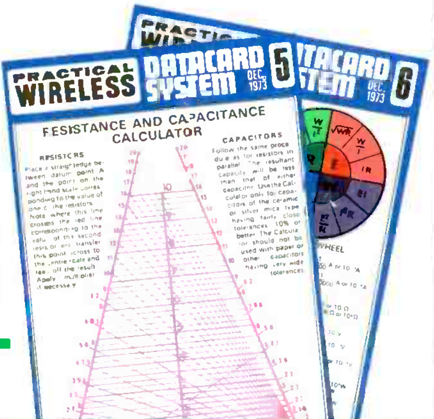
PRACTICAL WIRELESS

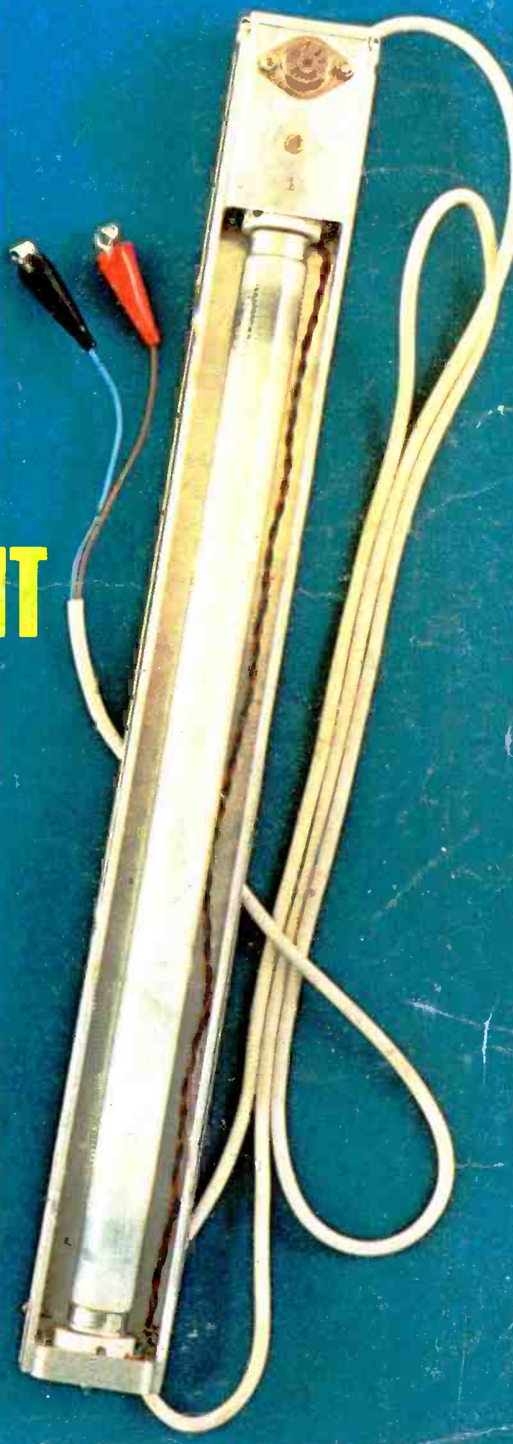
DECEMBER 1973

20p

FREE inside

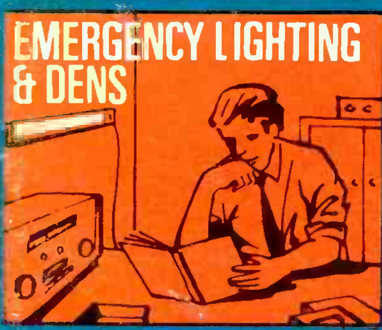
2 DATA-CARDS

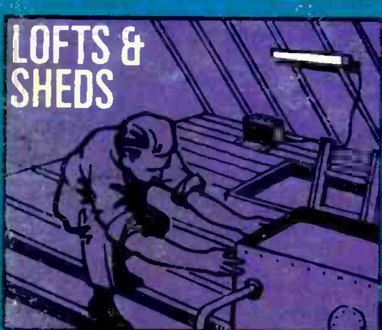




PORTABLE FLUORESCENT LAMP UNIT

-FROM YOUR 12V BATTERY





ALSO:- 3-BAND SHORT WAVE SUPERHET: USING THE LM380 I.C. AUDIO AMPLIFIER

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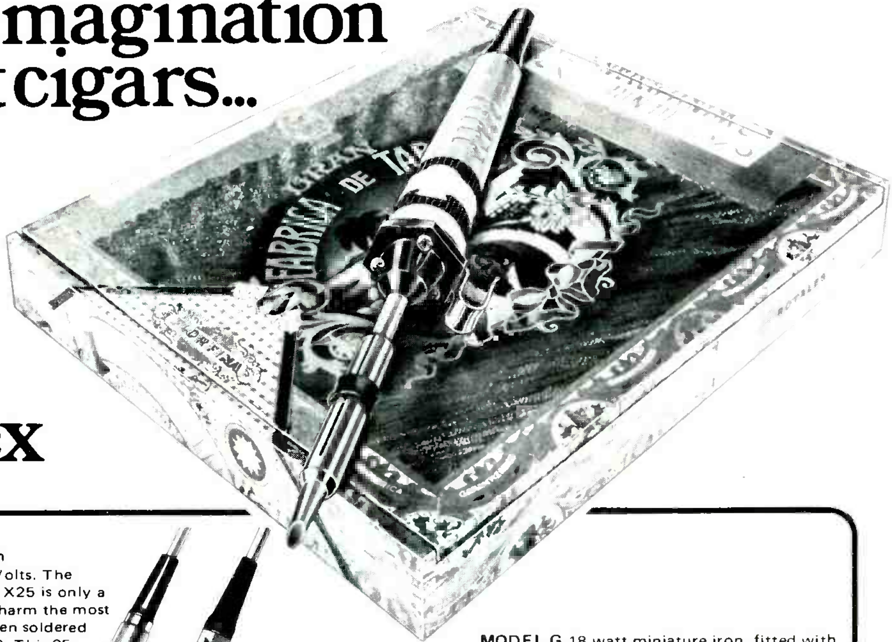

MODEL X25 Soldering Iron
220-240 Volts or 100-120 Volts. The leakage current of the NEW X25 is only a few microamps and cannot harm the most delicate equipment even when soldered "live". Tested at 1500v. A.C. This 25 watt iron with its truly remarkable heat-capacity will easily "out-solder" any conventionally-made 40 and 60 watt soldering irons, due to its unique construction advantages. Fitted long-life iron-coated bit 1/8". 2 other bits available 3/32" and 3/16". Totally enclosed element ceramic and steel shaft. Bits do not "freeze" and can easily be removed. **PRICE £1·93** (rec. retail) P & P 8p. Suitable for production work and as a general purpose iron.

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220 volts or 240 volts. The 15 watt miniature model CCN also has negligible leakage. Test voltage 4000v. A.C. Totally enclosed element in ceramic shaft. Fitted long-life iron-coated bit 3/32". 4 other bits available 1/8", 3/16", 1/4" and 3/64".
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MODEL G 18 watt miniature iron, fitted with long-life iron-coated bit 3/32". Voltage 240, 220 or 110. **PRICE £2·15.** (rec. retail) P & P 5p.

MODEL CN Miniature 15 watt soldering iron fitted 3/32" iron-coated bit. Many other bits available from 3/64", to 3/16". Voltages 240, 220, 110, 50 or 24. **PRICE £1·93.** (rec. retail) P & P 5p.

all prices include VAT at 10%

the DESIGN CENTRE

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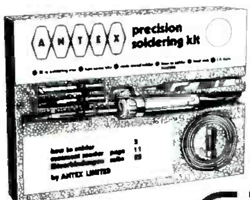
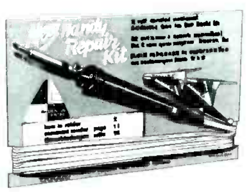
Contains 15 watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32" heat sink, solder, stand and "How to Solder" booklet.
PRICE: £2·87. (rec. retail) P & P 8p.





MODEL MLX KIT
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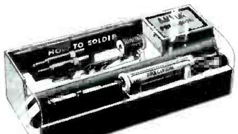

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PRACTICAL WIRELESS

VOL. 49 NO. 8
ISSUE 802
DECEMBER 1973

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

SUBSCRIPTIONS
Publisher's Subscription Rates for one year to any part of the world £2·65 including postage. Enquiries to Subscription Department, IPC Magazines Ltd., Carlton House, 68 Gt. Queen Street, London, WC2 5DD. Phone 01-242 4477. International Giro facilities Account No. 5122007. Please state reason for payment "message to payee".
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BACK NUMBERS
We regret that we are unable to supply back numbers of Practical Wireless. Readers are recommended to enquire at a public library to see copies. Requests for specific back numbers of *Practical Wireless* and *Television* only can be published in our CQ Column.

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INSET P.W. DATACARDS in COLOUR
No. 5 Resistance and Capacitance Calculator
No. 6 D.C. Circuits

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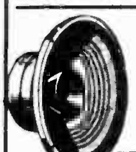

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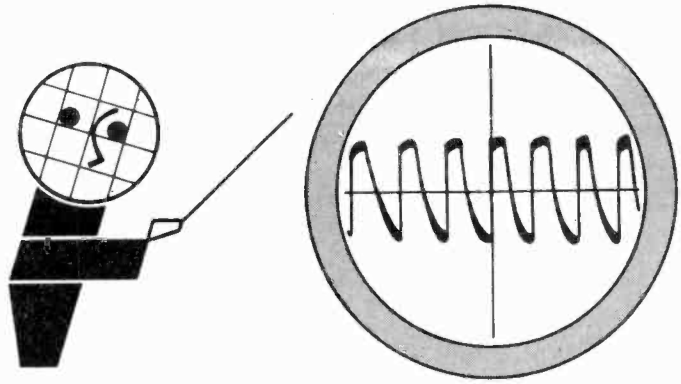

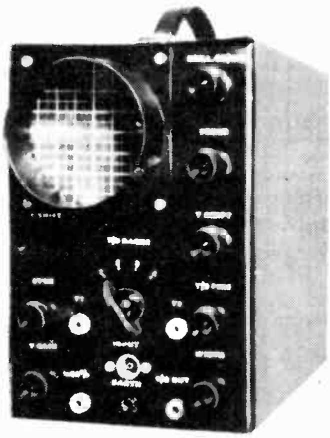

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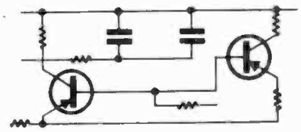

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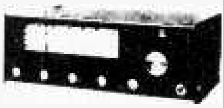

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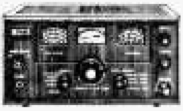

4 bands covering 550 Kc/s to 30 Mc/s continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW, ANL, Variable BFO. S meter. Sep. bandspread dial. IF frequency 445 kc/s, audio output 1·5w. Variable RF and AF gain controls 115/250 v. A.C. with instruction manual.

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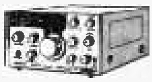

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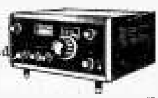
Our Price **£155·00** Carr. Paid

BELTEK W5400 CAR TRANSCEIVER

Solid state mobile transceiver for 12v DC neg. use. Transmits and Receives on any 12 of 28 channels between 144 and 146MHz. Power output 10w and 1w switchable. Controls: Volume/on/off, squelch channel selector Internal 3" speaker. Complete with dynamic mike, PTT switch, three sets of crystals for 144·48MHz, 144·60 MHz, 145·00MHz, mounting bracket and instructions. Size approx. 150 × 70 × 220mm.

Our Price **£75·00** P & P 50p

TRIO JR310 SSB RECEIVER



Covers 3·5, 7, 14, 21, 28, 28·5 and 29·1 MHz bands and WWV 15MHz. SSB, AM and CW. AF output more than 1 watt. Crystal controlled BFO for SSB. S meter. ANL etc. AC 110/120–220/240v. Size 330 × 179 × 310mm.

Our Price **£75·00** Carr. Paid

GWS
ALSO SEE PREVIOUS PAGES

UNR 30 RECEIVER

4 Bands covering 550 Kc/s-30 Mc/s B.F.O. Built-in Speaker 220/240 v. A.C. Brand new with instructions.

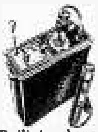
Our Price **£15·75** Carr. 37p

LAFAYETTE HA-600 RECEIVER

General coverage 150-400 Kc/s, 550 Kc/s-30 Mc/s, FET front end, 2 mech. filters, product detector, variable B.F.O., noise limiter, S Meter Bandspread. RF Gain. 220/240 v. A.C. or 12 v. D.C. Brand new with instructions.

Our Price **£50·00** Carr. 50p

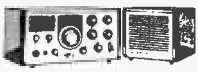
TRIO TR2000 TRANSCEIVER



Fully transistorised portable VHF Transceiver. Will transmit and receive on 6 channels between 144-146MHz. 1 watt transmitter. 12v DC internal or external supply. Built in charger for ni-cad cells. Power/volume switch, squelch control, channel selector, mike socket, earphone/external speaker socket. Complete with microphone, 144·48, 144·72 and 145·32 crystals. Size 134 × 58 × 180mm.

Our Price **£79·50** Carr. Paid

TRIO TS515/PS515 TRANSCEIVER



High quality TS515 SSB/CW amateur band receiver covering 80, 40, 20, 15 and 10 metre bands with PS515 power supply and speaker unit. Transmit/receive frequency 3·5–29·7MHz. Output 1·5 watts. Power requirements 110-120/220-240v. AC.
Sizes: TS515 330 × 185 × 340mm.
PS515 200 × 168 × 349mm.

Our Price **£210·00** Carr. Paid

SWR METER—Model SWR-3

Handy SWR Meter for transmitter antenna alignment, with built-in field strength meter. Accuracy: 5%, Impedance: 52, Indicator: 100μA DC, full scale 5 section collapsible antenna. Size: 145 × 50 × 60 mm.

OUR PRICE **£4·25** P. & P. 25p

AUDIOTRONIC AMR-900 GLOBAL AM/FM PORTABLE RADIO

10 wavebands covering AM: 535–1605 kHz, LW: 150–380 kHz, MB 1·6–4·00 MHz, SW1: 4·0–8 MHz, SW2: 8·0–1·6 MHz, SW3: 16–24 MHz, PSB1: 30–50 MHz, PSB2: 148–174 MHz, FM 88–108 MHz, AIR: 108–136 MHz. Features time zone map and timing dial. Large clear scale. Telescopic aerial and built in aerial. AFC or FM. 6" × 4" speaker and personal earpiece. Battery/mains operation. Size: 345 × 133 × 305mm.

OUR PRICE **£36·00** P. & P. 50p.

SH628 STEREO HEADPHONES

Outstanding value. Soft ear-pads, adjustable headband. 8-16 ohms. 20-20,000 Hz. Complete with lead and stereo plug.

Our Price **£1·87** P. & P. 30p

LH02S STEREO HEADPHONES

Lightweight headphones with padded earpieces. 4-16 ohms. 20-20,000 Hz. Complete with 6 ft. cord and plug.

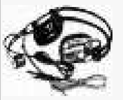
Our Price **£1·97** P. & P. 30p

TE1018 DE-LUXE MONO HIGH IMPEDANCE HEADSET

Sensitive magnetic headset with soft earpads. Impedance 2,600 ohms (d.c. 600 ohms). Frequency response 200–4,000 Hz.

Our Price **£2·25** P. & P 30p

BH.001 HEAD SET AND BOOM MICROPHONE



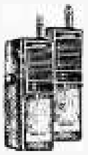
Moving Coil. Ideal for language teaching, communications. Headphone imp. 16 ohms. Microphone imp. 200 ohms.

Our Price **£4·95** P. & P. 30p

DH02S STEREO HEADPHONES

Wonderful value and excellent performance combined. Adjustable headband. 8 ohm impedance, 20–12,000 cps. Complete with lead and plug.

Our Price **£2·25** P & P 30p



HAND-HELD 2-WAY WALKIE-TALKIES

P. & P. 50p.

SKYFON—100MW. £24·95 pair.
P302—2 CHANNEL 300MW. £52·50 pair.
P1003—3 CHANNEL 1 Watt £71·25 pair.
LICENCE REQUIRED FOR OPERATION IN U.K.

AUDIOTRONIC DIGITAL CLOCK RADIO ADC.1

Covers AM 540 - 1600 KHz. FM 88 - 108 MHz with AFC Illuminated dial. 24 hour alarm setting. Wake up to the sound of music or loud buzzer. Sleep switch will automatically turn off radio etc. Internal speaker plus socket for earpiece or pillow speaker. AC 240v. Size 254 × 92 × 178mm. Complete with earpiece, and operating instructions.

OUR PRICE **£12·50** P. & P. 50p.

SPECIAL BARGAIN! PHONIC 10 TWO WAY SPEAKER SYSTEM

Matched pair of compact bookshelf speakers of unique design incorporating 2" high frequency tweeter and 6" woofer. 8 ohms impedance. 10 watts power handling. Size 348 × 228 × 110mm.

GWS SPECIAL PRICE **£9·95** per pair. P. & P. 50p plus VAT.

AUDIOTRONIC AHA101 STEREO HEADPHONE AMPLIFIER

All silicon transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9v battery.
INPUTS: 5mV/100mV.
OUTPUT: 50mV per channel.

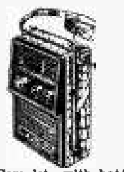
Our Price **£7·50** P. & P. 20p

AUDIOTRONIC AR.1000 SPORTSMAN AM/FM POLE BRTARADIO

5 wavebands covering AM 535-1065KHz FM 88–108MHz. AIR 108–135MHz. PB 147–174MHz. WB 162. 5MHz. Large horizontal slide dial with logging scale. Slider volume and squelch controls. 7 section telescopic aerial for FM and built in ferrite bar for AM. AFC. 3in. speaker. Earpiece socket. Size 152 × 79 × 219mm. Battery/mains operation.

OUR PRICE **£11·50** P. & P. 35p.

AUDIOTRONIC AMB.500 MULTIBAND RADIO



5 wavebands covering MW 535–1605KHz and FM 88–175MHz. All transistor. Battery or mains operation. Built in aerial and 8 section telescopic aerial. Complete with batteries, shoulder strap and earpiece.

OUR PRICE **£6·95** P & P 35p

BINATONE DS100 DIGITAL CLOCK

240v. mains operated. Plastic case with large clear numbers for hours, minutes and seconds. Approx. size 6½" × 3" × 3½".

OUR PRICE **£4·50** P. & P. 30p.

AUDIOTRONIC ACP.8 8 TRACK CAR PLAYER

12v neg. earth. Slider controls for Volume, Tone and Balance. Channel selector button with red pilot lamp, with speakers, mounting brackets and instructions.

Our Price **£12·50** P & P 40p

AUDIOTRONIC DOLBY 'B' NOISE REDUCTION UNITS

Reduce tape hiss by 3dB at 600Hz, 6dB at 1200Hz and 10bB for all frequencies above 3000Hz. Size 16½" × 8" × 3¼". AC 200/250v

PROCESS FOUR
For use with semi-professional tape recorders. Freq. res. 30Hz–20KHz ± 2dB. S/N better than 70dB. Full source tape monitoring. Record/Replay metering. Switchable multiplex filter. Supplied with test tape.

Our Price **£50·00** P & P 50p

PROCESS TWO
For use with cassette and tape recorders. Freq. res. 30Hz–20KHz ± 2dB. Off tape monitoring. Switchable multiplex filter. Two Dolby calibration meters. S/N better than 70dB.
Supplied with test cassette or tape as required.

Our Price **£34·50** P & P 50p

FM TUNER CHASSIS

6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6 × 4 × 2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88–108Mc/s. Ready built ready for use. Fantastic value for money.

Our Price **£5·95** P. & P. 20p

A1018 FM TUNER

Specification as above chassis but complete in cabinet with on/off switch Size 7½" × 3¼" × 5".

Our Price **£9·65** P & P 30p

Stereo multiplex adaptor £4·97.

AUDIOTRONIC AM/FM Portable Radio AR3000

4 wavebands covering FM 87 - 108 MHz, MW 510 - 1605 KHz, LW 145 - 285 KHz, SW 5·8 - 12·5 MHz. Push button wave change plus AFC and on/off. Thumb wheel tuning. Slider volume and tone controls. Earphone socket. Built-in and telescopic aerials. Car aerial socket. Battery/Mains operation.

OUR PRICE **£14·95** P. & P. 50p

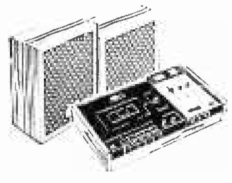
AUDIOTRONIC ACR3500 CAR RADIO

Manual tuning of Medium and Long waves. 12v pos. or neg. earth. Complete with speaker. mounting brackets and instructions.

Our Price **£6·50** P & P 50p

SAVE UP TO 33⅓% OR MORE! GWS

SUPER AKAI HI-FI BARGAINS
CS35 Stereo Cassette Recorder

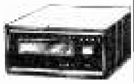


For conventional or Chromium Dioxide tape. 4 track record/playback. Volume and tone controls. Frequency response 40 - 16kHz (using CrO2 tape), distortion better than 2%, wow and flutter better than 0·2% RMS. Complete with pair of matching Akai CS88 speakers.

Rec. Price £96·10 OUR PRICE **£56·50** P.&P. 50p

MICROPHONES (P. & P. 50p)
ADM Dynamic (pair) £7·50

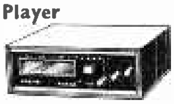
AUDIOTRONIC AHP-8D 8 Track Stereo Tape Deck



Can be used with most hi-fi amplifiers. Push button track selector and illuminated track indicators. Attractive cabinet with black and silver trim. Output level 750mV. AC 220/240v.

OUR PRICE **£11·95** P. & P. 50p.

AUDIOTRONIC AHP-8A 8 Track Stereo Tape Player



Incorporates built in amplifiers giving 2½ + 2½ watts rms output. Push button track selector, illuminated track indicators, slider controls for volume, balance and tone. Attractive cabinet with black and silver trim. Output impedance 8 ohms. AC 220/240v.

OUR PRICE **£17·25** P. & P. 50p.

SPECIAL PURCHASE! BSR 8 TRACK PLAYER CHASSIS

Famous BSR 8 track chassis as used in Model TD8S complete with silver and black escutcheon ready to fit into cabinet. Output 125mV. AC 240v. Overall size approx. 185 × 215 × 80mm.

OUR PRICE **£8·95** P. & P. 50p.

AUDIOTRONIC ACD.660 Stereo Cassette Deck

A beautifully styled 4 track stereo deck with an outstanding specification offered at a remarkably low price. Incorporates a host of features including switchable noise filter normal/chrome tape selector, twin VU meter, slider record/playback level controls, front panel headphone socket, recording indicator lamp, phono/Din line input sockets, 3.5mm mike input sockets etc. etc. Frequency response 100–8KHz (100–12KHz Cr02) S/N–45dB. Crosstalk 45dB. Separation–35dB. Noise limiter–6dB at 10KHz. Complete with phono connecting leads.

OUR PRICE **£39·50** Carr. & Ins.50p

AUDIOTRONIC ACR.14 Battery Mains Cassette Recorder

Portable twin track mono recorder with automatic recording level control. Built in speaker. Earpiece socket. Input for radio or record player. Fast forward and rewind. Output 500mW. AC 220/240v or 6v DC operation. Complete with remote control microphone, mains lead, earpiece and batteries.

OUR PRICE **£10·50** P. & P. 50p.

PORTABLE CASSETTE RECORDER CT5050

Instant recording and playing. Piano key controls. Automatic level control. Built in speaker. Complete with remote control microphone, carrying case and shoulder strap

OUR PRICE **£8·50** P. & P. 50p.

AUDIOTRONIC LOW NOISE CASSETTES

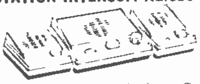
Top Hi-Fi quality in library cases

TYPE	5	10	25
C60	£1·29	£2·53	£5·99
C90	£1·85	£3·62	£8·59
C120	£2·29	£4·48	£10·63

P. & P. 15p.

Cassette Tape Head Cleaner 30p

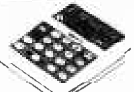
3-STATION INTERCOM KE.630



Master and two sub stations. Can be used on desk or wall mounted. Complete with cable and batteries.

Our Price **£5·25** P & P 50p

MINUTEMAN MM3 POCKET CALCULATOR



Size only 4 1/16" × 3" × 1". 8 digit display with overflow and error indicators. Floating decimal. Adds, subtracts, multiplies and divides. Chain and mixed calculations. Constant factor for series multiplication or division. Complete with batteries, instructions and case.

OUR PRICE **£23·95** P. & P. 25p

MINUTEMAN MM3M

as above with addition of memory key, per cent key and a fixed or floating decimal. Complete with rechargeable batteries, AC adaptor, instructions and case.

OUR PRICE **£28·50** P. & P. 25p

NEW! SINCLAIR CAMBRIDGE CALCULATOR

To build yourself. Complete kit of parts with step by step instructions to build a full specification pocket sized calculator.

OUR PRICE **£24·95** P. & P. 50p.

(Also available ready built Rec. Price £29·95)

OUR PRICE **£27·20** P. & P. 25p

AUDIOTRONIC Stereo Headphones

LSH.20 Individual volume controls Stereo mono switch. 8 ohms. 40–19,000 Hz. £3·50 P & P 30p

LSH.30 Open back type. Individual tone and volume controls. 8 ohms. 30–20,000 Hz. £5·50 P & P 30p

LSH.40 Two way speaker system. Individual volume controls. 8 ohms. 20–20,000 Hz. £6·95 P & P 30p

LSH.60 3" speaker units. 8 ohms. 20–20,000 Hz. Complete with zipped carrying case. £8·50 P. & P. 30p

LQH.400 4-channel dynamic headphones. Each earpiece has 4 drive units. 4-32 ohms. 20-20,000 Hz. £9·95 P. & P. 30p

LSH.50 Electrostatic with self powered energiser and control unit with headphone/speaker selector. 4-32 ohms. 20-24 000 Hz. £15·95 P. & P. 30p

RECORD DECKS

Carriage and Packing 50p

B.S.R. McDONALD

C114 Mini	£3·95
C129 Mono	£5·50
C137	£7·00
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610	£10·55
610/TPD1	£15·45
710	£21·15
810	£26·30
MP60	£8·25
MP60/G800	£10·90
MP60/TPD1	£13·20
MP60/TPD2	£11·25
HT70	£11·60
HT70/G800	£14·25
HT70/TPD1	£16·55

CONNOISSEUR

BD1 Kit	£9·10
BD1 Chassis	£11·35
BD2/SAU2/Chassis	£22·70
BD2/SAU2/Plinth/Cover	£28·20

GARRARD

2025 T	£6·35
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AP76/G800E	£28·65
AP76/M44E	£27·70
AP76/M44–7	£27·20
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AP76/M75ED	£34·90
AP76/M75EJ	£30·90
AP76 Module M75–6	£29·10
86SB Module/M75-6SM	£32·50
AP96 Module M75–6	£33·20
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Zero 100SB Module M75-6SM	£44·20

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GOLDRING

GL72/G800	£34·20
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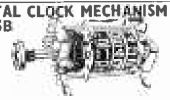
PZ8	£6·30
PZ8 Mains transformer	£4·05
Project 605	£20·97

DIGITAL CLOCK MECHANISM DT.55B



Features 24 hour alarm setting with built-in buzzer. On/off and auto alarm 'sleep' switch. Illuminated rotary dial with hours, minutes and seconds. Automatically turns off TV, radio, light, etc. and with autosetting will switch on again when required. AC 240v. operation. Switch rating 250v. 3A.

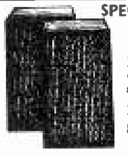
OUR PRICE **£5·95** P. & P. 30p.

EMI LOUDSPEAKERS

Model 350. 13" × 8" with single tweeter/crossover. 20–20,000 Hz. 15 watt RMS. Available 8 or 15 ohms. £7·25 each. P. & P. 37p.

Model 450. 13" × 8" with twin tweeter/crossover. 55–13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. £3·62 each. P. & P. 25p.

SPECIAL OFFER! STEREO SPEAKERS



Matched pair of stereo bookshelf speakers. Deluxe teak veneered finish. Size 14½" × 9" × 7½". 8 ohms. 8 watt RMS. 16 watt peak. Complete with DIN lead.

Our Price **£12·95** Carr. 50p

SPECIAL OFFER! FRUSTRATED EXPORT ORDER
PHILCO FORD MODEL 5245 MAINS TAPE RECORDER

2 track BSR deck with push button controls for easy operation. Tape counter and volume control. Complete with hand microphone, Direct recording lead, 1200' reel of tape & spare spool. 200/250V AC operation. Fully guaranteed.

OUR PRICE £17·50. C & P 75p.

PHILCO FORD MODEL 5248 MAINS TAPE RECORDER

4 track, 2 speeds (3¾ i.p.s. & 1⅞ i.p.s.). Piano key type controls, tape counter, recording level meter, volume & tone controls etc. Complete with hand microphone, direct recording lead, 1800' of tape with spare spool. 200/250V AC operation fully guaranteed.

OUR PRICE £27·50. C & P 75p.

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118, Edgware Road, W.2.	Tel: 01-723 9789
193, Edgware Road, W.2.	Tel: 01-723 6211
311, Edgware Road, W.2.	Tel: 01-262 0387
382, Edgware Road, W.2.	Tel: 01-723 4194
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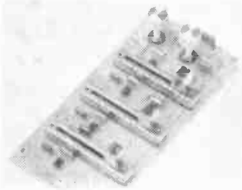
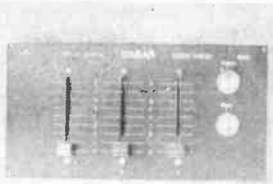
E & O E

DABAR MN3 MIXER KIT





INTRODUCING THE NEW DABAR MINI THREE CHANNEL MIXER KIT WITH THE FOLLOWING FEATURES:

★ Three inputs easily adjustable to suit users input requirements, e.g., Mic., Tape, Disc., etc.
★ Uses advanced design with five integrated circuits.
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★ Battery operated (2 x PP3) not supplied with kit.
★ Easy to follow assembly instructions (available separately 25p).
★ Attractive ready punched facia plate, available at extra cost, gives that professional finish to the unit.
★ Size: 9·5" x 4·8" x 2".

PRICE: KIT ONLY £11·00
FACIA PLATE £1·50
MANUAL AND ASSEMBLY INSTRUCTIONS 25p
AVAILABLE READY BUILT WITH FACIA £15·00

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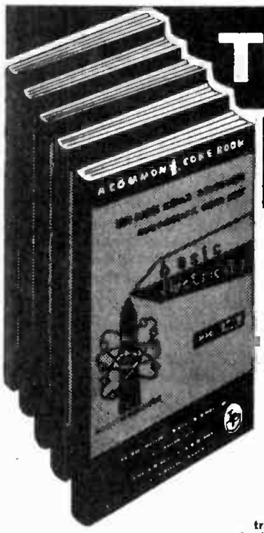

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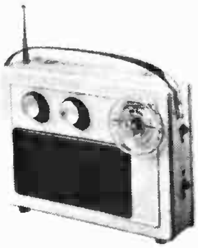

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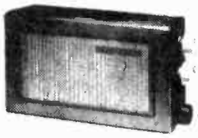

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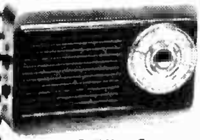

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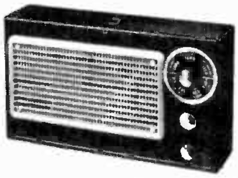

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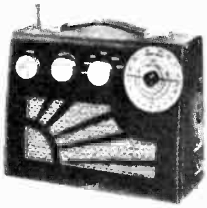

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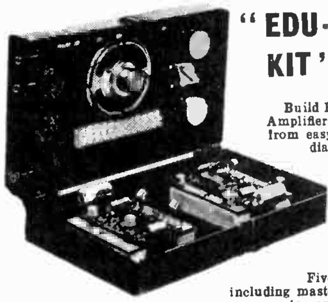

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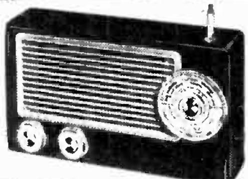

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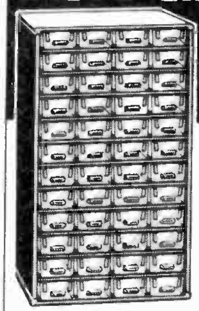

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AC187K	17p
AC188K	23p
AC187/188K	40p
ACY17	27p
ACY18	20p
ACY19	20p
ACY20	20p
ACY21	19p
ACY22	10p
AD140	60p
AD149	60p
AD161	44p
AD162	44p
AD161/162	88p
AF106	32p
AF114	27p
AF115	27p
AF116	25p
AF117	25p
AF118	44p
AF124	25p
AF125	24p
AF126	24p
AF139	47p
AF186	40p
AF239	52p
AF279	58p
ASY26	25p
ASY27	30p
ASY28	22p
ASY29	30p
BA138	15p
BB103	20p
BB104	34p
BB105	28p
BC107	13p
BC107/BC177	33p
BC108	12p
BC108/BC178	28p
BC109	13p
BC109/BC179	33p
BC109C	14p
BC117	15p
BC140	30p
BC147	12p
BC148	11p
BC149	12p
BC157	13p
BC158	12p
BC159	13p
BC147/157	25p
BC148/158	23p
BC149/159	25p
BC167	11p
BC168	10p
BC169	11p
BC169C	12p
BC177	20p
BC178	16p
BC179	20p
BC182	14p
BC182L	14p
BC183	13p
BC183L	14p
BC184	17p
BC184L	16p
BC212	16p
BC212L	16p
BC238	10p
BC238/308	20p
BC257	11p
BC258	10p
BC259	12p
BC307	12p
BC308	10p
BCY30	25p
BCY31	48p
BCY32	50p
BCY33	20p
BCY34	25p
BCY38	30p

BCY58	18p
BCY70	15p
BCY71	26p
BCY72	14p
BD124	75p
BD131	40p
BD132	40p
BD131/132	80p
BDY20	91p
BF115	23p
BF163	35p
BF167	25p
BF173	29p
BF177	25p
BF178	31p
BF180	35p
BF194	15p
BF195	15p
BF196	15p
BF200	35p
BF254	14p
BF255	15p
BFX13	25p
BFX29	32p
BFX84	25p
BFX85	34p
BFX86	25p
BFX87	30p
BFX88	24p
BFY50	22p
BFY51	19p
BFY52	20p
BFY53	17p
BFY90	£1·20
BP101	£1·40
BPX66	£1·50
BRY39	45p
BSX19	16p
BSX20	16p
BSX21	20p
BSY27	20p
BSY29	25p
BSY95A	12p
BY100	20p
BY127	22p
BTY79/400R	£1·80
BT106	£1·20
BZY88C3V3	10p
BZY88C3V6	10p
BZY88C3V9	10p
BZY88C4V3	10p
BZY88C4V7	10p
BZY88C5V1	10p
BZY88C5V6	10p
BZY88C6V2	10p
BZY88C6V8	10p
BZY88C7V5	10p
BZY88C8V2	10p
BZY88C9V1	10p
BZY88C10V	10p
BZY88C11V	10p
BZY88C12V	10p
BZY88C13V	10p
BZY88C15V	10p
BZY88C16V	10p
BZY88C18V	10p
BZY88C20V	10p
BZY88C22V	10p
BZY88C24V	10p
BZY88C27V	10p
BZY88C30V	10p
BZX61C7V5	28p
BZX61C8V2	28p
BZX61C9V1	28p
BZX61C10V	28p
BZX61C11V	28p
BZX61C12V	28p
BZX61C13V	28p
BZX61C15V	28p
BZX61C16V	28p
BZX61C18V	28p
BZX61C20V	28p
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CA3044	£1·28
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IRT84	£2·90
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LIC723C/14	£1·02
LIC741C/5	45p
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MC1303L	£1·75
MC1305P	£2·80
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MC1352P	£2·00
MC1466L	£4·20
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MFC6040	£1·15
MFC8010	£1·38
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OA91	5p
OA95	5p
OA200	6p
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OC25	45p
OC28	78p
OC29	79p
OC35	66p
OC36	69p
OC41	40p
OC42	40p
OC44	20p
OC45	20p
OC71	20p
OC72	20p
OC75	25p
OC76	25p
OC77	40p
OC81	20p
OC81D	20p
OC83	23p
OC84	25p
OC139	25p
OC170	25p
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ORP12	50p
ORP60	50p
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ZTX108	11p
ZTX300	13p
ZTX302	18p
ZTX303	15p
ZTX304	23p
ZTX314	11p
ZTX320	30p
ZTX330	18p
ZTX500	14p
ZTX501	15p
ZTX502	18p
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ZTX504	45p
1N914	4p
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1S940	6p
2N404	23p
2N696	15p
2N697	17p
2N698	30p
2N706	10p
2N706A	12p
2N708	16p
2N911	50p
2N914	20p
2N918	42p
2N929	25p
2N930	28p
2N1131	24p
2N1132	24p
2N1302	17p
2N1303	17p
2N1304	24p
2N1305	24p
2N1306	30p
2N1307	30p
2N1308	34p
2N1309	34p
2N1559 (CR1/401C)	71p
2N1613	15p
2N1711	15p
2N1893	54p
2N2218	33p
2N2218A	44p
2N2219	38p
2N2219A	53p
2N2368	17p
2N2369	17p
2N2369A	17p
2N2484	42p
2N2646	45p
2N2904	44p
2N2904A	49p
2N2905	65p
2N2905A	75p
2N2924	18p
2N2925	20p
2N2926	10p
2N3053	24p
2N3054	65p
2N3055	65p
2N3228	£1·10
2N3391A	29p
2N3525	£1·04
2N3702	14p
2N3703	12p
2N3704	12p
2N3705	12p
2N3706	12p
2N3707	12p
2N3708	12p
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2N4058	15p
2N4060	13p
2N4061	13p
2N4062	13p
2N4441	70p
2N4444	£2·20
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2N4991	46p
2N5245	45p
2N5457(MPF103)	49p
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3N140	92p
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3015F	£1·50
3015G	£2·00
7400	20p
7401	20p
7402	20p
7403	20p
7404	25p
7405	25p
7408	25p
7409	25p
7410	20p
7413	30p
7420	20p
7425	30p
7430	20p
7440	24p
7442	£1·16
7443	£1·45
7444	£1·45
7445	£2·06
7446	£1·45
7447	£1·25
7450	20p
7451	20p
7453	20p
7454	20p
7460	20p
7470	45p
7472	32p
7473	45p
7474	46p
7475	45p
7476	45p
7480	67p
7482	87p
7483	£1·32
7486	33p
7490	70p
7491A	£1·28
7492	85p
7493	75p
7494	£1·13
7495	80p
7496	£1·48
74100	£1·64
74107	52p
74121	43p
74141	£1·00
74150	£3·35
74151	£1·10
74153	£1·35
74154	£2·00
74155	£1·55
74156	£1·55
74190	£1·80
74191	£1·80
74192	£1·74
74193	£1·74
74196	£1·50
74197	£1·50
40250	66p
40309	40p
40310	60p
40311	42p
40312	62p
40320	42p
40360	56p
40361	45p
40362	45p
40406	52p
40407	40p
40408	54p
40409	62p
40410	62p
40430	£1·13
40468A	44p
40511	£1·92
40575	£1·54
40576	£1·46
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40602	45p
40603	70p
40669	£1·00
40673	56p
40739	£1·50

CAPACITORS ELECTROLYTIC AXIAL LEADS

Mfd.	Working Voltage	Price	Mfd.	Working Voltage	Price
1·0	40v	10p	100	16v	9p
1·0	100v	8p	100	25v	9p
2·2	25v	10p	100	40v	10p
2·2	63v	8p	100	63v	13p
4·7	40v	8p	220	25v	11p
10	25v	8p	220	40v	12p
10	63v	9p	470	25v	14p
22	25v	9p	1000	25v	21p
22	40v	9p	2200	25v	39p
47	25v	9p	4700	16v	46p
47	40v	9p			

CAPACITORS—METALLISED POLYESTER

Stock values: MFD	Price each
0·01, 0·015, 0·022, 0·033	4p
0·047, 0·068, 0·10	5p
0·150, 0·220	6p
0·33	8p
0·47	9p
0·68	12p
1·0	15p
1·5	22p
2·2	26p

Order as "Polyesters" + Capacitance.

CAPACITORS—POLYSTYRENE

Axial leads, Clear encapsulation. 5% Tolerance. 160 volt working.

Stock values	Price each
10pF, 15pF, 22pF, 33pF, 47pF, 68pF, 100pF, 150pF, 220pF, 330pF, 470pF, 560pF, 680pF, 820pF, 1000pF, 1500pF, 2200pF, 3300pF, 4700pF, 5600pF, 6800pF	4p

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NEW LOW PROFILE IC HOLDERS

14 pin Dil 18p, 16 pin Dil 26p, 8 pin Dil 16p.

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Cheese head screw bolts. Nuts with integral washer. Moulded in high density nylon. Ideal for mounting "live" assemblies, power transistors, etc.

Each pack consists of four nuts and four screw bolts.

Pack No.	Thread	Length	Quantity	Pack Price
HSN1	6BA	¼"	4	10p
HSN3	6BA	¾"	4	10p

Order as "Nuts and Bolts" + Pack No.

OPTO ELECTRONICS—3 devices

from our range—OCP71—42p, ORP12—50p, TIL209 Red led 35p

ANTEX SOLDERING EQUIPMENT

X25/240v 25w Iron £1·75 SK 2/240v 15w Kit £2·60

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OP. AMPS—NEW LOW PRICE!

741 8 PIN DIL 34p

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Metal Oxide resistors by Electrosil. Ultra low noise, ½ Watt, 2%. Available in the range E24 between 10 ohms and 1 Meg. E24 series—1·0, 1·1, 1·2, 1·3, 1·5, 1·6, 1·8, 2·0, 2·2, 2·4, 2·7, 3·0, 3·3, 3·6, 3·9, 4·3, 4·7, 5·1, 5·6, 6·2, 6·8, 7·5, 8·2, 9·1, and their decades.

Type No. TR5 Price: 4p each

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RESISTORS—CARBON FILM

A range of miniature high stability resistors with very low noise characteristics and long life. Tolerances, ranges and wattages as indicated. (Wattage ratings are at max. limiting voltage).

Type No.	Wattage	Tol.	Range	Series	Price
UPM050	0·5	5%	10E-1M	E12	1p each
UPM050	0·5	10%	1M -4·7M	E12	1p each
UPM075	0·75	5%	10E-1M	E12	1p each
UPM075	0·75	10%	1M -4·7M	E12	1p each
UPM100	1·00	10%	10E-1M	E12	2½p each

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STEREO 21

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Top-quality amplifier, BSR turntable, matching speakers. Deck and speaker cabinets you simply wrap round and glue to build. Screw in the amplifier and connect up (all push fit no soldering whatsoever), so simple literally anyone can do it. Except for glue and panel pins all parts supplied including full instructions—all for £18·45 (plus the cost of post and packing if you buy by mail), and—to round it all off—a money refund if not satisfied if your pleasure in STEREO 21 is not complete!

Just think—in only a few days you could be giving your ears the treat of a lifetime—AND introducing your envious friends to STEREO 21 !

Personal shoppers and mail order price

£18·45 INCLUDING VAT plus £1·60 p + p.

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Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance, if required £3·85.

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

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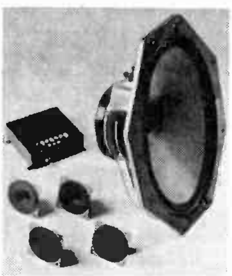

15" 14A/780. Bass unit on a rigid diecast chassis. Superior cone material handles up to 50 watts RMS, and is treated to give a smooth frequency response. Resonance 30 Hz. Fluse 360,000 Maxwells. Impedance at 1 kHz is 8 ohms. 3" voice coil.

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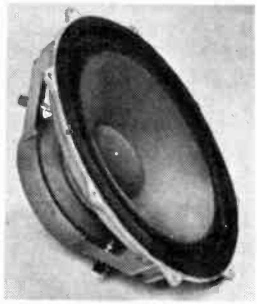

R T V C

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RTVC VISCOUNT III

a boost in the output,

VISCOUNT III now gives you an imposing 20 watts per channel—and the price quoted is actually INCLUSIVE OF VAT!
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The unique VISCOUNT III amplifier, plus the Garrard SP25 Mk III deck, plus the magnificent Duo Type III matched speakers (or Duo Type II for a small room) give you an audio installation that will prove unbeatable for listening pleasure! And the teak finish will harmonise and enhance virtually any style of interior decor! On the brushed aluminium front panel of the amplifier you'll find all the facilities you need—volume, bass, treble and balance controls, plus switches for mono/stereo, on/off function and bass and treble filters. Plus headphone socket on the back.
The heart-stopping timbre of Tom Jones at his most virile . . . the last lingering harmonics of a solo performance by Heifetz or Menuhin. . . , the pathos and the panache of Liza Minelli . . the majestic sonorities of the brass band and the elfin subtleties of the virtuoso clavichordist—hear every nuance with a fidelity that you have *never* experienced before!
Come and hear VISCOUNT III! If it's inconvenient to travel, buy by post in the confidence that you won't be disappointed (and with a 24-carat Money-Back Guarantee to give you extra reassurance). Don't settle for second-best!
SPEAKERS: **Duo Type II** Size approx. 17in × 10½in × 6½in. Drive unit 13in × 8in with parasitic tweeter. Max. power 10 watts 8 ohms. Simulated Teak cabinet. £14·00 a pair + £2·20 p. & p. **Duo Type III** Size approx. 23½in × 11½in × 9½in. Drive unit approx 13½in × 8½in with HF speaker. Max. power 20 watts, 8 ohms. Freq. range 20Hz to 20kHz. Teak veneer cabinet. £32·00 a pair + £3·30 p. & p.

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PRICES : SYSTEM 1

Viscount III R102 amplifier	£24·20	+ £1 p & p
2 Duo Type II speakers	£14·00	+ £2·20 p & p
Garrard SP25 Mk III with MAG. cartridge /plinth & cover	£18·00	+ £1·75 p & p
total	£56·20	

Available complete for only £49·00 + £3·50 p & p

PRICES : SYSTEM 2

Viscount R102 amplifier	£24·20	+ £1 p & p
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Garrard SP25 Mk III with MAG cartridge plinth & cover	£18·00	+ £1·75 p & p
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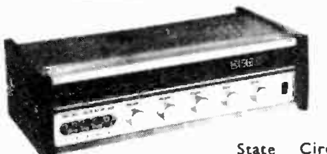
THE TOURIST PUSH-BUTTON CAR RADIO KIT £6·60

The Tourist PB is suitable for 12 volt working on both negative and positive earth vehicles. It covers the full medium and long wave bands. It is permeability tuned and sturdily constructed. Output is a full 2·5 watts into an 8 ohms speaker. But the Tourist PB will operate into any loud-speaker from 8 to 15 ohms.
Apart from the output stage, which is an integrated circuit, the only other electronic components that need soldering are some capacitors, resistors, etc. The kit includes a pre-built RF tuner unit, and fully modulised IF stages which are pre-aligned before despatch. As well as electronic components this kit also contains 2 diamond-spun aluminium knobs, elegant matching front panel, dial, washers, screws and wire.
The Tourist PB can be mounted in any standard size dash panel and it has an illuminated tuning scale. Chassis size is: 7in wide, 2in high and 4 3/16in deep.
Circuit diagram and comprehensive instructions 55p free with parts.
Fully retractable and lockable car aerial £1·37 post paid.

CAR RADIO KIT £6·60 p. and p. 55p. Speaker with baffle and fixing strips £1·65, + 23p p. & p. post free if bought with the kit. Send stamped addressed envelope for leaflet.
If you can solder on printed circuit board, you can build this push-button car radio kit. It's simple—just follow the step-by-step instructions.

RELIANT Mk IV

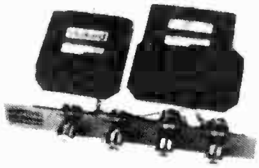
MONO AMPLIFIER



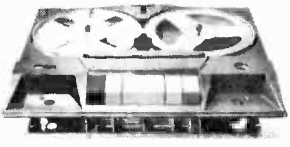
*5 Electrically Mixed inputs. *3 Individual Mixing controls. *Separate bass and treble controls common to all 5 inputs. *Mixer employing F.E.T. (Field Effect Transistors). *Solid State Circuitry. *Attractive Styling.
INPUTS 1. Crystal Mic or Guitar 9mV. 2. Moving coil Mic. or Guitar 8mV. Inputs 3, 4 & 5 are suitable for a wide range of medium output equipment (Gram, Tuner, Monitor, Organ, etc.) All 250mV sensitivity. Output 20 watts into 8 Ω (suitable for 15 Ω.) Size approx. 12½ x 6 x 3½ ins. **£13·50** p. & p. 60p

UNISOUND MODULES

ONLY £7·64 + 55p. p & p



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



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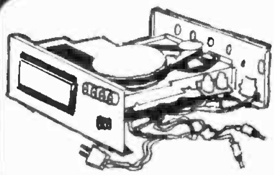
With this elegant stereo 8 track add on unit, audio enthusiasts now have the opportunity to extend their systems to include the playing of 8 track cartridges. Simply select your channel, by push button, four digital lamps indicate channel selected. The Viscount III, the fabulous Stereo 21 and the Unisound Modules will accept this unit, simply connect up. **£10·60** + 90p. p. & p.

SEE OPPOSITE PAGE FOR ADDRESS DETAILS

BI-PRE-PAK

AUDIO BARGAINS



8 TRACK
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incl. P. & P. and VAT

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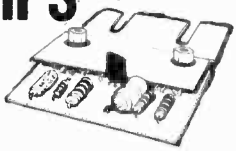
5W & 10W AMPS

5W ONLY £1.98
10W ONLY £2.49

incl. P. & P. and V.A.T.



Specification:—	5 Watt	10 Watt
Nominal Volts	12–14V	25–30V
Into 3 Ohms	5W	10W
Into 8 Ohms	2W	10W
Into 15 Ohms	1W	5W
Typical Distortion	·5%	·5%
Freq. response at 3dB	10Hz to 30KHz	10Hz to 30KHz
Sensitivity (Typically)	20mV	20mV
Full power consumption (30 Ohms)	650mA	580mA
Size	2¼" × 1¾"	2¼" × 1¾"

The 5W matchbox sized amplifier will run satisfactorily from a 12V car battery. Can also be used for portable voice reinforcement such as public functions where mains supply is not accessible. A small mains unit kit is available.
Two amplifiers are ideal for Stereo. Complete connection details and treble, bass, volume and balance control circuit diagrams are supplied with each unit.
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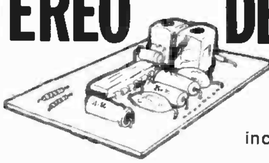
£4.95



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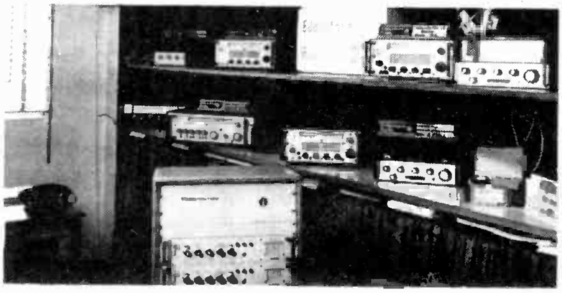

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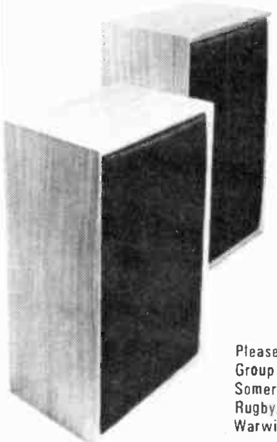

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VC29LA	MT31A/3		3—40 pF	8p
VC29LC	MT31A/12		7—60 pF	10p
VC29K	MT31A/4		10—80 pF	9p
VC29LB	MT31A/5		30—140 pF	10p
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VC29SA	TP10		400—1250 pF	19p
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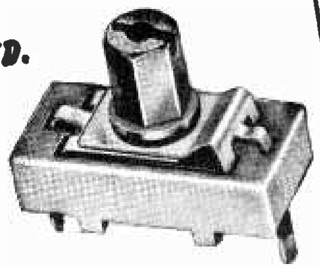
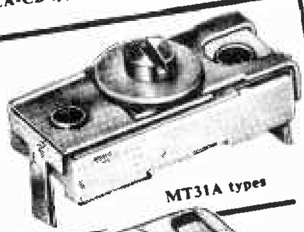


CA-CB types



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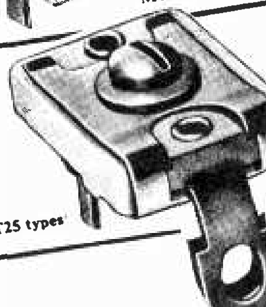

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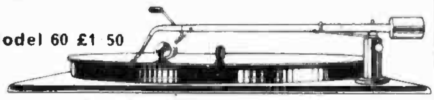

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PS 42	Jack Stereo Switched	0·26
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PS 23	D.I.N. 5 Pin 180°	0·17
PS 24	D.I.N. 5 Pin 240°	0·17
PS 25	Jack 2·5mm Plastic	0·10
PS 26	Jack 3·5mm Plastic	0·12
PS 27	Jack ¼″ Plastic	0·24
PS 28	Jack ¼″ Screened	0·28
PS 29	Jack Stereo Plastic	0·22
PS 30	Jack Stereo Screened	0·32
PS 31	Phono Screened	0·14
PS 32	Car Aerial	0·15
PS 33	Co-Axial	0·17

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PS 2	D.I.N. 3 Pin	0·12
PS 3	D.I.N. 4 Pin	0·15
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PS 10	Jack 3·5mm Screened	0·12
PS 11	Jack ¼″ Plastic	0·13
PS 12	Jack ¼″ Screened	0·18
PS 13	Jack Stereo Screened	0·29
PS 14	Phono	0·06
PS 15	Car Aerial	0·15
PS 16	Co-Axial	0·10

CABLES

CP 1	Single Lapped Screen	0·06
CP 2	Twin Common Screen	0·08
CP 3	Stereo Screened	0·08
CP 4	Four Core Common Screen	0·23
CP 5	Four Core Individually Screened	0·30
CP 6	Microphone Fully Braided Cable	0·10
CP 7	Three Core Mains Cable	0·07
CP 8	Twin Oval Mains Cable	0·06
CP 9	Speaker Cable	0·04
CP 10	Low Loss Co-Axial	0·10

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Log and Lin
4·7K, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M

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VC 2	Single D.P. Switch	0·26
VC 3	Tandem Less Switch	0·44
VC 4	1K Lin Less Switch	0·14
VC 5	100K Log anti-Log	0·44

HORIZONTAL CARBON PRESETS
0·1 watt   0·06 each
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8 Books comprising
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1 Radio and Electronic Colour Code and Data Chart
1 Radio Valve Guide PLUS
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Also 1 General Constructional book
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129	Universal Gram-Motor Speed Indicator	8p
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177	Modern Transistor Circuits for Beginners	40p
178	A Comprehensive Radio Valve Guide, Book 5	30p
183	How to Receive Foreign TV Programmes on your set by simple modifications	32p
185	Tested Shortwave Receiver Cuircuits using MAT's	30p
187	The TSL Mark '4' Valved FM Tuner and its construction	20p
196	Reactance-Frequency Chart for Audio & RF use	15p
	Resistor Colour Code Disc Calculator	10p

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ACOS GP91-18C. 200mV at 1·2cms/sec	£1·16
ACOS GP93-1. 280mV at 1cm/sec	£1·65
ACOS GP96-1. 100mV at 1cm/sec	£2·65
TTC J-2005. Crystal/Hi Output	95p
TTC J-20 10C Crystal/Hi Output Compatible	£1·10
TTC J-200 CS Stereo/Hi Output	£1·60
TTC J-2105 Ceramic/Med. Output	£1·64

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R3	50 Mixed 10K ohms-82K ohms	40p
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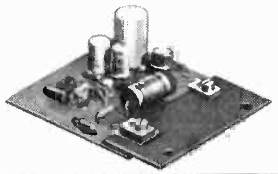
AL10/AL20/AL30 AUDIO AMPLIFIER MODULES



The AL10, AL20 and AL30 units are similar in their appearance and in their general specification. However, careful selection of the plastic power devices has resulted in a range of output powers from 3 to 10 watts R.M.S.
The versatility of their design makes them ideal for use in record players, tape recorders, stereo amplifiers and cassette and cartridge tape players in the car and at home.

Parameter	Conditions	Performance
HARMONIC DISTORTION	Po = 3 WATTS f = 1KHz	0·25%
LOAD IMPEDANCE	—	8 – 16 Ω
INPUT IMPEDANCE	f = 1KHz	100 kΩ
FREQUENCY RESPONSE Œ 3dB	Po = 2 WATTS	50 Hz – 25KHz
SENSITIVITY for RATED O/P	Vs = 25V. Rl = 8 Ω f = 1KHz	75mV. RMS
DIMENSIONS	—	3″ × 2¼″ × 1″

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

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

AUDIO AMPLIFIER MODULES

AL 10.	3 watts	RMS	£2·19
AL 20.	5 watts	RMS	£2·59
AL 30.	10 watts	RMS	£3·01

PRE-AMPLIFIERS

PA 12. (Use with AL10 & AL20) £4·35
PA 100. (Use with AL30 & AL50) £13·15

POWER SUPPLIES

PS 12. (Use with AL10 & AL20) 88p
SPM 80. (Use with also AL30 & AL50) £3·25
FRONT PANELS SP 12 with Knobs £1·10

TRANSFORMERS

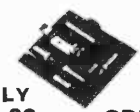
T461 (Use with AL10) £1·38 P & P 15p
T538 (Use with AL20) £1·93 P & P 15p
BMT80 (Use with AL30 & AL50) £2·15 P & P 25p

PA 12. PRE-AMPLIFIER SPECIFICATION

The PA 12 pre-amplifier has been designed to match into most budget stereo systems. It is compatible with the AL 10, AL 20 and AL 30 audio power amplifiers and it can be supplied from their associated power supplies. There are two stereo inputs, one has been designed for use with *Ceramic cartridges while the auxiliary input will suit most †Magnetic cartridges. Full details are given in the specification table. The four controls are, from left to right: Volume and on/off switch, balance, bass and treble. Size 152mm × 84mm × 35mm.

Frequency response— 20Hz – 50KHz (– 3dB)
Bass control— ± 12dB at 60Hz
Treble control— ± 14dB at 14KHz
*Input 1. Impedance 1 Meg. ohm
Sensitivity 300mV
†Input 2. Impedance 30 K ohms
Sensitivity 4mV

EA1000 AUDIO AMP MODULE 3 WATTS R.M.S.

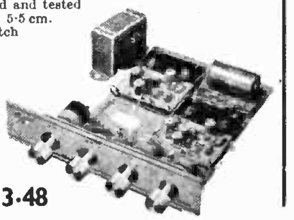


Module Tested and Guaranteed. Full hook-up diagrams and complete technical data supplied free with each module or available separately at 10p each.

ONLY £2·89 SPECIAL OFFER £2 each while stores last

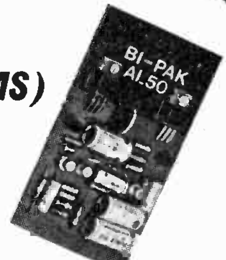
The STEREO 20

The 'Stereo 20' amplifier is mounted, ready wired and tested on a one-piece chassis measuring 20 cm × 14 cm × 5·5 cm. This compact unit comes complete with on/off switch volume control, balance, bass and treble controls, Transformer, Power supply and Power amps. Attractively printed front panel and matching control knobs. The 'Stereo 20' has been designed to fit into most turntable plinths without interfering with the mechanism or, alternatively, into a separate cabinet. Output power 20w peak. Input 1 (Cer.) 300mV into 1M. Freq. res. 25Hz-25kHz. Input 2 (Aux.) 4mV into 30K. Harmonic distortion. Bass control ± 12dB at 60Hz typically 0·25% at 1 watt. Treble con. ± 14dB at 14kHz.



£13·48

50W pk 25w (RMS)



0·1% DISTORTION!
HI-FI AUDIO AMPLIFIER

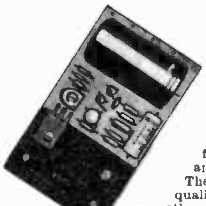
THE AL50

ONLY **£3·58 each**

★ Frequency Response 15Hz to 100,000—1dB.
★ Load—3, 4, 8 or 16 ohms.
★ Distortion—better than ·1% at 1 KHz.
★ Signal to noise ratio 80dB.
★ Supply voltage 10–35 Volts.
★ Overall size 63mm 105mm × 13mm.

Tailor made to the most stringent specifications using top quality components and incorporating the latest solid state circuitry and AL50 was conceived to fill the need for all your A.F. amplification needs.
FULLY BUILT—TESTED—GUARANTEED.

STABILISED POWER MODULE SPM80



AP80 is especially designed to power 2 of the AL50 Amplifiers, up to 15 watt (r.m.s.) per channel simultaneously. This module embodies the latest components and circuit techniques incorporating complete short circuit protection. With the addition of the Mains Transformer MT80, the unit will provide outputs of up to 1·5 amps at 35 volts. Size: 63mm × 105mm × 30mm.
These units enable you to build Audio Systems of the highest quality at a hitherto unobtainable price. Also ideal for many other applications including:—Disco Systems, Public Address Intercom Units, etc. Handbook available 10p **PRICE £3·25**

TRANSFORMER BMT80 £2·15 p. & p. 28p

STEREO PRE-AMPLIFIER TYPE PA100

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

SPECIFICATION

Frequency Response	20Hz – 20KHz ± 1dB
Harmonic Distortion	better than 0·1%
Inputs: 1. Tape Head	1·25 mV into 50K Ω
2. Radio, Tuner	35 mV into 50K Ω
3. Magnetic P.U.	1·5 mV into 50K Ω

All input voltages are for an output of 250mV. Tape and P.U. inputs equalised to RIAA curve within ± 1dB. from 20Hz to 20KHz.

Bass Control	± 15bB at 20Hz
Treble Control	± 15dB at 20 KHz
Filters: Rumble (High Pass)	100Hz
Scratch (Low Pass)	8KHz
Signal/Noise Ratio	better than – 65dB
Input overload	+ 26dB
Supply	+ 35 volts at 20mA
Dimensions	292mm × 82mm × 35mm

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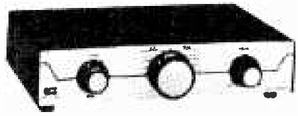

P.R.40

SOLID STATE R.F. PRESELECTOR

The PR40 R.F. Preselector is the solid state version of the world famous PR30 which is now supercedes.

It employs Silicon "N" Channel FET (Field Effect Transistor) front end, followed by silicon NPN Broad Band R.F. Amp., and will substantially improve receiver performance over the range 1·5 to 35 MHz, providing a considerable increase in gain up to an overall average of 30 dB, with improved image rejection and noise ratio.

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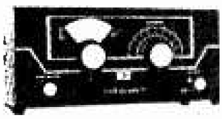

MULTIBAND—6

SOLID STATE

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All transistor T.R.F. Receiver tunes 550 KHz to 30 MHz (540 to 10 metres) complete coverage—no gaps. Medium waves—Trawlers—Ship/Shore Telephone—All Six Amateur Bands 160-10 metres—International Broadcast from Australia, Far East, Russia, USA etc. using 4 miniature plug in Coils.

Hi-Gain FET Regen, Det./AF/AF Module giving full loudspeaker output to any external 2/3 ohm speaker. Receives AM/CW/SSB.

Separate Electrical Bandspread, Calibrated Main Tuning.

A Quality CODAR-KIT with 12 months Guarantee. No technical knowledge required, simple to built, printed circuit and Pictorial Instruction Manual, fully detailed step by step.

Complete Kit with 4 Coils (less standard PP6 battery).

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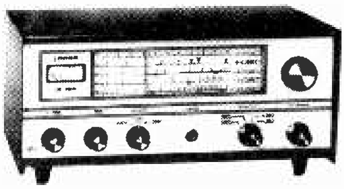

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The CODAR CR70A is an outstanding general coverage communication receiver, ideal for the keen S.W.L.
It tunes from 540 metres medium through to 10 metres with no gaps. Covers shipping, coastguard and distress frequencies, all six amateur bands 160-10 metres, International broadcast, Met. stations etc. etc. giving world-wide reception, Exclusive features include Air-spaced CODAR-COIL Hi-"Q" Aerial input, illuminated Meter and Slide Rule Scale, Two Speed vernier tuning, Switched B.F.O. for CW/SSB signals. Separate output for Tape recorder.
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I am delighted with the CODAR equipment I am using . . . everything has come up to your specifications.

Dr. R. E. Wood, Louisiana State University, U.S.A.
Congratutlaions on an excellent product. The PR40 Preselector is the first preselector I have found to operate efficiently with ample gain, and without feedback or image problems.

Mr. W. R. Jones, Woy, N.S.W., Australia.
The PR40 peaked signals remarkably and performed as you claim. I am very satisfied.

M. G. Bennett, Bath, Somerset.
I am very pleased with my CR70A—results are excellent with many overseas stations I have not heard before and excellent results on the Amateur Bands.

Mr. J. Macdonald, Coningsby, Lincoln.
Received Multiband Kit OK. Assembled it in two hours, worked a treat first time.

Mr. E. Joy, Chesham, Bucks.
The performance of the CR70A is out of this world for its price, and its construction and design, great. I am really delighted . . . I cannot fault it.

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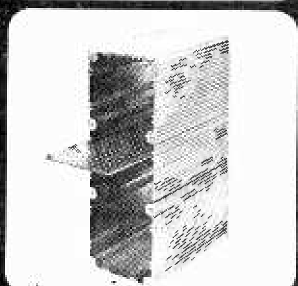

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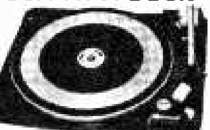
Powerful 3 watt output. 15 ohm. AC mains operated with transformer. 3-Controls, volume, treble, bass and On/Off switch with knobs. Ready made on printed circuit board. Fused inputs and outputs. Famous make.
Size 8in. wide × 4in. deep × 3in. high.
Suitable 7" × 4" speaker, £1. **PRICE £5·95** Post 25p

BSR JUNIOR SINGLE PLAYER

Heavy duty 4-speed motor with separate pick-up arm fitted LP/78 turnover mono compatable cartridge. **£4·95**

GARRARD DECCA HI-FI DECK



Single play Stereo/Mono Deram transcription head and arm.
Four speeds.
10½in. turntable.
Anti-rumble filter.
Bias compensation.
Laboratory motor.

SPECIAL PRICE **£18·50** Post 25p Ideal for Disco-Deck

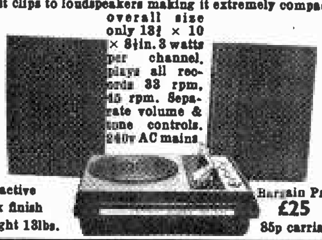
METAL PLINTH AND PLASTIC COVER

Cut out for most Garrard or B.S.R.
Most will play with cover in position.
12½ × 14¾ × 7½in.
Covered in black leatherette. **£4·95** Post 35p

ALSO AVAILABLE IN SOLID NATURAL MAHOGANY WAX POLISHED FINISH—AT SAME PRICE

COMPACT PORTABLE STEREO HI-FI

Two full size loudspeakers 13¾ × 10 × 8½in. Player unit clips to loudspeakers making it extremely compact.



overall size only 13¾ × 10 × 8½in. 3 watts per channel. plays all records 33 rpm, 45 rpm. Separate volume & tone controls. 240v AC mains.

Attractive Teak finish
Weight 13lbs.
Bargain Price **£25**
85p carriage

SPECIAL OFFER! SMITH'S CLOCKWORK 15 AMP TIME SWITCH

Single pole two-way Surface mounting with fixing screws. Will replace existing wall switch to give light for return home, garage, automatic anti-burglar lights etc. Variable knob Turn on or off at full or intermediate settings. Two types available, Type 'A' 0 to 60 minutes or Type 'B' 0 to 6 hours. Fully insulated. Makers last list price £4·50. Brand new and fully guaranteed.
OUR PRICE **£1·65** or £3 pair. Post 25p.
(PLEASE STATE TYPE A OR B WITH ORDER)

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in sides 6 × 4in 45p; 8 × 6in 53p; 10 × 7in 65p; 12 × 8in 85p; 14 × 9in 90p; 16 × 6in 90p; 12 × 3in 50p; 16 × 10in £1.
ALUMINIUM BOX 3 × 3 × 3 in. 60p. 4 × 4 × 4in. 70p. 6 × 4 × 4 in. 80p. 9 × 4 × 4 in. £1. 12 × 4 × 4 in. £1·30.
ALUMINIUM PANELS 18 s.w.g. 6 × 4in 9p; 8 × 6in 15p; 14 × 3in 16p; 10 × 7in 19p; 12 × 5in 20p; 12 × 8in 28p; 16 × 6in 28p; 14 × 9in 34p; 12 × 12in 40p; 16 × 10in 50p.
PAXOLIN PANEL 10 × 8in 15p.

1¼inch DIAMETER WAVECHANGE SWITCHES, 25p.
2 p. 2-way, or 2 p. 6-way, or 3 p. 4-way, 25p each.
1 p.1 2-way, or 4 p. 2-way, or 4 p. 3-way, 25p.
TOGGLE SWITCHES, sp. 14p; dp. 22p; dp. dt. 22p.
Sub-miniature, sp. 30p; dp. 37p; dp. dt. 45p.

R.C.S. STABILISED POWER PACK KITS

All parts and instructions with Zener Diode. Printed Circuit Bridge Rectifiers and Double Wound Mains Transformer. Input 200/240V a.c. Output voltages available 6 or 9 or 12 or 15 or 18 or 20V d.c. at 100mA or less.
PLEASE STATE VOLTAGE REQUIRED. **£2·20** Post 20p
Details S.A.E. Size 3½ × 1½ × 1¼in.

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

Ideal for Mike, Tape P.U., Guitar, etc. Can be used with Battery 9-12v. or H.T. line 200-300V. D.C. operation. Size 1¾" × 1¼" × ¾". Response 25 c.p.s. to 25 Kc/s, 26 db gain. For use with valve or transistor equipment. **99p** Post 10p
Full instructions supplied. Details S.A.E.

NEW TUBULAR ELECTROLYTICS				CAN TYPES	
/350V	14p	250/25V	14p	50+50/300V	50p
4/350V	14p	500/25V	20p	60+100/350V	85p
8/450V	18p	1000/25V	35p	32+32/250V	20p
16/450V	22p	1000/50V	47p	32+32/450V	45p
32/500V	35p	8+8/450V	22p	350+50/325V	55p
25/25V	10p	8+16/450V	25p	32+32+32/350V	55p
50/50V	10p	16+16/450V	40p	100+50+50/350V	55p
100/25V	10p	32+32/350V	40p		

LOW VOLTAGE ELECTROLYTICS.
1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 10p.
500mF 12V 15p; 25V 20p; 50V 30p.
1000mF 12V 20p; 25V 35p; 50V 47p; 100V 70p.
2000mF 6V 25p; 25V 42p; 50V 57p.
2500mF 50V 62p; 3000mF 25V 47p; 50V 65p.
5000mF 6V 25p; 12V 42p; 25V 75p; 35V 85p; 50V 95p.
CERAMIC 1pF to 0·01mF, 4p. Silver Mica 2 to 5000pF, 4p.
PAPER 350V-0·1 4p; 0·5 13p; 1mF 15p; 2mF 150V 15p.
500V-0·001 to 0·05 4p; 0·1 5p; 0·25 8p; 0·47 25p.
SILVER MICA. Close tolerance 1%. 2·2-500pF 8p; 560-2,200pF 10p; 2,700-5,600pF 20p; 6,800pF-0·01, mfd 30p each.
TWIN GANG. "0-0" 208pF+176pF, 65p;
Slow motion drive 365pF+365pF with 25pF+25pF, 50p;
500pF standard 65p; small 3-gang 500pF £1·60.
SHORT WAVE SINGLE. 10pF, 30p; 25pF, 55p; 50pF, 55p.

SHORT WAVE SINGLE GANG. Precision Silver Plated Gangable Tuning Condensers.
Values up to 100pF. **50p** each
Section Couplers supplied FREE with two or more gangs.

NEON PANEL INDICATORS. 250V AC/DC Amber, 20p.
RESISTORS. ¼ w., ½ w., 1 w., 20%, 1p; 2 w. 5p. 10 Ω to 10M.
HIGH STABILITY. ½ w. 2% 10 ohms to 6 meg., 10p.
Ditto 5%, Preferred values 10 ohms to 10 meg., 4p.
WIRE-WOUND RESISTORS. 5 watt, 10 watt, 15 watt, 10 ohms to 100K, 10p each; 2w 0·5 ohm to 8·2 ohms 10p.
TAPE OSCILLATOR COIL. Valve type, 35p.

MAINS TRANSFORMERS

ALL POST 25p each

Eagle MT12 12-0-12v 50MA 90p
250-0-250 80 mA. 6·3 v. 3·5 a. 6·3 v. 1 a. or 5 v. 2 a. £2·50
350-0-350 80 mA. 6·3 v 3·5 a, 6·3 v. 1a. or 5 v. 2 a. £3·00
300-0-300 v. 120 mA., 6·3 v. 4 a. C.T.; 6·3 v. 2 a. £3·25
MINIATURE 200 v. 20 mA., 6·3 v. 1 a. 2½ × 2½ × 2in. 75p
MIDGET 220 v. 45 mA., 6·3 v. 2 a. 2½ × 2½ × 2in... 90p
HEATER TRANS. 6·3 v. 3a.......... 60p
GENERAL PURPOSE LOW VOLTAGE. Tapped outputs at 2 amp., 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. £2·80
1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £2·80
2 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £3·80
5 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £8·75
3 amp., 5, 8 and 13 v. £1·00; Ditto 5 amp. £1·20. 3 amp., 3, 5, 8, 10, 13 and 5-0-5 v. £1·30, Ditto 5 amp. £1·50; 6-0-6 v. 500 mA 90p. 9 v. 1 amp 95p. 12 v. 300 mA 75p. 12 v. 500 mA 85p. 12v. 750 mA 95p. 40v. 1 amp £1·75.
AUTO TRANSFORMERS. 115v to 230v or 230v to 115v. 150w. £2·25; 500w. £6·25; 750w. £10; 1000w. £15.
CHARGER TRANSFORMERS. Input 200/250v. for 6 or 12v., 1½ amp. £1·50; 2 amp. £1·80: 4 amp. £2·50
BATTERY CHARGERS. Ready built with leads and clips 1½ amp. £2; 4 amp. £4; 5 amp. £4·50.
FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12v. outputs. 1½ amp. 40p; 2 amp. 55p; 4 amp. 85p.

MAINS ISOLATING TRANSFORMER

Primary 0-110-240v. Secondary 0-240v. 3 amps. 720 watts. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. **£10** Carr. 50p
Famous make. (Value £19) OUR PRICE
Can be used as 800 watt auto transformers 240-110V.

SET OF 3 MOTORS FOR COLLARO STUDIO TAPE DECK £2·50 Post 50p.

VOLUME CONTROLS

Long spindles. Midget Size 5 K. ohms to 2 Meg. LOG or LIN. L/S 15p. D.P. 25p. STEREO L/S 55p. D.P. 75p. Edge 5K. S.P. Transistor 25p

80 Ohm Coax 4p yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £1·40; 80 yd. £2.
FRINGE LOW LOSS Ideal 625 and colour. **10p** per yd

Wirewound controls 1¼in. diam. 3 watts. 10 ohms to 100K British made with long spindles ¼in. dia 45p ea.

HELICAL POT 10k LIN List £3, Bargain 75p.
DUAL CONCENTRIC POT 500k LOG + 500k LIN D.P. switch. Inner spindle 3¼in; outer spindle 2¼in. 75p.

E.M.I. 13½ × 8 in. SPEAKER SALE !

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

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

Bookshelf Cabinet 16 × 10 × 9in. Teak Veneer **£5·50** Post 25p

GOODMANS 6½in. HI-FI WOOFER

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

ELAC CONE TWEETER

The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 cps to 18,000 cps. Size 3½ × 3½ × 2in. deep. Rating 10 watt, 3 ohm or 15 ohm models. **£1·90** Post 20p
Crossover 95p.

GOODMANS 8 in. WOOFER

8 ohm 12 watt. Deep cone. Heavy ceramic magnet. Bass resonance 35 cps. Frequency response 30-8,000 cps.
Ideal bass unit for Hi-Fi systems **£3·75**

LOUDSPEAKERS P.M. 3 OHMS. 7 × 4in. £1·25; 6½in. £1·50; 8 × 5in. £1·60; 8in. £1·75; 10 × 6in. £1·90; 10in. £2·00.
SPECIAL OFFER! 80 ohm, 2¾ in. 2¾in. 35 ohm, 2in.; 3in; 5in. 25 ohm, 2½in. dia.; 3in. dia; 15 ohm. 3½in. dia.; 5in. /6 × 4in.; 7 × 4in.; 8 × 5in. 3 ohm, 2½in, 2¾in., 3½in., 5in. dia. (6 × 4in., 8 ohm, £1·50). **£1** EACH TYPE
RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8in. diameter 4W £2·50, 10in. diameter 5W £2·50; Post 25p. 12in. diameter, 6W. £2·95; 3 or 8 or 15 ohm models.
SPEAKER COVERING MATERIALS. Samples Large S.A.E.
FERRITE ROD 8" × ⅜" 20p; 6 × ¼" 20p; 3 × ⅜" 10p.
Horn Tweeters 2-16Kc/s. 8W 8 ohm or 15 ohm £1·95.
De Luxe Horn Tweeters 2-18 Kc/s, 15W, 15 ohm £3·50.
TWO-WAY 3,000 c.p.s. CROSSOVERS 3, 8 or 15 ohm 95p.

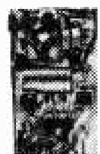
TWO-WAY CROSSOVER NETWORK 3,000 c/s
With variable tweeter attenuator giving accurate high/low frequency balance. Mounted on panel 5½in. × 4in. with control knob, tweeter and woofer leads and input terminals. Suitable for 3 to 8 ohm impedance. **£2·20** Post 20p

VALVE OUTPUT TRANSFORMER 25p
MIKE TRANSFORMRT MU. metal 100-1 £1·25.
5 WATT MULTI RATIO. 3, 8 and 15 ohms, 80p.
PUSH-PULL VALVE OUTPUT TRANSFORMERS.
50 watt .... £11·50 100 watt £14

ELECTRO MAGNETIC PENDULUM MECHANISM

1·5v d.c. operation over 100 hrs. continuous on SP2 battery. fully adjustable swing and speed. Ideal displays teaching electro magnetism or for metronome; strobe etc. 95p, Post 20p

BRITISH MADE STEREO MULTIPLEX DECODER



Brand New. 7 transistors plus integrated circuit. Fibre glass printed circuit board. Size 2¾ × 6¼ × ⅞in. Pre-aligned. Complete with stereo beacon indicator. 12V d.c. operation. 400mV output for 100MV input. Full instructions for any FM Tuner. Some technical experience essential. **£6·50** Post 15p
DIPOLE LOFT AERIAL £1·50.
80 OHM CABLE 4p yard.
300 OHM CABLE 5p yard.

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p
OUTLET BOXES, SURFACE MOUNTING 25p.
BALANCED TWIN RIBBON FEEDER 300 ohms, 5p yd.
JACK SOCKET Std. open-circuit 14p, closed circuit 23p; Chrome Lead Socket 45p. Phono Plugs 5p. Phono Socket 5p
JACK PLUGS Std. Chrome 15p; 3·5mm Chrome 12p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 15p. DIN PLUGS 3-pin 18p; 5-pin 25p.
VALVE HOLDERS 5p; CERAMIC 8p; CANS 5p.

BRITISH FM/VHF TUNING HEART
88 to 108 Mc/s British made. 2 Transistors ready aligned—requires 10.7 Mc/s IF. Complete with tuning gang. Connections supplied but some technical experience essential.
Our Price **£3·95** Post 20p.

ALL PRICES INCLUDE VAT MINIMUM POST AND PACKING 20p.

RADIO COMPONENT

Illustrated Colour Brochure, Radio Books & Component Lists 10p. Written guarantee.

ALL OUR PRICES INCLUDE V.A.T.

E.M.I. WOOFER AND TWEETER KIT

£5·75 THE PAIR. Post 25p. (Available separately. Woofer £4·25; Tweeter £1·90).

Comprising a fine example of a Woofer 10¼ × 6¼in. with a massive Ceramic Magnet. 44oz. Gauss 13,000 lines. Aluminium Cone centre to improve middle and top response. Also the E.M.I. Tweeter 3¼in. square has a special lightweight paper cone and magnet flux 10,000 lines. Crossover condenser and full instructions supplied.

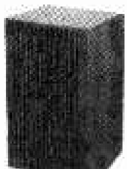
Impedance Standard	8 ohms
Maximum power	12 watts
Useful Response	25 to 18,000 cps
Bass Resonance	45 cps

SUITABLE ENCLOSURE 20 × 13 × 9in. MODERN DESIGN. TEAK WOOD FINISH. **£9·90** Post 25p

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

Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps. Bass resonance 55 cps. 8 ohm impedance. 8in. 10 watts, 10in. 12 watts **£3·75**

TEAK VENEER HI-FI SPEAKER CABINETS
Fluted Wood Fronts



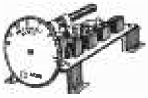
MODEL "A". 20 × 13 × 9in. For 12in. dia. or 10in. speaker. **£9·90** Post 25p

MODEL "B". 16 × 10 × 9in. For 13 × 8in. or 8in. speaker. **£5·50** Post 25p

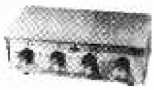
MODEL "B2" ditto. Triangular corner version.

MODEL "C". 16 × 8 × 6in. For 8 × 5in. speaker. **£4·40** Post 25p

LOUDSPEAKER CABINET WADDING 18in. wide, 15p ft.

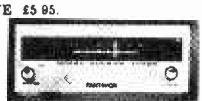


BARGAIN AM TUNER. Medium Wave. Transistor Superhet Ferrite aerial. 9 volt. **£4·95**



BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt battery operated. **£3·95**

STEREO VERSION OF ABOVE £5 95.



BARGAIN FM TUNER. 88-108 Mc/s Six Transistor. 9 volt. Printed circuit. Calibrated slide dial tuning. Walnut Cabinet. Size 7 × 5 × 4in. **£12·85**

BARGAIN FM TUNER. **£8·85** As above less cabinet.

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

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER. Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/250V. Leaflet S.A.E. **£2·50** Post 20p

WAFER THIN HEATING ELEMENTS

OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10½ × 8½ × 1/16in. Operating voltage 200/250V. a.c. 250 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photo-copiers and print drying equipment.

Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails—ideal for airing cupboards. Ideal for anti-frost device for the garage—preventing frozen radiators or acting as oil sump heater. Use in the greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

ONLY **40p** EACH (FOUR FOR £1·50)

ALL POST PAID—Discounts for quantity.

BAKER MAJOR 12" £9·90

Post Free

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

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£12·50**

Please state 3 or 8 or 15 ohms. Post Free

BAKER "BIG SOUND" SPEAKERS

Robustly constructed to stand up to long periods of electronic power. As used by leading groups. Useful response 30-13,000 cps. Bass Resonance 55 cps.

GROUP "25" 12in. 25 watt 3, 8 or 15 ohms. **£8·80** Post Free

GROUP "35" 12in. 35 watt 3, 8 or 15 ohms. **£9·90** Post Free

GROUP "50" 15in. 50 watt 8 or 15 ohms. **£22·00**

NEW 12" VERSION **£17·60**

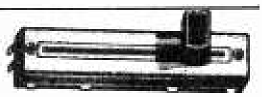
MAJOR 100 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

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

Q MAX CHASSIS CUTTERS
A die, punch and Allen Screw

Sizes	
3/8"	74p
7/16"	83p
Key 'T' for above	6p
1/2", 9/16", 5/8"	90p
11/16", 3/4"	92p
13/16", 7/8"	99p
Key 'A' for above	6p
15/16", 1", 1 1/16", 1 1/8"	£1·00
1 3/16", 1 7/32", 1 1/4"	£1·15
1 5/16", 1 3/8"	£1·20
1 1/2"	£1·35
1 5/8"	£1·70
1 3/4"	£1·70
Key 'B' for above	10p
2"	£2·25
2 3/32"	£2·50
2 1/2"	£3·30
Key 'C' for above	13p
2 5/8"	£4·50
2 3/4"	£5·75
3"	£9·00
Key 'E' for above	20p
1" Square, with key	£2·10

SLIDER VOLUME CONTROLS



Available in both LOG and LINEAR type. Size 3 5/8 × 3/8 × 5/16in. with knobs. 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1 MEG, 2 MEG. **65p** EACH

DELUXE 4 POLE MOTOR

1,400 r.p.m. Reversible 42 Watt, spindle 1½" × 7/32", size 3½" × 3". As illustrated, 240v. AC mains. **£1·95** Post 25p

E.M.I. GRAM MOTOR

120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2¾ × 2½ × 2¼in. **£1·00** Post 25p.

ONE RPM GEARED MOTOR

240v. A.C. mains. Ideal for displays/disco lightwheels. **£1·25** Post 25p.

BAKER HI-FI SPEAKERS
HIGH QUALITY — BRITISH MADE

REGENT
12in. 15 watts

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

Bass Resonance	45cps
Flux Density	12,000gauss
Useful response	45-13,000cps

3 or 8 or 15 ohm models.

£8·80 Post Free

DE-LUXE Mk II
12in 15 watts

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

Bass Resonance	30cps
Flux Density	14,000gauss
Useful response	25-16,000cps

8 or 15 ohms models.

£11 Post Free

SUPERB
12in. 20 watts

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

Bass Resonance	25cps
Flux Density	16,500gauss
Useful response	20-17,000cps

8 or 15 ohms models.

£16·50 Post Free

AUDITORIUM
12in. 25 watts

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

Bass Resonance	35cps
Flux Density	15,000gauss
Useful response	25-16,000cps

8 or 15 ohms models.

£15·40 Post Free

AUDITORIUM
15in. 35 watts

A high wattage loudspeaker of exceptional quality with a level response to above 8,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home.

Bass Resonance	35cps
Flux Density	15,000gauss
Useful response	20-14,000cps

8 or 15 ohms models.

£22 Post Free

Hi-Fi Enclosure Manual containing 20 plans, designs, crossover data and cubic tables. 42p. Post Free.

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"STEAM" ROLLING

ANNUAL Reports and Accounts of major organisations do not usually make exciting reading, but the latest from the IBA is different because of the entries describing the planning of independent commercial radio under the IBA banner.

Most of the information we are either aware of already, or we took for granted as being necessary minimum standards that are laid down to match the existing performance by the BBC. However, one or two interesting points emerge that have an important bearing for the listening audience.

The IBA, with very good reason, intends to encourage the major proportion of listening on v.h.f. The International Telecommunication Union is due to review the allocation of m.f. bands, under the present Copenhagen Convention and Plan, in 1974-5. Any proposed revisions are expected to take effect from 1976 and both the BBC and the IBA are expecting a reduction in the m.f. allocation largely due to "overcrowding". In the meantime both organisations continue to operate sound broadcasting on m.f. as a back-up for v.h.f.

The crunch is in sight for the listeners because it looks as if they must expect, after nearly twenty years of v.h.f. broadcasting, to convert to v.h.f. reception or go without. We have heard the pros and cons of v.h.f. and m.f. so many times that we will not pursue the matter here. Suffice it to say that the IBA are looking ahead to the "day of judgement" by planning in force for circular polarised transmitting aerials to compromise between horizontal and vertical polarised receiving aerials.

The m.f. transmitting aerials will be directional systems using three or four mast radiators so that several stations can transmit over a restricted area on 1151kHz. The radiated power will vary from one station to another, depending on local conditions, but in London it will be 0·5 to 1kW; elsewhere up to 5kW, with an 8kW mf1 and 30kW mf2 signal from Saffron Green (not until later next year) for London, when the IBA have finished with the installations at Lots Road Power Station.

The method of m.f. transmission adopted is not commonly used in Europe and it makes one wonder why not, even if large sites are necessary.

The other disturbing thought is the increasing availability of stations broadcasting on v.h.f. With the undesirable side-effects (such as "birdies" and inter-modulation distortion) and the greater sensitivity of tuner front-ends, we forecast a congestion (or indigestion!) problem on v.h.f. in the U.K. within the next five years. Some serious thinking and re-appraisal is therefore going to be needed with a view to extending the broadcast v.h.f. range below 88MHz; although we understand that a clash has occurred in Hertfordshire and the police service is expected to be moved to another frequency, it would be wishful thinking to expect the emergency services to be transferred out of their present 97MHz-plus domain.

M. A. COLWELL—*Editor*

The January issue, on sale 7th December, will include an Ultrasonic Remote Control Unit to switch on the television, radio, lamps, or almost any electrical device or appliance, without moving out of your armchair; a practical way of housing plug-in circuit boards; a signal generator for testing and fault finding in radio and audio equipment; an article dealing with radio interference problems in audio equipment; and first details of our plans for some of the spring issues of Practical Wireless, including some superb new ideas to help you make the most of d.i.y. radio and electronics.

Further details on page 751.

NEWS...

Mid-Lanark A.R.C.

THE above club has sent us some details of the future programme. There will be a bring-and-buy sale on Nov. 9, a demonstration of stereo radio and quadraphonic sound by GM3UCI on the 23rd and the A.G.M. on December 7th. December 21st is called "Oklahoma" and GM3BVU will give a talk on Amateur radio in the U.S.

Meetings are held at 7.30 in the Wrangholm Hall Community Centre, Jerviston Road, Motherwell.

Sonex 74

THE venue for Sonex 74 European High Fidelity Exhibition will be The Post House Hotel, London Airport and the dates March 29th to March 31st.

WIRELESS TELEGRAPHY ACT

Readers and advertisers are reminded of the requirements laid down by the Wireless Telegraphy Act. It is an offence in the U.K. to install or operate wireless telegraphy apparatus except under the provisions of the Act and, except in the case of broadcast sound-only receivers, a licence must be obtained from the Minister of Posts and Telecommunications.

Included within the provisions of the Act are any apparatus transmitting deliberate signals for any purpose such as "walkie - talkies", radio-controlled models or servos and some types of metal detectors. Apparatus radiating interference signals are subject to controls which also come under the administration of the same Ministry. If you require full information, please write to the *Ministry of Posts and Telecommunications, Waterloo Bridge House, Waterloo Road, London, SE1 8UA.*

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

Open University Course

ELECTROMAGNETICS and Electronics, a Post-experience course by the Open University, aims to provide an understanding of the scientific basis of electronics and electronic circuit design.

The course is intended for those preparing for higher level university study in science and technology and for those who need a knowledge of electronics but who do intend to study at a higher level.

It assumes little prior knowledge of electronics or electromagnetics but does assume a background of scientific or technical education beyond GCE "O" Level.

The first part deals with the basic ideas of electricity, magnetism and electromagnetism, semiconductors and the properties of simple circuits. The remainder deals with electronic circuits, stressing the need to design circuits to meet specifications of noise, distortion, output voltage as well as gain and input and output impedance.

Applications are now invited for the course which starts next February and lasts until November. As with all Post-experience courses, no formal academic qualifications are needed. They are self-contained courses designed to teach new developments or update knowledge of a subject.

The course consists of 17 written correspondence units linked to 17 television and five radio programmes. Students are required to attend a one week residential summer school and encouraged to attend evening or Saturday tutorial sessions. There are 12 assignments to complete and an examination at the end of the course.

A home experiment kit, including a cathode-ray oscilloscope and a signal generator, is sent to students who are expected to design and build circuits for checking at summer school.

Some elementary mathematics is required for the course. Students should know elementary calculus, the meaning of sine, cosine and imaginary numbers. A preparatory booklet is issued at the beginning.

The course tuition fee is £45 plus £37 for the residential summer school. Application forms are available from *The Post-experience Student Office, P.O. Box 76, Milton Keynes, MK7 6AA.*

What of D.N.L.?

PHILIPS Ltd. will be using the Dolby-B noise reduction system!!

Scottish show cancelled

BECAUSE of lack of interest, the Scottish International Hi-Fi Exhibition has been cancelled. Only 12 of the expected 27 firms confirmed their bookings for the show.

The organisers feel that the reason for the lack of interest is that many companies have stretched their budgets by representation at the Harrogate and Olympia shows.

Tyne/Wear radio contract

AFTER interviewing the six applicant groups for the Tyne/Wear radio contract, and giving full consideration to the written applications, the Independent Broadcasting Authority has announced that it has formed the view that Metropolitan Broadcasting is the leading contender.

The Authority now proposes, subject to contract, to offer the franchise to Metropolitan, the chairman of which is Sir John Hunter.

The company's programme plans will be published when it begins broadcasting — probably during the summer of 1974.

Physics Exhibition

THE Council of the Institute of Physics has decided that the Physics Exhibition should now be discontinued, and the show arranged for 1975 will now not take place.

In recent years the number of visitors to the exhibition has decreased considerably as have the number of industrial firms and other concerns that used to have exhibits there.

The very first Physics exhibition was held by the Physical Society in 1905. The one held in 1973 was the fifty-seventh in this series.

More for SQ

MORE manufacturers are getting onto the quadraphonic bandwagon by building SQ decoders into their equipment. Companies like Braun, Grundig, Korting, Philips, Revox, Saba, Sharp, Siemens have taken out SQ licences with CBS.

New 4-channel system

A NEW quadraphonic sound system devised by Duane Cooper and developed by Nippon Columbia was demonstrated at the Berlin Radio Show. The new system is called New Discrete or Discrete Matrix. It is said to have certain advantages over other quadraphonic systems because of its dual nature. A typical set-up would use a two-channel matrix for surround sound named BMX. This involves 45° phase shifts between the speakers rather than conventional 90° ones.

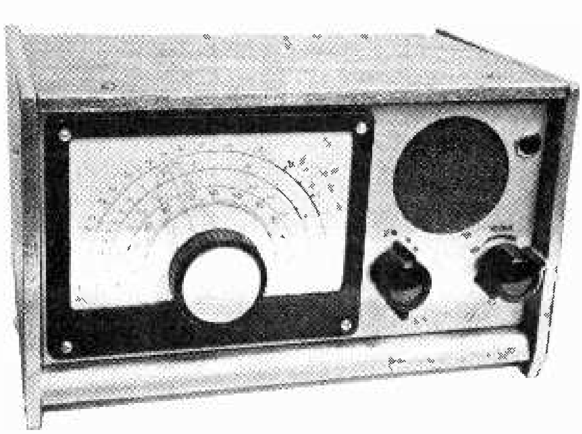
If increased definition in image placement should be required, a demodulator for the carrier channels on the records would be added, giving the set-up a potential 20dB separation between channels at mid-frequencies.

The Discrete Matrix system allows the two extra channels contained on the gramophone record to be of a narrow bandwidth resulting with the maximum frequency of the record being 36kHz compared with 45kHz on the CD-4 records.

Noise reduction techniques are not employed with this system, so making demodulators potentially cheaper.

3 BAND SW RECEIVER

F. G. RAYER G3OGR



THIS receiver employs two transistors and two IC's, one of the latter in the intermediate frequency amplifier section and the second in the driver and output stages. It has band switching and covers all the important short wave ranges, including the low frequency bands, which are not included in some short wave or "all-wave" receivers.

The receiver has a very inexpensive but quite attractive cabinet and operates an internal loudspeaker, a jack allowing headphones to be plugged in when preferred.

MIXER STAGE

The mixer section is shown in Fig. 1 and uses six miniature coils, the appropriate coils being selected by the 3-way 6-pole rotary switch. Each range is separate from the others and two coils are in circuit for each range. L1, L2 and L3 are the aerial coils, and L4, L5 and L6 the oscillator coils.

The six poles of the switch are numbered from S1 to S6. Pole S1 takes the aerial circuit to the aerial coupling windings of the aerial coils and S2 transfers the aerial tuning section of the gang capacitor, VC1, to the correct coil, for aerial tuning purposes. Pole S3 connects the base of Tr1 to the base coupling windings, as necessary. The earthed ends of all aerial coupling windings (pin 9) and tuned windings (pin 1) are permanently connected to the chassis, while all the base coupling windings are returned to the base bias network R1/R2.

In a similar manner, switch section S4 selects the collector coupling windings of the oscillator coils L4, L5 or L6, while S5 connects the emitter of Tr1 to the appropriate emitter winding. S6 selects the tuned windings of the oscillator coils which are tuned by the second section of the ganged capacitor, VC2.

All the emitter windings (pin 7 of each coil) are returned to the emitter bias circuit, C2 and R3. In the same way, each collector winding (pin 8) goes to the IF amplifier.

In order to secure proper coverage and tracking, oscillator coil L5 has a padder capacitor CP1 of 3000pF from pin 4 to chassis. L6 has a 1000pF capacitor CP2 from pin 3 to chassis while L4 requires no padder, pin 6 being wired to the chassis.

If the circuit in Fig. 1 appears difficult to follow, it is suggested that the switch is set at its middle position and L2 and L5 wired in. The receiver can then be tested on this band. When it is found to be in order L1 and L4 can be added and wired and a check made that this works correctly, before adding L3 and L6. This is much better than wiring in all the coils, then perhaps finding that a mistake has been made with the switch contacts or the operation of the switch, so that some wiring error is difficult to locate and correct. To avoid any possible confusion here, the bands, approximate coverage, and maker's range numbers are as follows:—

Band	Coverage		Maker's Range No.
A	30—10·5MHz	10— 28m	5T
B	15— 5 MHz	20— 60m	4T
C	5— 1·7MHz	60—180m	3T

L1 and L4 are for Band A, L2 and L5 for Band B and L3 and L6 for Band C.

In order to avoid squegging, or spurious oscillation and hissing spoiling reception, resistors R4, R5 and R6 are included in the individual collector circuits to L4, L5 and L6. The best values for these resistors depend on Tr1. Gain is maximum when these resistors are of the lowest values which allow proper working of this stage. The values shown should certainly be satisfactory, but it is an easy matter to have on hand a few resistors of various values between about 100Ω and 1kΩ (say about half a dozen different values) and try these in series with the circuit to pin 9 of each range, while tuning over the range. Excess oscillation is most likely at the high frequency end of any one band (VC2 nearly fully open).

Trimmers TC1, TC2 and TC3 are for aerial circuit trimming and each is adjusted on the appropriate band.

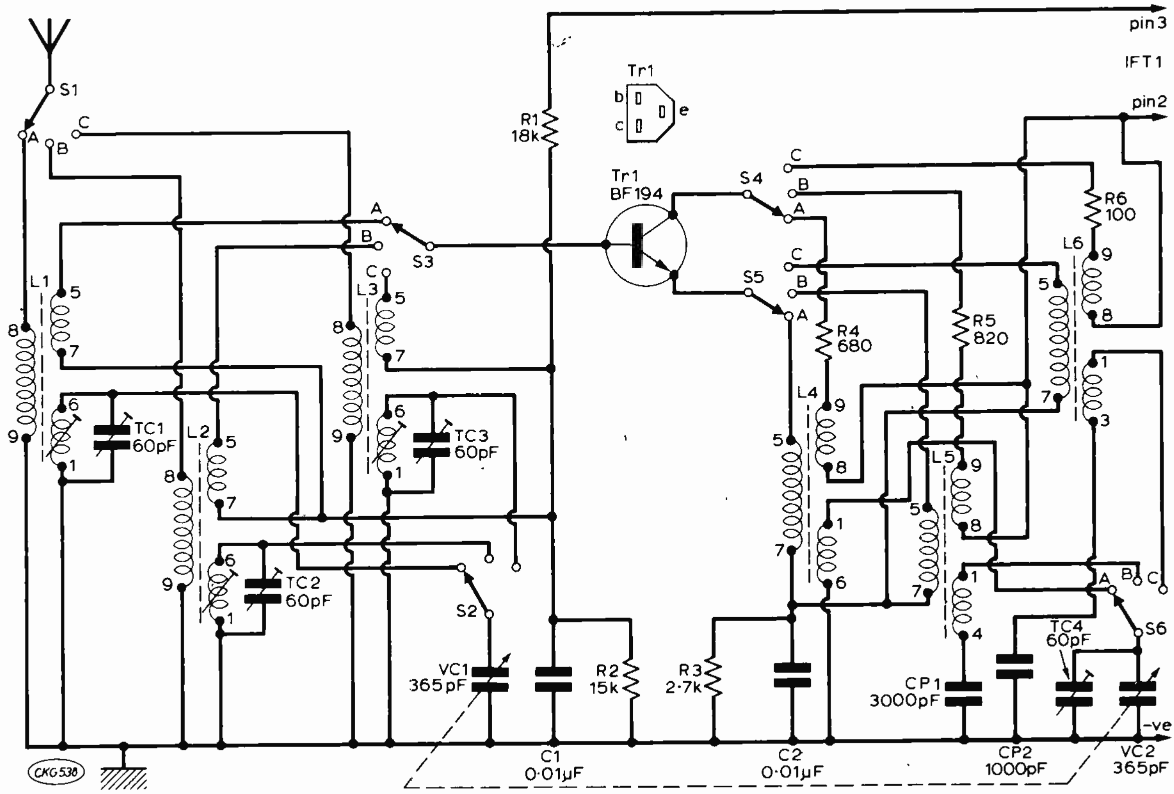
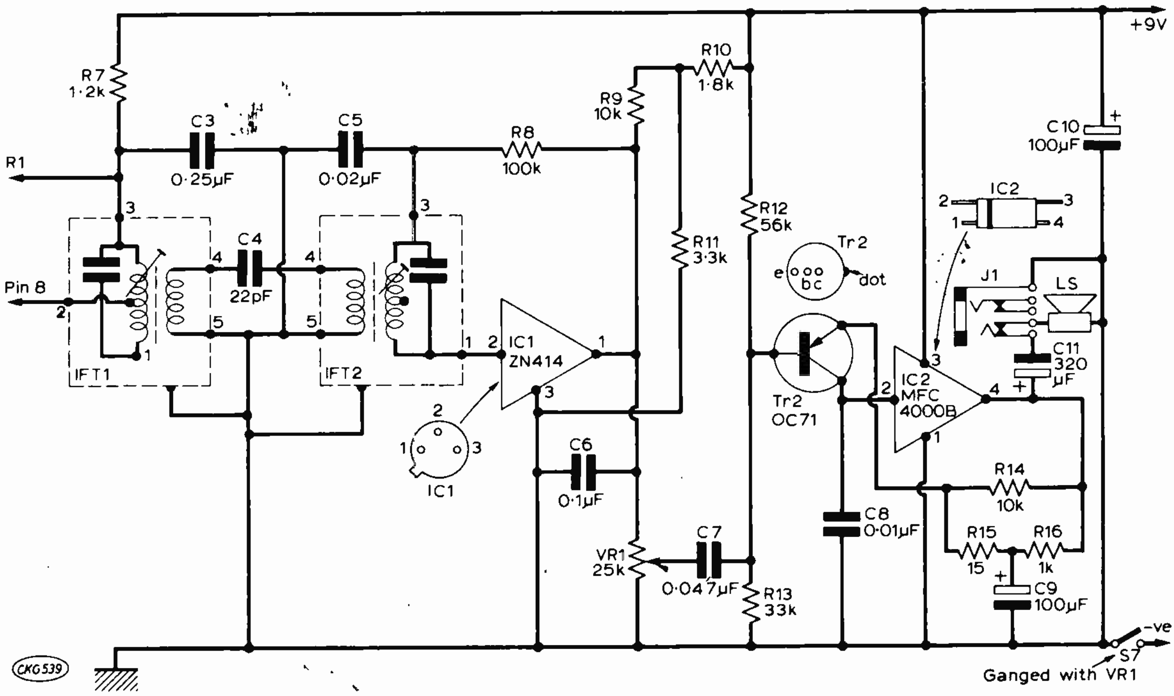


Fig. 1, above, and Fig 2, below, give the complete circuit of the receiver.



IF AMPLIFIER

Fig. 2 is the circuit of the intermediate frequency amplifier and audio amplifier, which are constructed on one small circuit board. The IF filter consists of two loosely coupled units, IFT1 and IFT2, tuned to 470kHz.

Output from IFT2 goes to IC1 which provides three stages of amplification at 470kHz and includes automatic gain control and detection circuitry, giving an audio output which is taken to the volume control VR1.

Resistors R10 and R11 form a potential divider across the 9V supply and current is taken by IC1 and VR1 through R9. This means that the circuit should not be operated with VR1 disconnected and that this potentiometer should be of the value given.

The mixer stage is fed from its own positive supply point at the junction of C3 and R7.

AF AMPLIFIER

Tr2 is a high gain pre-amplifier, followed by IC2 which has 6 transistors and 3 diodes in a driver-push-pull output circuit which delivers approximately 250mW to a 16Ω speaker. This IC is very economical on battery current and the output is easily adequate for normal loudspeaker reception. The load impedance is not too critical, so that speakers of higher impedance may be used. R14, R15 and R16 provide direct current feedback to stabilise the whole audio amplifier.

CIRCUIT BOARDS

The mixer board is approximately $1\frac{1}{4}$ x $1\frac{3}{16}$in, Fig. 3, with a bracket fixed as shown and a tag serving as a return point for C1, C2, R2 and R3. This bracket must be bolted tightly to the metal chassis so that the board is connected to the negative line.

External connections will be required to a few points. These can be made by providing Veropins, or by leaving a projecting wire, so that leads can be soldered on as necessary.

The small pins of Tr1 project from the underside of the board and connecting wires are soldered directly to them which will run to the sections of the bandswitch, as indicated in Fig. 3.

Both sides of the IF/AF board are shown in Fig. 4 and it is approximately $3\frac{3}{4}$ x $1\frac{1}{4}$in. Holes should first be drilled to clear the pins and can tags of the two IF transformers. If any small error is made when drilling these, they can be enlarged or elongated as necessary with a very small round file. Drill holes for two 6BA bolts, one marked MC is fitted with a tag which forms the negative return

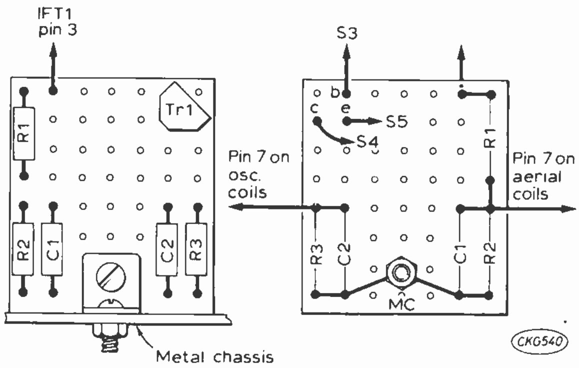


Fig. 3: Layout of components on the mixer board.

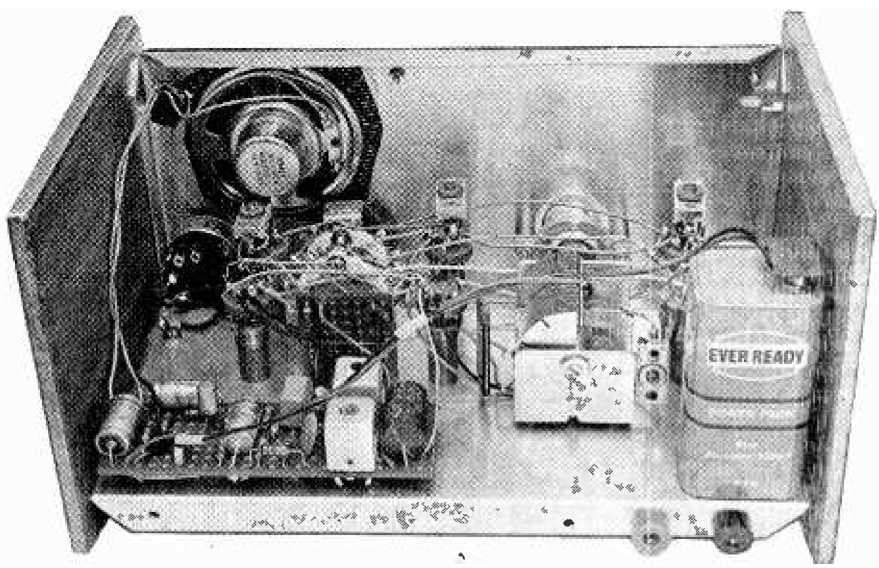
to the metal chassis. These bolts should be at least $\frac{1}{2}$in. long so that spacers or extra nuts will allow the board to be clear of the metal chassis.

C4 is underneath, directly from pin 4 of IFT1 to pin 4 of IFT2, but all other items are on top of the board. Position these as shown, noting the polarity of electrolytic capacitors.

In most places the wire ends of the resistors and other items are long enough to reach the connecting points. Elsewhere, 24 s.w.g. tinned copper or similar connecting wire can be used. Sleeving is put on all leads which cross other wires and anywhere else where this appears necessary.

Two thin flexible leads are soldered on to connect to the speaker. A red flexible lead, with a positive battery clip, is also provided, as shown.

Colour coded leads also run from R9 and the base of Tr2. C7 is soldered directly on the centre tag of the volume control, VR1. Fit a colour-coded lead from C3, to run on to R1 on the mixer board. A further lead is taken from pin 2 of IFT1, up through the board as in Fig. 4, and will be soldered to the circuit which connects pins 8 on the oscillator coils.



Rear view of receiver showing position of IF/AF board at front left with mixer board immediately behind.

★ components list

Resistors

R1 18kΩ	R7 1·2kΩ	R13 33kΩ
R2 15kΩ	R8 100kΩ	R14 10kΩ
R3 2·7kΩ	R9 10kΩ	R15 15Ω
R4 680Ω*	R10 1·8kΩ	R16 1kΩ
R5 820Ω*	R11 3·3kΩ	
R6 100Ω*	R12 56kΩ	VR1 25kΩ log with switch, S7

Resistors $\frac{1}{4}$W 5%. * See text

Capacitors

C1 0·01μF	C9 100μF 10V
C2 0·01μF	C10 100μF 10V
C3 0·25μF	C11 320μF 10V
C4 22pF	CP1 3000pF
C5 0·02μF	CP2 1000pF
C6 0·1μF	VC1/2 2 x 365pF (Jackson Type O. Cat. No. 5250/2)
C7 0·047μF	
C8 0·01μF	TC1–4 60pF pre-set trimmers

Semiconductors

Tr1 BF194 IC1 ZN414 } S.C.S. Components
Tr2 OC71 IC2 MFC4000B } POB 26, Wembley, Middx.)

Miscellaneous

IFT1/2 (Denco IFT13). L1, Blue 5T. L2, Blue 4T. L3, Blue 3T. L4, Red 5T. L5, Red 4T. L6, Red 3T. (All Denco). Tuning drive (Jackson Type 6/36 Cat. No. 4103). S1–6, 2 wafer switch, each 3 pole 3 way. Speaker, 2½in, 25 to 40Ω. Universal chassis members, 8 x 4in (2) (Home Radio). Switched output jack socket. Aerial and earth sockets. Veroboard 0·15in matrix, 1¼ x 1³/₁₆in approx. and 3¾ x 1¼in approx. Wood for cabinet. Knobs

IC1 has three leads, positioned as in the underside view of this component, in Fig. 4. IC2 has four spills, 2 and 3 being longer, as in Fig. 4. If this IC is located as shown, the tags will fit the Veroboard holes correctly and connections being soldered on underneath. Both ICs should be soldered without undue heating. It should only be necessary to keep the soldering iron in contact with the joint for a second or two. Lengthy heating may damage these items.

This circuit board should not be tested without VR1 and the loudspeaker being connected.

If a signal generator is to be used to adjust the circuits, couple this loosely to the lead running to pin 2 of IFT1. It is only necessary to place the generator lead near this lead with no actual connection. The cores of IFT1 and IFT2 should then be adjusted, with a proper tool, for best output.

When no generator is available, adjustment should prove quite easy as the IFTs are pre-aligned by the maker. It is then only necessary to tune in a stable signal and adjust each core for best volume. The cores should have a sharp resonance peak. Again, it should be stressed that a properly shaped tool must be used, as a wedge-shaped blade may easily break the cores so that they cannot be rotated, while inserting a steel or similar screwdriver will upset correct alignment.

The audio section should be found to provide good amplification and adequate loudspeaker volume. The small internal speaker will give quite reasonable audio quality, for SW listening purposes. A larger, external speaker may be plugged in (as well as phones) and this will naturally give some improvement. It should be of suitable impedance, about 16 to 25Ω. Though a small speaker can give satisfactory results, it cannot be expected to be quite as good as a larger unit operating with its own cabinet or baffle.

CONSTRUCTION

The chassis is a "universal chassis" flanged member 8 x 4in. with a second similar member used for the panel. The front edge of the chassis is set back $\frac{1}{2}$in. from the panel, as in Fig. 5, using two $\frac{1}{2}$in. spacers and two $\frac{3}{4}$in. countersunk 6BA

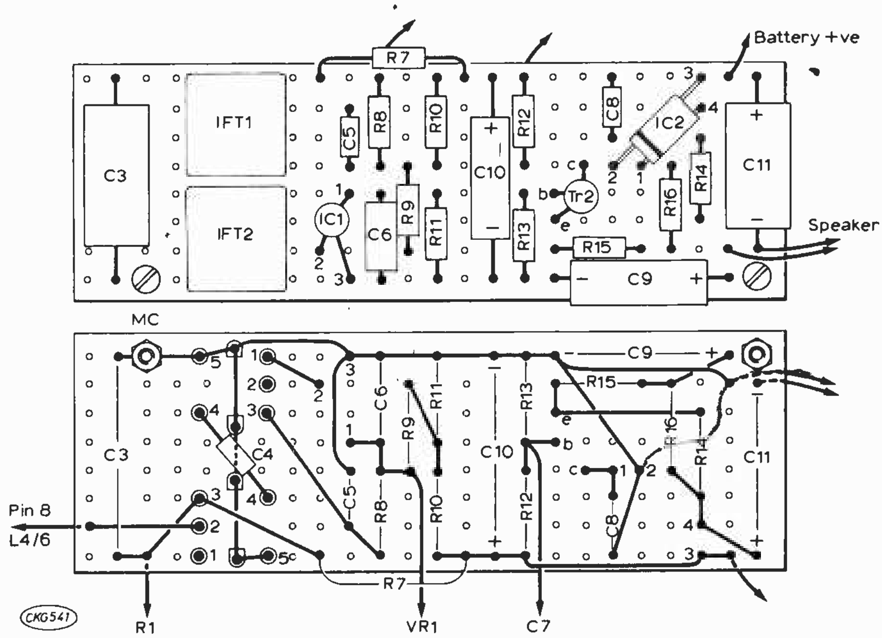


Fig. 4: The two sides of the IF/AF board and connections to the remainder of the circuit.

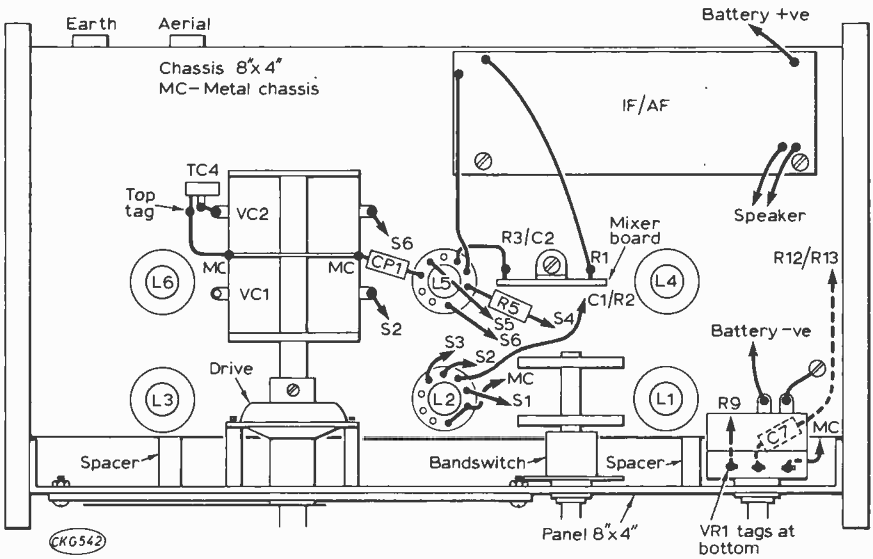


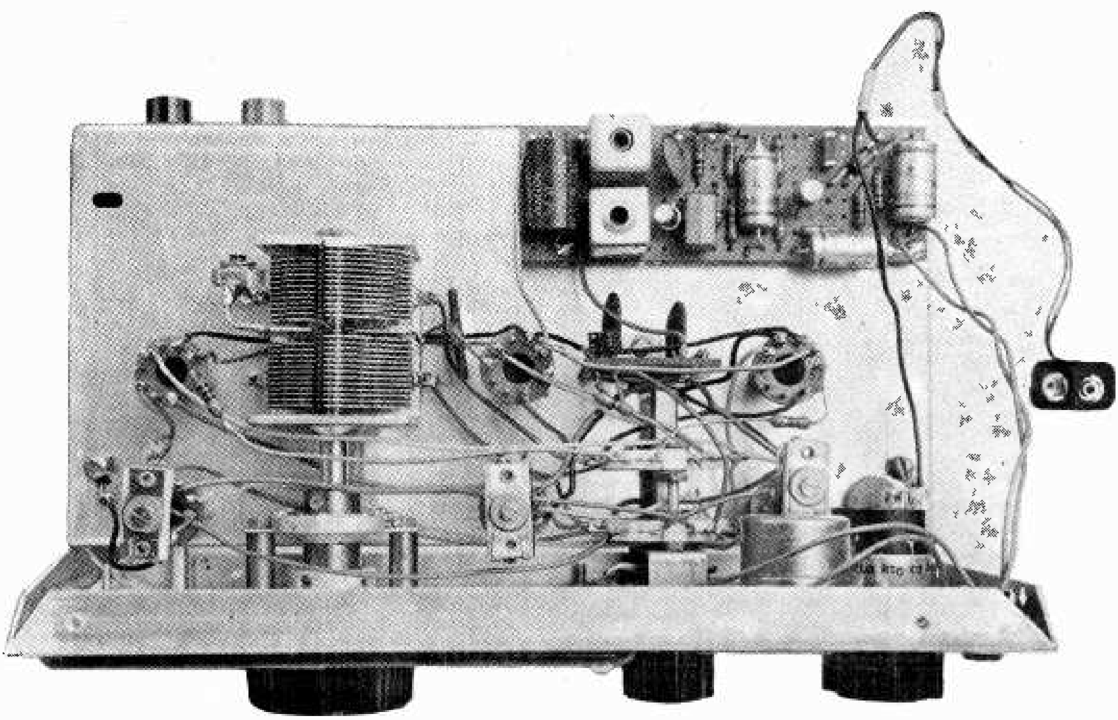
Fig. 5: Layout of major components on top of the chassis and interconnections.

bolts, which run through the panel and the front flange of the chassis. (These two bolts with spacers are not absolutely essential, as chassis and panel are held in position by the case sides. However, with the bolts securing these parts together, assembly and testing can be completed before fitting the sides in position, and wiring is thus more easily reached.)

Locate the drive template on the panel and drill the fixing holes for it and for the dual-speed ball drive. A large hole is also punched for the projecting part of the drive which carries the cursor.

Position the bandswitch and VR1 as in Fig. 5, keeping these as low as possible to leave room for the speaker. The speaker opening is made with a large chassis punch or adjustable washer or tank cutter, or by drilling a ring of small holes and clearing up the edge with a half-round file.

Check that the panel and chassis are correctly fixed and at right angles, then fit the ganged capacitor into the drive and drill the fixing holes for the capacitor. Washers are placed under the capacitor to bring it level with the drive. The position of the drive and capacitor should be carefully adjusted as necessary so that they are in line and turn smoothly.



General view of receiver from above to assist in locating components shown in Fig. 5.

Holes ¼in. in diameter are drilled for the six coils, which are located as in Fig. 5. Their fixing nuts should be tightened with the fingers only. Pins are counted in a clockwise direction from the space, from 1 to 9, and wiring is simplified if all the coils are positioned so that their pins are approximately in the same direction.

The IF/AF amplifier board and mixer board are fixed as in Fig. 5, but it is easier to leave these off until most of the wiring has been done to the lower tags of the switch. which are otherwise difficult to reach.

Pressure should not be imposed on the coil pins when these are hot, so a little care is required when soldering these to prevent them moving when the insulation softens.

The volume control is mounted as in Fig. 5. Connect the lower tag to S7 and to the metal chassis. Run a lead from the other outer tag, under the chassis and up through a hole near the AF amplifier, where it is soldered to R9, Fig. 4. Solder C7 to VR1 slider and take a further insulated lead under the chassis and up through to the junction of R12 and R13.

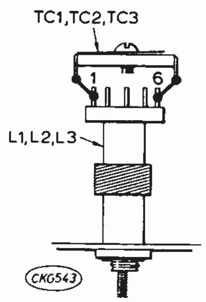


Fig. 6: Method of mounting trimmers on top of the coils.

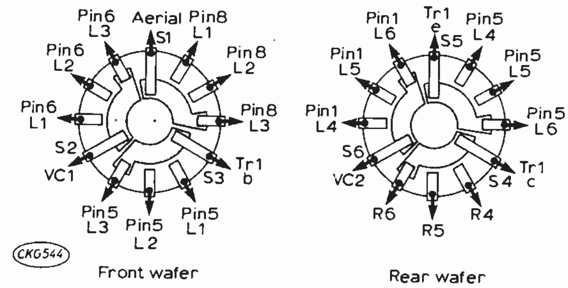


Fig. 7: Details of the wiring on the bandchange switch wafers.

Trimmers TC1, TC2 and TC3 are mounted directly across the coils L1, L2 and L3 as in Fig. 6. Short, stout wires are soldered to pins 1 and 6 of each coil, for this purpose, when wiring the receiver. It is preferable to take the upper plate tag of the trimmer to the earth side of the circuit (pin 1) in each case.

The single oscillator trimmer, TC4, is soldered to the ganged capacitor as in Fig. 5, the top tag being connected to the capacitor frame by a stout wire. A check should be made that the tuning capacitor fixing bolts are not too long, or they may touch the fixed plates of the capacitor.

A bandswitch with two wafers was used. The front wafer switches the aerial, base and VC1 circuits while the rear wafer is employed for the oscillator coils.

It is not essential to use a two-wafer switch provided the required number of poles are available and the switch is small enough to be accommodated.

Fig. 7 shows connections to the switch. It will be found very helpful to use colour-coded leads here. With the aerial coils, yellow may be used for aerial and S1 circuits, with red for base and S3 circuits, and green for S2, VC1 and associated circuits. For the back wafer, red can be used for S4, yellow for S5, and green for S6. Chassis returns to the coils can be black and the base bias circuit to C1/R2 may be blue. Whatever colours are used, employ them exclusively for one circuit.

It is also helpful to solder on lengths of wire, before mounting the switch, where the tags will be near the chassis, and hard to reach later. These wires can then be cut to length and taken to the various coils.

If the contacts of the switch cannot be seen, and its operation is not wholly clear, test it for continuity with a meter, in each position. Also it is advisable to wire in the coils for one band only, to confirm that no error is being introduced here, before proceeding with the other ranges.

ALIGNMENT

Alignment of the IFTs has been described. To align the aerial and oscillator coils, deal with one band at a time. Adjust the coil cores at a low frequency in the band (VC1/2 nearly closed) and the appropriate trimmer at a high frequency in the band (VC1/2 nearly open).

TC4 is initially set about half closed. If it is subsequently found that TC1, TC2 or TC3 is fully open for best volume, TC4 should be screwed down slightly. Provided TC1, TC2 and TC3 each have a definite peak giving best volume, there is no need for a separate trimmer for each oscillator coil.

Coverage is primarily determined by the settings of the oscillator coils and TC4. If a signal generator is available, set VC1/2 5° from the fully closed position and adjust the core of L4 for reception on 10·5MHz; similarly adjust L5 for reception on 5MHz, and L6 for reception on 1·67MHz.

L1 should then be adjusted at 11·5MHz for best volume. L2 is similarly adjusted at 5·5MHz, and L3 at 1·83MHz. VC1/2 is then opened to tune to 28·5MHz, and TC1 is adjusted. TC2 is adjusted at 13·5MHz, and TC3 at 4·5MHz.

These adjustments are repeated until no further improvement is possible. These frequencies are the most effective tracking points for the low frequency and high frequency end of each band and result in best tracking throughout the whole range.

CALIBRATION

The tuning drive listed has a scale marked 0-100°, in addition to scales for individual calibration. Set the cursor to 100° with the tuning capacitor fully closed. If calibrated as described the following points, read against the 0-100 scale, may be used as a guide to intermediate frequencies:—

Range A		Range B		Range C	
30MHz	12°	15MHz	7°	5·0MHz	8°
28MHz	15°	14MHz	10°	4·5MHz	12°
26MHz	17°	13MHz	13°	4·0MHz	17°
24MHz	19°	12MHz	16°	3·5MHz	22°
20MHz	27°	11MHz	19°	3·0MHz	29°
18MHz	32°	10MHz	23°	2·5MHz	41°
17MHz	36°	9MHz	28°	2·0MHz	62°
16MHz	40°	8MHz	35°	1·9MHz	70°
15MHz	45°	7MHz	44°	1·8MHz	79°
14MHz	52°	6MHz	59°	1·7MHz	89°
13MHz	60°	5·5MHz	71°		
12MHz	70°	5MHz	85°		
11MHz	81°				

CABINET

Each side of the cabinet is 6mm plywood, approximately 5¼in. deep, to give a front projection. The sides are 4½in. high at the back, and 5in. high at the front, to tilt the panel backwards slightly. (Note, however, that panel and chassis remain at right angles to each other.)

A strip of wood 8 x 1 x ½in. with a rounded front edge is fitted under the panel by means of two self-tapping screws run into the lower flange of the panel.

The cabinet top is 8 x 5¼in. and it is screwed to the back, which is 8 x 4in., by means of an inner strip about 8 x 1 x ½in. in size. This completed part (top and back) is secured with two self-tapping screws into the front flange, and two bolts at the back, so that it can be removed to renew the battery. The bottom of the chassis itself may be left open, or closed with a sheet of hardboard. ■

PW TECHNICROSS PUZZLE

Solution to No. 1 presented last month

1 P	2 A	S	3 S	■	4 W	5 A	V	6 E	F	7 O	R	8 M
■	Z	■	H	■	■	Y	■	N	■	K	■	O
9 K	I	W	I	■	10 L	E	F	T	H	A	N	D
■	M	■	11 E	R	A	■	■	R	■	P	■	U
12 P	U	L	L	■	Y	■	13 A	E	R	I	A	L
■	T	■	14 D	Y	E	D	■	E	■	■	■	U
15 O	H	M	S	■	R	■	16 T	■	17 F	I	18 G	S
V	■	■	■	19 G	■	20 F	R	E	E	■	A	■
21 E	X	22 C	E	L	S	■	A	■	23 R	I	N	G
R	■	H	■	O	■	■	24 C	U	R	■	G	■
25 F	E	E	D	B	A	26 C	K	■	27 I	R	I	S
E	■	S	■	E	■	I	■	■	T	■	N	■
28 D	I	S	C	S	E	A	L	■	29 E	G	G	S

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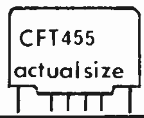

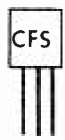

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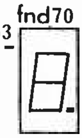

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using the LM 380N amplifier

J. B. DANCE M.Sc.

THERE are a number of integrated circuit audio power amplifiers available at the present time. One of these, the LM380N device, has a number of features which make it attractive to the amateur experimenter. In particular, it is very useful in circuits requiring the minimum number of components. The device is manufactured by the National Semiconductor Company, and is available from Ambit International, 37 High Street, Brentwood, Essex, or Athena Ltd., 140 High Street, Egham, Surrey.

ADVANTAGES

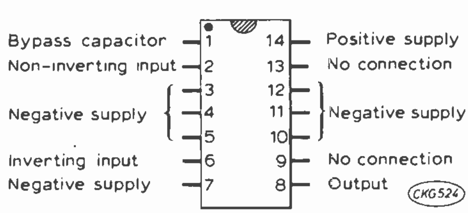
The LM380N automatically 'centres' its output at one half of the power supply voltage. This eliminates the need for additional circuitry (including a pre-set potentiometer) which is required with some other types of amplifier for adjusting the bias so that maximum voltage swing (and hence a maximum power output) can be obtained.

The LM380N device also incorporates internal protective circuits. If the silicon chip becomes too hot (above about 150°C) owing to incorrect operation, the circuit automatically becomes inoperative for a time until the chip has cooled. Protection is also incorporated against excessive current in the output stage; such currents will occur if the output is accidentally short-circuited. The limiting current in the output stages is about 1·3A.

The LM380N can feed up to 2·5W to an 8Ω loudspeaker when operated from an 18V supply. The absolute maximum permissible supply voltage is 22V, but it is wise to use a somewhat lower value to allow a margin for error. The writer has found that satisfactory loudspeaker volume can be obtained using the minimum recommended supply voltage of 8V. The total harmonic distortion is 0·2% at 2W output using an 18V supply.

It is normally convenient to use the LM380N in a standard 14 pin dual-in-line socket so that it can be removed easily from the circuit. However, one can solder directly to the terminals of the device.

Fig. 1:



CONNECTIONS

The connections of the LM380N are shown in Fig. 1. The input signal can be fed either to the non-inverting input or to the inverting input. Generally it is more convenient to feed the signal to the non-inverting input and to leave the inverting input unconnected.

If, however, the signal is fed to the inverting input, the non-inverting input should be returned to earth through a capacitor or a resistor or directly earthed. This will prevent positive feedback from the output to the non-inverting input causing instability. A capacitor is preferable when the signal source has a high impedance, but with a source of moderate impedance a resistor approximately equal in value to this source impedance is preferable to maintain the balance of the differential stage. When the source impedance is low, the non-inverting input may be earthed.

GAIN

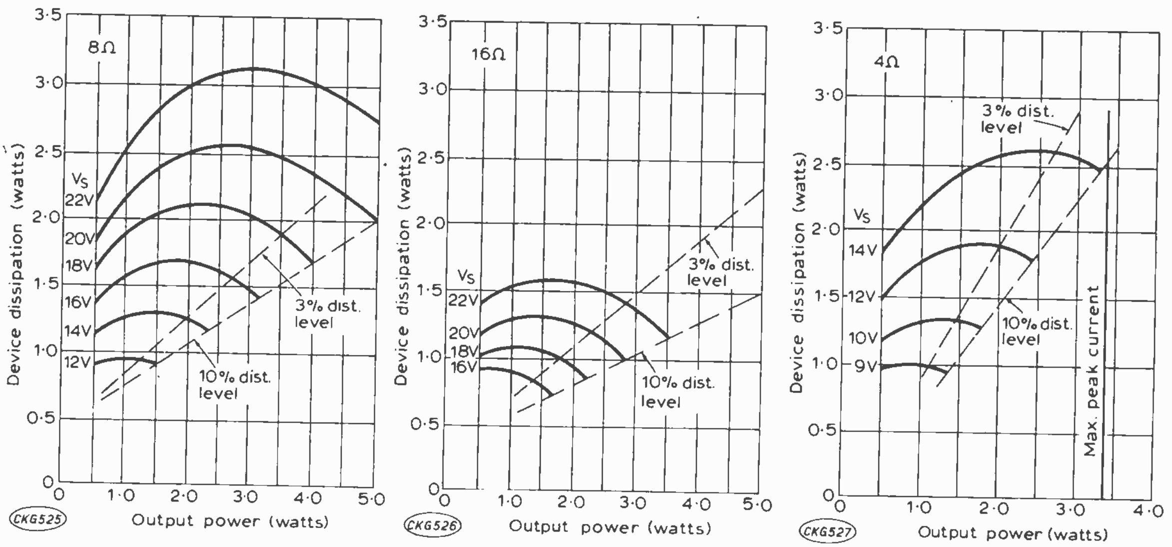
The voltage gain of the LM380N is fixed at 50 (or 34dB) by the internal circuitry of the device. Although this fixed gain limits the versatility of the amplifier, it does result in a minimum number of external components being required for its use.

HEAT SINK

The LM380N device itself can dissipate up to 1·25W when operated without any heat sink at ambient temperatures of up to 25°C; this is adequate for many applications. For example, Fig. 2 shows that the power does not exceed 1·25W at supply voltages up to 14V when an 8Ω speaker is employed. Even if a higher supply voltage is used, it is not likely that the dissipation will exceed 1·25W for an appreciable time.

Fig. 3 shows that there is still less chance of overheating when a 16Ω speaker is employed. In this case, the supply voltage would have to exceed 20V for the dissipation to exceed 1·25W.

In the case of a 4Ω speaker, however, Fig. 4 shows that the dissipation can reach 1·25W when a 10V supply is used. If a much higher supply voltage is employed, the pins 3, 4, 5, 10, 11 and 12 of the device should be soldered to a copper heat sink of



Figs. 2, 3 and 4: These graphs show dissipation of the LM380N against output power for various values of supply voltage and loudspeaker impedance

area about six square inches.

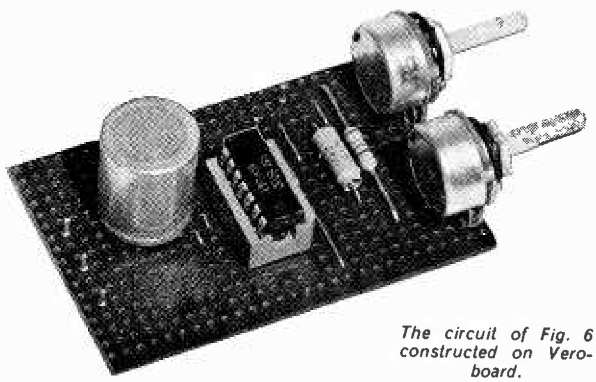
The three per cent total harmonic distortion line shown in Figs. 2 to 4 is approximately the onset of clipping.

POWER SUPPLY

If there is hum or noise on the power supply line, a hum rejection of about 38dB can be obtained by connecting a 5μF capacitor from pin 1 to earth. A smaller capacitor will also provide some measure of hum reduction.

If the power supply leads from a battery or filter capacitor are longer than two or three inches, a 0·1μF capacitor should be connected between pin 8 and earth to prevent oscillation.

In addition, a 2·7Ω resistor in series with a 0·1μF capacitor may be connected between pin 8 and earth to suppress any high frequency oscillations.



The circuit of Fig. 6 constructed on Veroboard.

The input pin operates with a mean potential equal to the earth potential. A capacitor in series with the input pin is therefore required only if the mean potential of the signal source is not also at earth potential.

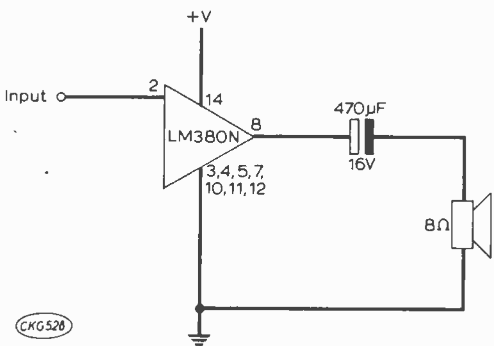


Fig. 5: A simple circuit using the LM380N.

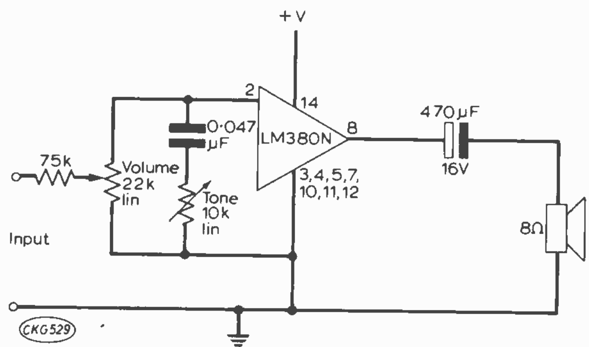


Fig. 6: A record player amplifier suitable for use with a crystal or ceramic pick-up cartridge.

SIMPLE CIRCUIT

The simplest circuit using the LM380N is shown in Fig. 5. The 470μF capacitor must be placed in series with the loudspeaker to prevent a steady current from flowing through the speaker from pin 8. A smaller capacitor than that shown will result in inferior bass response.

The writer has used the circuit of Fig. 5 in a radio receiver. Fig. 6 shows how a similar circuit may be used as a record player amplifier with volume and tone controls. The input impedance of the LM380N is about 150kΩ.

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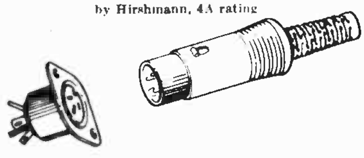

2 way LS—socket 10p; plug 12p. 3 way scr. socket 10p; plug 12p. 5 way scr. socket 12p; plug 15p.

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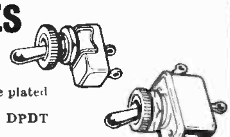

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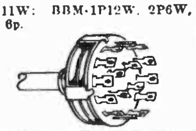

1P12W, 2P6W, 3P4W, 4P3W, each 24p

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1·0						10p		7p
2·2					10p		7p	8p
4·7				10p		7p	8p	7p
10					7p	8p	7p	8p
22			7p	7p		7p	7p	9p
47	7p		8p	7p	8p	7p	9p	12p
100	8p	7p	7p	7p	7p	9p	11p	19p
220	7p	8p	8p	8p	9p	10p	17p	27p
470	8p	9p	9p	10p	12p	17p	24p	43p
1000	10p	12p	12p	17p	20p	24p	40p	
2200	14p	17p	22p	25p	36p	40p		
4700	25p	28p	37p	41p	54p			
10,000	40p	43p						

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C	1/8W	5%	4·7 Ω–470K Ω	E24	1	0·9	0·75 nett
C	1/4W	5%	4·7 Ω–10M Ω	E12	1	0·9	0·75 nett
C	1/2W	5%	4·7 Ω–10M Ω	E24	1·2	1	0·9 nett
C	1W	5%	4·7 Ω–10M Ω	E12	2·5	2	1·6 nett
MO	1/2W	2%	10 Ω–1M Ω	E24	4	3	2 nett
WW	1W	10% ± 1/20 Ω	0·22 Ω–3·9 Ω	E12	7	7	6
WW	3W	5%	1 Ω–10K Ω	E12	7	7	6
WW	7W	5%	1 Ω–10K Ω	E12	9	9	8

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

Values:
E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
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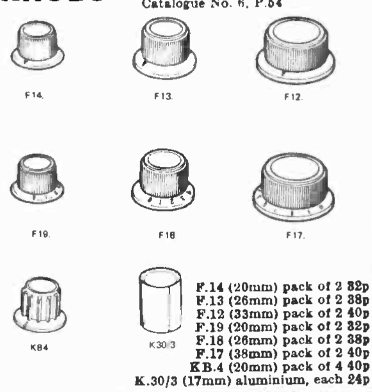

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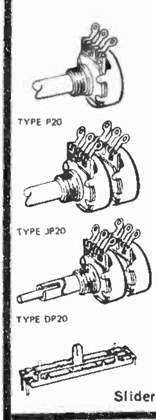

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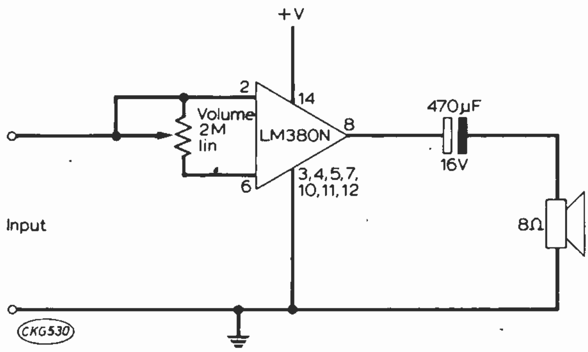


Fig. 7: A high input impedance achieved by use of a common-mode volume control.

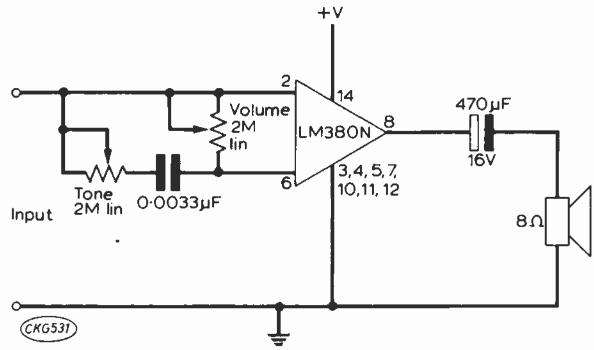


Fig. 8: This circuit features common-mode controls for both volume and tone.

HIGH IMPEDANCE INPUT CIRCUIT

An amplifier with a high impedance input is shown in Fig. 7; it is suitable for use with high impedance signal sources such as a crystal microphone. This circuit employs a 'common mode' volume control. When the potentiometer slider is at the bottom of its travel in Fig. 7, the input signal is fed to both the inverting and the non-inverting inputs. In this case the signals will almost cancel in the device and the output will be small. When the potentiometer is at the top of its travel, however, only pin 2 will receive an appreciable input voltage and maximum volume will be obtained.

The circuit of Fig. 8 shows how a common mode volume control circuit may be used with a common mode tone control to maintain the high input impedance.

A very high input impedance amplifier can be made using the field-effect transistor input circuit shown in Fig. 9. At low frequencies the input impedance is 22 megohms, but at high frequencies the input impedance is reduced by the gate to drain capacitance of the field effect transistor

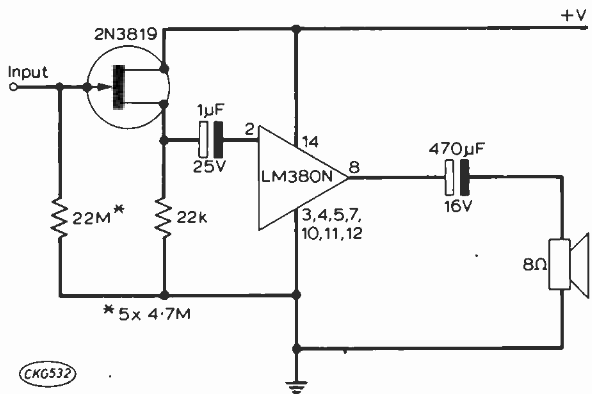
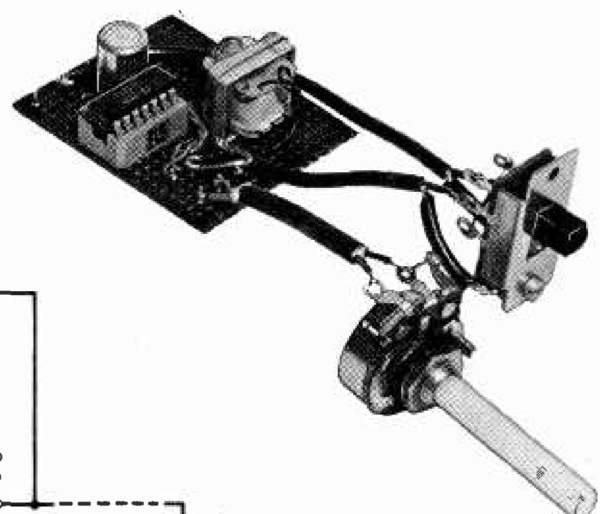


Fig. 9: The addition of a FET input stage gives a very high input impedance.

INTERCOM SYSTEM

A simple circuit for an intercom system is shown in Fig. 10. The transformer ratio of 25:1 multiplied by the gain of the LM380N produces a loop gain of 1250. The roles of the input and output speech transducers are reversed when the switch is operated.



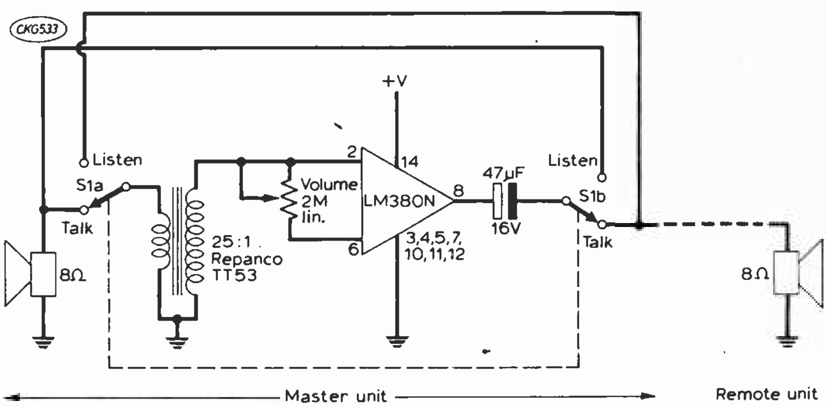


Fig. 10: An intercom system in which the loudspeakers double as microphones. The view above shows the amplifier with controls attached.

DUAL POWER SUPPLY

Another simple circuit using the LM380N is shown in Fig. 11; it provides a dual voltage supply balanced with respect to ground from a single supply. If the input is 20V, outputs of +10V and −10V can be obtained. The potentiometer can be used to balance the outputs relative to ground, but may be omitted if exact balance is not required.

An advantage of this circuit is that a high quiescent current is not taken when little current flows in the outputs.

EXTRA GAIN

Although the gain of the LM380N is fixed at 50 by the internal components, higher gain can be obtained by using additional positive feedback. For example, Fig. 12 shows how a gain of 200 can be obtained.

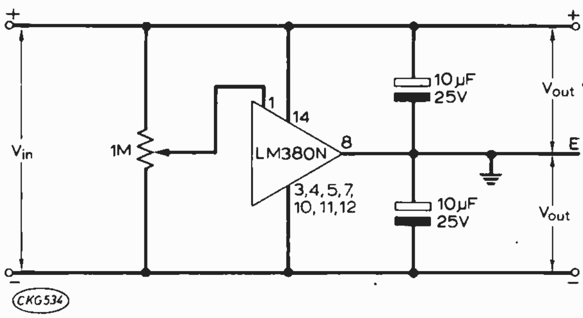


Fig. 11: A circuit to provide a split power supply from a single source.

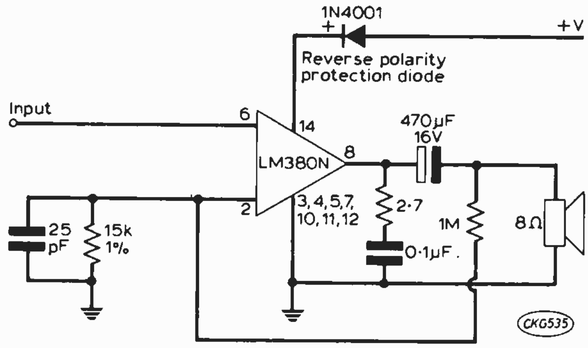


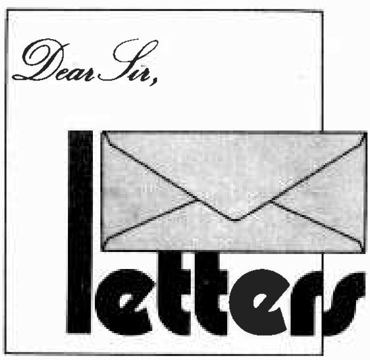
Fig. 12: Increased gain may be obtained by the use of positive feedback.

The maximum gain is around 300, since attempts to obtain still higher gain may merely result in oscillation.

SUPPLY POLARITY

As in the case of most integrated circuit audio amplifiers, if the power supply to the LM380N is applied with the polarity reversed, a large current will flow and the device will almost certainly be destroyed within a few milliseconds.

Readers may therefore wish to incorporate a diode in one of the power supply lines (normally the positive line). If a supply of reverse polarity is accidentally applied to the circuit at any time, the diode will prevent any appreciable current from flowing and will thus protect the LM380N. It is, of course, essential that the diode is connected with the correct polarity, see Fig. 12. ■



Microwave distance Record

On Thursday, 13th September a 3cm (10GHz) contact was made between GW8CKT/P on Snowdon and GM8AZU/P on the Cairnsmore of Fleet. We believe that, at 212·5km, this is a new British distance record.

Weather conditions were far from ideal, with gale force winds and both ends of the link well above the cloud base. Visibility on Snowdon at 3560 feet was only 15 yards, and on the Cairnsmore of Fleet at 2300 feet was only 20 yards. The high wind on Snowdon made it impossible to use a dish aerial and so a 10dB horn was used. At the Scottish end a 32in. dish was used, and a considerable amount of luck was in evidence when the beam heading, estimated using a cheap plastic compass, turned out to be correct to better than 0·5°. Earlier attempts to find a signal using a 10in. dish at the Scottish end had failed. Signal reports exchanged were readability 5 and strength 6/7.

Equipment used at GM8AZU/P: Tx, Mullard CXY19 Gunn device, output approximately 100mW; Rx, Mixer CS10B, Local Oscillator, Mullard CL8370; i.f., 70MHz; ANT, 32 inch dish with horn feed.

Equipment used at GW8CKT/P: TX, Mullard CXY19 Gunn device, output approximately 120mW; RX, Mixer, balanced pair of Mullard BAW95, Local Oscillator, Mullard CL8380; i.f., 70MHz; ANT, Small horn.

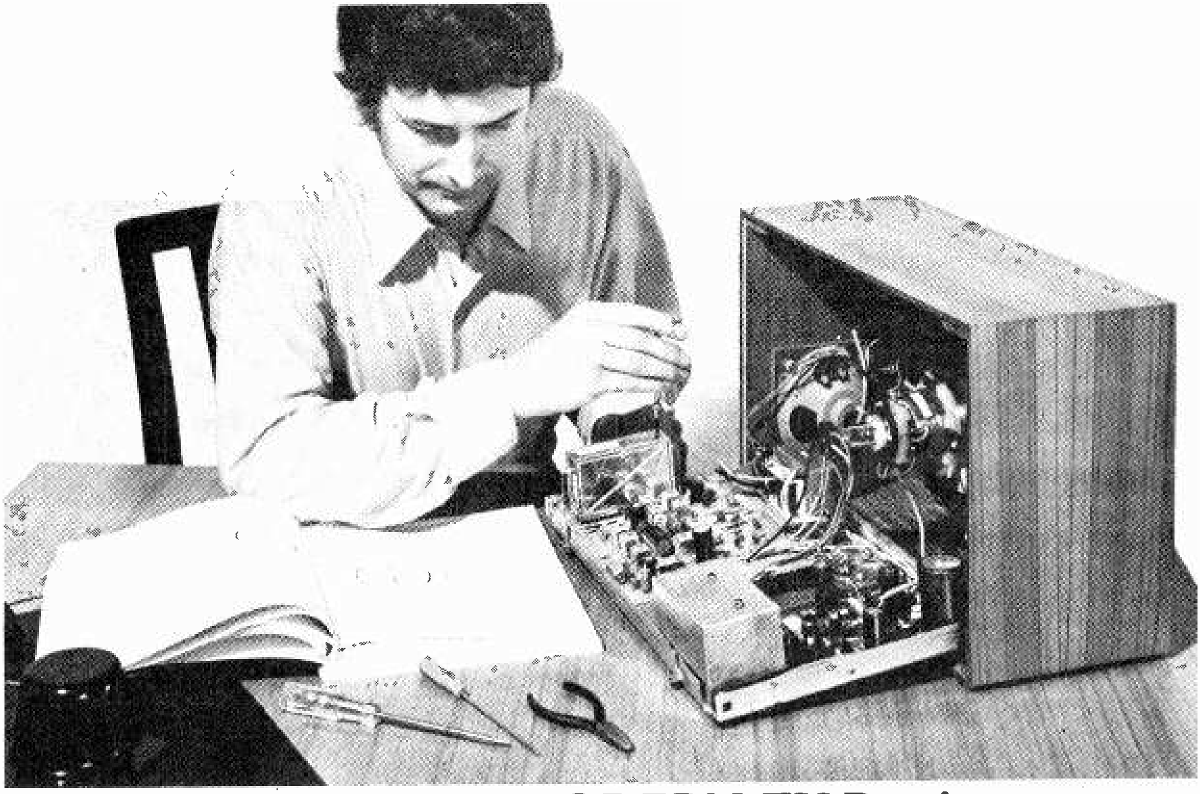
The equipment, which was all solid state, was carried to the summits of the two mountains concerned. Pundits who ask why the GW team did not use the train, may be interested to know that the train was not running due to the bad weather so it's just as well that they bargained on climbing!

80m talkback was used between the two base camps in order to co-ordinate the departure for the climb to the summit.

2m talkback was used from summit to summit.

Those involved were:—
At the GM end: G3VUQ, G3YCQ, G8AMG, G8APZ, G8AZU, G8DKK.
At the GW end: G3XSO, G3YMV, G8BPN, G8CKT, G8ENX, G8FTB, G8HCO.—**Michael H. Tooley, G8CKT,** (Weybridge, Surrey).

—continued on page 762



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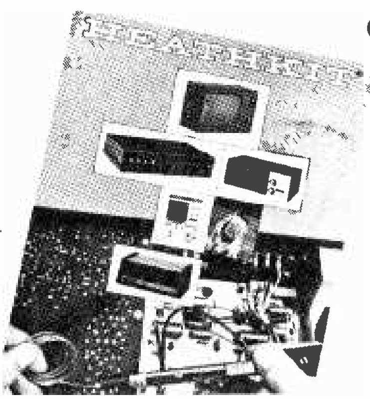

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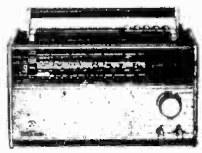

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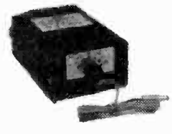

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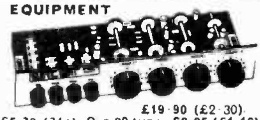

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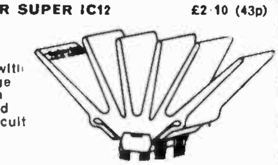

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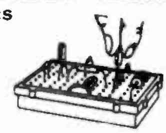

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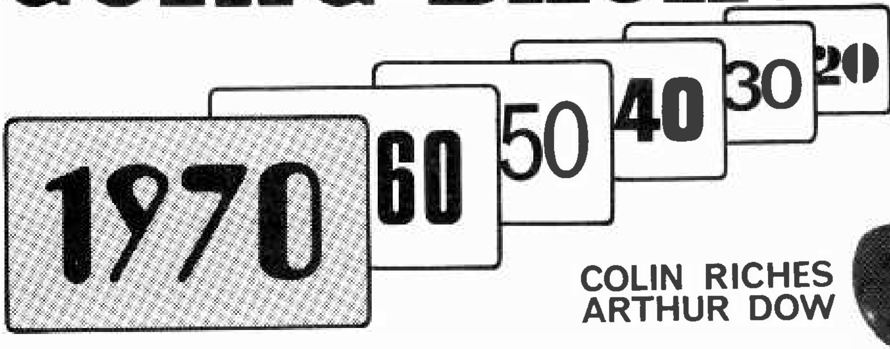


COLIN RICHES
ARTHUR DOW

Letter from America

FOR several years I have read your column religiously and at long last decided to write to you. Needless to say I have an avid interest in Vintage Radio. However, I have had to content myself with vintage parts, valves, radio books and magazines. Additionally I construct simple vintage radios out of antique parts using my own circuits or those from Hugo Gernsback publications from the early '30's. My valve collection fortunately contains many good useable valves. At present I am constructing a short wave receiver (semi-antique) using types '35 and '27 (U.S. tubes) and meant for mains operation.

I started my radio hobby in 1928 with a commercial crystal set (Vario Couple Type). I made crystal sets until 1932 when I started on valve short wave and medium wave receivers. My hobby continued through 1935 and 1936. It was interrupted in 1937 by my joining the U.S. Army. I did only occasional short wave listening thereafter until 1946 when I went back to radio construction.

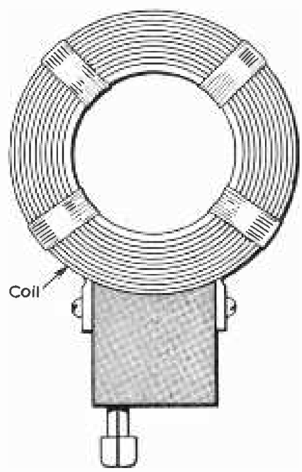
My recent vintage radio construction includes a one tube SW receiver (using a transmitting type '30). The coils (plug-in) are my originals from 1932. These are about the only parts surviving from that era. While I was in the army in pre-World War 2 days, a relative threw the rest away! I also have two surviving books.

The other receivers are a Short Wave Portable which is a good copy (including original vernier dial) from an article in a 1933 Short Wave Craft Magazine. I had been planning to build it for decades and only made it last year. Also I have a breadboard type Medium Wave receiver using a type '99. (A very good performer with one *modern* part—a ferrite rod aerial in it). I use it mostly for a quick test of old tubes. Much better than the tube tester!

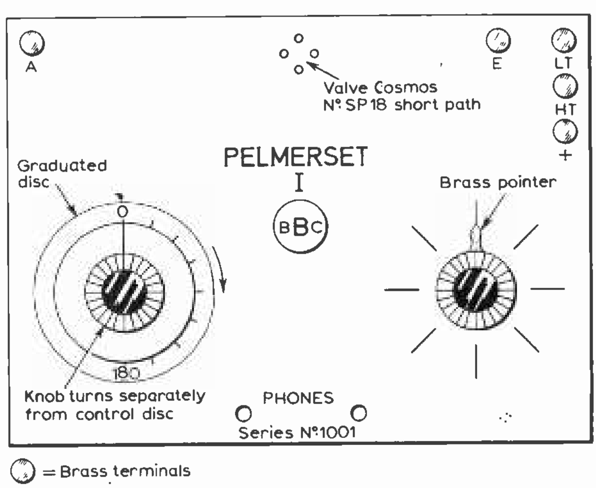
I possessed one vintage radio in recent years (an RCA Radiola) but an avid collector got it away from me. All I have at the moment is a vintage tube tester, Signal Generator and Output meter (Weston, circa 1929). The trouble is that some collectors in this country possess 100 to 300 radios leaving none for us pickers.—**Chester A. Beck, K6DFP,** *(9045 Margaret Street, Downey, California, 90241, U.S.A.)*

Mr. **W. H. Quick** tells us that he has been given an old one-valve radio which he would like to get going. He would like to know what the L.T. and H.T. voltages are. There is a 1·5A fuse fitted and we show in the diagram the front panel and a plug-in coil which fixes to the side of the set.

If anyone can help Mr. Quick, they can contact him at *15 Beechwood Grove, Horbury, Wakefield, Yorkshire.*



Mr. Quick's plug-in coil and the front panel of his vintage receiver.



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PART 3—TRIGGER CIRCUITS

LAST month we saw that there is, at least, one circuit which is sensitive to the rate of voltage change, i.e. the divider circuit would only respond correctly if we caused rapid changes in lighting level at the photo cell; slow changes would not make the divider work. There are other circuits which like to see what are known as "fast going edges" to signals; as a result, a range of circuits has been developed which will accept slow changing inputs and convert these into signals having fast rise and fall times.

These circuits are called *triggers* because their

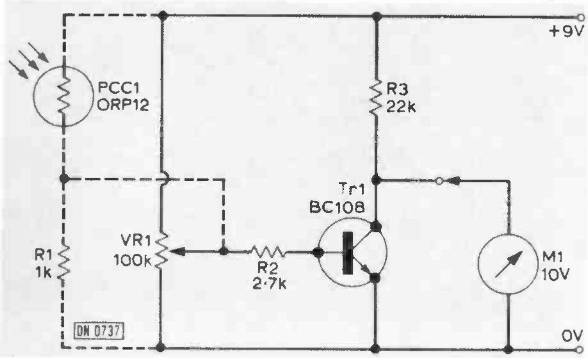

Fig. 14a If PCC1 and R1 are used as alternatives, omit VR1 and link in PCC1 on the "left-hand" end of R2.

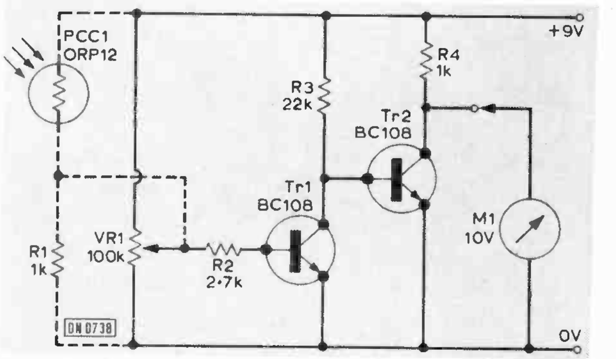

Fig. 15a The extra stage of amplification effectively improves the rise time of the output signal between the power rail extreme voltages.

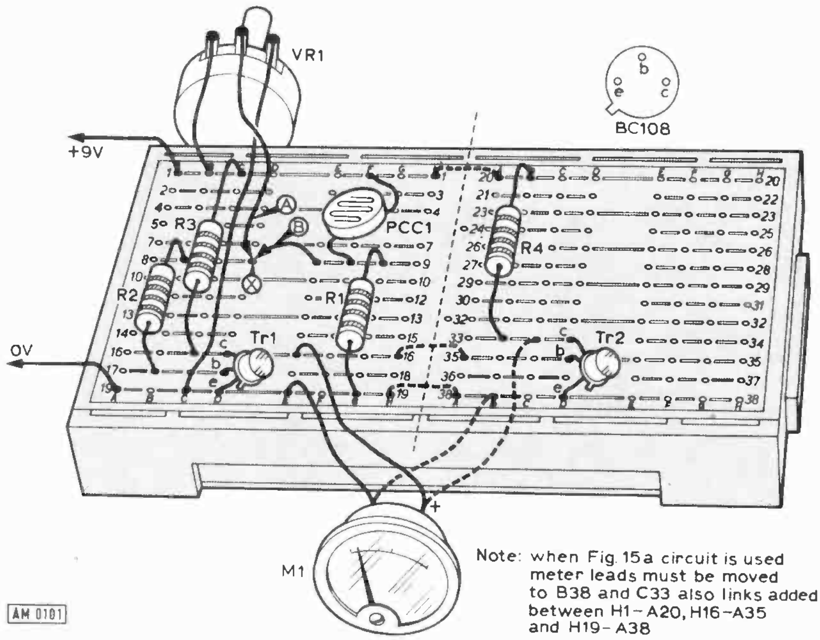

Fig. 14b: T-Dec layout for Fig. 14a.

Fig. 15b: T-Dec layout for Fig. 15a.

Note: when Fig. 15a circuit is used meter leads must be moved to B38 and C33 also links added between H1–A20, H16–A35 and H19–A38 output will always be in a certain state (say zero volts) until the input signal rises to a certain level and, irrespective of the time it takes the input to get to this level, when the critical voltage has been reached the output changes to a higher level (say +9V) instantaneously.

In practice everything takes a certain amount of time to happen, so "instantaneously" is, perhaps, too strong a term to use. Nevertheless, as you will see if you do some of the following experiments, we can make extremely slow voltage changes trigger a circuit to give edges to waveforms that change from one level to another in a few millionths of a second.

Fast and slow "edges"

First of all we had better look at what we are calling an "edge" so that we can compare the difference between fast and slow edges. Fig. 14a is a very simple transistor amplifier stage which gives an output inversely proportional to the voltage at the wiper of VR1 (or, if you are using the photocell alternative, the junction of PCC1 and R1).

Measure the voltage at the collector of Tr1 with VR1 set to the bottom of the track (Alternatively completely shade PCC1). You should read about +9V because the transistor, in the absence of base current, is not conducting. Slowly increase the voltage at the wiper of the potentiometer by rotating it (or slowly increase the amount of light falling on PCC1); base current will start to flow and the voltage at the collector will start to fall.

The thing to notice is that you can control the level of the measured voltage quite easily and get any value you like by careful adjustment of VR1 or the amount of light falling on PCC1. Try and get a "feel" for the rate at which the measured voltage changes for given rates of moving the potentiometer or illuminating the cell.

You can use the wires A or B in the layout and transfer one, or other, of them to point X—depending on whether you were using the cell or the potentiometer. Fig. 15a shows an extra stage of amplification. Carry out the same experiment but now measure the voltage at the collector of Tr2. Obviously the extra stage gives us inversion so when the potentiometer is down the measured voltage is low.

Now slowly increase VR1 until the voltage starts to rise and then try and control it in the same way as before. It should be very apparent that, for the same rate of change in position of the wiper of

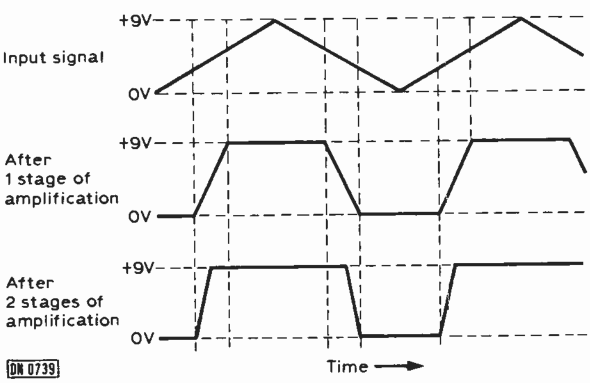

Fig. 16: Note the increased amplification appears to enhance the signal's rise time between the supply voltage limits.

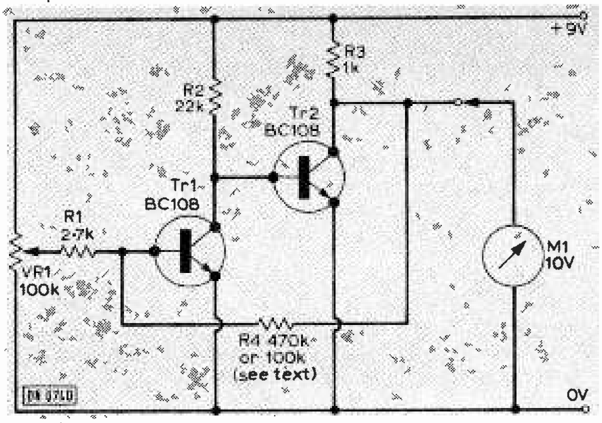

Fig. 17a. True trigger action is obtained by using positive feedback via R4.

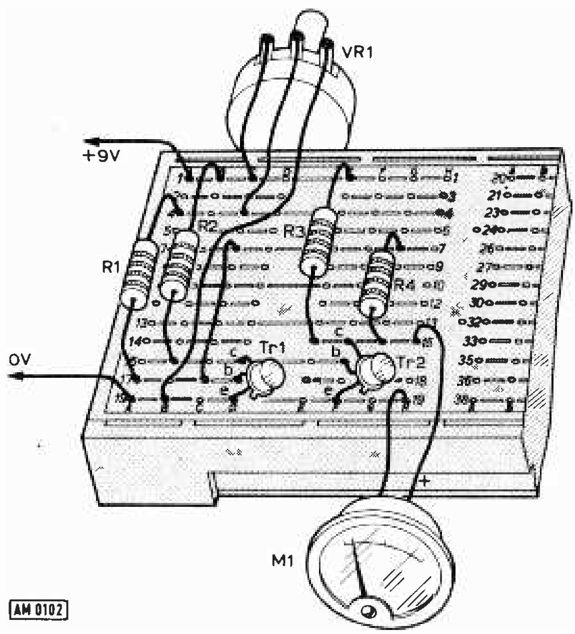

Fig. 17b: T-Dec layout for Fig. 17a.

the potentiometer, the voltage at Tr2 goes from zero to +9V very much quicker than it did before.

It is, however, still possible to set it mid-way between the two extremes by careful adjustment. The effect is even more pronounced using the photocell and you should start to appreciate the increase in the rate of change of the signal at the output.

Amplification

The signals we have been talking about can be described as waveforms as shown in Fig. 16. The portion of the signal between the low and high voltages of the output is called an edge and you can see that it has become much steeper with the extra amplification.

Simple amplification thus increases a signal's rise time but there is still the possibility of getting a mid-rail voltage during the transition—especially if the input signal was unusually slow. Ideally we

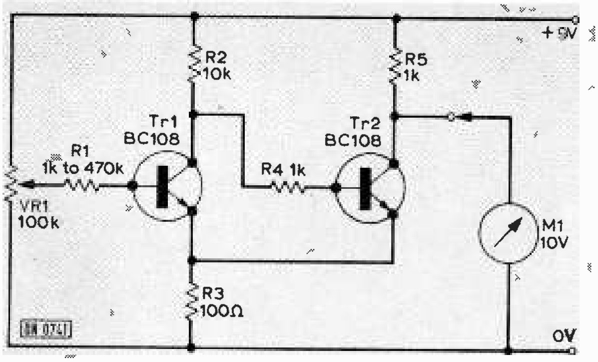

Fig. 18a: Schmitt trigger circuit. The trigger level can be controlled over small limits by changing R1 in the range 1kΩ to 470kΩ.

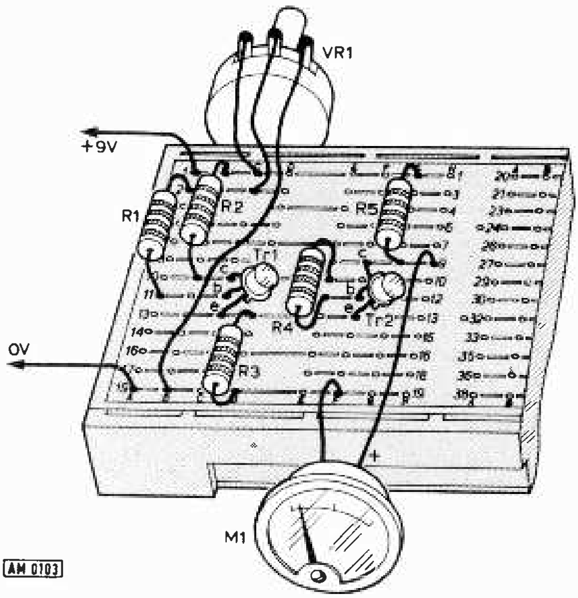

Fig. 18b: T-Dec layout for Fig. 18a.

would like to have a circuit that gives a fast change irrespective of the rate of change of input. The circuit in Fig. 15a has been modified in Fig. 17a with a resistor coupling the output back to the input. We have introduced a positive feedback loop.

If VR1 is slowly increased the voltage at Tr2 collector will, at some time start to rise; when this happens current starts to flow through R4 back into the base of Tr1 and effectively increases the base current we are already applying from the potentiometer. The effect is to make the voltage at Tr2 rise even more enhancing the effect until eventually Tr2 is totally non-conducting. All we needed to do was set the operation in motion by initiating base current into Tr1; once that was started the voltage at Tr2 collector would move from zero to +9V without any further movement of the potentiometer—the feedback loop did the rest.

The feedback cycle occurs extremely rapidly (the speed is limited only by certain internal parameters of the transistors) so the output changes level at a speed set by the circuit and no longer by the rate at which we turn the knob on VR1. Try it for yourself and you will find it impossible to set a mid rail voltage at the output.

When VR1 is at the limit of its travel, try turning it down; the same thing happens on the downward going edge of our input signal. Notice that there is a sort of "no-mans-land" between the positioning of the wiper for upward going triggering and downward triggering. This is known as "hysteresis" and is very useful in differentiating between the two levels we are considering.

Hysteresis

In this circuit, you can control the amount of hysteresis by means of the value for R4. A 470kΩ resistor will give the smallest differential between upward and downward triggering levels but by reducing it to 100kΩ you can widen the gap between the levels. This circuit is operating as a true trigger and the feature to take note of is the use of positive feedback to speed up the edge. If you think about the circuit a bit you will find it is not very different from the bistable described last month.

Schmitt trigger

Probably the best known trigger circuit is the Schmitt trigger shown in Fig. 18a. When the voltage

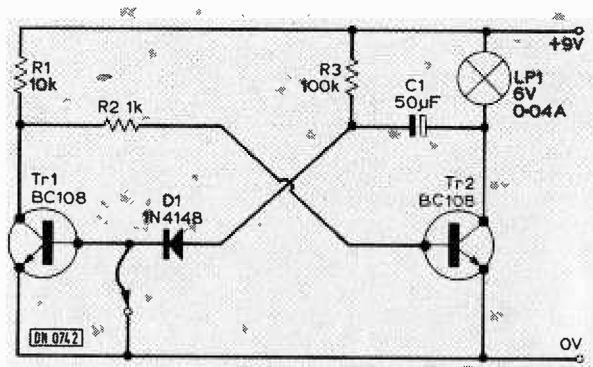

Fig. 19a: Basic monostable multivibrator. Capacitor C1 can be increased to 3,000μF to extend the dwell time.

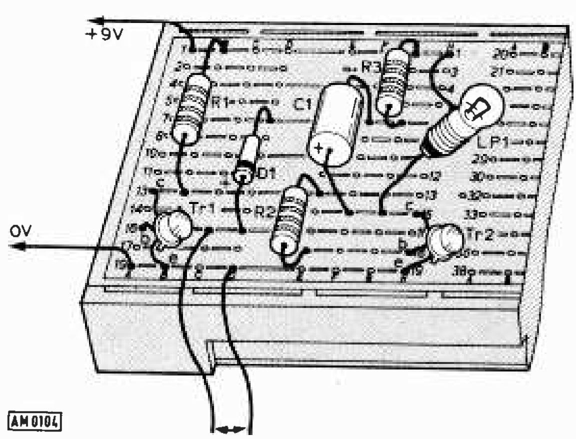

Fig. 19b: T-Dec layout for Fig. 19a.

at the wiper of VR1 has reached a certain level base current will start to flow in Tr1 and the voltage at its collector falls slightly; this reduces the base current into Tr2. The two emitters are, however, connected together and as Tr1 starts to conduct the voltage at the "top" end of R3 starts to rise.

Because this is connected to the emitter of Tr2 we reduce—even more—the potential difference between Tr1 collector and Tr2 emitter thus the base current into Tr2 becomes less. Here again we have a positive feedback loop caused by emitter coupling and the effect of this is to accelerate Tr2 going out of conduction and the output voltage drops very rapidly.

Again this occurs independently of the rate we are applying signal at the input and the speed is limited only by the transistors' parameters. Reduce the input voltage slowly and the opposite happens.

Monostable multivibrator

Another circuit which often comes into the category of trigger circuits is the "monostable multivibrator" shown in Fig. 19a. Unlike the Schmitt trigger it is a little bit more complicated to initiate triggering but it offers a useful bonus. It has a "short term memory". We can design it so that it will trigger rapidly on the receipt of a suitable signal but the output from it stays at the new level for a fixed period of time before rapidly returning to its original state.

Make up Fig. 19a on T-Dec and follow this brief description of how it works. Initially let us state that D1 serves no purpose in the circuit except to protect the emitter base junction of Tr1 from a high reverse voltage that is generated during the switching operation.

When the circuit is switched on the lamp may go on for a few moments until things have settled down. When the lamp has gone off we should arrive at a stable state of affairs in that base current is provided for Tr1 through R3—hence its collector is at near zero volts; because of this Tr2 will be cut off and the potential at its collector will be high (about +9V); consequently the lamp will be off.

If we deliberately knock Tr1 out of conduction, by rapidly short-circuiting its base to ground with the flying leads, we can momentarily establish base current in Tr2 and it conducts. The light goes on and the voltage at its collector drops to about zero. However the capacitor transmits this negative-going voltage excursion to the base of Tr1 and the potential at the junction of R3 and C1 falls to about −8V (it was previously +1·2V caused by the forward voltage drops of D1 and the base emitter junction of Tr1).

Assuming we have immediately removed our short-circuit link Tr1 will stay out of conduction because no base current can flow until the potential at the anode end of D1 has regained its level of +1·2V and this will take time because the negative end of C1 has to charge back to this value through R3. This takes quite a few seconds and during this period the lamp stays alight.

When this has been reached, Tr1 starts to go back into conduction and the potential at its collector falls giving rise to an increase in voltage at Tr2 collector; this is fed back momentarily through C1 and enhances the base current into Tr1 (positive feedback again). As a result of all this the lamp switches off very rapidly. If you have a 3,000µF capacitor you can substitute it for C1 and get a "dwell" time of about 3½ minutes. The dwell time can be calculated as 0·7×C1×R3 (C in Farads R in ohms and the time will be in seconds).

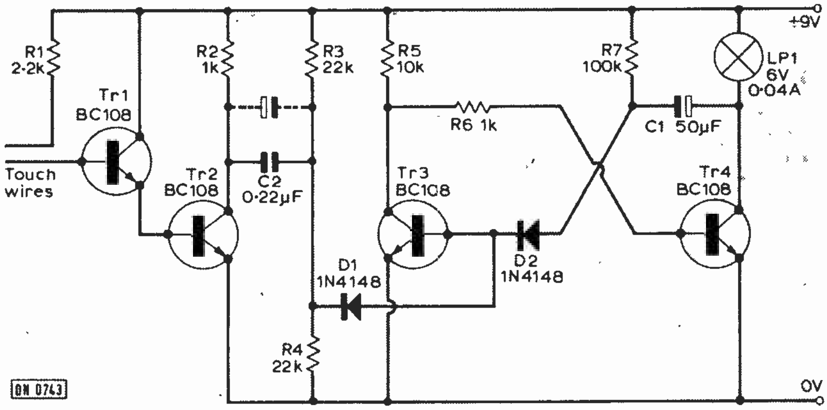

Fig. 20a: Touch-sensitive child's room-light. Supply current is approximately 1mA rising to about 80mA when the lamp is on. Duration of 3½ minutes can be obtained by making C1 3,000µF and C2 50µF. The capacitor shown dotted, across C2, indicates how it is connected—plus to R2.

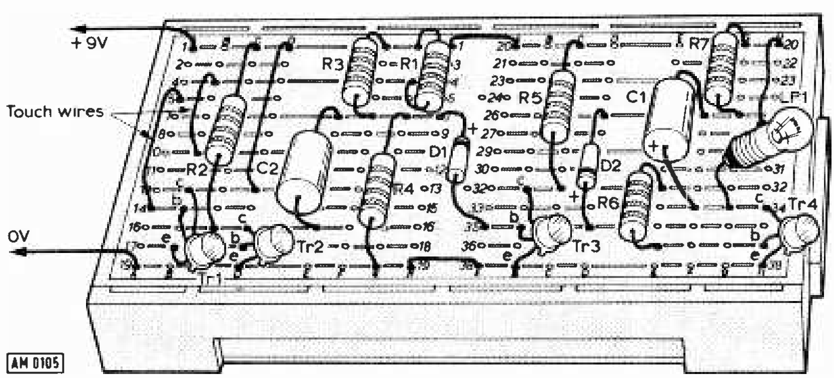

Fig. 20b: T-Dec layout for Fig. 20a.

Touch switch

The monostable thus gives us trigger action and a timing function which can be put to many uses. A novel circuit for a safe child's bedside light is shown in Fig. 20a. It is a touch sensitive switch coupled to a monostable that switches on a lamp for a pre-determined period of time (Warning: the novelty is more likely to keep a child awake than get him off to sleep!).

continued on page 756

HOTLINES ON RECENT DEVELOPMENTS

THE YEN

HAVE you ever had a yen to do something?—the Japanese have. My ageing eyeballs have recently scanned a report which comes from the Orient from an "impeccable source". In February of this year, the Electronic Industries Association of Japan found that the total sales of electronic parts and components from Japan amounted to 101,079 million yen—which is a lot of yen for just one month's effort. It is interesting to see how this figure breaks down. For example, electron tubes (that's valves in English or Toobs in American) in February amounted to 17,841 million yen and showed an increase in February 1972 of over 10%. Integrated circuits accounted for 8,483 yen and showed an increase over the same month last year of a staggering 92%. On these figures, the Western comics who chant "Ha so?" might easily find the answer to be "Velly well thank you".

Other news from Japan is equally interesting. One snippit from spies is that Sony are to withdraw from the electronic calculator market altogether. Another is that Government approval (Japanese) has been given for the joint enterprise between Alps Electric and Motorola for the manufacture and sale of ICs. This American / Japanese Company is aiming to sell 3,000 million yen's worth of ICs in 1974.

KEEPING A WATCH!

Still in yen land, the Japanese watch industry is claiming that some 200,000 watches using piezo-electric crystals, will be produced there this year. Production lines are eagerly being set up to manufacture C-MOS ICs and there is a hive of activity in the liquid crystal readout sector. If all this activity goes through, then clearly now is the time to watch Japan.

MINI FREQ. COUNTER

What other interesting things are happening in Japan? Well, quite apart from the considerable amount of electronics business that's taking place (would you believe that this country sold 83,349 million yen's worth of communications equipment in 1972?) there is always the neatness, the preciseness of some of the products. Perhaps an excellent example is in the field of frequency counters—feed a signal in and the frequency is flashed up on a digital readout. Well, one Company (and I'm talking about a production item, not a prototype laboratory wonder) is marketing a miniature but professional standard frequency counter. It gives a digital readout of frequency from 15Hz to 50MHz although there is an optional pre-scaler which extends this to 220MHz at the upper limit. It's completely portable and uses internal rechargeable cells. The internal oscillator is accurate for the majority of applications having a stability of $\pm$ 0·0005 at 25°C. The size is particularly impressive—120 x 175 x 25 millimetres. Just grab yourself a ruler or do a quick mental conversion and you'll see that this slips into your pocket (there's 25·4 millimetres to the inch!).

LASER TELEVISION

One could hardly look at the Japanese electronics scene without taking in the television industry. Latest thing in this sector to catch my eye is a large screen laser colour television projector. This beasty is a considerable improvement over its younger sister which made a debut at the World Exposition in Osaka in 1970. The earlier model had a resolution of 525 lines. The latest version has a resolution of 1,125 scanning lines. A krypton ion laser is used to generate the red, while an argon ion laser emits the green and blue spectrums. Perhaps we're not at the home use stage yet, but maybe the time will come when an entire wall will light up with a full colour, 3D life-size TV screen—so real you'll be able to step through your kitchen wall and join in a quick romp with Noddy or a punch-up with Ena Sharples; the mind boggles.

In serious terms, the new laser colour television projector has some very real advantages. The image is very clear and sharp. It is also very bright and there is very little divergence, too. One feature which my Japanese contact did not highlight but which is of interest is that the polygonal mirror used for horizontal scanning rotates in magnetic bearings. These have certain advantages over conventional bearings, notably reductions in noise and vibration.

CHINESE PUZZLE?

How many characters or words do you think there are on this page? How about a page in a Chinese newspaper then? No, I haven't nipped across on the Kowloon ferry, I'm still in Japan where a leading electronics manufacturer has just launched a very high-speed printer which prints out the Chinese language. It will produce some 600 lines of Chinese in 60 seconds which, as I'm sure you know, works out at 12,000 Chinese characters every minute. A computer is used to hold information prior to printout but manual over-ride can be used. The printout can be in either lateral or vertical rows so it doesn't matter which way you want to read it—the machine can oblige. Damn clever, those Chinese, or should that be Japanese? I'll have to get myself properly orientated.

EARTH STATIONS

In the early days, the Japanese electronics industry suffered (rightly or wrongly) from a "cheap goods" brand. It is now no longer possible to regard all its products as in this category. An earth terminal is no small thing, neither is there any room for sub-standard effort. In this field, one Japanese Company alone has built, supplied and/or installed very nearly 50 (fifty) earth stations.

GET ORGANISED!

A little gem from England to finish with. In a church at the Royal Naval Air Station Yeovilton, Somerset, an electronic organ began to play itself—a radar beam was being picked up by some of the internal components. About time the Navy got itself organised!

Ginsberg

ARE YOU 'SWITCHED-ON'? make this ULTRASONIC REMOTE CONTROLLER

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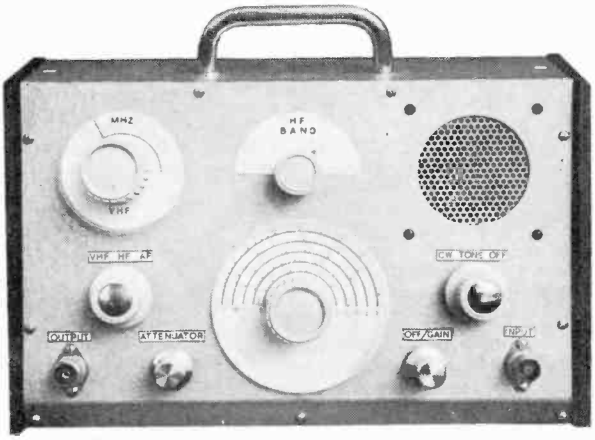
Our Trouble-Tracer will provide you with a test signal ranging from audio to VHF. Test probes pick up signals from the equipment under test and feed them into an amplifier and speaker. All in the one cabinet—What else could you want?



Curing Radio Interference in Audio Equipment

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JANUARY ISSUE ON SALE 7th DECEMBER

PORTABLE FLUORESCENT LAMP UI

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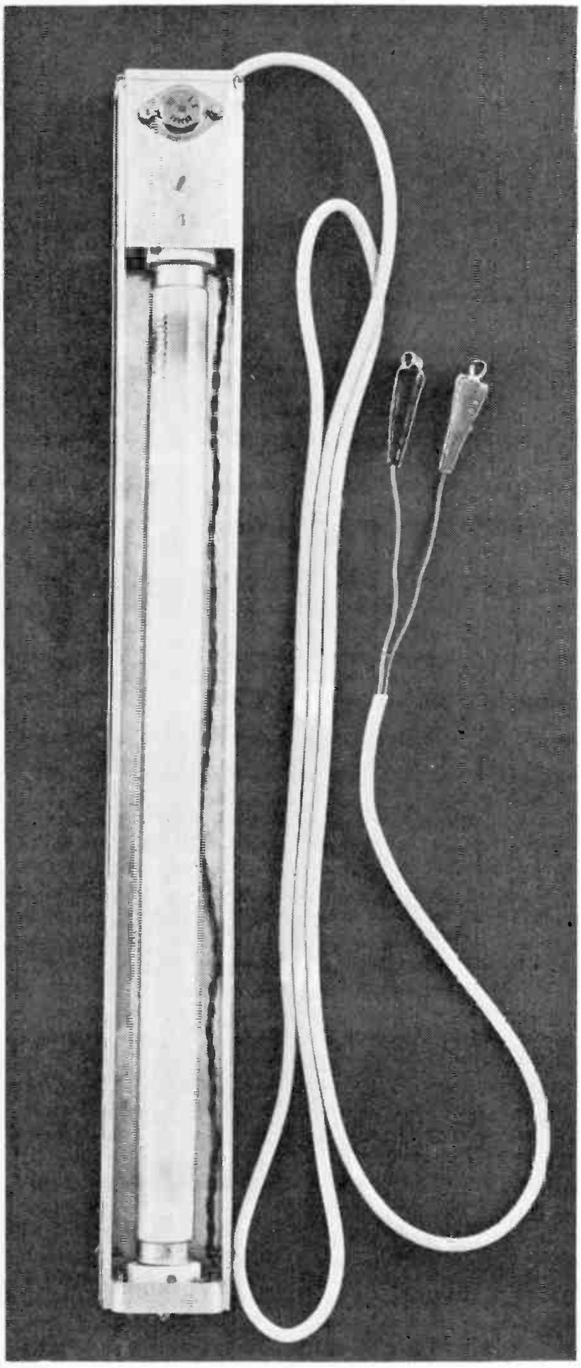

FOR: EMERGENCY LIGHTING, CAR

THE battery operated 15W fluorescent lamp unit described here is of simple construction, being designed around readily available components. The whole assembly is made up in aluminium, consisting of a framework which supports the tube and houses the oscillator module. A cover plate acts as reflector and dust cover.

CIRCUIT DESIGN

Fig. 1 shows the circuit. A 2N3055 silicon power transistor operates as a transformer coupled class 'C' oscillator. The fluorescent tube is supplied from a third winding on the transformer. Satisfactory operation is obtained from 10 to 15V.

A variable resistor provided in the base circuit of the transistor ensures correct operation with devices having any gain within normal spreads. The

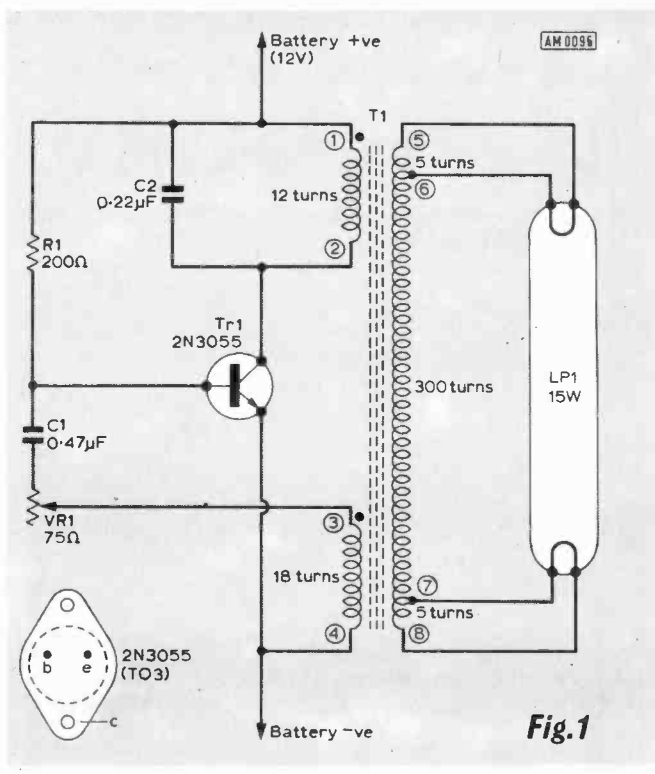

Fig.1

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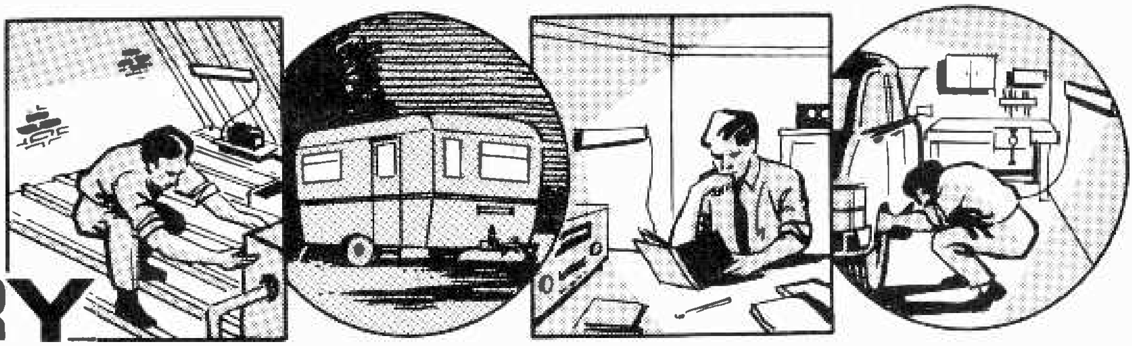


VANS & CARS, LOFTS, SHEDS, GARAGES, MOBILE RALLIES, ETC...

transformer is designed around Mullard FX2242 pot cores. The collector winding is tuned by a $0{\cdot}22\mu$F capacitor. Bias for the transistor is provided by a 200Ω resistor from the positive supply rail.

The operating frequency is determined by the $0{\cdot}47\mu$F base timing capacitor C1, the variable resistor, the tuning capacitor and the load conditions. Since the load (the fluorescent tube) is a high resistance until alight, the circuit has a "soft" start, the oscillations starting at low frequency and amplitude and building rapidly over a few seconds until settling down at steady amplitude and high frequency once the tube 'strikes'.

CONSTRUCTION

The tube and oscillator housing is made up from aluminium strip and sheet as shown in Fig. 2. This construction method allows assembly with the tools normally available in a small workshop. The cover plate is the most complicated piece, but being fabricated from 1/32in. sheet this makes the work quite easy. Cutting is accomplished with a Stanley knife using a laminate cutting blade (Stanley No. 5194). The cut edges should be filed smooth. The original cover plate made by the author was bent up in a normal small metalwork vice, extra long 'jaws' being made up from 2 x 1in. hardwood.

The oscillator housing is bent up from 1/16in. sheet as is the tube mounting bracket. The power transistor is mounted on the oscillator housing so that the base and emitter pins are inside the casing, directly above the circuit board. One bi-pin tube connector is also firmly mounted to a bracket bent up from this housing. Two side struts are bolted on to this oscillator housing. The smaller 'U' bracket supports them at the far end and also holds the

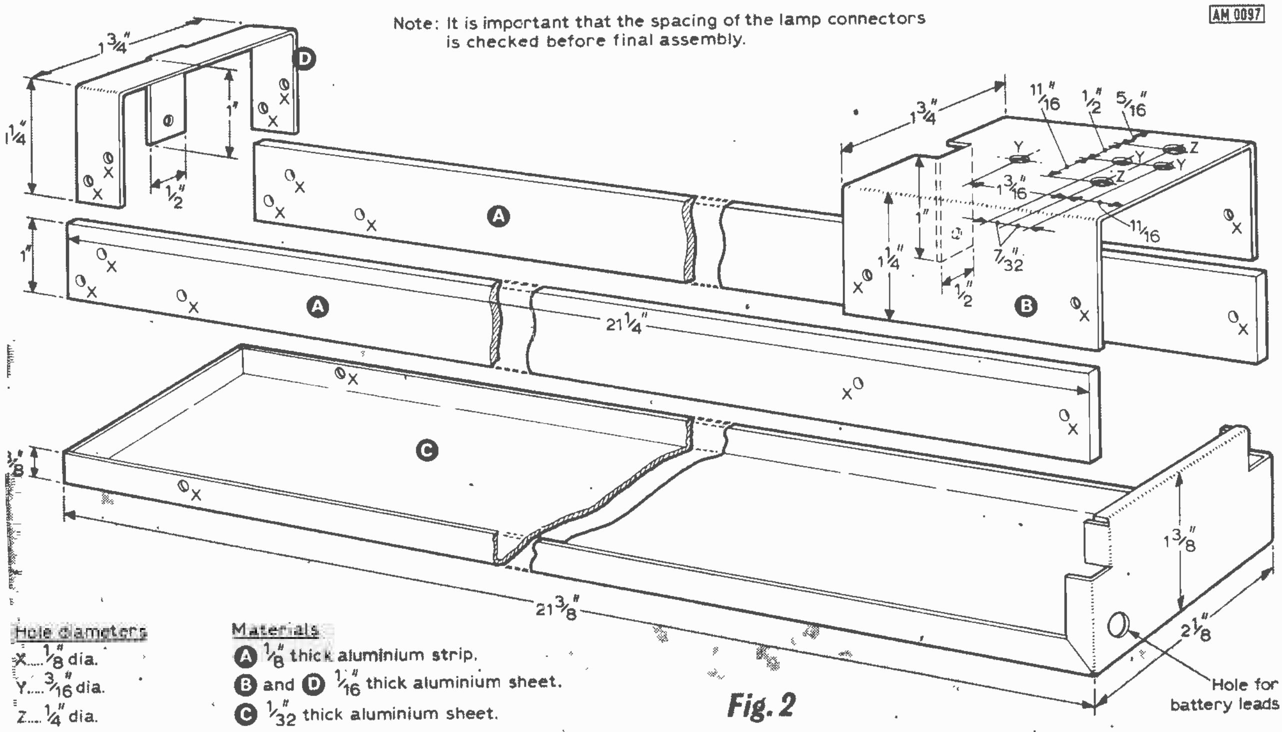


Fig. 2

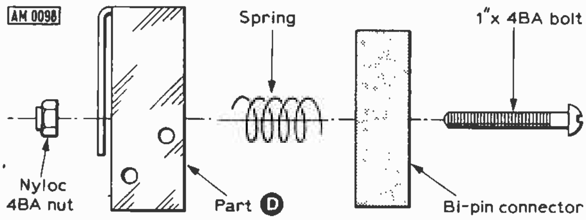


Fig. 3: Details of the spring-loaded tube connector.

other bi-pin tube connector. This connector is mounted on a 1in. 4BA bolt and spring, Fig. 3, to facilitate easy fitting of the fluorescent tube by pulling back the connector and then pushing it over the tube pins.

OSCILLATOR PCB

Fig. 4 shows full size layouts for both the component and the copper side of the circuit board. The board can be made by laying the drawing over a piece of copper clad board ready cut to size, and drilling through all the holes. It is essential that the drawing does not move during this operation. The layout can then be copied on to the board using a fine brush or mapping pen and cellulose paint. The board can then be etched off in ferric chloride (strong) solution. (A 500ml bottle is adequate and may be obtained from most chemists to order.) After etching the board should be washed thoroughly in warm water. The paint can be removed with thinners or rubbed off with scouring powder. The components can them be mounted in place and soldered. Flying leads are required for the three transistor connections. Veroboard terminal pins are used for the four connections to the fluorescent tube.

VARIABLE RESISTOR

The variable resistor VR1 used here is primarily intended for use as a convergence control in Colour TV receivers. If difficulty is experienced in obtaining this control, it should be ordered from a TV dealer as a spare part (e.g. Decca CTV25 Part No. 535167). This control is mounted near the edge of the board so that adjustment may be made by turning the knob edge with a forefinger from the end of the lamp unit.

THE TRANSFORMER

The transformer is wound on a Mullard DT2180 bobbin. Enamelled copper wire is used throughout and all windings are wound in the same direction.

The collector winding is put on first and consists of 12 turns of 28SWG wire, the start labelled (1) and the finish (2). The turns should be wound close together. The base winding is wound directly on top of the collector winding and consists of 18 turns of 28SWG wire, also closely wound. Label the start (3) and the finish (4). Next a single turn of insulating tape is put round the bobbin to isolate the low voltage windings from the tube supply winding.

Finally the high voltage winding is put on consisting of 310 turns of 32SWG wire with taps brought out after 5 and 305 turns. This winding is layer wound, with a turn of insulation put right round the finished bobbin. The start, tap 1, tap 2 and finish should be labelled (5) (6) (7) and (8) respectively. The two ferrite cores can then be placed around the bobbin and the transformer loosely bolted on to the circuit board.

The leadouts can now be cut to length, scraped clean at the ends and soldered to their respective points on the circuit board. Once this has been

★ components list

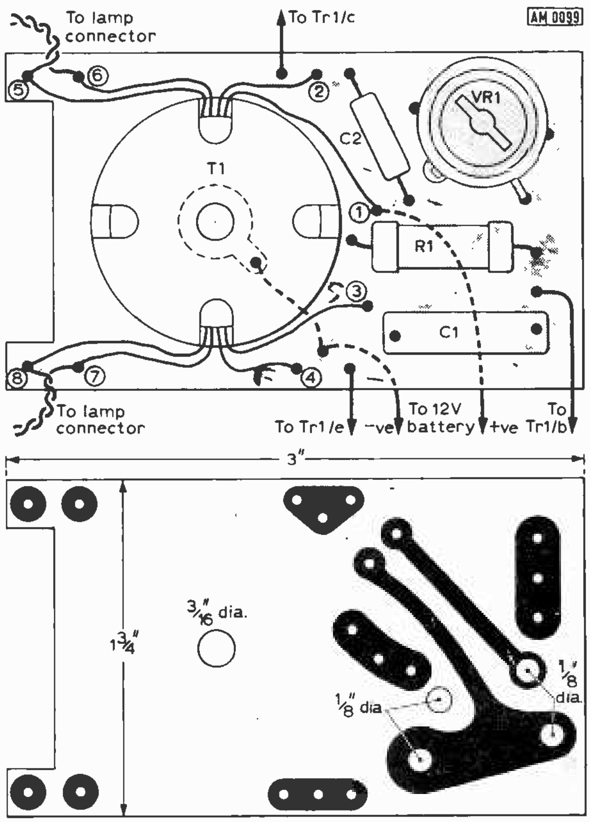
C1	0·47µF 250V polyester	
C2	0·22µF 250V polyester	
R1	200Ω 5W wire-wound	
VR17	5Ω pot. wire-wound (see text)	
Tr1	2N3055 with insulating kit	
LP1	15W fluorescent tube	

Miscellaneous

Pot core (2 x half cores) Mullard FX2242 and bobbin DT2180 (available complete from Hawnt Electronics Ltd., 112 Pritchett St., Birmingham, B6 4EN for £1·20 inc.).

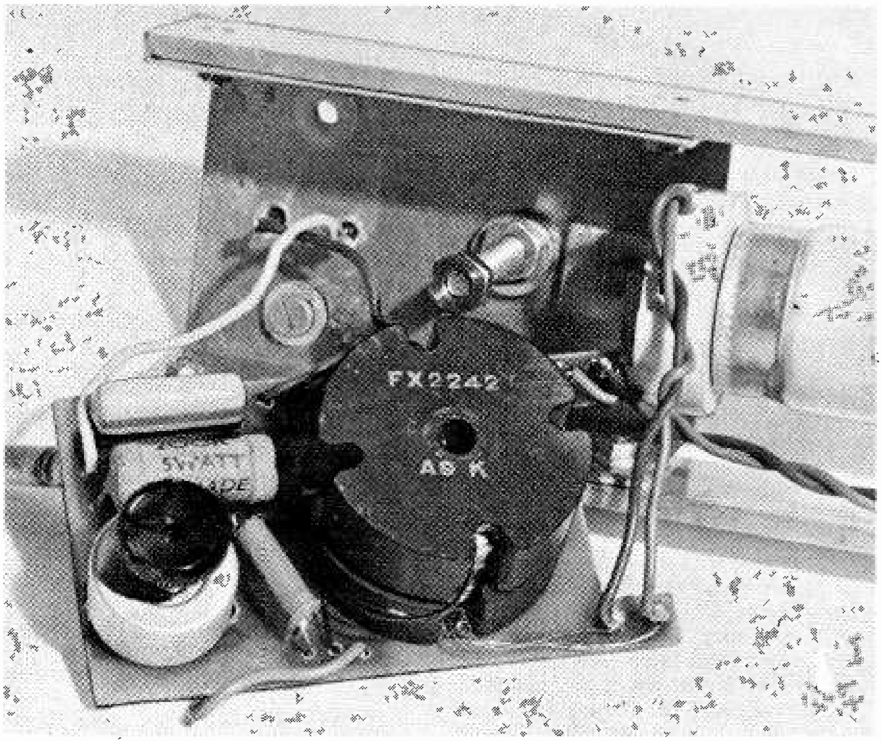
Bi-pin tube connectors (2). 28 and 32SWG enamelled copper wire. PCB, 3 x 1¾in. Length of twin 5A wire, as required, with two large crocodile clips.

Aluminium: 4ft of 1 x ⅛in. strip (Part A), 6 x 5in. of 1/16in. sheet (Part B), 24 x 3in. of 1/32in. sheet (Part C).



All holes drill No.55 unless otherwise stated.

Fig. 4: Full size layout of printed circuit board and component location on board.



A view of the oscillator assembly at one end of the lamp unit.

done, the fixing bolt may be removed and the top ferrite core taken off. A small piece of Sellotape should be stuck on to the centre pole-piece of the core. This provides a small gap which ensures that the core cannot be saturated by the primary magnetic flux. The upper core is then replaced and held into place with a further piece of Sellotape around the join (the cores are finally held together by the module mounting bolt).

An 'exploded' view of the transformer is shown in Fig. 5 which also shows the method of mounting the module.

TESTING

The power transistor should be mounted on the module housing with a mica washer and two nylon bushes, usually supplied with the transistor. A smear of silicone grease should be applied to each side of the mica washer to ensure good thermal contact. The flying leads should be connected to the transistor, ensuring that the base and emitter leads are not reversed. The supply lead should also be connected to the copper side of the circuit board. Do not fit the tube or module into the framework yet.

Connect the power leads to a 12V supply, ensuring correct polarity. The oscillator should 'whistle' loudly, since without a load the operating frequency is lower. If the circuit does not oscillate it is probable that the phasing between the collector and base windings is incorrect. Reversing either winding should ensure correct operation.

ASSEMBLY

Once it is established that the oscillator is functioning correctly, the fluorescent tube connectors may be wired up and the module bolted into the framework. Care must be taken not to overtighten the mounting bolt as the ferrite cores are very brittle and easily fractured. The nut can be sealed with a drop of paint or varnish. The tube can now be fitted into place and final adjustments made.

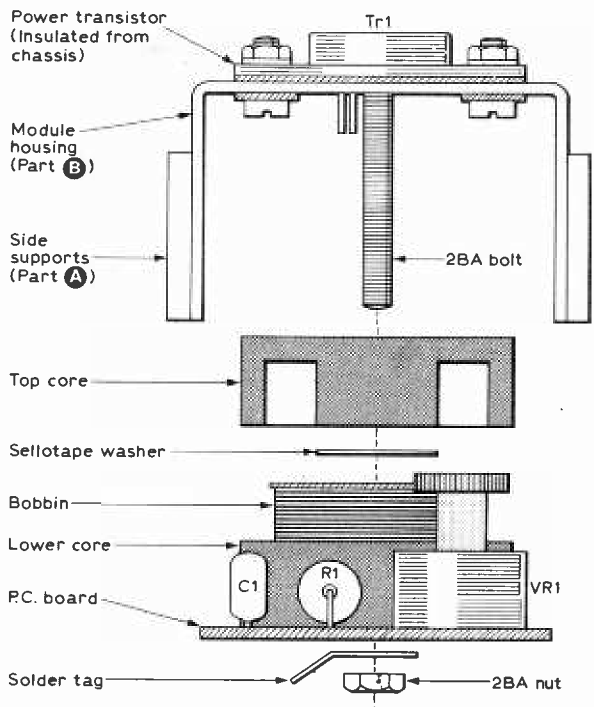


Fig. 5: An exploded diagram of the oscillator transformer and mounting.

Reconnect the 12V supply, ensuring correct polarity. The oscillator should start up at a medium frequency, increasing rapidly in pitch until the tube strikes and lights. The oscillator should then be inaudible. Adjust VR1 for maximum brightness. At one end of its travel the light will be dim and at the other extreme excessive base drive will cause squegging with consequent flickering of the lamp. Once the oscillator is correctly set operation should be satisfactory over the range 10 to 15V. The current consumption should be between 1·3 and 1·5A at 12V input.

The cover plate should now be clipped on at the oscillator end and pressed home. Two self tapping screws hold the cover in place.

NOTE 1 Connecting the lamp to the battery with reverse polarity will not cause any damage since the transistor is reverse biased and cut-off, resulting in practically zero current flow.

NOTE 2 The metal framework has been left completely isolated. Slight radio interference may be caused in the immediate vicinity of the lamp unit. To reduce this interference to a negligible level (field localised to within 4ft.) the frame should be connected to either the positive or the negative supply line. Connect a short lead from either to the soldering tag on the module mounting bolt. ■

EXPERIMENTAL WORKSHOP—Part 3—
Trigger Circuits—*continued from page 749*

If the gap between the touch wires is bridged with the fingers a minute current flows into the base of emitter follower Tr1. This produces a considerably larger current into Tr2 and its collector falls to zero. The junction of R3 and R4 is momentarily pulled down by C2 from about +4·5V to −4·5V. This negative going signal is coupled to the base of Tr3 of the monostable through D1 and this switches off Tr3 starting the monostable cycle.

The lamp goes on for the period set by C1 and R7. Capacitively coupling the touch-sensitive switch with C2 allows the user to keep his finger on the touch wires without interfering with the monostable action.

The values shown in the circuit only give a dwell time of a few seconds—for experimental purposes—but a reasonable period of time of 3½ minutes can be arrived at by increasing C1 to 3,000μF, and C2 must be increased to about 50μF.

Next month we shall look at a development of the monostable; the astable multivibrator.

COMING SOON
Q4 MATRIX MATE

Multimeter Competition RESULT

In our June "Multimeter" Competition readers were invited to place eight features of the new Sinclair Radionics multimeter DM1 in order of appeal to the average P.W. reader.

Having considered all entries, the judges decided that the best received were a large number of identical attempts which had placed features in the following order:

1st-E; 2nd-D; 3rd-L; 4th-J; 5th-K; 6th-B; 7th-A; 8th-C.

In accordance with the rules, these tying competitors then participated in a postal eliminating contest from which the eventual winners were judged to be Mr. J. Bertram, of Fenham, Newcastle-upon-Tyne; Mr. R. Harris, Knowle, Bristol; Mr. J. R. Mann, Knaresborough, and Mr. G. Rider, Hythe, Southampton.

These four readers each win a Sinclair digital multimeter and 12 months' free copies of Practical Wireless.

The tying competitors who entered the final postal eliminating contest, and were subsequently unsuccessful, each receive a consolation prize and 12 months' free copies of Practical Wireless.

SPRING INTO ACTION

The next series of special issues of P.W. will be in the Spring 1974.

In the coming months we shall be giving advance information on our new

EXCLUSIVE P.W. PROJECTS

COMING IN THE SPRING ISSUES.

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Successful Soldering

V. CAPEL

WITHOUT a doubt one of the most important tools for either professional engineer or amateur hobbyist is the soldering iron. Nearly every component has to be soldered, so whether constructional work or repairs are being carried out, the iron has to be called into use. There are a considerable number of soldering instruments of all sorts and sizes available, so in this article we will take a look at some of them to see which are most suitable for particular applications, and their respective advantages and disadvantages.

BASIC REQUIREMENTS

We will start off with what could be called the basic workshop instrument. This is an iron with the element operating at mains voltage and a wattage of between 25 and 40 watts. The size allows for most printed-circuit and general component soldering, but the bit may be rather large for some of the finer printed boards. For this reason, most irons have a variety of interchangeable bits so that a thinner one can be fitted for fine work.

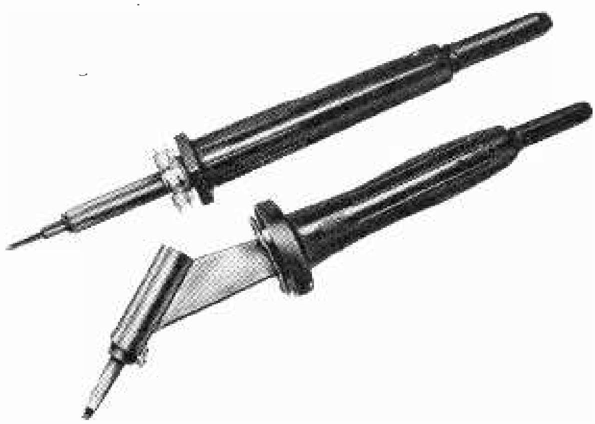
In practice though, bits are not often changed according to the requirements of the job. For one thing they have a habit of getting seized-up and difficult to remove. They should really be loosened from time to time to facilitate changing, but in practice this precaution is usually neglected. Also, most workshop irons are kept on continually in order to be instantly available, so to change the bit for a particular job would mean allowing the iron to cool down and waiting for it to warm up again after the change, plus of course a repeat performance for the re-fitting of the normal bit. Going to the other extreme, irons of this type and wattage have a limited heat output and so cannot tackle large jobs.

The difference between temperature and heat-volume must be noted here. All soldering irons attain a temperature which exceeds the melting point of solder (168°C for the high-quality 60/40 grade) otherwise they would be useless for their purpose, but some deliver a greater quantity or volume of heat than others. This is determined largely by the wattage of the instrument. Hence, a soldered joint to a punched-out chassis tag may be impossible with some smaller irons because the chassis conducts the heat away faster than the element can produce it, and so the bit cools rapidly to below the required temperature. Any large area of metal will have the same effect.

Another factor is the size of the bit. The bit effectively stores heat and so acts as a reservoir. Heat flows out of the bit when the iron is used and more heat is supplied by the element. However, the outflow can be greater than the input for a short period until the stored heat is exhausted. Thus larger areas can often be soldered than would be feasible with a particular element-wattage, if the iron is fitted with a large bit. When the iron has been thus used, it will take longer for the bit to return to correct operating temperature than would a smaller bit because it has what is termed, a slow heat recovery time.

IDLING TEMPERATURE

A further consideration is the heat loss when the iron is switched on but is not in use, as is the case in most workshops for the greater part of the time. While the iron may get hotter than needed because there is no heat conduction by application to a work area, it must not get so hot as to damage the element or cause premature deterioration of the bit. Hence the physical size of the iron barrel and bit must not be too small for the element size so that heat losses by convection and radiation are insufficient to keep the temperature to a safe limit. It follows then, that physical size is closely related to element rating and should not be too small or too large.



Stiron 20W and 60W irons, made in Sweden and featuring iron-coated bits.

In order to keep the temperature of an iron down when it is not being used for long periods, it is the practice in some workshops to operate a half-heat arrangement, whereby a lamp is switched in series with the iron. The temperature will gradually rise to not far short of the correct operating level, then when the iron is needed, the lamp is switched out and the temperature comes up within a few seconds. Another method is to stand the iron on a large chunk of metal which keeps it from overheating by conduction. An old speaker magnet is sometimes used for the purpose, as this also attracts the iron and keeps it in place.

A complete kit!

The kit comes to you packaged in a heavy-duty polystyrene container. It contains all you need to assemble your Sinclair Cambridge. Assembly time is about 3 hours.

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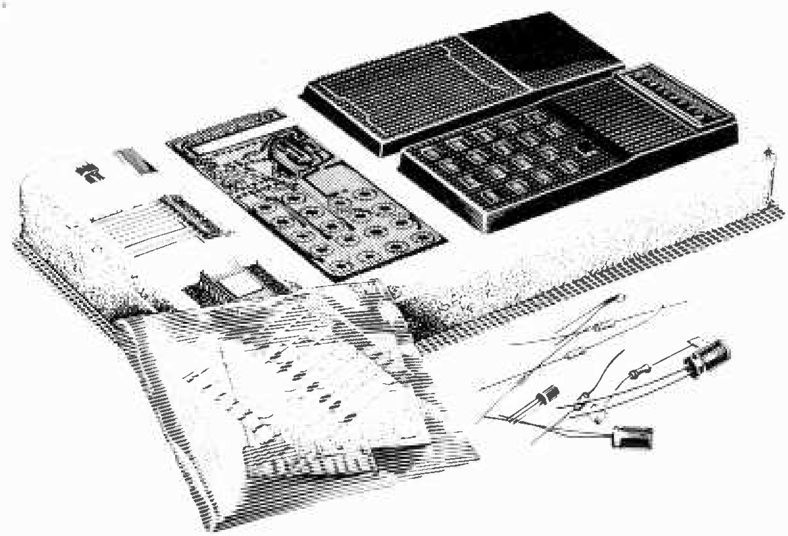
4. Thick-film resistor pack
5. Case mouldings with buttons, window and light-up display in position
6. Printed circuit board
7. Keyboard panel
8. Electronic components pack (diodes, resistors, capacitors, transistor)
9. Battery clips and on/off switch
10. Soft wallet



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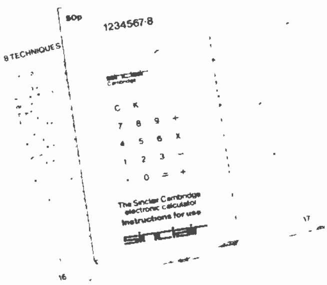
But if you want to get even more out of it, you can go one step further and learn how to unlock the full potential of this piece of electronic technology.



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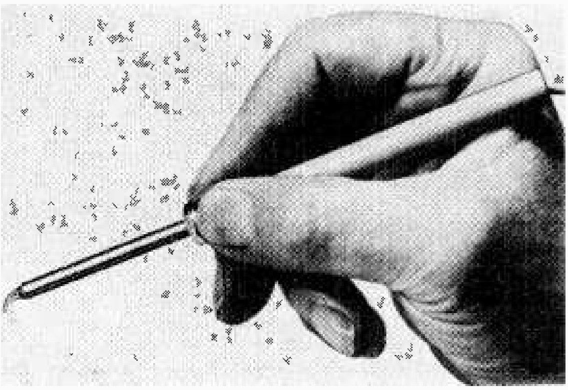
PLEASE PRINT

Because of the limitations of the 25 to 40 watt iron, most workshops have at least one or two other types and sizes of iron available. For larger jobs, an iron with a rating of 60 to 100 watts is required. These irons are similar to their smaller counterparts in general construction and appearance except for the size and element rating. The bit may be square instead of the usual pencil-type. As only occasional use would be expected, the iron would not normally be left on for long periods, so there would be no overheating problems.



Work on integrated circuits requires a very small iron such as the Micro Soldering Pencil, shown here.

For the smaller and more intricate jobs, there are irons that are little bigger than pencils with element ratings of 10 to 15 watts. These are ideal for some of the tiny printed circuits that are now encountered and for the wiring of I.C.'s where the connections are close and damage could be caused by excessive heat. Heat output is obviously limited and many larger jobs could not be tackled. The element wire for these mains-operated low-wattage irons is necessarily very fine and so they are less reliable than the higher-rated ones. They should not be run continuously but only when a particular job calls for their use. Because of their small bit size, they are usually quite fast in warming up. This and their size also makes them suitable for outside service work.

LOW VOLTAGE IRONS

Another type which has achieved a measure of popularity is the low-voltage iron. While these can be run from a low-voltage source such as a car battery, the more common method is to operate them from a mains transformer. The main feature is a very quick heating time, just a matter of seconds, and a rapid heat-recovery time. This means that the iron can be used for outside service work where delays waiting for a conventional iron to warm up are thus eliminated.

One type of low-voltage iron is constructed very similarly to the normal iron and fed from a separate transformer, which also serves as an iron-rest. Other types have the transformer built-in, either over the top of a pistol-grip handle, or in one make, actually inside the handle. With these the element is also the bit, consisting of a loop of wire connected across the transformer secondary, Fig. 1.

In either of these low-voltage types, the bit can very quickly become overheated, even when being used on large areas, so a switch is incorporated in the iron so that the operator can keep switching it on and off and thereby maintain the tool at about the

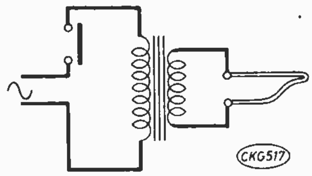


Fig. 1: Circuit of a transformer iron with element/bit consisting of a wire loop.

right temperature. In one make that uses a separate transformer, a thumb ring is used as a switch on the handle; while most of the built-in types, being pistol-like in construction, use a trigger switch.

This need for constant switching can be a drawback, especially if the switches are stiff as some are, and need considerable finger pressure. The danger of overheating due to switching on for too long can also be a hazard for transistors and other semiconductor devices.

A yet further drawback of the built-in transformer type is their weight. This is of little consequence for occasional use, but when used continuously, as in the professional workshop, they can be very tiring. The wire-loop bits are not very durable and need frequent replacement; while owing to their flexibility they cannot be used to unpick joints as can the conventional bit.

A pistol-grip soldering gun with integral transformer. The Welwyn KL3000.

The separate transformer type of low-voltage iron is therefore the more convenient, but for outside work the built-in type is probably the best. Neither though, really is as suitable as the mains-voltage type for workshop use.

CONTROLLED TEMPERATURE

Of recent years we have seen several thermostatically controlled irons which overcome some of the snags inherent with the uncontrolled types, whether high or low voltage. One, rather ingeniously, uses the Curie effect of iron. Iron, when it is heated beyond a certain point loses its magnetic properties. A small iron disc is fixed to the base of the soldering-iron bit and this has an attraction for a bar magnet which holds a switch in the 'on' position by means of a push-rod, Fig. 2. When the iron temperature reaches the Curie point of the disc, it loses its attraction, the magnet is released and the switch is opened. As the temperature drops to below the Curie point, attraction is re-established and the switch returns to the 'on' position.

Each bit has its own iron disc, which can be made with different Curie points, hence with its own temperature setting. This particular iron is a low voltage model and is operated from a separate transformer. It has a very rapid warm-up time and good heat recovery, but, because of being thermostatically controlled, does not overheat nor need switching attention by the operator. The barrel is a little short though, for some types of work.

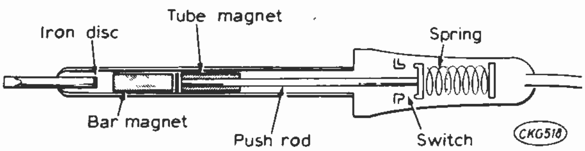


Fig. 2: Mechanism of a heat-controlled iron using the Curie effect.

Another thermostat iron is called the 'Litestat.' This is a mains-operated instrument, hence it is not encumbered with a transformer, either built-in or attached by lead. It has a 70 watt rating, but is only little larger than the average 25 to 40 watt instrument, the thermostat preventing it overheating. As with other thermostat irons, when there is a heavy outflow of heat from the bit due to working on a large heat conductive area, any loss of temperature is compensated by the switch remaining on longer than usual, and the larger element quickly supplies the extra heat volume. Thus we have the best of both worlds, a moderate sized iron that will handle reasonably small jobs (quite small if the extra-small bit is used) and will also tackle the big ones. Although the occasional user will probably get on quite well with a normal uncontrolled iron, the advantages of the thermostat control really make this type of iron a 'must' for professional workshops.

These then are the basic types of soldering instrument and their respective features. Within each category there are many makes and models and engineers and hobbyists alike often have a particular favourite that handles well and seems to produce good work for them.

SOLDERING BITS

Bits are available in several types. There are of course the various shapes and sizes that are produced for specific applications, most irons having a number of alternative bits obtainable as extras. There are though, differences in material. The most common is copper, which because of its high heat conduction is the best material (excluding precious metals) for the purpose. When clean it can be tinned quickly and easily, another great advantage. A disadvantage with copper bits is their deterioration with use. Prolonged periods of operation at high temperatures causes oxidization and flaking of the metal. In addition, at the bit face where the solder is melted, cavities begin to form due to the chemical affinity of solder for copper, which absorbs it each time the bit is used.

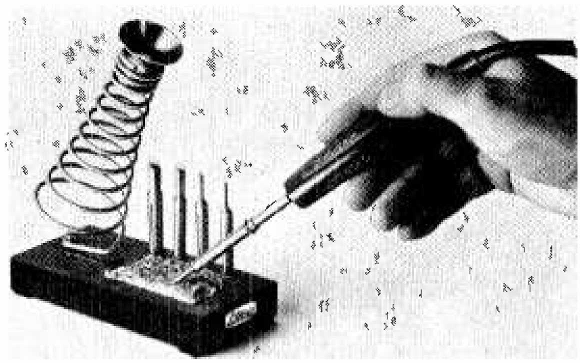
Little can be done to stop the flaking other than running the iron at a lower temperature during standby periods, but the cavities can be almost eliminated by using the Savbit solder developed by Multicore. This contains minute traces of copper which satisfies the affinity of the solder without it taking more from the bit.

Other types of bit are made from alloys, or are nickel or chromium plated to achieve longer life. One method used by some manufacturers is to clad the copper bit with iron which is harder and more durable than copper, yet has the copper core for its thermal properties. A disadvantage with all these bits is that they cannot be filed without ruining them, thus once the plating or cladding has gone the bit must be discarded, whereas a copper bit can be filed flat at its face many times before filing and flaking reduces the size to inoperative proportions.

The superior thermal qualities and ease of tinning make the copper bit still the favourite, especially since its life can be prolonged with special solders.

USING THE IRON

Now just a point or two on using the iron. It is surprising the number of people who are technically well qualified, professional engineers included, who cannot seem to produce a good soldered joint. It is very important to do so, as all sorts of faults can arise from poor soldering. It is noteworthy that all candidates for the RTEB servicing exams had to undergo soldering tests and failure led to automatic disqualification for the whole of the practical and theoretical examinations.



Litesold Conqueror iron and stand with bit-cleaning sponge and range of interchangeable bits.

There is nothing really difficult in making a good joint, just observing a few straightforward rules. The first one is to make sure that both surfaces are clean. In the case of wires, this can be done by pulling the wire a couple of times through the blades of a pair of side-cutters, as though one were stripping insulation. Terminals and tags can be scraped with a screwdriver blade. In most cases wires and terminals will be already tinned, but do not rely too much on it. Next both surfaces should be tinned. This is done by applying the iron to the surface for a few seconds, and then introducing the solder to bit and

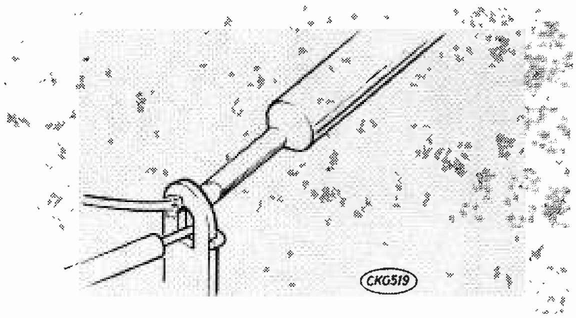


Fig. 3: The iron should heat the whole joint—not just the solder.

surface so that it runs easily over it, Fig. 3. If the solder is thick and slow to run, the bit temperature is too low, either because the iron has not been switched on long enough, or the iron is too small for the work. The solder may not run over the surface readily at first because insufficient heat has been transferred from the bit, and it is just not hot enough to melt the solder. This could be due to poor contact between bit and surface, but a little solder introduced at the junction of the two, will give a good thermal conduction, and the surface should then quickly attain sufficient temperature to itself melt solder when applied.

When both surfaces have been thus tinned, they are brought together in mechanical contact, and the iron applied again to both. More solder is then introduced so that it runs freely over both surfaces, then the iron is withdrawn. Do not move the work until the solder has solidified otherwise a weak joint will result; this will take only a second or two. Where possible the joint should be mechanically sound before soldering. No external flux should be used as these are often corrosive and will give trouble in the future. Sufficient of the correct type of flux is contained in the cores of solders intended for electronic wiring, to do the job.

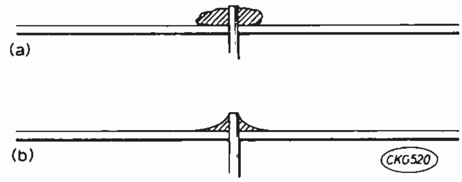


Fig. 4: (a) A 'dry' joint, showing the blob of solder due to insufficient heat or dirty surfaces.
(b) A good joint, showing smooth flow of solder over joined surfaces.

Do not use too much solder as this is not only unnecessary but could form a short to adjacent terminals. In appearance, the joint should be bright and smooth. A lumpy or pitted appearance shows the solder was not hot enough. It should also appear as a 'mound' rather than a blob. The illustration Fig. 4 shows what is meant by this. If the solder surface comes down and curls under as shown, it has not taken to the surface and we have a 'dry' joint. By observation of these points and a little practice, perfect joints can be made every time. ■

LETTERS—*continued from page 742*

Value for money

I greatly appreciated the article on 'Going Back' as it is full of nostalgia. I have taken *P.W.* off and on since the early beginnings, but only since 1967 have I bought it every montb and I only started then because a free record of audio faults was given away, but on reading the articles on transistorised equipment, and particularly details of a transistor SW receiver by F. G. Rayer, I was astonished at the transformation in building techniques (being brought up on ³₈″ thick breadboards and ¹₁₆″ dia. connecting wire!) and plunged up to the neck in transistor circuits and have been building them from *P.W.* projects ever since.

Though the price of *P.W.* has greatly increased, the contents have kept in step and I think it is still good value for money. It is improving all the time, as reference back to only a few years ago will show, and even in the last few months there have been detailed improvements, such as better layout and the contents page being put on the first page. Long may you continue!

Incidentally, radio parts seem to be one of the few things which have not greatly increased in price, and some, like transistors and i.c.s, have actually gone down.—**R. A. Read** *(Salisbury).*

A Fly in the Ointment?

Do any readers know how to build an electronic fly-catcher? We are driven crazy with flies in the summer and we are sure that it is the sheep that bring them in.

I was born in the UK and lived many years in Africa but the flies were never as bad as here. I have taken P.W. for over 20 years now but have not seen any details of fly catchers. Also, we are a bit lost out here for getting components especially as we can only get a £2 British P.O. here on demand at the Post Office.—**J. S. Skeels** *(One Tree Point, Rukaka, Northland, New Zealand).*

Short Wave Converter

I have built the Radio Nederland converter, *Practical Wireless*, September 1973, and am very pleased with the results, however. I should like to point out an error in publication which would result in disappointment to those to quote your preamble—"with little experience in electronics."

Reference page 409 figure 1 circuit diagram oscillator Tr2 AF 124 and page 410 drawing AM0022. Note the emitter and base connections are shown reversed so there could be no conduction in the collector circuit due to reverse polarity at the base.

As a note of interest I used Wearite P coils either PA4 or PHF4 which very nearly approximate the coil data given for L1 and L2, a similar coil was slightly modified to make up L3. A PHF6 coil tuned by a 200pF silver mica in parallel with a 250pF trimmer was used for L4. The unit is used with a BUSH TR130 receiver tuned to the extreme h.f. end of the m.w. band.—**A. J. Birkinshaw** (Telford, TF2 6RA).

GOING QUADRAPHONIC

PW **Q4 PROJECT**

- QS recordings
- SQ recordings
- Discrete CD-4 recordings
- SURROUND SOUND

PART 3 D. BOLLEN

THE article last month gave circuit descriptions of single and multi-system matrix decoders based on two circuit modules, Units A and B. There now follows constructional details of these two units, and of the additional units and components needed to build a multi-system decoder with infinitely variable front and back separation.

Readers are reminded that they will require, in addition to the decoder, a stereo outfit plus a pair of back amplifiers and speakers for quadraphonic reproduction from discs and tapes.

Unit A construction

Unit A is assembled on a piece of 0·1in. pitch Veroboard 0·9in. wide by 4in. long, see Fig. 16. Begin by making breaks in the copper strips, where shown, with a spot face cutter, and then insert and solder the terminal pins.

During assembly, it is important to ensure that the transistors are not overheated as this could have a detrimental effect on noise performance. A clip made of aluminium sheet should serve to conduct away heat when placed around the transistor can during soldering. Constructors who are not accustomed to 0·1in. Veroboard should also make sure that solder blobs do not bridge between the copper strips. It is a good idea to run a sharp knife blade along the gaps between strips to remove excess flux and any particles of solder. When inserting capacitors in the unit A circuit board, check that the polarity is as shown in Fig. 16.

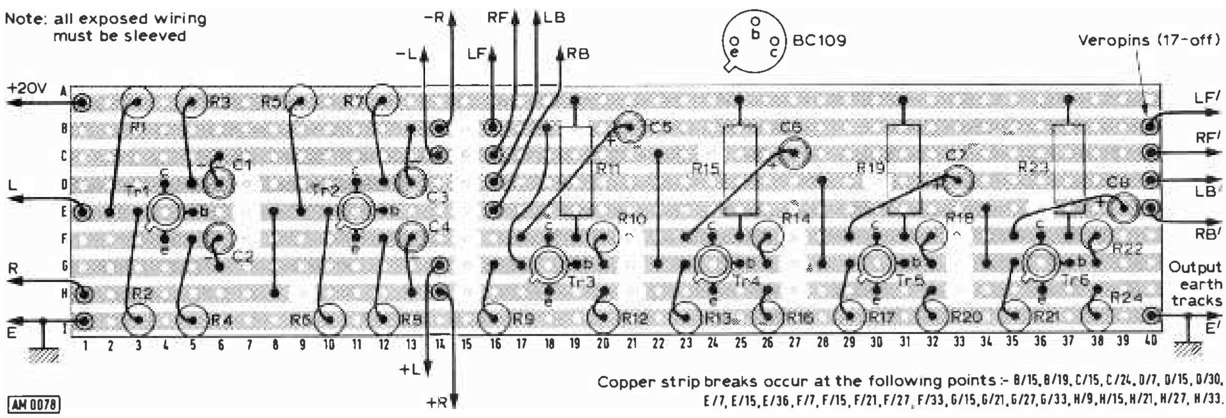
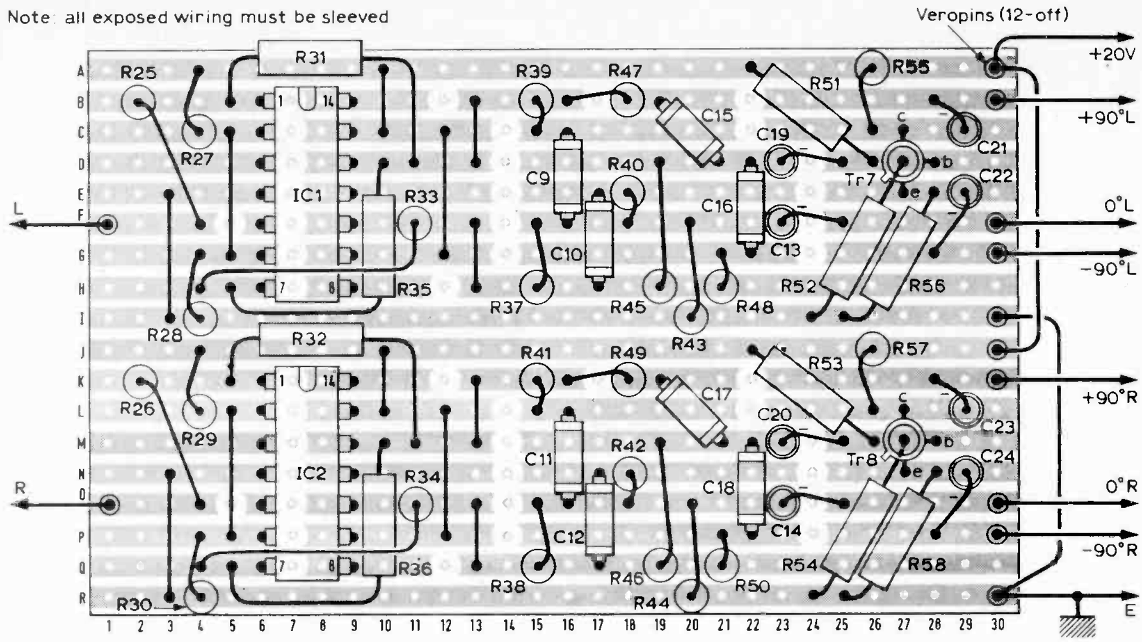


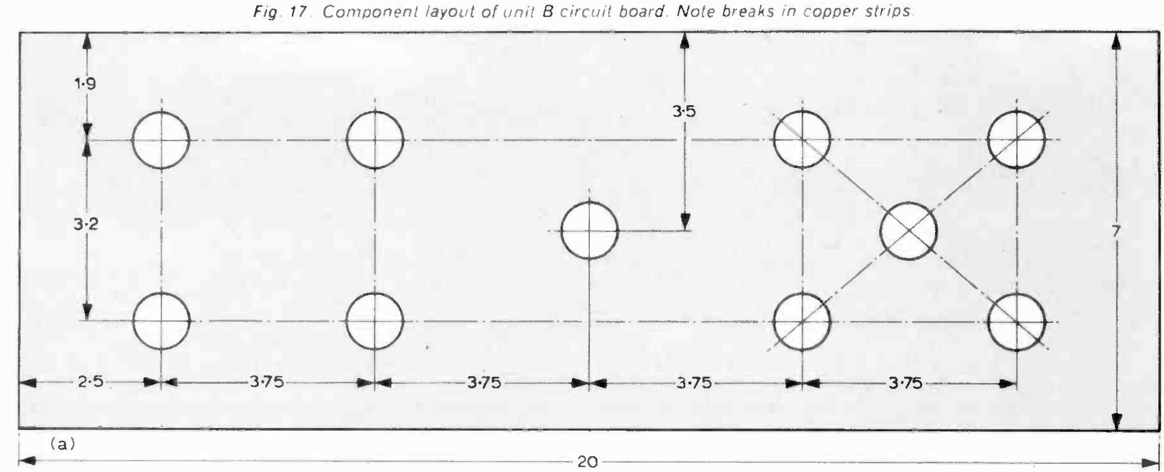
Fig. 16: Component layout of unit A circuit board. Note breaks in copper strips.



AM 0079

Copper strip breaks occur at the following points:–
B/7, B/12, B/17, B/22, C/7, C/14, C/22, D/7, D/14, D/24, E/7, E/14, E/24, F/5, F/7, F/14, F/24, G/7, G/14, G/24, H/7, H/12, K/7, K/12, K/17, K/22, L/7, L/14, L/22, M/7, M/14, M/24, N/7, N/14, N/24, O/5, O/7, O/14, O/24, P/7, P/14, P/24, Q/7, Q/12.

Fig. 17. Component layout of unit B circuit board. Note breaks in copper strips.



AM 0081 All dimensions in cm. Drill all holes 1cm diameter

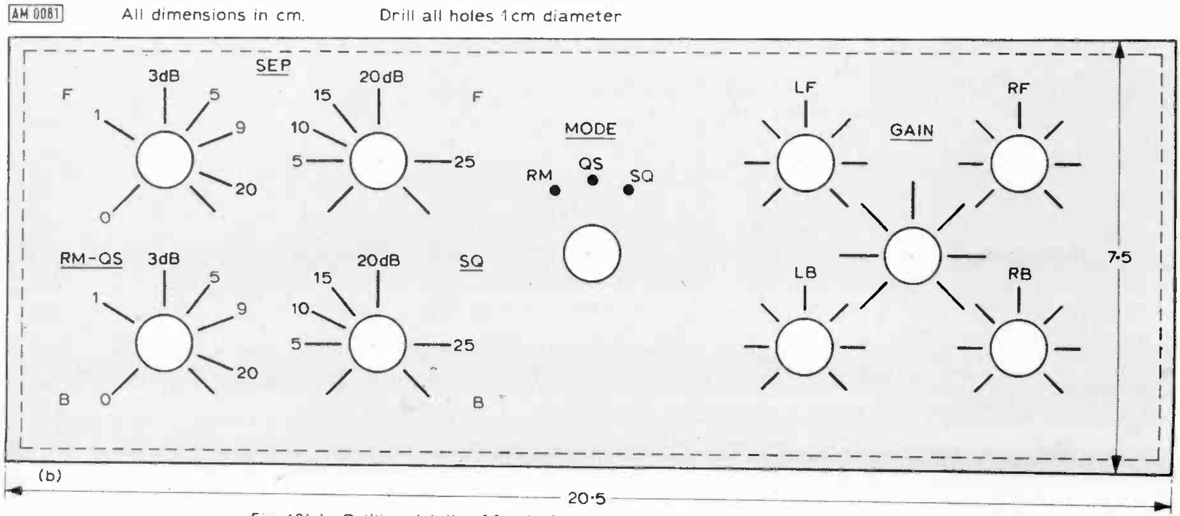


Fig. 18(a): Drilling details of front of chassis tray. Fig. 18(b): Front panel layout.

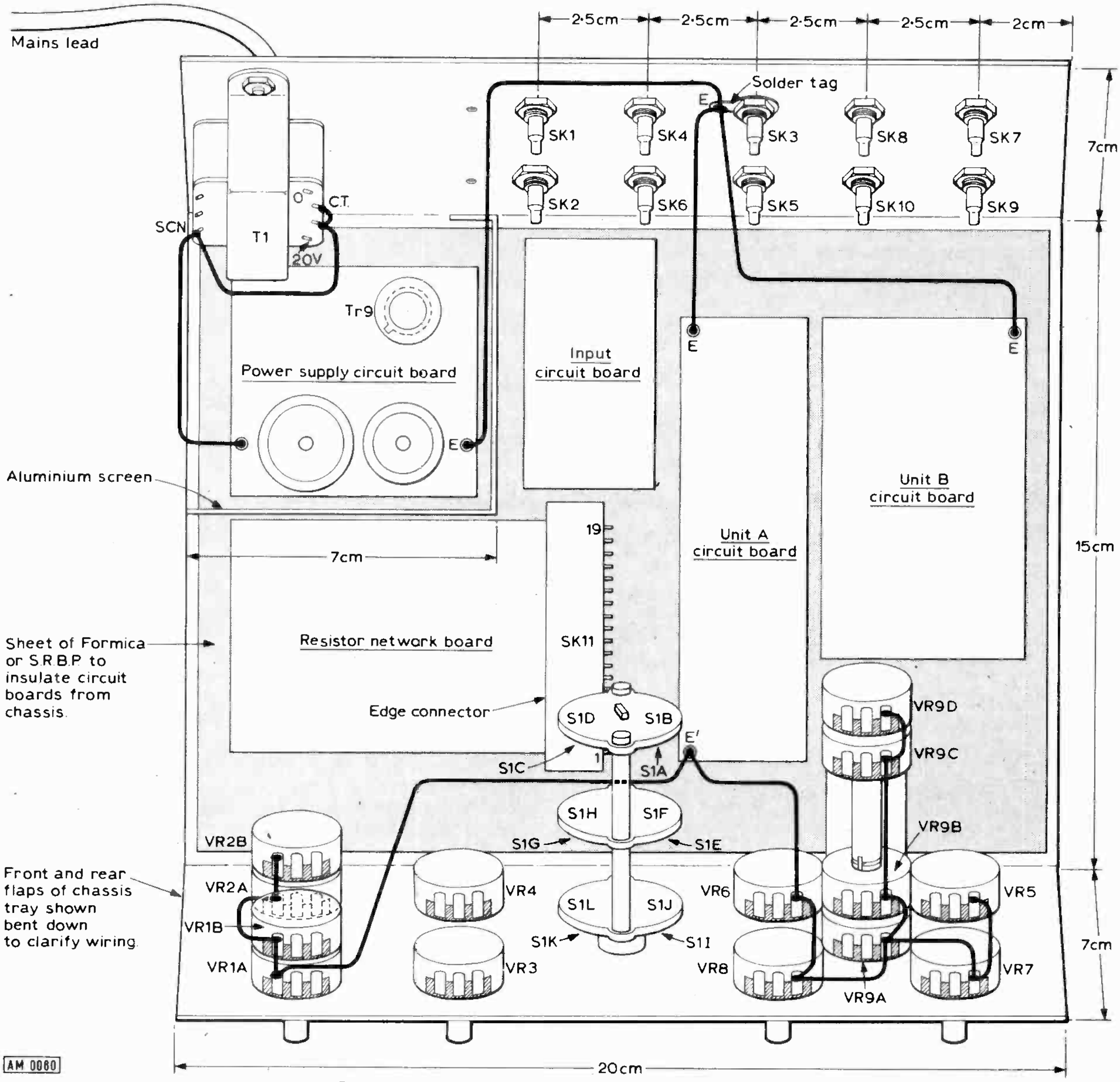


Fig. 19: Multi-system decoder layout showing earth wiring.

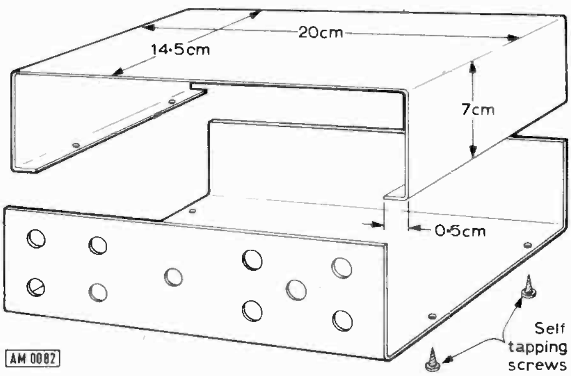


Fig. 20: Dimensions and fixing details of the chassis cover.

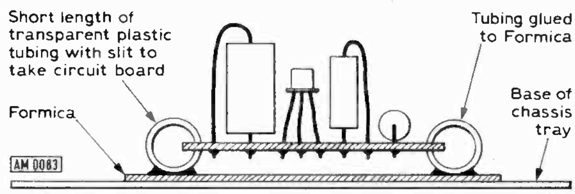


Fig. 21: A method of securing the circuit boards.

Unit B construction

A piece of 0·1in. pitch Veroboard 1·8in. wide by 3in. long is employed for unit B, and the layout is shown in Fig. 17. Left and right hand channels are identical and are arranged one above the other on the circuit board.

Make breaks in the copper strips according to the diagram of Fig. 17 and insert and solder all terminal pins. Commence with the ICs, leaving pins 3, 5, 8, 11, and 14 unsoldered, and then position and solder the remaining components. Use a heat clip on Tr7 and Tr8 and ensure that the polarity of the electrolytic capacitors is correct.

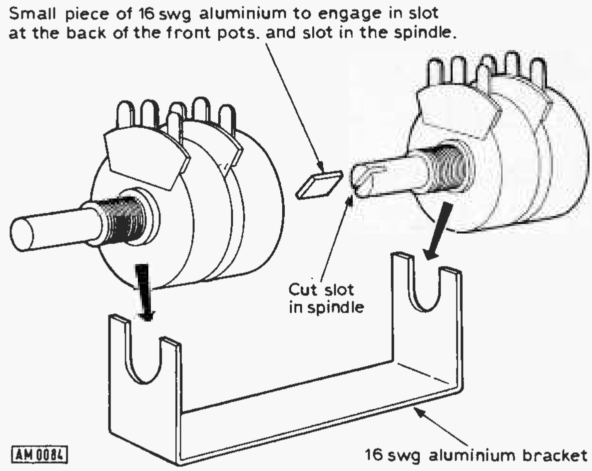


Fig. 22: VR9 assembly utilising two dual-gang potentiometers.

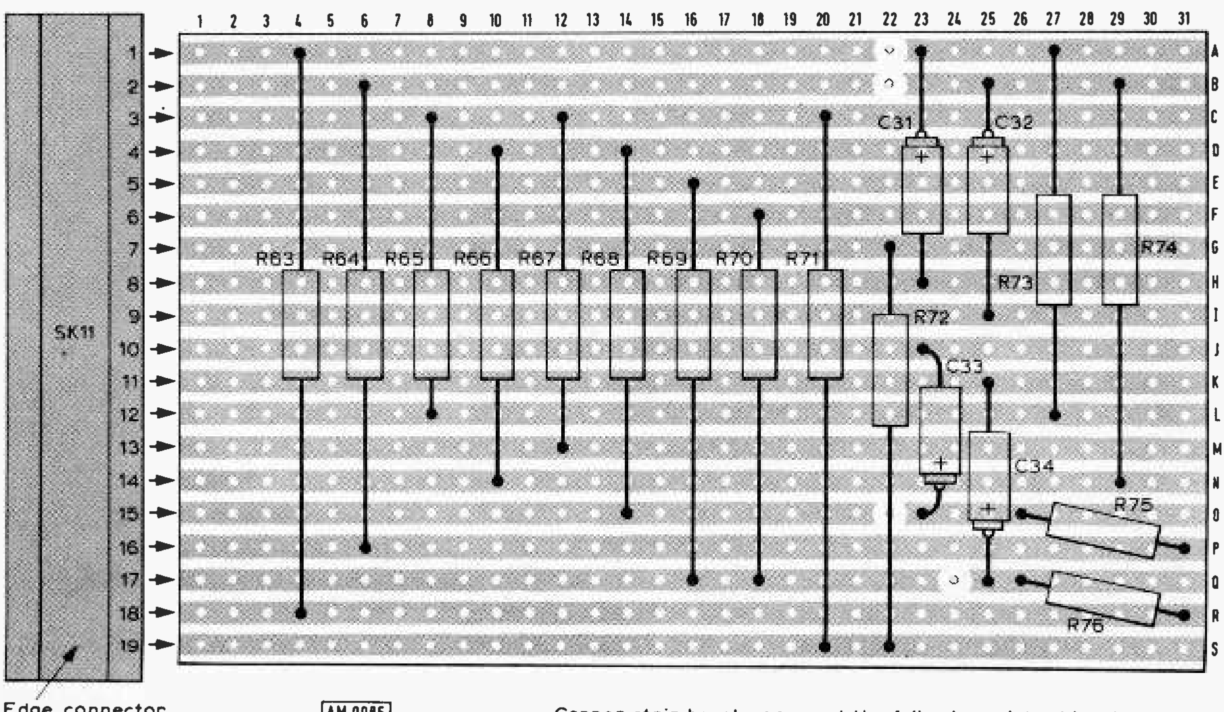
Checking units A and B

As a preliminary check, wire the earth and +20V terminal pins of unit A circuit board to an 18V battery (two PP9s in series) and with a testmeter measure the voltages between the earth terminal and the transistor cans. Tr1 and Tr2 should show a voltage of about 14V, and Tr3-Tr6 a voltage of 9V. If there is a serious discrepancy, look for a short circuit between the copper strips on the underside of the circuit board, or an error in component positioning.

To check unit B, connect the 18V battery to earth and +20V terminals and measure the voltage at IC1 and IC2 pins 10 and 12, which should be at 9V relative to the earth terminal pins. The can voltage of Tr7 and Tr8 will be about 14V if there are no constructional faults.

If the user intends to experiment with a single-system decoder, units A and B can be employed with an 18V battery, or the power supply of Fig. 15, with 22kΩ balance controls (VR5-VR8 Fig. 14) wired to the LF, RF, LB, and RB outputs of unit A. It is advisable to connect a 1000μF 25V electrolytic capacitor across the supply rails when operating units A and B from a battery.

Where an oscilloscope with X-Y facilities is available, unit B can be tested for 90° phase shifting by injecting a signal of 2kHz into the left input, with the X input of the scope linked to the 0°L output, and the Y scope input connected to each of the 90°L outputs in turn. The resulting display should be a near perfect circular trace. Repeat the test for the right hand channel.



Copper strip breaks occur at the following points:- Q/24, Q/22, B/22, A/22.

Fig. 23: Component layout of resistor network board.

Multi-system decoder construction

Fig. 19 shows the layout of a multi-system decoder based on the circuit of Fig. 14. Additional circuit boards serve to accommodate the resistor network, input capacitors and resistors, and power supply components; these will be described later.

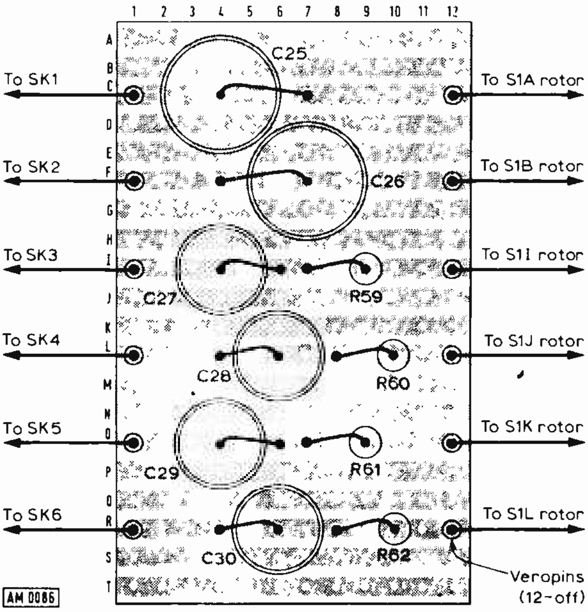
A start can be made by making up the chassis tray from 16s.w.g. aluminium sheet, to the measurements shown in Fig. 19. Allow 7cm of space for the power supply, and mark out and drill the rear of the chassis tray to take sockets SK1-SK10. Next, mark out and drill the holes to mount transformer T1, the power supply screen, and mains lead grommet.

Drilling details for the front of the chassis tray are given in Fig. 18a, and Fig. 18b shows a front panel made of 20·5cm by 7·5cm brushed aluminium or white Formica, which is drilled to match the holes in the chassis tray. The dimensions and fixing details of the chassis cover are shown in Fig. 20.

Glue a sheet of Formica or s.r.b.p. inside the base of the chassis tray to insulate the circuit boards from the chassis; this should measure 19cm by 14·5cm. A method of securing the circuit boards is shown in Fig. 21.

Make up switch S1 from three 4-pole 3-way wafers, with a three spacer gap between wafers. Mount the assembled switch on the front of the chassis tray, along with controls VR1-VR8.

In the absence of a four-gang component for VR9, this can be made up from two dual-gang potentiometers, as shown in Fig. 22. A small piece of sheet aluminium engages with the spindle slot at the rear of the front pair of pots, and with a slot in the spindle of the back pots. To align VR9, set the front pots to mid-track and measure the resistance between a slider and the earthed end of its track. Rotate the body of the rear pots to give a similar resistance reading on a rear pot slider and its track end, and then tighten the mounting nuts. VR9 can now be mounted on the chassis.



Copper strip breaks occur at the following points.- C/6,F/6,I/5,I/8, L/5,L/9,O/5,O/8,R/5,R/9.

Fig. 24: Component layout of input circuit board.

Resistor network board

The resistor network components are assembled on a piece of 0·1in. pitch Veroboard 1·9in. wide by 3·1in. long, and this is designed to plug into a 19-way edge connector (SK11) to facilitate easy modification of matrix parameters. The layout of the resistor network board is shown in Fig. 23.

A suitable edge connector, such as the RS Components 0·1in. 25-way, may be cut down to 19 ways with a small saw. When the resistor network board is completed it can be inserted in SK11, and the latter glued to the insulating board on the chassis tray.

Input circuit board

Fig. 24 shows the input circuit board with components mounted on 0·1in. Veroboard, which measures 2in. wide by 1·2in. long.

In Fig. 14 (last month) the lower unit board should have been designated unit B. We regret, that due to pressure on space, final constructional details, wiring and setting up, have had to be held over until next month.

TO BE CONTINUED

TAKE 20

DAVID ANDREWS

No. 55
TRIPLEX SIGNALLING UNIT

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

THIS project can be used as quite a useful gadget for signalling between the house and a shed or to illuminate signs outside an office door. Signals are produced by two lamps either, or both, of which can be switched on and off. This does not, in itself, sound very clever but the circuit to be described enables one to do this with a single pair of wires. Thus, over two wires one can display three separate codes on the two lamps.

Circuit

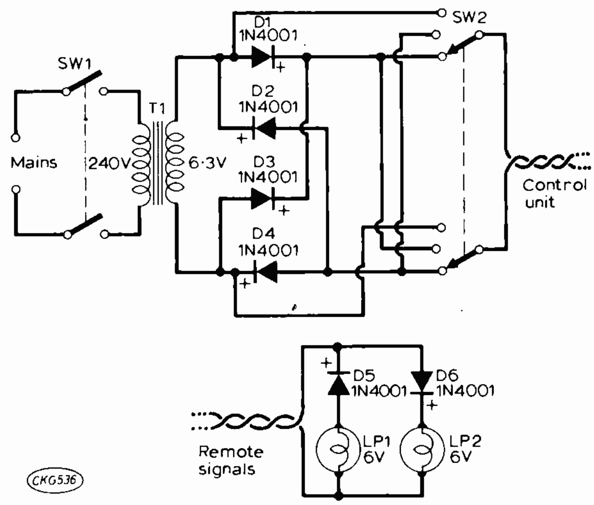
The trick is to make use of positive going half cycles of the mains supply to switch on one lamp. In Fig.1 D6 is forward biased for positive going cycles and LP2 will light but when SW2 is switched to the centre position the polarity of these half cycles is reversed and D5 becomes forward biased, turning on LP1 (D6 becomes reverse biased and LP2 goes out).

The third code, having both lamps on at the same time, is obtained by turning SW2 into the third position which applies a.c. to the signal wire pair direct from the transformer. LP1 and LP2 will now each light up, LP2 on positive and LP1 on negative half cycles.

Variations

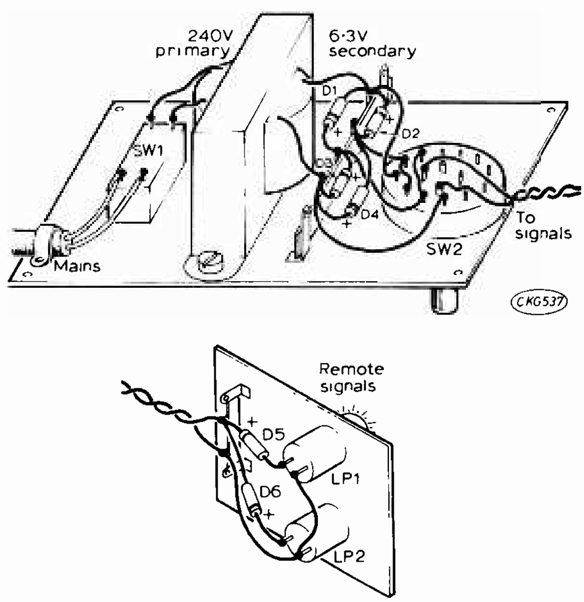
There are many variations to this circuit, and relays could be used instead of the lamps. Provided limiting resistors were inserted into the lines and the voltage reduced to below the reverse breakdown level, light emitting diodes could be used instead of the lamps, diodes D5 and D6 being omitted. For those who do not wish to bother with a.c. and a transformer one can still transmit two codes down the pair of wires by dispensing with the control unit. All that is needed in its place is a suitable battery and a reversing switch on the control end of the signal wires. One polarity will turn on one of the lamps, reverse the polarity of the supply and the other lamp will light. Apart from the diodes most of the components can be salvaged from old equipment. Any 6·3V transformer will do for T1 and probably the best source is an old valved radio.

Fig. 2 shows a suggested layout for the unit, on a metal or insulating material panel, which can be the lid of a box.



▲ *Fig. 1. Circuits of Control Unit and Remote Signals*

▼ *Fig. 2. Author's suggested layout for the two units.*



★ components list

D1–6	Diodes 1N4001
LP1–2	6V Lamps
SW1	2 pole mains switch
SW2	2 pole 3 way wafer switch
T1	Mains transformer, 240/6·3V
	Mounting box, tag strip, etc.

ON THE AIR

BROADCAST BANDS

SHORT WAVE DX

by MALCOLM CONNAH

AS many of you will know, propagation conditions vary according to the time of day, the time of year and the position in the 11-year sunspot cycle; as well as other minor factors. This means that, at any particular time, there is an optimum band for reception from any part of the world.

Forecasting these optimum bands is a relatively simple matter once one has collected all the necessary information. The following forecast is for reception in Western Europe and is listed by transmitter site.

North America During the late afternoon the most suitable band will be 25 metres, by 1900 GMT this will have changed to 19 metres but will return to 25 metres by 2300. During the early hours of the morning the most useful frequency will drop still further reaching 31 metres by 0300.

Central & South America The optimum frequency during the late afternoon will be 16 metres and this will drop gradually during the evening to be 19 metres at 1900; 25 metres at 2300 and 49 & 60 metres at 0300.

Middle East The late afternoon finds 19 metres as the best band dropping to 31 metres at 1900 and 41 metres at 2300.

Far East & Australasia Reception for this area will be much the same as the Middle East except that the best band will not drop below 31 metres.

Africa Late afternoon reception will be best on 16 metres dropping to 25 metres at 2000 and 31 metres at 2300.

DX News

COSTA RICA: Radio Capital de Costa Rica has been heard on 4832kHz at 0130 GMT. Reception is poor due to the low power of 1 kW.

ECUADOR: Radio Nacional del Ecuador has been noted with a programme of news and Latin-American music on 6170kHz at 0500 GMT.

EL SALVADOR: La Voz del Comercio, Colonial Sta. Lucia, Santa Ana, is asking for reception reports on 9545kHz. The best time for reception being 1600 GMT.

MEXICO: XERMX has been heard in Spanish on 15195kHz at 0330 GMT, this is a change from the usual frequency of 15125kHz.

TUNISIA: Radio Tunis has been noted on 15226 kHz at 2345 GMT and at 0910 GMT on 11970kHz. (Some of the above items by courtesy of Sweden calling DXers.)

Readers' Logs

John D. Porter of Bakewell (No jokes about Bakewell tarts—please) in Derbyshire has nine transistors and a few other components built into his superhet receiver. This, in combination with a 45 metre long-wire and some attention to the higher frequency bands, produced the following results:

11710 *R. Nacional d'Espana* at 0005.
15110 *R. Grenada, Windward Is.*, English at 2100.
15150 *R. Pyongyang, N. Korea* noted at 2030.
15375 *HCJB, Quito, Ecuador* at 2210.
15415 *R. Kuwait* in English at 1850.
15450 *R. Nacional de Brasilia* in English at 2355.
17820 *R. Canada Int.*, in Polish at 1540.
17885 *HCJB, Quito, Ecuador* noted at 2250.

Andrew Brown of Maidenhead in Berkshire is fourteen years of age so both his National HRO and R107 receivers are older than he is. The connection of a 10 metre long-wire antenna enabled the following stations to penetrate Andrew's shack:

7275 *RAI, Italy* in English at 1936.
9005 *Tehran, Iran* in English at 2000.
9560 *R. Jordan, Amman* in English at 1600.
9655 *R. Damascus, Syria* in English at 1930.
9745 *R. Baghdad, Iraq* in English at 1930.
11765 *Radio Australia* noted at 0710.
15165 *R. Denmark* in Danish at 0945.
15325 *R. Pakistan, Karachi* in English at 1530.
15520 *R. Bangladesh* in English at 1715.
17825 *NHK, Japan* in English at 0800.
21520 *RSA, South Africa* noted at 0755.
21655 *R. Norway*, Oslo in English at 2000.

David Thornley of Dukinfield, Cheshire has a Trio 9R59DS receiver and a Joystick antenna with ATU; which enabled him to hear:

7125 *R. Peking* in English at 0120.
9020 *R. Iran* in English at 2000.
9610 *R. Kiev* in English at 0030.
11672 *R. Pakistan* with news in English at 2000.
11880 *Voice of Turkey* in English at 2000.
15425 *Israel* with news in English at 1200.
17735 *R. Havana, Cuba* in English 2035.
21605 *RSA, South Africa* with quiz show at 1305.

ON THE AIR

MEDIUM WAVE BROADCASTS
by CHARLES MOLLOY

ROY PATRICK (Derby) has been busy with his National 1400 receiver on the medium waves. He reports good reception of Radio London on 1457kHz and the two IBA London transmitters on 557kHz and 719kHz. While on a visit to Farnborough (Hants) Roy logged Radio Brighton 1484kHz, Radio London and Radio Solent on 998kHz.

Richard Livesey (Guildford) has used his Audiotronic multiband receiver with internal ferrite aerial to hear Radio Portugal 755kHz at 2310hrs; Radio Prague 1286kHz; Trans World Radio Monte Carlo 1466kHz at 2230hrs; Radio Moscow 1493kHz at 2230hrs; Radio Warsaw 1502kHz at 2230hrs. All of these broadcast in English.

Ian Gordon (Birmingham) has a Codar CR70A receiver, a 25 metre longwire antenna and an aerial tuning unit (ATU). He reports hearing Radio Tirana 1394kHz with sign-on at 2000hrs; Radio Blackburn 854kHz; R. Leeds 1106kHz; R. Stoke 1502kHz; R. Nottingham 1520kHz; R. Bristol 1546kHz plus the American Forces Network in Germany on 611kHz (Grafenwohr / Kaiserslautern / Nürnberg), 872kHz (Frankfurt), 935kHz (Berlin), 1106kHz (Munich), 1142kHz (Bremerhaven/Stuttgart). The AFN can also be heard on 1034kHz (Karlsruhe), 1304kHz (Heidelberg), 1394kHz (Augsburg).

M. Laugharne (Didcot, Berks) reports hearing R. Solent 998kHz, R. London 1457kHz, R. Oxford 1484kHz and R. Bristol 1546kHz on his Philips portable receiver. T. D. Wilson (Hemel Hempstead) used a Grundig Mariner to hear R. Sweden 1178kHz and R. Portugal 755kHz, both in English at 2300hrs. He mentions receiving WINS, New York City on 1010kHz last February. Gary Celand (Southall, Middlesex) would like to listen to North American stations on the medium waves and when reception is possible. A path of darkness between transmitter and receiver is required for medium wave propagation. Listen for North Americans some five to six hours after sunset in the UK. From November to February they can be logged as early as 2330hrs when conditions are favourable. Those most frequently heard are CJON St. John's in Newfoundland on 930kHz; CHER Sydney, Nova Scotia on 950kHz; WINS New York City on 1010kHz; CBA Moncton, New Brunswick on 1070kHz and WNEW 1130kHz New York City.

The BBC have announced the location of the first four low power medium wave stations which will improve the Radio 4 service to the south-west of England. Torquay 854kHz (351m), Barnstaple 683kHz (439m), Plymouth 1457kHz (206m) should come into service before the end of 1973 and Redruth 755kHz (397m) by the Spring of 1974. The Barnstaple service will replace the present one on 692kHz (434m) while the others will be additional to the existing Radio 4 medium wave service.

VHF/FM DXING
by SIMON DAVID

T. J. Clamp of Cranbrook in Kent lists among other stations in the U.K., Markelo 2 on 98·4MHz and Roermond 1 on 88·3MHz, both from Holland, as well as Aalter, Belgium on 98·5MHz. He uses a Grundig Melody Boy 1,000 receiver and the in-built 86cm telescopic aerial. He also says "How about a list of BBC local radio station frequencies on f.m?" Other readers have also asked for this information, so I have included it in this month's column. The BBC Engineering Information Department issues complete lists with frequencies, powers, and polarization on Information Sheets 1034(24) and 1919(21) for any one with a technical interest. In the not too distant future I shall be giving details of some of the European frequency allocations. Details on Radio Telefis Eireann were given last month.

Igor Hájek has given me some very interesting gen on East European bands. With reference to my comments in the September issue, he points out that East European countries (including U.S.S.R.) use the 65-73MHz band, possibly with a view to making it difficult for their local population to have access to Western broadcasts. In spite of this, Czechoslovakia have tuners that cover West Europe (CCIR) and East Europe (OIRT). How long before we have this facility as commonplace in the U.K.? (see Leader article—Ed.).

This lower frequency band is in the 4 metre area of the dial and does lend itself very well to DX reception, as my colleague David Gibson will testify.

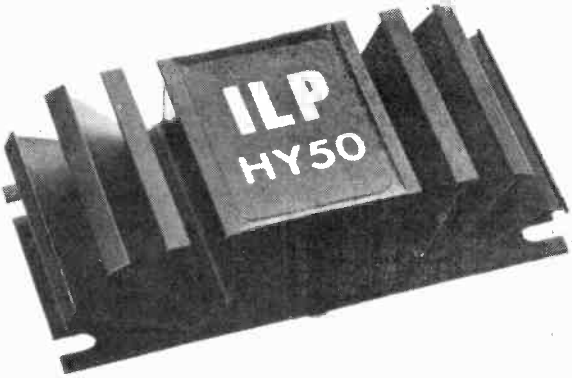
Future plans for stereo on v.h.f./f.m. include Wenvoe and Kirk O'Shotts next year, Pontop Pike and Sandale (near Carlisle) in 1975. It is surprising that Norfolk and Huntingdon areas are not yet planned, especially in view of the flat terrain.

The following is a list of BBC Local Radio stations. Birmingham, Blackburn, Manchester and Teesside will have transmission powers increased. Slant polarisation is employed at Blackburn, Derby, Leeds, Leicester, Manchester, Nottingham, and Sheffield (main). All others use horizontal polarisation. Medium wave shown in brackets.

Birmingham 95·6MHz (206m)
Blackburn 96·4MHz (351m)
Brighton 95·3MHz (202m)
Bristol 95·5MHz (194m)
Carlisle 95·6MHz (397m, 206m)
Derby 96·5, 94·2MHz (269m)
Humberside 96·9MHz (202m)
Leeds 92·4MHz (271m)
Leicester 95·1MHz (188m)
London 94·9MHz (206m)
Manchester 95·1MHz (206m)
Medway 96·7MHz (290m)
Merseyside 95·8MHz (202m)
Newcastle 95·4MHz (206m)
Nottingham 95·4MHz (197m)
Oxford 95·2MHz (202m)
Sheffield 97·4, 88·6MHz (290m)
Solent 96·1MHz (301, 188m)
Stoke-on-Trent 96·1MHz (200m)
Teesside 96·6MHz (194m)

I.L.P. (Electronics) Ltd

SECOND GENERATION 25 WATT HYBRID



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We have now finally reduced the modular amplifier to a simple input/output device requiring only the addition of a basic unstabilized (split line) power supply.
The HY50 takes medium power modules to their logical conclusion by incorporating with it a heatsink, which is designed in special high conductivity alloy, sufficient for normal audio use without additional chassis sinking. All this without significantly increasing the size of the module comparable in size to a packet of 'King-size' cigarettes.

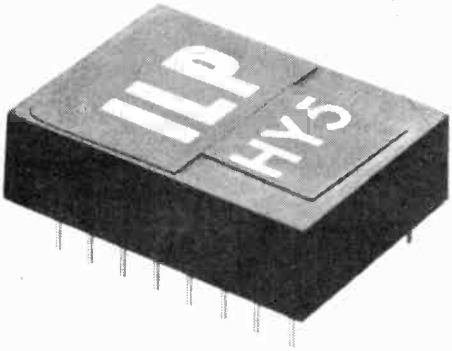
Consistent with modern thinking a triple rated output circuit with a load fuse allows for peak transient response without distortion but ensures the necessary protection.

	SPEC.
OUTPUT POWER:	25 watts RMS. 50 watts peak music power
LOAD IMPEDANCE:	4·16Ω into 8Ω
INPUT SENSITIVITY:	Odb (0·775 volts RMS)
INPUT IMPEDANCE:	47KΩ
TOTAL HARMONIC DISTORTION:	Less than 0·1% at 25 watts typically 0·05
SIGNAL/NOISE RATIO:	better than 75db
FREQUENCY RESPONSE:	10Hz-50KHz ± 1db
SUPPLY VOLTAGE:	± 25 volts
SIZE:	105 x 50 x 25 mm

Price £5·40 mono, £10·80 stereo

Price inclusive of VAT & P & P

NEW HY5 PRE-AMPLIFIER



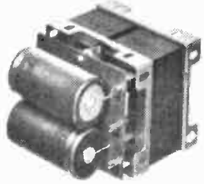
Unchallenged for two tears, the HY5, our unique multifunction preamplifier/tone hybrid, has been brought into line with the advancements in our power hybrids.
Like the HY50, the new HY5 has no external components & has been redesigned to run off a split power-line with improvements in signal/noise, overload, capability & reduced distortion. The output has been increased to match the power module (Odb), and to share the same power supply.
Overall size is reduced by the use of a new thin film circuitry while the device still retains all the functions of the earlier device.
When combined with the HY50 & power supply only potentiometers are required to complete a simple mono amplifier with input & output facilities expected to be found on Hi-Fi amplifiers.
The combination of two HY5's two HY50's sharing a common power supply (PSU50) are linked by a balance control to form a complete stereo system.

INPUTS **SPEC.**
Magnetic Pick-up 3mV (within 1db RIAA curve)
Ceramic Pick-up up to 3mV
Microphone 10mV
Tuner 250mV
Auxiliary 3-100mV
Input impedance 47kΩ 1kHz

OUTPUTS
Tape 100mV.
Main output, Odb (0·775volts)

ACTIVE TONE CONTROLS
Treble ± 12db at 10kHz
Bass ± 12db at 100Hz
OVERLOAD CAPABILITY (equalization stage) 40db on most sensitive input
OUTPUT NOISE LEVEL (below 10mV magnetic input) 68db
DISTORTION 0·05% at 1kHz
SUPPLY VOLTAGE ± 16-25 volts
SUPPLY CURRENT 15mA
Price £4·51 mono, £9·02 stereo
Price inclusive of VAT & P & P

POWER SUPPLY PSU50



The new PSU50 has a low profile look being only 2½ inches high and can be used for either mono or stereo systems.

SPEC.
OUTPUT VOLTAGE ± 25 volts
INPUT VOLTAGE 210-240 volts
SIZE L. 70,D. 90,H. 60 mm

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Price inclusive of **VAT & P & P**

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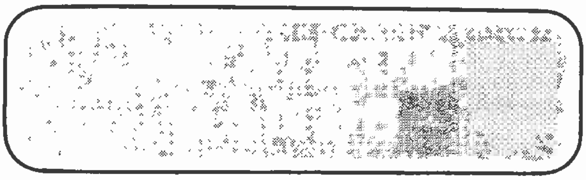
ON THE AIR



SHORT WAVES

by DAVID GIBSON, G3JDG

IT'S an interesting period for Amateur Radio. The sunspot count continues to creep lower and the longer, darker (colder) nights are making 14/21MHz less favourite for DX working. For the s.w.l. who reckons he's up to tackling something a little more difficult, then I suggest a serious DX assault on 7MHz. This will assume more and more the role of the major DX band. Further down, on 3·5MHz, more DX is becoming apparent so it could well be an l.f. DX winter.

On 3·5MHz this past month, goodies like OA4OS, ZS6TE and 9J2DT have been heard while up on 7MHz the air has been buzzing with c.w. offerings from calls like CM2JA, CR6AI, FG7XC, VK3MR, ZS5AN and 8P6DR.

Hair-raising happenings on top band. Several G stations have worked VP8KF in the Falklands. A few years back, this station would never have been thought about on 1·8MHz. Even now, a VP8 would cause excited s.w.l. squeaks if heard on 14MHz. Top-band sleuths are invited to lay in wait for r.f. travellers like ZL1MQ and a few JA stations who are known to be loitering. One station in Japan (JA7AO) has worked all continents (WAC) except Europe so it would be a safe bet to reckon his signal is there somewhere—who'll be first to report it?

Up on ten metres things seem to be fairly static. Long periods when one hears a noise like frying eggs (cheaper variety) and then, suddenly, an S9 plus five million dB's (well, it sounds like it) comes out of nowhere. South African stations are logged without too much effort and the South American continents comes romping in at times. Don't forget to listen first for the beacon stations since these will give a useful indication of what the bands are doing.

Before we take a peep at the logs sent in this month, let's open up the JDG little black book for contests in November. According to my crystal ball, the following are on: November 10-11, OK DX contest (c.w./phone); 10-11, topband contest; 11, four metre contest; 24-25, CQ WW (c.w./phone) contest.

First event in December is on the 9th and is a two metre contest for fixed stations—you've just got time to tie that 40-element Yagi beam to the chimney pot and switch on!

Readers' Logs

Dave Gregory (Plymouth) confesses, "I have been a Broadcast Bands maniac (is there any other kind?) for some months now". Brethren will be pleased to know that my Brother Gregory has seen the light and cleansed his sins by purchasing a 9R-59DS, RA-1 and CR100. With a homebrew a.t.u. and "DX processing unit" Dave repents on 14MHz with the following log; A51PN, A6XP, AR1RSP, EA7PS (an XYL—O'lay); WA5FW, ZB2BL, 3A2EE, 4Z4MQ, 5Z4GB, 5Z4GK.

A. McNeill (Newbury), comments on the many eastern europeans loose on 14MHz. He also praises the DX'ers processing unit which was featured in P.W. and queries the callsign NI3A who keeps popping up. Are there NI takers to answer this?

Derek Harding (Godstone) says he's 23 years old and has been an s.w.l. for four days (What a waste of 22 years, 361 days). Derek asks how he can filter out the various loud whistles which beset him? Anyone got any thoughts other than the on/off switch?

John Turner sends in a 21MHz selection from a log made during his school holidays (think of all the conkers you missed). Gear in his bedroom at Doncaster includes a Pye Cambridge receiver with an 85ft end fed supplying the microvolts to the tune of; A2CCY, CE3OE, CN8CG, CP1HL, CR6AD, CT1BY, CX2CS, CX7BM, DU1FE, EA8CS, EA8HH/M, EL1G, ET3USA, HK3CDW, HS4AJL, JA4PE, JA6PIC, JA7KHZ, JH1DEV, KP4AD, KZ5EK, LU5MAO, M1C, PZ1DR, TI2IO, TR8VT, TU2DO, VK4PU, VP2MF, VP8ML, VP9CB, VQ9BP, YN1AZ, YV5EED, ZD3D, ZD8MH, ZS4JW, 4Z4LM, 7X0WW, 8R1J, 9G1AF, 9H1DP, 9M2DQ, 9U5CR, 9X5VA.

Tam Large (Hassocks) lives on a farm in Sussex. His favourite animal is a 9R-59DE. Feed it a staple diet of mains electricity and put it on a 200ft. end fed lead and it yields the following twenty metre tweets; CR6LX, HP1TG, K2LZQ/OH0, M1C, PZ1DR, 4W1AF. Similar treatment brought forth the following from 21MHz; TG9CQ, XE1GR, ZD3D, 9M2CX.

Paul Davies (Blackpool) is learning to read c.w. (good lad). Meanwhile, he listens with baited breath on 14MHz to the following juicy jingle; CR6GA, EL8J, EP2SP, ET3GA, HR2WTA, IB0PV, JA4JUV/MM, JY6HCT, KA6HQ, 9H1CQ, 9H4B, 9K2AL, 9M2DW, 9X5NA, all on s.s.b. Gear used is a Heath HR-10B, Joystick antenna and an a.t.u.

S. Eldridge (Crawley), has a CR70A, 132ft. end-fed looped round the bedroom and a yen to listen on 15 metres. Here's the gen on his yen; A6XB, CE3PY, CR6AG, CR6HZ, CT2AB, HI8LC, JA8ISK, JE1MUM, JF1IUA, JH3EXI, JR1TAM, KA2PJ, LU6FEP, PT2JB, TI2STI, TR8VE, VQ9M, VU2DK, ZP5VO, ZS1J, ZS4JW, 5N2ESH, 5U7BA, 9X5VA.

BROADCAST BANDS

Short Wave Reports by 15th of the month to Malcolm Connah, 59 Windrush, Highworth, Swindon, Wiltshire, SN6 7DT.

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

VHF/FM Reports to Simon David, c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD.

AMATEUR BANDS

Short Wave/VHF

Logs in alphabetical order please by 15th of the month to David Gibson, G3JDG, 12 Cross Way, Harpenden, Hertfordshire.

TRANSFORMERS

PLEASE NOTE NEW ADDRESS AS BELOW

MAINS ISOLATING SERIES

Primary 120/240 Volts Secondary 120/240 Volts Centre Tapped and Earth Shielded

Ref. No.	VA (Watts)	Weight lb	oz	Size cm.	£	P & P p
07	20	1	8	7·0 x 6·0 x 6·0	1·94	30
149	60	3	12	9·9 x 7·7 x 8·6	2·88	36
150	100	5	8	9·9 x 8·9 x 8·6	3·16	52
151	200	8	0	12·1 x 9·3 x 10·2	5·31	52
152	250	13	12	12·1 x 11·8 x 10·2	7·01	67
153	350	15	0	14·0 x 10·8 x 11·8	9·40	82
154	500	19	8	14·0 x 13·4 x 11·8	13·55	–
156	1000	38	0	17·2 x 16·6 x 14·0	24·97	–
158	2000	60	0	21·6 x 15·3 x 18·1	41·25	–

AUTO SERIES

Ref. No.	VA (Watts)	Weight lb	oz	Size cm.	Auto Taps	£	P & P p
113	20	1	0	5·8 x 5·1 x 4·5	0-115-210-240	1·02	22
64	75	2	4	7·4 x 6·7 x 6·1	0-115-210-240	2·00	30
4	150	3	4	8·9 x 7·7 x 7·7	0-115-200-220-240	2·42	36
66	300	6	4	9·9 x 9·6 x 8·6	,,	4·70	52
67	500	12	8	12·1 x 11·2 x 10·2	,, ,,	6·93	67
84	1000	19	8	14·0 x 13·4 x 14·3	,, ,,	12·69	82
93	1500	30	4	14·0 x 15·9 x 14·3	,, ,,	18·39	–
95	2000	32	0	17·2 x 16·6 x 14·0	,, ,,	24·00	*
73	3000	40	0	21·6 x 13·4 x 18·1	,, ,,	32·67	*

TOTALLY ENCLOSED 115V AUTO TRANSFORMERS

115V 500 Watt totally enclosed auto transformer. complete with mains lead and two 115V outlet sockets. £9·49. P & P 67p. Also available a 20 Watt version 12·02 P & P 27p

LOW VOLTAGE SERIES (ISOLATED)

PRIMARY 240·250 VOLTS 12 AND OR 24 VOLT RANGE

Ref. No.	Amps. 12V	24V	Weight lb	oz	Size cm.	Secondary Windings	£	P & P p
111	0·5	0·25		8	4·8 x 2·9 x 3·5	0·12V at 0·25A·2	1·02	22
213	1·0	0·5	1	4	6·1 x 5·8 x 4·8	0·12V at 0·5A·2	1·22	22
71	2	1	1	12	7·0 x 6·4 x 6·1	0·12V at 1A·2	1·60	22
18	4	2	2	12	8·3 x 7·7 x 7·0	0·12V at 2A·2	2·24	30
70	6	3	3	8	8·9 x 8·0 x 7·7	0·12V at 3A·2	2·70	42
108	8	4	5	8	9·9 x 8·9 x 8·6	0·12V at 4A·2	3·00	52
72	10	5	6	4	9·9 x 9·6 x 8·6	0·12V at 5A·2	3·55	52
17	16	0	8	12	12·1 x 9·9 x 10·2	0·12V at 8A·2	5·48	52
115	20	10	11	8	14·0 x 9·6 x 11·8	0·12V at 10A·2	6·98	67
187	30	15	15	8	14·0 x 12·1 x 11·8	0·12V at 15A·2	12·90	82
226	60	30	32	0	17·2 x 15·3 x 14·0	0·12V at 30A·2	23·72	*

30 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	£	P & P p
112	0·5	1	4	6·1 x 5·8 x 4·8	0-12-15-20-24-30V	1·22	22
79	1·0	2	4	7·0 x 6·7 x 6·1	,, ,,	1·62	36
3	2·0	3	4	8·9 x 7·7 x 7·7	,, ,,	2·43	36
20	3·0	4	8	9·9 x 8·3 x 8·6	,, ,,	2·99	42
21	4·0	6	4	9·9 x 9·6 x 8·6	,, ,,	3·55	52
51	5·0	6	12	12·1 x 8·6 x 10·2	,, ,,	4·42	52
117	6·0	8	0	12·1 x 9·3 x 10·2	,, ,,	5·28	52
88	8·0	12	0	12·1 x 11·8 x 10·2	,, ,,	6·82	67
89	19·0	13	12	14·0 x 10·2 x 11·8	,, ,,	8·36	67

50 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	£	P & P p
102	0·5	1	12	7·0 x 6·4 x 6·1	0-19-25-33-40-50V	1·60	30
103	1·0	2	12	8·3 x 7·4 x 7·0	,, ,,	2·34	36
104	2·0	5	8	9·9 x 8·9 x 8·6	,, ,,	3·25	42
105	3·0	6	12	9·9 x 10·2 x 8·6	,, ,,	4·41	52
106	4·0	10	0	12·1 x 10·5 x 10·2	,, ,,	5·48	52
107	6·0	12	0	14·0 x 10·2 x 11·8	,, ,,	8·63	67
118	8·0	18	0	14·0 x 12·7 x 11·8	,, ,,	11·27	97
119	10·0	25	0	17·2 x 12·7 x 14·0	,, ,,	14·13	*

60 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	£	P & P p
124	0·5	2	4	7·0 x 6·7 x 6·1	0-24-30-40-428-69C	1·62	36
126	1·0	3	4	8·9 x 7·7 x 7·7	,, ,,	2·26	36
127	2·0	6	4	9·9 x 9·6 x 8·6	,, ,,	3·55	42
125	3·0	8	12	12·1 x 9·9 x 10·2	,, ,,	5·41	52
123	4·0	13	12	12·1 x 11·8 x 10·2	,, ,,	6·98	67
120	6·0	15	8	14·0 x 12·1 x 11·8	,, ,,	10·12	82
122	10·0	25	0	17·2 x 12·7 x 14·0	,, ,,	16·75	*

LEAD ACID BATTERY CHARGED TYPES

Ref. No.	Amps.	Weight lb	oz	Size cm.		£	P & P p
43	1·5	1	8	7·0 x 6·1 x 6·1	Please note, these units do not include rectifiers	1·61	30
5	4·0	3	4	8·9 x 7·7 x 7·7		2·45	42
83	6·0	6	4	9·9 x 9·6 x 8·6		3·70	52
146	8·0	6	12	9·9 x 10·2 x 8·6		4·22	52
58	12·5	12	0	14·0 x 10·2 x 11·8		6·29	67

All ratings are continuous. Standard construction: open with solder tags and vacuum impregnation. * Carriage via B.R.S.

FULL SPEC. TRANSISTORS

BC107/108/109 12p each | 2N 3055 60p each + mica and bushes | AD161 162 60p pair + mica and bushes

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KEMPSTON HARDWICK
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½W Iskra high stability carbon film—very low noise—capless construction.
⅓W Mullard CR25 carbon film—very small body size 7·5 x 2·5 mm.
½W 2% ELECTROSIL TR5.

Power watts	Tolerance	Range	Values available	Price 1–99	Price 100+
½	5%	4·7 Ω–2·2M Ω	E24	1p	0·8p
⅓	10%	3·3M Ω–10M Ω	E12	1p	0·8p
½	2%	10 Ω–1M Ω	E24	3·5p	3p
½	10%	1 Ω–3·9 Ω	E12	1p	0·8p
½	5%	4·7 Ω–1M Ω	E12	1p	0·8p
4	10%	1 Ω–10 Ω	E12	6p	5·5p

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

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

POTENTIOMETERS
Carbon track 5k Ω to 2M Ω, log or linear (log ½W, lin ½W).
Single, **12p.** Dual gang (stereo), **40p.** Single D.P. switch, **24p.**

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

TRANSISTORS

AC107	15p	AF126	20p	BF115	25p	OC42	12p	5N3707	12p
AC126	12p	AF139	32p	BF173	20p	OC44	12p	2N3708	10p
AC127	15p	AF178	32p	BF177	28p	OC45	12p	2N3709	11p
AC128	15p	AF180	40p	BF178	32p	OC70	12p	2N3710	11p
AC131	12p	AF181	40p	BF179	32p	OC71	12p	2N3711	11p
AC132	12p	BC107	12p	BF180	32p	OC72	12p	2N3819	32p
AC176	15p	BC108	12p	BF181	32p	OC81	12p	2N4062	12p
AC187	22p	BC109	12p	BF194	14p	OC82D	12p	2N4286	20p
AC188	22p	BC147	12p	BF195	14p	2N2646	60p	2N4289	20p
AD140	50p	BC148	12p	BF197	15p	2N2904	20p	40360	35p
AD149	45p	BC149	12p	BF200	32p	2N2926	10p	40361	35p
AD161	33p	BC157	14p	BFY50	20p	2N3054	58p	40362	40p
AD162	36p	BC158	14p	BFY51	20p	2N3055	60p	40408	40p
AF114	20p	BC159	14p	BFY52	20p	2N3702	13p	ZTX108	15p
AF115	20p	BC187	22p	BUY105	225p	2N3703	12p	ZTX300	15p
AF116	20p	BD131	75p	OC26	45p	2N3704	13p	ZTX302	20p
AF117	20p	BD132	75p	OC28	50p	2N3705	12p	ZTX500	15p
AF118	38p	BD133	75p	OC35	50p	2N3706	11p	ZXT503	20p

ZENER DIODES
400mW 5% 3·3V to 30V, **12p.**

WIRE WOUND POTS. 3W, 10, 25, 50 Ω and decades to 100k Ω, 35p.

DIODES

RECTIFIER				SIGNAL	
BY127	1250V	1A	12p	OA85	7p
BZY10	800V	6A	25p	OA90	5p
BZY13	200V	6A	20p	OA91	5p
1N4001	50V	1A	7p	OA202	7p
1N4004	400V	1A	8p	1N4148	5p
1N4007	1000V	1A	10p	BA114	8p

BRUSHED ALUMINIUM PANELS
12in x 6in, **25p** ; 12in x 2½in, **10p** ; 9in x 2in, **7p**

SLIDER POTENTIOMETERS
86mm x 9mm x 16mm, length of track 59mm.
SINGLE 10K, 25K, 100K log. or lin. **40p.**
DUAL GANG, 10K + 10K etc. log. or lin. **60p.**
KNOB FOR ABOVE, **12p.**
FRONT PANEL, **65p.**
18 Gauge panel 12in x 4in with slots cut for use with slider pots. Grey or matt black finish complete with fixings for 4 pots.

THERMISTORS

VA1055S	15p
VA1066S	15p
VA1077	15p
R53	£1·35

THYRISTORS

2N5060	50V	0·8A	30p
2N5064	200V	0·8A	47p
106F	50V	4A	40p
106D	400V	4A	55p

MULLARD POLYESTER CAPACITORS C296 SERIES
400V: 0·001µF, 0·0015µF, 0·0022µF, 0·0033µF, 0·0047µF, **2½p.** 0·0068µF, 0·01µF, 0·015µF, 0·022µF, 0·033µF, **3p.** 0·047µF, 0·068µF, 0·1µF, **4p.** 0·15µF, **6p.** 0·22µF, **7½p.** 0·33µF, **11p.** 0·47µF, **13p.**
160V: 0·01µF, 0·015µF, 0·022µF, 0·033µF, 0·047µF, 0·068µF, **3p.** 0·1µF, **3½p.** 0·15µF, **4½p.** 0·22µF, **5p.** 0·33µF, **6p.** 0·47µF, **7½p.** 0·68µF, **11p.** 1·0µF, **13p.**

MULLARD POLYESTER CAPACITORS C280 SERIES
250V P.C. mounting: 0·01µF, 0·015µF, 0·022µF, **3p.** 0·033µF, 0·047µF, 0·068µF, **3½p.** 0·1µF, **4p.** 0·15µF, 0·22µF, **5p.** 0·33µF, **6½p.** 0·47µF, **8½p.** 0·68µF, **11p.** 1·0µF, **13p.** 1·5µF, **20p.** 2·2µF, **24p.**

MYLAR FILM CAPACITORS 100V
0·001µF, 0·002µF, 0·005µF, 0·01µF, 0·02µF, **2½p.** 0·04µF, 0·05µF, 0·068µF, 0·1µF, **3½p.**

CERAMIC DISC CAPACITORS
100pF to 10,000pF, **2p** each.

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

SOLID TANTALUM BEAD CAPACITORS 12p

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

VEROBOARD

	0.1	0.15
2½ x 3¾	22p	16p
2½ x 5	24p	24p
3¾ x 3¾	24p	24p
3¾ x 5	27p	27p
17 x 2½	75p	57½p
17 x 3¾	100p	78p
17 x 5 (plain)	—	82p
17 x 3¾ (plain)	—	60p
17 x 2½ (plain)	—	42p
2½ x 5 (plain)	—	12p
2½ x 3¾ (plain)	—	11p
Pin insertion tool	52p	52p
Spot face cutter	42p	42p
Pkt. 50 pins	20p	20p

JACK PLUGS AND SOCKETS

Standard screened	18p	2·5mm insulated	8p
Standard insulated	12p	3·5mm insulated	8p
Stereo screened	35p	3·5mm screened	13p
Standard socket	15p	2·5mm socket	8p
Stereo socket	18p	3·5mm socket	8p

D.I.N. PLUGS AND SOCKETS
2 pin, 3 pin, 5 pin 180°, 5 pin 240°, 6 pin
Plug 12p. Socket 8p.
4 way screened cable, **15p**/metre.
6 way screened cable, **22p**/metre.

BATTERY ELIMINATOR £1.50
9V mains power supply. Same size as PP9 battery.

LARGE (CAN) ELECTROLYTICS

1600µF	64V	74p	2500µF	64V	80p	4500µF	16V	50p
2500µF	40V	74p	2800µF	100V	£2·60	4500µF	25V	£1·68
2500µF	50V	58p	3200µF	16V	50p	5000µF	50V	£1·10

HIGH VOLTAGE TUBULAR CAPACITORS—1,000 VOLT

0·01µF	10p	0·047µF	13p	0·22µF	20p
0·022µF	12p	0·1µF	13p	0·47µF	22p

POLYSTYRENE CAPACITORS 160V 2½%
10pF to 1,000pF E12 Series Values, **4p** each.

SMOKE AND COMBUSTIBLE GAS DETECTOR—GDI
The GDI is the world's first semiconductor that can convert a concentration of gas or smoke into an electrical signal. The sensor decreases its electrical resistance when it absorbs deoxidizing or combustible gases such as hydrogen, carbon monoxide, methane, propane, alcohol, North Sea gas, as well as carbon-dust containing air or smoke. This decrease is usually large enough to be utilized without amplification. Full details and circuits are supplied with each detector.
Detector GDI, **£2.** Kit of parts for detectors including GDI and P.C. board but excluding case. Mains operated detector **£5·20.** 12 or 24V battery operated audible alarm **£7·30.** As above for PP9 battery, **£6·40.**

PRINTED BOARD MARKER 97p
Draw the planned circuit onto a copper laminate board with the P.C. Pen, allow to dry, and immerse the board in the etchant. On removal the circuit remains in high relief.

LARGE RANGE ITT/TEXAS IC's NOW IN STOCK

PRICES ARE CALCULATED ON TOTAL NUMBER ORDERED REGARDLESS OF MIX

	1–11 p	12–24 p	25–99 p	100+ p
7400	18	16	14	13
7401	18	16	14	13
7402	18	16	14	13
7403	18	16	14	13
7404	20	18	16	14
7405	20	18	16	14
7406	50	45	40	35
7407	56	50	44	38
7408	36	30	27	23
7409	36	30	27	33
7410	18	16	14	13
7411	23	21	20	18
7412	36	30	27	23
7413	34	28	26	22
7416	45	43	39	34
7420	18	16	14	13
7421	36	30	27	23
7426	32	29	23	20
7430	20	18	16	14
7432	40	36	32	28
7440	20	18	16	14
7441	80	75	70	65
7442	80	75	70	65
7443	125	120	115	115
7447	175	165	150	120
7448	185	175	170	165
7450	18	16	14	13
7451	18	16	14	13
7453	18	16	14	13
7454	18	16	14	13
7460	18	16	14	13
7470	30	28	25	24
7472	30	28	27	23
7473	40	38	36	30
7474	40	36	32	28
7475	55	52	50	49
7476	40	36	32	30
7480	100	95	90	85
7481	125	115	110	105
7482	100	96	90	85
7483	100	97	95	92
7484	120	115	110	105
7485	250	245	240	230
7486	45	42	37	33
7490	75	67	60	52
7491A	100	92	85	79
7492	75	70	65	60
7493	75	68	60	52
7494	95	90	85	80
7495	105	100	95	90
7496	100	95	90	85
74100	250	240	235	230
74118	100	82	73	64
74121	43	40	38	36
74141	100	95	90	85
74145	150	140	135	130
74150	330	280	250	220
74151	110	100	95	89
74153	120	110	105	95
74154	200	180	170	160
74155	150	120	100	86
74156	130	120	100	96
74180	155	136	112	105
74190	195	190	185	180
74191	195	190	185	180
74192	200	190	180	164
74193	200	180	170	150
74196	200	190	180	170
74197	200	195	180	170

LINEAR IC's

709	14 pin DIL	40p
741	8 pin DIL	40p
741	14 pin DIL	38p
723	14 pin DIL	95p
747	14 pin DIL	85p
748	8 pin DIL	45p
DIL sockets	14 pin and 16 pin	16p

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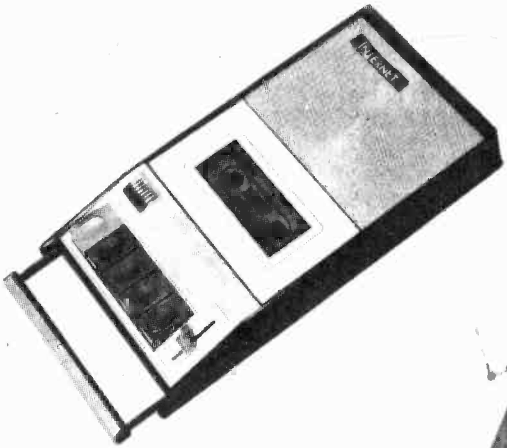

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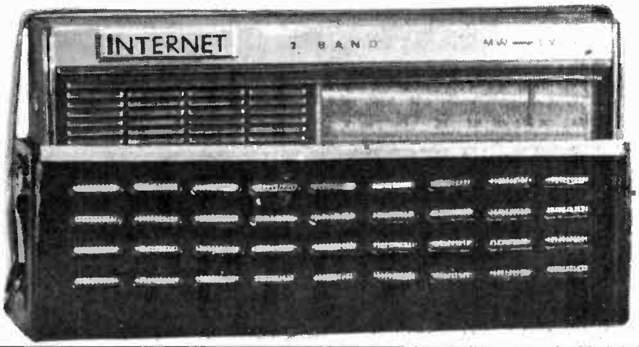

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SN7413	30p	SN7490	68p
SN7420	17p	SN7492	74p
SN7447	99p	SN7493	74p

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(0·3" HIGH CHARACTERS) ALSO + 1 REF LED 1A

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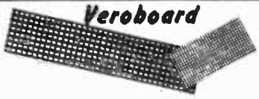
Veroboard



	Copperclad 0·1in	Plain 0·15in	0·15in	Extra P & P
2½in × 1in	6½p	6½p	—	—
2½in × 3¾in	22p	18p	11p	—
2½in × 5in	26½p	23p	13½p	—
3¾in × 3¾in	26½p	23p	—	—
3¾in × 5in	30p	30p	19p	—
17in × 2½in	74p	55p	41p	10p
17in × 3¾in	99p	77p	57½p	10p
17in × 5in	—	—	82½p	10p

DIP Breadboard, 4·15in × 6·15in, **110p.** Verostrip, 8·5in × 1·5in, **26½p.** Spot-Face Cutter, **40p.** Pin Injection tool (state 0·1in or 0·15in), **52p.** Terminal pins, **20p** (packs of 36)—state size.

I.C. SOCKETS

Dual-in-Line
8 pin 13½p 16 pin 17½p 36 pin 39½p
14 pin 15½p 24 pin 26½p 40 pin 44p
28 pin 30½p

HEAT SINKS

TV2 for TO-66 15p. 5F for TO-5
TV3 for TO-3 16p. 18F for TO-18

5½p.

TV4 for TO-126
TV5 for TO-220

DIP10/2 for SL403D
DIP14/5 for EA1000

14p

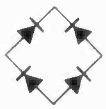
16p

10DN400 4 4Y-1 4

46p

35p

BRIDGE RECTIFIERS



P.I.V.	1 amp	R.M.S.	2 amp
100V	20p	50V	35p
200V	22p	100V	40p
600V	25p	200V	45p
1000V	38p	600V	50p

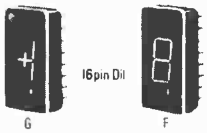
RECTIFIERS

P.I.V.	1 amp		3 amp	
50	1N4001	6½p	1N5400	15½p
100	1N4002	7½p	1N5401	16½p
200	1N4003	9p	1N5402	17½p
400	1N4004	9p	1N5404	22p
600	1N4005	11p	1N5406	26½p
800	1N4006	13½p	1N5407	30p
1000	1N4007	16½p	1N5408	33p

BY100	16½p	BY133	23p
BY103	22p	BY164	55p
BY105	16½p	BY176	£1·65
BY126	16p	BY182	£1·65
BY127	16½p	BY250	25½p

OR

FILAMENT INDICATOR MINITRON **3015**F & G



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LED 2. 0·125" 26p
LED 3. 0·175" 17p

GREEN
LED 4. 0·125" 69p
LED 5. 0·175" 75p

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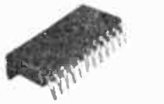
DIGITAL CLOCK on a chip



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RESISTORS

Rating	Type	Tolerance		Range	Price Each
⅛ watt	Metal Glaze	±5%	E12 Series	51Ω to 100KΩ	5p
¼ watt	Carbon Film	±5%	E24 Series	51Ω to 330KΩ	1½p
½ watt	Metal Oxide Film	±2%	E24 Series	10Ω to 1MΩ	4½p
½ watt	"Cermet" Thick Film	±2%	E12 Series	56Ω to 150KΩ	8p
½ watt	Carbon Film	±5%	E24 Series	10Ω to 10MΩ	1½p
½ watt	Carbon Composition	±0·5Ω		2·2Ω; 2·7Ω; 3·3Ω; 3·9Ω; 4·7Ω	4½p
1 watt	Carbon Composition			5·6Ω; 6·8Ω; 8·2Ω	5½p
1 watt	Carbon Film	±10%	E12 Series	10Ω to 10MΩ	3p
2 watt	Carbon Film	±5%	E12 Series	10Ω to 10MΩ	6p
2½ watt	Wire Wound	±5%	E12 Series	0·22Ω to 0·47Ω	10p
2½ watt	Wire Wound	±10%	E12 Series	1Ω to 270Ω	10p
5 watt	Wire Wound	±5%	E12 Series	0·5Ω to 8·2KΩ	10p
10 watt	Wire Wound			0·5Ω to 6·8KΩ	11p
10 watt	Wire Wound	±5%		10KΩ; 15KΩ; 20KΩ; 25KΩ	17p
15 watt	Wire Wound			10Ω to 6·8KΩ	13½p

CAPACITORS

MULLARD C333, 629 and 630 series—Ceramic Plate. E12 series from 1·8pF to 0·022µF. **5½p.**

CERAMIC DISC—LOW VOLTAGE—0·01µF, 0·022µF, 0·047µF, **5½p;** 0·1µF, 0·22µF, 0·47µF, **6½p.**

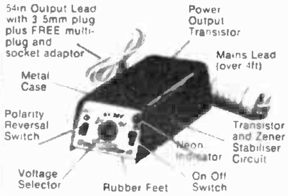
POLYSTYRENE (160V)—From 10pF to 0·01µF in multiples of 10pF; 15pF; 22pF; 33pF; 47pF and 68pF **3½p.**

MYLAR PLATE (100V)—1000 pF, 2000pF, 5000pF, **2½p;** 0·01µF, 0·02µF, 0·04µF, 0·05µF, **3½p;** 0·068µF, 0·1µF, **5p;** 0·2µF, **6½p.**

MULLARD C280 (250V POLYESTER)—0·01µF, 0·015µF, 0·022µF, 0·033µF, 0·047µF, **3½p;** 0·068µF, **4p;** 0·1µF, 0·15µF, **4½p;** 0·22µF, **5½p;** 0·33µF, **7p;** 0·47µF, **9p;** 0·68µF, **12p;** 1·0µF, **14½p;** 1·5µF, **22p;** 2·2µF, **26½p.**

new stabilised POWER PACK/CONVERTER

Switched 3, 6, 7½ or 9 volts.
Up to 400mA Output



Our Price £3·99 + P. & P. 16p.

Unstabilised Version of above	£2·99
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6 volts at up to 50mA	£1·65
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Fully Stabilised* Car Battery Converter, giving switched outputs of 6, 7½ or 9 volts	£5·49

P. & P. on all models 16p.

ZENERS

All 5% tolerance

BZY88, 400mW, 3·3V to 33V	11p
1ZS, 1W, 3·3V to 100V	18p
BZX70, 2·5W, 7·5V to 75V	27p

TRANSISTORS and DIODES

AC107	16p	AF179	71½p	BC214L	11p	BF177	28p	BSX20	18p	TIC44	46p								
AC126	13p	AF239	41p	BC268	15p	BF178	29p	BSX21	22p	TIC226D	£1·97								
AC127	13p	ASY26	33p	BC327	26½p	BF179	33p	BSY9SA	13p	TIP41A	81p								
AC128	13p	BC107	10p	BC328	24½p	BF180	33p	BU105	£1·75	TIP42A	99p								
AC176	15p	BC108	10p	BCY70	17p	BF181	35½p	BU105/02	£1·82	TIS43	36½p	2N3054	55p	2N4289	16½p	AAZ13	11p	BAX13	9p
AC187	22p	BC109	10p	BCY72	17p	BF184	27½p	D13V	53p	TIS73	£2·10	2N3055	52p	2N4441	87p	BA100	10p	BAX16	10p
AC187K	20p	BC114	15½p	BCZ10	28p	BF185	27½p	MJ4000	£1·49	TIS91	33p	2N3391A	29p	2N4442	£1·06	BA102	27½p	BAY38	41p
AC188	22p	BC117	22p	BCZ11	28p	BF194	15p	MJ4010	£1·49	2N697	16½p	2N3566	18p	2N4443	£1·45	BA110	45p	BB105	42p
AC188K	20p	BC147	9p	BD115	74p	BF195	17p	MJE340	52p	2N706	13p	2N3638	20p	2N4444	£2·09	BA111	55p	BB141	99p
ACY17	24p	BC148	9p	BD124	82p	BF196	16½p	MJE2955	£1·82	2N708	16½p	2N3702	11p	2N4871	60p	BA112	99p	BB142	82p
ACY18	21p	BC149	9p	BD131	68p	BF197	16½p	MJE3055	92p	2N914	24½p	2N3703	10p	2N5129	16½p	BA114	9p	OA5	99p
ACY19	25p	BC157	13p	BD132	83p	BF200	35½p	MPF102	27½p	2N1302	20p	2N3704	11p	2N5172	9p	BA115	19p	OA10	94p
ACY20	22p	BC158	12p	BD131/2 PR	£1·49	BF220	27½p	MPF103	41p	2N1303	24p	2N3705	10p	2N5459	36½p	BA116	9p	OA47	11p
AD140	40p	BC159	14p	BD133	83p	BF244B	27p	MPF104	45p	2N1304	24p	2N3706	10p	2N5777	47p	BA128	11p	OA79	10p
AD149	38p	BC168B	11p	BD135	42p	BF262	25p	MPF105	45p	2N1305	24p	2N3707	12p	2N6076	14p	BA129	23p	OA81	8p
AD161	29p	BC169	12p	BD136	50p	BF263	25p	MPF106	49½p	2N1306	24p	2N3708	9p	3N140	£1·01	BA143U	75p	OA85	10p
AD162	29p	BC171	20p	BD137	57½p	BF272	£1·21	OC28	33p	2N1307	27½p	2N3709	10p	3N141	89p	BA143V	87p	OA90	8p
AD161/2 PR	59p	BC172	17½p	BD138	74½p	BF390	37p	OC35	38p	2N1308	27½p	2N3710	11p	3N152	101p	BA144	20p	OA91	8p
AF114	14p	BC174B	35p	BD139	78p	BFS28	£1·01	OC36	38p	2N1309	27½p	2N3711	11p	3N153	89p	BA145	22p	OA95	9p
AF115	14p	BC177	22p	BD140	91½p	BFW10	67p	OC44	13½p	2N1613	22p	2N3771	£1·82	40360	51p	BA148	22p	OA200	11p
AF116	14p	BC178	22p	BD201	£1·55	BFW11	67p	OC45	13½p	2N1711	26p	2N3772	£2·75	40361	50p	BA154	20p	OA202	12p
AF117	14p	BC179	24p	BD202	£1·37	BFW87	38p	OC71	13½p	2N1893	52½p	2N3773	£2·20	40362	50p	BA155	15½p	OA210	19½p
AF118	92p	BC182L	9p	BD203	£1·55	BFX29	43p	OC72	13½p	2N2160	£1·54	2N3819	28p	40408	55p	BA156	16½p	OA211	30p
AF124	24p	BC183L	9p	BD204	£1·37	BFX30	37½p	OC75	15p	2N2219	41p	2N3823	99p	40430	£1·39	BA182	26½p	IN914	8p
AF125	22p	BC184	9p	BF109	75p	BFX88	26p	OC81	13½p	2N2646	55p	2N3903	16½p	40432	£2·17	BA220	7p	IN916	10p
AF126	22p	BC184L	9p	BF115	25p	BFY50	16½p	OC83	25p	2N2905	46p	2N3904	19p	40673	55p	BA221	7p	IN4148	5½p
AF127	22p	BC187	27½p	BF160	25½p	BFY51	16½p	OC140	22p	2N2924	18p	2N3905	23p	AA119	10p	BA222	7½p		
AF139	35p	BC212L	11p	BF167	27½p	BR100	43p	OC170	27½p	2N2926 all	10p	2N3906	25p	AA120	10p	BAV10	11p		
AF172	25p	BC213L	11p	BF173	22p	BRY39	44p	OC171	33p	2N3053	22p	2N4058	13½p	AA129	10p	BAW62	10p		

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UNLESS SHOWN OTHERWISE P&P ON U.K. ORDERS IS 8p. OVERSEAS ORDERS AT COST

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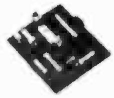
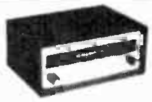
Varactor diode tuned F.M. tuning heart. **£4·15**, as described in P.E. May 1973. LP1185 matching I.F. strip, **£4·85**.

THE TEXAN
20 + 20 Watt Integrated Stereo Amplifier Kit. Superb state-of-the-art design by engineers of Texas Instruments. **£31·35** + P. & P. 49p.



SGS EA1000
3 watt amplifier module. Price including handbook and FREE heatsink. **Our price £2·49.** Quantity discounts.

A1005S
F.M. tuner chassis, fully transistorised. 9 Volt positive earth operation. **Our Price £6·35.**



A1018
F.M. tuner, similar to A1005S but in oiled walnut cabinet, etc. **Our Price £9·38.**

A1005MS
Multiplex Stereo Decoder, fully built and aligned, to match A1005S. **Our Price £5·95.**

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Audio I.C. Leaflet No. 12. FREE (only with I.C. s—10p separately.

Pre-Amplifiers
Dual. MC1303L **£1·89**
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Amplifiers
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15 watt. BHA0002 **£3·95**
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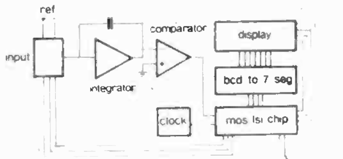
3½ decade DVM



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- Minimum Display + or − 1mV
- Can be scaled up to read 1.999V
- Automatic Polarity Detection
- Dual Ramp Integration
- Automatic Overange Indication
- Up to 50 readings per second
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Supplied with complete data
All this on a single 16 pin DIL packed MOS LSI Integrated Circuit
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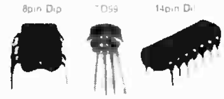
MC1312 decodes CBS SQ. Free leaflet No. 11 gives full circuit and details. **Our Price £6·49**
inc. all parts for decoder, inc. Veroboard, V.A.T., P. & P. (Leaflet alone 10p.)

Linears



	8pin Dip	TO99	14pin Dil
709	34p	40p	35p
710	35p	40p	39p
711		45p	39p
723		96p	95p
741	42p	45p	43p
747			92p
748	42p	45p	43p

CA3046	95p	MVR5V(L005)	£1·65
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R.F. CHOKES, 0·1µH to 19mH. For full details ask for List No. 5. P.&P. 5p.

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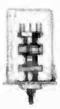

Transistor Range: Series 1T to 5T inclusive Blue, Yellow, Red and White all **44p** each.
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5pF	61p	50pF	66p
10pF	61p	60pF	79p
15pF	61p	75pF	79p
20pF	66p	100pF	75p
25pF	61p		

Type 0
365pF **80p**
365 + 365pF **96p**

Type 00
208 + 176pF with screen and trimmers **99p**

P. & P. all types 10p

NEW FERRANTI RANGE

ZN414

The Radio I.C. in a TO18 can. Supplied with our data leaflet No. 10. Giving circuits and component information. (Leaflet alone 10p.)

Our Price £1.32

BFS59	15p	ZTX302	17p	ZTX450	17p	ZS121	10p	ZS272	18p
BFS60	20p	ZTX303	14p	ZTX451	17p	ZS122	13p	ZS274	19p
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BFS96	15p	ZTX310	9p	ZTX501	13p	ZS124	18p	ZS278	37p
BFS97	23p	ZTX311	10p	ZTX502	17p	ZS140	25p		
BFS98	20p	ZTX312	10p	ZTX503	14p	ZS141	43p		
		ZTX313	11p	ZTX504	43p	ZS142	33p		
ZTX107	9p	ZTX314	13p	ZTX510	17p	ZS170	10p		
ZTX108	8p	ZTX320	31p	ZTX530	21p	ZS171	13p		
ZTX109	11p	ZTX330	15p	ZTX531	22p	ZS172	16p		
ZTX212	14p	ZTX331	16p	ZTX550	17p	ZS174	17p		
ZTX213	14p	ZTX341	22p	ZTX551	17p	ZS176	23p		
ZTX214	15p	ZTX382	13p			ZS178	38p		
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KSO30A Zener Series as BZY88 Series **11p** each.

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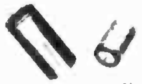
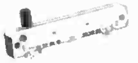


µF	4V	6.3V	10V	16V	25V	40V	63V	100V
1							6½p	8p
1.5							6½p	
2.2							6½p	
3.3							6½p	
4.7							6½p	8p
6.8						6½p	6½p	
10					6½p		6½p	9p
15				6½p		6½p		
22			6½p		6½p		6½p	11p
33		6½p		6½p		6½p		
47	6½p		6½p		6½p	6½p	8p	
68		6½p		6½p			10p	
100	6½p		6½p		6½p	8p	11p	23p
150		6½p		6½p	6½p	10p	13p	
220	6½p		6½p	8p	10p	11p	19p	31p
330	6½p		8p				22p	39p
470		6½p	10p		13p	19p	26p	48p
680		10p		13p	20p	23p		59p
1000	10p		11p	17p	22p	25p	44p	79p
1500		12p	20p	23p				
2200		18p	20p		36p	44p	79p	149p
3300		20p						
4700	29p			44p	68p	79p	149p	252p
6400				75p	93p			
10000							299p	333p

Potentiometers

5kΩ 250kΩ
10kΩ 500kΩ
25kΩ 1MΩ
50kΩ 2MΩ
100kΩ

Log or lin less switch (and 1kΩ lin)	13p
Log or lin with switch	26p
Dual less switch	44p
Dual with switch 10kΩ, 100kΩ and 1MΩ log only	57p
10kΩ log + 10kΩ antilog less switch	44p



10kΩ Single
25kΩ 33p
50kΩ Dual
100kΩ 55p

New Silver and Black Knob **16½p**

Presets

Vertical or Horizontal
0·1 watt **5½p** 0·25 watt **7p**

100Ω	1kΩ	10kΩ	100kΩ	1MΩ
250Ω	2·5kΩ	25kΩ	250kΩ	2·5MΩ
500Ω	5kΩ	50kΩ	500kΩ	5MΩ

Cermet Type to 1MΩ only **41p.**

VDR's & Thermistors

A15B	82½p	GL23	£1·10
CZ1	16½p	R53	£1·49
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CZ13A	14½p	VA1005	16½p
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E298CD A258	13p	VA1033	11p
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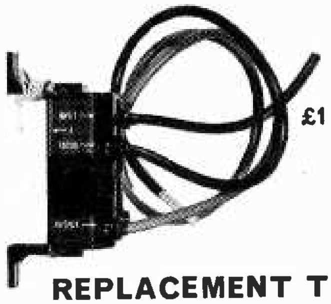
E298ED A262	11p	VA1040	11p
E298ED A265	11p	VA1053	11p
E298ED P268	11p	VA1055S	11p
E298ZZ 05	13p	VA1056S	11p
E298ZZ 06	11p	VA1066S	11p
E299DD P336	11p	VA1067S	16½p
E299DD P338	11p	VA1077	14½p
E299DD P342	11p	VA1098	21p
E299DD P348	11p	VA1104	29p
GL16	£1·10	VA1107	29p

Other types obtainable upon application

SOUTHEND ELECTRONICS

COLOUR 25 KV TRIPLERS



£1·70 + 17p V.A.T.

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UHF	£1·50	15p V.A.T.
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£1·00 10p V.A.T.

Money returned if not completely satisfied

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I.F. PANELS with Transistor & Resistors
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This Capacitor-Discharge Electronic Ignition System was recently described in Practical Wireless and has proved extremely popular. We are able to offer the kit in two forms; the standard kit containing the electronic components only, enabling the customer to tailor these to his own layout, or the de-luxe version containing a ready-drilled roller-tinned printed-circuit board and fully machined die-cast case with A.M.P Electrical Spade Connector Block. Each kit is supplied with a custom wound transformer, first grade components and full constructional details.

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Suitable for 12v systems with Pos. or Neg. earth.

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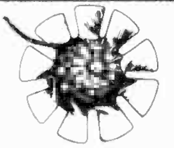

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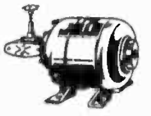

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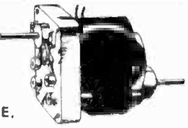

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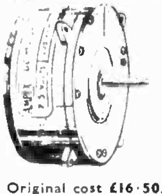

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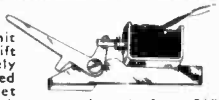

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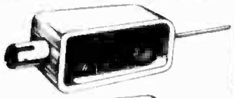

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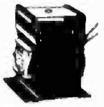

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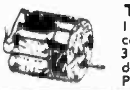

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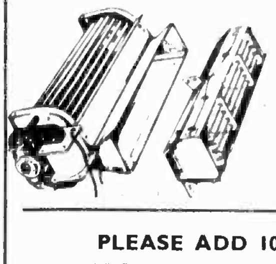

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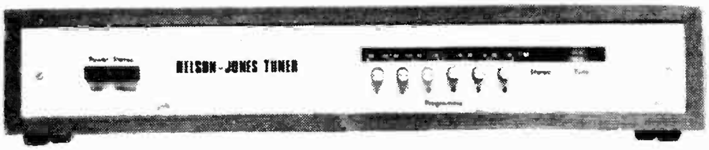

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as in 'W.W.' June '73

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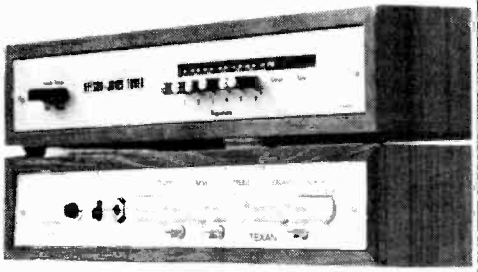

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BFX 43	30	500 MHz	20p	2N 1613	75	60 MHz	17p
BFX 86	40	50 MHz	17p	2N 2220	60	250 MHz	15p
BFY 53	30	50 MHz	10p	2N 3053	60	100 MHz	17p
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BXY 27	Varactor Diode. "S" Band. Cut-off	70 GHz	£1
BXY 28	Varactor Diode. Cut-off	100 GHz	£1
BXY 32	Frequency Multiplier. "X" Band	150 GHz	£1
BXY 35A/C	ditto	25 GHz	£1
BXY 36C/D	ditto	75 GHz	£1
BXY 37C/D	ditto	100 GHz	£1
BXY 38C/E	ditto	120GHz	£1
BXY 39C/D	ditto	150 GHz	£1
BXY 40D/E	ditto	180 GHz	£1
BXY 41C/D/E	ditto	200 GHz	£1
CV 7777 (AAY 51)	Microwave Mixer Diode	18 GHz	£2
CAY 10	Microwave Detector Diode	250 GHz	£5
AEY 13	Microwave Tunnel Diode	6 GHz	£5
AEY 16	ditto	10 GHz	£10
AEY 17	Microwave Detector	18 GHz	£3
AEY 31A	ditto	18 GHz	£3
BAW 95	Schottky Barrier Diode	12 GHz	50p

SILICON P.N.P.

Type	Voltage	Frequency	Price
BCY 71	45	200 MHz	12p
BFS 92	100	70 MHz	20p
BFS 95	40	70 MHz	17p
BFX 12	25	210 MHz	10p
2N 2906	60	200 MHz	15p
2N 3702	40	100 MHz	11p
2N 3703	50	100 MHz	12p
HIGH FREQUENCY, POWER			
BFR 64	40	1,200 MHz	£1
BLY 89A	35	650 MHz	£5
BLY 93A	60	500 MHz	£5
BLY 218	36	1,200 MHz	£2
2N 709	15	800 MHz	15p
2N 3926	36	250 MHz	£1

GERMANIUM P.N.P.

Type	Voltage	Frequency	Price
ACY 44	50	1 MHz	10p
ADY 26	80	75 watts	£1
AF 124	20	75 MHz	20p
AFY 19	32	350 MHz	20p
ASY 32	25	5 MHz	10p
ASZ 21	15	450 MHz	20p
GET 113	32		10p
GET 120	32	2 watts	10p
OC 123	50	1 MHz	10p
OCP 70	Light-sensitive		20p
2N 1307	30	10 MHz	15p
2N 1309	30	15 MHz	15p
2N 443	60	150 watts	£1

£1 100 ¼-½ WATT RESISTORS, 100 CERAMIC CAPACITORS, 100 DIODES — POSTAGE 20p — PACK No. 1

£1 100 RESISTORS, 100 CERAMIC CAPACITORS, 100 POLYSTYRENE CAPACITORS — POSTAGE 20p — PACK No. 2

£1 1 VERO-BOARD CUTTER, 5 2½ in. x 1 in. x ·15 BOARDS, 50 SQ. INS. "ODD PIECES" VERO — POSTAGE 20p — PACK No. 3

£1 100 RESISTORS, 100 CERAMIC CAPACITORS, 50 MULLARD POLYESTER CAPACITORS — POSTAGE 20p — PACK No. 4

£1 20 ASSORTED UNUSED MARKED, TESTED TRANSISTORS BC108 ETC. — POSTAGE 20p — PACK No. 5

£1 1 TRANSISTORISED SIGNAL TRACER KIT, 1 TRANSISTORISED SIGNAL INJECTOR KIT — POSTAGE 20p — PACK No. 6

£1 6 COMPUTER PANELS CONTAINING MASSES OF DIODES, TRANSISTORS, INDUCTORS, RESISTORS & CAPACITORS — POSTAGE 27p — PACK No. 7

£1 100 RESISTORS, 100 CAPACITORS (ASSORTED TYPES) — POSTAGE 20p — PACK No. 8

RECORD PLAYBACK HEADS (TRUVOX)

Individual prices of these are:—
2 track record playback heads 50p each
4 track record playback heads 72p each
Erase heads are also available separately—2 track 33p—4 track 55p
MU-metal mounting shields 39p each.
2 track-heads already fixed on heavy mounting plate with shield £1·22.

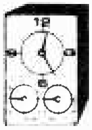
DRILL CONTROLLER

NEW 1KW MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. £1·95. Made up model also available. £2·95.

MIGHTY MIDGET

Probably the finest possible radio, as described in *Practical Wireless*, January 73. All electronic parts £2·20 post paid.



TIME SWITCH

Smith's mains driven clock with 15 amp switch, also notes showing how you can wake up with music playing, kettle boiling or come home to a warm house, warn off burglars, keep pets warm, halve your heating bill, etc. £1·95.

I CHIP RADIO

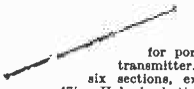
Ferranti's latest device ZN414—gives results better than superhet. Supplied complete with technical notes and circuits. £1·88 each. 10 for £11·11.

HI-Q TUNER COMPONENTS

For experimenting with the ZN414.
KIT NO. 1. Plessey Miniature Tuning Condenser with built-in LW switch and 3" Ferrite slab and litz wound MW coil, 72p.
KIT NO. 2. Air spaced tuning condenser 6" ferrite rod litz wound MW and LW coils, 94p.
KIT NO. 3. Air spaced TC with slow motion drive 8" ferrite rod, with litz wound LW and MW coils, £1·10.
KIT No. 4. Permeability tuner with fast and slow motion drive and LW loading coils, 50p.

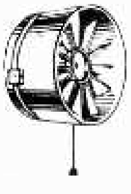
AUTO—ELECTRIC CAR AERIAL

with dashboard control switch—fully extendable to 40in or fully retractable. Suitable for 12V positive or negative earth. Supplied complete with fitting instructions and ready wired dashboard switch. £6·35 plus 25p post and insurance.



TELESCOPIC AERIAL

for portable, car radio or transmitter. Chrome plated—six sections, extends from 7½ to 47in. Hole in bottom for 6BA screw, 42p. KNUCKLED MODEL FOR F.M. 55p.



EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic ft. per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc., it's so quiet it can hardly be heard. Compact, 5½" casing with 5½" fan blades. Kit comprises motor, fan blades, sheet steel casing, pull switch, mains connector, and fixing brackets, £2·75 plus 20p post and ins.

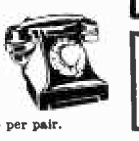
MAINS OPERATED SOLENOIDS

Model 772 — small but powerful 1in. pull— approx size 1½ × 1¼ × 1½in. 66p. Model 4001/—¾in. pull. Size 2¾ × 2 × 14in. 83p. Model TT1—1½in. pull. Size 3 × 2½ × 2in £1·98 plus 20p post and insurance

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer rectifier, smoothing and load resistor condensers and instructions. Real snip at only £1·10 plus 20p postage.

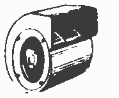
DESK TELEPHONES



Ex G.P.O. Black standard model with dialling dial but no internal bell. Supplied with connection diagram £1 each. Ditto with bell but without dialling dial £1·25 model as illustrated with bell and dial £1·50 each plus 50p post for single then 65p per pair.

SMOKE WILL KILL—GAS WILL KILL—FIRE WILL KILL

But, if you install SAGA (our smoke and gas alarm) your family will have the latest electronic protection against these killers.
Saga uses a fantastic electronic sensor which "smells" smoke and gas and sounds the alarm immediately. In a neat case measuring approx. 5" × 3½" × 2½", it has its own internal alarm, also a connector for additional bells. You just plug it in to the mains and hang it near the ceiling. Saga uses so little electricity that it will hardly move the meter, leave it on always to give night and day protection. £6·99 plus 30p post or Kit of Parts £5·99. Battery Model Kit only £4·99.



CENTRIFUGAL FAN

Mains operated, turbo blower type. Pressed steel housing contains motor and impeller. Motor is 1/10th h.p. giving considerable air flow but virtually no noise. Approx. dimensions 10½ in. wide × 12 in. dia. outlet into trunking 10½ × 4½ in. £6·55 plus £1 post and insurance.

STANDARD WAFER SWITCHES

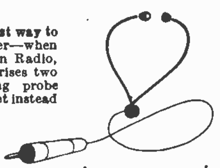
Standard size 1½" wafer—silver-plated 5 amp contact, standard ¼" spindle 2" long—with locking washer and nut.

No. of Poles	2way	3 way	4way	5way	6way	8way	9way	10way	12way
1 pole	44p	44p	44p	44p	44p	44p	44p	44p	44p
2 poles	44p	44p	44p	44p	44p	44p	44p	77p	77p
3 poles	44p	44p	44p	44p	77p	77p	77p	£1·04	£1·04
4 poles	44p	44p	44p	77p	77p	77p	77p	£1·32	£1·32
5 poles	44p	44p	77p	77p	£1·04	£1·04	£1·04	£1·60	£1·60
6 poles	44p	77p	77p	77p	£1·04	£1·04	£1·04	£1·87	£1·87
7 poles	77p	77p	77p	£1·04	£1·32	£1·32	£1·32	£2·15	£2·15
8 poles	77p	77p	77p	£1·04	£1·32	£1·32	£1·32	£2·42	£2·42
9 poles	77p	77p	£1·04	£1·04	£1·60	£1·60	£1·60	£2·70	£2·70
10 poles	77p	77p	£1·04	£1·32	£1·60	£1·60	£1·60	£3·00	£3·00
11 poles	77p	£1·04	£1·04	£1·32	£1·87	£1·87	£1·87	£3·25	£3·25
12 poles	77p	£1·04	£1·04	£1·32	£1·87	£1·87	£1·87	£3·52	£3·52

TWENTYLITE

Fluorescent lighting units with polyester choke and finished white enamel. 2ft. model. Ideal kitchen, bedroom, hallway, porch, lift, etc., with tube. Assembled ready to install. Price £2·50 + 25p p. & p.

RADIO STETHOSCOPE



Easiest way to fault find—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 earpiece. £2·20—twin stethoset instead of earpiece 88p. extra—post and ins. 20p

TANGENTIAL HEATER UNIT

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing £15 and more. We have a few only. Comprises motor, impeller, 2kW, element and 1kW. element allowing switching 1, 2 and 3kW, and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only needs control switch. £3·85. 2kW. Model as above except 2kW. £2·75. Don't miss this. Control Switch 39p, P. & P. 40p.

ROOM THERMOSTAT. Made by the famous Smiths Company. 15 amp. at 250v. Elegant white and beige case, size 4½ inches long by 1½ square approx. Adjustment is by slider (lockable) adjusts through range 30°—90°F. Special Snip price £1·65

CAPACITOR DISCHARGE CAR IGNITION

This system which has proved to be amazingly efficient and reliable was first described in the *Wireless World* about a year ago. We can supply kit of parts for an improved and even more efficient version (*Practical Wireless*, June). Price £6·55 plus 20p post. When ordering please state whether for positive or negative systems. De-luxe model including printed circuit board, etc. £7·95.

24-HOUR TIME SWITCH

Made by Smiths, these are AC mains operated, NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. Two completely adjustable time periods per 24 hours. 5A changeover contacts will switch circuit on or off during these periods. £2·75 post and ins. 25p. Additional time contacts 55p pair.

PHOTO ELECTRIC KIT

Contains photo cell, relay, transistor and all parts to make light operated switch. £1·75 plus 20p post and ins.

MULLARD UNILEX STEREO AMPLIFIER

We demonstrate these daily and almost always a sale results; it really is a cracking amplifier. Only Mullard with their know how could have made it possible at this low price. SPEC.: Mains operated. 4 watts music or speech per channel. Double wired power supply eliminates cross talk. Harmonic distortion less than 2%. Frequency response 50hz—16Khz. Input suitable for pick-up tuner or microphone. 6 month guarantee. Only £11·30 post paid, pair of ohm speakers £3·30.

NEW ITEMS THIS MONTH

White Rocker Switches. Four types available, all snap in fixing through oblong hole approx. 1" × 7/16", all rated at 10 amps AC. All have white rocker except S3, which is amber.
Our ref RS S1, push to make, spring return, 14p.
Our ref RS S2, push to break, spring return to on, 14p.
Our ref RS S3, change over contacts, luminous rocker, 28p.
Our ref RS S4, change over contacts, normal rocker, 16p.
Rocker Switches. 15 amp Britmac panel mounting, hole size 1½ × ⅞. Our ref RS S5 price 11p each. 5 amps made by Mem, their type ref 1600, our ref RS S6, price 11p each.
Miniature Hand Microphone. Dynamic, for tape recorders but equally suitable for amplifiers, good quality with lead and plug, price £1·37.
Open Coil Relays. All with 10 amp change over contacts, all brand new.
Our ref REL S1, 12 volt DC coil, double pole, 44p.
Our ref REL S2, 110 volt AC coil, treble pole, 44p.
Our ref REL S3, 250 volt AC coil, treble pole, 55p.
Photo Transistor Bargain. First class maker but slightly reject, covered, however, by our normal six month guarantee, these respond to light or infra red. Will work a burglar alarm system, make detector counter etc. Price 22p complete with three circuits.
Mains Flex. Padded, circular, cotton covered overall. Six amp (23·36) 100 yard coils. Price £2·75 plus 50p post.
Screened Cable. 70076 core suitable for pick up or mike lead or for inter-connecting amplifiers. 10 metres, 33p.
Stereo Pre-amp Module. Mullard ref LP 7182/2—transistors and all ancillary components mounted on PC board, £1·32 with connection dig.

GOOD COMPANION I.C. VERSION

We can now offer these again in I.C. version using Ferranti ZN414 and Mullard AF Module 1172. Cabinet size approx. 11" wide × 8" high × 3" deep. Complete assembly instruction. Excellent tone wood cabinet, £5·75 plus 25p post and insurance.

MOTORS FOR £1·50

As used in racing cars and power models. All battery operated and reversible.

RESISTANCE WIRE

Mainly Nickel Chrome. (Resistances 74 ohms per metre down to 1 ohm per metre). Price 15p per oz. on catch weight reels—so please send an open cheque—we will send the smallest reel over the quantity you want and make your cheque out for the quantity sent. You return the "over" amount within 1 month and we will refund for the amount you return. 25p returnable charge for reel.
Special Offer. 1 yard of 1·1mm wire. This is almost exactly 1 ohm. 10p.

PC BOARD MARKER

Valve action fire tipped marking pen filled with black etch resist—it's easy with this to make a perfect PC board, just draw straight on to the copper—allow 15 mins. to dry, then immerse in ferric chloride or other etchant on removal the circuit stands in high relief, 99p.
SL103D. Plessey IC, three watt amplifier which works with the Ferranti ZN414 to become probably the first two IC radio in existence, the circuit and constructional details appeared in September's *Practical Wireless*, so we can supply the SL103D at £1·75, the ZN414 at £1·35 also most other items, send for PW IC radio parts list.

EDUCATIONAL KITS—all with pictorial instructions

With 3 kits or more we give FREE an accurate 11 piece balance kit. Price of kits 44p each post paid. Special price for all 7 kits £3·00 with free balance kit.
KA2 Lens Kit. Eleven parts, concave lens, one convex lens, stage and slit frame, etc.
KA3 Water Pump Kit. Thirteen parts. Transparent so that operating parts may be observed. You can make Lift Pump, Force Pump and Force Pump with reservoir and nozzle.
KA4 Buzzer Kit. Eleven parts. Operation of buzzer seen.
KA7 Electro-Magnet Kit. Fifteen parts, includes compass, showing how magnetism works.
KA8 Current and Resistance Kit. Twenty-nine parts, including bench and light bulb. Learn "OHMS LAW", etc.
KA9 Bell Kit. Eight parts, including bell and push button switch. Build a complete electric bell.
KA10 Morse Key buzzer and bell kit. 25 part kit easy to construct, simple to operate.

TERMS: 10% discount if ten of an item ordered, send postage where quoted—other items, post free if order for these items is £6·00 otherwise add 20p.

J. BULL (ELECTRICAL) LTD.

(Dept. P.W.) 7 Park Street, Croydon CRO 1YD
Callers to: 102/3 Tamworth Road, CROYDON

Henry's

PANEL METERS · TRANSFORMERS · CONTROLS · RELAYS
IRONS · TOOLS · VALVES · POT CORES MOST TYPES OF COMPONENTS
You need a catalogue! 55p post paid complete with Discount Vouchers

UK's LARGEST RANGE OF KITS & GADGETS

TEST EQUIPMENT

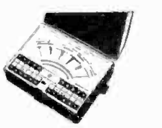
MULTIMETERS
(carr. etc. 30p)

200H (M210)	20K/Volt Slimline with case	4·95
TLH33D	2K/Volt Robust with case	4·95
U437	10K/Volt Steel case. AC up to 40 KHz	4·95
U4324	20K/Volt with AC current ranges	8·00
AF105	50K/Volt with Leather case	9·50
U4313	20K/Volt AC current. Steel case	10·50
U4341	Plus Built in transistor tester	10·50
Model 500	30K/Volt	9·95

OTHER EQUIPMENT

SE250B	Pocket Signal Injector	1·90 carr. 15p
SE500	Pocket Signal Tracer	1·50 carr. 15p
TE15	Grid Dip meter 440kHz–280mHz	13·45 carr. 30p
TE40	AC Millivoltmeter 1·2mHz	18·75 carr. 35p
TE65	28 Range valve voltmeter	19·25 carr. 40p
TE20D	120kHz–500mHz RF Generator	16·95 carr. 40p
TE22D	20Hz–200kHz Audio Generator	18·75 carr. 40p
SE350A	Deluxe Signal Tracer	9·95 carr. 20p
SE400	Volts/ohms/R-C sub./RF field/RF gen.	11·25 carr. 20p

New Revolutionary Supertester 680R

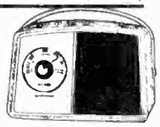


Accessories		
	680R Multi-tester	18·50
	Transistor tester	11·00
	Electronic voltmeter	18·00
	Ampclamp	11·95
	Temperature probe	11·95
	Guass meter	11·95
	Signal Injector	5·95
	Phase Sequence	5·95
	EHT Probe	5·95
	Shunts 25/50/100A	4·50 each

A SELECTION OF INTERESTING ITEMS

C3025	Compact transistor tester	5·50 p & p 15p
E1300	Mono mag. cart. preamp.	1·95 p & p 15p
E1310	Stereo mag. cart. preamp.	4·95 p & p 25p
Easiphone telephone amplifier		6·15 p & p 25p
D1203	Teleamp. with PU coil	3·60 p & p 20p
LL1	Door Intercomm. and chime	11·95 p & p 25p
Chattalite (lights as you talk)		13·90 p & p 20p
1 Kw Dimmer/controller		3·00 p & p 10p
9" Twin spring unit For		2·75 p & p 15p
16" Twin spring unit Reverbs		6·50 p & p 25p
Car Tachometer Electronic		7·50 p & p 15p
VHF 105 Aircraft Band Corrector		3·95 p & p 15p
B2005 4 Ch. mic. mixer		2·95 p & p 15p
B2004 2 ch. Stereo mixer		4·75 p & p 15p

BUILD THIS RADIO



Portable MW / LW radio kit using Mullard RF/IF module. Features MW — bandspread for extra selectivity. Slow motion tuning. Fibre glass PVC cabinet. 600MW output. All parts **£7·98** (battery 22p), carr. etc. 32p.

EXCLUSIVE: SPECIAL OFFERS

MW/LW CAR RADIO
+ or − Earth with speaker and fixings. £6·50 carr./packg. 30p.

8 TRACK CAR STEREO
(− Earth) with speakers in Pods & fixings. £12·50 carr/packg. 40p.

HANIMAX HC1000
Battery cassette recorder. £10·50 carr/packg. 25p.

HANIMAX HC2000
Battery/Mains cassette recorder. £13·50 carr/packg. 30p

AKAI GXC40
Stereo cassette recorder. £59·95 carr/packg. 50p.
Pair Akai ADM microphones. £6·95 carr/packg. 20p.

5 WAVEBAND PORTABLE TWIN SPEAKER RADIO. FM/MW/SW/AIRCRAFT—PUBLIC SERVICES. £10·45 carr/packg. 20p.

PORTABLE CASSETTE TAPE PLAYER—
for car or carry around. £7·25 carr/packg. 20p.

HANIMAX POCKET CALCULATOR WITH % KEY. £33·50.

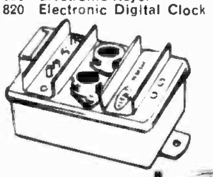
SPECIAL PURCHASES

AVOMETER MOVEMENTS
AVO 8 or 9 50μA MOVEMENTS. Ex Brand New AVO's £3·50 Post 20p.

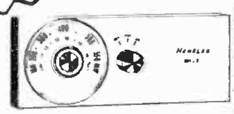
UHF TV TUNERS CHANNELS 21 TO 64
Brand new transistorised geared tuners for 625 Line Receiver IF output. £2·50, Post 20p.

EASY TO BUILD KITS BY AMTRON— EVERYTHING SUPPLIED

Model No.		
310	Radio control receiver	2·98
300	4-channel R/C transmitter	5·95
345	Superhet R/C receiver	5·95
455	AM signal generator	12·33
65	Simple transistor tester	1·40
115	8 watt Amplifier	3·90
120	12 watt amplifier	4·70
125	Stereo control unit	5·70
130	Mono control unit	3·60
605	Power supply for 115	4·55
610	Power supply for 120	4·55
615	Power supply for 2 x 120	5·73
230	AM/FM aerial amplifier	2·93
240	Auto packing light	5·90
275	Mic. preamplifier	6·08
570	LF generator 10Hz–1mHz	15·80
575	Sq. wave generator 20Hz–20Khz	14·60
590	SWR meter	12·85
620	Ni-CAD Charger 1·2–12v	8·00
630	STAB Power supply 6-12v 0·25-0-1 A	8·15
690	DC motor speed Gov.	2·87
700	Electronic Chaffinch	7·00
705	Windscreen wiper timer	6·80
760	Acoustic switch	10·75
780	Metal Detector (electronics only)	9·65
790	Capacitive Burglar alarm	6·85
835	Guitar preamp.	4·25
840	Delay car alarm	6·15
875	CAP. Discharge ignition for car engine (−Ve Earth)	13·15
80	Scope Calibrator	2·25
255	Level Indicator	6·15
525	120–160mHz VHF timer	11·30
715	Photo cell switch	7·70
795	Electronic continuity tester	4·30
860	Photo timer	13·25
871	Slide projector auto feed control	7·15
235	Acoustic Alarm for driver	7·60
465	Quartz XTAL checker	8·75
220	Signal Injector	2·30
390	VOX	15·50
432	Testakit	19·30
670	Buffer Battery Charger	6·55
885	Capacitive Contact Alarm	6·25
850	Electronic Keyer	18·75
820	Electronic Digital Clock	58·50



ALL KITS OFFERED SUBJECT TO STOCK AVAILABILITY



BUILD THIS TUNER

MW/LW Radio Turner to use with any amplifier. Features Mullard RF/IF module Ferrite aerial, built in battery. Excellent results. Size 7" x $2\frac{1}{4}$" x $3\frac{1}{4}$". All parts £4·85, carr. 15p.

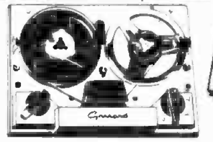
MULTI-USE & RADIONIC KITS

10–1	10 Projects	3·60
50–1	10 Projects	8·00
150–1	150 Projects	13·20
Telephone Communicator		7·20
X20	20 (Elec.) } Projects	4·95
X40	40 (radio) } Projects	9·45

(carr./packing 40p)

All transistor circuits with hand books

All types offered subject to availability. Prices correct at time of press E & OE. 10% VAT TO BE ADDED TO ALL ORDERS. UK post etc. 15p per order unless stated.



GARRARD BATTERY TAPE DECK

GARRARD 2 speed 9 volt tape decks. Fitted record/play and oscillator/Erase heads. Wind and rewind controls. Takes up to 4" spools. Brand new complete with head circuits.
£9·50 carr. 30p

TOP QUALITY SLIDER CONTROLS

60mm stroke high quality controls complete with knobs (post, etc. 15p any quantity).

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Complete with knobs.

MARRIOT TAPE HEADS

4 TRACK MONO or 2 TRACK STEREO
'17' High Impedance £2·00
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R730/E73 2 track mono Record/Erase low Imp. 75p pair.
Erase Heads for '17' and '18' 75p
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'43' Erase Head for '63' 75p
(Post, etc. 15p any quantity).

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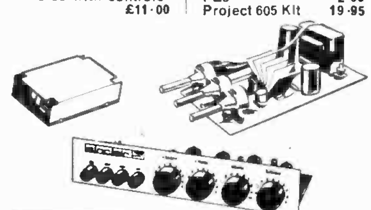
AMPLIFIERS (carr., etc. 20p)

4-300, 0·3 watt 9 volt	1·75
104, 1 watt 9 volt	2·20
304, 3watt 9 volt	2·50
555, 3 watt 12 volt	2·85
E1208, 5 watt 12 volt	4·50
608, 10 watt 24 volt	4·10
410, 10 watt 28 volt	4·95
Z30, 15 watt 30 volt	3·57
E1206, 30 watt 45 volt	9·75
Z50, 30 watt 50 volt	4·37
E1210, $2\frac{1}{2}$ + $2\frac{1}{2}$ watts 12 volt	5·25
RE500, 5 watt IC mains operated Amplifier with controls	£6·30
SAC14, 7 + 7 watt Stereo with controls	£8·00
SAC13, 15 + 15 watt Stereo with controls	£11·00

SINCLAIR PROJECT 60 (carr. 20p)
Z30 3·57 Z50 4·37
Stereo 60 Preamp. 7·97
PZ5 £3·97, PZ6 £6·37
PZ8 (for Z50) £4·77 (TRANS £2·95)
AFU £4·45
New SINCLAIR PROJECT 80

Stereo Preamp.	9·50
Audio Filter Unit	5·50
Z40 15 Watt Amp.	4·30
Z60 25 Watt Amp.	5·50
PZ5 Mod. for 1 on 2 Z40	3·98
PZ6 Mod. (S Tab) 1 on 2 Z40	6·25
PZ8 Mod. (S Tab) 1 on 2 Z60	6·30
TRANSFORMER FOR PZ8	2·95
Project 605 Kit	19·95



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Henry's RADIO LIMITED
EDGWARE ROAD, W2

SEE FACING PAGE FOR ADDRESSES

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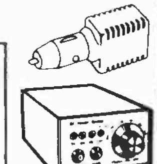
0·01 Diam. Mono Filament £1·50 per 25 metre reel
0·13 Diam. 64 Fibres Sheathed. £1·00 per metre
SPRAYS 15mm Diam. Mares Tails £9·50.



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	4000 Mk II	23·95
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	TSA151	34·85
	AA2	30·80
	AA4	42·45
	AA6	55·95
HOWLAND WEST	DA1000	22·45
HENELEC TEXAN	Kit	28·50
HENELEC TEXAN	Built	35·00
NIKKO	TRM300	25·95
	TRM400	32·50
PIONEER	SA500A	34·25
ROTEL	RA 211	32·65
	RA311	41·15
	RA611	60·80
	RA810	75·75
	RA1210	92·50
SINCLAIR	2000	22·95
	3000	28·95
TANDBERG	TA300	66·10
TELETON	SAQ206B	22·50
	SAQ307	22·50
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	AT580	94·50
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EAGLE	AA8	40·50
	TST152	29·45
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HENELEC Stereo Built		24·95
HOWLAND WEST	DA1000T	25·35
PIONEER	TX500A	48·75
ROTEL	RT222	32·65
	RT322	43·75
	RT622	65·40
SINCLAIR	2000	26·95
	3000	26·95
TELETON	GT202	30·50

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TATE 4	Chassis	19·95
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250		53·75 pr.
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150	15 watt	27·50 pr.
200	20 watt	34·50 pr.
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A10	20-60 watts	43·00 pr.
A25	20-60 watts	69·00 pr.
A35	20-60 watts	79·00 pr.
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Linton 2	20 watt	32·65 pr.
Melton II	25 watts	51·80 pr.
Triton	25 watt	40·80 pr.
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250	18 watt	44·30 pr.
CELESTION		
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COUNTY	25 watt	33·60 pr.
15	30 watt	50·40 pr.
44	44 watt	81·20 pr.

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	N2211	19·95
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	G800	3·95	G820	6·70
	G800H	3·95	G820E	10·00
	G800E	5·95	G820SE	13·35
ADC				
	Q36	10·70	Q30	5·90
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	F3E	11·25	F2	18·75
EMPIRE			999TEX	14·95
			999REX	3·70
			999QUX	4·80
			999XEX	8·50
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Complete with Speakers (c./p. £1·25)

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Sanyo	GXT4730KL	97·50
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Philips	RH802	159·95
Philips	RF836	57·20
Philips	GF826	41·75
Philips	RH811/RH421	84·95
Philips	RF839	55·95
Philips	GF829	39·95
Philips	GF815	47·75
Philips	GF808	65·75
Philips	RH814/RH411	96·75
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(with MW/FM stereo radio)

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Crown 9TV	9"	46·50
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Teleton TW12	12"	46·95
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Amerex	AC101	12·00
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PYE	9115	27·75
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(carr. etc. 30p)

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	ACR201	30·00
Elizabethan	LZ416	27·25
	LZ516	29·10
BASF	CC9301	50·75
Philips	RR322	28·75
	RR413	33·90
	RR712	48·30
Sanyo	M4141FG	43·20
	M2400W	36·90
	M2400FG	36·90
	M4400FG	68·50
Grundig	C250	47·95
Hitachi	TRK1240E	29·50
	TRS1161	35·00
	KCT1210L	33·50

STEREO RECORDER DECKS (carr./packing 50p)

Cassette		
Philips	N2506	44·50
	N2510	£87·10
Pye	9145	44·50
Tandberg	TCD300	112·00
Akai	CS30D	50·65
	CS33D Dolby	62·50
	GXC36D	65·15
	GXC40D	57·40
	GXC38D Dolby	81·45
	GXC46D Dolby	89·15
	GXC45D	74·30
TEAC	A250/A350—A450	Stocked
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Akai	4000DS	62·50
Tandberg	3321X/3341X	107·70

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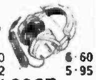

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			G3000	6·60
ASE11	4·75		G2222	5·95
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ASE22	8·25		MD802	1·95
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SH850GX	3·95		SE20A	5·90
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AKG			SE50	16·35
K60	9·25		SEL20	7·90
ROTEL			SEL25	11·15
RH630	4·85		SEL40	12·99
RH700	6·75		**ACCESSORIES**	
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HD414	11·25		JB3DE Din Junction Box	1·60
WHARFEDALE			JB11D De Luxe Junction Box	1·95
DD1	8·95		0250 Phone Switch	4·75
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K6	9·95		G1305 Controller	2·15
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KRD711	7·95		T5A	4·95
HV1	17·50		T10A	8·50
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K0747	15·95			
PR04AA	21·95			
PR05LC	23·95			
HOWLAND WEST				
CIS200	2·75			
CIS250	5·25			
CIS1000	7·50			
CIS2000	15·25			

8 Track

Akai	CR81D	53·60
	CR80DSS	93·65

STEREO RECORDERS
(carr./packing 70p)

Akai	1721L	67·20
Cassette		
Akai	GXC40 Dolby	59·95
	GXC46 Dolby	89·95
Philips	N2400/RH411	63·75
	N2401/RH411	74·50
	N2401S/RH411	79·95
	N2405/RH401	49·50
8 Track		
Akai	CR81	66·20

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Goodmans Module 80		59·20
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Goodmans One/Ten		88·50
Pioneer	SX525	90·75
	SX626	124·75
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Tandberg	TR200MPX	85·15
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	TR1010MPX	149·95
Teleton	TSF55	57·20

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Complete with Speakers

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PYE 2253	28·40
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Complete with speakers

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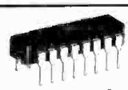

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7444	£1·30	£1·25	74116	£1·00	95p	74198	£5·55	£5·10
7445	£1·80	£1·76	74119	£1·35	£1·25	74199	£5·55	£5·10
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301A	TO99	69p	741c	TO99	41p
301A	8 PIN DIL	66p	747c	DIL	46p
307	DIL	69p	748c	DIL	39p
307	TO99	69p	748c	TO99	41p
307	8 PIN DIL	66p			
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47μF 6½p
100μF 6½p
220μF 6½p
330μF 6½p
1000μF 13p
4700μF 29p

6·3 VOLT
33μF 6½p
68μF 6½p
150μF 6½p
470μF 11p
680μF 13p
1500μF 18p
2200μF 18p
3300μF 26p

10 VOLT
22μF 6½p
47μF 6½p
100μF 6½p
220μF 8p
330μF 10p
470μF 10p
1000μF 11p
1500μF 20p
2200μF 24p

16 VOLT
15μF 6½p
33μF 6½p
150μF 6½p
150μF 8p
220μF 9p
680μF 17p
1000μF 17p
1500μF 25p
2000μF 43p

25 VOLT
10μF 6½p
22μF 6½p
47μF 6½p
100μF 8p
150μF 8p
220μF 10p
470μF 13p
680μF 20p
1000μF 22p
2200μF 39p
5000μF 68p

40 VOLT
6·8μF 6½p
15μF 6½p
33μF 6½p

40 VOLT
47μF 6½p
100μF 9p
68μF 10p
220μF 11p
470μF 19p
680μF 25p
1000μF 25p
2200μF 44p

63 VOLT
1μF 6½p
2·2μF 6½p
4·7μF 6½p
6·8μF 6½p
10μF 6½p
22μF 6½p
68μF 10p
100μF 11p
150μF 13p
220μF 19p
330μF 22p
470μF 26p
1000μF 44p

VOLUME CONTROLS
Potentiometers
Carbon track 500 Ω to 2·2M Ω.
Log or Linear.
Single 13p. Dual gang (stereo) 44p.
Single type with D.P. switch 13p extra.

CARBON SKELETON PRESETS
Small high quality type (linear only). All valves 100-5 meg ohms.
—1 watt 6p each
—2·5 watt 6½p each

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P.I.V.	50	100	200
1 Amp	28p	35p	41p
3 Amps	44p	50p	60p

P.I.V.	300	400
1 Amp	44p	53p
3 Amps	—	60p

SLIDE SWITCH
SPST 11p each. D.P.D.T. 13p each.

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240V or 110V 1·4 5p. 5 plus 4½p each.

Mullard Polyester Capacitors

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400V: 0·001μF, 0·0015, 0·0022, 0·0033, 0·0047 3p. 0·0068, 0·01, 0·015, 0·022, 0·033 3½p. 0·047, 0·068, 0·1 4½p. 0·15 6½p. 0·22 8½p. 0·33 12p. 0·47 14½p.
160V: 0·01μF, 0·015, 0·022, 0·033, 0·047, 0·068 3½p. 0·1 4p. 0·15 4p. 0·1 4½p. 0·15, 0·22 5½p. 0·33 7p. 0·47 9½p. 0·68 12p. 1μF 14½p. 1·5μF 22p. 2·2μF 24p

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We have been appointed stockists of Amtron high quality Construction Kits. (20p P.P. on all kits).

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BZY88 Series 3·3 volt to 33 volt.

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Specifications

Frequency:	500 Hz
Harmonics:	up to approx. 30 MHz
Output voltage:	1 V peak-to-peak
Maximum voltage applicable to the probe:	500 V DC
Power supply:	1·4 V DC
Transistors:	(2) BC208B

£2·57

UP TO 25% DISCOUNT OFF ALL OUR SEW CLEAR PLASTIC PANEL METERS

MR38P 1 21/32" Square fronts

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1 watt 10% carbon	2½p

range 10 ohms to 4·7 megohms.

½ watt m/o 2%	3p

range 10 ohms to 1 megohms.

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ACY39 68p
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BC145 26p
BC147 9p
BC148 9p
BC149 9p
BC153 16p
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U27	45p	UF80	30p	1S5	30p	5Z3	70p	6AT6	30p	6CH6	55p
U191	65p	UF89	35p	IT4	30p	5Z4	75p	6AU6	20p	6CL6	50p
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COLOMOR ALL valves guaranteed

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6SK7	45p	30P19	70p
6SL7GT	35p	30PL1	70p
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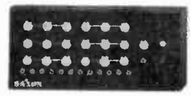

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- Channel section modules, for building your own mixer. Gain—16 x (24dB). Tone controls—18dB swing. Carr. pd. £3·50 + V.A.T.

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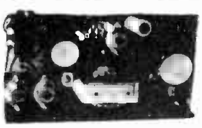

Rugged class A driver stage, this module will run from all our mixers, etc., and most other makes. Delivers 120 watts into an eight ohm load and employs 4 T03 can (115 watt) output transistors. These are the modules where extra power is demanded.

Power output	120 watts on 8 ohms
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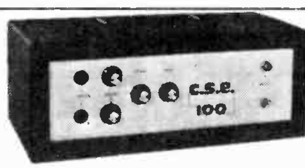

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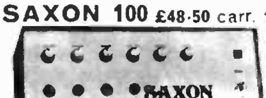

With an RMS output of 120 watts speech and music, 100 watts continuous power, four individually controlled FET input stages and wide range base and treble controls, this amplifier has established itself as a unit offering quality and reliability at low cost.

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Noise	Better than −75dB
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Size	4½" x 4" x 1" (SA 100) 4" x 3" x 1" (SA35/SA50)

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1	CF	22-1M	1	0·8	0·65	0·62	0·55	0·5	0·45	5·5×16
¼	MF	10-2M7	1	0·9	0·8	0·7	0·65	0·65	0·6	3×7
½	MF	10-2M2	1	0·9	0·8	0·7	0·65	0·65	0·6	4·2×10·8
1	MF	10-10M	1·5	1·25	1·25	1·1	1	0·95	0·88	6·6×13
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6·8μF	63V	6p	150μF	63V	15p
8·0μF	40V	6p	220μF	6·4V	6p
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10μF	25V	6p	220μF	16V	8p
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15μF	63V	6p	330μF	63V	25p
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22μF	25V	6p	470μF	40V	20p
22μF	63V	6p	680μF	16V	15p
32μF	10V	6p	680μF	40V	25p
33μF	16V	6p	1000μF	16V	20p
33μF	40V	6p	1000μF	25V	25p
32μF	63V	6p	1500μF	6·4	15p
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Fun With HI-FI

In this book Gilbert Davey defines exactly what high fidelity sound is. He describes the different links in the hi-fi system—the playing deck, cartridge, tuner, amplifier, loudspeaker and loudspeaker assembly—and the part each plays in the reproduction of hi-fi sound. He tells the reader what kind of equipment is available today, and concludes with the latest developments in stereo headphones and four-track stereo—'quadraphonic sound'. Fully illustrated, £1·15.

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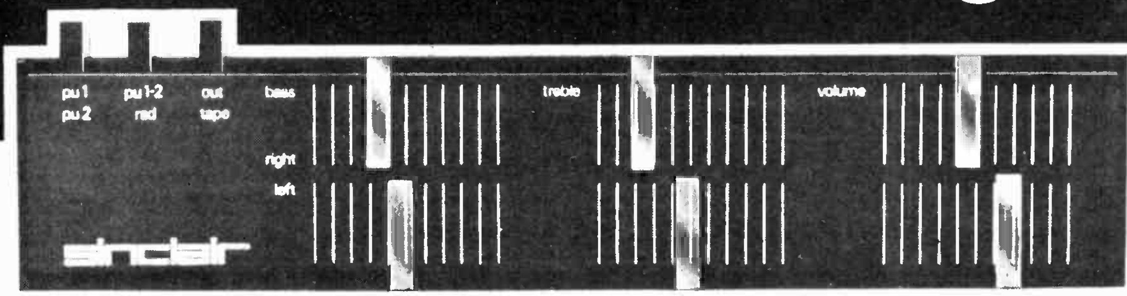
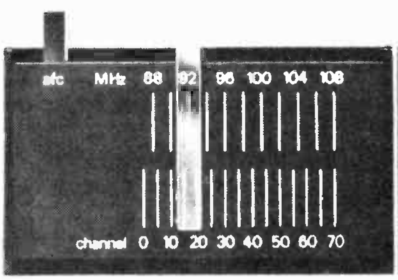
Project 80

...exciting new thinking in modular hi-fi design

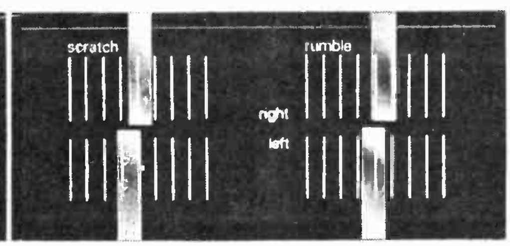


Stereo 80 pre-amplifier/control unit



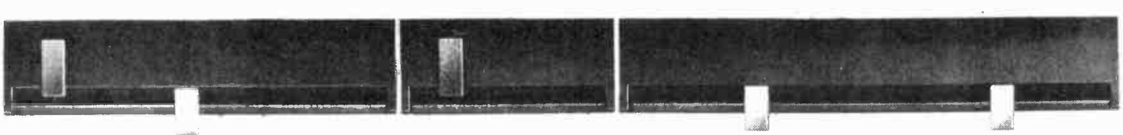
Project 80 tuner

Stereo decoder



Project 80 Active Filter Unit (AFU)

the slimmest, most elegant hi-fi modules ever made



Living with hi-fi takes on new meaning now that Project 80 is here. These amazing new modules mark a brilliant technical advance all round; their size and presentation bring exciting new opportunities to install systems in ways hitherto only dreamed about but never before made practical. You can build a Project 80 system virtually anywhere and it is unbelievably simple to install and connect up. Everything that could possibly be wanted in a top quality do-it-yourself domestic hi-fi system will be found in Project 80 – compactness, elegantly ultra-modern styling, ease of fixing and operation, new control methods, and above all superb performance. New as well as popular established ideas on installation are featured on page four of this announcement to provide just a few examples of the system's fantastic versatility.

sinclair

Project 80 new modules

Stereo 80 pre-amplifier and control unit

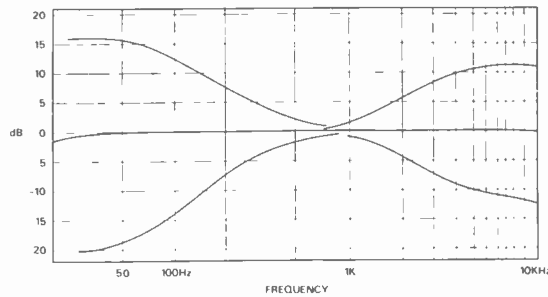
As with other Project 80 units, the Stereo 80 is mounted by means of two bolts fixed at the rear which pass through holes drilled in the wood or plastic on which modules are to be mounted. *All the electronics are contained within the ¾" deep front panel!* Connecting leads are taken away similarly out of sight Each channel in the Stereo 80 has its own independent tone and volume controls operated by sliders This enables exceptionally good environmental matching to be obtained. Provision is made for magnetic and ceramic pick-ups, radio and tape in and out A virtual earth input stage forms part of the up-dated circuitry of the Stereo 80 to ensure the finest possible quality from all signal sources Generous overload margins are allowed on all inputs Clear instructions with template are supplied.

TECHNICAL SPECIFICATIONS
Size – 260 · 50 × 20mm (10¼ × 2 × ¾ins)
Finish – Black, with white markings
Inputs – Mag P U. 3mV RIAA corrected; Ceramic P U 300 mV
Radio 300 mV; Tape 30 mV
S/N ratio – 60db
Frequency range – 20Hz to 15KHz ± 1dB 10Hz to 25KHz ± 3dB
Power requirements – 20 to 35 volts
Outputs – 100mV + AB monitoring for tape
Controls – Press button for tape, radio and P U selection Volume, Bass + 12dB to – 14dB at 100Hz, Treble + 11dB to – 12dB at 10KHz

NEW

- For P.U., radio and tape
- Tape monitoring switch
- Two-hole fixing

RRP £11.95 + £1 19 VAT

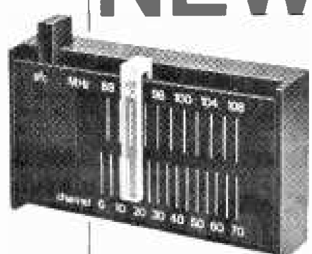


Project 80 FM tuner smaller, more efficient

A truly remarkable tuner in every way – its unbelievably compact size – its original circuitry – its dependable performance – all this in a boldly designed modern case measuring 85 × 50 × 20mm (3½ × 2 × ¾ins). Greater adaptability (and possibly financial convenience) results from the tuner and stereo decoder section being made available separately.

TECHNICAL SPECIFICATIONS
Size – 85 · 50 · 20mm (approx. 3½ · 2 · ¾ins)
Tuning range – 87 to 108 MHz
Detector – I C balanced coincidence, for good A M rejection
AFC – Switchable, with thermistor control to prevent from drift
One 26 transistor I.C.
Twin dual varicap tuning
Distortion – 0 3% at 1KHz for 75KHz deviation
Ceramic filter in I.F. section
Aerial impedance – 75 Ω or 240-300 Ω
Sensitivity – 4 microvolts for 30dB quieting
Power requirements – 12 to 45 volts

NEW



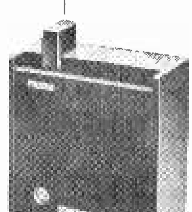
- AFC switch
- Twin dual varicap tuning
- 4-hole ceramic filter
- Slider tuning

RRP £11.95 + £1 19 VAT

NEW

Project 80 stereo decoder

Making the Project 80 decoder separate from the F.M tuner gives the constructor a wider choice of systems as well as saving money in cases where stereo reception may not be required This unit gives a 40dB channel separation with an output of 150mV per channel The gallium arsenide light emitting beacon automatically lights up to show when a stereo transmission is tuned in Designed essentially as an integral part of Project 80 systems, this multiplex stereo demodulator may be used in many cases with existing single channel frequency modulated tuners to provide stereo reception.
Size – 47 · 50 · 20mm (1⅞ · 2 · ¾ins)
One 19 transistor I.C.



- Solid-state stereo indicating beacon
- Readily adaptable for use with other tuners

RRP £7.45 + 0 74p VAT

new constructional techniques

. . .and again Sinclair leads the world

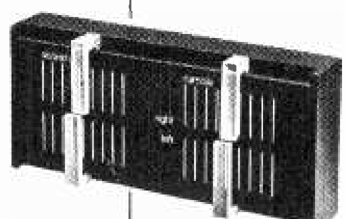
1962 Micro-miniature power amp small enough to stand on a 10p. piece. Slimline pocket receiver smaller than a 20 cigarette pack
1963 Micro-6 receiver, smaller than a matchbox
1964 Pocket F.M. receiver. PWM amp.
1965 Z.12 power amplifier module; PZ.3 power supply
1966 Stereo 25 pre-amp/control unit
1967 Micromatic Q.14 loudspeaker; the first Neoteric
1968 IC.10, the first ever integrated circuit for constructors use
1969 Q.16 – improved version of Q.14 Systems 2000 and 3000: Project 60 launched
1970 IC.12 Project 605
1971 Project 60 stereo FM tuner. Z.50 PZ 8
1972 Improvements to Project 60 with Z.50 MK.2 and PZ.8 Mk.3 The Executive Calculator. Digital multi-meter Q.30 speaker
1973 Cambridge Calculator PROJECT 80 LAUNCHED

. . . and next ?

Project 80 active filter unit

This efficiently designed unit makes a highly desirable part of any worthwhile system where inputs may be from record, radio or tape. As with Stereo 80, separate controls are applied to each channel thereby making it easier to obtain ideal stereo balance in any kind of indoor environment

TECHNICAL SPECIFICATIONS
Size – 108 × 50 × 20mm (4¼ × 2 × ¾ins)
Voltage gain – minus 0 2dB
Frequency response – 36Hz to 22KHz, controls minimum
Distortion – at 1KHz – 0 03% using 30V supply
HF cut off (scratch) – 22KHz to 5·5KHz, 12dB/oct slope
L.F. cut off (rumble) – 28dB at 20Hz, 9dB/oct. slope



NEW

- For scratch and rumble control
- Transistorised active circuitry

R.R.P £6.95 + 0 69p V.A.T

Z.40 & Z.60 power amplifiers
totally short-circuit proof

Either of these entirely new power amplifiers is intended for use in Project 80 installations although, of course, they are readily adaptable to an even wider range of applications. Both Z.40 and Z 60 incorporate built-in protection against shortcircuiting and risk of damage arising from mis-use is greatly reduced Comprehensive instructions are supplied with each of the modules

Z.40 Technical Specifications
Size – 55 × 80 × 20mm
(2⅛ × 3⅛ × ¾ins) 9 transistors
Input sensitivity – 100mV
Output – 15 watts RMS continuous into 8 Ω (35V). 30 watts music power into 4 Ω (30V)
Frequency response – 10Hz–100KHz ± 1dB
Signal to noise ratio – 64dB
Distortion – at 10 watts into 8 Ω less than 0 1%
Power requirements – 12-35 volts

Z 60 Technical Specifications
Size – 55 × 98 × 20mm
(2⅛ × 3⅞ × ¾ins) 12 transistors
Input sensitivity – 100-250mV
Output – 25 watts RMS into 8 Ω (45V). 50 watts music power into 4 Ω (50V)
Distortion – typically 0 03%
Frequency response – 10Hz to more than 200KHz ± 1dB
Signal to noise ratio – better than 70dB
Built-in protection against transient overload and short circuit
Load impedance – 4Ωmin; max. safe on open circuit

NEW

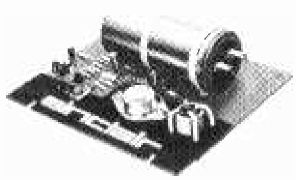
Z.40
R.R.P £5.45 + 0 54p V.A.T.

Z.60
R.R.P. £6.95 + 0·69p V.A.T.

Sinclair power supply units PZ.8

the worlds most advanced unit in its class

Stabilised power supply unit Re-entrant current limiting makes damage from overload or even direct shorting impossible, a principle never before incorporated in a commercially available constructor module. Normal working voltage (adjustable) 45V
R R P. £7.98 + 0 79p V.A T
Without mains transformer
PZ.5 30V unstabilised
R.R.P. £4.98 + 0.49p V.A T
PZ.6 35V. stabilised
R.R.P. £7.98 + 0 79p V.A.T



Recommended Project 80 applications

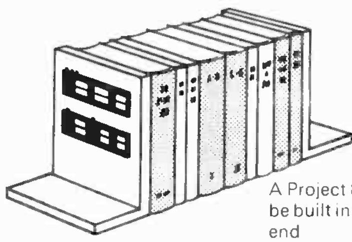
System	The Units to use	Units cost
Simple battery record player	Z.40	£5.45 +54p V A T
Mains-powered record player	Z.40, PZ.5	£10.43 +£1.04 V.A T
30W. RMS continuous sine wave stereo amp	2 × Z.40s, Stereo 80; PZ.6	£30.83 +£3 08 V A.T.
50W (8 Ω) RMS continuous sine wave de luxe stereo amplifier	2 × Z.60s, Stereo 80; PZ.8	£33.83 +£3 38 V A.T
Indoor P.A	Z.60, PZ.8	£14.93 +£1.49 V.A.T
Car Radio	F.M. tuner, Z.40	£16.40 +£1 64 V.A.T

sinclair

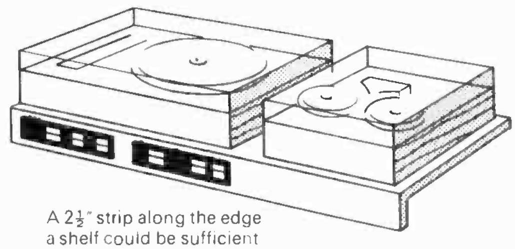
R.O. London Road, St. Ives, Huntingdon, PE17 4HJ   Reg. No. 699483 England

From Sinclair the worlds most advanced hi-fi modules

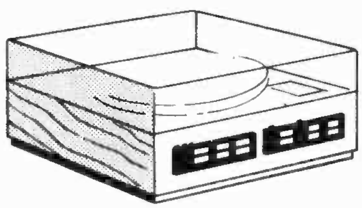
Sinclair Project 80 the ultra-modern non-obtrusive hi-fi



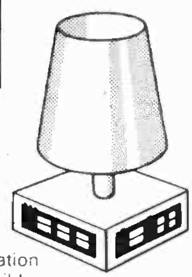
A Project 80 system could be built into a book-shelf end



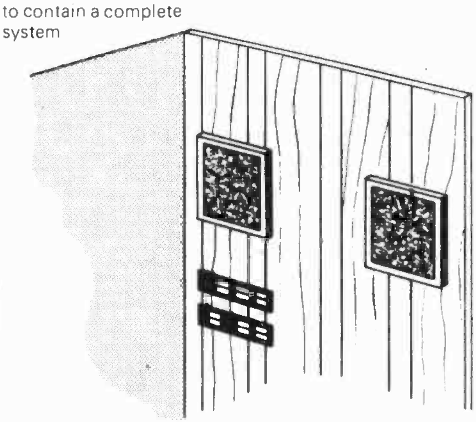
A 2½" strip along the edge a shelf could be sufficient to contain a complete system



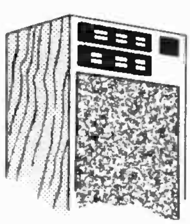
The modules mount very easily onto a playing plinth



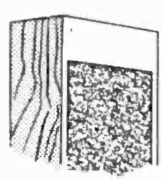
A novel application would be to build around the base of a lampshade



Two Sinclair Q.16 loudspeakers suitably positioned together with Project 80 could be mounted on to a false wall.



Project 80 could be easily mounted onto a loudspeaker cabinet



When you have seen for yourself how fantastically slim and cleverly designed these modules are, further ways will suggest themselves in which they can become a pleasing part of your particular domestic environment.

To **SINCLAIR RADIONICS LTD. ST. IVES, HUNTINGDON PE17 4HJ**

Please send post paid ______________________

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for which I enclose Cash/Cheque for £________including V.A.T.

Name ______________________

Address ______________________

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PW 12

Guarantee

If, within 3 months of purchasing any product direct from us, you are dissatisfied with it, your money will be refunded on production of receipt of payment. Many Sinclair appointed Stockists also offer this guarantee.

Should any defect arise in normal use, we will service it without charge. For damage arising from mis-use a small charge (typically £1.00) will be made.

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Huntingdon PE17 4HJ
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NEW MULLARD & MAZDA VALVES

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

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

DM70	0·63
DY51	0·85
DY86/7	0·42
DY802	0·45
EABC80	1·00
EB91	0·38
EBC81	0·75
EBF80	0·60
EBF83	0·62
EBF89	0·58
EC86	0·75
EC88	0·77
ECC81	0·45
ECC82	0·43
ECC83	0·45
ECC84	0·55
ECC85	0·53
ECC88	0·75
ECC189	0·71
ECF80	0·56
ECF82	0·73
ECF86	0·71
ECH81	1·00
ECH83	1·00
ECH84	0·78
ECL80	0·53
ECL82	0·61
ECL83	0·68
ECL86	0·63

EF80	0·46
EF83	1·03
EF85	0·43
EF86	0·90
EF89	0·81
EF91	1·30
EF92	1·40
EF95	1·35
EF183	0·60
EF184	0·60
EH90	0·56
EL34	0·95
EL36	1·05
EL81	0·90
EL84	0·47
EL85	0·55
EL86	0·95
EL95	0·70
EL91	1·31
ELL80	1·30
EM84	1·18
EM87	1·18
EY51	0·83
EY86/87	0·42
EY88	0·64
EZ80	0·51
EZ81	0·40
GY501	0·90
GZ34	0·78

PC86	0·75
PC88	0·75
PC97	0·45
PC900	0·56
PCC84	0·52
PCC88	0·80
PCC89	0·65
PCC189	0·65
PCF80	0·51
PCF82	1·30
PCF86	0·65
PCF200	0·85
PCF201	0·87
PCF801	0·65
PCF802	0·71
PCF806	0·66
PCH200	0·88
PCL82	0·54
PCL83	0·66
PCL84	0·59
PCL85	0·63
PCL86	0·63
PCL805/85	0·63
PD500	1·55
PFL200	0·80
PL36	0·88
PL81	0·75
PL81A	0·88
PL82	0·50
PL83	0·96

PL84	0·66
PL504	0·88
PL508	1·05
PL509	1·55
PL802	0·96
PY33	0·66
PY81/800	0·50
PY82	0·55
PY88	0·60
PY500A	1·05
PY800	0·50
PY801	0·50
U26	1·00
U191	1·00
U193	0·50
UABC80	0·90
UBC81	0·70
UBF89	0·60
UCC85	0·60
UCH81	1·00
UCL82	0·70
UCL83	0·70
UF89	0·80
UL84	0·95
UY85	0·50
6/30L2/ECC804	1·00
6F23/EF812	1·05
30C1/PCF80	0·51

30C15/PCF800	1·05
30C17	1·00
30C18/PCF805	0·90
30F5/PF818	1·10
30FL1/PCE800	0·75
30FL2	0·75
30FL12	1·05
30FL14	0·85
30L1/PCC84	0·52
30L15/PCC805	1·05
30L17	0·90
30P4MR	1·30
30P12/PC801	1·05
30P19/PC802	1·00
30PL1/PCL801	0·95
30PL13/PCL800	1·20
30PL14/PCL88	1·25
30PL15	1·05

NEW VALVES

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

AZ1	0·60
AZ31	0·55
CBL31	1·00
CL33	1·50
CY31	0·50
DAF91	0·30
DAF96	0·50
DCC90	1·35
DF91	0·30
DF96	0·50
DK91	0·45
DK92	0·70
DK96	0·60
DL92	0·40
DL94	0·48
DL96	0·55
DY86/87	0·37
DY802	0·37
EABC80	0·38
EAF42	0·75
EB91	0·22
EBC33	1·00
EBC41	0·75
EBC81	0·33
EBF80	0·40
EBF83	0·40
EBF89	0·32
EBL31	1·50
ECC81	0·40
ECC82	0·38
ECC83	0·38
ECC84	0·30
ECC85	0·40
ECC88	0·40
ECH35	1·25
ECH42	1·00
ECH81	0'30
ECH83	0·45
ECL80	0·45
ECL82	0·35
ECL83	0·68
ECL86	0·40
ECLL800	2·25
EF37A	1·20
EF39	1·20

EF80	0·25
EF85	0·35
EF86	0·30
EF89	0·28
EF91	0·37
EF92	0·35
EF95	0·40
EF98	0·75
EF183	0·30
EF184	0·35
EL32	0·60
EL33	1·75
EL34	0·50
EL36	0·50
EL37	2·50
EL41	0·90
EL42	0·90
EL84	0·25
EL95	0·35
ELL80	1·00
EM80	0·45
EM81	0·60
EM84	0·35
EM85	1·00
EY51	0·40
EY86	0·40
EZ40	0·75
EZ41	0·75
EZ80	0·28
EZ81	0·29
GY501	0·80
GZ30	0·45
GZ32	0·50
GZ34	0·60
GZ37	1·25
HN309	1·50
KT61	1·75
KT66	2·50
KT81 (7C5)	1·13
KT81	1·75
KT88	2·90
KTW61	1·00
MU14	1·00
N78	1·60

PC86	0·60
PC88	0·60
PC97	0·45
PC900	0·48
PCC84	0·40
PCC88	0·55
PCC89	0·50
PCC189	0·60
PCF80	0·30
PCF82	0·35
PCF86	0·60
PCF801	0·50
PCF802	0·50
PCF805	0·80
PCF806	0·75
PCF808	0·85
PCL82	0·35
PCL83	0·66
PCL84	0·45
PCL85	0·50
PCL86	0·45
PCL805/85	0·50
PD500	1·30
PEN45	0·75
PL36	0·55
PL81	0·50
PL82	0·45
PL83	0·45
PL84	0·40
PL500	0·75
PL504	0·75
PL508	0·90
PL509	1·55
PL802	0·95
PX4	3·00
PX25	3·00
PY33	0·63
PY81	0·30
PY82	0·35
PY83	0·38
PY88	0·40
PY500	0·47
PY81/800	0·50
PY801	0·50

SP41	3·00
SP61	0·75
T41	1·00
U14	1·00
U25	0·85
U26	0·85
U191	0·75
UABC80	0·40
UAF42	0·75
UBC41	0·75
UBC81	0·45
UBF80	0·40
UBF89	0·40
UCC85	0·45
UCH42	0·75
UCH81	0·40
UCL82	0·85
UCL83	0·70
UF41	0·75
UF89	0·40
UL41	0·85
UL84	0·43
UY41	0·48
UY85	0·40
VR105-30	0·40
VR150-30	0·40
OA2	0·40
OB2	0·40
1R5	0·45
1S5	0·30
1T4	0·30
3S4	0·40
3V4	0·48
5R4GY	0·75
5U4G	0·40
5V4G	0·50
5Y3GT	0·45
5Z4G	0·45
6/30L2	0·80
6AK5	0·40
6AM5	0·90
6AQ5	0·42
6AS7G	0·85
6AT6	0·38
6AU6	0·30
6BA6	0·28
6BE6	0·32
6BH6	0·75
6BJ6	0·55
6BQ7A	0·55
6BR7	0·90
6BS7	1·35
6BW6	0·90
6BW7	0·90
6C4	0·35
6CD6G	1·30
6CH6	0·60
6CW4	0·70
6F23	1·05
6F25	1·00
6F28	0·70
6J5M	0·60
6J5G	0·45

6J6	0·30
6J7M	0·45
6J7G	0·40
6K6GT	0·75
6K7M	0·43
6K7G	0·30
6K8M	0·60
6K8G	0·45
6K25	0·75
6L6G	0·55
6Q7M	0·50
6Q7G	0·50
6SL7GT	0·45
6SN7GT	0·45
6SQ7GT	0·50
6U5G	0·75
6V6G	0·40
6V6GT	0·45
6X4	0·40
6X5G	0·40
6X5GT	0·45
7B6	0·75
7B7	0·70
7C5	1·00
7C6	0·75
7H7	0·70
7R7	0·75
7S7	2·25
7Y4	0·75
12AT6	0·40
12AT7	0·40
12AU6	0·45
12AU7	0·33
12AX7	0·33
12BA6	0·45
12BE6	0·50
30C1	0·30
30C15	1·05
30C17	1·10
30C18	0·80
30F5	1·10
30FL1	0·75
30FL2	0·75
30FL14	0·85
30L15	1·05
30L17	0·90
30P4MR	1·30
30P12	1·05
30P19	1·00
30PL1	0·95
30PL13	1·20
30PL14	1·25
35W4	0·40
35Z4GT	0·70
50CD6G	1·20
807	0·50
813 ITT	£13
813 USSR	£5·75
866A	0·85

TRANSISTORS-INTEGRATED CIRCUITS

EXPRESS POSTAGE
3p for first Transistor, for each additional add 1p.

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

AA119	0·7
AAZ13	0.10
AAZ15	0·10
AC107	0·35
AC126	0·25
AC127	0·25
AC128	0·25
AC176	0·25
AC187	0·25
AC188	0·25
ACY21	0·20
ACY39	0·55
AD140	0·50
AD149	0·50
AD161	0·35
AD162	0·35
AF115	0·24
AF116	0·25
AF117	0·20
AF186	0·40
AF239	0·40
ASY27	0·30
ASY28	0·25
BA102	0·30
BA115	0·7
BC107	0·10
BC108	0·10
BC109	0·10
BC113	0·15
BC117	0·20
BC143	0·35
BC147	0·12
BC148	0·10
BC169C	0·12
BC182	0·10
BC182L	0·12
BC184L	0·11
BCY32	0·60
BCY33	0·34
BCY34	0·35
BCY70	0·15
BCY71	9·20
BCY72	0·15
BCZ11	0·50
BD121	0·75
BD124	0·80
BD131	0·75

BD132	0·80
BF115	0·25
BF167	0·25
BF173	0·25
BF179	0·30
BF180	0·30
BF181	0·32
BF194	0·15
BF195	0·15
BF197	0·15
BF200	0·35
BFS61	0·25
BFS98	0·25
BFX29	0·25
BFX88	0·20
BFY50	0·20
BFY51	0·20
BFY52	0·20
BFW10	0·61
BY100	0·15
BY126	0·15
BY127	0·15
BZX61 series	0·12
BZY88 series	0·10
CRS1-05	0·25
CRS1-40	0·35
CRS3-05	0·30
CRS3-40	0·45
MJE340	0·50
MJE370	0·70
MJE520	0·75
MJE2955	1·10
MJE3055	0·75
MPF102	0·42
MPF103	0·35
MPF104	0·37
MPF105	0·40
NKT404	0·50
OA5	0·50
OA10	0·35
OA79	0·7
OA81	0·10
OA91	0·7
OA200	0·7
OA202	0·10

OC16	0·75
OC20	0·95
OC23	0·85
OC25	0·40
OC28	0·65
OC35	0·50
OC36	0·65
OC42	0·40
OC44	0·15
OC45	0·15
OC71	0·15
OC72	0·25
OC76	0·40
OC77	0·45
OC81	0·25
OC81D	0·25
OC81Z	0·55
OC83	0·25
OC140	0·55
OC170	0·25
OC171	0·30
OC200	0·45
OC201	0·75
OC202	0·80
OC203	0·50
OCP71	1·25
ORP12	0·60
ORP60	0·40
T1005	0·30
TIC44	0·85
TIC226D	1·50
TIL209	0·30
TIS43	0·35
ZTX107	0·15
ZTX108	0·12
ZTX300	0·12
ZTX301	0·15
ZTX302	0·18
ZTX304	0·25

ZTX500	0·15
ZTX501	0·16
ZTX503	0·17
ZTX531	0·20
ZTX550	0·20
IN914	0·7
IN4001	0·6
IN4002	0·7
IN4003	0·8
IN4004	0·8
IN4005	0·10
IN4006	0·12
IN4007	0·15
IN4009	0·5
IN4148	0·8
IS921	0·10
IS2033	0·20
IS2051A	0·20
IS2100A	0·20
IS3010	0·25
2N696	0·15
2N697	0·15
2N706	0·10
2N706A	0·12
2N1131	0·25
2N1132	0·25
2N1302	0·18
2N1303	0·16
2N1304	0·22
2N1305	0·22
2N1306	0·22
2N1307	0·25
2N1308	0·25
2N1309	0·87
2N1613	0·20
2N1614	0·20
2N2147	0·75
2N2160	0·59
2N2369A	0·15

2N2646	0·50
2N2904	0·18
2N2904A	0·25
2N2905	0·26
2N2905A	0·23
2N2906	0·20
2N2926	0·10
2N3053	0·20
2N3055	0·55
2N3525	0·75
2N3614	0·59
2N3615	0·75
2N3702	0·10
2N3703	0·10
2N3704	0·10
2N3705	0·10
2N3706	0·10
2N3707	0·10
2N3708	0·10
2N3709	0·10
2N3710	0·10
2N3711	0·10
2N3819	0·35
2N3820	0·50
2N3823	0·62
2N3903	0·15
2N3904	0·17
2N3905	0·21
2N3906	0·12
2N4058	0·16
2N4059	0·9
2N4060	0·12
2N4061	0·12
2N4062	0·12
3N141	0·81
40360	0·40
40361	0·40
40362	0·50
40430	1·00

SN7400	0·20
SN7401	0·20
SN7402	0·20
SN7403	0·20
SN7404	0·20
SN7405	0·20
SN7406	0·30
SN7407	0·30
SN7408	0·20
SN7409	0·45
SN7410	0·20
SN7411	0·23
SN7412	0·42
SN7413	0·30
SN7416	0·30
SN7417	0·30
SN7420	0·20
SN7422	0·48
SN7423	0·48

SN7425	0·48
SN7427	0·42
SN7428	0·50
SN7430	0·20
SN7432	0·42
SN7433	0·70
SN7437	0·65
SN7438	0·65
SN7440	0·20
SN7441AN	0·75
SN7442	0·75
SN7450	0·20
SN7451	0·20
SN7453	0·20
SN7454	0·20
SN7460	0·20
SN7470	0·30
SN7472	0·30

SN7473	0·40
SN7474	0·40
SN7475	0·55
SN7476	0·45
SN7480	0·80
SN7482	0·87
SN7483	1·00
SN7484	0·90
SN7486	0·45
SN7490	0·75
SN7491AN	1·00
SN7492	0·75
SN7493	0·75
SN7494	0·80
SN7495	0·80
SN7496	1·00
SN7497	6·25
SN74100	2·50

SN74107	0·50
SN74110	0·80
SN74111	1·45
SN74118	1·00
SN74119	1·90
SN74121	0·60
SN74122	1·35
SN74123	2·70
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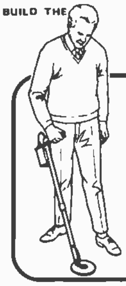

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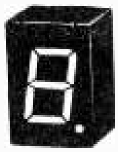

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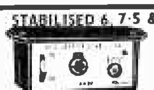

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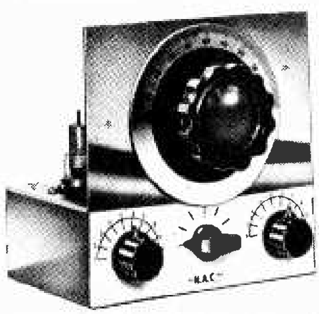

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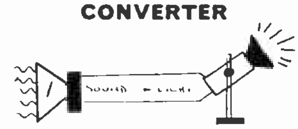

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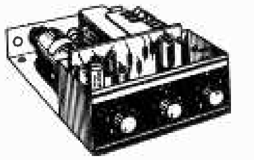
SUPERSOUND 13 HI-FI MONO AMPLIFIER



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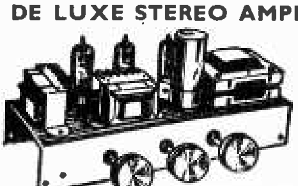

A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:—2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300m/v for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. **PRICE £9·90 P. & P. 50p.**

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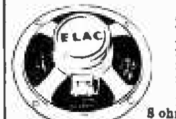

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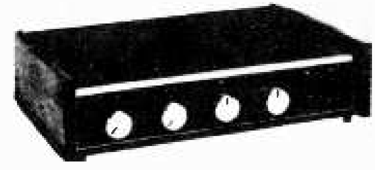

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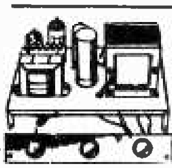

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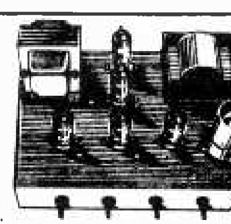

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