PL1	65	8F86	85	ECC189	40	EF53	37	HL64	70	PEN50	40	UCF110	50	2N3709	22	BC131	28	
6A8J	1-00	6J5GT	45	12A6	50	30PL13	85	DK40	70	ECC190	40	EF54	37	HL65	70	PEN50	40	UCF111	50	2N3709	22	BC132	28	
6AT5	45	6J6	30	12BA6	45	30PL14	1-10	DK92	90	ECC191	2-10	EF55	37	HL66	70	PEN50	40	UCF112	50	2N3709	22	BC133	28	
6AU6	30	6J7G	30	12BE6	50	30PL15	90	DK96	80	ECC192	1-00	EF56	37	HL67	70	PEN50	40	UCF113	50	2N3709	22	BC134	28	
6AV6	45	6J8A	70	12BH7	60	36A3	65	DL96	55	ECC193	38	EF57	37	HL68	70	PEN50	40	UCF114	50	2N3709	22	BC135	28	
6AW8A	85	6K7C	80	12BI	3-00	36D5	65	DM70	80	ECC194	44	EF58	37	HL69	70	PEN50	40	UCF115	50	2N3709	22	BC136	28	
6AX4	75	6K8G	45	12BTGT	55	36EGT	75	DM71	1-00	ECC195	85	EF59	37	HL70	70	PEN50	40	UCF116	50	2N3709	22	BC137	28	
6BG8	30	6L1	2-00	12K5	1-00	35W4	50	DY87/6	85	ECC196	85	EF60	37	HL71	70	PEN50	40	UCF117	50	2N3709	22	BC138	28	
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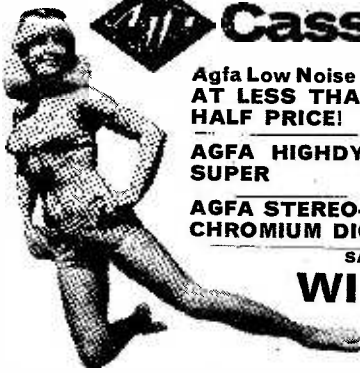
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47µF 10V	61p	1500µF 6-4V	15p
47µF 15V	61p	1500µF 16V	25p
47µF 20V	61p	2200µF 10V	25p
47µF 63V	8p	3300µF 6-4V	26p

**VEROBOARD 0-1 0-15**

2 1/2 x 5"	36p	36p
3 1/2 x 3 1/2"	33p	25p
3 1/2 x 4 1/2"	42p	46p
2 1/2 x 3 1/2"	36p	36p
2 1/2 x 5" (Plain)	—	19p
2 1/2 x 3 1/2" (Plain)	—	16p
2 1/2 x 5" (Plain)	—	29p
Insertion tool	73p	73p
Track Cutter	56p	56p
Pins, Pkt. 25	22p	22p

**POTENTIOMETERS**  
Carbon Track 5K Ω to 2M Ω, log or lin (and 1K lin). Single, 161p Dual Gang 46p. Log single with switch 26p. Slider Pots. 10K, 100K, 500K, semi log 30mm, 34p, 45mm, 47p, 60mm, 55p.

**DIODES**

IN4001 61p	DIN 2 Pin	12p
IN4002 71p	3 Pin	13p
IN4003 9p	5 Pin 180°	16p
IN4004 9p	Std. Jack	20p
IN4005 12p	2.5mm jack	13p
IN4006 14p	Phono	6p
IN914 7p	DIN 2 Pin	10p
IN916 7p	DIN 3 Pin	10p
BA10A 10p	5 Pin 180°	12p
OA5 42p	5 Pin	18p
OA47 9p	Std. Jack	15p
OA81 11p	2.5mm Jack	13p
OA200 8p	Phono	6p

**ELECTROLYTIC CAPACITORS. Tubular & Large Cans**  
(µF/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, 61p, 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.

**TRANSISTORS**

AC127 161p	BC212L 12p
AC128 22p	BC213L 12p
BC107 11p	BC214L 17p
BC108 12p	OC44 16p
BC109 13p	OC71 13p
BC148 12p	OC81 16p
BC149 12p	OC170 23p
BC182L 12p	TIS43 33p
BC183L 12p	2N2922 11p
BC184L 13p	2N3702 11p

**Integrated Circuits**

µA709C 49p	Stereo Screened Wire, Metre	12p
µA741C 50p	Connecting Wire. All colours, Metre	21p
µA723C 98p	Neon Bulb, 90V Wire Ended	5 for 24p
ZN414 43p	Panel Neon. 240V Red, Amber, Clear	20p

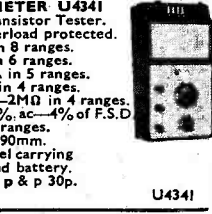
**SCREENED WIRE, METRE**  
Twin Screened Wire, Metre 12p  
Stereo Screened Wire, Metre 12p  
Connecting Wire. All colours, Metre 21p  
Neon Bulb, 90V Wire Ended 5 for 24p  
Panel Neon. 240V Red, Amber, Clear 20p

**ZENER DIODES**  
Low cost 400mW Tol±7%  
All values E24 series 3V-30V  
1-24 25-99 100-499 1000-3000  
9p 7p 6p 5p

**METALLISED PAPER CAPACITORS**  
250V: 0.05µF, 0.1µF, 0.2µF, 0.25µF, 0.5µF, 7p, 1µF, 9p, 500V: 0.025, 0.05, 0.1, 0.2, 0.25, 7p, 0.5, 9p, 1000V: 0.01, 0.025, 0.05, 0.1, 0.2, 0.25, 13p, 0.047, 0.1, 1.5, 0.22, 23p, 0.47, 34p.

**MULTIMETER U4323**  
22 Ranges plus AF/IF Oscillator 20,000 Ω  
Vdc—0-5-1000V in 7 ranges  
Vdc—2-5-1000V in 6 ranges  
Idc—0-05-500mA in 5 ranges  
Resistance—50Ω-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.

**MULTIMETER U4341**  
27 Ranges plus Transistor Tester, 16,700Ω/Volt. Overload protected.  
Vdc—0-3-900V in 8 ranges.  
Vdc—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.  
Ihf—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.

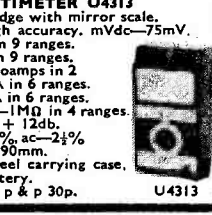


**MULTIMETER U4313**  
33 Ranges. Knife edge with mirror scale, 20,000Ω/Volt. High accuracy, mVdc—75mV.  
Vdc—1-5-600V in 9 ranges.  
Vdc—1-5-600V in 9 ranges.  
Idc—0-06-120mA in 5 ranges.  
Idc—0-6-1500mA in 6 ranges.  
Iac—0-6-1500mA in 6 ranges.  
Resistance—1KΩ-1MΩ in 4 ranges.  
db scale—10 to +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.

**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.  
Vdc—3-900V in 8 ranges.  
Idc—0-06-3A in 5 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.

**MULTIMETER U4313**  
33 Ranges. Knife edge with mirror scale, 20,000Ω/Volt. High accuracy, mVdc—75mV.  
Vdc—1-5-600V in 9 ranges.  
Vdc—1-5-600V in 9 ranges.  
Idc—0-06-120mA in 5 ranges.  
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.



**S-DeC**  
S-DeC £2.14  
T-DeC £3.92  
µDeC "A" £4.30  
µDeC "B" £7.53

**PANEL METERS**  
2" scale  
100µA £3.75  
500µA  
1mA All at 5mA  
10mA £3.75  
100mA  
500mA  
1A

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

**STYLII** Replacements for virtually all ACOS, BSR, COLLARO, GARRARD, PHILIPS, RONETTE, SONOTONE. Single Tip: Sapphire 19p, Diamond 37p. Double Tip: Can be ST/LP+78 or ST/LP+ST/LP Sapphire 37p, Double Tip: Diamond ST/LP+78 or ST/LP+78 65p, Diamond ST/LP+Diamond ST/LP £1.25. For GOLDRING Diamond 8800, 8800H and 8850 at £2-10 each, 8800E at £4-10. FREE LIST (FOR SAE) FULL DETAILS STYLII AND CARTRIDGE EQUIVALENTS including SURE, PICKERING, AUDIO PICK-UPS. Charges 10p any quantity.

**CARTRIDGES.** All with stylus and fittings. Replacements for ACOS GP/91 SC (Stereo-compatible series) at £1.05, GP93 Stereo at £1.45, GP94 Stereo Ceramic at £1.98; for RONETTE DC4008CM (Speed change switch at front for GP67, TCS & c) at £1.25; for BSR X3H, X5H and X5M at £1.35 each, X5H and X5M at £1.70 each. TC8H at £1.50, TC8 Stereo, 3 pins. £2.15; charges 10p any quantity.

**RECORDING TAPE.** ALL FINEST BRITISH MYLARS 5" 609 ft. 20p; 5" 900 ft. 55p; 5 1/2" 1200 ft. 75p; 7" 1800 ft. £1.05. Charges for 5" and 5 1/2", 1-4, 13p each; 5 and over, 35p the lot. Charges for 7", 1-3 15p each, 4-5 85p the lot, 6 and over 40p the lot.

**SPEAKERS 2T1,** 3, 8 or 64 ohms (state which) 55p. Charges 10p each.

**CONNECTING WIRE.** Pkts. of 5 coils, asstd. cols., each 5 yds. Solid core 10p (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 stylus, 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.

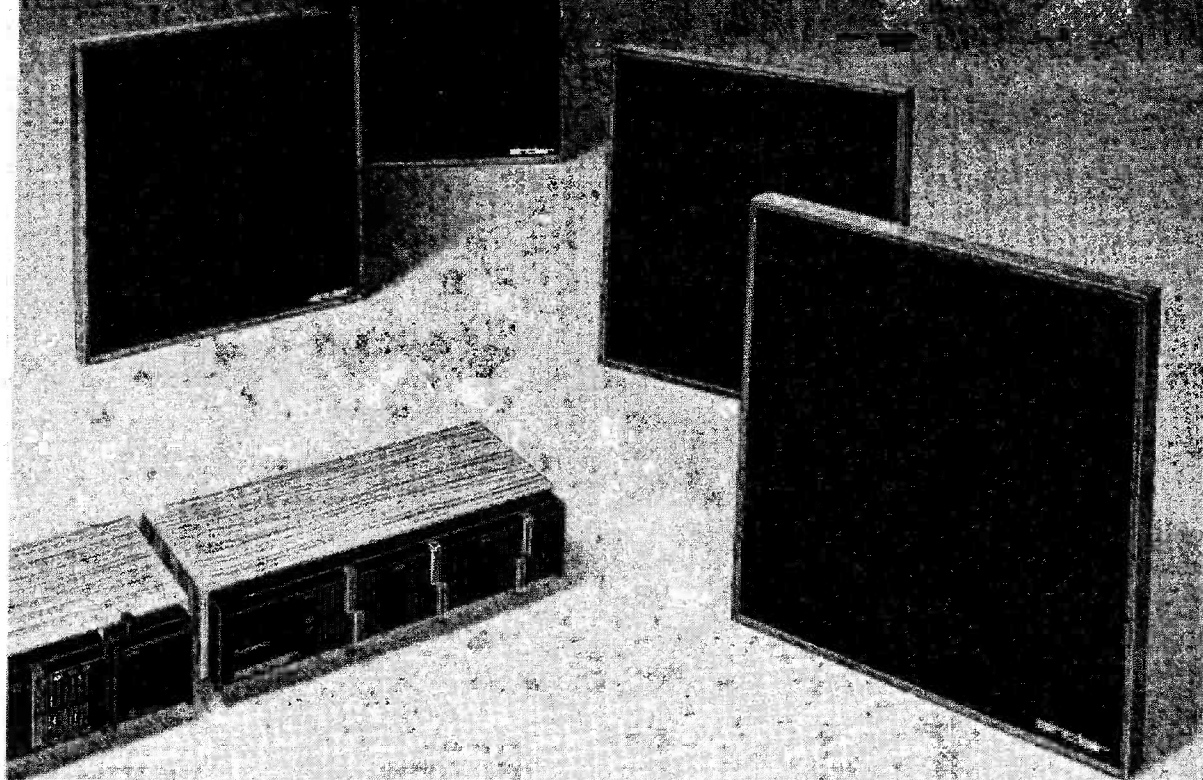
Power capability: 40 watts peak. Frequency range: 40 Hz-20 KHz  
Sensitivity: 85 dB/1m for 1 watt electrical input. Input impedance: 8 ohms. Operating temperature range: -20°F to +175°F. Size (WxDxL): 1-7/16" x 1-3/4" x 1-11/16". Weight: 19 ounces.

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

**web europa**  
P.O. Box 162, Watford WD1 1AA



# Quadraphonic Project 80



Sinclair's 4<sup>th</sup> dimension in high fidelity

## 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 difficulty. 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

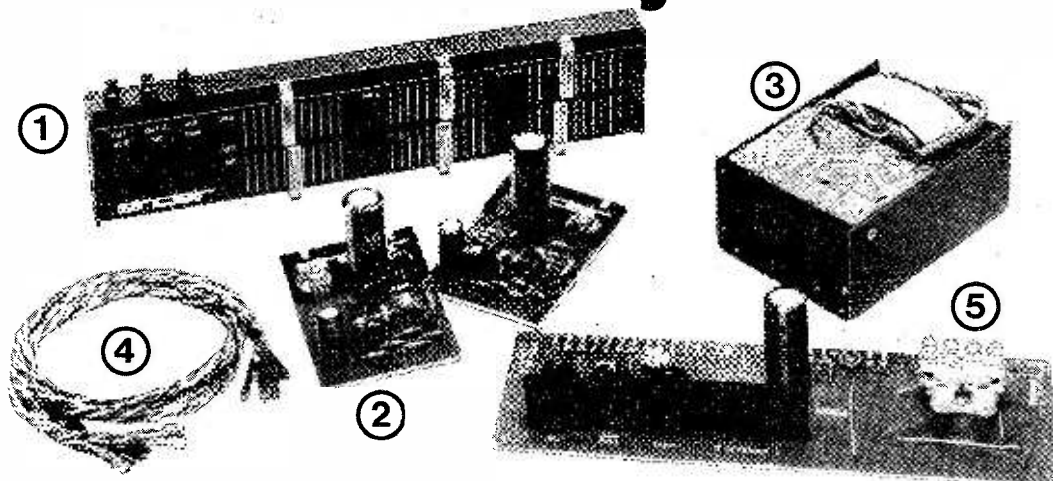


Project 805Q quadraphonic decoder

**sinclair**



# 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,  $\frac{1}{2}$ " 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 x 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

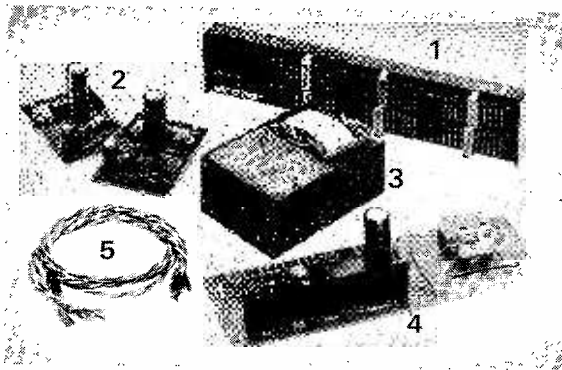
+£3.20 VAT (R.R.P.)

# sinclair



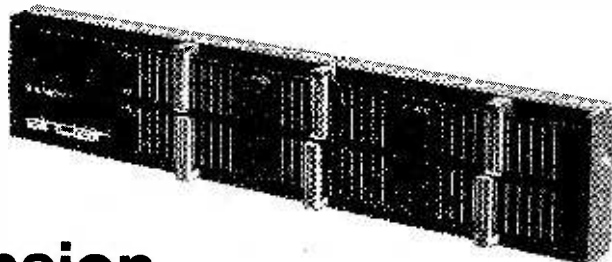
SINCLAIR RADIONICS LTD.  
London Rd, St. Ives, Huntingdon PE17 4HJ  
Telephone St. Ives (0480) 64646

# true quadraphonics... *NOW!*



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.

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



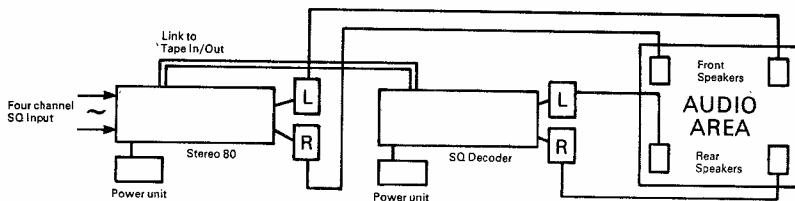
## Add a fourth dimension to your stereo sound

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 Masterlink, 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 quadraphonic assembly is compatible with stereo and mono records.

- Frequency response  $\pm 3\text{db}$  15 Hz-25kHz
- Rated output 100mV
- S/N ratio 58dB
- Distortion 0.1%
- Power requirements 22-35 volts
- Phase shift network  $90^\circ \pm 10^\circ$  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.

# The Project 80 programme to date

**KEEP THIS PAGE FOR HANDY REFERENCE USE THE PRIORITY ORDER FORM IN CASES OF DIFFICULTY**

## Stereo 80 pre-amp/control unit



260×50×20mm (10½×2×¾ ins.) separate slider controls on each channel for treble, bass and volume. INPUTS – Mag. P.U 3mV (RIAA corrected) ceramic – 300mV, Radio 100mV, Tape 30mV. S/N ratio 60dB. Frequency range – 20Hz to 15KHz ± 1dB. OUTPUTS – 2.5V rms max (30V supply) and tape plus AB monitoring. PRESS BUTTONS for P.U., Radio and Tape. Operating power – 20 to 35V. Black case with white indications.

**£13.95** +£1.12 VAT (R.R.P.)

## Project 80 F.M. tuner



Size 85×50×20mm (3½×2×¾ ins.). Tunes 87.5 to 108MHz. DETECTOR – I.C balanced coincidence (I.C equivalent to 26 transistors) Distortion – 0.2% at 1KHz for 30% modulation. SENSITIVITY – 5 microvolts for 30dB quieting. Output – 300mV for 30% modulation. Aerial imp. – 75 Ω or 240-300 Ω. Dual Varicap tuning. 4 pole ceramic filter. Switchable A.F.C. Operating power 23-30 volts.

**£13.95** +£1.12 VAT (R.R.P.)

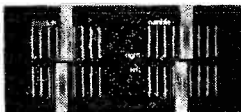
## Project 80 stereo decoder

Size 47×50×20mm. For adding to Project 80 FM tuner. With one I.C equal to 19 transistors, and LED indicator which glows on tuning in stereo signal.



**£8.95** +72p VAT (R.R.P.)

## Project 80 active filter unit (A.F.U.)



Size 108×50×20mm. Useful where there is need to eliminate unwanted high frequencies (scratch, whistle, etc) or low (rumble). Voltage gain – minus 0.2dB. Frequency response (filter at zero) 36Hz to 22KHz. H.F cut (scratch) variable from 22KHz to 5.5KHz 12dB/octave slope. L.F cut (rumble) – 28dB at 28Hz, slope 9dB/octave.

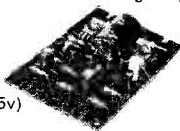
**£7.45** +60p VAT (R.R.P.)

## Project 80 power amplifiers

Intended for use in Project 80 installations, these modules readily adapt to an even wider range of applications. Both incorporate built-in protection against short circuiting and risk of damage from mis-use is greatly reduced.

### Z.40

Size – 55×80×20mm  
9 transistors  
Input sensitivity – 100mV  
Output – 12 watts RMS continuous into 8 Ω (35V)  
Frequency response – 10Hz – 100KHz ± 1dB  
S/N ratio – 64dB  
Distortion – 0.1% at 10 watts into 8 Ω at 1KHz  
Power requirements – 12 to 35 volts



**£5.95** +48p VAT (R.R.P.)

### Z.c0

Size – 55×98×20mm  
12 transistors  
Input sensitivity – 100-250mV  
Output – 25 watts RMS continuous into 8 Ω (50V).  
Distortion – 0.02% at 10W/8 Ω/1KHz  
Frequency response – 10Hz to more than 200KHz ± 3dB  
S/N ratio – better than 70dB  
Built-in protection against transient overload and short circuiting  
Load impedance – 4 Ω min; max. safe on open circuit



**£7.45** +60p VAT (R.R.P.)

## Power-supply units

**PZ.5** Unstabilized. 30 volts. Suitable for Z.40 assemblies, etc.

**£5.95** +48p VAT (R.R.P.)

**PZ.6** Stabilized. Output voltage adjustable between 20 and 50 volts approx. Protecting fuse.

**£8.95** +72p VAT (R.R.P.)

**PZ.8** Stabilized. Output adjustable from 20 to 60V. approx. Re-entrant current limiting makes damage from overload or even shorting impossible. Without mains transformer.

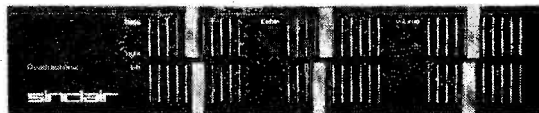
**£8.45** +68p VAT (R.R.P.)



**Project 805 (previous pages)** **£39.95** +£3.20 VAT (R.R.P.)

**Project 805SQ quadraphonic add-on kit** **£44.95** +£3.60 VAT (R.R.P.)

## Project 80SQ quadraphonic decoder

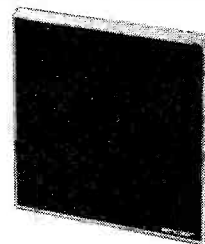


Size 260×50×20mm, matching Stereo 80 in style. Connects with tape socket on stereo 80 or similar facility on any stereo amplifier. Frequency response 15Hz to 25KHz ± 3dB. Distortion 0.1%. S/N ratio 58dB. Rated Output – 100mV. Separate bass and treble slider controls on each channel, also volume. Phase shift network 90° ± 10°, 100Hz to 10KHz. Operating power – 22-35V.

**£18.95** +£1.52 VAT (R.R.P.)

## Sinclair Q.16 loudspeaker

An original and uniquely designed speaker of outstanding efficiency. Balanced sealed sound chamber and special driver assembly. Loads up to 14 W./R.M.S. 8 ohms imp. Size 248mm square×120mm deep. Pedestal base. All-over black front, teak surround.



**£8.95** +72p VAT (R.R.P.)

**sinclair**

Sinclair Radionics Ltd.,  
London Road St. Ives  
Huntingdonshire PE17 4HJ  
Telephone St. Ives (0480) 64311  
R.O. St. Ives: Reg No. 6994583 Eng.

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To Sinclair Radionics Ltd.  
Please send, (carriage paid in U.K.)

NAME .....

ADDRESS .....

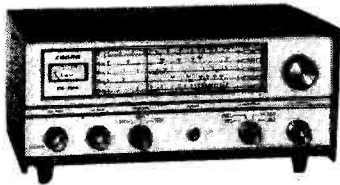
For which I enclose £..... cash/  
cheque/money order INCLUDING V.A.T.

PW11

LISTEN TO

**CODAR**® THE WORLD!

★ **CR70A**



**COMMUNICATION RECEIVER**

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, Mer. 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**

This fine receiver is not a mass produced item, but each set is hand built to your order, individually checked and air tested. Please allow for this when ordering—your delivery date will be shown on your order receipt, sent by return.

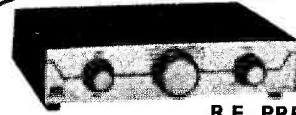
★ **MADE TO ORDER!**

**£34.14!**

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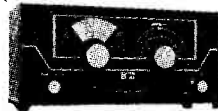
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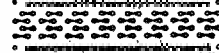
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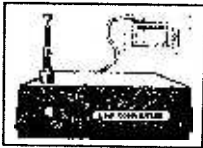
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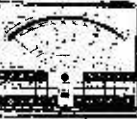
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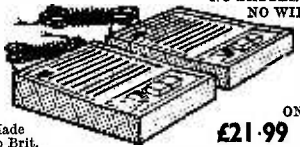
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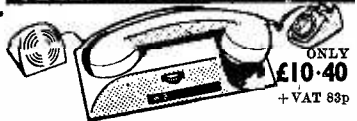
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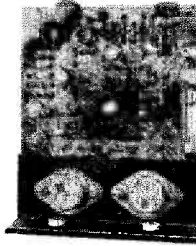
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| <b>SA35</b><br>35W RMS 25-50V<br>7 transistors, 7 diodes.   | <b>£5.45</b>  | Carriage free | ★ 25Hz-25kHz<br>★ 0.2% distortion<br>★ Noise—80dB<br>★ 500mV into 20K                    |
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| <b>SA100</b><br>100W RMS 45-70V<br>11 transistors, 6 diodes | <b>£10.90</b> |               | ★ Top-grade components   |
- 120 watt module complete with built-in supply—extra heavy duty £19.75 Carr. 60p**



THE SA100 MODULE

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| <b>PU45</b> | Suits 2 SA35 or 1 SA50  | <b>£4.90</b> | Carriage 30p |
| <b>PU70</b> | Suits 2 SA50 or 2 SA100 | <b>£7.75</b> | Carriage 40p |

### STABILISED

- |             |                        |              |               |
|-------------|------------------------|--------------|---------------|
| <b>PS45</b> | Suits 2 SA35 or 2 SA50 | <b>£3.50</b> | Carriage free |
| <b>MT45</b> | Transformer for above  | <b>£3.50</b> | Carriage 30p  |
| <b>PS70</b> | Suits 2 SA100          | <b>£4.90</b> | Carriage free |
| <b>MT70</b> | Transformer for above  | <b>£4.90</b> | Carriage 40p  |

N.B. PS70 is not suitable for the SA50

## Mk II STEREO DISCO MIXER £19.75 Carr. 30p

This well tried unit mixes two decks, handles any ceramic cartridge, and features mic over-ride plus separate full range bass and treble controls on both mic and deck inputs. Ample headphone power is available for P.F.L. May be used for mono and is mains operated. Fitted with sturdy screening case. Controls: Mic vol, bass, treble, Left/Right fade, deck volume, bass, treble, h/phone select, vol, Mains. Size 17½in x 3in x 4in deep.



## DISCO MODULE £8.00 Carr. 20p

Thousands sold of this extremely popular mono version. A mic input may be fitted using the VA30 (see below). Low consumption from a 9V battery. Features the same high standards of reproduction as the Stereo version. Controls: h/phone select, vol, Left deck vol, Right deck vol, bass, treble, master vol. Size 12½in x 3in x 2in deep.



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Only SAXON can supply such incredible value for money. This unit features 3kW power handling, full-wave control, bass, middle, treble AND master controls. Twin loudspeaker jacks for "through" connections. It may be used free standing or will panel mount next to either of the above. Also features unique CUT-BACK circuitry for extra wide range response. Size 12in x 3in x 2½in deep. Professional standards at a price you can afford!



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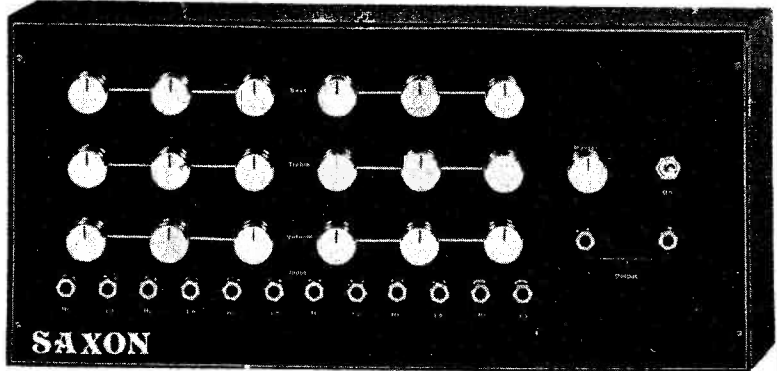
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**M6HL £27.50 Carr. 50p**

Featuring multiples of our VA30 module, the M4HL and M6HL fulfil the requirements of all clubs, groups, etc. where a high quality mixer is required. Each channel has one high and one low impedance input, plus volume, treble and bass controls. Input impedances may, if required, be easily changed. The M4HL has four channels, and one output, and the M6HL six channels (12 inputs) and a master control and two outputs. Either unit may be used free-standing or panel mounted. These mixers will feed all types of amplifier. Recommended for their versatility and high performance, and excellent value for money.

## VA30 CHANNEL MODULE £3.50 Carr. free

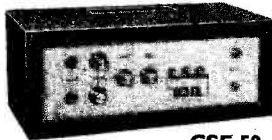
This is the basic channel module in the above mixers and may also be used for extra inputs on either the mono or stereo mixers. Fitted with volume, bass and treble controls, requires just a jack and supply (9-100V)



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sockets. Sturdy case, and an attractive fascia make this excellent value for money. Hundreds in use by groups, discos, clubs, etc. 50W version identical in appearance.

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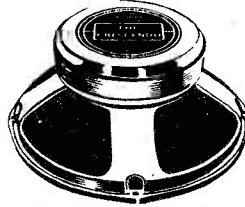
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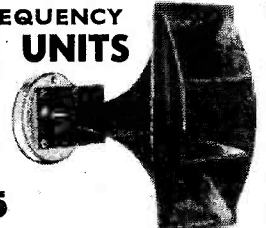
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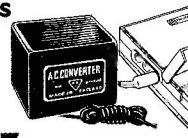
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1A 600V 25p	200V 3A 55p
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2A 200V 40p	600V 7A 95p
2A 600V 54p	
4A 200V 45p	
4A 600V 70p	
6A 200V 68p	
6A 600V 87p	

## THYRISTORS

100V 1 Amp 30p
400 1A 45p
600V 1A 45p
200V 3A 55p
300V 5A 75p
600V 7A 95p

## ALUM. BOXES

2 1/2" x 3 1/2" x 1 1/2" 45p
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4" x 5 1/2" x 1 1/2" 48p

## VEROBOARD

0-1	Pitch	0-15	0-15
		plain	14p
2 1/2 x 3"	30p	32p	15p
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3 1/2 x 5"	38p	38p	26p
2 x 17"	98p	75p	55p
3 x 17"	139p	105p	79p
5 x 17"	173p		105p



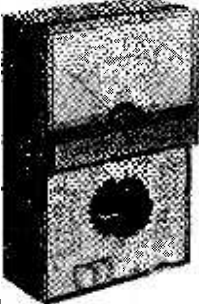
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## AC/DC MULTIMETER TYPE U4324



33 ranges up to  
3 Amps AC/DC;  
1200V DC, 900V  
AC, 500kΩ, +12  
db.

Sensitivity:  
20kΩ/V DC;  
4kΩ/V AC

Accuracy:  
±2.5% DC;  
±4% AC

Movement is protected by silicon diodes.

Dimensions 167×98×63 mm. Weight: 1.5lb.

PRICE: complete with test leads, instruction manual and fibre-board storage case £9.25. Packing & carr. £0.50.

## MULTIMETER TYPE U4323

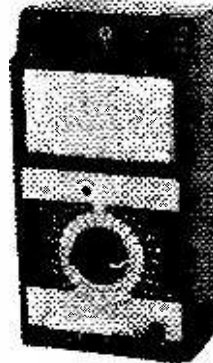
Sensitivity: 20,000Ω/V.



7 D.C. Voltage ranges 0.5-1000V  
6 A.C. Voltage ranges 2.5-1000V  
5 D.C. Current ranges 0.05-500mA  
4 Resistance ranges 1kΩ-1mΩ  
Built-in oscillator providing AF output of 1kHz and I.F. output of 465kHz with an amplitude of 1 volt minimum.

Dimensions: 140×87×40 mm. Weight 0.5kg  
PRICE complete with leads and plastic storage case £7.70. Packing & postage £0.50

## AC/DC MULTIMETER TYPE U4313



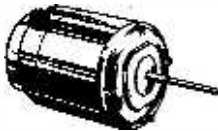
39 ranges:  
600μA to 1.5A  
AC  
60μA to 1.5A DC  
75mV to 600V  
DC  
1.5V to 600V AC  
1MΩ, 0.5μF, 12db  
Accuracy: 1.5%  
DC; 2.5% AC  
Sensitivity: 20k  
Ω/V DC; 2kΩ/V  
AC

Mirror scale 86mm long.

Dimensions: 115×215×90 mm, Weight 3.3lb.  
PRICE, complete with test leads, service manual and steel carrying case £12.50. Packing & carriage £0.50.

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Sizes: 12" x 12", 24" x 12", 24" x 24"; FULL SHEET 43" x 37" (11 sq ft). Single-sided Copper with thickness of 1/32", 3/64", 3/32". Also double-sided 1/32", 1/16", 3/32". £1 per sq ft. Cut sizes (1-10 sq. ft.) 25p. P. & P. Full Sheet £8 each. Carr. £1 for 1st sheet plus 25p each additional sheet.



### SMITHS RINGER-TIMER

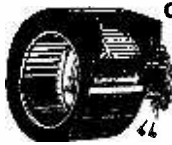
Reliable 15 minute times, spring wound (concurrent with time setting) 15 x 1min divisions, approximately 1/2" between divisions. Panel mounting with chrome bezel 3 1/2" dia. £1.40. 15p P. & P.

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by Air Control Ltd.



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240 AC, 28rpm. NEW HIGH TORQUE, approx. overall size: 3 1/2" x 3 1/2" x 2 1/2" + spindle 1/2" dia. as illustrated. £2.70. P. & P. 30p.  
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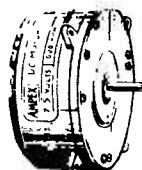
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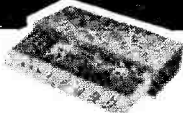
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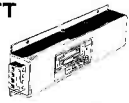
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