

PRACTICAL WIRELESS

MARCH
1977

40p

FREE INSIDE!

PRACTICAL WIRELESS MAR 1977

RESISTORS & CAPACITORS

INFO-CARDS

5

HERE'S THE FIRST!

Pw

fm

stereo

touch tuner

PART 1



also:

Easytune MW-LW Receiver
Practical Audio Amplifiers

RADIO EXCHANGE LTD.

**ALL PRICES
INCLUDE VAT**

NEW EDU-KIT MAJOR

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



Total Building Costs **£9.00**
P & P + Ins. 85p.

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

Components include: 24 Resistors ★ 21 Capacitors ★ 10 Transistors
 ★ 5" x 3" Loudspeaker ★ Earpiece ★ Mica Baseboard ★ 3 12-watt connectors
 ★ 2 Volume controls ★ 2 Slider Switches ★ 1 Tuning Condenser ★ 3 Knobs
 ★ Ready Wound MW/LW/SW Coils ★ Ferrite Rod ★ 6½ yards of wire
 ★ 1 Yard of sleeving, etc. Complete kit of parts including construction plans.

VHF AIR CONVERTER KIT

Build this Converter Kit and receive the Aircraft Band by placing it by the side of a radio tuned to Medium Wave or the Long Wave Band and operating as shown in the instructions supplied free with all parts. Uses a retractable chrome plated telescopic aerial, Gain Control, V.H.F. Tuning Capacitor, Transistor, etc.

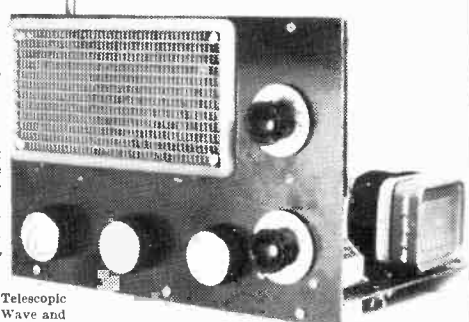


All Parts including Case and Plans. **£3.95**
P & P and Ins. 45p.

NEW ROAMER TEN MODEL R.K.3.

MULTIBAND V.H.F. AND A.M. RECEIVER
13 TRANSISTORS AND FIVE DIODES
QUALITY 5" x 3" LOUDSPEAKER

WITH Multiband V.H.F. section covering Mobiles, Aircraft, T.V. Sound, Public Service Band, Local V.H.F. Stations, etc. and Multiband A.M. section with Airspaced Slow Motion Drive Tuning Capacitor for easier and accurate tuning, covering M.W.1, M.W.2, L.W., Three Short Wave Bands, S.W.1, S.W.2, S.W.3, and Trawler Band. Built in Ferrite Rod Aerial for Medium Wave, Long Wave and Trawler Band, etc. Chrome Plated 7 section Telescopic Aerial, angled and rotatable for peak Short Wave and V.H.F. reception. Push Pull output using 600mw Transistors. Gain, Wave-Change and Tone Controls. Plus two Slider Switches. Negative Feedback circuit and SPECIAL POWER BOOSTER SOCKET AND RESISTOR, to virtually double gain if required. Powered by P.P.9 9 volt battery.



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 Case Enclosure Kit (if required) £1.80 inc. P & P.

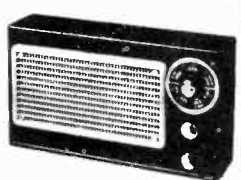
POCKET FIVE

NOW WITH 3" LOUDSPEAKER
3 Tuneable wavebands. M.W., L.W., and Trawler Band, 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, attractive black and gold case. Size 5½" x 1½" x 3½" approx. All Parts including Case and Plans. **£3.60**
P & P + Ins. 60p.



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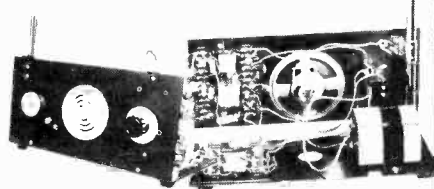
E.V.5. 5 Transistors and 2 diodes. MW/LW. Powered by 4½ volt Battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" x 6½" x 2½" approx. All parts including Case and Plans. Total Building costs **£4.30** P & P + Ins. 60p.

E.V. 6. Case and looks as above. 6 Transistors and 3 diodes. Powered by 9 volt battery. Ferrite rod aerial, 3" loudspeaker, etc., MW/LW coverage. Push Pull output. All parts including Case and Plans. Total Building costs **£4.95** P & P + Ins. 65p.

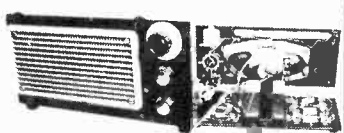
E.V. 7. Case and looks as above, 7 Transistors and 3 diodes. Six wavebands, MW/LW, Trawler Band, SW1, SW2, SW3, powered by 9 volt battery. Push Pull output. Telescopic aerial for short waves. 3" Loudspeaker. All parts including Case and Plans. Total Building costs **£6.95** P & P + Ins. 70p.

ELECTRONIC CONSTRUCTION KITS

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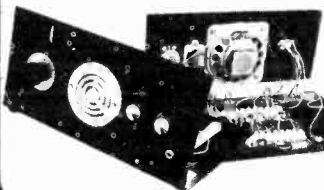
ECK4 7 Transistors, 6 tuneable wavebands, MW, LW, Trawler Band, 3 Short Wave Bands. Receiver Kit. With 5" x 3" Loudspeaker. Push/Pull output stage, Gain Control, and Rotary Switch. 7 Transistors and 4 Diodes. 6 section chrome-plated telescopic aerial. 8" Sensitive Ready Wound Ferrite Rod Aerial. Tuning Capacitor, Resistors, Capacitors, etc. Operates from a 9 Volt PP7 Battery (not supplied with kit). Complete kit of parts including construction plans. **£7.25** P & P and Ins. 70p.



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Completely Solderless Electronic Construction Kit. Build these projects without Soldering Iron or Solder.

- ★ Crystal Radio Medium Wave Coverage — No Battery necessary.
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 - ★ 2 Transistor Regenerative Radio
 - ★ 3 Transistor Earpiece Radio Medium Wave Coverage
 - ★ 4 Transistor Medium Wave Loudspeaker Radio.
 - ★ Electronic Noise Generator
 - ★ Electronic Metronome.
 - ★ 4 Transistor Push/Pull Amplifier.
- All parts including Loudspeaker, Earpiece, MW Ferrite Rod Aerial, Capacitors, Resistors, Transistors, etc. Complete kit of parts including construction plans. **£6.55** P & P + Ins. 60p.



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PRACTICAL WIRELESS

VOL. 52 NO. 11

ISSUE 841

MARCH 1977

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

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Published by IPC Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD. Tel. 01-634 4444

BINDERS

Binders £2-10 and indexes 45p (inc. VAT) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London, SE1 0PF.

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● NEWS & COMMENT

920 LEADER ARTICLE—Lend A Hand

920 NEWS . . . NEWS . . . NEWS . . .

934 LETTERS—Comments from PW Readers

937 PRODUCTION LINES—Bill Tull

939 NEXT MONTH IN PRACTICAL WIRELESS

948 HOTLINES—Recent Developments—Ginsberg

949 TELEVISION—What's in the March issue

955 KINDLY NOTE—Chromachase parts 1 & 2 (Dec. '76/ Jan '77), Oscilloscope calibrator Jan. '77

956 PW READERS PCB SERVICE

961 ON THE AIR—Amateur Bands—Eric Dowdeswell G4AR

Broadcast Bands SW—Derek Bell

Broadcast Bands MW—Charles Molloy

● CONSTRUCTIONAL

922 CIRCUITS FOR AUDIO AMPLIFIERS part 1—

F. G. Rayer G30GR

928 VIDEO-WRITER part 8—M. J. Hughes, MA, C.Eng., MIERE

Note:—The UHF Modulator, mentioned in Part VII of the Video-Writer has had to be held over till April due to pressure of space.

940 FM STEREO TUNER part 1—Francis How (BA Cantab.)

950 EASYTUNE MW-LW RECEIVER—F. G. Rayer

957 S-DeC PROJECTS No. 4—'Passionometer'—David Gibson

● OTHER FEATURES

925 SPECIAL PRODUCT REPORT—Heathkit HW8 QRP

Transceiver

938 TECHNICROSS—Puzzle No. 18

FREE THIS MONTH!
YOUR FIRST DOUBLE SIDED INFO-CARD
—See page 938 for full details

Can YOUR Antenna do all this?

A SMALL SELECTION FROM OUR HUGE FILE OF TESTIMONIAL LETTERS ON THE JOYSTICK VARIABLE FREQUENCY ANTENNA (.5-30MHz)

G4DJY's COPY LOG shows 68 North Americans worked in the ARRL W/VE contest.

W6TYP worked WA6JPR over hundreds of miles on 40m. using the JOYSTICK VFA and MICRO-WATTS "equivalent to 1,000,000 MILES PER WATT"—A WORLD RECORD—we can supply conclusive evidence!

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W7OE U.S.A. Government Electronics Engr. (ret'd.), claims "VFA 5ft below ground, same as dipole, elevated 15ft, one "S" point UP on dipole".

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124 30p	178B 18p	BF158 20p*	200 10p	2920 13p*
239 48p	179B 19p	184 25p	OC28 1-20	2928G 15p*
AU113 1-72*	184B 12p*	185 28p	29 1-20	3053 25p
BC107 11p	184L 11p*	194 18p*	35 1-20	3055 60p
107A 12p	187 26p	196 12p*	44 45p	3702 11p*
108 10p	212A 13p*	197 12p*	71 35p	3703 14p
CI108 9p	212L 15p*	199 15p*	ORP12 68p	3704 13p*
BC108B 11p	213B 12p*	200 30p	TIP29A 47p*	3705 14p
108C 12p	214 15p*	338 34p	30A 58p*	3707 12p
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400V 3A 21p		3V, 3V3, 5V1, 5V6, 7V5,	NE555
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60V 1A 20p		30V. All at 12p* each.	SN76013N 1-75*
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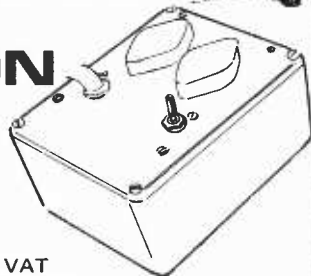
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An Electrocomponents Group Company

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50 WATT SPEAKER

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50 WATT SPEAKER

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40 WATT SYSTEM £99-95. 200 WATT SYSTEM £209-95
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with Integral Power Amplifier. Twin Jack output sockets.

TWIN FULL SIZE B.S.R. TURNTABLES

with cueing device. Cartridges with Diamond Stylis. Separate volume controls each turntable. Full Headphone Monitoring Facilities.

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Black Vynide covered cabinets. Approximate size 15" x 18" x 8".

COMPLETE WITH MICROPHONE PACKAGE PRICE £169-95

(Including VAT) Headphones extra. Carr. £4. Deposit £30.00 & 18 fortnightly payments. £9-18 (Total £195-24)

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of above system. Dep. £45-95 & 18 fortnightly payments £11-50 (Total £282-95). Carr. £5.

TD1M DISCO CONSOLE

Incorporating twin BSR MP00 type turntables and Sonotone or Acoas Cartridges with diamond stylis. Separate Vol. controls for each turntable. Also MONITORING FACILITIES plus Treble and Bass Controls. Separate input for 'mike' with vol. control. Black Vynide covered Cabinet with lid. Or DEP. £17-95 and 18 fortnightly payments £8-52 (Total £135-31) Carr. £1-50

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*POP 33T 12" 33w £13-95 Dual cone. Full range

*POP 50/12" 50w £15-99 Dep for Pair £8-00 and 8 monthly payments £3-54 (Total £36-32)

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TITAN GROUP/DISCO SPEAKERS GUARANTEED FOR 5 YEARS

Rating R.M.S.	List Price	RSC Price
T12/35 12" 45w	£21-00	£10-95
T12/60A 12" 60w	£26-00	£13-95
T12/100 12" 100w	£36-00	£24-95
T15/60 15" 60w	£28-00	£18-99
T15/70 15" 70w	£28-00	£19-95
T15/100 15" 100w	£41-00	£28-95
T18/100 18" 100w	£47-00	£32-95

Impedance 8-16 ohms

MODEL	MONTHLY DEPOSIT	PAYMENTS	TOTAL
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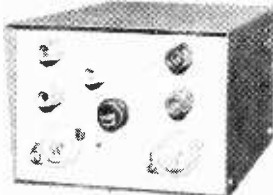
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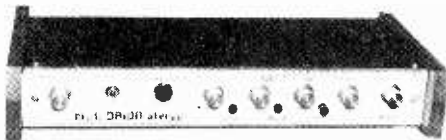
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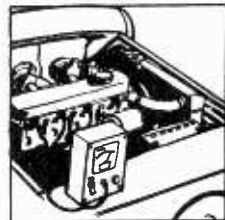
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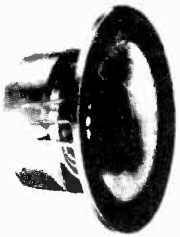
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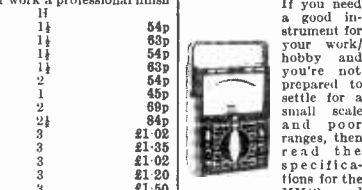
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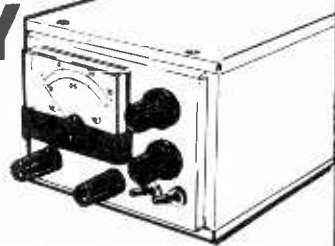
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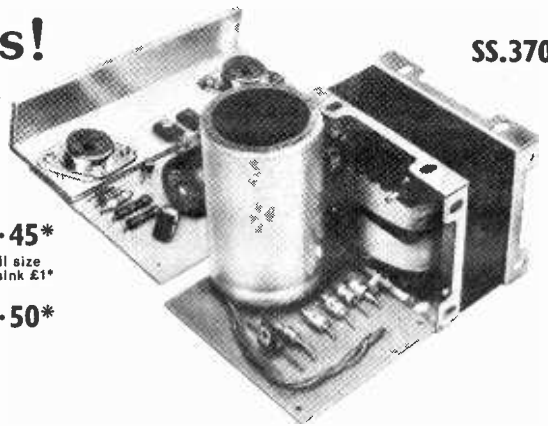
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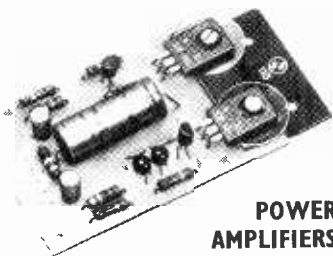
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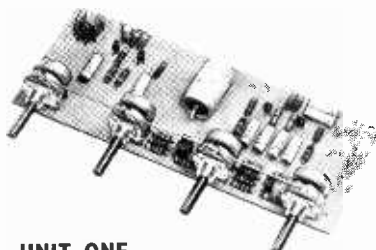
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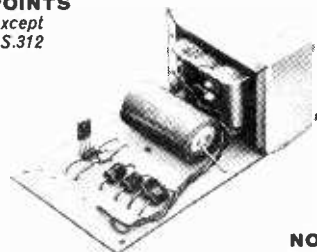
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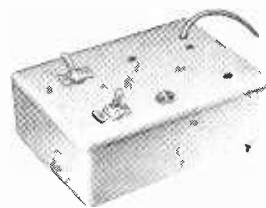
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Front half of calculator, really. Case 130 x 75mm, has display window, 2 slide switches, and 25 keys. Only £1.

DISPLAYS

Brand new 7-segment LED's, 9 MAN3M on PCB with multiplexed output. £1.35.

1 WATT AMPLIFIER

PCB 100 x 80mm with LM380 and associated components to make 1W amp operating from 9V. (Can be increased to 3W output by raising supply voltage and fitting heat sink). Complete with volume control. Connexion sheet included. Also on the board is a speed control circuit comprising 10 transistors, 2 presets, 4 pole 3 way switch, etc., but no data on this. Only £1.

POT PACKS

An overwhelming abundance of pots of all shapes and sizes, including duals, switched, sliders, etc., prompts us to make this offer: 20 assd for £2.29, 100 for £8.59.

PO 4 DIGIT METERS

Ex-equip, 500R coil, operates on 18V only 49p, 10 for £3, 100 for £29.

RELAY UNITS

Units vary slightly, but a guaranteed minimum 20 relays, PO 3000 type, various coil resistances and contact arrangements. May be a few bent contacts, but excellent value at only £4.99.

BUMPER BARGAIN PARCEL

25 kilos—yes, jcwct. Clearing several stores to make room for more goodies, mountains of miscellaneous items too time consuming to list, so we're disposing of it in this manner. You'll get a great variety of components and made-up units, contents too varied to describe, but excellent value at only £8.99.

SWITCHES

Water switches, 6p3w 30p. Water switch mechanism, 12 way. Room for 2 waters. 15p. Waters to fit, 7p2w 29p, 1p 12w 40p. Bank of 5 push button switches, 4 are 6 pole c/o. Interlocking, 5th is independent dpco. No knobs 70p. Sub-min dpco slide 15p; push to make 15p; push to break 29p. 10A 250V rocker 18p; DPCCO rocker 40p. Sub-min toggles spco 62p; dpco 74p; dpco centre off 86p.

TRIMMERS

2-7pf, 4-15pf, 6-25pf, 8-30pf ceramic. All 15p each. Compression types, 3-40pf 18p; 100-500pf 34p; 500-1250pf 46p.

NEON BANKS

Bank of 40 sub-min neons £1.80p
Bank of 20 std neons £1.80p
Recording heads, 1 1/2" track, type X/RPS/18 £1.90p

HIGH POWER POTS

Berco preset rheostat, type SEF 29.5 ohms 3.3A, with metal cover £2.39, 11 ohm 3.4A without cover £1.59. Rotary types: 25W, 6R, 25R, 114R £1.17 each; 50W, 50R, 100R 1k5 £1.44 each; 100W, 70R £1.88. Mounted Carbon High Voltage Pots, ideal for scope built for audio control, etc. Rated 3W, 2k5, 3k, 5k, 10k, 50k, 100k, 250k, 500, 1M, 2M5, all p82 each.

71b BARGAIN PARCEL

Hundreds of new components—pots, switches, resistors, capacitors, PC Boards with semiconductors, loads of odds and ends. Amazing value at only £2.99.

COMPUTER PANELS

Large quantity always available: 31b asstd. £1.75; 71bs £3.65; 581b £16. Pack with about 500 components inc. at least 50 transistors £1.99. Pack with 12 1/2" quality panels, incl. IC's, power transistors, multitrans trim pots, hundreds of small signal transistors, resistors, zeners, capacitors, etc. Only £2.75. 7400 IC pack—20 74 series IC's on panels £1.20.

PC ETCHING KIT

Contains 1lb Ferric Chloride, 100 sq ins copper clad board, DALO Quick Dri Etch resist pen, abrasive cleaner, 2 miniature drill bits, etching dish and instructions. £3.65.

FERRIC CHLORIDE

Anhydrous technical quality in 1lb double sealed packs. 1lb £1.99; 3lbs £2.18; 10lbs £5.99; 100lbs £39.99.

FIBREGLASS PCB

Large quantity of offcuts, all usable pieces. 200 sq ins, single sided, double sided or mixed £1.49.

DEVELOPMENT PACKS

50V ceramic plate capacitors, 5%, 10 of each value 22pF to 1000pF, total 210 caps. £2.79.

CR25 carbon film 1/3rd watt resistors, 5%, 10 of each value 10 ohms to 1M. Total 610 resistors £5.99. Electrolytics, wire ended 25V working 10 each of: 1, 2, 2, 4, 7, 10, 22, 47 and 100mfd. 70 capacitors for £3.29. 400mW zeners 5% 10 each 3V to 30V, 200 in all. Only £14.99.

COMPONENT PACKS

400 assd. carbon resistors £1.35
100 Wirewounds 2-15W £1.99
200 Miniature resistors, 1/2, 1 and 1 1/2W, mostly carbon film £1.29
200 poly, mica, ceramic caps £1.19
100 Polyester, .01-2.2uF £1.99
200 miniature electrolytics, but many unmarked so only £1.99

RELAYS

Miniature Plug-in types: 1250 ohm 4c/o 46p; 700 ohm 4c/o 50p. PO 3000 type 650 ohm with 6 heavy duty c/o contacts (Ex-equip) 75p; 10 for £4.99. 6 1/2" easily removable reeds in 3550 ohm coil 50p. Plug in relay, BTG Base 17mm dia x 42mm long 10k coil 1 c/o contact 46p. Omron MK3P plug in relay. 230V AC coil, 3 sets 10A/c/o contacts. £1.29. Bases 39p. Ex-equip on PCB board, min sealed type, 22 x 20 x 10mm 200R coil (ops on 6-12V) 2 c/o contacts 46p. Ex equip 34 x 30 x 15mm, 250R coil, ops on 6-12V 4 c/o contacts, 60p. Delay relay, 115V 20 sec coil, mains contact 60p; 230V coil 30 sec delay £1.

CRYSTAL FILTER UNIT

Chassis 210 x 115 x 80mm containing 24 way switch, 24 HC6U stal holders, 24 beehive trimmers, + board with 4 BF115, R's C's, etc. £3.59.

5MHz FREQUENCY SOURCE

High stability, better than 1 x 10⁻³ short term, better than 1 x 10 per month. 12.6V drive voltage, output 5MHz into 50R £12. 4-438619MHz colour sub-carrier crystals 69p.

BOOKS

All by R. M. Marston, these titles use readily available components.
20 Solid State Projects for the Home £2.20
Solid State Projects for the Car & Garage £2.10
Semiconductor Projects for the Home Constructor £2.76
110 Thyristor Projects for the Home Constructor £2.70
110 Integrated Circuit Projects for the Home Constructor £2.70
110 Op Amp Projects for the Home Constructor (uses 741) £2.70
110 CosMos Digital IC Projects for the Home Constructor £2.85
110 Electronic Alarm Projects for the Home Constructor £3.15.

VERO BOXES, CASES & BOARD

VEROBOARD

Size	0-1"	0-15"	0-1"	plain
3 1/2 x 3 1/2"	44p	48p	N/A	
5 x 3 1/2"	58p	55p	46p	
17 x 3 1/2"	£1.99	£1.60	£1.39	

Full or half pins, 0-1 or 0-15 35p 100. Spot face cutter for 0-1 or 0-15" 75p.

DIP BREADBOARD

Accommodates 20 x 14 way or 16 x 18 way IC's £2.99.

OFFCUTS

Pack A, All 0-1"
Pack B, All 0-15"
Pack C, Mixed
Pack D, All 0-1" plain

Each pack contains 7 or 8 pieces with a total area of 100 sq ins. Each pack is £1.39. Also available by weight, 1lb £3.45, 10lbs £29.

We are also VERO wholesalers—Trade price list on request from Bone Fide Companies.



VEROCASES

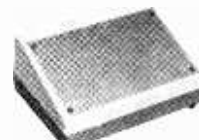
Plastic top and bottom, ally panels front and back.

Type 1410	205 x 140 x 40mm	£3.39
1411	205 x 140 x 75mm	£3.79
1412	205 x 140 x 110mm	£4.69
1237	154 x 85 x 40mm	£2.39
1238	154 x 85 x 50mm	£2.89
1239	154 x 85 x 80mm	£3.69

PLASTIC BOXES

Professional quality, two tone grey polystyrene with threaded inserts for mounting PC Boards.

Type 2518	120 x 65 x 40mm	£2.25
2520	150 x 80 x 50mm	£2.69
2522	188 x 110 x 60mm	£3.59



Sloping front version, Type 2523 220 x 174 x 100/52mm £4.00
Type 1798 171 x 121 x 75/37 5mm £4.59
Gen Purpose plastic potting box 71 x 49 x 24. In black or white 49p
Hand Controller box, shaped for ease of use in the hand, 94 x 61 x 23mm 62p

S-DECS & T-DECS

S-DEC Breadboard £2.10
T-DEC Breadboard £3.75

SOLDERING IRONS

Antex 15W Model C £2.79
Antex 15W Model CCN £2.99
DeeGee 25W Model 3612 £2.99
Litesold 10W £2.49
EK400 40W £2.49
Instant Heat Soldering Gun with built in lighting unit and 5 spare tips £4.59.

SOLDER

Multicore small reels, size 10 22g £1.45; Size 12 18g £1.45; 500gm reels 18g £8.59; Small packs of 18 or 22g 30p.

Our retail shops at 21 Deptford Broadway, London, SE8 (01-892 2999) and 38 Lower Addiscombe Road, Croydon (01-888 2359) stock some of the advertised goods for personal callers only. Ring them for details.

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SURPLUS CAPACITORS

15,000uF 6V 35mm dia x 55mm PC 19p
1,250uF 18V 20 x 50mm, tags 10p
1,250uF 40V 25 x 80mm, tags 20p
800uF 40V 25 x 50mm, tags 16p
10,000uF 10V 35 x 80mm, tags 18p
6,400uF 16V 35 x 80mm, tags 20p
4,000uF 25V 35 x 80mm, tags 25p
10,000uF 16V 40 x 80mm, tags 30p
50uF 350V 25 x 50mm tags 12p
1500uF 18V 18 x 34mm PC 6p
18,000uF 25V 50 x 105mm, screws 60p
NB: Add 30p postage for any quantity. Miniature resistors, carbon film 5% 1p each, £1.99 per 100 of one value 1R to 10M. 1W metal film 2 1/2p each.

BULK OFFERS

3mm wander plugs, black only at special price of £2.29/100. 63mA 20mm quick-blow fuses, £2/100 24V 1W LES lamps £3.99/100 50uF 350V 25 x 50mm tags £4/100

SPECIAL OFFER OF PLUG-IN MODULES

Large quantity just arrived, several diff types. Case size 77 x 50 x 50mm, either octal or 11 pin base. Send SAE for full list of types and circuits. Type R: Contains 6A 200V SCR, 4 x 5A 300V diodes, 24V read relay, C, R, etc. Octal base. With circuit. Only £1.99 each, 10 for £18.00. Type M: 5 BC184, C426, min. R's and C's 65p. Panel with 2 6A 400V triacs, 709C, 2N1711, 100V 1A bridge, 2 pots, 1 preset, zeners, R's, C's, etc. Only £1.59.

MULTIMETER MODEL LT22

WHAT A BARGAIN



Probably one of the lowest priced meters featuring a mirror scale, overload protection and 2000 ohms per volt sensitivity. Modern styled meter with unusually clear scale markings. Ranges: DC Volts 0-0.5-2.5-10-50-250-1000 AC Volts 0-10-50-250-1000 DC Current 0-50uA-25mA-250mA Resistance 0-50k-500k-5M (Mid Scale 300k-30k) db's 4 ranges —20db to +42db. Size 130 x 90 x 42mm. £12.70.

5V 12A REGULATED POWER SUPPLY

Brand new boxed fully stabilized PSU, complete with instruction manual. Load regulation 0.15%. Thermal & Electronic overload protection. Only £24.99.

TRANSFORMERS

All have mains primaries, secondaries as follows: 6-0-6V 100mA 65p; 9-0-9V 75mA £1.00; 12-0-12V 50mA 95p; 12-0-12V 100mA £1.18; 6.3V 1 1/2A £1.95; 6-0-6V 1 1/2A £2.39; 9-0-9V 1A £2.55; 12-0-12V 1A £2.85; 12V 5A £3.65; 12V 8A £4.35; 20V 55MA 90p; 22V 100mA £1.99; 25V 50mA 88p; Multi-tapped types, 0-12-15-20-24-30V 1A £3.50; 2A £5.00; 20-0-20V 2A £4.48; 55-0-55V 5A £8.30; 24-0-24V 2A £1.65.



£35.00 complete with circuit diagram
p & p

PYE STEREO GRAM CHASSIS

Complete ready to install—Wave bands L.M., VHF STEREO, VHF MONO. Controls for tuning, volume, balance, bass and treble. Power output 7 watts R.M.S. per channel 14 watts peak into 8 ohms. 2 x 8" approx chassis speakers and BSR C141 auto record player deck.

Personal shoppers only

NEW! **Sinclair** I.C. 20, 20 WATTS STEREO AMPLIFIER KIT WITH PZ 20 POWER UNIT **FANTASTIC SAVING**

A build-it-yourself stereo power amplifier with latest integrated circuitry 10W RMS per channel output, full short-circuit and overheat protection. **LIST £14.50** **DUM PRICE £4.95** p & p 11

Complete with PZ20 Power Supply

DIY SPEAKER KITS

EASY-TO-BUILD WITH ENCLOSURE

Specially designed by RT-VC for cost-conscious hi-fi enthusiasts, these kits incorporate two teak-simulate enclosures, two EMI 13" x 8" (approx.) woofers, two tweeters and a pair of matching cross-overs. Easily constructed, using a few basic tools. Supplied complete with an easy-to-follow circuit diagram, and crossover components. Input 15 watts rms. 30 watts peak, each unit. **£25.50** PER PAIR + p & p £5.50

Cabinet size 20" x 11" x 9 1/2" (approx.)



'COMPACT' FOR TOP VALUE

How about this for incredible bookshelf value from RT-VC! A pair of high efficiency units for only £7.50 — just what you need for low-power amplifiers. These infinite baffle enclosures come to you ready mitred and professionally finished. Each cabinet measures 12" x 9" x 5" (approx.) deep, and is in wood simulate. Complete with two 8" (approx.) speakers for max. power handling of 7 watts. **£7.50** per pair + p & p £1.70

15-WATT KIT IN CHASSIS FORM

When you are looking for a good speaker, why not build your own from this kit. It's the unit which we supply with the above enclosures. Size 13" x 8" (approx.) woofer (EMI), tweeter, and matching crossover. Power handling capacity 15 watts rms. 30 watts peak. **£8.50** PER SET + p & p £1.70

DECCA 20 WATTS STEREO SPEAKER

This matching loudspeaker system is hand-made, as only Decca know how, built to a specification, not down to a price.

The kit comprises of two 8" diameter approx. base drive unit, with heavy die cast chassis laminated cones with rolled PVC surrounds. Two 3 1/2" diameter approx. domed tweeters complete with crossover networks. **Our price per stereo pair £30.00** + p & p £4.00



20 x 20 WATT STEREO AMPLIFIER

£29.90
p & p £2.10



Superb Viscount IV unit in teak-finished cabinet Silver fascia with aluminum rotary controls and pushbuttons, red mains indicator and stereo jack socket. Function switch for mic, magnetic and crystal pick-ups, tape, tuner, and auxiliary. Rear panel features two mains outlets, DIN speaker and input sockets, plus fuse. 20 + 20 watts rms, 40 + 40 watts peak.

HOW YOU CAN SAVE

SYSTEM 1B For only £80, you get the 20+20 watt Viscount IV amplifier, a pair of our 12-watt-rms Duo Type IIB matched speakers; a BSR MP 60 type deck complete with magnetic cartridge, de luxe plinth **£80.00** + p & p £6.50

SYSTEM 2 Comprising our 20+20 watt Viscount IV amplifier; a pair of our large Duo Type III matching speakers which handle 20watts rms each, and a BSR MP 60 type deck with magnetic cartridge, **£92.00** de luxe plinth and cover. + p & p £7.60

Carnegie surcharge to Scotland System 1B + 2.50 System 2 + 5.00

SPEAKERS Two models—Duo IIB, teak veneer, 12 watts rms, 24 watts peak, 18 1/2" x 13 1/2" x 7 1/4" approx. **£34** PER PAIR + p & p £5.50

Duo III, 20 watts rms, 40 watts peak, 27" x 13" x 11 1/2" approx. **£48** PER PAIR + p & p £7.50

TURNTABLE Popular BSR MP 60 type, complete with magnetic cartridge, diamond stylus, and de luxe plinth and cover **£24.00** + p & p £3.50



30 x 30 WATT AMPLIFIER KIT

Specially designed by RT-VC for the experienced constructor, this kit comes complete in every detail. Same facilities as Viscount IV amplifier. Chassis is ready punched; drilled and formed Cabinet is finished in teak veneer. Black fascia and easy-to-handle aluminium knobs. **£29.00** Output 30+30 watts rms, 60+60 peak. + p & p £2.10



BSR T145 8-TRACK CARTRIDGE PLAYER MECHANISM

Requires some attention. Complete with built in pre-amp, A.C. 240V **£6.95** + p & p £1.50

SPECIAL OFFER



TOURIST IV PUSH BUTTON CAR RADIO KIT



MOTOR TOP 10 AWARD

Complete with speaker, baffle and fixing strip. The Tourist IV for the experienced constructor only. The Tourist IV has five push buttons, four medium band and one for long wave band. The tuning scale is illuminated and attractive small aluminium control knobs are used for manual tuning and volume control.

The modern style fascia has been designed to blend with most car interiors and the finished radio will slot into a standard car radio aperture. Size approx 7" x 2" x 4". Power Supply Nominal 12 volts positive or negative earth (altered internally) Power Output 4 watts into 4 ohms **£10.50** + p & p £1.50



35-WATT DISCO AMP

Here's the mono unit you need to start off with. Gives you a good solid 35 watts rms, 70 watts peak output. Big features include two disc inputs, both for ceramic cartridges, tape input and microphone input. Level mixing controls fitted with integral push-pull switches. Independent bass and treble **£27.50** controls and master volume. + p & p £1.50



PORTABLE DISCO CONSOLE with built-in pre-amplifiers

Here's the big-value portable disco console from RT-VC! It features a pair of BSR MP 60 type auto-return, single-play professional series record decks. Plus all the controls and features you need to give fabulous disco performances. Simply connects into your existing slave or external amplifier. **£55.00** + p & p £6.50



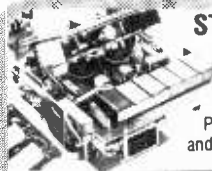
70 & 100 WATT DISCO AMPS

Brilliantly styled for easy disco performance! Sloping fascia, so that you can use the controls without fuss or bother. Brushed aluminium fascia and rotary controls. Five smooth-acting, vertically mounted slide controls — master volume, tape level, mic level, deck level, PLUS INTER-DECK FADER for perfect graduated change from record deck No. 1 to No. 2, or vice versa. Pre-fade level control (PFL) lets YOU hear next disc before fading it in. VU meter monitors output level 70 watts rms, 140 watts peak output. All the big features as on the 70-watt disco amplifier, but with a massive 100 watts rms, 200 watts peak output power.

70 WATT £49.00 + p & p £3.00
100 WATT £65.00 + p & p £4

STEREO CASSETTE DECK KIT

Again, this kit is specially designed for the experienced constructor—for mounting into his own cabinet. Features include solenoid-assisted AUTO-STOP, 3-digit counter, record/replay PC board, mains transformer and input and output controls. AC BIAS AND ERASE. **£32.50** + p & p £1.50



DELUXE ACCESSORY KIT Comprises of a matched pair of dynamic mics. and two replacement slider level controls. **£3.95** + p & p £1.00
This item post FREE when purchased with Cassette Deck kit

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AMBIT international (dept 85)

The Dynamic Twosome: Signalmaster/Audiomaster

After long and thorough deliberation, we are proud to announce a new unit from Larsholt - the Audiomaster. As ever, the instructions are designed to lead the unwary and the inexperienced- through point-to-point steps that culminate in a professionally styled and finished amplifier to complement the Signalmaster FM tuner. Price £79.00



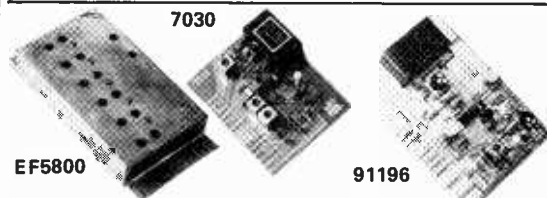
Power: 25+25W RMS
THD: Less than 0.3%
Dynamic range: an exceptional 80dB
(Signalmaster shown on top of the Audiomaster)

The Signalmaster Mk.8 is equally simple to assemble, and results reflect the superb Scandinavian styling and careful electronic engineering. £85.00.



International Mk.2:
A choice of tuners for the more experienced constructors.

A chassis, cabinet and front panel designed to be used with a variety of electronics inside. The standard set, with the Larsholt 7253 varicap FM tuner set, plus all necessary parts to complete costs £65.00. Alternative modules for the signal processing stages are available for the more advanced F.M. radio enthusiast/constructor. (EF5800/7030/91196)



From left to right, the EF5800 6 circuit varicap FM tunerhead. Two MOS RF stages, both with AGC control, and an ultra stable oscillator. Next the 7030 Linear Phase 10.7MHz IF. Distortion 0.08%, muting, AGC, meter, auto stereo switch outputs. Finally the new 91196 mpX decoder and combined birdy filter. Mono THD 0.05%, stereo sep. 55dB at 1kHz, 42dB at 10kHz - the best decoder module yet. EF5800.....£14.50 7030.....£10.95 91196.....£12.99 (Built).

Overall performance of the three modules when correctly assembled:- 30dB S/N at 0.85uV input. 60dB at 5uV. THD 0.09%. AFC holds THD below 0.2% over 400kHz if required. AGC effective over a 90dB range. Image rejection -90dB. Noise floor -73dB.

Components: Coils, ICs Filters, etc.

Radio ICs: (and modules)	Coils and filters:-
CA3089E/HA1137W FM 1.94	AM IFTs TOKO
CA3090AQ mpX 3.75	YRCS/YHCS types(10mm) 0.30
MC1310/KB4400 mpX 2.20	7MCS types (7mm) 0.30
HA1196 mpX 4.20	FM IFTs:
HA1197 AM radio 1.40	KACS/KALS types(10mm) 0.33
TBA120AS FM IF 1.00	94A types (10mm) 0.30
TBA651 AM radio 1.81	AM filters:-
UA720/CA3123E AM rad 1.40	CFT types ceramic (455) 0.55
LM380N 2W Audio 1.00	CFU type ceramic (470) 0.60
TBA810AS 7W Audio 1.09	SFD470 types (470) 0.75
TCA940 10W Audio 1.80	FM filters:-
TDA2020 20W Audio 2.99	CFS/SFE ceramic (10.7) 0.50
LM381N stereo preamp 1.81	SFE6MA (TV sound) 0.80
LM3900 Quad amp 0.68	3132 linear phase 2.25
78M12-20-24 volt reg ea:1.20*	MPX 19 & 38kHz notch 1.75
NE550A variable reg 0.50*	BLR3107 (4k7 imp) 1.75
TAA550B varicap reg 32v 0.50*	BLR2007 (3k3 imp) 1.75
NE560/2B PLL IC ea:2.50	23 or 36mH chokes 0.33
NE561B PLL IC 3.50	Tunerheads: (& tunersets)
NE565A/567V PLL ea:2.50	EF5600 5 gang varicap 12.80
810k kit for TBA810 amp 2.75	EC3302 3 gang varicap 5.50
2020k kit for 2020 amp 9.35	8319 (Larsholt) 12.00
92310 kit for mpX decoder 5.35	7252 tuner set complete 26.00
7020 kit for 3089 FM IF 6.65	7253 stereo tuner set 26.00
971197 kit for varicap AM radio tuner 9.65	Standard transistors also kept in stock - see lists for further detail and price information.
7700 built TV sound tuner 27.00	

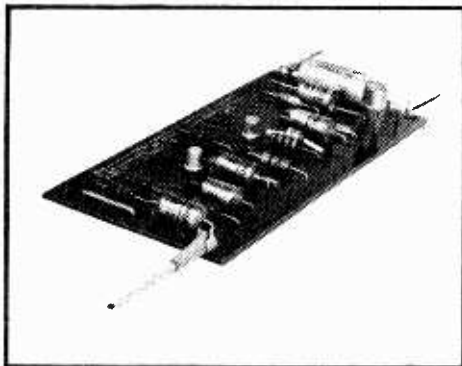
Terms: Vat extra, 12.5% unless marked *, which is 8%, all complete tuners require £3.00 for packing and carriage. The standard P&P rate remains at 22p per order. Catalogue 40p. Phone (0277) 216029 (After 3pm please). SAE for free price lists.

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VERO

VERO BOARD



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PW3

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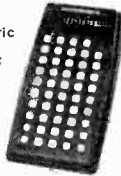
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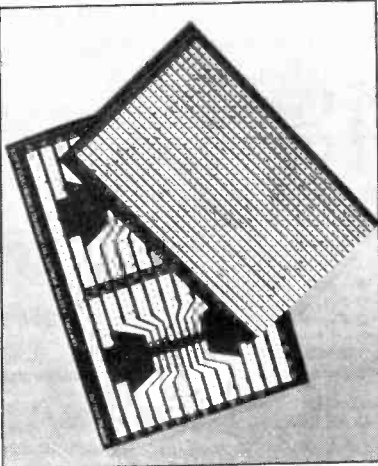


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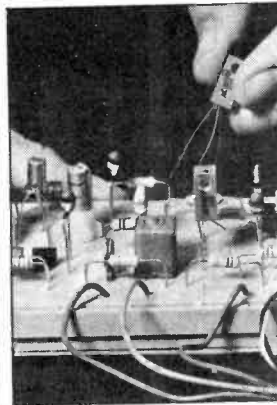
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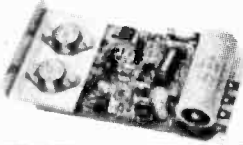
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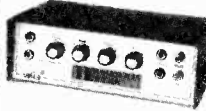
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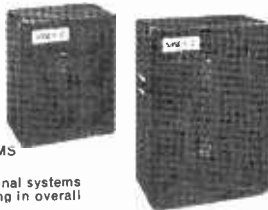
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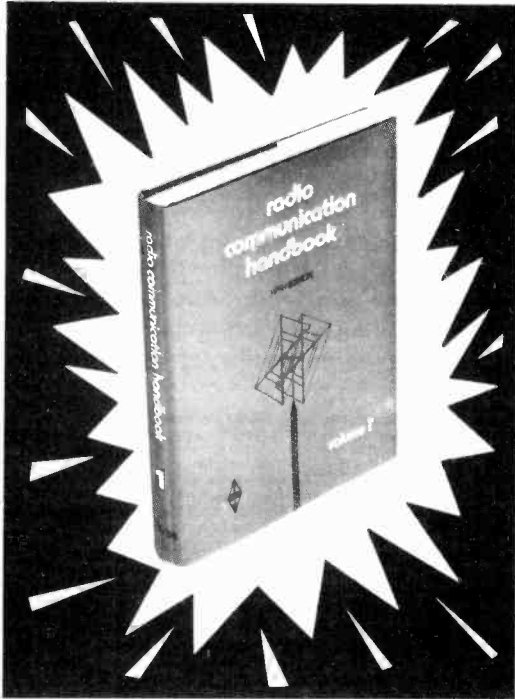
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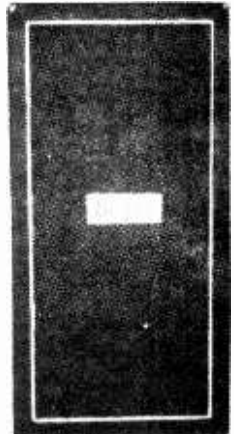
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Complete unit comprising power supply, pre-amplifier with filter networks, two power amplifiers and loudness control all in teak finished cabinet only **£88.00** plus VAT. As above but without filters and loudness control only **£79.00** plus VAT. Also available in module form complete with front panel but without cabinet—easily assembled by the average enthusiast.

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A wrist calculator is the ultimate in common-sense portable calculating power. Even a pocket calculator goes where your pocket goes – take your jacket off, and you're lost!

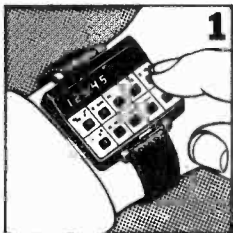
But a wrist-calculator is only worth having if it offers a genuinely comprehensive range of functions, with a full-size 8-digit display.

This one does. What's more, because it *is* a kit, supplied *direct* from the manufacturer, it costs only a very reasonable £9.95 (plus 8% VAT, P&P). And for that, you get not only a high-calibre calculator, but the fascination of building it yourself.

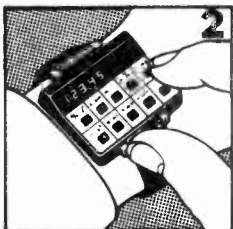
How to make 10 keys do the work of 27

The Sinclair Instrument wrist calculator offers the full range of arithmetic functions. It uses normal algebraic logic ('enter it as you write it'). But in addition, it offers a % key; plus the convenience functions \sqrt{x} , $1/x$, x^2 ; plus a full 5-function memory.

All this, from just 10 keys! The secret? An ingenious, simple three-position switch. It works like this.



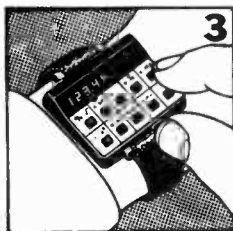
1. The switch in its normal, central position. With the switch centred, numbers – which make up the vast majority of key-strokes – are tapped in the normal way



2. Hold the switch to the left to use the functions to the left above the keys...

3. and hold it to the right to use the functions to the right above the keys.

The display uses 8 full-size red LED digits, and the calculator runs on readily-available hearing-aid batteries to give weeks of normal use.



Assembling the Sinclair Instrument wrist calculator

The wrist calculator kit comes to you complete and ready for assembly. All you need is a reasonable degree of skill with a fine-point soldering iron.

It takes about three hours to assemble. If anything goes wrong, Sinclair Instrument will replace any damaged components *free*: we want you to enjoy assembling the kit, and to end up with a valuable and useful calculator.

Contents

- Case and display window.
- Strap.
- Printed circuit board.
- Switches.
- Special direct-drive chip (no interface chip needed).
- Display.
- Batteries.

Everything is packaged in a neat plastic box, and is accompanied by full instructions.

The only thing you need is a fine-point soldering iron.

All components are fully guaranteed, and any which are damaged during assembly will be replaced free.

The wrist-calculator kit is available only direct from Sinclair Instrument. Take advantage of this 10-day money-back undertaking.

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To: Sinclair Instrument Ltd,
6 Kings Parade, Cambridge, Cambs., CB2 1SN.

* Please send me ... (qty) Sinclair Instrument wrist-calculator kits at £9.95 plus 80p VAT plus 25p P&P (Total £11).

* I enclose cheque/PO/money order for £.....

* Complete as applicable.

Name _____

Address _____

(Please print)

I understand that you will refund my money in full if I return the kit undamaged within 10 days of receipt.

PW/3

SEMI-CONDUCTORS—COMPONENTS

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4" RANGE

Size 4 1/2" x 3 1/2" x 1 1/2"	
Value No.	Price
0-50UA	1302 £4.50
0-100UA	1303 £4.50
0-500UA	1304 £4.50
0-1MA	1305 £6.00
0-50V	1306 £6.00

2" RANGE

Size 2 1/2" x 1 1/2" x 1 1/2"	
Value No.	Price
0-50UA	1307 £3.50
0-100UA	1308 £3.50
0-500UA	1309 £3.50
0-1MA	1310 £3.50
0-50V	1311 £3.50

MR2P TYPE

Size 4 1/2" x 4 1/2" x 30mm	
Value No.	Price
0-50UA	1313 £4.80
0-1MA	1315 £3.20

EDGEWISE

Size 3 1/2" x 1 1/2" x 2 1/2"	
Cut out 2 1/2" x 1 1/2"	
Value No.	Price
0-1MA	1316 £4.05
0-500UA	1317 £4.05

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No. 231 BEGINNERS GUIDE TO TRANSISTORS PRICE £2.25†

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No. 236 ELECTRONIC COMPONENTS PRICE £1.80†

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Sensitivity 100/0/100UA	
No.	Price
1319	£2.90

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Size 23 x 22 x 26mm	
Sensitivity 200UA	
No.	Price
1320	£1.95

VU METER

Size 40 x 40 x 29mm	
Sensitivity 130UA	
No.	Price
1321	£2.90

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U51	150	Germ. OA70/81 diode	16131	£0.60
U52	100	Silicon Diodes 200mA OA200	16132	£0.60
U53	150	diodes 75mA 1M448	16133	£0.60
U54	50	Sil Rect Top Hat 750mA	16134	£0.60
U55	20	Sil Rect Stud Type 3 Amp	16135	£0.60
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U57	30	NPN Trans BC107/8 Plastic	16137	£0.60
U58	30	PNP Trans BC177/178 Plastic	16138	£0.60
U59	25	NPN T039 2N927/2N1711 sil	16139	£0.60
U60	25	PNP T059 2N2905 silicon	16140	£0.60
U61	30	NPN T018 2N706 silicon	16141	£0.60
U62	25	NPN BFY50/51	16142	£0.60
U63	30	NPN Plastic 2N3906 silicon	16143	£0.60
U64	30	PNP Plastic 2N3905 silicon	16144	£0.60
U65	30	Germ. 0071 PNP	16145	£0.60
U66	15	Plastic Power 2N3055 NPN	16146	£1.20
U67	10	T03 Metal 2N3055 NPN	16147	£1.20
U68	20	Unijunction trans 1L543	16148	£0.60
U69	10	1 amp SCR T039	16149	£1.20
U70	8	3 amp SCR T066 case	16150	£1.20

Code No's mentioned above are given as a guide to the type of device in the pak. The devices themselves are normally unmarked.

COMPONENT PAKS

C1	200	Resistor mixed value approx. (Count by weight)	16164	*0.60
C2	150	Capacitors mixed value approx. (Count by weight)	16165	*0.60
C3	50	Precision resistors. Mixed values.	16166	0.60
C4	80	1/4W resistors mixed preferred values.	16167	*0.60
C5	5	Pieces assorted ferrite rods.	16168	*0.60
C6	2	Tuning gangs. MW/1W VHF.	16169	*0.60
C7	1	Pack wire 50 meters assorted colours single strand.	16170	0.60
C8	10	Reed switches.	16171	*0.60
C9	3	Micro switches.	16172	*0.60
C10	15	Assorted pots.	16173	*0.60
C11	5	Metal jack sockets 3 x 3.5mm. 2 x standard switch types.	16174	*0.60
C12	30	Paper condensers preferred types mixed values.	16175	*0.60
C13	20	Electrolytics trans. types.	16176	*0.60
C14	1	Pack assorted hardware—Nuts/bolts, gromets etc.	16177	0.60
C15	5	Mains slide switches ass.	16178	*0.60
C16	20	Assorted tag strips and panels.	16179	0.60
C17	15	Assorted control knobs.	16180	*0.60
C18	4	Rotary wave change switches.	16181	*0.60
C19	2	Relays 6-24V operating.	16182	*0.60
C20	1	Pak, copper laminate approx. 200 sq. ins.	16183	0.60
C21	15	Assorted fuses 100mA-5amp.	16184	0.60
C22	50	Metres PVC sleeving assorted size and colour	16185	0.60
C23	60	1/4 watt resistors mixed preferred values.	16188	*0.60
C24	25	Presets assorted type and value.	16186	*0.60
C25	30	Mejres stranded wire assorted colours.	16187	0.60

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S1	6	Slider potentiometers, mixed values.	16190	*0.60
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S3	6	Slider potentiometers, all 10k 11n.	16192	*0.60
S4	6	Slider potentiometers, all 22k 11n.	16193	*0.60
S5	6	Slider potentiometers, all 47k	16194	*0.60
S6	6	Slider potentiometers, all 47k log.	16195	*0.60

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C90	308 £1.56
C120	309 £2.22

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C90	311 £1.23
C120	312 £1.80

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C90	322 £1.44
C120	323 £2.04

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C60	324 £1.48
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CP6 Single Microphone H/Duty	3131	0.12
CP7 3 core Mains (5 amp)	3132	0.09
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CP9 2 core Speaker	3134	0.07
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7401	0 11 0 10	7450	0 12 0 10	74123	0 65 0 62
7402	0 11 0 10	7451	0 12 0 10	74141	0 68 0 65
7403	0 11 0 10	7453	0 12 0 10	74145	0 75 0 72
7404	0 11 0 10	7454	0 12 0 10	74150	1 10 1 05
7405	0 11 0 10	7460	0 12 0 10	74151	0 65 0 60
7406	0 28 0 25	7470	0 24 0 23	74155	0 70 0 68
7407	0 28 0 25	7472	0 20 0 19	74154	1 20 1 10
7408	0 12 0 11	7473	0 26 0 22	74155	0 70 0 68
7409	0 12 0 11	7474	0 24 0 23	74156	0 70 0 68
7410	0 09 0 08	7475	0 44 0 40	74157	0 70 0 68
7411	0 22 0 20	7476	0 26 0 25	74160	0 95 0 85
7412	0 22 0 20	7480	0 45 0 42	74161	0 95 0 85
7413	0 26 0 25	7481	0 90 0 88	74162	0 95 0 85
7416	0 28 0 25	7482	0 75 0 73	74163	0 95 0 85
7417	0 26 0 25	7483	0 88 0 82	74164	1 20 1 10
7420	0 11 0 10	7484	0 85 0 80	74165	1 20 1 10
7422	0 19 0 18	7485	1 10 1 00	74166	1 20 1 10
7423	0 21 0 20	7486	0 28 0 26	74174	1 10 1 00
7425	0 25 0 23	7489	2 70 2 50	74175	0 85 0 82
7426	0 25 0 23	7490	0 38 0 32	74176	1 10 1 00
7427	0 25 0 23	7491	0 65 0 62	74177	1 10 1 00
7428	0 36 0 34	7492	0 43 0 35	74180	1 10 1 00
7430	0 12 0 10	7493	0 38 0 35	74181	1 90 1 80
7432	0 20 0 19	7494	0 70 0 68	74182	0 80 0 78
7433	0 38 0 36	7495	0 60 0 58	74184	1 50 1 40
7437	0 26 0 25	7496	0 70 0 68	74190	1 40 1 30
7438	0 26 0 25	74100	0 95 0 90	74191	1 40 1 30
7440	0 12 0 10	74104	0 40 0 35	74192	1 10 1 00
7441	0 60 0 57	74105	0 30 0 25	74193	1 05 1 00
7442	0 60 0 52	74107	0 30 0 25	74194	1 05 1 00
7443	0 95 0 90	74110	0 48 0 45	74195	0 80 0 75
7444	0 95 0 90	74111	0 75 0 72	74198	0 90 0 85
7445	0 80 0 75	74118	0 85 0 82	74197	0 90 0 85
7446	0 80 0 75	74119	1 30 1 20	74198	1 90 1 80
7447	0 70 0 68	74121	0 28 0 26	74199	1 80 1 70

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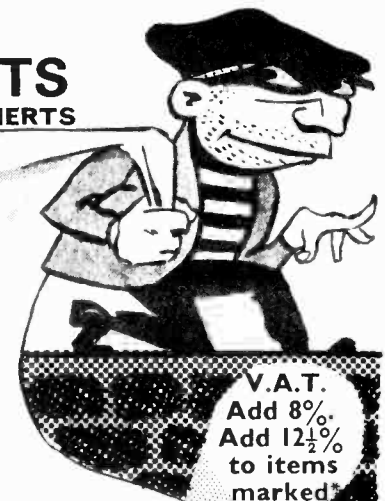
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BC 154	*16p	ZTX 500	*8p
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BC 148	*8p	ZTX 502	*12p
BC 149	*8p	2N 896	10p
BC 157	*10p	2N 697	11p
BC 158	*10p	2N 706	8p
BC 159	*10p	2N 706A	8p
BC 169C	*10p	2N 708	8p
BC 170	*6p	2N 1613	15p
BC 171	*6p	2N 1711	15p
BC 172	*6p	2N 1893	18p
BC 177	12p	2N 2217	18p
BC 178	12p	2N 2218	15p
BC 179	12p	2N 2218A	18p
BC 182L & K	*9p	2N 2219	15p
BC 183	*9p	2N 2219A	18p
BC 184	*9p	2N 2221	16p
BC 212L & K	*10p	2N 2221A	16p
BC 213	*10p	2N 2222	15p
BC 214	*10p	2N 2222A	16p
BC 251	*6p	2N 2369	12p
BC 327	*12p	2N 2369A	12p
BC 328	*12p	2N 2904	14p
BC 337	*11p	2N 2904A	15p
BC 338	*11p	2N 2905	14p
BF 115	10p	2N 2905A	15p
BF 167	10p	2N 2906	12p
BF 173	10p	2N 2906A	14p
BF 194	*9p	2N 2907	12p
BF 195	*9p	2N 2907A	13p
BF 196	*12p	2N 2926G	*8p
BF 197	*12p	2N 2926Y	*7p
BF 198	*12p	2N 3053	14p
BF 199	*12p	2N 3055	38p
BF 257	26p	2N 3702	*7p
BF 258	29p	2N 3703	*7p
BF 259	34p	2N 3704	*6p
BFX 29	18p	2N 3705	*6p
BFX 84	15p	2N 3706	*7p
BFX 85	20p	2N 3903	*11p
BFX 86	20p	2N 3904	*11p
BFY 50	12p	2N 3905	*11p
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IN914	4p	IN5403	14p
IN4148	4p	IN5404	15p
ZTX 501	3p	IN5405	16p
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L.E.D.'s	Order No.	Price
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FLV 117 Red .2"	1504	1504

Photo Devices	Order No.	Price
ORP 12	1515	38p
OCF 71	1520	5 for £1.00

THYRISTORS

TOS	Order No.	Price
IA/50 PIV	THY 1A/50	18p
1A/400 PIV	THY 1A/400	32p
1A/600 PIV	THY 1A/600	38p
TO66		
5A/50 PIV	THY 5A/50	25p
5A/400 PIV	THY 5A/400	40p
5A/600 PIV	THY 5A/600	50p
TO48		
16A/50 PIV	THY 16A/50	40p
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UT46/TIS 43	18p
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F.E.T.

2N3819	15p
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ORDERING

Please word your orders exactly as printed not forgetting to include our part number.



LEND A HAND

It may be supposed that the great majority of our readers are reasonably sound in wind and limb and able to move around, more or less freely, under their own steam. They can look at a project in the magazine, decide to make it and then jump into their car, or take a bus, and go and get the parts that they need. If they are very lucky and don't live in London or one of the other big cities then they can pop down to the local postbox and send off their order to one of our advertisers.

Having just received the latest copy of *Radial*, the magazine of the Radio Amateur Invalid and Bedfast Club, I am reminded that there are those among us who are not quite so fortunate. Some who are very enthusiastic licensed radio amateurs or listeners but who are handicapped in one way or another and must rely upon others to set up and maintain their gear and aeriels. But can you imagine the joy that these people derive from being able to communicate with or listen to other amateurs from all over the world?

The Club is very active and prospering under the Presidency of Bill Browning G2AOX and his committee but it must be remembered that it is the ordinary healthy member who is so important and on whom so much depends. One such recent recruit was Ken Alford G2DX (what a fabulous call!) who at 83 feels he ought to be helping the youngsters, no doubt!

How many of our readers have bits of equipment or, in particular, short wave receivers, knocking about in the attic or garden shed that could be put into good working order and handed over to the RAIBC without a great deal of trouble? Many, for sure. So even if you don't want to join the Club you can still help in a very practical way those who are generally unable to help themselves.

If you do help you will certainly feel a little glow of satisfaction after having done your bit and may even be tempted to carry on the good work. It might even mean a couple of hours less spent working the DX from your own rig but it will be worth while. After all, conditions aren't so good all the time! If you feel that you want to become involved write in the first instance to RAIBC Secretary Harry Boutle G2CLP of 14 Queen's Drive, Bedford and he'll put you on to the right track. Now, where's that loft ladder?

If you'd like to hear the RAIBC boys on the air try 3750kHz SSB at 1000 on Tuesdays or 1400 on Wednesdays when the Net controller is G3WJT or perhaps the Cheshire Homes Net around 3650 to 3700kHz SSB at 1330 on Thursdays when the MC is G3OPY.

Member Tony G4BPX summed it up very well, in an article in *Radial*, when he said 'In thinking with and for less able friends for over twenty years I have become less handicapped myself' Think about it!

Eric Dowdeswell—Assistant Editor

This issue contains the first of the free PW Info-Cards, on Resistors and Capacitors, see page 938. The second Info-Card will be given away with the May issue of PW and will deal with Semiconductors.

DON'T MISS IT!

NEWS...

Polling time

THE International Short-Wave Club is now holding the tenth in its series of official polls which have been held every three years since 1950 to determine, in the listeners opinion the most popular short-wave Broadcasting stations. The poll began on November 1st, 1976 and will continue until February 28th, 1977. In order to enter, write on a postcard your five favourite Short-Wave stations, in order of preference, and add in not more than 30 words, the reasons for your first choice.

Results will be published in the April issue of the ISWC and announced by many stations. Further information from Mr G. C. Gibbs, 118 Bournemouth Park Road, Southend-on-Sea, Essex, SS2 5LS. Please enclose an SAE with all correspondence.

New licence explained

FROM January 1, 1977, the Home Office has been issuing four new types of radio amateur licence which have replaced all existing amateur licences when they become due for renewal.

The new Amateur Licence A (full facilities) and B (having certain limitations) will include all those facilities available to holders of the existing Amateur (Sound) Licences A or B, and will also include operation from a vehicle, or vessel other than at sea, or as a pedestrian. Fascimile, amateur television, slow scan television, data on amateur bands 144-146 MHz and above, as well as double sideband suppressed carrier operation will also be included. Emergency County Planning Officers will also be added to the categories able to call upon Raynet (emergency communications).

The purposes of the new-style licences are:

- (1) to give more flexibility to

NEWS...

NEWS...

NEWS...

British radio amateurs, so that they may pursue their hobby without having to make special application for several of the above facilities at present needing separate licences or authorities.

(2) to enable the Home Office to deal with the increase in applications for amateur licences and regulatory work over the next few years with the minimum delay.

Existing facilities authorised by a total of 20 licences and special authorities will thus be contained (with a few exceptions) in the new Amateur Licence A or B; and for Aliens combined fixed and mobile facilities in the Amateur Licence C or D. The new fee for all UK amateur licences will be £5.50.

Catkin, Red E, Trigratrons . . . !

AT a recent meeting of the University College of North Wales ARS John Lawrence, GW3JGA, gave a talk on the "Development of the Radio Valve" and showed part of his collection of historic radio valves. On display were over 200 valves covering the 60 year period from 1915 to 1975.



Practical Wireless, March 1977

The pre-war range included an "R" triode, AOR triodes, early indirectly-heated valves, screen grid types, "Catkin", Mullard "Red E" and Mazda octal versions. The wartime range included klystrons, trigatrons, magnetrons (including a MAG1) and a range of unusual disc-seal triodes which were used in early radio-location equipment. The wartime and post-war types included many transmitting valves, one of the latest vapour cooled triodes on show being rated at 60kW CW output.

Smaller types such as acorns, deaf-aid valves and Nuvisitors were also included. In addition to valves a number of opto-electrical devices, photo-cells, camera and convertor tubes were on display. To give a cheery atmosphere to the meeting, two large VT31 tetrodes were set up with their directly-heated filaments glowing brightly (filament rating 10V 10A).

Navy days

ACTIVITY period from HMS *Belfast*, in the Pool of London, 8th to 17th April. Call sign will be GB3RN.

Mobile Rally at HMS *Mercury*, nr. Petersfield, Hants. Sunday, 19th June.

Navy Days at Portsmouth and

Plymouth dockyards, 27th, 28th and 29th August. GB3RN and GB3GUZ.

Jamboree-on-the-Air Camp and Radio Teach-In at HMS *Mercury*, 15th and 16th October.

Annual General Meeting at HMS *Mercury*, nr. Petersfield, Hants, 22nd October.

For further details or membership details of the RNARS write to M. J. Matthews, G3JFF, Hon. Secretary, HMS *Mercury*, East Meon, Petersfield, Hants.

Spring show

A SHORT note here for those readers who attend, or would like to attend the All-Electronics Show which is held annually. This year's show promises to be as successful as those in the past, and will be held at Grosvenor House, Park Lane, London W1 on the 19th-21st April. Watch this page in the coming months for more news on this exhibition.

Teach-in

THE Department of Electrical Engineering Science at Essex University will be holding its annual Electronics Summer School for teachers during the week July 11-15, 1977. Two courses will be run simultaneously. The Linear Circuit Design course is concerned with the use of transistors and operational amplifiers in analogue applications and the basic circuits of a HiFi amplifier will be investigated in detail. The Digital Circuit Design course concentrates on the use of the transistor as a switch and develops design using integrated logic circuits.

Further information from: R J. Mack, Department of Electrical Engineering Science, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, telephone Colchester (0206) 44144, extension 2408 or 2299.

Circuits for AUDIO AMPLIFIERS

PART 1

F.G.RAYER G30GR

THE circuits in this series are intended to give practical essential information for the construction of pre-amplifiers, mixers, tone-controls, low-level and Class A output stages as well as various types of push-pull output stages and IC audio amplifiers. Some circuits can be added to existing equipment, or require few components and can be constructed as separate units. Others are more ambitious.

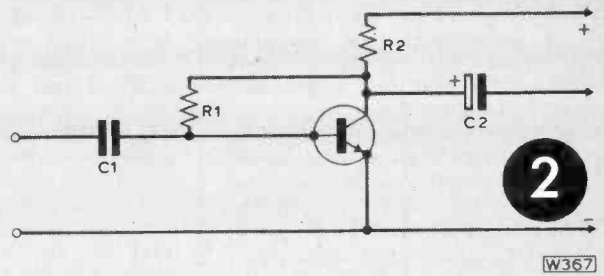
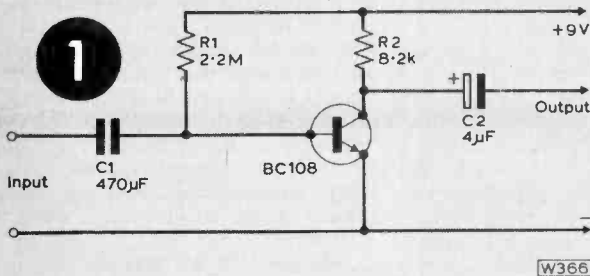
The simpler circuits can be assembled on tag-board but for the larger circuits Veroboard can be used, or printed circuit boards can be prepared. Copper-clad board and the other necessary materials for this purpose are readily obtainable. Numerous cases and cabinets suitable for housing the finished equipment are available and they can include space to accommodate the battery or AC power pack, as appropriate. Input and output sockets and controls can be mounted on the case panel, as well as brackets to carry the circuit board.

The circuits here employ both negative and positive "earth" or chassis line. This will prove to be convenient when new equipment has to suit existing units. Some circuits are readily adapted for either negative or positive earth though, in general, the positive earth is more likely to be found with older amplifiers employing PNP transistors.

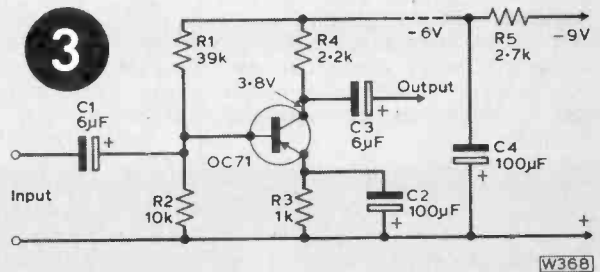
LOW-LEVEL "CLASS A" STAGE

A Class A stage is one which is required to amplify the whole audio cycle. The output from the stage should be as faithful a copy of the input as possible, unless some deliberate frequency correction has been made. A pre-amplifier or early audio stage should introduce as little noise as possible, as this would be amplified by later stages. Typical Class A low-level stages include pre-amplifiers and the early stages of an amplifier.

Fig. 1 is a simple low-level Class A stage. Resistor R1 furnishes base bias and the NPN transistor is



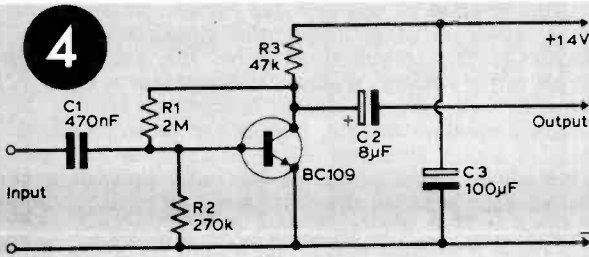
used as a grounded emitter amplifier. This particular circuit can be used by itself or in simple equipment, but lacks any form of stabilisation. As a result, collector current and operating conditions could vary considerably due to spreads in transistor characteristics, changes in temperature or variations in voltages. It is thus necessary with this circuit to limit base and collector currents to low levels. This circuit can be modified by taking R1 to the collector, Fig. 2. This provides a useful degree of stabilisation since base current through R1 depends on collector voltage, as well as on the value of R1. Component values may be as in Fig. 1.



The circuit of Fig. 3, which has a positive earth line, is stabilised. Resistors R1 and R2 form a potential divider setting the base operating point. R3 is the emitter bias resistor and R4 the collector load. With the PNP transistor, the base will be slightly negative, relative to the emitter. Should transistor spread, supply voltage or a rise in temperature cause collector current to be unusually high, the voltage drop across R3 rises due to the increased emitter current. The emitter moves negative, so that the base is relatively less negative with respect to the emitter than before, thus reducing collector current.

Should conditions result in an unusually low collector current, the reverse happens. The voltage

drop across R3 is reduced. The emitter thus moves positive, so that the base is relatively more positive and this tends to maintain collector current. In this way stable, satisfactory working conditions are maintained.

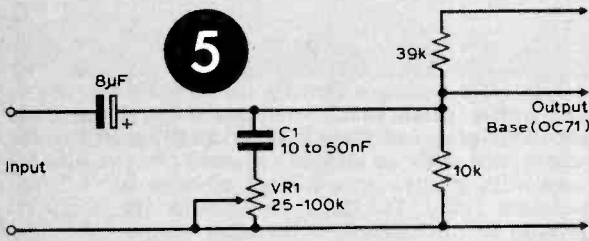


W369

Fig. 4 is another low-level amplifier, using a low-noise NPN transistor and it may be used to boost low-level inputs. The 14V supply line is not essential and R3 may be reduced in value with lower voltages, good results being obtained with 6V or less if necessary.

TONE CONTROLS

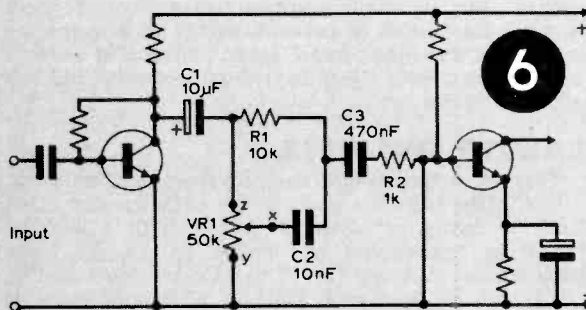
Tone controls may curtail or emphasise treble or bass, according to the circuits used, and are employed to obtain more satisfactory tonal balance or to compensate for recording characteristics, speaker deficiencies or other factors.



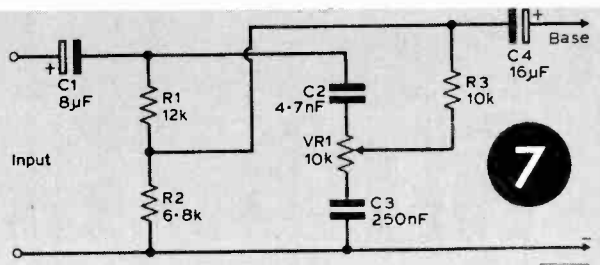
W370

Fig. 5 is a simple top-cut control, treble response being curtailed as the value of VR1 is reduced. The values shown are not critical. Such tone controls should not be added to a stage over which negative feedback takes place but to an early stage outside the feedback loop.

The reactance of a capacitor falls as frequency rises. In Fig. 5 C1 has a lower reactance to high frequencies, so that their amplitude is reduced at the transistor base. This change of capacitor reactance



W371

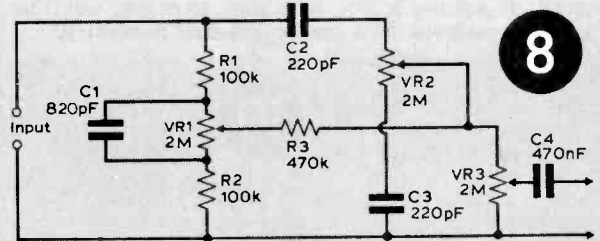


W372

with frequency is generally used in tone control circuits. Cutting treble and turning up the amplifier gain effectively increases the bass frequencies.

Fig. 6 is a circuit in which the potentiometer VR1 allows top frequencies to be cut when slider X is moved towards Y (similar to Fig. 5). However, when X is moved towards Z, C2 is increasingly effective across R1, to lift treble response. These and similar circuits can often be placed in existing equipment. Base, emitter and collector resistors are as for the stage without tone control.

Fig. 7 is another tone control for an early stage. R1 and R2 form an audio potential divider for C4 and the base of the following stage. VR1 provides best bass reproduction when adjusted towards C3 and best treble response when towards C2. Fig. 8 also controls bass and treble but has individual potentiometers. It can be fitted before the first stage if required. VR1 is the bass control and VR2 is for treble. VR3 is the volume control. This is a purely



W373

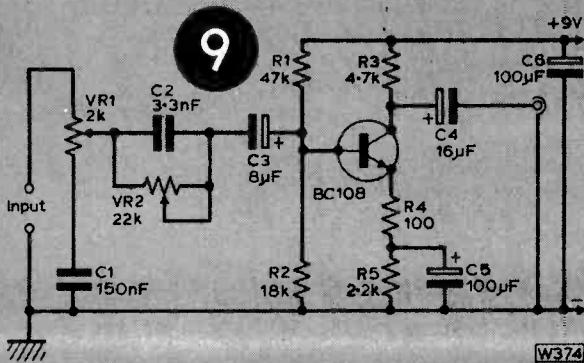
passive circuit which may be assembled in a metal screening box and requires no battery.

Circuits such as these can often be added to existing amplifiers without difficulty as they do not upset the DC working conditions. Some extra gain may be needed to compensate for losses in the tone control circuit when this does not incorporate a transistor. All values can be considerably modified, though there is no point in providing extremes of bass or treble which will never be wanted.

PRE-AMP WITH TONE CONTROL

Fig. 9 is a circuit of a pre-amplifier which incorporates two variable tone controls, VR1 is for treble cut and VR2 for bass cut. A volume control may be incorporated between VR1 and the input circuit, if required. Such a stage is useful when the main amplifier lacks sufficient gain for some particular purpose. This circuit also allows tone controls to be provided as well, with no changes to the main amplifier. If a pre-amplifier is operated from its own battery, no difficulties of hum or coupling through the power supply can arise.

When operation is required from the same supply as the main amplifier, a decoupling resistor is added



in the positive supply line, between C6 and the supply circuit. As most amplifiers will be operated from the mains these components (resistor and C6) also help to assure a smooth, hum-free supply for this stage.

A pre-amplifier can have circuits designed for various inputs such as for radio, or for moving-coil or crystal microphones. These may be selected by switching.

INPUT IMPEDANCE

Tuners, crystal pick-ups and other inputs are best operated into loads of a particular impedance. This is not too critical for general purposes but becomes important for improved fidelity. A suitable impedance is frequently obtained with a resistor network. It causes a loss in signal strength, but this is easily restored by a pre-amplifier, if necessary.

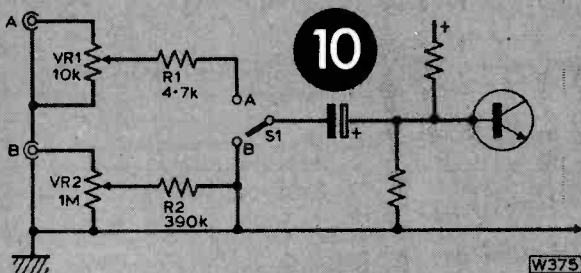


Fig. 10 is a circuit having two inputs, "A" is of relatively low impedance for a radio tuner, pre-amplifier and other inputs of around 10kΩ impedance. Input "B" is more suitable for a crystal pick-up and other high impedance inputs, where a low impedance would reduce frequency response. Individual volume controls VR1 and VR2 can be set to suit the signal levels provided.

INPUT LEADS

The microphone, pick-up or other input leads to the pre-amplifier and amplifier must be screened. So must the inter-connecting audio circuit leads from pre-amplifier, tuner or other units to the main amplifier. The purpose of such screening is to avoid pick-up of hum or other currents induced from adjacent circuits, which, if introduced into the input circuit would be amplified and accompany the signal or cause instability.

The screened leads are fitted with jack plugs or other audio-type connectors to match the equipment.

The outer conductors of the leads form the earthed or chassis return, but should not be used to carry power between units.

"CLASS A" OUTPUT

The addition of one or more further stages to the first, low-level stage raises the signal level, eventually to that required to drive the loudspeaker. With a dry battery, a single transistor as a Class A amplifier can provide ample headphone volume, or modest speaker volume, mainly for personal listening. A single transistor Class A amplifier can give very much higher power in car radio equipment or in mains-operated circuits where current is not limited to that available from dry batteries. Powerful Class A circuits require an output transistor able to handle a high current and the current drain is greater than with an equivalent power Class B output stage (described later). For this reason large Class A stages are not used in battery operated receivers or amplifiers.

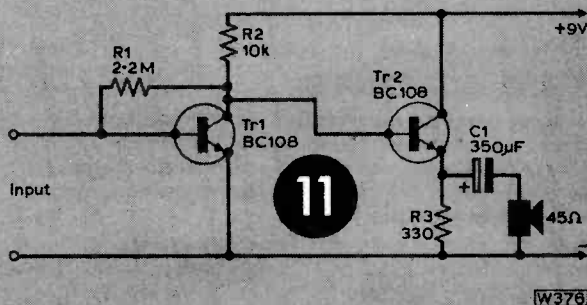


Fig. 11 is a simple directly coupled 2-stage amplifier with a small Class A output stage. It provides excellent gain and gives a surprisingly good volume when used with an efficient speaker. It can also be used with phones or a midget speaker for a small personal radio. The input is suitable for a crystal pick-up or microphone. With other inputs, an isolating capacitor will be necessary in the input circuit so that bias conditions (via R1) for Tr1 are not upset.

Tr2 is an emitter follower, with grounded collector. The collector is earthed as far as audio signals are concerned, as the battery supply is considered to have zero impedance. DC operating conditions for Tr2 are not upset by the speaker resistance as C1 isolates the speaker, but results are best if the speaker is of moderately high impedance.

When a Class A stage is operating properly, a milliammeter placed in the supply circuit should show no significant change of current with varying signals. But in small amplifiers like Fig. 11 there is some fluctuation of current, except at low volume levels. On the other hand, large changes in current are expected with Class B push-pull circuits and are quite in order.

LARGER OUTPUTS

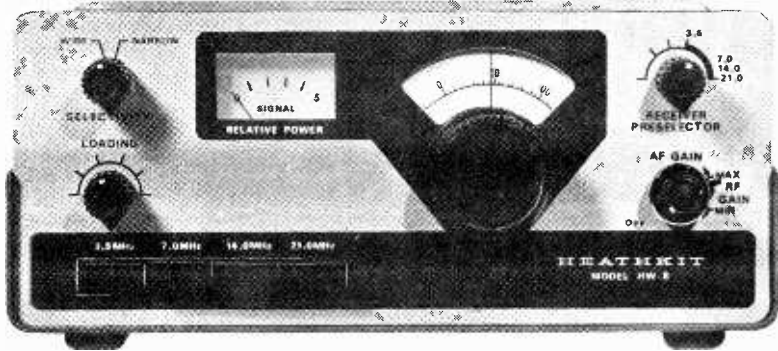
Class A output stages running from accumulators, about 12 to 14V, are popular for vehicles and often have a rating of about 2 to 5W with a current drain in the region of 400mA to 1A. A large power Class A stage for 12 to 14V is shown in Fig. 12. It can be used with PNP or NPN transistors of the OC26 or BD121 type with appropriate polarity

continued on page 927

**SPECIAL
PRODUCT
REPORT**

HEATHKIT

**HW8
QRP**



TRANSCEIVER

Many thousands of radio amateurs were introduced to the thrills of operating with low power CW when Heathkit thought up the earlier HW7 transceiver. However that did not have the 80 metre band available, a sad omission in these days of low sunspot activity. There was no gain control on the RF side and there was separate dial calibration for each of the three bands. On the credit side, it was possible to plug in a crystal for fixed frequency operation, a facility lacking on the HW8.

But what is 'low power'? In the USA, 100W or so is spoken of as low power, which it probably is when one considers their maximum licensed power. I prefer to go along with our ideas over here, which is something below 10W input, although there are many enthusiasts who use, and get good results from, a few hundred milliwatts.

DESCRIPTION

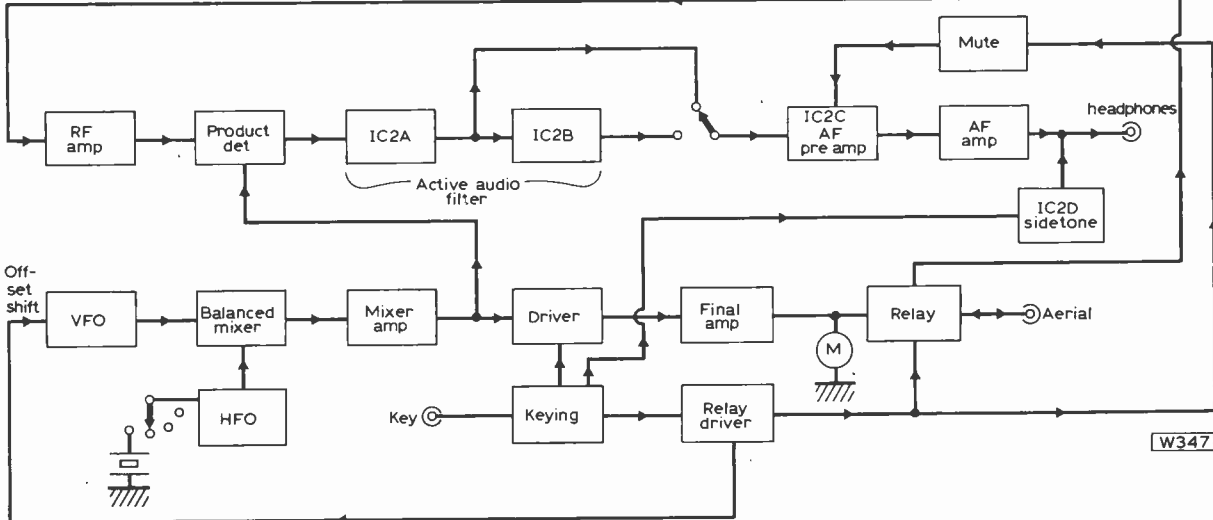
The HW8 transceiver is designed to work from a nominal 12VDC supply, in practice from a car battery if in the field or from a mains unit if at home or in a hotel on vacation. In

either case the actual input voltage will be nearer to 13-14V. On transmit the HW8 provides an input of around 3W on CW on the bottom 250kHz portion of the 3.5, 7, 14 and 21MHz bands. The output impedance is fixed at 50Ω with an output loading control on the front panel, coupled with a relative output meter. The receiver uses the direct conversion technique, as did the HW7, and as well as having an RF stage it has a switchable two-stage active filter giving audio bandwidths of 375 and 750Hz (6dB) at 750Hz. In use this means that SSB is just about uncopiable which is rather a pity, although only CW can be transmitted. The two modes are far from incompatible.

THE CIRCUIT

On both receive and transmit the VFO output (8-645 to 8-895MHz) is mixed with the output of an RF oscillator which provides four crystal controlled frequencies, 12-395, 15-895,

This block diagram shows how several of the stages of the HW8 are used on both transmit and receive.



abridged specification

TRANSMITTER	RECEIVER
DC Input 80m 3·5W 40m 3·0W 20m 3·0W 15m 2·5W	Direct conversion, CW only Sensitivity 1 μ V with 0·2 μ V providing readable signal Selectivity Wide:—750Hz @ 6dB down. Narrow:—375Hz @ 6dB down. Passband Freq. 750Hz
Output Impedance 50 Ω unbalanced	Output Imp. 1k Ω
Transmit Offset 750Hz lower	
GENERAL	
Frequency Range MHz 3·5 to 3·750, 7·0 to 7·250 14·0 to 14·250, 21·0 to 21·250	
Frequency Stability	Less than 150Hz/hour after 1 hour
Power Required	13·4VDC nominal 90mA/ receive 430mA/transmit
Dimensions	9 $\frac{1}{2}$ x 4 $\frac{1}{2}$ x 8 $\frac{1}{2}$ in. deep overall. (235 x 108 x 216mm)
Weight	4lbs. (1·8kg)

22·895 and 29·895MHz. The difference frequency is selected for each band by tuned circuits, thus giving 3·5 to 3·750, 7·0 to 7·250, 14·0 to 14·250 and 21·0 to 21·250MHz. The dial calibration of 0 to 250 is thus constant for each band. These frequencies are also used as the heterodyne frequencies for the direct conversion receiver.

This is a good point at which to say that there are 20 tuned circuits plus the four crystals all of which are diode switched! The band switch thus operates at DC rather than at RF, except for the PA tuned circuits. It is not surprising then that the main PCB carries some 300 or so components!

There are 32 coils, 37 diodes, 92 resistors, 120 capacitors and 16 transistors/IC's. Whether all this sophistication is justified to provide a couple of watts of CW on four bands is a matter of opinion!

On transmit the output of the mixer is amplified and fed to a tuned driver stage into the 2N4427 power amplifier. This stage is protected against excessive SWR conditions or accidental no-load dangers. Keying takes place in the driver stage, also activating the transmit/receive relay, the keying sidetone and the receiver muting circuits. There is an adjustable drop-out time control on the T/R relay.

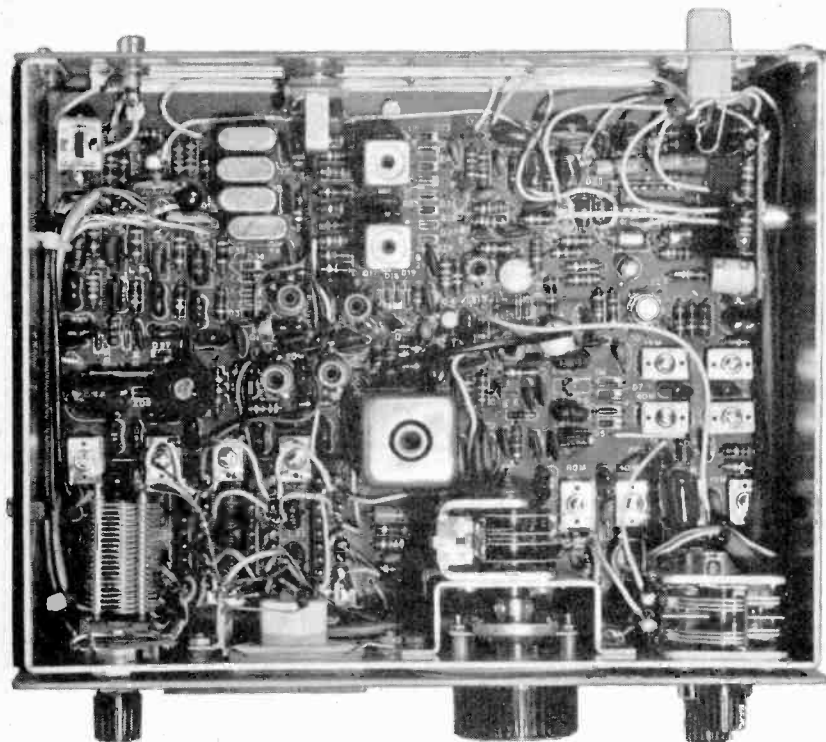
The receiver has an RF stage with the simplest of gain controls, which many amateurs, who complain of cross-modulation on their sets, would do well to copy. Namely, a potentiometer across the input terminals! An MC1496G IC forms the balanced product detector, also fed with a signal from the mixer stage, as previously mentioned. The active audio filter stages have also been covered earlier. Because of the 750Hz peaking effect of the audio filters the carrier has to be offset 750Hz on transmit. This is done automatically when the key is down. In practice this means tuning down from the HF end of a band and tuning a signal right 'on the nose' of the filter giving a 750Hz beat note. The transmitted signal will then be spot on the frequency of the incoming signal.

Two further stages of audio amplification feed a head-phone socket at high impedance, nominally 1k Ω , but in practice a stereo low impedance headset performed quite well! But an old pair of Browns diaphragm type of 4k Ω really got the signals pumping out when peaked on the filter frequency!

CONSTRUCTION

As with any kit the components supplied must be checked against the parts list. Every part, down to the nuts and bolts, is illustrated in the Heathkit manual which is an education in itself and even before construction begins a good knowledge of the HW8 is obtained. Personally, I always read the manual right through anyway, before ever lifting the soldering iron! It is time well spent, often explaining points that might otherwise prove mystifying during construction.

The bulk of the work is on the main PCB which carries no



Top view of the finished transceiver. All the cabling round the inside of the cabinet is fitted to the PCB before the cabinet is assembled round the board. The T/R relay is in the top left hand corner close to the aerial socket, with the four HF crystals further to the right. The large screened can in the centre is the VFO unit with the VFO tuning immediately in front on the panel. While the PCB may appear rather cluttered up, the wiring in of the components presented no difficulty at all. There are no components under the PCB which is in the bottom of the cabinet.

less than 308 components! Actually the job of wiring so many resistors and diodes etc. gets boring so give it a break now and again to avoid making errors. The PCB and the associated cabling took nine hours to complete. It is an excellent board on which to work and need not be any cause for apprehension for potential constructors. The PCB was carefully checked for solder 'bridges' with the aid of a watchmaker's eyeglass and all was well.

The simple cabinet, front and rear panels are fitted round the PCB and the wiring completed to the various controls on the front and sockets on the rear panel. The aerial socket is a 'phono' type easily changed to Belling-Lee type or to suit the rest of the station's RF cabling. After completing the PCB a further 5½ hours work saw the transceiver completed. A further check on the PCB underneath and the general wiring was made before tests began.

TESTING

Although the manual did not mention it, it was thought advisable to check the resistance across the 12V input terminals just in case there was a short there! The multimeter red prod (neg polarity) was connected to negative input, giving a reading of 550Ω with the transceiver switched on and on receive. The power unit used for testing was the Heathkit HWA-7-1 giving approx. 13.2V. The initial tests laid down in the manual all proved satisfactory. The relay worked on keying, the sidetone was present and the receiver controls worked but little RF output was present at this stage.

The test equipment required is a receiver, preferably of the communication type, capable of providing accurate checks at 7 and 7.250kHz for checking the VFO, and a high input impedance voltmeter preferably with an RF probe. The alignment is quite clearly described and it is a matter of logical progression which can be completed easily in half an hour.

If one runs into trouble there is plenty of advice in the manual including PCB layout drawings with the voltages to be expected at various points. With a stabilised input voltage of 13VDC the current on receive was 93mA and on transmit 450mA, remaining fairly constant over the four bands. The RF output was measured at the dummy aerial load with the dial set at mid position and the loading control peaked and was found to be 2W on 80m and 40m, 1.8W on 20m and 1.6W on 15m.

Since the accepted segments of the bands on CW are a lot less than the 250kHz coverage available on the HW8 it would seem feasible to align the circuits at, say, 50kHz from the band edge and improve the general performance on both transmit and receive. In practice with the recommended alignment the RF output is remarkably constant over the whole 250kHz.

GENERAL COMMENTS

The transmitted signal was monitored externally on all four bands and found to be clean with excellent keying characteristics. In fact it was possible to get the relay to follow keying up to about 25wpm although some may prefer to increase the relay drop-out time to a second or so. Plenty of DX has been heard on all four bands and the two position audio filter can really sort out the weak ones among the QRM. The RF gain control was most effective especially with some of the powerful signals on 80m.

AERIALS

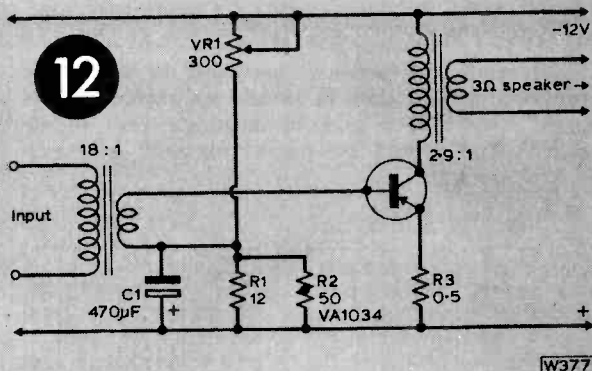
Nothing spectacular has been worked on any band yet due to lack of suitable aerials. It is a problem to get a four band aerial which provides a low impedance feed on all bands, without using a tuning unit. Anything introduced between the aerial and the set is going to absorb some of the precious power. A trapped dipole is the quick answer but it is a compromise and rather 'lossy'. It is hoped to erect a four band ground plane with a coax feeder when a further report on results obtained will be published.

AED
Heathkit k/HW8 Price £108.19 inc. VAT and post and packing from Heath (Gloucester) Ltd., Gloucester GL2 6EE.

CIRCUITS FOR AUDIO AMPS.—contd. from page 924

of supply, that is positive earth for PNP and negative earth for NPN devices. It can be driven by an AC128 (PNP), BC108 (NPN) or similar stage. The transformer ratios are typical and need not be exactly as shown.

Collector current is set by VR1 and this can be the lowest which gives satisfactory performance. Begin with VR1 at maximum value, corresponding to a low collector current. Actual collector current depends on the transistor and performance and should be around 350mA to 900mA. As the DC operating conditions of this stage are isolated from other stages it is useful for experimental circuits and can actually be employed with about 9V to 24V. With the higher voltages, check carefully that the transistor is not over-run.



The load impedance can be around 25Ω but it is not too critical, depending somewhat on the supply voltage. Note that with a Class A stage a loudspeaker can only be connected directly to the collector circuit when it is able to carry the required collector current. This is why a transformer is necessary in Fig. 12.

Thermistor R2 is for stabilisation, as described later, whilst R3 also assists in this direction and can be about 1Ω if the volume is sufficient. Resistor R2 may be omitted for low voltages, or providing a check is kept that the current is not too high.

TO BE CONTINUED

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WIDE-WRITER

PART 8

M. J. HUGHES M.A., C. Eng. MIERE

NON-KEYBOARD KEYING

Early on in the series we promised an alternative means of entering data to obviate an expensive keyboard. This is done with seven single pole toggle switches and a push-to-make button with an "anti-bounce" circuit.

The code for the character or control function is set up on the switches in binary form and the button depressed to produce a strobe. If this method is used it is suggested that a table of the codes be prepared to tally with the switch positions. The suggested front panel layout and circuit are shown in Figs. 38 and 39. These codes might come in use-

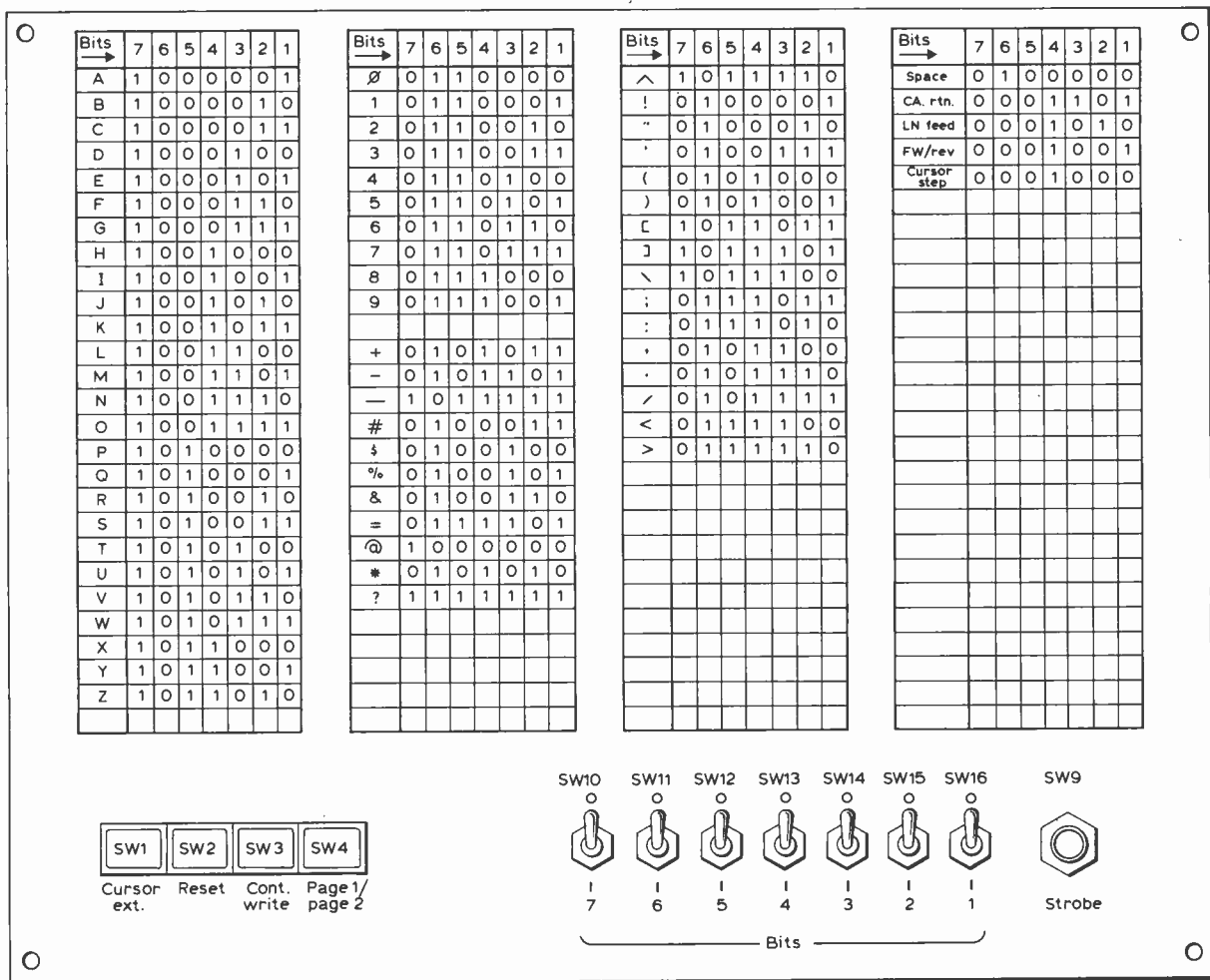


Fig. 38. A suggested layout of the front panel when toggle switches are used for data entry.

W400

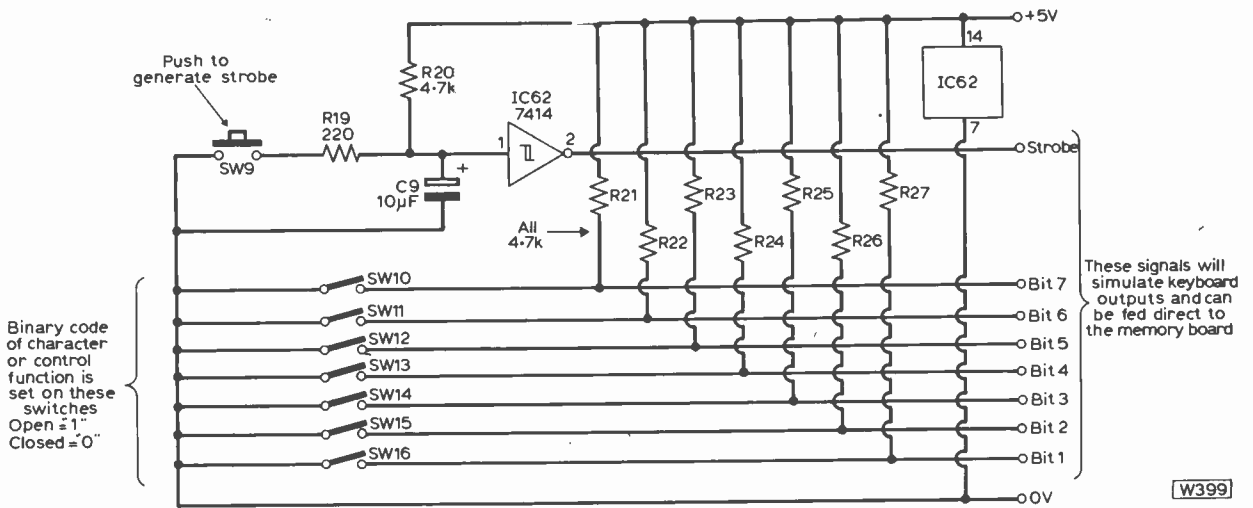


Fig. 39. The circuit diagram of the switching required to set data manually. A closed switch gives a logic "0", an open switch a logic "1".

ful for anyone carrying out the trouble shooting procedure mentioned earlier.

Although this method of entering data will be very tedious for normal use it is ideal for setting up permanent or semi-permanent displays.

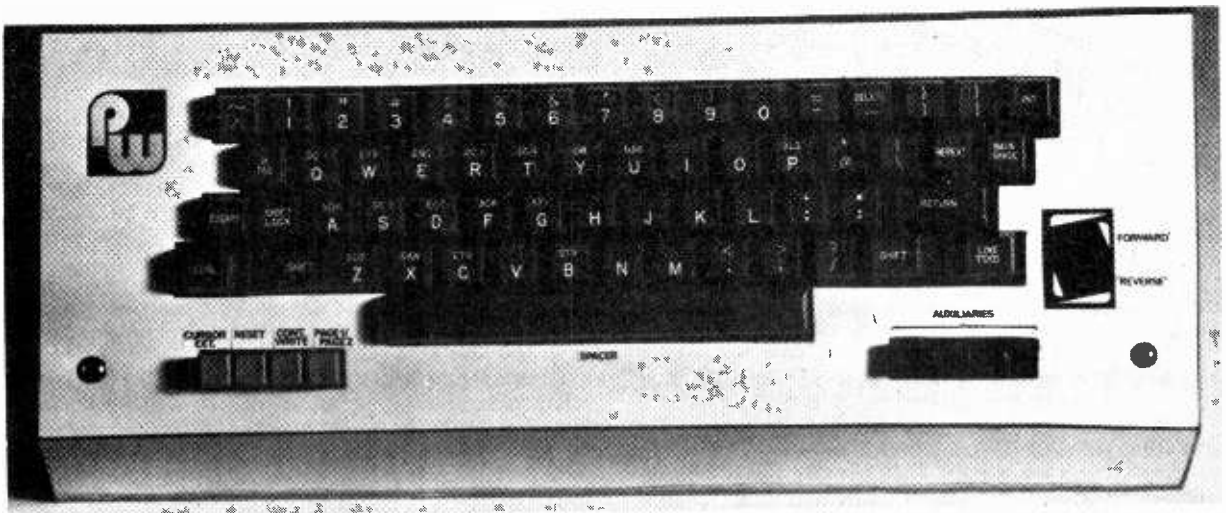
PAGE SEQUENCER

A page is selected by applying a logic level "1" or "0" to the most significant address bit of the random access memory. For page 1 this bit is held at logic "1" by R9 on the memory board. To change to page 2 the junction of R9 and the address input is shorted to ground (thus applying a logic level "0"). This is carried out by closing switch SW4 (page 1/2 select). This function could be carried out electronically by an oscillator and would give automatic page sequencing.

A variable-speed page-sequencing circuit can be added to the basic video-writer without any modifications to the original layout. The requirements are a small extra circuit board and a number of flying leads connecting it to the existing pinned "leadouts" on the main boards.

The circuit for such a sequencer is shown in Fig. 40 where IC62, a 555 operating in astable mode, is the oscillator and the frequency is set by VR1 and one of the three capacitors C9-C11. The range is set by selecting one of these capacitors via the auxiliary bank of switches (already embodied in the prototype).

VR1 gives fine control within the range selected and, in the prototype, is a preset but could be front panel mounted if desired. IC62 produces negative going pulses at the page sequencing rate and these are fed to the first part of IC63 which is a D-type



A photograph of the original keyboard. Note that the auxiliary switches are retained on the proposed layout for Non-Keyboard Keying.

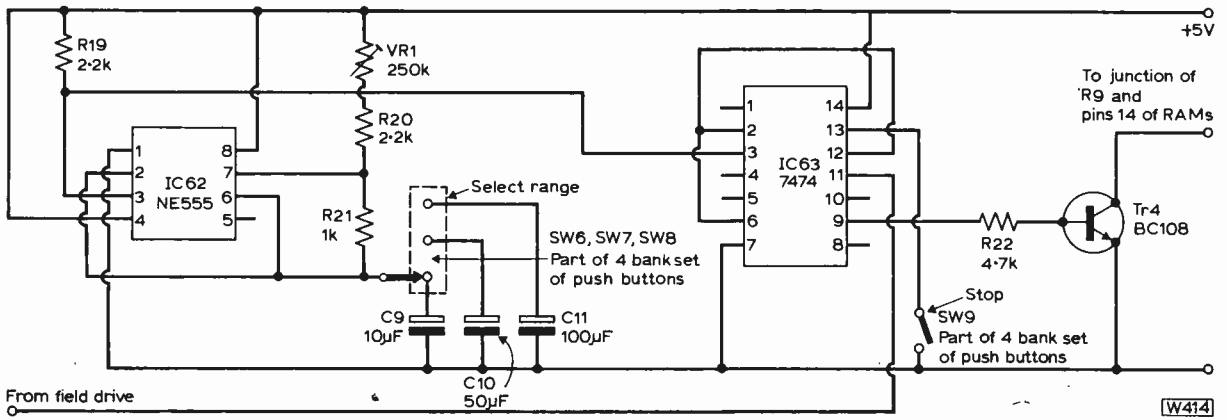
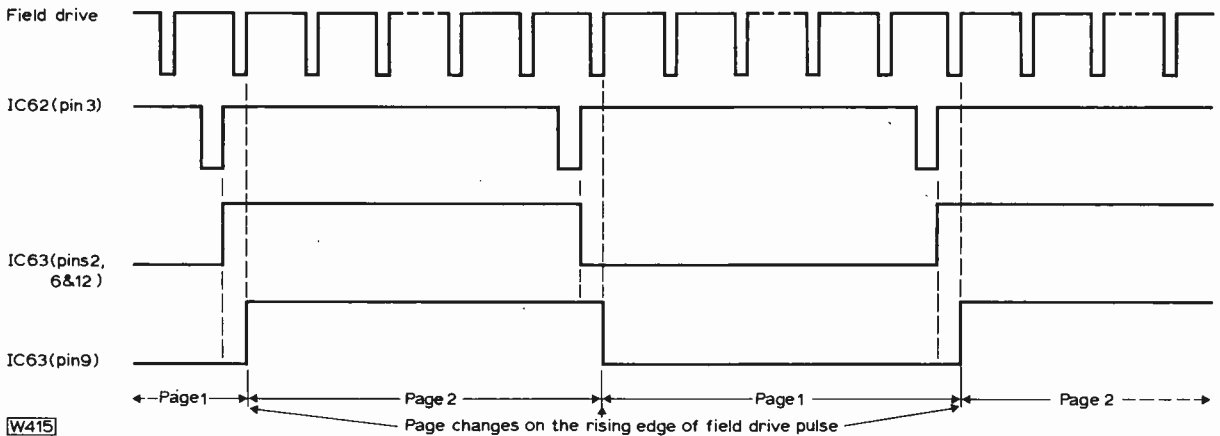


Fig. 40. The circuit diagram for the automatic page sequencer. SW4 must be open (i.e. switched to page 1) for this circuit to operate. C9, 10 and 11 can be selected for any range of speed required.

Fig. 41. The waveform appearing in the Page Sequencer.



flip-flop giving unity mark space output waveform. It is desirable for the page to change during the field sync period. This prevents the displayed information changing while the scan is in the middle of a raster.

To do this it is necessary to synchronise the output at pins 2 and 6 of IC63 with the field drive pulse (obtained from the Sync Generator Board). This is done by applying the output of the first D type flip-flop in IC63 to the "D" input of its twin and using the Field Drive Pulse as a clock signal. The Clear input of this second half is connected to the fourth push-button of the auxiliary bank which serves as a "disable" to the page sequencer, (i.e. switches it off), and holds the output on pin 9 at logic level "0". The associated waveforms are shown in Fig. 41.

This signal has to be applied to the junction of R9 and the paralleled connections to pins 14 of the random access memories. This is most easily accomplished by the open collector transistor (TR4) which will pull the junction to ground when the output from the page sequencer is at logic level "1". Pro-

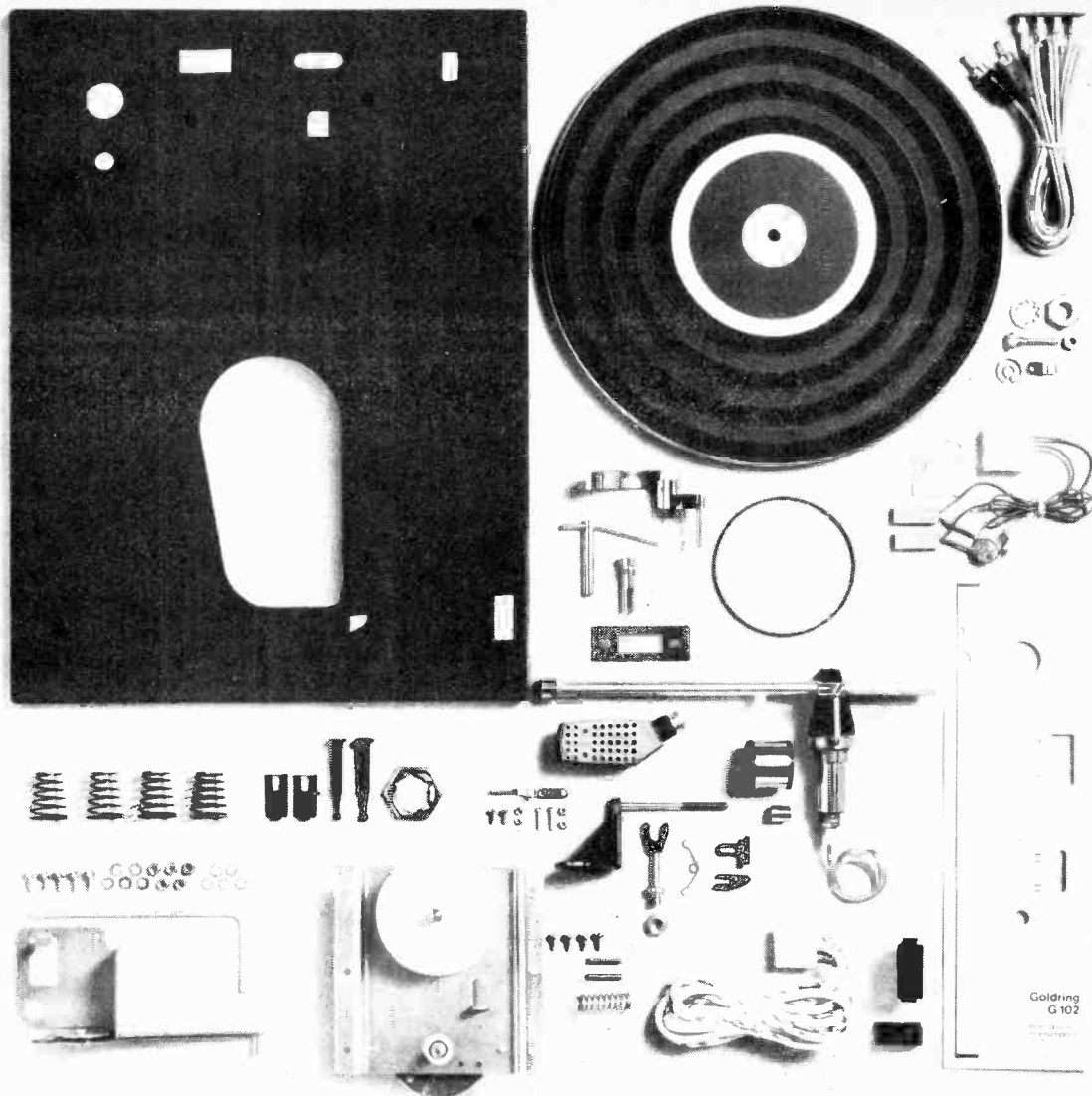
vided the manual page select switch SW4 is in an open circuit condition, TR4, in conjunction with R9, will allow the address to alternate from "1" to "0", according to the instruction from the sequencer unit.

If the disable button SW5 is pressed there is no base drive into TR4 and SW4 is free to give manual control of page selection. Note that for automatic page sequencing to occur, SW4 must be in an open circuit state otherwise the address will be permanently grounded (displaying "Page 2").

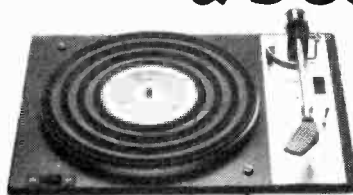
Using the values of capacitors and variable resistor in the parts list the duration of the page display can be varied from approximately 20 seconds a page to a fraction of a second a page.

High speed page strobing can produce interesting effects for advertising but should be used with discretion due to the hypnotic effects that can be induced. It is possible to strobe at the "Bio" Beta Frequency and under certain circumstances this can produce unpleasant side effects in a viewer.

The wiring pattern of the printed circuit board is shown as Fig. 42 and the component layout as Fig.



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74H04	30p	74100	116p
7405	24p	74101	116p
7406	43p	74105	60p
7407	43p	74107	36p
7408	22p	74109	70p
7409	22p	74110	55p
7410	22p	74111	80p
74H10	40p	74118	90p
7411	26p	74121	32p
7412	27p	74122	52p
7413	40p	74123	73p
7414	85p	74125	70p
7416	40p	74126	65p
7417	40p	74132	75p
7420	18p	74136	81p
7421	43p	74141	85p
7422	28p	74142	300p
7423	38p	74145	95p
7425	33p	74146	173p
7427	40p	74150	120p
7428	39p	74151	72p
7430	18p	74153	92p
7432	37p	74154	164p
7437	37p	74155	97p
7440	18p	74156	97p
7441	85p	74157	96p
7441	85p	74159	220p
7442	75p	74160	107p
7443	116p	74161	107p
7444	116p	74162	107p
7445	120p	74163	107p
7446	95p	74164	130p
7447	90p	74165	150p
7448	80p	74166	140p
7450	18p	74167	340p
7451	18p	74170	300p
7453	18p	74173	60p
7454	18p	74174	28p
7460	18p	74175	145p
7470	36p	74176	131p
7472	32p	74177	100p
7473	36p	74180	108p
7474	37p	74181	322p
7475	45p	74182	45p
7476	37p	74185	146p
7480	54p	74190	155p
7481	103p	74191	155p
7482	85p	74192	130p
7483	99p	74193	76p
7484	99p	74194	76p
7485	120p	74195	102p
7486	36p	74196	108p
7489	340p	74197	108p
7490	43p	74198	270p
7491	90p	74199	270p

C-MOS ICs

4000	21p	4029	120p
4001	21p	4030	59p
4002	21p	4042	60p
4008	104p	4043	100p
4007	21p	4046	150p
4009	67p	4047	100p
4011	21p	4049	68p
4012	22p	4050	50p
4013	55p	4055	120p
4015	90p	4056	120p
4016	54p	4056	145p
4017	100p	4060	120p
4018	120p	4069	40p
4019	50p	4071	29p
4020	120p	4072	29p
4022	103p	4084	19p
4023	21p	4082	29p
4024	75p	4510	142p
4025	21p	4511	160p
4026	200p	4516	140p
4027	81p	4518	140p
4028	152p	4528	130p

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15V	7815	130p
18V	7818	150p
24V	7824	150p
1 Amp	Negative	150p
5V	7905	215p
12V	7912	215p
15V	7915	215p
18V	7918	215p
24V	7924	215p

LM309K (TO3) 5V 1 Amp 150p
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AC126	20p
AC127	20p
AC128	20p
AC178	20p
AC187	20p
AC188	20p
AD149	54p
AD161	39p
AD162	39p
AF114	22p
AF115	22p
AF116	22p
AF117	22p
AF139	40p
AF239	48p
BC107B	10p
BC108B	10p
BC109	10p
BC109C	11p
BC147	9p
BC148	8p
BC157	11p
BC158	13p
BC159	13p
BC169C	15p
BC171	12p
BC172	11p
BC177	20p
BC178	17p
BC179	20p
BC182	12p
BC183	12p

OP. AMPS

301A	Ext. Comp. 8 pin DIL	40p
536T	FET. Comp. AMP TO 99	300p
709	Ext. Comp. 8/14 pin DIL	30p
710	Diff. Comp. 14 pin DIL	45p
747	Int. Comp. 8/14 pin DIL	25p
748	Diff. 7/14 pin DIL	25p
748	Ext. Comp. 8 pin DIL	40p
749	Prog. Op. Amp TO 99	153p
1458	Dual Op. Amp. 8 pin DIL	70p
3130	CMOS/Bipolar Mosfet	108p
3140	BIMOS/FET Input 8 pin DIL	108p
3900	Quad. Op. Amp. 14 pin DIL	78p

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CA 3028A	Diff. Cascade Amp. To 99	112p
CA 3046	5 Transistor Array 14 pin DIL	85p
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CA 3053	Diff. Cascade Amp. TO5/DIL	75p
CA 3080	Op Transconduct. Amp. 8 DIL	97p
CA 3089E	FM IF System 16 pin DIL	250p
CA 3090AQ	FM Stereo Decoder QIL	500p
ICL8038CC	VCO Fun. Ken 14 pin DIL	370p
LM380N	2W Audio Amp 14 pin DIL	112p
LM381N	Stereo Pre Amp 14 pin DIL	190p
LM389N	Aud Amp + 3 Trs. Arr. 18 DIL	175p
M252	Rhythm Ken 16 pin DIL	850p
MC1310	FM Stereo Decoder 14 pin DIL	180p
MC1351P	Lim/Det. Audio Preamp	104p
MC1495	Multiplier 14 pin DIL	370p
MC1496	Bal. Mod/Demod 14 DIL	115p
MC3340P	Elec. Attenuator 8pin DIL	180p
MFC4000B	1W Audio Amplifier PCB	90p
NE540L	Audio Pwr. Driver TO99	140p
NE555V	Timer 8 pin DIL	48p
NE556	Dual 555 14 pin DIL	75p
NE61B	PLL with AM Demod	420p
NE562B	PLL with VCO 16 pin DIL	425p
NE565	PLL 14 pin DIL	200p
NE566V	PLL Function Gen 8 pin DIL	200p
NE567V	PLL Tone Decoder 8 pin DIL	200p
SN7514	Dual 555 14 pin DIL	400p
SN72733	Video Amplifier 14 pin DIL	150p
SN76003N	Audio Pwr. Amp with HS	275p
SN76008	10W in 4 ohms 5pin Plas.	280p
SN76013N	Audio Pwr Amp with HS	175p
SN76023N	Audio Pwr Amp with HS	175p
SN76033N	Audio Pwr. Amp with HS	275p
TAA621A	Aud. Amp. for TV QIL	310p
TAA661B	FM IF Amp Lim/Detector QIL	150p
TBA641B	Audio Amp QIL	300p
TBA800	5W Audio Amp QIL	100p
TBA810	7W Audio Amp QIL	125p
TBA920	2W Audio Amp QIL	100p
TDA2020	20W Audio Amp QIL	405p
XR2240	Prog Timer/Counter 16 pin DIL	400p
ZN414	TRF Radio Receiver TO18	140p

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OCp72	18p	
2N5777	18p	
2N5778	58p	
LDRs	0.2"	
ORP12	70p Red + clip	18p
ORP60	75p Green	38p
ORP61	75p Yellow	32p

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3015F	Minitron 0.3"	160p
DL704	Com. Cathode 0.3"	160p
DL707	Com. Anode 0.3"	160p
DL747	Com. Anode 0.6"	250p

SCR THYRISTORS

BF258	39p
BFR39	34p
BFR40	34p
BFR79	34p
BFR80	34p
BFR88	37p
BFX30	32p
BFX84	30p
BFX85	30p
BFX86	30p
BFX87	30p
BFX88	30p
BFY50	17p
BFY51	16p
BFY52	17p
BRV39	48p
BSX19	20p
BSX20	20p
BU105	175p
BU108	312p
MJE340	48p
MJE2955	130p
MJE3055	130p
MJSA06	37p
MPSA12	62p
MPSU06	78p
MPSU08	88p
OC28	90p
OC35	90p
OC41	19p
OC42	19p
OC45	19p
OC71	25p
TIP29A	50p
TIP29C	62p

DIACs

2N1133	22p
2N1134	22p
2N1135	22p
2N1136	22p
2N1137	22p
2N1138	22p
2N1139	22p
2N1140	22p
2N1141	22p
2N1142	22p
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2N1172	22p
2N1173	22p
2N1174	22p
2N1175	22p
2N1176	22p
2N1177	22p
2N1178	22p
2N1179	22p
2N1180	22p
2N1181	22p
2N1182	22p
2N1183	22p
2N1184	22p
2N1185	22p
2N1186	22p
2N1187	22p
2N1188	22p
2N1189	22p
2N1190	22p

DIACs

2N1133	22p
2N1134	22p
2N1135	22p
2N1136	22p
2N1137	22p
2N1138	22p
2N1139	22p
2N1140	22p
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2N1177	22p
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2N1181	22p
2N1182	22p
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2N1190	22p

DIACs

2N1133	22p
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2N1144	22p
2N1145	22p
2N1146	22p
2N1147	22p
2N1148	22p
2N1149	22p
2N1150	

Fig. 42. The etched wiring pattern of the Page Sequencer board drawn full size.

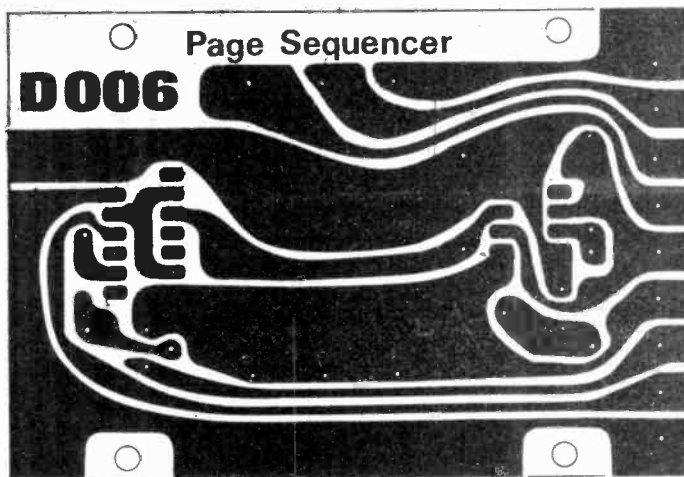
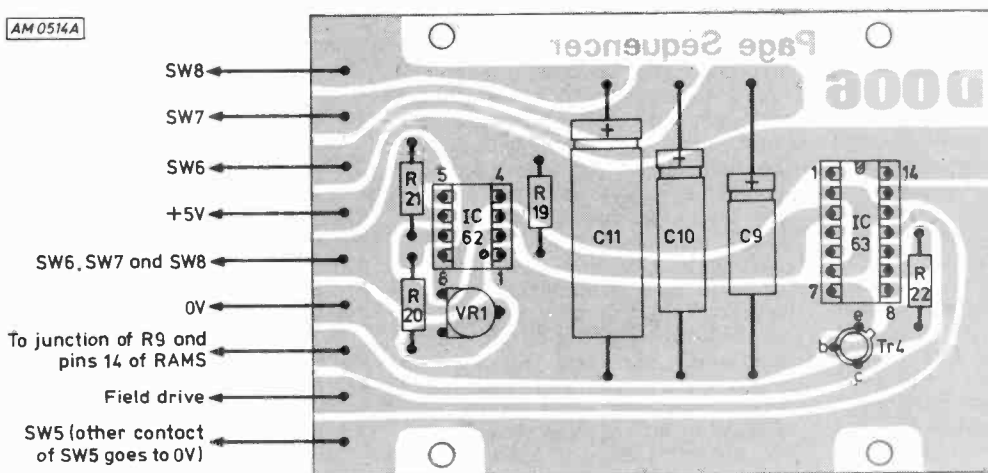


Fig. 43. The component overlay information. Observe the +ve marking when using polarised capacitors. VR1 is shown as a miniature preset but could be externally mounted.

AM 0514A



★ components list

NON-KEYBOARD KEYING

- R19 220Ω 10% 1/4W
- R20 4.7kΩ 10% 1/4W
- R21 4.7kΩ 10% 1/4W
- R22 4.7kΩ 10% 1/4W
- R23 4.7kΩ 10% 1/4W
- R24 4.7kΩ 10% 1/4W
- R25 4.7kΩ 10% 1/4W
- R26 4.7kΩ 10% 1/4W
- R27 4.7kΩ 10% 1/4W
- C9 10μF 12V 10% 1/4W
- SW9 Push-to-make button switch
- SW10-SW16 Single pole toggle switches
- IC62 7414
- Small piece of Veroboard.


★ components list

PAGE SEQUENCER

- R19 2.2kΩ, 10%, 1/4W
- R20 2.2kΩ, 10%, 1/4W
- R21 1kΩ, 10%, 1/4W
- R22 4.7kΩ, 10%, 1/4W
- VR1 250kΩ (sub-min horizontal pre-set)
- C9 10μF (10V)
- C10 50μF (10V)
- C11 100μF (10V)
- TR4 BC 108
- IC6 NE 555
- IC6 7474
- One off 8 pin DIL socket
- One off 14 pin DIL socket
- SW5-SW8 Interlocking bank of 4 push switches
- Printed Circuit Board
- Printed Circuit Board Pins

43. The +5V and 0V supply lines are taken off the respective pins of the memory board; the output from the page sequencer goes to the Page 1/Page 2 input of the memory board; the Field Drive is taken from its associated pin on the Sync Generator Board and the page sequencer disable and range select inputs are taken to the respective contacts on SW5, 6, 7 and 8.

This extra board can be mounted inside the Videowriter in any convenient position.

These two modifications complete the original article. Other add-on and interface units are under consideration and, subject to there being sufficient demand, will be published at a later date. 

Dear Sir,



Thermionic passion

Being a long-standing reader, and not too old to remember valves, I really must protest about the dismissal of the Good Old Valve. December issue letters raised my passion. I rarely write protest letters but Mr. Harcourt must surely remember the Coherer, this being one of the earliest forms of detector and non-semiconductor.

Mr. Hill should live surrounded by transmitters as I am. Radio 4 appears as 150mV of RF at the aerial and can be measured using a 20,000 Ω voltmeter in a tuned circuit. The poor transistor, be it unipolar or bipolar, just cannot stand the strain unlike the good old valve, which can be abused to a great degree before it gives up the ghost. Transistors and I.C.s die at the first spike or serious overload, but they still have their uses.

My final comments are that the valve will not be replaced for many years, and to this day there are jobs where the valve remains supreme master. Two examples are front-end stages of communications receivers and high power transmitters. Ask the Radio Amateurs! G. Sims (Derbyshire).

Powerful argument

With reference to Mr. Nuttall's comments in the November issue on your August Editorial, he complains of ignorance on your part, but what hypocrisy!

I refer Mr. Nuttall in the following to "Hi-Fi in the Home", by John Crabbe. (Never heard of it, Mr. Nuttall?)

The amount of power required by an amplifier in excess of 30W RMS has got very little to do with

headroom. It is a question of relating power to loudspeaker efficiency, equated to the volume of the listening environment. Up to 30W power should give plenty of headroom. If it doesn't, then turning down the volume on any amp will assist, and if the result is then lack of loudness and realism in the music, this is a sign that the amp—to speaker—to room conversion efficiency, is unbalanced. High power amps have uses, such as filling halls and auditoriums, but the myth that they are necessary to smooth reproduction all the time is a half-baked truth. Certainly they can help, but only when considering numerous other factors, such as the power supply, pre-amp overload, and speakers.

For the sound powers needed in all but the most exceptional domestic surroundings, the electrical power required from the amp depends mainly on speaker efficiency:- "The quantities of acoustic energy transmitted into the air in a normal sized room when reproducing orchestral music at a realistic loudness, are absolutely minute; a power level of about half of one acoustic watt representing the very maximum needed during peaks of the most enormous climaxes. But most loudspeakers are so inefficient that production of this $\frac{1}{2}$ W of sound output requires about 10W of electrical input. An electro-acoustic efficiency of 5 per cent".

I can assure Mr. Nuttall that low power amps are quite capable of Hi-Fi. If they are not, then it is not the power output availability which is failing, but rather pre-amp overload, transistor junction storage capability, rise-time and slow rate related to negative feedback. A 20W RMS amp with the correct degree of engineering will probably knock up 80W music power, which covers transient peaks quite effectively, other factors allowing. How the loudspeaker interprets this is another story again, depending on the thermal energy and general elasticity of the system amongst other factors.

The newer loudspeaker enclosures on the market are rarely above 2-3 per cent efficient throughout the whole audio bandwidth, so higher power amps are required. But not because they give more headroom, but because the speakers need on average a slightly higher drive level on

music content, all the time. Check the difference between old and new speakers.

So, Mr. Nuttall, although at certain peaks, muddiness does set in on Hi-Fi systems (in this you are right). You are not strictly correct in interpreting its cause. Lets face it Mr. Nuttall, any amp (even your Naim 160) of any power description, will cause its output transistor to bang its head against the power rail and say, "that's enough, no more" if driven hard enough. It's only good pre-amp engineering, transistor stage design and your hand on the volume pot which prevents this—and here we reach the crux, which was partly the point made in the August Editorial. Power transistors cost many pence, signal transistors (even low-noise ones) are comparatively cheap. This is why it is possible for a well designed amp of £30 to be well up in Hi-Fi quality.

My point is made Mr. Nuttall. Your view on power reminds me of the gentleman in the sports car who once said to me, he believed he went a lot, lot faster with the hood down!

Wake-up Mr. Nuttall, and when you do, try appraising what you read or hear a little, before criticising.—E. Hoskins, (Technical Director, CEH Audio-Visual Enterprises, Tonbridge).

Any ideas?

Being an "old timer" I have been a reader of Practical Wireless for many years and am particularly interested in the "Going Back" series. A hobby (or rather a hobby within a hobby) of mine is the rebuilding of pre-war and pre-1930 radio designs and I have accumulated a large amount of gear of this date. One snag is that loudspeaker and headphone magnets have nearly always seriously deteriorated in strength and despite the most thorough reading of technical books available, no worth while information is available on the remagnetisation of these components (I think mostly of balanced armature speakers). Do any PW readers know of literature that deals with this, or can supply any info. on this subject.—T. Howells, (Radio Officer, m/v Geestcrest, c/o Geest Industries, Barry Dock, Glamorgan).

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7403	18p	7417	40p	7440	30p	7471	30p	7493	45p	74123	75p	74142	32p	74157	100p	74175	100p	74191	160p
7404	25p	7420	18p	7441	70p	7472	70p	7494	35p	74125	70p	74143	32p	74158	120p	74176	130p	74192	130p
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7409	25p	7426	38p	7446	85p	7477	85p	7499	130p	74130	100p	74148	150p	74163	130p	74181	90p	74197	125p
7410	18p	7427	40p	7447	18p	7478	100p	7500	35p	74131	60p	74149	80p	74164	150p	74182	185p	74198	250p
7411	25p	7428	45p	7448	20p	7479	285p			74132	85p	74150	90p	74165	370p	74183	150p	74199	250p
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AC121	30p	BA154	12p	BC188C	15p	BC549B	13p	BF180	30p	BFX82	30p	OA10	40p	TIP30	55p	TIP42B	85p	2N2483	30p
AC126	19p	BA157	15p	BC190C	15p	BC549C	14p	BF181	35p	BFX85	30p	OA90	6p	TIP30A	58p	TIP295F	70p	2N2906	18p
AC127	19p	BA173	15p	BC171	12p	BC557	13p	BF182	30p	BFX87	25p	OA91	6p	TIP30B	65p	TIP3055	55p	2N2907	20p
AC127/01	25p	BA216	16p	BC172C	12p	BC574	80p	BF183	30p	BFX88	25p	OA202	8p	TIP30C	80p	TIS90	25p	2N3053	20p
AC128	18p	BA316	16p	BC178A	16p	BCV70	15p	BF184	25p	BFY50	20p	OC23	200p	TIP31	55p	TIS91	25p	2N3055	60p
AC151	25p	BA313	5p	BC182	10p	BCV71	20p	BF185	25p	BFY51	20p	OC25	100p	TIP31B	65p	IN914	5p	2N3439	50p
AC176	20p	BA318	5p	BC182L	12p	BCV72	15p	BF191	10p	BFY52	20p	OC28	75p	TIP31C	75p	IN3754	10p	2N3702	11p
ACV17	35p	BA305A	35p	BC183L	12p	BD123	100p	BF192	10p	BR101	35p	OC35	75p	TIP32	60p	IN4001	5p	2N3703	12p
AD127	30p	BB110	45p	BC183L	12p	BD131	36p	BF197	10p	BRY36	35p	OC42	75p	TIP32A	65p	IN4002	5p	2N3704	11p
AD149	80p	BC107	10p	BC184	10p	BD132	36p	BF199	25p	BRY56	35p	OC43	35p	TIP32B	85p	IN4003	5p	2N3705	11p
AD161	40p	BC108	10p	BC184L	12p	BD133	36p	BF199	25p	BSX20	20p	OC45	35p	TIP32B	85p	IN4004	5p	2N3706	11p
AD162	40p	BC108C	10p	BC186	24p	BD135	45p	BF200	30p	BSY40	25p	OC71	25p	TIP32C	90p	IN4005	5p	2N3711	12p
AD161/2M	90p	BC109	10p	BC205	14p	BD137	40p	BF201	30p	BSY45	20p	OC72	30p	TIP33A	105p	IN4006	6p	2N3715	12p
AF114	22p	BC109C	14p	BC212	11p	BD139	38p	BF202	20p	BT100A	80p	OC73	30p	TIP33B	115p	IN4007	7p	2N3722	175p
AF115	22p	BC117	19p	BC213L	12p	BD140	40p	BF244B	35p	BU133	75p	OC81	30p	TIP33C	130p	IN4148	4p	2N3819	25p
AF116	22p	BC125	20p	BC214	13p	BD181	80p	BF257	25p	BU208	220p	OC81D	25p	TIP34	115p	2N456A	90p	2N3866	95p
AF117	22p	BC126	15p	BC214L	14p	BD182	80p	BF258	28p	BY100	20p	OC83	30p	TIP34A	118p	2N697	15p	2N4062	14p
AF118	50p	BC146	12p	BC258	13p	BD207	70p	BF259	30p	BY129	15p	OC10	150p	TIP35	225p	2N929	20p	2N4126	20p
AF125	25p	BC147	10p	BC294	35p	BDY10	100p	BF274	15p	BY127	15p	OC171	40p	TIP35A	230p	2N930	20p	2N5061	35p
AF139	35p	BC148	10p	BC303	55p	BDY10	100p	BF274	15p	BY164	50p	OC200	80p	TIP35C	280p	2N1302	25p	2N5163	35p
AF238	45p	BC149	10p	BC317	15p	BDY62/01	30p	BF337	35p	BY164	50p	ORP12	70p	TIP36A	350p	2N1305	30p	2N6207	50p
ASV26	40p	BC157	10p	BC323	60p	BF120	50p	BF363	60p	BYX94	8p	R1039	150p	TIP41A	70p	2N1306	38p	25D234	50p
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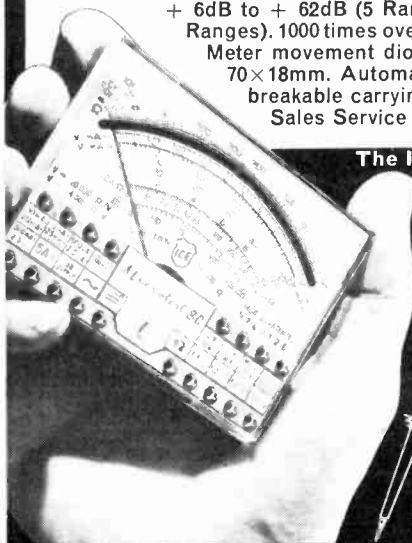
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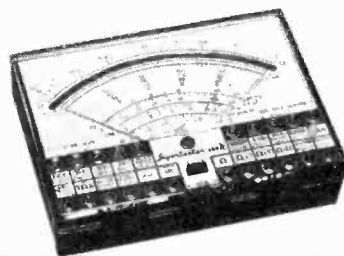
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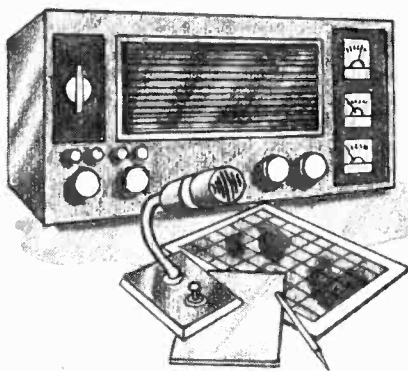
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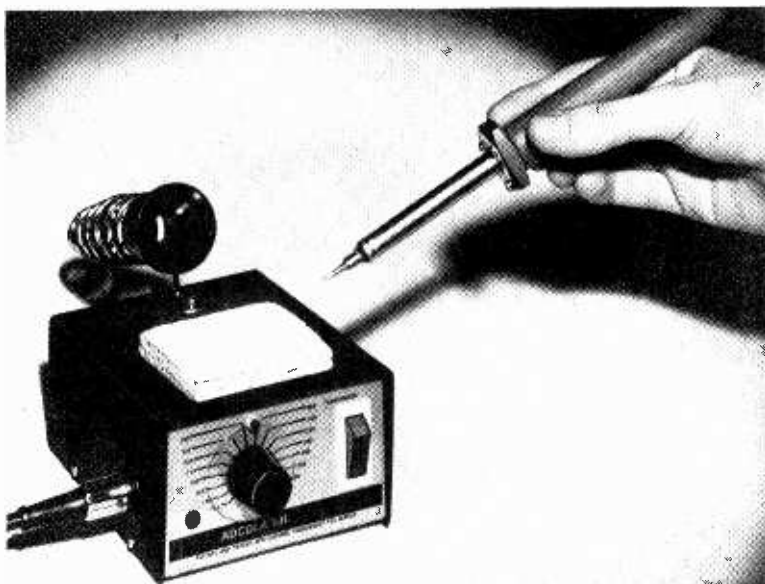
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Spot-on iron

I suppose there must be literally hundreds of soldering irons of one kind or another available in the UK at this very moment. Of course the cheap iron that is thrust upon an unsuspecting constructor, accompanied with the words 'psst—wanna buy a cheap iron guv' is little better than useless. A good maxim when looking for an iron is the one that says 'you pays yer money and takes yer choice', and although the latest iron from Adcola is a little on the expensive side, it could be argued that it is simply one of the best irons available to the general public.

Incorporating a thermocouple at the rear of the soldering bit, which then feeds an Op. amp and other circuitry, the temperature can be kept within $\pm 2\%$ of the indicated dial temperature which is 120°C to 420°C . Heating time from a cool 24°C up to a blistering 420°C is claimed to be less than 2 minutes, while at any temperature the handle stays cool and comfortable for the user.

Operating from a 24V toroidal transformer, this 50W, Unit 101 soldering station carries a price tag of £36.75.

Further information from Adcola Products Ltd., Adcola House, Gauden Road, London, SW4.

Space age tape

'Enough to go to the Moon and back 24 times' is the claim put forward by AMSA Magnetics, who further claim to be the largest manufacturer of cassette tape in the world. Realising the enormous potential of the UK market, they have launched a new range of cassettes which are said to be of a very high quality and feature a specially developed jam-proof mechanism—Paraflo guides.

The range of cassettes available are Standard—a quality low noise tape with a permanent head cleaner

leader. Extra—available in C66 or C99 lengths and featuring the new Paraflo guides and head cleaner Leader. Super—Ferric Oxide tape, and XHE—the top of the range tape containing Magnalinc™ Ferric Oxide which is claimed to give a superior S/N ratio and good frequency response. The XHE cassette also features instant-start recording and a jamfree mechanism. Prices range from 89p for a standard C-60 to £2.65 for a C-120 XHE.

AMSA Magnetics, 121 Loverock Road, Reading, Berks.

implies, a lightweight carrier fitted with a velvet pad and cleaning brush, automatically tracks parallel across the record, silently, at the same speed as the pick-up arm.

The Groov-Kleen is supplied with



cleaning brush, a spare tracking brush plus velvet pad, together with spare self-adhesive base pads.

Price of this new Bib accessory is £3.97 and can be obtained from all good audio shops. Bib HiFi Accessories, PO Box 78, Hemel Hempstead, Herts. Tel: 0442 61291.

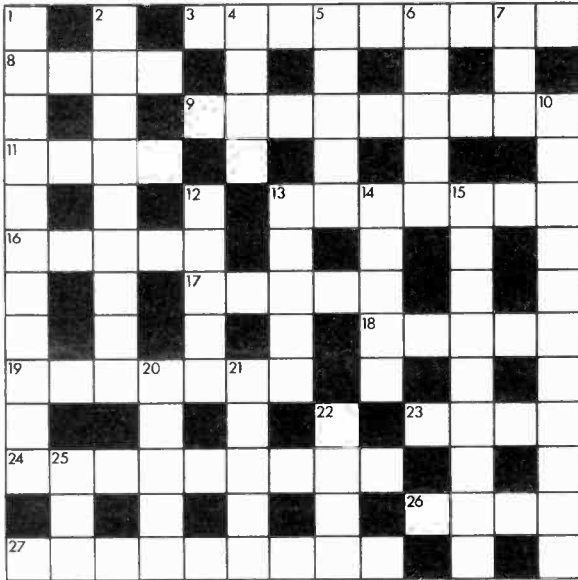


Keep-it-kleen

Record cleaners tend to follow much the same lines these days, with the designs based loosely on the pick-up arm. In an endeavour to get away from this standard design, Bib have introduced a new parallel tracking record cleaner, called the Groov-Kleen 101.

As the name of this new cleaner

PW TECHNICAL CROSS PUZZLE No. 18



ACROSS

- 3 Only one part of the set (9)
- 8 A circuit-breaker misses a turn on it? (4)
- 9 Type of receiver for dance or brass enthusiasts? (9)
- 11 Answer distortion pique out east? (4)
- 13 Repro blemish that needs solving inside? (7)
- 16 Choose to add Ron to the energetic unit? (5)
- 17 Turn in on cell starter for lightweight set? (5)
- 18 Does without a diode use to say goodbye? (5)
- 19 Lacking outside interference in pastoral areas (7)
- 23 Neat oscillator with a heat generator? (4)
- 24 Microphone with an illegal bar? (9)
- 26 Only a saint understands this circuit! (4)
- 27 It gives you a measure of power (9)

DOWN

- 1 How often are they very high? (11)
- 2 Harshness in the reception area? (9)
- 4 The load we are carrying? (4)
- 5 Oriental in part assembly for Dad? (5)
- 6 Not a shilling Scottish audio for an Indian? (5)
- 7 Two-way system for a dedicated lady? (3)
- 10 Equipment said to make you old-fashioned anon? (11)
- 12 Tax for a broken coral circuit? (5)
- 13 Fear copper casing of Ian's rectifier? (5)
- 14 A lot of water from one A.C. vibrator? (5)
- 15 Live modulator at hand endlessly in a big vessel (9)
- 20 Swapped tales of miniaturization? (5)
- 21 Mrs Forsyte in the wire network? (5)
- 22 Coast-to-coast hook-up excludes it? (4)
- 25 He's no ham! (3)

**FOR AMUSEMENT ONLY
ANSWERS NEXT MONTH**

HERE IT IS!

● Your first Info-Card, presented free this month, is designed to be used flat, or folded as shown here.



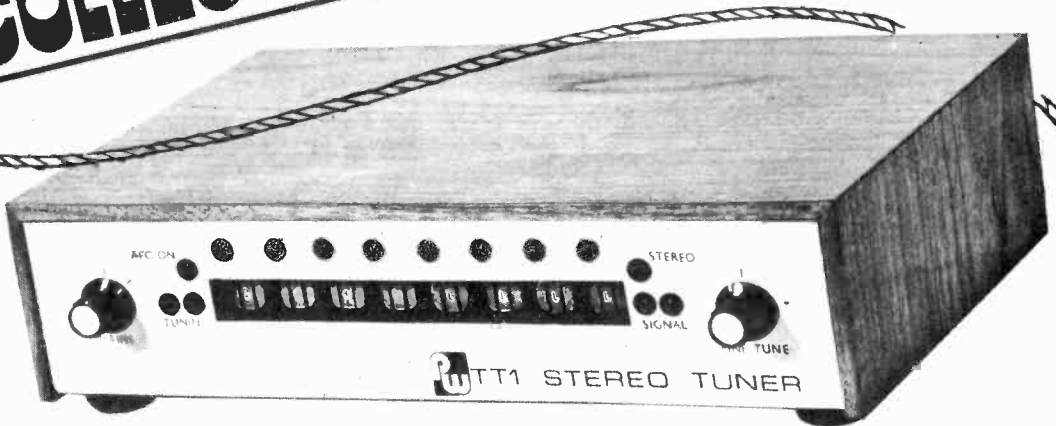
● When folded it fits into almost any pocket thus providing a readily accessible source of information when buying resistors and capacitors. Check the wattage rating of resistors by comparing them with the full size drawings.



● Do you wonder what nanofarad or nF means? It's all explained on the PW Info-Card for Capacitors and Resistors.

Our **PW** 
'SPRING COLLECTION'

**IN NEXT MONTH'S
 PRACTICAL
 WIRELESS**



**FM
 STEREO TOUCH TUNER
 (PART 2)**

If Part 1 of this project on page 940 has excited your interest then make sure that you order the April issue which will contain details of the remaining PCB's plus assembly and alignment information.



**SMOKE
 SENSOR
 ALARM**

TUG-O-WAR



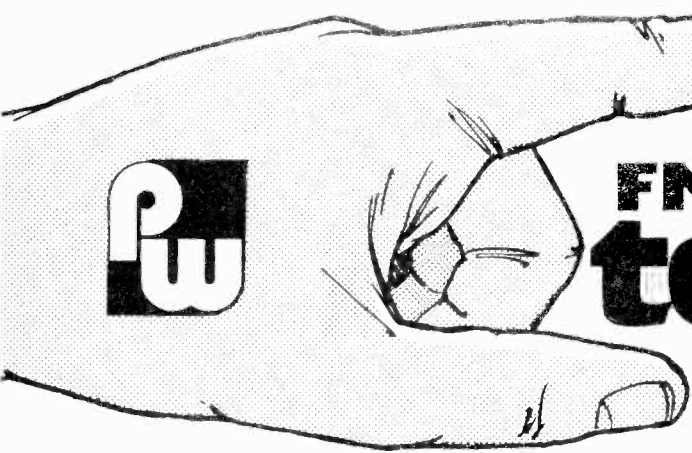
It's usually a game reserved solely for those muscular, hairy he-men, but now you ordinary mortals have a chance to take part in PW's latest electronic game—Tug 'O' War.

This project incorporates a sensor unit sensitive to many different gases and to smoke. A sensitivity control sets the level at which the audio alarm is triggered. Can be run from a 12 volt battery or the mains.

**PLUS ALL THE
 REGULAR FEATURES**

**ON SALE IN
 MARCH**

WHILST touch selection of preset stations is not uncommon on modern TV sets, such a method of tuning has yet to make an impact in the FM tuner market. The tuner to be described is therefore unusual in that it possesses just this feature. Any one of eight pre-tuned stations may be selected simply by touching the appropriate "button" on the front panel. The tuner also has stereo defeat, mute and automatic frequency control functions and the required combination of these is set up for each station by a pre-arrangement of diodes inserted in two dual-in-line sockets. Thus when a station is



FM STEREO touch tuner

selected, the desired associated set of functions is also switched in.

The tuner itself makes use of fairly orthodox circuitry, using for the most part readily available integrated circuits and a Mullard tunerhead. Light emitting diodes are used to give indications of the station selected, tuning accuracy and signal strength, the presence of a stereo transmission and whether the AFC circuitry is operative or not.

Fig. 1 shows the power supply, which uses two 723 IC regulators. The main power supply rail should be set to about 12V. The tuner will work with anything between about 9 and 14V, but for a variety of reasons, the figure quoted is the most suitable. When a strong signal is being received, and consequently several LEDs are on, current consumption rises to about 200mA; under no-signal conditions it is only 70mA. The tuning voltage is obtained from a separate regulator, IC2. The touch selection ICs require a tuning supply at least 2V higher than the main voltage, and a value of about 17.5V is chosen. Both supplies include current limiting protection and the main power supply uses a power transistor, Tr1,

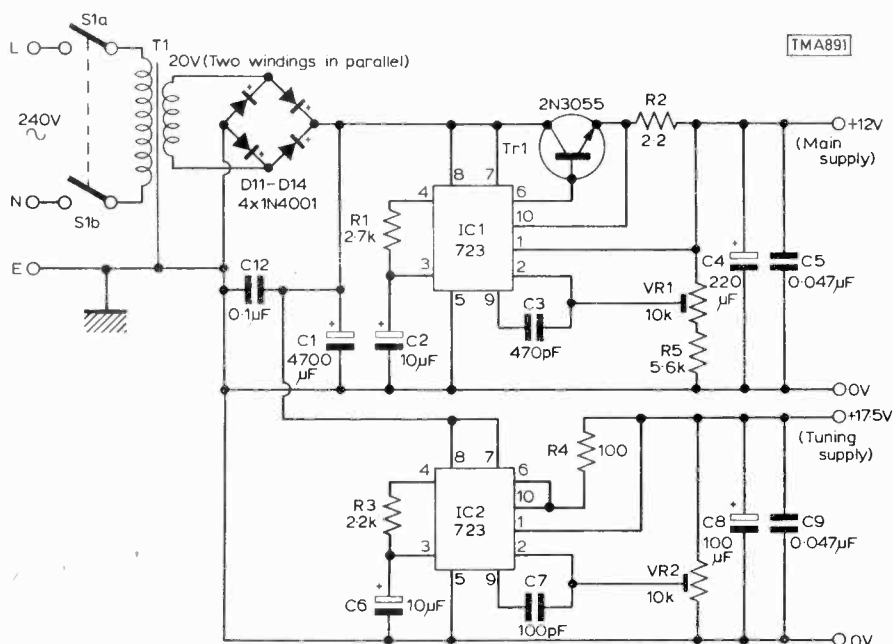


Fig. 1: The power supply section of the tuner provides two regulated voltages, one for the tuning circuitry only and the other for the remainder of the tuner requirements.

Fig. 2: Circuit of the tuner proper comprising the tunerhead, IF amplifier IC3, demodulator IC4, stereo decoder IC5 and the audio output filter.



er

Part 1 FRANCIS HOW (B.A. Cantab)

to dissipate the heat generated in dropping the voltage.

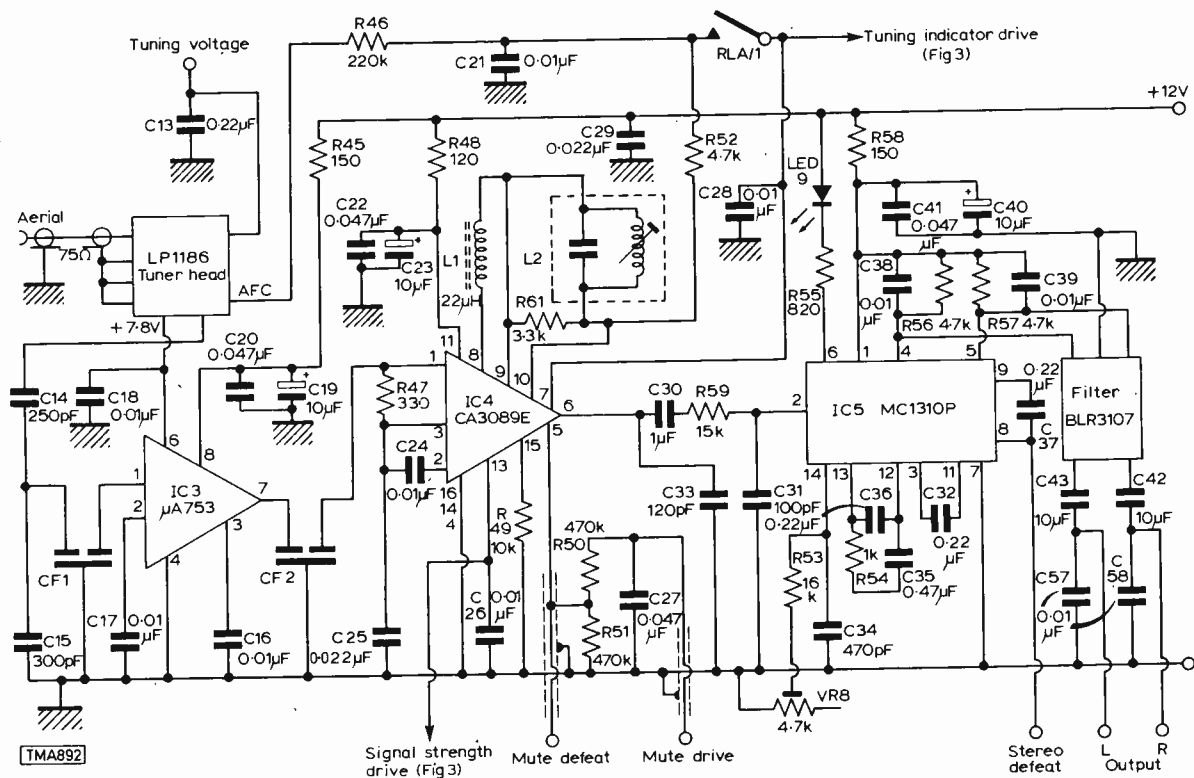
TUNER-IF-AFC

The circuitry for the radio part of the tuner is shown in Fig. 2. The tunerhead is a Mullard LP1186 module which is prealigned and provides a partially filtered IF output of 10.7MHz. This avoids one of the

most difficult problems of FM tuner construction, namely that of designing a good, trouble-free RF amplifier and frequency changer. IC3 is an IF amplifier designed particularly for use with ceramic filters (CF1 and CF2) in the configuration shown, having suitable matching impedances of 330Ω. It has two outputs of differing levels, and here it is quite sufficient to use the lower one (pin 7). The device has a useful additional feature in that pin 6 provides a stabilised DC voltage of 7.8V suitable for driving the tunerhead.

In the prototype CFSA10.7 ceramic filters were used; if however it is intended to use the tuner for long range reception where it may be rather trying to separate stations less than about 300kHz apart it may be worthwhile paying a little more for Vernitron FM4 filters. These have a better out-of-band performance and will make the receiver less susceptible to heterodyning of adjacent station signals (which have leaked through the system) with any stereo pilot tones present, producing annoying chirping in the output.

The well-known CA3089E (IC4) is employed to demodulate the filtered IF signal and a single-tuned detector coil (L2) simplifies alignment of this stage. The IC provides an AFC voltage on pin 7. When the AFC is switched on this voltage is fed via reed relay contact RL1 to the local oscillator in the tunerhead. When off, the oscillator is left tied only to the reference voltage on pin 10 via R52. The tuning indication voltage is also obtained from pin 7, and a signal strength indication from pin 13. The IC also includes a muting circuit which cuts off the audio output in the absence of a signal of sufficient strength. In this instance it is not possible to drive the mute logic (input on pin 5) from the internal



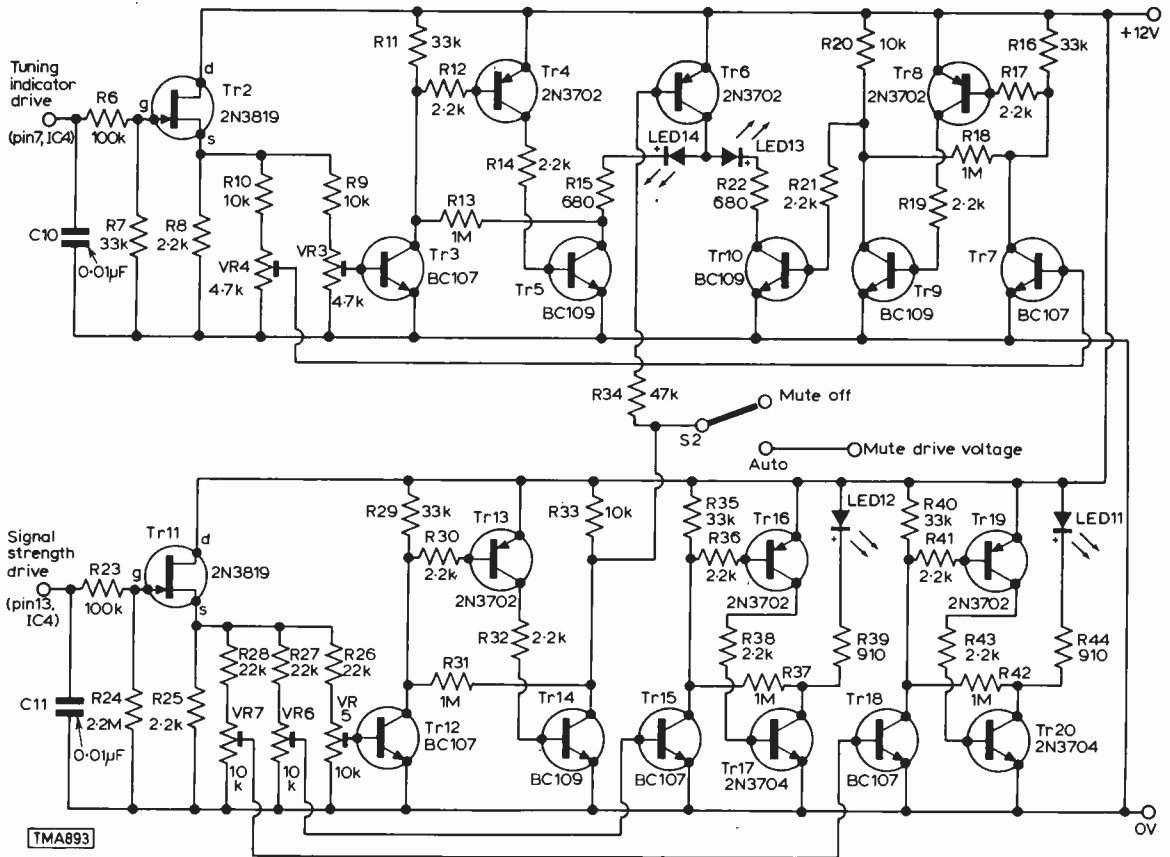


Fig. 3: Tuning indicator circuit including the LED tuning indicators is at the top with the signal strength and associated LEDs at the bottom.

mute drive voltage (pin 12) because the stability of this voltage is upset by the use of a high gain IF stage preceding IC4. Pin 5 is therefore driven by an externally derived voltage.

STEREO DECODER

The stereo output from IC4 (in its multiplexed form) is fed to the stereo decoder MC1310P (IC5) via C33, C30, R59 and C31 which produce a high frequency roll-off to help prevent leakage of adjacent station signals to the decoder (as mentioned before). This filter is not chosen for a -3dB point at 55kHz (the ideal situation) as this tends to diminish the stereo separation. More complicated circuitry would be needed to prevent the leakage and still maintain the full 53kHz bandwidth occupied by the two channels.

The decoder is a phase-locked loop system and the only adjustment required is alteration of the internal oscillator by VR8 until the device captures and demultiplexes the incoming signal. The decoding action can be defeated by earthing pin 8, and the means of doing this will be shown later. The output is fed to a DIN socket via the filter module BLR3107. This unit severely attenuates the 19kHz and 38kHz pilot and multiplex frequencies in the output. If this were not done the frequencies might cause disastrous whistling and howling when recording from the tuner by mixing with the tape head bias frequency. The presence of a stereo signal is indicated by the illumination of the beacon, LED9. Capacitors C57 and C58 are inserted to balance to audio output. The filter

should be terminated with $4.7\text{k}\Omega$ resistors but a better tonal quality was obtained with the arrangement shown. The reader may wish to alter this to suit himself or his amplifier!

TUNING INDICATORS

A pair of LEDs is used to indicate the tuning accuracy. When properly adjusted both lights will come on, and as the receiver is de-tuned one way or the other, will be extinguished depending upon the direction of de-tuning. Similarly the signal strength is indicated by a pair of LEDs. Under good signal conditions both will be on, but only one or neither for weaker signals. With zero or extremely weak signal reception the tuning LEDs will also be extinguished. Most LED tuning indicators of the type described use a long-tailed pair, but the switching of the lamps by this circuitry is not particularly sharp.

The author preferred indicators with a sharp on/off action, and to this end a voltage level detector circuit was designed with low hysteresis but a sharp transition. The basic unit is used five times in the indicator circuitry, Fig. 3. Each is fed by one of two FET buffers via a preset potentiometer (VR3-VR7) which determines the switching level of the circuit. Circuit action is fairly straightforward, the $1\text{M}\Omega$ resistors introducing a small amount of positive feedback to sharpen the switching action.

The top half of the circuit shows the tuning indicator drive. It will be seen that the second level detector contains an extra transistor, Tr10. This

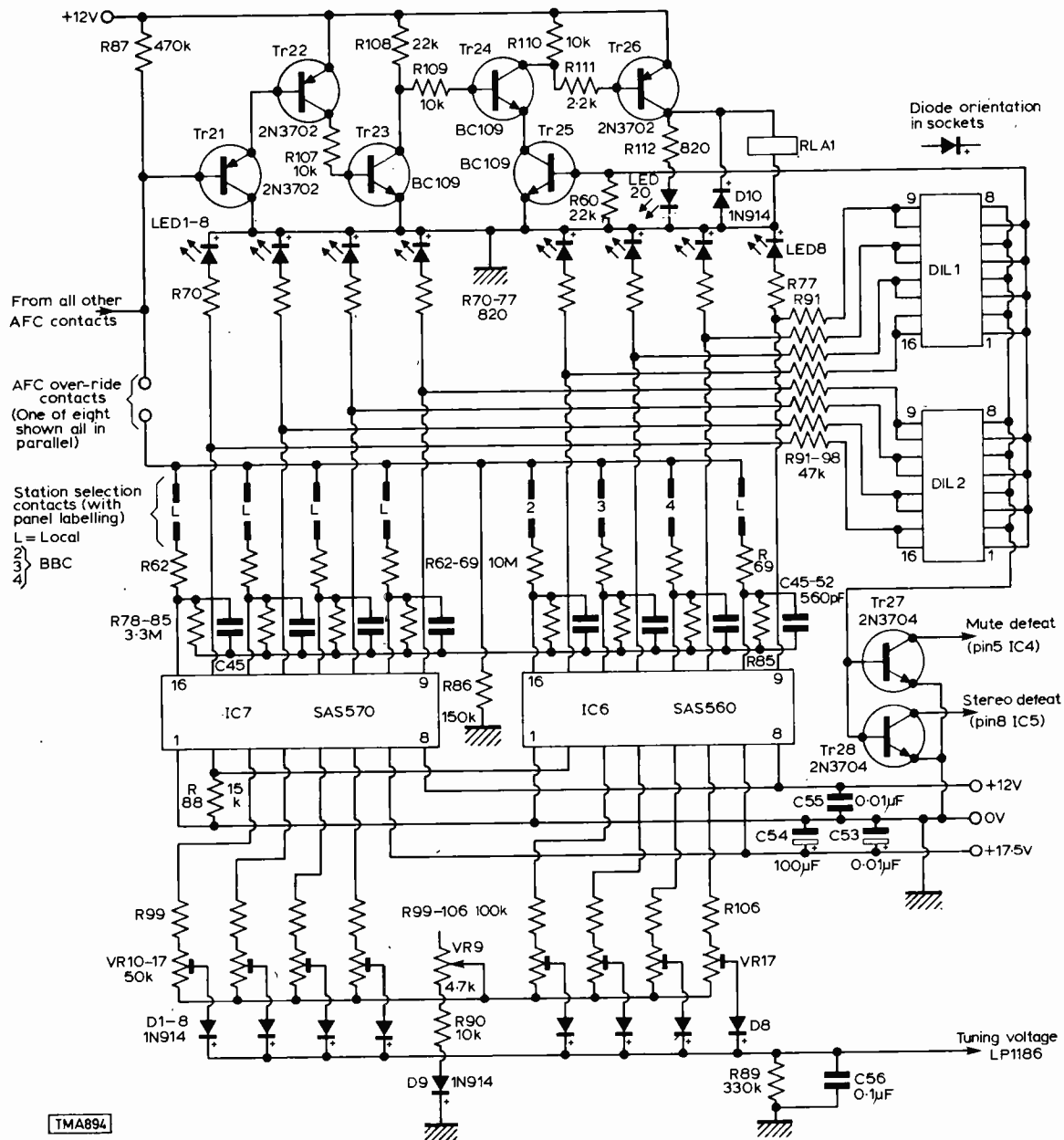


Fig. 4: All the circuits of Figs. 1, 2 and 3 are mounted on the main PCB. The eight touch buttons and the touch selection circuit shown above are mounted on two smaller boards mounted behind the front panel.

inverts the action of that circuit so that the system as a whole acts as a window voltage detector, providing indications as to whether the tuning indicator drive voltage from pin 7 on IC4 is above, below, or in the window. Only in the latter state is the tuner correctly tuned to a station. Tr6 is driven by a signal strength level detector from the bottom half of the circuit so that when that detector is switched off, Tr6 is off and both tuning LEDs are extinguished. This circuit also provides the mute drive voltage mentioned earlier. When Tr14 is on the mute drive falls to about 1V and the audio is not attenuated. S2 is fitted to the rear of the tuner chassis and may be switched either to auto (when the mute action is as described) or to "mute off" when the audio output is never attenuated, regardless of the signal

conditions. The other two level detectors in the bottom half of Fig. 3 provide the signal strength drive to LEDs 11 and 12.

TOUCH SELECTION

All the circuitry so far described is mounted on PCB1 (Figs. 5a and 5b) which lies flat in the bottom of the chassis. Two more PCBs house the touch selection circuitry and they are mounted vertically, just behind the front panel and about 1/4 in. apart. PCB3 is nearer the panel and on this are etched the eight touch "buttons", PCB2, behind PCB3, houses all the circuitry shown in Fig. 4, namely the touch selection ICs, the tuning presets and the AFC over-ride circuitry.

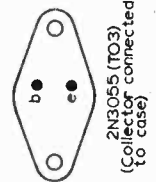
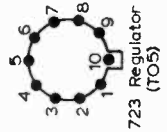
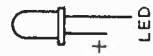
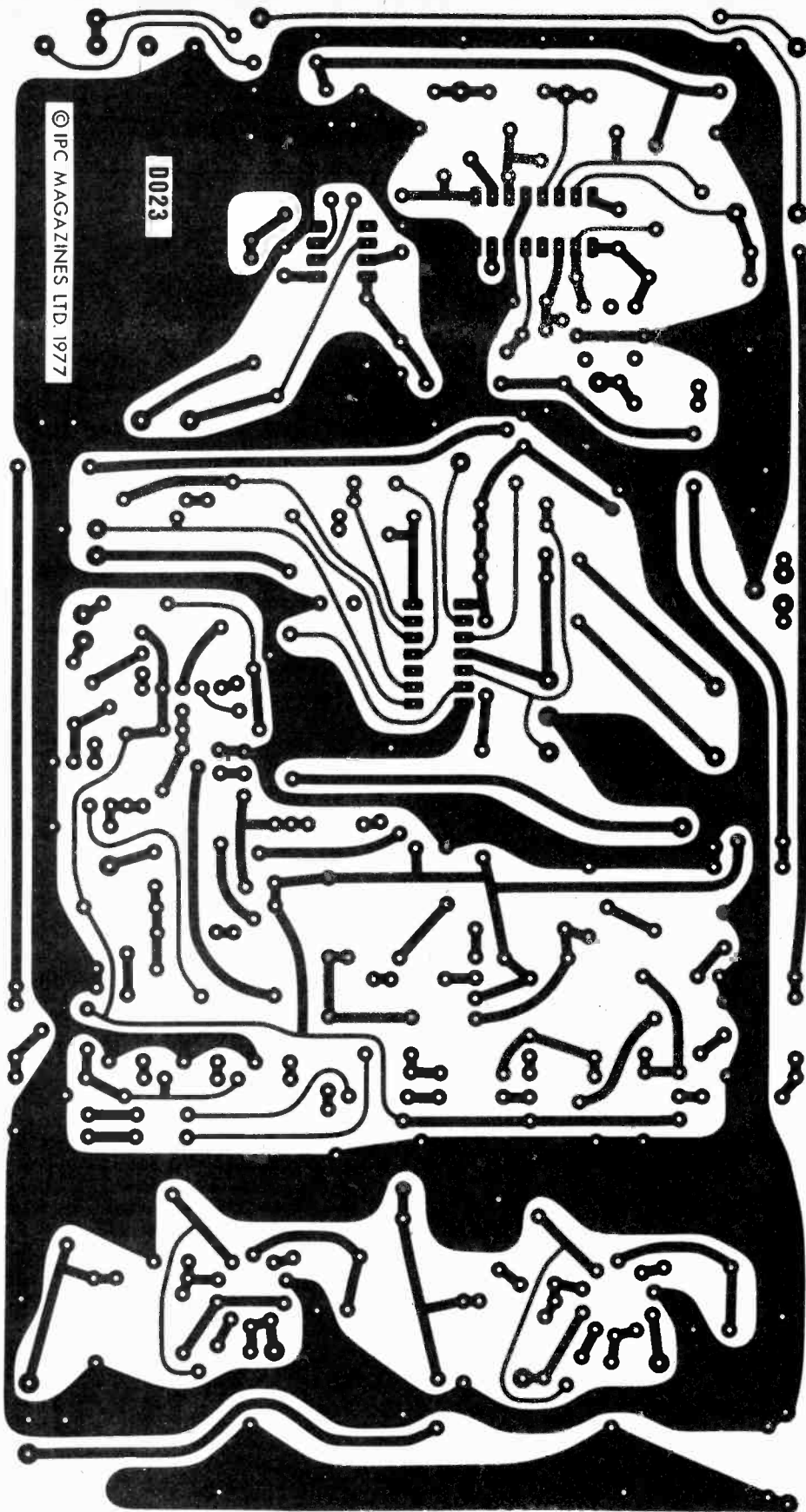
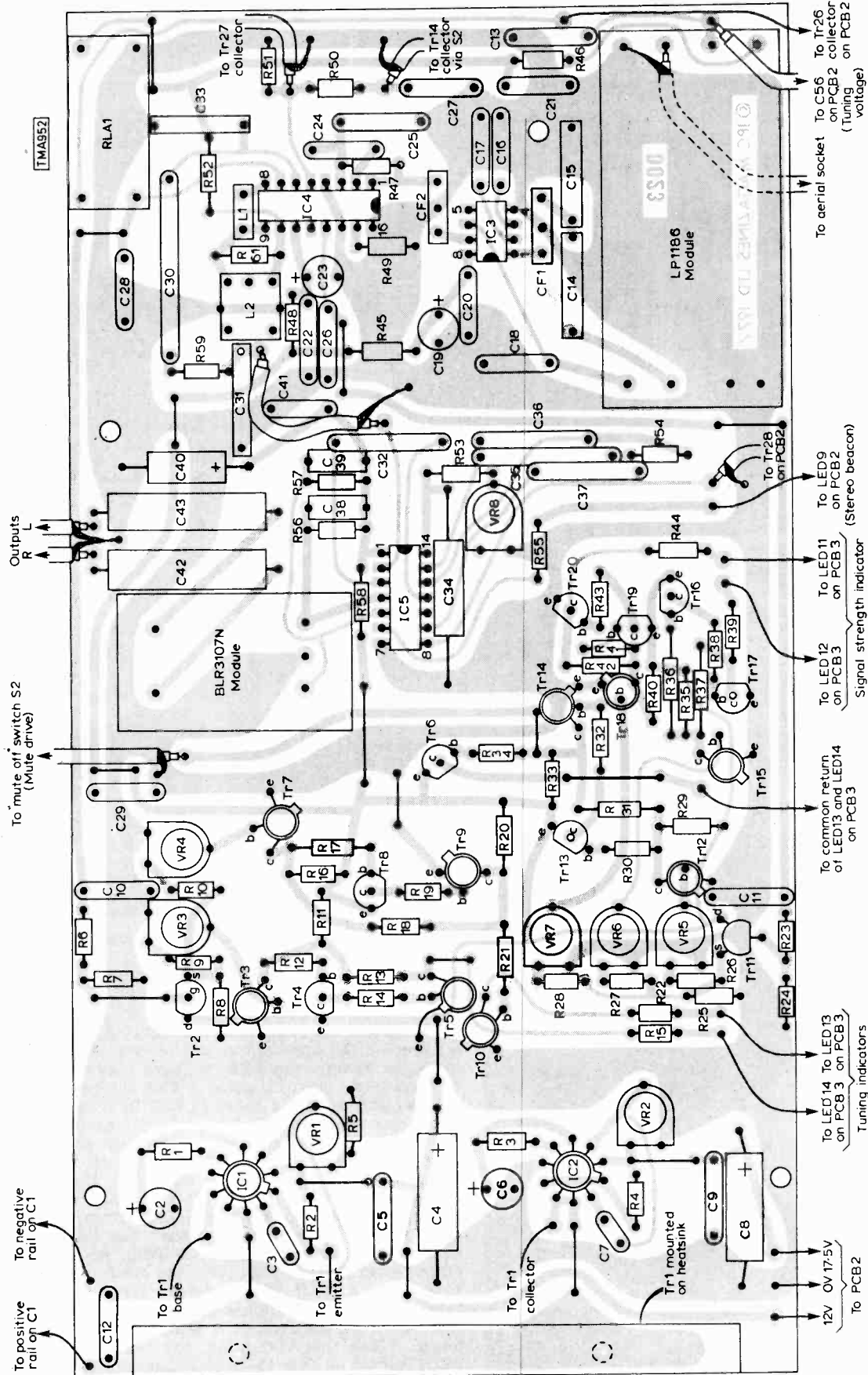


Fig. 5a: The foil layout for the main board PCB1 is shown here full size together with the leadout identification for the transistors, voltage regulators and LEDs.



ling this PCB. Care must be taken if using a reed relay other than the one shown to ensure that the contacts of the relay and the operating coil connections go to the correct points on the PCB.

Fig. 5b: Component layout on top of the main PCB. Details of the Tr1 heatsink and reed relay assembly will be shown next month. The IF filters CF1 and CF2 may be mounted either way round. Reference to the photograph of the tuner on page 947 may be helpful when assembling this PCB.

★ components list

Resistors

R1 2.7kΩ	R27 22kΩ	R53 16kΩ
R2 2.2Ω(½W)	R28 22kΩ	R54 1kΩ
R3 2.2kΩ	R29 33kΩ	R55 820Ω
R4 100Ω	R30 2.2kΩ	R56 4.7kΩ
R5 5.6kΩ	R31 1MΩ	R57 4.7kΩ
R6 100kΩ	R32 2.2kΩ	R58 150Ω
R7 33kΩ	R33 10kΩ	R59 15kΩ
R8 2.2kΩ	R34 47kΩ	R60 22kΩ
R9 10kΩ	R35 33kΩ	R61 3.3kΩ
R10 10kΩ	R36 2.2kΩ	R62—R69 10MΩ
R11 33kΩ	R37 1MΩ	R70—R77 820Ω
R12 2.2kΩ	R38 2.2kΩ	R78—R85 3.3MΩ
R13 1MΩ	R39 910Ω	R86 150kΩ
R14 2.2kΩ	R40 33kΩ	R87 470kΩ
R15 680Ω	R41 2.2kΩ	R88 15kΩ
R16 33kΩ	R42 1MΩ	R89 330kΩ
R17 2.2kΩ	R43 2.2kΩ	R90 10kΩ
R18 1MΩ	R44 910Ω	R91—R98 47kΩ
R19 2.2kΩ	R45 150Ω	R99—R106 100kΩ
R20 10kΩ	R46 220kΩ	(2%)
R21 2.2kΩ	R47 330Ω	R107 10kΩ
R22 680Ω	R48 120Ω	R108 22kΩ
R23 100kΩ	R49 10kΩ	R109 10kΩ
R24 2.2MΩ	R50 470kΩ	R110 10kΩ
R25 2.2kΩ	R51 470kΩ	R111 2.2kΩ
R26 22kΩ	R52 4.7kΩ	R112 820Ω

All resistors ½W 5% carbon except where indicated otherwise.

VR1, VR2 10kΩ pre-set	VR9 4.7kΩ lin. carbon pot.
VR3, VR4 4.7kΩ pre-set	VR10—VR17 20-turn cermet trimpots all 50kΩ.
VR5—VR7 10kΩ pre-set	
VR8 4.7kΩ pre-set	Presets are miniature type, horizontal mounting.

Capacitors

C1 4700μF 40V	C27 0.047μF*
C2 10μF 25V	C28 0.01μF*
C3 470pF ceramic plate	C29 0.022μF*
C4 220μF 25V	C30 1μF*
C5 0.047μF*	C31 100pF mica
C6 10μF 25V	C32 0.22μF*
C7 100pF ceramic plate	C33 120pF mica
C8 100μF 25V	C34 470pF polystyrene
C9 0.047μF*	C35 0.47μF*
C10 0.01μF*	C36 0.22μF*
C11 0.01μF*	C37 0.22μF*
C12 0.1μF*	C38 0.01μF*
C13 0.22μF*	C39 0.01μF*
C14 250pF mica	C40 10μF 25V (axial leads)
C15 300pF mica	C41 0.047μF*
C16 0.01μF*	C42 10μF non-polarised 25V
C17 0.01μF*	C43 10μF non-polarised 25V
C18 0.01μF*	C45—C52 560pF ceramic plate
C19 10μF 25V	C53 0.01μF*
C20 0.047μF*	C54 100μF 25V
C21 0.01μF*	C55 0.01μF*
C22 0.047μF*	C56 0.1μF*
C23 10μF 25V	C57 0.01μF*
C24 0.01μF*	C58 0.01F*
C25 0.022μF*	
C26 0.01μF*	

* C280 polyester. C44 is omitted

A set of three PCB's can be obtained from the PW Readers PCB Service, see ad. on page 956. Semiconductors are available from Chromasonic Electronics, A Marshall Ltd., Watford Electronics, etc.

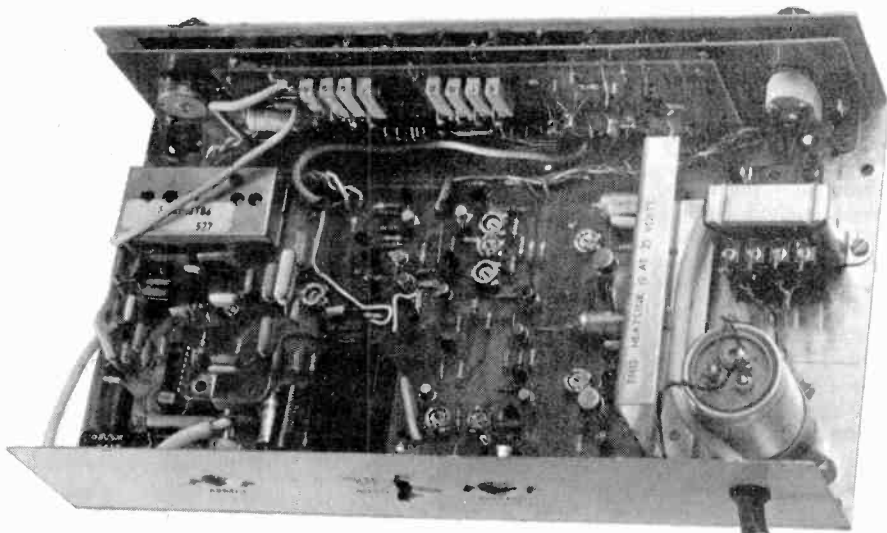
Semiconductors

IC1 } 723 regulators	Tr15 BC107
IC2 } (TO5 can)	Tr16 2N3702
IC3 μA753	Tr17 2N3704
IC4 CA3089E	Tr18 BC107
IC5 MC1310P	Tr19 2N3702
IC6 SAS560	Tr20 2N3704
IC7 SAS570	Tr21 2N3702
	Tr22 2N3702
Tr1 2N3055	Tr23 BC109
Tr2 2N3819	Tr24 BC109
Tr3 BC107	Tr25 BC109
Tr4 2N3702	Tr26 2N3702
Tr5 BC109	Tr27 2N3704
Tr6 2N3702	Tr28 2N3704
Tr7 BC107	
Tr8 2N3702	
Tr9 BC109	D1 to D10 1N914
Tr10 BC109	D11 to D14 1N4001
Tr11 2N3819	
Tr12 BC107	LED1 to LED14 (GP, 0.2" red, with clips)
Tr13 2N3702	Diodes for D1L
Tr14 BC109	Sockets:—1N914's

Miscellaneous

Tunerhead, (Mullard LP1186).	S2, Switch, SP on-off, miniature slide.
L1, 22μH choke (Ambit)	Coaxial socket.
L2, 10.7MHz tuned circuit type KACSK-586HM (Ambit)	DIN socket, 5-pin 180°.
RLA Relay, reed type miniature, 12V 1kΩ, normally open.	Aluminium sheet, 18SWG
Pilot filter, type BLR-3107 (Ambit).	300 x 180mm (11½ x 7¼in.)
CF1, CF2, IF Filters CFSA10.7 (Ambit) specify colour code as 'blank', or Vernitron FM4 (Home Radio).	300 x 90mm (11½ x 3½in.)
T1, mains transformer 240V/0.20V + 0.20V 150mA (6VA). (Doram 980-704).	Mounting clip, vertical, for C1.
S1, Switch, DP mains on-off, rotary.	Mains cable and grommet.
	Plywood and veneer for sleeve.
	Rubber feet, 4 off.
	Panel knobs, 2 off.
	Angle brackets for sleeve, 6 off.
	D1L1, D1L2 16-pin IC sockets.

Construction of the touch selection unit is simplified by the use of two ICs, SAS560 and SAS570, Fig. 4, which are purpose-built for this type of application. They have four high impedance inputs and provide the same number of tuning voltage and LED drive outputs. Any one station is selected by placing a finger on the appropriate pair of contacts, whereupon the tuning and LED voltages appear at the corresponding pins. By using a high tuning voltage (17.5V) and dropping resistors R99 to R106, a fine tune control VR9 on the front panel can be incorporated so that it gives approximately the same range of adjustment at the extremes of the FM broadcast band. Diodes D1 to D8 ensure that those tuning presets (VR10 to VR17) not being fed with the tuning supply voltage are isolated from the one which is. Each electronic "button" has three contacts; one is an earth link (via R86), one is connected to an input on IC6 or IC7 and one is connected to the base of Tr21. This transistor forms the input to a circuit which switches out the AFC (assuming it is on) when the contact is bridged to earth by a finger. When the AFC is on, the tuning indicator LEDs remain on over the whole range for which the



General view inside the finished Touch Tuner. The two PCBs behind the panel carry the touch buttons and selection circuits. The tunerhead is at top left with the audio output filter at bottom centre. At the right is the Tr1 heatsink, mains transformer and smoothing capacitor.

COLLATED COMPONENTS LIST

Resistors $\frac{1}{4}$ W 5% carbon, ex 2-2 Ω

2-2 Ω $\frac{1}{4}$ W	1	2-7k Ω	1	100k Ω 2%	8
100 Ω	1	3-3k Ω	1	100k Ω	2
120 Ω	1	4-7k Ω	3	150k Ω	1
150 Ω	2	5-6k Ω	1	220k Ω	1
330 Ω	1	10k Ω	9	330k Ω	1
680 Ω	2	15k Ω	2	470k Ω	3
820 Ω	10	16k Ω	1	1M Ω	5
910 Ω	2	22k Ω	5	2-2M Ω	1
1k Ω	1	33k Ω	6	3-3M Ω	8
2-2k Ω	15	47k Ω	9	10M Ω	8

Pre-set pots, miniature, horiz.

4-7k Ω	3	10k Ω	5
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Pot. linear carbon

4-7k Ω	1
---------------	---

Trimpot, 20 turn Cermet

50k Ω	8
--------------	---

Capacitors

Mica					
100pF	1	0-1 μ F	2		
120pF	1	0-22 μ F	4		
250pF	1	0-47 μ F	1		
300pF	1	1 μ F	1		
P'sty		Elec			
470pF	1	10 μ F 25V	5		
Ceramic		10 μ F 25V			
100pF	1	NP	2		
470pF	1	100 μ F 25V	2		
560pF	8	220 μ F 25V	1		
C280		4700 μ F 40V	1		
0-01 μ F	15				
0-022 μ F	2				
0-047 μ F	6				

Semiconductors

IC's					
723 (T05)	2	2N3819	2		
μ A753	1	BC107	5		
CA3089E	1	BC109	7		
MC1310P		LED GP 0-2" Red			
SAS560	1	wlth clip	14		
SAS570	1				
Tr's		Diodes			
2N3055	1	1N914	10+		
2N3702	9	1N4001	4		
2N3704	4				

station is pulled into tune. Thus to tune the station accurately the AFC must be temporarily defeated, and this is a convenient way of achieving it.

We now come to the two DIL sockets, Fig. 4. Conventional tuners have a row of switches on the front panel, controlling the action of such functions as the stereo defeat, the mute circuitry and the AFC. This tuner is exceptional in that the desired combination of these functions is preset for each station by the insertion of diodes in DIL1 and DIL2. Thus the desired arrangement is automatically switched in when the station is selected. So for Radio 2 (the station labelling is located between electrodes on Fig. 4) LED5 is illuminated; by connecting a diode across pins 1 and 16 on DIL 1 the AFC may be switched in for that station, providing base drive to Tr25 and to defeat the stereo and mute action a diode would be inserted across pins 2 and 15. Similarly diodes may be connected for other stations.

The mute and stereo defeat circuitry always act together since it is rare to require one without the other. Tr27 shorts pin 5 on IC4 to earth when turned on thus switching the mute circuit off, and likewise Tr28 shorts pin 8 on IC5 to earth which inhibits the decoding action of the stereo de-multiplexer IC.

It might be suggested that if tuning is all preset, there is no need for a mute circuit. However, when actually tuning, the interstation noise is very loud and best removed, in this case by the mute action. Secondly, when a station goes off the air that channel then is silent instead of producing 200mV of noise (unless of course the station is so weak that the mute had to be defeated to hear it).

IN PART 2, NEXT MONTH, WE DESCRIBE THE 'BUILD AND TEST AS-YOU-GO' PROCEDURE FOR CONSTRUCTING AND ALIGNING THE TOUCH TUNER. PLUS DETAILS OF THE BOARDS PCB2 AND PCB3 AND GENERAL ASSEMBLY INFORMATION

HOTLINES

ON RECENT DEVELOPMENTS

The melting pot

Things are hotting up in the solar energy field. Latest method is the subject of patents and looks quite ingenious. With a solar cell, sunlight is converted direct into electrical energy. In this newer approach, the sunlight is converted into electricity by chemical means.

First step is to take a solar furnace (a suitable container with a dirty great lens focussing the sun's rays into the centre of it). Into this furnace is pumped some stuff called Sulphur Trioxide—chemically educated associates tell me that it's also known as SO_3 .

The Sulphur Trioxide gets hot and absorbs heat, and as it does so it separates by a process called dissociation. By persuading the separated parts to pass through another chamber, they recombine to form Sulphur Trioxide again but in the process they give up the heat. The Sulphur Trioxide, now recombined and happy with life, is simply pumped back into the solar furnace for the next round of heat absorption and transfer.

Boom boom boom boom— SO_3 .

Ion bullets

Remember Jan's story about I²L, well I see that this new process involves a thing called ion implantation. To achieve this, the semiconductor substrate is prepared and set up inside a chamber. Then ions, tiny particles of the desired impurity, are 'fired' by an electronic machine gun at the substrate. If you were to look at the whole shooting match under a "times umpteen million" microscope, you'd see the lattice structure of the atoms in the substrate surface. And along, at great speed, would come these ions. Depending upon how you angle the substrate and thereby the lattice, will depend on whether the ions go straight into the lattice without striking any of the individual member atoms which make up this lattice, or whether the ions will collide with lattice atoms. If they do they will be slowed down and will not penetrate so far into the substrate. Thus

ion implantation is a very precise method of doping semiconductors and this process is used in the manufacture of this new I²L. Incidentally, the manufacturers are calling it "Substrate-fed logic" or Schottky I²L.

Probing power

New products are launched onto the market by their hundreds every month (some people argue that it's hundreds every week in electronics). Two which caught my eye last month might interest readers. One was a logic probe which allows one to prod round a logic circuit and find out what's happening. It's called the Catch-a-Pulse and will inform on six states; positive-going pulses, negative-going pulses, square waves, a logic one, logic nought, and no signal. Fountain-pen shaped it looked a useful device but most impressive was the price in the U.S.—just \$32.

The second device is a transistor: and what a transistor. It has the impressive name of STC9160 and the even more impressive power handling capability of 500W. This transistor is housed in a TO-3 package and is described by its manufacturer as a 50A device. It's quick, too. It will turn on in just 3.5 millionths of a second.

We've come a long way from those little "red-spot" transistors.

Small talk

If there ever was such a word as "Littlerer" it would surely apply to a new development at the research labs of a British manufacturer. Previously, I've mentioned a semiconductor technology called injection logic or I²L. What the British company has done is to adopt a significant variation of I²L with the result that the packing density—how many transistors can be got in a given size—has been increased some three times. At the latest head count they had managed to squeeze some 800 semiconductor gates into an area of 1mm x 1mm. Just get a ruler and look at one lone millimetre. Better still draw a 1mm square on a

piece of paper and then imagine 800 transistors inside that. See what I mean about "littlerer"?

Spot-on

Yet another interesting device mentioned at the Washington conference was a stable reference voltage source. This one is the brainchild of an American company and is still at the laboratory stage but it looks extremely promising. It employs a short channel MOSFET in what's called the punchthrough mode (don't even ask!) What is important is that when persuaded to supply a reference voltage at just over 3.8V, this device held the voltage stable to within $\pm 0.0005V$. Even more important, it held the voltage to within that 0.0005V over the temperature range of 25°C to 50°C.

Perhaps the government could have a whip round and purchase one for the British economy?

4-layer switch

What about getting a Thermosensor for Easter? I didn't believe it either but it cropped up at the International Electron Devices Meeting in Washington recently. It's basically a temperature-sensitive switching device and it's the handwork of a Japanese company who gave a paper on it at the conference. The theory of it is quite horrendous (I reckon a degree in Venesian physics is required to understand it) but in simple terms it is a pnpn semiconductor, a four-layer device. If it is forward biased it can then switch on at a predetermined temperature. The precise turn-on temperature is decided by the value of a solitary resistor which is wired in parallel with the emitter of the Thermosensor. The temperature switching range extends from 50°C up to 150°C.

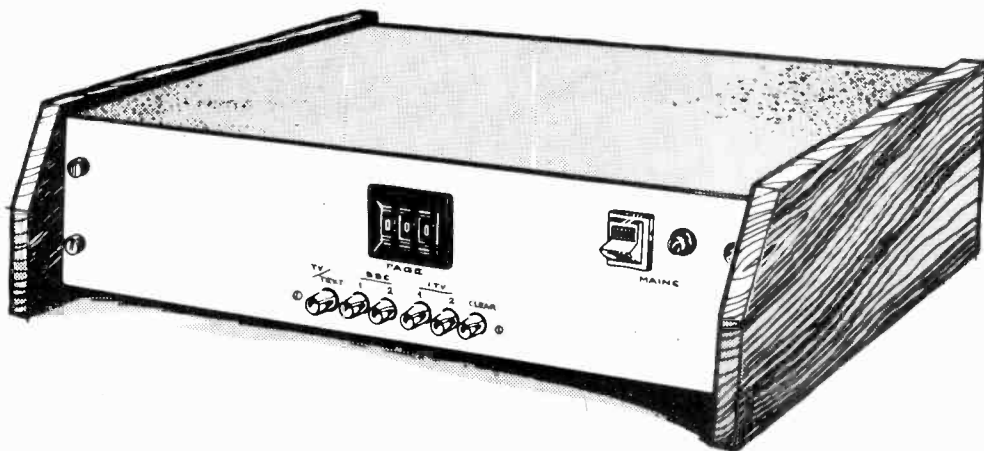
Ginsberg

in next month's issue

TELEVISION

MARCH issue, on sale February 21st.

The "TV" TELETEXT DECODER

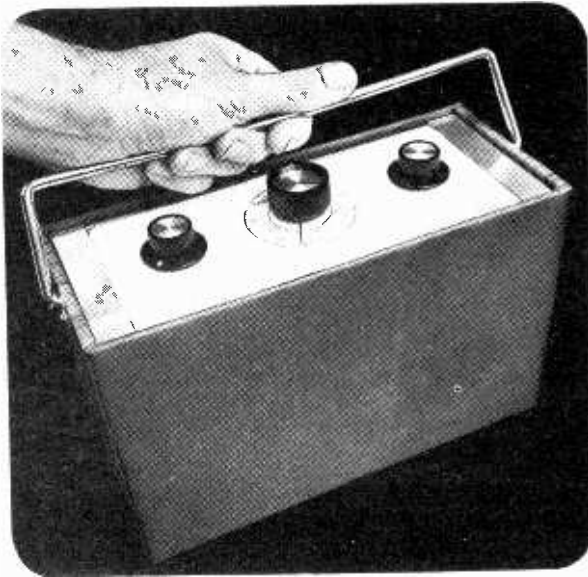


Have you seen Ceefax/Oracle yet? By building the *Television* Teletext decoder you could soon be watching these services in your own home. It's designed to work with any 625-line receiver, either monochrome or colour, and has the advantage that you don't need to modify your domestic TV set in any way – just plug the decoder's output into the aerial socket. A Teletext decoder is complex, but to make assembly easy this design uses plug-in printed boards and a mother board, while the very latest receiver techniques are used in order to simplify alignment. The unit has its own mains power supply.

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EASYTUNE MW-LW Receiver

F.G.RAYER



THIS receiver uses three transistors and an audio IC in a circuit which is capable of very good results. With the usual form of receiver tuning, signals at the high frequency end of the medium wave band are crowded together and tuning is critical. As an aid to operation on these frequencies high-frequency bandspread is fitted, in addition to long wave and medium wave coverage. This provides three bands, approximately as follows:

- Long Wave: 165 to 270kHz.
- Medium Wave: 550 to 1525kHz.
- Bandspread: 1475 to 1850kHz.

The receiver is not a miniaturised design which simplifies wiring and construction to some extent.

Receiver Circuit

The circuit is shown in Fig. 1 where L1 and L2 are the medium wave and long wave sections of the internal ferrite rod aerial. Base coupling to Tr1 is via L3 and a tapping on L2. Coil L4 is the oscillator coil, common to long and medium waves. For LW coverage L1 and L2 are in series, VC1 with integral trimmer TC1 being for aerial tuning. Switch S2 introduces C3 and TC4, loading the oscillator coil

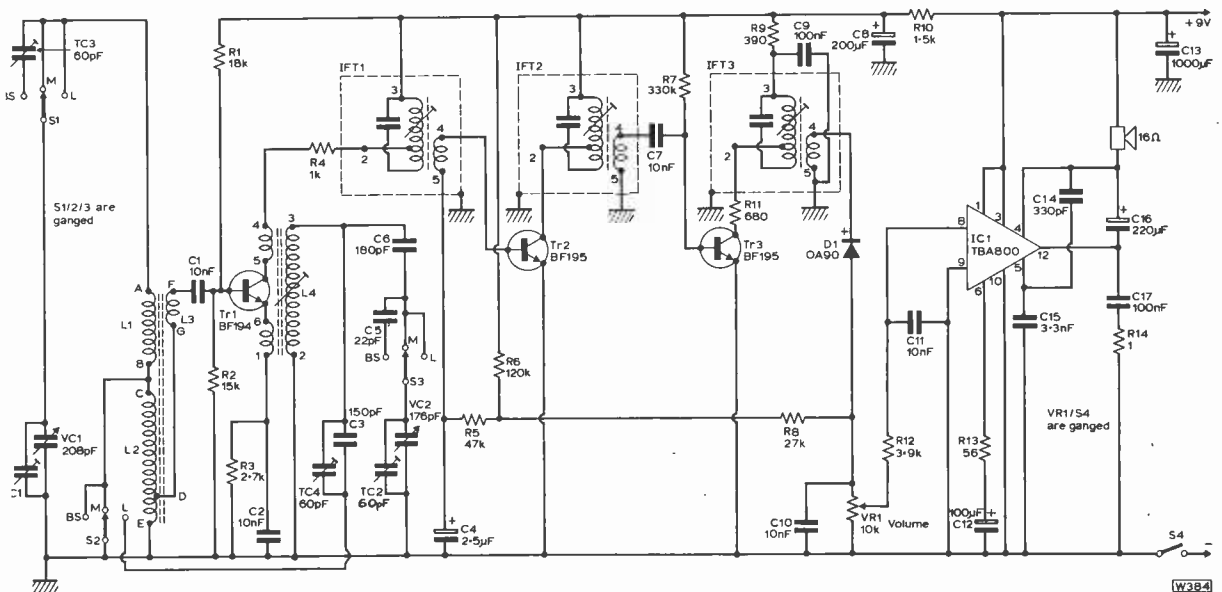


Fig. 1. Complete circuit diagram for the Easytune medium and long wave receiver. The third waveband spreads out the high frequency end of the medium wave band where congestion of stations is prevalent.

★ components list

Resistors	
R1 18k Ω	R8 27k Ω
R2 15k Ω	R9 390 Ω
R3 2.7k Ω	R10 1.5k Ω
R4 1k Ω	R11 680 Ω
R5 47k Ω	R12 3.9k Ω
R6 120k Ω	R13 56 Ω
R7 330k Ω	R14 1 Ω
All $\frac{1}{2}$ or $\frac{1}{4}$ W 5%	
VR1/S4 10k Ω log pot with switch	
Capacitors	
C1 10nF	C10 10nF
C2 10nF	C11 10nF
C3 180pF	C12 100 μ F 6V
C4 2.5 μ F	C13 100 μ F 10V
C5 22pF	C14 330pF
C6 180pF 5%	C15 3.3nF
C7 10nF	C16 220 μ F 10V
C8 200 μ F 10V	C17 100nF
C9 100nF	TC3/4 60pF trimmers
VC1/2 208/178pF, slow motion, with trimmers (Jackson 00)	
Semiconductors	
Tr1 BF194	D1 OA90
Tr2/3 BF195	IC1 TBA800
Inductances	
L1/2/3 MW/LW ferrite rod aerial (Denco FR5)	
L4 Oscillator coil (Denco TOC1)	
IFT1/2 IF transformer (Denco IFT13) IFT3 (Denco IFT14)	
Miscellaneous	
Speaker 16 Ω 3 $\frac{1}{2}$ in. dia., impedance not critical.	
Battery 9V and terminal clips. Knobs. Material for cabinet and covering. 10 x 4in. flanged plate (Home Radio, universal chassis member). Handle. Plastic feet. Two brackets, home made. S1/2/3 3-pole 3-way single waver switch	

Circuit Board

The board is approximately 127 x 70mm (5 x 2 $\frac{3}{4}$ in), Fig. 2. The first step is to drill holes for TC4, L4 and the three IFTs. Position them so that the tags will come as shown in Fig. 3. A coloured spot marks pin 4 of L4. A $\frac{3}{32}$ in drill is suitable here, with a $\frac{1}{16}$ in drill for the can tags of L4 and the IFTs. No force should be used to fit these items and if necessary holes may be adjusted to give an easy fit by employing a small file.

It is as well to leave the transistors and IC1 off until later. Underneath wiring is shown in Fig. 3. Probably the simplest way is to begin by wiring the earth line to the can tags, using 24SWG tinned copper wire. Follow by placing resistors and capacitors as in Fig. 2, then turn the board over and shape and solder the wire ends, cutting off any excess leads. Sleeving is put on leads which cross or run near each other or near joints and tags. There is plenty of space for components but reasonable care is necessary to make a sound job here.

If necessary check resistor values as they are inserted. The electrolytic capacitors must be placed with the polarity shown. If each connection and component is marked in coloured pencil as completed it is unlikely that anything will be omitted.

Semiconductors

The pins of the transistors are placed as in Fig. 3 and leads are soldered to them. Avoid lengthy heating of these joints in particular. The iron should be at its full temperature and should be applied to the cored radio grade solder, which is held on the joint. The solder should flow in a second or so, and the iron is then removed at once.

Shape the ends of D1 to reach pin 4 and R8. Be sure this component is fitted with the polarity correct. Positive on the diode is indicated by a coloured band. If this diode is reversed the AGC action is upset.

The pins of IC1 are located as in Fig. 2 and spaced to fit the 0.15in matrix of holes. Bend the heat sink fins up slightly to clear the board and C14. Only pin 1 is marked on the actual IC. These pins come close together and they are small so a little care is needed when soldering them to connections, as in Fig. 3. Unused tags must not touch other connections or joints.

Wiring

Leads can be provided by fitting lengths of thin coloured flex or by inserting Veropins, which will take leads running to the appropriate points. A lead will run from C1 to F on L3, another from C3 and C6 to sections S2 and S3 of the bandswitch and a wire will run from 2 on the oscillator coil to the frame tag of VC1/2. In the audio section, D1 negative and an earthing lead from pin 5 of IFT2 run to VR1. Resistor R12 is soldered to the rotor tag of VR1 and is wired to C11 and pin 8 of IC1. Twin leads are provided from pins 3 and 4 of IC1 to go to the loudspeaker.

All these leads can be several inches long and arranged to come from the board as in Fig. 2 so that they can be readily identified later.

for suitable coverage. This coil is tuned by VC2, TC2 being part of the ganged capacitor.

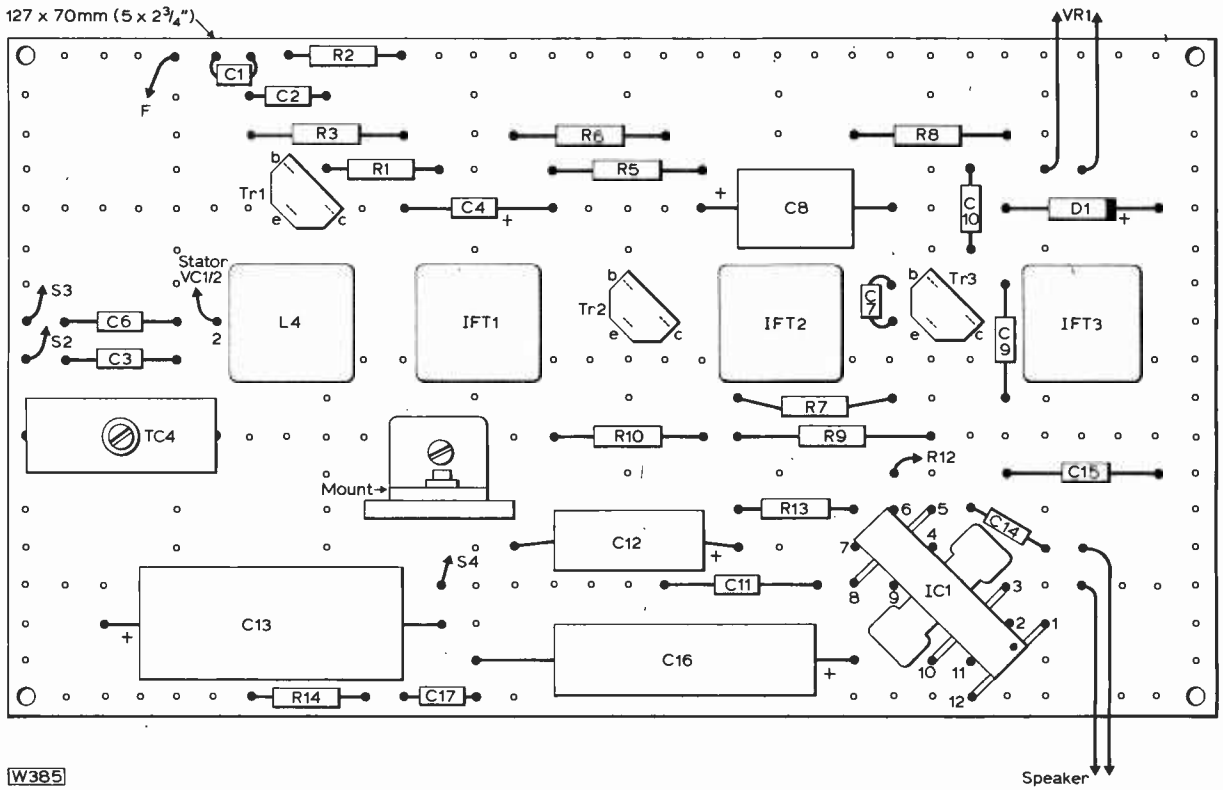
For MW reception S2 shorts out L2 and C3/TC4 are out of circuit. C6 is the oscillator coil padder. For bandspread reception, S1 places TC3 in series with VC1 and S3 places C5 in series with VC2. This results in a narrow frequency coverage for the full rotation of VC1/2. Switch S2 shorts out L2 as for ordinary MW tuning.

Silicon transistors are used for the self-oscillating mixer Tr1, and the two IF amplifiers Tr2 and Tr3. Diode D1 is the detector also providing an automatic gain control voltage for Tr2 through R8 and R5.

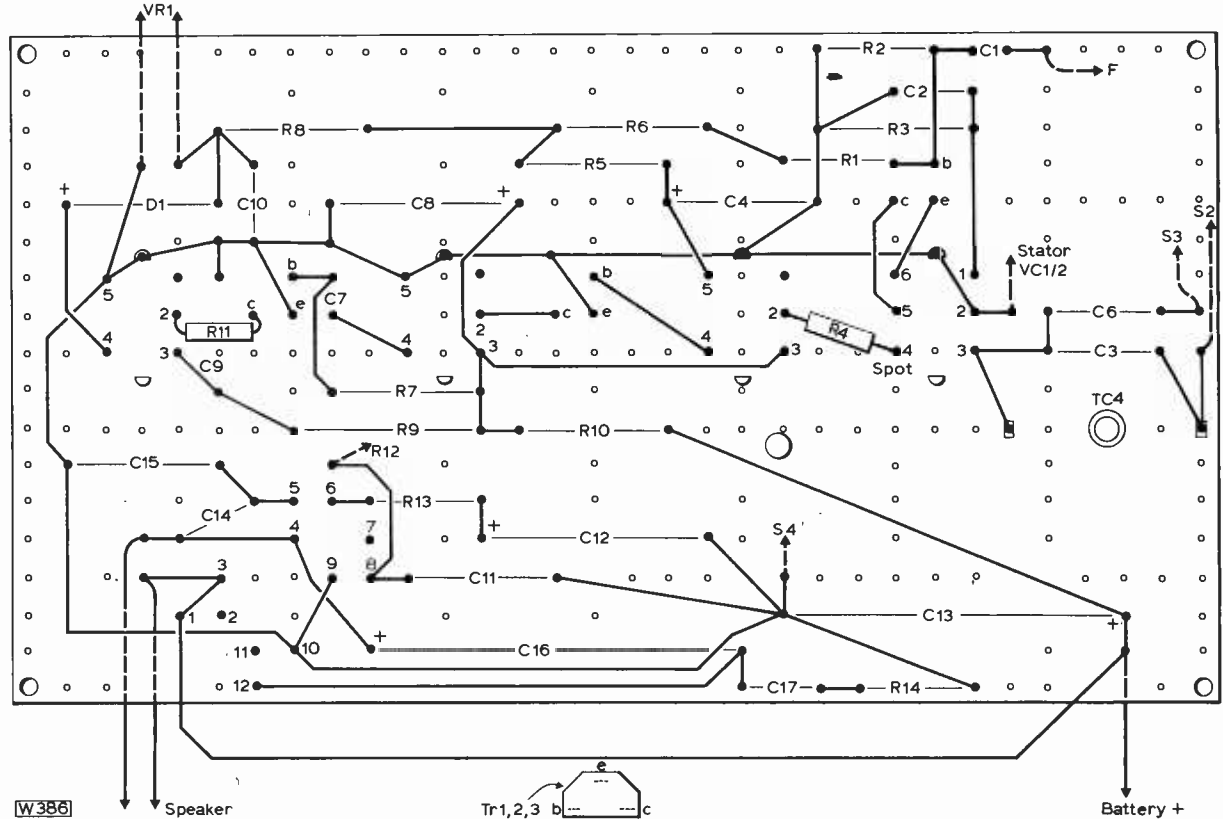
The required audio level is provided by the volume control VR1. The IC provides audio, driver and push-pull output stages, with diode compensation, and operates the loudspeaker directly. This audio IC has a low standing current and is economical while giving excellent volume from a 9V supply. S4 is the on/off switch incorporated in the audio gain control.

The three IF transformers are pre-tuned and there should be no particular difficulty in aligning the receiver even if no signal generator or other instrument is available.

127 x 70mm (5 x 2 3/4")

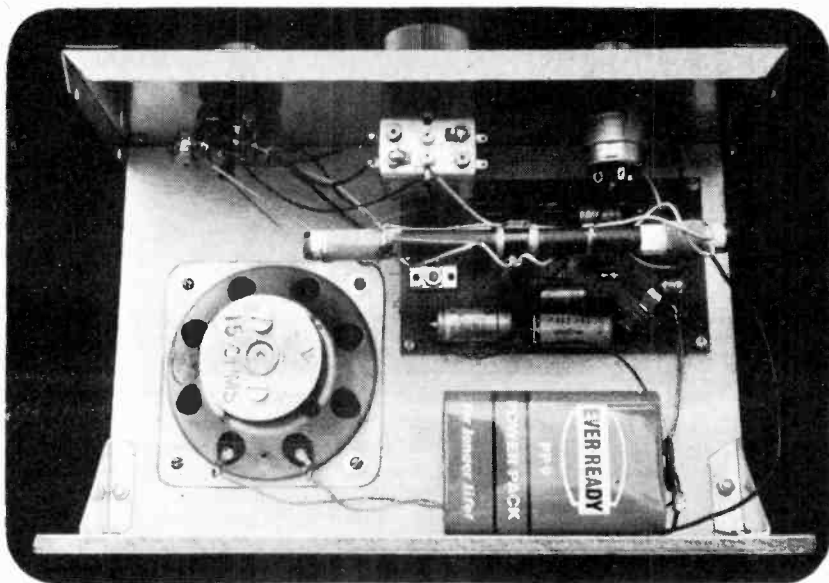


W385



W386

Fig. 2: at the top, shows the top of the veroboard and layout of components. The board size is 127 x 70mm (5 x 2 3/4 in.). Fig. 3: at the bottom, illustrates the wiring necessary under the board. In many cases the component lead is sufficiently long to make a connection.



General view of the finished receiver. The details of the bracket holding the ferrite rod aerial can be seen in Fig. 2.

Sub-assembly

This assembly allows the receiver to be made up as a complete working unit while all connections and the underside of the circuit board are easily reached. Cut a piece of 6mm plywood 250 x 160mm ($9\frac{7}{8}$ x $6\frac{1}{4}$ in). At the right, 63mm ($2\frac{1}{2}$ in) from the right edge and 63mm ($2\frac{1}{2}$ in) from the bottom, mark a centre, and draw a 75mm (3in) diameter circle. Cut out this part to take the speaker. If a speaker of different size is used, cut this aperture to suit the dimensions of its cone.

Position the circuit board approximately 12mm ($\frac{1}{2}$ in) from the left edge and a similar distance from the top of the plywood. Mark round the circuit board with a pencil. This part is now cut out, but corners approximately 16mm ($\frac{5}{8}$ x $\frac{5}{8}$ in) and of tri-

angled brackets. This acts as a shelf for the battery and allows the receiver to stand upright when out of its case, or to rest on its back or either end. The top panel is a 254 x 100mm (10 x 4in) flanged "universal chassis member." Using a centre-line, punch a 16mm ($\frac{5}{8}$ in) hole in the middle for VC1/2. At 73mm ($2\frac{7}{8}$ in) distance from this centre, punch holes for the bandswitch and VR1.

Place the top of the plywood inside the front flange and drill flange and wood for three counter-sunk 6BA bolts which will secure these parts together. VC1/2 is fitted by means of three counter-sunk 4BA bolts. This component is set back about 10mm ($\frac{3}{8}$ in) from the panel to bring the tuning knob lower (the spindle cannot be cut short due to the integral reduction drive). This requires spacers, or

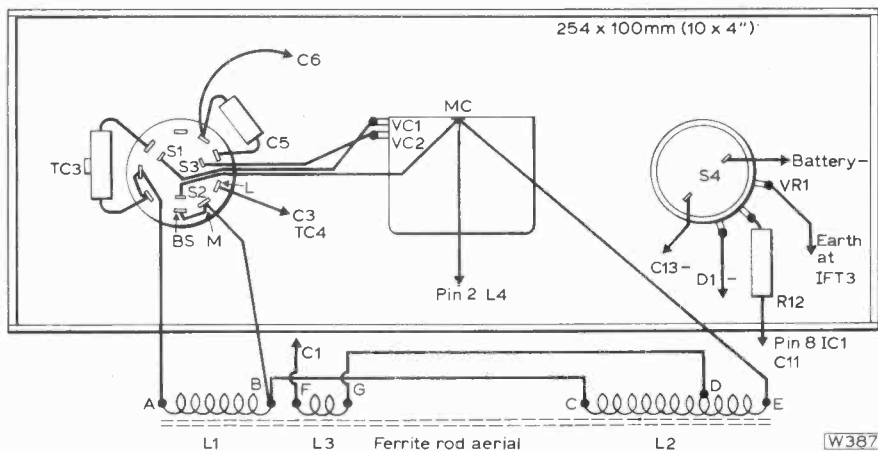


Fig. 4: Arrangement of the components on the front panel and wiring between the range switch and the ferrite rod aerial, and between the volume control and the board.

angular shape are left so that the circuit board can be secured by four woodscrews driven through the holes in Fig. 2, and into the wood. The circuit board is fitted with the IFTs towards the top and IFT3 at the edge. It is then possible to reach all connections, etc. under the board if this should prove to be necessary.

A piece of 6mm plywood 250 x 95mm ($9\frac{7}{8}$ x $3\frac{3}{4}$ in) is fitted to the bottom of the assembly by two right-

extra nuts, locked against the panel and capacitor. The ends of the bolts must on no account project beyond the thickness of the front capacitor plate.

Fig. 4 shows the panel and connections to the circuit board can now be fitted. The trimmers TC1 and TC2 are provided on the ganged capacitor, so are not shown separately. TC3 is soldered directly to the tags of S1 as shown. Capacitor C5 is mounted on S3.

Ferrite Aerial

The aerial can be mounted by cutting a strip of paxolin about 75mm (3in) long and securing it by a small bracket, Fig. 2. The rod is then bound to the top of the paxolin. An alternative method is to cut a piece of hardwood or insulating material about 63mm (2½in) long from material about 12mm (½in) wide and 9mm (⅜in) thick. This can be tapped for a bolt to secure it to the board or drilled for a self-tapping screw. At the top, a 'V' is filed to take the rod which is held with adhesive and thread passed round the rod and through a hole in the mount.

Coils L1 and L3 are supplied wound on one former. Place this so that L3 is towards the middle of the rod, Fig. 4. Connect the beginning of L1, lead A, to S1 and wire F of L3 to C1. L2 is the largest winding, on a separate former. The tapping D is electrically near the end E. This can be seen by examination. Place L2 on the rod in such a way that the direction of rotation of the winding A to B is followed on by C to E. If this is not done LW alignment is impossible and L2 must be taken off the rod and placed the other way.

Point G of L3 is then wired to tapping D. Points B and C are connected together and to S2. Point E of L2 goes to the frame, MC, of VC1/2. These leads should be long enough to allow a little movement of the coils on the rod. Connections are best made with quite thin wire and sleeving is put on all the leads.

IF Alignment

The IFTs are aligned by the maker and it is better not to touch these until proper results are obtained. They may then be adjusted a little as necessary, using a proper trimming tool, such as that available from the maker. A wedge-shaped blade is likely to break the cores.

To adjust the IFTs tune in a weak signal, with VR1 turned up near maximum, and rotate each core for best results. Only a small movement should be necessary. If equipment is available a signal generator may be used, and output observed with an output meter. This allows more precise adjustment than does aligning the IFTs by ear. But despite this, perfectly satisfactory results should be obtainable without instruments. Once the IFTs are aligned, leave them alone, as they do not need touching when trimming the aerial and oscillator circuits.

RF Alignment

Trimmers TC1 and TC2 should be very slightly unscrewed. Switch to MW. Check that the medium wave coverage is from approximately 550kHz to 1525kHz. If there is much error at the LF end of the band rotate the core of L4 to correct this. Should there be considerable error at the high frequency end of the band, adjust TC2 as necessary. Subsequent adjustments depends on the positions of L4 core and trimmer TC2. This means that if any change is made to the settings of these, later adjustments will be upset. So the correct positions for L4 core and TC2 must be found first, as shown by correct MW coverage, with the bandswitch in its central position.

Tune in a weak transmission near the LF end of

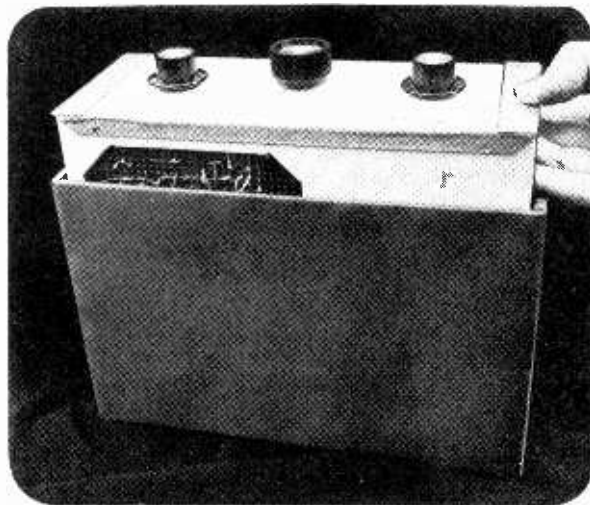
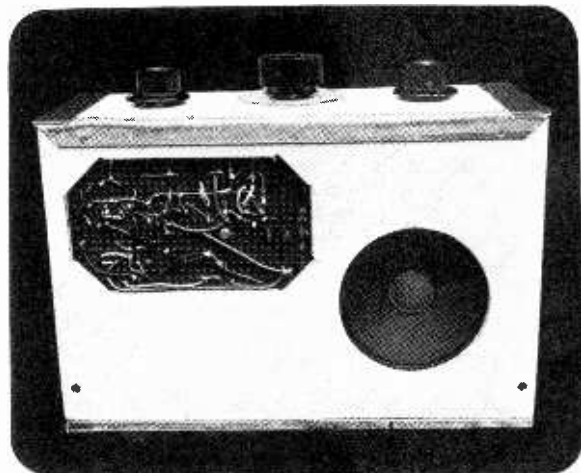
the MW band and move L1 on the rod for best volume. Then tune to a signal around 1500kHz and adjust TC1 for best volume. As these adjustments influence each other, repeat them a few times.

Switch to LW, set VC1/2 half closed and rotate TC4 until the 200kHz BBC Radio 2 is heard. Then tune to a signal near the LF end of this band, one or more foreign stations should be audible and move L2 on the rod for best results.

If these adjustments are difficult to achieve check wiring to L2 and its "sense" upon the rod, and also, if necessary, the setting of the core of L4.

Bandspread Adjustment

A signal should be tuned in around 1500kHz, VC1/2 nearly two-thirds closed, and TC3 should be rotated for best results. All the trimming adjustments can, of course, be made with the aid of a signal generator. When using actual transmissions for this purpose, avoid very strong signals. These will operate the ACG system and its action will mask adjustments so that a critical setting is not found easily. Distant signals will be subjected to



The top photograph shows the cutout in the base which enables the circuit to be worked on by merely pulling the set out of the cabinet. In the view at the bottom the set is lowered into its cabinet, when the speaker should align with the hole in the cabinet, shown in Fig. 5.

fading, especially on the higher frequencies, and this may make adjustment difficult. So choose a local transmission and carefully orientate the receiver for a low level of signal. Check again through each band to get best results.

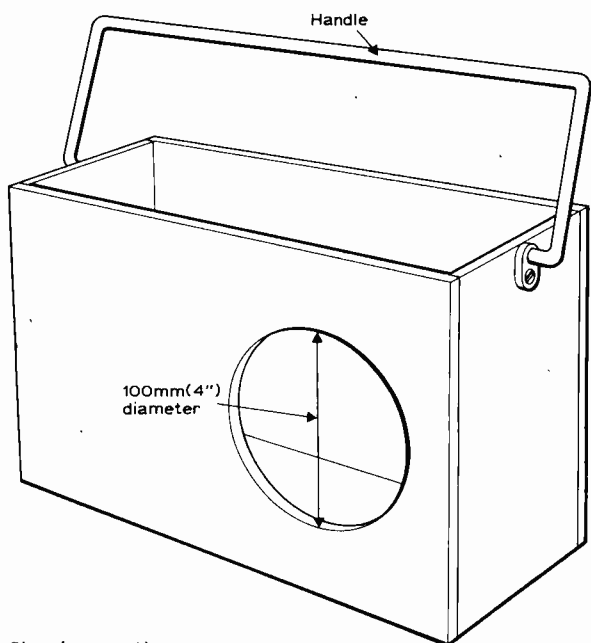
Cabinet

Construction of the cabinet is shown in Fig. 5. The receiver panel or top is assumed to be 254 x 100mm (10 x 4in) so it is essential that the cabinet will clear this inside. Bearing this in mind the dimensions given are correct. The sides are of plywood while the front and back are hardboard. Glass-paper all meeting surfaces smooth and wipe away all dust. The sides are then secured to the bottom, using adhesive and a few panel pins. A 100mm (4in) diameter opening is cut in the front matching the

to cover the sides and bottom. This is 100mm (4in) wide and overlaps into the top of the case. Four small feet are screwed on the bottom. The handle was pivoted in two small flat plates, screwed to the sides of the case. A flexible handle could be made from a length of material, folded and sewn, to match the case.

The receiver panel can be provided with a card scale, calibrated in frequencies with the aid of a signal generator, or with station names marked. A straight wire can be soldered to the spindle of VC1/2 or a dial can be cut from Perspex and fitted to the spindle.

The bare aluminium was covered with self-adhesive material and contrasting strips cemented on at each end. There is a great deal of latitude, here, for individual finishes to be used.



Sides (plywood)
178 x 105mm (7 x 4 1/8")

Front and back (hardboard)
270 x 178mm (10 5/8 x 7")

Bottom (hardboard)
257 x 105mm (10 1/8 x 4 1/8")

W388

Fig. 5: Dimensions of the cabinet and material required for its construction.

position of the speaker. The sides and bottom edges and front are smeared with adhesive, placed together and fixed with pins. The case is then turned over and the back similarly fitted. When the adhesive is dry, the exterior can be sanded.

The back and front are covered with fabric secured with adhesive along the bottom of the case, at each end, and inside at the top, drawing the material taut. Any adhesive on the front of the case may penetrate the fabric and spoil the appearance.

Wood-grained self-adhesive material is then cut

KINDLY NOTE!

CHROMACHASE 4

December 76/January 77

Several readers have commented on the fact that the diode matrix in this project is unsatisfactory and many of them have suggested solutions. Although each solution appears to solve the problem each varies from the others.

However, common to all is the correction to D8. As it is used in the article it prevents any operation except Clock Reverse. The removal of this diode will enable the unit to function in all modes except Auto.

We are trying all the readers' recommendations as well as some of our own and will publish our findings as soon as they are clear.

OSCILLOSCOPE CALIBRATOR

January 77

In the components list R12 should be 100kΩ and not 100Ω.

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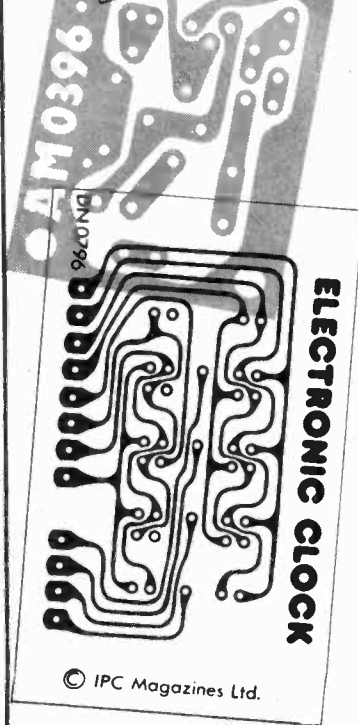
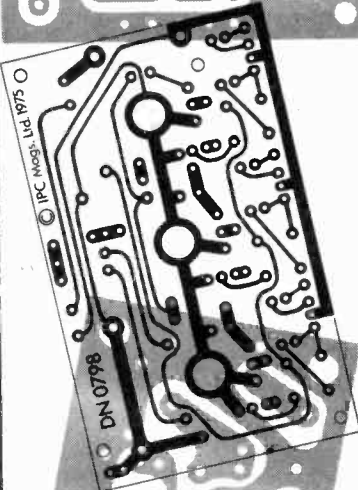
Issue	Project	Ref	Price P/P	
Sep 75	Electronic Clock (set of three)	DN0795/6/7	2·40+15	<input type="checkbox"/>
Dec 75	Random Number Selector	DN0793A	0·98+12	<input type="checkbox"/>
Dec 75	Sound-To-Light Display	DN0798	1·15+12	<input type="checkbox"/>
Dec 75	12V PA System	DN2/JM	0·98+12	<input type="checkbox"/>
Dec 75	Disco System, Amplifier (2 required)	each AM0421	4·40+22	<input type="checkbox"/>
Dec 75	Disco System, Light Modulator	AM0423	3·50+22	<input type="checkbox"/>
Jan 76	Music Box	SRBP DN1/JM	2·25+18	<input type="checkbox"/>
		glassfibre DN1/JM	3·00+18	<input type="checkbox"/>
Mar 76	CMOS Crystal Calibrator	AM0438	1·19+12	<input type="checkbox"/>
Apr 76	DF Receiver (set of two)	DN4/JM DN5/JM	1·92+15	<input type="checkbox"/>
Apr 76	Wobblator	AM0443	1·08+12	<input type="checkbox"/>
Apr 76	Auto. Slide Synchroniser	AM0441	2·33+15	<input type="checkbox"/>
June 76	Dig. Freq. Meter (set of 4)	4X A004	3·17+15	<input type="checkbox"/>
July 76	Transistor Tester	A002	3·08+18	<input type="checkbox"/>
July 76	Disco Preamplifier	A003	0·65+12	<input type="checkbox"/>
Aug 76	Cassette Player Power Supply	A001	0·65+12	<input type="checkbox"/>
Sep 76	Jingle Machine	A005	2·30+12	<input type="checkbox"/>
Sep 76	Capacitance Meter	A009	2·59+14	<input type="checkbox"/>
Sep 76	Octavia AF Source	A010	1·30+12	<input type="checkbox"/>
Oct 76	Jingle Machine, Mains Unit	A006	2·08+12	<input type="checkbox"/>
Oct 76	Digital Car Clock (set)	A001/2/3	2·58+12	<input type="checkbox"/>
Oct 76	Interwipe	DN8JM	0·80+12	<input type="checkbox"/>
Oct 76	Video-Writer (set)	D002/3/4/5 A007	21·44+50	<input type="checkbox"/>
Oct 76	Hazard Flasher	D005	0·76+12	<input type="checkbox"/>
Nov 76	Low Level Battery Indicator	A016	0·40+12	<input type="checkbox"/>
Nov 76	Electronic Thermostat	A017	1·30+12	<input type="checkbox"/>
Nov 76	Cirtest Probe	A018	0·48+12	<input type="checkbox"/>
Nov 76	Burglar Alarm	A019	0·50+12	<input type="checkbox"/>
Nov 76	DFM Pre-scaler PCB A015 will be added to set of four DFM boards at no extra cost.			
Dec 76	Chromachase	A021	5·70+22	<input type="checkbox"/>
Jan 77	Oscilloscope Calibrator	A023	1·25+12	<input type="checkbox"/>
Jan 77	Icelert	A020	1·45+12	<input type="checkbox"/>
Jan 77	Polyphon, motor and main boards	A025/4	7·90+20	<input type="checkbox"/>
Jan 77	Polyphon, tune disc, blank, SRBP	A008*	0·90+15	<input type="checkbox"/>
Feb 77	Transistor Checker	A026	1·18+12	<input type="checkbox"/>
Feb 77	FM Stereo Touch Tuner	D023/4/5	7·50+20	<input type="checkbox"/>

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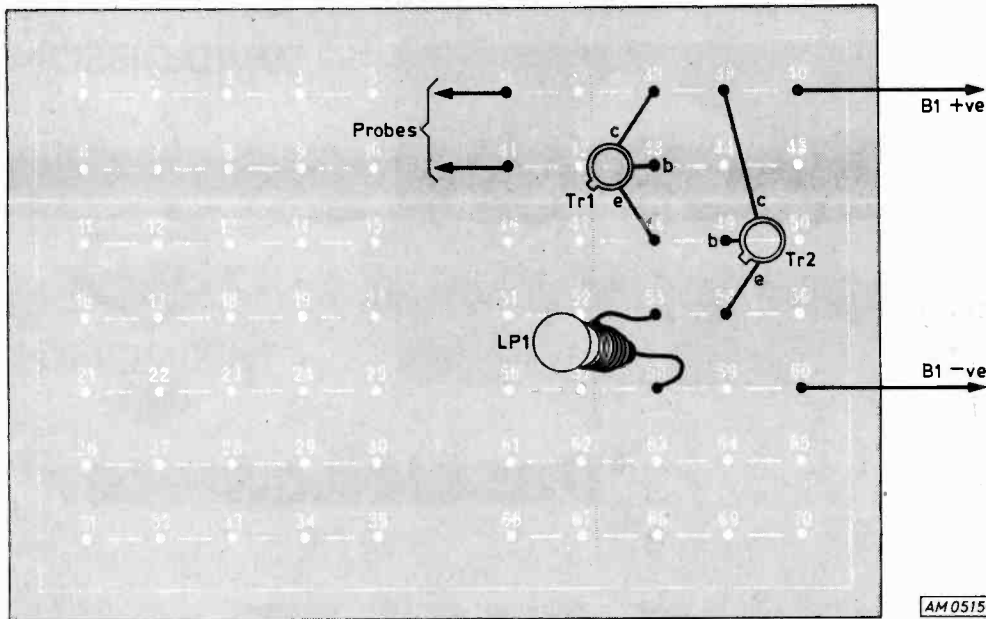
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S-DeC holes 36 and 41 will complete the base to positive rail circuit via the resistance of the bodies.

With fairly dry hands the bulb will probably not light at all. But if one waits for a few moments the fingers will perspire slightly and this "wetness" will

vincing version then you might consider purchasing a meter. It would be necessary to remove the dial and recalibrate it with segments labelled "Cold, Cool, Warm, Hot, Passionate and Danger". By simply connecting the meter in series with the bulb LP1



Drawing of the S-DeC shown full size. If a meter is used as well as a lamp, it should be connected to holes 59 and 64.

AM0515

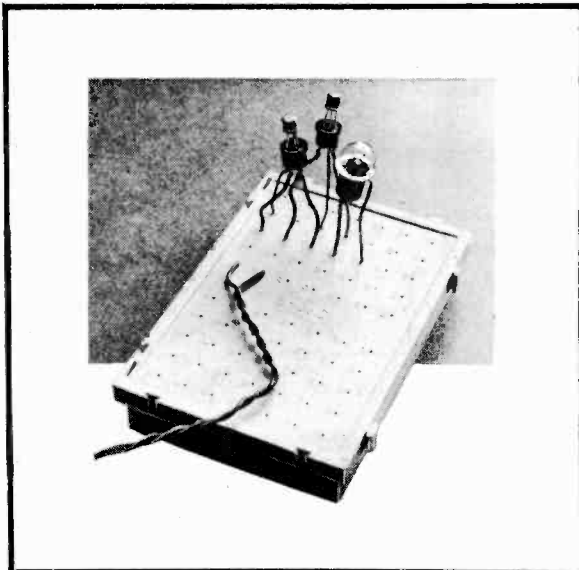
improve the conducting properties of the skin by lowering its resistance thus causing the bulb to start glowing.

Metered

As described, the "Passionometer" is very simple, cheap and will cause a lot of fun at any party. If you wish to make a more sophisticated and con-

it would read the current drawn by the bulb. Thus as the bulb started to glow brighter so the meter would read a higher "passion" score. A 6V 100mA bulb together with a 6V battery was found to be optimum, trading acceptable brilliance against reasonable circuit action.

For those considering making the "meter version", the meter must be capable of reading 100mA FSD (full scale deflection). On test, simply plug the meter into S-DeC holes 59 (positive side of the meter) and 64, and transfer the battery negative lead from S-DeC hole 60 to hole 65. The probes were simply the free ends of two wires which were plugged into holes 41 and 36 on the S-DeC.



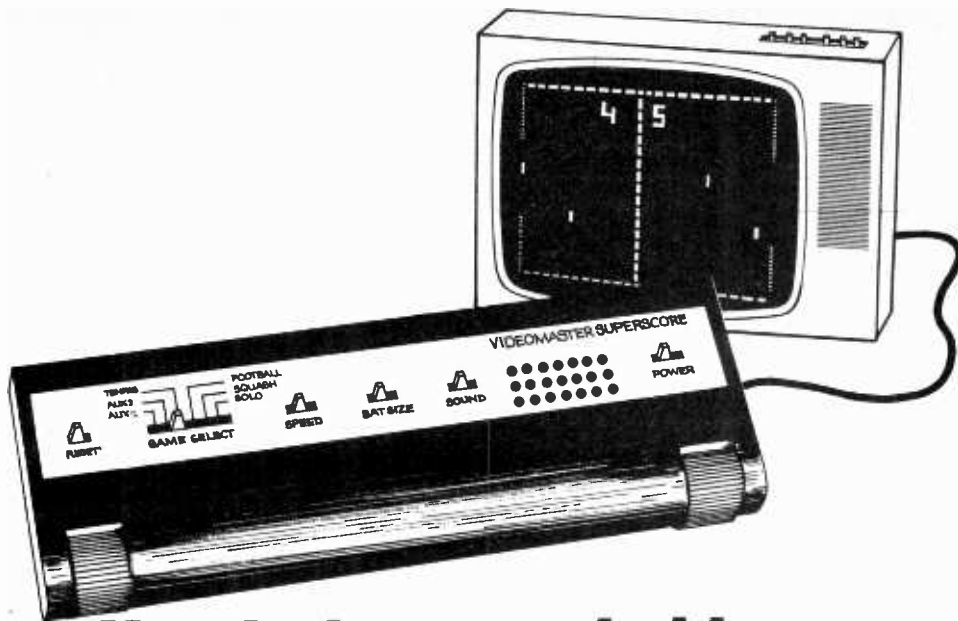
Photograph showing the actual 'Passionometer'. As can be seen only three components are needed to complete this simple circuit.

No guarantee

That's all there is to this month's circuit. Of course, I cannot guarantee that the device will indicate passion with any accuracy nor will it measure emotion—but you can have an awful lot of fun trying to prove me wrong!

Next month's S-DeC circuit again uses many of the components already employed in earlier projects. It can also be used at a party, or for more serious applications. Basically a miniature pocket stroboscope, it is simple and easy to build. It can be employed to give the stroboscopic motion-freezing effect commonly found at Disco's these days. It can also be used for more serious things such as splitting an apparently continuous stream of water from your tap into thousands of tiny crystal droplets.

The S-DeC project after that is even more fascinating . . . but I'll tell you about that in next month's Practical Wireless.



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PW93

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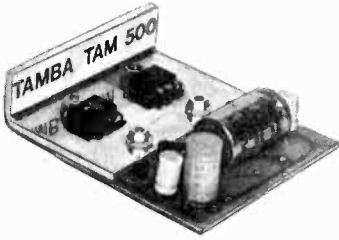
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AMATEUR BANDS

by Eric Dowdeswell G4AR

ALTHOUGH I haven't seen one yet I gather that we radio amateurs in the UK are to get a nice, new, shiny, and more expensive, licence from the Home Office as we renew our 'tickets'. Seems all the odd bits of paper separately authorising one to operate /T, /M and various odd modes not in the normal licence have all been abolished, and high time too. It is opportune to mention that the RSGB was fully consulted on the new licence at all stages and no doubt they have obtained every advantage for us that they could.

The three world regional organisations that make up the International Amateur Radio Union have reached agreement on the radio frequency allocations to be sought for the Amateur Service at the World Administrative Radio Conference to be held in 1979. Such early agreement augurs well for our cause but whether we amateurs get all that's being asked for will largely depend upon how well each national society presents its case to its own administration.

We should count ourselves as being very lucky to have the RSGB behind us considering the very high esteem in which it is held by our authorities but, regrettably, the opposite is the case in many other countries where commercial interests and politics decide such matters. Whatever happens at the WARC at least we shall know that the RSGB did its best on our behalf.

I wish it were possible for me to check back and see how long it takes someone writing in as a 'first timer' to go on and get his amateur radio licence. **Jim Oram**, just moved to a new QTH in Basingstoke, has been a SWL for about a year now and has joined the Basingstoke ARS. He hopes to take the RAE next May and while I am sure that we all wish him all the best I feel that he is being a trifle optimistic. However, have a go, Jim! The experience of taking the exam is worth its weight in gold, pass or fail. Jim has a Heathkit GR64 and expects to really get into the DX when he gets his new aerial up.

Alan Doherty BRS34968 is now in the peace and calm of Rotorua in New Zealand, at least until March next year when he is due to return to Northern Ireland. He has managed to listen around the bands

using two old valved radios, one as a BFO, so that he can copy SSB. Alan visits local ZL1QC who runs an FT401 and uses a Zepp aerial system, so he doesn't feel too home sick!

In Holyhead **John Higginbotham** now has a nice new FR100B which puts his old receiver to shame. He is also talking about an FL200 Tx and a linear, so obviously John is not too far off getting his RAE. Don't forget the Morse exam OM, you'll need it if you are going to use all that gear! The only QRM being suffered by John at the moment is that caused by exam worries! Newcomer **Bob Harvey** of Oxford is 15 and has got under way on the SW bands with a Codar Mini-Clipper but feels he could do with something more ambitious. Perhaps Father Christmas came up trumps OM? Anyway, Bob added an audio amplifier and a large dial which he calibrated himself, and with a 32ft. aerial he started to hear things. Bob, too, has made contact with his local ARS and looks forward to starting an RAE course soon.

Anent the misfortunes of **Robin Bayley** of All-ripton whose local RAE course collapsed, he heard from G4FGR who put him on to another course so let's hope it all proves worthwhile for Robin. He now has an Eddystone EC10 which enables him to copy CW and SSB from 15 to 80m, using a long wire. Readers often refer to a 'long wire' aerial but I wonder if that is really what they mean. In this sense it should mean that the aerial is long in terms of the wavelength which would mean 275 odd feet to be a couple of wavelengths on the 40m band! I don't think that many readers can go to that sort of garden! Most aerials are much shorter which is why it is so essential to employ an aerial tuning unit to make up the length electrically.

In Harrogate **Steve Cottis** A8961 reports new countries with VP5, 5W1, VQ9 (Chagos Is) and FR7 all on 80m. He finds 20m closing down around dusk although the DX is still there after the Europeans have gone. **Brian Harrison** found something for the log on most bands down in Hastings, including rare KX6MU on 20m SSB. FO8EB is another that is quite rare and a worthwhile at any time on any band. **Arnold Silverwood** won't mind if I call him a 'first timer'. He lives in Nottingham and has built himself an HAC receiver and is starting to understand some of the amateur 'language'. While his set can be made to give quite good results I have pointed out to Arnold that there are more sophisticated sets around, and that he shouldn't write off our hobby too soon, if he feels he is not getting results!

A very interesting club magazine that comes my way each month is TARS TALK, the 'voice' of the Torbay ARS, edited by F. Bolton G3VTQ. Besides



all the usual club chatter there are a couple of small but interesting articles in the November issue on Roof Space Aerials and Receiver Drift. At present, meetings are held at Bath Lane, Torquay (rear of 94 Belgrave Road) but more suitable accommodation is being investigated. Anyone interested in joining the TARS is recommended to contact the Secretary, M. Yates G3UIQ at 23 Waverley Road, Newton Abbott, Devon.

In Hastings, Jesse Luxton G8GMI is not bothering too much about VHF but concentrating on getting his code up for the examination. Unfortunately Jesse had a stroke in 73 which he feels has not helped at all. He recommends PA0AA for slow morse as they run a course over the air and suggests getting their booklet from PO Box 2083, Eindhoven, Holland for 6 IRC's.

Andy Grendon of Dun Laoghaire, Co. Dublin has really got going since I wrote to him recently. He joined the IRTS and is now EI508 and attending Morse classes while a Heathkit SW717 helps him to cover the HF bands. He is in a built-up area and has little space for aerials. A 30ft end-fed suffices for the moment.

Log Extracts

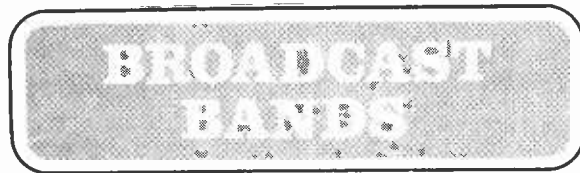
R. Bayley:— 80m CW VS6DO ZL2BFU ZS2PR 40m CW CT2BP EA9FD K8CCV VE1AF 20m CR6LF FP8DH HK0COP TG9TI VP8AA 15m AP2AD DU1DBT VK3XI ZP5CD

A. Doherty:— In New Zealand 20m DL8NU EA3AEA EA6CK SV1BR

S. Cottis:— 80m A4XGB FP8DX (QSL K9OTB) JA6YDG WA6EGL/VQ9 (Chagos Is) 20m CX7BV FP8ZZ FR7BI HK1CMX VP2GMB 5W1AB 15m A9XBD JY9CR VP5A YV2AMM 10m ZS1EZ

B. Harrison:— 80m ZC4FS HP1YV 7X2HM 20m DU2EL KX6MU 9D5A (Iran) 15m PY0ZAE (Trinidad Is)

All SSB except where indicated otherwise.



MEDIUM WAVE DX

by Charles Molloy

TRANSATLANTIC DX dominates the scene this month, reception on this path being better than it has been for several years. Reader's logs show stations not normally heard while others, trying this path for the first time, are able to report success. Laurence Bennett writes from Bristol "at long last, mainly through help from your column, I have heard and verified my first transatlantic DX catches. Here is my complete North American log to date". Many thanks for the bouquet, Laurence. The

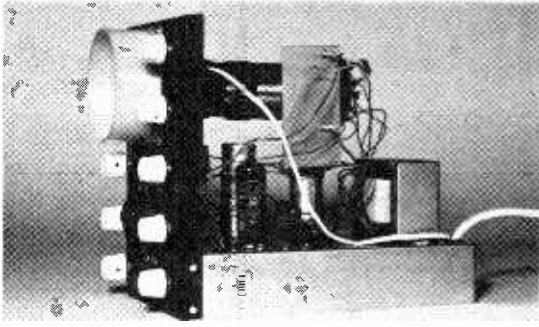
receiver is a Trio 9R59DS connected via an aerial tuning unit to a 68ft longwire aerial and the log consists of three stations from Newfoundland, CBN on 640 kHz, CKVO on 710, CJON on 930 plus four in New York City, WOR on 710, WCBS on 880, WINS on 1010 and WNEA on 1130. DXers who have still to hear North America should try after midnight for one of these stations, and if the path is open then at least one should be heard.

Laurence raises an interesting point when he says "I managed to hear both WOR and CKVO on 710 at the same time which resulted in a jumble which was difficult to resolve". DX signals on the MWs are usually subject to slow fading, the cycle often lasting a minute or two. This is typical of E layer reception which is quite different from the fast fading experienced on the short waves and, occasionally, at the high frequency end of the medium waves, where the F layer is the part of the ionosphere responsible for propagation. The technique on the medium waves is to stay tuned to a channel for several minutes when hopefully DX will appear out of the noise or, in the case of WOR and CKVO, either one will become dominant long enough for an identification to be heard.

Simon Knott who lives in Cambridge reports two instances of DX on a channel normally occupied by a North American "local". Using a Trio 9R59 and a 48in loop he heard CFRB in Toronto as well as WINS on 1010kHz and on 930kHz which is normally the domain of CJON he logged CFBC Saint John City in New Brunswick. CFBC sent a QSL after a month and Simon asks if this station has been logged by anyone else recently. CFBC is something of a rarity in the UK because of the directional aerial used at the transmitter. This produces a null towards the north east which protects CJON from interference within its service area but, unfortunately, DXers in Europe as well are prevented from receiving its signal. Simon refers to CBM Montreal on 940kHz which he hears occasionally. CBM has an omnidirectional aerial which presents a rather weak signal to any European DXer who is patient enough to sit on the channel when the path to North America is open.

Derek Taylor (Preston) is still trying to identify a US station on 1390kHz. Although he taped the identification it sounds different every time he plays it! WCSC in Charleston, South Carolina, is a likely candidate here, the writer having heard it several times and the other possibility is WEGP Presque Isle in Maine. Derek who uses a Realistic DX160 and loop also reports hearing WJR Detroit on 760 at 0109, WHAS Louisville Kentucky on 840 together with All India Radio outlets in Bikaner on 1330 (at sign-on at 0100) and Gwalior on 1390 at 0125, Radio Antilles, Montserrat on 930 at midnight, Radio Victoria in Aruba NWI on 960 at 0040 and WMDD in Puerto Rico on 1480 at 0310. Puerto Rico, although in the Caribbean, is one of the states of the USA and consequently US call signs are used. Surprisingly, there are 52 medium wave stations operating in Puerto Rico and since the language can be Spanish or English it is very confusing for the DXer. Other Puerto Ricans heard in the UK are WKAQ Radio on 550, WKVM in San Juan on 810, WHOA Radio Capital in Hato Rey on 870 and WUNO (Radio Uno) on 1320.

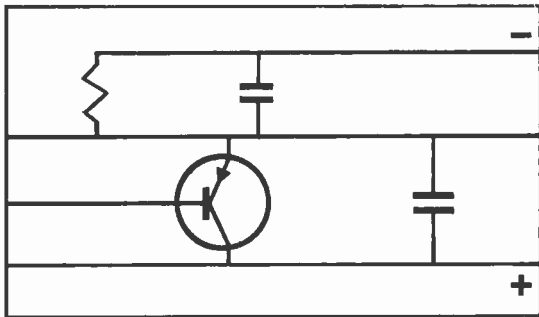
Steve Whitt (G8KDL) who DXes in London with a Chapman S6BS communications receiver, PW loop and differential amplifier (*Practical Wireless*, April 1973) has been experimenting. He replaced the



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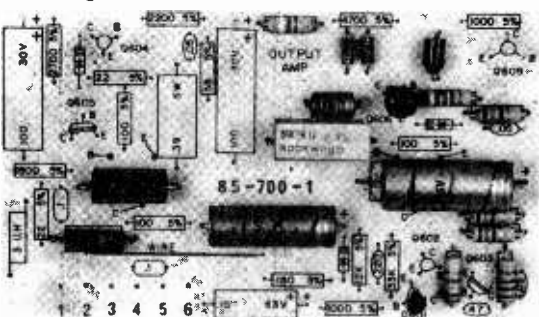
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2N2369	25p	2N3712	1-20	2N5449	19p	AF125	65p	BC170	16p
2N2369A	25p	2N3713	2-30	2N5457	22p	AF126	65p	BC171	14p
2N2646	75p	2N3714	2-45	2N5458	33p	AF127	65p	BC172	12p
2N2647	1-40	2N3715	2-35	2N5459	33p	AF139	69p	BC177	

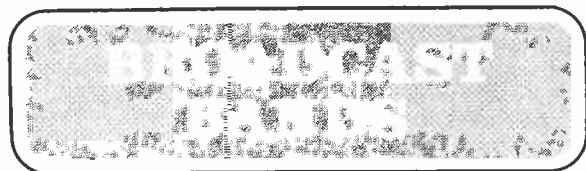


2N3819 FETs in the differential amp with 2N4416s and the resistors with metal oxide types and obtained greater gain and less cross modulation. He says that conditions have been excellent and on some days (nights!) WINS on 1010 has been roaring in as early as 2230 causing interference to the Dutch station (Lopik) on 1007kHz. Steve finds North American stations excellent verifiers, he sends an International Reply Coupon with every report, and quotes from a letter from WBZ Boston (on 1030) which suggests that since they beam their signal on 270° he may have received them after their signal had circled the world! Unlikely, as propagation on the medium waves requires a path of darkness between transmitter and receiver.

More DX from Michael Illingworth of Christchurch who reports hearing KMOX in St Louis on 1120 with his Trio 9R59DS receiver. This is a really good catch which is only logged when reception is really good. Incidentally, US stations use one of two prefixes in their call signs. Those beginning with the letter K are with one exception, KDKA, to the west of the Mississippi while those with the letter W are to the east. A call sign beginning with K means real DX from the UK.

An unusual request for identification comes from Nick Hall-Patch of Victoria, British Columbia, who, with a friend, heard an unidentified broadcast, in a transatlantic direction on 566kHz. It was at 0725 and consisted of a single short pip every 15 seconds. The station according to a law well known to medium wave DXers, faded out just before 0730 when of course Radio Eireann would have signed-on for the day. The writer had never noticed these pips before which only shows that one man's DX is another's QRM. (BBC Radio 4 also uses them—AED.)

Bob Bonsall of Buxton wants to buy a good radio that will pick up North American stations on the medium waves. Reports this month come from users of the Trio 9R59D/E, Realistic DX160 and Chapman S6BS. It would be a great help to readers starting the hobby if all logs were accompanied by full details of the receiver, aerials and any other gear in use. The time, in GMT, of any outstanding logging would also be invaluable.



SHORT WAVE BROADCASTS

by Derek Bell

THE Christmas season has slipped into history and one can collect together not only one's thoughts but the paperwork that floods in at this time! From Radio Havana there is the usual

collection of those awful calendars, the size of a matchbox, printed with the dates, unrelentingly, in Spanish! Radio Havana is now asking for letters to be sent to Apartado 7026, Havana, Cuba, and is sending out a schedule which advises that broadcasts for northern Europe will be on 17885 between 2010 and 2140, a very sparse service, with more time devoted to English language broadcasts to north, central and south America on 17750, 11865, 11760, 11725, 9685 and 9525. Nearly 16 hours, in fact!

Alongside this there is the usual crop of "Happy New Year" cards from other similar countries who seem to ignore the fact that the countries they send them to also celebrate Christmas!

Tony Cook, at present living in Gibraltar, logs a few of the signals that whizz around the ether over the Rock. These are as follows: Radio Togo on 5048 at 2100, Morocco on 4650 at 1930, Radio Prague (African Service) on 5760 and 5350 at 1900. Tony asks for information on the HAC Mk 2 set. I must confess I do not know a lot about this set but perhaps other HAC users can answer Tony on the problem of why the reception goes "up the spout" when he connects the bandsread! Finally, Tony would like to know of any books on the subject of DXing and here I can help. Radio Nederland has a very wide range of pamphlets on all aspects of the hobby and their address is PO Box 222, Hilversum, Holland. These publications are all free.

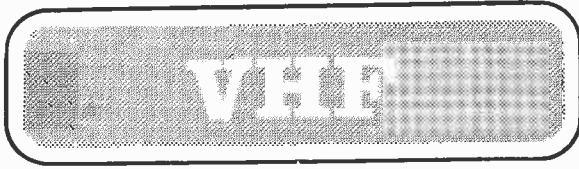
Lawrence Bennett, from Bristol, takes me to task for the lack of Latin American and African stations in the column. Regular readers will remember that a few months ago, with the aid of a Latin American reader resident in London, we looked at the LA scene. However I can only report on the logs that I receive and if no one logs LA then I can't print it! It must be said that it is a long time since anyone sent in such a comprehensive list as Lawrence has and here are a handful of the "DXotics" that his Trio 9R59DS has pulled in via a longwire:—

Radio Difusoras, Venezuela	on 4890 at 2355
Radio Timbira, Brazil	on 4975 at 0430
Radio Sutatenza	on 5095 at 0045
Sierra Leone	on 3316 at 2153
Radio Banqui	on 5038 at 2200

Perhaps it's the thought of the very late nights that puts off the majority of DXers but it is a fact that Latin Americans are strictly for the birds, night owls that is.

M. G. Hayman has also a pet peeve and that is the fact that he waited for the arrival of his Codar Multiband 6 only to find that the firm had sent the order in two lots, and one parcel had got lost in the post! This must be a situation that drives the home-brew enthusiast right up the wall! Meanwhile he has to make do with his HAC Mk 2.

The final letter this month is from V. Marland who resides in Connahs Quay, Clwyd, who requests information on the way that a station report should be laid out. This is very simple, the station name first, then the frequency plus the time in GMT. It is not worth logging signal strength since this can vary enormously. Add some notes on the programme heard and any identification signal heard. Notes on interference to the station are sometimes helpful. If you enclose a couple of IRCs this will expedite a confirmation but don't be too impatient! For now I will wish you best 73s to you and yours.



by Ron Ham

THE sun has been very quiet during December; in fact the writer recorded only one burst of solar radio noise (midday December 8th) and that was the first since November 21st. **Alan Taylor**, G3DME, Crowborough, Sx, heard the "seashore sound," normally associated with solar noise, on the 10m band at 1747 on the 15th. Although the sun was set there could have been a large solar burst and Alan detected the radio signals as they came above the horizon. These reports are valuable and since Alan collects the International Beacon Project reports for the RSGB, any that you send to me will eventually end up with him.

At 0947 on Dec. 15th the writer heard the signal from the IBP Beacon in Cyprus (5B4CY 28·180MHz) and that was the first time for a month. An interesting observation came from **Walter Butt** GC2FZC, St Peter Port, Guernsey, who noticed that when he can hear DL0IGI and 5B4CY on 10m, conditions on the 2m band are above normal. What about it readers? The writer would like to hear a lot more about this.

Very soon the number of sunspots will increase as the new cycle gets underway, and **Derek Poulter** G3WHK, Morden, Surrey, a keen all-band DXer, wants to know how to observe these with a telescope. First of all Derek, **NEVER** look at the sun directly through a telescope or any other optical aid, it is **dangerous** to the eyes, in fact it is unwise to look at the sun at all. The technique is to point your telescope toward the sun and project its image on to a white card (shaded from the main sunlight) and pencil in the spots that you can see. Most basic astronomical books will show this.

Of course, you can always direct your 2m beam toward the setting or rising sun and listen around 143MHz (Quiet spot outside amateur band) for the "seashore sound" or "whooshing" which is the radio noise from a sunspot.

Although the atmospheric pressure was below 30·0" for most of December it did rise sharply from 29·5" at noon on the 8th to 30·0" by noon on the 9th and continued to rise slowly reaching 30·4" by noon on the 12th, and true to form, as this high pressure system moved southward, and the AP began to fall, there was a tropospheric opening.

During the late afternoon of the 14th, **Roy Bannister**, G8LXR, Lancing, Sussex, worked several French stations on 2m SSB and on the 15th Roy heard a PA0 and an ON come up on two. From his QTH at Newhaven, Sussex, **Alan Baker** G8LGQ, worked into the Midlands during the evening of the 14th and also noticed patterns on his TV screen, another sure sign that an opening is in progress. From midday until late evening on the 15th the

writer was receiving a strong picture from Lichfield on Chan. 8 (189MHz) and around 2000 a 559 signal from the Sutton Coldfield beacon (GB3SC) on 70cm.

At 0930 on Dec. 5th, **Joost Berden** G3RND, Cowes, IOW, was taking his usual weather picture from the NOAA5 satellite as it passed over and was surprised to find that it's 137·50MHz signal was weak and fluttery for about five minutes, a long time in a pass. The satellite came in at 20°E for an overhead pass, but the signal did not become strong and steady until it was 65°N. At that time, Joost noted that conditions on 70cm were reasonable, he could hear GB3SC and during the previous evening he worked G3OSS in London for the first time, using SSB. There was definitely movement in the troposphere throughout both days, therefore it is possible that this region absorbed the satellite's VHF signal for a short time. The writer has known times when conditions were "up" on 70cm and flat on 2m.

Derek Poulter, G3WHK, has worked a lot of 2m DX by keeping an eye on the barometer and he makes a point of watching the late night weather map on BBC TV to see if there are any "highs" building up. Derek has moved QTH and just received planning permission for his new aerial array:—HQ1 mini-beam for 10/15/20, 4 element yagi for 70MHz, 2 x 6 element arrays for 2m, and something for 70cm, and all supported by a 40ft Versatower! Our readers will be looking for some good reports, Derek!

Another barometer watcher is that experienced VHF DXer, GC2FZC, who monitors the 2m beacons GB3CTC and GB3VHF daily and relates their signal strengths to the prevailing atmospheric pressure. He also has a regular Sunday morning sked with G3IEA and G8DOJ, both in Torquay, and they seldom miss out. In fact the sked with G3IEA has been going on for some 15 years!

Don't forget, if anything unusual occurs on the VHF's the writer will be pleased to have the details. After all, it is your observations that help to put a particular propagation event into its proper perspective.

Late Note: A slight change in the prevailing high pressure during the evening of 23rd December caused a predominantly N/S opening which upset UHF TV and provided some good DX on both 2m and 70cm. Between 1900 and 2200 the writer received 599 signals from beacons GB3SC (432·890MHz) and GB3EM (432·910MHz). At 2117 a 59 signal from G3DY in Northants, while on Ch. 8 (189MHz) a strong picture was received from the IBA transmitter at Lichfield. For most of the evening the 2m band was open from France through to northern-G.

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.

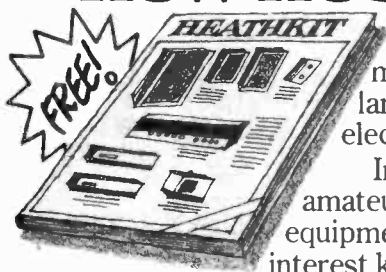
AMATEUR BANDS

Logs covering any amateur band/s in band/alphabetical order by the 25th of the month to **Eric Dowdeswell** G4AR, **Silver Firs**, Leatherhead Road, Ashted, Surrey, KT21 2TW.

VHF

Reports on VHF matters to **Ron Ham**, Faraday, Greyfriars, Storrington, Sussex RH20 4HE.

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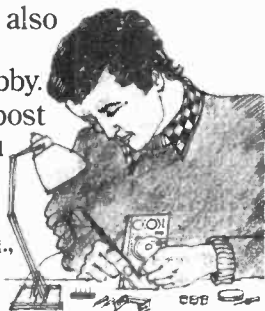
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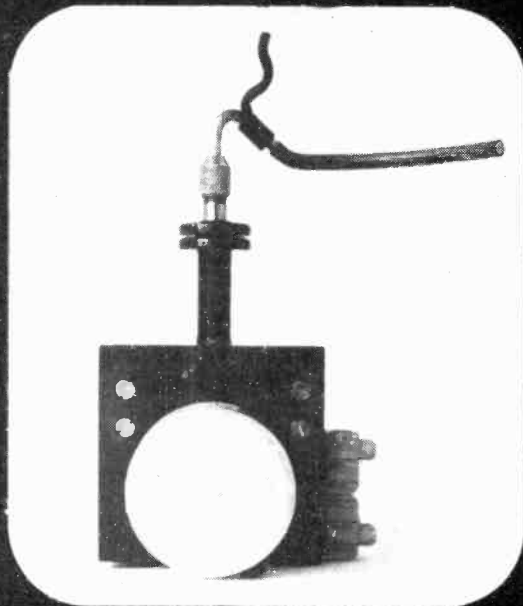
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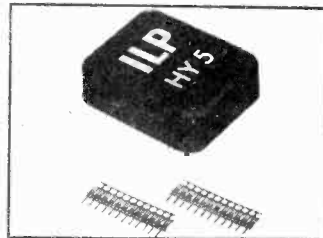
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HY50 25 Watts into 8 Ω

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.

FEATURES: Low Distortion—Integral Heatsink—Only five connections—7 amp output transistors—No external components

APPLICATIONS: Medium Power Hi-Fi systems—Low power disco—Guitar amplifier

SPECIFICATIONS:

INPUT SENSITIVITY: 500mV
OUTPUT POWER: 25W RMS into 8 Ω **LOAD IMPEDANCE:** 4-16 Ω **DISTORTION:** 0.04% at 25W at 1kHz
SIGNAL/NOISE RATIO: 75dB **FREQUENCY RESPONSE:** 10Hz-45kHz—3dB
SUPPLY VOLTAGE: \pm 25V **SIZE:** 105 50 25mm
Price £6.20 + 77p VAT P&P free.



HY120 60 Watts into 8 Ω

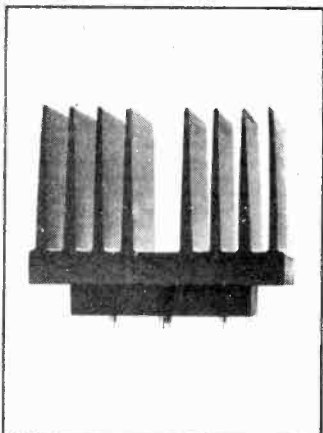
The HY120 is the baby of I.L.P.'s new high power range. Designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

FEATURES: Very low distortion—Integral heatsink—Load line protection—Thermal protection—Five connections—No external components

APPLICATIONS: Hi-Fi—High quality disco—Public address—Monitor amplifier—Guitar and organ

SPECIFICATIONS:

INPUT SENSITIVITY: 500mV.
OUTPUT POWER: 60W RMS into 8 Ω **LOAD IMPEDANCE:** 4-16 Ω **DISTORTION:** 0.04% at 60W at 1kHz
SIGNAL/NOISE RATIO: 90dB **FREQUENCY RESPONSE:** 10Hz-45kHz—3dB **SUPPLY VOLTAGE:** \pm 35V
SIZE: 114 50 85mm
Price £14.40 + £1.15 VAT P&P free.



HY200 120 Watts into 8 Ω

The HY200 now improved to give an output of 120 Watts has been designed to stand the most rugged conditions such as disco or group while still retaining true Hi-Fi performance.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—Integral heatsink—No external components

APPLICATIONS: Hi-Fi—Disco—Monitor—Power slave—Industrial—Public Address

SPECIFICATIONS:

INPUT SENSITIVITY: 500mV
OUTPUT POWER: 120W RMS into 8 Ω **LOAD IMPEDANCE:** 4-16 Ω **DISTORTION:** 0.05% at 100W at 1kHz
SIGNAL/NOISE RATIO: 96 dB **FREQUENCY RESPONSE:** 10Hz-45kHz—3dB **SUPPLY VOLTAGE:** \pm 45V
SIZE: 114 100 85mm
Price £21.20 + £1.70 VAT P&P free.

HY400 240 Watts into 4 Ω

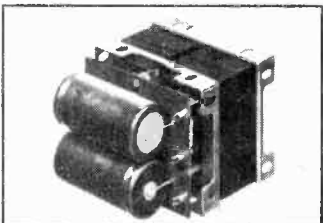
The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4 Ω ! It has been designed for high power disco address applications, if the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—No external components

APPLICATIONS: Public address—Disco—Power slave—Industrial

SPECIFICATIONS:

OUTPUT POWER: 240W RMS into 4 Ω **LOAD IMPEDANCE:** 4-16 Ω **DISTORTION:** 0.1% at 240W at 1kHz
SIGNAL NOISE RATIO: 94dB **FREQUENCY RESPONSE:** 10Hz-45kHz—3dB **SUPPLY VOLTAGE:** \pm 45V
INPUT SENSITIVITY: 500mV **SIZE:** 114 x 100 x 85mm
Price £29.25 + £2.34 VAT P&P free.



POWER SUPPLIES

PSU36 suitable for two HY30's £4.75 plus 59p VAT. P/P free.
PSU50 suitable for two HY50's £6.20 plus 77p VAT. P/P free.
PSU70 suitable for two HY120's £12.50 plus £1.00 VAT. P/P free.
PSU90 suitable for one HY200 £11.50 plus £0.92 VAT. P/P free.

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PLASTIC BOXES IN 5 SIZES

Easily drilled or punched, grey ABS boxes incorporate slots for 1.5mm pcb's with lid fixing screws running into integral brass bushes

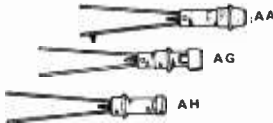
100x50x25mm	51p	(1-9)	49p	(10+)
112x62x31mm	59p	(1-9)	52p	(10+)
120x65x40mm	68p	(1-9)	62p	(10+)
150x80x50mm	77p	(1-9)	74p	(10+)
190x110x60mm	£1.33	(1-9)	£1.30	(10+)

Polystyrene version

Plain inside, no integral bushes
112x61x31mm 35p (1-9) 32p (10+)
Add 25p per £1 order value for Post & Packing

TYPE A NEON INDICATORS

Held in 8mm hole by plastic bezel
150mm wire leads



Red, Amber, Clear, Opal 19p each
Green 28p each

TYPE MP NEON INDICATOR

150mm leads, held in 6.4mm hole by nut

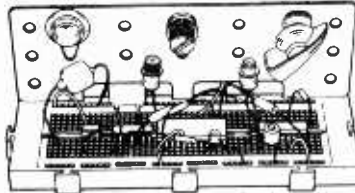


Red, Amber, Clear, Opal 20p each

On all orders quote reference PW/3/77.

Stop wasting time soldering

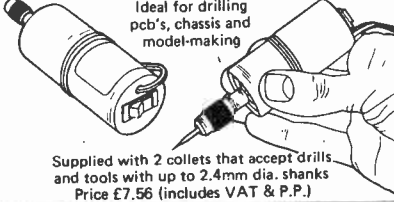
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pcb's, chassis and
model-making



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Price £7.56 (includes VAT & P.P.)

SEVEN SEGMENT DISPLAYS

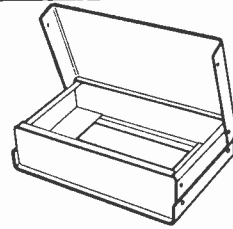
Economy Quality - Only 66p
0.3" - Red
Common Anode - Left Decimal



Full specification displays also available
Red, Green and Yellow
£1.35 each inc. data

P.P. Note. Unless included in price add 25p post & packing for orders totalling under £10. Prices include VAT and are valid in UK only for 2 months from journal issue date.

Michael Williams Electronics
47 Vicarage Av., Cheadle Hulme, Cheshire SK8 6JP



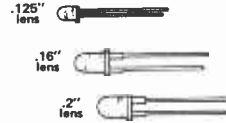
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Packs contain 5 LED's, clips and data



DH LAMPHOLOER

For LS or Midget flange lamps
13mm hole fixing, lamp not included
Red, Blue, Green, Amber, Clear, Opal, Orange
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Quantity quotations on request.

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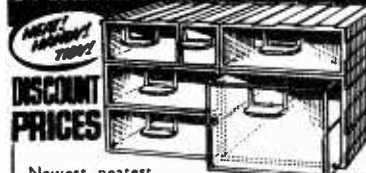
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EOC84 52p	PCL85 } 62p	8P28 60p
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EL41 58p	PL82 38p	30C17 80p
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Easiest way to find fault. Traces signal from aerial to speaker, when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything. Complete kit comprises two special transistors and all parts including probe tube and crystal ear-piece. £2.95, twin stetho-est instead of ear-piece. £1.00 VAT and postage incl.

MICRO SWITCH BARGAINS

Rated at 5 amp, 250 v., ideal to make a switch panel for a calculator and for dozens of other applications. Parcel of 10 for £1.00, VAT and post paid.

MOTORIZED DISCO SWITCHES

With six 10 amp changeover switches. Multi adjustable switches are rated at 10 amp each so a total of 2000w's can be controlled and this would provide a magnificent display. For mains operating £4.95 post & VAT Paid. Ditto 9 switch £4.95 Post & VAT Paid. DITTO BUT 12 SWITCH £5.75 Post & VAT Paid.

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Model TT2—small but powerful 1in. pull—approx. size 1 1/2 x 1 1/2 x 1 1/2in., £1.00
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Price include VAT & postage.

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Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450W). Units in box all ready to work. £7.95 plus 95p VAT & Postage

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Type 600 relay with twin 500 ohm coils which may be joined in series or parallel thus relay will operate off voltages between 5 and 30 volts DC. Price 44p each, 10 for £4 post and VAT paid.

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Famous Atlas in metal case with meter, output lead terminated by crocodile clips. For 6 or 12V charging simply by changing plug on front by changing plug on front by changing plug on front. Ready built, new and still £2.95 plus £1 Post & VAT

MULTISPEED MOTORS

Six speeds are available 500, 850 and 1,100 r.p.m. and 7,000, 9,000 and 11,000 r.p.m. Shaft is 1/2 in. diameter and approximately 1 in. long. 230/240v. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2 in. dia x 5 in. long. Price £2.00 including Post & VAT.

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18in x 10in £1.85. Post & VAT 50p.

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Self priming, portable, fits drill or electric motor, pumps up to 200 gallons per hour depending upon revs. Virtually uncorrodible, use to suck water, oil, petrol, fertilizer, chemicals, anything like liquid. Hose connectors each end. £2.00 Post Paid.

SPIT MOTOR WITH CARTER GEAR BOX

Probably one of the best spit motors made. Originally intended to be used in very high priced cookers however this can be put to plenty of other uses, for instance your garden barbecue or to drive a tumbler for stone polishing; in fact, there are no ends to its uses. Normal mains operation. £3.25 including Post & VAT.

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A mains operated 4 + 4 stereo system. Rated one of the finest performers in the stereo field this would make a wonderful gift for almost any one in easy-to-assemble modular form and complete with a pair of Goodmans speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only £14.00 including VAT and postage.



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Learn in your sleep: Have radio playing and kettle boiling as you wake—switch on lights to ward off intruders—have a warm house to come home to. All these and many other things you can do if you invest in an electrical programmer. Clock by famous maker with 15 amp. on/off switch. Switch-on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price £2.95, VAT & Postage 60p, or with glass front, chrome bezel, £1.50 extra.

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Famous Satchwell, elegant design, intended for wall mounting. Will switch up to 20 amps at mains voltage, covers the range 0-30°C. Special snip this month £2.50, post and VAT paid.

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Price £7.50 including VAT and postage.

RANDALL CENTRAL HEATING CONTROLLER

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THIS MONTH'S SNIP

250 WATT TRANSFORMER

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AEROSOL RELEASE LUBRICANT

Dry Film Lubricant. In aerosol can for easy application and for putting lubricant in places where the normal oil can't reach. Home and everyday uses. We have purchased a large quantity of these from the Liquigrator and are able to offer them to you for about half of the original list price. 85p per 8oz can or 12 cans for £5 Post & VAT Paid. The lubricant is I.C.I. fluon LI69.

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With triple 10 amp changeover contacts—operating coil wound for 230 volts AC, chassis mounting, one screw fixing, ex unused equipment 60p each, 10 for £5 post and VAT paid.

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With 6 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
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4	All Day	All Day
5	Continuously	Continuously

Suitable, 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 3in x 3in x 2in deep. Price £5.50. 80p Post and VAT, as illustrated but less case

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Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19, 25, 31, 29 metre bands. Kit contains chassis front panel and all the parts £1.90—crystal ear-phone 55p including VAT and postage.

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West German make, these fine motors are noted for their performance and reliability. Special features are the rotating heavy outer which acts as a flywheel to eliminate wow and flutter and switchable reversing. We have four types in stock, all 1350 revs., including starting capacitor.

- (1) Reference No. KLZ 20.50-4, 230 volts 50HZ, price £5.50
- (2) Reference No. KLZ 32.50-4, 230 volts 50HZ, price £5.50
- (3) Reference same as above, 115 volts 50HZ, price £2.50
- (4) Reference same as above, 110 volts 60HZ, price £2.50

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Remember 7.029? Electricians of the old school most certainly will, and will agree it has greater current capacity (20 amps against 13 amps) and being stranded it will not break so easily and being larger it is easier to use. A fortunate buy enables us to offer 3 core 7.029 cheaper than we could offer 3 core 2.6mm. If you are contemplating installing a ring main, an immersion heater, storage heaters or fires, then you should definitely buy some of this cable. It is p.v.c. covered, correctly colour coded and up to all British standards; in fact, was made by one of our most famous cable companies. Price £3.50p + 75p per 100 metre coil. Carriage £2.50 + 20p.

For lighting we offer 3 core 1.8mm only £5.50p + 44p per 100 metres. Post £1.50 + 12p.

Isolation Transformer. Very high current 415 amps, primary 0-260 volts, last 60 volts in 10 volt steps so this transformer can be used to step up voltages for instance at the end of a long cable run. Secondary, 0-20v. -0.130v so this transformer will isolate and step down voltage will isolate at normal mains in and normal mains out or finally it will isolate and step up. A big transformer completely enclosed in sheet steel box weighing about 300 lbs. Price £100 + 32. Carriage as cost but we would prefer you to collect this.

5 Bank Switch Panel. A simple and convenient Burpium item so it is very well made and contains switches which will break 15 amps DC. The 5 switches are completely separate so may be used to control separate circuits or they may be ganged together to bring in 5 heaters in parallel suitable for mains or battery work. Size of the switch is approximately 5 1/2 x 1 1/2 in. An operation is by nickle plated toggles. Price 75p each + 6p. Post 20p + 2p.

Cooling Thermostat. The normal thermostat switches off as the temperature in the room rises. It is, therefore, suitable for controlling electric room heating. We have a simple thermostat but with contacts which switch on as the temperature rises. These are for air conditioning or cooling circuits. Contacts again rated at 20 amps and these have changeover contacts so they can be used for cooling or heating or both but as their original function was intended for cooling they are set and calibrated for 12-40°F. Price £3.50p + 25p.

Flash Ernie is the name we have given to our latest disco light display because it is a random flasher and is very effective especially with coloured bulbs. Kit consists of motorised stud switch, master control switch, anti spark caps, 9 lamp holders, connecting wire and wiring diagram. Price £5 + 40p. Post 50p.

Neon Novelties. One of the most versatile of electronic devices is the neon, you can make it do all sorts of things to regulate voltage, imitate "Ernie" by lighting numbers at random. We have miniature neons at 20p each also just come in neon values 4 pin type, 10 for £1 + 5p. Post 50p + 4p.

Emergency Lighting. We are coming up to the darkest and coldest days so most of us will have memories of power cuts during the previous similar periods. If you are thinking of installing temporary emergency lighting at all you might be interested to know that we have just received some Philips invertors for working 12" fluorescent tubes from 12v car batteries. We are able to offer these invertors at half the proper price, namely £1.50p + 12p. Post 40p + 3p.

Miniature Tubes also available 12" 75p + 6p., no extra post if ordered with invertors, bi pin holders for these miniature tubes 10p + 1p each.

Central Heating; Regulating, Mixing, Pumping System. In addition to circulating the water through the system, this can be used to regulate the supply to upstairs radiators or to domestic water or central heating as in addition to normal pumping (which is itself adjustable 4 ways) the output of the pump passes first through a valve system, this valve system is motorized (or can be hand operated) and can be made to share the output evenly between two sets of pipes or can be made to give an increase in amount to one at the expense of the other. In the Spring for instance, you may not want much heat going through to your radiators but you still want maximum for baths etc. During the daytime you do not want to heat the bedrooms so you can send all the heat through the downstairs rooms etc. The pump is for normal mains operation and comes complete with 4 pipe unions. Summary of the special features of this system is as follows:—Inductive pump drive (without shaft). Self cleaning pump construction, continuous water lubricated rotor, pump output adjustable in 4 stages. Switch to gravity circulation possible. Accurate automatic temperature regulation ± 1°C. We understand that the regular price of this pump is around £40. Our price is £20 + £1.60p. Post £3.24p.

Panel Meters mainly G.P.O.
(1) 3" x 2 1/2" flush mounting, 25UA f.s.d., scale calibrated 0-1000 meg ohms ideal if you are thinking of making a portable insulation tester. Price £3.24p. Post 40p + 4p.
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100	0-25*	0-25	0-40	0-37	0-47	0-48	0-54	1-02
200	0-27*	0-35	0-45	0-40	0-58	0-60	0-68	1-14
400	0-30*	0-40	0-50	0-45	0-87	0-88	0-98	1-40
600	—	0-65	0-70	—	1-09	1-19	1-26	1-80

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100V	0-60	0-60	0-70	0-70	0-78	0-78	0-83	0-83	0-83	1-01	1-01	1-01	1-01	1-01	1-01
200V	0-64	0-64	0-75	0-75	0-87	0-87	0-87	0-87	0-87	1-17	1-17	1-17	1-17	1-17	1-17
400V	0-77	0-78	0-80	0-83	0-97	1-01	1-13	1-19	1-19	1-70	1-70	1-70	1-70	1-70	1-70
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7413 0-25

7414 0-26

7416 0-43

7417 0-43

7420 0-18

7422 0-38

7423 0-40

7425 0-30

7427 0-48

7428 0-53

7430 0-16

7432 0-37

7433 0-49

7437 0-35

7438 0-35

7440 0-16

7441 0-78

7442 0-65

7445 1-50

7448 2-58

7447 0-81

7448 0-81

7450 0-85

7451 0-16

7453 0-18

7454 0-18

7460 0-18

7470 0-32

7472 0-26

7473 0-30

7474 0-32

7475 0-47

7476 0-36

7480 0-55

7481 1-26

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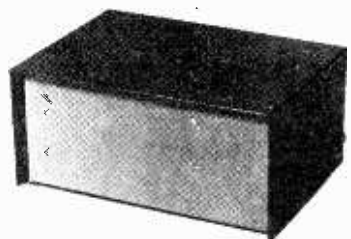
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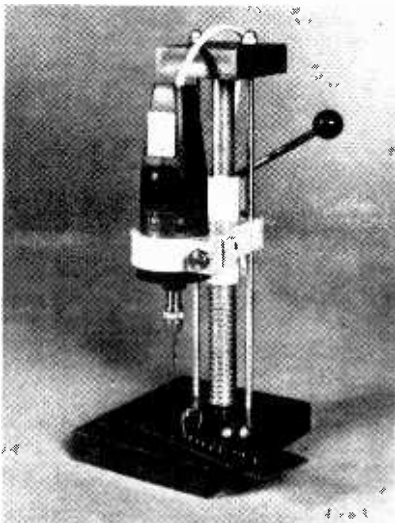
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3Q5	-65	6J5	-50	30C17	-75	E182CC	3-10	EF91	-50	PC88	-60	QQV06/40	
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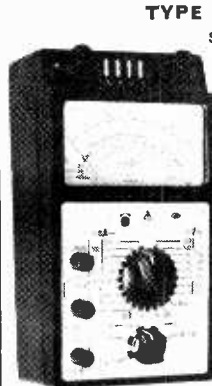
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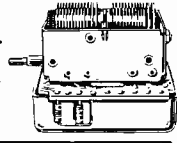
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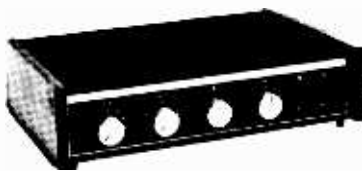
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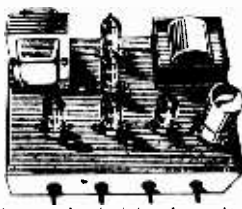
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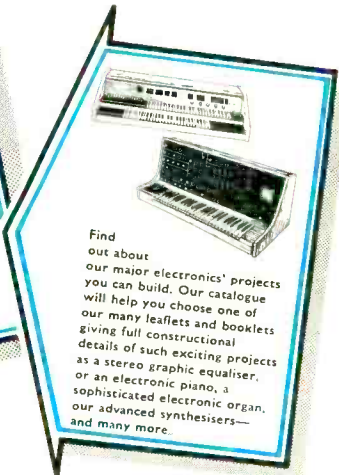


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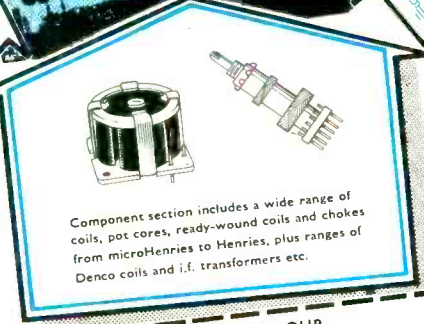
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