

# PRACTICAL WIRELESS

MARCH  
1975

30p

## FREE INSIDE

FREQUENCY  
ALLOCATION  
WALL CHART

PW 'Easubuild'  
ELECTRONIC  
ORGAN  
PART 1

PW  
**FREE**  
Competition

**£500**  
worth of HEATHKIT equipment  
to be won!

# NEW EDU-KIT MAJOR

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

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

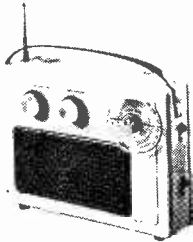
Components Include: 24 Resistors • 21 Capacitors • 10 Transistors • 3 1/2" Loudspeaker • Earpiece • Mica Baseboard • 3 12-way connectors • 2 Volume controls • 2 Slider Switches • 1 Tuning Condenser • 3 Knobs • Ready Wound MW/LW/SW Coils • Ferrite Rod • 6 1/2 yards of wire • 1 Yard of sleeving etc. • Parts Price List and Plans 55p. (Free with parts).

## Total Building Costs

**£7-23** P P & Ins. 44p  
(Overseas Seamail P & P £2-35)  
(+ 8% VAT 57p)

## NEW ROAMER NINE

WITH V.H.F. INCLUDING AIRCRAFT



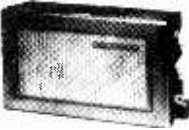
Nine Transistors, 9 Tunable wavebands as Roamer Ten. Built in ferrite rod aerial for MW/LW. Retractable chrome-plated telescopic aerial for VHF and SW. Push Pull output using 600 mW transistors. 9 Transistors and 3 diodes, tuning condenser with V.H.F. section, separate coil for aircraft, moving coil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

**Total Building Costs £6-95** P P & Ins. 44p  
(Overseas Seamail P & P £2-35)  
(+ 8% VAT 55p)

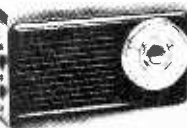
## POCKET FIVE

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 20p (Free with parts). (+ 8% VAT 20p) (Overseas Seamail P & P £1-70)



**Total Building Costs £2-50** P P & Ins. 36p  
(Overseas Seamail P & P £1-70)



## 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 free with parts. (Overseas Seamail P & P £1-70)

**Total Building Costs £2-75** P P & Ins. 36p  
(+ 8% VAT 21p)

## 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 1/4 x 2 1/2 in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and plans free with parts.

**Total building costs £4-48** P P & Ins. 40p  
(+ 8% VAT 36p)  
(Overseas Seamail P & P £2-00)

## ROAMER SIX

CASE AND LOOKS AS TRANS-EIGHT

6 Tunable Wavebands: MW, LW, SW1, SW2. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker 8 stages—5 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 5 1/4 x 2 1/2 in. approx. Plans and parts price list free with parts.

**Total building costs £3-98** P P & Ins. 40p  
(Overseas Seamail P & P £2-00)  
(+ 8% VAT 32p)

## 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 6 1/2" x 2 1/4" approx. Parts Price List and Plans free with parts.

**Total Building Costs £2-95** P P & Ins. 36p  
(Overseas Seamail P & P £1-70)  
(+ 8% VAT 23p)

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 free with parts.

**Total Building Costs £3-60** P P & Ins. 36p  
(Overseas Seamail P & P £1-70)  
(+ 8% VAT 29p)

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 free with parts. Overseas P & P £1-65.

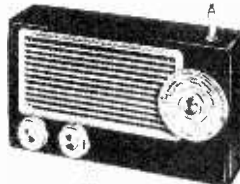
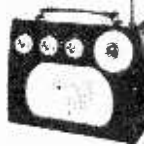
**Total Building Costs £4-08** P P & Ins. 38p  
(Overseas Seamail P & P £2-00)  
(+ 8% VAT 32p)

## 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 L.W. Chrome plated Telescopic aerial can be angled and rotated for peak short wave listening. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Latest 4 1/2 watt ferrite magnet loudspeaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4 1/2 in. approx. Easy to follow instructions and diagrams. Parts price list and plans free with parts.

**Total building costs £6-98** P P & Ins. 47p  
(Overseas Seamail P & P £2-50)  
(+ 8% VAT 56p)



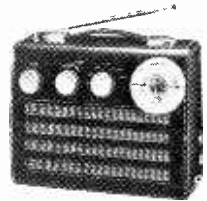
## ROAMER TEN Mk 2

WITH VHF INCLUDING AIRCRAFT

Now with free earpiece and switched socket.

10 Transistors. Latest 4 1/2 watt Ferrite Magnet Loudspeaker. 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 50p (FREE with parts).

**Total building costs £9-50** P P & Ins. 52p  
(Overseas Seamail P & P £2-50)  
(+ 8% VAT 76p)



## "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 Tune 3" Moving Coil Speaker; Terminal Strip; Ferrite Rod Aerial; Battery Clips; 4 Tag Boards; 10 Transistors; 4 Diodes; Resistors; Capacitors; Three 1/2" 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 free with parts.

**Total building costs £5-50** P P & Ins. 40p  
(Overseas Seamail P & P £2-00)  
(+ 8% VAT 44p)

## RADIO EXCHANGE LTD

★ Callers side entrance "Lavelle" 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. Ref. No. 788372.

I enclose £..... for .....  
Name .....  
Address .....  
(Dept. PW3.)

# PRACTICAL WIRELESS

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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.

## ● NEWS & COMMENT

- 986 **THOU SHALT NOT LISTEN**—Leader article
- 987 **NEWS . . . NEWS . . . NEWS . . .**
- 1011 **NEXT MONTH IN PRACTICAL WIRELESS**
- 1022 **PRODUCTION LINES** by *Colin Riches*
- 1032 **ON THE AIR**
- 1032 **Amateur Bands**—*Eric Dowdeswell, G4AR*
- 1035 **Broadcast Bands—Short Wave**—*Derek Bell*
- 1036 **LETTERS**—Readers comment
- 1039 **HOTLINES** on recent developments by *Ginsberg*
- 1040 **TELEVISION**—Coming in the March issue

## ● CONSTRUCTIONAL

- 988 **2 VHF CONVERTERS**—Part 1—*G. Severn*
- 991 **P.W. 'ASCOT' STEREO CASSETTE DECK**—Part 2—*Keith Cummins & Tony Francis*
- 1001 **MODEL CONTROL BY RADIO**—Part 3—Actuators and Monitor—*F. G. Rayer, G3OGR*
- 1012 **P.W. 'EASYBUILD' ELECTRONIC ORGAN**—Part 1—*M. J. Hughes, M.A., C.Eng., MIERE*
- 1024 **TAKE 20, No 69 MORSE CODE OSCILLATOR**—*David Andrews*

## ● OTHER FEATURES

- 997 **IC OF THE MONTH**—Fairchild  $\mu$ A720 A.M. Receiver
- 1009 **GOING BACK**—Earlier days of Wireless—*Colin Riches*
- 1027 **SPECIAL PRODUCT REPORT—SINCLAIR 'SCIENTIFIC' KIT**

1030 **HEATHKIT COMPETITION—YOUR CHANCE TO WIN A PRIZE!**

★ **FREQUENCY ALLOCATION WALLCHART—FREE INSIDE**

# HUGE DISCOUNTS

**ON LEADING BRAND HI-FI** ALL RSC PRICES INCLUDE VAT  
**LOW DEPOSIT CREDIT TERMS**  
Full labour and material guarantees for 12 months

	List Price	RSC Price
WHARFEDALE DENTON II	£45.49 Pr.	£29.95
„ DENTON I (White)	£33.78 Pr.	£24.95
WHARFEDALE LINTON	£56.33 Pr.	£38.95
„ LINTON Spkr Kit	£26.61 Pr.	£19.50
LEAK 2030 L/Spkr	£83.99 Pr.	£65.00
LEAK 2060 L/Spkr	£72.54 Ea.	£57.50
FANE MODE I Spkr Kit	£21.95 Pr.	£18.95

Amplifier	£68.04	£49.95
LINEAR 202 Amplifier	£39.23	£24.95
ROTEL RX150A Tun/Amp	£77.09	£54.95
ROTEL 152 Tuner/Amp	£92.50	£65.95
ROTEL 154A (Quad) Amp	£144.85	£89.95
ROTEL 202 Tuner/Amp	£104.50	£74.95
ROTEL RT222 AM/FM Tuner	£56.45	£38.95
ROTEL RT 322	£73.16	£53.50
LEAK 2000 Tuner/Amp	£178.16	£149.50

Also Shure Cartridges, Bass Tapes, Koss H/Phones, etc.  
Prices of above correct at Jan 10 1975

## AKAI TAPE UNITS

Model	Rec. Price	£86.90	£62.95	GXC 510D	Rec. Price	£189.90	£135.95
CS 30D				GXR 82D		£122.65	£89.95
GXC 36D		£110.72	£72.50	4000 DS		£130.10	£94.95
GXC 38		£147.19	£105.95	4000 DB (Dolby)		£196.27	£139.95
GXC 38D		£137.38	£97.95	1722 L		£125.18	£91.95
GXC 46D		£157.59	£109.95	CR 81D		£98.10	£69.95
GXC 40T		£186.09	£135.95	CS33D		£105.81	£75.95
GXC 75D		£199.90	£142.95				

**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  
**T/TABLES with MAGNETIC CARTRIDGE/PLINTH & COVER**  
**GARRARD SP25 MK IV with G850 Special Price £22.95** (Carr. £1)  
**RANK BD2000** Rec. Price £67.25 **£48.95** (Carr. £1)

## FANE HIGH FIDELITY SPEAKERS

Limited number at approx. 1/3 off list prices.

Model	Special Price	Model	Special Price
5" 501	8 ohms £5.20	12" 122/14*	8 & 15Ω £11.50
8" 804*	8 ohms £3.65	12" 122/14LR	8Ω £12.95
10" 1005LR	15Ω £5.75	12" 122/17*	8 & 15Ω £12.95

Above are available by Mail Order carr. free or may be ordered through Branches

\*Basic models made to individual specification of equipment manufacturers

## HI-FI 7 Watt LOUDSPEAKERS fitted Parasitic Tweeter Imp 8Ω

8" x 5" £1.25 ea. 6 1/2" £1.45 ea. 8" £1.85 Carr. 20p

## GENERAL PURPOSE 3-4 Watt SPEAKERS Imp 8Ω

4" 88p. 5" or 6" x 4" 95p. 8" x 5" 99p Carr. 20p

Model	Price	Notes
MEB 13 x 9 1/2 x 6 1/2 in.	£3.95	Both cut for 8in. speaker
JEB 16 x 11 x 9 in.	£5.95	
SE10 25 x 16 x 9 in.		Cut for 10in. and Tweeter £8.95
SE12 25 x 16 x 9 in.		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 **£6.95** Carr. 45p  
OR SENIOR 15 WATT INCLUDING **£8.95** Carr. 50p  
HF123 13,000 GAUSS SPEAKER

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

200-250v. AC mains operated. Response 20-20,000 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 9 1/2 x 6 1/2 in. Silver finish fascia 10 1/2 x 8 1/2 in. **FACTORY BUILT** Complete kit, wiring diagrams and instructions. **£7.95** Carr. 40p. **£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, Radio Tuner, Tape Rec. etc. Input Sel. Switch. Bass, Treble, Vol. & Bal. Controls. **COMPLETE KIT OF PARTS WITH FULL £12.95** Carr. 40p.  
Wiring Diagrams & Instructions. **£19.55** Dep. £2.50 & 8 mthly pymts 12 mths guarantee **£16.61** Or in Teak **£19.55** Dep. £2.50 & 8 mthly pymts 12 mths guarantee **£26.60** (Total £28.60).

## RSC G66 MkII 6.6 WATT high quality STEREO AMPLIFIER

Controls: Bass, Treble, Vol. and Bal. 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Bass Control ± 12db. Treble Control ± 13db. Selector switch for Crystal P.U. or Tape/Radio. For speaker output impedances of 3 - 15 ohms. For standard 200-250v. A.C. mains operation. Attractive Black and Silver finished metal fascia plate and matching control knobs. **COMPLETE KIT OF PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT and COMPREHENSIVE WIRING DIAGRAMS & INSTRUCTIONS £12.95** 40p. as illustrated £16.95 or dep. £2.12 and 8 monthly payments £2.12 (Total £19.08).



COMPREHENSIVE WIRING DIAGRAMS & INSTRUCTIONS £12.95 40p. 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.

Model	Size	Price	Model	Size	Price
HF808T	8" 10W	£8.55	HF150D	15" 15W	£8.50
HF102D	10" 10W	£8.50	HF180	18" 15W	£7.95
HF120	12" 15W	£6.95	HF180D	18" 15W	£8.80

## AUDIO FIDELITY MODEL 80 HI-FI SPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. 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 8-15 Ω. **£4.50 ea. £7.98** pr.

MODEL 83 8" 15w. with parasitic Tweeter. 45.99 ea. **£10.95** pr. Response 25 Hz to 15 KHz. Gauss 13,000 Imp 8-15Ω.

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

BUILD AN AMPLIFIER WORTH APPROXIMATELY DOUBLE THE KIT PRICE INCLUDING CABINET

- Only high grade components by leading manufacturers
  - Push Button Selector Switching
  - Jack Socket for Headphones
  - Neon Indicator
  - Satin Silver Finish Metal Fascia
  - Solid State Circuitry
  - Twenty Silicon Transistors
  - Four Diodes, Four Rectifiers
  - Send S.A.E. for full descriptive leaflet.
- For Magnetic or Ceramic Pick-Ups regardless of Price. Output (per channel) 15 watts RMS into 8Ω. Frequency Response 7 Hz to 70 KHz ± 1 1/2 dB. Assembled unit in cabinet £42.50



COMPLETE KIT (less cabinet). **£22.95** Carr. 70p. Cabinet if req. £4.90 extra.

## R.S.C. TRANSFORMERS, L.F. CHOKES & RECTIFIERS FULLY GUARANTEED. Impregnated and Interleaved where necessary. Primaries 200-250V. 50/60c/s. Screened.

Model	Price	Model	Price
MIDGET CLAMPED TYPE 2 1/2 x 2 1/2 x 2 1/2 in.		TOP SHEATHED DROP-THRO' TYPE	
250v.-250v., 6.3v. 2a	£1.50	250-0-250v. 70mA, 6.3v. 2a. 0-5-6.3v. 2a.	£2.25
250-0-60mA., 60mA 6.3v 2a	£1.60	250-0-250v. 100mA, 6.3v. 3.5a.	£2.50
FULLY SHEATHED UPRIGHT MOUNTING		250-0-250v. 100mA, 6.3v. 2a., 0-5-6.3v. 1a.	£2.75
250-0-250v. 60mA, 6.3v. 2a., 0-5-6.3v. 2a.	£2.25	350-0-350v. 60mA, 6.3v. 2a., 0-5-6.3v. 2a.	£2.75
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£3.75	250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£3.75
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£3.75	300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£3.75
300-0-300v. 130mA, 6.3v. 4a., c.t. 6.3v. 1a.	£4.50	300-0-300v. 130mA, 6.3v. 4a., c.t. 6.3v. 1a.	£4.50
For Mullard 610 Amplifier	£4.50	350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£3.75
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£4.50	350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	£4.50
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	£4.50	FILAMENT or TRANSFORMER POWER PACK	
425-0-425v. 200mA, 6.3v. 4a., c.t. 5v. 3a.	£8.60	6.3v. 6.3v. 1.5a. 92p; 6.3v. 2a. 92p; 6.3v. 3a. £1.45p;	
425-0-425v. 200mA, 6.3v. 4a., Twice 5v. 3a.	£8.70	6.3v. 6a. £2.25 12v. 1a. 96p; 12v. 3a. or 24v. 1.5a. £2.25; 0.9-18v 12v. £1.95; 0-12-25-42v 2a. £2.75	
450-0-450v. 250mA, 6.3v. 4a., c.t. 5v. 3a.	£9.00		

## SELENIUM RECTIFIERS F.W. (Bridged)

All 6/12v. D.C. output. Max. A.C. input 18v.

1a. 38p. 2a. 48p. 3a. 65p. 4a. 81p. 6a. 97p.

## L.F. CHOKES

150mA, 7-10H, 250 Ω £1.10; 100mA, 10H, 200 Ω 95p; 60mA, 10H, 400 Ω 55p.

# RSC 100 watt DISCO SYSTEM

50 WATT SPEAKER 50 WATT SPEAKER  
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
  - (b) PAIR OF HI-FI HEADPHONES
  - (c) MATCHING DYNAMIC 'MIKE' (attached to h'phone)
  - (d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18" x 18" x 8"
- (a) (b) (c) & (d) Carr. £3-00 **£159-95**

# RSC TDI DISCO CONSOLE

Incorporating twin Garrard SP25 or BSR MP60 type turntables and Sonotone or Aco's 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. £9-00 and 18 fortnightly pymts. **£79-95**

£4-61 (Total £91-98) Carr. £1-50

DEP. £19-95 & 18 fortnightly payments of £9-11 (Total £183-93).

STEREO VERSION OF ABOVE SYSTEM  
Or DEP £28-95 and 18 fortnightly pymts. **£199-95**  
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NAS0162X 200V	28	NAS0652X 200V	56	NAS1002X 200V	74
NAS0164W 400V	40	NAS0654W 400V	84	NAS1004W 400V	109
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NAS006S 400PIV	40	NAS106S 400PIV	57	NAS206S 100PIV	77
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0B7	.40	8BA6	.25	6LI	2.00	12K5	1.00	35W4	.50	DM71	1.50	EOL80	.55	ET97/6	.35	PCL82	.35	UBF80	.40	Transistors	AF117	.21	BYZ13	.28	
0Z4	.47	8BC8	.60	8L6GT	.55	12K7GT	.50	35Z3	.75	DY87/6	.85	EOL82	.34	ET88	.48	PCL83	.50	UBF89	.40	& Diodes	AF121	.23	PSY11A	.25	
1A1	.45	8BE6	.35	6L7	.50	12Q7GT	.45	35Z4GT	.70	DY80Z	.35	EOL83	.70	EY01	.58	PCL84	.45	UBL21	.77	IN4744	.15	AF125	.28	PSY41A	.25
1A5GT	.50	8BH6	.60	6L18	.55	12BCT	.50	35Z5GT	.75	E800C	2.00	EOL84	.60	E240	.50	PCL85	.47	UCB4	.45	2N966	.58	AF126	.30	OA10	.47
1A7GT	.55	8BJ6	.55	6L19	2.00	12BGT	.40	.42	.50	E800F	1.40	EOL85	.60	E241	.55	PCL86	.55	UCB5	.75	2N968	.58	AF128	.30	OA17	.47
1B3GT	.60	8BK7A	.60	6L20	.75	12BH7	.65	.43	1.00	E800G	1.20	EOL86	.45	E260	.35	PEN45	.55	UCB8	.45	2N1756	.55	AF180	.53	OA47	.11
1B5GT	.60	8BQ7A	.55	6L21	.60	12BZ7	.45	6B5	.60	E800H	1.00	EOL87	.45	E261	.35	PEN45DD	.55	UCF80	.70	2N1247	.75	AF186	.61	OA70	.17
1L4	.25	8BR7	1.00	6QGT	.50	12BZT	.45	6B5C	.60	E800I	1.00	EF40	.75	EY501	.75	.80	.80	UCH21	2.00	2N1297	.25	BA115	.15	OA73	.17
1B6GT	.65	8BR8	1.50	6QGT(M)	.55	14H7	.65	50EH5	.75	E182CC1.25	.25	EF41	.70	EZ32	.50	PEN46	.50	UCH42	.75	2N1269	.15	BA116	.30	OA79	.16
1B8	.85	8BW6	1.40	6Q7(M)	.65	14H7	.65	50EH5	.75	E182CC1.25	.25	EF42	.70	EZ33	1.25	PEN46DD	.50	UCH81	.40	2N1805	.35	BA129	.14	OA81	.16
1B4	.85	8BW6	.80	6R7G	.60	14B7	.30	50L6GT	.85	E1148	.53	EF43	.50	EZ34	.60	.3.00	.3.00	UCH81	.40	2N1805	.35	BA129	.14	OA81	.16
1U4	.60	8BW7	.70	6R7M	.75	14B7	.50	55A2	.60	E2A76	1.00	EF44	.55	EZ35	1.00	PENDD	.50	UCH81	.40	2N1805	.35	BA129	.14	OA81	.16
1U8	.75	8BZ8	.45	6B4T	.44	19G6	6.00	85A3	.60	E2A76	1.00	EF45	1.50	EZ36	1.00	PENDD	.50	UCH81	.40	2N1805	.35	BA129	.14	OA81	.16
SD21	.45	8C4	.35	65C7GT	.25	20P2	.75	90A3	2.50	RAC80C	.35	EF46	1.00	EZ37	1.00	PENDD	.50	UCH81	.40	2N1805	.35	BA129	.14	OA81	.16
SD25	.55	8C5	.50	65C7GT	.44	20L1	1.10	90C1	.75	EAC91	.75	EF47	.85	EZ38	1.00	PENDD	.50	UCH81	.40	2N1805	.35	BA129	.14	OA81	.16
2K2	.60	8C6	.40	68H7	.44	20P3	.80	90C2	2.40	EAF42	.75	EF48	.85	EZ39	1.00	PENDD	.50	UCH81	.40	2N1805	.35	BA129	.14	OA81	.16
2A4	.60	8C9	1.00	69J7	.55	20P4	1.00	150B2	.75	EAF401	.75	EF49	.37	HL41	1.00	PL36	.60	UF85	1.40	AA129	.17	BC108	.14	OA95	.10
SD4	.40	8CD8G	1.25	68K7GT	.44	20P5	1.30	2158G	.60	EB34	.85	EF50	.37	HL41DD	1.00	PL36	.60	UF85	1.40	AA129	.17	BC108	.14	OA95	.10
8Q4	.60	8CG8A	.75	68Q7GT	.55	20A6	.60	807	1.00	EB31	.85	EF51	.37	HL41DD	1.00	PL36	.60	UF85	1.40	AA129	.17	BC108	.14	OA95	.10
3Q5GT	.85	8CL8	.65	6V6G	.17	20A6G	.60	807	1.00	EB31	.85	EF52	1.00	HAC800	.60	PL200	.70	UF42	.70	AA119	.17	BC109	.14	OA200	.10
3B4	.40	8CL8A	.85	6V6GT	.25	20P2	.75	90A3	2.50	RAC80C	.35	EF53	.85	HL23	.60	PL200	.70	UF42	.70	AA119	.17	BC109	.14	OA200	.10
3Y4	.70	8CM7	.75	6X4	.40	28Z4G	.40	8060	1.00	EBF89	.60	EF54	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
4C3B	.55	8C6U5	.75	6X54T	.45	25Z5	.60	6067	1.00	EBF89	.60	EF55	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
5C08	.55	8CW4	1.00	7B6	.75	25Z6G	.70	7193	.58	EBF89	.60	EF56	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
5B4GT	.40	8DE7	.75	7B7	.70	28D7	1.00	9002	.60	EBL21	2.00	EF57	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
5U4G	.40	8DT6A	.75	7H7	.75	30A5	.85	9006	.60	EC88	.70	EF58	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
5V4G	.40	8EW6	.75	7R7	.80	30C15	.50	ACFEN	1.00	EC81	.75	EF59	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
5WGT	.45	8E5	.75	7Z4	.80	30C15	.50	DD	1.00	EC82	.45	EF60	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
5Z4	.45	8F6G	.50	9D7	.65	30F5	.50	ACCFEN	1.00	EC82	.45	EF61	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
5Z4GT	.45	8F13	.70	10C2	.87	AC/TH1	.87	AC/TH1	.87	EC84	1.00	EF62	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6J30L2	.30	8F14	.75	10DK7	.75	30FL3	.67	ATL4	1.00	EC81	.75	EF63	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6ABG	1.25	8F15	.65	10F1	.75	30FL12	.90	ATP4	.60	EC81	.75	EF64	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AC7	.49	8F18	.65	12P9	.65	30FL12	.90	ATP4	.60	EC81	.75	EF65	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6A08	.87	8F28	.85	10F18	.55	30PL14	.75	AZ31	.60	EC84	.35	EF66	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AH6	.60	8P24	.85	10LD11	.70	30L15	.75	AE41	.25	EC88	.45	EF67	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AJ5	.65	8P26	1.00	10P13	.75	30L17	.70	BL63	2.00	EC88	.45	EF68	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AK5	.40	8P28	.87	10P14	.80	30P4MR	.80	OL3	1.60	EC88	.45	EF69	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AK6	.40	8P28	.87	10P14	.80	30P4MR	.80	OL3	1.60	EC88	.45	EF70	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AK6A	.80	8P28	.50	12A5	1.00	30P13	1.00	GY31	.50	ECF80	.45	EF71	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AMB8A	.60	8086G	.60	12AC6	.70	30P13	.80	GY31	.50	ECF80	.45	EF72	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AN8	.70	8018A	.65	12AD6	.65	30P13	.80	GY31	.50	ECF80	.45	EF73	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AQ5	.45	80K6	.65	12AE6	.65	30P4	.75	DAF96	.50	ECF86	.75	EF74	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AR8	.40	80G7	.75	12AT8	.65	30P13	.85	DC90	.50	ECF86	.75	EF75	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AR8	1.00	80G7	.25	12AU8	.45	30P13	.85	DF91	.30	.3.25	.3.25	EF76	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AT6	.45	835GT	.45	12AV6	.50	30P14	1.10	DF96	.50	EOH21	2.00	EF77	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AU6	.60	836	.30	12BA6	.45	30P15	.90	DK40	.70	EOH25	1.25	EF78	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AV6	.45	837G	.20	12B26	.50	35A3	.65	DK92	.70	EOH24	.70	EF79	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AW6A	.95	8JUS8A	.75	12BH7	.60	35C5	.75	DK96	.60	EOH24	.70	EF80	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6AX4	.75	8K7G	.30	12E1	.80	35D5	.75	DL86	.55	EOH23	.44	EF81	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10
6B6G	.80	8K8G	.45	12J7GT	.60	35L6GT	.75	DM90	.60	EOH24	.44	EF82	.85	HL23DD	.75	PL33	.50	UF80	.35	AA120	.17	BC109	.14	OA200	.10

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<b>H38</b>	<b>30</b>	Short lead Transistors, NPN Silicon Planar types	<b>H66</b>	<b>4</b>	40362. Type PNP Sil. Transistors TO-5 can comp. to H65

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<b>B86</b>	<b>150</b>	Germanium Diodes Min. glass type	<b>H20</b>	<b>20</b>	BY126/7 Type Silicon Rectifiers 1 amp. plastic. Mixed ed volts
<b>B83</b>	<b>200</b>	Transistors, manufacturers' rejects, AF, RF, Sil. and Germ.	<b>H34</b>	<b>15</b>	Power Transistors, PNP, Germ. NPN Silicon TO-3 Can
<b>B84</b>	<b>100</b>	Silicon Diodes DO-7 glass, equlv. to OA200, OA202	<b>H67</b>	<b>10</b>	3819N Channel FET's plastic case type

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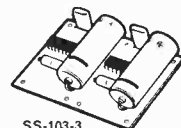
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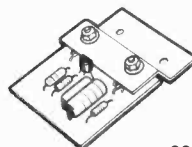
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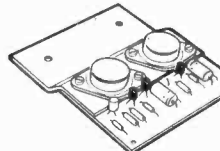
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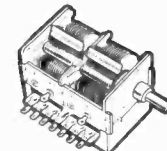
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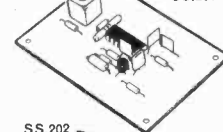
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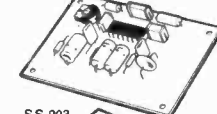
SS.140



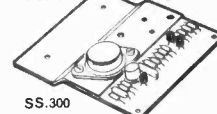
SS.201



SS.202



SS.203



SS.300

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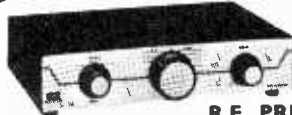
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## POWER UNIT Type A125

Supplying 6 or 9 Volt DC at 200 mA.

In moulded case forming a 2 pin 5A mains plug.

2 metre output lead with 4-way multiplex giving 2-1 and 2-5 mm sockets and 3-5 mm plugs.

Price £2-25. Post 10p.



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2"		4"	
SIZE: 60mm Wide 45mm High 40mm Deep.	Movement	SIZE: 110mm Wide 82mm High 43mm Deep.	Movement
0-50 micro A.	1250	0-50 micro A.	1400
0-100 micro A.	580	0-100 micro A.	730
0-500 micro A.	170	0-500 micro A.	200
0-1 mA	170	0-1 mA	200
0-5 mA	170	0-5 mA	200
0-10 mA	6	0-10 mA	6
0-50 mA	0-5	0-50 mA	0-5
0-100 mA	0-5	0-100 mA	0-5
0-500 mA	0-5	0-500 mA	0-5
0-1 AMP	0-5	0-1 AMP	0-5
0-2 AMP	0-5	0-2 AMP	0-5
0-25 Volt	15K	0-25 Volt	15K
0-50 Volt	50K	0-50 Volt	50K
0-300 Volt	300K	0-300 Volt	300K
"g" Meter	170	"g" Meter	200
VU Meter	5250	VU Meter	5250

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1/2 watt at 70°C E 12 range 10Ω-1MΩ 5% tol above 470 KΩ 10% tol at 95p per 100.

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**Special Offer**  
Compact General Purpose Mini Multimeter. Input Resistance 1000 ohms per volt.  
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DC Current 0-1 mA 0-100 mA  
Resistance 0-150K ohms  
Size 60 x 24 x 90 mm  
Complete with Batteries, Test Prods, Instructions. Special price £3-20 Post 20p.



## C1001 MULTIMETER

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Overload protection  
150 μA movement, clear scale  
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DC Current 0-50 mA  
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Carrying Case, Test Prods and Batteries included.  
Size: 11-3 x 8-3 x 2-7 cm.  
Price £9-85. Post 20p.

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Housed in smart resin-cased steel cases, with 3-core power cable and outlet socket, fused primary winding. Isolation types are fitted with 3-pin outlet sockets, and are available with 110 volt or 240 volt output. (Please state). Auto types are fitted with 2-pin flat style sockets up to 500 VA. 3-pin sockets from 750 to 3000 VA. See Auto and Isolation sections for prices.

## SAFETY ISOLATING

Prim. 120/240V. Sec. 120/240V. Centre Tap with Screen.

VA (watts)	Ref. No.	Price Cased £	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	4-80	0-52
200	151	10-20	0-80	7-40	0-52
250	152	11-88	0-80	8-88	0-65
350	153	14-10	0-80	10-80	0-80
500	154	15-88	0-80	12-38	1-00
750	155	24-83	1-00	18-72	1-20
1000	156	32-49	1-00	26-50	1-20
1500	157	38-18	1-00	30-34	O.A.
2000	158	45-20	2-40	34-88	O.A.
3000	159	68-50	2-40	53-35	O.A.

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

Amps	Ref. No.	Price £	Post £
12V 24V			
0-2	0-16	2-42	1-34
0-5	0-25	1-11	1-38
1	0-5	2-13	1-58
2	1	2-71	2-09
4	2	18	2-68
6	3	7-9	3-80
8	4	10-8	4-20
16	4	7-2	4-80
12	5	11-6	5-01
16	8	17	6-22
20	10	11-5	9-47
30	15	18-7	11-95
40	20	22-2	13-26
50	30	22-6	15-30

## 30 Volts

Amps	Ref. No.	Price £	Post £
0-5	112	1-72	0-22
1	79	2-21	0-38
2	3	3-26	0-38
3	20	4-10	0-42
4	21	4-68	0-52
5	51	6-80	0-52
6	117	6-50	0-52
8	86	8-50	0-67
10	89	8-97	0-67

## AUTO TRANSFORMERS

VA Watts	Ref. No.	Price Cased £	Price Plugs 2 & 3 pin £	Price Open £	Post £
Tapped at 115, 220, 240 Volts					
		113	3-00	0-15	1-55
Tapped at 115, 200, 220, 240 Volts					
150	4	5-80	0-15	3-98	0-39
200	65	6-40	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	85	12-36	0-75	9-78	0-82
1000	84	15-70	0-75	12-40	0-82
1500	93	19-88	0-75	16-58	1-50
2000	95	30-10	1-44	22-05	1-50
3000	73	43-58	1-90	32-00	1-90

## 50 Volts

Amps	Ref. No.	Price £	Post £
Prim. 200-240V. Sec. 19, 25, 33, 40, 50V.			
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
6	107	11-17	0-67
8	118	14-19	0-97
10	119	15-47	0-97

## 60 Volts

Amps	Ref. No.	Price £	Post £
Prim. 230-240V. Sec. 24, 30, 40, 43, 60V.			
0-5	124	2-08	0-38
1	126	2-96	0-38
2	127	4-83	0-42
3	125	6-84	0-52
4	123	7-94	0-67
5	40	8-86	0-67
6	120	10-15	0-82
8	121	13-68	1-00
10	122	18-15	1-00
12	189	16-00	1-10

## MINIATURE AND EQUIPMENT

Sec. 1 Volts	Sec. 2	Sec. 1 Milliamperes	Sec. 2	Ref. No.	Price £	Post £
3-0-3		200		228	1-23	0-10
0-6	0-6	500	500	234	1-30	0-10
0-6	0-6	1000	1000	212	1-93	0-22
9-0-9		100		13	1-23	0-10
0-9-9	0-9	330	330	225	1-43	0-10
0-8-9	0-8-9	500	500	207	1-75	0-22
0-8-9	0-8-9	1000	1000	206	2-80	0-36
15-0-15		40		240	1-21	0-10
0-15	0-15	200	200	236	1-30	0-10
0-20-20		30		241	1-23	0-10
0-20	0-20	150	150	237	1-30	0-10
0-15-20	0-15-20	300	300	205	2-47	0-38
0-20	0-20	300	300	214	1-72	0-22
0-20	0-20	3500 (NO SCREEN)		1116	3-00	0-40
20-12-0 12 20		700 (NO SCREEN)		221	1-21	0-10
0-15-20	0-15-20	1000	1000	206	3-22	0-28
0-15-27	0-15-27	500	500	203	2-73	0-38
0-15-27	0-15-27	1000	1000	204	3-52	0-38

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100 P.I.V. 25p	100 P.I.V. 40p	200 P.I.V. 60p	100 P.I.V. 70p
200 P.I.V. 28p	200 P.I.V. 45p	400 P.I.V. 65p	200 P.I.V. 80p
600 P.I.V. 30p	400 P.I.V. 50p	600 P.I.V. 75p	400 P.I.V. 90p

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7401	0-15	0-14	7442	0-73	0-68	7483	0-95	0-89
7402	0-15	0-14	7445	0-99	0-92	7486	0-35	0-34
7403	0-15	0-14	7447	0-98	0-98	7489	3-56	3-33
7434	0-18	0-16	7450	0-15	0-14	7490	0-54	0-50
7430	0-15	0-14	7474	0-36	0-34	7423	0-72	0-67
7408	0-18	0-16	7453	0-15	0-14	7493	0-54	0-50
7410	0-15	0-14	7454	0-15	0-14	7495	0-73	0-68
7412	0-23	0-21	7460	0-15	0-14	7496	0-83	0-78
7413	0-33	0-32	7472	0-29	0-27	74107	0-36	0-34
7420	0-15	0-14	7473	0-33	0-32	74121	0-36	0-34
7432	0-31	0-29	7474	0-36	0-34	74123	0-72	0-67
7437	0-31	0-29	7475	0-51	0-50	74127	0-87	0-81
			7476	0-35	0-32	74175	1-01	0-95

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AC113	0-22	AD162 0-22	BC152	0-19	BD135	0-44	BF185	0-44	MJE3440	0-55	2G308	0-21	2N1894	0-41	2N3054	0-19	2N4059	0-11
AC117	0-32	AD174 0-55	BC153	0-33	BD136	0-44	BF187	0-30	MFF104	0-41	2G309	0-21	2N1895	0-41	2N3055	0-45	2N1606	0-13
AC122	0-13	AF114 0-27	BC154	0-33	BD137	0-50	BF188	0-44	MFF105	0-41	2G306	0-44	2N1896	0-63	2N3056	0-16	2N1607	0-13
AC125	0-19	AF116 0-27	BC155	0-20	BD138	0-55	BF194	0-13	OC19	0-39	2G308	0-39	2N1897	0-39	2N3057	0-18	2N1608	0-13
AC126	0-19	AF117 0-27	BC156	0-13	BD139	0-61	BF195	0-13	OC20	0-70	2G309	0-39	2N1898	0-39	2N3058	0-16	2N1609	0-13
AC127	0-20	AF118 0-27	BC159	0-13	BD140	0-66	BF196	0-18	OC22	0-62	2G338	0-20	2N1899	0-39	2N3059	0-16	2N1610	0-13
AC129	0-20	AF119 0-27	BC160	0-50	BD155	0-88	BF197	0-16	OC23	0-54	2G339A	0-18	2N1900	0-24	2N3060	0-16	2N1611	0-13
AC128	0-20	AF124 0-33	BC161	0-55	BD175	0-66	BF200	0-50	OC24	0-62	2G344	0-20	2N1901	0-24	2N3061	0-16	2N1612	0-13
AC132	0-16	AF125 0-33	BC167	0-13	BD176	0-66	BF222	0-15	OC25	0-42	2G345	0-18	2N1902	0-24	2N3062	0-23	2N1613	0-13
AC134	0-16	AF126 0-31	BC168	0-13	BD177	0-72	BF227	0-50	OC26	0-32	2G371	0-18	2N1903	0-24	2N3063	0-23	2N1614	0-13
AC137	0-16	AF127 0-31	BC168	0-13	BD178	0-72	BF268	0-66	OC28	0-55	2G371B	0-13	2N1904	0-24	2N3064	0-23	2N1615	0-13
AC141	0-20	AF139 0-33	BC170	0-13	BD179	0-77	BF269	0-94	OC29	0-55	2G373	0-19	2N1905	0-22	2N3065	0-46	2N1616	0-13
AC141K	0-32	AF178 0-55	BC171	0-16	BD180	0-77	BF292	0-61	OC35	0-46	2G474	0-19	2N1906	0-19	2N3066	0-17	2N1617	0-13
AC142	0-20	AF179 0-55	BC172	0-16	BD181	0-77	BF293	0-61	OC36	0-56	2G477	0-19	2N1907	0-19	2N3067	0-17	2N1618	0-13
AC142K	0-28	AF180 0-55	BC173	0-16	BD186	0-72	BF270	0-39	OC41	0-82	2G378	0-18	2N1908	0-18	2N3068	0-16	2N1619	0-13
AC151	0-17	AF181 0-55	BC174	0-16	BD187	0-77	BF271	0-32	OC42	0-27	2G381	0-18	2N1909	0-18	2N3069	0-16	2N1620	0-13
AC154	0-22	AF186 0-55	BC175	0-24	BD188	0-77	BF272	0-83	OC44	0-17	2G382	0-18	2N1910	0-27	2N3070	0-23	2N1621	0-13
AC155	0-22	AF239 0-41	BC177	0-21	BD189	0-83	BF273	0-39	OC45	0-14	2G401	0-33	2N1911	0-27	2N3071	0-23	2N1622	0-13
AC156	0-22	AL102 0-72	BC178	0-21	BD190	0-83	BF274	0-39	OC70	0-11	2G414	0-33	2N1912	0-27	2N3072	0-23	2N1623	0-13
AC157	0-27	AL103 0-72	BC179	0-16	BD191	0-83	BF275	0-39	OC71	0-11	2G417	0-33	2N1913	0-27	2N3073	0-23	2N1624	0-13
AC165	0-22	ASV26 0-28	BC180	0-27	BD196	0-94	BF280	0-30	OC72	0-16	2N388	0-39	2N1914	0-23	2N3074	0-10	2N1625	0-13
AC166	0-22	ASV27 0-33	BC181	0-27	BD197	0-99	BF284	0-24	OC74	0-16	2N388A	0-61	2N1915	0-23	2N3075	0-13	2N1626	0-13
AC167	0-22	ASV28 0-28	BC182	0-16	BD198	0-99	BF285	0-38	OC75	0-17	2N404	0-22	2N1916	0-23	2N3076	0-13	2N1627	0-13
AC168	0-27	ASV29 0-28	BC182L	0-16	BD199	0-105	BF286	0-24	OC76	0-17	2N404A	0-21	2N1917	0-23	2N3077	0-13	2N1628	0-13
AC169	0-18	ASV30 0-28	BC183	0-18	BD200	0-105	BF287	0-27	OC77	0-28	2N524	0-46	2N1918	0-23	2N3078	0-13	2N1629	0-13
AC176	0-22	ASV31 0-28	BC183L	0-16	BD205	0-88	BF288	0-24	OC81	0-17	2N527	0-54	2N1919	0-23	2N3079	0-13	2N1630	0-13
AC177	0-31	ASV32 0-28	BC184	0-22	BD206	0-88	BF289	0-24	OC82	0-17	2N598	0-46	2N1920	0-23	2N3080	0-13	2N1631	0-13
AC178	0-31	ASV34 0-28	BC184L	0-22	BD207	0-105	BF290	0-22	OC82	0-17	2N599	0-50	2N1921	0-23	2N3081	0-09	2N1632	0-13
AC179	0-31	ASV55 0-28	BC186	0-31	BD208	0-105	BF292	0-22	OC82D	0-17	2N696	0-14	2N1922	0-23	2N3082	0-09	2N1633	0-13
AC180	0-22	ASV56 0-28	BC187	0-31	BDY20	0-10	BFY53	0-19	OC83	0-22	2N697	0-15	2N1923	0-16	2N3083	0-10	2N1634	0-13
AC180K	0-32	ASV57 0-28	BC187	0-12	BF115	0-27	BX19	0-17	OC139	0-22	2N698	0-27	2N1924	0-16	2N3084	0-10	2N1635	0-13
AC181	0-22	ASV58 0-28	BC188	0-12	BF117	0-50	BX20	0-17	OC140	0-22	2N699	0-17	2N1925	0-16	2N3085	0-10	2N1636	0-13
AC181K	0-22	ASV73 0-28	BC189	0-18	BF118	0-77	BX21	0-17	OC141	0-22	2N706	0-09	2N1926	0-16	2N3086	0-10	2N1637	0-13
AC187	0-24	ASZ31 0-44	BC212L	0-14	BF119	0-77	BX22	0-17	OC170	0-28	2N706A	0-10	2N1927	0-16	2N3087	0-10	2N1638	0-13
AC187K	0-25	BC107 0-9	BC213L	0-14	BF121	0-50	BX23	0-17	OC171	0-28	2N708	0-13	2N1928	0-11	2N3088	0-31	2N1639	0-13
AC188	0-24	BC108 0-9	BC214L	0-18	BF123	0-55	BX24	0-17	OC200	0-28	2N711	0-33	2N1929	0-11	2N3089	0-31	2N1640	0-13
AC188K	0-25	BC109 0-9	BC226	0-28	BF125	0-50	BX25	0-17	OC201	0-31	2N717	0-37	2N1930	0-11	2N3090	0-31	2N1641	0-13
AC176	0-22	BC110 0-12	BC226	0-28	BF127	0-55	BX26	0-20	OC202	0-31	2N718	0-37	2N1931	0-11	2N3091	0-31	2N1642	0-13
AC177	0-31	BC111 0-12	BC301	0-30	BF128	0-61	BX27	0-20	OC203	0-31	2N719	0-37	2N1932	0-11	2N3092	0-31	2N1643	0-13
AC178	0-31	BC112 0-17	BC302	0-27	BF130	0-60	BX28	0-20	OC203	0-31	2N720	0-37	2N1933	0-11	2N3093	0-31	2N1644	0-13
AC179	0-31	BC116 0-17	BC303	0-35	BF154	0-60	BX41	0-31	OC205	0-31	2N904	0-25	2N1934	0-11	2N3094	0-31	2N1645	0-13
AC180	0-22	BC117 0-20	BC304	0-40	BF155	0-77	BX45	0-14	OC309	0-44	2N743	0-22	2N1935	0-11	2N3095	0-31	2N1646	0-13
AC181	0-22	BC118 0-11	BC440	0-34	BF156	0-53	BSY95A	0-14	OC371	0-48	2N744	0-22	2N1936	0-11	2N3096	0-31	2N1647	0-13
AC182	0-22	BC119 0-33	BC460	0-40	BF157	0-61	BU105	0-20	ORP12	0-48	2N914	0-18	2N1937	0-11	2N3097	0-31	2N1648	0-13
AC183	0-22	BC120 0-33	BC370	0-29	BF158	0-61	BU106	0-20	ORP16	0-44	2N915	0-18	2N1938	0-11	2N3098	0-31	2N1649	0-13
AC184	0-22	BC121 0-33	BC371	0-28	BF159	0-66	BU107	0-20	ORP21	0-44	2N928	0-33	2N1939	0-11	2N3099	0-31	2N1650	0-13
AC185	0-22	BC122 0-33	BC372	0-28	BF160	0-44	CA24	0-28	ORP26	0-44	2N930	0-33	2N1940	0-11	2N3100	0-31	2N1651	0-13
AC186	0-22	BC123 0-33	BC373	0-33	BF162	0-44	CA24	0-28	P346A	0-22	2N1131	0-22	2N1941	0-11	2N3101	0-31	2N1652	0-13
AC187	0-22	BC124 0-33	BC374	0-28	BF163	0-44	CA26	0-55	P397	0-46	2N1132	0-24	2N1942	0-11	2N3102	0-31	2N1653	0-13
AC188	0-22	BC125 0-33	BC375	0-28	BF164	0-44	CA26	0-55	P397	0-46	2N1132	0-24	2N1943	0-11	2N3103	0-31	2N1654	0-13
AC189	0-22	BC126 0-33	BC376	0-28	BF165	0-44	CA28	0-28	P397	0-46	2N1132	0-24	2N1944	0-11	2N3104	0-31	2N1655	0-13
AC190	0-22	BC127 0-33	BC377	0-28	BF166	0-44	CA28	0-28	P397	0-46	2N1132	0-24	2N1945	0-11	2N3105	0-31	2N1656	0-13
AC191	0-22	BC128 0-33	BC378	0-28	BF167	0-24	CA41	0-33	TP129	0-48	2N1303	0-16	2N1946	0-11	2N3106	0-31	2N1657	0-13
AC192	0-22	BC129 0-33	BC379	0-28	BF173	0-24	CA42	0-33	TP130	0-58	2N1305	0-16	2N1947	0-11	2N3107	0-31	2N1658	0-13
AC193	0-22	BC130 0-33	BC380	0-28	BF174	0-28	CA44	0-39	TP131	0-58	2N1306	0-23	2N1948	0-11	2N3108	0-31	2N1659	0-13
AC194	0-22	BC131 0-33	BC381	0-28	BF177	0-39	CA44	0-39	TP132A	0-73	2N1307	0-23	2N1949	0-11	2N3109	0-31	2N1660	0-13
AC195	0-22	BC132 0-33	BC382	0-28	BF178	0-33	CA44	0-39	TP132A	0-73	2N1308	0-23	2N1950	0-11	2N3110	0-31	2N1661	0-13
AC196	0-22	BC133 0-33	BC383	0-28	BF179	0-33	CA44	0-39	TP142A	0-73	2N1309	0-26	2N1951	0-11	2N3111	0-31	2N1662	0-13
AC197	0-22	BC134 0-33	BC384	0-28	BF180	0-33	CA44	0-39	TP142A	0-73	2N1309	0-26	2N1952	0-11	2N3112	0-31	2N1663	0-13
AC198	0-22	BC135 0-33	BC385	0-28	BF181	0-33	CA44	0-39	TP142A	0-73	2N1309	0-26	2N1953	0-11	2N3113	0-31	2N1664	0-13
AC199	0-22	BC136 0-33	BC386	0-28	BF182	0-44	CA44	0-39	TP142A	0-73	2N1309	0-26	2N1954	0-11	2N3114	0-31	2N1665	0-13
AC200	0-22	BC137 0-33	BC387	0-28	BF183	0-44	CA44	0-39	TP142A	0-73	2N1309	0-26	2N1955	0-11	2N3115	0-31	2N1666	0-13

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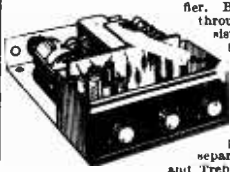


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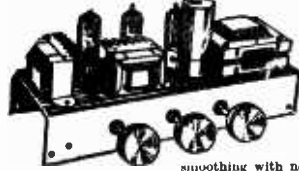
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A.C. mains 200-240 v. Fully insulated heavy duty bolted mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up: 2 x ECL86 Triode Pentodes, 1 x EZ80 as rectifier. Two dual potentiometers are provided 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" x 4 1/2". Overall height including valves 5". Ready built & tested to a high standard. £10.75. P.&F. 50p.

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A super quality gram amplifier using a double wound fully insulated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3.5 watts. Volume and tone controls. Chassis size only 11" wide x 3 1/2" deep x 6 1/2" high overall. A.C. mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer. £4.20 P. & F. 40p BARGAIN PRICE

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**BRAND NEW MULTI-RATIO MAINS TRANSFORMERS** Giving 13 alternative Primary: 210-240V. Secondary combinations 0.5-10-15-20-25-30-35-40-50-60. half wave at 1 amp, or 10-0-10, 20-0-20, 30-0-30v. at 2 amps full wave. Size 3in. long x 3 1/2in. wide x 3in. deep. Price £2.60 P. & F. 40p.

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Designed and styled to match our 10 + 10 amplifier but will suit any other standard stereo amplifier. The design incorporates the very latest circuitry techniques with high-gain, low noise IF stages. Automatic frequency control to "lock-on" station and prevent drift. IC stereo decoder for maximum stereo separation. I.E.D. for stereo beacon indicator. Nominal output of tuner 100mV. Approximate size 12" wide x 8" deep by 2 1/2" high. Supplied ready built, fully tested and fully guaranteed (not available in kit form). Price £28.00 Post and Packing 50p.

**STEREO-DECODER** SIZE 2" x 3" x 1/2" ready built. Pre-aligned and tested. Sens. 20-500 mV for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. £5.00 plus 10p. P. & F. Stereo beacon light if required 40p extra.



**SPECIAL BARGAIN OFFER!** Limited number of BSE C123 Auto Changer De Luxe with lightweight tubular arm and stereo cartridge. Brand new, ONLY £8.00 + P. & F. 60p.

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**CERAMIC STEREO CARTRIDGE.** Universal Mounting brackets and turnover stylus. 70mV per channel output. ONLY £1.75 + 15p P. & F.

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Beautifully made, simulated teak finish enclosure with attractive slatted front. Size 16 1/2" high x 10 1/2" wide x 9" deep (approx.). Fitted with E.M.I. Ceramic Magnet 13" x 8" bass unit, H.F. tweeter unit and crossover. **AVAILABLE IN NOMINAL** 4 Ohm, 8 Ohm or 16 Ohm Impedance (state which). **OUR PRICE £9.50** each Carr. 90p Cabinet Available Separately £5.00, Carr. 90p Also available in 8 ohms with EMI 13" x 8" bass speaker with parasitic tweeter £9.00, Carr. 90p.

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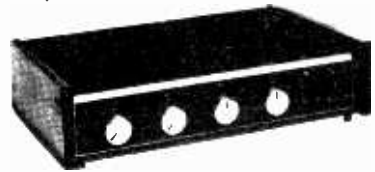
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## HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for 8 to 15 ohms. Compact design, all parts supplied including drilled metalwork high quality ready drilled printed circuit board with component identification clearly marked, smart brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification; Power output: 14 watts r.m.s. per channel into 8 ohms. Frequency response  $\pm$  3dB 12-30,000 Hz. Sensitivity: better than 80mV into 1M $\Omega$ . Full power bandwidth:  $\pm$  3dB 12-15,000 Hz. Bass boost approx. to  $\pm$  12dB. Treble cut approx. to -16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp. Overall size 12" w. x 8" d. x 2 1/2" h.

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

**AMPLIFIER KIT** £18.96 P. & P. 30p (Magnetic input components 33p extra)

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*Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi-Fi Discotheque use, etc.*



### 3-VALVE AUDIO AMPLIFIER HA34 MK II

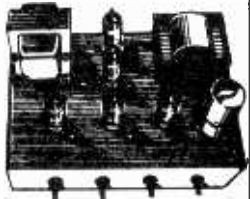
Designed for Hi-Fi reproduction of records, A.C. Mains operation. Ready built on anodised heavy gauge metal chassis, size 7 1/2" w. x 4 1/2" x 4 1/2" h. Incorporates EOC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4 1/2 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £6.50. P. & F. 45p.

speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4 1/2 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £6.50. P. & F. 45p.

**HSL "FOUR" AMPLIFIER KIT.** Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. £5.50 P. & F. 45p.

### 10/14 WATT HI-FI AMPLIFIER KIT

A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-16  $\Omega$  speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, EOC83, EF86 and EZ80 rectifier. Simple instruction booklet included with parts! All parts sold separately. ONLY £10.25 P. & F. 60p. Also available ready built and tested £14.00 P. & F. 70p.



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Adjustable headband with comfortable softfoam ear-cuffs. Wired and fitted with standard stereo 3 1/2 jack plugs. Frequency response 30-15,000Hz. Matching impedance 8-16 ohms. Easily converted for Mono. PRICE £3.50. P. & F. 25p.

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A superb unit with a guaranteed output of 30 watts RMS per channel into 8 ohms. Full power THD is a mere 0.02%, and frequency response is -3 dB from 20 Hz to 100 kHz into 8 or 15 ohms. Electro Spares have already sold 100s and 100s of these Kits. Get yours now! Depending on your choice of certain components, the price can vary from £50 to £60 inc. VAT and p & p.

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*in radio television  
and electronics*

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# NEW MULLARD & MAZDA VALVES

All individually boxed and guaranteed. Full trade discounts to bona fide companies. Price and availability lists on application.

## EXPRESS POSTAGE

5p for 1 Valve.  
Each additional Valve add 2p.

DM70 0-81	ECL83 0-86	GY501 1-18	PL82 0-48	30C1/PCF80 1-04
DY31 0-80	ECL86 0-84	GZ34 0-80	PL83 1-04	30C15/ 0-54
DY86/7 0-41	EF90 0-42	PC88 0-95	PL500 0-90	PCF800 1-01
DY802 0-46	EF83 0-98	PC89 0-42	PL504 0-90	PC317 1-01
EABCC80 1-03	EF85 0-42	PC800 0-57	PL508 1-24	30C18/ 1-00
EB91 0-64	EF86 1-16	PC855 0-60	PL509 1-56	PCF805 1-00
EBF81 0-79	EF89 1-14	PC880 0-64	PL802 1-40	30F5/FF818 1-03
EBF83 0-58	EF91 1-10	PC889 0-80	PY33 0-65	30FL1/ 1-03
EBF89 0-53	EF92 1-37	PC8189 0-80	PY82 0-57	PC8E800 0-80
EC86 0-73	EF183 0-83	PCF802 1-22	PY800A 1-02	30FL12 1-13
EC88 0-76	EF184 0-83	PCF85 0-84	PY800 0-49	30FL14 0-84
EC90 0-86	EF190 0-85	PCF200 1-00	PY801 0-49	30L1/PC84 0-84
EC97 0-60	EL34 0-92	PCF201 0-00	U26 0-88	
ECC81 0-47	EL35 1-01	PCF801 0-64	U91 0-88	
ECC82 0-44	EL84 0-47	PCF802 0-70	U193 0-54	
ECC83 0-47	EL85 0-86	PCF806 0-64	UABC80 0-90	PC8E805 1-03
ECC84 0-58	EL86 0-82	PCF82 0-58	UBC81 0-71	30L17 0-89
ECC85 0-71	EL89 0-90	PCF83 0-64	UF89 0-58	30F4MR 1-27
ECC88 0-84	EL95 0-72	PCFL84 0-61	UC88 0-49	30P12/ 1-00
ECC189 0-68	ELL80 2-50	PCL85 0-64	UJCH81 1-12	PC801 1-01
ECF80 0-60	EM81 1-10	PCL86 0-64	UJCH82 0-72	PC802 0-89
ECF82 0-68	EM84 1-19	PCL805/85 0-84	UF89 0-80	30PL1/ 1-00
ECF86 0-68	EM87 1-16		UL84 0-92	PCL801 1-00
ECF81 1-16	EY51 0-75	PD500 1-28	UA88 0-54	30P15/ 1-15
ECH83 0-94	EY86/7 0-40	PFL200 0-83	6/30L2/ 0-84	PCL500 1-15
ECH84 1-00	EY88 0-72	PL36 0-90	ECC804 0-98	30PL14/ 1-85
ECL80 0-67	EZ60 0-54	EL81 0-77	EF23/EF812 1-03	30PL15 1-13
ECL82 0-64	EZ81 0-38	PL81A 0-90		

# NEW VALVES

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

AZ1 0-75	EF39 1-25	N78 3-50	PY500 1-10	6F28 0-75
AZ31 0-60	EF80 0-85	OA2 0-45	PY81/800 0-50	6J5M 0-65
CBL31 1-40	EF85 0-45	OB2 0-45	SP41 3-00	6J6 0-80
CL33 1-50	EF86 0-50	OC86 0-65	SP41 3-00	6J7G 0-80
CY31 0-60	EF89 0-35	PC88 0-85	T41 1-00	6J7M 0-85
DAF91 0-40	EF91 0-40	PC97 0-55	U14 0-75	6K6GT 0-80
DAF96 0-60	EF92 0-50	PC900 0-55	U25 1-00	6K7G 0-85
DC90 1-35	EF95 0-45	PC884 0-45	U26 0-85	6K7M 0-45
DF91 0-40	EF98 0-80	PC888 0-82	U191 0-75	6K8G 0-45
DF96 0-60	EF183 0-40	PC889 0-55	UA88 0-54	6K8M 0-70
DK91 0-50	EF184 0-40	PC8189 0-85	UF42 0-75	6K25 1-00
DK92 1-00	EL32 0-80	PCF80 0-40	UBC41 0-60	6L6G 0-55
DK96 0-75	EL33 2-00	PCF82 0-42	UBC81 0-50	6Q7G 0-40
DL92 0-50	EL34 0-70	PCF86 0-65	UBF80 0-50	6Q7M 0-60
DL94 0-48	EL36 0-60	PCF801 0-60	UBF89 0-50	6SL7GT 0-85
DL96 0-55	EL37 0-50	PCF802 0-65	UC85 0-60	6S7GT 0-85
DY86 0-42	EL41 0-90	PCF805 0-90	UCH42 0-60	68Q7GT 0-40
DY87 0-45	EL42 1-65	PCF806 0-90	UCH81 0-50	6V6GT 0-80
DY802 0-47	EL84 0-35	PCF808 0-90	UCL82 0-40	6V6G 0-80
EABCC80 0-38	EL95 0-60	PCL82 0-45	UCL83 0-79	6V6GT 0-80
EAF42 0-70	ELL80 2-00	PCL83 0-70	UF41 0-75	6X4 0-45
EB91 0-25	EM80 0-55	PCL84 0-60	UF89 0-50	6X6G 0-65
EB93 1-00	EM81 0-60	PCL85 0-60	UL41 0-85	6X6GT 0-55
EB94 0-75	EM84 0-40	PCL86 0-60	UL84 0-85	7B6 0-80
EB98 0-40	EM85 1-00	PCL805/85 0-60	UY41 0-50	7B7 0-80
EBF83 0-40	EY86 0-45	PD500 0-60	UY85 0-45	7C8 1-30
EBF89 0-32	EZ40 0-60	PEM45 0-85	VR105/30 0-40	7C8 1-30
EBL31 2-00	EZ41 0-75	PL36 0-85	VR150/36 0-45	7I7 0-80
ECC81 0-45	EZ80 0-30	PL81 0-45	OA2 0-45	7R7 0-80
ECC82 0-38	EZ81 0-31	PL82 0-50	OB2 0-45	787 2-25
ECC83 0-38	GY501 0-90	PL83 0-50	OR2 0-45	7Y4 0-40
ECC84 0-35	GZ30 0-85	PL84 0-80	1R5 0-50	12A76 0-45
ECC85 0-45	EZ82 0-65	PL85 0-85	1R4 0-40	12A77 0-45
ECC88 0-80	GZ34 0-75	PL504 0-85	3B4 0-50	12A78 0-50
ECH35 1-50	GZ37 1-25	PL508 0-90	3V4 0-95	12A79 0-88
ECH42 0-85	JIN309 1-50	PL509 1-55	5R4GY 1-00	12AX7 0-88
ECB81 0-35	KT61 2-00	PL802 1-00	5U4G 0-55	12BA6 0-60
ECB83 0-60	KT66 2-50	PX4 3-50	5Y3GT 0-85	12B6E 0-80
ECL80 0-60	KT81 (7C3) 1-30	PC85 3-50	5Y4G 0-60	30C1 0-40
ECL82 0-42	KT82 1-30	PY33 0-83	6Z4G 0-65	30C1E 1-00
ECL83 0-75	KT81 1-75	PY81 0-45	6/30L2 0-90	30C17 1-00
ECL86 0-55	KT88 2-90	PY82 0-45	6AK5 0-45	30C18 0-90
ECLL800 3-50	KTW61 1-50	PY83 0-50	6AM5 1-00	30F5 1-00
EF37A 1-20	MU14 1-00	PY88 0-50	6AQ5 0-60	30FL1 1-00

# TRANSISTORS-INTEGRATED CIRCUITS

## EXPRESS POSTAGE

5p for 1st Transistor, for each additional add 1p.

AA119 0-07	BD124 0-80	OA200 0-08	ZTX500 0-16	2N2904 0-20
AA127 0-10	BD131 0-45	OA202 0-10	ZTX501 0-15	2N2904A 0-25
AAZ15 0-10	BD132 0-50	OC16 1-00	ZTX503 0-18	2N2905 0-32
AC107 0-85	BF115 0-22	OC20 2-00	ZTX531 0-25	2N2906A 0-25
AC126 0-25	BF167 0-25	OC23 1-25	ZTX550 0-18	2N2906 0-20
AC127 0-25	BF173 0-28	OC28 0-70	IN4001 0-07	2N3053 0-20
AC128 0-20	BF179 0-33	OC35 0-55	IN4002 0-07	2N3055 0-60
AC176 0-25	BF180 0-35	OC36 0-65	IN4003 0-08	2N3055 0-60
AC178 0-25	BF181 0-35	OC42 0-40	IN4004 0-08	2N3624 0-80
AC188 0-20	BF194 0-35	OC44 0-18	IN4005 0-12	2N3616 0-65
ACY21 0-22	BF195 0-13	OC45 0-18	IN4006 0-10	2N3702 0-11
ACY39 0-65	BF197 0-16	OC72 0-25	IN4007 0-12	2N3703 0-12
AD140 0-60	BF200 0-32	OC76 0-20	IN4008 0-06	2N3704 0-14
AD149 0-60	BF561 0-25	OC77 0-25	IN4009 0-06	2N3705 0-15
AD161 0-60	BF808 0-25	OC81 0-25	18R21 0-07	2N3706 0-11
AD162 0-60	BFW10 0-61	OC81 0-25	18R23 0-07	2N3707 0-11
AF115 0-25	BFX29 0-28	OC81D 0-28	18R23 0-07	2N3708 0-07
AF116 0-25	BFX88 0-22	OC81Z 0-45	18R23 0-07	2N3709 0-10
AF117 0-20	BFY60 0-20	OC83 0-25	18R30 0-25	2N3710 0-11
AF186 0-40	BFY61 0-20	OC83 0-25	18R30 0-25	2N3711 0-11
AFY29 0-44	BFY92 0-20	OC83 0-25	18R30 0-25	2N3712 0-11
ABY27 0-80	BY126 0-14	OC140 1-00	2N695 0-15	2N3711 0-11
ABY28 0-80	BY127 0-15	OC170 0-25	2N696 0-15	2N3712 0-11
BA109 0-12	BZ X61 series 0-20	OC171 0-20	2N706 0-10	2N3820 0-60
BC107 0-12	BZY88 series 0-20	OC200 0-55	2N706A 0-12	2N3823 0-50
BC108 0-12	CR81-05 0-40	OC201 1-00	2N1131 0-25	2N3903 0-15
BC109 0-12	CR81-40 0-45	OC202 0-90	2N1132 0-25	2N3904 0-20
BC113 0-16	CR83-05 0-40	OC203 0-55	2N1302 0-18	2N3905 0-25
BC117 0-21	CR83-06 0-40	OC203 0-55	2N1302 0-18	2N3905 0-25
BC143 0-80	CR85-40 0-75	OC203 0-55	2N1302 0-18	2N3905 0-25
BC147 0-12	MJE320 0-80	OC203 0-55	2N1302 0-18	2N3905 0-25
BC148 0-10	MJE370 0-85	OC203 0-55	2N1302 0-18	2N3905 0-25
BC162C 0-14	MJE520 0-65	OC203 0-55	2N1302 0-18	2N3905 0-25
BC182 0-12	MJE2965 1-10	OC203 0-55	2N1302 0-18	2N3905 0-25
BC182L 0-12	MJE3055 0-75	OC203 0-55	2N1302 0-18	2N3905 0-25
BC184L 0-18	MPF102 0-40	OC203 0-55	2N1302 0-18	2N3905 0-25
BC187 0-12	MPF103 0-35	OC203 0-55	2N1302 0-18	2N3905 0-25
BCY32 1-20	MPF110 0-35	OC203 0-55	2N1302 0-18	2N3905 0-25
BCY83 0-88	MPF105 0-45	OC203 0-55	2N1302 0-18	2N3905 0-25
BCY84 0-45	NKT404 0-60	OC203 0-55	2N1302 0-18	2N3905 0-25
BCY70 0-18	OA5 0-60	OC203 0-55	2N1302 0-18	2N3905 0-25
BCY71 0-18	OA10 0-40	OC203 0-55	2N1302 0-18	2N3905 0-25
BCY72 0-18	OA11 0-10	OC203 0-55	2N1302 0-18	2N3905 0-25
BCY73 0-18	OA81 0-18	OC203 0-55	2N1302 0-18	2N3905 0-25
BD121 1-00	OA91 0-07	OC203 0-55	2N1302 0-18	2N3905 0-25

BN7400 0-80	BN7425 0-87	BN7478 0-44	BN74107 0-51	BN74107 1-09
BN7401 0-80	BN7427 0-87	BN7479 0-48	BN74110 0-51	BN74170 2-88
BN7402 0-80	BN7428 0-48	BN7475 0-58	BN74111 0-86	BN74174 1-80
BN7403 0-80	BN7430 0-80	BN7476 0-48	BN74112 0-86	BN74175 1-44
BN7404 0-80	BN7432 0-87	BN7480 0-80	BN74113 0-86	BN74176 1-44
BN7405 0-80	BN7438 0-48	BN7482 0-87	BN74114 0-86	BN74177 2-80
BN7406 0-40	BN7437 0-48	BN7483 1-20	BN74115 0-86	BN74178 2-80
BN7407 0-40	BN7438 0-48	BN7484 1-00	BN74116 0-86	BN74179 2-80
BN7408 0-28	BN7440 0-48	BN7485 0-80	BN74117 0-86	BN74180 2-80
BN7409 0-28	BN7441A 0-48	BN7486 0-75	BN74118 0-86	BN74181 2-80
BN7410 0-80	BN7442 0-85	BN7491A 0-85	BN74119 0-86	BN74182 2-80
BN7411 0-28	BN7442 0-85	BN7491A 0-85	BN74120 0-86	BN74183 1-44
BN7412 0-28	BN7443 0-85	BN7492 1-10	BN74121 0-86	BN74184 1-88
BN7413 0-80	BN7445 0-80	BN7493 0-78	BN74122 0-86	BN74185 1-88
BN7414 0-80	BN7446 0-80	BN7494 0-78	BN74123 0-86	BN74186 1-88
BN7415 0-80	BN7447 0-80	BN7495 0-85	BN74124 0-86	BN74187 1-88
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BN7417 0-80	BN7449 0-80	BN7497 4-32	BN74126 0-86	BN74189 1-88
BN7420 0-80	BN7450 0-80	BN7498 4-32	BN74127 0-86	BN74190 1-88
BN7422 0-28	BN7472 0-38	BN7499 2-16	BN74128 0-86	BN74191 1-88

# THIS MONTH'S

## OSCILLOSCOPE TUBES

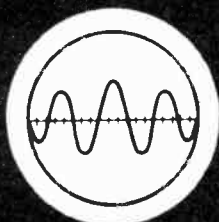
Types CV 1526,  
DG 7-5, VCR 139A

All at £8.00 each, + p & p 25p.

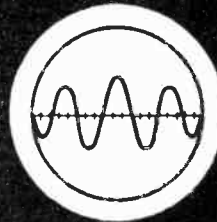
# SPECIAL OFFER

TERMS OF BUSINESS: C.W.O. A/c's available to approved companies on application. Telephone and telex orders accepted. Export and trade enquiries welcomed. Lists, etc. on application. Open daily to callers 9 a.m.-5 p.m. Mon.-Sat. Closed Sat. 1-3 p.m. Prices correct when going to press.

# VALVE MAIL ORDER CO.



# TUAC



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

## TUAC DISCOTHEQUE MIXER WITH AUTO FADE



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

Specification: Deck Inputs—50mV into 1m $\Omega$ ; Deck Tone Controls—Treble +20 - 10dB at 12kHz. Bass +22 - 15dB at 40Hz; Mic input—200 ohms upwards. 2mV into 10k $\Omega$ ; Mic Tone Control—Total Variation Treble 15dB. Total Variation Bass 10dB; Tape input—30mV into 47k $\Omega$ ; Power Requirements—30-45 volts at 100mA.

**£26.50**

PANEL SIZE  
18 x 4½ in.  
DEPTH 3in.

### HOW TO ORDER BY POST

Make cheques/P.O.s payable to TUAC LTD (P.W.2). OR QUOTE ACCESS/BARCLAYCARD No. and post to TUAC LTD (P.W.2). 163, MITCHAM ROAD, LONDON S.W.17 9PG.

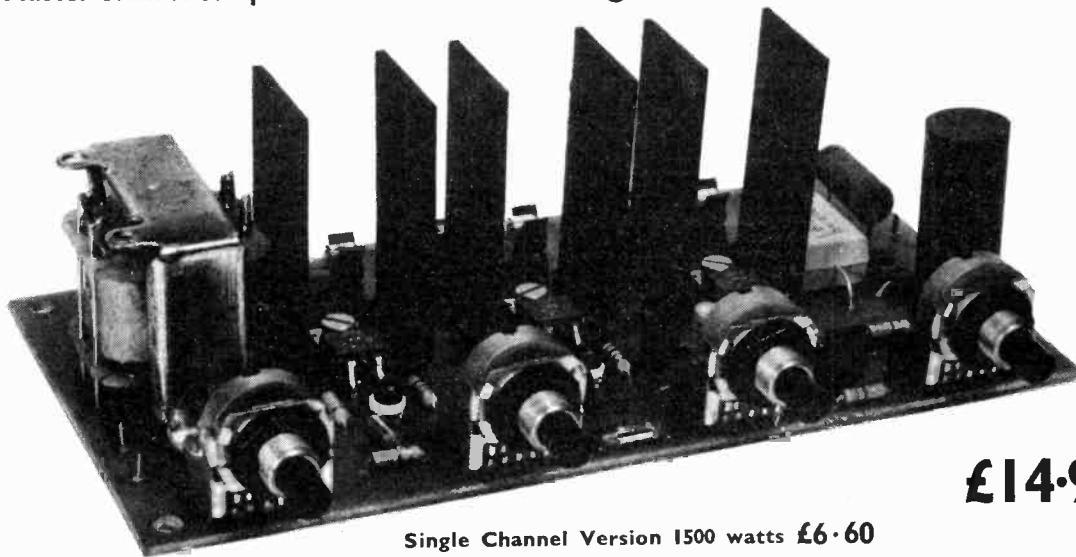
We accept Phone orders against ACCESS/Barclay Card Holders. Phone. 672 3137/9080.

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ARTHUR SALLIS LTD. 28 Gardner St., BRIGHTON, Sussex. Tel. 65806  
BRISTOL DISCO CENTRE 86 Stokes Croft, BRISTOL 1. Tel. 41666  
SOCODI 9 The Friars, CANTERBURY. Tel. 60948  
CALBARRIE AUDIO 88 Wellington St., LUTON. Tel. 411733  
A.I. MUSIC CENTRE 88 Oxford St., MANCHESTER. Tel. 236 0340  
DAMON ELECTRONICS 99 Carrington St., NOTTINGHAM. Tel. 53880  
MITCHELL ELECTRONICS 64 Winchester St., SALISBURY. Tel. 23689  
WEC LIGHTING 35 Northam Road, SOUTHAMPTON. Tel. 28102

## 3 CHANNEL LIGHT MODULATOR

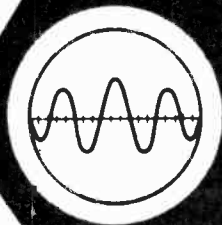
- R.C.A. 8 Amp Triacs ● 1000W per channel ● Each channel fully suppressed and fused
- Master control to operate from 1W to 100W ● Full wave control—12 easy connections



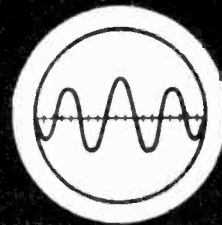
**£14.90**

Single Channel Version 1500 watts **£6.60**

MANUFACTURERS OF ELECTRONIC AND AMPLIFICATION EQUIPMENT  
SPECIALISTS IN QUALITY TRANSISTOR EQUIPMENT · OPEN 6 DAYS A WEEK 9.30am-6.00pm

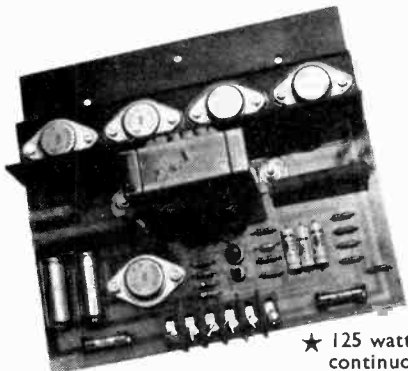


# TUAC



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

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



Specification on all power modules:  
All output power ratings  $\pm 0.5$ dB;  
Output impedance 8-15 ohms; THD at full power 2% typically 1%;  
Input sensitivity 60mV into 10k $\Omega$ ;  
Frequency response 20Hz-20kHz  $\pm 2$ dB; Hum and noise better than -70dB.

**TP125**

7 x 6 $\frac{1}{2}$  x 3in

**£17.00**

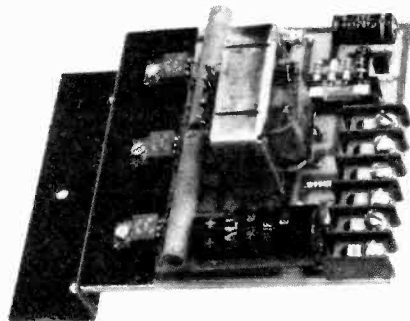
★ 125 watts RMS continuous sine wave output

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

**TL30**

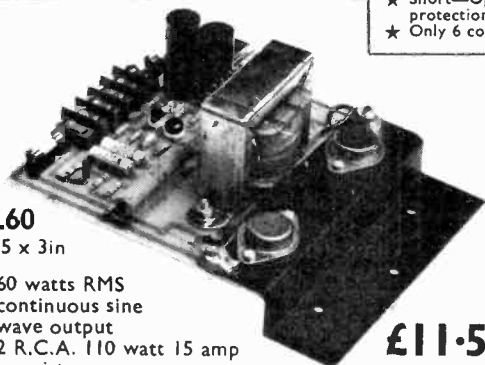
4 x 5 $\frac{1}{2}$  x 2 $\frac{1}{2}$ in

**£7.90**



★ 30 watts RMS continuous sine wave output  
★ 2 R.C.A. 40 watt output transistor

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



**TL60**

5 x 5 x 3in

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

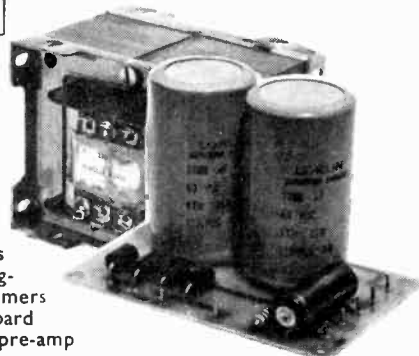
**£11.50**

**TL100**

5 x 5 x 3in

★ 100 watts R.M.S. continuous sine wave output  
★ 2 R.C.A. 150 watt 15 amp transistors

**£13.20**



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

PS 125  $\pm$  50 volts for one TP125 ..... **£11.50**  
PS 100  $\pm$  45 volts for one TL100 ..... **£10.50**  
PS 60  $\pm$  40 volts for one TL60 ..... **£9.30**  
PS 30  $\pm$  50 volts for one TL30 ..... **£5.90**  
PSU 2 for supplying disco mixer ..... **£4.65**

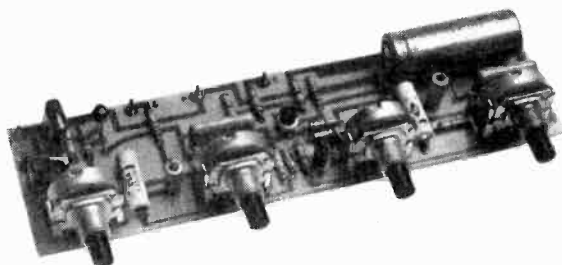
## PREAMPLIFIERS

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

**VA08** Vol, Treble, Mid and Bass controls. Hi. IMP. FET, I/P suitable Mid, Guitar, Radio, Crystal/Ceramic P.U. Sensitivity 4mV. Treble +35dB at 16kHz. Mid +20-15dB at 1Hz. Bass +20-10dB at 40Hz. **£4.90**

**VA06** Vol, Treble and Bass controls. Sensitivity 8mV. Treble +28-15dB at 12kHz. Bass +18dB at 40Hz. **£4.15**

**SVA01 STEREO PRE AMP**; Vol, Treble, Mid and Bass controls. Hi. IMP. FET, I/P suitable Mid, Guitar, Radio, Crystal/Ceramic P.U. Sensitivity 4mV. Treble +35dB at 16kHz. Mid +20-15dB at 4kHz. Bass +20-10dB at 40Hz. Plus Full Balance Control **£10.00**



**ALL PRICES INCLUDE V.A.T. (8%) AND POSTAGE AND PACKING**

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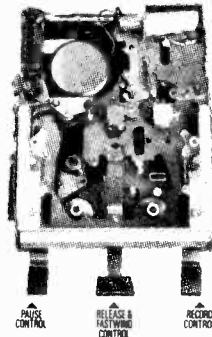
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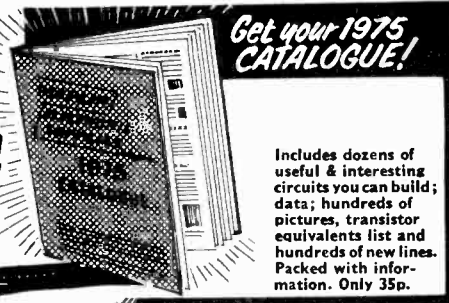
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 12-0-12V 50mA 95p  
 (Size both approx. 30 x 27 x 25mm)  
 Min. mains  
 0-6V 500mA, 0-8V 500mA £1.36  
 0-12V 250mA, 0-12V 250mA £1.36  
 0-20V 150mA, 0-20V 150mA £1.36  
 0-24V 125mA, 0-24V 125mA £1.36  
 Mains MT3AT: Sec: 12-15-20-24-30V 2A £3.60  
 Mains MT206AT: Sec: 0-15-20V 1A, 0-15-20V 1A £3.98

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 Sloping-front 61-note C to C £20.44  
 Swell pedal with 10k log. pot £5.98  
 \*Spring Line Unit (Short) £3.05  
 \*Spring Line Unit (Long) £7.59  
 \*Reverberation Driver Module £5.84  
 \*S.A.E. pleaser for full details: leaflet MES 24. Gold-clad phosphor-bronze wire 30p per yd. Palladium earth bar 15p per octave length. Contact Blocks 2-make (GB2) 22p  
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# Thou shalt not listen!

**H**OW many of our readers have tuned their radio receivers over the long, medium, short and v.h.f. wavebands and have often paused to identify and listen to the many different transmissions that can be received?

There are many radio transmissions that can be picked up on domestic receivers that if received by you—and it is necessary to listen, to identify these transmissions—you would by listening, be committing an indictable offence under Section 5 of the 1949 Wireless Telegraphy Act.

Pause for a moment to think—how many of us have listened to either the police, fire brigade, taxis or aircraft transmissions that suddenly appear—often breaking through on top of other stations—as we tune our v.h.f./f.m. receivers or tuners? You are all GUILTY of the offence of LISTENING and the penalties for this offence are severe!

We have recently received, from a department of the Home Office, a letter which draws attention to the receiver design, *Low Frequency and Marine Receiver* by Charles Heath, that appeared in the January 1975 issue of this magazine. This receiver, if constructed and used for listening to transmissions from other than broadcast or licensed Amateur stations, render the listener liable for prosecution. It was requested that we should draw this interpretation of the 1949 Act to the attention of our readers.

Many of our wavebands—especially the Amateur bands are operated on a shared basis. This means that you—members of the public—may listen to licensed Amateur stations within these bands but not to the unending garble that emanates from the transmitters of the so-called “privileged” user. Take for example, one form of privileged transmission that litters the 80m Amateur band—not Amateur stations—they have no privilege: we refer to the never-ending “traffic” between North Sea oil rigs and their base stations. These stations, operating within the 80m Amateur band transmit without any identification for prolonged periods. Thou shalt not listen to them!

Quite recently, there was a spate of station closure notices, some served without prior warning, upon licensed Amateur stations (the non-privileged) by the Home Office—for what could only be, in the opinion of many, minor infringements of the regulations.

Licensed Amateur stations are required to identify themselves regularly during transmission times. Hands up anyone who has heard the station operators on oil rigs identify themselves? Remember, we are now discussing transmissions from “privileged” users in an Amateur band. These are but a few of the many “privileged” transmissions that, in the opinion of the Home Office, are entitled to a degree of privacy of transmission. These regulations are seeking to preserve the confidential nature of the messages which are not intended for reception by members of the public. There is no privacy or sanctuary for the licensed radio Amateur.

During a recent BBC television programme (Barlow, BBC-1, Jan. 8th, 1975) it was stated that it was *not illegal* to listen to public service broadcasts!! Poor Barlow—who will have whom on the carpet this time?

A recent report in the *Daily Express* (see Letters on page 1036 of this issue “Plane Spotters Beware”) brings forth comment from one of our readers.

Listeners, beware!!

LIONEL E. HOWES—Editor.

## NEWS...

### Frequency List from the United States

**T**HE most casual twirl of the dial of an all-band receiver reveals hundreds of radio signals that are neither broadcasters nor radio amateurs. Many of these signals are unintelligible meaningless sounds, and although your curiosity may be aroused to wonder who they are, finding out has, up to now, not been a simple or easy task. The purpose of this book is to shed some light on the question of identification of these many signals—predicated upon information not generally available in print.

The title of this book, *Confidential Frequency List*, is not intended to be facetious. In every country around the world there are prohibitions about “listening in” or “monitoring” the stations listed in this book. These prohibitions range from extreme to extreme: including outright forbidding (with penalties) to simple warnings that the content of the broadcasts must not be revealed to a third party. Although it is problematical how some of these prohibitions can be enforced—and what useful purpose they serve—it is NOT the desire, nor intent, of the author and/or the publisher to encourage circumvention.

This handbook is the distillation of various data from a great number of sources: private commercial, governmental and off-the-air monitoring. Although every effort possible has been made to verify these data, it is not to be expected that this book is 100% accurate. However, in the opinion of the author and publisher, it is the best that can be done without specifically violating some governmental radio security, although “classified” radio stations can frequently be overheard on many ordinary radio receivers.

Copies of the *Confidential Frequency List* are available from the publishers, *Ham Radio Magazine, Greenville, New Hampshire, U.S.A.* for £1.70. Payment may be made either by international money order or a British cheque.



### Calculator programmer

**A** NEW programming device, developed by Advance Electronics Limited for use with the 162P low-cost programmable calculator extends the capabilities of this machine for dealing with routine, repetitive calculations. Programmes are punched onto a plastic strip which is fed through a slot in the calculator to load the programme into the machine. Thus standard programmes of up to 40 steps in length can be held in permanent form. In addition, a simple mechanical "punch" is available for users to write their own programmes.

On the standard 162P calculator, programmes are fed into the machine directly from the keyboard, and the calculator can retain two programmes at any one time: one of up to 30 steps and one of up to ten steps in length.

Although these limitations are not significant for many applications, there are cases where users are continually carrying out several standard calculations, and clearly these users will benefit from having the programme in a permanent form ready to load into the machine.

In operation, the new pro-

gramming device bypasses the indentations on a sprocketed plastic strip, which is fed over a sensing device by a miniature drive motor. A novel principle is used in the patented sensing device; the indentations in the plastic strip are 'detected' by a row of miniature ball bearings which then depress a strip of electrically conductive rubber onto a row of contacts.

The plastic strips are about 30cm long (the exact length depends on the number of programme steps required), and are shaped so that pushing the strip into the slot on the calculator starts up the drive mechanism.

The 162P calculator fitted with the new programming mechanism and complete with the programming punch costs £249 (Plus V.A.T.). The mechanical punch for writing the programmes is available separately at a cost of £15. In addition, Advance Electronics is making available a series of commonly used programmes, as well as providing an advisory service to users who wish to write their own programmes. More information from: *Advance Electronics Ltd., Calculator Division, Raynham Road, Bishop's Stortford, Herts.*

### Pressure transducers

**S**E LABS, EMI's instrumentation and measurement company have added the EPI-080 series transducers to their range.

These miniature pressure transducers are capable of measuring static and dynamic pressures where small size and minimum pressure sensing area are of prime importance. The transducers incorporate semiconductor techniques which represents a significant advance in micro-circuitry.

#### Price increase

Like so many other magazines, *Practical Wireless* has become a victim of the ever-increasing world paper shortage resulting in large increases in the cost of raw materials. So that we can maintain our high standard of providing technical information and projects for readers, we have been forced to increase our cover price to 30p.

### "Exhibition madness" says APAE man

**T**HE President of the Association of Public Address Engineers, Keith Monks appealed recently to all interested parties to get together and sort out the "exhibition madness that is overtaking the audio industry".

He pointed out to members of the Press that in 1975 there are seven exhibitions of interest to everyone in the audio industry. All these shows take place within six weeks of one another.

Mr. Monks said that even if it was not possible to arrange a single venue, common dates should be arranged. If this were done, foreign visitors could make one visit to Great Britain and cover all the shows.

The APAE Exhibition, or "Sound 75 International Exhibi-

### Heathkit catalogue



**T**HE new Heathkit catalogue contains details of a great range of kits—many available for the first time in this country, like GR-1075 AM/FM Digital Electronic Alarm Clock-Radio; IC-2100 Desktop Slide-rule Calculator; GC-1093 Digital Electronic Car Clock/Timer; CI-1080 Exhaust Gas Analyser; CM-1073 Tune-Up Meter; IO-4510 Triggered, Dual-Trace Oscilloscope; IG-1271 Function Generator; SB-104 Solid-State SSB Transceiver with Digital Readout; HP-1144 AC Power Supply for the SB-104; SB-604 Station Speaker for the SB-104; SB-230 Linear Amplifier; SB-614 Station Monitor for the SB-104; SB-634 Station Console for the SB-104; SB-644 Remote VFO for the SB-104.

There is an article included which tells about kit building "The Heathkit Way" and shows how easy it is to construct a kit.

If you would like a copy of this new catalogue, which is free, write to *Heath (Gloucester) Limited, Bristol Road, Gloucester, GL2 6EE*. If you want to phone for one the number is Gloucester (0452) 29451.

tion" will take place from 11-13th March at the Bloomsbury Centre Hotel, London.

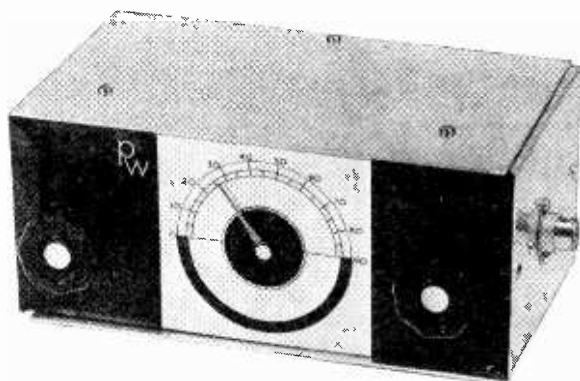
Among exhibitors there for the first time, will be firms from Japan and Finland.

# 2 VHF Converters

## PART 1

G. SEVERN

USED in conjunction with a communications receiver, either of these converters will give VHF reception, bringing in amateur and other transmissions and in some cases TV sound programmes, using only a simple dipole aerial. The simpler converter is tunable and the more complex converter is crystal controlled, so a few notes on the advantages and limitations of each method should prove helpful.



### TUNABLE CONVERTER

This is relatively simple, inexpensive and can be used over a wide band by adjusting the pre-set tuning. Though only two transistors are used, little gain is expected from an RF stage at these frequencies, so that sensitivity is quite good without this stage. An important advantage arises from the fact that the receiver can be tuned to a frequency where breakthrough of unwanted transmissions is minimal and tuning carried out on the converter. With the equipment used in this way, the receiver acts as a fixed tuned IF amplifier.

### CIRCUIT

This is shown in Fig. 1. The aerial feeder is connected to L1 while L2 is adjusted to the wanted band by trimmer TC1. As L2 tunes broadly TC1 need not be adjusted except when setting up for a different band. Tr2 is the local oscillator tuned by the 4.5pF variable capacitor VC1, operated by a cord drive. TC2 is a trimmer for the oscillator coil L5, with injection via C4 to gate 2 of the dual-gate mixer Tr1. (Gates 1 and 2 must not be reversed.)

Output from Tr1 goes to L3 which is tuned to about 10MHz. The coupling winding L4 provides a means of connecting a screened co-axial lead to the receiver, while the frequency of L3 can be adjusted by tuning its core for best signal strength

at around the receiver frequency to be used. The latter, of course, should be free from unwanted short wave signals.

### CIRCUIT BOARD

The components, with the exception of Tr1, are placed as shown in Fig. 2 and the board turned over so that their leads can be soldered. Two tags are bolted on at the point MC. All leads should be as short as reasonably practicable.

When wiring of this board is finished, with the exception of Tr1, take Tr1 and check that the collar, spring or binding of thin wire which shorts its four leads is present. Adjust the leads with a matchstick so that they come through the board as shown, and solder them. The means of shortening the four leads can then be removed. Touching the leads of Tr1 with a metal or plastic tool, or the fingers, can be expected to damage this transistor, until R1, R2 and R3 are connected, thereby protecting the insulated gates against static charges

### PANEL ASSEMBLY

The panel is a 7 x 3in flanged universal chassis member with VC1 mounted centrally. Fit the on-off switch and drive cord spindle at 2½in distance each

### ★ components list

#### TUNABLE CONVERTER

##### Resistors

R1 100kΩ	R5 1kΩ
R2 2.2kΩ	R6 10kΩ
R3 100kΩ	R7 10kΩ
R4 15Ω	All 5 or 10% ¼ or ½W

##### Capacitors

C1 22pF	C5 0.02μF
C2 1000pF	C6 1000pF
C3 39pF	C7 5pF
C4 5pF	C8 5000pF

All disc or tubular ceramic preferred  
 TC 1/2 30pF Philips type airspaced trimmer  
 VC1 4.5 pF variable (Jackson C804)

##### Semiconductors

Tr1 3N141	Tr2 BF200
-----------	-----------

##### Miscellaneous

L3, former ⅜in. dia. with core. Drum drive, 2½in. dia. with cord, spring and drive spindle (Home Radio). Casework, 7 x 4 x 3in. universal chassis with extra plate 7 x 4in. (Home Radio). Perspex 7 x 4in, approx ⅜in. thick. Knobs. Co-axial sockets (2). Veroboard 2 x ½in. 0.15in. Matrix. On-off switch. PP3 battery, terminal clips and holder.

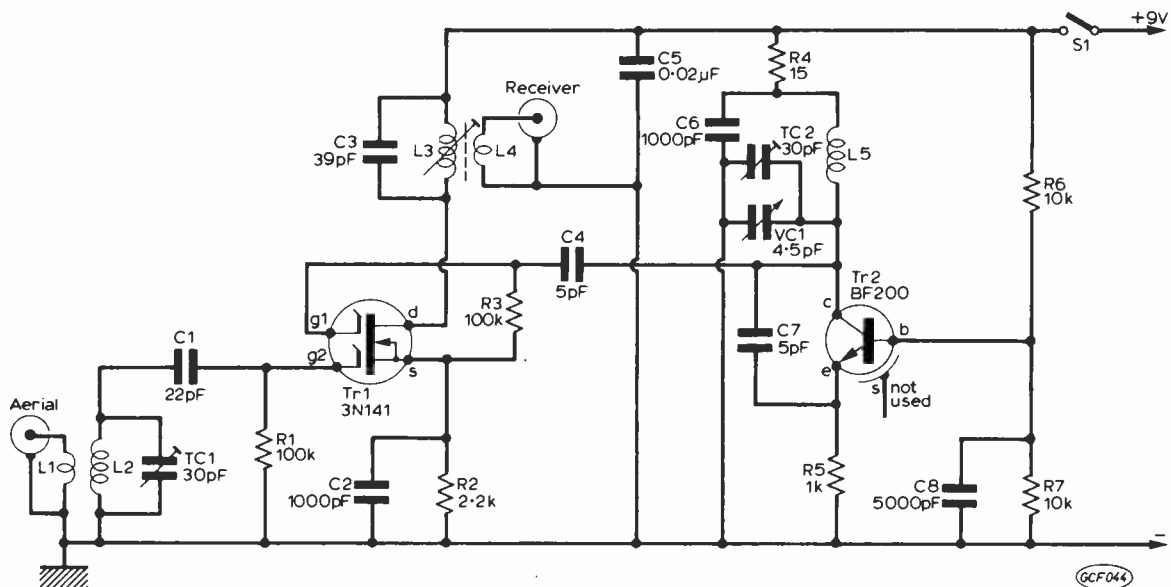


Fig. 1: Two transistors are the basis of this circuit for the tuned converter.

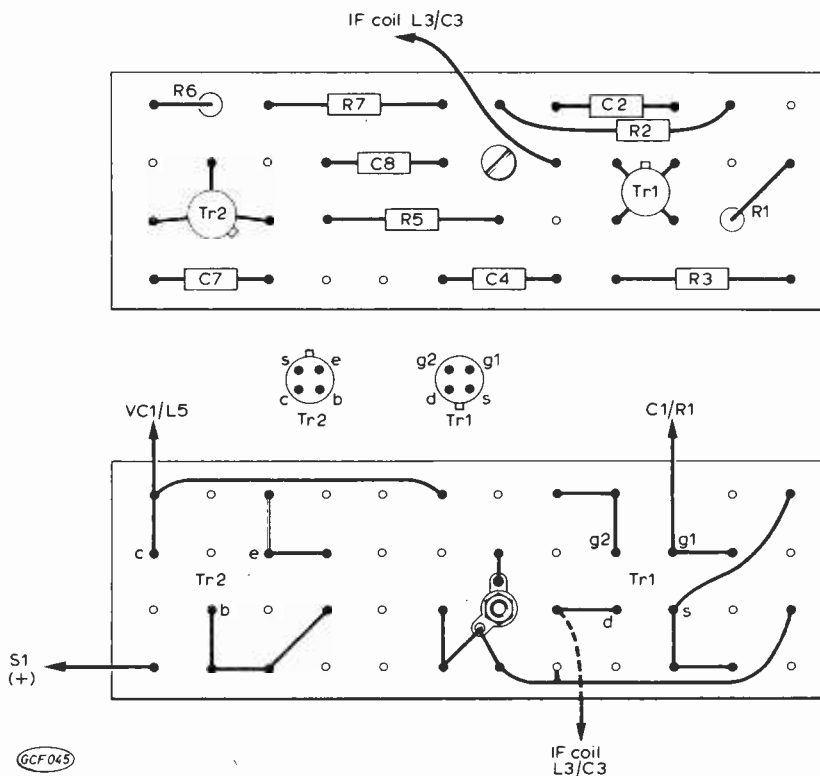


Fig. 2: Layout of components and wiring on the circuit board for Fig. 1.

from VC1. Set VC1 back by extra washers or an extra nut and the drive spindle forward by similar means. (If this is not done, insufficient spindle may project for the tuning knob.)

Solder TC2 directly to VC1 fixed plates and solder a stout wire about 1in long to the moving plates tag of VC1, letting it project backwards. Solder the MC tag of the board to this, as in Fig. 2 and make good other connections. Note that the board is horizontal, behind VC1 (as in the photograph of the

rear of the converter). The shortest possible leads are used to TC1, C1, L2, C6, L5 and TC2.

## COILS

L2 consists of 5 turns of 22 swg wire, formed by winding round an object  $\frac{1}{4}$ in in diameter, with its ends soldered directly to TC1. L1 comprises 2 turns of similar diameter, supported by taking one end to the co-axial aerial socket, and the other to a stout wire which runs from VC1 to MC, as shown in Fig. 3.

GCF046

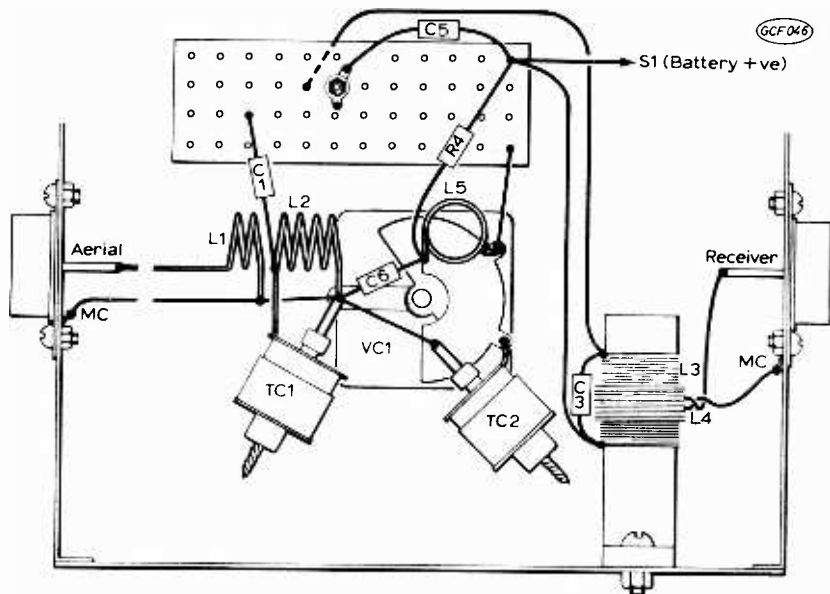
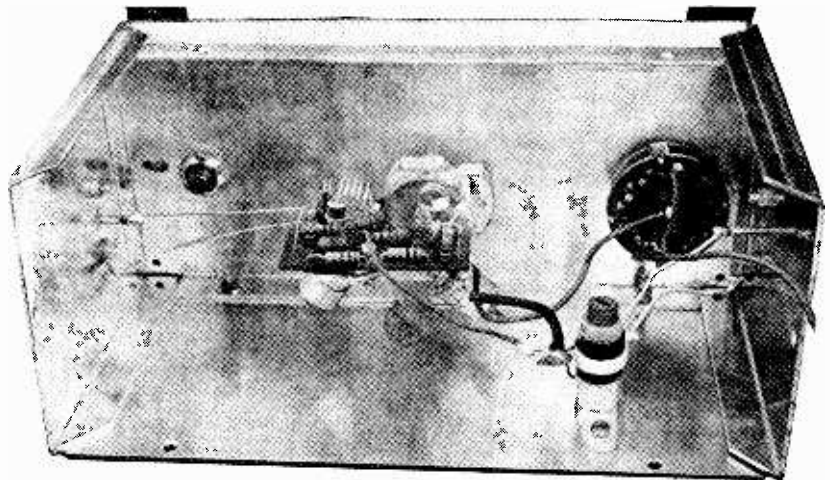


Fig. 3: Arrangement of components in the case. For clarity the circuit board is shown as being vertical. In fact, it is mounted horizontally over the tuning capacitor, as can be seen in the photograph below.

L5 is 13 $\frac{1}{4}$  turns, directly from VC1 to C6. Quite large changes in frequency can be obtained by TC1 and TC2, while for frequencies outside this limit of adjustment, L2 and L5 would have to be altered.

L3 consists of 21 turns, 24swg enamelled wire, close wound, near the top of the former. The ends only can be secured with thread or adhesive, noting that the whole winding should not be completely covered with adhesive. L4 is 4 turns of insulated connecting wire, wound on L3 as shown in Fig. 3.



## CASEWORK

Complete screening is required to avoid troublesome hand-capacity effects. The sides are each 4 x 3in flanged members; bottom and tops are 7 x 4in flat plates, the bottom being fixed with four 6BA bolts which also hold rubber feet. The top is secured with self-tapping screws. Note that the flanged member forming the panel is set back just sufficiently to give clearance for the drum and drive. The flanges have to be cut to allow for this.

Give the cord one complete extra turn round the driving spindle, take it round the drum and draw it tight, tying it with the drum spring under tension. The spindle of VC1 projects through a hole in a card, on which a scale is drawn. A pointer is fixed to VC1 by drilling a hole in the spindle and using a small self-tapping screw, although it could be fixed with adhesive.

A piece of Perspex, 7 x 3in, with holes to clear the switch and drive spindles, is bolted to the front flanges of the side members. The bottom, back and top of the case are not fitted until construction and wiring are finished.

## ADJUSTMENTS

TC2 is set to obtain the required band coverage with VC1 and TC1 adjusted for best volume with the receiver AGC switched off. L3 core is aligned for maximum output at the frequency to be used with the receiver. A co-axial lead with the outer braid earthed is used from converter to receiver and should be kept as short as possible.

A suitable aerial can be made from  $\frac{1}{4}$ in. to  $\frac{1}{2}$ in. diameter light alloy tubing. Two equal lengths are used, fixed with their inner ends about  $\frac{1}{2}$ in. apart in an insulated electrical junction box. A length of 75 $\Omega$  co-axial cable is taken from the box with the inner conductor connected to one element and the outer braid to the other element. A plug is then fitted to match the converter.

Such an aerial can be raised on a pole or mast, or otherwise fixed at a reasonable height. It will have little directivity, while giving reception over quite a wide band of frequencies. Length is not too important but if 2m reception is the primary aim, the aerial should be about 38in. to 39in. overall.

**Next month:—A crystal controlled converter**

# PW 'ASCOT' STEREO CASSETTE DECK

## PART 2

KEITH CUMMINS & TONY FRANCIS\*

### PLAYBACK

The input and equalisation stages of the playback amplifier are almost identical to those employed in the car cassette player described earlier in this magazine. Instead of driving an output stage, however, the equalisation stage feeds a noise limiting circuit, the output from which is taken to an external power amplifier at suitable level. The circuit of this section is shown in Fig. 5.

Incoming signals from the record/playback head are conveyed to the base of Tr10 by C20. R31 and R32 are the base biasing resistors. The input amplifier is of the complementary type, DC feedback being established by the network R34, R33, AC feedback is set by the ratio of R34:R35 and so the gain is defined at approximately 100. The signal is conveyed to the equalisation stage via C24 and the "set level" pot VR4. This pot is provided so that the gains of the channels can be equalised and set at the correct level for optimum operation of the noise limiter circuit.

The equalisation stage consists of Tr12, Tr13 and Tr14, the first two forming another complementary stage and the latter an emitter follower. DC feedback to stabilise the working point is applied via R40 and R39, following the same technique as before. The equalisation network consists of C26, C27 and R42, and feeds back from the emitter follower Tr14 to the emitter of Tr12.

Those who have read the previous articles referred to will recall that the equalisation network is necessary to correct the velocity characteristic of the tape



replay, that is, every time the frequency doubles, so does the output. This results from the fact that should the frequency double, twice as many molecular magnets are passing the replay head at a given instant, and consequently the rate of change of flux is doubled. As the induced voltage is directly proportional to the rate of change of flux, it follows that the voltage will also be double.

The process of recording and playback equalisation is actually somewhat more complex than this brief description would indicate; head losses at high frequencies result in the output first rising, then falling again. This is why we emphasise the highest frequencies during the recording process.

### NOISE REDUCTION

The output from Tr14 emitter is DC-coupled to the noise limiter circuit. The noise limiter employs transistors Tr16 and Tr15, the latter providing the output from the machine.

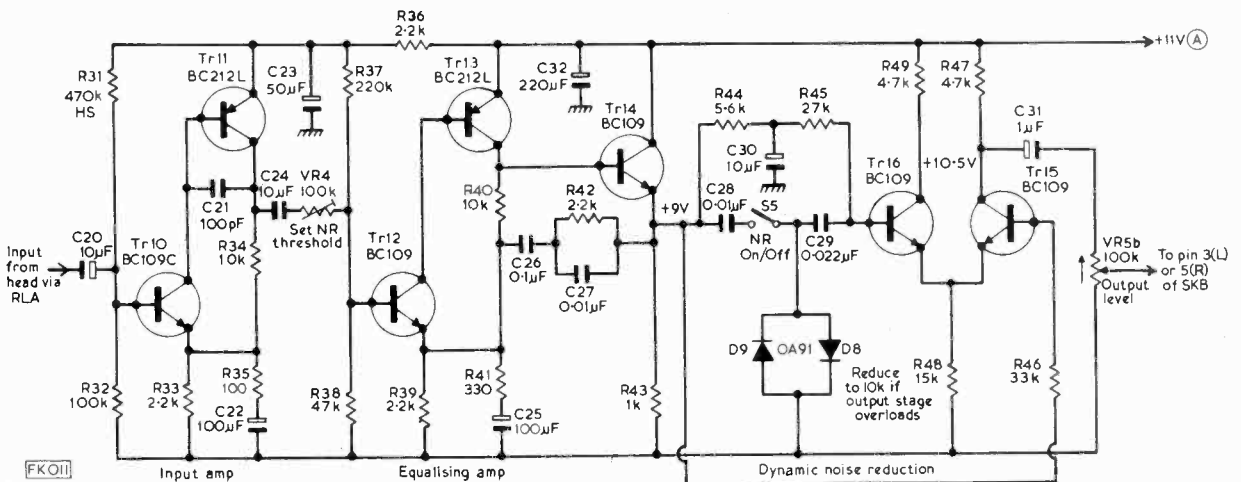


Fig. 5: One channel of the input, equalisation and noise limiting stages.

The noise limiter acts as a low pass filter which operates in the absence of high frequency signals. High frequency noise, which occurs in quiet musical passages, or between items, is therefore reduced. Before we discuss the operation of the circuit, we must first establish the principles involved, and the reader is referred to Fig. 6.

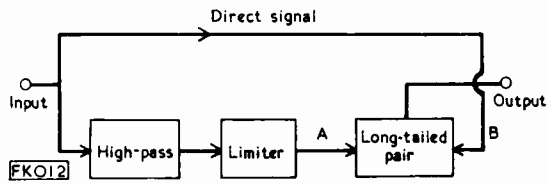


Fig. 6: Block diagram showing the linking of the stages of Fig. 5.

The signal is split into two parts, one containing high frequencies only. Each of these parts is taken to a long-tailed pair circuit, which in our application has two inputs and one output. If the same signal is applied to both inputs of the long-tailed pair no output occurs and the inputs are said to be in common mode. Antiphase signals, or signals appearing at one input only, appear at the output.

High frequency low level signals (principally tape hiss) are present in the direct signal applied to input B of the long-tailed pair. These signals are also present at the input A, since they come from the same source, and have passed through the high-pass filter. Because they are of low amplitude, they are unaffected by the limiter and so arrive at input A to produce the same signal at both inputs. As a result, no significant output is produced from the long-tailed pair and the hiss is effectively reduced.

Higher level high frequency signals are limited by the limiter circuit, after passing through the filter, and so cannot appear at their correct amplitude at input A to the long-tailed pair. Consequently, cancellation does not take place and the high frequency signals are present in the output. The circuit can be switched out by opening the signal path to the high-pass filter.

Now to the circuit in detail (Fig. 5). The long-tailed pair consists of Tr16 and Tr15. The non-processed direct signal is taken via R46 to the base of Tr15. The high-pass characteristic required for the input

to Tr16 base is achieved by inserting C28 and C29 in the signal path. The bias for Tr16 is provided via R44 and R45 (totalling the same value as R46), but the signal is decoupled via C30.

The junction of the capacitors C28 and C29 is taken to the limiter diodes D9 and D8. The diodes only start to have an effect when the applied signal exceeds about 200mV, so limiting takes place above this level. The halves of the long-tailed pair are basically identical, except that the collector of Tr15 is used to provide the source of output. The emitter circuit is common to both Tr16 and Tr15. It is essential, if a long-tailed pair is to have a high common-mode rejection, for the AC impedance of the emitter circuit to be high. This is achieved by using a large value resistor, but of course this implies that a high emitter voltage will be needed so that the rest of the circuit can operate correctly. For this reason, the output of Tr14 is centred on +9V.

The output signal is taken from Tr15 collector via C31 and applied to the output level control pot VR5. The signal is taken from VR5 slider to the output DIN socket [pins 3(L) and 5(R) for stereo]. The output is then adjusted to suit the amplifier being used.

Note that while the bias oscillator and power supply circuits are common to the two stereo channels, the record and playback circuits each have to be duplicated, hence two sets of components are needed for each of the circuits shown in Figs. 4 and 5.

## MOTOR CONTROL

The motor control board contains circuits for two basic functions, motor speed regulation and automatic stopping of the machine at the end of a cassette.

We shall deal first with the motor speed control. It will be seen from the circuit diagram (Fig. 7) that the motor is fed from the nominal 12V supply line via transistor Tr19 and resistors R55, R56 and R58. The base current for Tr19 is formed by the collector current of Tr18, the sensing transistor.

When power is supplied to the system, by inserting a cassette, a potential of just under two volts appears at the junction of resistors R53 and R54. This potential is applied, via diode D10, to the base of Tr18, so

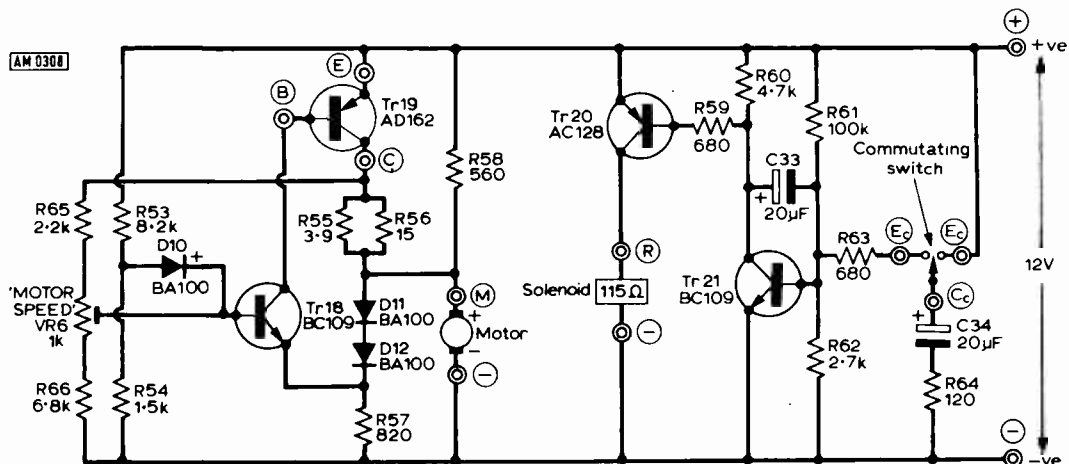


Fig. 7: Circuit of the motor control board. This is identical to that used in the 'Kempton' cassette player (Dec. 74).

turning this transistor on. Collector current flowing in Tr18 provides the base current to turn Tr19 on and the resultant current flows into the motor via R55 and R56 in parallel. The motor starts to turn and diodes D11 and D12 conduct, so clamping the emitter of Tr18 at a fixed voltage negative with respect to the positive side of the motor.

This action results in the emitter of Tr18 moving positive, but the base also moves positive since the collector of Tr19 is connected to Tr18 base via network R65, VR6 and R66. As a consequence, D10 becomes reverse-biased, so disconnecting the starting circuit, R53, R54 from Tr18 base. The emitter-base bias on Tr18 is now a function of the voltage developed across R55 and R56, since the top end of these resistors feeds the base circuit, while the bottom end is clamped to the emitter of Tr18 via D11 and D12.

If the motor load increases, so does its current drain. As a result, the voltage drop across R55 and R56 increases, so increasing the forward bias on Tr18. The increase in Tr18 collector current increases the flow of current in Tr19, so applying more power to the motor to compensate for its increase in load. If the load decreases, the process operates in reverse. Likewise, changes in the supply voltage are accommodated since the only reference required is the measure of current through the resistors in series with the motor, and the apparent DC resistance of Tr19 is adjusted accordingly.

The running speed of the motor is set by VR6 which varies the preset forward bias applied to Tr18. R58 provides a bleed current through the motor in the starting condition and also shunts Tr19, reducing its dissipation.

## ★ components list

### MOTOR CONTROL BOARD

#### Resistors

R53 8.2k $\Omega$	R58 560 $\Omega$	R63 680 $\Omega$
R54 1.5k $\Omega$	R59 680 $\Omega$	R64 120 $\Omega$
R55 3.9 $\Omega$	R60 4.7k $\Omega$	R65 2.2k $\Omega$
R56 15 $\Omega$	R61 100k $\Omega$	R66 6.8k $\Omega$
R57 820 $\Omega$	R62 2.7k $\Omega$	

R55 and R56 are  $\frac{1}{4}$ W, remainder  $\frac{1}{2}$ W 5%  
VR6 1k $\Omega$  miniature preset

#### Capacitors

C33 and C34 22 $\mu$ F 25V electrolytic

#### Semiconductors

D10, 11, 12 BA100 Tr18, 21 BC109 Tr19 AD162  
Tr20 AC128

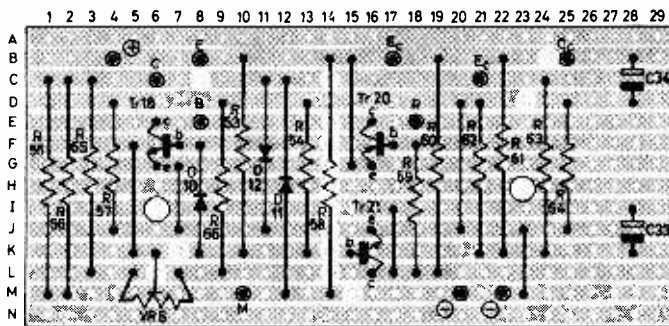
#### Miscellaneous

Mounting kit for Tr19. Veroboard 3 x 1.4in. 0.1in. matrix

charging of the capacitor. Under these circumstances C33 would eventually become fully charged, and the current would stop flowing, so de-energising the solenoid and releasing the latch. However, this process is not allowed to complete.

## LATCHING

As soon as the cassette is inserted, the motor starts to move the tape, and the commutating switch commences operation. C34 is alternatively charged from the 12V supply, and discharged via R63 into



Track breaks required at:-  
B24; C8,14; D23; E14; F14; G14;  
H14; I14; J14; K7,14; L6,14; M15

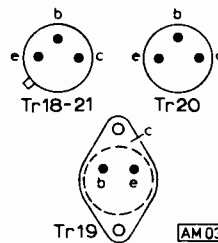


Fig. 8: Component layout of the motor control board, shown here larger than actual size.

## AUTO STOP

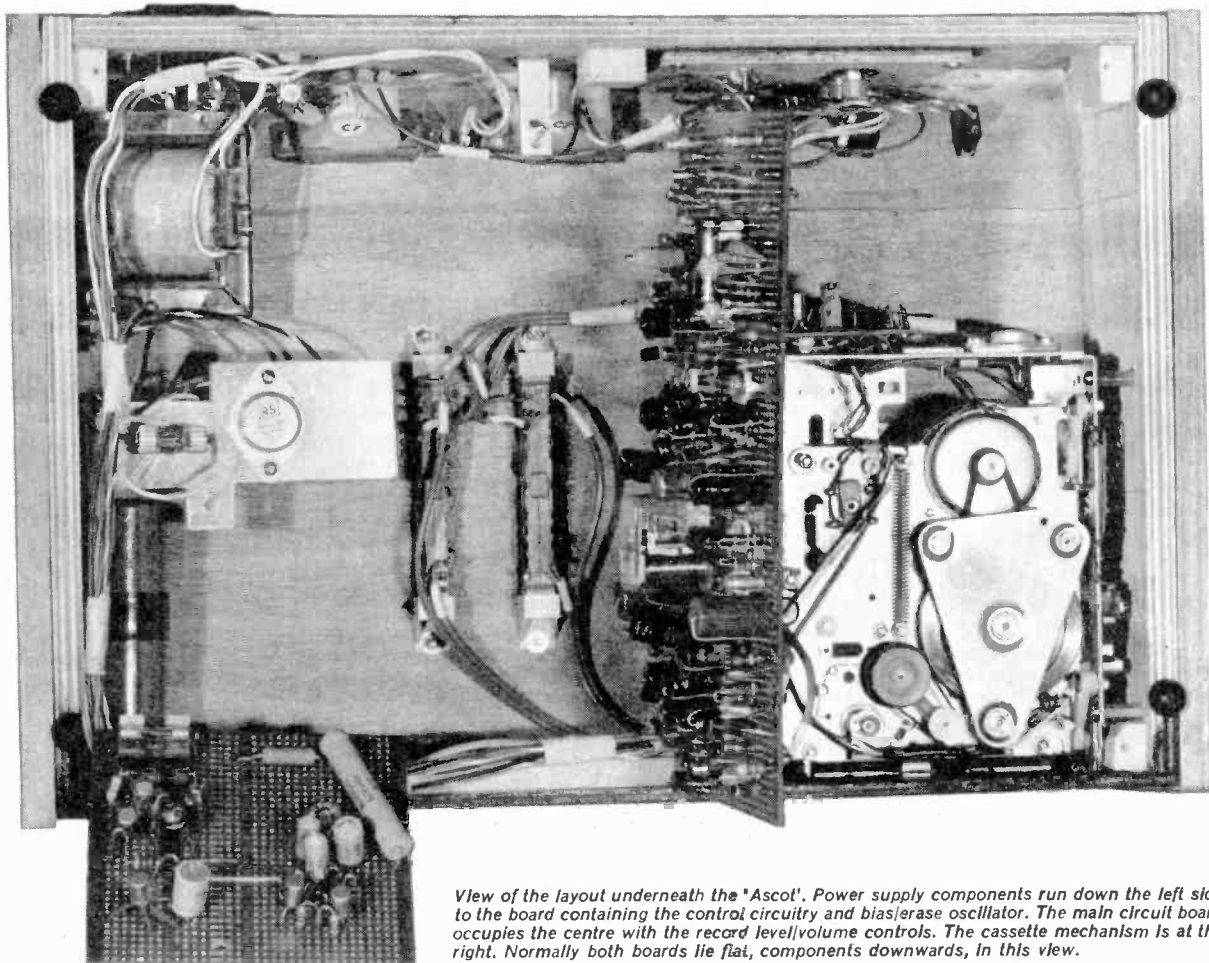
Now we come to the autostop mechanism. When the cassette is pushed in, it will only hold in provided the solenoid is energised, to operate the latch. The solenoid is controlled by transistor Tr20. Attached to the cassette feed-spool hub is a commutating switch, below the deck, which constantly switches a common contact between the others provided the hub is rotating.

When power is applied to the circuit by inserting a cassette, capacitor C33 charges via R60, R59 and the base circuits of both Tr20 and Tr21. The resultant collector current in Tr20 energises the solenoid to hold the latch. The flow of collector current in Tr21 reduces the charging voltage applied to C33, so forming a "Miller integrator" circuit linearising the

base of Tr21. The process is integrated by C33 so that a constant hold-in current flows through the solenoid. R64 is included to prevent excessive charging current in C34, with the attendant risk of contact wear and electrical interference.

When the cassette comes to the end, the feed hub stops rotating, and with it the commutating switch. As a result, no current pulses are fed into the base of Tr21, and C33 reaches its point of maximum charge. Current flow in the transistors then ceases, so de-energising the solenoid. The latch drops out releasing the deck mechanism and the cassette is ejected.

Obviously, any attempt to re-insert the cassette without turning it over will be fruitless, since the



*View of the layout underneath the "Ascot". Power supply components run down the left side to the board containing the control circuitry and bias/erase oscillator. The main circuit board occupies the centre with the record level/volume controls. The cassette mechanism is at the right. Normally both boards lie flat, components downwards, in this view.*

commutating switch will be inoperative and the cassette will be promptly ejected again.

## CONSTRUCTION

The motor control board, Fig 8, is quite straightforward but take care to cut the tracks in the correct places. When completed, the board is mounted on the rear panel of the cassette mechanism in the position shown in the photograph. Nylon nuts and bolts should be used to avoid shorting or earthing any of the tracks.

The rear panel also acts as the heatsink for Tr19 and is supplied already punched with the necessary pattern of holes. An insulating mounting kit must be used for this transistor.

**Part 3, next month, will deal with the construction of the circuit boards, cabinet and general wiring.**

# points arising...

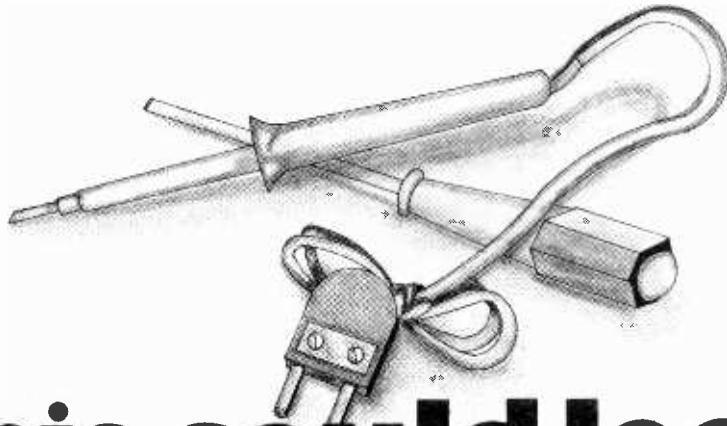
## ELECTRONIC HOME TELEPHONE EXCHANGE

Feb. 1975. In Fig. 6 page 895 the diode D10 is shown reversed. The bar (+) should go to the +7V line. Note:— the diode is shown correctly on the pcb layout, Fig. 10 page 898.

Also in Fig. 6 the line numbers 1 to 9 are in reverse order, should be 9 at top, down to 1. Relay contacts RLB1 to RLJ1 are in reverse order, should be RLJ1 at top, down to RLB1. The pcb layout is correct, Fig. 10, and these discrepancies do not affect the correct operation of the exchange.

In Fig. 10 C5 polarity is incorrect, the positive side should be at the right, pin 10 IC3. There should be a link between the two pads immediately left of IC2, pin 10 to earth.





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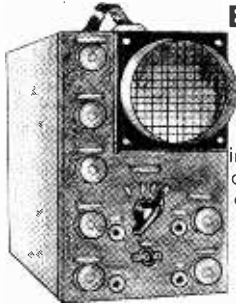
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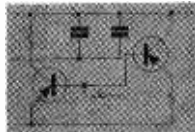
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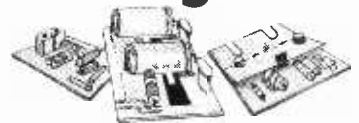
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Number 50

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In order to make a complete radio receiver using this device, it is only necessary to connect suitable tuned circuits, a detector and an audio power amplifier.

## TYPICAL CIRCUIT

A typical  $\mu$ A720 circuit is shown in Fig. 1. It operates as a conventional receiver with an RF stage and an IF of about 475kHz. For simplicity no band switching is shown in the circuit of Fig. 1, but this can be added if a wide frequency coverage is required.

The aerial input is coupled to pin 12 of the device through the input coil L1, while pin 11 is decoupled

to ground by C1. After passing through the internal RF amplifier stage, the signal appears at pin 13 and is fed to the coil L2. The tuned circuit comprising VC2 and part of L2, and provides image frequency rejection before the signal is fed to the input of the mixer stage at pin 1.

The oscillator frequency is determined by the value of VC3 and the part of L3 across which this capacitor is connected. The capacitor C4 provides decoupling of the mixer while the output from this stage appears at pin 14. IFT1 provides much of the adjacent channel selectivity.

The IF signal passes to the input of the IF amplifier at pin 7 while the output of this amplifier is taken from pin 6 to the second IF transformer, IFT2. It is then detected by D1 and filtered by C8, R3 and C9 to provide the audio output. C10 is merely a DC blocking capacitor.

The IF amplifier output at pin 6 is also coupled back into pin 5 of the  $\mu$ A720 where it is demodulated

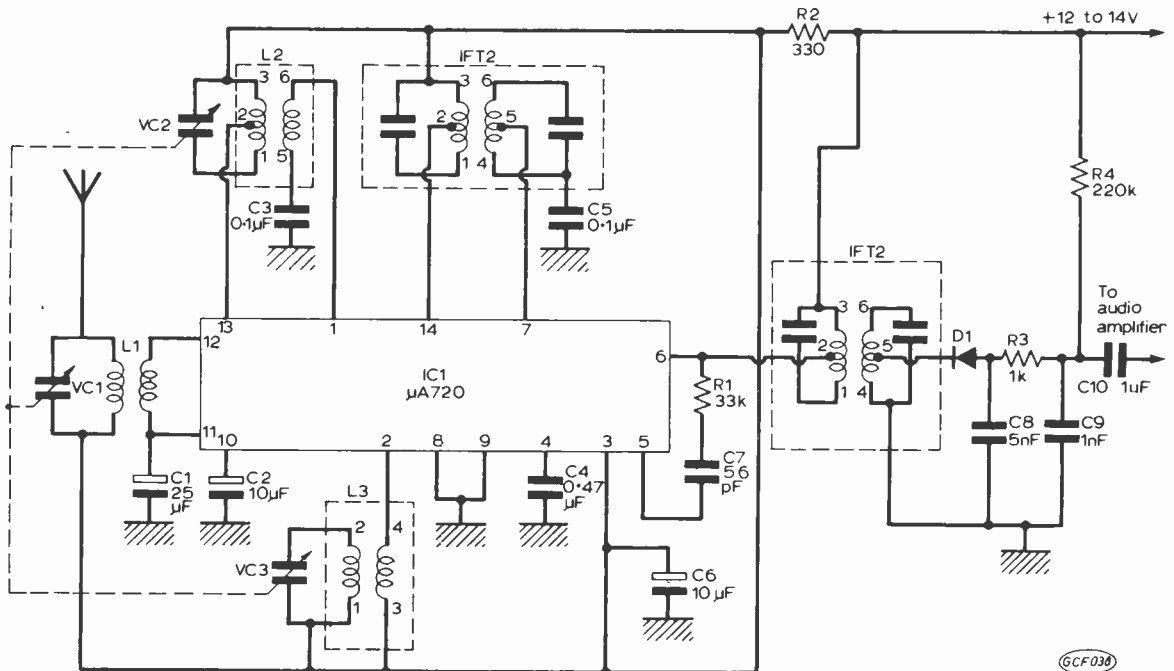


Fig. 1: Circuit of an AM radio receiver built round the  $\mu$ A720 integrated circuit and using variable capacity tuning.

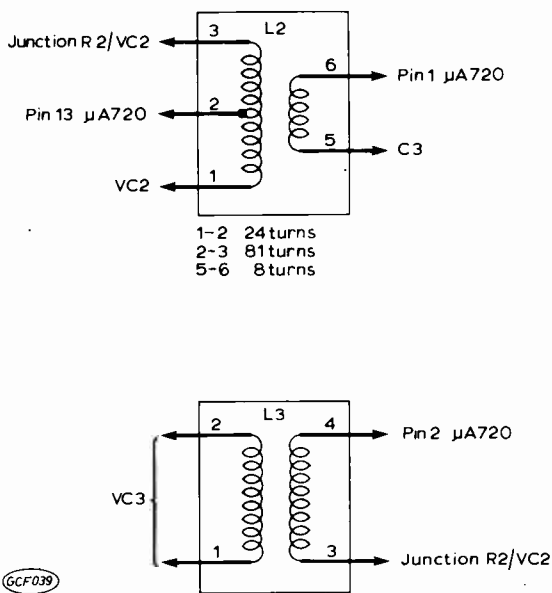


Fig. 2: Details of coils for use in Fig. 1.

by internal diodes and is used to provide the AGC signal.

The audio output from Fig. 1 may be used to drive a Fairchild  $\mu$ A706 IC audio power amplifier, although a somewhat simpler circuit can be made using the National Semiconductor LM380N power amplifier (see *Practical Wireless*, December 1973).

## POWER SUPPLY

The absolute maximum permissible voltage which can be applied to the  $\mu$ A720 circuit is 16V. It is wise however to operate the device from a supply of about

12V with a maximum of 14V to allow a reasonable margin of safety. It should be noted that there is no direct connection between any pin of the device, and the positive power supply line. The current required is in the order of 20mA.

## COILS

For medium and long wave coverage, the coil L1 may consist of a conventional ferrite rod aerial, but an outdoor aerial is essential for good short wave reception.

Suitable medium wave coils for the RF coil L2 and the oscillator coil L3 are shown in Fig. 2, the diameter of the coil formers being about  $\frac{3}{8}$ ". These coils are designed for a 190pF RF tuning capacitor ganged with an 80pF oscillator capacitor. However, it is more satisfactory to obtain the Toko type YXRS 18576 AQ coil of 100 $\mu$ H for MW use.

Conventional IF transformers may be employed for IFT1 and IFT2. However, it is difficult for the home constructor to wind such coils neatly and obtain the maximum Q factor for optimum selectivity. It is therefore advisable to purchase IF transformers, bearing in mind the writer prefers to use one of the miniature Toko ceramic filters between pins 14 and 7 of this IC.

These ceramic filters provide a selectivity curve with a flat bandpass characteristic and steep sides; this enables one to obtain the best audio quality from a fairly weak station adjacent to that of a much stronger one. The filters are obtainable with bandwidths of 8kHz (type CFT455B), 6kHz (type CFT455C) and 4.8kHz (type CFU60A), all these pass-bands being quoted at 6dB down. At 10kHz away from the centre frequency, the response is 22, 27 and 28dB down for these respective types. Each filter contains a special piezo-ceramic disc and an input and output transformer, both of which are tuned in a similar manner to that of an IF transformer.

—continued on page 1040

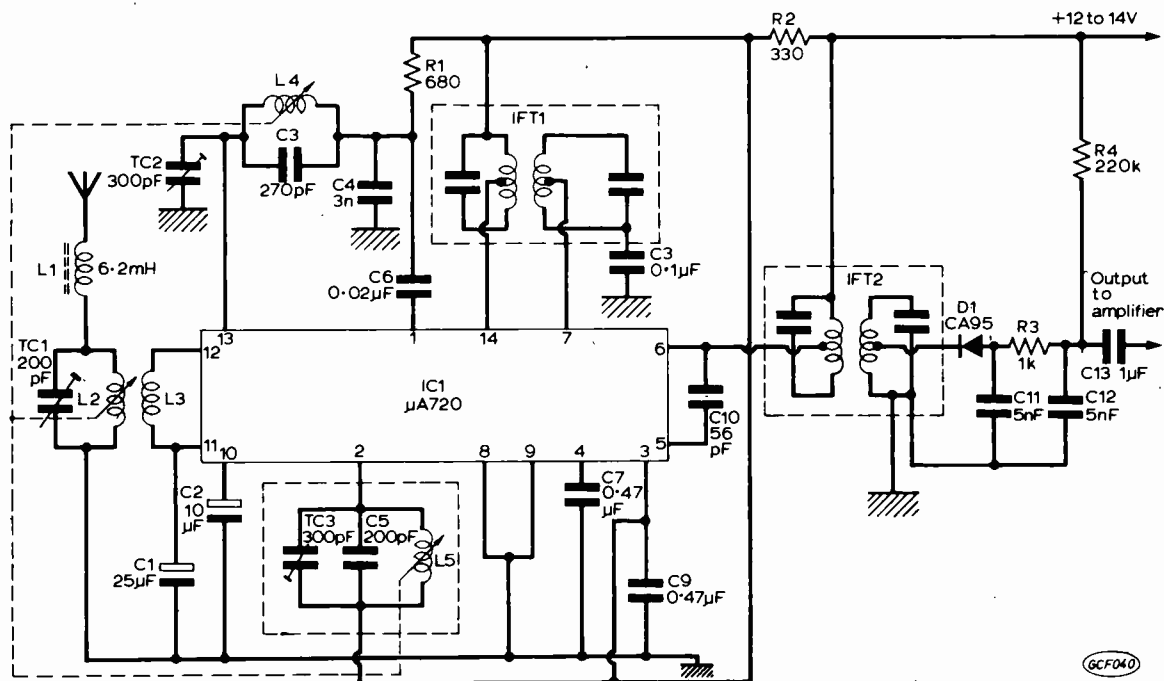
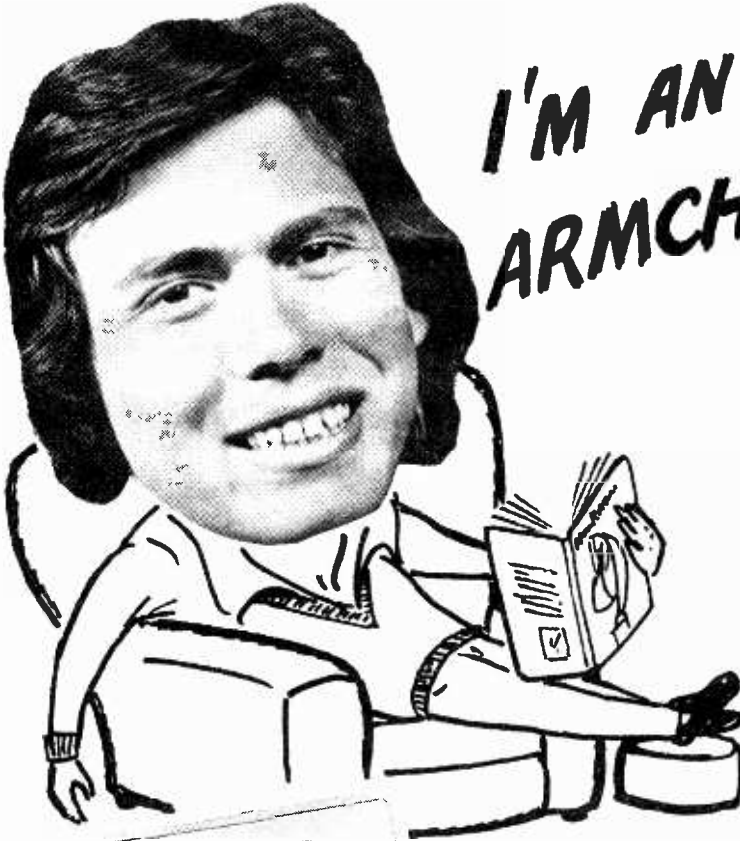


Fig. 3: In this version permeability tuning is employed in place of the capacity tuning of Fig. 1.

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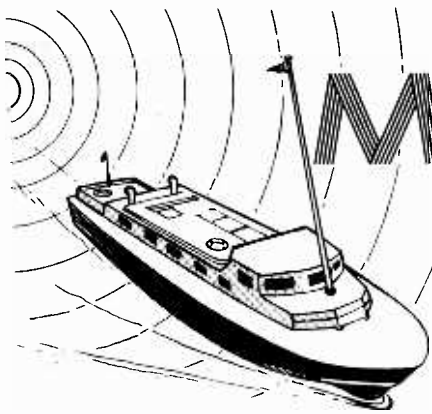
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# MODEL CONTROL

## PART 3: ACTUATORS & MONITOR

# BY RADIO

F. G. RAYER G3OGR

**T**HE model control transmitter and receiver already described provide a radio link with the model. The equipment is designed for single channel operation which allows a relay in the model to be opened or closed at will. This, in turn, operates an actuator which is a device which moves the rudder of a model boat, switches on the propulsion motor or carries out other functions.

Complex mechanical actuators are not easily made but the simpler type of actuator is a straightforward device, quite easy to construct. In this case, it is intended for a model boat. Somewhat similar points apply to the guidance of other types of model.

### CONTROL PROVIDED

A model control system can begin in the simplest form, additions being made later. The simplest control provided is probably for steering only. This can be satisfactory with a yacht or other boat guided at will, or with a model plane adjusted to climb when flying straight, lose altitude when turning and glide to land when fuel is exhausted. Propulsion control is easily arranged with an electrical motor and the actuator described here allows turning to port or starboard, sailing straight ahead or stopping the main motor.

The simple type of actuator gives definite degrees of turn either way and this unit is of this type. Proportional and other methods of control are necessary for turns of any particular degree, or a small electric motor with a worm or screw drive to move the rudder can be used.

### ACTUATOR CONSTRUCTION

This actuator is based on a small Meccano clock-work motor (available from toy and model shops) though other motors could be used. It provides some hundreds of operations with each winding and is wound before starting the model.

In Fig. 1, the propulsion motor is off and the rudder is straight. End X of the rotating arm is held by A of the escapement. When the transmitter is keyed A is drawn to the core of the electro-magnet. The arm turns until Y engages B, the rudder link moving the rudder. Contacts Z-Z close, completing the circuit to the propulsion motor and battery. To sail straight, the key is released so that Y turns to engage A. To turn the other way, the key is pressed, causing X to engage with B. Any unwanted position can be passed almost immediately by momentary pressure on the key, any of the four positions being

held as long as required. Relay circuit current is only drawn when turning the model.

The rotating arm is about 2in long and filed from scrap metal. Several holes allow the crank throw of the rudder link to be adjusted. A short length of  $\frac{1}{4}$ in diameter rod is drilled to fit on the motor spindle and held with the screw which also opens contacts Z-Z. The rotating arm is soldered to this, high enough to clear the winding spindle. One contact Z is a spring brass strip, soldered to a bracket. The other is a small screw, fixed to a bracket which is in turn held to a paxolin strip by small screws. These contacts close firmly, except when opened by the screw as in Fig. 1.

The escapement is fashioned from a piece of metal about  $\frac{3}{8}$ in wide by  $3\frac{1}{2}$ in long. Catch A is formed by bending. Catch B is obtained by cutting away about  $\frac{1}{4}$ in from the strip. The narrow end continues, meeting a projection on the paxolin, to form a limiting stop. Elastic under tension keeps the escapement in this position until the magnet is energised. If the escapement is not ferrous metal, bolt or solder a

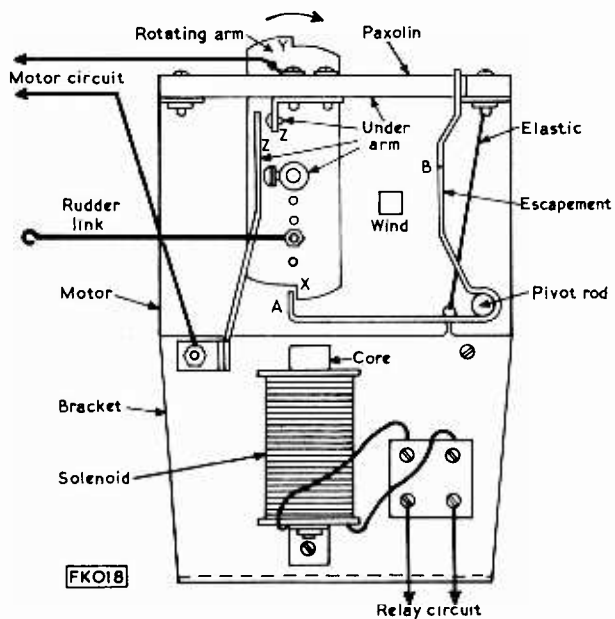
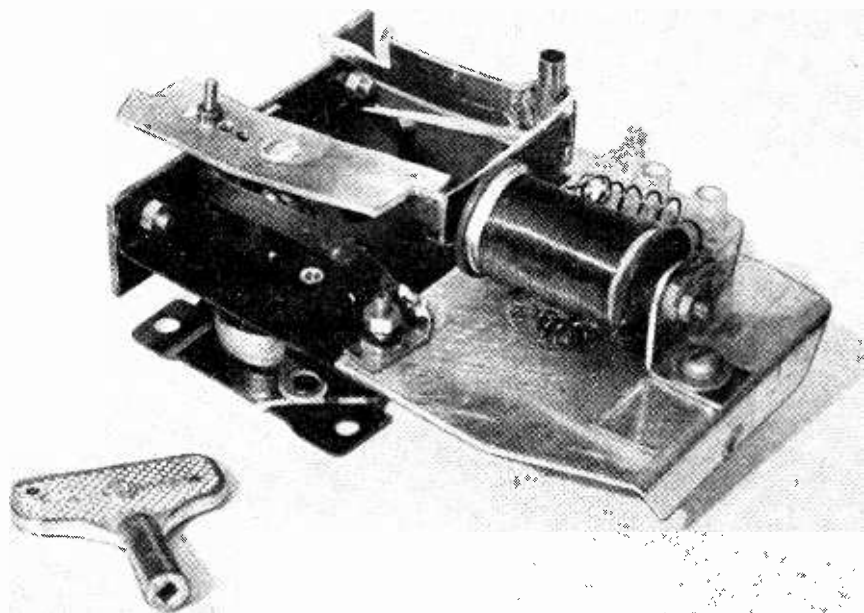


Fig. 1. Diagram showing the construction of a typical actuator, in this case to provide motor control and rudder steering on a model boat.



Actuator made by the author, based on Fig. 1. The motor control contacts are under the rotating arm but shown on top in Fig. 1, for clarity.

piece of iron or mild steel near the core of the solenoid.

The solenoid is fixed to a slotted bracket, to allow adjustment. It can be made from an old bell or buzzer, or it can be a few hundred turns of 26SWG or similar wire on an iron or mild steel core. The large bracket is 2½ x 2in cut from scrap metal, with a flange to allow mounting by a screw at this end, as well as by screws passing through the holes in the clockwork motor.

## RUNNING CHECK

Turn the rotating arm to see that ends X and Y project equally. If not, correct this by filing. Bend the escapement so that when A is moved slowly towards the magnet to release X,Y strikes B. Check that the meeting parts are reasonably smooth and that the elastic tension will return the escapement to the position in Fig. 1.

Position the magnet quite close to A. The mechanism should then operate reliably from a 4.5V or similar battery. Finally, with the mechanism mounted in the model, adjust the length of the rudder link so that the rudder is straight with X or Y engaging A. Adjust the crank throw so that a suitable turn is obtained with X or Y engaging B.

## ADDITIONAL CONTROL

Fig. 2 shows how the reversing function may be added. The rotating part of the escapement mechanism now has four arms. Its rotation operates the rudder as in Fig. 1. With this form of escapement, the spindle is allowed to move one-quarter of a turn each time the electro-magnet is briefly energised. To make this clear:— when the magnet is energised X is released and a very small rotation brings Y against Z. When the magnet releases, Y turns to the position formerly occupied by X, no holding current being necessary.

The reversing relay is connected to the same circuit. With no relay current present, battery A

drives the model forward. The escapement can thus take up any of four positions with the reversing relay not energised. However, if the transmitter key is held, the reversing relay is retained in the position bringing battery B into use, sailing the model astern. It is convenient to use an old or lower voltage battery for astern. For changing battery polarity with a single battery, a double pole relay is necessary for reversing.

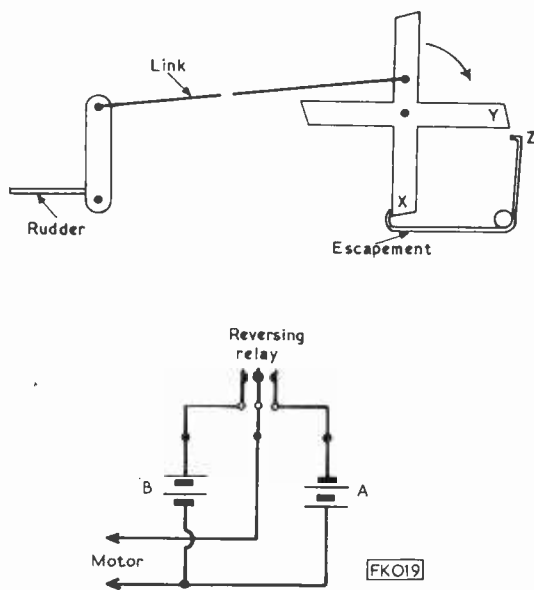


Fig. 2. Modifications to the rotating arm to provide reversing facilities on the propulsion motor.

Propulsion motors, except the larger types, are of permanent magnet construction and can be reversed by reversing the supply polarity. This type of motor gives best efficiency especially with dry cells. If a motor having a field winding is used, this will not be





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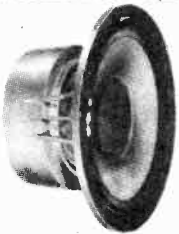
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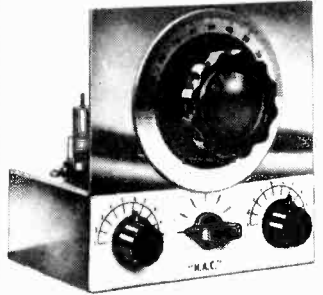
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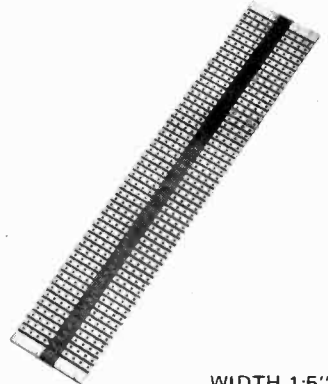
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reversed when the supply polarity is changed. To reverse this type of motor, a double-pole relay is required, so wired that the supply is reversed to either the field or armature, but not to both.

A system of this kind can be modified by shortening arm Z so that the mechanism can come to rest in any one of eight equally divided positions. This gives half-port and half-starboard steering, as well as full-port and full-starboard. The reversing relay cannot then be held by the same circuit, but can be energised by contacts Z-Z in Fig. 1, giving straight astern as well as straight ahead and two degrees of turn each way.

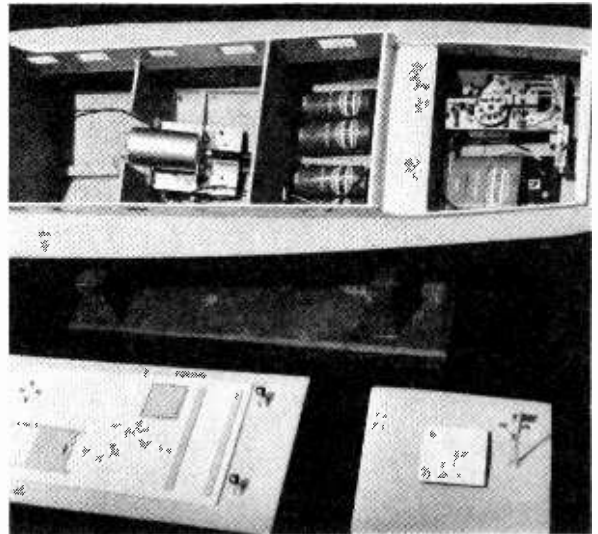
The mechanism shown in the photograph of the boat is the Graupner Kinematic cascade switcher, which provides motor control by short blips and steering control by holding the transmitter keyed on. It is completely electric. A lightweight escapement suitable for small boats and planes, weighing only 1<sup>1</sup>/<sub>4</sub>oz and having four positions without holding, is the Rising & Schulz Mark I FR unit. Boat and other model kits, hulls, propulsion motors, steering and other control gear are available from model control equipment shops or large toy shops and model shops.

## INSTALLATION

It is convenient to use colour-coded leads to run through the model, for the receiver relay and other circuits. It is preferable to use separate batteries for the receiver and any other devices, as this helps avoid interference between the systems. A separate battery is generally required for the main motor. Interference problems can be reduced by keeping the receiver at the front of the model with electromagnetic control devices and motors towards the back. Suppressor capacitors of about 5000pF will usually be necessary across motor, electro-magnet or actuator circuits if interference upsets the receiver. Such interference may be shown by chattering or buzzing of a relay.

Plugs, terminals or other suitable means should be provided for connecting together the various parts of the whole system. On/off switches should be included for the receiver, etc. Fig. 3 shows the whole equipment for the boat illustrated which is typical of a straightforward model of this type.

The receiver, with battery and relay, occupies the forward section of the model. The actuator, with battery, is fitted in the stern near the rudder. Two propulsion batteries are placed forward of this with



Hatches off to show the compartments for the propulsion motor, left main batteries, centre, actuator and auxiliary battery, right.

the propulsion motor near the middle driving the propeller shaft through a flexible coupling in the usual way. For convenience in reaching the equipment, front cabin and decks lift off.

## MODEL CONTROL MONITOR

This instrument is almost indispensable for tuning and testing model control transmitters for the 27MHz band. With such transmitters, some indication of the strength of the signal actually radiated is of great help when tuning oscillator and output circuits, or aerial loading coils, when provided. A receiver is not very suitable as an aid to tuning, as usually it gives only an indication that the equipment is in fact working.

If this monitor is placed a small distance from the transmitter adjustments can be made to the transmitter circuits while observing the reading on the monitor meter. The maximum monitor reading corresponds to the strongest radiated signal and thus to best operation of the transmitter and subsequent reliable range.

The monitor also incorporated a headphone socket so that a check can be made on the audio tone or tones produced by the transmitter.

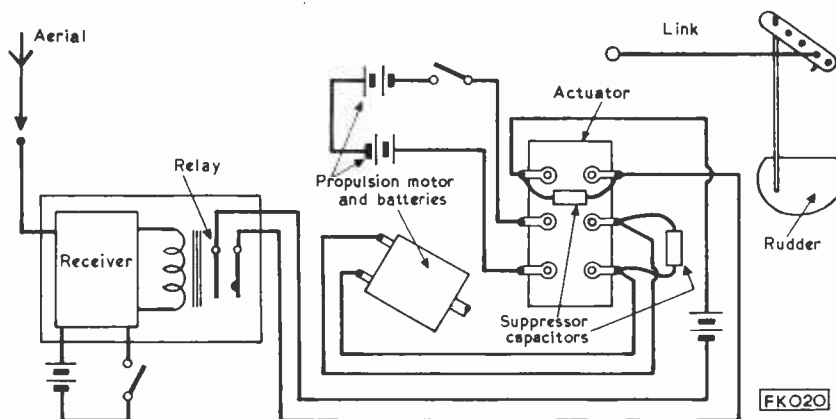
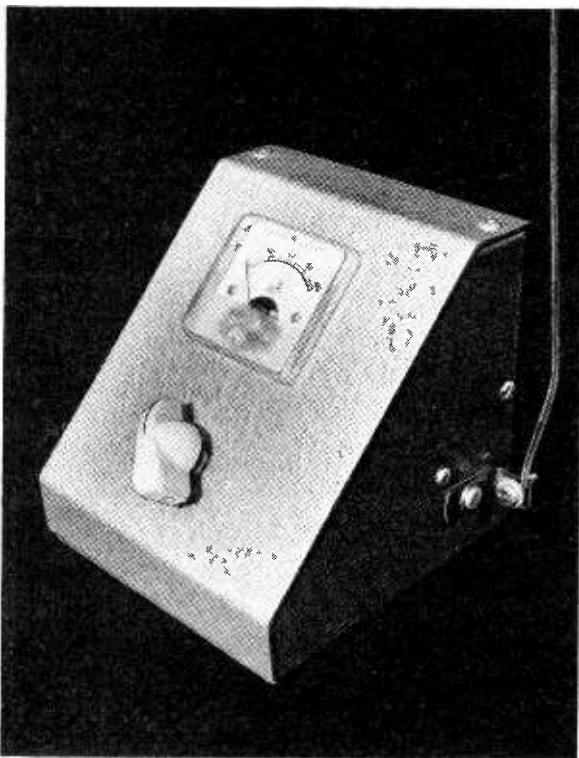


Fig. 3. Interconnection of the various units as arranged in a model boat. The link plate between the link and the rudder post enables the amount of rudder movement to be varied.



The monitor is an invaluable aid in setting up a transmitter for maximum output and hence maximum range of control.

## MONITOR CIRCUIT

The arrangement is shown in Fig. 4 and when trimmer TC1 is set so that the tuned circuit resonates at about 27MHz VC1 should be half closed. The required band is then tuned by VC1 which allows compensation to be made for changes in the aerial used. L2 is a coupling winding the diode D1 providing DC for the meter M1. The headphone jack socket is of a type normally closed until a plug is inserted.

## CONSTRUCTION

Component values and constructional details are not too important, provided the frequency coverage is suitable. A ready-made Wearite PHF3 coil may be used, or a coil may be wound. For a home-wound coil, use a  $\frac{5}{8}$ in diameter paxolin tube  $1\frac{3}{4}$ in long. Ten turns of 20SWG wire are required from points 1 to 2, spaced to occupy  $\frac{7}{8}$ in as in Fig. 5. The ends are passed through small holes in the tube, and the

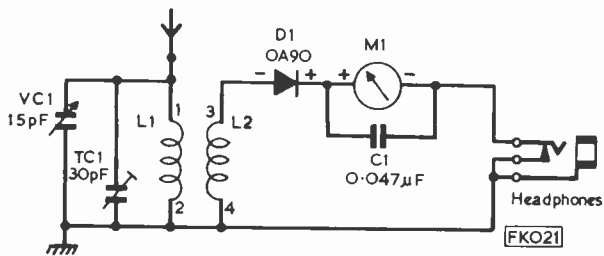


Fig. 4. Circuit of the monitor, in this case for the 27MHz model control band.

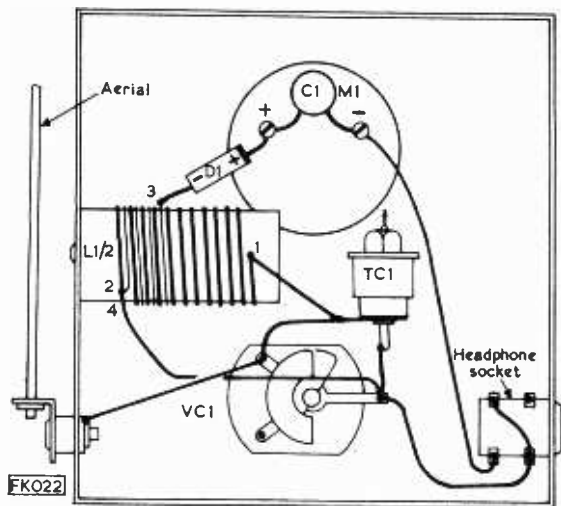


Fig. 5. Internal wiring of the simple monitor and details of the coil windings.

turns can be secured with Bostik 1 or similar adhesive. L2 has four turns of thin insulated wire, between the turns of L1, as shown.

A  $200\mu\text{A}$  indicating instrument is suggested, but if a more sensitive meter should be available it can be fitted which will allow the use of a smaller aerial on the monitor.

A sloping front case is used, as in Fig. 5. The coil is fixed with a bracket, or single 6BA bolt for the PHF3 while TC1 is supported by the wiring and VC1. A bracket is fixed to one side of the case, for the aerial, and insulated from the metal by adding insulating washers or any similar means. A telescopic aerial is ideal and some have a suitable bracket supplied. If so, this is fixed to the case.



## AERIALS

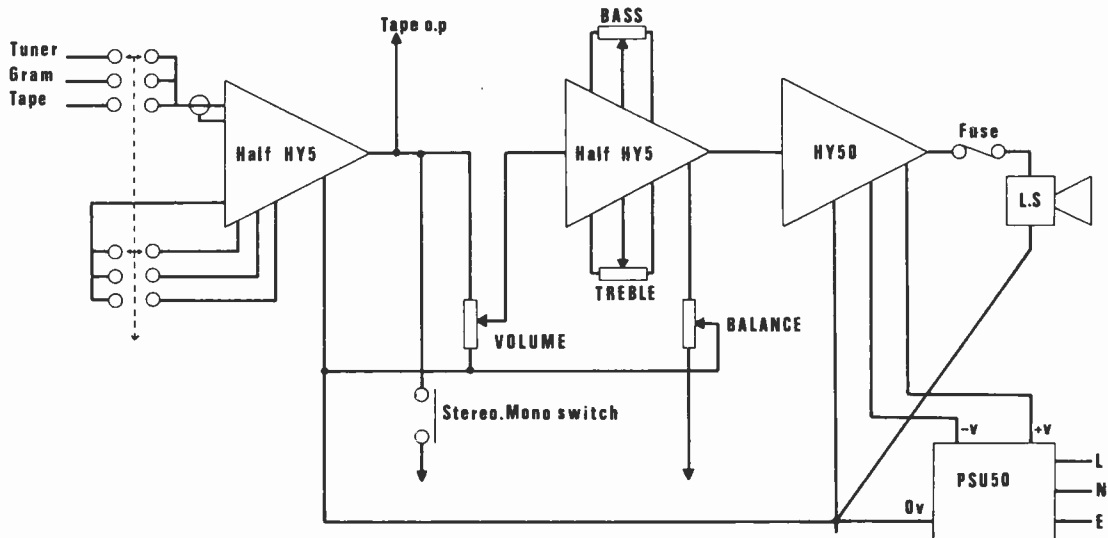
The aerial actually used may be a stiff wire from about 12 to 24in long, a telescopic receiver type aerial, a vertical rod, interlocking tubes or any other self-supporting aerial. When making a first

*continued on page 1010*

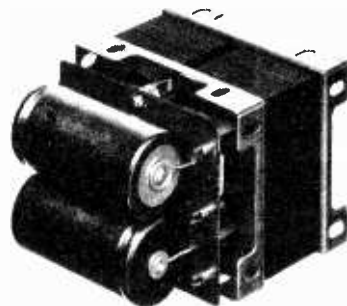
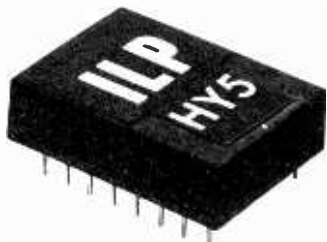


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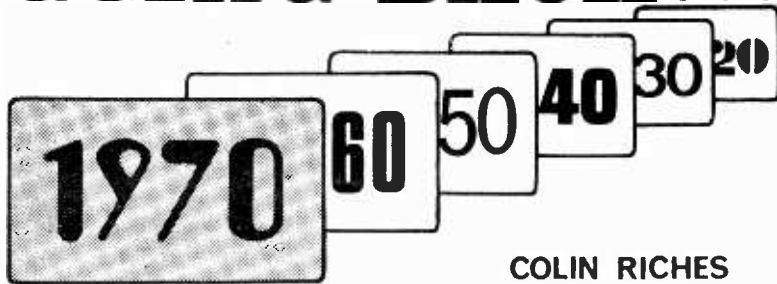
**PRACTICAL  
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March issue

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# GOING BACK...



## Golden Oldies

ONE company that really believes in Going Back is Retrieval Recordings Ltd. which devotes itself exclusively to the reissue of vintage recordings, mainly from the ragtime and the Twenties periods. Using the archive material of the directors (themselves enthusiastic collectors), and employing special equipment of their own design, many historic and rare recordings of the early days of popular music have been preserved for all to hear—and with quite astonishing quality of reproduction.

Most of the LPs are of complete sets of recordings by particular performers arranged in chronological sequence and are backed by liner stories by specialist writers and include complete authenticated recording information. At the moment, the LPs cover vintage jazz, dance music, blues and popular music nostalgia, but other associated

idioms are under consideration.

The latest addition to the Fountain/Retrieval catalogue, Fountain FJ-109 (Curtis Hitch and Hoagy Carmichael) is a fine collection of Mid-West jazz from 1923 to 1927. The sub-title 'Indiana Summer' sets the mood for this album of bouncy music recorded in Richmond, Indiana.

Side 1 consists of the complete recorded output of The Happy Harmonists, a collection of lively foot-tapping numbers by a band organised by Curtis Hitch and featuring the spirited cornet playing of Fred Rollison. The last two tracks feature Hoagy Carmichael, who takes over the piano chair from Curtis Hitch.

Side 2 comprises recordings by groups led by Emil Seidel and Hoagy Carmichael. The highlight of this side is the recording of "Star Dust", which is not only the very first recording of the top pop of all time but includes a monumental and imaginative piano solo by composer Hoagy Carmichael. These recordings also include the complete output of Carmichael—cornettist extraordinary.

FJ-109 is presented in a gate-fold sleeve and contains full authenticated discographical information on the recordings. The fully packed LP includes no less than 19 titles. The r.r.p. is £2.44 including VAT.

Readers interested in the genuine article can obtain a copy of the latest catalogue of Fountain and Retrieval LPs on request (and enclosing a stamp for return postage) to: Retrieval Recordings Ltd., 48 Eversley Avenue, Barnehurst, Kent DA7 6RB.

## Who were they?

I have received numerous enquiries from many younger

readers who ask questions like, "who were Heinrich Hertz, Popoff, R. A. Fessenden, Nikola Tesla, Sir Oliver Lodge etc, etc.? When did they live and can you describe their contributions to wireless and explain some of their experiments?"

It is for this reason that I hope, from time to time to feature some of the great pioneers of wireless in the Going Back column.

## Nikola Tesla



Nikola Tesla was born in the town of Smiljan in Yugoslavia in 1857. He was educated at Prague and Graz Universities and studied "electricity". In 1882 he commenced the study of high frequency currents and developed the "Tesla Coil"—a loose-coupled air-cored high frequency transformer.

In 1883 he joined the Austrian Telegraphs department and shortly after emigrated to America. He became naturalized and managed to get himself a job as an assistant to Thomas A. Edison.

While working for Edison, Tesla made a special study of high frequency alternating currents and invented an alternator in 1890 which would develop 1kW at 10,000Hz. He patented a synchronous spark discharger in 1896. It was obvious from his patent that he had exhibited an exceedingly clear knowledge of the principle of tuning and a method of adjusting the phase of discharge by varying the position of the stationary electrodes of the spark gap. Like the Tesla Coil,



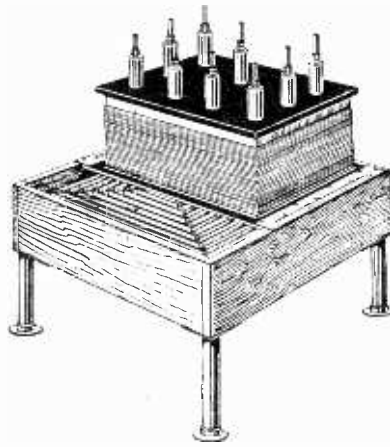
One of the sets of authentic recordings of historic popular music, Fountain FJ-101 includes the legendary sides made by the Original Dixieland Jazz Band in 1917, originally issued on 'hill-and-dale' 78s. This is jazz at the very beginning!

this device was not invented primarily to aid radio telegraphy but was designed to aid Tesla's research into high frequency currents.

A point to bear in mind is that a device similar to that patented by Tesla, was used by Marconi in 1907 when he used the "timed disc" in his spark transmitter.

The Tesla Transformer was used by the Marconi Company in the 1/2kW transmitting sets. It consisted basically of a primary of a few turns of thick copper wire and a secondary with a large number of turns of a much finer gauge wire. The primary and secondary were separated by an air-space, a glass or ebonite dielectric.

The Marconi version of Tesla's coupling transformer invention was often referred to as a "jigger". The type used for the 1/2kW spark transmitter had a primary of copper ribbon wound on edge as a sort of "square" spiral. It was mounted on an ebonite support. The secondary was wound outside the primary and a sheet of ebonite was fixed between them. The secondary



Tesla's transformer

winding comprised insulated copper stranded cable wound round a square wooden box. This had an ebonite panel mounted on which were the secondary tappings.

### A Clean Sweep

In Germany, the listening tax in 1932 had to be paid monthly. Its collection from the set owners

was made by the postman on his rounds. The annual broadcast licence was 24 Marks (then about 30/-).

Germany, at that time possessed roughly four and a quarter million registered listeners and radio pirates were discovered by the municipal chimney sweeps, who, in the course of their daily duties, visited all houses, flats and apartments. It was their duty to notify all wireless receivers to the local authority, thus allowing the latter to make the necessary investigations.

So, if you're naughty and have not paid your TV licence fee yet, keep a wary eye out for chimney sweeps—they may be detector van personnel in disguise.

#### J.S.T. — O.B.E.

We are very pleased to learn from the New Year's Honours List that Wing Commander John Scott-Taggart, M.C., Italian Order of Merit, has been appointed an officer of the British Empire 'for services to radio engineering'.

Among many other notable achievements 'ST' was the author of the famous ST series of receivers beginning in 1923, designed specifically for the home-constructor.

MODEL CONTROL—continued from page 1006

### ★ components list

#### ACTUATOR

Clockwork motor (Meccano No. 1 "Magic").  
Axle Rod (Meccano No.17 2in.)  
Collar with screw (Meccano No. 59)  
Rod connector (Meccano No. 213)  
Bell electromagnet (see text)  
Materials for bracket, escapement etc.

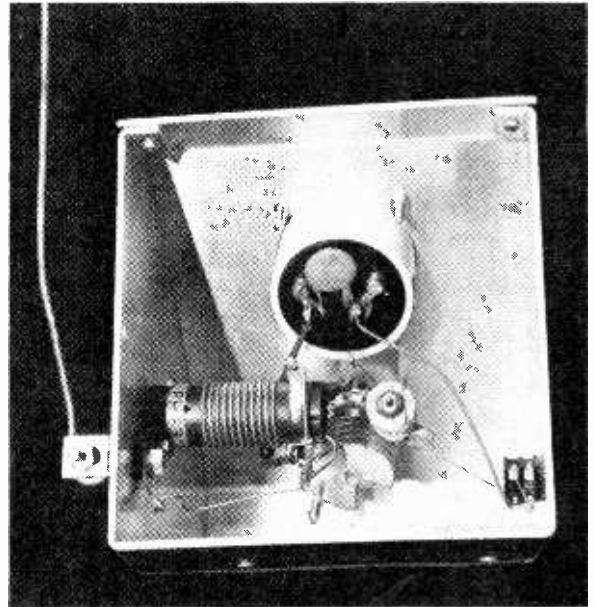
#### MONITOR

C1, 0.047μF. TC1, trimmer 30pF. VC1, 15pF variable (Jackson C804). D1, OA90. L1/2, coil (Wearite PHF3 or home-made). Case, 4 x 4 x 4in. or similar (H. L. Smith, Type U). Telescopic aerial (see text).

check, especially with a powerful transmitter, take care that the meter is not damaged. Should there be any sign that the reading will exceed full-scale, when tuning VC1, move the monitor to a greater distance or reduce the length of aerial.

### USING THE MONITOR

With the transmitter switched on VC1 is rotated for maximum reading on the meter and only needs re-adjustment if the monitor aerial is changed or the transmitter frequency changed. The monitor is placed so that a reading of about a quarter to half scale is obtained. With a low power transmitter, running possibly only a few hundred milliwatts, the monitor will only need to be at a short distance. But if the maximum permitted power is used, the distance will become inconveniently large, so a very short aerial wire should be used with the monitor.



Inside the monitor. Compare with Fig. 5.

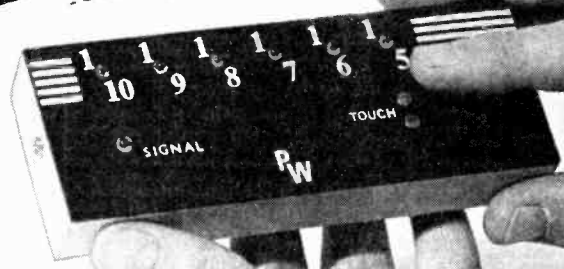
Provided transmitter and monitor remain in the same positions and other circumstances which could influence the field strength are also unchanged any modification to the transmitter which increases the power of the radiated signal can be seen. It will be found that quite small adjustments to transmitter tuning can have a considerable effect on radiated power. PW



# SPEED UP YOUR REFLEXES!

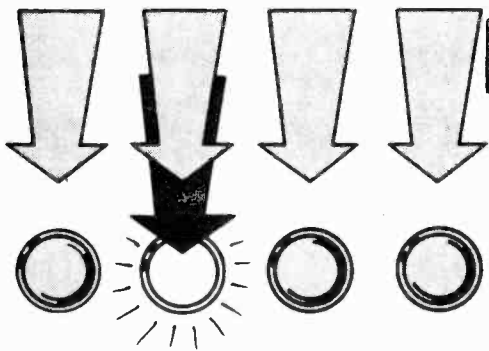
# IN NEXT MONTH'S PRACTICAL WIRELESS

## REACTION TIMER



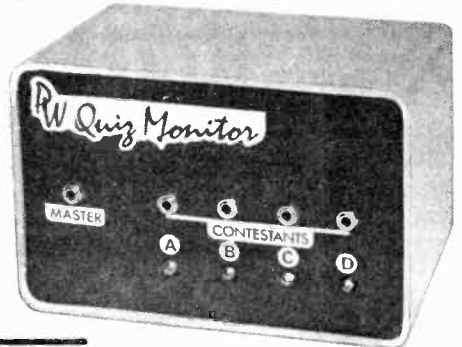
Here is an amusing device that will enable you and your friends to compare reaction times without any further argument! Full details given for the construction and calibration of the timer.

*and*  
*be first to 'hit the button' on our...*



## QUIZ MONITOR

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Output impedance at external LS socket	8-35Ω
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Notes available	60
Number of pitches	Two-8ft. and 16ft.
Master oscillator frequency	500kHz nominal.
Three voices each pitch	slider 1—triangular slider 2—square slider 3—spike
Supply voltages from internal power supply	-12V and -27V

IT must be the ambition of thousands of people to own and be able to play an electronic organ, failing to do so only because of the universal hurdle that has to be overcome—the price of a worthwhile instrument. In recent years however, a number of “Reed Organs” have appeared in the shops at more realistic prices but (apart from some near fraudulent claims) none of these, by any stretch of the imagination, can be classed as electronic organs, and of course, none of them get close to emulating the wide range of tone colours and effects that a true electronic organ is capable of producing.

The more adventurous amateur electronics enthusiasts have built their own instruments, but of these courageous people, probably very few have ever been able to complete their project either because time has been against them, or they have run up against the financial barrier. Those who have attempted making their own organ to conventional designs will be very much aware of the tremendous amount of time required to complete the job, caused simply by the number of components, interconnections and complex mechanical structure of the instrument.

The instrument to be described in this article has been designed with all the foregoing problems in mind and the resulting design is neat and extremely simple to make. Four or five evenings of work can

complete the electronic assembly, the cabinet is a straightforward carpentry job and the finished organ is small, compact, and light enough to carry around and produces a wide range of tone colours from rich church tones to bright crisp group sounds. It even features a few effects only found on the most expensive of commercial organs. All this is obtained for a comparatively low cost, about £50-£70 at current prices, but it depends, of course, on how one does the shopping and what work one is prepared to do at home.

To keep mechanical problems down to a minimum there are only two printed circuit boards; one of which houses the tone generating and tone forming circuits, including controls, and the other, a very simple board contains the power supply. Apart from these boards the only other wiring is a loom of wires to the keyboard and input and output lines to an external amplifier, if this is required.

Some sacrifices have had to be made to make it possible to meet the ultimate objective. The main one is the way tone colours are controlled. An organ purist will, no doubt, wince at the way these are generated because we have deliberately avoided the temptation of making a unit that will synthesise a pipe organ. The author feels that if one is making an electronic organ one ought to make the best possible use of electronic techniques to produce acceptable sounds, rather than to make an instrument sound like something it isn't!

INTERNAL AMPLIFIER

It is assumed that the instrument will be used either on the domestic scene, where high powers are not required, or for use with groups which are well catered for with dozens of watts of power from external amplifiers. There is, therefore, a built-in simple one watt audio stage which drives a small internal speaker; this provides ample power for the average room but lacks in bass response (more from the loudspeaker than the amplifier itself). It is for this reason that there are built-in options for headphone output and phono output which will plug into any high power or Hi-Fi amplifier system, for a truly high quality output.

# PW 'Easybuild'

# ELECTRONIC ORGAN

## MIERE

## PART 1

Anyone with some experience of soldering should be able to make this organ but, as one might expect, some care and patience is needed to prevent problems. The complexity has been removed from the hands of the constructor and transferred to the main printed circuit board. While assembly is simply a matter of putting the right components into the right place the right way round, the job of "soldering in" has to be done carefully to avoid bridging some of the narrowly separated conductors on the board. The organ also uses a large number of MOS (Metal Oxide Semiconductor) devices which have to be handled correctly to prevent damaging them. This may ring alarm bells in some areas but we shall explain exactly how to handle these devices when the time comes.

It is imperative that before embarking on this project that you obtain a good quality miniature solder-

ing iron. The bit diameter should, ideally, be  $\frac{3}{32}$ in. but under no circumstances should it exceed  $\frac{1}{8}$ in. diameter. Apart from this you will need normal tools i.e. side cutters, small pliers, a small screwdriver and resin cored solder. Use 22 gauge solder rather than the heavier 18 gauge to help keep connections neat. We recommend that you also have available a continuity tester (ohmmeter) to check for short circuits, any simple multimeter will suffice.

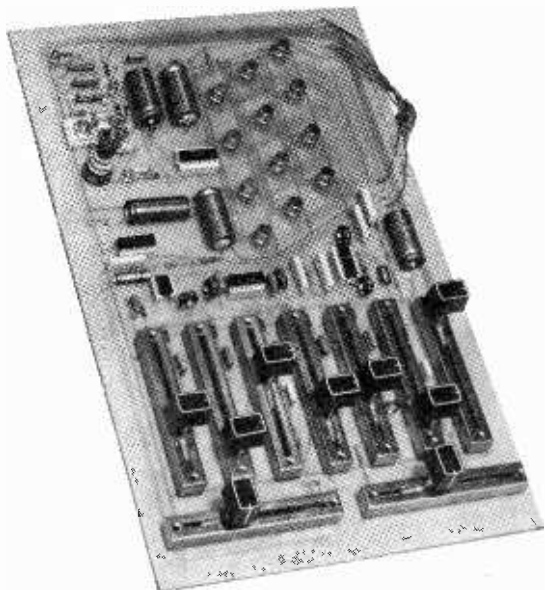
Armed with this equipment you should experience no problems, and, apart from being very pleased with the sound of the completed instrument, you should obtain great pleasure and satisfaction from the neat way it goes together. The only danger envisaged is that when the neighbours see and play it, you will find yourself embarking on it a second time round! A complete shopping list for all the components and hardware is given in this part together with the names and address of suppliers of the more unusual components.

## NOTE GENERATION

Before describing the circuitry in detail we will, for the benefit of those who have not encountered an organ before, go through the system in block form. The complete system is shown in Fig. 1.

A proper organ (unlike simple stylus organs) is a polyphonic device. This means that we can play as many notes as we like, all at the same time. Consequently it is necessary to have a large number of tone generators, each producing a frequency for every note on the keyboard. Using a 49 note keyboard (four 12 note octaves + top "C") we need, on the face of it, 49 separate tone generators. In practice more than these are needed for an organ because we have to provide the facility to play two notes (an octave apart) by depressing a single key which helps to generate the wide range of tone colours. To make this possible and to get the two pitch effect over the whole keyboard it is necessary to provide an extra octave of notes which extend below the bottom end of the normal keyboard. The tone generator in this circuit provides a total of 60 separate signals, each one of which has to have an exact frequency to keep the organ in tune. In the past this in itself has been an awesome task for the home constructor, but by making use of modern technology and integrated circuits this part of the system is now the simplest.

To generate the 60 different notes, we start off by



Main printed board containing tone generating and tone forming circuits, as well as all slider controls.

producing 12 tones that give the highest octave required on the keyboard. The notes occurring in octaves beneath this topmost one have an exact two to one relationship with each other. For example, if the frequency for the highest "C" on the keyboard is  $f$ , then the "C" an octave lower will be  $f/2$  and for the octave beneath that will be  $f/4$  and so on. The same applies to the other 11 notes in the top octave. To generate notes for sub-octaves it is only necessary to take the frequency of that note for the top octave and subject it to division by two for each successive octave lower. This is easily accomplished using divide-by-two integrated circuits. Operating with a top octave plus four other sub-octaves, for each note four divide-by-two circuits are needed. As it happens there are integrated circuits on the market which contain the four stages we require (for each note) all in the same package, so 12 such integrated circuits are required.

The problem remaining is to generate the 12 original notes for the top octave. In the past this has required 12 separate oscillators each of which needed

careful tuning. Apart from the tuning problem these oscillators required a lot of assembly time and proved quite costly. It is now possible to use a single oscillator and a special integrated circuit (which is, admittedly, rather costly) to produce the 12 notes in one operation. This means that there will no longer be any problems with tuning because every note will be precisely locked in an exact frequency relationship with its neighbour, so it is only necessary to set the master oscillator at the right frequency to tune the organ to the international pitch.

Again, the organ purists will wince at this because we are making use of the equal temperament scale which assumes an exact mathematical relationship between the frequencies of adjacent half tones within the musical scale. There is also the apparent drawback that it is virtually impossible to generate this relationship to perfection with simple electronics. Our organ will, intrinsically, be slightly out of tune from the equal temperament scale, but in fact the deviation is so small that it is impossible to discern the difference. It is worth remembering that many

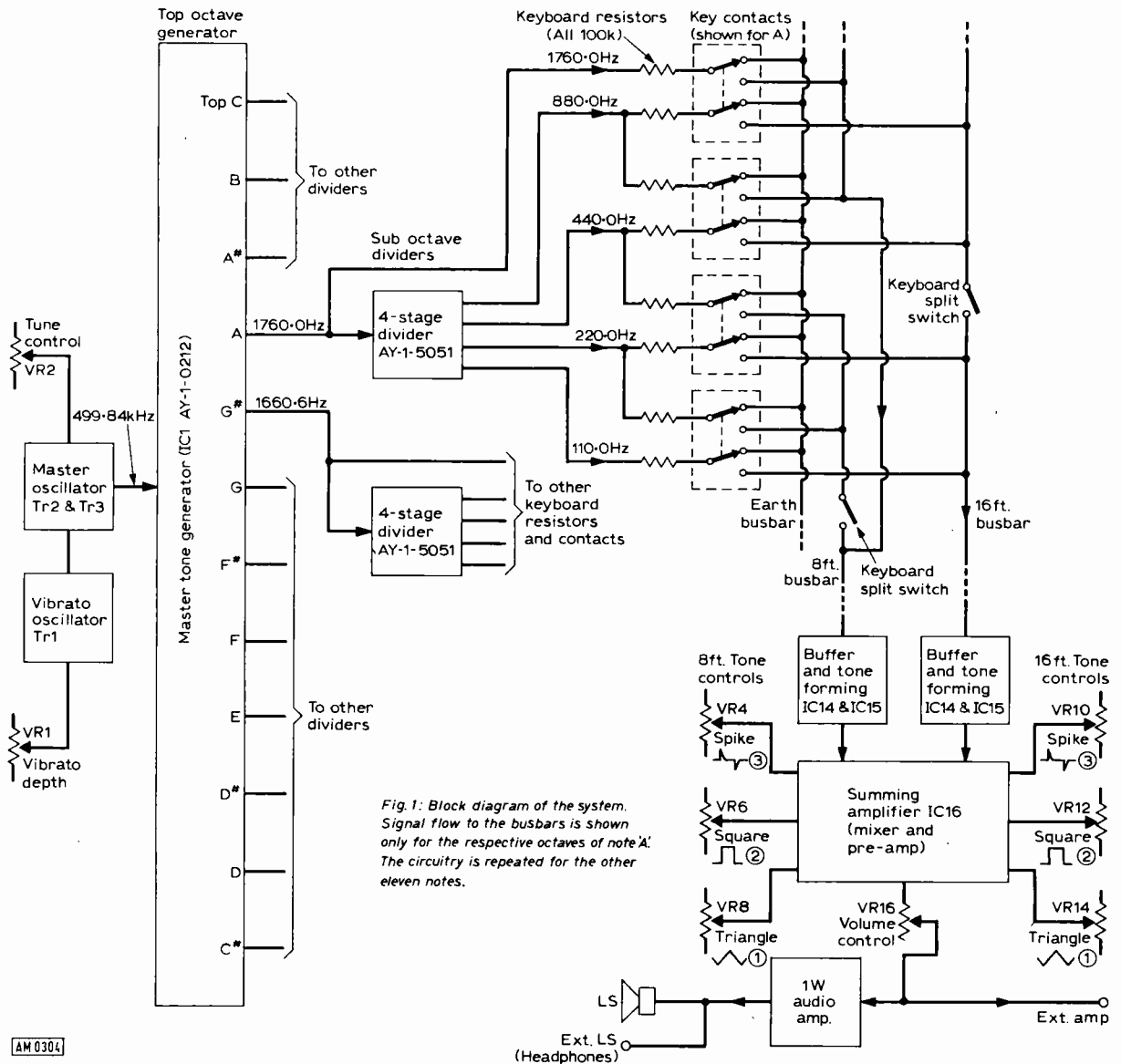


Fig. 1: Block diagram of the system. Signal flow to the busbars is shown only for the respective octaves of note 'A'. The circuitry is repeated for the other eleven notes.

highly priced commercial organs are now using exactly the same technique that we are advocating. This master tone generator IC produces the correct musical intervals by dividing down from an input frequency that is considerably higher than any of the notes required. The IC has 12 internal divisors, consequently there are 12 separate notes at the outputs. In our organ a master oscillator producing a nominal 500kHz output signal is used. The table shows the frequencies of the notes generated from the divisors for the top octave and for the subsequent four octaves beneath it. If the organ is to be tuned to International A (440Hz) the input frequency should be 499.840kHz and the figures in the table assume this as being the signal available from the master oscillator.

Even though the master oscillator may not be exactly on the stated frequency the organ will sound in tune with itself throughout its range because the tone intervals are locked. The only problem is that the organ, as a whole, would not necessarily be in tune with other instruments. This immediately presents two advantages in having an organ tuned this way: (1) there are absolutely no problems in setting up the basic tuning and (2) by adjusting one control only the organ can be brought into tune with any other instrument.

By voltage controlling the frequency of the master oscillator at low frequencies (approximately 6Hz) we can introduce frequency modulation of all the tones and this gives a very good vibrato effect. The vibrato is not ideal because all the tones are varying their frequencies in unison and this, to an organ purist, is not desirable, although the result is perfectly acceptable. By applying a DC shift to the voltage controlling the oscillator we can introduce a "tune" control to give Hawaiian guitar type sounds over about 1½ tones.

## THE KEYBOARD

The 60 tone lines from the dividers are fed through resistors to contacts on the keyboard. Each key has two contacts which have the true note fed to one contact (we call the genuine notes 8ft pitch) and the corresponding note an octave lower (16ft pitch) to the other contact. When the keys are not pressed the end of each resistor is connected to an earth rail and consequently the signal is shorted to earth. If a key is pressed the signals are fed to a line common to all the keys, called a busbar. There are two busbars in this organ; one for the 8ft pitch notes and the other for the 16ft pitch. The more keys that are pressed the more frequencies are superimposed on each other on each busbar, giving rise to the chords with

which we are all familiar. Using the series resistor on each line ensures that the signals superimpose additively which means that the volume will increase somewhat as more keys are pressed.

The signals impressed on the busbars are very much attenuated after the generators but they are in the same form, i.e. they are square waves that have been additively mixed. One could feed the busbar straight into an amplifier and listen to the sound of the square waves but the effect would be most uninteresting, being very much like a clarinet. The next step is to feed the output from each busbar into a circuit that will modify the wave shape of each set of signals. Such a circuit is called a tone forming circuit and there are two sets of these in the organ; one which operates exclusively on 8ft pitch notes while the other operates independently on 16ft pitch.

## TONE FORMING

Most organs carry out tone forming by feeding the busbar signals into complex filters, which is called subtractive tone formation because it simply filters out frequencies in various bands to "colour" the sound. The PW organ uses a totally different technique which is a form of additive tone colouration. The technique will be described in more detail later but basically the square wave signal is amplified and in turn forms one of the signals used in the additive process. It is then differentiated to produce a series of fast spikes. Such a signal maintains many of the characteristics of the original sound but becomes extremely "reedy". This signal is easy to produce and forms the second of the additive mixing signals. Finally the original square wave is fed to a two-ramp integrator which converts the square wave into a series of triangular waves. These triangular waves are more mellow in sound quality and closely resemble a flute. Ideally it would have been nice to produce sine waves rather than triangular waves but this would have required far too much circuitry.

These three modifications of the original busbar signals, "square", "spike" and "triangle" are fed via three slider potentiometers to a voltage summer. We can thus mix any proportion of one type of waveform with another and vary the colouration of the sound over a wide range. All the above is repeated for the other pitch (either 8ft or 16ft) and the output from the mixing sliders of the second pitch are also fed to the same summing point. One can therefore mix the spike waveform of, say, the 8ft pitch with the triangle waveform of the 16ft pitch and produce a totally different kind of sound. With the six controls an infinite number of sound patterns can be generated.

NOTE	Divisor	fHz (top octave)	fHz (next octave)	fHz (next octave)	fHz (next octave)	fHz (bot. octave)
Top C	÷ 239	2091.4	1045.7	522.9	261.4	130.7
B	÷ 253	1975.7	987.8	493.9	247.0	123.5
A#	÷ 268	1865.1	932.5	466.3	233.1	116.6
A	÷ 284	1760.0	880.0	440.0	220.0	110.0
G#	÷ 301	1660.6	830.3	415.2	207.6	103.8
G	÷ 319	1566.9	783.5	391.7	195.9	97.9
F#	÷ 338	1478.8	739.4	369.7	184.9	92.4
F	÷ 358	1396.2	698.1	349.1	174.5	87.3
E	÷ 379	1318.8	659.4	329.7	164.9	82.4
D#	÷ 402	1243.4	621.7	310.9	155.4	77.7
D	÷ 426	1173.3	586.7	293.3	146.7	73.3
C#	÷ 451	1108.3	554.2	277.1	138.5	69.3

## ★ components list

### Resistors

R1	1MΩ	R17	100kΩ
R2	4.7kΩ	R18	100kΩ
R3	38kΩ	R19	10kΩ
R4	38kΩ	R20	680Ω
R5	2.2kΩ	R21	100kΩ
R6	22kΩ	R22	100kΩ
R7	100kΩ	R23	10kΩ
R8	1kΩ	R24	100kΩ
R9	470kΩ	R25	100Ω
R10	1kΩ	R26	2.2kΩ
R11	100Ω	R27	2.2kΩ
R12	100Ω	R28	22kΩ
R13	10kΩ	R29	4.7kΩ
R14	680Ω	R30	680Ω
R15	10kΩ	R31-R128	100kΩ
R16	100kΩ		

All resistors 10% $\frac{1}{2}$ W	VR9	100kΩ min vert preset
VR1 5kΩ lin slider	VR10	10kΩ lin slider
VR2 5kΩ lin slider <sup>1</sup>	VR11	4.7kΩ min vert preset
VR3 100kΩ min vert preset	VR12	10kΩ lin slider
VR4 10kΩ lin slider	VR13	220kΩ min vert preset
VR5 4.7kΩ min vert preset	VR14	10kΩ lin slider
VR6 10kΩ lin slider	VR15	100kΩ min vert preset
VR7 10kΩ lin slider	VR16	10kΩ lin slider
VR8 10kΩ lin slider		

### Capacitors

C1	0.22μF	C16	0.33μF
C2	0.22μF	C17	0.047μF
C3	0.22μF	C18	0.1μF
C4	0.1μF	C19	0.33μF
C5	2200μF	C20	0.1μF
C6	1000μF (16V)	C21	0.1μF
C7	500pF (trimmer)	C22	0.1μF
C8	1000μF	C23	10μF (25V)
C9	0.33μF	C24	47μF (10V)
C10	0.033μF	C25	1000μF (16V)
C11	0.1μF	C26	0.33μF
C12	0.33μF	C27	1000μF (16V)
C13	0.1μF	C28	100μF (16V)
C14	0.1μF	C29	3000μF (35V)
C15	0.1μF		

All polyester 240V unless otherwise stated

### Semiconductors

Tr1	BCY71	D2	1N4004
Tr2	BCY71	D3	1N4004
Tr3	BCY71	D4	1N4004
Tr4	AD162	D5	1N4004
D1	1N4004	D6	1N4004
		D7	12V 400mW zener

### Integrated circuits

IC1	AY-1-0212	IC10	AY-1-5051
IC2	AY-1-5051	IC11	AY-1-5051
IC3	AY-1-5051	IC12	AY-1-5051
IC4	AY-1-5051	IC13	AY-1-5051
IC5	AY-1-5051	IC14	747 dual-in-line
IC6	AY-1-5051	IC15	747 dual-in-line
IC7	AY-1-5051	IC16	741 dual-in-line
IC8	AY-1-5051	IC17	LM380 dual-in-line
IC9	AY-1-5051		

### Miscellaneous

T1 240V prim. 18V  $\frac{1}{2}$ A sec. L1 and L2 Denco Maxi-Q aerial coil (blue) range T2. S1 240V  $\frac{1}{2}$ A mains slide. S2 single pole rocker. S3 single pole rocker. LS1 8Ω to 35Ω to suit cabinet. Sk1 switched jack. Sk2 switched jack. 49 note (C to C) keyboard. 49 two pole contact assemblies. Main PCB, power supply PCB, 16 circuit board pins, 98 way tag strip (tag separation approx.  $\frac{1}{2}$ in.) and approx. 50 yards fine insulated flexible connecting wire.

## ★ collated component list

### Resistors

3 off	100Ω	4 off	10kΩ
3	680Ω	2	22kΩ
2	1kΩ	2	38kΩ
3	2.2kΩ	105	100kΩ
2	4.7kΩ	1	470kΩ
		1	1MΩ

All resistors 10% $\frac{1}{2}$ W

### Potentiometers

7 off	10kΩ	} All linear sliders with three terminals (type TTC, PW organ)—from Radio Components Specialists or Henrys Radio
2 off	5kΩ	

### Presets

2 off 4.7kΩ min vertical, 3 off 100kΩ, 2 off 220kΩ

### Capacitors

1 off	500pF Compr. trimmer	3 off	0.22μF
		5	0.33μF
1	2200pF (polyester)	1	10μF (25V)
1	0.033μF	1	47μF (10V)
1	0.047μF	1	100μF (16V)
9	0.1μF	4	1000μF (16V)
		1	3000μF (35V)

### Transistors

3 off BCY71 and 1 off AD162

### Diodes

6 off 1N4004 and 1 off 12V 400mW zener

### Integrated circuits

1 off	AY-1-0212	1 off	741 dual-in-line
12	AY-1-5051	1	LM380
2	747 dual-in-line		

### Inductor

1 off Denco Maxi-Q aerial coil (blue) range T2

### Transformers

1 off 240V prim. 18V  $\frac{1}{2}$ A sec. type MT50 $\frac{1}{2}$

### Switches

1 off 240V  $\frac{1}{2}$ A mains slide, 2 off single pole rockers (miniature)

### Loudspeaker

1 off 8Ω to 35Ω to suit enclosure

### Miscellaneous

16 printed board pins. 3 x 14 pin DIL sockets. 1 x 16 pin DIL socket. 1 x 8 pin DIL socket. 50 yards fine insulated flexible connecting wire. 93 way tag strip comprising four separate strips holding 24,24,24 and 26 tags each, (these have to be constructed by the builder). Two switched jack sockets ( $\frac{1}{2}$ in.).

49 note (C to C) keyboard with 49 two pole contact assemblies, paxolin mounting plates and palladium earthing busbars; available as a kit from Maplin Electronic Supplies, PO Box 3, Rayleigh, Essex SS6 8LR priced £29.95 incl. p.p. & VAT.

Main printed circuit board and power supply printed circuit board available from Foresight Electronics, 62 High Street, Croydon CR9 2UT; price of both boards £7.20 incl. p.p. & VAT.

Integrated circuits, Transistors and Diodes available from Chromasonic Electronics, Dept. 1, 56 Fortis Green Rd., London N10; Henry's Radio, 404-406 Edgware Rd., London W2; Marshall's, Dept. PW, 42 Cricklewood Broadway, London NW2 3HD, Tel:01-452 0161 and Foresight Electronics.

### NOTE

Practical Wireless is offering a full size paper drawing of the main printed board showing track layout. For those who require one of these, please write, marking the envelope 'Easybuild Organ' to Practical Wireless, Fleetway House, Farringdon St., London, EC4A 4AD. and enclosing a PO or cheque for 25p and a 10x8in size S.A.E.

The output from the six input summer is fed to an internal integrated circuit power amplifier to give about one watt output from the internal loudspeaker. Alternatively the output from the summer can be taken to an external Hi-Fi amplifier if greater power and/or higher quality is required.

## SPLIT KEYBOARD

A drawback with a single manual organ is the lack of ability to emphasise the right hand or the left hand. An option in this system (which is included as standard but can be removed if not desired) is to "split" the keyboard. This allows us to use the 16ft pitch only over the bottom two octaves and the 8ft pitch only over the top two octaves. Thus, by means of a switch, it is possible to have 16ft operating over the whole keyboard but 8ft only over the top two octaves; this would make anything played by the right hand stand out over the accompaniment. Likewise 8ft can be operational over the whole keyboard with 16ft only over the bottom range, giving emphasis to bass notes. There is very little complication introduced to the electronics by doing this, all that is necessary is a series switch in each of the two busbars. The complications arise when trying to play in this mode, and only skilled organists are likely to be able to make the best use of this facility.

Due in part to the lack of pure sinewaves the organ tends to favour reed tones and although there are plenty of mellow tones to be produced, the tone colouration lacks variety. To overcome this drawback and increase the range considerably, it is suggested that the organ be connected to a Hi-Fi amplifier, where the treble and bass controls can be used to the best effect.

## CIRCUIT DETAILS

Fig. 2 shows the master oscillator and vibrato oscillator. The nominal 500kHz signal is generated by Tr3 which is a Hartley Oscillator using a standard medium wave tuning coil as the inductor. Making C7 500pF brings its tuning range well down to the frequency required. D1 and D2 are ordinary power rectifier diodes operating as varactor diodes and are, effectively, in shunt across C7. The more negative the potential of Tr2 emitter, the more reverse biased these diodes become, their junction capacitance reduces and the frequency of the oscillator rises.

The quiescent potential at Tr2's emitter is set over a limited range by VR2, the "tune" control already mentioned. On this quiescent potential one can superimpose a low frequency AC signal (about 6Hz) from the phase shift oscillator comprising Tr1. The amplitude of this vibrato signal can be varied from zero to maximum by VR1. There is no built-in preset control to the vibrato frequency but if desired it can be modified by changing the values of R3 and R4 (increasing them to 47kΩ will reduce the frequency and vice-versa). Do not use resistors outside the range of 22kΩ to 47kΩ.

The characteristics of the tuning diodes are by no means linear and it will be found that the vibrato has greater effect when VR2 is set to its earthy end (this corresponds to low frequencies). Values have been chosen to keep the variation to a minimum but in practice this should present no problems because for normal playing VR2 will not be altered once set—unless producing special "tune" effects and even then the "tune" will greatly over-ride the change in vibrato level.

The output from the collector of Tr3 is used to drive the master tone divider integrated circuit (IC1 in Fig. 3). This is an MOS integrated circuit in a 16 lead DIL encapsulation. It requires two negative supply rails of -12V and -27V as well as earth. Because of this, and the fact that other MOS devices having similar power requirements are used, the rest of the circuit is designed to operate from a -12V rail. Provided IC1 sees an input signal of 10V it will carry out its complex division with no problems. Each output is a square wave with unity mark space ratio for even divisions and a slight divergence from unity for odd divisions; this is mentioned purely for information and plays no part in the efficiency of the operation.

The output impedance of the master tone generator is 3-5kΩ. Being comparatively low there are no problems with interfacing it with the subsequent dividers and taking a parallel tapping from it to provide the tones for the topmost octave. Each output is fed to the input of a four stage divider, with 12 such circuits designated IC2 to IC13. These operate from the same supply rails as IC1 and are fully compatible. The only problem with these circuits is that they are in 10 lead TO-5 encapsulations which makes them slightly more difficult to handle. C8 and R12 are for decoupling and to prevent any breakthrough of the

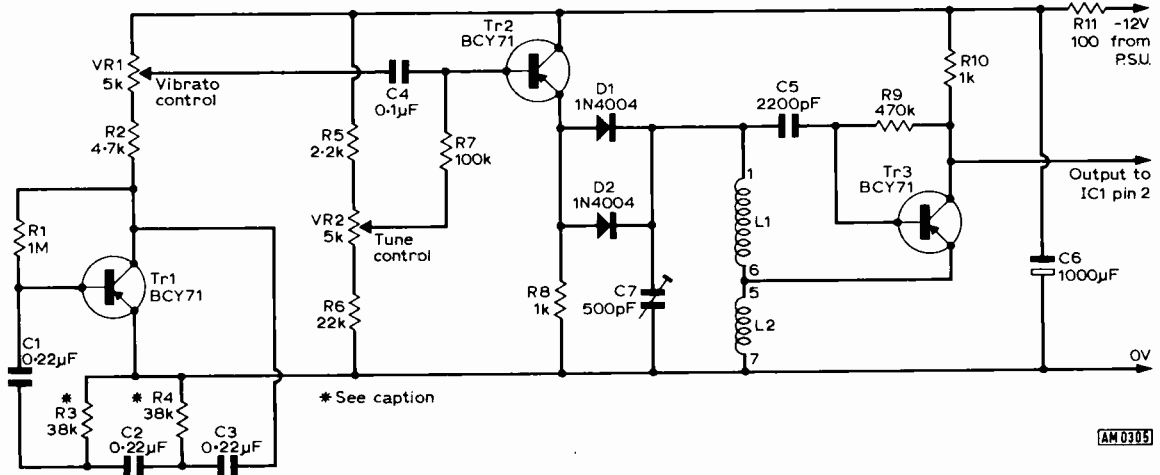


Fig. 2: Circuit diagram of Master oscillator, Vibrato and Tune circuits. R3 and R4 can be varied in the range 22kΩ to 47kΩ to preset vibrato speed to the desired value.

# NEW LOW PRICES!

## Sinclair Scientific kit

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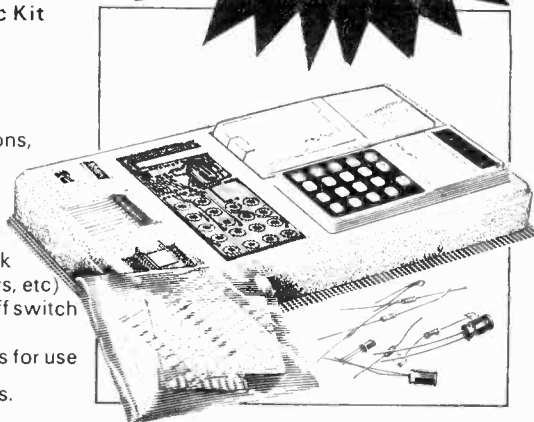
All parts are supplied - all you need provide is a soldering iron and a pair of cutters. Complete step-by-step instructions are provided, and our Service Department will back you throughout if you've any queries or problems.

Of course, we'll happily supply the Scientific or the Cambridge already built, if you prefer - they're still exceptional value. Use the order form.

Components for Scientific Kit (illustrated)

1. Coil
2. LSI chip
3. Interface chips
4. Case mouldings, with buttons, windows and light-up display in position
5. Printed circuit board
6. Keyboard panel
7. Electronic components pack (diodes, resistors, capacitors, etc)
8. Battery assembly and on/off switch
9. Soft carrying wallet
10. Comprehensive instructions for use

Assembly time is about 3 hours.



## Features of the Sinclair Scientific



- 12 functions on simple keyboard  
Basic logs and trig functions (and their inverses), all from a keyboard as simple as a normal arithmetic calculator's. 'Upper and lower case' operation means basic arithmetic keys each have two extra functions.

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- 200-decade range  
 $10^{-99}$  to  $10^{99}$

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4 AAA manganese alkaline batteries (e.g. MN2400) give 25 hours continuous use. Complete independence from external power.

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4 1/3" x 2" x 11/16".  
Weight 4 oz. Attractively styled in grey, blue and white.



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### Components for Cambridge Kit

1. Coil
2. LSI chip
3. Interface chip
4. Thick film resistor pack
5. Case mouldings, with buttons, window and light-up display in position
6. Printed circuit board
7. Keyboard panel
8. Electronic components pack (diodes, resistors, capacitors, transistor)
9. Battery clips and on/off switch
10. Soft wallet

Assembly time is about 3 hours.

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The Sinclair Cambridge and Scientific kits are fully guaranteed. Return either kit within 10 days, and we'll refund your money without question. All parts are tested and checked before despatch - and we guarantee any correctly-assembled calculator for one year. (This guarantee also applies to calculators supplied in built form.)

Simply fill in the preferential order form below and slip it in the post today.

### Scientific

Price in kit form £14.95 inc. VAT

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Price in kit form £9.95 inc. VAT.

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## Features of the Sinclair Cambridge



- Uniquely handy package. 4 1/3" x 2" x 11/16", weight 3 1/2 oz.
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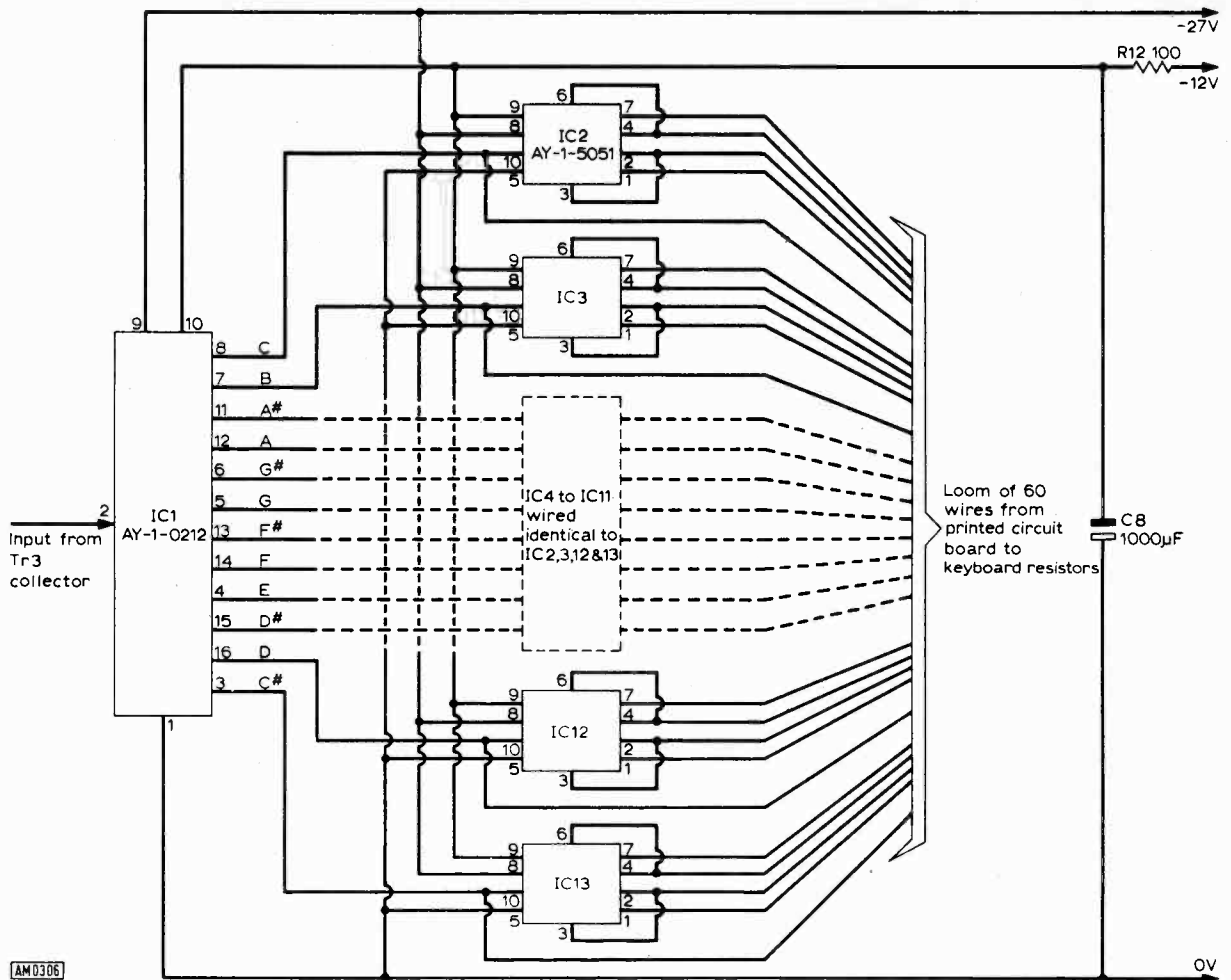


Fig. 3: Master tone generator and divider stages. The note 'C' is 'Top C' for each octave generated. Hence the lowest 'C' for 16ft pitch on the four octave keyboard is not available.

"chorus" from all the notes into the final audio stages of the organ which operates from the same -12V rail.

The four outputs from each divider together with a loop from its input are fed into a 60 wire loom which is routed to the keyboard resistors (mounted immediately adjacent to the key contacts).

## CONTROLS

The two wires from the 8ft and 16ft pitch busbars are routed back to the circuit shown in Fig. 4 which embraces the tone forming circuits, mixing stage and summing amplifier. The top portion and bottom section of Fig. 4 are identical apart from the values of C10 and C17. SW2 acts as the keyboard splitting switch at 8ft pitch. When it is closed the organ operates normally over its full range but when opened, only the top two octaves are fed through C9 to the input buffer amplifier ( $\frac{1}{2}$  of IC14). VR3 is used to preset the gain of this stage and its function will be explained during the setting up procedure. C10 with R14 differentiate the square wave signal from IC14 to produce the spikey waveform already described. Proportions of this are divided off by the manual control VR4 to be fed through C11 to the summing point of the six input mixer.

The preset VR5 taps off a proportion of the unmodified square wave signal which is fed via the control VR6 to the summing point. The preset is necessary to control, to a sensible level, the balance between the three tone colours. Without it the square wave signal would be grossly overpowering. C12 feeds the square wave signal to half of IC15 which operates as a two-ramp integrator. The rate of ramp is set by C14 with R15. The slope of the ramp remains constant for all input frequencies, resulting in higher frequencies being subjected to attenuation. Over the frequency range of the organ there is approximately a five to one amplitude variation in signals from the integrator but as it is the higher end that is attenuated this just about compensates for the ear's frequency response. In fact, although this ratio of five to one sounds dramatic there is very little difference on the ear!

The integrator by itself causes a very nasty keying "thump" and this is particularly noticeably at higher frequencies. To remove this effect the capacitor C14 is bypassed by VR7. On setting-up this is adjusted to the minimum value possible, consistent with a useful signal. The higher the value of VR7 the higher the gain of the integrating amplifier and hence the higher the overshoot, which causes the "thump". The

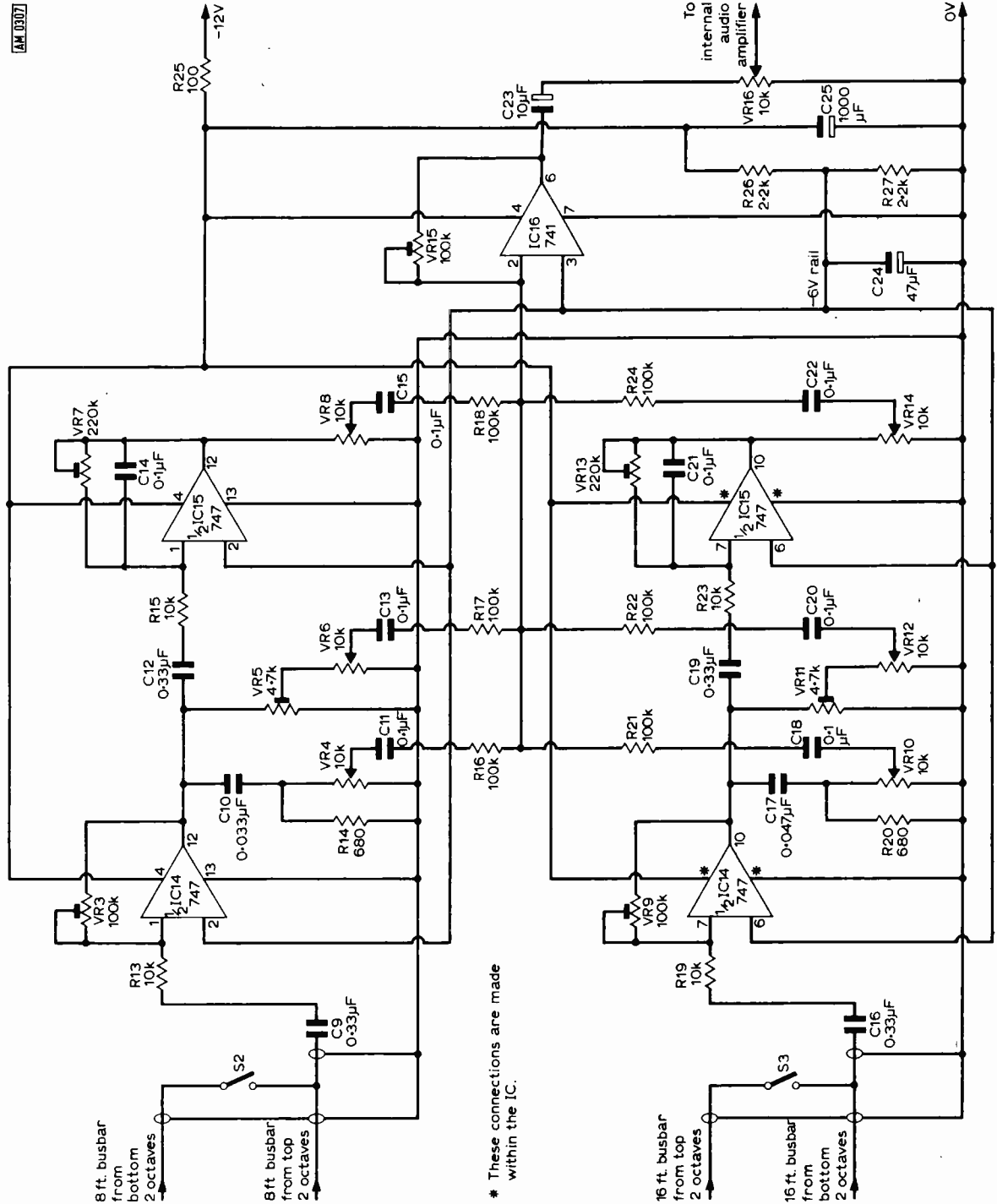


Fig. 4. Circuit diagram of the Tone forming circuits, the mixing stage and preamplifier.

triangular wave output from the integrator is now fed via the control VR8 to the summing point.

The tone forming circuit for 16ft pitch is identical except, of course, that the keyboard splitting switch operates on the bottom two octaves and in order to get a bit more power in the spike waveform, C17 has a slightly higher capacitance.

IC16 acts as a summing amplifier but perhaps ought to be called the pre-amplifier for the output signal. Its gain is set by the preset VR15 so that the

output from the wiper of VR16, the volume control, matches the input requirements of the external amplifier (probably in the range of 100 to 500mV). Remember that the output level depends very much on how many notes are being played and how the tone forming sliders are set. It is always better to have less gain than seems necessary in this stage to prevent overloading the other audio stage.

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# PRODUCTION LINES

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## 23CM CONVERTER

This SSM 23 converter uses schottky diodes in a balanced hybrid ring mixer. The secrets of its high performance lie in the balance of the mixer circuit, the image suppression stub, accurate matching into the i.f. amplifier and a clean, filtered oscillator injection signal. These features not only aid in the suppression of u.h.f. TV signals but also contribute to the final overall noise figure.

The crystal used in the oscillator chain is a close tolerance, low temperature co-efficient unit oscillating in the region of 100MHz. This is multiplied into the 1,200MHz region and the desired harmonic is selected in a *tuned* 2 pole resonator to provide a high rejection to unwanted harmonics.

In the hybrid ring mixer the signal input, the oscillator chain and the two diodes are each spaced  $\lambda/4$  apart, with the oscillator fed in between the two diodes. Therefore, the diodes see an *in phase* injection from the oscillator port and an out of phase signal from the aerial port. The injection is cancelled at the aerial and thus not radiated and the signal is cancelled at the oscillator port and not attenuated in the oscillator filter. Just like the balanced modulator in an SSB transmitter.

The i.f. amplifier employs two stages of amplification designed to have a very low noise figure and carefully matched into the diodes output.

Overall noise figure is 7dB, gain is 27dB and size 4in x 2½in x 1½in. Connectors for Standard converter—BNC co-axial socket input; Belling Lee co-axial output socket; 2mm colour coded supply terminals.

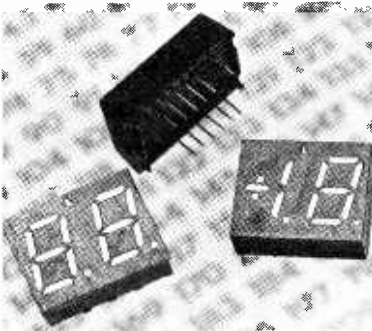
Price is £21.60 (this includes VAT and carriage). Converters are available for other frequencies (including satellite frequencies) or to customers' special requirements—up to the microwave region. Your enquiries are invited. If you would like further details, send a stamped, addressed envelope to: *S.S.M. Solid State Modules, 63 Woodhead Road, Solid, Lockwood, Huddersaeld, HD4 GER. (Tel. 0484 23991).*

## DUAL-DIGIT DISPLAYS

Litronix announce two new dual-digit red-lit numeric displays, believed to be the only displays of their type currently available. Designated DL-721 and DL-727, they have been created for a broad range of commercial and domestic applications, from digital clocks and t.v. tuner indicators to digital instrumentation and point-of sale systems. DL-721 contains a polarity indicator, and can register from 00 to 19; DL-727 incorporates two 7-segment digits, and can register from 00 to 99.

In both cases, the digits measure 0.5in. in height and have a right-hand decimal point. They are end-stackable on 0.5in. digit centres.

Typical electrical characteristics of these common-anode units include a forward voltage of 2V at 0.5 to 50mA, dynamic resistance of 6-ohm at 10mA, and luminous intensity of 3mcd at 20mA.



Both the -721 and the -727 are priced at £2.44 in quantities of 1,000. For further information and prices, contact *Litronix, European Headquarters—Bevan House, Bancroft Court, Hitchin, Herts SG5 1LW.*

## P.C.B.'s

W.K.F. Electronics tell us that they are able to offer any current circuit board published in *Practical Wireless* at 70p each, irrespective of size, complexity, etc.

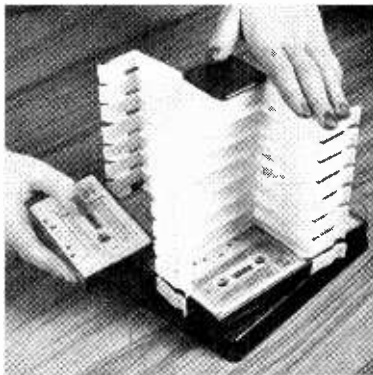
If you would like further information on this service, contact: *W.K.F. Electronics, Welbeck Street, Whitwell, Worksop, Notts.*

## CASSETTE STORAGE

This excellent new cassette storage system is being sold direct from the manufacturers, Plastic Engineers Ltd. At a price of £2.50, it represents very good value for money.

The "Tape-Rax" holds 32 cassette cases on eight levels. Extra levels can be added and an extra four levels to hold another 16 cassette cases costs £1 plus 20p post and packing.

"Tape-Rax" may be obtained by sending £2.50 plus 30p postage and packing to *Plastic Engineers Limited, Treforest Industrial Estate, near Pontypridd, Glamorgan.*



## THE CHANTICLEER

The "Chanticleer" is a new digital alarm clock from Bywood Electronics. The figures are shown as an orange display 0.7in. high. A brightness control dims the display for bedroom use.

It is very simple to set both time and alarm by two switches. At the time the alarm has been set for, a "beep" is emitted. This can be reset for five minutes simply by tilting the clock. This feature is jolly useful, for if you do doze off the alarm will wake you again in five minutes. The clock is mains operated and if the supply should fail, the display flashes to indicate that it may not be showing the correct time.

Recommended price of the "Chanticleer" is £19.95 plus VAT. It comes complete with case and 2-year guarantee. Further gen from: *Bywood Electronics, 181 Ebbens Road, Hemel Hempstead, Herts, HP3 9RD.*



## THE SWING S

Audio Workshops Ltd., have introduced a new Swing S indoor f.m. aerial. It has a low profile central body and two clear acrylic plastic "wings" along the edges of which there is an aluminium strip which acts as the aerial's element.

The aerial has a built-in tunable r.f. amplifier which can be tuned by turning the top of the body of the amplifier (white disc in picture) until the chosen optimum frequency is selected.

Audio Workshops tell us that the gain in signal strength is around 3-6dB and good stereo reception is possible under fringe conditions.

The aerial's tuning frequency range is 87-104MHz. It is supplied with two input cables, one for power and one for connection to the tuner. Retail price is £18.09 (including VAT). *Audio Workshops Limited, 29 High Street, Robertsbridge, Sussex.*

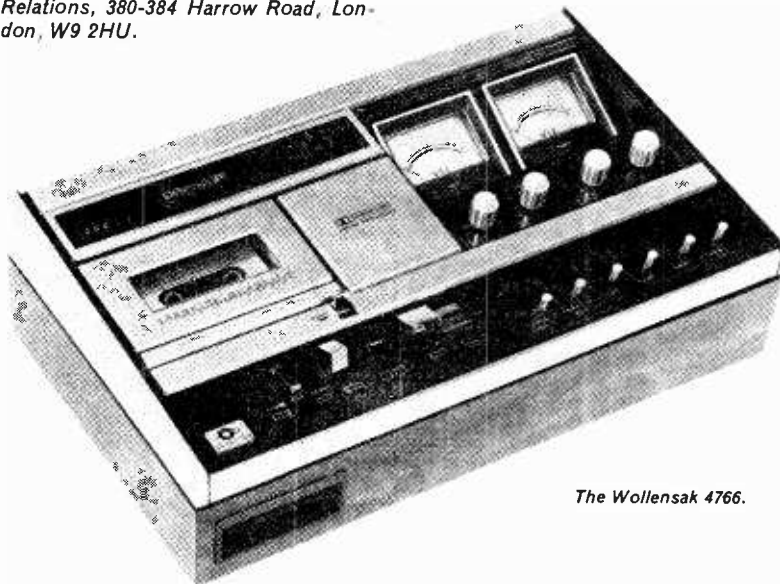
## 3M CASSETTE DECK

The Wollensak stereo cassette deck type 4766 from 3M employs beltless capstan drive, heavy-duty flywheel and Dolby noise reduction.

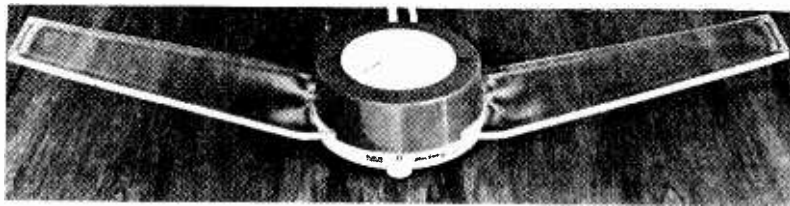
Features include sound mixing, peak overload indicators and 3-position bias switching.

Most "Dolbyised" decks have only a service-adjustable calibration system. The 4766 however, has a built-in calibration test tone which the user can adjust himself. Peak level recording indicators flash immediately over-modulation is reached.

Recommended retail price, excluding VAT is £231.48. Further information may be obtained from *3M United Kingdom Limited, Public Relations, 380-384 Harrow Road, London, W9 2HU.*



*The Wollensak 4766.*



## ALPHANUMERIC NIXIE TUBES

Electronic Brokers Ltd., the electronic components and test equipment specialists of London NW1, are importing direct from the USA Alphanumeric Nixie tubes for digital or alphabetical displays.

The Nixie tube can display all the letters of the alphabet and the numerals from 0-9 in a single tube.

The tube has 13 or 15 cathode segments, with a common anode. By applying a negative voltage to the proper combination of cathode segments, the alphanumeric characters are formed.

Special features of the Nixie tube include, all DC operation, all characters uniform and of equal height, simple solid-state drive circuits for the memory, and maintenance free operation with long life and no loss of brightness.

Model B-7971 has  $2\frac{1}{2}$ " character heights and for quantities up to 1,000, the price is 99p each, with special prices beyond this figure. A numeric version—model B-5853 ST is also available with  $\frac{1}{2}$ " high characters, priced at £1.00 for a single unit, or 80p each for quantities over 100. *Electronic Brokers Ltd, 49/53 Pancras Road London NW1 2QB England Telephone 01-837 7781*

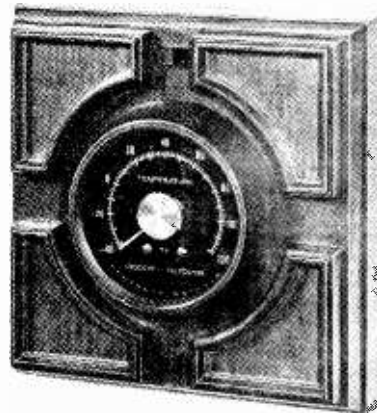
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Kit K/GD-1019 costs £16.20 (including 8% VAT and delivery within United Kingdom). *Heath (Gloucester) Ltd., Gloucester, GL2 6EE.*

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

The circuit of this easily made Morse practice oscillator is shown in Fig.1 and it requires only two components in addition to the transistors, speaker and pitch control VR1. Current drain will depend somewhat on the transistors but is about 5mA from the 9V battery supply.

The OC42 and BSY95A are inexpensive surplus types but the circuit will operate with almost any small audio or similar type transistors. Tr1 must be PNP and Tr2 NPN transistors. Other suitable transistors are AC128 for Tr1 and BC108 for Tr2 and connections are the same as for Tr2 in Fig.2. Other transistors to hand could easily be tried.

The audio note or pitch obtained depends on the value of C1, speaker impedance and total value of R1 and VR1 in series. It is also influenced by the battery voltage. The exact values shown need not be used, provided the tone is satisfactory. Increasing the value of C1 lowers the frequency.


Fig.2 shows assembly inside a sloping front 4x4x4in. case, but any small box or case which would accommodate the parts would be quite satisfactory. Tr1, Tr2, C1 and R1 are supported on a 5-way tag strip and leads run from here to the speaker and other connecting points. The centre tag of the 5-way strip and negative line is in contact with the metal case, but this is not essential and an insulated box can be used if connections are made as in Fig.2.

A 2-way tag strip holds leads which run to the key. If the key is used with other equipment and is fitted with a jack plug, a suitable socket for this can be fitted to the case. No separate on-off switch is needed as the circuit is off when the key is open. Check that the battery connectors are not able to touch the metal case.

## Practicing the code

It is important to form letters and words correctly. A dash should equal three dots in duration and the spaces between dots and dashes forming a letter equal one dot each. Letters are separated by a space of three dots, and words by a space of five dots.

Practice with someone already experienced in the code is probably best. Two beginners, alternately sending and reading, need to take care to avoid habitual errors and is not recommended. This also applies to anyone trying to learn alone. Any learner will find a tape recorder very useful, both for checking sending and for obtaining some code practice for reading purposes. To avoid too much filling in from memory, material recorded to be read later will have to be random letters. These can be obtained by writing A to Y at random in a 5x5 block, to read vertically, horizontally, diagonally and backwards in any combination.

Records and tapes are available and the RSGB slow Morse transmissions on the amateur bands can be heard on a SW receiver, will also provide practice. After the code has been fully memorised, practice eventually brings speed in sending and reading. 

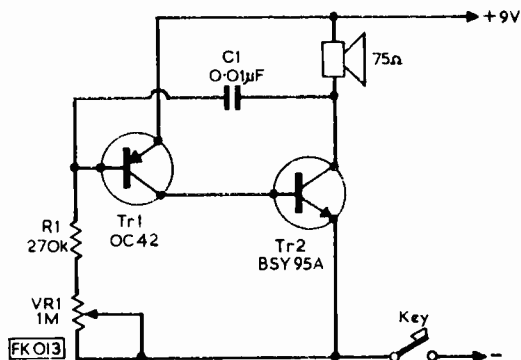
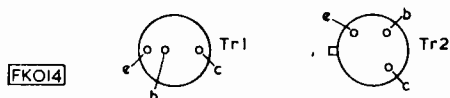
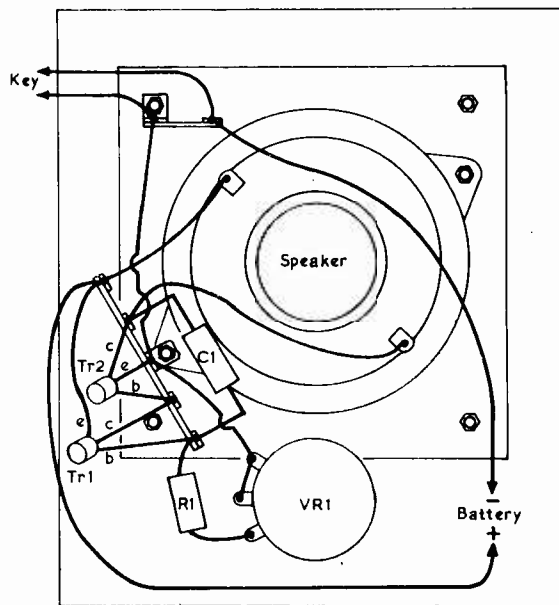


Fig. 1: above, gives circuit of the oscillator. Fig. 2: below, construction using a tag strip to mount components.



## ★ components list

- |  |  |
|--|--|
| R1   | 270kΩ 1/4W.                            |
| VR1  | 1 MΩ potentiometer.                    |
| C1   | 0.01μF.                                |
| Tr1  | OC42, AC128 or other audio PNP type.   |
| Tr2  | BSY95A, BC108 or other audio NPN type. |
| 75Ω speaker, 2 1/2" or similar.  |  |
| Tag strips, knob, 4 x 4 x 4in. sloping front case (H. L. Smith & Co. Ltd.) |  |
| PP3 or other 9V battery and clips.   |  |

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38 kHz rejection 90dB  
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Automatic stereo muting with the CA3089E

<b>CA3090AQ</b>	<b>£3.75</b>
<b>2mH inductor</b>	<b>30p</b>
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<b>CFS 10.7</b>	<b>40p</b>
<b>22µH inductor</b>	<b>15p</b>
<b>KACS K586 Quadrature coil</b>	<b>30p</b>
<b>FM 1185 Built and tested</b>	<b>£4.35</b>

The unique **LARSEN** FM tunerhead, type **7252**, combines a high quality tunerhead and IF, to provide an advanced VHF receiver module, with high gain and low distortion. Also included are features such as mute, AFC on all front end tuned circuits, and audio preamplification.

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'AUTO' **each 20p**

'ON' **each 20p**

'OFF' **each 20p**

'SET' **each 20p**

'RESET' **each 20p**

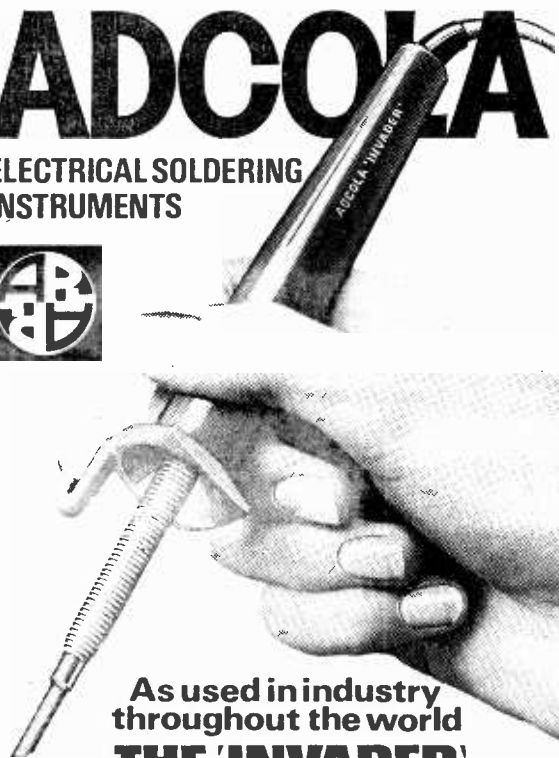
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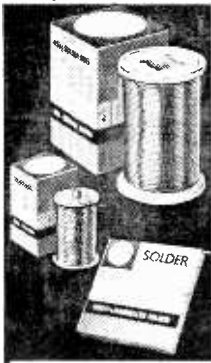


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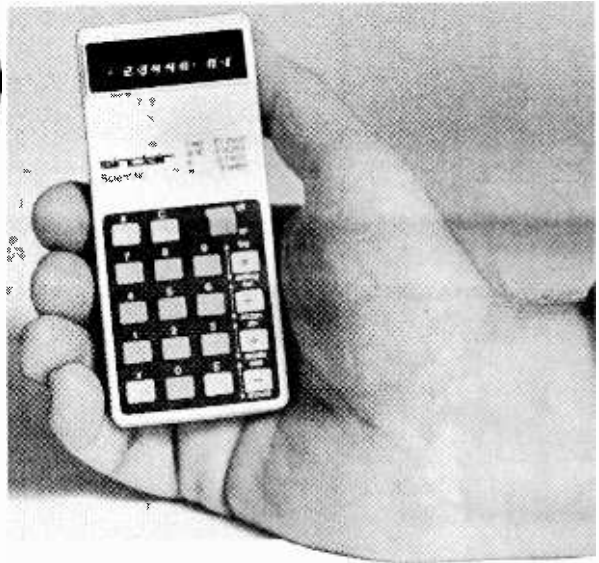


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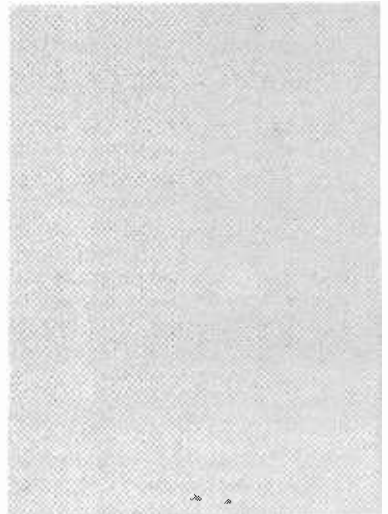
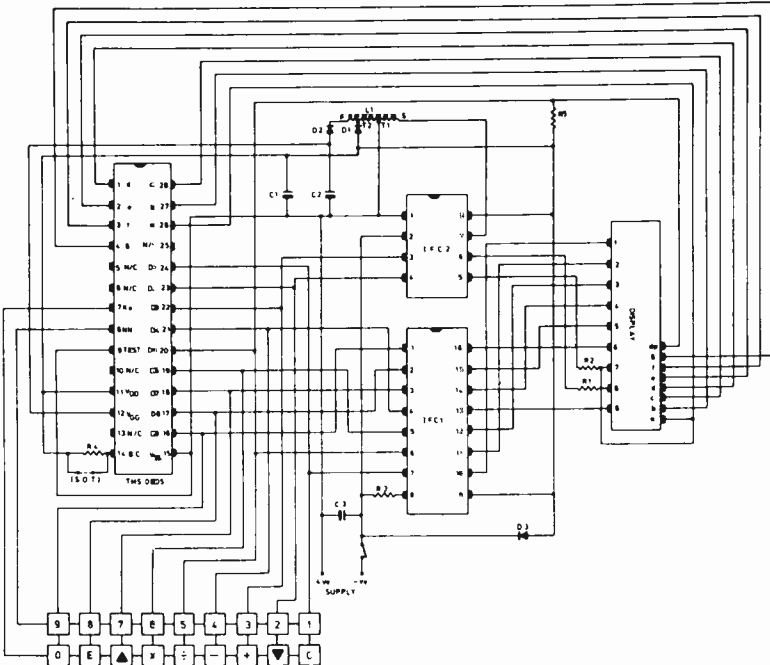
**T**HE kit is supplied in a protective pack of expanded polystyrene, and was complete, even down to two spare buttons for the keyboard. Also included were a small coil of fine gauge solder, a length of desoldering braid and a booklet "Hints on soldering".

The assembly instructions open with a summary of the construction steps and a components list to help you check and identify the various items in the kit. Then follow tips on soldering and assembly methods, a list of recommended tools and a very important and useful section on avoiding damage to the calculator chip from static electricity buildup.

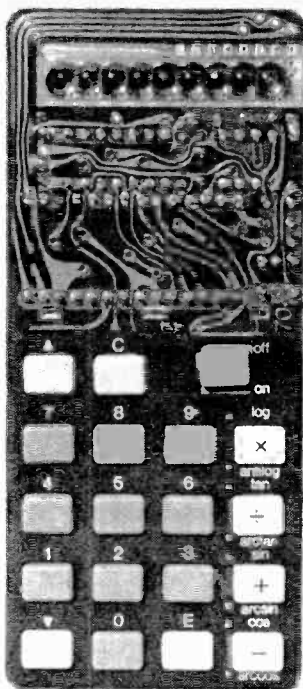
A series of notes keyed to the list of construction steps give more detailed information on identifying each component and fitting it correctly to the printed circuit board.

The kit handbook is generally very good though it does contain a number of small inaccuracies. Two of these are very minor and should not cause too much head-scratching except to very inexperienced constructors.

The first occurs in the p.c.b. drawings which show two diodes called D1 and no D3. Since all diodes are the same type it doesn't really matter, of course. The second comes in the assembly instructions for the keyboard and case, where step 13—fitting the on/off switch blade—cannot be accomplished until after the p.c.b. has been located over the keyboard assembly in step 14.



*Circuit diagram of the Scientific. The calculator uses three i.c.s plus twelve discrete components and a basic 9-digit i.e.d. display. The value of R4 is selected on test before despatch to match the particular calculator chip supplied. With some i.c.s it may be replaced by a wire link.*

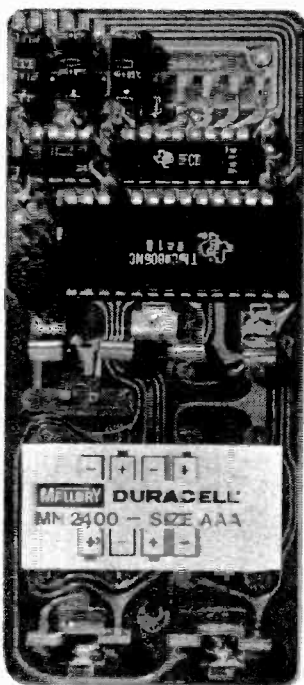


Front view of the p.c.b. and keyboard. All soldering, except for the battery clips and display, is done on this side of the board, which is double-sided fibreglass with plated-through holes. These ensure reliable connections between the two sides but also make removing a wrongly fitted component very difficult.



## Diode Polarity

The third is not so much an inaccuracy but rather a case of not allowing for all possibilities. In the section on determining diode polarity, the booklet says that the + end or cathode is identified by a band painted on the body of the diode, and this is normally true. In this particular kit the diodes supplied appear to have a black body with a blue band painted around one end. Meter checks revealed that the end with the blue band was the anode. Rather confusing for the uninitiated!



Rear view of the assembled p.c.b. The display drops into a slot in the board and is secured by the soldered connections to its edges.

Apart from these points, the instructions are clear and easily followed, and assembly was completed in under two hours. There are a total of 95 soldered joints to be made, half of them on the pins of the three i.c.s. For these the very small soldering iron (1/16" bit) recommended by Sinclair is really essential.

On fitting a set of batteries (four MN2400) the calculator worked right from switch-on. It has now seen considerable use over a period of three months and has just started on its second set of batteries. During that time one fault developed—a battery clip came adrift from the p.c.b. It seems that for this particular job a larger iron, say 25W, is advisable to get the solder to melt over the whole of the mating surfaces.

## Fault-finding

For those who suffer the traumatic experience of their calculator not working correctly when first tested, Sinclair thoughtfully provide a simple faultfinding guide. Since the components in each kit are tested before despatch, it is assumed that the most likely cause of any fault is a poor soldered joint, either open circuit or else shorted to an adjacent connection. In that event, the information provided should help the constructor to pinpoint the trouble.



The two case halves snap together to secure the p.c.b. A door in the back section covers the battery compartment.

In the last resort, you may return your calculator to Sinclair's Service Department for repair. They make a fixed charge of £2.50 unless a major component has been damaged during assembly, in which case the replacement may be charged for.

As a way of buying a truly pocket-sized calculator with more than just the four standard functions of addition, subtraction, multiplication and division, all for under £20, the Sinclair Scientific Kit would seem to take quite a lot of beating. Some prior experience of soldering on p.c.b.s is essential but otherwise you should not encounter any problems in assembly.

Undoubtedly the single most useful extra function on this calculator is log/antilog, which opens the door to a wide range of other functions. On the other hand the most annoying omission is a 'clear last entry' key. Having to repeat a lengthy calculation because you push a wrong button can be very frustrating. The lack of any memory is less of a drawback and can be overcome by using paper and pencil to note down intermediate results in more involved calculations.

**The Sinclair Scientific Kit is available from retailers or direct from Sinclair Radionics Ltd., London Road, St. Ives, Huntingdonshire PE17 4HJ. See their current advertisement for recommended retail price.**



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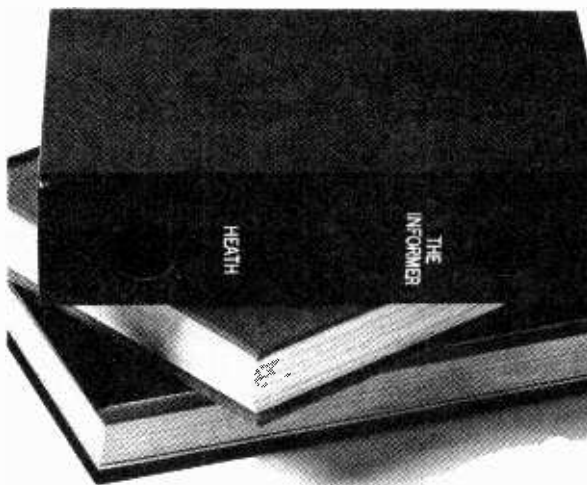
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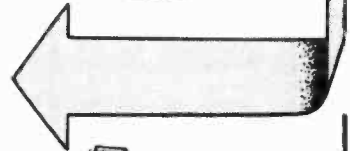


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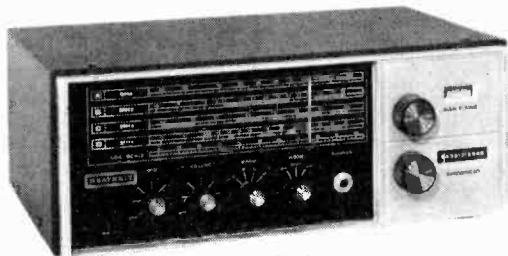


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The competition is open to all readers in Great Britain, Northern Ireland, The Channel Isles and Isle of Man, except employees (and their families) of IPC Magazines Ltd., the printers of Practical Wireless, and of Heath (Gloucester) Ltd.

All winners will be notified and the result published in the earliest possible issue of Practical Wireless.



## AMATEUR BANDS

by Eric Dowdeswell G4AR

IT seems strange to be writing this at the end of December for the March issue! I hope that many of you will be poring over the instruction manuals for a shiny new receiver, sent to you from the North Pole. Much more sensible than the eternal socks, shirts and racing cars! The trick is to let the word get around the family quite a few weeks before Christmas, coupled with hints dropped concerning filter bandwidths, sensitivity and desirable modes of operation. This invariably leads to veiled questions as to what you really mean and your prompt reply that the So-and-So receiver will fill the bill!

I managed to get a MFJ Enterprises CW filter this way this year and have since spent a lot of time sorting out signals with the three bandwidths available, down to 80Hz. It can be used at the output socket of a receiver thus avoiding having to dive inside the set! In my case I fitted it after the product detector in my much-modified HRO and coupled with the mechanical filter previously installed I have all the selectivity I need. If interested contact Hockley Audio Centre, Spa Road, Hockley, Essex.

Paul Barker BR334898 (Sunderland) sent in his usual immaculate log but bemoans the poor conditions on 20m which rather reduced his SSTV loggings. Tim Charles (Colchester) is having problems with his Satellite receiver but still managed to log a lot of DX. He comments on the many W stations above 3.8MHz who seem to want to work the DX but never listen below our end of the band at 3.8MHz. Tim's log for 40m shows what can be heard on this much neglected band.

Alan Rae (Glasgow) has been taking advantage of the problems which have beset schools in his part of the country by putting up some more aerials. One is a square loop, 12ft on each side, and tuned with a capacitor for the 15m band. Alan felt a little down-in-the-mouth when he subsequently passed by the Rugby transmitting site with its masses of fantastic aerial arrays. Makes our efforts in the amateur radio field seem a waste of time! Gary Edge (Warrington) is also A8740 and he writes to the column for the first time. As one would expect nowadays his best DX has been on 80m using a 9R59DS. More details of his set-up next time, I hope. Another newcomer is Stephen Budd, A8713 (Worthing) who has some

rather nice things to say about our column coupled with suggestions for more info on DXpeditions, contests etc. Stephen uses old favourite AR88 and pre-selector, with 150ft of wire.

Regular contributor Max France (Warrington) finds that his spare time, such as it is, coincides with best conditions on 80m, which is just as well, I suppose! With catches such as VR1AA and KS6DH he has not been idle. He's been listening to the 10m downlink from Oscar VII but his poor results would seem to suggest that his gear is not yet optimised for that band. Suggest, Max, that you look at a copy of *Radio Communication* each month which covers the Oscar programme very thoroughly.

Alan Doherty BR334968 (Portrush Co. Antrim) copied plenty on 80m and 20m but found DX sadly lacking on 40m. I think it is a matter of digging below the blanket of Euro QRM, as proved by the log of Tim Charles. Eric Carling (Lymington) managed another couple of countries to make it 229 for the year. KC6VE in the Eastern Caroline Is. and YJ8GS were good ones on 20m as were ZL3RB and 8P6ES on the 15m band. John Porter (Baslow, Derbys) has been airing his new FR50B (perhaps Christmas comes early in them parts!) and has consequently relegated his 9R59DS to the broadcast bands. You will find that it does a very good job there OM, the IF selectivity of about 4kHz being just right for the QRM and yet not too narrow for listening to a bit of music now and again while working in the shack!

Roger Trett (Norwich) apologises for the lack of reports but he has been busy taking his RAE and we can but wish him every success. He's added another long wire to his collection, mainly to pull in the VK's on his FR50B. Michael Green A8088 (Northwich) has been out of commission while getting his receiver's trimmers tickled, as he puts it. Bigger and better logs in future OM? Michael is full of praise for the Mid-Cheshire ARS which meets every Wednesday evening at the Verdin Comprehensive School, Winsford providing instruction for the RAE and Morse practice. I ought to mention that there are many such clubs around the country crying out for more members so make an effort to find your local club and join in the fun if you feel that you are a bit of a loner at the moment. The RSGB can usually help with info or see their callbook.

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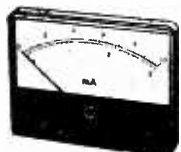
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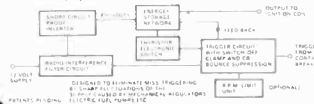
The SPARKRITE MK.2 is a full capacitive discharge electronic system. Specifically designed to retain the points assembly — with all the advantages and none of the disadvantages. No misfire because contact breaker bounce is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high rpm. Contact breaker burn is eliminated by reducing the current to about 1/50th of norm, thus avoiding arcing. But you can still revert to normal ignition if need be. In seconds. If points go (very unlikely) you can get replacements anywhere. All these advantages.

- Fitted in 15 minutes. ● Up to 20% better fuel consumption.
- Instant all weather starting. ● Cleaner plugs — they last 5 times longer without attention.
- Faster acceleration. ● Faster top speeds.
- Coil and battery last longer. ● Efficient fuel burning with less air pollution.

### The kit comprises everything needed

Ready drilled scratch and rust resistant case, metalwork, cables, coil connectors, printed circuit board, top quality 5 year guaranteed transformer and components, full instructions to make positive or negative earth system, and 6 page installation instruction leaflet.

WE SAY IT IS THE BEST SYSTEM AT ANY PRICE!



Sparkrite Mk II — full capacitive discharge electronic system — not just a transistorised inductive discharge booster.

### PRICES

D.I.Y. Kit only £10.93 incl. VAT and P & P  
Ready Built Unit £13.96 incl. VAT and P & P  
(Both to fit all cars with coil/distributor ignition up to 8 cylinders)  
We can supply units for any petrol engine vehicle (boat, motorcycle etc) with coil/contact breaker ignition.  
Details on request. Call in and see us for a demonstration.

### ORDER NOW TO:

ELECTRONICS DESIGN ASSOCIATES  
(Dept PW 3 ) 82 Bath Street,  
Walsall WS1 3DE Phone 33652

Please supply:

- Sparkrite Mk.2 D.I.Y. Kit(s) at £10.93 each incl. VAT and P & P (Will make pos. or neg. earth).
- Sparkrite Ready Built Neg. Earth Unit(s) at £13.96 each incl. VAT and P & P
- Sparkrite Ready Built Positive Earth Unit(s) at £13.96 each incl. VAT and P & P

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

I enclose cheque/P.O. for £ \_\_\_\_\_  
Send SAE for brochure.





## Log extracts

**Michael Green:**—20m DU6BG FP8DH VE3CD/SU 80m UK1ADZ

**Roger Trett:**—20m HP9MC HV9VX HZ1TA VP1FF VP2MRA ZB2A 15m CE6EF VU2DK VK6KG ZS1WA

**John Porter:**—20m FL8DJ OH0NC VP2SV 5U7AG 15m VP8NP YS1MAE ZE3JU

**Eric Carling:**—20m FM7AQ HK0BKX KC6VE P29FV VS6BL YJ8GS 3D2AJ 15m AP2KS ZL3RB 8P6ES

**Alan Doherty:**—80m EA8CR KL7HNQ KP4AN VP2DM VS6DL ZL4KF 4S7PB 8R1AG 40m CT2BN 20m SV1IE VE6JD ZL2AIL 6W8FN 7X20A

**Max France:**—80m AP2KS KZ5JM KS6DH TR8DG VP7NX VP8NP VR1AA VS6FB ZD7FT ZK1DX (Cook Is.) plus 12 ZL's

**Stephen Budd:**—80m EL7D FP8FU 9M2DQ 20m VP2MRA ZL1BD ZL2WC 15m HS4AFD HZ1KE VK6QL VP2SM VP7DF 5N2ESH 9Y4CR

**Gary Edge:**—80m AP2KS DU1AU PJ2CW ZL2AW 40m VP2GMB 20m VK9YR VP8NS ZD7ST

**Alan Rae:**—80m A4GCV (Oman) A9ZBK (Bahrain) VP2VBU VP8FK 40m ET3DCO 15m H18HOG KG4AMI VP2MRA YS1WPE

**Paul Barker:**—20m (SSTV) I1NKT 12PET OE1SF 20m 9X5PT 15m CR7AF KV4AD ZD3R

**Tim Charles:**—80m CT2BP OJ0MA 40m CO2IP CT3AR DU1HKG FW8OR HH9LJ HP1BM KL7TY VK9WT XZ1OT YA1AL YB3CB YS3A ZL1AEA ZL2AKW 3V8AZ

All stations are SSB except those in bold which are CW.

knows only one other value either the frequency (MHz) or the wavelength (m). Taking an example:—

$$\text{Wavelength (metres)} = \frac{300,000}{6020} = 49.23\text{m.}$$

or as the station says "the 49 metre band". The equation also works by dividing metres into 300,000 to give the frequency in megahertz.

Another "crie de-coeur" from Glenn is that he is lacking traffic in the 60 metre band and he wonders if a special aerial is needed. Not at all, says I, try making a centre-fed aerial that is a half wave on 60 metres, using the formula in the P.W. Aerial Data Chart, that is  $468/f(\text{MHz})$  ft. Try cutting a length of copper wire to a quarter wave or about 45ft. which will also match a low input impedance.

One of the regular sounds on the 60 metre band is the atomic clock broadcast from Turin. There are many countries that put out these fixed standard frequency signals and the DXer will find them very handy for checking the calibration of his set since they are usually on a precise frequency, in this case 5MHz. Turin also will QSL if asked nicely.

A "first time" letter comes from **Michael Bridgewaters** of Shifnal, in Shropshire and he would like a feature on propagation popped in. Well, Michael, the fact is that printing and editorial deadlines would make the news stale, if not useless, by the time you got your copy of PW if you are referring to current conditions.

Twelve-year-old **Timothy James** from Basset was written in reporting Radio Australia at 0715 on 9570. He has not given a date for this but he must have heard it at the latter end of the summer season since Australia is now on from 0815 to 0915 on 9570 and they have registered I1760 with the ITU from 1845 to 2000 for this winter.

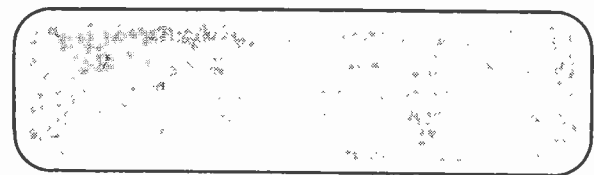
Someone who seems to have winkled out a few good signals is another youngster **Christopher Rowson** of Tittensor, Staffs., reporting as follows:—

11955 Voice of the Gospel (Ethiopia) at 1545  
15483 Radio Tanzania at 1930.

This thirteen-year-old pilots his Grundig Elite Boy and its long wire aerial and reports that he has pulled in the so-called "Paris calling Africa" programmes of ORTF. These are the "Afrique Inter" relays normally intended for French-speaking parts of Africa. By the way, these programmes are very good for French language practice, for those dreaded exams!

One of the many "giveaways" that stations are prone to send out is the pennant. News has been given to me of at least three more countries that have jumped on the bandwagon, namely Poland, Norway and Spain. Radio Nigeria sent out copper necklaces last year, but that did not last very long. Pennants, if you can get them, are fine to hang on the shack wall and those I have seen range from the large red, white and blue plastic of Radio Nederland to the exquisite pale-blue silky textured example from Adventist World Radio.

**Paul Heath** of Wednesfield informs us that HCJB Quito is at present sending out a form with its QSL card asking about the religion of their correspondent and how many times the said correspondent goes to church. This I think must rank, for sheer impertinence, alongside the penetrating questions that Radio Peking asks. For instance, they want to know one's occupation and how long one has held it. While touching on the subject of Gospel stations, **Rex**



## SHORT WAVE BROADCASTS by Derek Bell

**G**lenn Tobin, aged 16, opens our box of goodies this month and he, on his Astrad VEF 204, has pulled in the following:—

7220 Voice of America at 1950 from Tangier  
9560 Radio Ghana External service (no time given)

not bad for a simple set with only an added length of wire for an aerial.

Glenn, however, mixes up metres and megahertz because, as he says, his set is only marked in metres and he has to rely on the frequencies announced by the station. The answer to this OM is the following formula, to get the old grey matter stirring! Frequency in metres equals 300,000 over frequency in megahertz. So there! It will make an equation if one



Cooper of Foulden, Norfolk reports having heard 15120 ETLF Addis Ababa at 1415, one of the more difficult loggings. To his Marconi CR150 Rex has added a preselector and a 33 foot vertical aerial. All I can say is, may the winds stay calm! Rex says that he bought the set in the local market and after "breathing on it" is getting reasonable results. One of his favourite stations was FEBA in the Seychelles and Rex would like anyone who knows what has become of it, to shout up.

From the horse racing scene round Yorkshire, Doncaster to be exact, **Jack Hanson** says that he has a couple of questions. The first is "who puts out the fixed-frequency signals on 2.5, 5, 10 and 15 MHz. If it is a beat at one second intervals it is probably one of the standard frequency stations mentioned earlier.

The way to check is to listen for a speech or morse announcement. His second query concerns the BBC World Service on 17700, broadcast on 8th Dec. at 1100. Jack reports that it had "a booming echo rather like two path propagation". Almost certainly it was a combination of sky and ground waves.

We must welcome a new station on the air. From Antarctica comes news that the American Forces Antarctic Network opened in December on 6012 using one kilowatt pumped into a vertical aerial. On that happy note comes time for me to close the shop and say "best 73s" to you and yours.

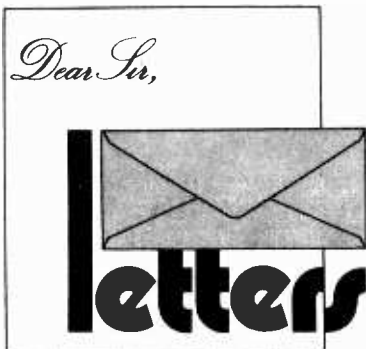
#### BROADCAST BANDS

**Short Wave** reports by the 15th of the month to **Derek Bell** c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.

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

#### AMATEUR BANDS

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



(P.W. April '69) without undue cramping. The quality of performance of this set is unbelievable and I'm sure puts the majority of commercial built pocket superhets to shame.

I would like to offer my humble thanks for all your efforts in making this possible, and providing so many hours of enjoyment for, I am sure, a great number of people. Thank you.—**John Bloxham** (Warwickshire).

#### Planespotters beware

On the 7th January this year a BAC One-Eleven was hijacked from Heathrow, and subsequently flown to Stansted. This you are all probably well aware of. What perhaps is news to a number of your readers is the fact that listening-in on the v.h.f. communications link between plane and control tower is illegal; as is listening to the Police, Fire Service and any other public service organisation.

Although the manufacturers are well aware of this fact, they persist in equipping their domestic v.h.f. receivers with full coverage of the 96-110 MHz band. It's possible to buy a receiver in any market place for £5, go to Heathrow, and eavesdrop on highly confidential communications between the aeroplane and ground stations.

The result of this latest hijack drama has finally brought home to those in high places the danger of allowing receiving equipment of this type to get into the hands

of the general public. It was disclosed recently, that during the drama, talks were going on between the plane's Captain, the Home Office and Scotland Yard, nearby 'plane spotters' heard the lot, apparently to the amazement of 'Security Chiefs'!!

The danger here of course, is in the definition of the word 'plane spotter'. If they are genuine enthusiasts, the dangers are not too great, but what's to stop would-be hijackers listening-in, or other undesirables? The complete procedure that Scotland Yard and the Home Office has worked out together with regards hijacks, could very soon become common knowledge, and as such a serious security risk.

The answers are many. Either put the public service communications on another frequency, scramble or code the messages, or stop making receivers capable of tuning over the present frequencies. The problem with the latter is the million or so radios already in public hands. What do we do?, tell those owners to report to their local friendly security centre to have their radios doctored?!

Maybe we ought to enforce the law already in existence, and punish anyone found listening to the Police, aeroplanes etc. You may well ask how does one do this? The answer is again simple—put microphones and cameras in everyones' homes, in the streets and the countryside,—ah well, 1984 here we come!—**Andrew Auger** (South London).

#### Thank you P.W.

Eighteen years ago a school friend showed me his home made one valve short wave receiver and introduced me to *Practical Wireless*, from then on I was hooked. Over the years I built numerous receivers and items of test gear from the pages of your magazine. In recent years with the aid of *Television* magazine I have progressed through the deeper mysteries of television and gained practical experience by repairing friends' equipment and with the 'five bobs' gained thereby have furnished a small workshop and acquired a supply of spares.

I must confess that in spite of the fascination of television I cannot resist constructional articles on pocket transistor radios. I recently made the "Mimi Pop" two I.C. radio (P.W. May '74) which I fitted into the 'Boots Soapdish Lid' case as described for the "Mite" radio

## AUTOMATIC EMERGENCY LIGHTING

Power cut days will soon be upon us. Our simple kit makes any light a fail-safe light. Kit containing relay and rectifiers and data, only 65p each. 10 or more 60p each. Suitable case 40p extra.

## PORTABLE CABINET OFFER

A nicely made portable cabinet, soft padded black finish intended for portable stereo system. Dimensions as sketch. With motor board cut out for Garrard SP 25. This was obviously a very costly cabinet originally made for a de-luxe record player. Offered at £1.95 plus £1 carriage, free if bought with the Garrard or BSR record decks



## LIGHT DIMMER KIT

For dimming up to 250w without heat sink or 750w with heat sink. This comprises, quadric variable control potentiometer, condenser, resistor, tag strip for mounting and data. Price £1.50. 5 amp Industrial Model £2.80.

## RELAY BARGAIN

Type 600 relay, 2 changeover one open and one closed contact. Twin 500 ohm coils make this suitable for closing off DC 6v, DC 12v, DC 24v or AC mains using resistor and rectifier, 33p each. Resistor and rectifier 20p extra.



## MAINS MOTOR

Precision made—as used in record decks and tape recorders—ideal also for extractor fans, blower, heaters, etc. New and all perfect. 81mp at 75p. Postage 20p for first one then 10p for each one ordered. 1" stackmotor £1.04. 1 1/2" stackmotor £1.20.

## TIME SWITCH

Smith's mains driven clock with 15 amp switch, also notes showing how you can wake up with music playing, kettle boiling or come home to a warm house, warn off burglars, keep pets warm, halve your heating bills, etc. £2.45.

## MACLAREN THERMOSTAT

Make and break 20A a.c. with the sensor probe coupled by a 2 feet capillary covering range of 10-100°C—complete with large engraved control knob. Price 88p.

## WINDSCREEN WIPER CONTROL

Vary speed of your wiper to suit conditions. All parts and instructions to make. £2.75.



## 6 DIGIT COUNTER

Resetable. 440 ohm coil up to 25 impulses per second. Ex-equipment but guaranteed perfect. £2.84 each. 4 digit counter as specified for telephone charge calculator 88p.



## PRESSURE SWITCH

Containing a 15 amp change over switch operated by a diaphragm which in turn is operated by air pressure through a small metal tube. The operating pressure is adjustable but is set to operate in approx. 10 in. of water. These are quite low pressure devices and can in fact be operated simply by blowing into the inlet tube. Original use was for washing machines to turn off water when tub has reached correct level but no doubt has many other applications £1.72, each.



## NUMICATOR TUBES

For digital instruments, counters, timers clocks, etc. Hi-vac XN.3. Price 99p each. 10 for £9.

## MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied. Model 1153 500mW power output 80p Model 1172 750mW power output £1.07 Model EP9000 4 watt power output £2.00 RP 9001 twin channel or stereo pr amp £1.41

## EXTRACTOR FAN

Cleans the air that rises from 10,000 cubic ft. per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc., it's so quiet it can hardly be heard. Compact, 5 1/2" casing with 5 1/2" fan blades. Kit, comprises motor, fan blades, sheet steel casing, pull switch, mains connector, and fixing brackets. £2.75 + 20p P. & P.



## CENTRIFUGAL BLOWER

Miniature mains driven blower centrifugal type blower unit by Woods. Powerful but specially built for quick 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 flange, air is blown into the equipment but to suck air out, mount it from centre using clamp. Ideal for cooling electrical equipment or fitting into a cooker hood, film drying cabinet or for removing flux smoke when soldering, etc. etc. A real bargain at £2.50p.



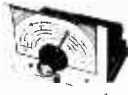
## TANGENTIAL HEATER UNIT

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters. Comprises motor, Impeller, 2kW element allowing switching 1, 2kW, and with thermal safety cut-out. Can be fitted into any metal lined case or cabinet. Only needs control switch, £2.75. Don't miss this. Control Switch, 55p. P. & P. 50p.



## SHORTWAVE CRYSTAL SET

Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19.25-31.39 metre bands—Kit contains chassis front panel and all the parts. £1.25—crystal 50p.



## DRILL CONTROLLER NEW IKW MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £2.25 plus 25p post and insurance. Made up model also available. £3.25 plus 30p post & p.



## THIS MONTH'S SNIP

High compliance 8" round speakers suitable for 8-12 ohm outputs, these speakers have rubber mounted diaphragms and will handle up to 12.5 watts. Made originally for an expensive Decca hi-fi outfit, we offer at £3.75 each or £7.00 a pair plus 40p each postage.

## SMITHS CENTRAL HEATING CONTROLLER

Push button gives 10 variations as follows: (1) continuous hot water and continuous central heating (2) continuous hot water but central heating off at night (3) continuous hot water but central heating on only for 2 periods during the day (4) hot water and central heating both on but day time only (5) hot water all day but central heating only for 2 periods during the day (6) hot water and central heating on for 2 periods during the day time only—then for summer time use with central heating off (7) hot water continuous (8) hot water day time only (9) hot water twice daily (10) everything off. A handsome looking unit with 24 hour movement and the switches and other parts necessary to select the desired programme of heating. Supplied complete with wiring diagram. Originally sold, we believe, at over £15—we offer these, while stocks last, at £5.95 each, post 30p.



## TAPE DECK

In metal case with carrying handle, heavy fly wheel and capstan drive. Tape speed 3 1/2. Mains operated on metal platform with tape head and guide. Not new but guaranteed good working order. Price £1.95 plus £1 post and insurance.



## GENERAL PURPOSE SWITCH

Responds to moisture, heat, light, touch, time delays, etc. etc. Basic kit comprising relay, transformers, diodes, condensers, resistors, etc. and data—only £1.50 + 30p post.



## AMMETERS

—moving from 0 AC/DC—ideal for chargers etc. 2" sq. full vision 0-8 amp 85p. 1 1/2" round 0-2 amp 65p, 0-3 amp 65p, 0-4 amp 75p.

## DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. £2.75 plus 25p P. & P.

## SOIL HEATER

Or could be used on bench for seed trays. Comprises mains transformer to reduce to safe voltage also heater wire. £2.00 plus 25p p. & p.

## SPIT MOTOR

200-250V induction motor, driving a Carter gearbox with a 1 1/2" output drive shaft running at 5 revs p.m. Intended for roasting chickens, also for driving models—windmill, coloured disc lighting effects, etc. £2.50 plus 20p post and ins.



TERMS—  
ADD 8% V.A.T.  
Send postage where quoted—other items, post free if order for these items is £6.00, otherwise add 30p.

**J. BULL (ELECTRICAL) LTD.**  
(Dept. PW), 102/103 TAMWORTH RD.  
GROUDON GRO IXX

## NEW ITEMS THIS MONTH

The bargains in this column are just some of the items which appeared in the December supplement to our catalogue. You can receive this catalogue and the next 12 supplements by sending £1.

**Room Thermostat.** Mercury Switch type with thermometer for low voltage gas central heating systems etc. Made by a famous American Company, these are of very neat appearance, in plastic case, easily mounted but the most important feature is that they cut in and out quickly, thus maintaining a very steady temperature. Price £1.85

**12v Sealed Plug-in Relay** with two sets changeover contacts 10 amp rating. Fit into a standard octal valve base. Limited quantity. £1.50p.

**Constant voltage step down transformer.** American made 500w leading tap voltage can be either 115 + or - 20% or 250 + or - 20% for 50 c.p.s. mains output 115v or 250v. A real quality transformer, probably cost well over £100. Not new but guaranteed perfect. Our price £40. £110 to 750w £60. Carriage paid.

**Mercury Batteries.** Bank of 7 mercury cells. Type No. 625 which measure approx. 7" diameter by 1" thick in plastic tube with positive and negative ends marked giving a total of 10.7v. Only 5p per bank or £1 per carton of 25. With simple holder these will replace the PP3 and similar, or can be quite easily separated for operating simple pocket radios and instruments, dead aids, etc.

**Two circuit micro-switch.** Famous American Licon, maker's ref. 16-40411. Size approx. 1 1/2" long 1" wide 1" thick. Not necessarily suitable for switching the main supply breaks when using push rod is depressed. Circuit rating we estimate at 5 amps 250v. 12p each. Sound to light unit for enhancing your audio either with the addition of coloured lighting or white light responding to the music. Our unit, which will work up to three 150w lamps, is available as kit or parts at £6.95 or made up ready to work £7.95.

**Emergency lighting.** It would seem that once again there is a possibility of power cuts and black-outs. We hope it won't be as bad as last year, but the possibility of having to work off batteries is definitely with us. We can still offer 12v battery fluorescents. 24" uses the standard 24w tube and gives an excellent light, price £4.50 + 50p post and insurance. Also the 40", which uses the 40w tube, is now available, price £7 + 75p post and insurance. We also still have stocks of big inverters, ref. XB. This is a 500w 24v output inverter, unfortunately not 60 c.p.s. Its frequency, we believe, is 400 c.p.s. which means that whilst fluorescent lighting could be worked off it, special chokes would have to be used. Normal incandescent lamps can of course be used without any bother. The price of this unit is £11.50 + 50p post and insurance.

**Luminous rocket switch,** suitable for 13 amps at mains voltage, these are illuminated with neon through amber panel, snap-in fixing into hole size 1 1/2" x 1 1/2". Special bargain, 22p each.

**Chrome plated metal legs, heavy duty, really good quality, made originally for an expensive Decca outfit, height 12", £1.50 per set of 4 plus post 30p.**

**Experimenters Relay Parcel.** 10 type 600 relays all different coil values covering most experimenters needs. Also one mounting bracket. Total retail value £25.00—yours for £8.50 plus 30p post.

**Motor with fan blade—**if you want something to cool a cabinet or if you are making a cooker hood or a blower heater, this may be the answer. 1" stack induction motor with a set of Smith's fan blades, approx. 5" diameter. £1.50 + 30p post.

**Microswitch bargain—**Honeywell, brand new 10 amp 250v gold on silver contacts, standard fixing, normal operation. Price 10p each.

**Cooling fans—**heavy duty for TO8 type semi-conductors, extruded aluminium, size 4 1/2" x 3". Price 60p each.

**Full wave rectifiers** 4 x 1N3208 which we understand are rated at 25 amps mounted on cooling fins, these were intended for computers but were never installed. Price 88 each.

**Insulated terminals.** These are the popular type which will take a wire under the head or a 4mm plus in the top, fully insulated for mounting with metal panels, available in several popular colours—price 12p each.

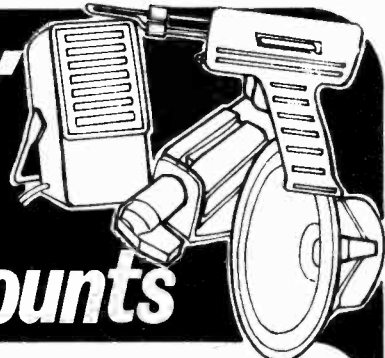
**Delay Switch.** Depending on the amount of voltage applied, so this switch will delay making the circuit of up to 15 amps at normal mains voltage for up to 10 seconds, delay may be made or made variable with a suitable potentiometer. These can also be used as thermal relays as suitably connected a low current relay can switch up to 100 amps or more—these are glass tubes plus in a pin base—with base 75p each.

**Smiths 24 hr. timer heart, really the 'Autoset'** without its plastic case. This is a 24 hr. twice on, twice off, clock switch which will repeat until re-programmed. Switches rated at 15 amps. Limited supplies—£3.75 each.

**Smiths colour stat.** Customers will remember that we had a supply of these wall mounting thermostats last year. We were able to supply these at £1.65. A new batch has just arrived but like most other things these days they have gone up in price and we must now charge £2.25 each. However, this is still a very low price for such a thoroughly reliable wall thermostat.

**Panel meter with trip.** American made. These are fixed mounting, full vision, moving coil meters, face size 2 1/2" x 2 1/2" with two front settings which enable an external circuit to be tripped, a light lit or an alarm sounded, at pre-set voltages within the range of DC meters. We have meters covering the following DC voltages:—0 to 6; 0 to 15; 0 to 25; 0 to 45; 0 to +150. All £4.75 each.

# BIG Discounts



## ALL PRICES INCLUDE V.A.T.

SPEAKER BARGAINS		GOODMANS 6 1/2" 8 ohm	
	£		£
EMI 13" x 8" 3, 8 or 15 ohm		Dualcone	2.15
Plain	2.05	ELAC 6 1/2" 8 ohm Dualcone	2.15
With Co-Axial Tweeter		ELAC 8" 8 ohm Dualcone	2.30
8 ohms only	2.20	ELAC 10 ohm Dualcone 10 watt	3.50
Twin Tweeter	4.10	FANE 7" x 4" 3 or 8 ohm	1.00
Type 350 8 or 15 ohm,		ADASTRA 10" 8 or 15 ohm,	
20 watt	7.95	10 watt	3.55
6 1/2" 8 ohm, 10 watt	2.40	BAKER GROUP 25 12" 8 or	
8" 8 ohm, 10 watt	3.75	15 ohm, 25 watt	7.65
12" 8 ohm, 20 watt	6.70	P. & P.	
8" x 5" C/Mag. 5 watt	1.25	5" 8 ohm, C/Mag.	.85
8" x 5" Dualcone		2 1/2" 8 ohm or 84 ohm	.50
8 ohm, 10 watt	2.55	P. & P.	.15

TWEETER & CROSSOVER		Dome Tweeter 8 ohm, 30 watt	
	£		£
EMI 3 1/2" 3 or 8 ohm C/Mag	1.25	Crossovers CN23 (3 ohm),	5.40
Cone Tweeter 8 or 15 ohm,		CN28 (8 ohm), CN216 (16	
19 watt	2.60	ohm)	1.20
Cone Tweeter 8 ohm, 3 watt	1.45	P. & P.	.10
Horn Tweeter 8 ohm, 20 watt	6.40		

KIT FORM CABINETS TEAK VENEER		18 x 11 x 9 with 13" x 8" cutout	
	£		£
12 x 12 x 6 with 8" 8" x 5" or		for EMI 350	4.25
6 1/2" and 3 1/2" cut out.	3.30	P. & P. ea.	.45
17 x 10 x 9 with 8" or 13" x 8"			
cutout	3.80		

MICROPHONES		TW209	
	£		£
CM70 Planet stick metal,		CONDENSER MIKE 600 ohm,	5.75
switch crystal	1.55	uni-dir	0.35
DM180 Dynamic omni-dir.		Cassette Stick Mike with R.	
ball metal	4.75	Control on/off switch	1.45
UD130 50K/600 ohm, uni-dir		(2.5 & 3.5mm J/Pi)	.20
ball metal	6.40	P. & P.	

SOLDERING IRONS		X25 25 watt (low	
	£		£
ANTEX CN240 15 watt	2.15	leakage)	2.15
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# HOTLINES

ON RECENT DEVELOPMENTS

## TIME HAS COME

Timers are an evergreen idea in electronics and many ingenious circuits have been published using a variety of techniques. One of the latest ideas on the market isn't just an integrated circuit requiring a "few external components" to make an electronic timer unit. The latest is just a component and, apparently doesn't require any assistance at all, other than power.

It comprises a two-terminal cylindrical case measuring 0.75in. in diameter and 2in. long. With a wire from each end it looks rather like a capacitor.

Series connected, the module provides fixed delay times of 1, 5, 10, 30 and 60 seconds. It is accurate over its temperature range to within  $\pm 10\%$ . The temperature range is given as 32 to 125°F. The device comes in three input voltages; 12, 24 or 48V. The inductive output is rated at 500mA and the equivalent British price is about £3. Not available in the UK yet, as far as I know.

## REALLY WIRE-LESS!

One of the interesting events on the hi-fi market was the launch of a headset which isn't attached to the equipment by any wires of any sort. Just put these headphones on and out comes your stereo hi-fi. But it's not done by magic—just infra red. The system utilises photodiodes which emit a modulated IR beam. This in turn is detected by photosensitive diodes on the headset itself. It's thought that this system is almost ideal for the average hi-fi enthusiasts room since the type of emission is unaffected by surfaces and colours etc. The modulated light source itself is diffused throughout the room so it isn't necessary to wander round with the top of your head always pointing towards the IR transmitting diodes. The power output of the IR diodes is only 60mW to cover the average room so the system does not waste precious watts.

As a point of interest, Ginsberg confesses to remembering a similar system being shown at the SRDE

(Signals Research and Development Establishment) near Bournemouth some 6-7 years ago. The idea then was that a whole class could be fed with instructions from a single IR source located in the ceiling. Wonder what happened to that idea or if anyone ever took it up?

## FIBRE OPTICS

The coaxial cable has been with us for many years, and will doubtless be around for some time to come. But already there are serious rivals stirring. Fibre optics is one which has been quietly developing for some time. Thinking of the price of copper is one good reason for trying fibres for communications purposes. Pilkington Brothers is well known in the field of glass and this company has been carrying out a considerable amount of work on fibres. However the first demonstration given on short cables was given recently.

The company calls its cable Hytran and it can replace copper cable for short range applications. A most significant feature is that Hytran is said to cost only one tenth the price asked for low-loss fibres which were previously thought to be the "real McCoy" if one wanted to communicate. The current suggestion is that Hytran is eminently suitable for cables up to around 180 metres in length. Pilkington are also recorded as saying that the demand for short range cables of this kind is on the increase although long distance usage of fibres is still another decade away.

## NUCLEAR MAGNETICS

The Air Force Weapons Laboratory in the US is concerned about the effects that a huge electromagnetic pulse from a nuclear blast might have on the electronics systems in aircraft. So it's built a "little" gadget which simulates the effect—quite safely I'm told. The aircraft under test is held in a huge trestle structure made of wood and nylon. And just when it least suspects it, the US Airforce fires an 8MV pulse at it via a nearby antenna. The 8MV pulse is triggered in only 10nS. The electronics to

accomplish all this is quite horrendous and, just for interest, the entire complex should be completed by 1976—and each of the trestles can accommodate an aircraft the size of a jumbo jet.

## ALL BRITISH

Have you heard the name Godfrey Hounsfield? If you haven't, then you've missed something. He's British and a pioneer. His work, or rather the results of it have been described as the most significant thing in its field since Rontgen discovered X-rays. Hounsfield's work led to the EMI-Scanner manufactured by British company EMI Limited (Now you must of heard of His Masters Voice!).

The EMI-Scanner is a computerised brain examination system. It employs a computer to calculate the many thousands of readings which have been taken through various cross sections of the patients brain. The readings are obtained by using a narrow beam of X-rays which are rotated around the head for a short time while examination is in progress. The results of this are reproduced as detailed and very accurate pictures of brain tissue. These are projected onto a television screen. It is claimed that the system produces 100 times the amount of information on brain tissue compared to that obtained from normal skull Xray techniques.

Perhaps the most important question is, "Has it caught on or is it one of those laboratory wonders which has problems in practice?". Well, EMI introduced it just two short years ago and orders to date have amounted to £22 million (that's twenty two million pounds sterling) with £21 million being exports.

Can you think of anything that's gone from nothing to £22 million in two years. I think its a super achievement by a British man and exploited by a British company.



Miniature 3 gang tuning capacitors VC1, VC2 and VC3 in Fig. 1 are not readily available at the present time. The constructor can therefore either use a larger three gang type or make a simpler receiver using a miniature two gang type. In the simpler receiver, the RF stage of the  $\mu$ A720 is not used and the signal from the aerial coupling coil is fed directly to pin 1 (i.e. to the mixer input). The performance of such a simple receiver will not be so good as when an RF stage is employed, but will be perfectly

adequate for the reception of normal broadcasting stations which provide a reasonable signal strength at the location concerned.

In car radio receivers, one may wish to replace the variable tuning capacitor with a permeability tuning system in which iron dust cores move along the centre of the coils concerned. A circuit for this purpose is shown in Fig. 3.

AVAILABILITY

The  $\mu$ A720 is available from advertisers. At the time of writing the price is about £1.25 plus VAT, but this should be checked before ordering. **D.W.**

# TELEVISION

## IN THE MARCH ISSUE

ON SALE FEBRUARY 17th—25p

### COLOUR RECEIVER PRE-INSTALLATION CHECKS

Thorough pre-installation checking and setting-up contributes more to the quality of a colour picture than the actual design of the chassis—most of the poor quality pictures so often seen are due to this vital procedure having been ignored. Vivian Capel describes what is required and how to go about it.

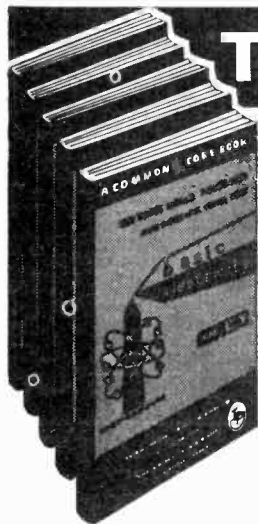
### GREY-SCALE GENERATOR

The first essential in setting up a colour receiver is to obtain a first class monochrome display. After the purity and convergence have been set the next step is to adjust the conditions at the three c.r.t. guns for an accurate grey-scale from black through to white. For this purpose a video signal consisting of several discrete amplitude levels is invaluable. The generator to be described uses i.c.s. to generate eight levels from black to white and for simplicity is synchronised from the receiver.

### JELLY-POTS AND STICK RECTIFIERS

Jelly-pot line output transformers and selenium stick e.h.t. rectifiers have been widely used in Thorn/BRC sets from 1964 to the present time. John Law describes the various types employed over the years.

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Top value 1,000 opv pocket multimeter. Ranges: 0/10/50/250/1,000 volt AC and DC. DC current 0.1mA/100mA. Resistance: 0/150k ohms. Decibels: -10 to +22dB. Size 90 x 60 x 28mm. Complete with test leads.



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Jewel movement, attractively moulded case with edgewise ohms adjustment. Ranges: 0.3/1.5/15/300/1200V AC. (2500 opv), 0.3/30/300/600V DC. (5000 opv), 0-800 uA/0.300mA DC. Resistance: x 10 & x 100. -10 to +16dB. Supplied with battery test leads and data booklet. Size: 121 x 73 x 29mm.



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## HIKI 730X

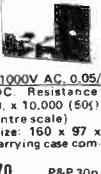
30,000 opv. Overload protection. Ranges: 6/30/60/300/600/1200V DC. 12/60/120/600/1200V AC. 60 uA/30mA/300mA. 2K/200K. 2 Meg Ohm. -10 to 63 dB.



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## U4323 MULTIMETER

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30,000 opv DC. 15,000 opv AC. Ranges: 6/3/15/60/300/1200V DC. 6/30/60/300/600/1200V AC. DC Resistance: x 1, x 10, x 100, x 1000 (50k) centre scale. DC Current: 30uA. 3/30/600mA. 20 to +63dB.



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## U4324 MULTIMETER

High sensitivity, overload protected. 20,000 opv. Ranges: 0.6/1.2/3/12/30/60/120/600/1200V DC. 3/6/15/60/300/600/900V AC. Current: 0.06/0.6/6/60/600mA/3A DC. 0.3/3/30/300mA. 25A AC. Resistance: 35/500 ohms/0.5/5/50/500k ohms/5 Mohms. Decibels: -10 to +12dB. Size: 167 x 98 x 63mm. Supplied complete with test leads, spare diode and instructions.



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High sensitivity. DC 10k ohm/V. AC 10k ohm/V. 5" mirror scale, overload protected. Ranges: 0/5/2.5/10/50/250/1000V DC. 5/10/50/250/1000V AC. Current: 0.01mA/0.5/5/50/500mA/10A. Resistance: 0/1/1/10/100 ohms/1/10/100k ohms/10/100M ohms. Decibels: -20 to +62dB. Battery operated. Size: 180 x 140 x 80mm. Supplied complete with test leads etc.



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Overload protected shock proof circuits. 9.5uA Meter with mirror scale. Sensitivity 100kV. Polarity change switch. Ranges: 0.5/2.5/1.5/50/500/1000 Volts DC. 2.5/10/50/250/1000 Volts AC. DC Resistance: 0-20/200k/20 Meg ohms. DC current: -10/250mA/2.5/25/250 mA/1/10A. -10A, -20 to +62dB. Operates from 2 x 1.5V batteries. Size: 180 x 134 x 79mm.



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## 370WTR MULTIMETER

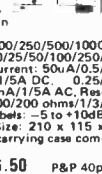
Features AC current ranges. 20,000 opv. 0/0.5/2.5/10/50/250/500/1000V DC. 0/2.5/10/50/250/500/1000V AC. 0/50uA/1/10/100 mA/1/10A DC. 0/100mA/1/10A AC. 0/5k/50k/500k/5 Meg/50 Meg Ohms. Decibels: -20 to +62dB.



**OUR PRICE £19.95 P & P 30p**

## U4317 MULTIMETER

High sensitivity instrument for field and laboratory work. Knife edge pointer. 96mm mirror scale. Overload protection. Ranges: 0.5/2.5/10/25/50/100/250/500/1000V DC. 0.5/2.5/10/25/50/100/250/500/1000V AC. Current: 50uA/0.5/1.5/10/250mA/1/5A DC. 0.25/0.5/1.5/10/250mA/1/5A AC. 0/5k/50k/500k/5 Meg/50 Meg Ohms. Decibels: -5 to +104dB. Battery operated. Size: 210 x 115 x 90mm. Supplied in carrying case complete with leads.



**OUR PRICE £16.50 P & P 40p**

## KAMODEN 72.200 Multitester

High sensitivity tester. 200,000 opv. Overload protected Mirror scale. Ranges: 0.06/3/3/30/120/600/1200V DC. 0/3/12/60/300/1200V AC. 0/5uA/1.2mA/120mA/600mA/12A DC. 0/1/2A AC. -20 to +63dB. 0/2k/20k/2 Meg/20 Megohms.



**OUR PRICE £22.50 P & P 30p**

## MOEL AF.105 VOM

50,000 opv. Mirror scale. Meter protection. 0/3/12/60/120/300/600/1200V DC. 0/6/30/120/300/600/1200V AC. 0/30uA/6/60/300mA/12 Amp. 0/10K/1m/10m/100 Meg Ohms. 20 to 17dB.



**OUR PRICE £12.50 P & P 30p**

## TMK MODEL 117 FET ELECTRONIC VOLTMETER

Battery operated. 11 Meg input, 26 ranges. Large 4 1/4" mirror scale. Size: 149 x 117 x 60mm. 0.3-1200kV DC. 3-300V RMS AC. 8-800V P.P. DC current 0.12-12mA. Resistance up to 2000Mohms. Decibels: -20 to +51dB. Supplied complete with leads and instructions.



**OUR PRICE £18.50 P & P 20p**

## TMK 100K LAB TESTER

100,000 opv. 6 1/2" scale. Buzzer short circuit check. Sensitivity 100,000 opv DC. 5kV AC. DC Volts: 0.5/2.5/10/50/250/1000V AC. 3/10/50/250/500/1000V DC. current 10/100uA/10/100/250mA. Resistance: 1k/10k/100k/10 Meg/100 Meg ohms. Decibels: -10 to +45dB. Plastic case with carrying handle. Size: 190 x 172 x 99mm.



**OUR PRICE £19.95 P & P 30p**

## LB4 TRANSISTOR TESTER

Tests PNP or NPN transistors. Audio indication. Operates on two 1.5V batteries. Complete with instructions etc.



**OUR PRICE £4.50 P & P 20p**

## KAMODEN TT35 TRANSISTOR TESTER

High quality instrument to test reverse leak current and DC currents. Amplification factor of NPN, PNP diodes, transistors, SCR's etc. 4" clear scale meter. Operates from internal batteries. Complete with instructions, leads carrying handle.



**OUR PRICE £17.50 P & P 40p**

## U4341 MULTIMETER & Transistor Tester

27 ranges. 16,700 opv. Overload protected. Ranges: 0.3/1.5/10/50/250/500/1000V DC. 1.5/7.5/30/150/300/750V AC. Current: 0.05/0.5/6/60/600mA AC. 0.3/3/30/300mA AC. Resistance: 0.06/0.6/6/60/600 ohms/2 Mohms. Battery operated. Supplied complete with probes, leads and steel carrying case. Size: 115 x 215 x 90mm.



**OUR PRICE £10.50 P & P 30p**

## STO0TR MULTIMETER TRANSISTOR TESTER

100,000 opv. Mirror scale. Overload protection. 0/0.12/0.6/1.2/30/120/600V DC. 0/6/30/120/600V AC. 0/12/60uA/12/300mA/12A DC. 0/10k/1 Meg/100 Meg. -20 to +60dB. 0.01-2 MFD Transistor tester measures Alpha, Beta and ICO. Complete with instructions, batteries and leads.



**OUR PRICE £19.95 P & P 25p**

## SWR METER Model SWR3

Handy SWR meter for transmitter antenna alignment, with built-in field strength meter. Accuracy 5%. Impedance 52 Ohms. 19dBm. Full scale 5 section collapsible antenna. Size 145 x 50 x 60mm.



**OUR PRICE £4.25 P & P 30p**

## C15 PULSE OSCILLOSCOPE

For display of pulsed and periodic waveforms on electronic circuits. VERT. AMP. Bandwidth: 10MHz. Sensitivity at 100kHz V RMS/mm: 0.1-25. HOR. AMP. Bandwidth: 500kHz. Sensitivity at 100kHz V RMS/mm: 0.3-25. Preset triggered sweep 1-300 usec. Free running 20-200 kHz in nine ranges. Calibrator pip. 220 x 360 x 430mm. 115-230V AC.



**OUR PRICE £43.00 Carr. paid**

## ALL PRICES EXCLUDE VAT

Also see following pages

### SINCLAIR DM2 DIGITAL MULTIMETER



Will measure AC and DC volts, AC and DC current, and resistance in a total of 20 ranges. The large light emitting diode display will read up to 1999 and automatically indicate polarity. Indication of positive and negative overloads is also provided. The instrument is fitted with a combined carrying handle and bench stand and sockets are provided for the connection of an external power supply RANGES:  
DC VOLTS 1v, 10v, 100v, 1000v  
AC VOLTS 1v, 10v, 100v, 1000v  
DC CURRENT 1mA, 10mA, 100mA, 1000mA  
AC CURRENT: 1mA, 10mA, 100mA, 1000mA  
RESISTANCE 1k, 10k, 100k, 1000k  
**OUR PRICE £59.95** P & P 50p

### RUSSIAN C116 Double Beam OSCILLOSCOPE

5 MHz pass band. Separate Y1 and Y2 amplifiers. Rectangular 5" x 4" CRT. Calibrated triggered sweep from 0.2µsec to 100 milli-sec/cm. Free running time base, 50Hz-1MHz. Built-in time base. Calibrator and amplitude Calibrator. Supplied complete with all accessories and instruction manual.  
**OUR PRICE £87.00** Carr. paid



### MODEL TE15 GRID DIP METER

Transistorised. Operates as Grid Dip Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440kHz-280MHz. In six coils, 500µA meter, 9V battery operation. Size: 180 x 80 x 40mm.  
**OUR PRICE £17.50** P&P 30p



### TRANSISTORISED L.C.R. A.C. BR/8 MEASURING BRIDGE

A new portable bridge offering excellent range and accuracy at low cost. Resistance: 6 ranges: 0.1 ohm-11.1 megohm ± 1% Inductance: 6 ranges: 1 microhenry-111 henries ± 2% Capacity: 6 ranges: 10pF-1110 mfd ± 2% Turns Ratio: 6 ranges: 1:1/1000-1:11000 ± 1% Bridge Voltage at 1,000cps. Operates from 9-volt battery. 100 micro-amp meter indication. Size 7 1/2" x 5" x 2"  
**OUR PRICE £27.50** P&P 30p

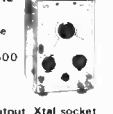
### TE16A TRANSISTORISED SIGNAL GENERATOR

5 ranges, 400kHz to 30 MHz. An inexpensive instrument for the handy man. Operates on 9V battery. Wide easy to read scale. 800kHz modulation. Size: 149 x 149 x 92mm. Complete with instructions and leads.  
**OUR PRICE £8.97** P&P 30p



### TE-20D RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 kHz-500 MHz on 6 bands. Directly calibrated. Variable RF attenuator audio output, Xtal socket for calibration. 220/240V a.c. Brand new with instructions. Size 140mm x 215mm x 170mm.  
**OUR PRICE £19.95** P&P 50p



### MODEL TE20 RF SIGNAL GENERATOR

Six bands, 120kHz-260MHz. Dual output RF terminals. Separate variable audio output. Accuracy ± 2%. Audio output to 8V. Power requirements: 105-125V, 220/240V AC. Size: 193 x 265 x 150mm. Complete with test leads etc.  
**OUR PRICE £18.95** P&P 50p



### ARF 300 AF/RF SIGNAL GENERATOR

All transistorised compact fully portable. AF sine wave 18Hz to 220 kHz. AF square wave 18Hz to 100kHz. Output Square/Sine wave 10V. P.P. RF 100kHz to 200MHz. Output 1V maximum. 220/240V AC operation. Complete with instructions and leads.  
**OUR PRICE £37.50** P&P 50p



### MODEL MG100 SINE SQUARE WAVE AUDIO GENERATOR

Range 19 220,000Hz. Sine Wave 19-100,000 Hz Square Wave. Output Sine or Square wave 10V. P to P. Size 180 x 90 x 90mm. Operation 220/240V AC.  
**OUR PRICE £19.95** P&P 50p



### TE22 SINE SQUARE WAVE AUDIO GENERATOR

Sine 20cps to 200kHz on 4 bands. Square 20 cps to 30 kHz. Output impedance 5000 Ohms. 200/250V AC operation. Supplied brand new guaranteed, with instruction manual and leads.  
**OUR PRICE £24.95** P&P 50p



### BELCO AT201 Decade ATTENUATOR

Frequency range 0-200kHz. Attenuator 0-111dB, 0.1dB steps. Impedance 600 ohms. Input power maximum 30dBm. Size: 185 x 90 x 55mm.  
**OUR PRICE £12.50** P&P 50p



### DT 124 POWER UNIT

220 240V AC Input. Output 6, 7.5 or 9V DC 400mA.  
**OUR PRICE £2.20** P&P 50p



### PS200 Regulated POWER SUPPLY UNIT

Solid state. Variable output 5-20V DC up to 2 Amp. Independent meters to monitor voltage and current. Output 220/240V AC. Size: 190 x 136 x 98mm.  
**OUR PRICE £19.95** P&P 50p



### VU METER TYPE 3

Size 33mm 20mm  
**£1.25** P&P 15p



### SDH8V MOND/STEREO HEADPHONES

Volume control for each channel. 4/16 ohms impedance. Frequency response 20Hz-18kHz. Complete with 10ft. coiled lead and jack plug.  
**OUR PRICE £4.97** P&P 30p



### BH001 HEADSET and 800m Microphone

Moving coil. Ideal for language teaching, communications etc. Headphone impedance 16 ohms. Microphone impedance 200 ohms.  
**OUR PRICE £5.95** P&P 30p



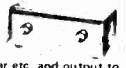
### UNIPEX NT 100A

The unipex NT100A is a compact portable transistorised PA amplifier. This versatile unit has a maximum output of 10 watts RMS and operates on any 1.0-16V DC source, negative or positive ground and uses only 1.5A at rated output. Supplied complete with mounting brackets etc, plus full installation and operating instructions.  
**OUR PRICE £21.75** P&P 50p



### EA41 REVERBERATION AMPLIFIER

Self contained, transistorised, battery operated. Simply plug in microphone, guitar etc. and output to your amplifier. Volume control and depth of reverbation control. Bawlnut cabinet. 184 x 77 x 108mm.  
**OUR PRICE £7.50** P&P 30p



### RANK AUDIO RA 210T STEREO AMPLIFIER

7 1/2 watts rms. Inputs for magnetic phono, tuner, tape and aux. Separate base, treble, balance and volume controls. Headphone socket. Teak case. Unrepeatable offer.  
**OUR PRICE £17.50** P&P 50p

### VHF 105

This unit will give instant reception of the ground-air, air-to-ground waveband. Simply place beside any AM or FM Radio covering 535-1605 kHz. 88-108 MHz. No conversion or connection required. This converter is self powered by one 9-volt (PP3 Type) battery and comes complete with a full set of instructions and battery.  
**OUR PRICE £3.50** P&P 50p



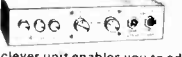
### Just arrived - the sensational WIEN ET1008 CASSETTE RECORDER

A highly recommended cassette recorder at this really low Laskys price. **ONLY £8.95** P&P 50p. **FANTASTIC VALUE!**



### SPECIAL OFFER! CONVERT YOUR STEREO SYSTEM TO 4D SOUND

This clever unit enables you to add 4D sound to your existing system. Complete with simple connection details. Use this converter (together with 2 extra speakers) to achieve the fantastic 4D Quadrophonic sound! The effect of being immersed within the music becomes a thrilling new experience (2 year guarantee).  
**OUR PRICE £3.95** P&P 50p



### FM TUNER CHASSIS

6 transistor high quality tuner. Size only 153 x 106 x 63mm. 3 IF stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Covers 88-108MHz. Ready built, ready for use. Fantastic value for money.  
**OUR PRICE £8.95** P&P 20p  
Stereo Multiplex Adaptor £9.95 extra.



### WALKIE TALKIES SKYFON NV7

Super low cost transmitter receivers. 100MW with call buzzer and on/off volume control. 7 transistors. Telescopic rod antenna.  
**OUR PRICE £31.50** per PAIR P & P 50p. **NOT LICENSABLE IN THE U.K.**



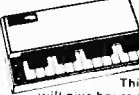
### ELECTRONIC CALCULATORS

We carry a tremendous range of both pocket and desk calculators from as little as £8.95. Owing to the demand that is not possible to include them in this advertisement, so send for our latest price list or call into any branch.



### MINIATURE ORGAN MUSIC MASTER AM100

Spanning nearly two octaves, including semi-tones. This instrument will give hours of enjoyment to all the family. Beautifully finished. The keyboard range can be adjusted to be in tune with any instrument. Operates from internal 9V battery. Fitted with on/off switch, vibrato switch, earphone socket and external 9V D.C. socket.  
**OUR PRICE £7.95** P&P 50p



### BINATONE DIGITAL CLOCK

Attractive ivory case. Large clear numbers for hours, minutes and seconds. A.C. 240V operation. Size approx 6 1/2 x 3 x 3 1/2 inches.  
**OUR PRICE £4.50** P&P 50p



### SINCLAIR IC12 INTEGRATED CIRCUIT AMPLIFIER

complete with printed circuit mounting board.  
**OUR PRICE £1.50** P & P 15p.



### SINCLAIR Project 80 Modules

240 Power Amp. £5.95 P & P 15p  
260 Power Amp. £7.45 P & P 15p  
Stereo Clear Amp. £13.95 P & P 15p  
Active Filter Unit. £7.45 P & P 15p  
FM Tuner. £13.95 P & P 15p  
Stereo Decoder. £8.95 P & P 15p  
P25 Power Supply. £5.95 P & P 30p  
P26 Power Supply. £8.95 P & P 30p  
P28 Power Supply. £8.45 P & P 30p  
Transformer for P28. £4.05 P & P 50p

### SINCLAIR Project 80 Packages

2x240/Stereo 80/P25 £25.44 P & P 35p  
2x240/Stereo 80/P26 £27.84 P & P 35p  
2x260/Stereo 80/P28 £29.84 each

### TE1021 Stereo Listening Station

For balancing and gain selection of loudspeakers with additional facilities for stereo headphone switching. Two gain controls, speakers on-off side switch, stereo headphone socket.  
**OUR PRICE £2.25** P&P 15p



### AUDIOTRONIC LOW NOISE CASSETTES

TYPE	5	10	25
C60	£1.57	£3.00	£7.08
C90	£2.24	£4.25	£10.00
C120	£2.73	£5.17	£12.24

P&P 3p each. 10 and over Post Free

### MPT MIXER-PREAMPLIFIER

5 Microphone inputs each with individual gain control. Includes complete mixing facilities. Battery operated. Size: 235 x 127 x 76mm. Inputs: Mics. 3 x 3mV. 50k; 2 x 3mV 600 ohms. Phono. Mag. 4mV. 50k; Phono Ceramic 100mV. 100k.  
**OUR PRICE £8.97** P&P 20p



### AUDIOTRONIC AH401 Stereo Headphone Amplifier

All silicon, transistor amplifier. Operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9V battery. INPUTS: 50mV and 100mV. OUTPUT: 50mV per channel.  
**OUR PRICE £8.50** P&P 30p



### HIGH QUALITY CONSTRUCTION KITS

WE ARE APPOINTED STOCKISTS AT Oxford Street, 142 & 34 Lisle Street, 152, Fleet Street, 311 Edgware Road, CROYDON BIRMINGHAM KINGSTON LEICESTER NORTHAMPTON SOUTHEND TUNBRIDGE WELLS WOLVERHAMPTON branches or by Mail Order

All kits are complete with comprehensive easy to follow instructions and covered by full guarantee. Post and Packing 15p per kit.

AF20 Mono amplifier.....	£5.61
AF25 Mixer.....	£3.29
AF30 Mono pre amplifier.....	£3.30
AF35 Emitter amplifier.....	£2.42
AF80 50W mic. amplifier.....	£4.86
AF305 Intercom.....	£7.67
AF310 2 Mono Amplifier.....	£7.55
M160 Multi-vibrator.....	£2.18
M1302 Transistor tester.....	£8.33
M191 VU Meter.....	£5.37
M193 Stereo balance meter.....	£5.93
LF380 Guard amplifier device.....	£8.42
AT5 Automatic light control.....	£3.75
AT30 Photo cell switch unit.....	£6.68
AT150 400V triac light dimmer/speed control.....	£5.18
AT50 2 200V triac light dimmer/speed control.....	£6.75
AT60 1 channel light control.....	£10.82
AT65 3 channel light control.....	£16.52
GU330 Triac unit.....	£8.10
HF61 Diode detector.....	£3.87
HF65 FM transmitter.....	£3.21
HF75 FM receiver.....	£3.66
HF310 FM tuner.....	£16.32
HF325 Deluxe FM tuner.....	£26.33
HF330 Decoder (HF310/325).....	£10.55
GP310 Stereo pre-amplifier for use with AF310.....	£22.98
GP312 Circuit board.....	£10.02
GP304 Circuit board.....	£5.33
HF380 lw/hf aerial amplifier.....	£6.02
HF395 broadband aerial amp.....	£2.10
NT10 Stabilised power supply 100mA, 9V.....	£6.27
NT300 Stabilised s. supply.....	£13.16
NT310 Power Supply 240 V AC or 2, 15 V D.C. at 2 amps.....	£5.64
NT306 Voltage converter.....	£9.64
NT315 Power supply 240V AC to 4.5/15V DC, 500mA.....	£12.06

Amateur Electronics by Justy-Kit, the professional book for the amateur covers the subject from basic principles to advanced electronic techniques. Complete with circuit board for AE1 to AE10 listed below.  
**OUR PRICE £3.30** (No VAT) P&P 25p plus VAT

AE1 100mV output stage.....	£1.55
AE2 Pre-amplifier.....	£1.32
AE3 Diode receiver.....	£2.05
AE4 Flasher.....	£1.26
AE5 Adjustable multi-vibrator.....	£1.14
AE6 Monostable multi-vibrator.....	£1.11
AE7 RC generator.....	£1.08
AE8 Bass filter.....	£1.05
AE9 Treble filter.....	£1.05
AE10 CCIR filter.....	£1.05

Also see previous page  
**ALL PRICES EXCLUDE VAT**



# SEW PANEL METERS

SEW PANEL METERS ARE STOCKED AT OUR 3 LISLE ST., 311 EDGWARE RD., & 152 FLEET ST., BRANCHES or order by post.



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

Over 200 ranges in stock—other ranges to order. Quantity discounts available. Send for fully illustrated brochure.

## CLEAR PLASTIC MODEL SD640

Size: 85 x 64mm

50uA	£3.90
100uA	£3.85
200uA	£3.80
500uA	£3.75
50-0-500uA	£3.85
100-0-1000uA	£3.80
1mA	£3.75
5mA	£3.75
10mA	£3.75
50mA	£3.75
100mA	£3.75
500mA	£3.75
1A DC	£3.75
5A DC	£3.75
10A DC	£3.75
5V DC	£3.75



10V DC	£3.75
20V DC	£3.75
50V DC	£3.75
300V DC	£3.75
15V AC	£3.75
30V AC	£3.85
VU Meter	£4.00

## CLEAR PLASTIC MODEL SW100

Size: 100 x 80mm

50uA	£4.70
100uA	£4.60
200uA	£4.40
50-0-500uA	£4.55
100-0-1000uA	£4.55
1mA	£4.40
5A DC	£4.40
10A DC	£4.40
20V DC	£4.40
50V DC	£4.40
300V DC	£4.40
5V DC	£4.40



150V AC	£4.55
300V AC	£4.55
VU Meter	£5.00

## EDGWISE MODEL PE70

Size: 90 x 34mm

50uA	£4.25
100uA	£4.20
200uA	£4.15
500uA	£4.20
50-0-500uA	£4.40
100-0-1000uA	£4.15
1mA	£4.05
300V AC	£4.05
VU Meter	£4.40



## MODEL E0107 EDUCATIONAL METER

Size: 100 x 90 x 150mm including terminals

50uA	£8.70
100uA	£8.10
50-0-500uA	£8.10
1mA	£7.80
1-0-1mA	£7.80
1A DC	£7.80
5A DC	£7.80
5V DC	£7.80
10V DC	£7.80
15V DC	£7.80



20V DC	£7.80
50V DC	£7.80
300V DC	£7.80
500mA/5A DC	£8.80
5V/15V DC	£8.80
1/5A DC	£8.80

## CLEAR PLASTIC MODEL MR 85P

Size: 120 x 110mm

50uA	£5.80
100uA	£5.85
200uA	£5.80
500uA	£5.40
50-0-500uA	£5.65
100-0-1000uA	£5.65
500-0-5000uA	£5.35
1mA	£5.35
1-0-1mA	£5.35
5mA	£5.35
10mA	£5.35
50mA	£5.35
100mA	£5.35
500mA	£5.35
1A DC	£5.35
5A DC	£5.35
15A DC	£5.35
30A DC	£5.35
10V DC	£5.35
20V DC	£5.35
50V DC	£5.35
150V DC	£5.35



300V DC	£5.40
15V AC	£5.45
30V AC	£5.45
S Meter 1mA	£5.35
VU Meter	£5.70
1A AC	£5.35
5A AC	£5.35
10A AC	£5.35
20A AC	£5.35
30A AC	£5.35

## \*Items with asterisk are Moving Iron type, all others are Moving Coil

### CLEAR PLASTIC MODEL SD830

Size: 110 x 83mm

50uA	£4.40
100uA	£4.35
200uA	£4.30
500uA	£4.25
50-0-500uA	£4.35
100-0-1000uA	£4.30
1mA	£4.20
5mA	£4.20
10mA	£4.20
50mA	£4.20
100mA	£4.20
500mA	£4.20
1A DC	£4.20
5A DC	£4.20
10A DC	£4.20
5V DC	£4.20



10V DC	£4.20
20V DC	£4.20
50V DC	£4.20
300V DC	£4.20
15V AC	£4.30
30V AC	£4.30
VU Meter	£4.50

### CLEAR PLASTIC MODEL MR 45P

Size: 50 x 50mm

50uA	£3.30
100uA	£3.25
200uA	£3.20
500uA	£3.10
50-0-500uA	£3.25
100-0-1000uA	£3.20
500-0-5000uA	£3.05
1mA	£3.05
5mA	£3.05
10mA	£3.05
50mA	£3.05
100mA	£3.05
500mA	£3.05
1A DC	£3.05
5A DC	£3.05
10V DC	£3.05
20V DC	£3.05
50V DC	£3.05
300V DC	£3.05
15V AC	£3.15



300V AC	£3.15
S Meter 1mA	£3.50
VU Meter	£3.50
1A AC	£3.05*
5A AC	£3.05*
10A AC	£3.05*
20A AC	£3.05*
30A AC	£3.05*

### CLEAR PLASTIC MODEL MR 38P

Size: 42 x 42mm

50uA	£3.20
100uA	£3.15
200uA	£3.10
500uA	£2.90
50-0-500uA	£3.10
100-0-1000uA	£2.85
1mA	£2.85
1-0-1mA	£2.85
2mA	£2.85
5mA	£2.85
10mA	£2.85
20mA	£2.85
50mA	£2.85
100mA	£2.85
150mA	£2.85
200mA	£2.85
300mA	£2.85
500mA	£2.85
1A DC	£2.85
2A DC	£2.85
5A DC	£2.85
10A DC	£2.85
3V DC	£2.85
10V DC	£2.85
15V DC	£2.85



20V DC	£2.85
50V DC	£2.85
150V DC	£2.85
300V DC	£2.85
500V DC	£2.85
750V DC	£2.95
15V AC	£2.95
30V AC	£2.95
50V AC	£2.95
150V AC	£2.95
300V AC	£2.95
S Meter 1mA	£3.10
VU Meter	£3.30

### CLEAR PLASTIC MODEL SD460

Size: 59 x 46mm

50uA	£3.50
100uA	£3.55
200uA	£3.50
500uA	£3.45
50-0-500uA	£3.55
100-0-1000uA	£3.50
1mA	£3.40
5mA	£3.40
10mA	£3.40
50mA	£3.40
100mA	£3.40
500mA	£3.40
1A DC	£3.40
5A DC	£3.40
10A DC	£3.40
5V DC	£3.40



10V DC	£3.40
20V DC	£3.40
50V DC	£3.40
300V DC	£3.40
15V AC	£3.55
30V AC	£3.55
50V AC	£3.55
150V AC	£3.55
300V AC	£3.55
VU Meter	£3.75

POSTAGE & PACKING 15p

## CLEAR PLASTIC MODEL MR 65P

Size: 86 x 78mm

50uA	£4.05
100uA	£3.95
200uA	£3.90
500uA	£3.85
50-0-500uA	£3.95
100-0-1000uA	£3.90
1mA	£3.80
1-0-1mA	£3.85
5mA	£3.80
10mA	£3.80
50mA	£3.80
100mA	£3.80
500mA	£3.80
1A DC	£3.80
5A DC	£3.80
10A DC	£3.80
15A DC	£3.80
20A DC	£3.80
30A DC	£3.80
50A DC	£3.80
5V DC	£3.80
10V DC	£3.80
15V DC	£3.80
20V DC	£3.80
50V DC	£3.80
150V DC	£3.80



300V DC	£3.80
15V AC	£3.90
30V AC	£3.90
50V AC	£3.90
150V AC	£3.90
300V AC	£3.90
500V AC	£4.00
S Meter 1mA	£3.90
VU Meter	£4.20
1A AC	£3.80*
5A AC	£3.80*
10A AC	£3.80*
20A AC	£3.80*
30A AC	£3.80*
50A AC	£3.80*
100A AC	£3.80*
200A AC	£3.80*
500A AC	£3.80*

## BAKELITE MODEL S80 Enlarged Window

Size: 80 x 80mm

50uA	£4.60
100uA	£4.55
500uA	£4.30
50-0-500uA	£4.55
100-0-1000uA	£4.50
1mA	£4.30
1A DC	£4.30
5A DC	£4.30
10A DC	£4.30
50V DC	£4.30
300V DC	£4.30
300V AC	£4.40
VU Meter	£4.80



## CLEAR PLASTIC MODEL MR 52P

Size: 60 x 60mm

50uA	£3.80
100uA	£3.80
200uA	£3.75
500uA	£3.60
50-0-500uA	£3.60
100-0-1000uA	£3.45
1mA	£3.40
5mA	£3.40
10mA	£3.40
50mA	£3.40
100mA	£3.40
500mA	£3.40
1A DC	£3.40
5A DC	£3.40
10V DC	£3.40
20V DC	£3.40
50V DC	£3.40
300V DC	£3.40
15V AC	£3.50
30V AC	£3.50



S Meter 1mA	£3.40
VU Meter	£3.90
1A AC	£3.40*
5A AC	£3.40*
10A AC	£3.40*
20A AC	£3.40*
30A AC	£3.40*

## BAKELITE MODEL MR 65

Size: 80 x 80mm

25uA	£5.40
50uA	£4.10
100uA	£4.05
500uA	£3.75
50-0-500uA	£4.05
100-0-1000uA	£4.00
500-0-5000uA	£3.70
1mA	£3.70
1-0-1mA	£3.70
5mA	£3.70
10mA	£3.70
50mA	£3.70
100mA	£3.70
500mA	£3.70
1A DC	£3.70
2A DC	£3.70
5A DC	£3.70
10A DC	£3.70
15A DC	£3.70
30A DC	£3.70
50A DC	£3.70
5V DC	£3.70
10V DC	£3.70
15V DC	£3.70
50V DC	£3.70
150V DC	£3.70



300V DC	£3.90
30V AC	£3.70*
50V AC	£3.70*
150V AC	£3.70*
300V AC	£3.70*
500V AC	£3.70*
S Meter 1mA	£4.20
VU Meter	£4.20
1A AC	£3.70*
5A AC	£3.70*
10A AC	£3.70*
20A AC	£3.70*
30A AC	£3.70*
50A AC	£3.70*
100A AC	£3.70*
500A AC	£3.70*
50mV DC	£3.85
100mV DC	£3.85

## 240° Wide Angle

1mA METERS	
MW1-6.60 x 60 mm	
£6.50 P & P 15p	
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£6.90 P&P 15p	



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Excellent quality at low cost. Input: 230V 50/60Hz. Output 0-260V. MODEL S260 BENCH MOUNTING

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10A	£33.75	£1.00
12A	£36.40	£1.00
20A	£85.00	£1.50
25A	£96.00	£1.50
40A	£120.00	£1.50



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# CHROMASONIC electronics

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telephone: 01-883 3705

## RESISTORS

The standard ranges of Resistors stocked are either E12 or E24 and the values are all in multiples of ten times the decade shown below. The E12 items are only those in bold type. The E24 items are both those in bold and light type.

10	1.8	33	56
11	20	36	42
12	22	39	68
13	24	43	75
15	27	47	82
16	30	51	91

CARBON FILM  $\frac{1}{2}$  watt  $\pm 5\%$  tol. 2p ea.  
E12 Series 10 $\Omega$  to 330K $\Omega$

CARBON FILM  $\frac{1}{2}$  watt  $\pm 5\%$  tol. 13p ea.  
E24 Series 10 $\Omega$  to 10M $\Omega$

CERMET THICK FILM  $\frac{1}{2}$  watt  $\pm 2\%$  tol. 8p ea.  
E12 series 56 $\Omega$  to 150K $\Omega$

METAL OXIDE FILM  $\frac{1}{2}$  watt  $\pm 2\%$  tol. 43p ea.  
E12 series 10 $\Omega$  to 1M $\Omega$

CARBON COMPOSITION  $\frac{1}{2}$  watt 43p ea.  
2.2, 2.7, 3.3, 3.9, 4.7,  $\pm 0.5$  tol.  
5.6, 6.8, 8.2  $\pm 10\%$  tol.

CARBON COMPOSITION 1 watt 53p ea.  
2.2, 2.7, 3.3, 3.9, 4.7,  $\pm 0.5$  tol.  
5.6, 6.8, 8.2  $\pm 10\%$  tol.

CARBON FILM 1 watt  $\pm 5\%$  tol. 33p ea.  
E12 series 10 $\Omega$  to 10M $\Omega$

CARBON FILM 2 watt  $\pm 5\%$  tol. 63p ea.  
E12 series 10 $\Omega$  to 10M $\Omega$

WIRE WOUND  $2\frac{1}{2}$  watt  $\pm 5\%$  tol. 0.22 to 0.47 $\Omega$  153p  
E12 series  $\pm 10\%$   $\pm 1$  to 270 $\Omega$  13p

WIRE WOUND 5 WATT 13p ea.

$\frac{1}{2}$	25	250	1.5K
1	30	270	1.8K
1.8	39	390	2K
2.2	50	330	2.2K
2.7	60	350	2.5K
3.3	68	400	2.7K
3.9	75	470	3K
4.7	82	500	3.3K
5	100	560	3.5K
5.6	125	600	3.9K
6.8	133	680	4.7K
8.2	150	750	5K
10	180	820	5.6K
15	200	1K	6.8K
21	220	1.2K	8.2K

WIRE WOUND 10 watt 14p ea.  
All the values shown in bold in the 5 watt range.

WIRE WOUND 10 watt  $\pm 5\%$  tol. 20p ea.  
10K, 15K, 20K, 25K

WIRE WOUND 15 watt 133p ea.  
All the values from 10 $\Omega$  upward shown in bold in the 5 watt range.

## POTENTIOMETERS



5K 250K Log or Lin Less Switch (and 1K Lin) 14p  
10K 500K Log or Lin with Switch 26p  
25K 1 Meg Dual Less Switch 46p  
50K 2 Meg 1 Meg Log only 57p  
100K 10K Log + 10K Antilog Less Switch

## Sliders

10K Single 33p  
50K DUAL 55p  
100K

## Presets

Vertical or Horizontal  
.1 Watt 53p .25 Watt 7p  
100 1K 10K 100K 1Meg  
250 2.5 25K 250K 2.5 Meg  
500 5K 50K 500K 5Meg

## Cerrets

100 2.5K 25K 250K  
500 5K 50K 500K  
1K 10K 100K 1Meg  
40p

## VDR's

### Thermistors

CZ1 17p  
CZ4 16p  
CZ13A 18p  
CZ19 18p  
E298CA258 13p  
E298DA258 13p  
E298DA260 13p  
E298DA262 13p  
E298DA265 13p  
E298DP268 13p  
E298Z05 13p  
E298Z06 13p  
E299DDP336 14p  
E299DDP338 14p  
E299DDP342 14p  
E299DDP348 14p  
GL16 E1.21  
GL23 E1.21  
R53 E1.49  
R54 E1.61  
VA1005 14p  
VA1026 14p  
VA1033 14p  
VA1034 14p  
VA1039 14p  
VA1040 14p  
VA1053 14p  
VA1055 14p  
VA1056 14p  
VA1066 17p  
VA1057 19p  
VA1067 19p  
VA1077 19p  
VA1098 21p  
VA1104 31p  
VA1107 29p

## CAPACITORS



Silvered Mica 350V.  
Tol.  $\pm 0.5\%$  11p each  
2.2 pf 18pf 30pf  
3.3 pf 20pf 33pf  
5 pf 22pf 39pf  
10 pf 25pf 47pf

Tol.  $\pm 1\%$  11p each  
50pf 150pf  
50pf 82pf 180pf  
68pf 100pf 200pf  
75pf 120pf 220pf

12p each  
250pf 330pf 560pf  
270pf 390pf 680pf  
300pf 470pf 820pf

17p each  
1000 pf 1500pf 220pf  
1800pf

26p each  
2700pf 3600pf 5000pf  
4700pf

33p each  
6800pf 8200pf 10000pf

Mixed Dielectric 600 Volts Wkg.  
0.01 uF 8p, 0.1 uF 9 p  
0.022 uF 8p, 0.22 uF 17 p  
0.033 uF 8p, 0.47 uF 26 p  
0.047 uF 8p, 1 uF 36 p  
0.068 uF 9p

Mixed Dielectric 1000 Volts Wkg.  
1000 pf 63p, 0.022 uF 11p  
2200 pf 63p, 0.047 uF 13p  
3300 pf 7p, 0.1 uF 13p  
4700 pf 7p, 0.22 uF 24 p  
0.01 uF 10p, 0.47 uF 33p

Solid Tantalum Beads  
all at 163p  
0.1 uF 35v, 10 uF 6.3v  
0.22 uF 35v, 10 uF 16v  
0.47 uF 35v, 10 uF 25v  
1.0 uF 35v, 22 uF 16v  
2.2 uF 35v, 47 uF 6.3v  
4.7 uF 35v, 100 uF 3v

Feed-through Ceramics  
1000 pf 350v 6p  
Disc Ceramics 750 Volt Wkg.  
all at 53p each  
470 pf, 1000 pf, 5000 pf, 0.01 uF

Metallised Polyester Film  
0.01 uF 33p, 0.22 uF 53p  
0.015 uF 33p, 0.33 uF 7p  
0.022 uF 33p, 0.47 uF 9p  
0.033 uF 33p, 0.68 uF 12p  
0.047 uF 33p, 1.0 uF 14p  
0.068 uF 4 p, 1.5 uF 22p  
0.1 uF 4p, 2.2 uF 26p  
0.15 uF 4p

Tubular H1-K Ceramics 750 Volts Wkg.  
1000 pf 53p 3000 pf 53p  
1500 pf 53p 5000 pf 53p  
2000 pf 53p 0.01 uF 53p

Pulse Ceramics all at 10p each  
12 kv D.C. Wkg. 8kv D.C.  
10pf 120pf 200pf  
22pf 140pf  
68pf 150pf 250pf  
82pf 120pf 270pf  
100pf 200pf 300pf

## CAPACITORS

Ceramic Plate  
Mullard C333 Series 63 Volts Wkg.  
all at 53p each  
0.025pf 1.8 pf  $\pm 2\%$  12 pf  $\pm 2\%$  48 pf  
2.2 pf 15 pf 82 pf  
3.3 pf 18 pf 100 pf  
3.9 pf 22 pf 120 pf  
4.7 pf 27 pf 150 pf  
5.6 pf 33 pf 180 pf  
6.8 pf 39 pf 220 pf  
8.2 pf 47 pf 270 pf  
10 pf 56 pf 330 pf

Mullard 630 series 40 volts  $\pm 10\%$  tol.  
\* 629 series 100 volts  
all at 53p each  
390 pf 1000 pf 3300 pf  
470 pf 1200 pf 3900 pf  
560 pf 1500 pf 4700 pf  
680 pf 1800 pf \* 10 nf  
820 pf 2200 pf \* 22 nf  
2700 pf

Erie Monolithic Ceramic 30 Volts Wkg.  
27 nf 11p, 47 nf 13p, 100 nf 17p

Low Voltage Disc Ceramics  
all at 53p each  
0.01 uF 18v, 0.1 uF 30v  
0.022 uF 18v, 0.22 uF 4v  
0.047 uF 18v, 0.47 uF 3v

Mylar Film 100 Volts Wkg.  
1000 pf 23p, 0.05 uF 33p  
2000 pf 23p, 0.068uF 5p  
5000 pf 23p, 0.1 uF 5p  
0.01 uF 33p, 0.2 uF 63p  
0.02 uF 33p, 0.47 uF 7p  
0.04 uF 33p

MULLARD C295 Series 63 volts  
Tolerance  $\pm 1\%$  Polystyrene  
6,800pf (6.8nf) C295 AH/D06K8 11p  
8,200pf (8.2nf) C295 AH/D08K2 11p  
13,000pf (13nf) C295 AH/D13K 15p  
18,000pf (18nf) C295 AH/D18K 15p  
20nf (.02uF) C295 AH/D20K 15p  
30nf (.03uF) C295 AH/D30K 18p  
39nf (.039uF) C295 AH/D39K 18p  
51nf (.051uF) C295 AH/D51K 25p

Polystyrene 160 volts Wkg.  
Tolerance  $\pm 1\%$  pf up to 33pf,  $\pm 5\%$  47pf up.  
10 pf to 10,000 pf (0.01 uF) in multiples of.  
10, 15, 22, 33, 47, 68.

Wima MKS 0.22uF  $\pm 5\%$  100v 11p

Mullard C280 Series 250 Volts Wkg.  
Metallised Polyester Film  
0.01 uF 33p, 0.22 uF 53p  
0.015 uF 33p, 0.33 uF 7p  
0.022 uF 33p, 0.47 uF 9p  
0.033 uF 33p, 0.68 uF 12p  
0.047 uF 33p, 1.0 uF 14p  
0.068 uF 4 p, 1.5 uF 22p  
0.1 uF 4p, 2.2 uF 26p  
0.15 uF 4p

Mullard C281 series 400 Volts Wkg.  
Metallised Polycarbonate Film  $\pm 10\%$   
0.01 uF 5p, 0.1 uF 8p  
0.015 uF 5p, 0.15 uF 9p  
0.022 uF 5p, 0.22 uF 11p  
0.033 uF 5p, 0.33 uF 15p  
0.047 uF 6 p, 0.47 uF 16p  
0.068 uF 6 p

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## INDUCTORS

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FRA1 Long & Medium Wave band (300pf) 84p  
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Tuning Coils in two series:

Range	150 kHz to 400 kHz
1	515 kHz to 1.545 MHz
3	1.67 MHz to 5.3 MHz
4	5 MHz to 15 MHz
5	10.5 MHz to 31.5 MHz
6	30 MHz to 50 MHz*
7	45 MHz to 78 MHz*

\* 50 pf tuning, all others based on 300 pf.

Series A Transistor - 48p each

Only available in ranges 1 to 5 inc.

4 Coils complete each range.

Blue	Aerial Coil
Yellow	R.F. Interstage
Red	Osc. Coil for 465 kHz I.F.
White	Osc. Coil for 1.6 MHz I.F.

give range number, letter 'T' and colour.

Series B Dual Purpose Coils 48p each

For FET or Valve Circuits

All ranges available

5 Coils complete each range.

Blue	Aerial
Yellow	Interstage R.F.
Green	R.F. plus reaction
Red	Osc. Coil for 465 kHz I.F.
White	Osc. Coil for 1.6 MHz I.F.

(Note use Red instead of White for ranges 6 & 7.)

### Chokes



We stock from 1 µH to 19 mH  
Check levels & prices when ordering

## TUNING CONDENSERS

TYPE E  
3 gang 310pf  
E3.99

TYPE OO  
208 + 176 pf with screen & trimmers  
E1.48

TYPE C804  
83p  
Slow Motion Drive Ratio 6:1 Ref. 4511

TYPE O  
365 pf  
365 x 365 pf E1.07

DILECON  
100pf 69p  
300pf 69p  
500pf 69p

### I.F. Transformers

IFT 13	465 kHz 1st & 2nd d/tuned	65p
IFT 14	465 kHz Final single tuned	65p
IFT 15	10.7 MHz d/tuned	65p
IFT 16	1.6 MHz 1st & 2nd d/tuned	65p
IFT 17	1.6 MHz Final d/tuned	65p
IFT 18	465 kHz or 1.6 MHz d/tuned	75p

## VEROBOARD

	COPPERCLAD	PLAIN	EXTRA
	0.1" 0.15"	0.15"	P&P
2 1/2" x 1"	7p	7p	-
2 1/2" x 3 1/2"	24p	21p	-
2 1/2" x 5"	30p	25p	13p
3 1/2" x 3 1/2"	30p	25p	-
3 1/2" x 5"	34p	34p	25p
1 7/8" x 2 1/8"	90p	69p	45p
1 7/8" x 3 1/8"	E1.21	75p	57p
1 7/8" x 5"	-	99p	10p

D.1 P. Breadboard 4.15" x 6.15" E1.40  
VEROSTRIP (State 1" or 1.5") 30p  
Pin Insertion Tool (State 1" or 1.5") 65p  
Spot Face Cutter 51p  
Terminal Pins in Pkts. of 50 (State 1" or 1.5") 22p

Details of I.C.'s, Rectifiers, Diodes, Bridges, Passive Components; LED's, Clocks, Triacs etc. can be seen on other pages and/or issues of Wireless World; Practical Wireless; and Practical Electronics.

## Electrolytics

UF	4V	6.3V	10V	16V	25V	40V	63V	100V	160V	450V
1							63p		83p	15p
1.5							63p			
2							63p		83p	
2.2							63p			
3							63p			
3.3							63p			
4							63p			
4.7							63p			
6.8							63p	83p		
8										21p
10										
15										24p (16uF)
22										
33										33p (32uF)
47	63p	63p	63p	63p	63p	63p	83p			8p
68										11p
100	63p	63p	59p	63p	63p	83p	14p	25p		
150										11p
220	63p	59p	8p	11p	14p	19p	31p			
330	63p	3p	11p				25p	44p		
470		8p	11p	14p	20p	26p	47p	59p		
680		10p		14p	20p	25p	44p	79p		
1000	13p		14p	19p	22p	25p	44p	79p		
1500		19p	19p	25p						
2200		18p	24p							
3300		26p								
4700		25p		44p	68p	79p	149p	25p		
6800				75p						

## DIODES

AA119	10p	BY103	22p	0A91	8p
AA120	10p	BY105	16p	0A200	11p
AA129	10p	BY126	16p	0A270	10p
BA100	10p	BY127	16p	Z5120	8p
BA102	27p	BY133	23p	Z5140	25p
BA110	44p	BY164	54p	Z5141	42p
BA115	19p	BY176	E1.62	Z5142	32p
BA144	25p	BY182	E1.62	Z5170	10p
BA145	22p	BY250	25p	Z5270	11p
BA148	22p	BZX70	27p	Z5271	14p
BA154	20p	Series		Z5278	36p
BA155	15p	BZY88	11p	IN914	8p
BA156	16p	Series		IN916	10p
BAX16	10p	0A47	11p	IN4009	7p
BB104	45p	0A79	10p	IN4148	5p
BB105B	41p	0A81	8p	IN4448	9p
BY100	16p	0A85	10p	I2S Series	18p
		0A90	8p		

## TRANSISTORS

AC107	16p	BC213L	13p	D13V	52p	ZTX301	13p	ZN3707	12p
AC126	13p	BC214L	13p	D40N3	59p	ZTX302	17p	ZN3708	10p
AC127	13p	BC268	13p	MJ480	93p	ZTX303	14p	ZN3709	10p
AC128	15p	BC407	16p	MJ481	E1.18	ZTX304	21p	ZN3710	11p
AC174	15p	BCY70	17p	MJ490	E1.93	ZTX310	10.1p	ZN3711	11p
AC187	22p	BCY71	17p	MJ491	E1.42	ZTX312	10p	ZN3722	E2.00
AC187K	20p	BCY72	17p	MJ500	E1.42	ZTX341	22p	ZN3791	E2.55
AC188	22p	BD115	73p	MJ100	E1.22	ZTX384	18p	ZN3819	27p
AC188K	25p	BD123	89p	MJ2955	E1.88	ZTX500	12p	ZN3821	81p
ACY17	39p	BD124	80p	MJ3055	E1.21	ZTX501	13p	ZN3823	9p
ACY17	38p	BD131	44p	MJ4000	E1.46	ZTX502	17p	ZN3903	15p
ACY20	74p	BD132	59p	MJ4010	E1.93	ZTX503	14p	ZN3904	15p
AD140	48p	BD131/2PR	E1.17	MJ340	45p	ZTX504	42p	ZN3905	22p
AD149	48p	BD135	41p	MJ350	97p	ZTX531	22p	ZN3906	25p
AD161	37p	BD136	43p	MJ2955	E1.20	ZTX550	17p	ZN4056	13p
AD162	38p	BD201	E1.95	MJ3055	72p	ZN697	16p	ZN4059	19p
AD161/62MP	74p	BD202	E1.46	MPF102	27p	2N706	13p	ZN4062	16p
AF114	17p	BF109	74p	MPF103	40p	2N708	16p	ZN4289	19p
AF115	17p	BF120	25p	MPF104	44p	2N714	24p	ZN4441	85p
AF116	17p	BF160	25p	MPF105	44p	2N930	22p	ZN4442	E1.04
AF117	17p	BF167	24p	MPF106	49p	2N1302	20p	ZN4443	E1.42
AF118	54p	BF173	24p	MPF111	22p	2N1303	24p	ZN4444	E2.04
AF124	32p	BF178	28p	MP5U06	63p	2N1304	24p	ZN4871	59p
AF139	34p	BF179	32p	MP5U56	77p	2N1305	24p	ZN4901	E1.13
AF172	25p	BF180	32p	OC28	49p	2N1306	24p	ZN5067	E1.07
AF179	40p	BF181	32p	OC35	45p	2N1307	27p	ZN5129	16p
ASV26	42p	BF184	32p	OC36	49p	2N1308	34p	ZN5172	11p
BC107	11p	BF185	27p	OC44	14p	2N1309	34p	ZN5191	77p
BC108	11p	BF194	15p	OC45	14p	2N1718	26p	ZN5194	91p
BC109	12p	BF195	17p	OC71	14p	2N1718	E4.37	ZN5295	52p
BC117	22p	BF196	10p	OC72	14p	2N1893	52p	ZN5447	10p
BC147	10p	BF197	10p	OC75	15p	2N1218	22p	ZN5449	16p
BC148	10p	BF200	31p	OC76	27p	2N1219	39p	ZN5457	46p
BC149	10p	BF244B	10p	OC81	14p	2N1246	54p	ZN5504	65p
BC157	13p	BF262	25p	OC83	25p	2N2894	97p	ZN5459	43p
BC158	12p	BF263	25p	OC170	27p	2N2904	32p	ZN5485	52p
BC159	14p	BF272	E1.19	OC171	32p	2N2905	30p	ZN5777	48p
BC167	17p	BF292	E1.54	OC771	E1.54	2N2924	16p	ZN6008	44p
BC168B	11p	BF597	23p	OMP12	65p	2N2925	18p	ZN6069	51p
CC169	12p	BF598	25p	TPP29	53p	2N2926	10p	ZN6070	57p
BC171	20p	BFW10	65p	TPP31	67p	2N3012	65p	ZN6401	65p
BC172	10p	BFX29	41p	TPP31A	67p	2N3054	50p	ZN6073	67p
BC177	22p	BFX88	26p	TPP32A	79p	2N3055	51p	ZN6075	E1.46
BC178	22p	BFY50	22p	TPP41A	79p	2N3375	E3.56	ZN6076	16p
BC179	24p	BFY51	22p	TPP42A	97p	2N3442	E1.19	ZN6111	54p
BC182L	11p	BFY90	E1.09	TS43	36p	ZN3566	18p	ZN6288	60p
BC183L	12p	BF100	42p	TS68A	39p	2N3638	20p	ZN6140	99p
BC184	12p	BFY39	43p	TS69	32p	2N3702	13p	ZN6401	65p
BC187	27p	BSX20	18p	ZTX107	10p	2N3703	12p	ZN153	87p
BC204	14p	BSX21	22p	ZTX108	10p	2N3704	13p	40321	54p
BC209	14p	BSY95A	14p	ZTX109	15p	2N3705	12p	40430	E1.39
BC212L	12p	BU105/02	E1.95	ZTX300	12p	2N3706	14p	40673	55p

## REGULATORS

# TRANSFORMERS

## SAFETY MAINS ISOLATING TRANSFORMERS

Pr. 120/240 V Sec. 120/240 V Centre Tapped and Screened

Ref. No.	VA (Watts)	Weight lb oz	Size cm.	Auto Taps	P & P
07	20	1 8	7.0 x 6.0 x 4.0	2.55	38
149	60	3 12	9.9 x 7.7 x 8.6	3.98	45
150	100	5 8	9.9 x 8.9 x 8.6	4.45	45
151	200	8 0	12.1 x 9.3 x 10.2	7.39	53
152	250	13 12	12.1 x 11.8 x 10.2	8.93	73
153	350	15 0	14.0 x 10.8 x 11.8	10.80	73
154	500	19 8	14.0 x 13.4 x 11.8	12.41	91
155	750	29 0	17.2 x 14.0 x 14.0	18.65	91
156	1000	38 0	17.2 x 16.6 x 14.0	26.50	*
157	1500	46 0	21.6 x 13.4 x 18.1	30.23	*
158	2000	60 0	21.6 x 15.3 x 18.1	33.70	*

## AUTO TRANSFORMERS

Ref. No.	VA (Watts)	Weight lb oz	Size cm.	Auto Taps	P & P	
113	20	1 8	5.8 x 5.1 x 4.5	0-15-210-240	1.42	30
64	75	2 4	7.4 x 6.7 x 6.1	0-15-210-240	2.64	38
4	150	3 4	8.9 x 7.7 x 7.7	0-15-200-220-240	3.75	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	18 8	14.0 x 13.4 x 14.3	"	12.44	91
18	1500	24 4	14.0 x 15.9 x 14.3	"	16.65	*
95	2000	32 0	17.2 x 16.6 x 14.0	"	22.00	*
73	3000	40 0	21.6 x 13.4 x 18.1	"	31.90	*

## CASED AUTO TRANSFORMERS

115V mains lead input and U.S.A. 2-pin outlets. 20VA £2.85 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	4.8 x 2.9 x 3.5	0-12V at 0.25A x2	1.34	23
213	1.0	0.5	4.8 x 3.5 x 4.8	0-12V at 0.5A x2	1.58	30
71	2	1	6.1 x 6.4 x 6.1	0-12V at 1A x2	2.09	38
18	4	2	8.3 x 7.7 x 7.7	0-12V at 2A x2	2.60	38
70	6	3	8.9 x 8.0 x 7.0	0-12V at 3A x2	3.75	45
108	8	4	9.9 x 8.9 x 8.6	0-12V at 4A x2	4.15	45
72	10	5	9.9 x 9.6 x 8.6	0-12V at 5A x2	4.67	53
116	12	6	12.1 x 10.2 x 8.6	0-12V at 5A x2	5.02	63
17	16	8	12.1 x 9.9 x 10.2	0-12V at 8A x2	6.62	60
115	20	11	14.0 x 9.6 x 11.8	0-12V at 10A x2	9.45	73
187	30	15	15.8 x 12.1 x 11.8	0-12V at 15A x2	12.29	85
226	60	30	17.2 x 15.3 x 14.0	0-12V at 30A x2	15.30	*

### 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	1.65	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 7.7 x 7.7	"	3.18	38
20	3.0	4 8	9.9 x 8.3 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 9.2 x 10.2	"	6.52	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	"	9.97	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	2.35	30
103	1.0	2 12	8.3 x 7.4 x 7.0	"	3.08	38
104	2.0	5 8	8.9 x 8.9 x 8.6	"	4.26	45
105	3.0	6 12	9.9 x 10.2 x 8.6	"	5.28	53
106	4.0	10 0	12.1 x 10.5 x 10.2	"	6.91	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	"	11.80	85
119	10.0	25 0	17.2 x 12.7 x 14.0	"	15.45	*

### 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
126	1.0	3 4	8.9 x 7.7 x 7.7	"	3.10	38
127	2.0	6 4	9.9 x 9.6 x 8.6	"	4.62	45
125	3.0	8 12	12.1 x 9.9 x 10.2	"	6.84	60
123	4.0	13 12	12.1 x 11.8 x 10.2	"	7.96	67
40	5.0	12 00	14.0 x 10.2 x 11.8	"	8.87	73
120	6.0	15 8	14.0 x 12.1 x 11.8	"	10.27	85
121	8.0	25 00	14.0 x 14.7 x 11.8	"	13.64	*
122	10.0	25 0	17.2 x 13.7 x 14.0	"	15.93	*
189	12.0	29 00	17.2 x 14.0 x 14.0	"	18.16	*

### 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	4.6x1.5x8x4.8	0-6-0-6	1.67	30
13	100	1	4.3x2.6x2.9	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	6.1x5.4x4.8	0-8.9-0-8.9	1.75	30
308	1A 1A	1	12.7x0.6x4x6.1	0-8-0-8-9	3.00	38
339	200 200	4	4.8x2.9x3.5	0.15-0.15	1.30	19
214	300 300	1	4.6x1.5x8x4.8	0-20-0-20	1.76	30
221	700 (D.C.)	1	8.7x0.6x1x6.1	20-12-0-12-20	1.98	38
206	1A 1A	2	12.8x3.7x7.0	0.15-20-0.15-20	3.15	38
203	500 500	2	4.8x3.7x7.0	0.15-27-0.15-27	2.73	38
204	1A 1A	3	4.8x9.7x7.7	0.15-27-0.15-27	3.50	38

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

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B12—For the older VHF Television, please state BBC1 and ITV Channels.

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Pack 2—Electrolytic Capacitors—complete mix selection from 1 UF to 1000 UF, and from 10V/W to 63V/W. Price 100 £1.50, 500 £6 (our choice).

Pack 3—Transistors—any 10 80p, any 100 £7 (your choice). AC128 - AC176 - BC113 - BC115 - BC135 - BC153 - BC171 - BC172.

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| <b>SA35</b><br>35W RMS 25-50V<br>7 transistors, 7 diodes    | <b>£5-45</b><br>Carriage free  | ★ 25Hz-25kHz<br>★ 0.2% distortion<br>★ Noise-80dB<br>★ 500mV into 20K<br>★ 4-16 ohms<br>★ Simple wiring<br>★ Short and open circuit proof<br>★ Continuously rated<br>★ Top-grade components |
| <b>SA50</b><br>50W RMS 25-65V<br>7 transistors, 7 diodes    | <b>£6-90</b><br>Carriage free  |   |
| <b>SA100</b><br>100W RMS 45-70V<br>10 transistors, 7 diodes | <b>£12-50</b><br>Carriage free |   |



THE SA100 MODULE

## POWER SUPPLIES

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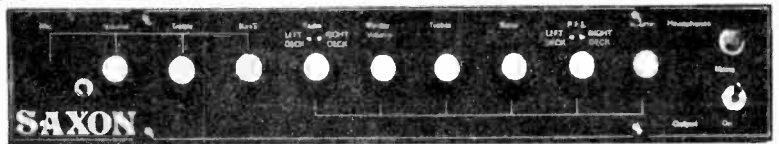
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| <b>PU45</b>       | Suits 2 SA35 or 1 SA50 (4 ohm)  | <b>£5-45</b> | Carriage 30p  |
| <b>PU70</b>       | Suits 2 SA50 (8 ohm) or 2 SA100 | <b>£8-45</b> | Carriage 40p  |
| <b>STABILISED</b> |                                 |              |               |
| <b>PS45</b>       | Suits 2 SA35 or 2 SA50 (4 ohm)  | <b>£4-45</b> | Carriage free |
| <b>MT45</b>       | Transformer for above           | <b>£3-50</b> | Carriage 30p  |
| <b>PS70</b>       | Suits 2 SA100                   | <b>£5-45</b> | Carriage free |
| <b>MT70</b>       | Transformer for above           | <b>£4-90</b> | Carriage 40p  |

N.B. PS70 is not suitable for the SA50

120 watt module complete with built-in supply—extra heavy duty **£22-50** Carr. 60p

## Mk II STEREO DISCO MIXER £22-50

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, base, treble. Left/Right fade, deck volume, bass, treble, h/phone select, vol, Mains. Size 17½in x 3in x 4in deep.



## DISCO MODULE £9-50

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.



## 3-CHANNEL SOUND-LITE £22-50

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 loudspeakers 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!

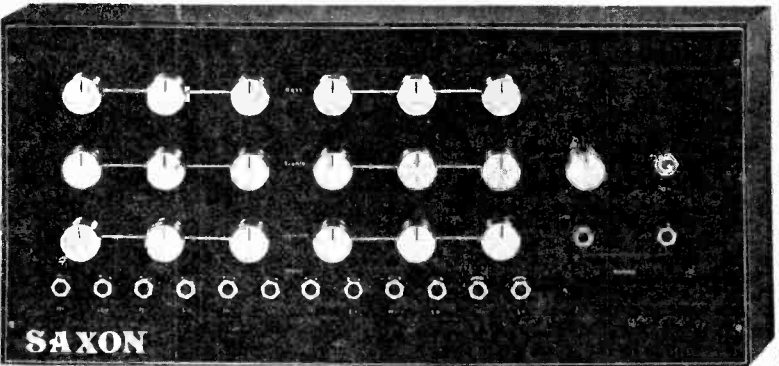


**SINGLE CHANNEL VERSION £7-50** Carr. free  
Recently reduced in price due to increasing sales, handles 1kW. Full wave operation.

ADD 8% VAT TO ALL ORDERS

## MULTI-PURPOSE MIXERS

**M4HL £19-50** Carr. 50p  
**M6HL £29-50** 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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**£39-90**  
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100W of speech and music—Two separately controlled inputs. Wide range bass and treble controls. Sturdy and attractive vinyl case. Twin outputs. Ideal for groups, discos, etc. Fully tested and guaranteed. 50W version identical in appearance.



**CSE50 £29-50** Carr. free

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100W rms four inputs slider controls plus master slider. Wide range bass and treble controls. Fantastic value, ideal for complete disco's, groups, clubs etc. SAXON MULTIMIX 50—Exactly as above but 50W rms. £45-00

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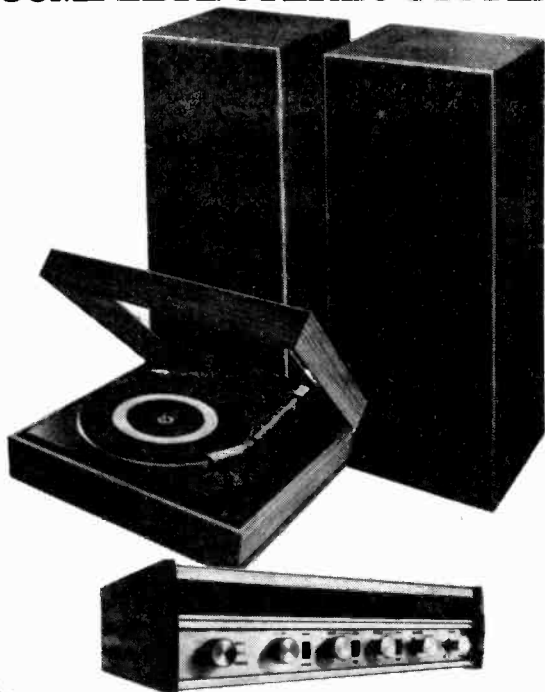
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# R T V C

# FOR AUDIO AT A BUDGET

## 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.A. *Radio* 150mV into 220K. (Sensitivities given at full power). Tape out facilities: headphone socket, power out 250mW per channel. *Tone controls and filter characteristics:* Bass: +12dB to -17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble +12dB to -12dB @ 15kHz. Treble filter: 12dB per octave. *Signal to noise ratio:* (all controls at max.) -58dB. Crosstalk better than 35dB on all inputs. Overload characteristics better than 26dB on all inputs. Size approx. 13 $\frac{1}{2}$ " x 9" x 3 $\frac{1}{2}$ ".  
**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 $\frac{1}{2}$ " x 10 $\frac{1}{2}$ " x 6" in simulated teak. Drive unit 13" x 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 III matched speakers** - Enclosure size approx. 127" x 13" x 11 $\frac{1}{2}$ "  
 Finished in teak veneer. Drive units 13" x 8" bass driver, and two 3" (approx.) tweeters. 20 watts R.M.S., 8 ohms frequency range - 20 Hz to 18,000 Hz.

**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 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



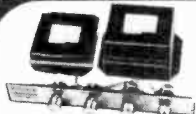
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**Complete only £19.55 + £1.60 p & p.** Extras if required. Optional Diamond Styli **£1.37**.  
 Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance. **£3.85**.



## **BUILD YOUR OWN\*** STEREO AMPLIFIER

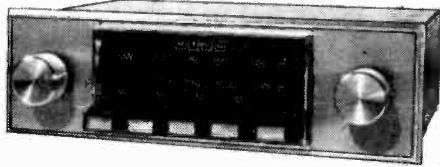
For the man who wants to design his own stereo - here's your chance to start, with Unisound - pre-amp, power amplifier and control panel. No soldering - just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic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

## **8 TRACK HOME 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 **£11.95 + 90p p & p.**

# PUSH BUTTON CAR RADIO KIT \* The Tourist II



**NO SOLDERING REQUIRED!**

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

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 3/4" deep approx **£7.70** +55p p & p

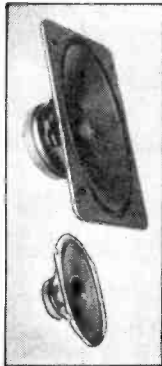
**Speaker** including baffle and fixing strip **£1.65+23p. p & p.**

**Car Aerial** Recommended — fully retractable **£1.37+20p. p & p**

**The Tourist I Kit** For the experienced constructor if you can solder on a printed circuit board you can build this model.

Same technical specification as Tourist II **Price £6.60 + 55p p & p.**

## EMI SPEAKERS AT FANTASTIC REDUCTIONS



### 20 WATT SPEAKER SYSTEM \*

System consists of a 13" x 8" (approx) elliptical woofer unit with a 8" x 5" (approx.) mid range unit incorporating parasitic tweeter and crossover components. Circuit Diagram

#### Technical Specification:

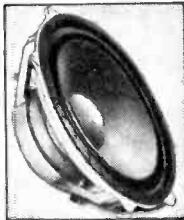
##### Bass Unit

Flux density—100 K, speech coil—1 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.



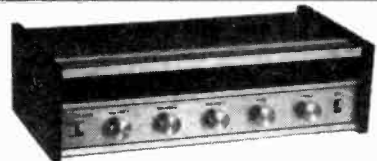
### 15" 14A/780 BASS UNIT

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



## 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.

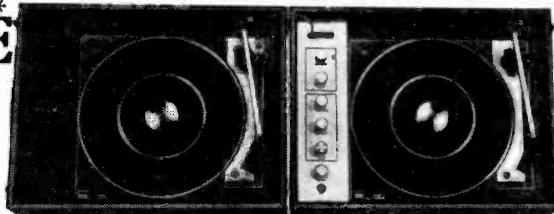
\*Mixer employing F.E.T. (Field Effect Transistors) \*Solid State circuitry.

\*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 1/2" x 6" x 3 1/2". **£15.00 + 60p. p & p**

## 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 kaloe 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 1/2" x 13 1/2" x 8 1/2" (approx.)

Unit Open — 35 1/2" x 13 1/2" x 4 1/2" (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.**



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Mail orders to Acton. Terms C.W.O. All enquiries stamped addressed envelope. Goods not despatched outside U.K. Leaflets available for all items listed thus \* Send stamped addressed envelope. All items subject to availability. Prices correct at 1st Jan. 1975 and subject to change without notice. All prices include V.A.T. at 8% rate.

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323 Edgware Road, London W2

**SPOT FREQ OSC UNITS** suitable for testing A.F. Amps etc., these give a low distortion Sine Wave O/P of 1 volt RMS into 1K, with Thermistor stabiliser, reqs supply of 9 to 12v DC, contained in Ali case  $4\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2}$ " fitted standard coax sk plug supplied, available in the following freqs 100, 500c/s, 1, 2, 5, 10, 20, 50 & 100Kc. Price £4 other freqs in this range 25p extra. See Feb. P.W. for Sq Wave Osc units.

**INDICATOR UNIT 266** contains 6" VCR97 tube, 18 valves, slow motion dial, tuning conds etc in case 11 x 9 x 18" with cover £7-50.

**BLOWER MOTORS.** Small double ended blower for use on 6 to 28v DC new boxed £2-55.

**AERIAL LOOP CONTROLLER** were used for R1155 loops consists of handwheel & 360' Indicator new £2.

**ELECTRONIC MULTIMETERS** AV0 type CT38 bench unit for 200/250v 50c/s covers AC/DC volts, AC/DC Amps, Res, Watts, with copy of H/B tested £24.

**DUAL GANG POTS** 10K ohm ea section  $2\frac{1}{2}$ " dia okay for AF osc with knob & dial £1-35.

**CODER UNIT** with 10 min valves, 13 min relays 12v, 12 min micro swts in case with cover £3-75.

**REED RELAYS** coils 12 v DC as 2 N.C. & 3 N.O. reeds 55p.

**TEST SET 502** contains meter 2-5 Ma FSD, 3x Yax swts, close tol res etc in neat case 8 x 12 x 4" okay for portable meter £2-32.

**POWER UNITS** mains operated & stabilised made to operate BC221 freq meter. Fits in battery compartment. Tested with circ. £7-16.

**CRYSTAL FILTER UNITS** 100Kc SSB Rx filter contain 4 xtals, coils, trimmers etc with connectors £2-30.

**SANTON TYPE SWT** 2p 4w rated 250v/10a new 75p.

**LARGE INST TYPE SWTS** 8p 12w 8b & 2p 23w 2b both £1-30. ea. 7p 23w 7b £1-60 all new.

**COAX CABLE** 75 ohm 15 mts for £1-20 also low loss type 10 mts for £1-90.

**MAINS CABLE** 3 core 3 amp 10 mts for 86p.

**METER UNIT** X pointer type dual 110 Ua for use with R1155 £1-79.

**INDICATOR UNIT.** 6" display, module construction with min & sub valves, int RF type EHT unit 3 counter dial linked to CRT cursors, thought to be Sonar Ind first MOD release £12-50 new, £10-50 S/H.

**SCOPES.** American service general purpose bench scopes 115v 50c/s I/P, single beam, 3" tube, Y amp 2c/s to 11 Mc/s at 50 Mill/V per inch, Time & Voltage Calibrators, with probes & Accs tested with copy of Inst Book. £40.

**SILICON DIODES** 200 PIV 8 amps 4 for 75p also 800 PIV 750 Ma new 15 for £1-10.

**VALVES.** Ex equip 5U4, 6X5, 6SN7, 12AT7, 12AU7, 12AX7, 6BH6, EL85, 6H6, 6Y6, 6SK7, 6N7, 6J6, 6AK6, 6X4, CV173, EF50, OB2, 12SJ7, 12J5, 12A6, 6BE6, 5R4, 6CH6, CV286 95v stab, CV284 75v stab, 85A2, any 3 for 65p.

**METER** 1 Ma FSD scale knots  $2\frac{1}{2}$ " dia £1.

**CRYSTAL OVEN** with 12 type Hc6/u holders can be removed oven 24v 76p.

**MIKES** American type T17 carbon with swt new £1-35.

**DYNAMOTOR UNITS** American 12v DC I/P O/P 440v at 200 Ma £2-65.

**TAG STRIPS** solder type 24 way new 10 for 40p.

**LAMPS** double filament type with silvered reflector 28v 14w new 5 for 65p.

**SPEAKERS** p.m. type 4 x 4" coil 3 ohm with trans to match o/p pentode 80p.

**I.F. TRANS** double wound 100Kc 2 for 60p.

**NUTS & BOLTS** etc in 2, 4, 6 & 8 Ba assorted 250 items new £1.

**FLAME STATS** operate about 90' C new £1.

**INVERTOR UNITS** rotary type I/P 28v DC, O/P 115v 400c/s 6-5 amps 1 phase, with V.R. & circ. American Surplus. £18.

**VEEDER COUNTERS** 4 digit with reset coil 230v DC new £2.

**Copies of Manuals & circs available** List on request

Above prices inc carr & VAT. SAE for list or enquiry.

Goods are ex equipment unless stated otherwise.

**A. H. SUPPLIES** 57 MAIN RD, SHEFFIELD S9 5HL 444278 (0742)

# ELECTROVALUE

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Completely replaces the conventional cone speaker  
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Power capability: 40 watts peak. Frequency range: 40 Hz-20 KHz  
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£8-00 each Stereo pair £15-50

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Which enables the use of a standard TV as a monitor for CCTV and Video games (TV Tennis). Operates from 8V-12 VDC. Tuneable over VHF Channels 27-40. Input—Standard 1V poss Video. Output—7.5mV into 75ohm at 600 MHZ. Dimensions  $2\frac{1}{2}$ " x 2" x  $\frac{1}{2}$ "—6' Coax.

Price—Fully Assembled and Tested £6-50 inc. VAT and postage.

Please send cheque or P.O. with order to:

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### SINCLAIR CALCULATORS

Sinclair Scientific £22.45 (£2.05)  
Cambridge Assembled £15.95 (£1.55)  
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### FERRANTI ZN414

IC radio chip with data £1.20 (22p). Also available kit of extra parts to complete a radio £2.55 (43p). Send sae for free leaflet.

### SINCLAIR PROJECT 80

AFU £6.38 (73p)  
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Project 80S SQ £33.95 (£3.10).  
Project 80 SQ Quad Decoder £15.95 (£1.18)



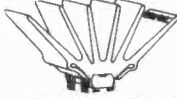
### ECONOMICAL QUADROPHONICS

Introducing the Napalex QA10 self contained matrix quadrophonic synthesizer. Just feed the output of any stereo system (Including Project 80 or 60) into it and hook on 4 speakers to obtain the latest experience in sound. Send sae for free leaflet. Only £10.15 (£1.10).



### SINCLAIR SUPER IC12

6 watt IC power amp and preamp. With 44 page booklet and printed circuit £1.80 (40p).



### NEW SINCLAIR IC20

High power IC audio amplifier £6.95 (82p).

### DELUXE KIT FOR THE IC12

Includes all parts for the printed circuit and volume, bass and treble controls needed to complete the mono version £4.80 (28p). Stereo model with balance control £3.90 (46p).

### IC12 POWER KIT

Supplies 28V 0.5 Amps £3.07 (52p).

### LOUDSPEAKERS FOR THE IC12

Mono model £1.50 (27p). Stereo model £1.75 (47p).  
5" x 8 ohm £1.40 (39p). 5" x 8" 8 ohm £1.75 (47p).

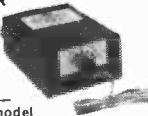
### PREAMP KITS FOR THE IC12

Type 1 for magnetic pickups, mics and tuners Mono model £1.50 (27p). Stereo model £2.70 (35p). Type 2 for ceramic or crystal pickups. Mono 80p (20p). Stereo £1.60 (27p).

SEND SAE FOR FREE LEAFLET ON KITS

### BATTERY ELIMINATOR BARGAINS

The most versatile battery eliminator ever offered. Switched output of 3, 4, 6, 7, 9 and 12V at 500 mA £3.90 (70p).  
Other eliminators stocked:—  
250mA:—3 way switched model giving 6, 7½ and 9V £2.50 (50p).



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4½V £2.40 (40p). 6V £2.40 (40p). 9V £2.40 (40p). 7½V cassette type £2.80 (50p). Double 4½V + 4½V £2.95 (50p). 6V + 6V £2.95 (50p). 9V + 9V £2.95 (50p).  
500mA:— Heavy duty deluxe models 6V £2.78 (55p). 7½V £2.78 (55p). 9V £2.78 (55p).

### S-DECS AND T-DECS

S-DeC £1.98 (31p)  
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IC carriers:—  
16 dil: plain 81p (15p) with socket £1.77 (25p).  
10 TO5: plain 78p (15p). With socket £1.88 (24p).  
Experiment guides:—A £1.59 (30p), E £1.77 (39p), C 90p (28p), D £2.40 (45p), E £4.20 (63p).



## SWANLEY ELECTRONICS

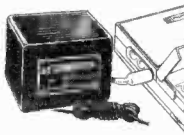
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Please add the sum shown in brackets after the price to cover the cost of post and new VAT. Official credit orders from schools etc. welcome. No VAT charged on overseas orders.

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RUN YOUR TRANSISTOR RADIO OR CASSETTE RECORDER FROM YOUR CAR BATTERY (Similar to illustration)

This unit enables you to run your cassette tape recorder from the car whilst travelling. It is easily fitted and comes complete with fitting instructions. Please state make of cassette, voltage and type of plug required.



ONLY £2.86

RUN YOUR TAPE RECORDER OFF AC MAINS

Mains unit supplied complete and ready to plug into your cassette recorder. (State voltage, make and type of plug required, if in doubt send diagram of recorder socket.)



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RUN YOUR TRANSISTOR RADIO OFF AC MAINS

For single outputs, 6v, 9v £2.86

For two separate outputs, 6v + 6v, 9v + 9v £3.52 per unit. (Please state outputs required.)

All units are completely isolated from mains by double wound transformer ensuring 100% safety. All British Made. All Prices inc. V.A.T. and P. & P. R.C.S. PRODUCTS (RADIO) LTD. (Dept. P.W.M.)

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Full refund if not completely satisfied.

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Complete kits are available for both "Mullard" and "P.E." design. Each kit includes a comprehensive construction manual, and a completely FREE technical back up service to ensure your success. VHF and UHF Modulator kits also available to allow standard domestic T.V. to be used as monitor.

All parts available separately, including a wide range of lenses, vidicon tubes and focus/scan coil assemblies. Ready built cameras also available. Complete kits available for P.W. tele-tennis game. Send 5" x 7" S.A.E. for full details, or come along for a demonstration and a chat with our technical staff.

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Wire Wound Resistors. Our selection of mixed values. 30 for £1.50. 100 for £4.00.

Audio Amplifier Module. Mullard LP1173, output power, nominal 10 watt, supply voltage +24 volt, with data and circuit, £2.50.

Ferguson Stereogram chassis Model 3357, all transistor, medium long, VHF/FM, 3 watts per channel S/M, with connection data, less tuning scale, £20. Post paid.

Crystals HC6U: £2 03333 MHz: 52-02500 52-01667: 51-56667: 51-58330: 37-76250 37-75000: 12-895 8: 12-891 6: 12-700-0 9-458-33: 9-456-25: 9-455-55: 9-533-33: 9-531-94: 9-530 55: 9-090-62: 9-087-5 50p each.

Electrolytics. 32/32/32µF, 325v. 2" x 1½" 35p; 80µF 150vt 1" x 1" 20p; 2000µF 30v 2½" x 1" 25p; 2000µF 35v 3" x 1" 30p; 470µF 100v 3" x 1½" 25p; 2000µF 25v 2" x 1½" 35p; 30000µF 25v 4½" x 2½" 50p; 700µF 200v 3½" x 1½" 30p; 16/16µF 275v 1½" x 1" 20p; 40 40; 20µF 275v 3" x 1" 20p; 4500 300/900µF 30v 2½" x 1½" 50p; 4000µF 35v 3" x 1½" 40p; 4000µF 35vt 3" x 1½" 35p; 2500µF 40vt 2½" x 1½" 40p; 4300µF 18v 2" x 1" 20p; 470µF 25v 1½" x 1" 15p.

Matched pair of bookshelf speakers. Teak fin sh, size 12" x 3" x 5". 8x5 8" ohms ceramic, 5 watts RMS. Complete with din leads. £1.00 pair.

Thorn TV IF chassis, 950 series (less valves), £1.75.

UHF 625 transistor push button tuner (NSF Telefunken) as used on Decca MS2400. Brand new and boxed, £3.25. Light Dependent Resistors (RCA sq3536) 30p each 4 for £1.00.

P-C Boards (not computer panels) 1 off 6 transistor single wave band. 1 off 4 transistor audio 1 off 3 transistor £1.60, three boards.

Rank EVR Teleplayer colour transistor panels, type and components on new panels listed as follows, £2.50, each panel. Z605—14 off BC148: 2 RCA ca3064 (ic): 1 crystal 4-433618 MHz—Z607—12 off BC148: 1 BC108: 1 BC158: 1 RCA ca3046 (ic), 1 RCA ca3045 (ic): Z608—23 off BC148: 2 BC158—Z612—12 off ME4103: 2 BC-251B: 1 BFY50.

Mains Droppers, 10 mixed values, £1.00.

Edgewise level meters, 200µA, size 2" overall, 50p.

Chrome Plastic knobs, 3 types, 4 off each with spring clip, £1.25.

Aluminium Chassis, 7½" x 5½" x 2½" 70p; 10" x 7½" x 2" 85p; 11" x 7½" x 2½" 95p.

BSR P128, similar to HT70 single play, with heavy die cast turntable, less cartridge, £11.00.

Transistorised FM tuner head, with A.M. gang slow motion drive 88-108 Mics, with circuit diagram, £2.30.

Ferguson Stereogram Chassis. MW/LW/VHF with tuning scale (5+5 watts sine wave) 15 ohms £28.50. Post paid 15 ASSORTED SWITCHES £2.00.

50-3 way to 7 way TAG STRIPS, £1.25. ALMA RIEDEL RELAY TYPE DRH. 3 VOLTS, 55p.

REPAO & DENCQ COILS. NEW/BOXED OUR SELECTION—5 FOR £1.25

Goods not despatched outside UK 15p Handling charge on orders under £1.00. Please add 10% for post and packing on all items except gram chassis. All items include VAT.

## SURPLECTRONICS

216 LEAGRAVE ROAD,  
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## "SLO-SYN" 3-LEAD SYNCHRONOUS STEPPING MOTOR



Type SS15. These fine motors are easily reversed, starting and stopping in less than 50 without electrical or mechanical braking. Simple relay circuit can be applied to give DC., to winding for a maximum holding torque of 3000z/in with 35v at 0.35 amps through winding. For AC. (synchronous) operation at 120r., 50Hz. Speed 60 rpm at 60Hz., 72 rpm. STEPPING. Holding torque at 50 steps per second—100 oz/in. Can be wired to give 100 or 200 steps per revolution with accuracy of 0.1° per step non-cumulative. Torque characteristics can be modified by simple R.C. circuits. Dimensions: dia. 4", body length 4 1/2", spindle length 2 1/2" x 3/8" dia. Weight 6 1/2 lbs. BRAND NEW in maker's packing. Offered at less than 1/2 maker's price. **OUR PRICE ONLY £15 P & P £1-00**

### UNISELECTORS

12 Bank 25 way double sweep 48v. D.C. ex-computer in 1st class condition. £8 plus 50p. P & P.

### SHADED POLE MAINS MOTOR

A quality shaded pole motor. Open frame, 3" high x 2 1/2" x 2". Spindle 1" x 3/8". 1,420 r.p.m. £1.95 P & P 20p

### CARTER ELECTRIC

Similar to above with alloy gear case, 60 r.p.m. This item is ex-equipment but perfect. £1.95. P & P 30p.

### "LABGEAR ELIMINAC"

P.S.U. 200-250v. 40/60Hz. Alternative outputs fully variable (variac incorporated). Output 1. 12v at 5a D.C. fully smoothed. Output 2. 12v at 8a D.C., with ripple content. Output 3. 20v at 10a A.C. 2 1/2" x 2 1/2" flush 0-20v D.C. m.c. meter. In attractive grey hammer finish case. In maker's carton £27.50. Carr. & Pkg. £1.50.

### SPECIAL OFFER

## LIGHT DEPENDENT RESISTORS

Matched pairs Pioneer Type 174 similar to OPR 12. Resistance 1K to 40K Dia 1/2" with 1/2" flange. £1.50 for two pairs (minimum) 10 or more pairs, 50p. per pair Incl. P & P.

### MAINS SOLENOID

This little unit gives vertical lift of approximately 1" through hinged "elbow". Bracket incorporates 2 fixing screws. Length of arm, 2 1/2". 240V AC. Pull at coil is approximately 1lb. £1. FREE P. & P. Special quotes for quantities.

### SOLENOIDS by WESTOOL

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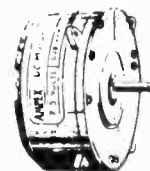
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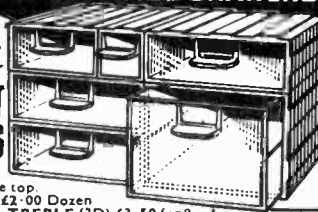
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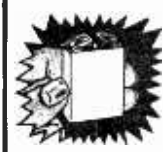
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Allard Electronics	1054
Ambit International	1025
Arrow Electronics	1051
A.S.P. Ltd.	973
B. B. Supplies	1057
Barrie Electronics	1046
Baykin Engineering Ltd.	1056
Bentley Acoustics	970
Beta Devices	1054
B. H. Component Factors Ltd.	996
Bi-Pak Semiconductors	974-975
Bi-Pre-Pak Ltd.	971
Bib Hi-Fi Accessories Ltd.	972
Boffin Projects	1056
Bothwell	984
British Institute of Engineering Technology	1029, 1038 cover iii
British National Radio & Electronics School	968, 982, 995
J. Bull (Electrical) Ltd.	1037
Bush & Meissner	976
C. Caranna	1055
Chillmead Ltd.	982
Chromasonic Electronics	1044-1045
C. J. L. Ltd.	970
Codar	972
Colomor (Electronics) Ltd.	1000
Crescent Radio Ltd.	1033
Crofton Electronics	1052
Dabar Electronic Products	1026
D.E.W. Ltd.	1056
Doram Electronics Ltd.	1003
Electronics Brokers	1057
Electronic Design Associates	1034-1057
Electronic Mail Order Ltd.	1046
Electron-kit	996
Electrospares	978
Electro-Tech	1053
Electrovalue Ltd.	1050

Felstead Electronics	996
Flairline	1053
Foresight Electronics	1057
Foulsham Tab	1053
F. W. Electronics	1056
Galleon Trading	1054
Garfields	1056
Greenweld Electronics	1026
H.A.C. (Shortwave) Products	1004
Harversons Surplus Co. Ltd.	977
Heath (Gloucester) Ltd.	1029
Henry's Radio Ltd.	cover iv
Home Radio	999
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Imperial Trading	1055
Interface International	973
Intertext (I.C.S.)	978, 1055
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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

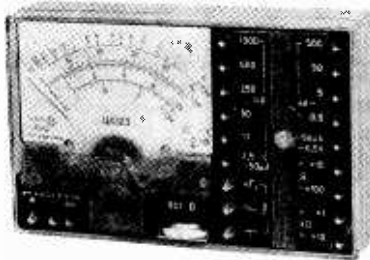
Movement is protected by silicon diodes.

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

PRICE: complete with test leads, instruction manual and fibre-board storage case £9.85. Packing & carr. £0.50.

## MULTIMETER TYPE U4323

Sensitivity: 20,000Ω/V.



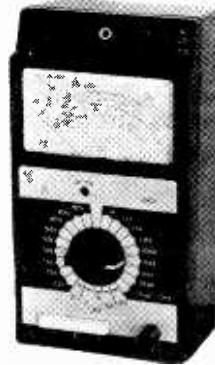
7 D.C. Voltage ranges 0.5-1000V  
6 A.C. Voltage ranges 2.5-1000V  
5 D.C. Current ranges 0.05-500mA  
4 Resistance ranges 1kΩ-1mΩ

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 £8.00. 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 £13.80. Packing & carriage £0.50.

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7402	£0.15	£0.125	£0.10	7445	£0.855	£0.712	£0.57	7496	£0.72	£0.60	£0.48
7403	£0.15	£0.125	£0.10	7446	£1.05	£0.875	£0.70	74104	£0.315	£0.262	£0.21
7404	£0.18	£0.15	£0.12	7446A	£1.05	£0.875	£0.70	74105	£0.315	£0.262	£0.21
7405	£0.18	£0.15	£0.12	7447	£1.05	£0.875	£0.70	74107	£0.315	£0.262	£0.21
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7408	£0.15	£0.125	£0.10	7450	£0.15	£0.125	£0.10	74123	£0.83	£0.525	£0.42
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7437	£0.27	£0.225	£0.18	7486	£0.315	£0.262	£0.21	74193	£1.275	£1.062	£0.85
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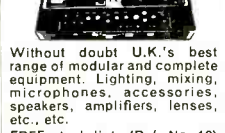
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Marriot XRPS/18 1/2 Track Med.	3.50
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Marriot Erase Heads for XRSP 17/18 (XES11)	75p
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R/R/P1 Rec'd/Play 1 Track HRP S'gle Trk Rec/Play 35p	
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Miniature Stereo Cassette Rec/Play	2.25

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 Semiconductor—Any one type or mixed SN74 Series 'IC', 12—extra 10%; 25—extra 15%; 100—extra 20%.  
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SN7400N 0.16	SN7485N 1.63	SN74191N 2.00
SN7401N 0.16	SN7486N 0.47	SN74192N 2.00
SN7402N 0.16	SN7489N 3.87	SN74193N 2.00
SN7403N 0.16	SN7490N 0.55	SN74194N 1.30
SN7404N 0.22	SN7491N 1.38	SN7495N 1.10
SN7405N 0.26	SN7492N 0.70	SN7496N 1.20
SN7406N 0.42	SN7493N 0.70	SN7497N 1.20
SN7407N 0.42	SN7494N 0.80	SN7498N 2.77
SN7408N 0.28	SN7495N 0.80	SN7499N 2.52
SN7409N 0.28	SN7496N 0.95	RCA
SN7410N 0.16	SN7497N 3.87	CA3012 1.32
SN7411N 0.25	SN74100N 1.89	CA3014 1.80
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SN7413N 0.36	SN74105N 0.53	CA3019 1.02
SN7414N 0.72	SN74107N 0.45	CA3020 1.80
SN7416N 0.36	SN74110N 0.58	CA3022 1.93
SN7417N 0.36	SN74111N 0.86	CA3028A 1.03
SN7420N 0.16	SN74112N 0.86	CA3036 1.08
SN7421N 0.33	SN74118N 0.90	CA3046 0.70
SN7422N 0.25	SN74119N 1.68	CA3048 2.11
SN7423N 0.37	SN74120N 0.95	CA3075 1.75
SN7425N 0.37	SN74121N 0.50	CA3081 1.80
SN7426N 0.32	SN74122N 0.70	CA3089E 2.94
SN7427N 0.25	SN74123N 1.00	CA3090 4.23
SN7428N 0.40	SN74125N 0.65	Signetics
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SN7440N 0.22	SN74153N 0.95	Motorola
SN7441A 0.92	SN74154N 2.00	MC1301L 1.42
SN7442N 0.79	SN74155N 1.00	MC1304P 1.79
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SN7470N 0.36	SN74173N 1.66	702C 0.75
SN7472N 0.38	SN74174N 1.57	709C 0.39
SN7473N 0.41	SN74175N 1.10	723C 0.90
SN7474N 0.45	SN74176N 1.42	725C 0.45
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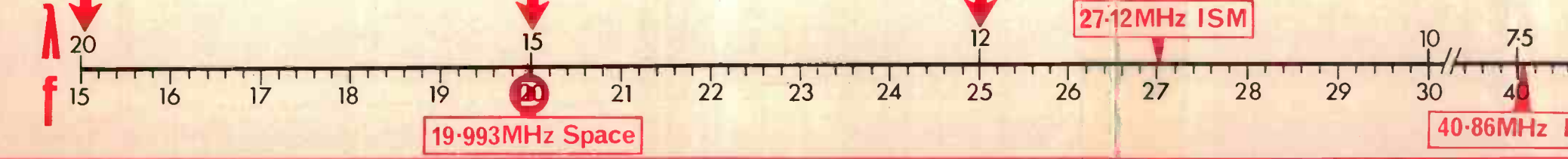
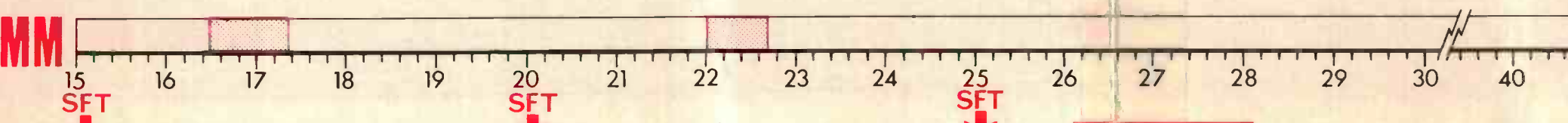
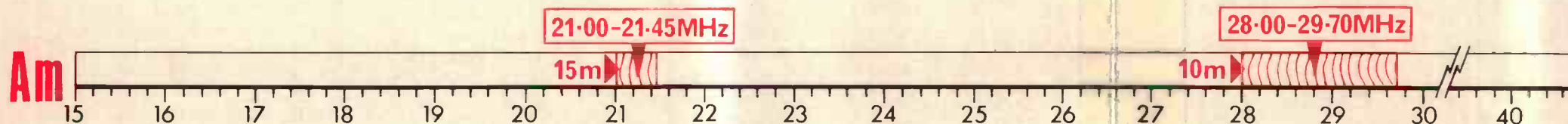
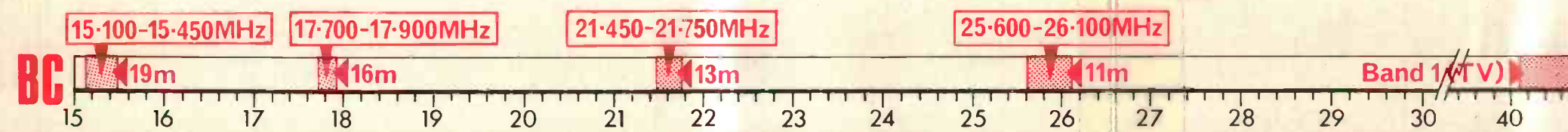
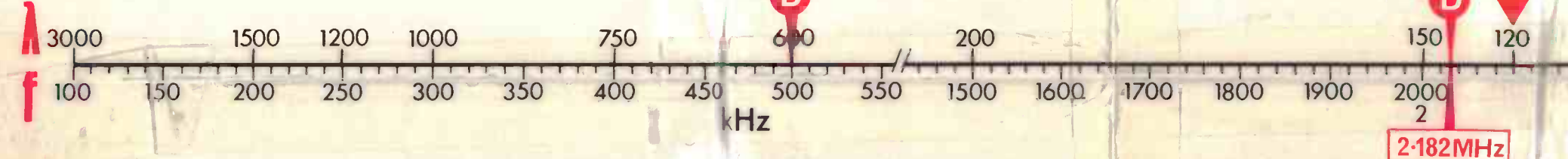
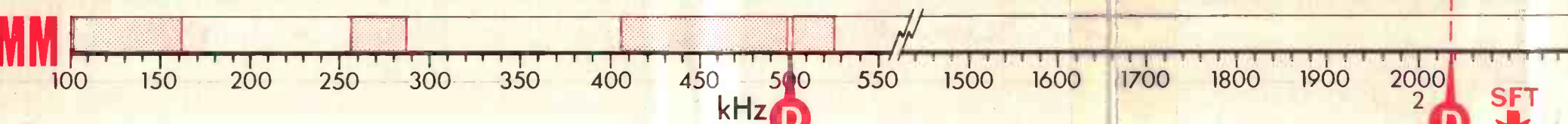
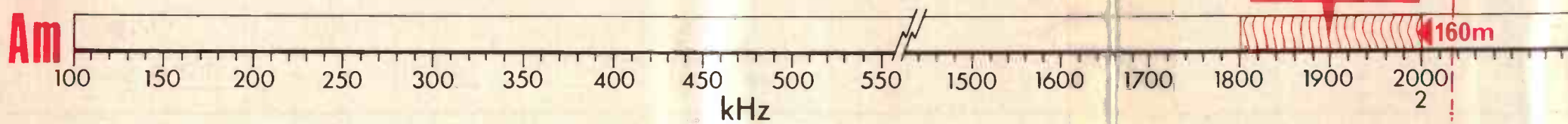
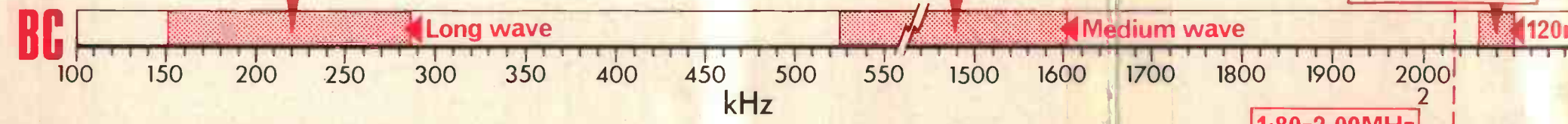
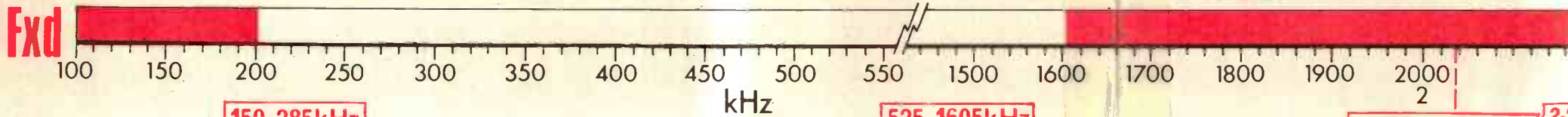
AAZ13 0.12	BLY36 6.00	TIP42A 0.90
AC107 0.51	BSX20 0.13	TIS43 0.26
AC128 0.15	BU105 2.20	VA05A 4.02
AC187 0.21	BY100 0.27	ZTX108 0.18
AC197 0.40	BY127 0.12	ZTX300 0.13
ACY29 0.78	BYZ13 0.78	ZTX302 0.45
AD149 0.50	CO160 0.54	ZTX500 0.13
AD161 0.44	GET111 0.12	2N697 0.16
AD162 0.44	GET115 0.60	2N705 0.12
AF117 0.24	GET880 0.90	2N930 0.18
AF118 0.57	LM309K 2.00	2N987 0.42
AF149 0.25	MA121 0.25	2N102 0.25
AF186 0.48	MJE340 0.47	2N1304 0.28
AF239 0.44	MJE520 0.63	2N1613 0.21
ASY27 0.33	MJE3055 0.77	2N1771 0.20
BA115 0.10	MJE2955 1.27	2N1214 0.78
BAX13 0.05	MPF105 0.66	2N1216 0.78
BCY07 0.14	MPF107 0.66	2N2925 0.42
BC108 0.13	OA5 0.12	2N3053 0.18
BC109 0.14	OA81 0.78	2N3054 0.18
BC109C 0.16	OA200 0.08	2N3055 0.45
BC113 0.15	OA202 0.06	2N3440 0.58
BC147 0.10	OC28 0.66	2N3442 1.30
BC148 0.08	OC35 0.66	2N3525 0.81
BC149 0.10	OC36 0.60	2N3614 0.65
BC169C 0.15	OC44 0.20	2N3702 0.11
BC182 0.12	OC45 0.20	2N3714 1.41
BCY32 0.85	OC71 0.18	2N3771 1.77
BCY39 1.50	OC72 0.28	2N3773 0.40
BCY55 0.40	OC73 0.54	2N3792 2.10
BCY70 0.18	OC81 0.29	2N3819 0.38
BCY71 0.22	OC83 0.27	2N3886 0.72
BCY72 0.12	OC140 1.14	2N3903 0.15
BD124 0.65	OC170 0.30	2N4002 0.15
BD131 0.42	OC200 0.54	2N4126 0.45
BF185 0.90	OC202 0.90	2N4871 0.34
BF190 0.36	OCPT7 1.20	2N5457 0.30

# **FREQUENCY ALLOCATION CHART**

This frequency allocation chart is based on information taken from International Telecommunication Union documents for one or more of the three ITU Regions. There are many subdivisions within the allocations shown resulting in many frequencies being shared by various services or allotted on a secondary basis. The amateur service allocations shown here are those for the UK. Only Aeronautical Mobile allocations above 118MHz have been shown on this chart.



# FREQ ALLO CHA



# FREQUENCY LOCATION CHART

PRESENTED  
FREE WITH  
PRACTICAL  
WIRELESS  
MARCH 1975

Fxd	Fixed Services	AM	Aeronautical Mobile Service
BC	Broadcasting Services	D	Distress Frequencies
Am	Amateur Service	SFT	Standard Frequency Transmissions
MM	Maritime Mobile Service	ISM	Industrial, Scientific and Medical

