

PRACTICAL WIRELESS

FEBRUARY
1975
25p

PW
'ASCOT'

STEREO CASSETTE DECK

FOR
Hi-fi Systems

PART 1



ALSO:-

**HOME TELEPHONE EXCHANGE
RADIO CONTROL SERIES PART 2-TRANSMITTER**

NEW EDU-KIT MAJOR

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

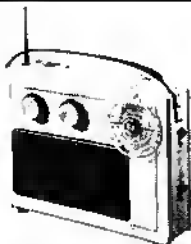
- ★ 4 Transistor Earpiece Radio.
- ★ 6 Transistor Push Pull Amplifier.
- ★ Batteriless Crystal Radio.
- ★ Signal Tracer.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ One Transistor Radio.
- ★ Signal Injector.
- ★ 6 Transistor Short Wave Radio.
- ★ 2 Transistor Regenerative Radio.
- ★ Transistor Tester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

Total Building Costs
£7-23 P & Ins. 44p
(Overseas P & £1-85)
(+ 8% VAT 67p)

Components Include: 24 Resistors • 21 Capacitors • 10 Transistors • 31" Loudspeaker • Earpiece • Mica Baseboard • 3 12-way connectors • 2 Volume controls • 2 Slider Switches • 1 Tuning Condenser • 3 Knobs • Ready Wound MW/LW/SW Coils • Ferrite Rod • 6 1/2 yards of wire • 1 Yard of sleeving etc. • Parts Price List and Plans 50p. (Free with parts).

NEW ROAMER NINE

WITH V.H.F. INCLUDING AIRCRAFT

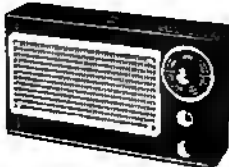


Nine Transistors, 9 Tunable wavebands as Roamer Ten. Built in ferrite rod aerial for MW/LW. Retractable chrome-plated telescopic aerial for VHF and SW. Push Pull output using 600mW transistors. 9 Transistors and 3 diodes, tuning condenser with V.H.F. section, separate coil for aircraft, moving coil loudspeaker, volume ON/OFF and wavechange controls. Attractive all white case with red grille and carrying strap. Size 9 1/2" x 7" x 2 1/2" approx. Parts Price List and Plans 40p (Free with parts).

Total Building Costs **£6-95** P & Ins. 44p
(Overseas P & £1-85)
(+ 8% VAT 56p)

NEW Everyday Series

Build this exciting New series of designs



E.V.S. 6 Transistors and 2 diodes. MW/LW. Powered by 4 1/2 volt Battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" x 5 1/2" x 2 1/2" approx. Parts Price List and Plans 30p. Free with parts.

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

E.V.S. 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 30p. Free with parts.

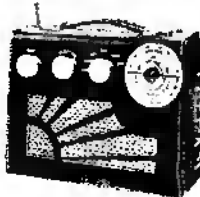
Total Building Costs **£3-60** P & Ins. 30p
(+ 8% VAT 29p)
(Overseas P & £1-25)

E.V.7. Case and looks as above. 7 Transistors and 3 diodes. Six wavebands. MW/LW, Trawler Band, SW1, SW2, SW3. Powered by 9 volt battery. Push Pull output. Telescopic aerial for short waves. 3" Loudspeaker. Parts Price List and Easy Build Plans 30p. Free with parts. Overseas P & £1-05.

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

ROAMER TEN

WITH VHF INCLUDING AIRCRAFT



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

On some cases the grill pattern will be horizontal bars and not as illustrated

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 **£8-50** P & Ins. 52p
(Overseas P & £1-86)
(+ 8% VAT 66p)

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 2 1/2" approx. Plans and Parts Price List 20p (Free with parts).

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



TRANSONA FIVE NOW WITH 3" LOUDSPEAKER

Wavebands, transistors and speaker as Pocket Five. Larger Case with Red Speaker Grille and Tuning Dial. Plans and Parts Price List 20p (Free with parts).

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

(Overseas P & £1-25)

ROAMER EIGHT Mk I

NOW WITH VARIABLE TONE CONTROL



7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Chrome plated Telescopic aerial can be angled and rotated for peak short wave listening. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Latest 3" 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 60p (FREE with parts).

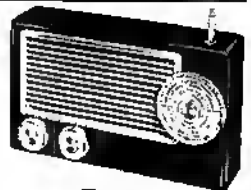
Total building costs **£6-98** P & Ins. 47p
(Overseas P & £1-85)
(+ 8% VAT 56p)

TRANS EIGHT

8 TRANSISTORS and 3 DIODES

8 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. 8in. 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 6 1/2 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 35p (FREE with parts).

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



ROAMER SIX

CASE AND LOOKS AS TRANS-EIGHT

Trawler band plus an extra Medium waveband for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 8in. Speaker. 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 6 1/2 x 2 1/2 in. approx. Plans and parts price list 35p (FREE with parts).

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

"EDU-KIT"



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

Five units including master unit to construct.

Components include:

Tuning Condenser; 2 Volume Controls; 2 Slider Switches; Fine Tone 3" Moving Coil Speaker; Terminal Strip; Ferrite Rod Aerial; Battery Clips; 4 Tag Boards; 10 Transistors; 4 Diodes; Resistors; Capacitors; Three 4" 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 40p (FREE with parts).

Total building costs **£5-50** P & Ins. 33p
(Overseas P & £1-86)
(+ 8% VAT 44p)

RADIO EXCHANGE LTD

★ Callers side entrance "Lavelle's" shop.
★ Open 10-1, 2.30-4.30, Mon.-Fri. 9-12 Sat.

To RADIO EXCHANGE CO., 61a HIGH STREET, BEDFORD, MK40 1SA
 Tel.: 0234 52367. Reg. No. 788972.
 I enclose £..... for
 Name
 Address
 (Dept. PW2.)

PRACTICAL WIRELESS

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FEBRUARY 1975

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

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BACK NUMBERS

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

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

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HUGE DISCOUNTS

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

Model	List Price	RSC Price
WHARFEDALE DENTON	£45-49 Pr.	£29-95
WHARFEDALE LINTON	£56-33 Pr.	£38-95
LINEAR 202 AMPLIFIER	£39-23	£24-95
ROTEL RT222 AM/FM Tuner	£56-45	£38-95
ROTEL RT322	£73-16	£53-50
ROTEL RX150A Tuner/Amp	£77-09	£54-95
LEAK 2000 Tuner/Amp	£178-16	£149-50
Wharfedale Denton Tun/Amp	£93-28	£59-95
RANK 150a Stereo System	£137-35	£84-95

Also Shure Cartridges, Basf Tape, Koss H/Phones, etc.
 Prices of above correct at Nov 14 1974

AKAI TAPE UNITS All £1-30 carr.

Model	Rec. Price	£62-95	GXC 510D	Rec. Price	£189-90	£135-95
CS 30D	£86-90		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 31D	£98-10		£69-95
GXC 40T	£186-09	£135-95	CS 83D	£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
BSR TD85 8 track player. Special price £14-95
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 HI-FI LOUSPEAKERS AT APPROXIMATELY HALF-PRICE

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

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
5045	£2-75	807T 3Ω	£2-25	12110	£3-27	138110L1H	£2-50	138110T1H	£2-50
5046	£2-81	1001	£4-37	12110T	£3-37	138110T1H	£2-50	101150A	£4-27
5047	£1-08	1002	£4-19	12110T	£3-37	138110L1H	£2-50	101150A	£4-27
801	£3-83	1003	£3-85	12110T	£3-78	138111L1H	£3-87	101150A	£4-27
802	£3-69	1004	£3-50	12110T	£4-01	138112	£3-84	101150A	£4-27
802T	£3-82	1008	£2-92	12110L1H	£4-83	138113L1H	£4-15	101150A	£4-27
K05	£2-25	1001L1H	£5-06	138110	£2-18	138116	£4-51	101150A	£4-27
K05T	£2-50	1001L1H	£4-97	138110T	£2-31	138116L1H	£4-63	101150A	£4-27

RSC G66 MkII 6.6 WATT high quality STEREO AMPLIFIER

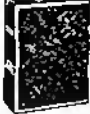
Controls: Bass, Treble, Vol. and Bal. 10 Transistors plus Diodes. Output rating 1.1 H.F.M. Frequency range 20-20,000 c.p.s. Bass Control - 12db. Treble Control - 13db. Selector switch for Crystal P.U. or Tape/Radio. For speaker output impedances of 3 - 15 ohms. For standard 200-250v. A.C. mains operation. Attractive Black and Silver finished metal fascia plate and matching control knobs. COMPLETE KIT OF PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT



COMPREHENSIVE WIRING DIAGRAMS & INSTRUCTIONS £12-95 Carr. 40p
 OF FACTORY BUILT IN TEAK VENEERED CABINET £12-95 Carr. 40p
 as illustrated £18-95 or dep. £2-12 and 8 monthly payments £2-12 (Total £18-00)

HI-FI SPEAKER ENCLOSURES

Teak veneer Carr. 50p. Sizes approx. per cm.
 JE8 13 x 9 1/2 x 6 1/2 in. £3-95 } Both cut for 8in. speaker
 JE10 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 ensure surprisingly realistic reproduction. £6-95 Carr. 45p
 OR SENIOR 15 WATT INCLUDING £8-95 Carr. 50p
 HF123 13,000 GAUSS SPEAKER



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 1/2 ohms. PLEASE STATE CHOICE.
 Exceptional performance at low cost.
 HF808T 8" 10W £2-85 HF1200 12" 15W £6-50
 HF108D 10" 10W £3-50 HF128 12" 18W £7-95
 HF120 12" 15W £6-95 HF128D 12" 15W £6-50

AUDIO FIDELITY MODEL 80 HI-FI SPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. Full P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 30 c.p.s. Tweeter cone filled to extend high note response. Frequency range 25 Hz to 16 KHz. Gauss 10,000. Impedance 8-16 Ω. £4-50 ra. £7-98
 MODEL 80 8" 15watt, with parasitic Tweeter, £6-99 ca. £10-95 pr.
 Response 25 Hz to 15 KHz, Gauss 13,000 Imp. 8-16Ω.

HI-FI 8" x 5" 7 watt LOUSPEAKERS £1-25

with parasitic Tweeter 8 ohm imp. Post and Packing 50p

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

200-250v. AC mains operated. Response 30-20,000 c.p.s. S.M.I. Separate Bass and Treble "lift and cut" controls. 3 input sockets for Diode, Gram, Radio or Tape. Input selector switch. Output for 3-15 ohm speakers. Max. sensitivity 5mV. O.P.P. rating 1.1 H.F.M. Enclosed etched metal case 9 1/2 x 2 1/2 x 5 1/2 in. Silver finish fascia 10 1/2 x 4 1/2 in. Carr. 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 copy 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
 Factory built with 12 inch guarantee £16-61 Or in Teak Dep. £2-30 & 8 monthly pymts 12 mins guarantee £19-55 Veneer housing £19-55 £22-50 (Total £22-50).

AUDIO FIDELITY FRI SPEAKER KIT

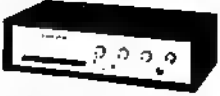
Response 30Hz-15KHz. Rating 15 watts in sealed cabinet, Imp. 8-15 ohms. 8" Bass Unit with P.V.C. Cone surround for ultra low resonance. Pressure Tweeter, Printed Circuit. Inductive (capacitive) Cross-over. Muffling £10-78
 Material, Screws, Terminal Panels. Carr. 75p.
 SPECIAL OFFER £14-99 Pair Carr. 75p. Carr. Free.



R.S.G. 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
 - Needs 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 ±13 dB.
 COMPLETE KIT (less cabinet). £22-50 Carr. 70p. Cabinet if req. £4-90 extra. Assembled unit in cabinet £42-60

'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

★ Moderate size only 25 x 14 x 10 in. approx.
 ★ Response 30-20,000 c.p.s. Impedance 15 ohms
 Performance comparable with COMPLETE KIT units at twice the cost £25-95 Carr. 75p

Deposit £4-71 and 8 monthly payments £3-12 (Total £29-57)
 Consists of (1) 12in. 15w Bass unit with cast chassis. Roll rubber cone surround for ultra low resonance, (2) 3-way quarter section series cross-over system, (3) 8 x 4in. High flux midrange speaker, (4) Dome Pressure Tweeter, (5) Quantity acoustic damping material, (6) Handsome Teak veneered cabinet, (7) Circuit and full instructions.



R.S.C. TRANSFORMERS, L.F. CHOKES & RECTIFIERS FULLY GUARANTEED. Intermagned and interleaved where necessary. Primaries 200-350v. 60Hz Screened

MIDTET CLAMPED TYPE 7 1/2 x 2 1/2 x 2 1/2 in.	TOP SHROUDED DROP-THRO' TYPE	CHARGER TRANSFORMERS 0-9-15v. 7.5a. £1-75.	SELECTOR RECEPTORS P.W. (Bridge)
250v. 60mA, 6-3v. 2a. £1-50	250-0-250v. 70mA, 6-3v. 2a., 0-5-5-3v. 2a. £2-25	21a. £1-95; 3a. £2-00; 6a. £2-45; 6a. £2-75; 6a. £2-90	All 6 1/2v. D.C. output. Max. A.C. input 15v.
250-0-250v. 100mA, 6-3v. 2a. £1-60	250-0-250v. 100mA, 6-3v. 3-5a. £2-50	AUTO (Step Down) TRANSFORMERS	1a. 85p. 2a. 40p. 3a. 65p. 4a. 51p. 6a. 67p.
	250-0-250v. 100mA, 6-3v. 2a., 0-3-3-1a. £2-75	0-10/120v. 200-230-250v. 50-80 watts £2-50	L.F. CHOKES
	150-0-150v. 80mA, 6-3v. 2a., 0-5-5-3v. 2a. £2-75	150 watts, £2-50 250 watts £2-50 500 watts £2-50	150mA, 7-10H, 250 Ω £1-10; 100mA, 10H, 200 Ω 95p; 60mA, 10H, 400 Ω 85p.
	250-0-250v. 100mA, 6-3v. 4a., 0-5-5-3v. 3a. £3-75	OUTPUT TRANSFORMERS	
	300-0-300v. 100mA, 6-3v. 4a., 0-5-5-3v. 3a. £3-75	8Ω, Pentode 5000-3 Ω or 700-3 Ω. 85p	
	300-0-300v. 100mA, 6-3v. 4a., c.t. 6-3v. 1a. £4-50	Push-Pull 8 watts EL84 to 3 Ω or 15 Ω. £1-45	
	350-0-350v. 100mA, 6-3v. 4a., 0-5-5-3v. 3a. £3-75	Push-Pull 10 watts 6V, 3-5-8-15 Ω. £2-25	
	350-0-350v. 100mA, 6-3v. 4a., 0-5-5-3v. 3a. £4-50	Push-Pull EL84 to 3 Ω or 15 Ω 10-12 watts. £2-25	
	FLAMELET of TRANSFORMER POWER PACK	Push-Pull Ultra Linear for Mullard 610, etc. £2-75	
	Type 6-3v. 1-5a. £2; 6-3v. 2a. 85p; 6-3v. 3a. £2-45;	Push-Pull 15-18 watts, sectionally wound £1-65	
	6-3v. 6a. £2-25; 12v. 1a. 85p; 12v. 2a. or 24v. 1-5a. £2-25; 0-9-15v. 12a. £1-95; 0-12-25-42v. 2a. £2-75.	6L6, KTH6, etc., for 3 or 15 Ω. £2-20	
		Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω £2-50	

RSC 100 watt DISCO SYSTEM



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 RSC MF60 type turntables and Sonotone or Acco cartridges with diamond styl. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike's with vol. control switch. Black Vynide covered cabinet with lid. See illustration on left.
 Or Dep. 29-00 and 18 fortnightly pymts. £79-95
 Carr. £1-60

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

STEREO VERSION OF ABOVE SYSTEM
 Or DEP £29-00 and 18 fortnightly pymts. £199-95
 Carr. £3-00 (Total £229-93)

TD'S STEREO VERSION OF ABOVE SYSTEM
 Terms. Dep. £15-00 and 18 fortnightly payments 29-51
 (Total £182-18) Carr. £1-60

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F.A.L. PHASE 50 MK. III AMPLIFIER £47-88	PACKAGE PRICE
FR. FANE POP 50 L/SPEAKERS £25-90	Carr. £1-10
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F.A.L. PHASE 50 AMPLIFIER £47-88	PACKAGE PRICE
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50K	15p each 50K	50K	Less
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2 1/2 x 5	84p	15p	
3 1/2 x 3 1/2	84p	15p	
2 1/2 x 5	89p	15p	
17 x 2 1/2	1-06p	77p	80p
17 x 3 1/2	1-45p	1-15p	75p
17 x 5	1-85p		1-10p

Pin insertion tool 72p
Spot face cutter 62p
Pkt. 36 pins (extra 1 or 15) 25p

LOUDSPEAKERS

2 1/2" 8 ohm	50p
2 1/2" 40 ohm	50p
2 1/2" 80 ohm	50p
5" 8 ohm	ceramic 41-25
6 1/2" 8 ohm dual cone	ceramic 42-50
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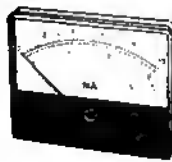
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ME13	= 0 to 100 mA Full Scale
ME14	= 0 to 500 mA Full Scale
ME15	= 0 to 1 amp Full Scale
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RTCH	RESIST	PEN	1"	68p
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OUR PRICE 80p				Key "B" 10p
ADD LUXURY TO YOUR CAR with a motor driven car aerial				Key "C" 20p

SPCC-	★	5 section	1 1/2"	21-05
	★	extended length 100cm	1 1/2"	21-10
	★	Length under fender 40cm	1 1/2"	21-25
	★	Cable length 120cm	2 1/2"	22-30
Supplied complete with fixing bracket and control switch				Key "E" 20p

1" SQUARE PUNCH complete with key 22-10

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TIP 29A		55p
TIP 30A		82p
BC107		10p
BC 108		10p
BC109		10p



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SPOT FREQ. OSC UNITS. Suitable for testing A.F. & Vid Amps Scopes, Digital circs, Signal Injection etc. These give a 1 : 1 Square wave of 6v Pk Pk or 2.5v Pk Pk into 75 ohm uses 4 transis inc Unijunction osc. Contained in all case size 4½" x 1½" x 1½" fitted standard coax sk plug supplied, reqs supply of 9v DC. The following freq are available 100, 500c/s, 1, 5 & 10Kc. Price £2 other freqs in this range are available at 25p extra. Supplied with circ. **HEAD & MIKE SETS** for use with 19 set new boxed £2. U.H.F. W.M. absorbtion type range 410 to 470 Mc/s direct calibration req 150v Ht & 6.3 to work, can be used with phones £3. **METER UNIT** 270° scale 1 Ma FSD 3½" sq front scale 0 to 20 also as 100-0-100Ua meter in same case ex a/c £3-38. CRT type 7BP7A 7" flat face Blue/Yell phosfor 6.3 heater okay for SSTV new £2. **SCOPES** American general purpose bench scopes 115v 50c/s, 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. **LEDEX SWTS** coils 12/24v DC as 7 contact banks, also dual actuators allowing clock or anticlock rotation new £1-30. **TELEPRINTERS** Creed type 85R printing reperforators good cond £12. **H.T. TRANS** 230v prla, 1125-0-1125v at 565 Ma new £8-64 matching choke £1-50. **YAXLEY SWTS** all new unused with ceramic wafers, 2p 5w, 3p 3w, 4p 2w all 35p ea. 3p 11w 3b 75p ea, 6p 11w 6b & 12p 4w 6b £1 ea. larger type Inst swts with pax wafers new unused 8p 12w 8b & 2p 23w 2b both £1-30 ea. 7p 23w 7b £1-60 ea. H.D. Tx type ceramic 2p 3w 2b 4 pos new £1-70. **METER** 500 Ua 1½" dia scale 0 to 5 on small panel with swts £1-45. **TRIMMERS** 20pf ceramic air spaced new 10 for 65p. **VIDICON CAMERA TUBES** type P862 general purpose 6.3 95 Ma heater with data sheet tested £9-50 CRT type VCR138 3.5" green phosfor, 4v heater, 1.5Kv EHT, with base, mu metal shield & connections ex equip £4-40. **CONT METER** No. 1 Geiger counter .1 to 10 Mill/Rongt with mains P.U. new boxed & tested with carrying haversack £6-10. **HEADPHONE LEAD** with high to low res trans, 5ft lead with standard jack plug new 70p. **NEONS** small wire ended type new 10 for 70p. **TUNING CONDS** 50pf ½" shaft 55p. Also 2 gang 25pf ½" shaft 95p. **RELAYS** 12v 4p c/o sealed 75p also 2p c/o min type 40p. **SILICON DIODES** 200 PIV at 8 amps 4 for 75p. **COAX CABLE** good quality 75 ohm 15 mts for £1-20. **HEAD & MIKE SET** No. 15 for use with 88/31 set as boom type mike ex equip £2. **PLUGS & SKS** with cover & cable clamp 25 way 55p. 18 way 35p. Also miniature types 50 way £1, 36 way 75p. 24 way 50p. **MANUALS.** The following are Photostat copies R1155 A to N, R1475, 19 set, 62 set, R107, CT38, 13A, AR88D or LF, 1049 Mk. 1, all £2-42 ea, CR100 £3-85, CT316 £2-20, CT52/84 £1-32, R1392 £1-43, R209 Mk 1 & 2 £1-65, S640 £1-10, 88 set £1-21, 31 set £1-65, TF144G £1-21, 92 set £1-10, HRO Rx Ux & Octals £2-64. 730/4 £2-20, CD711. S2 £4. **CIRCS** only R3673, R220, CRT26, PCR 2 & 3, ARR-2, B44, all 70p ea. 1035 Mk. 1, 2 or 3: 1049 Mk 1 or 3a 88p ea. CT54 with P.U. 70p. R4187 £1-10, others available.

Above prices inc Carr and VAT. SAE for list No. 11 or enquiry. Goods ex equipment unless stated otherwise.

A. H. SUPPLIES

57 MAIN RD., SHEFFIELD S9 5HL. 444278 (0742)

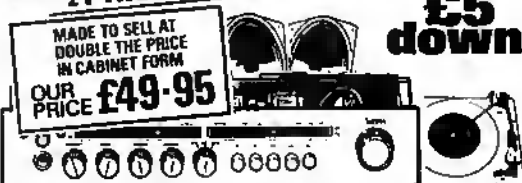
QUALITY STEREO SOUND

SOLENT AUDIO SYSTEM

ALMOST 1/2 PRICE OFFER!

MADE TO SELL AT DOUBLE THE PRICE IN CABINET FORM
OUR PRICE £49-95

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

Order early limited stocks available cash price £49-95. Credit Sale £5-00 deposit 9 monthly payments of £5-75 (Total Credit price £56-75). P. & P. £2-50. Send £7-50 today.

Chassis only available for cash at £35-00.

Full 12 months Guarantee.

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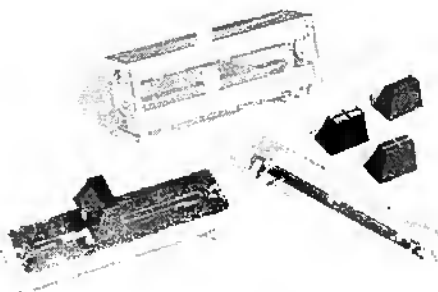
Stereo headphones supplied with every complete order.

LEWIS radio

PW/2/75

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CARBON SLIDE POTENTIOMETERS



60mm Single Track including Black Knob 50p (inc. V.A.T.), 60mm Twin Track including Black Knob 60p (inc. V.A.T.), 60mm Quad Slide Potentiometers—Prices upon application. 1K, 5K, 10K, 25K, 50K, 100K, 500K ohms Log, Lin, Antilog. Metal Case. 3.2db Matched Track. 15mV Nominal Noise (B.S. 2122). Life Exceeds 20,000 cycles. Fixing Holes 2 x M3 on 80mm Centres.

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TMK 200 MULTIMETER KIT

Build yourself a quality 20000 opv. multimeter and save money. Complete kit with meter scale, movement and rotary range selector ready mounted in cabinet. All parts, batteries, test leads and instructions. Ranges: 0.6 6 30/120/600/1200V D.C. 0.6 30/120/600/1200V A.C. Current: 0.0 0.6/6/60/600mA. Resistance: 0 10/100k/1.1 Meg ohms. Decibels: -20 to +63dB. Size: 90 x 150 x 35mm

OUR PRICE £7.95 P & P 30p



U4323 MULTIMETER

20,000opv. Simple unit with audio/IF oscillator. Suitable for general receiver tuning. Resistance: 0.5/2.5/10/50/250/500/1000V DC. 2.5/10/15/250/500/1000V AC. 0.05/0.5/5 50 500mA DC. Resistance: x 10, x 100, x 1,000, x 10,000 (50k). 500k, 1k, 50k (centre scale). Battery operated. Size: 160 x 97 x 40mm. Supplied in carrying case complete with test leads.

OUR PRICE £7.70 P & P 30p



MODEL 500

30,000 opv with overload protection. Mirror scale. 0/0.5/2.5/10/25/100/250/500/1000V DC. 0/2.5/10/25/100/250/500/1000V AC. 0/0.5/0.5/5/50/500mA. 12A DC. 0/60k/6 meg/60 megohms.

OUR PRICE £13.95 Carr. paid



HIKI 730X

-30,500 opv. Overload protection. 6.30/60/300/600/1200V DC. 0.2/160/120/800/2700V AC. 60/μA/30mA/300mA. 2k/20k ohms. 2 Meg Ohm. -10 to 63dB.

OUR PRICE £7.50 P & P 30p



HIKI 750X VOLT-Ohm-MILLIAMETER

43 range. 0-0.30/6/1.5/3/6/12/30/60/150/300/600/1200V DC. 0-3/6/15/30/60/120/300/600/1200V AC. Current: 0-30/60mA/1.5/3/15/30/150/300mA/8/12A. Resistance: 0-3/200k/20Megohms. Decibels: -10 to +17dB. Output: -0.3/6/15/30/60/120/300V. Accuracy: 3% DC, ±4% AC. Sensitivity: 50,000 opv DC, 5,000 opv AC. 4 inch meter. Built in protection. Size: 57 x 102 x 153mm.

OUR PRICE £11.95 P & P 40p



U4324 MULTIMETER

High sensitivity, overload protected. 20,000opv. Ranges: 0.6/1.2/3/12/30/60/120/600/1200V DC. 3/6/15/30/60/150/300/600/1200V AC. Current: 0.06/0.6/6/60/600mA/3A DC. 0.3/3/30/300mA/3A AC. Resistance: 25/50 ohms/0.5/5/50/500k ohms/5 Megohms. Decibels: -10 to +12dB. Size 167 x 98 x 63mm. Supplied complete with test leads, spare diode and instructions.

OUR PRICE £9.25 P & P 30p



TMK MODEL TW50K

46 ranges, mirror scale. 50kV DC. 50kV AC. DC Volt: 0.125/0.25/1.25/2.5/5/10/25/50/125/250/500/1000. DC current: 25/50A/2.5/5/25/50mA. 12A. Resistance: 0.5/5/50/500/10k/100k/1Meg/10Meg/100Meg. -20 to +81.5dB.

OUR PRICE £12.50 P & P 24p



U435 MULTIMETER

20,000opv. Ranges: 75mV/2.5/10/25/50/100/250/500/1000V DC. 2.5/10/25/100/250/500/1000V AC. Current: 50mA/1/5/15/30/60/100mA/1A DC. 5/25/100mA/0.5/2.5/5A AC. Resistance: 0.3/3/30/300 ohms. Size: 205 x 110 x 84mm. Supplied complete with leads, crocodile clips and steel carrying case.

OUR PRICE £8.75 P & P 30p



HIKI MODEL 780X

100,000opv. Overload protection. Mirror scale. 0.3/0.6/1.2/1.5/3/6/12/30/60/120/300/600/1200V DC. 1.5/3/6/12/30/60/150/300/600/1200V AC. 0/6/30/60/120/300/600/150/500mA/8/12A DC. 2k/20k/200k/200Megohms. -20 to +63dB.

OUR PRICE £14.95 P & P 30p



U4312 MULTIMETER

Sturdy sturdy instrument for general electrical use. 6670 opv. 0/0.2/1.5/3/30/60/150/300/600/300V DC & 75mV/0.30/3.15/5/30/60/150/300/600/900V AC. 0/300mA/1.5/6/15/150/60/0.01/0.1/1/5/5A DC. 0/1/5/6/15/60/150/300/600mA. 0.2/200/3k/30k ohms. DC resistance 1%. AC 1.5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions.

OUR PRICE £10.25 P & P 50p



Model HT10084 MULTIMETER

Overload protected, shock proof circuitry. 8.5uA Wrist with mirror scale. Sensitivity 100kV. Polarity change over. Ranges: 0.5/2.5/10/25/50/100/200V DC. 2.5/10/50/100/200/500/1000V AC. 0-20/20k/220 Meg. ohms. DC current: 10/250mA/2.5/25/250mA/10A. AC current: -10A, -20 to +82B. Operates from 2 x 1.5V batteries. Size: 180 x 134 x 79mm.

OUR PRICE £17.50 P & P 40p



U91 Clamp VOLT AMMETER

For measuring AC voltage and current without breaking circuit. Ranges: 300/600V AC. Current: 10/25/100/250/500A. Accuracy 4%. Size 283 x 90 x 38mm. Complete with carrying case, leads and fuses.

OUR PRICE £13.50 P & P 30p



MODEL AS.1000 VOM

100,000 opv. Mirror scale. Built-in meter protection. 0.3/12/60/120/300/600/1200V DC. 0.6/30/120/300/600V AC. 0/10/10A/6.6/30mA/2k/20k/200 Meg Ohms. -20 to +17.6B.

OUR PRICE £17.50 P & P 30p



MODEL C720ZEN

20,000 opv DC. 10,000 opv AC. Mirror Scale. 5 25 50 250 600 1000 2500 V. DC. 10 50 100 500 1000 V. AC. DC Resistance x10, x100 (30k) centre scale) DC Current 50uA 2 SinA 250mA. -20 to +68 dB.

OUR PRICE £6.95 P & P 30p



KAMODEN HM720B FET VOM

Input impedance 10 Megohms. Ranges: 0.25/1.25/10/50/100/500/1000V DC. 0.2/5/10/50/100/500/1000V AC. 0/2.5/10/50/100mA DC. 0/5/10/50/500/5M 500 Megohms

OUR PRICE £21.00 P & P 40p



KAMODEN 360 MULTIMETER

High sensitivity. DC 100kOhm/V. AC 10kOhm/V. 5" mirror scale, overload protection. Ranges: 0.5/2.5/10/50/100V DC. 5/10/50/250/1000V AC. Current: 0.1/1/10/100 ohms/1/10/100 ohms/10/100 ohms. Decibels: -20 to +62B. Battery operated. Size: 180 x 140 x 60mm. Supplied complete with test leads etc.

OUR PRICE £17.50 P & P 40p



TMK MODEL 117 FET ELECTRONIC VOLT METER

Battery operated. 11 Meg input, 26 ranges. Large 4.5" mirror scale. Size: 149 x 117 x 60mm. 0.3-12000V DC. 3-300k/10MS AC. 8-800V P-P. DC current 0.12-12mA. Resistance up to 200Megohms. Decibels: -20 to +51dB. Supplied complete with leads and instructions.

OUR PRICE £18.50 P & P 20p



TMK 100K LAB TESTER

100,000opv. 6" scale. Buzzer, short circuit check. Sensitivity 100,000 opv. 50kV AC. DC Volt: 0.125/0.25/1.25/2.5/5/10/50/100/250/500/1000V AC. 3/10/50/250/500/1000V DC. current: 10/100mA/100/100/25/10A. Resistance: 1k/10k/100k/10 Meg/100 Meg ohms. Decibels: -10 to +45dB. Plastic case with carrying handle. Size: 130 x 172 x 39mm.

OUR PRICE £19.95 P & P 30p



370WTR MULTIMETER

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

OUR PRICE £19.95 P & P 30p



KAMODEN 72.200 Multitester

High sensitivity tester. 20,000 opv Overload protected. Mirror scale. Ranges: 0.01/0.1/0.3/3/30/120/300/600/1200V DC. 0/3/12/60/300/1200V AC. 0/0.6/6/60/600mA/10A DC. 0/100mA/1A DC. 0/100mA/1A DC. 0/100mA/1A DC. 0/100mA/1A DC. 5 Meg/50 Megohms. Decibels: -20 to +62dB.

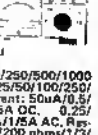
OUR PRICE £22.50 P & P 30p



U4317 MULTIMETER

High sensitivity instrument for field and laboratory work. Knife edge pointer, 36mm mirror scale. Overload protection. Ranges: 100mV/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: 50mA/0.5/1/5/10/50/250mA/1/5A AC. Resistance: 0.5/10/100/200 ohms/1/2k/30/300k ohms. Decibels: -5 to +10dB. Battery operated. Size: 210 x 115 x 30mm. Supplied in carrying case complete with leads.

OUR PRICE £16.50 P & P 40p



MODEL C720BFM

30,000 opv DC. 15,000 opv AC. 6 3 15 50 300 600 1200 V DC. 6 30 120 600 1200 V. AC. DC Resistance x1, x10, x100, 1000 (50k) centre scale) DC Current 30uA/3.30 600mA -20 to +63dB.

OUR PRICE £8.95 P & P 30p



MODEL U4311 Sub-standard Multi-range Volt-Ammeter

Sensitivity 330 Ohms/Volt AC and DC. Accuracy 0.5% DC. 1% AC. Scale length: 165mm. 0/300/750mA/1.5/3/7.5/15/30/75/150/300/750mA/1.5/3/7.5/15/30/75/150/300/750V AC. Automatic cut out device. Supplied complete with test leads, manual and test certificates.

OUR PRICE £52.00 P & P 50p



MODEL AF.105 VOM

50,000 opv. Mirror scale. Meter protection. 0/3/3/12/60/120/300/600/1200V DC. 0.6/30/120/300/600/1200V DC. Decibels: -20 to +62B. 0-30uA. 6-60/200mA. 2.2mA. 0.1/10k. 1m/10m/100 Meg Ohms. 20 to 17dB.

OUR PRICE £12.50 P & P 30p



LB3 TRANSISTOR TESTER

Tests ICO and ICS. PNP/NPN. Operates from 9V Battery. Instructions supplied.

OUR PRICE £3.95 P & P 20p



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 current. Amplification factor of NPN/PNP diodes, transistors, SCR's etc. 4" square 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. 15,700opv. Overload protected. Ranges: 0.3/1.5/6/30/60/150/300/600V DC. 1.5/7.5/30/150/300/750V AC. Current: 0.06/0.6/6/60/600mA AC. 0.3/3/30/300mA AC. Resistance: 0.01/0.1/1/10/100/1000/10000 Ohms. Battery operated. Supplied complete with probes, leads and steel carrying case. Size: 115 x 215 x 90mm.

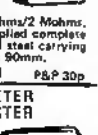
OUR PRICE £10.50 P & P 30p



S100TR MULTIMETER TRANSISTOR TESTER

100,000opv. Mirror scale. Overload protection. 0.3/3/12/30/120/300V DC. 0.6/3/12/30/120/300V AC. 0/10k/100k/1M/10M/100M Ohms. Decibels: -20 to +50dB. 0.01-0.2 mFD. Transistor tester measures Alpha, Beta and ICS. Complete with instructions, batteries and leads.

OUR PRICE £19.95 P & P 25p



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 on to 1999 and automatically indicate polarity. Indication of positive and negative overload 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, 10, 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

SWR Meter Model SWR3

Handy SWR meter for transmitter antenna alignment, with built-in SWR strength meter. Accuracy 5%. Impedance 50 Ohm. Indicator 100uA DC. 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 in electronic circuits. VERT. BANDW. Bandwidth: 10MHz. Sensitivity at 100kHz: 1Vrms/mm: 0.1-25; 100uA: AMP. Bandwidth: 500kHz. Sensitivity at 100kHz: 1Vrms/mm: 0.3-25. Pulse triggered sweep 1-3000times. Free running 20-200kHz in nine ranges. Calibrator 30p, 200 x 360 x 430mm, 115-230V AC.

OUR PRICE £43.00 Carr. paid

RUSSIAN C116 Double Beam OSCILLOSCOPE

5MHz p.p.s. band. Separate Y1 and Y2 amplifiers. Rectangular 5" x 4" CRT. Calibrated triggered sweep from 0.2usec. to 100 micro-sec/m. 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 40kHz-280MHz. In six coils, 500uA meter, 9V battery operation. Size: 180 x 80 x 40mm.

OUR PRICE £17.50 P & P 30p

TRANSISTORISED L.C.R. A.C. BR/B MEASURING BRIDGE

A new portable bridge offering excellent range and accuracy at low cost. Resistance: 6 ranges; 0.1 ohm-11.1 megohm. Inductance: 6 ranges; 1 microhenry-111 henries. Capacity: 6 ranges; 10pF-1110 microfarads. Ratio: 6 ranges; 1:1, 1000:1-1:11100. Bridge Voltage at 1.000cps. Operated from 3-volt battery. 100 microamp meter indication. Size 7 1/2" x 5" x 2"

OUR PRICE £25.00 P & P 30p

TE-200 RF SIGNAL GENERATOR

Accurate wide range signal generator covering 10 to 100 MHz on 6 bands. Directly calibrated Variable R.F. attenuator audio output. Xial socket for calibration 230 240V a.c. Brand new with instructions. Size 140mm x 215mm x 170mm.

OUR PRICE £17.50 P & P 50p

TE22 SINE SQUARE WAVE AUDIO GENERATOR

Sine 20cps to 200kHz. Square 20 cps to 30 kHz. Output impedance 500 Ohms. 200/250V AC operation. Supplied brand new guaranteed, with instruction manual and leads.

OUR PRICE £24.95 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 Wave 100V P.P. 100kHz in 20MHz. Output 1V maximum. 220/240V AC operation. Complete with instructions and leads.

OUR PRICE £37.50 P & P 50p

WALKIE TALKIES SKYFONN2

Super low cost transmitter receivers. 100MW with call buzzer and on off volume control. 7 Transistors. Telescopic antenna.

OUR PRICE £28.95 per PAIR P & P 50p. NOT LICENSABLE IN THE U.K.

MODEL MC100 SINE SQUARE WAVE AUDIO GENERATOR

Range 19-220,000Hz Sine Wave 15-100,000 Hz Square Wave Output Sine or Square wave 10v P to 50 x 50 x 90mm Operation 220-240V A.C.

OUR PRICE £19.95 P & P 50p

POWER RHEOSTATS

High quality ceramic construction. Windings embedded in epoxy enamel. Heavy duty brush wiper. Continuous rating. Sine hole fixing. 3/4" diameter shafts. Bulk quantities available.

25 WATT 10 25 50 100 500-1000 2500 ohms. £1.15 P & P 10p
50 WATT 10 50 100 250 500. 1500 5000 ohms. £1.62 P & P 10p
100 WATT 1/5 10/25 50 250-500 2500 ohms £2.34 P & P 15p

SPECIAL PURCHASE (LIMITED QUANTITY)

Tannoy 12" DR/8 Bass Speakers
8 ohms 30 watt Heavy duty. Ideal for Hi-Fi A Group.

OUR PRICE £12.50 P & P 50p.

AUDIOTRONIC LE-102A INTERCOM

Beautifully made and finished in two tone ivory buff, the LE-102A is useful in the home, office or shop and is suitable for use as a baby alarm, Wall or desk mounting. 57mm speaker. mics give clear 2-way communication with on off volume control on master unit. Operates on 9V batt. Approx 60ft lead.

OUR PRICE £3.95 P & P 30p

PS200 Regulated POWER SUPPLY UNIT

Solid state. Variable output 5-20V DC up to 2 Amp. Independent meters to monitor voltage and current. Output 200/240V AC. Size: 190 x 136 x 98mm.

OUR PRICE £19.95 P & P 50p

TRITON 4318 PORTABLE 8 TRACK CARTRIDGE PLAYER WITH MW/LW RADIO

Will play 8 track stereo cartridge manually. Channel selector switch. Covers medium and long wave bands. Volume and tone controls. Earphone socket. Battery Mains operation.

OUR PRICE £11.95 P & P 50p

EA41 REVERBERATION AMPLIFIER

Self contained, transistorised battery operated. Simply plug in microphone, guitar etc. and output in your amplifier. Volume control and depth of reverberation control. Bandwidth cabinet, 184 x 77 x 108mm.

OUR PRICE £7.50 P & P 30p

LH025 STEREO HEADPHONES

Light weight headphones with padded ear-cups. 16 Ohms 20-20,000Hz. Complete with 5' lead and plug.

OUR PRICE £1.97 P & P 30p

DH025 STEREO HEADPHONES

Wonderful value and excellent performance combined. Adjustable head band. Impedance 8 ohms. 20-12,000Hz. Complete with lead and plug.

OUR PRICE £2.25 P & P 30p

TE1035 Stereo HEADPHONES

Low cost with excellent response. Foam rubber earcups. Adjustable headband. 8 ohms impedance. Frequency response 20Hz-18kHz. Complete with cable and stereo jack plug.

OUR PRICE £2.80 P & P 30p

SDMBV MONO/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.

Headphone impedance 16 ohms. Microphone impedance 200 ohms.

OUR PRICE £5.95 P & P 30p

HANIMEX HRC 3075 CASSETTE RADIO

Covers Medium and FM wave-bands. Slider volume and tone controls. Battery Mains operation. Will record direct from radio or through built in condenser microphone. Complete with batteries, earphone, and cassette.

OUR PRICE £24.30 P & P 50p

SPECIAL OFFER! CONVERT YOUR STEREO SYSTEM TO 4D UNDER 10!

Exclusive offer of GOODWIN 4 CHANNEL CONVERTER and a pair of AD15 10 watt 8 ohm bookshelf speakers enables you to 'add 4D' sound to your existing system. Complete with simple connection details. Retail rental value £25.50.

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GOODWIN CONVERTER available separately £3.95 P & P 50p

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50mA	£3.80
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1A DC	£3.80
5A DC	£3.80
10A DC	£3.80
15A DC	£3.80
30A DC	£3.80
50A DC	£3.80
5V DC	£3.80
15V DC	£3.80
20V DC	£3.80
25V DC	£3.80
30V DC	£3.80
35V DC	£3.80
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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
10A DC	£3.05
15A DC	£3.05
20A DC	£3.05
25A DC	£3.05
30A DC	£3.05
35A DC	£3.05
40A DC	£3.05
45A DC	£3.05
50A DC	£3.05
55A DC	£3.05
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75A DC	£3.05
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1mA	£4.30
5mA	£4.30
10mA	£4.30
50mA	£4.30
100mA	£4.30
500mA	£4.30
1A DC	£4.30
5A DC	£4.30
10A DC	£4.30
15A DC	£4.30
20A DC	£4.30
25A DC	£4.30
30A DC	£4.30
35A DC	£4.30
40A DC	£4.30
45A DC	£4.30
50A DC	£4.30
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1mA	£2.85
5mA	£2.85
10mA	£2.85
50mA	£2.85
100mA	£2.85
500mA	£2.85
1A DC	£2.85
5A DC	£2.85
10A DC	£2.85
15A DC	£2.85
20A DC	£2.85
25A DC	£2.85
30A DC	£2.85
35A DC	£2.85
40A DC	£2.85
45A DC	£2.85
50A DC	£2.85
55A DC	£2.85
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5mA	£3.50
10mA	£3.50
50mA	£3.50
100mA	£3.50
500mA	£3.50
1A DC	£3.50
5A DC	£3.50
10A DC	£3.50
15A DC	£3.50
20A DC	£3.50
25A DC	£3.50
30A DC	£3.50
35A DC	£3.50
40A DC	£3.50
45A DC	£3.50
50A DC	£3.50
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1mA	£5.15
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50mA	£5.15
100mA	£5.15
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10A DC	£5.15
15A DC	£5.15
20A DC	£5.15
25A DC	£5.15
30A DC	£5.15
35A DC	£5.15
40A DC	£5.15
45A DC	£5.15
50A DC	£5.15
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65A DC	£5.15
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10mA	£3.40
50mA	£3.40
100mA	£3.40
500mA	£3.40
1A DC	£3.40
5A DC	£3.40
10A DC	£3.40
15A DC	£3.40
20A DC	£3.40
25A DC	£3.40
30A DC	£3.40
35A DC	£3.40
40A DC	£3.40
45A DC	£3.40
50A DC	£3.40
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80A DC	£3.40
85A DC	£3.40
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1mA	£3.70
5mA	£3.70
10mA	£3.70
50mA	£3.70
100mA	£3.70
500mA	£3.70
1A DC	£3.70
5A DC	£3.70
10A DC	£3.70
15A DC	£3.70
20A DC	£3.70
25A DC	£3.70
30A DC	£3.70
35A DC	£3.70
40A DC	£3.70
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65A DC	£3.70
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741 25p MFC4000 40p	7410 15p 7480 84p	
747 70p TBA800 21-00	7413 30p 7480 48p	
748 38p TBA810 21-25	7420 15p 7493 46p	
7805 21-40 TBA820 80p	7430 15p 74107 46p	
7812 21-40 2N414 21-10	7441 75p 74121 84p	
7812 21-40 2N414 21-10	7447 95p 74141 84p	
Data sheet on above ICs 10p ea.		

FOR MORE SELECTION PLEASE REFER TO OUR ADVERTISEMENT IN P.E. & W.W.

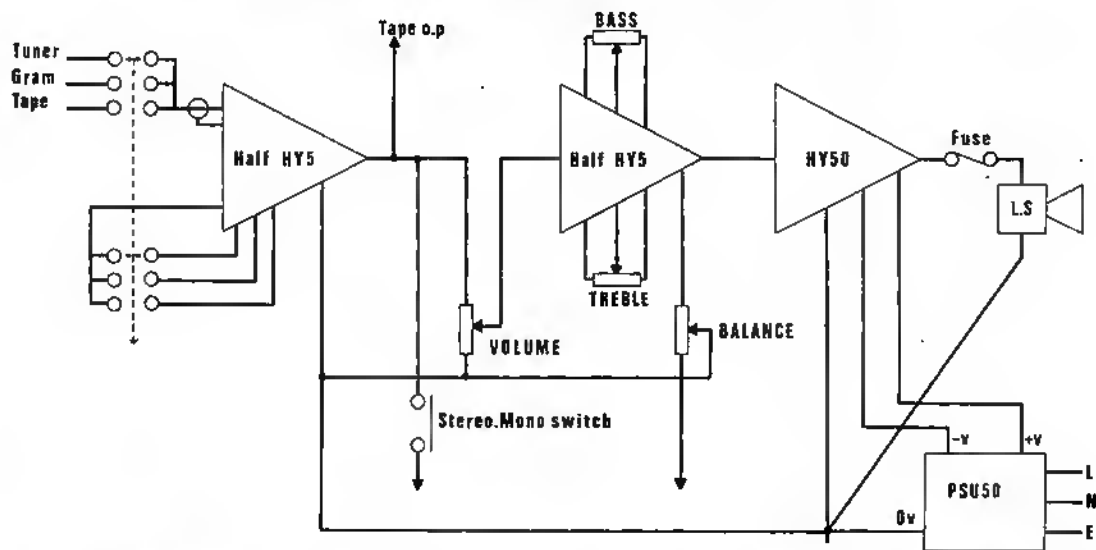
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Rhythm Generator	CA3046 55p
Novel Transistor Tester	MC1310P 2-40
Please send S.A.E. for prices.	MC1312P 2-20

Minimum Order £2. All prices exclusive of VAT. P. & P. 10p orders below £5. Trade, Colleges enquiries welcome.

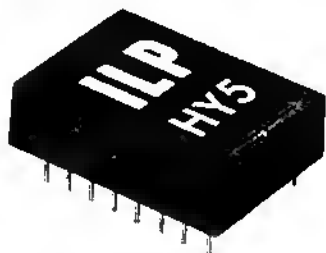


I.L.P. (Electronics) Ltd

SHEER SIMPLICITY!



MONO ELECTRICAL CIRCUIT DIAGRAM WITH INTERCONNECTIONS FOR STEREO SHOWN



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

TECHNICAL SPECIFICATION

Inputs: Magnetic Pick-up 3mV RIAA; Ceramic Pick-up 30mV; Microphone 10mV; Tuner 100mV; Auxiliary 3-100mV; Input Impedance 47k Ω at 1kHz. Outputs: Tape 100mV; Main output 0db (0-775V RMS). Active Tone Controls: Treble \pm 12db at 10kHz; Bass \pm 12db at 100Hz. Distortion: 0-5% at 1kHz. Signal/Noise Ratio: 66db. Overload Capability: 40db on most sensitive input. Supply Voltage: \pm 18-25V.

PRICE £4.50 + 36p VAT
P. & P. free

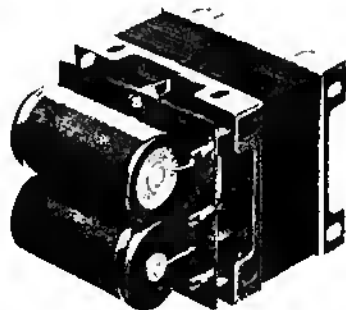


The HY50 is a complete solid state hybrid HI-FI amplifier incorporating its own high conductivity heatsink hermetically sealed in black epoxy resin. Only five connections are provided, input, output, power lines and earth.

TECHNICAL SPECIFICATION

Output Power: 25W RMS into 8 Ω . Load Impedance: 4-16 Ω . Input Sensitivity 0db (0-775V RMS). Input Impedance: 47k Ω . Distortion: Less than 0.1% at 25W typically 0-05%. Signal/Noise Ratio: Better than 75db. Frequency Response: 10Hz-50kHz \pm 3db. Supply Voltage: \pm 25V. Size: 105 x 50 x 25mm.

PRICE £5.98 + 48p VAT
P. & P. free



The PSU50 incorporates a specially designed transformer and can be used for either mono or stereo systems.

TECHNICAL SPECIFICATIONS

Output voltage: 50V (25-0-25V). Input Voltage: 210-240V. Size: L.70. D.90. H.60mm.

PRICE £6 + 48p VAT
P. & P. free

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Crossland House,
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TRANSFORMERS

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 multipole giving 2-1 and 2-5 ma sockets and 3-5 ma plug.
Price £2-25, Post 10p.



2" and 4" PANEL METERS

2"

4"

4mm Dia. Movement	I.H. Ohms	4mm Dia. Movement	I.H. Ohms
0-50 micro A.	1250	0-50 micro A.	1400
0-100 micro A.	680	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	8	0-10 mA	8
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	13K	0-25 Volt	13K
0-50 Volt	50K	0-50 Volt	50K
0-200 Volt	300K	0-200 Volt	300K
"m" Meter	170	"m" Meter	200
V/I Meter	3260	V/I Meter	3260

VU Meters are complete with detectors. Modern wide view.
Price 2" £2-15 Post 10p. Price 4" £2-15 Post 10p. Lamps 75p per set.

1/2 watt CARBON FILM RESISTORS

1/2 watt at 70°C E 12 range 10Ω-13M 5% (tol above 470 KΩ 10%). (tol at 95p per 100).

C1000 MULTIMETER

Special Offer

Compact General Purpose Mini Multimeter. Input Resistance 1000 ohms per volt



AC Volts	0-15, 50, 250, 1000 V
DC Volts	0-10, 50, 250, 1000 V
DC Current	0-5 mA
Resistance	0-100MΩ
Resistance	0-100KΩ ohm
Size	90 x 24 x 30 mm
Complete with Batteries, Test Prods.	
Instructions, Special price	£3-20 Post 20p.

C1001 MULTIMETER

Input Resistance 20,000 ohms per volt Overload protection 150 mA movement, clear scale Ranges—AC Volts 0-10, 50, 250, 1000V DC Volts 0-5, 25, 125, 500, 2500V DC Current 0-50 mA Resistance 0-60 Kohms, 0-4 Mohms Decibels -20 to +22 dB. Carrying Case, Test Prods. and Batteries included. Size: 11.5 x 8.3 x 2.7 cm. Price £3-85, Post 20p.

CASED TRANSFORMERS

Housed in smart resin-coated 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 V.A. 3-pin sockets from 750 to 3000 V.A. See Auto and Isolation sections for prices.

SAFETY ISOLATING

Prim. 220-240V. Sec. 120-240V. Centre Tap with Screen.

V.A.	Ref. No.	Price £	Price Cancel £	Price 2 Pin Earth £	Price Open £	Post £
60	140	7-35	0-80	4-00	0-38	
100	150	8-22	0-80	4-80	0-32	
200	151	10-20	0-80	7-40	0-52	
250	152	11-58	0-80	8-88	0-55	
350	153	14-10	0-80	10-60	0-59	
600	154	15-63	0-80	12-38	1-00	
750	155	24-03	1-00	18-78	1-20	
1000	156	32-19	1-00	26-60	1-20	
1500	157	38-13	1-00	30-24	O.A.	
2000	158	45-25	1-00	34-68	O.A.	
3000	159	58-50	2-40	49-38	O.A.	

12 & 24 Volts Prim. 200-240V.

Atch.	No.	Ref. No.	Price £	Post £
0-3	12V	24V		
0-3	0-15	24V	1-84	0-29
0-6	0-25	11V	1-48	0-23
1	0-5	21V	1-58	0-23
2	1	7V	2-08	0-22
3	2	15	2-58	0-28
4	3	7V	3-50	0-42
5	4	10V	2-52	0-22
10	5	7V	4-80	0-53
12	6	11V	5-01	0-52
16	8	17	6-22	0-62
20	10	11V	9-47	0-69
30	15	18V	11-95	0-97
40	20	22V	13-28	1-00
50	30	22V	16-30	1-10

30 Volts

Prim. 200-240V. Sec. 12, 15, 20, 24, 30V.

Amps	Ref. No.	Price £	Post £
0.5	112	1-72	0-22
1	79	2-21	0-26
2	3	3-28	0-36
3	20	4-10	0-42
4	21	4-88	0-52
5	41	4-80	0-52
6	117	6-50	0-62
8	86	8-50	0-67
10	89	9-97	0-67

AUTO TRANSFORMERS

V.A.	Ref. No.	Price Cased £	Price Plug £	Price Open £	Post £
Tapped at 115, 220, 240 Volts					
20	113	3-00	0-15	1-55	0-30
Tapped at 115, 220, 230, 240 Volts					
100	4	5-80	0-15	3-98	0-39
200	65	6-40	0-15	4-60	0-40
300	66	7-27	0-15	5-28	0-52
300	67	9-90	0-15	8-28	0-57
750	81	12-58	0-75	9-78	0-82
1000	84	15-70	0-75	12-40	0-82
1500	93	18-88	0-75	16-38	1-50
2000	95	30-10	1-44	22-05	1-50
3000	73	42-58	1-90	32-00	1-90

50 Volts

Prim. 200-240V. Sec. 10, 25, 30, 40, 50V.

Amps	Ref. No.	Price £	Post £
0.5	102	2-33	0-30
1	103	3-00	0-28
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	16-47	0-97

60 Volts

Prim. 230-240V. Sec. 24, 30, 40, 43, 60V.

Amps	Ref. No.	Price £	Post £
0.5	124	2-98	0-28
1	125	2-98	0-28
2	127	4-63	0-42
3	123	6-84	0-52
4	128	7-94	0-67
6	44	8-86	0-67
8	129	10-15	0-89
10	131	13-58	1-00
12	132	16-15	1-00
12	180	16-00	1-10

MINIATURE AND EQUIPMENT

Prim. 240V with screen.

Sec. 1	Volts	Sec. 2	Milliamps	Ref. No.	Price £	Post £
2-0-5		200		258	1-23	0-10
0-6	0-6	500	330	264	1-30	0-10
0-6	0-6	1000	1000	212	1-38	0-22
0-0-5		100		13	1-23	0-10
0-0	0-0	330	330	253	1-43	0-10
0-0-5	0-0-5	500	500	207	1-75	0-22
0-0-10	0-0-10	1000	1000	206	2-20	0-36
0-15	0-15	200	200	298	1-24	0-10
20-0-20		30		341	1-28	0-10
0-20	0-20	150	150	237	1-80	0-20
0-15-20	0-15-20	500	500	205	2-47	0-38
0-2R	0-2R	300	300	314	1-72	0-22
0-0-0		3500	NO SCREEN	1117	3-00	0-40
20-12-0 12 20	0-15-20	700 (10V)		291	2-31	0-30
0-15-20	0-15-20	1000	1000	290	2-31	0-30
0-15-27	0-15-27	500	500	203	2-73	0-38
0-15-27	0-15-27	1000	1000	204	3-62	0-38

PLASTIC CASED SILICON BRIDGE RECTIFIERS

One Amp	Two Amp	Four Amp	Six Amp
30 P.I.V. 25p	50 P.I.V. 35p	100 P.I.V. 55p	50 P.I.V. 65p
100 P.I.V. 25p	100 P.I.V. 45p	200 P.I.V. 55p	100 P.I.V. 70p
200 P.I.V. 25p	200 P.I.V. 45p	400 P.I.V. 55p	200 P.I.V. 80p.
400 P.I.V. 30p	400 P.I.V. 50p	600 P.I.V. 75p	400 P.I.V. 90p.

ADD 10p P & P PER ORDER!

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POWER UNIT Type CC 12-05

Output switched 3, 4.5, 6, 7.5 and 12 volts at 500 mA D.C. Operates from 240 V mains. Suitable for: Radios, Tape Recorders, Record Players etc. Size 7.5 x 5.0 x 14.0cm. Price £3-85, Post 20p.



MINIATURE NEONS

5mm dia., 12mm length leads length approx. 20mm. Recommended ballast resistor 250K ohms for 240 Volt operation Price: Packet of 10 for 60p. Postage 10p.

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Bargain component parcels contain Resistors, Capacitors, Potentiometers, Knobs, Rotary and Slide Switches, JPs, Tag Strips, Drive Drums, Coil Formers, Wire, Grommets, Relays, Pulley Wheels, Magnets, Transistor Panels, etc. Save yourself £'s on these well selected parcels, 6lb net weight £1-00, p.p. 50p.

Brand New Wire-wound Resistors 1-7 watts, mostly Plessey GWS-1-3-5-7. Good selection. 100 for £1-00, p.p. 20p.

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

SPECIAL OFFER. Metallized Polyester Capacitors by Eric, Mullard, etc. Values include .01/160V, .01/250V, .015/160V, .022/160, .033/160, .047/160V, .068/160V, .1/160-250V, .22/160V, etc. This is a bargain not to be missed. 100 for £1-50, p.p. 20p.

Assorted Capacitors, Silver Mica, Tubular and Disc Ceramics, Polystyrene, Tremendously good selection. 300 for £1, p.p. 20p.

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CARTRIDGES. All with stylis and fittings. Replacements for ACOS GP/91 6C (Stereo-mono compatible series) at £1.20, GP93 Stereo at £1.60, GP94 Stereo Ceramic at £2.80. Actual GP67-2, Front switch at £1.10, for BSR 23H, X5H and X6M at £1.50 each. SK53H and SK53L at £1.80 each. TCSH at £1.80, TCS Stereo, 3 pins £2.80; charges 10p any quantity.

RECORDING TAPE. ALL FINEST BRITISH MYLAR 5" 600ft. 40p; 5" 900ft. 60p; 6" 1200ft. 84p. 7" 1800ft. £1.10. Charges for 5" and 6" 1-4 13p each. 5 and over, 23p the c. Charges for 7", 1-3 13p each, 4-5 35p the lot, 6 and over 40p the lot.

SPEAKERS 2", 3, 8 or 84 ohms (state which) 55p. Charges 10p each.

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BARRIAGES. Magnetic 2.5mm or 3.0mm plus (state which) 15p. CRYSTAL (3.6mm only) 35p (all 10p up to 6).

VIBRATORS. 7 pin SYNCL (12BR7 type) 75p. 4-pin NON-synch (121HD4) 45p (all 10p each).
Send SAE for free stylis, cartridge, accessories and components list. All prices include V.A.T.

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	0-61	ECL83	0-86	GY501	1-18	PL53	0-48	30C1/PCF80	
DY51	0-80	ECL88	0-84	K284	0-80	PL83	0-04	BZ84	0-54
DY86/7	0-41	EF80	0-42	PC86	0-95	PL84	0-69	30C15/	
DY80/2	0-48	FF83	0-88	FCR8	0-85	PL85	0-88	PCF800	1-01
EABCB80	1-04	EF85	0-82	PC884	0-84	PL86	0-84	30C17	1-00
EB01	0-84	EF88	1-16	PC885	0-80	PL87	0-84	30C18/	1-01
EB051	0-78	EF89	1-14	PC888	0-88	PL88	0-80	PCF865	1-01
EBF80	0-66	BF91	1-00	PC889	0-84	PY33	0-65	30F6/PCF818	1-03
EBF83	0-60	FF92	1-27	PCF89	0-80	PC81/800	0-49	30FL1/	
EBF89	0-68	EF95	1-47	PCF890	0-84	PC82	0-67	PCF800	0-80
EC86	0-73	EF183	0-63	PCF82	1-22	PC83	0-86	30FL2	0-80
EC88	0-78	EF184	0-63	PCF86	0-84	PC84	0-71	30FLJ1	1-19
EC89	0-68	EH90	0-85	PCF9200	1-00	PC85	0-49	30FL14	0-94
EC90	0-68	EL34	0-82	PCF201	1-00	PC86	0-88	30L1/PC83	
EC97	0-60	EL36	1-01	PCF801	0-84	U193	0-68		
EC98	0-47	EL31	0-85	PCF803	0-70	U199	0-68	30L15/	
EC99	0-44	EL84	0-87	PCF806	0-84	UABC80	0-80	PC805	1-04
EC983	0-47	EL84	0-87	PCF806	0-84	UABC80	0-80	30L17	0-87
EC984	0-48	EL86	0-82	PCL82	0-88	UBF89	0-65	30P4MR	1-29
EC985	0-71	EL81	0-80	PCL83	0-84	UOC86	0-69	30F12/	
EC988	0-84	EL90	0-76	PCL84	0-84	UOC81	1-19	PC801	1-01
EC989	0-84	EL90	0-76	PCL85	0-84	UOC82	0-72	30P19/	
EC990	0-84	EL90	0-76	PCL86/85	0-84	UOC83	0-72	PC802	0-89
EC991	0-84	EL90	0-76	PCL86/85	0-84	UOC84	0-80	30L17/	
EC992	0-84	EL90	0-76	PCL86/85	0-84	UOC85	0-82	PCL801	1-00
EC993	0-84	EL90	0-76	PCL86/85	0-84	UOC86	0-84	30FL13/	
EC994	0-84	EL90	0-76	PCL86/85	0-84	UOC87	0-82	PCL800	1-15
EC995	0-84	EL90	0-76	PCL86/85	0-84	UOC88	0-84	30FL14/	
EC996	0-84	EL90	0-76	PCL86/85	0-84	UOC89	0-84	PCL84	1-85
EC997	0-84	EL90	0-76	PCL86/85	0-84	UOC90	0-84	30FL13	1-18

TRANSISTORS-INTEGRATED CIRCUITS

All transistors, I.C.'s offered are new and branded. Manufactured by Mullard, Texas, RCA, Ferranti, Motorola, ITT, Fairchild, Lucas, etc. Quantity discounts on application. Send SAE for full lists.

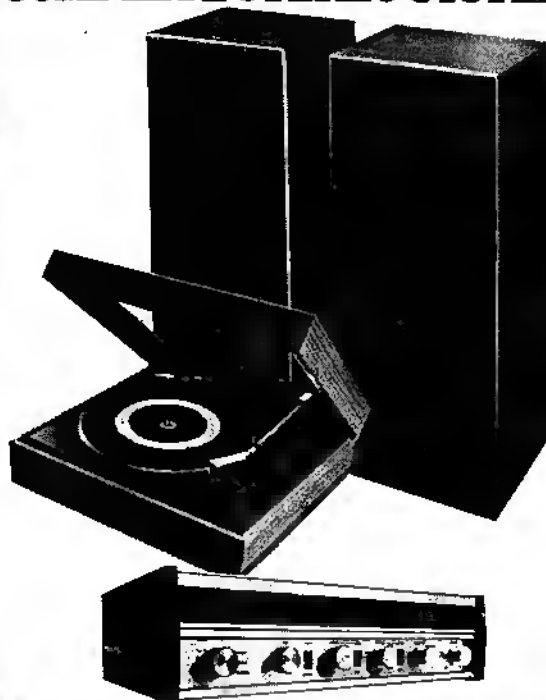
EXPRESS POSTAGE

5p for 600 Transistor. For each additional add 1p.

AA119	0-07	HD144	0-80	OA200	0-08	ZTX200	0-16	2N2994	0-20
AA213	0-10	HD131	0-48	OA209	0-10	ZTX501	0-15	2N2904A	0-25
AA215	0-10	BD152	0-60	OC16	1-00	ZTX503	0-16	2N2905	0-22
AC107	0-85	BF115	0-22	OC20	2-00	ZTX501	0-25	2N2905A	0-22
AC126	0-25	BF147	0-26	OC23	1-25	ZTX590	0-18	2N2906	0-20
AC127	0-26	BF173	0-28	OC25	0-45	1N314	0-08	2N2928	0-10
AC128	0-20	BF179	0-38	OC29	0-70	1N4001	0-05	2N2953	0-20
AC175	0-26	BF180	0-35	OC35	0-53	1N4002	0-07	2N2955	0-20
AC187	0-20	BF181	0-35	OC40	0-40	1N4003	0-08	2N2928	0-10
AC188	0-20	BF194	0-12	OC42	0-40	1N4004	0-08	2N2914	0-25
ACY21	0-20	BF195	0-12	OC44	0-18	1N4005	0-10	2N2815	0-89
ACY39	0-85	BF197	0-18	OC45	0-18	1N4006	0-12	2N2928	0-11
AD140	0-80	BF200	0-25	OC46	0-15	1N4007	0-12	2N2929	0-12
AD149	0-80	BF201	0-25	OC48	0-15	1N4009	0-05	2N2974	0-14
AD171	0-80	BF202	0-25	OC49	0-15	1N4148	0-08	2N2976	0-15
AD182	0-80	BF210	0-61	OC52	0-65	18021	0-07	2N2976	0-12
AF115	0-25	BF229	0-28	OC54	0-20	18023	0-20	2N2977	0-18
AF116	0-25	BF229	0-28	OC56	0-15	18023A	0-20	2N2978	0-07
AF117	0-20	BF230	0-20	OC58	0-15	18024	0-20	2N2979	0-10
AF186	0-40	BF232	0-20	OC62	0-25	180301	0-28	2N2979	0-11
AF239	0-44	BF210	0-15	OC78	0-80	1N4148	0-08	2N2976	0-15
AGY37	0-80	BY126	0-14	OC77	0-85	18021	0-07	2N2976	0-12
AGY38	0-85	BY127	0-15	OC81	0-28	18023	0-20	2N2977	0-18
AGY49	0-85	BY128	0-15	OC82	0-28	18024	0-20	2N2978	0-07
AD149	0-80	BY129	0-15	OC83	0-25	180301	0-28	2N2979	0-11
AD182	0-80	BY210	0-61	OC140	1-00	2N2959	0-18	2N2971	0-10
AF115	0-25	BF229	0-28	OC170	0-85	2N2977	0-18	2N2919	0-11
AF116	0-25	BF229	0-28	OC171	0-20	2N2978	0-10	2N2820	0-20
AF117	0-20	BF230	0-20	OC200	0-55	2N2906A	0-18	2N2823	0-20
AF186	0-40	BF232	0-20	OC201	1-35	2N1151	0-85	2N2903	0-16
AF239	0-44	BF210	0-15	OC202	0-60	2N1208	0-28	2N2904	0-20
AGY37	0-80	BY126	0-14	OC203	0-55	2N1302	0-18	2N2906	0-25
AGY38	0-85	BY127	0-15	OC204	0-55	2N1303	0-18	2N2906	0-22
AGY49	0-85	BY128	0-15	OC205	0-55	2N1806	0-22	2N2905	0-16
AD149	0-80	BY129	0-15	OC206	0-55	2N1806	0-22	2N2906	0-12
AD182	0-80	BY210	0-61	OC207	0-55	2N1806	0-22	2N2906	0-11
AF115	0-25	BF229	0-28	OC208	0-55	2N1806	0-22	2N2906	0-16
AF116	0-25	BF229	0-28	OC209	0-55	2N1806	0-22	2N2906	0-20
AF117	0-20	BF230	0-20	OC210	0-55	2N1806	0-22	2N2906	0-12
AF186	0-40	BF232	0-20	OC211	0-55	2N1806	0-22	2N2906	0-16
AF239	0-44	BF210	0-15	OC212	0-55	2N1806	0-22	2N2906	0-16
AGY37	0-80	BY126	0-14	OC213	0-55	2N1806	0-22	2N2906	0-12
AGY38	0-85	BY127	0-15	OC214	0-55	2N1806	0-22	2N2906	0-16
AGY49	0-85	BY128	0-15	OC215	0-55	2N1806	0-22	2N2906	0-16
AD149	0-80	BY129	0-15	OC216	0-55	2N1806	0-22	2N2906	0-16
AD182	0-80	BY210	0-61	OC217	0-55	2N1806	0-22	2N2906	0-16
AF115	0-25	BF229	0-28	OC218	0-55	2N1806	0-22	2N2906	0-16
AF116	0-25	BF229	0-28	OC219	0-55	2N1806	0-22	2N2906	0-16
AF117	0-20	BF230	0-20	OC220	0-55	2N1806	0-22	2N2906	0-16
AF186	0-40	BF232	0-20	OC221	0-55	2N1806	0-22	2N2906	0-16
AF239	0-44	BF210	0-15	OC222	0-55	2N1806	0-22	2N2906	0-16
AGY37	0-80	BY126	0-14	OC223	0-55	2N1806	0-22	2N2906	0-16
AGY38	0-85	BY127	0-15	OC224	0-55	2N1806	0-22	2N2906	0-16
AGY49	0-85	BY128	0-15	OC225	0-55	2N1806	0-22	2N2906	0-16
AD149	0-80	BY129	0-15	OC226	0-55	2N1806	0-22	2N2906	0-16
AD182	0-80	BY210	0-61	OC227	0-55	2N1806	0-22	2N2906	0-16
AF115	0-25	BF229	0-28	OC228	0-55	2N1806	0-22	2N2906	0-16
AF116	0-25	BF229	0-28	OC229	0-55	2N1806	0-22	2N2906	0-16
AF117	0-20	BF230	0-20	OC230	0-55	2N1806	0-22	2N2906	0-16
AF186	0-40	BF232	0-20	OC231	0-55	2N1806	0-22	2N2906	0-16
AF239	0-44	BF210	0-15	OC232	0-55	2N1806	0-22	2N2906	0-16
AGY37	0-80	BY126	0-14	OC233	0-55	2N1806	0-22	2N2906	0-16
AGY38	0-85	BY127	0-15	OC234	0-55	2N1806	0-22	2N2906	0-16
AGY49	0-85	BY128	0-15	OC235	0-55	2N1806	0-22	2N2906	0-16
AD149	0-80	BY129	0-15	OC236	0-55	2N1806	0-22	2N2906	0-16
AD182	0-80	BY210	0-61	OC237	0-55	2N1806	0-22	2N2906	0-16
AF115	0-25	BF229	0-28	OC238	0-55	2N1806	0-22	2N2906	0-16
AF116	0-25	BF229	0-28	OC239	0-55	2N1806	0-22	2N2906	0-16
AF117	0-20	BF230	0-20	OC240	0-55	2N1806	0-22	2N2906	0-16
AF186	0-40	BF232	0-20	OC241	0-55	2N1806	0-22	2N2906	0-16
AF239	0-44	BF210	0-15	OC242	0-55	2N1806	0-22	2N2906	0-16
AGY37	0-80	BY126	0-14	OC243	0-55	2N1806	0-22	2N2906	0-16
AGY38	0-85	BY127	0-15	OC244	0-55	2N1806	0-22	2N2906	0-16
AGY49	0-85	BY128	0-15	OC245	0-55	2N1806	0-22	2N2906	0-16
AD149	0-80	BY129	0-15	OC246	0-55	2N1806	0-22	2N2906	0-16
AD182	0-80	BY210	0-61	OC247	0-55	2N1806	0-22	2N2906	0-16
AF115	0-25	BF229	0-28	OC248	0-55	2N1806	0-22	2N2906	0-16
AF116	0-25	BF229	0-28	OC249	0-55	2N1806	0-22	2N2906	0-16
AF117	0-20	BF230	0-20	OC250	0-55	2N1806	0-22	2N2906	0-16
AF186	0-40	BF232	0-20	OC251	0-55	2N1806	0-22	2N2906	0-16
AF239	0-44	BF210	0-15	OC252	0-55	2N1806	0-22	2N2906	0-16
AGY37	0-80	BY126	0-14	OC253	0-55	2N1806	0-22	2N2906	0-16
AGY38	0-85	BY127	0-15	OC254	0-55	2N1806	0-22	2N2906	0-16
AGY49	0-85	BY128	0-15	OC255	0-55	2N1806	0-22	2N2906	0-16
AD149	0-80	BY129	0-15	OC256	0-55	2N1806	0-22	2N2906	0-16
AD182	0-80	BY210	0-61	OC257	0-55	2N1806	0-22	2N2906	0-16
AF115	0-25	BF229	0-28	OC258	0-55	2N1806	0-22	2N2906	0-16
AF116	0-25	BF229	0-28	OC259	0-55	2N1806	0-22	2N2906	0-16
AF117	0-20	BF230	0-20	OC260	0-55	2N1806	0-22	2N2906	0-16
AF186	0-40	BF232	0-20	OC261	0-55	2N1806	0-22	2N2906	0-16
AF239	0-44	BF210	0-15	OC262	0-55	2N1806	0-22	2N2906	0-16
AGY37	0-80	BY126	0-14	OC263	0-55	2N1806	0-22	2N2906	0-16

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.I. (for ceramic cartridges) 150mV into 3 Meg. P.U.I. (for magnetic cartridges) 4mV @ 1kHz into 47K, equalized within ± 1dB R.I.A.A. Radio 150mV into 220K. (Sensitivities given at full power). Tape out facilities: headphone socket, power out 250mW per channel. *Tone controls and filter characteristics:* Bass: +12dB to -12dB @ 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 1/2" x 9" x 3 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 1/2" x 10 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. 27" x 13" x 11 1/2"
 Finished in teak veneer. Drive units 13" x 8" bass driver, and two 3" (approx.) tweeters. 20 watts R.M.S., 6 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
total:	£59.20

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

PRICES: SYSTEM 2

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

Available complete for only: **£69-00**
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STEREO 21 * QUALITY SOUND FOR LESS THAN £20-00

Stereo 21, easy to assemble audio system kit. No soldering required.

The unit is finished in white P.V.C. and the acrylic top presents an unusually interesting variation on the modern deck plinth.

Includes: - BSR 3 speed deck, automatic, manual facilities together with stereo cartridge.

Two speakers with cabinets.

Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.

Specifications: For the technically minded: -

Input sensitivity 500mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel.

Output impedance 8-15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs - radio, tape, etc., and outputs for taping discs. Overall dimensions. Speakers approx. 15 1/2" x 8" x 4". Complete deck and cover in closed position approx. 15 1/2" x 12" x 6".

Complete only **£19.55 + £1.60 p & p**. Extras if required. Optional Diamond Styl **£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

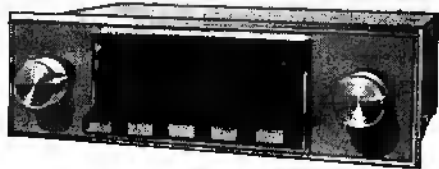
For the man who wants to design his own stereo - here's your chance to start, with Unisound - pre-amp, power amplifier and control panel. No soldering - just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic 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 1/4" 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 3" x 5" (approx.) mid range unit incorporating parabolic tweeter and crossover components. Circuit Diagram Technical Specification:

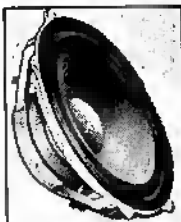
Base Unit
Flex density-100 K, speech coil-1 1/2", Cone. Triple laminated paper with P.V.C. surround.
Mid Range Unit
Flex density-33K, speech coil-1" with parabolic tweeter.

Power Handling
10 watts R.M.S., impedance - 8 ohms, frequency response - 20 Hz to 18,000 Hz.

OUR PRICE

£6.60. Complete

+ 90p p & p.



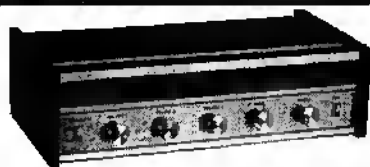
15" 14A/780 BASS UNIT

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. Resistance 10 Ohm. Flux density 340,000 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 stand 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 - 8mV into 100K, 240 volt operation.

Turntables capacity - 7", 10" or 12" records.

Rumble, wow and flutter -

Rumble Better than -35dB. Wow Better than 0.2%.

Flutter Better than 0.06% (Gaumont kalea meter).

Finish - Satin black mainplate with black turntable

met 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 3/4" 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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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 mistra 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. ● Ignition 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

Heady 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!

PRICES

DIY Kit only £10.93 incl. VAT and P & P
Heady Built Unit £13.86 incl. VAT and P & P
(Both to fit all cars with coil distributor ignition up to 5 cylinders)

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2' x 12" Cabinet



4' x 12" Cabinet



Disco Console (includes lid not shown)
Takes two slaves

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

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

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

PRICE & TYPE LIST

Type	Size	Price manufactured	Kit price
2 x 12" (illustrated above)	36" x 18" x 13" x 3/4"	£19.50	£12.50
4 x 12" (illustrated above)	31" x 31" x 13" x 3/4"	£24.50	£17.50
4 x 12" P.A. Column	48" x 27" x 13" x 3/4"	£30.00	£21.50
1 x 18"	31" x 31" x 13" x 3/4"	£24.50	£17.50
1 x 15" with two top horn cutouts	36" x 20" x 13" x 3/4"	£21.00	£13.50
Mini Disco (state deck cutout BSR, GARRARD etc.)	33" x 20" x 10" x 1/2"	£20.00	£13.00
Maxi Disco (illustrated) (state deck cutout BSR, GARRARD etc.)	42" x 20" x 10" x 1/2"	£25.00	£18.50

Please ask for quotation on any other type or size of cabinet you may require.
ALL OUR PRICES INCLUDE VAT AND UK DELIVERY

BYWOOD CHANTICLEER

- * READ: TIME AND ALARM
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- * TEN MINUTE 'SNOOZE' FEATURE
- * BRIGHT, CLEAR DISPLAY
- * NO MOVING PARTS
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The heart of the CHANTICLEER is a tiny electronic package containing thousands of transistors which divide the 50 cycles/second mains frequency into precise time units. The clock "movement" in fact has no moving parts to wear out or tick or tock or hum or click.

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NO MOVING PARTS**

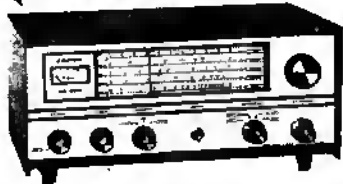


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Has a.m. or p.m. setting with alarm on/off indicator. A gentle electronic 'beep' tone with special snooze feature that resets the alarm for ten-minute intervals. The snooze is activated by simply tilting the clock forward and then releasing. Upon cancelling, the alarm can be immediately reset for the same time next day.

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The CODAR CR70A is an outstanding general coverage communication receiver, ideal for the keen S.W.L.

It tunes from 540 metres medium through to 10 metres with no gaps. Covers shipping, coastguard and distress frequencies, all six amateur bands 160-10 metres, international broadcast, Met. stations etc. etc. giving world-wide reception. Exclusive features include Air-spaced CODAR-COIL HI-"Q" Aerial input, illuminated Meter and Slide Rule Scale, Two Speed vernier tuning, Switched B.F.O. for CW/SSB signals. Separate output for Tape recorder.

Ready to plug in to 200/240 volts A.C. it only needs your aerial and a 2/3 ohm loudspeaker to bring the world to your finger tips. 12 months full guarantee.

★ **IMPORTANT NOTE**

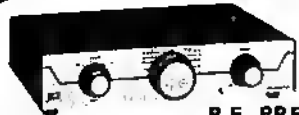
This fine receiver is not a mass produced item, but each set is hand built to your order, individually checked and air tested. Please allow for this when ordering—your delivery date will be shown on your receipt, sent by return.



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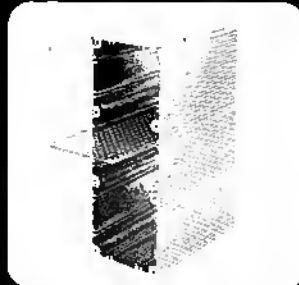
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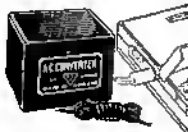
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C	1/2	4-7-10M	1-3	1-1	0-9 nett
C	3/4	4-7-10M	1-5	1-2	0-97 nett
C	1	4-7-10M	3-2	2-5	1-02 nett
MO	1/2	10-1M	4	3-3	2-3 nett
WW	1	0-22-3-9Ω	11	10	8 nett
WW	3	1-10K	9	8	6 nett
WW	7	1-10K	11	10	8 nett

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C = carbon film, high stability, low noise.
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1-0	—	—	—	—	—	—	3p	8p
2-2	—	—	—	—	15p	—	3p	8p
4-7	—	—	—	11p	—	3p	8p	8p
10	—	—	—	—	3p	8p	8p	8p
22	—	—	8p	—	8p	8p	10p	10p
47	8p	—	8p	—	8p	8p	10p	10p
100	8p	8p	8p	8p	8p	10p	12p	13p
220	8p	8p	8p	10p	10p	11p	17p	20p
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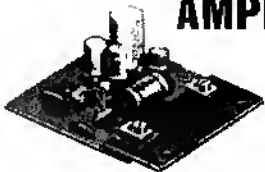
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Parameter	Conditions	Performance
HARMONIC DISTORTION	$P_o = 3 \text{ WATTS } f = 1\text{KHz}$	0-25%
LOAD IMPEDANCE	—	8-16 Ω
INPUT IMPEDANCE	$f = 1\text{KHz}$	100 k Ω
FREQUENCY RESPONSE $\pm 3\text{dB}$	$P_o = 2 \text{ WATTS}$	50 Hz - 20KHz
SENSITIVITY for RATED O/P	$V_s = 28\text{V}, R_L = 8 \Omega f = 1\text{KHz}$	75mV R.M.S.
DIMENSIONS	—	3" x 2 1/2" x 1"

The above table relates to the AL10, AL20 and AL30 modules. The following table outlines the differences in their working conditions.

Parameter	AL10	AL20	AL30
Maximum Supply Voltage	25	30	30
Power output for 2% T.H.D. (RL = 8 Ω f = 1 KHz)	3 watts R.M.S. Min.	5 watts R.M.S. Min.	10 watts R.M.S. Min.

AUDIO AMPLIFIER MODULES
 AL 10. 3 watts R.M.S. £2.50
 AL 20. 5 watts R.M.S. £2.55
 AL 30. 10 watts R.M.S. £2.50

PRE-AMPLIFIERS

PA 12. (Use with AL10, AL20 & AL30) £4.25
 PA 100. (Use with AL60) £18.15

TRANSFORMERS

T461 (Use with AL10) £1.60 P & P 15p
 T838 (Use with AL20, AL30) £2.30 P & P 15p
 BMT80 (Use with AL60) £2.75 P & P 25p

PA 12. PRE-AMPLIFIER SPECIFICATION

The PA 12 pre-amplifier has been designed to match into most budget stereo systems. It is compatible with the AL 10, AL 20 and AL 30 audio power amplifiers and it can be supplied from their associated power supplies. There are two stereo inputs, one has been designed for use with Ceramic cartridges while the auxiliary input will suit most Magnetic cartridges. Full details are given in the specification table. The four controls are, from left to right: Volume and on/off switch, balance, bass and treble. Size 102mm x 84mm x 35mm.

Frequency response-- 20Hz - 50KHz ($\pm 3\text{dB}$)
 Bass control-- $\pm 32\text{dB}$ at 60Hz
 Treble control-- $\pm 14\text{dB}$ at 14KHz
 *Input 1. Impedance 1 Meg. ohm
 Sensitivity 500mV
 †Input 2. Impedance 30 K ohms
 Sensitivity 4mV

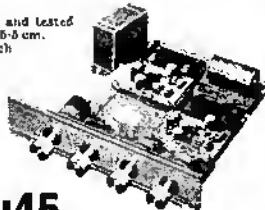
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The STEREO 20

The 'Stereo 20' amplifier is mounted, ready wired and tested on a one-piece chassis measuring 20 cm x 14 cm x 5.5 cm. This compact unit comes complete with on/off switch, volume control, balance, bass and treble controls, Transformer, Power supply and Power amps. Attractively printed front panel and matching control knobs. The 'Stereo 20' has been designed to fit into most turntable plinths without interfering with the mechanism or alternatively, into a separate cabinet. Output power, 20w peak. Input 1 (Cer.) 300mV into 1M. Freq. res. 20Hz-25KHz. Input 2 (Aux.) 4mV into 30K. Harmonic distortion. Bass control $\pm 32\text{dB}$ at 60Hz typically 0-25% at 1 watt. Treble con. $\pm 14\text{dB}$ at 14KHz.



£14.45

TC20 TEAK VENEERED CABINET

For Stereo 20 (front board omitted) size 10 1/2" x 8 1/2" x 3", £3.95, plus 30p postage

SHP80 STEREO HEADPHONES

4-16 ohms impedance. Frequency response 20 to 20,000Hz Stereo/mono switch and volume control £4.95

NOW WE GIVE YOU 50w PEAK (25w R.M.S.) PLUS THERMAL PROTECTION! The NEW AL60 Hi-Fi Audio Amplifier FOR ONLY £4.25

- Max Heat Sink temp. 90°C.
- Frequency Response 20Hz to 100KHz
- Distortion better than 0.1% at 0-1KHz
- Supply voltage 15-50 volts

- Thermal Feedback
- Latest Design Improvements
- Load—3, 4, 8 or 16 ohms
- Signal to noise ratio 80dB
- Overall size 63mm x 105mm x 13mm

Especially designed to a strict specification. Only the finest components have been used and the latest solid state circuitry incorporated in this powerful little amplifier which should satisfy the most critical A.F. enthusiast.



STABILISED POWER MODULE SPM80

SPM80 is especially designed to power 2 of the AL60 Amplifiers, up to 15 watt (r.m.s.) per channel simultaneously. This module embodies the latest components and circuit techniques incorporating complete short circuit protection. With the addition of the Mains Transformer BMT80, this unit will provide outputs of up to 1-3 amps at 35 volts. Size: 63mm x 105mm x 30mm. These units enable you to build Audio Systems of the highest quality at a hitherto unobtainable price. Also ideal for many other applications including—Disc Systems, Public Address Intercom Units, etc. Handbook available 10p PRICE £3.25

TRANSFORMER BMT80 £2-15 p. & p. 28p

STEREO PRE-AMPLIFIER TYPE PA100

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



SPECIFICATION

Frequency Response 20Hz - 20KHz $\pm 3\text{dB}$ better than 0.1%
 Harmonic Distortion 3-25 mV into 50K Ω
 Inputs: 1. Tape Head 75 mV into 50K Ω
 2. Radio, Tuner 3 mV into 50K Ω
 3. Magnetic P.U. 3 mV into 50K Ω
 All input voltages are for an output of 250mV. Tape and P.U. inputs regulated to RIAA curve within $\pm 1\text{dB}$. from 20Hz to 20KHz.
 Bass Control $\pm 15\text{dB}$ at 20Hz
 Treble Control $\pm 15\text{dB}$ at 20 KHz
 Filters: Rumble (High Pass) 100Hz
 Scratch (Low Pass) 8KHz
 Signal/Noise Ratio better than - 65dB
 † 28V
 † 35 volts at 20mA
 Supply 252mm x 82mm x 35mm
 Dimensions ONLY £14.25

MK 60 AUDIO KIT

Comprising: 2 x AL60, 1 x SPM80, 1 x BMT80, 1 x PA 100, 1 front panel, 1 kit of parts to include on-off switch, neon indicator, stereo headphone sockets plus instruction booklet. Complete Price: £28.75 plus 30p postage

TEAK 60 AUDIO KIT

Comprising: Teak veneered cabinet size 10 1/2" x 11 1/2" x 3 1/2", other parts include aluminium chassis, heatsink and front panel bracket, plus back panel and appropriate sockets etc. Kit price: £29.50 plus 30p postage

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POLLUTION

WHEN Samuel Morse first pressed his key and sent the letter 'A' (dit-dah) he heralded the start of communication by a method now universally referred to as the Morse Code.

In the days of the spark transmitter and coherer receiver radio communication was fraught with many problems. Atmospheric conditions, electrical storms and static were about the only phenomena that inhibited etheric communication. The spark transmitter with its familiar "buzz" spreading over a wide band of frequencies certainly made life easy on the receiving side—no tuning was required—it was possible to receive many stations all at the same time.

With the advancement of radio communication techniques and the introduction of the superheterodyne receiver, the art of communication by *wireless waves* has become commonplace. Our readers who monitor the many wavebands for one reason or the other, surely have cursed when reception has been all but obliterated by man-made electrical interference of one kind or the other. Interference of this nature is widespread and is on the increase. The introduction of a multitude of devices that produce electrical arcing or sparking either when switches or electric motors are operated all add to the levels of electronic pollution. The short wavebands are polluted with a proliferation of garbling jammers running RF output powers in the megawatt region. The orbital scrapyard surrounding Mother Earth is rapidly filling with devices emitting weird noises and interference to our radio telescopes is on the increase.

We were told that VHF FM broadcasting would be the answer to the medium wave interference problem. We now find that the VHF FM band is a truly excellent medium for the reception of every piece of electrical interference in the neighbourhood. Thermostats, boilerstats on gas-fired domestic systems, fridges, washing machines, hairdryers, sewing machines—the list is endless. One *device* that causes interference over a wide band (from long waves to the 10m band and beyond) is the modern TV receiver—especially the more recent models that incorporate thyristor switching in the line timebase output circuit, which is now a most virulent source of "electronic pollution". This also applies to domestic thyristor lighting dimmers and thyristor/triac psychedelic lighting displays for the home and discotheque. It would appear that we are really up against it. One step forward in one field of technology inevitably results in a backward step for the listener wherever he may be! We all contribute in one way or the other to the levels of "electronic pollution".

The Post Office will investigate certain forms of interference—a pamphlet* is available at most post offices—but before we all deluge the P.O. with unnecessary moans, read the leaflet carefully and ascertain whether your "electronic pollution" problems are covered by existing legislation.

You never know—you may be the offender yourself!

LIONEL E. HOWES—Editor.

* Good Radio and Television Reception—Form T113G.

NEWS...

45W UHF Transistor

LATEST in the series of UHF power transistors from Motorola is the MRF621. Designed for 12.5V operation between 406 and 512MHz, the MRF621 forms an ideal basis for power amplifiers in commercial/industrial u.h.f. mobile radio equipment. This advanced device will provide 45W Pout at 470MHz with a 12.5V collector supply. At rated power output minimum power gain is 4.8dB with a collector efficiency of 55% minimum. No degradation in output power occurs when working into a 20:1 VSWR at any phase angle.

Sonab wins Design Award

FOUR products in the current range of Sonab hifi equipment have received Design Awards for 1974 from the Swedish Society of Industrial Designers (SID).

The award-winning Sonab products are the R4000 tuner-amplifier; the 0A12 pair of loudspeakers; the 55S turntable and H20 headphones—all designed for Sonab by Lars Lallerstedt.

Scottish stereo

FROM the start of programmes last October, some of Radio Scotland's music and light entertainment programmes and certain Radio 4 items were being broadcast in stereo from the Kirk o'Shotts v.h.f. transmitter. Radio 2 and Radio 3 were already in stereo.

The stereo signals are re-broadcast by the relay stations at Ashkirk (serving much of the Border country), Ayr, Campbeltown, Forfar (covering most of Angus), Lochgilphead, Perth, Pitlochry, Millburn Muir (Vale of Leven), Rosneath (Gareloch) and Toward. Some of these stations are a long way from Kirk o'Shotts and the quality and consistency of the re-broadcast stereo signals will not be known for some time, after tests have been carried out.

Canadian tower

A £1.25 million contract to equip the new third-of-a-mile CN observation and communications tower in Toronto, Canada, with a complete antenna complex for all f.m. and TV broadcasting services has been won by the Telecommunications Division of EMI Ltd, Hayes, Middlesex.

When completed, the 1805 foot high CN tower in Toronto will be the tallest self-supporting structure in the world. The antenna system surmounting the main concrete tower will be carried on a 220 ton needle-shaped steel structure over 300 feet tall.

Transmissions from this height give major benefits in range and the elimination of "ghosting" but, at over 1500 feet, the arduous climatic conditions found normally even at ground level during the Canadian winter are aggravated by extremely severe icing, snow and high winds. For this reason, an important part of the contract comprised the provision of a glass reinforced plastic radome. This will be designed and constructed in Britain by Hunting Industrial Plastics Ltd, and erected to protect the mast structure during the winter.

The complete installation to be provided by EMI comprises a formation of four arrays arranged as follows:—Channel 5, Canadian Broadcasting Corporation. Intended for colour TV transmissions, this is a single channel, directional v.h.f. antenna having a gain of 8. The array is 55 feet tall and is at a mean height of 1,572 feet. Channel 9, CFTO-TV Ltd. Also intended for colour TV transmissions this second directional v.h.f. is similar to that for channel 5, but has a gain of 11 radiated from a 49 foot high array located at a mean height of 1,635 feet. Channel 19 and 25, CBC and Educational. An omnidirectional u.h.f. array for colour TV. It is arranged as a dual antenna, with one channel allocated to CBC and the second to the educational transmissions. Positioned on the mast at a mean height of 1,695

feet, this array is 60 feet tall and has a gain of 31. FM Transmissions. The master f.m. antenna occupies the lowest section of the mast, and has a mean height of 1,513 feet. Measuring 60 feet high by 26 feet diameter, this antenna is being manufactured under licence from Alford Manufacturing Co of the USA, and is based upon those supplied for the Empire State Building and Hancock Tower, Chicago.

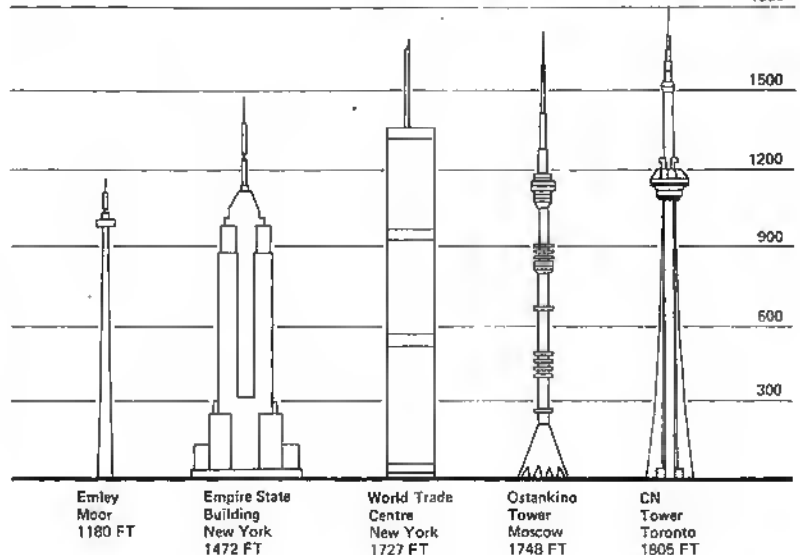
The array comprises a high-power circularly polarised antenna, and enables the simultaneous transmission of eleven f.m. sound broadcasts. Although not yet allocated, provision is also being made for two further arrays to accommodate channels 45, 51 and 57 and channel 79. These will comprise a 50 foot long, three channel u.h.f. array for channels 45, 51 and 57, with a 25 foot long by 5 foot diameter omnidirectional type u.h.f. array for channel 79.

On the f.m. array cross dipoles are employed, whilst channels 5 and 9 are equipped with conventional dipoles. Additionally, the channel 19 and 25 array is provided with Emislot panels, and provision is made for these panels on the two remaining arrays.

The tower (pictured Aug. 15).
Below: the tower compared with other buildings.



1800



ELECTRONIC HOME TELEPHONE EXCHANGE

J. Thornton Lawrence T. Eng (C.E.I.)

SEVERAL mail order firms dealing in surplus electronic equipment are offering for sale, at very reasonable prices, ex G.P.O. telephones complete with dial and bell. Two of these telephones can be connected to provide ringing and speech communication between, for example, workshop and house, bedroom and downstairs, office and shop, etc. A simplified circuit of the telephone is shown in Fig. 1 and the method of connection in Fig. 2.

and heavy current through the LF choke. On releasing the dial, the "normally closed" dial contacts open and close ten times producing a substantial pulsing voltage across the line.

This voltage is passed through the bell series capacitor of the called telephone and rings the bell. When the dial comes to rest the N.O. contacts open and current again flows through the transmitter. The called subscriber lifts his handset and his transmitter is also energised.

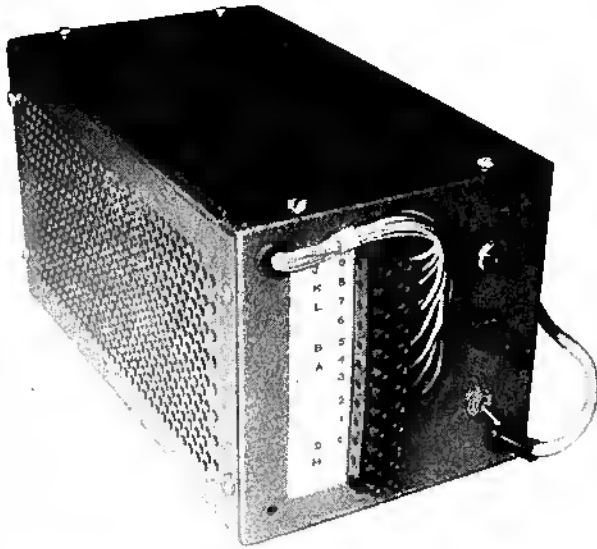
During speech, variations in transmitter resistance will cause speech voltages to be developed across the line and incoming speech voltages will operate the receiver (earphone). The LF choke provides a direct current path to energise the transmitters whilst presenting a high AC impedance to the speech signals.

The dial pulsing rate is different from the frequency normally used for ringing the bell and some improvement in ringing can be made by suitable adjustment to the bells. To do this the base of the telephone should be removed. The bell fixing hole is made off-centre and loosening the fixing screw will allow the bell to be rotated, then tightened, to give the best sounding ring.

After using a simple two telephone system for some time the need was felt for a system incorporating several extensions and the automatic telephone exchange, which is the subject of this article, was developed. In the past, home telephone exchanges have used Uniselectors for calling and speech routing, but as the Unselector is very noisy in operation an alternative system was designed using solid state devices and reed relays. The reed relays are used for ringing purposes and the diodes used for speech routing.

TWO TELEPHONE OPERATION

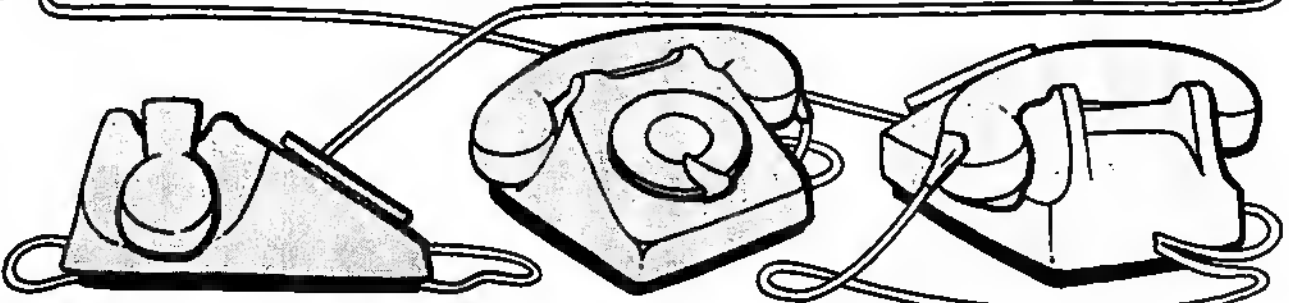
The two telephones are connected in parallel and fed with direct current through an LF choke as shown in Fig. 2. When calling, the caller lifts his handset and the rest contacts close thus energising



his transmitter (carbon microphone) as shown in Fig. 1. He then dials "0" and the "normally open" dial contacts close causing a short circuit across the line

SPEECH ROUTING

The basic arrangement of diodes for speech-routing is shown in Fig. 3. With the receivers at rest, the telephones draw no current and both diodes are non-conducting. If the handset is lifted at Subscriber 1, D13 will conduct and D14 will remain non-



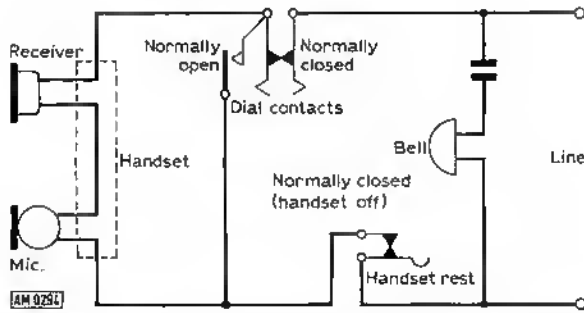


Fig. 1: With the handset lifted the contacts in a simple dial telephone circuit are in the position shown here.

★ components list

Resistors

R1 100Ω	R5 330Ω	R9 4.7kΩ
R2 330Ω	R6 330Ω	R10 4.7kΩ
R3 2.2kΩ	R7 1kΩ	R11 3.3kΩ
R4 2.2kΩ	R8 1kΩ	R12-20 47kΩ

All ½ watt 5%
 R21 500Ω 2W WW
 R22 125Ω 5W WW
 VR1 50kΩ miniature preset, horizontal mounting

Capacitors

C1 50μF 6V	C6 0.1μF
C2 10μF 6V	C7 0.1μF
C3 200μF 6V	C8 4000μF 40V
C4 0.01μF	C9 8μF 250V
C5 100μF 6V	

Semiconductors

Tr1 BC184B	Tr2 BC214B	Tr3 BC184B
D1-22 1S44 (or 1N914)		IC1 7413
D23 VR475F (4.75V zener)		IC2 7490
D24 1S3007 (7V zener)		IC3 74121
D25 10DB1A (1A bridge rec.)		IC4 74145

Miscellaneous

F1 fuse 250mA anti-surge. F2 500mA fuse, F3 500mA fuse. L1 LF choke 3H 350Ω (see text). LP1 Mains neon indicator, RLA to RLJ Reed relays 700Ω (Doram 348-970). S1 DPST toggle. T1 transformer mains/16.3V (Doram 196-218). T2 transformer mains/20 + 20V (Doram 196-319). Case 5" x 5" x 8" long (Lektrokrit, Home Radio) or similar.

The PCB can be obtained from J. Stuart, 40 Aberconway Road, Prestatyn, Clwyd, LL19 9HL for £2 inclusive of post and packing.

conducting because of the associated resistor R13 maintaining line 2 at the battery supply voltage.

If Subscriber 2 handset is now lifted D14 will now also conduct and speech communication can take place through D13 and D14, the LF choke being the common impedance as before.

RINGING SYSTEM

The simplified arrangement for ringing is shown in Fig. 4. When the handset is lifted at Sub. 1, D13 conducts as before and as the voltage on the line is greater than +7 volts D12 remains non-conductive. When the dial on Sub. 1 is operated, the line voltage falls to zero and D12 conducts and passes dialling pulses into the counting and ringing circuit.

If the caller, Sub. 1, has dialled "2," the counting and ringing circuit will energise reed relay Sub. 2 and cause a 60 volt peak-peak AC signal to be connected to line 2 thus ringing the bell at Sub. 2. As soon as the handset at Sub. 2 is lifted, D14 (omitted from Fig. 4 for clarity) conducts, allowing speech communication as described previously. A separate reed relay is required for each subscriber.

CIRCUIT OPERATION.

The full circuit is given in Fig. 5 and Fig. 6. The circuit operation begins when the caller lifts his handset. Assume that, as before, the caller is Sub. 1. When the handset is lifted, current will flow from the +20 volt supply through L1, D13 and Sub. 1 telephone to the common line, Fig. 6. This telephone is now energised and the voltage across the line is approximately 8 to 16 volts, depending on the total resistance of the telephone.

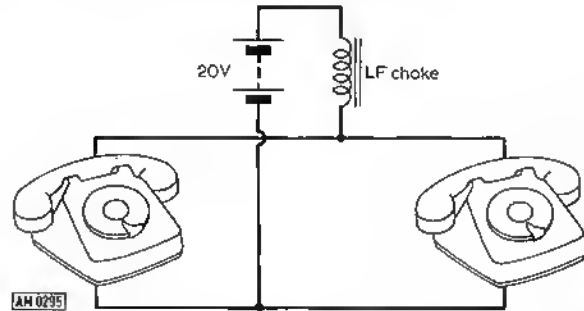


Fig. 2: Basic connections for a two telephone system.

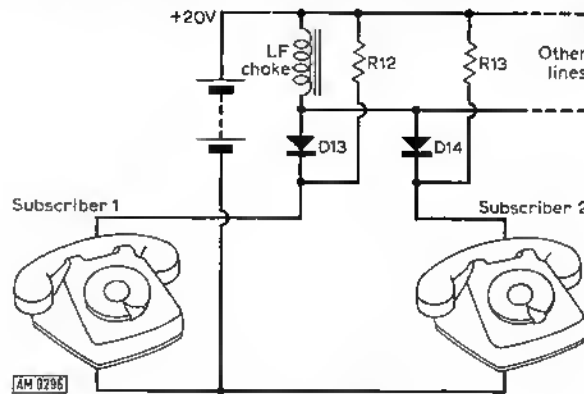


Fig. 3: Simplified speech switching circuit.

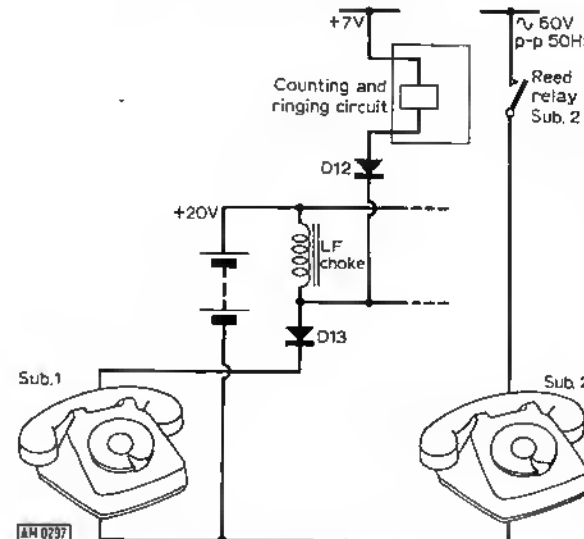


Fig. 4: Ringing circuit in a simple form.

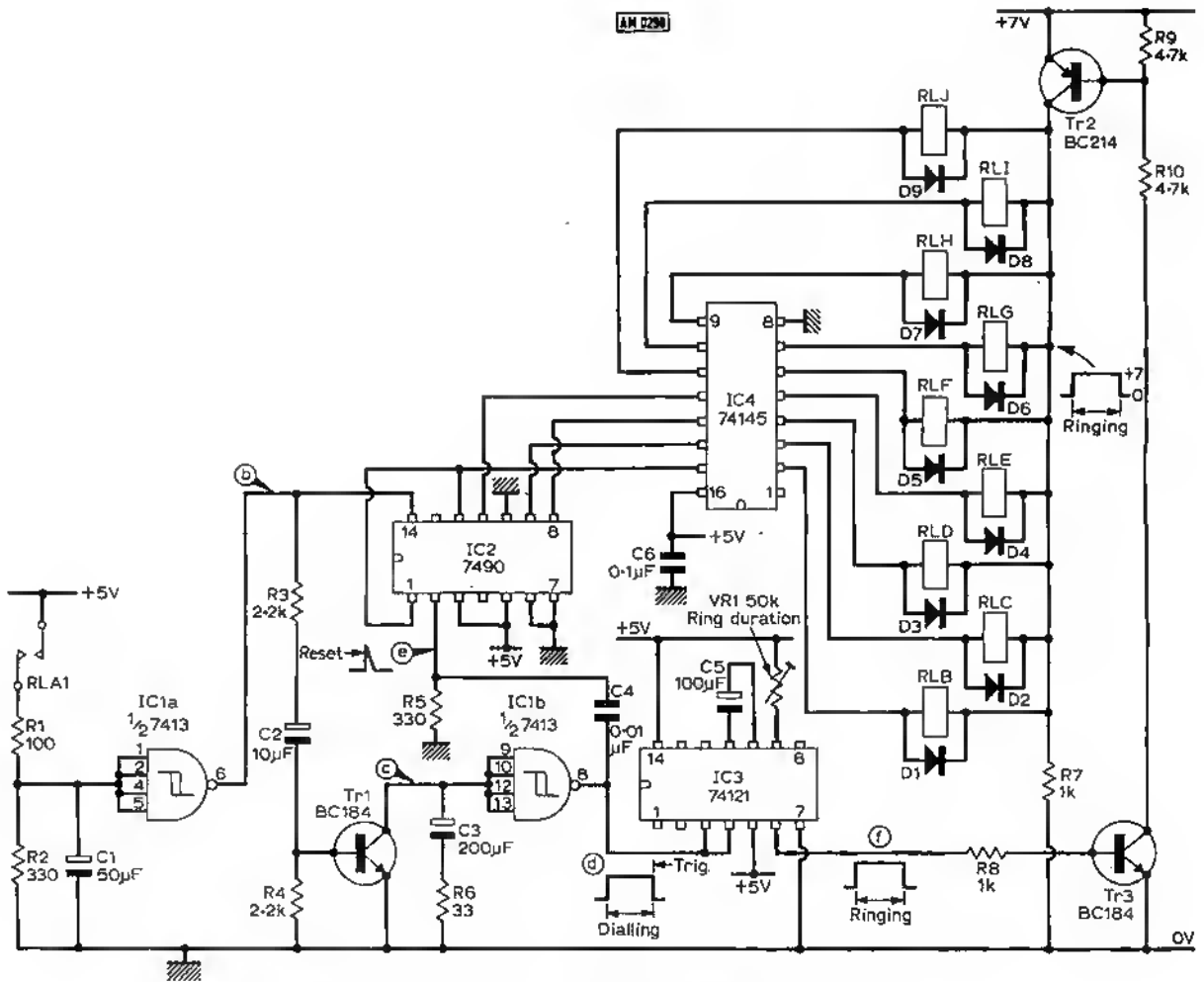


Fig. 5: Counting and ringing circuit in the exchange described in the text.

Assume that Sub. 1 dials Sub. 3. On the backward rotation of the dial, the line is shorted by the dialling contacts and the voltage across the line is zero. Current now flows through relay A, D12 and D13, thus energising relay A (Fig. 6). When Sub. 1 releases the dial it returns to rest and in so doing contacts open and short the line three times, finally coming to rest with the telephone energised as previously. The waveforms are shown in Fig. 8.

The contacts of relay A connect R1 to the +5 volt supply, Fig. 5, and a logic 1 level is applied to the Schmitt trigger gate IC1a. A Schmitt trigger is used in this position so that the input signal can be smoothed by R1, C1 to eliminate spurious signals caused by contact bounce and yet provide a fast-switching clean output suitable for driving the logic circuits. The output of IC1a, containing the dialled information now follows two routes, to Tr1 and IC2.

In order to detect the completion of a group of dialling pulses and to produce a signal at the end of this group it is necessary to have an electronic circuit equivalent to a "slugged" relay. This is formed by Tr1 and IC1b. The first of the dialling pulses turns Tr1 hard on, discharging C3 and causing the inputs of IC1b to be at logic 0 and thus the output of IC1b to be at logic 1. This positive transition is differentiated by C4 and R5 to produce a positive pulse to logic 1 which resets the 7490 decade counter to zero.

Between each dialling pulse C3 begins to recharge from the input current of IC1b but does not reach logic 1 level because the next dialling pulse discharges it again. However, after the last dialling pulse, the input to IC1b rises to logic 1 and the output flips to logic 0. The other route for the dialling pulses is direct to the input of the 7490 decade counter, IC2. The counter counts on the negative-going edge of each dialling pulse and in our example would count 3 (binary 0011).

It will be noted from the waveforms that a negative step (to logic 0) occurs when the dial is first rotated and this is counted by the decade counter, but as the counter is reset to zero on the leading edge of the first true dialling pulse, it does not cause a dialling error.

The binary coded decimal output from IC2 is fed directly to the 74145 decoder-driver, IC4, where, in our example, output 3 would be clamped to the 0v line and all other outputs would be non-conducting.

Returning now to IC1b, at the end of a group of dialling pulses, the output flips from logic 1 to logic 0. This negative transition triggers the 74121 monostable IC3, which produces a logic 1 output pulse having a duration set by VR1 (1.5 seconds approx.). The positive pulse from IC3 turns on Tr3 and Tr2, thus energising only relay D as this is connected to the 0v line through the No. 3 output of IC4.

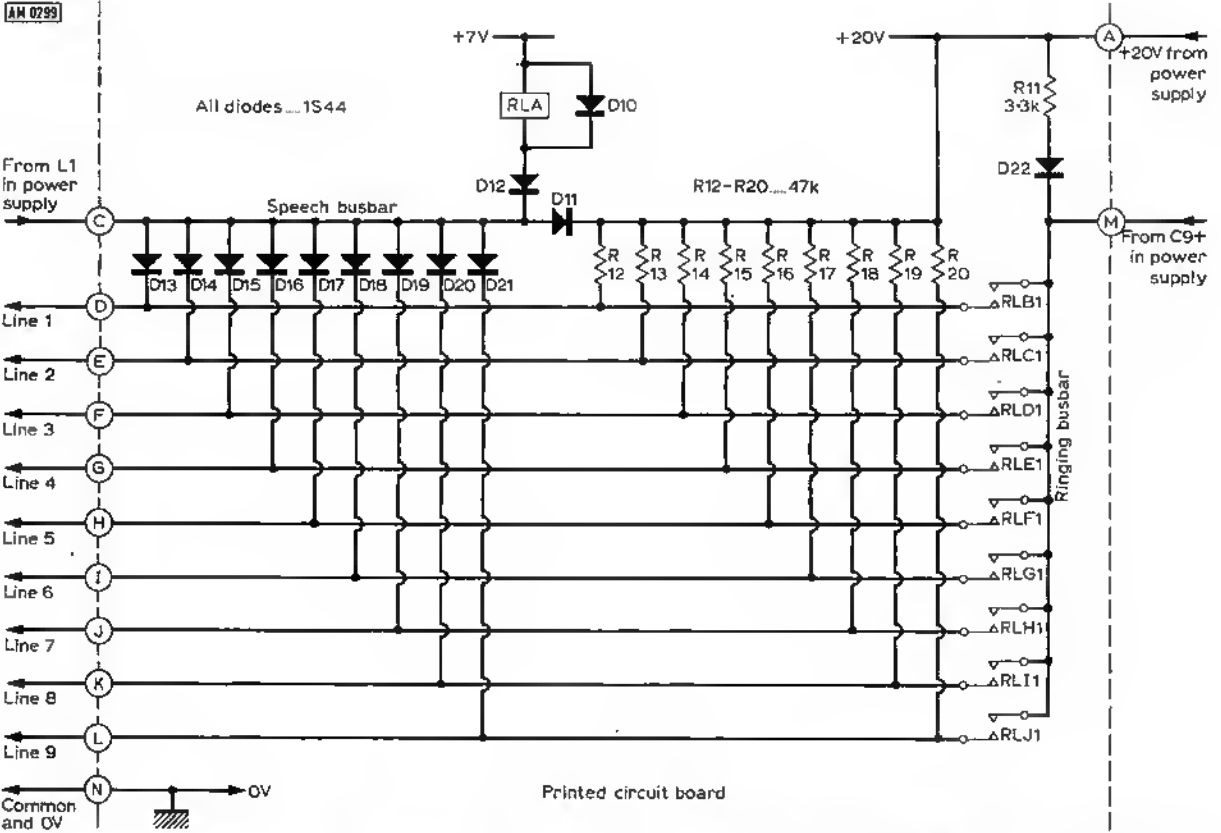
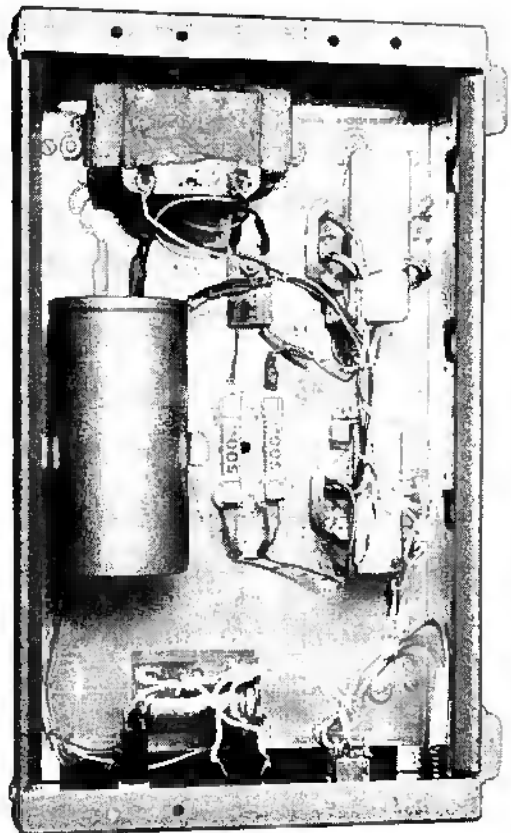
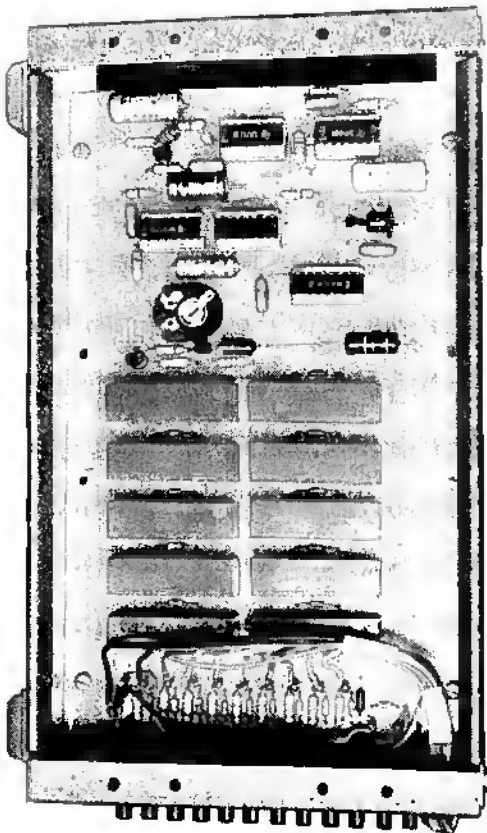


Fig. 6: Remainder of the exchange, showing the speech switching and ringing circuitry. Below left, the finished PCB of an earlier version of the exchange in which five IC's were used instead of four. Below right, power supply panel.



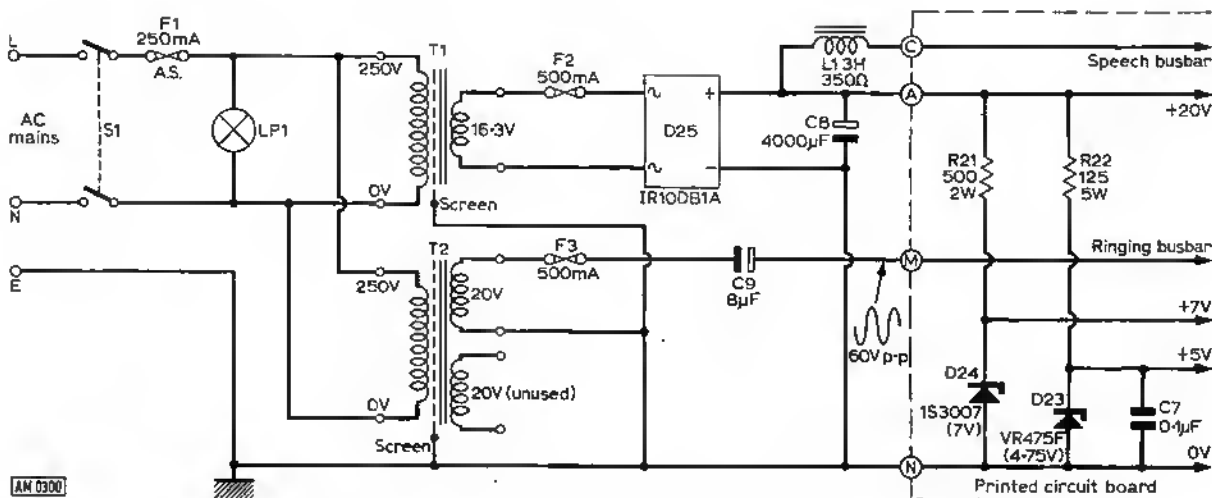


Fig. 7: Power supply circuit, the panel for which is mounted on the righthand side of the unit shown on the first page.

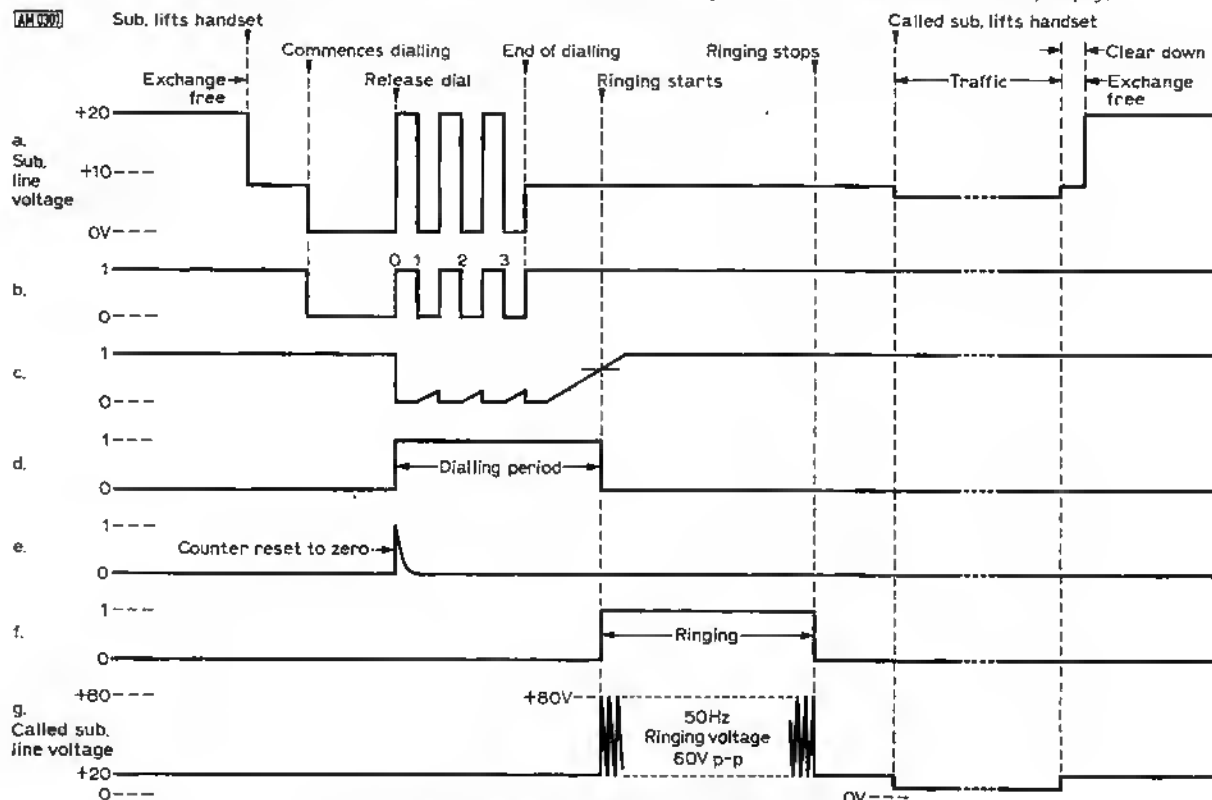


Fig. 8: Waveforms and timing diagram in the dialling sequence.

The reed relay D connects an AC ringing signal of 60 volts peak-peak from T2 to line 3 which rings the bell in Sub. 3 telephone for a duration set by VR1. When Sub. 3 lifts his handset, current flows through D15 thus connecting both telephones to the Speech Bus bar, permitting two-way conversation. At the completion of the call the caller and the called replace their hand sets causing D13 and D15 to disconnect. No other "clearing down" is required, the decade counter is reset to zero at the commencement of the next call.

The 50Hz ringing voltage from T2 is AC coupled to the Ringing Bus bar, by C9 and the negative peaks cause D22 to conduct, charging C9 and thus prevent-

ing the negative half cycles from swinging below +20 volts. This ensures that when the ringing signal from the Ringing Bus is connected to a subscriber it will not cause the associated speech routing diode to conduct and will prevent the ringing signal from appearing on the Speech Bus.

The inductance of the LF choke, L1, is not critical but the resistance should be approximately 350 ohms. If a choke of the correct resistance is not available, one having a lower resistance may be used with a suitable resistor connected in series to raise the total resistance to the correct value.

The power supply for the telephone exchange is in operation continuously and consumes approximately

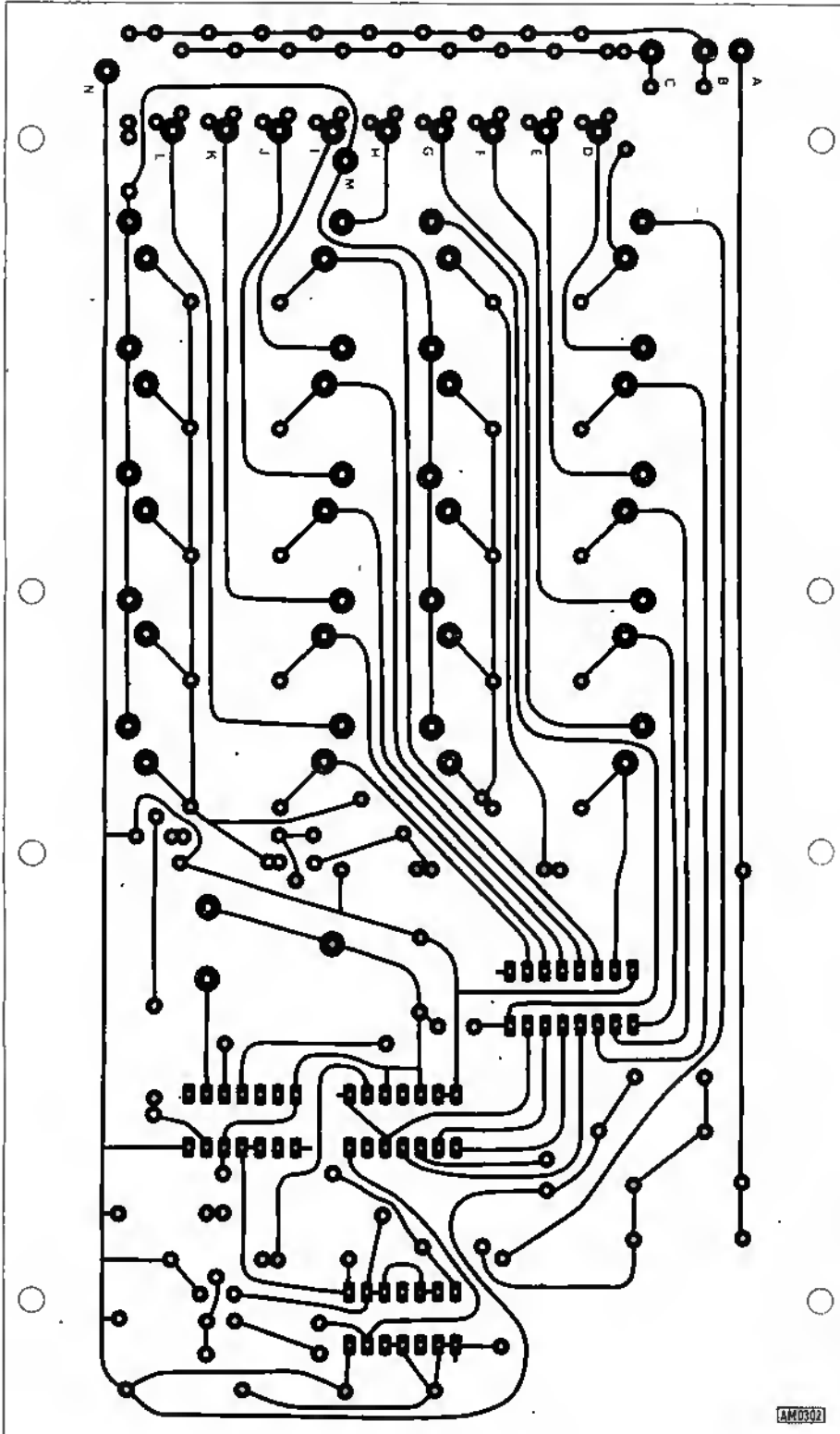


Fig. 9: The PCB layout is given here actual size so that it may be copied.

3 watts. Transformer T1, bridge rectifier D25 and C8 provide the +20 volt supply for powering the telephones and this is also the source of the +5 volt and +7 volt supplies which are regulated by zener/break-down diodes D23 and D24 respectively, Fig. 7.

Transformer T2 provides the ringing voltage for the Ringing Bus. Both transformers are adequately fused for safe unattended operation.

All the circuitry with the exception of the power supply components is built on a 8in x 4³/₄in printed

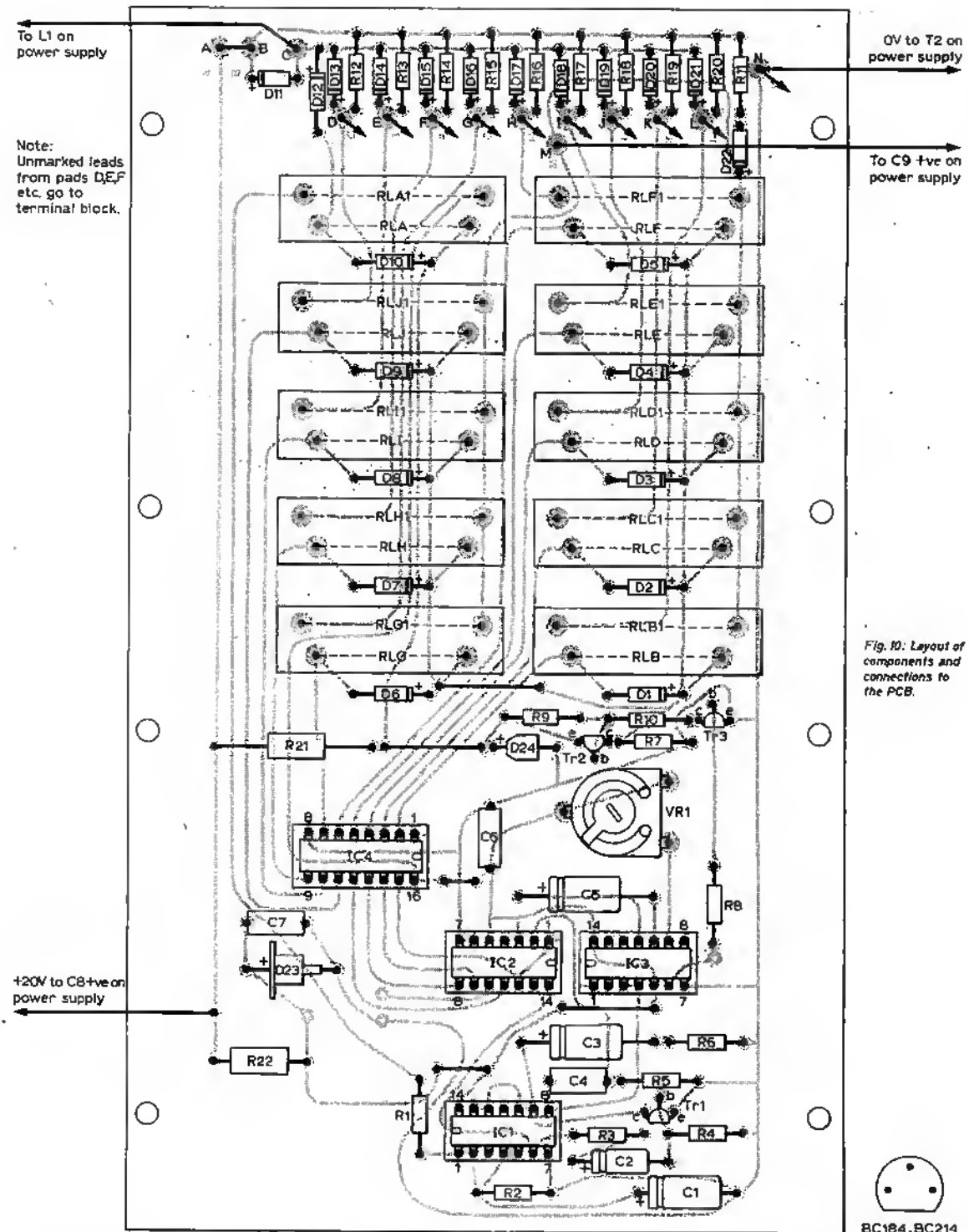


Fig. 10: Layout of components and connections to the PCB.

circuit board, Fig. 9/10. The power supply components are mounted on a similar sized metal plate and the complete unit is housed in a 5in x 5in case 8½in long, constructed from Lektrokit parts.

CONNECTION AND OPERATION

Each telephone is connected between the appropriate line terminal and the common line terminal. Dial-

ling is carried out in the usual way and VR1 may be adjusted to give the required length of ring. The telephone bells may be adjusted for best ringing as described previously.

The system has the advantage that when the two subscribers are in communication a further subscriber may be dialed and join in the conversation. Two telephones may be connected in parallel on one line if required.

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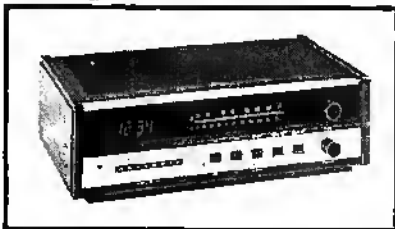
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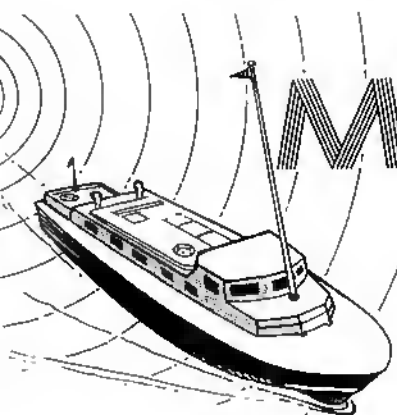
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MODEL CONTROL

PART 2: THE CONTROLLER BY RADIO

F. G. RAYER G3OGR

A MODEL Control Licence is obtainable, without difficulty, on application, see panel, allowing operation in two bands 26.96-27.28MHz and 458.5-459.5MHz. Transmitting equipment for the 27MHz band is easily built and the transmitter described here is for this band and crystal controlled to ensure the frequency is within the band. The limitation on power is easily met since the circuit used is incapable of exceeding the power permitted. The type of emission A2 (modulated carrier) also falls within the licence conditions.

The transmitter may be used with a receiver of the type described in Part I but both transmitter and receiver are compatible with commercially made equipment using the same mode of control.

Equipment of this type is intended for the control of a land model, model boat or plane.

SYSTEM OF WORKING

This is a single channel of control to the model, with the equipment outlined in Fig. 1. The transmitter is hand held, with a push button which forms an on-off switch. Signals are radiated from a telescopic aerial and picked up by a short aerial on the model. The received signal closes a relay which in turn switches an electrical-mechanical device, termed the actuator, on or off. The actuator fitted in the large model boat used by the author allows switching on or off, or reversing, of the main propulsion motor by short blips. Turning the rudder to port or starboard is achieved with long blips, the rudder returning to straight ahead with no signal (transmitter button released). The boat can thus be started, stopped, turned either way, sailed straight ahead or astern.

The transmitter described here will operate with tone-controlled super-regenerative receivers. However, the receiver already described is crystal controlled since this has the advantages of stable operation on the required channel without the need for constant re-adjustment as well as freedom from interference by other radio controlled transmitters on adjacent frequencies.

AM 0284

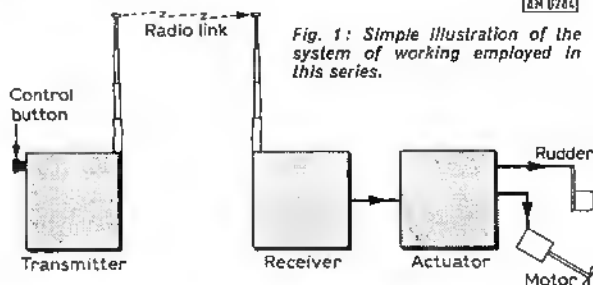
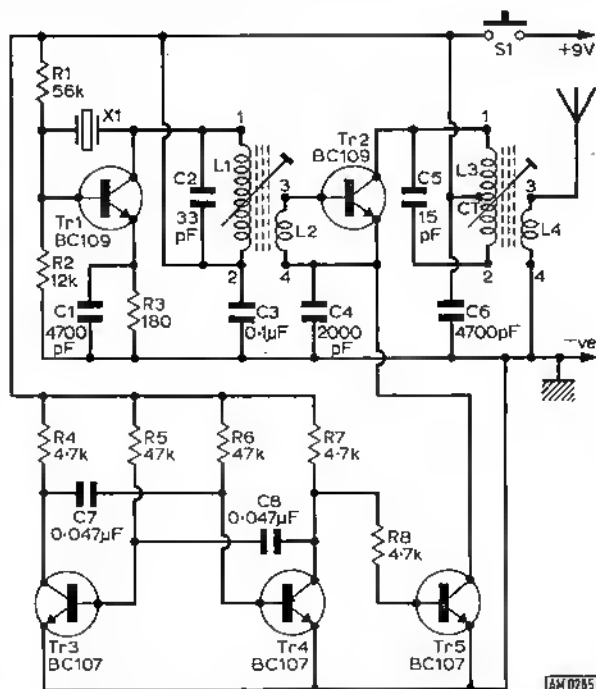


Fig. 1: Simple illustration of the system of working employed in this series.

TRANSMITTER CIRCUIT

This is shown in Fig. 2. Tr1 and Tr2 comprise the RF section while Tr3, Tr4 and Tr5 form the tone modulator circuit. Tr1 is the crystal controlled oscillator, the collector circuit being tuned to near resonance by the adjustable core of L1. This oscillator circuit proved to be reliable, with no critical adjustments required and it gave a good output.

The coupling winding L2 applies drive to the amplifier Tr2 whose collector coil L3 is also tuned. The coupling winding L4 energises the aerial. This circuit is designed for a 48in. telescopic aerial which is easily obtainable and does not prove to be unwieldy with a hand-held transmitter.

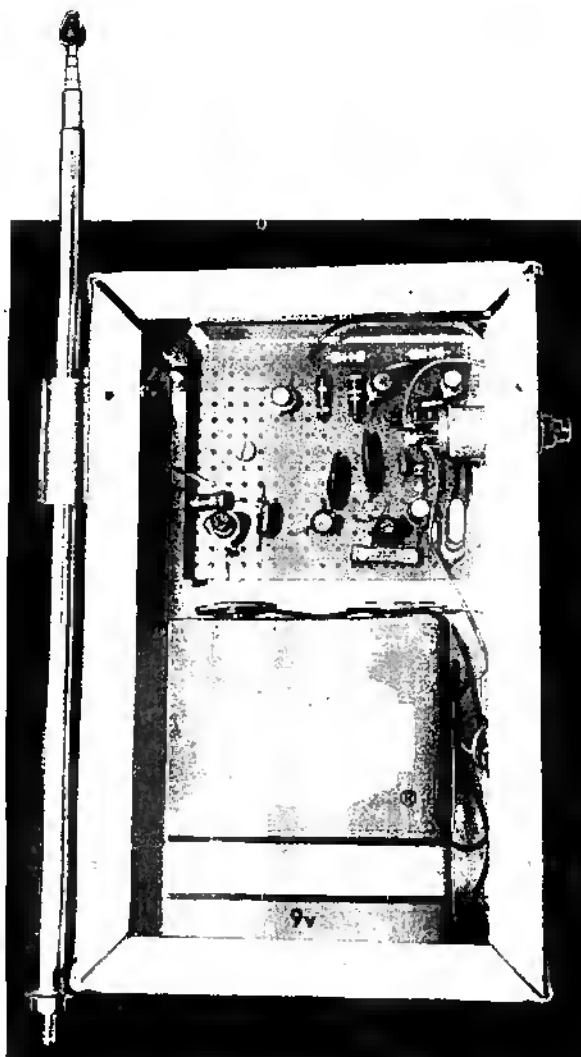


AM 0285

Fig. 2: Complete circuit of the five transistor transmitter.

Tr3 and Tr4 form the tone generator and, with the single channel receiver described, the frequency of the tone is not very important. Tr5 is alternatively driven in and out of conduction thus modulating the amplifier Tr2. This method avoids the need for a transformer or other components for modulation purposes.

The circuit is intended for use with a single PP9 battery which is fitted in the case. A 20in. aerial on



The front cover of the controller box is removed to show the transmitter circuit board.

the receiver and equipment at ground level was found to give reliable control easily in excess of 100 yards which was well outside the limit at which it was wished to observe and sail the model, even with the transmitter aerial not fully extended.

It should be noted that it is possible to increase power by increasing the battery voltage, provided dissipation in any stage does not exceed 300mW. Radiation may also be increased by placing a loading coil between pin 3 on L4 and the aerial, and space is left for this on the circuit board, though it was not required.

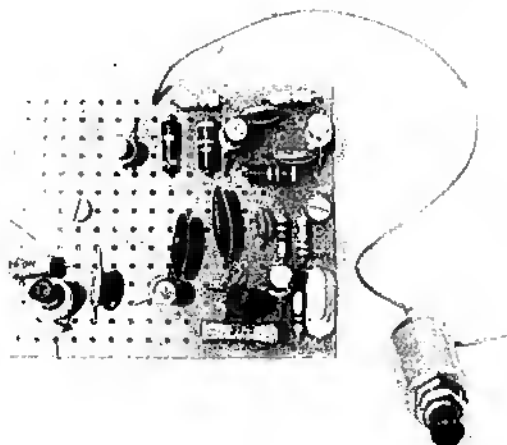
Note that the push-button S1 gives complete on-off switching of the transmitter so that no other switch is required. Where a single channel tone is used with a super-regenerative receiver it is usual to leave the transmitter RF carrier on continuously, to reduce the receiver response to interference or spurious operational signals. Should the transmitter be used for this purpose S1 should key only the modulation tone section, Tr1 and Tr2 operating continuously, an additional on-off switch being fitted in the battery circuit.

CRYSTAL FREQUENCIES

If a super-regenerative or tunable receiver is to be used with this transmitter any crystal in the 26.96 to 27.28MHz band will be suitable, as the receiver can be adjusted accordingly.

For the receiver described in Part 1 transmitter and receiver crystals are obtained as a pair the difference in frequency between them corresponding to the intermediate frequency of the receiver. For the receiver, this difference may be 455, 465 or 470kHz. The crystals actually used were 27.005MHz for the transmitter, and 27.460kHz for the receiver. However, the selectivity of the receiver plus crystal control permits the working of a number of transmitters without interference and pairs of crystals for various channels are obtainable.

Provided transmitter and receiver are working correctly together a change of frequency would only be needed where two or more models are used together and the transmitters chance to be on the same or adjacent frequencies.



The finished circuit board which should be tested and adjusted before fixing it into the case.

CONSTRUCTION

The board is about 2 $\frac{5}{8}$ x 2 $\frac{1}{4}$ in. and both sides are shown in Fig. 3. Drill holes for the crystal holder tags, for two bolts MC which are necessary to mount the

TAKE NOTE!

The use of radio for controlling a model is permitted only under the authority of a licence issued by the Home Office. This authorises the use of A1, A2, F1 and F2 emissions in the frequency band 26.96 to 27.28 MHz with a maximum effective radiated power of 1.5 watts and in the band 458.5 to 459.5 MHz with a maximum effective radiated power of 0.5 watt. The licence authorises the use of the apparatus anywhere in the UK and is valid for five years. Applications for the licence should be sent to:—Home Office (Radio Regulatory Division), Waterloo Bridge House, Waterloo Road, London SE1 8UA together with the fee of £1.50 NO EXAMINATION IS REQUIRED.



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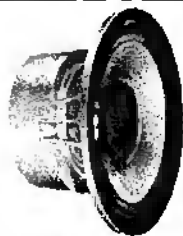
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Matched pair of bookshelf speakers. Teak finish, size 12" x 8" x 5", 8" x 8" ohms ceramic, 5 watts RMS. Complete with din leads. £11.00 pair.

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 SC353B) 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 ca3054 (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.

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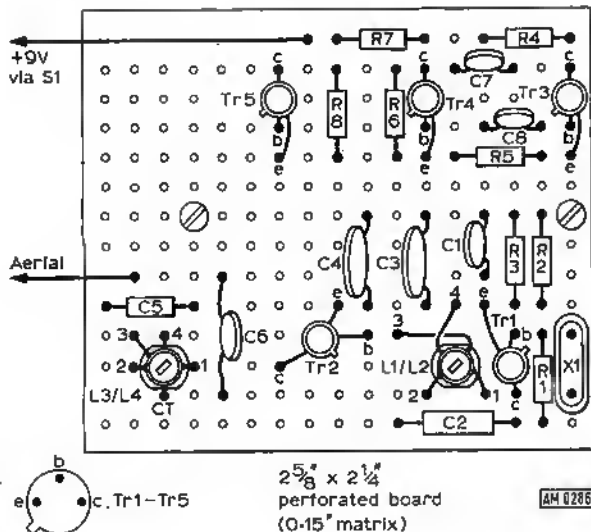
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board as possible, wind on 14 turns close wound and apply a little quick-drying adhesive. Take the end down through hole 2, scrape the wire, and solder to C3. L2 is wound in the same way 4 turns, immediately alongside L1. The beginning of L2 goes through hole 4, and the end through hole 5.

L3 has 17 turns in all, Begin at 1, against the board, and wind $8\frac{1}{2}$ turns, scrape the wire, twist to form a loop and solder for the centre tapping CT. Wind a further $8\frac{1}{2}$ turns in the same direction and cement end 2. L4 is 5 turns of thin insulated wire, such as 22SWG connecting wire, wound on top of L3. Take the beginning to MC and the end to hole 3, across the board, and up as shown for the aerial connection. A connection can now be made to CT of L3 and end 2 can be connected to C5. A few spots of adhesive will keep L4 in place.

Fit a flexible lead from R7 to the push switch S1 and take the second switch tag to a further lead, with a battery positive clip.

CASEWORK

The transmitter is intended to be used in a metal case which is held in the hand. The case is made from a 6 x 4 in. universal chassis with an additional 6 x 4 in. plate for the back. The 6 x 2 in. sides and 4 x 2 in. top and bottom are assembled with bolts and the front plate is similarly attached. Drill this plate to take the bolts of the circuit board and hold the board about $\frac{3}{16}$ in. clear of the metal using spacers or extra nuts.

Fit S1 to the side of the case so that it comes readily to finger or thumb when holding the case. The aerial is fitted to the opposite side, near L4, and insulated from the metal case by insulated bushes and washers, or by using two pieces of $\frac{1}{16}$ in. thick paxolin, one for each side of the metal, with insulating washers between to prevent contact with the metal. The simpler type of telescopic aerial may require a mount formed from scrap metal, in which it is a sliding fit. Some aeriels have a bracket of this type already provided.

The battery occupies the bottom of the case and a small bracket on the back plate holds the battery in position.

★ components list

Resistors

R1 56k Ω	R5 47k Ω
R2 12k Ω	R6 47k Ω
R3 180 Ω	R7 4.7k Ω
R4 4.7k Ω	R8 4.7k Ω
All $\frac{1}{4}$ W 5 or 10%	

Capacitors

C1 4700pF disc ceramic	C5 15pF tub ceramic
C2 33pF tub ceramic	C6 4700pF disc ceramic
C3 0.1 μ F disc ceramic	C7 0.047 μ F
C4 2000pF ceramic	C8 0.047 μ F

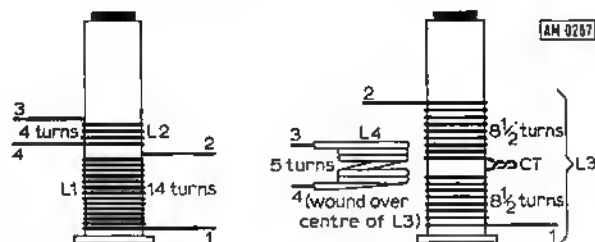
Semiconductors

Tr1/2 BC109	Tr3/4/5 BC107
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Miscellaneous

Coil formers, 4mm. with cores (4). Crystal 27MHz, see text and Part 1. Crystal holder type HC6U. Case 6 x 4 x 2 in. with extra plate 6 x 4 in. (Home Radio). Telescopic aerial. Push switch, normally off. Veroboard 2 $\frac{1}{2}$ x 2 $\frac{1}{2}$ in. 0.15 in matrix.

Fig. 3: Constructional information for the circuit board, the winding details for the coils being shown below.



Note: L1, L2 and L3... 32 swg enameled copper wire, close wound. L4... 22 swg insulated connecting wire, close wound.

board and provide a return to the metal case, and holes to give a push fit for the coil formers which are also secured with adhesive.

Position items as shown in Fig. 3, turn the board over and solder finally snipping off excess leads. Sleeving is put on all wires which may touch other wires or joints. Connections should be short and direct in the RF section.

It was found best to wind the coils when the formers have been cemented in position. To wind L1, take a length of 32SWG enameled wire, scrape one end, pass this down through hole 1, Fig. 3, and solder it to C, Tr1. Draw the wire taut and beginning as near the

TESTING

The transmitter should be tested and provisionally tuned before fixing it into the case. Connect a 9V battery placing a meter, set to the 100mA range, between battery negative and one of the bolts MC. Temporarily take the aerial lead to a bulb holder, one side of which is returned to a bolt MC. Fit a 6V 0.04A bulb.

With S1 closed, rotate the core of L1 until the meter current begins to rise. When this happens, rotate the core of L3 while observing the bulb. Tune L3 and L1 for maximum brightness. Check that the oscillator starts when S1 is opened and then closed. If it does not, re-adjust L1 core until it oscillates every time. With optimum tuning, the bulb should light quite brightly.

To check for the modulating tone, use either the monitor, of Part 3, or receiver. Alternatively, connect a pair of headphones to a few turns of wire, with a diode in one lead, and bring this near L3, when the audio tone should be heard strongly.

FINAL TUNING

If the aerial is closed and L1 and L3 are adjusted for best brilliance of a 6V 0.04A bulb held temporarily from aerial to case this will probably give all the range required when the aerial is subsequently extended. However, more accurate tuning is possible with a field-strength indicator or monitor, Part 3. This is placed a little distance from the transmitter and tuning adjusted for the best reading obtainable. The aerial should be fully extended with the transmitter held in the hand at about chest height. It is usual for both transmitter and receiver aerials to be roughly vertical to avoid directional effects.

When controlling the equipment at short range, it will be found that adjustments are not critical and the transmitter aerial need not be extended very far. But adjustments to secure the maximum radiated field strength are, of course, important when trying to achieve the maximum possible range. If there is any chance of a model being lost, a test should always be made at maximum range, before releasing it. Avoid letting the distance approach the known maximum range in case reduced battery power or other circumstances result in control being lost.

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TELEVISION

IN THE FEBRUARY ISSUE

CRT TESTER AND REACTIVATOR

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SERVICING TV RECEIVERS

The next chassis to be dealt with by Les Lawry-Johns is the current Decca Single-standard one used in Models MS1700, MS2001 and MS2401.

TWO-TERMINAL STABILISERS

A review of the many two-terminal devices that can be used to provide voltage and current stabilisation, outlining their operation and characteristics. Leading from simple diodes up to the TAA550 type i.c. stabiliser.

TRANSISTOR VIDEO CIRCUITS

The second part of S. George's series on video circuits and faults looks at solid-state circuits. Because of the very different characteristics of transistors, circuit design and the faults experienced differ markedly from those associated with valves as outlined in Part 1.

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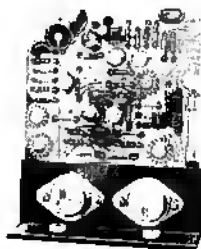
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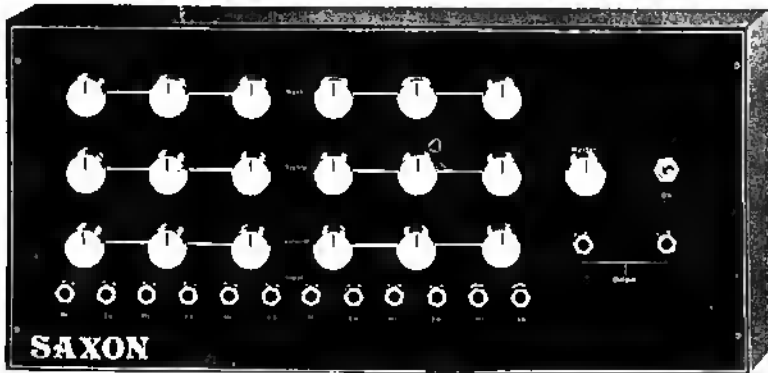
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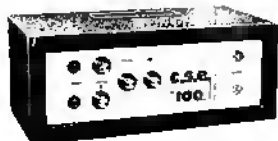
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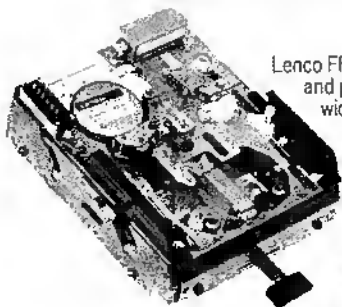
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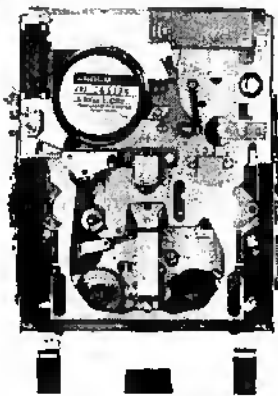
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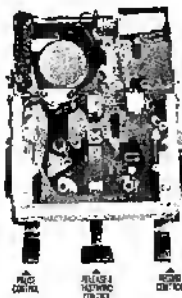
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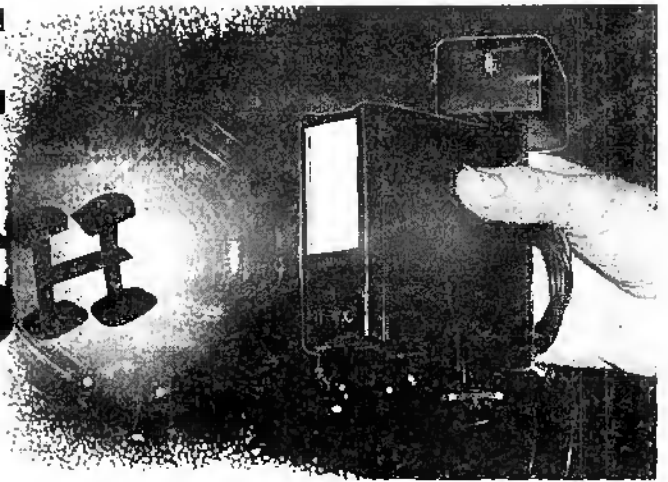
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ELECTRONIC SLAVE * FLASH *

Alan Ainslie



ONE of the drawbacks of conventional flash photography (with the gun mounted on the camera) is that little modelling is possible with such simple lighting. Quite obviously it would be better to use several flashguns all fired simultaneously and placed in such positions as would give the most effective lighting. Conventionally the guns are connected to the camera by extension leads which tend to get in the photographer's way and get tangled up.

During recent years there have appeared on the market 'Slave Flash' units which pick up the light from the main flashgun and fire the slave almost simultaneously without the need for connecting wires. Most of these units are battery operated and amplify the pulse from a phototransistor to switch on a thyristor which in turn fires the flashgun.

For occasional use a battery operated unit can be a severe disadvantage as one might leave the unit switched on for a period, and be unaware of the state of the battery after storage. However, using the latest techniques it is possible to construct a slave flash that needs no battery power.

TYPICAL FLASHGUN

Fig. 1 shows the tube firing circuitry of a normal electronic flashgun. In normal operation the 0.01 μ F capacitor charges to 300V via both 2.2M Ω resistors. Closing the camera shutter discharges the capacitor

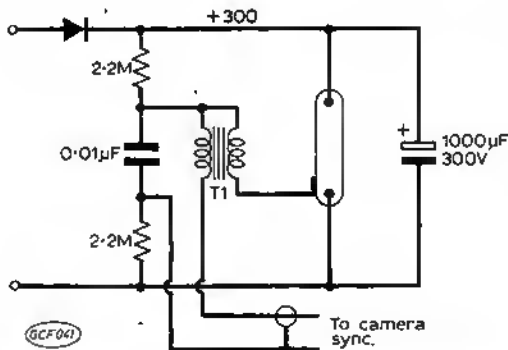


Fig. 1: Typical tube firing circuit of an electronic flashgun.

into transformer T1. The secondary of T1 produces oscillations of a few KV peak amplitude which triggers the tube drawing energy from the 1000 μ F capacitor. The purpose of the 2.2M Ω resistors is to isolate the sync connections from the tube circuitry, sparing the photographer electrical shocks when the equipment is earthed in any way—intentionally or not.

Current available at the sync terminals amounts to a few μ A, whereas the open circuit voltage is a few hundred volts. It is therefore essential if any attempt be made to draw current from the unit through the sync lead the current should be very small so that the voltage dropped across the 2.2M Ω resistors is not excessive. In this way the full voltage is still available across the capacitor to discharge into T1. Drawing too much current reduces the capacitor voltage and results in uncertain operation.

CIRCUIT

The full circuit of the slave flash unit is shown in Fig. 2. The current flowing from the sync lead charges C2 to a voltage set by zeners D1 and D2. These are 10V devices but the very small currents cause the zener voltage to rise by about 25%. Therefore C2 charges to about 25V. The voltage across C2 acts as the supply for the phototransistor Tr2, which is a Photo Darlington device connected as an emitter follower. At tiny currents the 2N5777 has a good

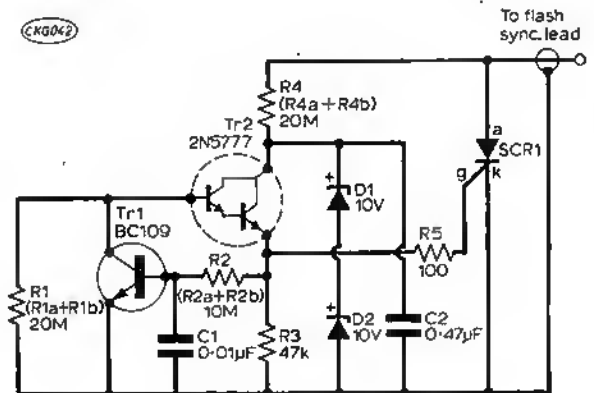


Fig. 2: Circuit of slave flash unit.



View of the completed slave flash unit, right. The photo-Darlington transistor can be seen through the aperture at the front.

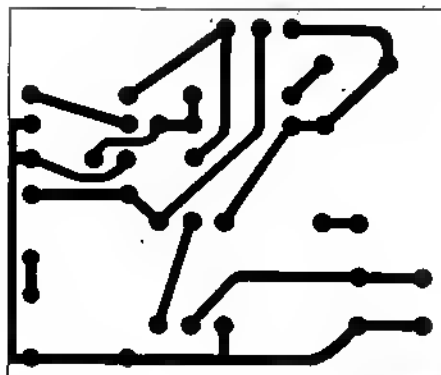


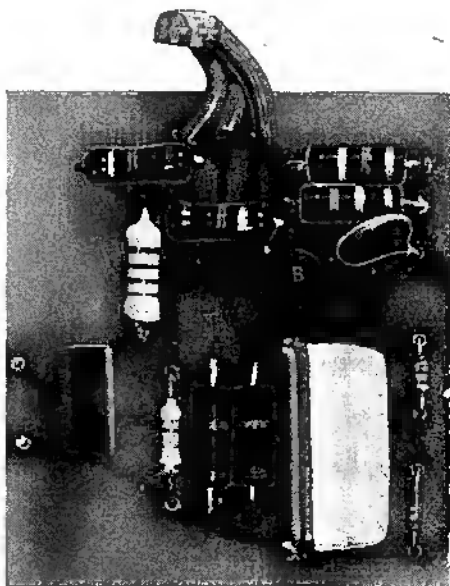
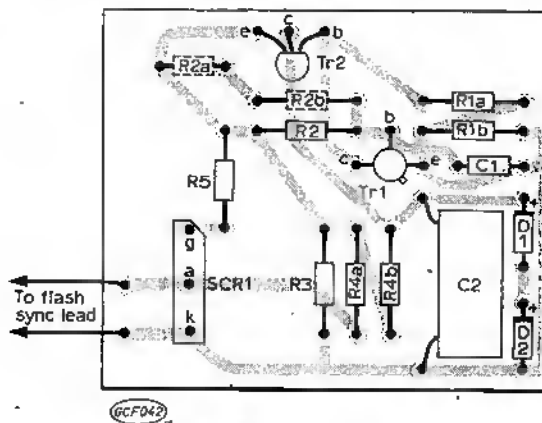
Fig. 3: above, details of the PCB actual size which must be made of fibreglass. Below, layout of components on the PCB together with a photograph of the finished board.

degree of gain while under quiescent conditions it is almost cut off. Any tendency to increase conduction through an increase in ambient light level is counteracted by Tr1.

An increase in Tr2 emitter current would increase the voltage across R3, biasing Tr1 further on and so draining base current from Tr2. This negative feedback compensates for wide variations in ambient light levels.

A transient increase in Tr2 emitter current due to the light from a flashgun, however, does not cause the feedback loop to operate due to C1 decoupling Tr1 base. Consequently Tr2 discharges C2 into R3 and the gate of the thyristor—turning the thyristor on. As soon as the thyristor switches on it effectively shorts the sync leads, resulting in the flashgun firing. The current on the sync lead falls to a very small value after the flash, as the 1000 μ F capacitor is now discharged. This current is less than the holding current for the thyristor which switches off.

The recycling time of the slave unit is a few seconds longer than that of the flashgun. Normally it will not exceed 15 seconds.



are to be drilled and then filling in free hand. The actual design is drawn on to the copper with one of the readily available resist pens or enamel paint.

When the resist is dry the board is ready to be etched by floating face down on a saturated solution of ferric chloride. With fresh solution the etching should take less than half an hour at room tempera-

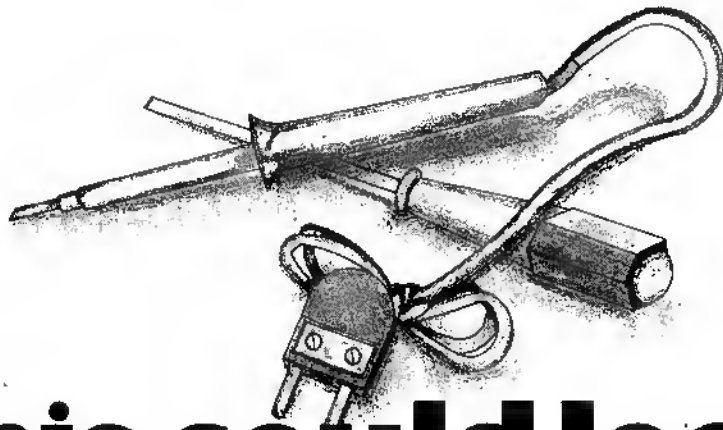
CONSTRUCTION

The circuit operates with very small currents at medium voltages. Any PCB leakage therefore, would adversely upset the operation of the unit which rules out Phenolic or SRBP board for construction due to the rather high, and unpredictable leakage of such boards. Good quality glass fibre is the only satisfactory medium for this circuit.

The unit is made up on a small PCB as shown in Fig. 3. For those constructors, perhaps photographers, not fully familiar with PCB etching a reasonably detailed description will follow.

PRINTED CIRCUIT BOARD

The drawings show the board full size. A piece of fibreglass board is first cut to size with the edges filed smooth. The copper is polished with fine wire wool and should be rubbed over with a cloth moistened with trichloroethylene to remove any grease from the surface. The design of the conductors can be transferred with carbon paper or by punching through with a compass where the holes



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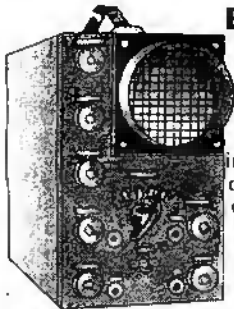
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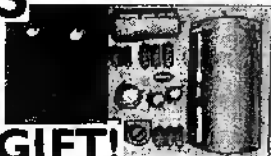
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★ components list

Resistors		
R1 (R1a + R1b)	20M Ω	
R2 (R2a + R2b)	10M Ω (see text)	
R3	47k Ω	
R4 (R4a + R4b)	20M Ω	
R5	100 Ω	
Capacitors		
C1	0.01 μ F	10V ceramic
C2	0.47 μ F	100V
Semiconductors		
Tr1	BC109	
Tr2	2N5777 (General Electric)	
D1	10V 400mW Zener	
D2	10V 400mW Zener	
SCR1	MCR120 or 2N5064 (RCA)	
Miscellaneous		
Printed circuit board fibreglass 2 $\frac{1}{2}$ x 1 $\frac{1}{2}$ in., 3mm female connector, plastic box.		

ture after which it should be washed and the resist removed with a solvent such as trichloroethylene or paint stripper. The holes are all drilled with a number 60 drill in a hand brace or preferably in a pedestal drill.

BOARD ASSEMBLY

20M Ω resistors are specified for two of the resistors in this unit. 10M Ω is usually the highest value obtainable "over the counter" at a reasonable cost, and so each 20M Ω resistor is in practice two 10M Ω in series, i.e. R1a=10M Ω and R1b=10M Ω , therefore R1=20M Ω .

The space shown for R2 allows for a single 10M Ω resistor. However, a particularly good BC109 will work with R2 as 20M Ω which gives a higher overall gain to the unit. The position for the two resistors in this case is shown dotted in the diagram. The unit photographed has R2 as a single 20M Ω resistor.

C1 and C2 should be low leakage components. Generally, reputable film devices should prove satisfactory.

Tr1 should be a device of a reputable manufacturer in order that the leakage currents be low, while Tr2 is specified as a 2N5777 as this is the cheapest device of the 2N5777/79/78/80 range—any of which is suitable for this application.

The thyristor used in the prototype was a general purpose 300V device by IR. However, the devices specified are the Motorola MCR120 or 2N5064 which have low gate currents.

The screened cable by convention is positive on the inner conductor and negative on the shield.

TESTING

The PCB when constructed can be easily tested by connecting to a flashgun with a 3mm socket and trying it by exposing Tr2 to the flash from another gun. Should any malfunction be apparent, voltage tests can only be carried out with a valve voltmeter or high impedance (10M Ω) oscilloscope. Even then the readings may well be subject to considerable error. In the development of the original a 90M Ω precision resistor was used in series with a 10M Ω probe and a DC coupled 'scope.

FINAL ASSEMBLY

The assembled PCB has to be placed in a small container for protection and ease of use. The prototype was fitted quite conveniently into an old "Cosmocord" Phono cartridge box. This box has a transparent plastic lid which is ideal as it allows Tr2 to be illuminated. The transparent lid can be painted from the inside except for a small aperture at one end for Tr2. The sensitive side of the device is the convex surface, which should therefore face outwards.

The slave unit is best fitted with a 3mm socket, but these can be hard to obtain. As an alternative the female end of a flash extension cable can be used, as in the prototype.

CONCLUSION

The slave flash unit fires the second flash usually within 5mS of the first flash. This means that with focal plane shutters on their fastest X sync speeds no difficulty should arise. With leaf shutters 1/125 of a second should be regarded as the maximum usable speed.

Although operating range depends on the power of the main flash gun, the slave unit will fire line-of-sight to about 40 feet and by reflected light from an average scene at 20 feet. These figures are based on the main flash being a guide number 32 gun (at 25 ASA) which is the least powerful available. **PW**

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DAVID ANDREWS

No. 68 9V POWER SUPPLY

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

WE cannot claim any form or originality for this month's project; however it is offered as a compensation for those who need a very straightforward power supply. There has been a large number of fairly sophisticated pieces of equipment published in these pages and it is difficult to sort out the power supply stages in some of these projects. "Pinching" the power stage circuitry from one project to fit another used to be quite commonplace but these days there is often as much complexity in the supply stage as in the piece of equipment being supplied.

One thing is sure about our project this month—complexity is out. There are certain limitations to it but at the same time there are many changes that can be rung with the circuit as it stands, to provide alternative voltages and currents. As there are few difficulties in respect of the workings of the circuit we shall devote much of this part to explaining how one can make the necessary changes to give alternative outputs. First of all we had better describe the circuit as shown in Fig. 1.

Design

In any power supply we have to use a transformer to provide isolation from the mains and generate a lower level voltage, usually slightly higher than that which we ultimately want. The output from the 10V secondary winding of the transformer, T1, is quoted in RMS terms (root mean square value); this means that the AC output voltage will rise to peak values, a factor of root two (1.414) times the quoted RMS value. The bridge rectifier comprising D1 to D4 gives full wave rectification and the capacitor C1 charges up to the peak voltage, in this case approximately

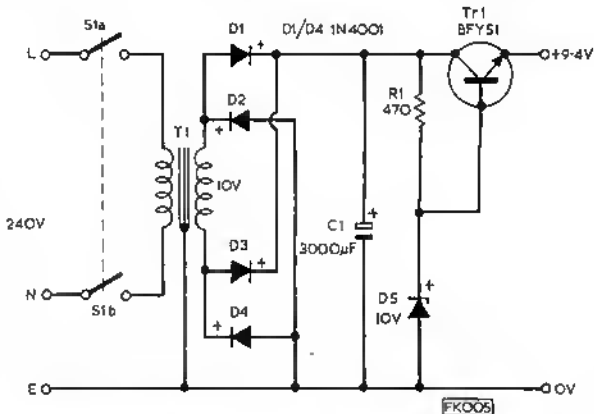


Fig. 1: Circuit of the 9 volt stabilised power supply with a maximum current rating of 200mA.

14V. If no current is drawn from the capacitor the voltage produced by the charge stored will be extremely stable and free from AC ripple. It would be naïve to expect a power supply to be entirely from ripple so it is worth spending a moment or two explaining how the value of C1 is selected.

This is basically a "bucket" capacitor which charges up rapidly from the low impedance source of the transformer and diodes when the AC voltage rises in a positive direction. When the input AC voltage falls the diodes become reverse biased and the stored charge on the capacitor cannot leak away back through the transformer. Assuming no current is drawn from the capacitor by load circuitry a few cycles of the mains will "fill" the capacity of the

—continued on page 928

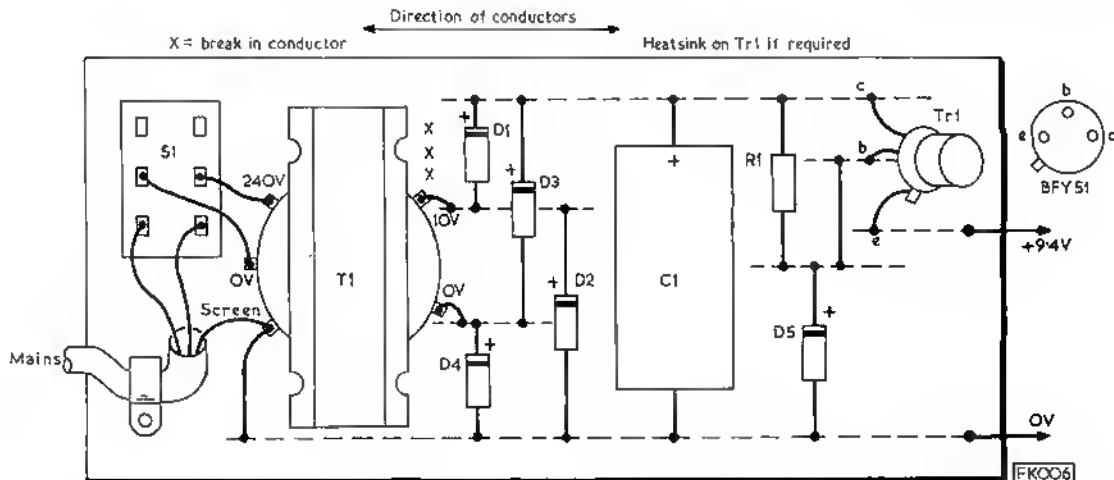


Fig. 2: The unit can be assembled on plain veroboard with pins or on veroboard with copper rails as shown here. A heatsink is advisable on the transistor.

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P.W. 'ASCOT' STEREO PART 1

CASSETTE

THOSE readers who have followed the series of articles on the car cassette player will probably have been interested in the possibility of constructing a domestic mains-powered cassette recorder/player. It was our intention from the outset to produce such a machine and we first discuss the design philosophy involved.

A cassette recorder is not a particularly easy piece of apparatus to design. A manufacturer can set up special machining facilities to enable production to be efficiently carried out, but the home constructor is faced with different problems. The projects he builds will in all probability be "one off" efforts; as a result he cannot reasonably be expected to provide facilities better than a well-equipped domestic workshop, and at worst, may have only a work-table, vice and toolbox.

It is totally unrealistic to attempt to construct the deck mechanics so we have a Goldring Lenco model CRV mechanism with a DC motor and electronic speed control. The constructor has to build the casing and chassis work, mount the deck and build up the circuitry on Veroboard.

Anyone experienced in the handling of commercial tape recorders will know that the multiple switching involved between the basic play and record functions is usually both mechanically and electrically complicated. This can pose many problems for the would-be constructor, and to reduce the difficulties we have employed separate recording and playback amplifiers. A degree of electronic switching is used and this simplifies the problem further.

Some readers may feel that the use of separate amplifiers is somewhat extravagant. In fact this is not the case. The special switching mentioned before is avoided and much expense saved in that direction. Also, trouble-shooting is eased by the use of separate, less complicated amplifiers.

Another problem which can beset the constructor is the winding of coils. Tape machines usually employ tuned circuits as bias traps and also in the oscillator circuit providing HF bias and erase head drive when recording. Our machine has eliminated the use of such coils by a special approach to the recording amplifier design, and by using the erase head itself as the inductive part of the oscillator circuit. It will be seen from the foregoing remarks that the entire project has been orientated for the home constructor, and should therefore be considered in this light.

The use of a DC motor for the tape deck makes the machine speed independent of mains frequency and, by removing a potential source of fields in the form of an AC motor, the overall problem of hum pickup is eased. The supply voltage for the electronics is obtained via a stabiliser unit which is complete in a TO3 type transistor casing. The machine is therefore very tolerant of mains voltage and frequency fluctuations.

NOISE

A considerable amount of thought has been directed towards reducing background noise. A tape cassette, when used for stereo recording, employs four tracks on a tape $\frac{1}{8}$ in wide, moving at only $1\frac{1}{2}$ in per second. As a result, the output from the tape head is very low, usually between 300 and 500 microvolts, and considerable amplification of the weak signals is required. Low noise transistors are employed in the input stages of the amplifier, but the signal to noise ratio could still be improved. The use of Dolby-type systems was contemplated, but these are both complicated and difficult for the constructor to set up. Also, tapes have to be recorded using the system.

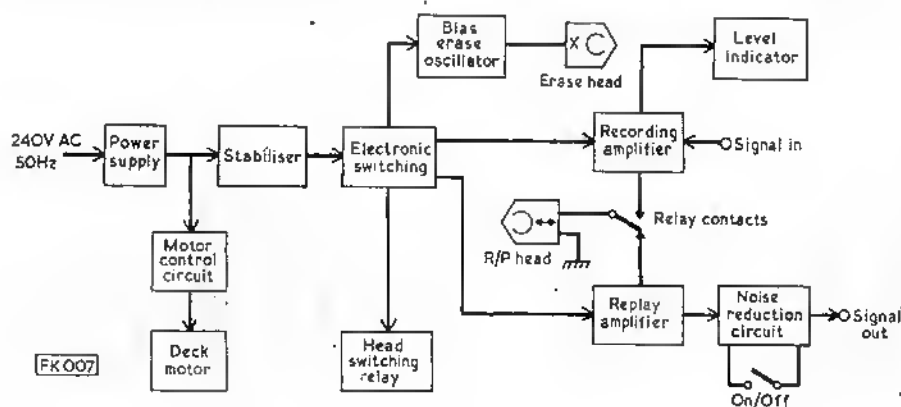


Fig. 1: Block diagram of the P.W. "Ascot" stereo cassette deck.

DECK



TH CUMMINS & TONY FRANCIS*

It was finally decided to use a dynamic noise reduction system, which reduces the response at the higher audio frequencies in the absence of such signals on the tape. This reduces hiss considerably and has the advantage that the system will operate on any tape; special recording techniques not being required.

As it is intended that the machine be used with an existing amplifier, outputs are provided at "LINE OUT" level only, for feeding the main amplifier. No audio output stages are provided. Inputs are provided for both line and microphone. Bias is switchable for the use of standard ferric oxide or the low noise chrome dioxide tape.

The foregoing description has been basically a synopsis of the design approach. We shall now examine the circuits in detail. In order that the circuit may be easily identified, the reader is referred to Fig. 1. Here the interconnections between the basic blocks are clearly illustrated.

POWER SUPPLIES

The basic power supply for the amplifier and erase oscillator is +12V, which is switched to the amplifiers as required. Rather than have elaborate switching arrangements and release mechanism linked to the stop facility on the machine, electronic switching is employed. The circuit of the power supply and switching is shown in Fig. 2.

The AC mains supply is introduced via the on-off switch S1 and fuse F1 to the mains transformer T1. The transformer secondary supplies 15V AC to the indicator lights which are situated within the V.U. meters, and also feeds D1-4, a bridge rectifier which converts the supply to DC. The DC supply is smoothed by the 5000 μ F capacitor, C1. The motor control circuit is fed directly from this source, which also connects to the regulator ICL. The +12V stabilised supply is conveyed via fuse F3 to the final filter capacitor C2, from whence it feeds the electronic switching and amplifiers.

* Hamilton Electronics Ltd.

ELECTRONIC SWITCH

The active elements of the electronic switch are the transistors Tr1, Tr2 and Tr3. The first two form a complementary bistable circuit, the base bias of one being derived from the collector of the other. When the machine is switched on both Tr1 and Tr2 are cut off. It will be seen that the collector of Tr1 connects, via R4, to a supply rail marked C. Also connected to this rail is the diode D5, relay RLA and the recording indicator lamp LP3.

The reader will probably have deduced that rail C has to be switched to +12V for the machine to record. By this means, the record/playback head relay is energised and power is fed to the bias/erase oscillator connected to rail C. Also rail B, which feeds the recording amplifier, is energised via D5 and the record lamp is illuminated. When rail C is energised, the forward bias is removed from the base of Tr3 which cuts off, together with Tr17, thus interrupting the power supply to rail A, which feeds the replay amplifier circuit. Tr17 provides additional smoothing of rail A.

The machine normally starts in the replay mode, which means that rail A is available, and rails B & C absent. The change-over is achieved by pressing S2, which makes only for the duration of being pressed. This short-circuits Tr2, and in so doing connects the base of Tr1 to earth via R3. Since the emitter of this pnp transistor is at +12V the device turns on, so applying power to rail C and establishing conditions for recording as previously described. Also, as rail C is now at the +12V level, this voltage is applied to the base of Tr2 via R5, so turning the device on. As a result, the conduction of Tr2 keeps Tr1 turned on even when S2 is released. The circuit is now said to be "latched-up".

Switch S3 is mounted on the deck mechanism and closes when a cassette is inserted. This open-circuits the base feed to Tr2 when the cassette is

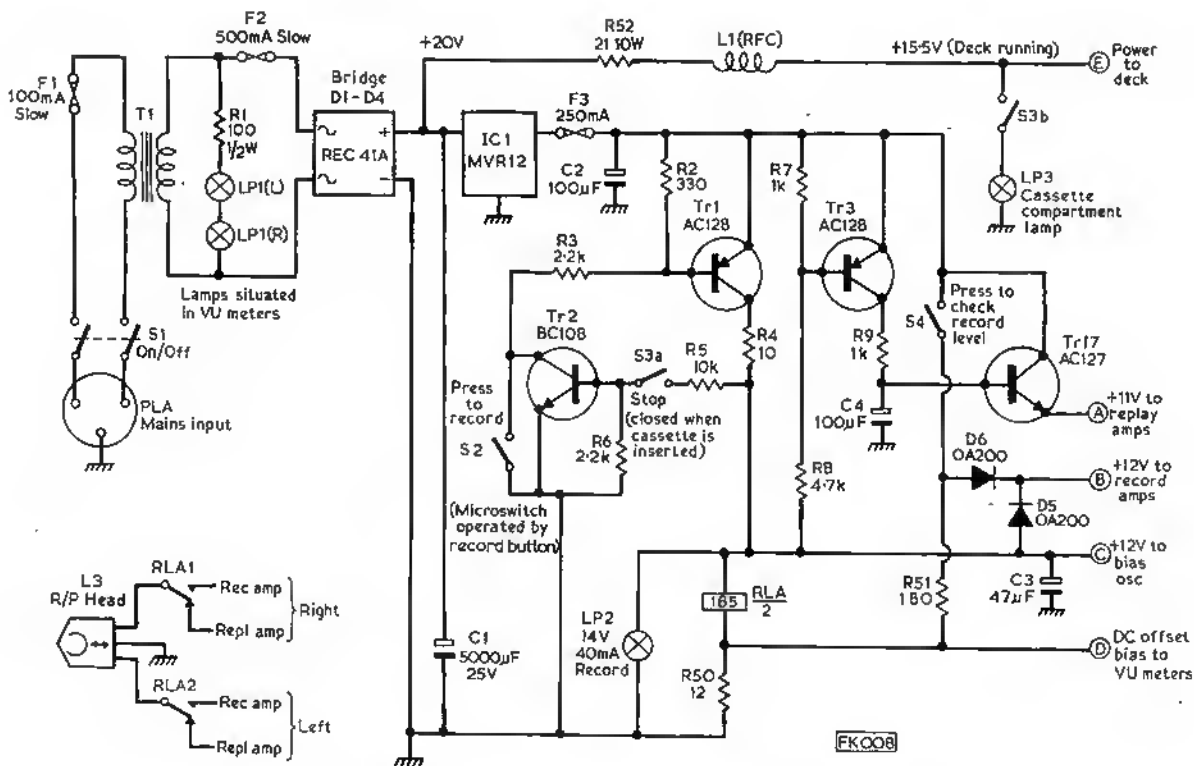


Fig. 2: Circuit diagram of the power supply and electronic switching. Relay RLA connects the record/playback head to the appropriate amplifier.

ejected, so "unlatching" the record switching circuit and ensuring that the machine has reverted to the play mode. It will be seen also that interruption of the supply mains will likewise result in the circuit unlatching.

Switch S4 is provided so that it is possible to monitor an incoming recording signal on the VU meters without having to have the machine actually switched fully to record. It connects the stabilised +12V supply via D6 directly to rail B, which feeds the recording amplifier. Diode D5 is reverse-biased under these conditions so no power is fed to the erase oscillator, head switching relay, record lamp or latching circuit. When starting a new recording directly, the cassette is inserted while S2 is held down. C3 and C4 are antiparasitic capacitors while R4 and R9 are surge-limiting resistors.

A lamp is provided in the cassette compartment, which enables the amount of tape used to be assessed. It illuminates the cassette from above, so enabling the tape to be seen in the window. Because this lamp is situated near the record/playback head, it is fed with smoothed DC to avoid any problem from hum pickup. For long life, a 24V bulb is used.

BIAS AND ERASE OSCILLATOR

In Fig. 3 we show the circuit of the bias and erase oscillator. The tuned circuit consists of L2, C6 and C7. The junction of C6 and C7 provides a capacitive tap across the circuit which is used as a feedback point. The operation is based on the use of complementary transistors Tr4 and Tr5. Each transistor in effect represents a differential load, the emitters working into the feedback point at the junction of C6 and C7. Voltage magnification takes

place across the tuned circuit, and this is coupled to the base network of the transistors by the capacitor C5. Resistors R12, R13, R14 and R15 bias the transistors on sufficiently at the application of power to enable the circuit to commence oscillation. The use of this type of circuit, being symmetrical, reduces even harmonic distortion which can seriously impair the signal to noise ratio. Odd harmonics have far less effect.

The bias signal is taken from the top end of the erase head. Two levels are provided, one for standard

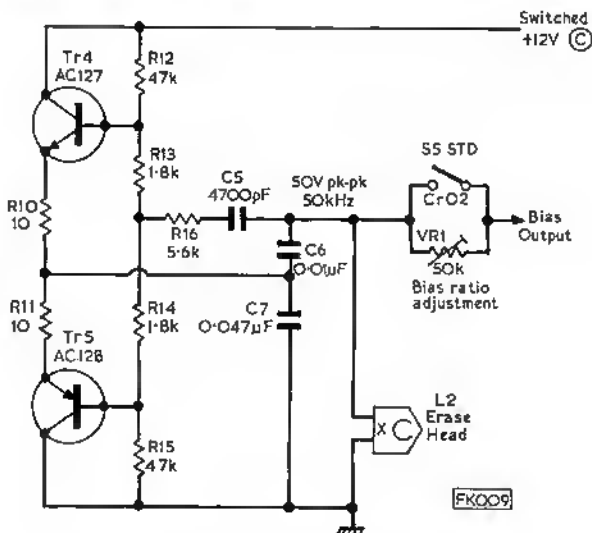


Fig. 3: The bias and erase oscillator circuit uses the erase head as its inductive element.

and one for chromium dioxide tape. The higher level for chrome tape is achieved by shorting out VR1 with S5. Setting-up instructions are dealt with later.

RECORDING AMPLIFIER

Now we come to the recording amplifier, shown in Fig. 4. This amplifier has to lift the incoming signal to a suitable level, and feed it to the head in the recording mode. It is also necessary to provide a meter for monitoring signal level.

The first stage, Tr6, uses a low-noise BC109c to amplify the low-level microphone signals. The auxiliary input from the DIN socket is attenuated down to microphone level, and is connected when the microphone is removed from its jack. While it may be thought that the signal to noise ratio will suffer because of this, in fact the arrangement is completely satisfactory. The recording level is adjusted by VR6, which is placed immediately after the input stage.

The more complicated part of the circuit involves Tr7, Tr8 and Tr9. This section is the recording amplifier proper, and we must first consider its special requirements.

The head has an impedance of 18k Ω at 50kHz, and requires a bias current of 500 μ A. 9V rms of bias therefore have to be present across the recording head, and this signal will obviously feed back into the recording amplifier via R30.

It is common practice to insert a parallel tuned circuit, resonant at the bias frequency, in series with the audio feed to the head. This "bias trap" prevents the bias entering the recording amplifier. The reader will realise, of course, that this involves coils, one in each channel of a stereo recorder. Our design has obviated the need for a bias trap coil, by rendering the effective output impedance of the recording amplifier extremely low at 50kHz. R30 and the output impedance form a potential divider, which ensures that less than 100mV of bias is found at the output of the recording amplifier.

It may not be obvious why the bias should be kept at a low level within the amplifier; one reason is that an excessive level would limit the output swing available, so introducing premature overloading and intermodulation. Another reason is that the bias is really an interference signal as far as the audio is concerned, and spurious beat frequencies can occur resulting in "birdies" on the final recording.

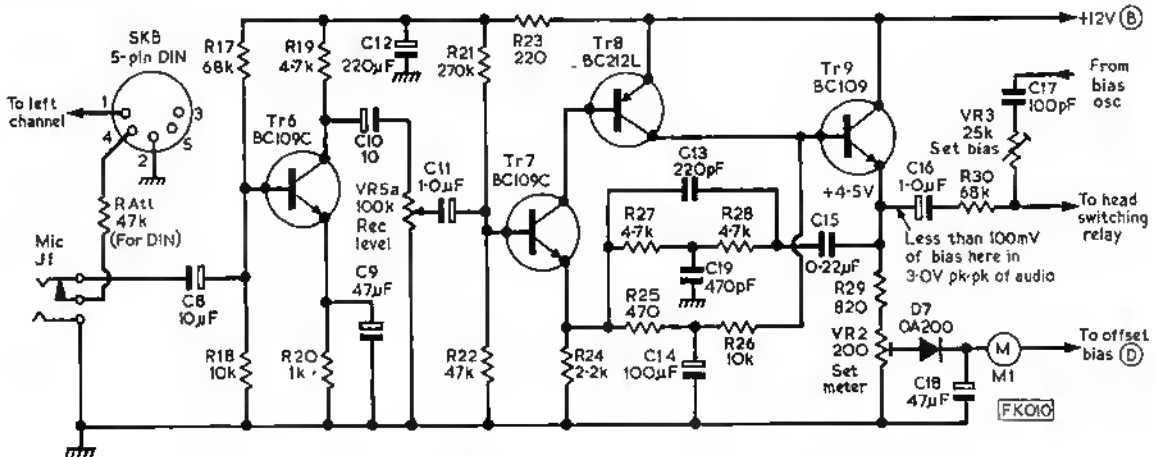


Fig. 4: Circuit diagram of one channel of the recording amplifier. VR5 is a dual-ganged slider potentiometer with one track controlling the record level and the other the playback volume.

In order to record linearly, it is necessary to ensure that the output impedance to the head is high. The effects of head inductance are thereby swamped and the current through the head will be proportional to the applied voltage. It follows therefore that the magnetisation of the tape will be proportional to the input voltage—the signal we wish to record. The simplest means of achieving the required characteristic is to place a resistor in series with the head. Obviously this involves a loss of signal, but we should remember that the head only needs 50 μ A of recording current into an impedance of 500 Ω .

The recording amplifier is designed to produce about 3V peak to peak signal, at low impedance, which is then fed to the head via the 68k Ω resistor R30. It should also be remembered that we have to introduce a bias signal into the head. This is adjusted to the correct level by VR3. C17 represents a high impedance at audio frequencies while allowing the bias signal to pass with little attenuation.

We shall now examine the output end of the recording amplifier in detail. Three transistors are employed, the first two forming a complementary amplifier pair, with the last acting as an emitter-follower to provide a low output impedance. The DC working point of the circuit is stabilised, the components concerned are the input potential divider R21-R22 which sets the base level of Tr7, R24, R25 and R26. R25 and R26 form the upper leg of a divider completed by R24.

Substantial DC feedback is therefore applied around the complete loop. AC feedback around this path is prevented by decoupling R25 and R26 with the capacitor C14. R25 therefore represents, in parallel with R24, an impedance across which AC feedback may be introduced. The AC feedback network consists of C15 (DC blocking), R27, R28, C13 and C19. C13 has a low impedance at the bias frequency and allows heavy feedback to occur at 50kHz. This maintains the low output impedance at bias frequency referred to earlier.

★ components list

Resistors

R1 100Ω	R19 4.7kΩ	R37 220kΩ H.S.
R2 330Ω	R20 1kΩ	R38 47kΩ
R3 2.2kΩ	R21 270kΩ	R39 2.2kΩ
R4 10Ω	R22 47kΩ	R40 10kΩ
R5 10kΩ	R23 220Ω	R41 330Ω
R6 2.2kΩ	R24 2.2kΩ	R42 2.2kΩ
R7 1kΩ	R25 470Ω	R43 1kΩ
R8 4.7kΩ	R26 10kΩ	R44 5.6kΩ
R9 1kΩ	R27 4.7kΩ	R45 27kΩ
R10 10Ω	R28 4.7kΩ	R46 33kΩ
R11 10Ω	R29 820Ω	R47 4.7kΩ
R12 47kΩ	R30 68kΩ	R48 15kΩ
R13 1.8kΩ	R31 470kΩ H.S.	R49 4.7kΩ
R14 1.8kΩ	R32 100kΩ H.S.	R50 12Ω
R15 47kΩ	R33 2.2kΩ	R51 180Ω
R16 5.6kΩ	R34 10kΩ	R52 21Ω 10W
R17 68kΩ H.S.	R35 100Ω	Ratt 47kΩ (DIN)
R18 10kΩ	R36 2.2kΩ	330kΩ (0.5v)

All 1/4W ± 5% except R52

Variable resistors

VR1 50kΩ	VR2 200Ω	VR3 25kΩ
VR4 100kΩ	all skeleton presets	
VR5a/b	100kΩ + 100kΩ dual slider, log.	

Capacitors

C1 5000μF 25V	C12 220μF 25V°
C2 100μF 25V	C13 220pF (C)
C3 47μF 25V	C14 100μF 10V
C4 100μF 25V	C15 0.22μF (P)
C5 4700pF (P)	C16 1μF 25V (T)
C6 0.01μF (P)	C17 100pF (M) or (S)
C7 0.047μF (P)	C18 47μF 10V
C8 10μF 10V	C19 470pF (M) or (S)
C9 47μF 3V	C20 10μF 10V (T)
C10 10μF 25V	C21 100pF (S)
C11 1μF 25V	C22 100μF 10V
	C23 50μF 25V
	C24 10μF 25V
	C25 100μF 10V
	C26 0.1μF (C)
	C27 0.01μF (C)
	C28 0.01μF (C)

C29 0.022μF (C)

C30 10μF 25V

C31 1μF 25V

C32 220μF 25V

Key to capacitor types: (C) Ceramic, (M) Mica, (P) Polyester, (S) Polystyrene, (T) Tantalum. Remainder electrolytic.

Semiconductors

Tr4, Tr17, AC127 Tr1, Tr3, Tr5 AC128
 Tr2 BC108 Tr9, Tr12, Tr14-Tr16 BC109
 Tr6, Tr7, Tr10 BC109c Tr8, Tr11, Tr13 BC212L
 D1-D4 100V 2-2A Bridge D5-D7 OA200
 D8, D9 OA91 IC1 12V Regulator in TO3
 can (RS Components MVR12)

Switches

S1 DPST Min. toggle switch
 S2 SPST Sub-min microswitch
 S3 Part of deck assembly
 S4 SPST Push switch
 S5 DPST Min. toggle switch

Miscellaneous

T1 15V 1-8A secy.; RLA 4pco Min. Relay, 12V coil;
 M1 100μA Miniature edgewise meter with lamp-
 holder;
 L1 2A 9μH Suppressor choke; L2 Erase head;
 L3 Record/playback head; (L2, L3 supplied with
 deck)
 F1 100mA Delay fuse with holder; F2 500mA
 Delay fuse with holder; LP1 6V LES Lamp; LP2
 14V 40mA Red lamp; LP3 24V LES Lamp with
 holder; J1 3.5mm switched jack; PLA Mains plug,
 3-pin, with socket and lead; SKB 5-pin DIN chassis
 socket (180°); Cassette mechanism Goldring-Lenco
 CRV, stereo with DC motor.

NOTE

Two each of the following components are required for the two stereo channels:—
 R17-R49, Ratt, C8-C32, Tr6-Tr16, D7-D8, M1,
 J1, VR2-VR5, LP1.

The symmetrical network R27, C19 and R28 produces negative feedback falling off at the higher audio frequencies, and this offsets head and tape losses by providing a degree of emphasis at these frequencies. On replaying the tape, the levels are restored to normal, and noise is reduced by the same process.

The signal for recording appears at the emitter of Tr9 and is applied to the recording head via C16, the DC blocking capacitor, and R30, mentioned earlier. The emitter load is completed by R29 and VR2. A proportion of the voltage developed across VR2 is applied to diode D7. This silicon diode needs approximately 600mV applied in the forward direction before it can conduct, and the setting of VR2 enables the diode to be biased to a point just short of conduction. Audio modulation causes the voltage to increase on positive half cycles, so that current "spills over" through the diode and into the capacitor C18. The selected V.U. (Volume Unit) meter has an impedance which needs no further series resistance, and the meter is connected directly to C18.

The time-constant of C18 and the V.U. meter impedance is chosen so that the circuit has a

sharper attack than decay time, enabling peak modulation to indicate reasonably quickly. Since the V.U. meter is effectively buffered by R29 from the emitter of Tr9, the non-linear characteristic of the diode and meter circuit is prevented from having a distorting effect on the audio signal.

A relay is used to connect the head to either the recording or the playback amplifier as required. The relay is RLA shown in Fig. 2. To offset the DC bias applied to the V.U. meter via D7, the earthy side of the meter is returned to R50, placed between the relay coil and earth.

Next month, in Part 2, we describe the replay amplifier and dynamic noise reduction circuitry and the motor control, before passing on to the first stage of construction—building the cabinet.

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

COMMENT accompanying the many logs this month seems to favour a listeners competition of some kind. While I am only too glad to organise one and even arrange some small trophy there remains a basic problem. How does one submit confirmation of stations heard? It is bad enough getting QSL's I know and indeed quite costly these days but if the competition is to have any worthwhile meaning then how are the claims of the leading contenders to be verified? We all know it is too easy to sit down and copy the calls of DX stations being worked by some high power G DX'er without being really sure that we have genuinely copied the call of the DX station ourselves! Transmitting amateurs can get QSL's or submit a statement that the QSL's have been seen by some responsible club official but what can the SWL do? Submit a tape recording? How about the first SWL to submit a card from an amateur station in each of the six continents after a certain deadline? Jot down your ideas with your next log.

First newcomer this month is **A. Doherty** (Portrush, Co. Antrim) whose FR50B brought in 'funnies' BY1MAO and ZA1ZA among an otherwise excellent log for 80m SSB. Also has a war surplus R119 probably best employed as a paper weight! Sorry, forgot to say he is also BRS34968. **Stephen Terry** (Banbury, Oxon) has had his dormant interest in SWL'ing revived by a strong injection of FR50B producing a good assortment on four bands. I hope, Stephen, you will do the set justice by feeding it from a decent aerial in future. A first letter from **Stephen Lawrence A8719** (Market Harboro) reports a string of JA and allied prefixes on 15m from his 9R59DS and multiband dipole plus a 180ft wire. His sole goodie on 80m was VS6DO with infrequently heard KL7 on 20m.

Next newcomer is **Roger Trett** (Norwich) who reports a 'new toy in the shape of a Yaesu FR50B'. He's concentrating on getting a 30ft tower up soon complete with 8 element yagi for 2m plus a good long wire for the HF bands. Which will all come in very useful after Roger has passed his RAE which he will have taken by the time this appears in print. Back to regular **Tim Charles** (Colchester) who supports the idea of a band/countries sort of table in which he would be well away judging by his figures.

But he admits to just one country on 160m! Something wrong somewhere OM . . . this past weekend I worked 12 countries on CW including four W's in a few hours operating in the CQ WW contest. Make a point of listening in the CQ 160m CW contest during the last weekend of January, when intense activity can be assured. Tim seems to be convinced that Father Christmas will be wanting a large stocking in which to deposit a new receiver on the big day!

Steve Blake (Aylesbury) has parted with his ex-WD gear in favour of a Codar CR70A plus PR30 pre-selector and homebrew ATU. Steve A8597 is appalled, like many others, at the behaviour of certain people on 80m and trusts that they will eventually grow up one day. Hear, hear! Steve's plans include a move to 2m with a converter and cubical quad. **Michael Green A8088** (Northwich, Cheshire) reports that ST2AY is old friend GW3UPK, heard on 80m (and sought by me on 160m!) and that JY9US is ex-W3HLR c/o US Embassy, Aman. **Paul Barker** (Sunderland) our SSTV expert reports a fine catch in K0YKJ Boulder, Colorado on 21MHz SSTV. Contest prefixes noted were CV4 Uruguay and CT7 Portugal.

Max France (Warrington) has made a scoop with ZL4JF on Campbell Island on 80m SSB which must be near the ultimate in DX from this part of the world, while still remaining earthbound! Max reports a move to the relative quiet of 160m copying 15 countries on SSB over the weekend. Tim Charles to note! Max is also an RAE-taker in the December exam and we wish him luck. **John Porter** (Baslow, Derbys.) also noted strange prefixes such as CF Canada and those mentioned above, plus 9H4 the pretty little island of Gozo nestling alongside Malta.

Eric Carlington (Lymington) stuck to 10m in contrast to most other reporters finding the band open from 0800 to 1630 with such juicy ones as WB2VUO/VQ9 on Chagos Is. and VQ9HCS on Astove Is. **Tim Charles**, again, reporting on his go in the 40m SSB contest when he copies 277 stations 'without stopping up all night!' His best, in my opinion, was KS6DW, a good one on any band.

Back to the first-loggers in the form of **John Martin A8781** (Kingsbridge, S. Devon) who recently completed the building of his Heathkit SW717, coupled to a tapped dipole. John, only 16, is studying for his RAE and learning Morse and putting up some verticals and putting an S-meter in his set and, and . . . where on earth does he get the time! **Andrew Swiffin's** first log to the column also concentrated on 10m. His PW Comprehensive Multiband receiver is fed with a multiband dipole mounted in the loft. I forgot to say that Andrew is A8603 and lives in Cheadle, Cheshire.

Log extracts

Tim Charles:—80m PJ8KGI ZL2GX ZL3ES ZL4AV 601AO 9M2AQ 40m FB8TD OA4XX XT2MB YN0KI ZL2VC 5T5TS 5V4IW 20m DJ6QT/CT3 FK8XA HL9KT KG6SX T19K ZLIKE ZL3SW 5T5KFZ 9H4D.

A. Doherty:—80m FL6CVC PJ2CW S21CW VP8NP 4S7PB.

Stephen Terry:—80m FL8DJ OX3DL S21CW ZD7FT 20m DU2VZ KX6BU ST2SA VR6TC ET2AP 8P6FU 15m A9XV ZD3G ZE6JL.

Stephen Lawrence:—80m VS6DO 15m JA0PFU JG1OQZ JR1MCK.

Roger Trett:—20m P29FV ZF1XG 15m FY7AN H18MAG 10m CR6RJ 9G1AR.

Steve Blake:—80m EP2LT FL80M JY3ZH KS6DH VPIFF YK4TU ZL3ACJ 20m 3D2AJ 3D2AN (Fiji) 15m VP9HM YN9GL.

Michael Green:—80m JY9GR ST2AY VP9AF 20m JY9US VS5MC ZD3M 15m HS4AFD.

Paul Barker:—20m CT7SH CX7B JY9US VP2MCU XU1DX (Khymer Rep.) 7P8AQ 7X0WW 9L7JT 15m CV4C K0YKJ (SSTV) 10m A4XFE (Oman) HZ1KE 3B8CV.

Max France:—160m HB0LL OE3AML OH3MG PA0HIP 4X4UR 4U1TU 9H1BX 80m CR7JO EP2TW FC6CX EP8DH HZ1KE ST2AY TN8AD 5R8AC 7X4MD.

John Porter:—15m KV4AD KZ5BC TU2EF 20m DUXKE FP8DH HZ1TA MID OY1A PZ9AA VP8NS.

Eric Carling:—10m TI3BVF PJ2RR HK4DF FL8HM ZD8RD A6XT ZD3X XU1DX 6W8FP 8RIG.

John Martin:—15m EL2FP KG4NY VP2GTE VP2EY 80m ST2AY UA9GBO ZL4KF ZL4BX.

Andrew Swiffin:—20m KL7HRB ZL1AJL 3D2AJ 4W1GM 15m FY0BHI VP2GMB VP5WW ZB2GM 10m CE6EZ CX5CB CV4C.

CW stations in bold, remainder SSB.

BROADCAST BANDS

MEDIUM WAVE BROADCASTS

by Charles Molloy

ARTHUR TAIT (Lerwick, Shetland) asks 'Am I the only UK listener to clearly pick-up Faroes Radio from Torshavn on 584kHz (513)?' Using an Armstrong 626 tuner-amp and a 25ft loft aerial, Arthur enjoys regular reception of Torshavn in the Faroe Islands and mentions that this station has a request programme on Sunday afternoons at 1400hr. This 5kW broadcaster is sometimes heard in southern UK in spite of interference from Vienna, Paris and Madrid, all on the same channel. It has been logged occasionally by the writer at the 0715hr sign-on, using a communications receiver (Marconi Mercury) and a medium wave loop antenna. Torshavn will verify a correct reception report with a picturesque QSL card which makes the effort involved in logging this elusive station well worth while.

Brendon McNamee has moved from Portrush to Loughborough. He has been using an outdoor UHF TV aerial connected to his Sharp BZ-23 portable

receiver from medium wave reception at his new QTH. His log includes BBC local radio outlets at Derby on 115kHz (271m), Humberside on 1484kHz (202m), Nottingham on 1520kHz (197m), Leicester on 1594kHz (188m). **R. Dixon** who lives in Grimsby has only a limited space available and he wonders what type of aerial would be suitable to hear as many as possible of the BBC and commercial radio stations which have opened up over the British Isles. An outdoor TV aerial (as used by Brendon McNamee) makes a good aerial for use on the medium waves. Connect the outer (screen) of the co-ax TV downlead to the aerial terminal on the receiver and, if possible, connect the receiver earth terminal to a good earth connection. Results will much depend upon the length of the downlead.

Brian Murray, our regular reporter from Edinburgh is still active on the medium wave with his GEC BC3248 receiver and end-fed 25ft outdoor aerial. Brian reports hearing Murcia in Spain on 854kHz at 0023hr, CSB2 in Lisbon, Portugal on 1034kHz at 0030hr; Radio Centro in Madrid on 1385kHz at 0038hr and Radio Swansea was heard testing on 1169kHz. **J. Livsey** (Rochdale) has been having trouble with his ITT/KB Tiny 3 receiver. When tuned to the medium waves, reception is marred by 'a conglomeration of CW, RTTY and a very active amateur band'. The trouble of course lies in the aerial tuned circuit which probably is not working or mis-tuned and image frequencies, 1550 to 2500kHz, are being received at the same time as the medium wave band. Receiver mis-alignment can give similar troubles and whenever weak CW signals are heard at the high frequency end of the MW band, this should be suspected.

Asiatic stations are often heard on the medium waves during the winter months. Listen during the late evening for Kuwait on 539kHz; Riyadh in Saudi Arabia on 587kHz; Kermanshah, Iran on 985kHz; Bagdad on 760kHz; Kabul, Afghanistan on 1280kHz; Kuwait on 1345kHz; Bagdad on 1360kHz; Ahwaz, Iran on 1390kHz and Dubai, United Arab Emirates on 1480kHz. The 1000kW Voice of Free Asia in Thailand transmits on 1580kHz (between W. Germany on 1586kHz and Italy/Norway on 1578kHz). This station comes on the air for half an hour nightly at 2200hr with news in Cambodian and it is often heard here in the UK.

SHORT WAVE BROADCASTS

by Derek Bell

NOW that the Far Eastern DX season is with us, by coincidence comes a letter from **Leonard Adlard** of Leigh-on-Sea, who has a problem. His daughter lives in Bangkok, Thailand and he wishes to hear the same radio programmes that she does in order to establish some sort of link with her.

A pity, Mr. Adlard, but the only thing you will hear is the overseas service of Radio Thailand. This is on 9655 and 12450 aimed at North America, it has news in English but this is at 0045, 1030 and 1115. I personally have not heard them for many a long day but if you care to, contact the Public Relations Dept. Bangkok, Thonburi Metropolis 2, Thailand. However, some of our readers may be able to help so drop me a line folks if you can assist.

Our old friend **Albert Ord** has moved house, now being safely esconced at Bolden Colliery, Tyne and Wear, and he writes that he can pull in the following:



5805 R. Sanaa, Yemen in Arabic at 2000.
 11970 Voice of Nigeria in English at 1830.
 17690 R. Bangladesh in English at 1230.
 on his Trio 9R5 9DS plus Hamgear Preselector and Joystick.

He also heard R.S.A. in Chichiwa on 11970 at 1700, this in itself is not a difficult station to hear, but this part of R.S.A.'s service is not intended for the UK and the aerials would be on a beam for Rhodesia, Zambia and Malawi area. I am sorry Albert, but your question about artificial earth equipment is surrounded by patents and all sorts of legal tie-ups.

November the first, as you perhaps know, heralded the change to winter schedules for many of the short wave stations. K. W. Snipe (sorry no christian name), whose QTH is on the Isle of Wight, notices that the strength of certain stations is dropping and that he has to use aerials of progressively greater length. He also writes to say that Radio Pekin has changed to 7590, 6860, 6270 for their English transmissions.

Robert Hill of Hough, near Crewe, sends us more information on changed transmission times. He writes to let us know that R. Nacional de Brazil now transmits in German and Portuguese on 11780 with a sign-off at 2200. The English service now moves to 9605. Robert, it seems, has a slight problem. Not content with DXing with his Pye Invicta 8027, his GEC UHF TV set has got into the act and he reports that it has been "putting out" the Deutsche Welle signature tune"! Robert then goes on to ask if this is a stray signal. Well, my own TV has given me the Radio Tirana sign-on tune, lying behind a satellite transmission from the US. I would say it is cross-modulation but that blanket covers a lot of freak happenings. Perhaps someone, with more knowledge of TV than I, can provide the answer.

The item on QSL timing in a previous Short Wave News has sparked off some interest, in the form of a letter from a DXer from "way back", namely Lex Arnold. He writes from Hemel Hempstead to send a list of QSL's that have reached him along with the time taken:

Helsinki	1 week
RSA	3 weeks
Pekin	3 weeks

but the top is R. Nacional de Brazil at a staggering five weeks. Lex then goes on to point out that he has heard Polish Pathfinders on 6830 at 1530 with folk and pop music. So come on you music buffs, this is a station that is very rarely reported, have a listen and let us all know what it sounds like.

Two sheets of eye-catching orange note paper herald some very valuable info from Malcolm Collins of Middlebrough. Driving a Prinzsound R888 hooked on to 45ft of wire, this correspondent, in his first try at reporting to SWN, tells us that he has latched on to the Deutsche Welle relay tests from Malta on 9610 at 0030. Malcolm also reports Radio-diffusion Television Ivorienne on 11920 at 2208 in French. This imposing title covers a 100 watter at Abidjan that puts out French and local vernacular programmes for the Ivory Coast.

Radio Norway in English on 6185 at 1200 is the

"cream of the crop" from David Brooks of Melton Mowbray, who has a Grundig "Yacht Boy". It seems that David has the unenviable record of having been waiting 190 days for a QSL from Belgrade. Paul Broadhurst of Tickenham down in the Zider lands of Somerset is a QSL fan and sent me the contrast of Bulgaria taking 270 days and R. Finland taking nine. Finally on QSL's for this month Trevor Bland of Lea, Lincolnshire, writes to ask how long he would have to wait for a QSL from All-India Radio. Sad news Trevor, because back in October they were reported taking 128 days and sending by seamount. Return airmail postage would help!

Northwards to Scotland goes your intrepid reporter now, first to answer Brian Murray of Edinburgh, who while listening to his GEC BC3248 which hangs on the end of a 25ft end fed aerial, came up with Radio Norway on 6185 at 1220 in English, the same service as reported by our earlier contributor. Well gents, a little bird tells me that this new frequency was chosen by R. Norway because they found that they were being interfered with by the BBC and to avoid fuss, they moved!

A scion of the clan, Douglas Mackenzie of Griefi is our second Scot and he would like to know something about public service stations, and if any DX club has been formed for them. The short answer Douglas is, NO. Under British law it is illegal to report or to listen to such stations, and therefore no club can be formed in Britain for them.

Three letters now all asking the same thing, D. Vbranch of Annesley, Notts, A. E. M. McCarthy of Southampton, and the gentlemen of High School of Stirling Radio Club. These folk are all newcomers to the short wave scene, and all would like information. To them I can only say that to fulfil these requests would take the whole of this magazine, resulting in the Editor standing me against a wall and shooting me!

What I can tell you though is that Radio Nederland, P.O. Box 222, Hilversum, Holland, publish some superb free leaflets covering most aspects of the hobby and they are well worth getting in touch with.

The time has come for me to close this month's column. To my surprise the mail was 300% up on my first effort, and to all whose worthy efforts have not been included my apologies and keep trying. Two small items to wind up, Reg Kennedy of World Radio Club writes that his times of transmission have changed from January 4th:

1330 to 1345
2315 to 2330
2030 to 2045
0815 to 0830

While for philatelists, Andrew Knock of Witham, Essex, reports that Sri Lanka on 15425 at 1545 on Sundays is now putting out a stamp programme followed by BBC World Service news.

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.



PW
KEMPTON

CAR STEREO CASSETTE PLAYER

PART THREE

KEITH CUMMINS & TONY FRANCIS*

METALWORK

The mechanism and amplifier panel are arranged side by side in a metal case, whose overall dimensions fit a standard car radio slot. The case is built from four pieces of 16 or 18 s.w.g. aluminium. These are a bottom section with sides formed by bending upwards, a front panel, a rear panel and a lid.

The rear panel, besides providing access for external connections, acts as a heat sink for the four output transistors. The front panel carries the volume, tone and balance controls and a pilot lamp, and is slotted for the insertion of the cassette. The deck mechanism control lever is brought out through a smaller slot. No on-off switch is provided; insertion of the cassette switches the machine on. Automatic ejection occurs at the end of the cassette, while fast wind and manual eject are selected by the control lever.

Measurements for the metalwork are shown in Figs. 5 and 6. To avoid trouble later on, the various parts should be offered up to their appropriate fitting points to ensure that the drilling has been accurately carried out. Burrs should be removed carefully. Failure to pay attention to this point could result in disastrous short-circuits occurring, particularly through the mica insulators on the output transistors. Great care should be taken with the marking and drilling. Remember that it is best to measure twice and cut or drill once, rather than have to start again.

The diagrams should be studied carefully before commencing anything. The most difficult parts of making the case are the bending, which must of course be accurate, and the cutting of the slots in the face-plate. If a bending machine is available the job is easy, so it is worth trying to gain access to one. Failing this, a vice and wooden blocks will have to suffice, though it is best to use 18 s.w.g. aluminium in this case. The cutting of slots requires some very careful filing if the job is to look professional and, even more important, if the cassette mechanism is to operate easily.

ASSEMBLY

When the case has been built, the deck mechanism can be assembled into it using the small bracket shown in Fig. 5 to support the right rear corner. Then the output transistors and other components attached to the case rear panel can be bolted on before it is fitted to the main casing.

Mount the completed amplifier board in the case, and connect it to the remainder of the equipment as shown in Fig. 7. The output transistors are wired to the amplifier board by suitably neat loomed cable connections and the power input and speaker output leads taken through the grommet positions in the back panel.

The connection between the tape head and the amplifier board has to be made, and the controls wired according to the diagrams. Once the controls and panel light have been attached to the front panel (the balance control used in the prototypes was fixed with Araldite), the panel can be finally positioned and secured to the front of the machine.

A 3A fuse should be fitted in the power input line to the machine. The speaker leads can be taken either to separate speaker DIN cable-mounting sockets, or to one 3 pin DIN socket, using pin 2 as a common return.

A check with a multimeter should next be made, using the lowest resistance range, to ensure that no short-circuits are present either in the wiring, across the power input, or from the output transistor collectors to the case. The resistance reading between the bases of each pair of output transistors should be set to zero by adjustment of the quiescent current potentiometers, VR4. Note that the zero position is at opposite ends of the track for the right and left hand channel pots.

TESTING

The fuses should be left out of the output stages at this point and the machine powered up from a tapping on a car battery, say 8 volts, to see whether the mechanism runs. A cassette should be inserted, and if it appears that the mechanism shows signs of running correctly, the voltage may be increased to 12. Keeping the volume down, the current across each vacant fuse position should be metered and adjusted to 10 mA, using the potentiometers VR4. After setting up this quiescent current, the fuses may be fitted and the speakers connected for a test of all functions and controls.

The alignment of the tape head should be checked when playing a cassette. The head is secured by two screws: the one with spring under it (on the right when viewed from the front) is adjusted for maximum treble response. The other screw sets the head height and should not be touched.

* Hamilton Electronics Ltd.

Mark fixing holes in lid and rear plate using lower case section as a template

Mark out each transistor position using mounting washer as template

Brackets for under-dashboard mounting if required.
(fit to case before mounting cassette mechanism)

Drilling key:

a... $\frac{1}{4}$ dia., b...2BA clear, c...4BA clear, d...6BA clear, e...6BA tapped.
*...are drilled 4BA, while accepting 6BA bolt for deck securing, to allow for tolerances.

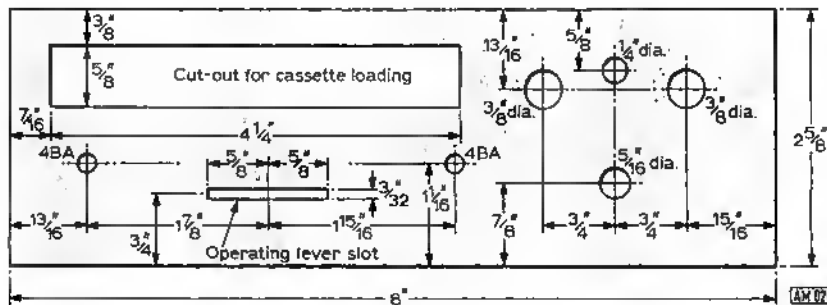


Fig. 5: Dimensions and assembly of the metalwork forming the case.

Fig. 6: Drilling and cutting details for the front panel. The slots for the cassette mechanism must be accurately cut for smooth operation.

Finally, it will be necessary to adjust the motor speed so that the resultant tape speed is correct. VR51 on the motor control panel sets this. A simple way is to use a previously recorded cassette, and time the period a given item runs on another machine. The potentiometer may then be adjusted so that the time taken is the same on the car player.

Now, some remarks on using a positive-earthed system. You will have noticed that the amplifier board earthing occurs via the output transistors and ends up at the deck mechanism. Also, all the output transistors are fitted with insulating washers. Therefore it is relatively simple to reverse polarity on the amplifier section, though the change-over for the deck mechanism needs more care. The alternative arrangements are illustrated in Fig. 7.

A disadvantage of using a positive-earthed system is the fact that the "earth" of the head windings is

then at $-12V$ with respect to the chassis. Care should be taken to ensure that a short circuit between the cable screen and chassis cannot occur at the head.

FAULTFINDING

If all is well with your tests, the machine should now be running normally, and the effect of all the controls may be finally checked before fitting the top cover to the machine and mounting it in the car.

In the event of a fault being evident, the following checks will help to reveal the cause:

1. The emitter voltages of the output transistors should be approximately half the battery voltage.
2. Likewise, a reading of about half the positive rail voltage should be obtained at the emitter of Tr5 and the collector of Tr2 if these stages are operating normally.

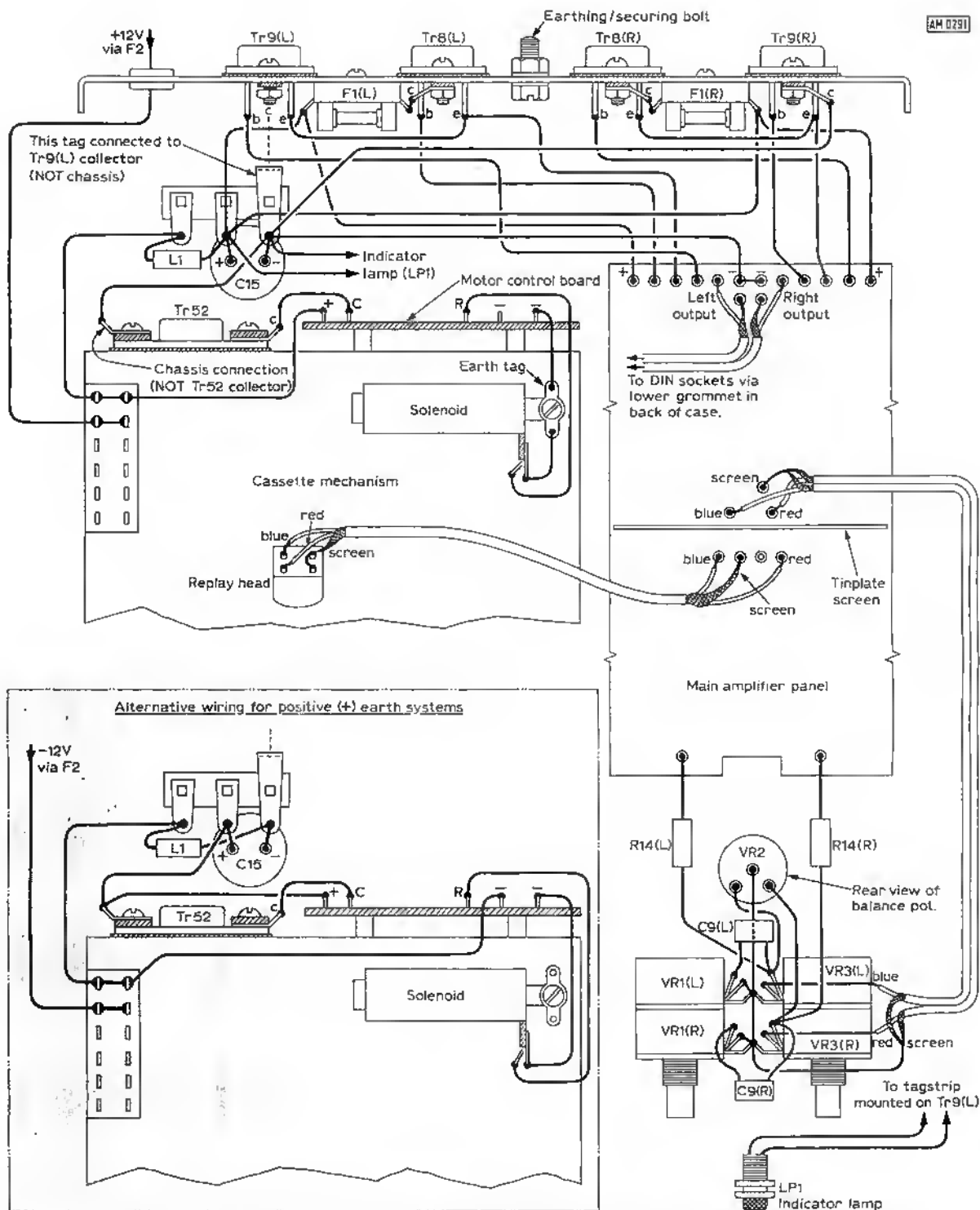


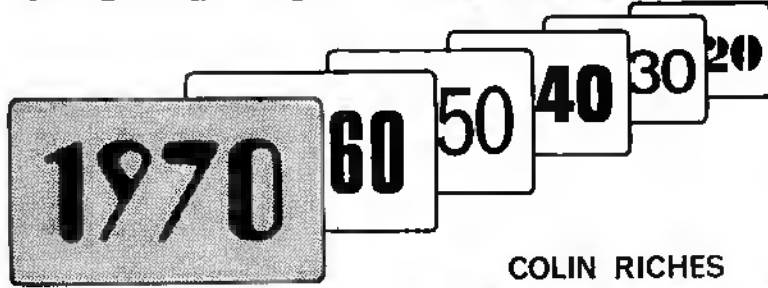
Fig. 7: Wiring diagram, including details of changes required for positive earth working. Connections between the Motor Control board and the motor, the commutating switch and Tr 52 base and emitter are not shown.

3. If one channel operates while the other does not, transposing the leads from the volume control slider between channels will show whether the pre-amp or the main amplifier is at fault. If the output changes channel, the pre-amplifier is defective, while if it does not, the fault lies in the main

amplifier.

It would seem opportune at this point to re-stress the need for constructional accuracy in making up the unit. We are all inclined to think that the other fellows are the only ones to make a mistake, while really we are as fallible as the rest. So be careful,

GOING BACK...

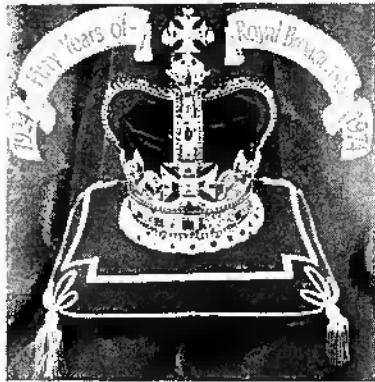


COLIN RICHES

OUR friends at the BBC have issued a record entitled "Fifty Years of Royal Broadcasts—1924 to 1974". This magnificent collector's piece is a natural successor to the very popular record which I reviewed some time ago called "BBC 1922-72, 50 Years of Broadcasting."

This new record is a double-album which recalls some of the most famous and memorable Royal and National events which have taken place over the past 50 years.

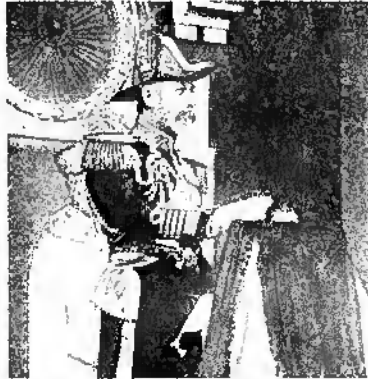
Narration is by Robert Hudson from a script by John Laird. It has been compiled from recordings from the BBC Archives and



The record sleeve which shows a full-colour picture of the Crown.

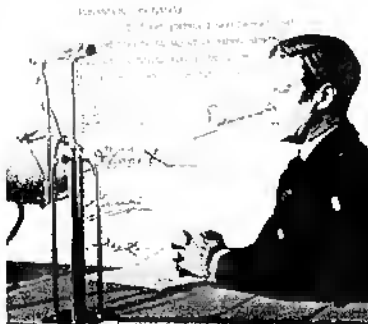
covers recordings from the very first Royal broadcast in 1924 by H.M. King George V to the wedding of H.R.H. Princess Anne and Mark Phillips.

Other recordings include the September 1936 march of miners through London singing "Ebenezer"; H.R.H. Prince Edward (1936) making his speech of abdication to the Nation; the two princesses broadcasting to the children of the nation on 13 October, 1940; the Christmas 1944 broadcast by George VI—the last Christmas message of the war—and many others.

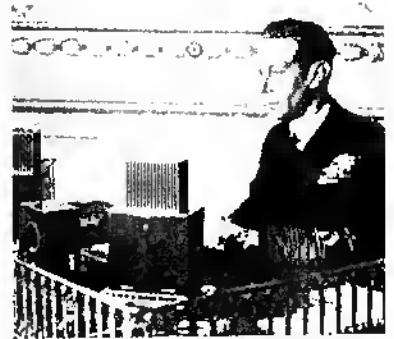


23rd April 1924. H.M. King George V opens the British Empire Exhibition. This was the very first broadcast by a British Monarch

It is interesting to compare King George V's formality and sense of wonderment at the miracle of radio in his speech at the opening of the 1924 British Empire Exhibition, with the Queen's wonderful informality when she remarks "My husband and I—we, and by that I mean both of us..." in a speech at a luncheon to celebrate their 25th wedding anniversary. H.R.H. the Duke of Edinburgh also demonstrates his informal approach to broadcasting when he recites a limerick about the "young man from Khartoum."



11th December 1936. H.R.H. The Prince Edward speaks to the nation from Windsor Castle, following his abdication so that he could marry the woman he loved so dearly.



25th December 1944, H.M. King George VI broadcasts on the last Christmas Day of the war.

This double album also contains reminders of events and situations of national importance like the Rt. Hon. Neville Chamberlain's "peace in our time" speech. The grave voice of Lionel Marson announces the Nazi takeover of Poland in the Second World War. The sounds of war are recorded and on 23rd September, 1940, H.M. King George VI announces the creation of the George Cross for civilian acts of valour. On side 2 of the album the King speaks to the Empire on the last Christmas day of the war. On May 8th, 1945, an excited Stuart Hibberd informs the nation that peace has been declared.

Princess Elizabeth and her little sister Margaret broadcast to the children of the world. They say,



"My sister is by my side and we are both going to say 'goodnight' to you. Come on Margaret! Goodnight children, Goodnight and good luck to you all!"

"When peace comes, it will be for us, the children of today, to make the world of tomorrow a better and happier place."

There is also a very emotional track of the V.E. Day crowds in Whitehall singing "God Save the King."

Side 3 starts with H.M. The King speaking on the first Christmas Day of peace. The 26th April,



21st April 1947. H.R.H. The Princess Elizabeth in Cape Town broadcasts her Speech of Dedication on her 21st Birthday.

1948, Silver Jubilee Celebrations of Their Majesties King George VI and Queen Elizabeth, who speak to the peoples of the Commonwealth is a very interesting track. We also hear a magnificent recording of the wedding of H.R.H. Princess Elizabeth to the Duke of Edinburgh.

John Snagge, on 6th February, 1952, announces the sudden death of H.M. King George VI and there is a beautiful recording of Queen Elizabeth's Coronation in Westminster Abbey.

Side 3 ends with Her Majesty broadcasting to her people on the Coronation Day.

Side 4 starts with the 1953 "Ceremony of the Keys" at Edinburgh Castle, and the Rt. Hon. Winston Churchill speaking in the Guildhall at the luncheon given by the Corporation of London to welcome back The Queen and The Duke after their Canadian tour.

The July 1st, 1969, Investiture of The Prince of Wales is recorded with the Prince proving that he can actually speak Welsh by saying, "Rydych chi'n canu yn iawn. Diolch yn fawr" (Your



Rydych chi'n canu yn iawn. Diolch yn fawr. July 1st 1969—the investiture of the Prince of Wales.

singing is fine. Thank you very much).

The collection of recordings finishes with the wedding of Princess Anne to Captain Mark Phillips.

These two records, which come in a very attractive presentation folder come complete with a 12-page booklet of photographs and excerpts from the speeches. The BBC number is REJ 187 and the price is £4.42.

I would say to you collectors of vintage equipment and recordings and to those of you who just love to bathe in the nostalgia of the "gold old days" that this double album is well worth every penny of the £4.42.

If you want to buy a copy, you can go to almost every record shop in the country. Please don't go to the BBC, however, because they are unable to supply their records and tapes direct. Incidentally, the BBC tell me they hope to issue their records on cassette and cartridge also.

We wish to thank the BBC for allowing us to use photographs contained in the 12-page booklet which accompanies this album.

TAKE 20—continued from page 914

capacitor and from that moment on there will be no change in voltage across it (this, of course, assumes that you do not have a leaky capacitor!). If, however, one is drawing current from the capacitor with a load the charge stored will reduce during the period when the AC input voltage falls away from peak; this causes a slight fall in voltage but is rapidly corrected when the AC rises to its next peak positive value.

The more current one draws from the capacitor the greater will be the momentary fall in voltage. We end up with a 100Hz ripple on the DC voltage across the capacitor. Its frequency is 100Hz because of the full wave rectification action of the diode bridge. The greater the load current the greater will be the ripple. To avoid extreme values of ripple one should aim to have a large value of capacitance which is charged up from as low an impedance source as possible and try to avoid drawing too much load current.

Stabilisation

The foregoing assumes we have no stabilisation but in this case we have included a first order degree of stabilisation which helps reduce the ripple content of the output voltage and also ensures that the output is fairly constant under a wide range of loads and mains voltages. We have adopted the straightforward series stabiliser circuit which is simply an emitter follower (Tr1). The voltage at the emitter of Tr1 will be set by any voltage we apply to its base. In actual fact the voltage we obtain at the

output will be approximately 600mV less than the base voltage because of the forward voltage drop across the base/emitter junction. The base voltage (or reference voltage) must come from a source that is capable of supplying enough current to satisfy the input requirements of an emitter follower. That is to say, we must be capable of passing base current equal to the load current divided by h_{FE} for the transistor in question.

★ components list

T1, transformer, Mains/10V 250mA
 D1/4, 1N4001. D5, 10V 400mW zener diode.
 R1, 470Ω ½W. C1, 3000μF 20V. Tr1, BFY51.
 S1, DPST toggle 250V. Heatsink for Tr1, TO5 style.

We are using a 400mV 10V zener diode D5 fed through a low value resistor R1 to provide this current. Irrespective of the voltage at the top end of R1 the voltage across the zener will be 10V so obviously the supply voltage must be greater than 10V for this to be possible. Consequently any variations in the supply voltage will not change the voltage across the zener. This statement is only true to the first order of approximation because the voltage of a zener is only constant when the current flowing through it is constant. Nevertheless variations in supply voltage produce only small voltage variations across the zener. Having said that the output voltage will equal the base voltage you should now see how we get a reasonably good degree of voltage stabilisation.

HOTLINES

ON RECENT DEVELOPMENTS

THE SIZE OF THINGS

Two items of news have reached me from the US which might be of interest to readers. The first concerns the size of things. Apparently the funds available for "advanced technology research" for 1975 are a staggering \$90 million. This is money made available to the US Army's Ballistic Missile Defense System Command. One of the things that some of this money is to be spent on is miniaturisation—and I do mean miniaturisation. A spokesman is quoted as saying that the size of radar units could be eventually reduced by up to 90%. Since the commercial and industrial worlds of electronics nearly always benefit from the spin-off which comes from the military, readers can appreciate the implications. Perhaps that wristwatch television is just around the corner.

A WATCH ON TIME!

A friendly industrial spy, just back from the US informs that the digital watch scene will almost certainly hot up next year. He visited something like 24 different manufacturers in the States and everyone appears to be manufacturing millions and millions of circuits for digital watches. With a hard time coming for the industry, and these manufacturers having all these circuits to unload, I believe that the digital watch with its current price tag in the UK of £200 or so will come spiralling down very fast indeed. So, if you're going to buy a digital watch—watch it, the market I mean, and perhaps wait a little while and save yourself some hard cash.

DIGITAL MULTIMETERS

Digital multimeters are in the news again but the cheapest I have found is the ISA DMM3. It costs £40 and covers the usual current, voltage and resistance. It does incorporate one clever idea. On the face of it, the voltage range covers up to 1kV. Once the input gets over this the instrument goes into "over-range". This effectively protects it from blowing up. Interesting thing is that the over-range permits double the rating to be used—and the digital readout will display just what this

reading is. So, if you were on the 0-1A current range (for example) and you put 1.890 through it, the readout would read 1.890A. The dodge is that you effectively get twice the range. Thus the 0-1kV range will read, in fact, 0-2kV automatically and the 0-1A current range reads 0-2A automatically and so on.

VIDEO SYNTHESIZER

With accent these days on television "games" such as Tele-Tennis and the like, a topical product is the colour-video synthesizer. What does it do? Well, if you think of sound synthesizers where all sorts of funny little squeaks (some musical others mystical) can be played, then just translate this idea into colour video where all sorts of coloured shapes and patterns (static or moving) can be displayed on a television screen.

The digitally-based system is called Spectre (I might have expected that) and it can display its self-generated images in up to 64 different colours. It also boasts the capability of 16 levels of luminescence and can input also from TV cameras (including monochrome) ordinary film and still life photographs and pictures.

Spectre controls colour and brightness by using digital signals on an X-Y axis technique. The user has a matrix of sockets which can be "programmed" by plugging in diodes to form the shapes, etc. In the pipeline (so I'm unofficially told) is a keyboard which gives the user a chance to "play" preset chords of colour and shapes. I wonder whether Leonardo da Vinci should be played largo or pianissimo, or whether Kenny Ball and his jazzmen will soon give us their rendition of the Mona Lisa?

ENERGY SOURCES

With the ever increasing cost of fuel it just has to mean that there is a great deal of research going into other forms of energy. Any cut back by the US military could mean that effort might be channelled into this energy problem. Just imagine what could be achieved if the effort on energy was the same as that on military and space items.

One area already bearing fruit is that of harnessing solar energy. Admittedly efficiencies are low, but

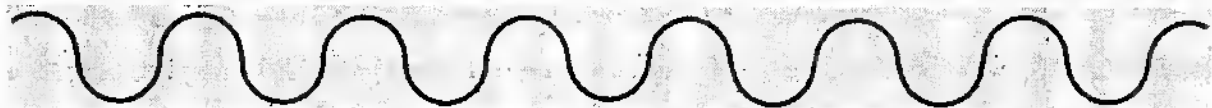
then it's early days. Up till now, most people have looked upon the solar cell as a discrete "thing" up to 2in. in diameter. Not any more. One go-ahead company has started to produce solar cells, well, not so much cells as strips. This manufacturer is turning out single crystal silicon solar cells which are in ribbon one inch wide by six feet long. Efficiency is given as 10% so far. Maybe this method could outstrip all others?

LED

There's a standard schoolboy joke about things on the other side of the world being upside down, but in electronics it's almost a true statement. Hitachi, the Japanese company, has developed a light emitting diode (LED) display where the light shines through the substrate—sort of upside down. But before you say "Why doesn't somebody tell them", think of the many advantages of doing things upside down. First, it means easier production for people who are using these LEDs. Instead of individually wiring each segment to the circuitry, one can use flip-chip techniques where the contacts from each segment (because they're on the underneath side) can be bonded down direct. Again, in the more conventionally produced LEDs, the contacts on top of the diode tend to block off some of the light trying to get out of the top surface directly above them, i.e., from the viewing surface. In the Hitachi approach, the light is being seen from the other side, the side opposite to the contacts and thus there's no "hole" where these metallic ohmic contacts are. Another point is that gallium phosphide used in these devices has quite a large refraction index. Goody, goody say the Japanese coz that means all the emitted rays of light which strike the internal surface at an angle greater than 17° are totally reflected back internally. Ah so grasshopper, time for you to glow!

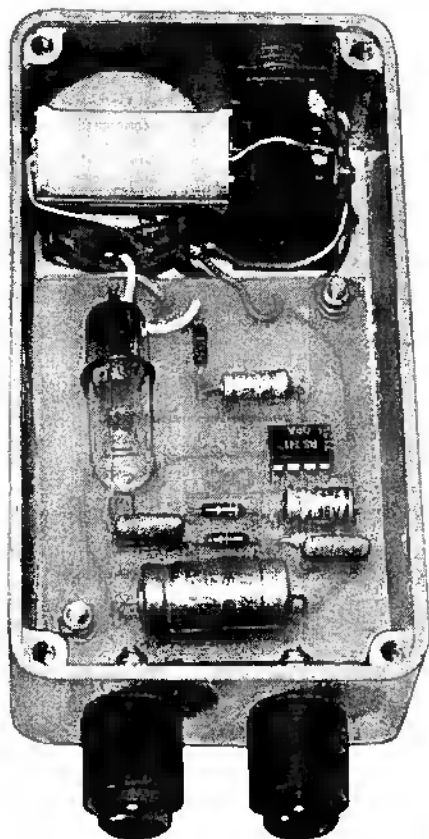
Ginsberg

SINGLE FREQUENCY



A. FOORD

Audio Oscillator



selective network comprising resistors and capacitors.

The basic diagram for the Wien Bridge type oscillator to be used is shown in Fig. 1. Components R1, R2, C1 and C2 form a frequency selective network. In order for oscillation to occur there must be zero phase shift between the input of the amplifier and the output at only one frequency. The frequency selective network acts as a low Q filter having a resonant frequency:

$$f = \frac{1}{2\pi R_1 R_2 C_1 C_2} \text{ Hz}$$

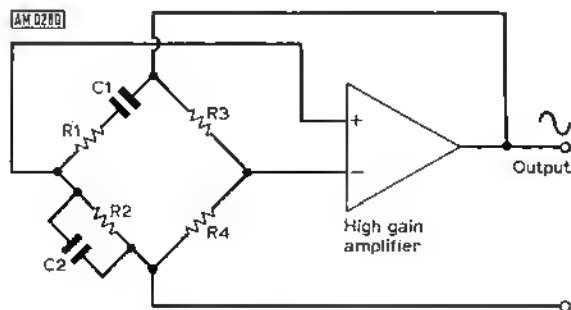


Fig. 1: The audio oscillator is based on the Wien Bridge circuit shown here plus a high gain amplifier.

At this particular frequency the network reduces the signal at the non-inverting (+) input to a third of that at the output of the amplifier. In order to maintain oscillations the amplifier must make up for this loss by having a gain of three.

THERMISTOR STABILISATION

The circuit of Fig. 1 is a perfectly good oscillator in theory, but in practice certain difficulties must be overcome. If the gain of the amplifier is less than three, or the loss of the network more than a third, oscillation will be very slow to build up or at worst may not start at all. On the other hand if the amplifier has a gain of more than three or the network loss is less than predicted then oscillations will build up in amplitude causing distortion to occur. It is clear that some form of automatic gain control is required.

In the practical circuit of Fig. 2 the resistor R1 of Fig. 1 has been replaced by a thermistor TH1. The thermistor has a negative temperature coefficient, i.e. its resistance decreases as it warms up, either because of ambient temperature rises or because current is flowing through it. When power is first applied to the oscillator the cold thermistor will have a high resistance and provided it has been properly

IN audio applications a wide range oscillator is often used with an oscilloscope or audio millivoltmeter to plot the frequency response of an amplifier, filter or tone control. While this approach is invaluable for design work, the basic equipment is expensive and may cost more than a modest hi-fi system.

This article describes a single frequency oscillator which may be used for signal injection where an established design needs testing. Component values are given for operation at 1kHz, the standard test frequency in audio work, but this frequency may be altered over a wide range if it is so desired.

THE WIEN BRIDGE

Resistance-capacitance tuned oscillators are essentially positive feedback amplifiers in which the positive feedback is applied through a frequency

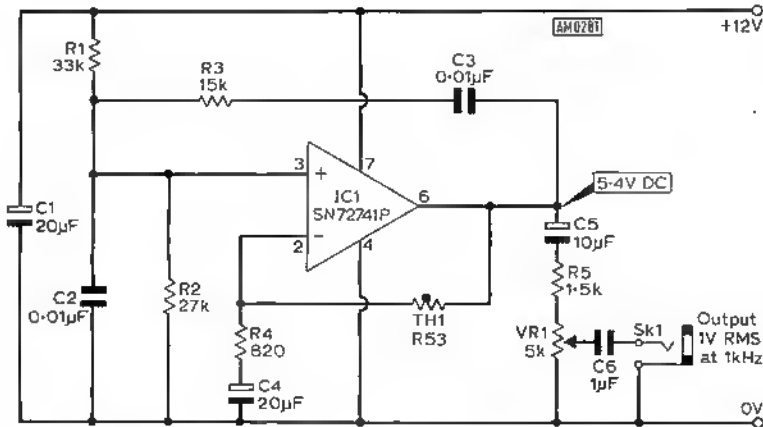
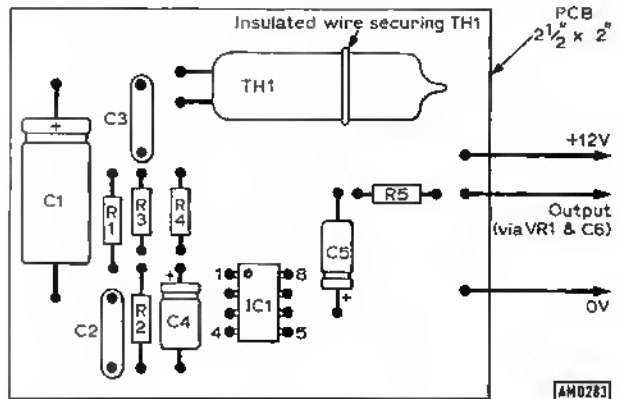
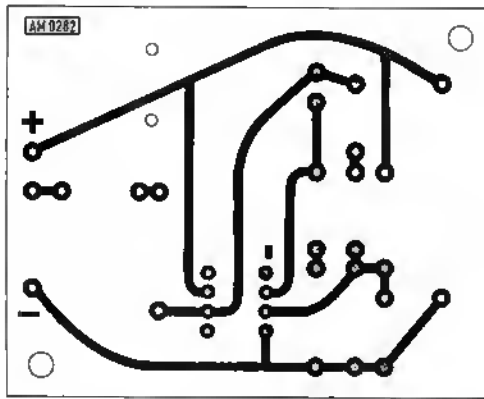


Fig. 2: left, complete circuit of the fixed frequency oscillator. Fig. 3: below, layout for the printed circuit board, shown actual size, together with the component positions. Output control VR1, socket Sk1 and capacitor C6 are mounted on the case, as shown in the photograph.



selected will give the amplifier a gain of more than three allowing oscillations to build up quickly. As the thermistor passes current it warms up, its resistance decreases and the amplifier gain is maintained at exactly three giving a low distortion output at constant amplitude.

A high gain operational amplifier type 741 is used in the oscillator but not with its usual dual power supply. Resistors R1 and R2 form a bias network which produce a DC voltage of approximately 5.4V at the output. The output voltage then swings about this point. Resistors R1 and R3 in parallel are effectively the R2 of Fig. 1. The gain of the amplifier is determined by the thermistor resistance and R4.

The capacitors C1 and C4 are decoupling components. The output coupling capacitor C6 is smaller than might be expected for audio applications because the frequency response does not have to extend below 1kHz. This has the advantage that a non-polarised high voltage component may be specified, allowing signals to be injected into high voltage valve circuits if required.

ALTERNATIVE FREQUENCIES

As mentioned earlier other frequencies may be produced by altering the value of the network components. It is easiest to change C3 and C2 since the resistors also form part of a biasing chain. If the frequency is reduced C6 may need to be increased by a similar ratio. The frequency response of the 741 puts a limit on the maximum frequency of a few kilohertz.

★ components list

Resistors

- R1 33kΩ
- R2 27kΩ
- R3 15kΩ
- R4 820Ω
- R5 1.5kΩ
- All 1/4W 5%
- VR1 5kΩ potentiometer

Capacitors

- C1 20µF 25V
- C2 0.01µF polyester
- C3 0.01µF polyester
- C4 20µF 16V
- C5 10µF 16V
- C6 1µF polyester

Integrated Circuit

- IC1 SN72741P (or any type 741)

Miscellaneous

- TH1 Type R53 thermistor
- Sk1 Jack socket
- PCB, case, supply terminals (2), knob

CONSTRUCTION

The construction is quite straightforward. A printed circuit board and component layout are shown in Figs. 3 and 4.

The current consumption of the circuit is only 17mA and any supply voltage from 9V upwards is suitable. Battery operation is quite feasible, thus making possible a self-contained unit.

PRODUCTION LINES

colin riches

CALCULATING PYE

Pye Limited are out for a slice of the £35 million calculator market. They are now offering three models—all featuring rechargeable batteries and mains adaptor/battery recharger.

Model 630 is just a basic calculator and solves normal arithmetical problems (price £35.60). Model 640, priced at £47.70 has a memory store facility and Model 650 (priced at £56.95) performs square roots etc.

Pye Limited, P.O. Box 49, Cambridge.

"SCIENTIFIC" KIT

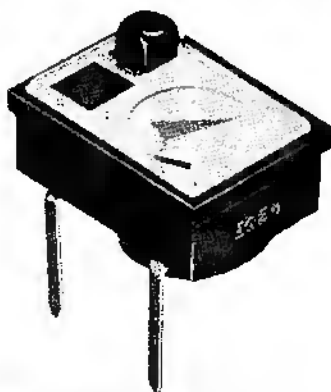
The "Scientific" pocket calculator is now available in kit form direct from Sinclair Radionics, London Road, St Ives, Hunts, at £19.95.

Apart from the basic four (+ - × ÷) operator keys the "Scientific" incorporates the following additional functions: logarithms to base 10, antilogarithms, sine, cosine, tangent, arcSine, arcCosine and arcTangent. These enable rapid squaring, doubling and x^y including square and other roots. Post fixed operators give full calculation facility on all functions.

Entry and result are in scientific notation with a signed 5 digit mantissa and a signed 2 digit exponent giving the "Scientific" a capacity for very large or very small numbers from 10^{-99} to 10^{99} .

The calculator kit which is powered by four standard Mallory batteries giving around 25 hours of continuous use, can be assembled in around 3 hours. It comprises coil, L.S.I. chip, interface chips, case moulding with buttons, windows and display, printed circuit board, keyboard panel, components pack (diodes, resistors, capacitors) battery assembly and on/off switch, soft carrying wallet plus a comprehensive instruction booklet both for assembly and use. The only additional equipment required is a soldering iron (1/16 inch bit) and a pair of cutters. Any queries regarding construction can be directed to Sinclair's service department. *Sinclair Ltd., London Road, St. Ives, Hunts, PE1 4HJ.*

BATTERY LEVEL INDICATOR



Egen Electric have introduced a low-cost battery-level indicator.

The indicator, which measures 16mm in height and 22mm in width, can be mounted by a spring clip fixing to the case or to a PCB with solder tags. It takes no current until an integral push-button switch is depressed. The pointer then moves into either the red or green portion—the limits being set to match the requirements of the particular circuit it is used in by installing the appropriate shunt or series resistor in the measuring circuit. Details of prices etc. may be obtained by writing to *Egen Electric Ltd., Canvey Road, Canvey Island, Essex, SS8 0PG.*

RECORD CORNER

"Goon Show Classics" (REB 177) is the latest Goon album to be released by the BBC Records and Tapes Department and comprises two famed good show broadcasts. Side 1 is the "Dreaded Batter Pudding Hurler of Bexhill-on-Sea". It was first broadcast in 1954 and tells of the investigation to find out who had the audacity to chuck 38 batter puddings at little Minnie Bannister.

Side 2 features the "Mysteries of Pliny the Elder"—broadcast in 1957—and tells of a football match in the E.U.F.A. Cup between the Ancient Britons and the Romans.

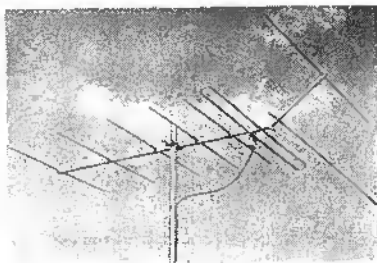
Not many comedy shows have had such a profound and lasting effect on the British public as the Goon Shows and though it is now over 20 years since the first Goon Show was broadcast, the BBC feel there is still a tremendous interest shown in the zany humour of Messrs. Milligan, Secombe and Sellers.

Both shows feature these three plus the Ray Ellington Quartet, Max Geldray and Wallace Greenslade.

The record is priced at £2.46 and is available from most good record stores.



UKA STEREO-8



This eight-element model is the star performer in the extensive Fuba aerial range imported into the UK by Audio Workshops Ltd.

Designed for reception in the worst possible conditions the Stereo 8 will often provide good signals in areas where previously no useful signal was obtainable. Particularly suitable for long-distance reception, continental or otherwise, the Stereo 8 is probably the highest performance i.m. aerial available in the UK—as its development is the result of technical design applications by Fuba's team of professional equipment engineers.

The model has a detachable junction box with correct matching for either 75Ω coaxial cable or 300Ω balanced twin feeder. This feature, which is almost unobtainable from UK manufacturers, gives the UKA Stereo 8 unparalleled matching characteristics. The junction box is designed for simple, very easy cable fitting with no screws to lose. It will easily take any diameter of cable. Fitted with a double reflector for best front-to-back ratio, the aerial performance is fully specified according to internationally recognised procedures. The rectangular boom gives strength and correct element alignment thus avoiding the "hedgehog" effect well known in this country and the aerial is designed for outdoor use, but may be left mounted.

Clamps are supplied to suit masts of up to 2 inch (50mm) diameter.

All alloy parts have a protective coating for longer life, and steel parts are cadmium plated to provide protection from corrosion and rust.

Technical specification: Gain: 2·8 to 9·9dB (average 9·0dB). Front-to-back ratio: 20 to 27dB (average 24dB). Standing wave ratio: Typically 1·2 over most of the band, covering the full internationally agreed European band. Cable connection: Unbalanced coaxial cable or balanced twin feeder. Output Impedance: 75Ω unbalanced or 300Ω balanced, balun incorporated in junction box.

Audio Workshops, 29 High Street, Robertsbridge, Sussex.

EKCO ZU440

Another unit from the Pye/Ekco stable is the ZU440. It is described in some circles as a TAPC/DJ—that's sales jargon for a tuner/amplifier/player/cassette unit. The "DJ" part stands for "disc jockey" facility—this enables announcements to be made over the loudspeaker system whilst using tuner, records or cassettes. Output power of the amplifier is 15W per channel. The turntable motor is belt-driven and the cassette recorder has a special magnetically-coupled clutch. A DNL switch on the recorder can be used when recording quiet passages of music to cut down hiss.



The ZU440 has a built-in amblophony circuit which simulates quadraphonic sound (they call it "Stereo 4") when two extra speakers are used. Other features include switchable AFC, automatic recording level control, stylus pressure gauge and four preset push-button controls on the stereo tuner in addition to manual tuning. The ZU440 comes complete with matched teak-veneered speakers with 8in. bass/midrange drive unit and 1in. dome tweeter.

The recommended retail price of the ZU440 is £273·93 and further details may be obtained from Pye Limited, P.O. Box 49, St. Andrews Road, Cambridge, CB4 1DS.

TEXAN-SWEDISH STYLE

The "Texan U66", which we had on show at the recent Audio Fair is not available in Great Britain in kit form at the present time.

Many visitors to our stand showed a great deal of interest in the U66 which also employs an FM tuner with preset tuning controls.

The phono input impedance at 1kHz is 47kΩ and sensitivity for 25W output is quoted as 3·4mV.

Tape input impedance at 1kHz is 100kΩ and sensitivity is variable with a 100mV minimum. Tape recorder output is 100mV.

Tone controls: Treble = ±14dB at 10kHz. Bass = ±16dB at 25Hz. Top Cut Filter = -10dB at 15kHz and

Loudness = +10dB at 50Hz.

Power output is 25W per channel with both channels driven. Speaker impedance can be anywhere between 4-16Ω. Distortion is quoted as being less than 0·1% at 1kHz (25W).

The FM Tuner section has three preset controls covering the frequency range of 87 to 102MHz. Sensitivity is 2μV and the tuner features AFC. The decoder stereo separation is 50dB at 1kHz. The pilot tone rejection is greater than 40dB and there is automatic stereo/mono switching.

If you would like further information now, please write to U66 Elektronik A. B., (Practical Wireless) Valigatan 8, 411 16 Gothenburg, Sweden.



The U66 Swedish Texan amplifier

SPECIAL PRODUCT REPORT

ULTRASONIC INTRUSION ALARM

"There are two transceivers in this picture. The one you can't see is protecting the one you can".

WITH the recorded increase of petty theft by breaking and entering of private premises, we were prompted to look around the market for a reasonably priced alarm system for domestic use which would afford a general degree of protection.

In view of our previous experience of the Heathkit range, which also has a high degree of interest for the home constructor, the Heathkit GD-39 attracted our attention, for this fulfills both our primary and secondary aims.

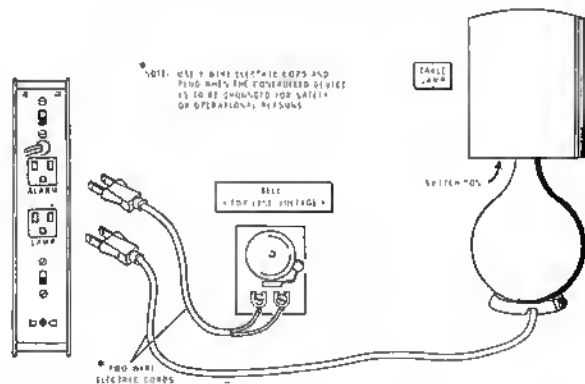
The Heathkit GD-39 home protection alarm, as received, was well packed and protected from transit damage.

Following the manual instructions all parts were checked and found to be correct. The easy step-by-step instructions were first read through and then assembly was commenced. After a pleasant and instructive two evenings of construction the GD-39 was completed and ready for setting up.

To avoid upsetting the household a low power 240V domestic lamp was used for initial testing purposes.

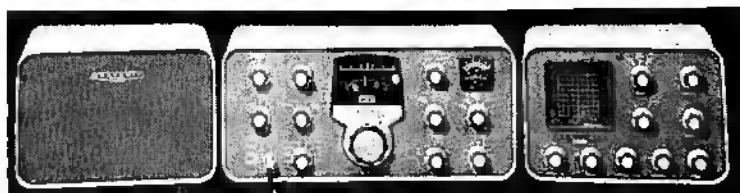
In the assembly manual, at the commencement of the operation test, a "caution" is printed regarding the two screws used during set-up. Take heed, for this is important, for the threads of the screws, which play no active part after set-up, are tapped into the SRBP circuit board. In the event of any reader making the same error as we did, for we overtightened one screw, a suitable screw can be affixed to the rear of the board, with a nut.

With the normal amount of trepidation and holding of



Showing how an alarm bell and lamp can be used with the GD-39.

HEATHKIT GD-39



Top shelf, 9th book from the left, the Heathkit GD-39.

MANUFACTURERS' SPECIFICATIONS

Operating range:

Varies with installation. Typical maximum range is 25 feet.

Operating times:

Turn-on delay: Approximately 10 seconds.

Alarm delay: 20 to 30 seconds (lamp-on time).

Automatic reset delay: 20 to 30 seconds (alarm-on time).

Ultrasonic frequency:

Approximately 41kHz.

Power outlets:

Two AC sockets: One for Lamp, one for Alarm.

Power outlet current:

Three amperes total for both sockets.

Power requirements:

110-130 or 220-260 VAC, 50/60 Hz, 1.5 watts.

Dimensions:

Chassis only, 2in wide x 9½in high x 7in deep (approximately). In book-style cover, 2½in wide x 10½in high x 7½in deep (approximately).

Net weight:

Approximately 3 lbs in book-style cover; approximately 2½lbs without cover.

breath, the unit was switched "on". As usual, we were surprised when all went well except for one "dry" joint. At this stage we must make comment on the excellent "Kit Builders Guide" which is issued with every Heathkit. It contains all the general assistance information, to give a beginner confidence to tackle these kits, even if for the first time of doing so.

Our interest now was naturally how the GD-39 would perform under varying environmental domestic conditions, and the following tests were made, carried out in a detached private house.

Tuned to the highest sensitivity, movement of a 6' tall man could not be detected beyond 18' unless movement was

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ACY20	25p	BD124	65p	OA79	10p
ACY21	30p	BD131	60p	OA81	10p
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AF117	25p	BF194	14p	OC22	55p
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AS223	60p	BF197	20p	OC35	60p
BA102	30p	BF200	30p	OC38	65p
BA112	50p	BE224	30p	OC42	40p
BA114	33p	BFK29	30p	OC44	20p
BA158	15p	BFK34	30p	OC45	25p
BC107	12p	BFK35	30p	OC71	12p
BC108	12p	BFK36	30p	OC72	29p
BC109	14p	BFK38	30p	OC75	25p
BC113	15p	BFY10	35p	OC76	25p
BC115	15p	BFY44	50p	OC77	40p
BC117	20p	BFY50	25p	OC21	25p
BC118	12p	BFY51	25p	OC23	25p
BC147	11p	BFY52	25p	OC24	25p
BC148	11p	BFY53	25p	OC138	30p
BC149	12p	BFY59	25p	OC170	25p
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12 VOLT 1 1/2 AMP. POWER PACK

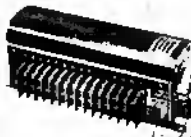
This comprises double-wound 230/240V mains transformer with full wave rectifier and 20000 mF smoothing. Price £2.50 plus 20p post & packing. **Heavy Duty Mains Power Pack.** Output voltage adjustable from 15-40V in steps—maximum load 250W—that is from 6 amp at 40V to 15 amp at 15V. This really is a high power heavy duty unit with dozens of workshop uses. Output voltage adjustment is very quick—simply interchange push on leads. Silicon rectifiers and smoothing by 3,000mF. Price £5.95 plus £1.00 post.

PC BOARD MARKER

Valve action fibre tipped marking pen filled with black etch resist—It's easy with this to make a perfect PC board. Just draw straight on to the copper—allow 15 minutes to dry, then immerse in ferric chloride or other etchant on removal the circuit stands in high relief. 99p.

HONEYWELL PROGRAMMER

This is a drum type timing device, the drum being calibrated in equal divisions for switch setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs. per min. Some of the many uses of this timer are Machinery control, Boiler firing, Dispensing and Vending machines, Display lighting animated and signs, Signalling, etc. Price from makers probably over £20 each. Special snip price £7.50 plus 23p post and insurance. Don't miss this terrific bargain.

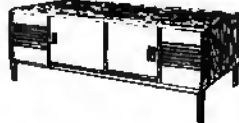


TANGENTIAL HEATER UNIT

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 line case or cabinet. Only needs control switch. £2.75. Don't miss this. Control Switch, 44p. P. & P. 50p.

STEREO RADIO CABINET

Long, Low and Modern. Teak veneered with sliding front and tapered leg. Speaker spaces each end. Size approx. 4ft. 2in x 13in x 15in. Probably cost over £20 to make. Our Price £8.10 each.



TWENTYLITE

Fluorescent lighting units with polyester choke and finished white enamel. 24 in. model. Ideal kitchen, bedroom, hallway, porch, lift, etc., with tube. Assembled ready to install. Price £2.80 + 30p p. & p.



THIS MONTH'S SNIP

SOUND TO LIGHT UNIT
 Add colour or white light to your amplifier. Will operate at 2 or 3 lamp transmission 4-way Unit in Box all ready to work. £7.95 plus 95p VAT and postage.



HORSTMANN 24-HOUR TIME SWITCH

With 8 position programmer. When fitted to hot water systems this could programme as follows:—

Programme	Hot Water	Central Heating
0	Off	Off
1	Twice Daily	Off
2	All Day	Off
3	Twice Daily	Twice Daily
4	All Day	All Day
5	Continuously	Continuously



Butable of course, to programme other than central heating and hot water, for instance, programme upstairs and downstairs electric heating or heating and cooling or taped music and radio. In fact there is no limit to the versatility of this Programmer. Mains operated. Size 3 1/2 in x 3 1/2 in x 2 1/2 in deep. Price £3.65 as illustrated but less case.

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 & 49 metre bands—Kit contains chassis front panel and all the parts. £1.25—crystal earphone 50p.

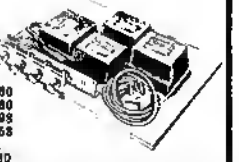


MULLARD UNILEX STEREO SYSTEM

There is no doubt that it is a good system, we believe that for the money it is without comparison. We demonstrate gladly at our Tamworth Road depot. Prices of the individual items for this:—

1 Unilex Amplifier	Ref. EP.9000	£1.00
1 Unilex Amplifier	Ref. EP.9000	£1.40
1 Unilex Pre-Amp	Ref. EP.9001	£1.95
1 Unilex Power Unit	Ref. EP.5002	£2.58
1 Control panel kit with spun aluminium faced knobs		£3.30

Pair of 15 ohm speakers made by Goodmans are also available if required, price £3.30 the pair. No extra postage if ordered with the above, otherwise add 25p.



SPECIAL PRICES TO COLLEGES AND INSTITUTIONS WISHING TO INCLUDE THIS KIT IN THEIR CURRICULUM

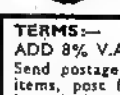
SWITCH TRIGGER MATS

So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc.

24in x 18in	£1.80
13in x 18in	£1.50

HORSTMANN "TIME AND SET" SWITCH

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



Two models 15 amp £2.18, 30 amp £3.35. P. & P. 25p each

AM/FM TUNER

Unit made by the American GEC company. 8 transistors, all-wired ready to work. Complete with tuner condenser, needs only scale and pointer. Tunes AM range 540 to 1620 KHz, FM range 88 to 108 MHz. Switches for on-off and AFC. Output for MXP or direct. Special snip price £5 plus 30p post. Three or more post free.

7 WATT STEREO AMPLIFIER

Again by the American GEC company. This has exceptionally good tone quality. It complete with pre-amp and treble base, volume and balance controls. Also has mains smoothing circuit and rectifiers so requires only mains transformer. Output for 15 ohm speakers. Inputs for tuner, pick-up, mike, etc. Special snip price £8 plus 30p post. Three or more post free.

COMPLETE SYSTEM

AM/FM and MPX Tuner
 Decoder and stereo amplifier. Specifications of tuner and amplifier are approximately as given above. This is ready built and tested system complete with scale and pointer, ready to install into suitable cabinet. (Our big stereo cabinet should be ideal for this.) Limited quantity, £15 each.

AMPLIFIER PANELS

Very nice looking, polished black presspan with fixing holes, 6 phone sockets and changeover slide switch and is printed as sketch. Price is 80p.

BATTERY CHARGERS

Famous Atlas in metal case with meter, output leads terminated by crocodile clips. For 6 or 12V charging simply by changing the plug on front panel. Ready built new and still in maker's original packing. Two models: 1 1/2 amp £1.99 and 3-4 amp £2.95. Please add 40p postage for one and 75p postage for two.



ONLY
£1
 FOR
5
 ELECTRIC MOTORS

5 powerful battery motors as used in racing cars and power models. Output and types vary to make them suitable for hundreds of different projects—tools, toys, models, etc. All brand new reversible and for 10 to 12v. Bats, wiring diagrams included. Post and VAT 30p.

FREE DETAILS OF HOW TO MAKE MINIATURE POWER STATION

NEW ITEMS THIS MONTH

Car Cassette Power Kit. With a stabilised output of 6v, 9v or 12v. The kit comprises transistors, zener diode, resistors and condensers. Price £2.10. Suitable plastic case 40p extra.
Black Light as used in discotheques and for stage effects, etc. Virtually no white light appears until the rays impinge on luminous paint or white shirts, etc. We offer 12" 8w tubes complete with starter, choke, lamp holders and starter holder. Price £2.76 + 30p post. Tubes only £2 + 30p post.
8 KV Rectifiers. For replacement in colour TVs or for experimenting with really high voltage for doublers and triplers, etc. Famous maker. 45p each. Quantity prices available.
Meters. All Bush mounting with 0-2 amp 50p, 0-3 amp 60p, 0-4 amp 75p, 0-8 amp 85p.
Rectifiers. All 25v full wave (bridge) with cooling fan. 11-12 amp 25p, 3-4 amp 25p, 6-7 amp 21.25, 15 watt Screen Grid. Suitable for equipment wiring, multi-way telephone installations, etc. Each core has seven strands copper, PVC insulated and colour coded differently from every other core. These are then laid together encased first by a metal screen and then grey PVC. Price 80p metre or 10 metres £2.50.
Touch Switch. This switch suitable for up to 10 amps mains voltage. Stands up approximately 1" rather like a joy stick and no matter which direction it is pushed, it makes contact. Base size approximately 2 1/2" x 2". Price 25p each.
Light Switch. Automatically switches on lights at dusk and off at dawn. Can also be used where light and dark is a convenient way to stop and start an operation. Requires only a pair of wires to the normal switch. In bakelite box normal switch plate size. 1 amp model £2.85.

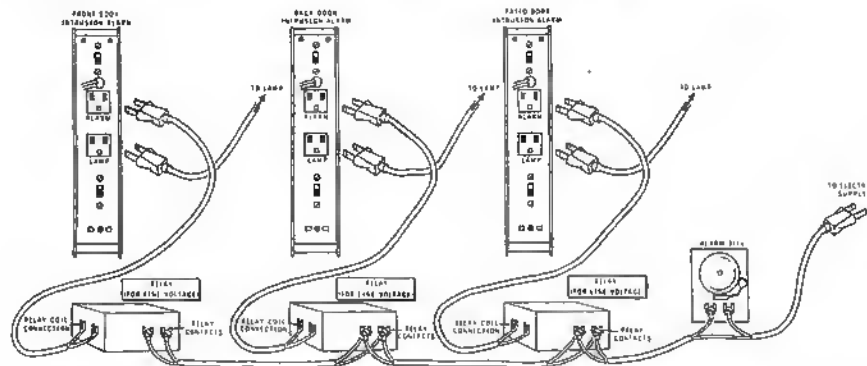
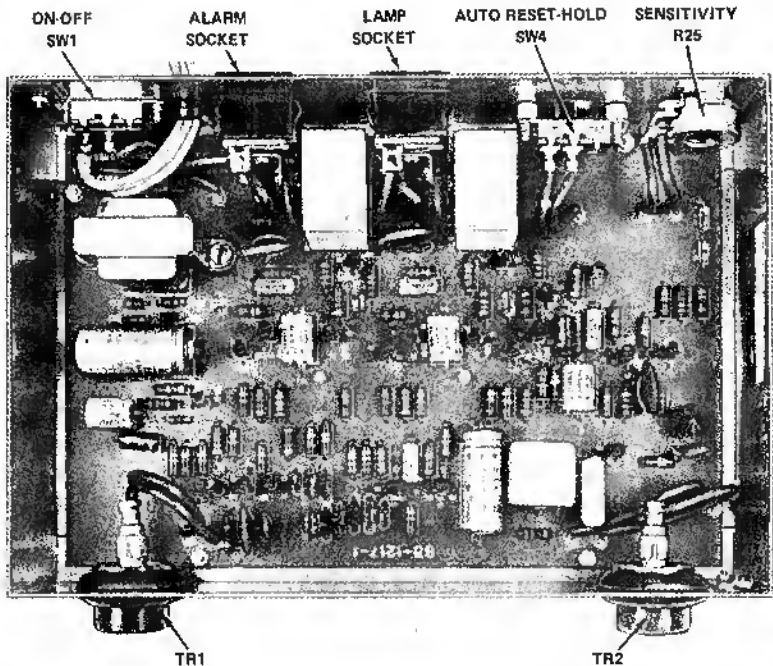
exaggerated. At this setting the device was ultra-sensitive to the movement of curtains, within 1' of the unit, disturbed by the wind through an open window.

At the lowest sensitivity, movement within inches of the unit was not detected. The most satisfactory setting was slightly above mid-point, when adequate coverage of a room approx 16ft square was achieved.

However with the unit placed 6ft away from the open doorway of the room, movement was detected in the passageway, and to a limited extent, in two adjacent small rooms. This is due, no doubt, to "spillage" of the standing waves into adjacent areas.

Obviously, the best position for the GD-39 will be, for general use, at a point within the house which must be used to gain access to other areas.

Operation of radio and TV sets, electro-mechanical relays, thermostats and fluorescent light tubes failed to create an alarm condition. Convected heat from a gas fire, placed in the proximity of the unit had no effect but a 3kW electric fan heater directed towards the unit, from a safe distance, did so, due no doubt to the high local temperature over ambient.



Printed circuit layout showing component positions, sockets and controls.

Diagram to show how three Intrusion Alarms may be wired to give comprehensive protection to a complete building.

The GD-39 has wiring options for either 110 or 220VAC operation and during assembly take note of the option instructions.

During operation, or under alarm condition, this supply is switched by an internal relay to two USA type sockets at the rear of the GD-39. On our final installation, for we had obtained the optional extras, a.c. mains alarm bell, and quiet buzzer with its transformer, from Heathkit, the alarm bell was wired direct from the outlet socket (and directly earthed), but the quiet buzzer was wired via a relay.

Adequate information is provided in the manual for wiring options. We would point out to our readers, that in event of a mains supply disconnection to the GD-39 it is rendered inoperative.

Normally, more sophisticated systems incorporate a battery standby but this of course would represent cost addition to the price.

Ultrasonic movement detector suitable for providing audible or visual warning of intrusion of a specific area. Can be connected by itself or with other detection devices to a variety of signalling devices or can be used for simple switching purposes. Frequency approx 41kHz. The device is housed in a case which simulates a book approx 10 x 7 1/2 x 2 1/2 in. This disguise could well prevent the device from being noticed by an intruder.

Method of function

An RF signal is transmitted by one transducer. A receiving transducer receives the transmitted signal and monitors it for a change in amplitude. If a change is detected (produced by a moving object) then the lamp and alarm outlets are switched on until they are reset either automatically or manually.

The a.c. mains 6in heavy duty alarm bell was mounted under the eaves at the front of the house. It has not gone unnoticed by neighbours and local tradesmen. One question—in particular that has been asked upon a number of occasions—"Is it connected to the local police station?". The reply has been—"you will have to find out!" The large out door alarm bell alone—mounted in a prominent position is no doubt a psychological deterrent to the would-be intruder. The Heathkit GD-39 is excellent value for money. Installation of the basic alarm system is extremely easy to install and affords a high degree of protection. Top marks for this one Heathkit!

The GD-39 kit is manufactured by Heath Co., U.S.A. but is distributed in the United Kingdom by Heath Gloucester Ltd., with a one year warranty on all parts.

The GD-39 kit is priced at £29.90. The indoor buzzer alarm with transformer (GDA-39-10G) costs £5.80 and the large 6in alarm bell (GDA-39-20G) costs £10.90. All prices include 8% VAT and carriage (U.K. only) HEATH (GLOUCESTER) LTD., BRISTOL ROAD, GLOUCESTER GL2 6EE (Telephone GLOUCESTER 29451).

low frequency & marine receiver

PART
2

CHARLES HEATH

AUDIO AMPLIFIER

This board is approximately 4½ x 2in and both sides are shown in Fig. 9. The tags MC are fixed by ½in long 6BA bolts. Extra nuts on these bolts allow the finished amplifier to be mounted on the chassis supporting the tuning capacitor.

Insulated sleeving will be required on most leads here. It will be found helpful to use black on the negative line, red for positive circuits, and some other colour elsewhere.

Solder on insulated leads for the speaker, for S5 (battery positive) and from C20. The amplifier can be tested by connecting a 2/3-ohm speaker, 9V battery, and feeding an audio signal to C20 taking care that this is not at such a high level as to cause overloading. The pre-set resistor VR2 is initially set at about half value and is adjusted either with the aid of a meter, or by ear. If a meter is used, set VR2 so that the amplifier draws about 8-10mA with no signal. Otherwise rotate VR2 to reduce its value until audio distortion sets in, then turn it back just sufficiently to overcome this.

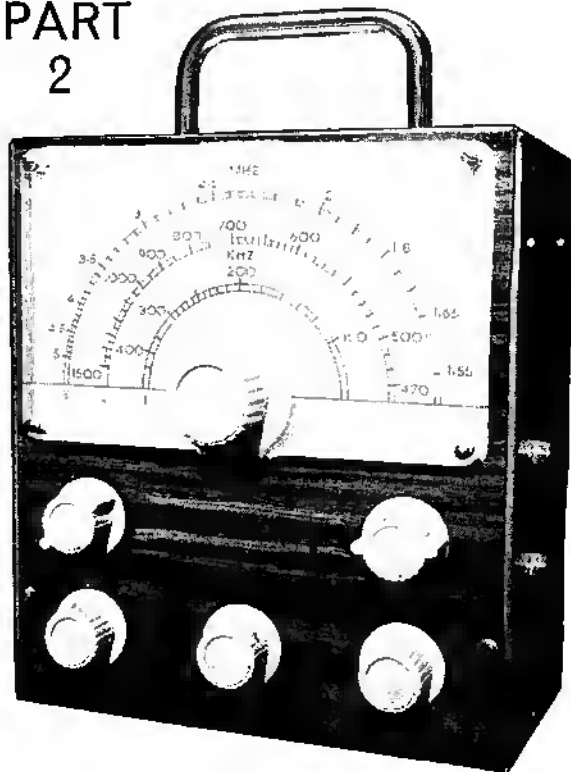
PANEL AND CHASSIS

It is necessary to assemble these before the circuit boards can be fitted. First drill the panel for the dial, using the template provided by the manufacturer as guidance. Fit the ball drive as in Fig. 10, but leave the transparent cover off.

In order that drive and gang can be accommodated, ¾in has to be cut off the spindle of the gang. This is best done by gripping the unwanted end in a vice, meanwhile supporting the capacitor with the hand while sawing through the spindle. Take care that metal fragments do not get into the capacitor and remove any burrs on the spindle with a file. The capacitor is then placed as in Fig. 10.

Drilling positions for the bolts securing it, can now be marked on the 7 x 4in flanged plate. Holes can also be drilled in the plate and panel, enabling them to be fitted together. Note that the plate is towards the top of the case, so that Fig. 10 is actually an underside view.

These items can now be bolted tightly together. Check that the drive and capacitor rotate smoothly. Should any small adjustment be necessary, the fixing holes can be elongated with a very small round file. Bolts holding the flange to the panel should be countersunk as they will be under the tuning scale.



The five controls below the main tuning are as follows:—Top left: mode switch OFF—CW/SSB—AM. Bottom left: BFO pitch control. Bottom centre: Audio volume control. Top right: Band selector switch. Bottom right: RF trim.

Note that just sufficient is cut out of each corner flange, as in Fig. 10, to allow the side flanges of the case to fit.

Secure the IF and BFO boards in the way described. The rear bracket supporting the larger board also provides a shorter earth circuit return to the gang.

The audio amplifier is on top of the chassis plate, with T2 towards the outside.

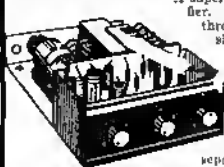
COILS AND SWITCHING

The coils are placed as in Fig. 10. The switch will come in this position, but is above the coils on the panel. Connections from the board to the switch are as in Fig. 5.

If there is any doubt about the switch connections, check the switch with a meter or other means of showing continuity, so that all tags for each pole will be wired correctly. Alternatively, check that proper results are obtained with coils for only one band, at first. Then add the second band and check, finally wiring the third band.

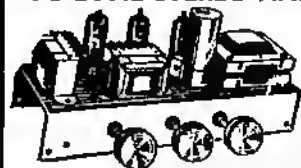
The coil pins should be clean, and not heated for a lengthy time when soldering. No stress should be put on the pin until it is cool. Connections to VC1 and VC2 are as shown.

SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz-30KHz \pm 3dB. Fully integrated pre-amplifier stage with separate Volume, Bass boost and Treble cut controls. Suitable for 8-16 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, switchgear panel, input and output plugs. Overall size 8" high x 5" wide x 7 1/2" deep. AC 200/250V. Price £18.50. P. & P. 50p.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. U.S.A. 1 to 5 heavy duty fully insulated mains transformer or with full wave rectifier. 2 to 4 giving a u a c smoothing with negligible hum. Valve line up: 2 x ECL86 Triode Pentodes, 1 x E230 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 8 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11" w x 4" d. Overall height including valves 6". Ready built & tested to a high standard. £10.75. P. & P. 50p.

POWER SUPPLY UNIT 200/240V. A.C. input. Four switched fully smoothed D.C. outputs giving 5v, 40v, 175v, and 0v, and 12v. at 1 amp on load. Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 3" x 3 1/2" x 2 1/2". Suitable for Transistor Radios, Tape Recorders, Amplifiers etc. etc. Ready built and tested. Price £5.20 P. & P. 35p.

VYAIR & REXINE SPEAKERS & CABINET FABRICS ap. 54 in. wide. Our price £1.90 sq. length. P. & P. 15p per yd. (min. 1 yd.). S.A.E. for samples.

HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound fully insulated mains transformer, rectifier and ECL86 triode pentode valve as audio amplifier and power output stage. Impedance 8 ohms. Output approx. 3.5 watts. Volume and tone controls. Chassis size 10 1/2" wide x 3 1/2" deep x 6 1/2" high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer. Price £4.20 P. & P. 40p BARGAIN PRICE

FEW ONLY!

High grade mains transformer with grain orientated laminations. Primary 200/240 Secondary 18.5 volts at 0.5 amps and 4.5 volts at 1 amp. Size 2" h x 2 1/2" w x 2" d overall. £1.35 plus 25p P. & P.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0-210-400v. Secondary combinations 0-5-10-15-20-25-30-35-40-50v, half wave at 1 amp, or 10-10-10, 20-0-20, 30-0-30v, at 2 amps full wave. Size 3in. long x 3 1/4in. wide x 3in. deep. Price £2.00 P. & P. 40p.

MAKES TRANSISTORS. For transistor power supplies. Pri. 200/240v. Sec. 0-2 at 500 mA. £1.25. P. & P. 25p. Pri. 200/240v. Sec. 12-0-12 at 1 amp. £1.40. P. & P. 25p. Pri. 200/240v. Sec. 10-0-10 at 2 amp. £2.00. P. & P. 35p.

3 VOLT RELAY

100 mA electric pole normally closed. 2 for 60p + 15p P. & P.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER

For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 0-18v. battery or from B.T. line 200/300v. Frequency response 13Hz-35KHz. Gain 26dB. Solid encapsulation size 1 1/2" x 1 1/2". Brand new complete with instructions. Price 1.20p. P. & P. 15p.

HANDBOOK OF TRANSISTOR EQUIVALENTS AND SUBSTITUTES
A must for servicemen and home constructors. Including many 1000's of British, U.S.A. European and Japanese transistors. ONLY 40p. Post 6p.

8 Reference Encyclopedias for Electronic Engineers and Designers, covering between them transistor characteristics, diode and transistor equivalents. Many thousands of up to date European types listed. Diode Equivalents, 80p; Transistor Equivalents, 90p; Transistor Characteristics, £1.15; POST FREE All three together, £2.80

NEW ISSUE

Thyristor, Triac, Dinc etc. encyclopedias 85p. Post Free 8 pole 3 way 2 bank low loss Vaylax type switches 1 1/2" sections. Standard spindle. 8 switches 65p + 10p P. & P.

Open 9.30-5.30 Monday to Friday, 9.30-5 Saturday Closed Wednesday

All prices and specifications correct at time of press and liable for alteration.

HARVERSONIC MAINS OPERATED SOLID STATE STEREO FM TUNER

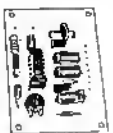


Enjoy fabulous stereo radio at this fabulous low introductory price!

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 1 watt 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 £23.00 Post and Packing 60p.

STEREO-DECODER

£12.95 2" x 3" 1" ready built. Pre-aligned and tested. Sens. 20-500 mV for 9-16V ac. 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. & P. Stereo beacon light if required 40p extra.



SPECIAL BARGAIN OFFER!

Limited number of BSR C123 Auto Changer De Luxe with lightweight tubular arm and stereo cartridge. Brand new. ONLY £28.00 + p. & p. 60p.

LATEST!!! Sensitivity Uni-directional ultra-linear condenser microphone as used by many professionals. Very low acoustic feedback. Available in impedance or low impedance. State which required. £12.50 plus 25p P. & P.

LATEST ACO'S GPM/180 mono compatible cartridge with 1/2" stylus for LE/PL/78. Universal mounting bracket. £1.40. P. & P. 15p.

CERAMIC STEREO CARTRIDGE. Universal Mounting brackets and turnover stylus. 70mV per channel output. ONLY £1.75 + 10p P. & P.

MONO COMPATIBLE STEREO CARTRIDGE 7/10 stylus Diamond Stereo LP and Seraphine 78. ONLY £2.27 P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP, £2.70. P. & P. 15p.

LATEST T/O STEREO / COMPATIBLE CARTRIDGE for EP/PL/78/seraphine £2.80 P. & P. 15p. **LATEST T/O MONO COMPATIBLE CARTRIDGE** for playing EP/PL/78 mono or stereo records on mono equipment. Only £1.47. P. & P. 15p.

QUALITY RECORD PLAYER AMPLIFIER MK. II

A top quality record player amplifier employing heavy duty double wound mains transformer, ECL86, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide x 3in. deep x 6in. high. Ready built and tested. Price £5.50. P. & P. 50p.

ALSO AVAILABLE mounted on board with output transformer and speaker. Price £6.70. P. & P. 60p.

HI-FI LOUDSPEAKER SYSTEM MK II

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. Ceramio Magnet 13" x 8" bass unit, H.F. tweeter unit and crossover. AVAILABLE IN NOMINAL 4 Ohm, 8 Ohm to 15 Ohm impedance (state which).

OUR PRICE £9.50 each Carr. 90p

Cabinet Available Separately £5.00, Carr. 50p
Also available in 8 ohms with EM1 13" x 8" bass speaker with parasitic tweeter £8.00, Carr. 90p.

LOUDSPEAKER BARGAINS

5in. 3 ohm £1.25. P. & P. 15p. 7 x 4in. 5 ohm £1.40. P. & P. 20p. 10 x 6in. 3 or 15 ohm £2.10. P. & P. 30p. E.M.I. 8 x 6in. 3 ohm with high flux magnet £1.70. P. & P. 20p. E.M.I. 13" x 8in. with high flux ceramic magnet with parasitic tweeter 3, 8 or 15 ohm £5.50. P. & P. 30p. E.M.I. 13 x 8in. 3, 8 or 15 ohm with built-in tweeter and crossover network £4.25. P. & P. 30p. E.M.I. tweeter. Approx. 3 1/2". Available 3 or 8 or 15 ohms. £1.25 + 20p. P. & P.

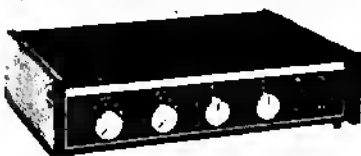
BRAND NEW. Bakers Loudspeakers at substantial discounts. 12in. 15w. H/D Speakers, 3, 8 or 15 ohms. State which. Current production by well-known British maker. Now with Hi Flux ceramic ferrous magnet assembly £7.50. Guitar models: 25w £7.50, 25w £7.50. P. & P. 45p.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER

Size 11" x 14" x 1 1/2" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Resonance 40Hz-25KHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details. Only 68 00 each.

NOW ALSO AVAILABLE. 8", 10 watts, r.m.s. 20 watt peak 40Hz-20,000Hz. Overall depth 3". Ideal for Hi-Fi or for use in cars. £4.32 + 30p P. & P.

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT

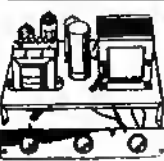


A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 8 to 15 ohms. Compact design, all parts supplied including drilled metalwork high quality rear 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. 12-20,000 Hz. Sensitivity: better than 80mV into 1M Ω . Full power bandwidth: \pm 3dB 12-15,000 Hz. Bass boost approx. to \pm 12dB. Treble cut approx. to -16dB. Negative feedback 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 postage. S.A.E. **AMPLIFIER KIT** £12.95 P. & P. 30p (Magnetic input components 35p extra) **POWER PACK KIT** £4.92 P. & P. 40p **CABINET** £4.92 P. & P. 40p

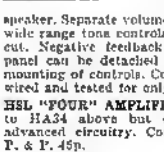
(Post Free if all units purchased at same time)
Full after sales service

Also available ready built and tested £28.00. Post Free. *Note: The above amplifier is suitable for feeding two mono sources (i.e. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi-Fi Discosque use, etc.*



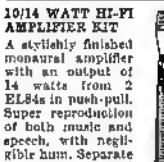
3-VALVE AUDIO AMPLIFIER HA34 MK II

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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. & P. 45p.



10WATT 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 5-15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, E786 and E230 rectifier. Simple instruction booklet 15p + SAE (Free with parts) All parts sold separately. ONLY £10.25 P. & P. 60p. Also available ready built and tested £14.00 P. & P. 70p.

HI-FI STEREO HEADPHONES

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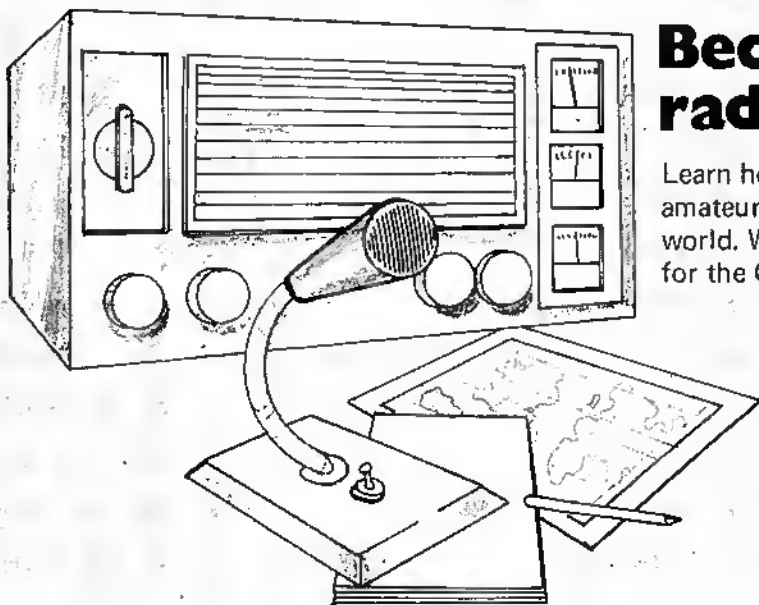
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QBZ	.40	61AG	.28	61L7	.55	12Q7GT	.45	35Z3	.75	1Y7B76	.35	EP73	1.50	6Z34	.60	UHF80	.40	Transistors	AF117	.21	HYZ13	.28		
OZ4	.47	6BC8	.80	8L18	.55	12B7	.30	35Z4GT	.70	1Y902	.35	EP80	.25	6Z37	1.00	UHF89	.40	& Diodes	AF121	.33	PNY11A	.25		
1A8	.45	6BE6	.35	6L19	2.00	12B7	.40	35Z5GT	.75	8B00C	2.20	EP83	1.00	HA8C80	.60	UD191	.77	1N4744	.15	AP124	.28	FSY11A	.25	
1A60T	.60	6BH6	.80	6L20	.75	12B17	.35	.45	.50	12BP7	1.40	EP89	.34	11L29	.80	UC92	.55	2N404	.20	AF126	.19	OA8	.47	
1A70T	.65	6BJ8	.65	6N7GT	.80	12B7	.45	.30	1.00	12BP7	1.50	EP95	.45	11L33DD	.75	UC94	.70	2N4768	.55	AF126	.20	OA10	.47	
1B8GT	.85	6C47A	.55	6Q7A	.58	12B7	.65	6BR5	.65	8B00C	2.50	EP99	.45	11L34	1.00	UC94H	0.00	2N3147	.84	AF126	.20	OA10	.47	
1H8GT	.60	6BR7	.60	6Q7GT	.60	12B7	.75	6C5	.80	8P20C	6.00	EP91	.37	11L41DD	.82	UC94	.75	2N2889	.16	BA116	.20	OA10	.47	
1L4	.28	6BH8	1.50	6Q7M1	.55	1417	.65	60CD6G	1.25	8B07	1.00	EP92	.50	11L42DD	.82	UC94H	.40	2N2053	.68	BA129	.14	OA81	.10	
1N8GT	.85	6HS7	1.40	6R7M	.80	1487	.80	60E15	.75	8A182CCL	.25	EP97	.80	11L43	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
1R6	.45	6HW6	.80	6R7M	.78	18A05	.50	60L6GT	.55	8L148	.58	EP98	.80	11L44	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
1R4	.85	6HW7	.70	6B47	.44	1906	6.00	68A2	.60	EA60	.27	EP99	.30	11L45	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
1U4	.80	6H26	.48	6S7GT	.33	20D4	2.00	85A3	.80	EA76	1.00	EP104	.35	11L46	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
1V6	.75	6H4	.35	6M7	.44	20F7	.75	90M1	2.50	EA80	1.00	EP104	.35	11L47	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
2D21	.45	6C84	.50	6H17	.44	20L1	1.10	90C1	.75	EA89	.75	EP100	.55	11L48	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
20K5	.55	6C84	.40	6H17	.55	20P2	.80	90L2	2.40	ZAP42	.75	EL32	.60	11L49	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
2X3	.80	6C9	1.00	6H7GT	.48	20P4	1.00	105H2	.75	EA84	.75	EL34	1.00	11L50	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
8A4	.30	6CD6G	1.25	6R7GT	.48	20P5	1.80	105H0	.60	EB34	.35	EL36	2.50	11L51	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
8D4	.40	6C84	.75	8V6	.17	28A6G	.80	807	1.00	EBH1	.30	EL37	2.50	11L52	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
8Q4	.60	6C84	.85	8V6T	.48	28L6G	.80	8799	1.00	EBD41	.75	EL41	.80	11L53	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
8R4	.55	6C84	.85	8X4	.40	28Y6G	.70	8057	1.00	EBD81	.35	EL41	.80	11L54	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
8R8GT	.384	.60	6C84	.75	8X5GT	.48	28Z4G	.40	8062	1.00	EBP80	.39	EL43	.55	11L55	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09
3V4	.70	60C6	.75	786	.75	28Z6	.80	8067	1.00	EBF84	.48	EL44	.81	11L56	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
4CR8	.84	8GW4	1.00	7B7	.70	28Z6G	.70	71R3	.63	EBF69	.32	EL45	.43	11L57	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6C08	.55	8H7	.75	717	.75	28D7	1.00	8062	.50	EBL21	2.00	EL46	.38	11L58	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6R4V4	.85	8H7A	.75	717	.75	30A5	.85	9006	.30	EC86	.70	EL41	.80	11L59	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6U4B	.45	6HW6	.75	717A	.75	30C15	.80	ACPEN	1.00	EC88	.70	EL60	1.20	11L60	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6V4G	.60	6E6	1.00	7Z4	.80	30C17	.80	ACPFEN	1.00	EC91	.45	EL60	1.20	11L61	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
5Y8GT	.45	8F1	.75	8D7	.85	30C18	.80	DD	1.00	EC93	1.50	EL60	1.20	11L62	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6Z3	.75	8P6G	.50	10C2	.85	30F6	.80	ACPEN	.60	EC96	.95	EL60	1.20	11L63	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
2Z4G	.45	6F19	.70	10D7	.75	30FL1	.67	AC/TH1	.81	ECU40	1.00	EL61	.85	11L64	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6Z4GT	.45	6F14	.75	10F1	.75	30FL2	.67	AL60	1.00	ECG81	.34	EL62	.85	11L65	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
680L2	.30	8F15	.65	10P9	.65	30FL7	.80	AT14	.30	ECG82	.33	EL63	.85	11L66	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6A8G	1.25	8F23	.85	10L19	.55	30FL13	.55	AZ1	.25	ECG83	.33	EL64	.85	11L67	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
8C7	.48	8F24	.85	10LD11	.70	30FL14	.75	AZ11	.60	ECG84	.33	EL65	.85	11L68	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6A16	.27	8F28	1.00	10L12	.75	30L15	.74	AZ41	.25	ECG85	.40	EMH803	.25	11L69	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6A16	.60	8F28	.87	10P14	2.00	30L17	.70	B133	2.00	ECG86	.85	EL66	.40	11L70	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6A16	.85	8F32	.50	12A6	1.00	30P4MR	.70	GL33	1.60	ECG88	.85	EL67	.40	11L71	1.00	UC94H	.38	2N3121	2.75	BA130	.11	OA85	.09	
6A16	.40	606G	.60	12A06	.70	1.00	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70
6A16	.80	6018A	.75	12A16	.65	30P12	.80	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.85	60K6	.85	12A25	.65	30P19	.80	DAF81	.30	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.70	60G7	.75	12A28	.60	30P4	.75	DAF86	.60	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.45	6H6GT	.25	12A06	.45	30P11	.85	DF90	.30	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.80	6J20T	.45	12A4V	.60	30PL13	.93	DF91	.30	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	1.00	6J6	.30	12D46	.45	30PL14	1.10	DF96	.50	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.45	6J7G	.80	12D66	.60	30PL15	.90	DK40	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.30	6K48A	.75	12H17	.50	35A3	.85	DK91	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.45	6K7D	.30	12E1	8.00	35C6	.75	DK96	.80	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.85	6K8G	.45	12J7GT	.80	8D5	.75	DL96	.85	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6A16	.75	8L1	2.00	12K15	1.00	35L6GT	.75	DM70	.60	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	
6B8G	.30	6L6GT	.88	12K7GT	.50	30W4	.50	DM71	1.50	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	606G	.70	

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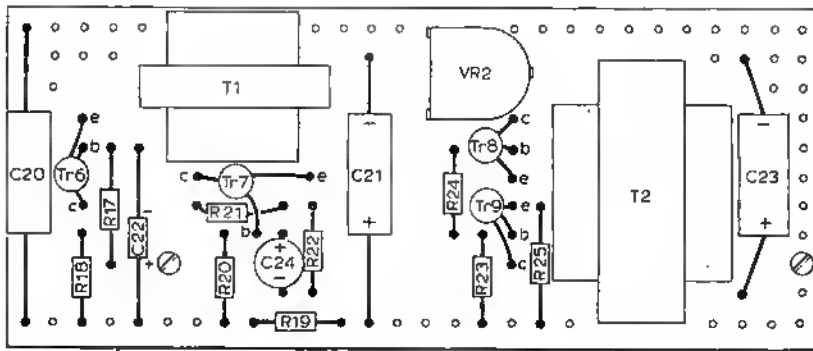
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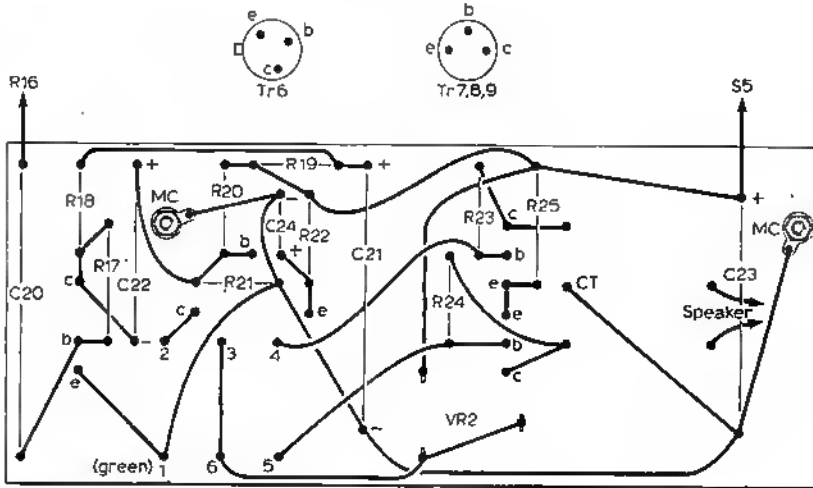
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GCF026



▲ Fig. 9: above, gives full constructional information on the audio circuit board.

▼ Fig. 10: below, shows the wiring required between the band-change switch and the various coils in the aerial and oscillator stages.

LOUDSPEAKER

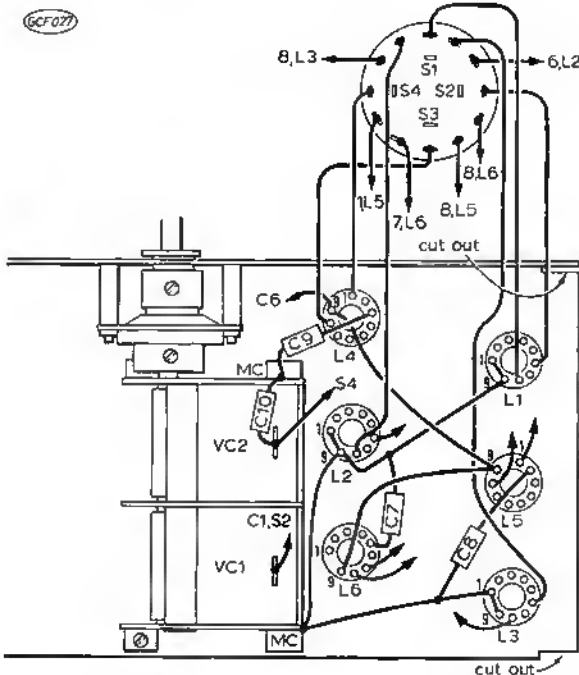
The speaker is bolted to the side near the chassis, the aperture being covered with material or perforated metal and leads from T2 secondary passing through the chassis to the speaker. This side is bolted to the end flange of the chassis, and fixed to the panel with a self-tapping screw.

Remaining connections to the volume control and other points can now be completed, enabling the receiver to be tested before adding the remaining side, top and bottom. R16 is soldered directly on to VR1. Connections are near the panel so that the PP9 battery can rest between the boards when the bottom is added.

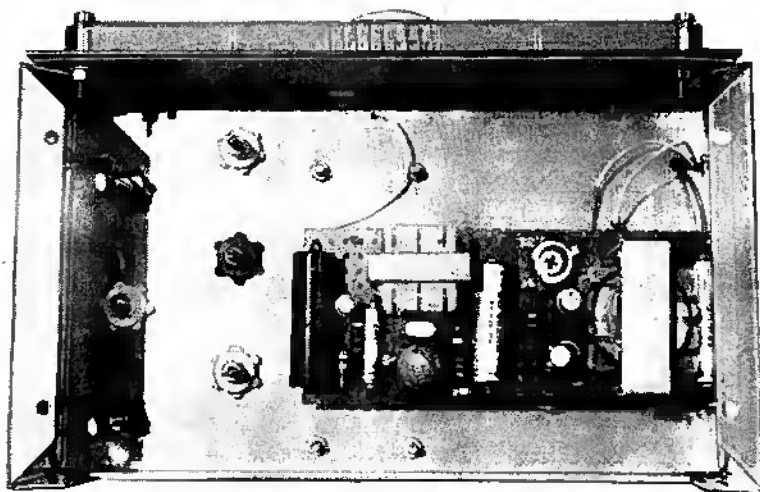
IF ADJUSTMENT

If a signal generator is available, use this in the normal way to check the alignment of the IFT's at 1.6MHz. Should any cores need adjusting, a wedge-shaped or metal tool must not be used, as if a core is cracked it may be impossible to remove. The TT5 tool available from the IFT maker, is recommended, or a similar core adjusting tool if this is unobtainable.

When no signal generator is available, tune in any stable transmission found, removing the aerial if necessary, so that volume is not too high, even with VR1 well advanced. Each core can now be rotated slightly, as necessary, for best volume. Very little adjustment may be required, but each core should have a definite peak giving best results. Once the cores are set they should be left without further adjustment.



GCF071



This shot was taken before the top of the cabinet was fitted. It shows the audio amplifier board of Fig. 9, with the coils L1 to L6 mounted at the left.

RF ALIGNMENT

Band 2 is probably the easiest to align. If a generator is available, set L5 core to tune 470kHz with the gang fully closed. Otherwise tune in a station of known frequency near the LF end of the band, and adjust L5 core to secure a suitable dial reading.

With TC1 about half closed, adjust L2 core for best volume, tuning in a signal a little removed from the extreme LF band end. TC1 should then be rotated to allow signals to be peaked up for best volume at any frequency throughout the band, while not being fully opened or fully closed. L2 core can be slightly re-adjusted, to avoid unnecessary modification to TC1 when tuning through the band, and both cores can then be locked with 6BA nuts.

Band 3 is dealt with in a similar manner. The IF band end can be found by tuning in a signal near 1.55MHz (1550kHz). This band includes 1.6MHz, but reception is impossible for a small range of frequencies each side of this, which is common to the IF amplifier. After setting L6 core to secure suitable coverage, the core of L3 is adjusted in a similar manner to that employed with the MW band aerial coil.

Band 1 can then be aligned noting that quite small changes to the positions of the coil cores will have considerable influence on the frequencies tuned. However, the adjustments of each range are separate from those of the other wavebands.

BFO ADJUSTMENT

Tune in a stable signal, such as a MW broadcast station, half close VC4, and with the switch in its third position, rotate the core of L7 until a loud heterodyne is heard. L7 is adjusted for the silent or zero beat position. When this is so, rotating VC4 either way should cause an audio tone which rises in pitch.

CW will be heard as a clicking sound, if strongly received, and is made audible by switching in the BFO, and rotating VC4 for the wanted audio tone. In some cases having VC3 one side of the zero beat position may give greater freedom from interference than if it is placed the opposite side.

SSB signals are most likely to be heard in the 3.6-3.8MHz region. To render these intelligible, tune in correctly, then with the BFO on, adjust the BFO frequency slowly for best readability. If the BFO is the wrong side of the SSB, it cannot resolve the signal. The lower sideband is normally transmitted by amateur stations, and the upper side band is used by marine stations in the 1.6-3.8MHz band. If the SSB is very strong, better reception is possible by detuning TC1 to reduce signal strength.

There is enough coupling from L7 due to the proximity of the boards, but this can be increased by running an insulated lead from BFO to D1. Solder the lead to the junction of C16 and C17. Run it across to D1, avoiding the battery, and thread the insulated end through the board in the hole adjacent to that used for the positive end of D1. No actual connection is made here.

CALIBRATION

A temporary pointer is provided, and scale markings can be made along its straight edge, which corresponds to the hair line on the usual pointer or cursor. Dial markings can be obtained by any of the usual means. That is, from a signal generator; from known stations; or from the harmonics of a crystal or harmonic marker.

After calibration, the dial is assembled with the transparent cover in position.

CASE

A strong case of quite good appearance is made by assembling the universal chassis members, with the panel covered in self-adhesive wood-grain style material before assembly. If this is done, a washer should be put under each fixing bush nut.

Four feet are attached with 6BA bolts, and a carrying handle is fitted to the top. Insulated sockets for aerial and earth are on one side, the earth socket being connected to the metal. The battery should be sandwiched between stout folded card to insulate it from the boards. Self-tapping screws hold the back in place. Appearance is improved and the top is more easily fitted if its end flanges are cut off.

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Ready built unit only **£9.95** Complete kit **£7.95**

(Includes p. & p. but no batteries)

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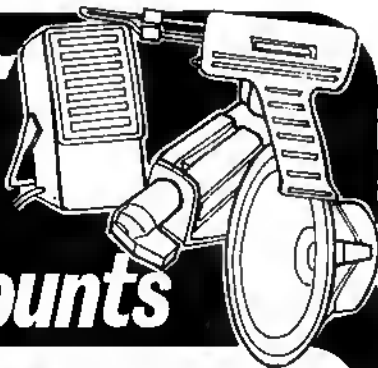
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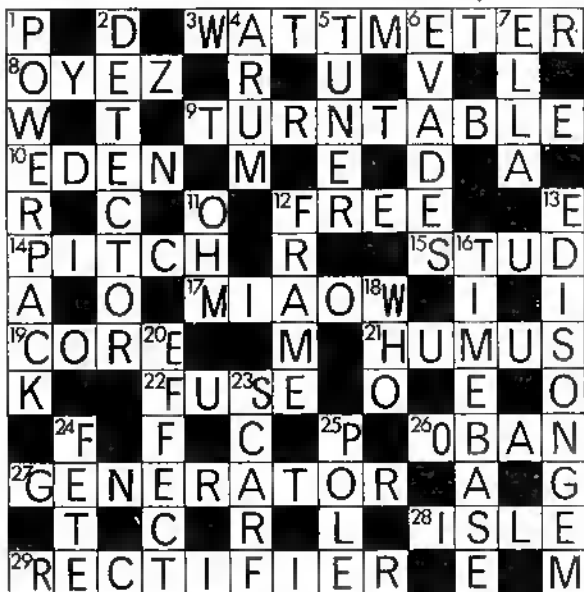
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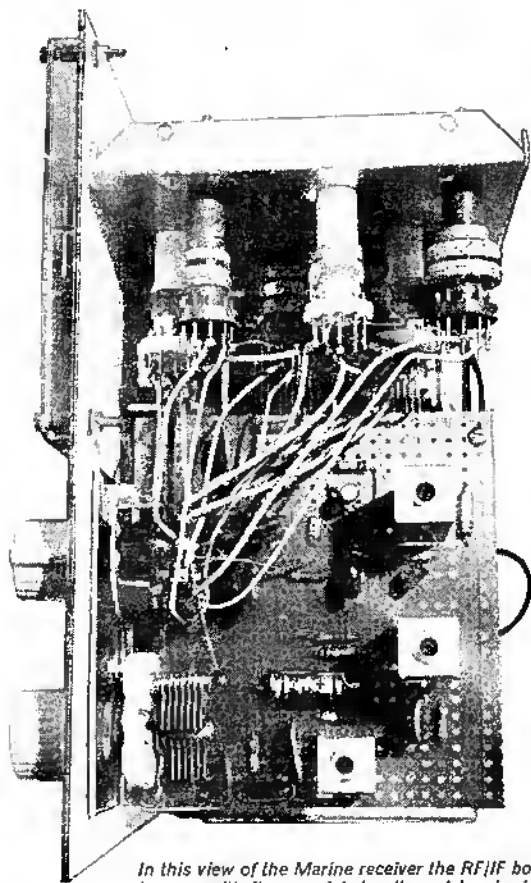
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PW TECHNIGROSS PUZZLE No. 8

presented last month



L.F. AND MARINE RECEIVER—continued from page 942



In this view of the Marine receiver the RF/IF board is seen with its associated coils and bandswitch.

P. W. KEMPTON—continued from page 926

check everything twice and you may save yourself hours of stripping down and trouble-shooting later. Once you tear the unit apart to look for a fault, the finished item will never look quite as neat as when it was first completed.

INSTALLATION

Mounting the unit in the car can be achieved in either of two ways. If a slot is available as part of the car's dashboard layout, the unit may be inserted from the front and held by a bracket constructed to meet the earthing bolt at the rear. The bracket is finally tightened to draw the machine in securely. Alternatively, the unit may be mounted beneath the dash panel or parcel tray using two angle-brackets. If this method is to be used, the bolts for the brackets should be fitted prior to assembly of the main unit, since it is impossible to fit them with the deck and amplifier panel in position.

Finally, make sure that the cases of the four output transistors cannot come into contact with any metalwork and so short-circuit. If necessary a strip of insulating material (srpb) may be fixed to the rear of the machine by the earthing bolt.

AERIAL SYSTEM

For best possible results, some attention is necessary to the aerial-earth system. What is used here can also depend on the more important frequencies and purpose in view.

Quite a number of the stronger transmissions can be received with a short aerial, and no earth connection, however, for weaker and more distant signals, an earth will increase signal strength considerably. For maximum range on the 160m band, and indeed most other bands, a quite long, outdoor aerial will greatly improve reception. Such an aerial is likely to cause overloading with powerful BBC and other broadcasts, and results are then better if either a short wire is used, or a small pre-set capacitor is placed in the aerial lead, or the aerial lead is twisted round an insulated wire which in turn runs to the receiver. PW


The speakers should be fitted in the car, bearing in mind the required stereo effect. If they can be built into the door panels, good results are obtained but a lot of work is needed. There is also the hazard of a short-circuit developing in the wiring because of the opening and closing of the doors. Probably the favourite place is the rear window ledge. A satisfactory stereo effect is usually obtained and the wiring up presents little difficulty. PW

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ELAC CONE TWEETER

The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 cps to 18,000 cps. Size 8 1/2" x 3 1/2" dia. Deep. Rating 10 watt. 3 ohm. Crossover £1.25

£1-90 Post 20p

GOODMANS 8 in. WOOFER

8 ohm 12 watt. Deep cone. Heavy ceramic magnet. Bass response 30-8,000 cps. Frequency response 30-8,000 cps. Ideal bass unit for £3-75 Hi-Fi systems



LOUDSPEAKER P.M. & OHMS. 7 x 4in. £1-25; 8 1/2in. £1-50; 8 x 6in. £1-75; 10 x 6in. £1-50; 11 1/2in. £2-00.

SPECIAL OFFER LOUDSPEAKERS! All Brand New. 3 ohm. 2 1/2in; 2 1/2in; 3 1/2in; 5in. 8 ohm. 2 1/2in; 2 1/2in; 5in x 3 1/2in; 5in. 15 ohm. 3 1/2in; 6 x 4in; 6in x 3in; 7 x 4in; 8 x 5in. 25 ohm. 2 1/2in; 3in; 6 x 3in; 5in. 35 ohm. 3in; 6in. 80 ohm. 2 1/2in; 2 1/2in. 120 ohm. 3in.

£1 EACH.

LOUDSPEAKER VOLUME CONTROL 15 ohm 10 watt with 1in line threaded bush for wood panel; mounting 65p.

RICHARD ALLAN TWIN CORE LOUDSPEAKERS. 5in. diameter 4W £2-50, 10in. diameter 5W £2-95; Post 25p. 12in. diameter, 5W, £3-50; 3 or 8 or 15 ohm models. SPEAKER COVERING MATERIALS. Samples Large S.A.E. Horn Tweeters 2-16Kc/s. 10W 8 ohm or 10 ohm £2-20. 2in. Line Horn Tweeters 2-18 Kc/s. 15W. 8 ohm £4-00. TWO-WAY 3,000 & 8,000 c.p.s. CROSS OVERS 3, 8 or 15 ohm £1-25. 3-WAY CROSSOVER 800 cps and 3000 cps (25 watt) £1-95.

DECCA DOME TWEETER 18,000 cps. 25 watts. 8 ohm. Price £3-30.

ELECTRO MAGNETIC PENDULUM MECHANISM

1.5v d.c. operation over 250 hrs. continuous on 5P2 battery. 1 1/2" x 1 1/2" x 1 1/2" size and speed. Ideal display for electro-mechanism or for metronome; stereo etc. 85p. Post 20p

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2 Stage Triode Pentode valve. 3 watts 3 ohm output. Volume on/off and tone controls AC mains. Complete and tested. With Loudspeaker. **£4-50** Post 25p.

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PS07AC-60p. EA2W 85p. Twin Gang £1-10.
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PS07CC-40p. LPDT4. 65p.

COAXIAL Plug 10p. PANEL SOCKETS 10p. LINE 16p. OUTLET BOXES, SURFACE MOUNTING 25p.

BALANCED TWIN RIBBON FEEDER 300 ohms, 7p rd.

JACK SOCKET 8in. open-circuit 14p. closed circuit 25p.

Chrome Lead Socket 45p. Phone Plug 6p. Phone Socket 5p.

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300 ohm suitable for stereo 7p per yard.

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88 to 108 Mc/s British made. 2 Transistors ready aligned—requires 10.7 Mc/s I.F. Complete with tuning gauge. Connections supplied but some technical experience required. SUITABLE I.F. STRIP 24-95. Post 20p.

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THE PAIR. Post 45p. (Available separately. Woofer £4.25; Tweeter £1.50.)

£5-75

Comprising a fine example of a Woofer 10 1/2" x 8 1/2" in. with a massive Ceramic Magnet, 44oz, Gauge 13,000 lines, Aluminium Cone centre to improve mids and top response. Also the E.M.I. Tweeter 8 1/2" in. square has a special lightweight paper cone and magnet flux 18,000 lines. Crossover condenser and full instructions supplied.

Impedance Standard 8 ohms
12 watts
Maximum power 25 to 18,000 cps
Useful Response 45 cps
Bass Resonance 45 cps

SUITABLE ENCLOSURE 20 x 13 x 8 in. MODERN DESIGN, TEAK WOOD FINISH.



£10-50
Post 75p

ELAC 8in. or 10 x 6in. HI-FI SPEAKER



Dual cone plasticized roll surround. Large ceramic magnet. 30-18,000 cps. Bass resonance 65 cps. 8 ohm impedance. 8in. 10 watts

£3-75

TEAK VENEER HI-FI SPEAKER CABINETS

Fluted Wood Fronts

MODEL "A", 20 x 13 x 8 in. For 12in. dia. **£10-50** Post 75p

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MODEL "C", 18 x 8 x 8 in. For 8 x 6in. **£4-95** Post 35p

LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft.



BAKER RECOMMENDED 12 inch Enclosure 4 cubic ft. HI-FI CABINET £18-60. Carr. £2 each. Size 20 x 20 x 12in. Teak Finished Fluted Front.

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STEREO VERSION OF ABOVE £5-85.

BARGAIN FM TUNER. 68-102 Mc/s Six Transistor. 9 volt. Printed circuit. Calibrated slide dial tuning. Walnut Cabinet. £14



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BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated. £3-50

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OFFERING 100% USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10 1/2" x 8 1/2" x 1/4" in. Operating voltage 200/250V. a.c. 200 watts approx. Printed circuit element enclosed in asbestos filled with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopyers and print drying equipment. Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convactor Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryer, towel rails—ideal for airing cupboards. Ideal for anti-frost devices for the garage—preventing frozen radiators or acting as oil pump heater. Use in the greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., can be used in series for lower heat. Or in parallel for higher heat applications.

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30-14,500 c/s. 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s Rated 20 watts. NOTE: 3 or 8 or 16 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£10-95**

Please state 3 or 8 or 16 ohms.

"BIG SOUND" BAKER SPEAKERS

Robustly constructed to stand up to long periods of electronic power. As used by leading groups and discos

Useful response 30-13,000 cps. Bass Resonance 55 cps.

GROUP "25" **£7-75**
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3, 8 or 16 ohms.

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12in. 35 watt
3, 8 or 16 ohms.

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15in. 50 watt
8 or 16 ohms.

GROUP 50/12in. **£12-95**
50 watt 8 or 16 ohms

Group + PA Cabinets in stock Sand for leaflet.



MAJOR 100 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 4 way mixing. Output 8/15 ohm a.c. Mains. Separate treble and bass controls. Guaranteed. Details SAE.



£49 Carr. £1-00

NEW MODEL--MAJOR 50 WATT £39-85. Carr. £1. 4 inputs 2-way mixing. 2 outputs separate treble and bass controls. Ideal disco or p.a. amp.

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4 input 10 wide range controls. For Mikes, Discos, Organs, Guitars, etc. 4, 8 & 16 ohm loudspeakers matching 200-00.

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Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/250V. Label S.A.E. **£3-75** Post 30p



QUALITY LOUDSPEAKER ENCLOSURE

Teak veneered 1 1/2" thick wood cabinet. Size 18 1/2" x 18 1/2" x 8 1/2" in. Weight 2 1/2 lbs. This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for 8 inch Woofer. £7-60 Carr. 85p. Rosewood Version 28-50 Carr. 85p. Baffle could be cut to take larger speaker.



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100 Ohm 20 watt Rheostat 2 1/2 in diam. Ceramic Former. Brown Terminals 1/2 in. diam. spindle. 95p. Post 25p. AC mains relay 3 pole change over 75p.



REVERSIBLE 4 POLE MOTOR
1,400 r.p.m. Reversible 42 Watt. **£2-25**
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As illustrated, 240v. AC mains.

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BAKER HI-FI SPEAKERS HIGH QUALITY — BRITISH MADE

REGENT 12in. 15 watts

An inexpensive unit for the beginner in high fidelity and for general purposes. May be used to improve any Radio, Amplifier, Hi-Fi or Television receiver.

Bass Resonance 45cps
Flux Density 12,000gauss
Useful response 45-13,000cps
3 or 8 or 16 ohm models.



£7-75

DE-LUXE Mk II 12in 15 watts

Especially designed to provide full range reproduction at an economical cost. Suitable for use with any high fidelity system. Built-in concentric tweeter cone.

Bass Resonance 80cps
Flux Density 14,000gauss
Useful response 25-18,000cps
8 or 16 ohms models.



£9-75

SUPERB 12in. 20 watts

A high quality loudspeaker. Its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.

Bass Resonance 25cps
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Useful response 20-17,000cps
8 or 16 ohms models.

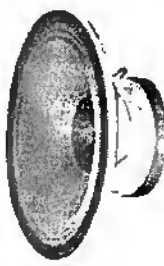


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A full range reproducer for high power. Electric Guitars, public address, multi-speaker systems, electric organs. Ideal for Hi-Fi and Disco-theques.

Bass Resonance 35cps
Flux Density 15,000gauss
Useful response 25-18,000cps
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A high wattage loudspeaker of exceptional quality with a level response to above 6,000 cps. Ideal for Public Address, Discoteques, Electronic Instruments and the home Hi-Fi.

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Hi-Fi Enclosure Manual containing plans, formulae, crossover data and cubic tables. 60p. Post 3p.

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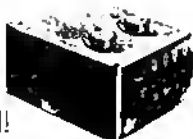
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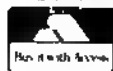
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Always thousands in stock, all sizes shapes and prices from 5p. 31bs assorted £1.40, 71bs £2.65, 561bs £35. 12 high quality panels with power transistors, IC's, trimpos etc £2.50. Pack containing about 500 components inc at least 50 transistors 95p. Pack of boards with 50 14 pin DIL DTL IC's £1.

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All mains primary, 5.0-5V → 100mA 85p; 9-0V → 100mA 90p; 12-0-12V → 100mA 95p; 16-0-16V with 1V → 1 1/2A £2; 24-0-24V → 800mA £1.85; 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30V → 1A £2.45; The following are ex-equip: 22j-0-22jV → 1A £2; 12V → 15A £3.50; 15V → 5A £2; 55V → 5A £4.

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 E12 11Ω to 910k: 5% E12 & E24 1p each

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 1/2W 10Ω to 1M: 2% E12 & E24 4p each
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Rotary miniature carbon track 1" spindle.
 Values available: 5k, 10k, 25k, 50k, 100k, 200k, 500k, 1M, 2M.
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 Lin. Single-gang (+ 1K) 16p
 Log. or Lin. Single-gang with switch 38p
 Log. or Lin. Dual-gang without switch 49p
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 Log. or Lin. Single-gang 1k, 5k, 10k, 25k, 50k, 100k 36p each
 Log. or Lin. Dual-gang 1k, 5k, 10k, 25k, 50k, 100k 45p each
 Presets: 0.1W. Vertical or Horizontal.
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Sub-miniature Axial lead electrolytic
 Mid V Price Mid V Price
 1 53 5p 68 6.3 5p
 1.5 63 5p 68 15 6p
 2 63 5p 68 25 14p
 3 63 5p 100 4 5p Mid V Price
 4 63 5p 100 10 5p 470 5.3 6p
 6 63 5p 100 25 6p 470 10 14p
 8 63 5p 100 40 6p 470 25 16p
 10 25 5p 100 63 16p 470 40 25p
 10 25 5p 150 6.3 6p 680 5.3 14p
 15 16 5p 150 16 6p 680 15 28p
 18 40 5p 150 25 6p 680 20 25p
 15 63 5p 150 40 14p 680 40 28p
 22 10 5p 150 63 16p 1000 4 14p
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| AC128 | 15p | BY127 | 13p |
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| AD161/102 MP | 35p | BY278H series | |
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| BA145 | 25p | OA81 | 35p |
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| BA109 | 10p | OC71 | 20p |
| BC109 | 15p | SC140D | 88p |
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| BC142 | 28p | WG05 | 30p |
| BC143 | 28p | W040 | 32p |
| BC147 | 10p | IN914 | 4p |
| BC148 | 10p | IN4001 | 6p |
| BC149 | 12p | IN4002 | 6p |
| BC168C | 12p | IN4003 | 7p |
| BC169C | 12p | IN4004 | 7p |
| BC178 | 17p | IN4005 | 8p |
| BC182L | 15p | IN4004 | 8p |
| BC183L | 15p | IN4007 | 9p |
| BC184L | 12p | IN1148 | 4p |
| BC212L | 14p | 2N1302 | 20p |
| BC213L | 14p | 2N1303 | 20p |
| BC214L | 13p | 2N1304 | 30p |
| BCF71 | 22p | 2N1711 | 24p |
| BD131 | 45p | 2N2910 | 25p |
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| BD131/ED132 | 2N2905 | 88p | |
| MP | £1.20 | 2N2936 Or. | |
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| BD139 | 49p | 2N3053 | 18p |
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| BF259 | 25p | 2N5458 | 51p |
| BFX29 | 30p | 7460 | 16p |
| BFX30 | 38p | 7443 | 8p |
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| SC1495 (14-pin DIL) | £2.70 |
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| µA7490 (8-pin DIL) | 89p |
| ZN414 (TO18) | £1.20 |

VOLTAGE REGULATORS

| | |
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| µA7805 5V 1.5A (TO9) | £1.75 |
| µA7815 15V 1.5A (TO9) | £2.30 |
| MVR 5V, 12V, 15V, 500mA (TO9) | £1.60 |
| µA78M05 5V 500mA (Plastic power) | £1.30 |
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| µA78L05 5V 100mA (TO92) | 80p |
| µA78L15 15V 100mA (TO92) | 90p |
| µA723C Variable 2 to 37V (TO99 or 14-pin DIL) | 75p |

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 Push to make Non-locking SPST 14p
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| 3-pin | 9p | 7p |
| 3-pin A (180°) | 10p | 7p |
| 3-pin B (240°) | 10p | 7p |
| 5-pin B | 10p | 9p |

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| 1in. Std. Stereo Metal Barrel | 30p |
| 2.5mm Plastic Barrel | 8p |
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| 3.5mm Plastic Barrel | 8p |
| 3.5mm Metal Barrel | 15p |

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| | |
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| Sub-min. mains 0-0.6V 100mA | 95p |
| 12-0-12V 50mA (Size both approx. 30 x 27 x 26mm) | |
| Min. mains | |
| 0-6V 500mA, 0-6V 500mA | £1.20 |
| 0-12V 250mA, 0-12V 250mA | £1.30 |
| 0-20V 150mA, 0-20V 150mA | £1.35 |
| 0-24V 125mA, 0-24V 125mA | £1.35 |
| Mains MTSAT: Sec: 12-15-20-24-30V 2A | £3.60 |
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THE NEW NELSON-JONES FM TUNER

PUSH-BUTTON VARICAP DIODE TUNING (6 Position)

(WW' JUNE '73)

Exclusive Designer Approved Kits



What are the important features to look for in an FM tuner kit? Naturally it must have an attractive appearance when built, but it must also embody the latest and best in circuit design such as:-

- MOSFET** front end for excellent cross modulation performance and low noise.
- 3 GANG** tuning for high selectivity.
- VARICAP** tuning diodes in back to back configuration for low distortion.
- CERAMIC** filters for defined IF response.
- INTEGRATED** circuit IF amplifiers for reliability and excellent limiting/AM rejection.

- PHASE LOCKED** Stereo decoder with Stereo mute, see below
- LED** fine tuning indicators.
- PUSH BUTTON** tuning (with AFC disable) over the FM band (88-104)
- IC STABILISED** and 5/C protected power supply.
- CABINET** double veneered anti-rattle warp.

The Nelson-Jones Tuner has all of these features and many more, and more importantly the design is fully proven not just with a few prototypes but with many thousands of working tuners spread across the world.

Typ. Spec'n: 20 dB Quieting 0-75uV, Image rejection -70dB.I.F. Rejection -85 dB.

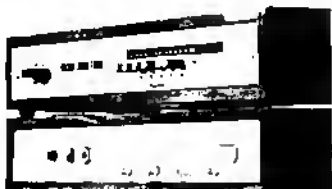
Basic tuner module prices start as low as £12-31, with complete kits starting at £25-95 (mono) + P.P. 65p, and of course all components are available separately.

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PORTUS AND HAYWOOD PHASE LOCKED DECODER (W.W. Sept. '70). Still the lowest distortion P.L. decoder available, THD typically 0-05% (at Nelson-Jones Tuner O/P level) Supplied complete with Red LED.

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Available as basic or complete kits

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TYP. SPECIFICATION
2uV for 30dB S/N
Image rejection 40dB
IF rejection 65dB

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P. & P. 65p

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TRANSISTORS, DIODES etc.

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| AC 112 | AF 139 | BSY 27 | OA 202 | OC 200 | SN 3053 |
| AC 126 | AF 178 | BSY 36 | OAZ 200 | OC 204 | SN 3054 |
| AC 127 | AF 185 | BSY 56A | OC 22 | OC 206 | SN 3055 |
| AC 128 | AF 192 | BR7 16 | OC 25 | OC 208 | SN 3056 |
| AC 175 | AF 226 | CR8 110 | OC 28 | OC 210 | SN 3057 |
| AC 176 | AF 23 | CR8 120 | OC 29 | OC 212 | SN 3058 |
| AC 177 | AF 28 | CR8 130 | OC 30 | OC 214 | SN 3059 |
| AC 178 | AF 28 | CR8 140 | OC 31 | OC 216 | SN 3060 |
| AC 179 | AF 28 | CR8 150 | OC 32 | OC 218 | SN 3061 |
| AC 180 | AF 28 | CR8 160 | OC 33 | OC 220 | SN 3062 |
| AC 181 | AF 28 | CR8 170 | OC 34 | OC 222 | SN 3063 |
| AC 182 | AF 28 | CR8 180 | OC 35 | OC 224 | SN 3064 |
| AC 183 | AF 28 | CR8 190 | OC 36 | OC 226 | SN 3065 |
| AC 184 | AF 28 | CR8 200 | OC 37 | OC 228 | SN 3066 |
| AC 185 | AF 28 | CR8 210 | OC 38 | OC 230 | SN 3067 |
| AC 186 | AF 28 | CR8 220 | OC 39 | OC 232 | SN 3068 |
| AC 187 | AF 28 | CR8 230 | OC 40 | OC 234 | SN 3069 |
| AC 188 | AF 28 | CR8 240 | OC 41 | OC 236 | SN 3070 |
| AC 189 | AF 28 | CR8 250 | OC 42 | OC 238 | SN 3071 |
| AC 190 | AF 28 | CR8 260 | OC 43 | OC 240 | SN 3072 |
| AC 191 | AF 28 | CR8 270 | OC 44 | OC 242 | SN 3073 |
| AC 192 | AF 28 | CR8 280 | OC 45 | OC 244 | SN 3074 |
| AC 193 | AF 28 | CR8 290 | OC 46 | OC 246 | SN 3075 |
| AC 194 | AF 28 | CR8 300 | OC 47 | OC 248 | SN 3076 |
| AC 195 | AF 28 | CR8 310 | OC 48 | OC 250 | SN 3077 |
| AC 196 | AF 28 | CR8 320 | OC 49 | OC 252 | SN 3078 |
| AC 197 | AF 28 | CR8 330 | OC 50 | OC 254 | SN 3079 |
| AC 198 | AF 28 | CR8 340 | OC 51 | OC 256 | SN 3080 |
| AC 199 | AF 28 | CR8 350 | OC 52 | OC 258 | SN 3081 |
| AC 200 | AF 28 | CR8 360 | OC 53 | OC 260 | SN 3082 |
| AC 201 | AF 28 | CR8 370 | OC 54 | OC 262 | SN 3083 |
| AC 202 | AF 28 | CR8 380 | OC 55 | OC 264 | SN 3084 |
| AC 203 | AF 28 | CR8 390 | OC 56 | OC 266 | SN 3085 |
| AC 204 | AF 28 | CR8 400 | OC 57 | OC 268 | SN 3086 |
| AC 205 | AF 28 | CR8 410 | OC 58 | OC 270 | SN 3087 |
| AC 206 | AF 28 | CR8 420 | OC 59 | OC 272 | SN 3088 |
| AC 207 | AF 28 | CR8 430 | OC 60 | OC 274 | SN 3089 |
| AC 208 | AF 28 | CR8 440 | OC 61 | OC 276 | SN 3090 |
| AC 209 | AF 28 | CR8 450 | OC 62 | OC 278 | SN 3091 |
| AC 210 | AF 28 | CR8 460 | OC 63 | OC 280 | SN 3092 |
| AC 211 | AF 28 | CR8 470 | OC 64 | OC 282 | SN 3093 |
| AC 212 | AF 28 | CR8 480 | OC 65 | OC 284 | SN 3094 |
| AC 213 | AF 28 | CR8 490 | OC 66 | OC 286 | SN 3095 |
| AC 214 | AF 28 | CR8 500 | OC 67 | OC 288 | SN 3096 |
| AC 215 | AF 28 | CR8 510 | OC 68 | OC 290 | SN 3097 |
| AC 216 | AF 28 | CR8 520 | OC 69 | OC 292 | SN 3098 |
| AC 217 | AF 28 | CR8 530 | OC 70 | OC 294 | SN 3099 |
| AC 218 | AF 28 | CR8 540 | OC 71 | OC 296 | SN 3100 |
| AC 219 | AF 28 | CR8 550 | OC 72 | OC 298 | SN 3101 |
| AC 220 | AF 28 | CR8 560 | OC 73 | OC 300 | SN 3102 |
| AC 221 | AF 28 | CR8 570 | OC 74 | OC 302 | SN 3103 |
| AC 222 | AF 28 | CR8 580 | OC 75 | OC 304 | SN 3104 |
| AC 223 | AF 28 | CR8 590 | OC 76 | OC 306 | SN 3105 |
| AC 224 | AF 28 | CR8 600 | OC 77 | OC 308 | SN 3106 |
| AC 225 | AF 28 | CR8 610 | OC 78 | OC 310 | SN 3107 |
| AC 226 | AF 28 | CR8 620 | OC 79 | OC 312 | SN 3108 |
| AC 227 | AF 28 | CR8 630 | OC 80 | OC 314 | SN 3109 |
| AC 228 | AF 28 | CR8 640 | OC 81 | OC 316 | SN 3110 |
| AC 229 | AF 28 | CR8 650 | OC 82 | OC 318 | SN 3111 |
| AC 230 | AF 28 | CR8 660 | OC 83 | OC 320 | SN 3112 |
| AC 231 | AF 28 | CR8 670 | OC 84 | OC 322 | SN 3113 |
| AC 232 | AF 28 | CR8 680 | OC 85 | OC 324 | SN 3114 |
| AC 233 | AF 28 | CR8 690 | OC 86 | OC 326 | SN 3115 |
| AC 234 | AF 28 | CR8 700 | OC 87 | OC 328 | SN 3116 |
| AC 235 | AF 28 | CR8 710 | OC 88 | OC 330 | SN 3117 |
| AC 236 | AF 28 | CR8 720 | OC 89 | OC 332 | SN 3118 |
| AC 237 | AF 28 | CR8 730 | OC 90 | OC 334 | SN 3119 |
| AC 238 | AF 28 | CR8 740 | OC 91 | OC 336 | SN 3120 |
| AC 239 | AF 28 | CR8 750 | OC 92 | OC 338 | SN 3121 |
| AC 240 | AF 28 | CR8 760 | OC 93 | OC 340 | SN 3122 |
| AC 241 | AF 28 | CR8 770 | OC 94 | OC 342 | SN 3123 |
| AC 242 | AF 28 | CR8 780 | OC 95 | OC 344 | SN 3124 |
| AC 243 | AF 28 | CR8 790 | OC 96 | OC 346 | SN 3125 |
| AC 244 | AF 28 | CR8 800 | OC 97 | OC 348 | SN 3126 |
| AC 245 | AF 28 | CR8 810 | OC 98 | OC 350 | SN 3127 |
| AC 246 | AF 28 | CR8 820 | OC 99 | OC 352 | SN 3128 |
| AC 247 | AF 28 | CR8 830 | OC 100 | OC 354 | SN 3129 |
| AC 248 | AF 28 | CR8 840 | OC 101 | OC 356 | SN 3130 |
| AC 249 | AF 28 | CR8 850 | OC 102 | OC 358 | SN 3131 |
| AC 250 | AF 28 | CR8 860 | OC 103 | OC 360 | SN 3132 |
| AC 251 | AF 28 | CR8 870 | OC 104 | OC 362 | SN 3133 |
| AC 252 | AF 28 | CR8 880 | OC 105 | OC 364 | SN 3134 |
| AC 253 | AF 28 | CR8 890 | OC 106 | OC 366 | SN 3135 |
| AC 254 | AF 28 | CR8 900 | OC 107 | OC 368 | SN 3136 |
| AC 255 | AF 28 | CR8 910 | OC 108 | OC 370 | SN 3137 |
| AC 256 | AF 28 | CR8 920 | OC 109 | OC 372 | SN 3138 |
| AC 257 | AF 28 | CR8 930 | OC 110 | OC 374 | SN 3139 |
| AC 258 | AF 28 | CR8 940 | OC 111 | OC 376 | SN 3140 |
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Due to current world shortages, resistor kits may contain some high and value substitutions.

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250V P.C. Mounting: 0-01µF, 0-015µF, 0-022µF, 0-033µF, 0-047µF, 3p, 0-068µF, 12p, 1µF, 4p, 0-15µF, 4p, 0-22µF, 5p, 0-33µF, 8p, 0-47µF, 9p, 0-68µF, 12p, 1µF, 15p, 1-5µF, 23p, 2-2µF, 26p.

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160V: 0-01µF, 0-015µF, 0-022µF, 0-033µF, 0-047µF, 0-068µF, 3p, 0-1µF, 4p, 0-15µF, 5p, 0-22µF, 5p, 0-33µF, 6p, 0-47µF, 8p, 0-68µF, 12p, 1µF, 14p.

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

POLYSTYRENE CAPACITORS 160V 5%
(pF) 10, 15, 22, 33, 47, 68, 100, 150, 220, 330, 470, 680, 1000, 1500, 2200, 3300, 4700, 6800, 10000, 4p.

RESISTORS

CF—High Stag Carbon Film, 5% MF—High Stag Metal Film, 5%.

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

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VALUES AVAILABLE—E12 Series only. (Net prices above 100.)

PRESET SKELETON POTENTIOMETERS
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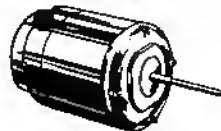
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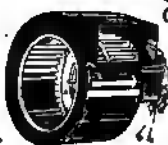
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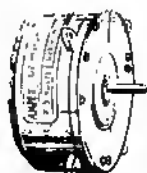
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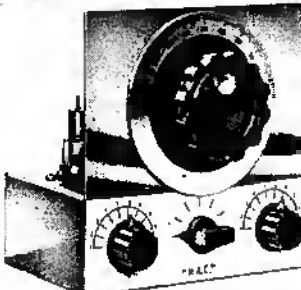
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| LM 3900 | 0.68 | 7413 | 0.38 |
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| SN 76660N | 1.00 | 7447 | 1.20 |
| CA 3089e/ | | 7448 | 1.25 |
| TDA 1200 | 1.94 | 7473 | 0.31 |
| CA 3053 | 0.52 | 7474 | 0.31 |
| ua 753 | 0.99 | 7490 | 0.71 |
| TBA 651 | 1.81 | 7493 | 0.71 |
| CA 3123E | 1.40 | 74S112 | 2.30 |
| MC 1310 | 2.80 | 74121 | 0.38 |
| CA 3090Q | 2.80 | 74192 | 1.57 |
| CA 3090AQ | 3.75 | | |
| ua 7805UC | 1.75 | | |
| ua 7805KC | 2.05 | | |
| NE 550A | 0.80 | | |
| ua 753 | 0.80 | | |
| ua 710 | 0.55 | | |
| ua 733 | 1.80 | | |
| ua 741CV | 0.40 | | |
| NE 560B | 3.19 | | |
| NE 561B | 3.19 | | |
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| NE 565A | 2.75 | | |
| NE 566V | 2.55 | | |
| NE 567V | 2.75 | | |
| NE 555V | 0.78 | | |
| ICL 8038 | | | |
| CC | 3.10 | | |
| LM 1496 | 1.02 | | |

Transistors

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| BC 109 | 0.12 |
| BC 183L | 0.14 |
| BC 212 | 0.14 |
| BF 256LB | 0.34 |
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| 1N 4004 | 0.10 |
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| CA 3090Q | 0.30 |
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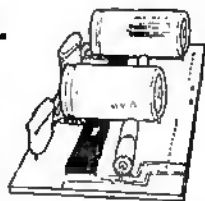
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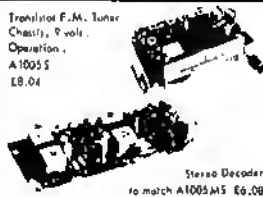
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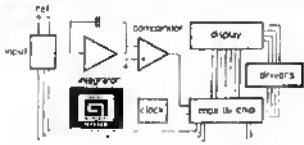
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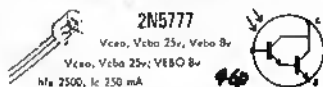


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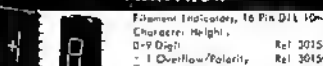
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| 2N697 | 16p | 2N3708 | 70p | AD143 | 45p | BC137 | 21p | TO99 | 38p |
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| 2N699 | 45p | 2N3716 | £1.80 | AD162 | 45p | BCY70 | 17p | 14D1L | 40p |
| 2N1302 | 19p | 2N3771 | £2.20 | AD161 | pr | BCY21 | 22p | LM723C | 90p |
| 2N1303 | 19p | 2N3772 | £1.80 | AD161 | pr | BCY72 | 13p | LM741 | 13p |
| 2N1304 | 24p | 2N3773 | £2.65 | AF109R | 40p | BD123 | 32p | TO99 | 40p |
| 2N1305 | 24p | 2N3819 | 37p | AF115 | 24p | DB131 | 40p | 8D1L | 70p |
| 2N1306 | 31p | 2N3870 | 39p | AF124 | 30p | DB132 | 30p | 8D1L | 30p |
| 2N1307 | 23p | 2N3823 | £1.10 | AF125 | 39p | BD135 | 45p | LM747 | £1.00 |
| 2N1308 | 25p | 2N3904 | 27p | AF126 | 28p | BD136 | 49p | LM7805 | £2.00 |
| 2N1309 | 36p | 2N3905 | 24p | AF127 | 28p | BD137 | 55p | MC1310 | £2.92 |
| 2N1671 | £1.44 | 2N4036 | 63p | AF139 | 39p | BD138 | 63p | M1480 | 90p |
| 2N1671A | £1.54 | 2N4037 | 42p | AF170 | 55p | BD139 | 71p | M1481 | £1.14 |
| 2N1671B | £1.72 | 2N4216 | 20p | AF179 | 65p | BD140 | 82p | M149C | 98p |
| 2N1671C | £4.32 | 2N4299 | 36p | AF180 | 36p | BF115 | 50p | M1491 | £1.38 |
| 2N2102 | 76p | 2N4921 | 73p | AF179 | 51p | BF116 | 23p | MJE340 | 45p |
| 2N2147 | 78p | 2N4922 | 84p | AF240 | 73p | BF117 | 43p | MJE2955 | £1.12 |
| 2N2148 | 94p | 2N4923 | 83p | AF279 | 54p | BF154 | 16p | MJE3055 | 68p |
| 2N2160 | 60p | 2N5190 | 92p | AF280 | 54p | BF163 | 32p | MFC4000B | 40p |
| 2N2218A | 22p | 2N5191 | 95p | 8C107 | 16p | BF180 | 35p | MFC4010A | 49p |
| 2N2219 | 24p | 2N5192 | £1.24 | BC108 | 15p | BF181 | 34p | MFC4060 | 54p |
| 2N2219A | 26p | 2N5195 | £1.46 | BC109 | 19p | BF184 | 30p | MFC6040 | 91p |
| 2N2221 | 18p | 2N5202 | 45p | BC124 | 75p | BF194 | 12p | NE560D | £4.48 |
| 2N2221A | 21p | 2N5457 | 49p | BC148 | 13p | BF195 | 13p | NE531 | £4.48 |
| 2N2222 | 20p | 2N5458 | 45p | BC149 | 13p | BF196 | 13p | NE565A | £4.48 |
| 2N2222A | 25p | 2N5459 | 49p | BC167B | 13p | BF197 | 15p | OC28 | 76p |
| 2N2646 | 55p | 40361 | 44p | BC168B | 13p | BF198 | 18p | OC42 | 50p |
| 2N2904 | 22p | 40362 | 50p | BC168C | 11p | BF200 | 40p | OC71 | 17p |
| 2N2904A | 24p | 40363 | 80p | BC169B | 13p | BF237 | 22p | OC71B | 17p |
| 2N2905 | 24p | 40407 | 44p | BC124 | 75p | BF238 | 22p | OC71C | 17p |
| 2N2905A | 26p | 40408 | 50p | BC182 | 13p | BFX29 | 20p | SL414A | £1.80 |
| 2N2906 | 18p | 40408 | 50p | BC182L | 12p | BFX30 | 27p | TAA263 | £1.80 |
| 2N2906A | 21p | 40409 | 52p | BC183 | 12p | BFX64 | 24p | TBA800 | £1.50 |
| 2N2907 | 22p | 40410 | 52p | BC183L | 12p | BFX85 | 30p | TBA810 | £1.50 |
| 2N2907A | 24p | 40411 | £1.25 | BC184 | 13p | BFX87 | 28p | TIP29A | 49p |
| 2N2926 | 11p | 40602 | 46p | BC184L | 13p | BFX88 | 25p | TIP30A | 58p |
| 2N3053 | 25p | 40604 | 56p | BC212K | 16p | BFX89 | 45p | TIP31A | 62p |
| 2N3054 | 26p | 40605 | 49p | BC212L | 16p | BFX19 | 65p | TIP32B | 62p |
| 2N3055 | 75p | AC117 | 20p | BC214L | 21p | BFY51 | 21p | TIP33A | £1.01 |
| 2N3441 | 97p | AC126 | 20p | BC237 | 13p | BFY52 | 21p | TIP34A | £1.51 |
| 2N3442 | £1.69 | AC127 | 20p | BC238 | 13p | BFY90 | 75p | TIP35A | £2.90 |
| 2N3415 | 10p | AC128 | 20p | BC239 | 13p | BRY39 | 48p | TIP36A | £3.70 |
| 2N3416 | 15p | AC151V | 25p | BC257 | 14p | CI060 | 65p | TIP41A | 79p |
| 2N3417 | 21p | AC152A | 17p | BC258 | 13p | CA3020A | 1.80 | TIP42A | 90p |
| 2N3702 | 11p | AC132K | 35p | BC124 | 75p | CA3046 | 1.80 | TIP295 | 90p |
| 2N3703 | 12p | AC176 | 18p | BC300 | 36p | CA3048 | £2.11 | TIP3055 | 60p |
| 2N3704 | 14p | AC176K | 25p | BC301 | 34p | CA3089E | £1.96 | ZTX300 | 13p |
| 2N3705 | 12p | AC187K | 23p | BC307 | 11p | CA30900 | £4.23 | ZTX302 | 20p |
| 2N3706 | 9p | AC188K | 14p | BC308 | 12p | LM1301A | 46p | ZTX500 | 15p |

TRANSFORMERS

SAFETY MAINS ISOLATING TRANSFORMERS

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

| Ref. No. | VA (Watts) | Weight lb oz | Size cm. | £ P & P |
|----------|------------|--------------|--------------------|----------|
| 07 | 20 | 1 | 7-0 x 6-0 x 6-0 | 2.55 38 |
| 149 | 60 | 3 | 9-9 x 7-7 x 8-6 | 3.98 45 |
| 150 | 100 | 5 | 9-9 x 8-9 x 8-6 | 4.45 45 |
| 151 | 200 | 8 | 12-1 x 9-3 x 10-2 | 7.39 53 |
| 152 | 350 | 13 | 12-1 x 11-8 x 10-2 | 8.93 73 |
| 153 | 350 | 15 | 14-0 x 10-8 x 11-8 | 10.80 73 |
| 154 | 500 | 19 | 14-0 x 13-4 x 11-8 | 12-41 91 |
| 155 | 750 | 29 | 17-2 x 14-0 x 14-0 | 18.65 .. |
| 156 | 1000 | 38 | 17-2 x 16-6 x 14-0 | 26.50 .. |
| 157 | 1500 | 46 | 21-6 x 13-4 x 18-1 | 30.23 .. |
| 158 | 2000 | 60 | 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 | 5-8 x 5-1 x 4-5 | 0-115-210-240 | 1.52 30 |
| 64 | 75 | 2 | 7-4 x 6-7 x 6-1 | 0-115-210-240 | 1.64 30 |
| 4 | 150 | 3 | 8-9 x 7-7 x 7-7 | 0-115-200-220-240 | 3.75 45 |
| 66 | 300 | 6 | 9-9 x 9-6 x 8-6 | .. | 5.29 53 |
| 67 | 500 | 12 | 12-1 x 11-2 x 10-2 | .. | 8.02 67 |
| 84 | 1000 | 19 | 14-0 x 13-4 x 14-3 | .. | 12.49 91 |
| 93 | 1500 | 30 | 14-0 x 15-9 x 14-3 | .. | 16.65 .. |
| 95 | 2000 | 32 | 17-2 x 16-6 x 14-0 | .. | 22.00 .. |
| 73 | 3000 | 40 | 21-6 x 13-4 x 18-1 | .. | 31.90 .. |

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500VA £9.50 pp 80p 1000VA £15.92 via B.R.S.

TRANSFORMERS

PRIMARY 140-250 VOLTS 12 AND OR 24 VOLT RANGE

| Ref. No. | Ampr. | Weight lb oz | Size cm. | Secondary Windings | £ P & P |
|----------|-------|--------------|-------------------------|--------------------|----------|
| 111 | 0.5 | 0.25 | 8 4-8 x 2-9 x 3.5 | 0-12V at 0.25A x2 | 1.34 23 |
| 213 | 1.0 | 0.5 | 1 4 6-1 x 5-8 x 4-8 | 0-12V at 0.5A x2 | 1.58 30 |
| 17 | 1 | 1 | 1 12 7-0 x 6-4 x 6-1 | 0-12V at 1A x2 | 2.09 38 |
| 110 | 4 | 2 | 12 8-3 x 7-7 x 7-0 | 0-12V at 2A x2 | 2.69 38 |
| 70 | 6 | 3 | 8 8-9 x 8-0 x 7-7 | 0-12V at 3A x2 | 2.75 45 |
| 108 | 8 | 4 | 5 8 8-9 x 8-9 x 8-6 | 0-12V at 4A x2 | 4.15 45 |
| 72 | 10 | 5 | 6 4 9-9 x 9-6 x 8-6 | 0-12V at 5A x2 | 4.67 53 |
| 116 | 12 | 6 | 6 12 9-9 x 10-2 x 8-6 | 0-12V at 5A x2 | 5.02 53 |
| 17 | 16 | 8 | 8 12 12-1 x 9-9 x 10-2 | 0-12V at 8A x2 | 6.62 60 |
| 115 | 20 | 10 | 11 8 14-0 x 9-6 x 11-8 | 0-12V at 10A x2 | 12.43 73 |
| 126 | 30 | 15 | 15 8 14-0 x 12-1 x 11-8 | 0-12V at 15A x2 | 12.99 85 |
| 132 | 60 | 30 | 32 0 17-2 x 15-3 x 14-0 | 0-12V at 30A x2 | 15.30 .. |

30 VOLT RANGE

| Ref. No. | Ampr. | 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 11-8 x 8-6 x 10-2 | .. | 5.83 53 |
| 117 | 6.0 | 8 | 0 12-1 x 9-3 x 10-2 | .. | 6.51 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. | Ampr. | 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 | .. | 3.06 38 |
| 104 | 2.0 | 5 | 8 9-9 x 8-9 x 8-6 | .. | 4.26 45 |
| 105 | 3.0 | 6 | 12 9-9 x | | |

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| A1161/162 | 0.35 | CR81120 | 0.60 | | |
| A1143/167 | 0.14 | CR81130 | 0.45 | | |
| AP18 | 0.35 | CR81140 | 0.55 | | |
| BC107/80 | 0.08 | | | | |
| BC147/80 | 0.10 | | | | |
| BC182/104 | 0.10 | | | | |
| BC212/104 | 0.11 | | | | |
| BC107/172 | 0.12 | | | | |
| BC113/132 | 0.35 | | | | |
| BC184/104 | 0.10 | | | | |
| BF550/1163 | 0.10 | | | | |
| BY127 | 0.25 | | | | |
| MJ3570 | 0.62 | | | | |
| MJ3571 | 0.73 | | | | |
| 2N2218 | 0.18 | | | | |
| 2N2906 | 0.13 | | | | |
| 2N2906 all | 0.11 | | | | |
| 2N2907 | 0.15 | | | | |
| 2N3054 | 0.42 | | | | |
| 2N3055 | 0.44 | | | | |
| 2N3702/3/4 | 0.10 | | | | |
| 2N3703/5 | 0.10 | | | | |
| 2N3707/8 | 0.08 | | | | |
| 2N3712 | 0.28 | | | | |
| TL1220 754 | 0.20 | | | | |
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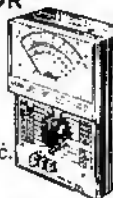
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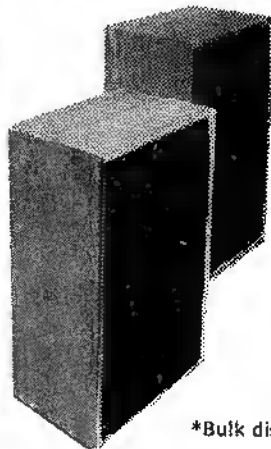
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 100V: 0-001 μ F, 0-002 μ F, 0-005 μ F, 3p.
 0-01 μ F, 0-015 μ F, 0-02 μ F, 0-04 μ F, 0-05 μ F 4p.
 0-1 μ F, 0-15 μ F, 0-2 μ F. 30V: 0-47 μ F 6p.

PRESET POTENTIOMETERS
 0-25W: 100 Ω -1M Horizontal 6p
 1K-1M Vertical 4p
 0-1W: 50 Ω -1M Vertical 6p

RESISTORS High Stability Low noise
 Type C Tol. Range Val. 1-49 50+
 1W C 5% 2-20-10M E24 8p -5p
 1W C 5% 2-20-10M E12 1p -5p
 1W C 5% 2-20-10M E12 2-5p 2p
 1W WW 10% 1 Ω -100 Ω E12 8p -

| JACK PLUGS | SOCKETS | | PANEL METERS |
|---------------------|-----------------|-----------------------------|--|
| | Screened chrome | Open metal | |
| 2-5mm 10p | 4p | Moulded with break contacts | Size 2 1/2" x 1 1/2" requires 1 1/2" diam. hole. |
| 3-5mm 14p | 4p | | ME5-50 μ A |
| Standard mono 17p | 13p | | ME7-100 μ A |
| Standard stereo 30p | 13p | | ME8-500 μ A |
| | 18p | | ME9-1m/A |
| | | | ME10-5m/A |

| DIN | PLUGS | SCKTS. | INLINE SCKTS. | OIL SOCKETS LOW PROFILE |
|-------------------------------|-------|------------------------|---------------|-------------------------|
| 2, 3, 4, 5 (180°, 240°) 6 pin | 12p | 6p | 15p | 6 Pin 14p |
| CO-AXIAL (TV) | 10p | 6p | 13p (I.I.) | 14 Pin 15p |
| PHONO assorted colours | 8p | 5p (spl.) 10p (I.I.P.) | 8p | 15 Pin 16p |
| BANANA 8p | 5p | - | - | ME11-10m/A |
| | | | | ME12-80m/A |
| | | | | ME13-100m/A |
| | | | | ME14-500m/A |
| | | | | ME15-1 AMP |
| | | | | ME15-30V AC |
| | | | | ME17-300V AC |
| | | | | ME18-"S" METER |
| | | | | ME19-"VU" METER |

| TOGGLE: SPST | DPDT | PUSH BUTTON: Miniature push to make or break nonlocking |
|----------------------|---------------|--|
| 18p | 22p | 15p |
| SUB-MINIATURE TOGGLE | SP changeover | ROCKER (white): 5A 250V SP changeover |
| 35p | 35p | 25p |
| SPST on/off | DPDT | ROCKER SWITCH (White) 3A 250V Illuminated neon switch |
| 84p | 19p | 50p |
| SLIDE: 1A DP 250V | 1A DP 250V | ROTARY WAFER: 1 pole/12 way, 2p/6w, 2p/2w, 2p/4w, 3p/2w, 3p/4w, 4p/2w, 4p/3w |
| 8p | 8p | 24p |

| TRANSFORMERS | Mains | LAMP HOLDERS/LAMPS |
|-------------------|------------|--|
| Primary 220V-240V | 100mA 90p | LES HOLDERS Dome top, Red, Blue, Green/Yellow/White, 1" hole 14p |
| 6-0-6 (miniature) | 100mA 80p | Les Bulbs 6v and 12v 8p |
| 6-0-9 " | 100mA 80p | MES HOLDER, Heavy duty, round top Red and Amber requires 1 1/2" hole 25p |
| 12-0-12 " | 100mA 80p | NEON, 240V Red round top 1 1/2" hole 25p |
| 18-0-18 also 24V | 100mA 80p | NEON, A as above but with 1" square Red or Green top 25p |
| 24-0-24 | 500mA 220p | LAMPS LES 6v, 12v, MES 3-5v, 24v All 6p each |
| 30-24-20-15-12-0 | 1A 230p | |
| 5-0 | 2A 110p | |

| VEROBOARD | Pitch (copper clad) | 0-15 (plate) | 0-15 (plate) |
|--------------------|---------------------|--------------|--------------|
| 2 1/2x3 1/2" | 30p | 23p | 14p |
| 2 1/2x3" | 32p | 32p | 15p |
| 3 1/2x3" | 35p | 32p | 15p |
| 3 1/2x2 1/2" | 38p | 38p | 25p |
| 2 1/2x1 1/2" | 88p | 75p | 55p |
| 3 1/2x1 1/2" | 130p | 105p | 75p |
| 4 1/2x1 1/2" | 173p | - | 105p |
| Pin of 35 pins | 20p | | |
| Spot face cutter | 49p | | |
| Pin insertion tool | 69p | | |

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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

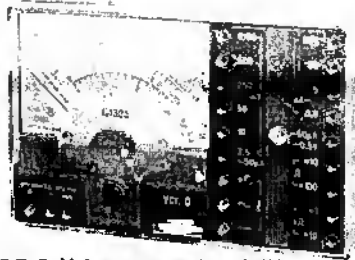
Movement is protected by silicon diodes.

Dimensions 167x98x63 mm. Weight: 1.5lb.

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

MULTIMETER TYPE U4323

Sensitivity: 20,000Ω/V.



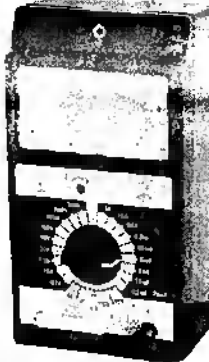
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8 A.C. Voltage ranges 2.5-1000V
5 D.C. Current ranges 0.05-500mA

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: 140x87x40 mm. Weight 0.5kg

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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

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Dimensions: 115x215x90 mm, Weight 3.3lb.

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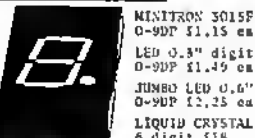
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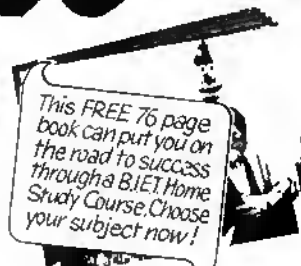
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| 789C | 0-39 | 792C | 0-65 |
| 792C | 0-65 | 747C | 0-45 |
| 747C | 0-45 | 748C | 0-61 |
| 748C | 0-61 | LM30 | |