PRACTICAL WIRELESS

AUGUST 1975

30p

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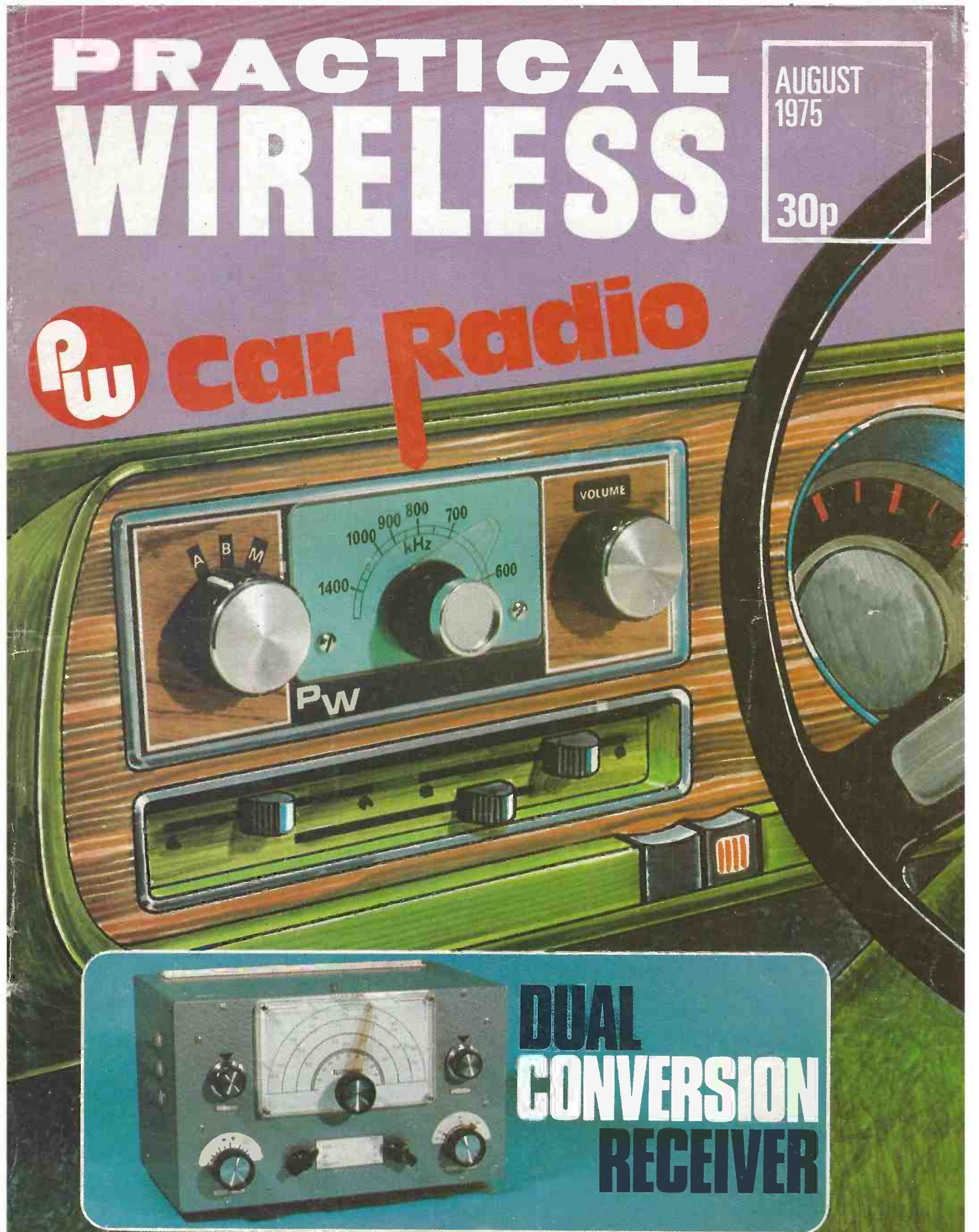

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PRACTICAL WIRELESS

VOL. 51 NO. 4
ISSUE 822
AUGUST 1975

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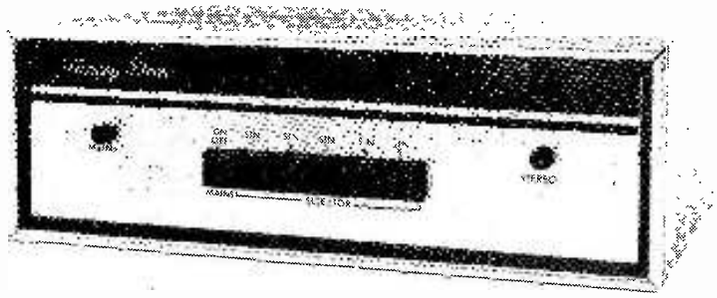

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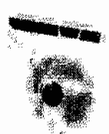

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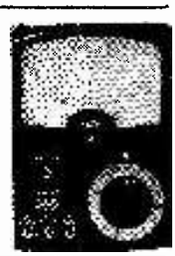

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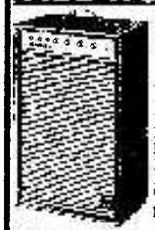

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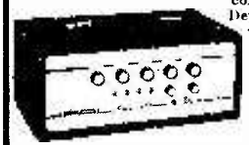

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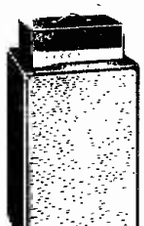

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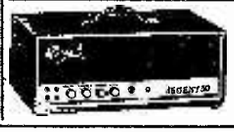

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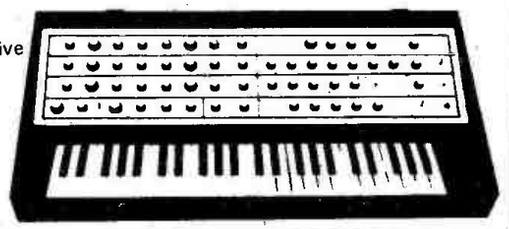
Really good value for money at just 40p.

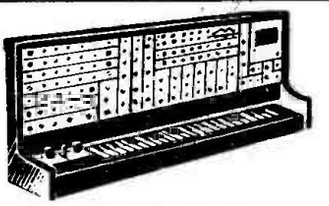
The 3600 SYNTHESISER

The 3600 synthesiser includes the most popular features of the 4600 model, but is simpler. Faster to operate, it has a switch patching system rather than the matrix patchboard of the larger unit and is particularly suitable for live performance and portable use.



Please send S.A.E. for our price list.

The 4600 SYNTHESISER



We stock all the parts for this brilliantly designed synthesiser, including all the PCB's, metalwork and a drilled and printed front panel, giving a superb professional finish. Opinions of authority agree the ETI International Synthesiser is technically superior to most of today's models. Complete construction details available shortly in our booklet price £1.50, or S.A.E. please for specification

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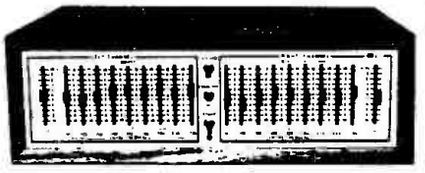

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Build yourself an exciting Electronic Organ. Our leaflet MES51, price 15p, deals with the basic theory of electronic organs and describes the construction of a simple 49-note instrument with a single keyboard and a limited number of stops. Leaflet MES52, price 15p, describes the extension of the organ to two keyboards each with five voices and the extension by an octave of the organ's range. Solid-state switching and new footages along with a pedal board and a further extension of the organ's range are shown in leaflet MES53, also priced at 15p.

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NOTE: The price list is based on the Order Codes shown in our catalogue so an investment in our super catalogue is an essential first step.

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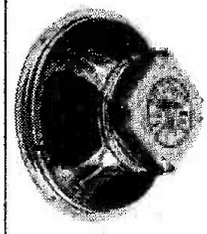
Ceramic Magnet
Weight: 600 Gms

Rec. Price **£13·00**



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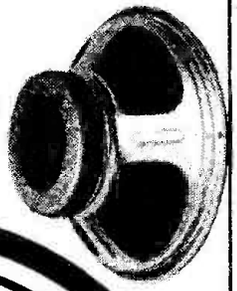

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Weight: 1250 Gms

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Ceramic Magnet
Weight: 1150 Gms
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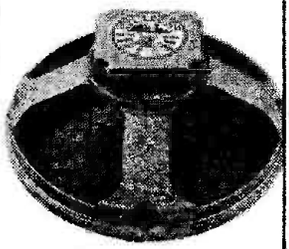
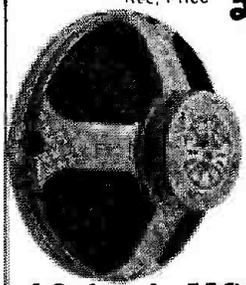


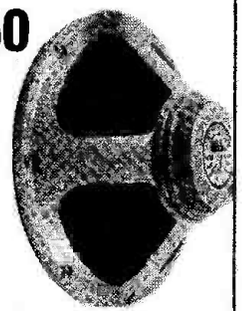


T15/100 Rated Power 100 WATTS

Centre Pole Diam. 3" Imp. 8–15Ω
Ceramic Magnet
Weight: 1250 Gms.
Range: 50–4000Hz

Rec. Price **£38·50**

18 inch MODEL



T18/100 Rated Power 100 WATTS

Centre Pole Diam. 3" Imp. 8–15Ω
Ceramic Magnet
Weight: 1250 Gms.
Range: 35–4000Hz

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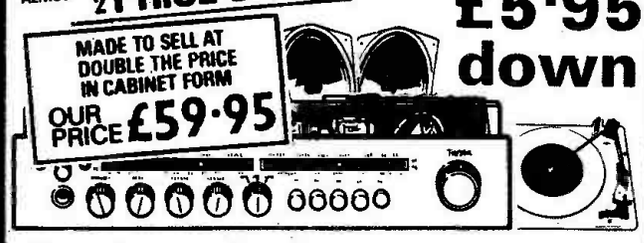

*Stereo Tuner Amplifier chassis with AM/FM radio covering long medium short and Stereo FM wavebands. Separate Base and Treble controls. 30 watts total power output (frequency response 25-20,00 Hz) Tape record and playback facilities. Dimensions 18″ x 8½″ x 3¼″. The very latest BSR automatic record deck with cue and pause control. Two matching elliptical speaker units.

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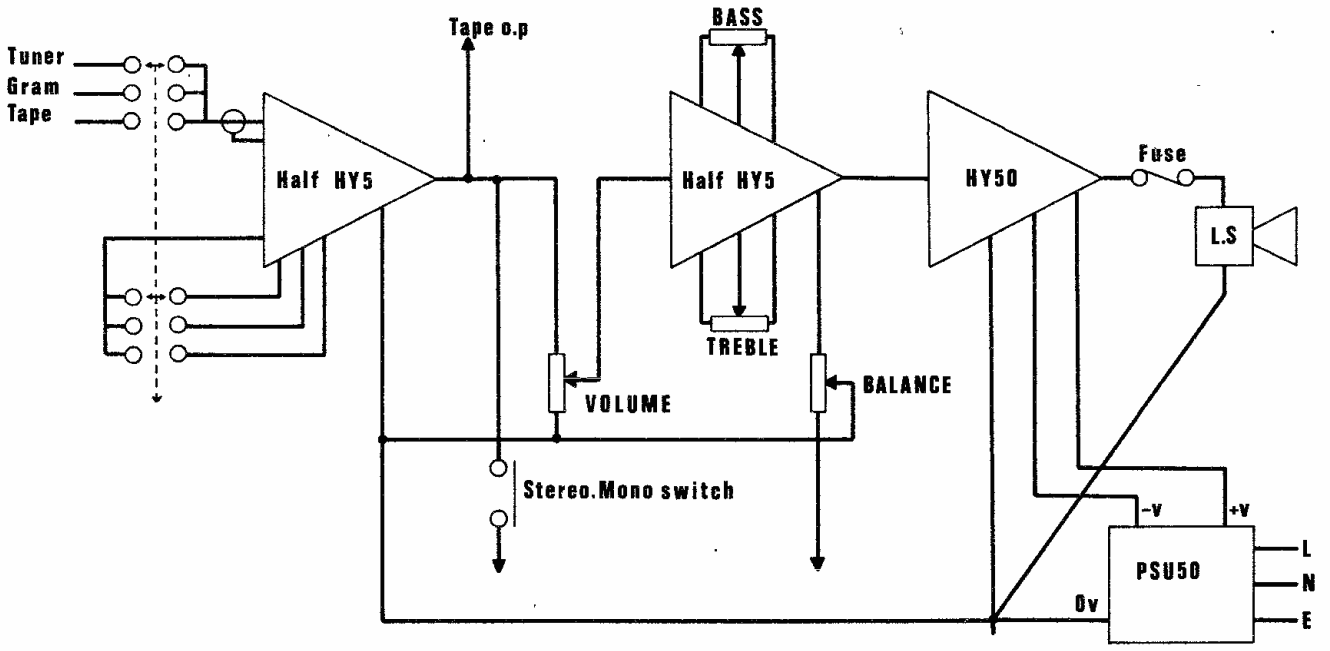
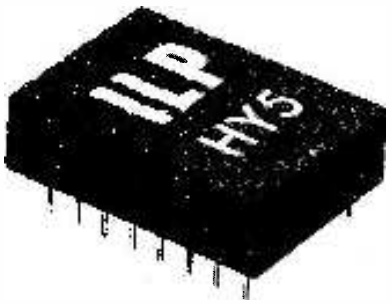


MONO ELECTRICAL CIRCUIT DIAGRAM WITH INTERCONNECTIONS FOR STEREO SHOWN



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

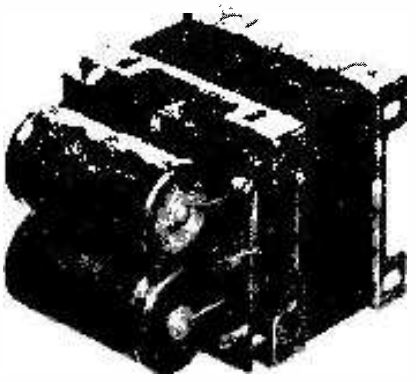
TECHNICAL SPECIFICATION
Inputs: Magnetic Pick-up 3mV RIAA: Ceramic Pick-up 30mV; Microphone 10mV; Tuner 100mV; Auxiliary 3–100mV; Input Impedance 47kΩ at 1kHz. **Outputs:** Tape 100mV; Main output 0db (0·775V RMS). **Active Tone Controls:** Treble ± 12db at 10kHz; Bass ± 12db at 100Hz. Distortion: 0·5% at 1kHz. **Signal/Noise Ratio:** 68db. **Overload Capability:** 40db on most sensitive input. **Supply Voltage:** ± 16–25V.

PRICE £4·50 + 36p VAT P. & P free

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

TECHNICAL SPECIFICATION
Output Power: 25W RMS into 8Ω. **Load Impedance:** 4–16Ω. **Input Sensitivity** 0db (0·775V RMS). **Input Impedance:** 47kΩ. **Distortion:** Less than 0·1% at 25W typically 0·05%. **Signal/Noise Ratio:** Better than 75db **Frequency Response:** 10Hz–50kHz ± 3db. **Supply Voltage:** ± 25V. Size: 105 x 50 x 25mm.

PRICE £5·98 + 48p VAT P. & P. free



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

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

PRICE £6 + 48p VAT P. & P. free

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POWER UNIT Type A126

Supplying 6, 7·5 or 9 Volt DC at 200 mA.

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

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

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0–100 micro A.	580	0–100 micro A.	730
0–500 micro A.	170	0–500 micro A.	200
0–1 mA	170	0–1 mA	200
0–5 mA	170	0–5 mA	200
0–10 mA	6	0–10 mA	6
0–50 mA	0·5	0–50 mA	0·5
0–100 mA	0·5	0–100 mA	0·5
0–500 mA	0·5	0–500 mA	0·5
0–1 AMP	0·5	0–1 AMP	0·5
0–2 AMP	0·5	0–2 AMP	0·5
0–25 Volt	15K	0–25 Volt	15K
0–50 Volt	50K	0–50 Volt	50K
0–300 Volt	300K	0–300 Volt	300K
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Ranges:

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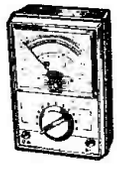
DC Volts 0–10, 50, 250, 1000 V

DC Current 0–1 mA 0–100mA

Resistance 0–150K ohms

Size 60 × 24 × 90 mm



Complete with Batteries, Test Prods, Instructions. Special price **£3·30** Post 25p.

C1001 MULTIMETER

Input Resistance 20,000 ohms per volt

Overload protection

150 μA movement, clear scale

Ranges—AC Volts 0–10, 50, 250, 1000V

DC Volts 0–5, 25, 125, 500, 2500V

DC Current 0–50 mA

Resistance 0–60 Kohms, 0–6 Mohms

Decibels −20 to +22 dB.

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SAFETY ISOLATING

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

VA (watts)	Ref No.	Price Cased £	Price Plugs 2 Pin + 1 Earth £	Price Open £	Post £
60	149	3·35	0·88	4·37	0·56
100	150	9·15	0·88	4·90	0·64
200	151	11·45	0·88	8·14	0·80
250	152	12·90	0·88	9·80	0·88
350	153	15·50	0·88	11·88	0·95
500	154	17·25	0·88	13·62	1·13
750	155	27·10	1·10	20·59	O.A.
1000	156	35·40	1·10	29·15	O.A.
1500	157	42·00	1·10	33·37	O.A.
2000	158	49·75	2·64	37·10	O.A.
3000	159	73·15	2·64	58·55	O.A.

12 & 24 Volts Prim. 200–240V.

Amps 12V	Amps 24V	Ref. No.	Price £	Post £
0·3	0·15	242	1·58	0·34
0·5	0·25	111	1·38	0·34
1	0·5	213	1·74	0·47
2	1	71	2·30	0·47
4	2	18	2·96	0·56
6	3	70	4·18	0·56
8	4	108	4·56	0·64
10	5	72	5·20	0·72
12	6	116	5·51	0·72
16	8	17	7·00	0·80
20	10	115	10·42	0·88
30	15	187	13·25	1·01
40	20	232	14·85	O.A.
60	30	226	16·83	O.A.

30 Volts

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

Amps	Ref. No.	Price £	Post £
0·5	112	1·90	0·47
1	79	2·40	0·56
2	3	3·50	0·56
3	20	4·50	0·64
4	21	5·15	0·72
5	51	6·40	0·72
6	117	7·16	0·88
8	88	9·55	0·95
10	89	9·87	0·95

AUTO TRANSFORMERS

VA Watts	Ref. No.	Price Cased £	Price Plugs 2 & 3 pin	Price Open £	Post £
Tapped at 115, 220, 240 Volts					
20	113	3·85	0·20	1·71	0·47
Tapped at 115, 200, 220, 240 Volts					
150	4	6·38	0·20	4·12	0·56
200	65	7·04	0·20	4·95	0·64
300	66	8·00	0·20	5·81	0·72
500	67	10·99	0·20	8·85	0·88
750	83	13·82	0·85	10·80	0·95
1000	84	17·27	0·85	13·68	1·13
1500	93	21·87	0·85	18·31	0·A
2000	95	33·11	1·60	24·25	0·A
3000	73	47·94	2·10	35·10	0·A

50 Volts

Prim. 200–240V. Sec. 19, 25, 33, 40, 50V.

Amps	Ref. No.	Price £	Post £
0·5	102	2·58	0·47
1	103	3·48	0·56
2	104	5·03	0·64
3	105	5·81	0·72
4	106	7·58	0·88
6	107	12·30	0·95
8	118	13·20	1·13
10	119	17·02	O.A.

60 Volts

Prim. 230–240V. Sec. 24, 30, 40, 48, 60V.

Amps	Ref. No.	Price £	Post £
0·5	124	2·30	0·56
1	126	3·41	0·56
2	127	5·09	0·72
3	125	7·52	0·80
4	123	8·75	0·95
5	40	9·75	0·95
6	120	11·20	1·01
8	121	15·00	1·19
10	122	18·20	O.A.
12	189	18·50	O.A.

MINIATURE AND EQUIPMENT

Prim. 240V with screen.

Volts Sec. 1	Volts Sec. 2	Milliamps Sec. 1	Milliamps Sec. 2	Ref. No.	Price £	Post £
3–0–3	—	200	—	238	1·50	0·25
0–6	0–6	500	500	234	1·38	0·25
0–6	0–6	1000	1000	212	1·90	0·47
9–0–9	—	100	—	13	1·40	0·25
0–9	0–9	330	330	235	1·50	0·25
0–8·9	0–8·9	500	500	207	1·93	0·34
0–8·9	0–8·9	1000	1000	208	2·75	0·47
15–0–15	—	40	—	240	1·35	0·25
0–15	0–15	200	200	236	1·38	0·25
20–0–20	—	30	—	241	1·35	0·25
0–20	0–20	150	150	237	1·38	0·25
0–15–20	0–15–20	500	500	205	2·73	0·56
0–20	0–20	300	300	214	1·93	0·47
0–20	—	3500	NO SCREEN	1116	3·30	0·64
20–12–0–12–20	—	700 (D/C)	—	221	2·20	0·47
0–15–20	0–15–20	1000	1000	206	3·50	0·56
0–15–27	0–15–27	500	500	203	3·00	0·56
0–15–27	0–15–27	1000	1000	204	3·85	0·56

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B81	10	Reed Switches, 1 long ¾" dia. High-speed P.O. type
H35	100	Mixed Diodes, Germ. Gold bonded, etc. Marked and Unmarked.
H38	30	Short lead, NPN Silicon Planar Ex Equipment.
H39	6	Integrated circuits 4 gates BMC 962, 2 flip flops BMC945
H41	2	BD131/BD132 Complementary Plastic Transistors.
H65	4	40361 Type NPN Sil. Transistors TO-5 can comp. to H66
H66	4	40362. Type PNP Sil. Transistors TO-5 can comp. to H65

UNMARKED & UNTESTED

B1	50	Germanium Transistors PNP, AF and RF
B66	150	Germanium Diodes Min. glass type
H68	10	Experimenter's pack of I.Cs, D.T.L. and T.T.L. (some marked)
B86	100	Sil. Diodes sub. min. IN914 and IN916 types
H6	40	250mV zener diodes. At least 20 good.
H15	30	Silicon rectifiers 750mA assorted. Top-hat type.
H34	15	Power Transistors, PNP. Germ. NPN Silicon TO-3 Can
H67	10	3819N Channel FET's plastic case type

PLASTIC POWER TRANSISTORS

40 WATT SILICON

Type	Polarity	Gain	VCE	Price
40N1	NPN	15	15	20p
40N2	NPN	40	40	30p
40P1	PNP	15	15	20p
40P2	PNP	40	40	30p

90 WATT SILICON

Type	Polarity	Gain	VCE	Price
90N1	NPN	15	15	25p
90N2	NPN	40	40	35p
90P1	PNP	15	15	25p
90P2	PNP	40	40	35p

NEW X-HATCH GENERATOR Mk. 2

Essential for Colour T.V. alignment of 4 patterns. Featuring plug in IC's and a more sensitive sync. pick-up circuit. The case is virtually unbreakable—ideal for the engineer's toolbox—only measures 3" x 5¼" x 3". Operates from 3 U.2 type batteries (extra).

P/P add 30p Complete kit **£7·93*** Ready built unit only **£9·93***

TO CLEAR

Hundreds of various portable transistor radio chassis with FM & AM tuning. Ideal for experimenters. All electronic components in good order, but no instructions or tuning drives. A cheap way to make a portable. Each **£1**

SUNDRY

Capacitor Discharge Ignition Kit **£7·50** (8). 8 assorted relays **£1·00** (8). Rev counter device (for cars) **£1·00**, U.H.F./TV Tuner Units **£2·50**. LM.389 Audio I.C. **£1·00**. Technical books of all kinds (no VAT).

TERMS OF BUSINESS

V.A.T. Prices shown do not include V.A.T. This must be added to total value of your order including postage at 25% except for prices marked * or (8%) when only 8% V.A.T. is required. No V.A.T. on overseas orders.

POSTAGE Except where stated, add 20p for postage & packing in U.K. Overseas—add £1, any difference being charged or refunded.

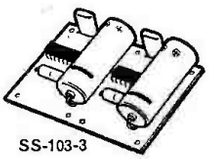
PAYMENT Cash with order, Cheque or money order. Minimum order value £1. You can also pay by ACCESS.

IMPORTANT—*Every effort is made to ensure accuracy of prices and description at time of preparing this advertisement and going to press. Prices are subject to alteration without notice.*

challenging values!

Stirling Sound

STIRLING SOUND AUDIO MODULES come to you as basic units assembled on P.C.Bs enabling you to add required components in layouts of your own choice. Modules are tested and boxed before despatched and include well printed instructions.

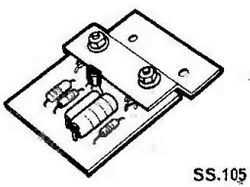


SS-103-3

PRE-AMP TONE CONTROLS

Pre-amplifiers; tone control

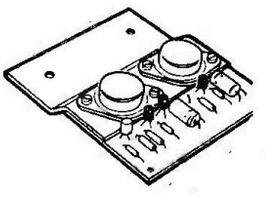
SS.100	Active tone control unit to provide bass, treble, balance and volume controls	£1·60
SS.101	Pre-amp for ceramic cartridge, tape and radio	£1·60
SS.102	Pre-amp for low output magnetic cartridge, tape and radio. With R.I.A.A. correction ±1dB at 1K	£2·25



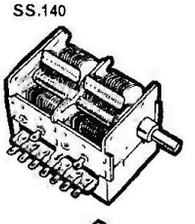
SS.105

POWER AMPLIFIERS

SS.103	Compact I.C. amp. with 3 watts R.M.S. output. Operating voltage 10-20v. Size 3½"x2"	£1·75
SS.103-3	Stereo version of above using one I.C. on each channel	£3·25
SS.105 MK2	New improved all-purpose power amp which will run excellently on a 12V supply. With 5 watt output, two make a good stereo amp. Size 3½" x2"	£2·25
SS.110 MK2	Similar in size to SS.103 but with a 10 watt output. Ideal for many domestic and small-size P.A. applications. Operates from 26 to 32V.	£2·75
SS.140	Excellently designed 40 watt R.M.S. (into 4 ohms) hi-fi amplifier. S/N ratio better than 75dB. THD better than 0·2%. Power requirements—45V. d.c. With 0·15" centre edge connections. Two can be bridged to give 80 watts R.M.S. into 8 ohms	£3·60

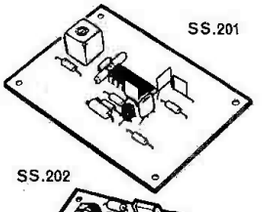


SS.140



BUILD A STEREO FM TUNER!

SS.201	Ganged tuning condenser with accurately engineered slow-motion drive in rugged housing. Excellent sensitivity. Tunes 88-108MHz. With A.F.C. facility. Operates from 6-16V	£6·25
SS.202	I.F. stage (with I.C.) Pre-tuned. A.F.C. connection. Operates from 4·5 to 14V	£5·25
SS.203	Stereo Decoder. Designed essentially for use with SS.201 and 2, this module can also be used in most mono FM tuners. A LED may be attached. Operating voltage 9-16V. d.c.	£5·62

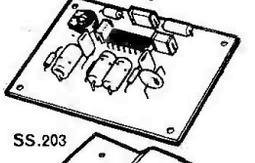


SS.201

SPECIAL £5 MONEY SAVING OFFER
Buy all three modules for building a stereo FM Tuner (Total list £17·21) and you pay only **£12·12**

POWER SUPPLY STABILIZER

SS.300	Add this to an unstabilised supply (say typically 45V output) to obtain a steady powerful working output adjustable from 12 to 60V. Essential on your audio and special systems as well as test bench. Money saving and very reliable	£3·25



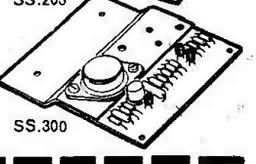
SS.202

MAINS TRANSFORMERS FOR ABOVE

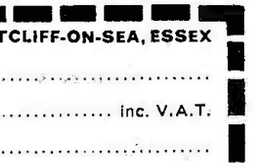
Add 35p per transformer for P/P

Type A 18V/1A (Suit SS.103)	£1·50
Type B 25V/2A (Suit SS.110)	£2·00
Type C 30V/2A (Suit SS.140)	£4·50

Bridge Rectifiers—Type A **27p**. Types B & C **38p**



SS.203



SS.300

Founded 1959

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RTVC*

NEW!

VISCOUNT IV STEREO SYSTEM

System 1a. £65.00

The new 20+20 watt Stereo Amplifier incorporating the latest silicon transistor solid state circuitry, the RT-VC VISCOUNT IV gives you a powerful 20 watts RMS per channel into 8 ohms. Superb teak-finished cabinet, with anodised fascia to harmonise with any decor. Polished trim and knobs.
The VISCOUNT IV has a comprehensive range of controls — volume, bass, treble, balance, mono/stereo, mode selector, and scratch filter.
Front panel socket for stereo headphones. And a host of sockets at the rear — for left and right speakers, tape recorder, auxiliary, tuner, disc and microphone.
SPECIFICATION: 20 watts RMS per channel 40 watts peak. Suitable 8-15 ohms speakers. Total distortion @ 10 watts better than 0.2%. Six switched inputs: 1. Magnetic P.U. — 3 millivolts @ 47 K ohms (R.I.A.A.); 2. Crystal/ceramic P.U. — 50 millivolts @ 50 K ohms (R.I.A.A.); 3, 4, 6. Tape Tuner/Aux. — 140 millivolts @ 50 K ohms (flat frequency response); 5. Microphone — 3 millivolts @ 50 K ohms (flat frequency response).
CONTROLS: Push button ON/OFF, stereo/mono, scratch filter, 6 position rotary selector. Individual rotary controls for treble, bass, balance and volume. Headphone socket, tape out socket. Aux. mains output. **Frequency response:** 25 Hz to 25 KHz @ full rated output. **Signal to noise ratio:** better than −50 dB on all inputs. **Tone control range:** Bass ± 15 dB @ 50 Hz; Treble ± 12 dB @ 10 KHz. **Power requirements:** 200-250V A.C. mains @ 60 watts. **Approx. size:** 15¼" × 3" × 10".
MP60 type deck with magnetic cartridge, de luxe plinth and cover.
Two Duo Type IIa matched speakers — Enclosure size approx. 19½" × 10¾" × 7¾" in simulated teak. Drive unit 13" × 8" with 3" tweeter. 15 watts handling. 30 watts peak.
Complete System with these speakers £69.00 +£6.50 p & p.

System 2. £81.00

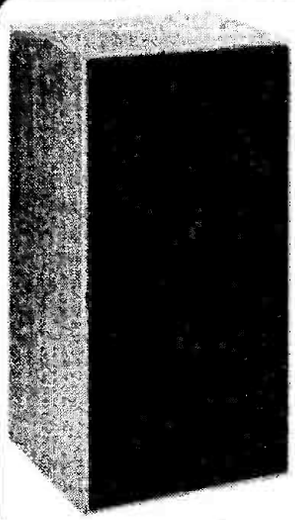
Viscount IV amplifier (As System 1a)
MP60 type deck (As System 1a)
Two Duo Type III matched speakers — Enclosure size approx. 27" × 13" × 11½". Finished in teak simulate. Drive units 13" × 8" bass driver, and two 3" (approx.) tweeters. 20 watts RMS. 8 ohms frequency range — 20 Hz to 18,000 Hz.
Complete System with these speakers £85.00 +£7.60 p & p.

PRICES: SYSTEM 1a
Viscount IV R103 amplifier £25.00+£1.90 p & p.
2 Duo Type IIa speakers £30.00+£6.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover £20.00+£3.30 p & p.
Total if purchased separately: £75.00
Available complete for only: £65.00 +£6.50 p & p.

PRICES: SYSTEM 2
Viscount IV R103 amplifier £25.00+£1.90 p & p.
2 Duo Type III speakers £46.00+£7.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover £20.00+£3.30 p & p.
Total if purchased separately: £91.00
Available complete for only £81.00 +£7.60 p & p.

20x20 SYSTEM

Scotland P & P Surcharge
System 1a £1.75 System 2 £3.50



EMI SPEAKERS AT FANTASTIC REDUCTIONS

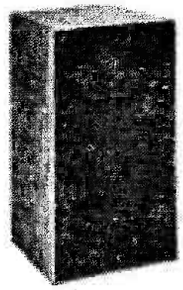
LE-4 SPEAKERS

Superb performance and beautifully finished in selected teak veneers. A professional standard four-way speaker system giving 25 watts RMS power handling. Bass unit is 14"×9" with 8"×5" unit for mid-range and twin 3" high frequency units to give monitor type quality and performance.
Specification — Size 33"×14"×16" approx. Impedance 8 ohms. Power handling 25W RMS. (Peak 50 watts.) Frequency range 35 Hz–20 KHz.

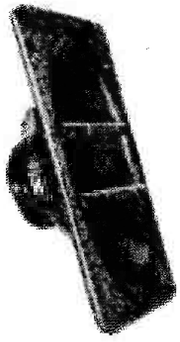
Our Price £34.00
(normally £66.00)+£5.80 p & p.

EASY TO BUILD SPEAKER KITS

These superb simulated teak-finished speaker kits have been specially designed by RT-VC for the cost-conscious hi-fi enthusiast who wants top quality speakers but doesn't want to spend the earth. Built to EMI's exacting specification, these new RT-VC speaker kits (350 type kit) incorporate 13" × 8" woofer, 3¼" tweeter and matching crossover.
Easily put together with just a few basic tools.
Specification (each speaker): Impedance 8 ohms. Power handling 15 watts RMS (30 watts peak). Response 20–20,000 Hz. Size 20" × 11" × 9½" approx. Comparable built units (EMI LE3) sold elsewhere for over £45 pair.



£22.00 pair complete
+£5.20 p & p. Complete with crossover Components and circuit diagram



EMI 350 KIT

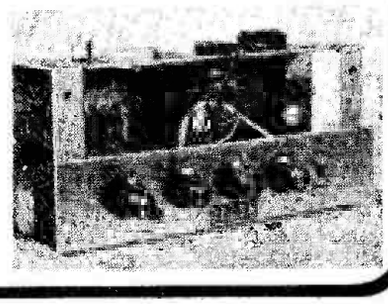
System consists of a 13" × 8" approx. woofer with a 3" tweeter, crossover components and circuit diagram. Frequency response: 20 Hz to 20 KHz. Power handling 15 watts RMS into 8 ohms. (Peak 30 watts.)

£6.50 +£1.20 p & p.
Complete with crossover Components and circuit diagram

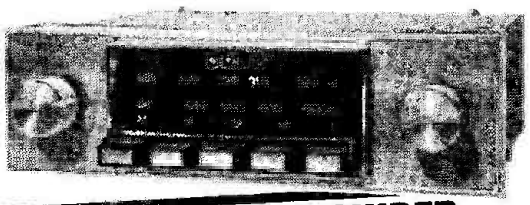
DECCA STEREO AMPLIFIER CHASSIS

Specification: 4+4 watts into 8 ohms. Input Sensitivity 4mV into 47K (for magnetic cartridges). AC Mains only 240V. Controls — volume, bass, treble, on/off, mono/stereo switch. Chassis size 11"×5½"×3¼" approx.

£6.90 +£1.20 p & p.



PUSH BUTTON CAR RADIO KIT— THE TOURIST TT*



NO SOLDERING REQUIRED

NOW BUILD YOUR OWN PUSH BUTTON CAR RADIO

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

TECHNICAL SPECIFICATION: (1) **Output** 4 watts RMS output. For 12 volt operation on negative or positive earth. (2) **Integrated circuit** output stage, pre-built three stage IF Module. **Controls volume** manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands. Size chassis 7" wide 2" high and 4¾" deep approx. **£9.50** +£1.05 p & p. Speaker including baffle and fixing strip £2.00 +45p p & p. Car Aerial Recommended — fully retractable £1.60+40p p & p.

The Tourist I Kit For the experienced constructor. If you can solder on a printed circuit board you can build this model. Same technical specification as Tourist TT. **Price £8.20** +£1.05 p & p.

*STEREO 21 QUALITY SOUND FOR LESS THAN £24.00

Stereo 21, easy to assemble audio system kit. No soldering required.
The unit is finished in white P.V.C. and the acrylic top presents an unusually interesting variation on the modern deck plinth.
Includes — **BSR 3 speed deck**, automatic, manual facilities together with stereo cartridge.
Two speakers with cabinets.
Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.
Specifications — For the technically minded:
Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel. Output impedance 8—15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs — radio, tape, etc., and outputs for taping discs.
Overall Dimensions. Speakers approx 15½"×8"×4". Complete deck and cover in closed position approx. 15½"×12"×6".

Complete only £23.20 +£3.00 p & p.

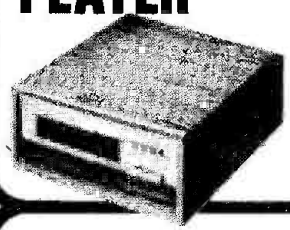
Extras if required. Optional Diamond Styli **£1.60.**
Specially selected pair of stereo headphones with individual level controls and padded earpieces to give optimum performance **£5.80.**

*DISCO AMPLIFIER

Reliant Mk IV Mono Amplifier, ideal for the small disco or house parties. Output 20 watts RMS into 8 ohms (suitable for 15 ohms).
Inputs *4 electrically mixed inputs. *3 individual mixing controls. *Separate bass and treble controls common to all 4 inputs. *Mixer employing F.E.T. (Field Effect Transistors). *Solid State circuitry. *Attractive styling.
INPUT SENSITIVITIES — Input — 1). Crystal mic. guitar or moving coil mic, 2 and 10mV. (Selector switch for desired sensitivity.) — Inputs — 2), 3), 4). Medium output equipment — ceramic cartridge, tuner, tape recorder, organs, etc. — all 250mV sensitivity. AC Mains. 240V operation. Size approx: 12½"×6"×3½".

£20.00 +£1.35 p & p.

*8 TRACK HOME CARTRIDGE PLAYER



Elegant self selector push button player for use with your stereo system. Compatible with Viscount IV system, Unisound module and the Stereo 21. Technical specification Mains input, 240V. Output sensitivity 125mV. Comparable unit sold elsewhere at £24.00 approx. Yours for only

£16.20 +£1.70 p & p.

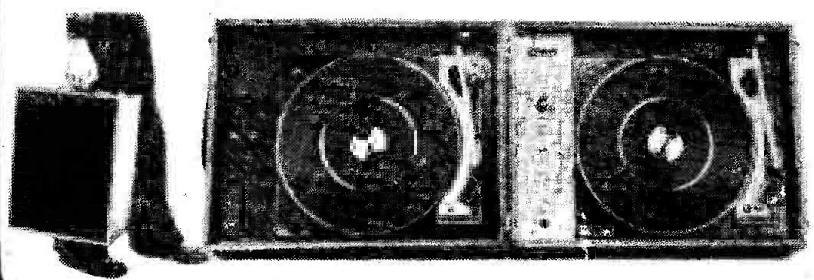
BUILD YOUR OWN STEREO AMPLIFIER*

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

Also available with 2 speakers (7" x 4") £10+£1.75 p & p. £8.95 +£1.05 p & p.

PORTABLE DISCO CONSOLE*

INCORPORATES: Pre-Amp with full mixing facilities, including switched input for mic with volume control, switched input for auxiliary with volume control, bass and treble controls, volume control and blend control for turntables. Two B.S.R. MP60 type single play professional series decks, fitted with crystal cartridges.



TECHNICAL SPECIFICATION:
Pre-amp — Output — 200mV. Auxiliary inputs — 200mV and 750mV into 1 meg. Mic input — 6mV into 100K. 240 volt operation. **Turntables capacity** — 7", 10" or 12" records. **Rumble, wow and flutter** Rumble Better than —35dB. Wow Better than 0.2%. Flutter Better than 0.06% (Gaumont-kalee meter).
Finish — Satin black mainplate with black turntable mat inlaid with brushed aluminium trim. Tonearm and controls in black and brushed aluminium.

Console size —
Unit Closed — 17¾"×13¾"×8¾" (app.)
Unit Open — 35¾"×13¾"×4⅛" (app.)
This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.
The unit is finished in black PVC with contrasting simulated teak edging, diamond spun control knobs with matching control panel.

Yours for only
£57.00 +£6.50 p & p.

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Mail orders to Acton. Terms C.W.O. All enquiries stamped addressed envelope. Goods not despatched outside U.K.
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Personal Shoppers **EDGWARE RD**: 9 a.m.–5.30p.m. Half day Thurs.
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SUPERSOUND 13 HI-FI MONO AMPLIFIER

A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume, Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high × 6" wide × 7¼" deep. AC 200/250V. **PRICE £15·00.** P. & P. 65p.

DE LUXE STEREO AMPLIFIER

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. **£12·50.** P.&P. 85p.

ALL-PURPOSE POWER SUPPLY UNIT 200/240v. A.C. input. Four switched fully smoothed D.C. outputs giving 6v. and 7½v. and 9v. and 12v. at 1 amp on lead. Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" × 3½" × 2½". Ready built and tested. **PRICE £5·35** P. & P. 55p.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. **Our price £1·30 yd. length.** P. & P. 30p per yd. (min. 1 yd.). S.A.E. for samples.

HARVERSON'S SUPER MONO AMPLIFIER
A super quality gram amplifier using a double wound fully isolated mains transformer, rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3·5 watts. Volume and tone controls. Chassis size only 7in. wide × 3in. deep × 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer. P. & P. 60p BARGAIN PRICE **£5·00**

FEW ONLY!
High grade mains transformer with grain orientated lamination. Primary 200/240 Secondary 18·5 volts at 0·6 amps and 4·6 volts at 0·3 amps. Size 2" 1×2½" w× 2" d overall. **£1·40** plus 35p P. & P.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0-210-240v. Secondary combinations 0-5-10-15-20-25-30-35-40-60v. half wave at 1 amp. or 10-0-10, 20-0-20, 30-0-30v. at 2 amps full wave. Size 3in. long × 3½in. wide × 3in. deep. Price **£2·75** P. & P. 65p.
MAINS TRANSFORMER. For power supplies.
Pri. 200/240v. Sec. 9-0-9 at 500 mA. **£1·35.** P. & P. 30p.
Pri. 200/240v. Sec. 12-0-12 at 1 amp. **£1·50.** P. & P. 30p.
Pri. 200/240v. Sec. 10-0-10 at 2 amp. **£2·20.** P. & P. 40p.

3 VOLT RELAY
100 m/A single pole normally closed. 2 for **60p** + 15p P.& P.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER
For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz—25KHz. Gain 26dB. Solid encapsulation size 1¼" x 1¼" x ¾". Brand new complete with instructions. Price **1·86p.** P. & P. 15p.

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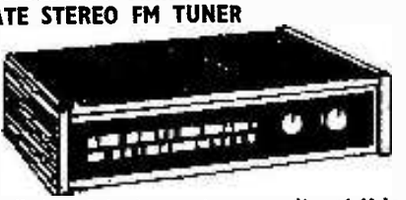

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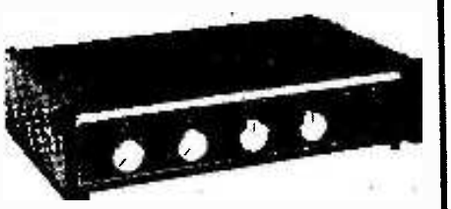

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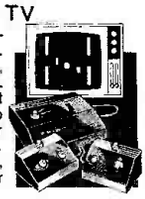

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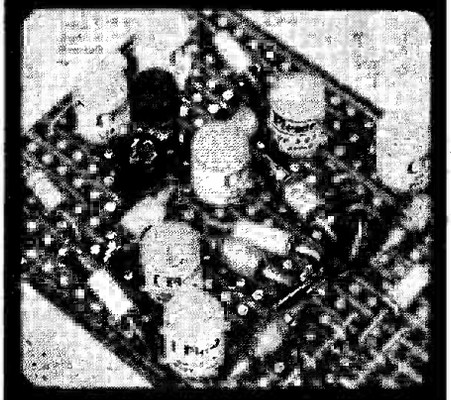

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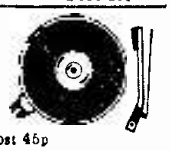

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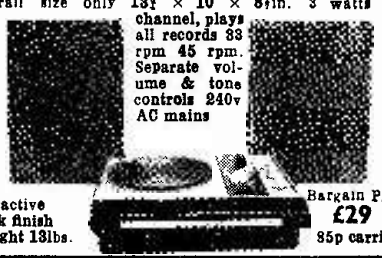

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2 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £7·00
3 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £8·70
5 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £11·25
5, 8, 10, 16 v. ½ A £2. 6-0-6 v. 500 mA 90p. 9 v. 1 amp. 95p.
12 v. 300 mA 75p. 12 v. 500 mA 85p. 12 v. 750 mA 95p.
40 v. 2 amp. tapped 10 v. or 30 v. £2·50. 20V 3 amp. £2.
40V 3 a. £2·50. 22V 4 a. £3
AUTO TRANSFORMERS. 115v to 230v or 230v to 115v. 150w. £4·60; 500w. £8·70; 750w. £17·50; 1000w. £21·00.
CHARGER TRANSFORMERS. Input 200/250v. for 6 or 12v., 1½ amp. £1·50; 2 amp. £1·80: 4 amp. £3
BATTERY CHARGERS. Ready built with leads and clips 4 amp. £4; 5 amp. £4·50.
FULL WAVE BRIDGE CHARGER RECTIFIERS : 6 or 12v. ontputs. 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. Famous make. (Value £19) OUR PRICE **£13·50** Carr. 95p Suitable for outside use.

R.C.S. 3 WAY CROSSOVER

Complete with 12 ft. twin lead fitted with din speaker plug. Ready assembled with leads for speakers, bass, mid and tweeter. Crossover frequencies—950 cps and 3,000 cps. **£2·20**

VOLUME CONTROLS

5 K. ohms to 2 Meg. LOG or LIN. L/S 20p. D.P. 35p. STEREO L/S 55p. D.P. 75p. Edge 5K. S.P. Transistor 25p

80 Ohm Coax 5p yd.

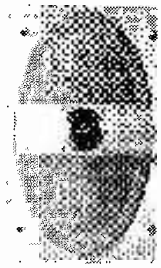
BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £2; 60 yd. £3.

FRINGE LOW LOSS 10p per yd Ideal 625 and colour.

Wirewound controls 1¼in. diam. 3 watts. 10 ohms to 100K British made with long spindles ¼in. dia 80p ea.

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 tweeter. And crossover. 10 watt. State 3 or 8 or 15 ohm. As illustrated. **£5·25** Post 35p

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. **£3·45** Post 35p

Bookshelf Cabinet £6·60

Fluted wood front 16×10×7in. Teak Veneer Post 45p

GOODMANS 6½in. HI-FI SPEAKER

8 ohm, 10 watt. Large ceramic magnet Special Rubber cone surround. Frequency response 30-15,000 cps. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. Suitable cabinet 12 × 8 × 6 £4·60. Suitable Tweeter £2·30. **£4·60**

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. Crossover £1.90 Post 20p **£2·25**

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 **£4·35**

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 LOUDSPEAKERS! All Brand New. 3 ohm, 2½in; 2½in; 3½in; 5in. 8 ohm, 2½in; 2½in; 5in × 3in; 5in. 15 ohm, 3½in; 5in; 6×4in; 5in×3in; 7×4in; 8×5in. 25 ohm, 2½in; 3in; 3in; 5 × 3in; 5in. 35 ohm; 3in; 5in. 80 ohm, 2½in; 2½in. 120 ohm, 3in. **£1·25** EACH.

LOUDSPEAKER VOLUME CONTROL 15 ohm 10 watt with 1in long threaded bush for wood panel mounting 75p.

RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8in. diameter 4W £2·50, 10in. diameter 5W £2·95; Post 25p. 12in. diameter, 6W, £3·50; 3 or 8 or 15 ohm models.
SPEAKER COVERING MATERIALS. Samples Large S.A.E.
Horn Tweeters 2-16Kc/s. 10W 8 ohm or 16 ohm £2·60.
De Luxe Horn Tweeters 2-18 Kc/s, 15W, 8 ohm £4·00.
TWO-WAY 3,000 c.p.s. CROSS OVERS 3, 8 or 15 ohm £1·60.
3-WAY CROSSOVER 850 cps and 3000 cps (25 watt) £2·20.

GOODMANS CONE TWEETER

18,000 cps, 25 watts. 8 ohm. Price **£3·60.**

ELECTRO MAGNETIC PENDULUM MECHANISM

1·5v d.c. operation over 250 hrs. continuous on SP2 battery. fully adjustable swing and speed. Ideal displays teaching electro magnetism or for metronome; strobe etc. 95p. Post 20p

R.C.S. VALVE AMPLIFIER

2 Stage Triode Pentode valve. 3 watts 3 ohm output. Volume on/off and tone controls AC mains. Complete and tested. With Loudspeaker. **£4·50** Post 35p.

WEYRAD COILS

P50/1AC-60p.	RA2W	85p.	Twin Gang	£1·10.
P50/2CC-40p.	OPT1	65p.	Printed Circuit	85p.
P50/3CC-40p.	LFDT4.	65p.		

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p OUTLET BOXES. SURFACE MOUNTING 25p.
BALANCED TWIN RIBBON FEEDER 300 ohms, 7p yd.
JACK SOCKET 3d. open-circuit 15p, closed circuit 23p; Chrome Lead Socket 45p. Phono Plugs 10p. Phono Socket 8p
JACK PLUGS 3d. Chrome 20p; 3·5mm Chrome 15p. 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 10p; CANS 5p.

FM/VHF AERIAL FEEDER CABLE

300 ohm suitable for stereo 7p per yard.

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 required. SUITABLE I.F. STRIP £4·95. Our Price **£3·95** Post 20p.

ALL PRICES INCLUDE VAT MINIMUM POST AND PACKING 30p. CALLERS WELCOME

RADIO COMPONENT

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

ALL OUR PRICES INCLUDE V.A.T.

E.M.I. WOOFER AND TWEETER KIT

£6·75 THE PAIR. Post 45p. (Available separately. Woofer £4·25; Tweeter £1·90). Post 45p

Comprising a fine example of a Woofer 10¼ × 6½in. 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 3½in. 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 × 12in. **£14·50**
MODERN DESIGN. TEAK WOOD FINISH. Post 75p

ELAC 8in. or 10 × 6in. 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 **£4.35**

TEAK VENEER HI-FI SPEAKER CABINETS
Fluted Wood Fronts

MODEL "A". 20 × 13 × 12in. For 12in. dia. 10in. speaker. **£14·50** Post 75p

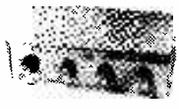
MODEL "B". 16 × 10 × 7in. For 13 × 8in. or 8in. speaker. **£7·60** Post 45p

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

BAKER RECOMMENDED 12 inch Enclosure 4 cubic ft. HI-FI CABINET £21·50. Carr. £2 each. Few only. Size 30 × 20 × 12in. Teak Finished Fluted Front.

TEAKWOOD LOUDSPEAKER FRONT GRILLS
Modernise your cabinets with the Grooved look. Sizes—18¼" × 10½"—75p. 10½" × 7⅞"—45p.

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. **£5·20**



STEREO VERSION OF ABOVE £6·85.

R.C.S. STEREO FM TUNER BRITISH MADE

This completely cased mains powered Hi-Fi Tuner with brushed aluminium facia is British made using the latest circuitry. Barga in **£30** Post 45p.

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

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 × ⅛in. 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. Snitable 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" £11·50

Post 40p

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. **£14.50**

Please state 3 or 8 or 15 ohms. Post 45p

"BIG SOUND" BAKER SPEAKERS

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

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

GROUP "25" 12in. 25 watt 3, 8 or 15 ohms. **£8·95** Post 40p

GROUP "35" 12in. 35 watt 3, 8 or 15 ohms. **£10·50** Post 40p

GROUP "50" 15in. 50 watt 8 or 15 ohms. **£19·50** Post 50p

GROUP 50/12in. 50 watt 8 or 15 ohms **£14·50** Post 50p

Group + PA Cabinets in stock
Send for Leaflet.

MAJOR 100 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

All purpose transistorised.
Ideal for Groups, Disco and P.A.
4 inputs speech and music. 4 way mixing. Output 8/15 ohm. a.c. Mains.
Separate treble and bass controls.
Guaranteed. Details SAE.
De Luxe Model in wood case £69.

£59 Carr. £1·00

NEW MODEL—MAJOR 50 WATT **£49·95** Carr. £1.

4 inputs 2-way mixing. 2 outputs separate treble and bass controls. Ideal disco or p.a. amp.

DE LUXE 100 WATT VALVE AMPLIFIER CHASSIS

4 input 10 wide range controls. For Mikes, Discos, Organs Guitars, etc. 4, 8 & 15 ohm loudspeakers matching £32·00.

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. **£4.35** Post 30p

QUALITY LOUDSPEAKER ENCLOSURE

Teak veneered ¾in thick wood cabinet. Size 18½in × 18½in × 8½in. Weight 23lbs. This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for 6½inch Woofer. £8·50 Carr. 85p.
Rosewood Version £9·50 Carr. 85p.
Baffle could be cut to take larger speaker.

SPECIAL OFFERS
100 Ohm 20 watt Rheostat 2½in diam. Ceramic Former.
Screw Terminals ¼in. diam. spindle. 95p. Post 25p.
AC mains relay 3 pole change over 75p.

E.M.I. GRAM MOTOR 120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2⅝ × 2½ × 2¼ in. **£1·25** Post 30p.

E.M.I. TAPE MOTOR 4 pole, 240 v. 135 mA. Size 3¼ × 2¼ × 2½in. 1200 rpm. Spindle ⅛in diameter. 120v version £1. **£2.00** Post 30p

BAKER HI-FI SPEAKERS
HIGH QUALITY — BRITISH MADE

REGENT
12in. 15 watts

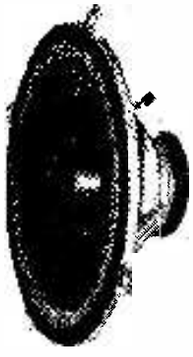
An inexpensive unit for the beginner in high fidelity and for general purposes. May be used to improve any Radio, Amplifier, Hi-Fi or Television receiver.

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

8 or 8 or 15 ohm models.

£9·50 Post 40p

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.

£12·50 Post 40p

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.

£17·00 Post 50p

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.

£14·50 Post 50p

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 HI-FI.

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

8 or 15 ohms models.

£19·50 Post 50p

Hi-Fi Enclosure Manual containing plans, designs, cross-over data and cubic tables. 60p. Post 3p.

CUSTOMERS FREE CAR PARK

OPEN 9-6. WEDNESDAY 9-1. SATURDAY 9-5. Closed for lunch 1-15—2-30

SPECIALISTS

337 WHITEHORSE ROAD . CROYDON

(Exports Remit cash and extra postage.)

Buses 50, 68, 159. Rail Selhurst

Telephone 01-684-1665

NEW ITEMS THIS MONTH

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

Telephone cords. 4 core, curly cords as fitted to telephone handsets, made for the GPO so obviously very good quality. Standard length, **25p each. VAT & Post 15p each.**

Fire alarm switches. In red cast iron case with break glass panel. These are engraved "In case of fire break glass" and have a hinged lid and second safety switch for testing purposes. **£1·75 each. VAT & Post 45p each.**

Tacho-motors. A precision motor made by Muirhead, when driven at 1000 rpm it generates 3V so it is the basis of a tacho-meter. It is a battery operated motor which can be used for precision work and within limits its speed can be brought to that desired by choosing the right voltage. Ex-equipment but fully guaranteed by us. **50p. VAT & Post 15p each.**

Mains motor. Heavy duty made by Smiths with special long bearings for extra quiet running. This is a powerful (1¼") stack motor; good quality of these available at the price of **£1·25 each. VAT & Post 30p each.**

Crouzet motor. With gear box, mains input. final speed 12 revs per hour, fitted on mounting plate with on-off switch. **£1·50 each. VAT & Post 30p.**

2½ r.p.m. mains motor. With gear box, ideal for driving colour wheels, etc. **95p each. VAT & Post 20p.**

Battery motor. With gear box. Extremely well-made motor and gear box which with a 4 volt battery will rotate at 1 r.p.m. Speeds easily adjustable up and down (within limits) by changing the battery volts. **Price £3 each. VAT & Post 60p.**

Multi-purpose relay. Work with coil volts from 6v to 24v or from the mains through diode and 15w lamp or equivalent resistor. It has two sets of normal change-over contacts and a further two sets of change-overs which make before break. Supplied complete with mounting bracket. Price **50p. VAT & Post**

24v power pack. Normal mains input, with a thermal safety device in primary of mains transformer and 4000 mfd of smoothing with full wave rectifier; completely enclosed in plastic box and with flex for mains, and terminal block for output. **Price £1·75 + VAT & Post 95p.**

Pointer knob. With brushed aluminium embellishers, for 3/16 spindle. **10 for £1 + 40p VAT & Post.**

500K Edgeways control. 1¼" diameter made by Morganite s/log, ideal for light dimmer control or similar. **10 for £1 + 40p VAT & Post.**

Battery charger. For nickel cadium cells intended or small 1" diameter cells but suitable for other sizes using adaptors or external leads. This pushes straight into a 2-pin razor socket and is completely encased. **35p each + 20p VAT & Post.**

Permeability tuners. Two stage ideal for use with ZN414 or similar circuit. **Price 15p each + 15p VAT & Post.**

·47 uf 400v condensers by Erie. 10 for 50p + 25p VAT & Post.

8 switch disco lamp controller. This is a mains motor driving a rotating drum on which are 8 adjustable segments. These segments operate individual changeover 10 amp switches, so a total of 8 x 20 amps of lighting can be controlled enabling an unlimited variety of lighting effects to be achieved and changed with the minimum of effort. This is a real snip at **£6·50 + 95p VAT & Post.**

Wire ended neons. For incorporating in random lighting effects or simply as mains indicators, with long leads and resistors for working directly off mains. **10 for £1 + 20p VAT & Post.**

Oven thermostat. Made by the famous Diamond H Company, this has a sensor joined by a capilliary to a variable control and when fitted with a knob is ideal for many ovens or processes. **50p each + 25p VAT & Post.**

150w auto transformer. 230-240v in, 115-150v out. very well made and dip sealed for quiet running. upright mounting with fixing legs. **£2 each + 75p VAT & Post.**

Immersion heaters. Standard screw-in fitting for normal tanks 23" **4KW - £2·50**; 21" **3KW - £2·25**; 10" **2KW - £2.** Rod thermostats to suit. **£1 each. Postage 40p per heater. VAT 8%.**

Mains transformer. 25v-0-25v 2 amps and 110v 100mA secondaries normal tapped primary. **Price £2·50 + £2 VAT & Post.**

Instrument mains transformer. With 140v secondary tapped at 130, 120, 80 and 5v at 1 amp rating. **Price £2 + 56p VAT & Post.**

Panel lamps. With plastic lens, push through circular hole for 6v operation, **20p.** Ditto for 12v operation **20p.** Ditto for 24v operation **20p. + 10p each VAT & Post.**

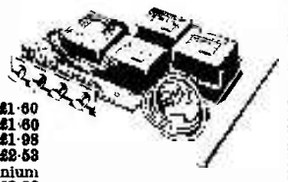
2 pole 3 way wave change switch. Standard length ¼" spindle. **20p + 15p VAT & Post.**

Panel meter. 2½" 0-500mA, flush mounting. **Price £1·50 + 50p VAT & Post.**

Mercury batteries. Tube of 7 batteries connected together to give 10·7 volts offered some time ago at **5p** per tube or **£1** per carton of 25 tubes. A further large purchase of these enables us to offer at an even better price - 10 cartons making a total of 250 x 10·7 volt batteries for only **£7·50 + £1·65 VAT & Postage per 10 cartons.**

EHT transformer, American made, sealed in a steel case measuring 6½" × 6" × 5½" high with large porcelain stand-off insulators; it is extremely well-made, looks good enough to give 10 kv at ·1 amp, intended for American mains, its primary would have to be fed through a variac or similar. With 90v input EHT output is 6·5v. **Price £15 each + carriage and VAT £3.**

MULLARD UNILEX STEREO SYSTEM



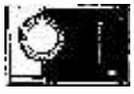
There is no doubt that it is a good system, we believe that for the money it is without comparison. We demonstrate gladly at our Tamworth Road depot. Prices of the individual tems for th is:

1 Unilex Amplifier	Ref. EP.9000	**£1·60**
1 Unilex Amplifier	Ref. EP.9000	**£1·60**
1 Unilex Pre-Amp	Ref. EP.9001	**£1·98**
1 Unilex Power Unit	Ref. EP.9002	**£2·53**
1 Control panel kit with spun aluminium faced knobs		**£3·80**

Pair of 15 ohm speakers made by Goodmans are also available if required, **price £3·30** the pair. No extra postage if ordered with the above, otherwise add 25p.

ALL SUBJECT TO 25% VAT

SMITHS CENTRAL HEATING CONTROLLER



Push button gives 10 variations as follows:–(1) continuous hot water and continuous central heating (2) continuous hot water but central heating off at night (3) continuous hot water but central heating on only for 2 periods during the day (4) hot water and central heating both on but day time only (5) hot water all day but central heating only for 2 periods during the day (6) hot water and central heating on for 2 periods during the day time only—then for summer time use with central heating off (7) hot water continuous (8) hot water day time only (9) hot water twice daily (10) everything off. A handsome looking unit with 24 hour movement and the switches and other parts necessary to select the desired programme of heating. Supplied complete with wiring diagram. Originally sold, we believe, at over **£15**—we offer these, while stocks last, at **£5·95 each, VAT & Postage 85p each.**

WALL THERMOSTATS

Wall mounting and in a handsome plastic case. (Cream and beige). Adjustable by slider (lockable) and may be set to control temperatures from around freezing through to 50°C. The slide panel is engraved and indicates (frost), (warm), (very warm), etc. The thermostat will control heaters, etc., up to 15 amp at normal mains voltage and is ideal for living room, bedroom and greenhouse, etc. Price **£1·95, VAT & Postage 30p.** Don't miss this.

THIS MONTH'S SNIP

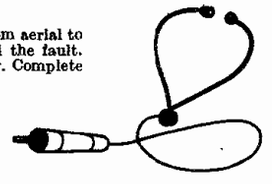
High power battery motor, 12v operated, strong enough to power a motor mower, go-cart or similar. Speed easily variable. These motors can also be used as a brake for any rotating machine, simply by coupling the spindle to the machine and short-circuiting the windings by a variable resistance, price **£2·50, VAT & Postage 64p.**

Even more poweful 6/12 volt model **£3·50, VAT & Postage 92p.**

BREAK-DOWN UNIT

Contains a whole range of most useful parts some of which are as follows—66 silicon diodes equivalent OA91. 68 resistors, mostly ¼ watt 5% covering a wide range of values. 4 × ·1 mfd 400v condensers. 5 × ·01 mfd 100v condensers. 2 RF chokes. 8 × B9 valve holders. 1 × 4H choke. 1 × 115v transformer. 1 boxed unit containing 4 delay lines. Tag panels, trimmer condensers, suppressors, all mounted up on a useful chassis sized approx. 9" × 5" × 7". Offered at only **75p**—the 66 diodes would cost at least 10 times this amount, so this is obviously a snip not to be missed. **VAT & Postage 70p.**

RADIO STETHOSCOPE

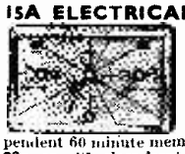


Easiest way to fault find, traces-signal from aerial to speaker, when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything. Complete kit comprises two special transistors and all parts including probe tube and crystal earpiece, **£2·20** twin stetho-set instead of earpiece **88p, VAT & Postage 45p.**

DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 × 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. **£2·75, VAT & Postage 65p.**

ISA ELECTRICAL PROGRAMMER



Learn in your sleep: Have radio playing and kettle boiling as you awake—switch on lights to ward off intruders—have a warm house to come home to. All these and many other things you can do if you invest in an electrical programmer. Clock by famous maker with 15 amp. on/off switch. Switch-on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price **£2·30, VAT & Postage 60p,** or with glass front, chrome bezel, **£1·00** extra.

SHORTWAVE CRYSTAL SET

Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19, 25, 31, 39 metre bands–Kit contains chassis front panel and all the parts, **£1·50**—crystal earphone **55p, VAT & Postage 75p.**

INSTANT START FLUORESCENT LIGHTING BARGAINS

Starterless control gear, complete with tube ends and tube clips for window lighting, signs, fascias, etc. 4 ft. 40 w. £1·50; 5 ft. 65w. £1·60; 5 ft. 80w. £1·75; 6 ft. 80w. £1·95; and for pairs as follows:—twin 2 ft. 20w. £2·55; twin 3 ft. 30w. £2·75; twin 4 ft. 40w. £2·95; twin 5 ft. 65w. £3·25; twin 5 ft. 80w. £3·95; twin 8 ft. 125w. £4·50. These are about one half of maker's current prices and can't be repeated once stocks are cleared. Please add 30p per piece to cover postage or carriage and 8% VAT.

J. BULL (ELECTRICAL) LTD.

(Dept. P.W.), 103 TAMWORTH ROAD, CROYDON CRO 1XX

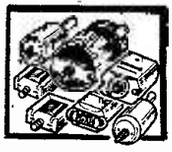
MAINS TRANSFORMERS

All standard 230-250 volt primaries.

			£ p
1v	1 amp (special)		1·75
2·4v	5 amp ..		·85
6·3v	2 amp ..		1·00
6·3v	3 amp ..		1·50
9v	1 amp ..		·95
9v	3·5 amp ..		1·95
12v	1½ amp ..		1·50
12v	1 amp ..		1·00
6·5v-0-6·5v	1 amp ..		1·35
18v	1 amp ..		1·25
20v	½ amp		1·00
24v	1 amp ..		1·50
24v	3 amp ..		3·50
12·0·12v	50mA ..		1·20
6·0·6v	50mA ..		1·20
8·0·8v	½ amp ..		1·25
18·0·18v	2 amps ..		3·50
25v	1½ amp ..		1·95
50v 2 amp & 6·3v ..	1 amp ..		4·50
60v 5 amp & 5v ..	1 amp ..		7·50
27v	8 amp ..		4·50
30v	37 amp ..		22·00
80v tapped 75v & 70v	4 amp ..		5·50
230v-60mA & 6·3v ..	1·5 amps		1·75
275-0-275v at 90mA & 6·4v	3 amps ..		2·25
EHT Transformer 5000v 23mA	(intermittent)		5·50
Charger Transformers			
6v and 12v	2 amps ..		1·25
6v and 12v	3 amps ..		2·25
6v and 12v	5 amps ..		3·50

Add 30p per piece to cover postage and VAT 25%.

ONLY £1 FOR SEVEN ELECTRIC MOTORS



7 powerful batt. motors as used in racing cars & power models. Output & types vary for use in hundreds of different projects—Tools, toys, models, etc. All brand new reversible & for 1½-12v. batts. Wiring diag. inc. **VAT & Post 40p. FREE plan for min. power station.**

RELAY BARGAIN

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

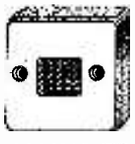
BLACK LIGHT

As used in discotheques and for stage effects, etc. Virtually no white light appears until the rays impinge on luminous paint or white shirts, etc. We offer 9" 6w tubes complete with starter, choke, lamp-holders and starter-holder. Price **£2·75 + 30p post.** Tubes only **£2. Post & VAT 50p.**

TAPE DECK

In metal case with carrying handle, heavy fly wheel and capstan drive. Tape speed 3¾. Mains operated on metal platform with tape head and guide. Not new but guaranteed good working order. Price **£1·50** plus **VAT and Postage £1·50.**

LIGHT SWITCH



Automatically switches onlights at dusk and off at dawn. Can also be used where light and dark is a convenient way to stop and start an operation. Requires only a pair of wires to the normal switch. In bakelite box, normal switch-plate size. 1 amp model **£2·95.**
VAT and Postage 50p.

MAINS TRANSISTOR 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: main transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only **£1·50. VAT & Postage 60p.**

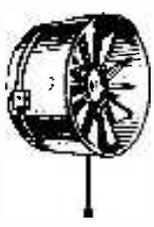
SOUND TO LIGHT UNIT

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450w). Unit in Box all ready to work. **£7·95** plus 95p VAT and postage.

MAINS MOTOR

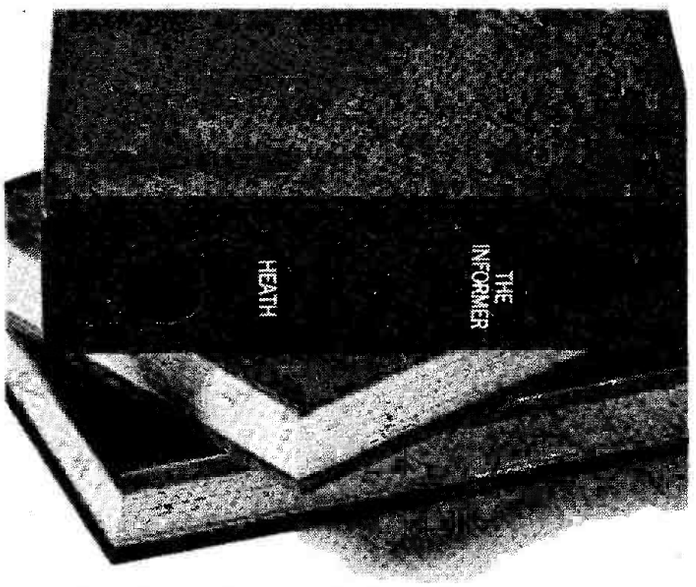
Precision made—as used in record decks and tape recorders—ideal also for extractor fans, blower, heaters, etc. New and perfect. Snip at **75p** Postage 20p for first one then 10p for each one ordered.
1" stackmotor **£1·04.**
1½" stackmotor **£1·20. VAT 8%.**

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. **£3·75 VAT & Postage £1·25.**

Enough books are written about crime, this one stops it.



Outside it's a book. Inside it's an ingenious ultrasonic burglar alarm from Heathkit. The GD-39.

A complete kit that can be assembled in only a few enjoyable hours, with the help of a very easy to follow instruction manual.

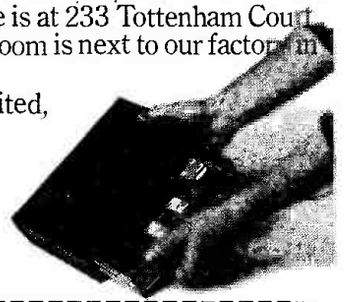
The GD-39 works by transmitting a silent, ultrasonic signal throughout the room. And continuously monitoring it. Any movement made by an intruder in the room will then automatically produce a change in the signal. Which triggers off a lamp and, thirty seconds later, a remote buzzer, that just you hear, or a loud bell.

Enough to scare the living daylights out of a burglar.

For more details, and a bookful of other ideas, just post the coupon now for your free Heathkit catalogue.

Or, if you're in London or Gloucester, call in and see us. The London Heathkit Centre is at 233 Tottenham Court Road. The Gloucester showroom is next to our factory in Bristol Road.

Heath (Gloucester) Limited,
Dept. PW-85, Bristol Road,
Gloucester GL2 6EE.
Tel: (0452) 29451.



The GD-39
Ultrasonic Burglar Alarm

To: Heath (Gloucester) Limited, Dept. PW-85, Gloucester GL2 6EE. Please send me a free Heathkit catalogue.

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Address_____

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_____ Postcode_____

Remember easy terms are available with the Heathkit Monthly Budget Plan.

HEATH
Schlumberger

TRANSFORMERS

MAINS ISOLATING
PRI 120/240v SEC 120/240v CENTRE TAPPED AND SCREENED

Ref. No.	VA (Watts)	£	p & p p
07	20	2·80	38
149	60	4·37	45
150	100	4·89	45
151	200	8·13	53
152	250	9·83	73
153	350	11·88	73
154	500	13·65	91
155	750	20·51	BRS
156	1000	29·15	BRS
157	1500	33·23	BRS
158	2000	37·07	BRS

12 and or 24 Volt
PRIMARY 240-250 VOLTS

Ref. No.	Amps 12v	Amps 24v	£	p & p p
111	0·5	0·25	1·35	23
213	1·0	0·5	1·74	30
71	2	1	2·29	38
18	4	2	2·86	38
70	6	3	4·12	45
108	8	4	4·56	45
72	10	5	5·14	53
116	12	6	5·52	53
17	16	8	7·28	60
115	20	10	10·39	73
187	30	15	13·59	83
226	60	30	16·83	BRS

30 VOLT RANGE
SECONDARY TAPS
0-12-15-20-25-30

Ref. No.	Amps	£	p & p p
112	0·5	1·81	30
79	1·0	2·40	38
3	2·0	3·49	38
20	3·0	4·53	45
21	4·0	5·13	53
51	5·0	6·41	53
117	6·0	7·16	60
88	8·0	9·87	67
89	10·0	9·90	73

50 VOLT RANGE
SECONDARY TAPS
0-19-25-33-40-50

Ref. No.	Amps	£	p & p p
102	0·5	2·58	30
103	1·0	3·38	38
104	2·0	4·68	45
105	3·0	5·81	53
106	4·0	7·60	67
107	6·0	12·10	67
118	8·0	12·98	85
119	10·0	16·99	BRS

60 VOLT RANGE
SECONDARY TAPS
0-24-30-40-48-60

Ref. No.	Amps	£	p & p p
124	0·5	2·33	38
126	1·0	3·41	38
127	2·0	5·08	45
125	3·0	7·52	60
123	4·0	8·75	67
40	5·0	9·75	73
120	6·0	11·30	85
121	8·0	15·00	BRS
122	10·0	17·52	BRS
189	12·0	19·98	BRS

AUTO TRANSFORMERS

Ref No.	VA (Watts)	Auto Taps	£	p & p p
113	20	0-115-210-240	1·67	30
64	75	0-115-210-240	2·90	38
4	150	0-115-210-220-240	4·12	45
66	300	" "	5·82	53
67	500	" "	8·82	67
84	1000	" "	13·68	91
93	1500	" "	18·11	BRS
95	2000	" "	24·20	BRS
73	3000	" "	35·09	BRS

CASED AUTO TRANSFORMERS
240V mains lead input and USA 2 pin outlets 20VA **£3·23** p & p 38p.
500 VA **£10·45** p & p 80p
1000 VA **£17·51** BRS

HIGH VOLTAGE
Mains Isolating
PRI 200/220 OR 400/440
SEC 100/120 OR 200/240

VA	Ref.	£	p & p p
60	MT243	4·37	63
350	MT247	10·41	95
1000	MT250	27·06	BRS
2000	MT252	41·07	BRS

MINIATURE TRANSFORMERS WITH SCREENS

Ref	MA	Volts	£	p&p p
238	200	3-0-3	1·54	10
212	1A, 1A	0-6, 0-6	1·84	30
13	100	9-0-9	1·41	13
235	330, 330	0-9, 0-9	1·56	19
207	500, 500	0-8-9, 0-8-9	1·92	30
208	1A, 1A	0-8-9, 0-8-9	3·30	38
236	200, 200	0-15, 0-15	1·43	19
214	300, 300	0-20, 0-20	1·93	30
221	700(DC)	20-12-0-12-20	2·17	38
206	1A, 1A	0-15-20, 0-15-20	3·46	38
203	500, 500	0-15-27, 0-15-27	3·00	38
204	1A, 1A	0-15-27, 0-15-27	3·85	38

BRIDGE RECTIFIERS

50v	2A	30p
100v	2A	35p
200v	1A	40p
400v	4A	60p
600v	2A	45p
PM7A6		£2·35

P & P 15p

POWER UNITS
A125 6-9v at 200mA in moulded case forming a 2 pin 5A plug **£2·45** P & P 25p.
CC12-05 Output Switched 3-4-5-6-7·5-9-12V at 500mA £4·08 P & P 30p.

METERS

AVO 8 Mk 5	£50·80
AVO 72	£19·75
U4313*	£11·80
U4315*	£13·85

* (USSR) Inc. Steel Case P & P 95p.

CARBON FILM RESISTORS
¼W 10 ohm–1 Mohm **90p** per 100, inc. P & P.

CAPACITORS
MINIATURE CERAMICS 22pf–0·047mfd **30p** per doz.
PAPER (Metal cased) 0·01–0·025–0·05–0·1mfd **85p** per doz. P & P 15p

MAINS KEYNECTORS
£3·25. P & P 25p.

MAINS TIMER
Delay 1–30 minutes (Adjustable)
£5·95, P & P 25p.

PLEASE ADD 25+ VAT INCLUDING P & P.

ELECTROSIL AND SEMICONDUCTOR STOCKIST SEND STAMP FOR CAT.

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TELEPHONE: 01-488 3316/8
NEAREST TUBE STATIONS: ALDGATE & LIVERPOOL ST.

SAXON

Money saving high performance audio equipment

DIRECT FROM OUR OWN FACTORIES

GUARANTEED TESTED HIGH PERFORMANCE MODULES—now better value than ever

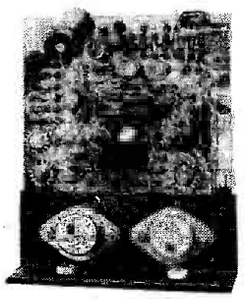
SA35 £6·60 Carriage free
35W RMS 25–50V
7 transistors, 7 diodes

SA50 £8·50 Carriage free
50W RMS 25–65V
7 transistors, 7 diodes

SA100 £12·50 Carriage free
100W RMS 45–70V
10 transistors, 7 diodes

★ 25Hz–25kHz
★ 0·2% distortion
★ Noise—80dB
★ 500mV into 20K
★ 4–16 ohms
★ Simple wiring
★ Short and open circuit proof
★ Continuously rated
★ Top-grade components

120 watt module complete with built-in supply—extra heavy duty £24·75 Carr. 60p



THE SA100 MODULE

POWER SUPPLIES

UNSTABILISED—READY WIRED & FUSED

PU45	Suits 2 SA35 or 1 SA50 (4 ohm)	£6·50	Carriage 50p
PU70	Suits 2 SA50 (8 ohm) or 2 SA100	£9·50	Carriage 60p

STABILISED

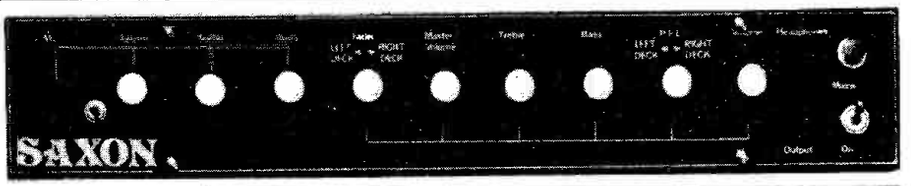
PS45	Suits 2 SA35 or 2 SA50 (4 ohm)	£5·50	Carriage free
MT45	Transformer for above	£3·90	Carriage 50p
PS70	Suits 2 SA100	£6·50	Carriage free
MT70	Transformer or above	£5·50	Carriage 60p

N.B. PS70 is not suitable for the SA50

Mk II STEREO DISCO MIXER £29·50

Carr. 60p

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



DISCO MODULE £12·50 Carr. 50p

Thousands sold of this extremely popular mono version. A mic input may be fitted using the VA30 (see below). Low consumption from a 9V battery. Features the same high standards of reproduction as the Stereo version. Controls: H/phone select, vol, Left deck vol, Right deck vol, bass, treble, master vol. Size 12¾in x 3in x 2in deep.

3-CHANNEL SOUND-LITE £24·75 Carr. 50p

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

SINGLE CHANNEL VERSION £7·90 Carr. free

NOTE: ONLY 8% VAT TO BE ADDED TO ORDER VALUE

MULTI-PURPOSE MIXERS

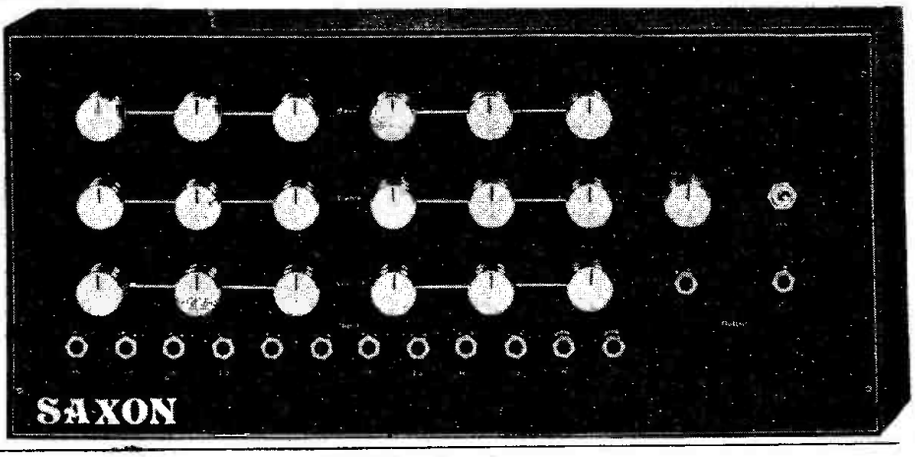
M4HL £25·00 Carr. 60p

M6HL £35·00 Carr. 60p

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

VA30 CHANNEL MODULE £3·90 Carr. free

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

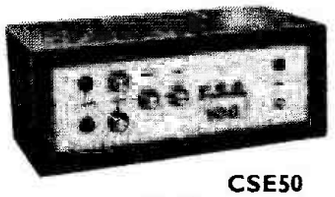


SAXON CSE 100

COMPLETE AMPLIFIER

£39·90
Carr. 60p

100W of speech and music—Two separately controlled inputs. Wide range bass and treble. controls. Sturdy and attractive vynide case. Twin outputs. Ideal for groups, discos, etc. Fully tested and guaranteed. 50W version identical in appearance



CSE50
£33·00 Carr. 60p

NEW ! !

SAXON MULTIMIX 100 £57·00 carr. £1·00

100W rms four inputs *slider* controls *plus* master slider. Wide range bass and treble controls. Fantastic value, ideal for complete disco's, groups, clubs etc.

SAXON MULTIMIX 50—Exactly as above but 50W rms. **£45·00**

CALLERS AND MAIL ORDER

SAXON ENTERTAINMENTS LIMITED

327-331 WHITEHORSE ROAD · CROYDON CR0 2HS

(Please quote magazine when ordering)

SHOP HOURS: 9 a.m.–5 p.m. — LUNCH 12.30–1.30 p.m. MAIL ORDER DESK: 10 a.m.–3 p.m.
24-HOUR ANSWER SERVICE. TEL. 01-684 6385. TECHNICAL ENQUIRIES: 01-684 0098.

SEND 10p FOR OUR 26 PAGE MANUAL—full circuits & details.

TERMS OF BUSINESS: C.W.O. C.O.D. or ACCESS (just send in card number). Send 50p for C.O.D.

Please send S.A.E. with all enquiries.

VAT @ 8% must be added to all orders including carr. charges.

Technological Poverty

THE radio and electronic technician is expected to spend some years of his life in training and study to become qualified. He usually joins a professional society, such as The Society of Electronic and Radio Technicians, and continually updates his knowledge of radio and electronic science. He does this for love.

Compared to members of powerful trade unions, workers in all branches of technology have lost not only their salary differential above these workers but are in the majority of cases substantially *below* what these workers earn. A look at recent advertisements for technicians in this magazine tells the story: Wireless technician £40 to £46 pw, Laboratory technician grade 5 £42 to £49, Prototype wiremen £45 **including** overtime. Recent news items draw the comparison; to Chryslers workers £54·77 is a pittance, they want £70 per week, seamen *reject* 30% giving them £70 for their rather long week, dockers basic rises to £55 and average earnings will be £60 to £70 per week, and now the miners are talking about £100 per week in 1976.

Is it really so difficult to bolt bits of car together? To labour on a ship? To hump containers or coal? The results are beginning to show; hands up any prototype wiremen who are **not** self-employed. This is the only way these skilled electronic workers are able to make a decent living, supervised by technicians who are paid less. There is a chronic shortage of technicians which is not corrected by the law of supply and demand, because the professionally qualified engineers, physicists and chemists are in a similar position. Car builders, dockers and miners have caught them up and, in many cases, overtaken them. Low professional salaries hold the technicians back.

How has this situation come about? Firstly, integrated circuits have streamlined the design and subsequent maintenance of electronic equipment; secondly, lack of industrial investment has slowed the growth of automation and instrumentation; thirdly, the powerful unions insist on high manning levels and prevent investment in technology. All of this reduces the need for technological staff, and has given rise to a surplus at the professional level. By standing still British industry is rapidly becoming underdeveloped; nations with underdeveloped industry have little need for advanced technology. It comes as no surprise to technicians that universities, technical colleges and teachers training colleges are beginning to find a shortage of technical students.

What can the individual do about it? Some technicians have, like the prototype wiremen, become self-employed to gain extra money, tax relief on their cars and relief on travel to work. Some have come under the umbrella of powerful unions in printing works and similar establishments. Some have found employment in the EEC, USA, Canada, South Africa, Gulf States, Australia and New Zealand who **all** provide a much higher standard of living for technicians of all grades. Many 'moonlight' but the vast majority just put up with it and hope for better things in the future.

Those of us who are already qualified have a message for all the students about to study technology; in Britain today your certificate, diploma or degree in technology is a passport to poverty.

LIONEL E. HOWES—*Editor*

NEWS...

Radar Lights

AT the Mullard Research Laboratories, radars have been designed which can detect whether moving objects are advancing or receding. One of these has been applied to the control of portable traffic lights in a way which, at reasonable cost, gives the performance required by the Department of the Environment.

The radars are fitted to a pair of traffic lights and are interfaced with a control unit; they respond to traffic movement but not to irrelevant objects such as moving branches of trees.

The advantages of this system over conventional timed lights is that traffic is not held at 'stop' when no traffic is approaching from the other direction. At times when traffic is approaching from each direction the control unit shares the cycle time; the system ensures a steady flow of traffic at all times.

The system is now at the pre-production stage and production is planned to start very soon.

Cramer Electronics

MOTOROLA has appointed Cramer Electronics to be a UK franchised distributor for its range of products.

Cramer has established its UK headquarters at Ealing (16 Uxbridge Road, Ealing, London W.5. Telephone No. 01-579 3001) with office and warehouse facilities. A complete range of Motorola products is available from stock and products manufactured by any of the more than 100 other top companies for which Cramer Electronics in the USA is franchised can be obtained. All products stocked in the USA are available in the UK within 48 hours, so Cramer inform us.

"Radio Exchange"

Due to a printing error, the above advertiser's full-page advertisement space which appeared in the July issue, is incorrect. Prices quoted were at the old VAT rate. We apologise to all our readers for any inconvenience caused.

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

INTERFACE '75—TEXAS SEMINAR

THURSDAY, 5th June, saw the 1975 Texas Instruments Ltd. Seminar at South Bank in London. The day started at 10.00 a.m. with a talk on Technology Trends in Integrated Circuits. This was followed by an updating on advanced digital circuits entitled New I.C. Products and their Applications.

The next very informative lecture was entitled Semiconductor Memories—it was a comparison of memory products in different systems; their reliability and system interface requirements; the reliability of programmable read-only memory (PROM); fusible links using the PROM in random logic applications, etc. New concepts in power devices were then discussed; high-speed Darlington transistors and their operation and the benefits of fast, slow-recovery high voltage rectifiers.

The following talk entitled Power Control discussed new Darlington transistors in deflection circuits for VDUs, economical switching regulated power supplies with multiple outputs and power control with triacs and thyristors in "touch-switching circuits".

The afternoon lectures started with a discussion on Scientific Calculator Developments—a review of advances in calculator techniques and the development from an initial 4-function chip to that of the latest complex scientific and statistical machines.

J-FETs and MOSFETs was the title of the next lecture and subjects covered were: low-noise J-FETs in audio and other applications, dual gate MOSFETs in tuner front ends and in a digital frequency display and FETs for switching circuits.

What makes a VLED bright? That was the question posed for a discussion entitled Operating Techniques with Visible Light Emitting Diodes. The physiological aspects of VLED brightness were covered together with various techniques used to optimise their efficiency and circuit considerations necessary to maximise visual response.

The last in the series of lectures was Microprocessor Units—an introduction to various MPU architectures. Trade-offs in technology versus complexity and performance were covered together with Schottky microprocessors and an I^2L expandable 4-bit-slice MPU, MOS single and multi-chip microprocessors. Delegates were also shown how to build a 16-bit mini-computer from standard products.

All in all, this was yet another very successful and extremely well-attended Texas Instruments seminar. Exceedingly good value at the £16 plus VAT charge, for a good lunch was included together with wads of useful reference data and a copy of Semiconductor Circuit Design (which, by itself, costs £5). If you would like to know more about Texas Instruments components or be interested in attending next year's Seminar, please contact *Richard Mann* at *Texas Instruments Limited, Manton Lane, Bedford, MK41 7PA.*

Bulk Buying

ABOUT five years ago a buying group was formed among the small electronic component retailers. The main object was, and still is, to buy goods at cheaper rates by bulk buying.

The membership at present is 25 but for obvious reasons it would be better to enlarge it. There are not sufficient funds to advertise the group as total revenue is derived from a modest £6 a year subscription.

It's possible that there are other component retailers who may like to join this group and help us all by keeping the prices of components down.

Would those who may be interested please write to *Alan Sproxton, c/o Home Radio (Components) Ltd., 240 London Road, Mitcham, Surrey, CR4 3HD. Telephone 01-648 8422.*

Books received

Elements of Transistor Pulse Circuits
By T. D. Towers
Expanded and updated coverage on digital microcircuits readily commercially available.
Price: £3·50
Butterworth & Company, 88 Kingsway, London, WC2B 6AB.

Radio Servicing Pocket Book
By Vivian Capel
A practical book for the radio service man. A lot of space is devoted to workshop planning and practice, test equipment, repair techniques and hints as well as fault diagnosis and quick economical repair etc.
Price: £1·95
Newnes-Butterworth, the Butterworth Group, 88 Kingsway, London, WC2B 6AB

Television
By K. Wicks
Shows basic principles of converting light into electricity, scanning and sound systems, the organisation of a TV studio. Shows developments and processes of TV which result in pictures.
McDonald Educational, St. Giles House, 49-50 Poland Street, London, W1A 2LG.

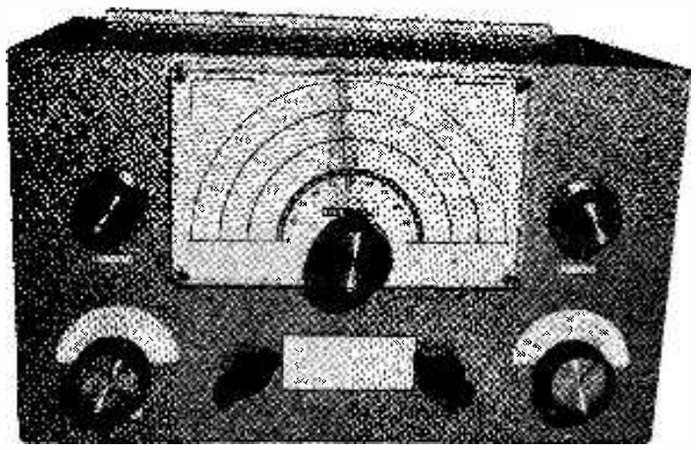
DUAL CONVERSION receiver

PART: 1

F. G. RAYER

TO reduce second channel interference, it is necessary either to increase selectivity **before** the mixer or frequency-changer, or to use a higher intermediate frequency. If an RF stage is used to increase selectivity, the need for a number of coils, with switching and ganged tuning, is introduced. On the other hand, the high IF alone does not result in better selectivity.

The receiver described here seeks to avoid these difficulties by double conversion. It has a first IF of 5·5MHz to reduce second channel interference, followed by conversion to 465kHz, for improved selectivity. The choice of a first IF around 5·5MHz, combined with the fact that the oscillator may be above or below the received signal frequency, allows four amateur bands to be tuned, without any need for oscillator coil switching. This considerably simplifies construction.



AERIAL TUNING

The variable tuned circuits of the receiver are shown in Fig. 1. S1 to S4 are sections of the 4-way bandswitch. Only two aerial coils are required. L1 tunes 160m and 80m, while L2 covers 40m and 20m. Variable capacitor VC1 is the aerial tuning control which is peaked for best reception. There is no ganged tuning in the receiver.

Aerial socket A1 is for normal aerials, S1 switching to the required primary of L1 or L2. Socket A2 is for a short aerial, which is useful, as even a short indoor wire or rod will provide a considerable number of signals. The 5·5MHz trap is optional and can be added later. It is only needed in those circumstances where breakthrough around 5·5MHz is troublesome.

A small 365pF capacitor is used for VC1 but only about 250pF is required here. However, this capacitor, and similar midget ganged capacitors for transistor portables, can be easily obtained.

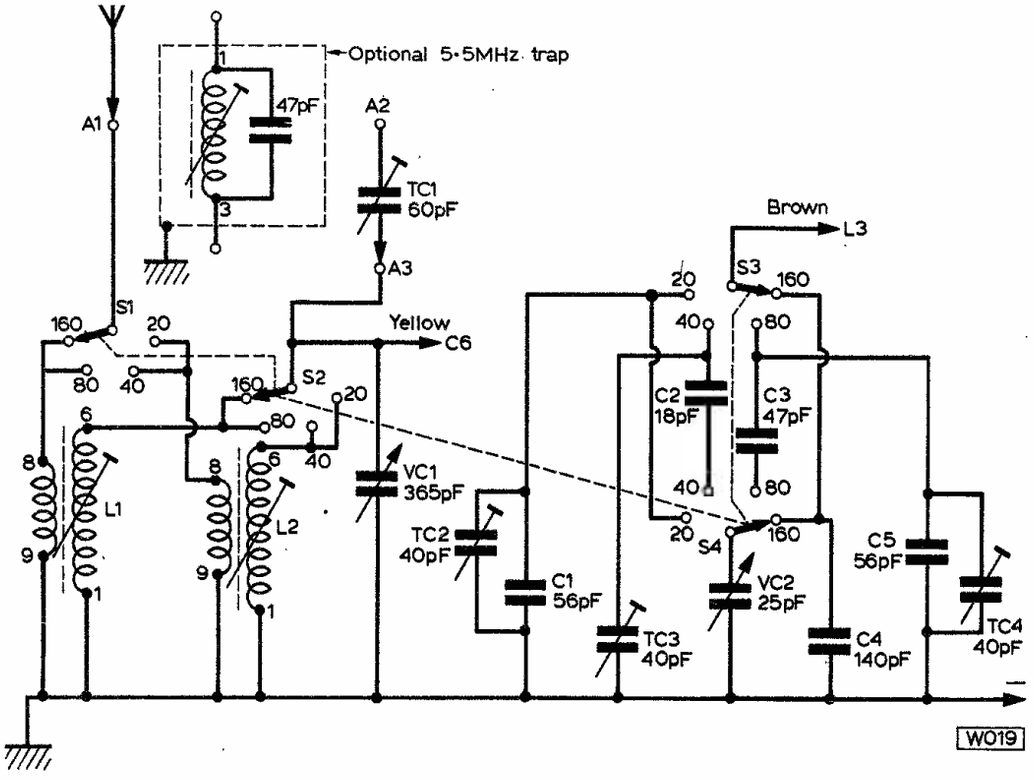


Fig. 1. Circuits of aerial and oscillator tuned circuits.

★ components list

Resistors

R1	100kΩ	R18	2·2MΩ
R2	2·2kΩ	R19	8·2kΩ
R3	100kΩ	R20	2·7kΩ
R4	2·7kΩ	R21	1·2kΩ
R5	1MΩ	R22	3·9kΩ
R6	5·6kΩ	R23	100Ω
R7	15kΩ	R24	56Ω
R8	13kΩ	R25	680Ω
R9	2·7kΩ	R26	390Ω
R10	120kΩ	R27	5·6Ω
R11	47kΩ	R28	5·6Ω
R12	33kΩ	R29	2·2kΩ
R13	330kΩ	R30	22kΩ
R14	27kΩ	R31	4·7kΩ
R15	390Ω	R32	1kΩ
R16	1·5kΩ	R33	2·7kΩ
R17	2·7kΩ		

All resistors are ¼, or ⅓W 10%
VR1 5kΩ linear potentiometer
VR2 10kΩ log. potentiometer

Capacitors

C1	56pF*	C17	6μF (6V)
C2	18pF*	C18	0·1μF
C3	47pF*	C19	0·01μF
C4	140pF*	C20	220μF (10V)
C5	56pF*	C21	0·1μF
C6	150pF	C22	0·02μF
C7	0·01μF	C23	0·25μF
C8	10pF	C24	100μF (10V)
C9	5000pF	C25	10μF (6V)
C10	100pF	C26	200μF (6V)
C11	0·1μF	C27	32μF (6V)
C12	100pF 2%	C28	320μF (6V)
C13	100pF 2%	C29	220μF (10V)
C14	0·04μF	C30	0·01μF
C15	0·02μF	C31	0·01μF
C16	330pF 2%	C32	0·01μF

TC1 60pF compression trimmer
TC2 40pF ceramic or beehive trimmer
TC3 40pF ceramic or beehive trimmer
TC4 40pF ceramic or beehive trimmer
VC1 365pF variable (Jackson 01)
VC2 85pF variable (Jackson C804)
VC3 15pF variable (Jackson C804)
* C1-C5 are 2% silver mica.

Semiconductors

Tr1	40673	Tr6	BC107
Tr2	MPF102	Tr7	AC128
Tr3	BF194	Tr8	AC141
Tr4	BF195	Tr9	AC142
Tr5	BF195	Tr10	BC107
D1	OA91		

Miscellaneous

Aerial coils L1 and L2, Denco valve type 'Blue' Range 3 and 4 respectively. Oscillator coil L3, Denco valve type 'Red' Range 4. L4, Denco 'Red' range 4T. BFO coil L5, Denco IFT14. IFT1, Denco IFT15. IFT2, Denco IFT18/456. IFT3, Denco IFT18/465. IFT4, Denco IFT14. Optional 5·5MHz trap, Denco valve type 'White' Range 3 with 47pF silver mica capacitor. S1/S2/S3/S4, 4-pole 4-way rotary switch, single or double wafer. S5/S6, 2-pole 3-way switch. 3·5mm jack socket. 1st mixer and osc. board, plain perforated board 0·15in. matrix 51 x 57mm (2 x 2¼in.). 2nd mixer and IF board, plain perforated board 0·15in. matrix 135 x 45mm (5⅜ x 1¾in.). Audio amplifier board, plain perforated board 0·15in. matrix 83 x 52mm (3¼ x 2in.). BFO board plain perforated board 0·15in. matrix 75 x 32mm (3 x 1¼in.) Type W case 305 x 178 x 178mm (12 x 7 x 7in.) available from H. L. Smith & Co. Ltd. Chassis, four sided 254 x 153 x 51mm (10 x 6 x 2in.). Pair of panel brackets 102 x 102mm (4 x 4in.) Dial and drive, Type DL6 Home Radio.

OSCILLATOR TUNING

VC2 tunes the oscillator coil L3 and is operated by a two-speed ball drive. For 160m C4 is across VC2 while on 80m C5 and TC4 are in use, with C3 in series with VC2. For the 40m band TC3 is across L1 with C2 in series with VC2. For 20m C1 and TC2 are in parallel with VC2 and L3.

The oscillator is HF of the signal frequency for 160, 80 and 40m, and LF of the signal frequency for 20m. With a 5·5MHz IF, the oscillator frequency coverage is a follows:

	Aerial Circuit	Oscillator
160m	1·65— 2·05MHz	7·15— 7·55MHz
80m	3·45— 3·90MHz	8·95— 9·40MHz
40m	6·70— 7·60MHz	12·20—13·10MHz
20m	13·90—14·60MHz	8·40— 9·10MHz

It is not necessary, of course, that the first IF is exactly 5·5MHz. When adjustment of the oscillator coil and trimmers is to be made, 160m is dealt with first, as C4 is fixed. With the bandswitch at 160m, L3 is adjusted until the swing of VC2 gives Top Band reception 1·8-2·0MHz. The switch is then set to 80m and TC4 adjusted to bring this band into the tuning range. In a similar way, TC3 is adjusted to bring in 40m, and TC2 for 20m.

1st MIXER/OSCILLATOR

The circuit of the 1st mixer and oscillator is shown in Fig. 2. When assembled, this board has flying leads and a chassis return, for connecting to the bandswitch, etc.

As Tr1 is a gate-protected device, assembly is straightforward. The oscillator coil L3 is on the board, and the same coil is used for the four bands,

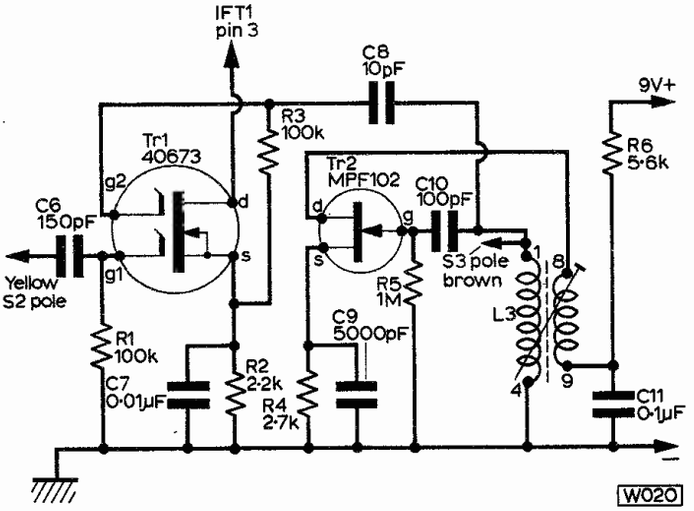


Fig. 2: First mixer and oscillator stages.

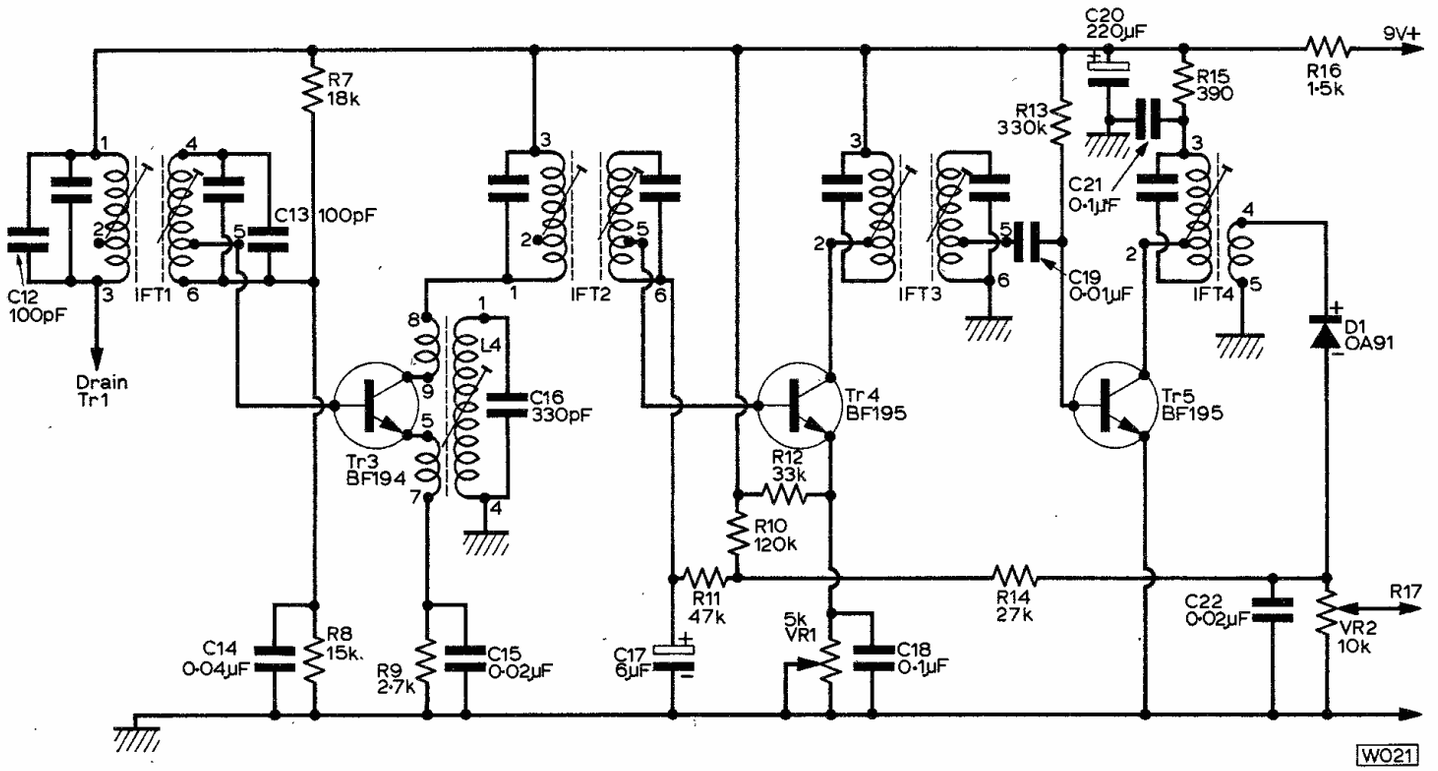


Fig. 3: Circuit diagram of the 5·5MHz IFT input circuit, 2nd mixer/oscillator, and 465kHz amplifier.

as described. The drain circuit of Tr1 passes to the primary of the 5·5MHz IF transformer mounted on the next board.

2nd MIXER AND IF

Fig. 3 shows this part of the receiver. IFT1 is a 10·7MHz IF transformer, loaded by C12 and C13 so that it can be tuned to 5·5MHz. As the extra capacitance needed here depends on the internal capacitors, different values might be necessary with other 10·7MHz IFT's. There are thus two circuits operating at 5·5MHz and the small screened transformer was found to be ideal here.

Tr3 is a self-oscillating mixer, with oscillator coil L4 and C16 in parallel. When L4 is correctly tuned, a 465kHz signal is fed for IFT2. Diode D1 provides automatic gain control bias in the usual way, through R14. The gain of Tr4 is also controlled manually by VR1. This is essential, as strong signals will overload later stages, while the signal level will be too great for satisfactory SSB or CW operation.

The board for this section of the circuit also has flying leads and a pin for the positive connection. All components in Fig. 3, except VR1 and the volume control VR2, are present on this board.

AUDIO AMPLIFIER

The amplifier is shown in Fig. 4, and is a transformerless circuit giving excellent gain and output. An IC or equivalent audio amplifier could no doubt be used, but the transistors are inexpensive and

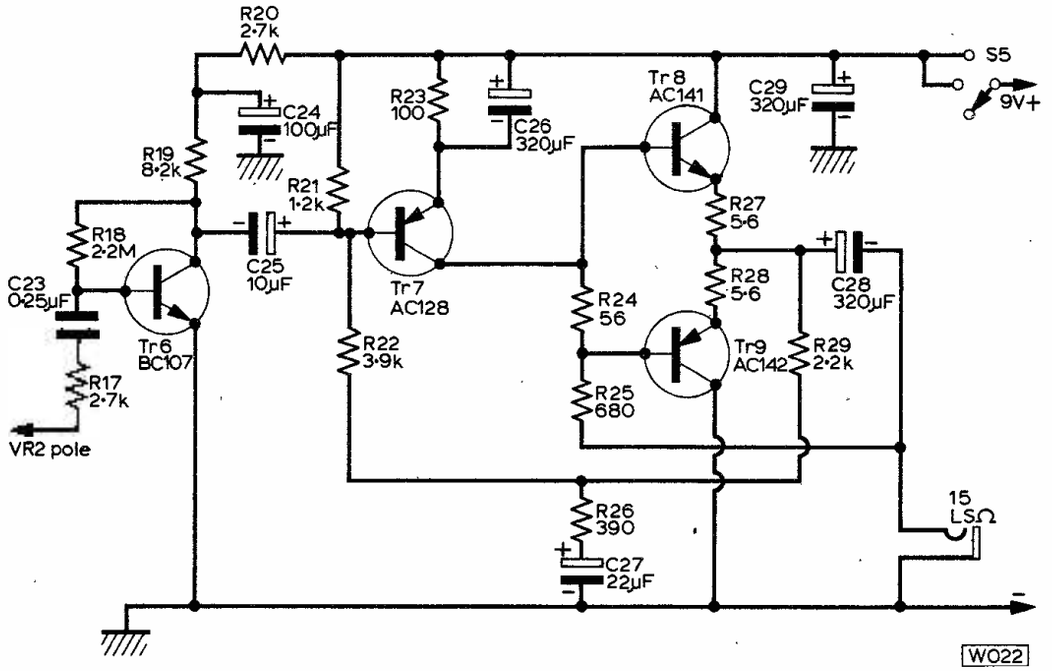


Fig. 4: Circuit of the four transistor audio amplifier. The loudspeaker impedance should be around 15Ω.

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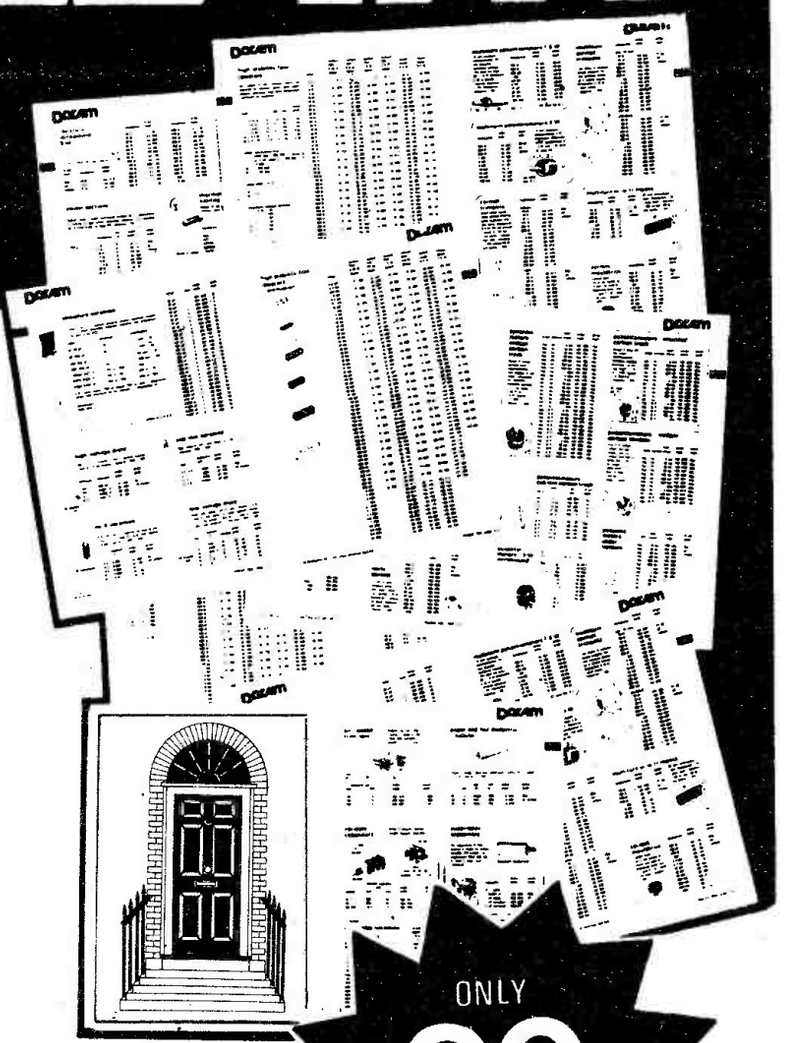

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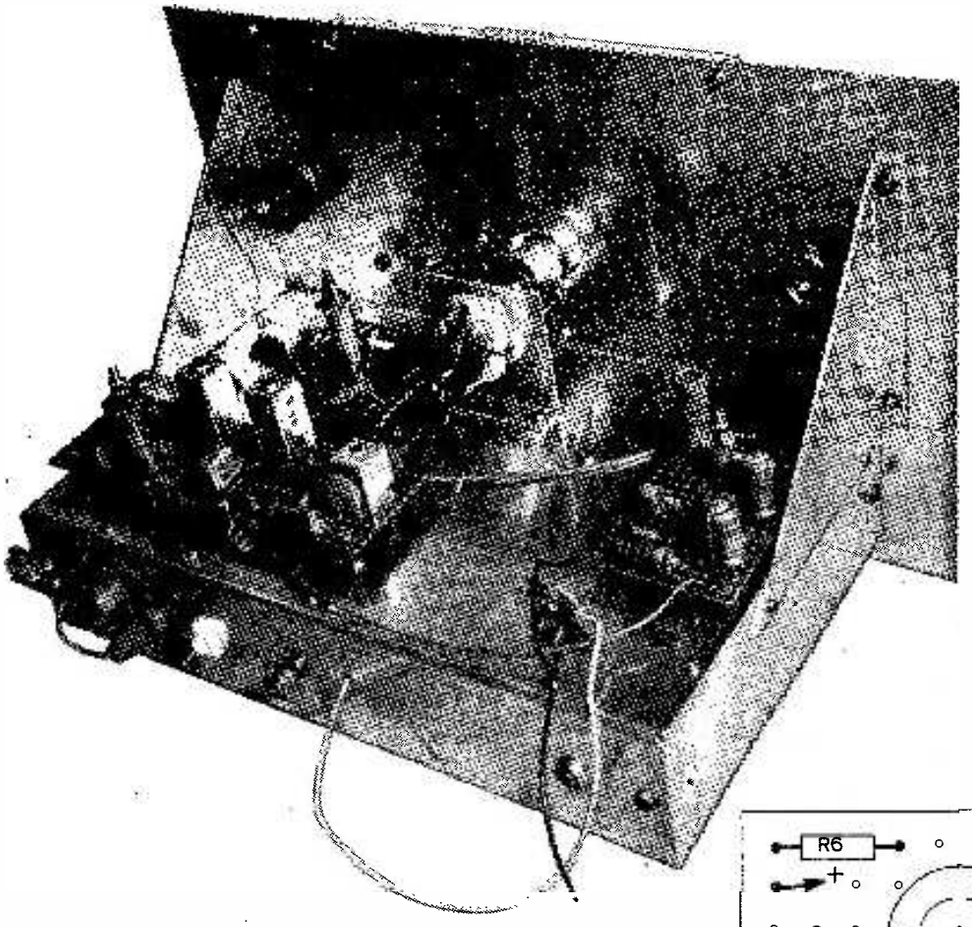
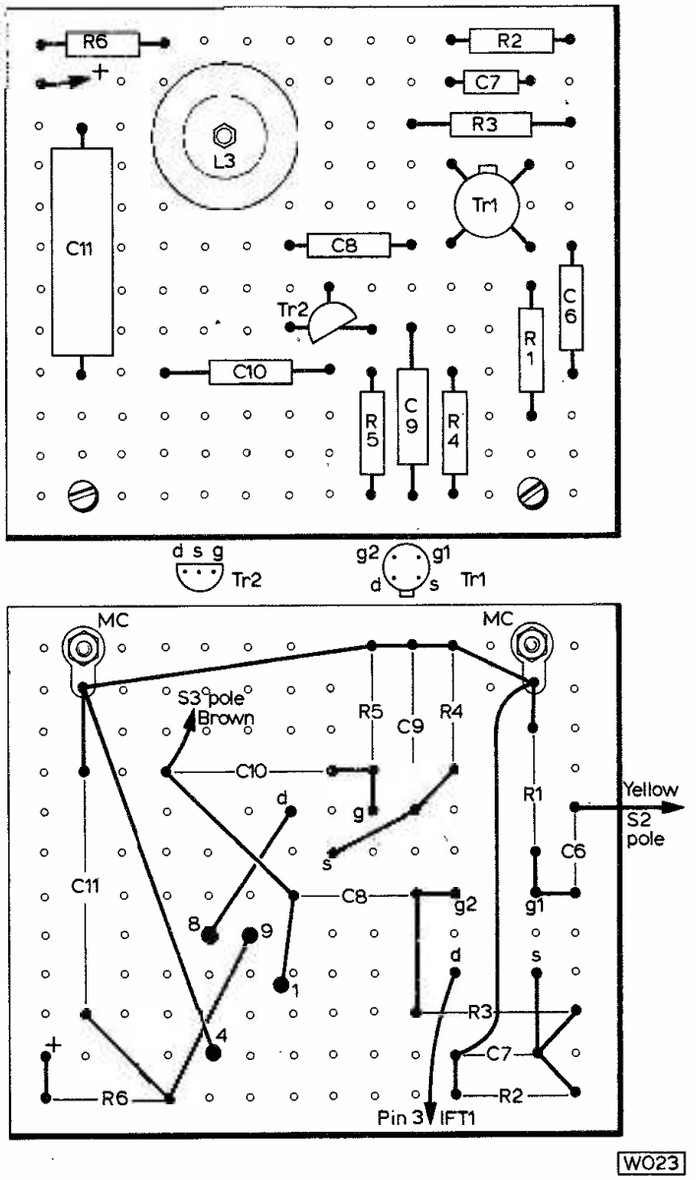


Rear view photograph of the receiver, showing the layout of the boards, the mounting for the tuning capacitor and the various aerial sockets.

Fig. 5: below, drawing showing both sides of the first mixer and oscillator board.



easily obtained and the circuit perfectly straightforward. Tr6 gives high gain with low noise, while Tr7 and the output pair are directly coupled to stabilise DC conditions, with selective feedback through R29 and R22.

FIRST MIXER BOARD

The method of wiring here is followed in the other circuit boards of the receiver. Plain perforated board, 0·15in. matrix, is used, approximately 51 x 57mm (2 x $2\frac{1}{4}$in). Fig. 5 shows both sides of the board.

Drill two holes for the 6BA bolts MC. The metal chassis can also be drilled at the same time, through these holes, so that no fitting difficulty arises later. Each bolt is 12·5mm ($\frac{1}{2}$in) long and has a tag forming the chassis return. When the board is finished, extra nuts hold it about 6mm ($\frac{1}{4}$in) clear of the chassis and nuts under the chassis lock it in position.

Holes are drilled for the pins of the oscillator coil L3 which is then fixed with adhesive. The resistors and capacitors are added as in Fig. 5. Bend the wire ends over, cut as needed and solder, keeping all connections and joints near the board so that there is no possibility of contact with the chassis. Insulated sleeving is put on wires which cross other leads.

As it is difficult to check the leads of Tr1 and Tr2 when these are fitted, short lengths of coloured insulated sleeving are put on these wires first. Brown is used for source, yellow for gate 1 of Tr1 with white for gate 2, and drain leads left bare. The devices are then positioned as in Fig. 5. Tr1 is gate-

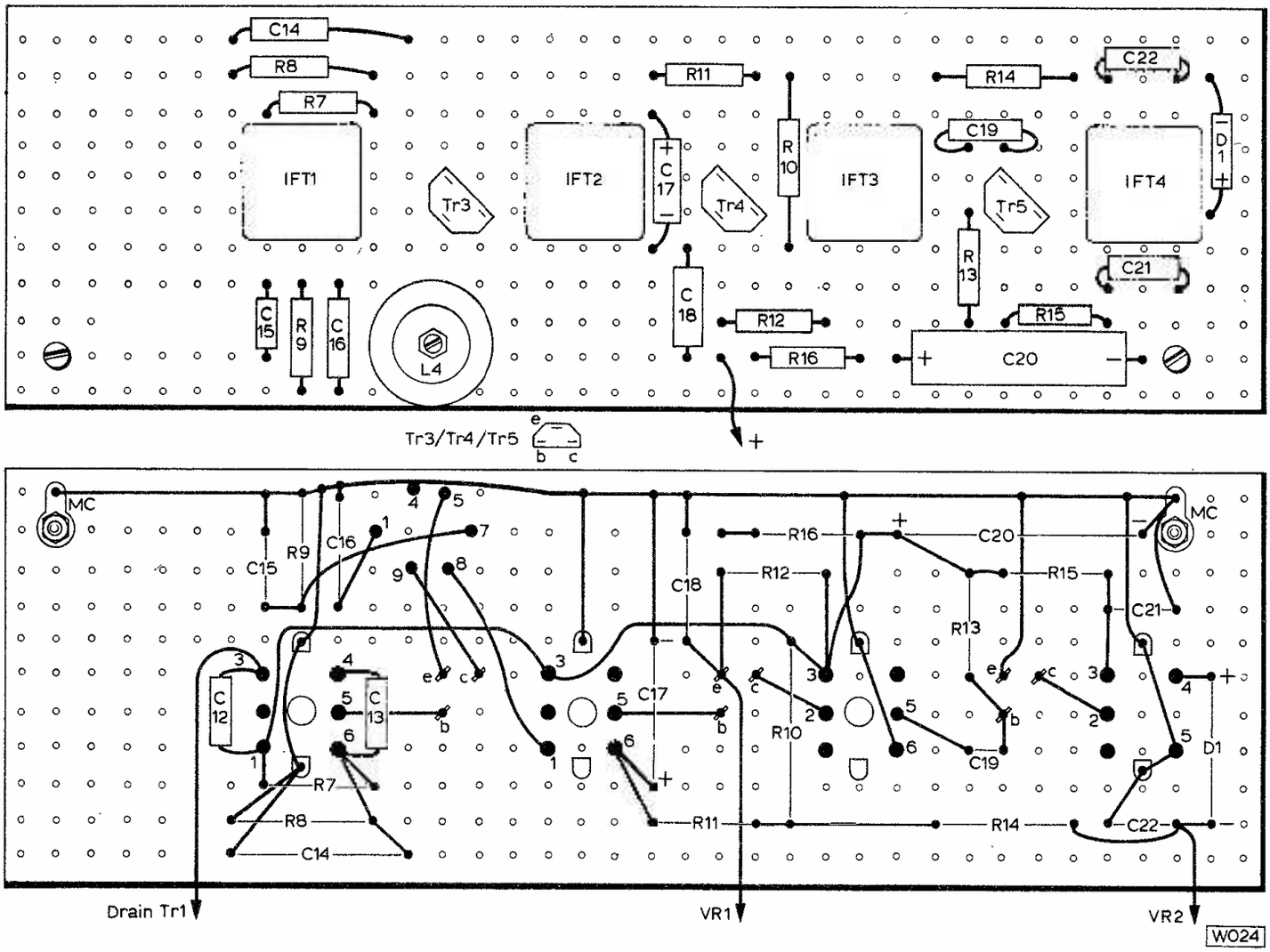


Fig. 6: Topside and underside views of the 2nd mixer/oscillator and 465kHz IF board.

protected, so that no special care is necessary when soldering, except for the usual caution to avoid lengthy and unnecessary heating.

A pin or flying lead is provided from R6, for the battery positive circuit. A wire (Yellow in Fig. 5) runs from C6, down through the chassis to the bandswitch together with a brown wire from pin 1 and C8 which is for oscillator tuning. On top of the chassis, a wire runs from D of Tr1, to pin 3 of IFT1. The chassis return is via the bolts mentioned.

If desired, this board can be tested by connecting up a 9V supply and using a receiver to note that the oscillator carrier can be found with the receiver on any of the oscillator frequencies mentioned.

2nd MIXER-IF BOARD

Fig. 6 shows both sides of this board. It is prepared by drilling for the four IFT's, bolts MC and second oscillator coil L4. Central holes are necessary under IFT1, 2 and 3 for trimming purposes. A very small round file may be helpful when making the holes as the IFT's and coil should fit without any strain on the pins.

All the IFT screening cans are connected to the chassis while C12 and C13 are directly across the windings of IFT1, below the board, as in Fig. 6. Leave a pin or projecting wire of R16 for the positive supply as this is a junction point for other leads later. Flying leads are left for VR1 (from C18) and for VR2 (from C22). When the board is finished, the drain wire from Tr1 can be cut to a suitable length and soldered to pin 3, IFT1. Correctly positioned holes for the bolts MC are made by placing the board on the chassis before wiring it. Chassis holes are drilled to reach the cores of IFT1/2 and 3.

If desired, this board can be tested before fitting. To do this, leave pin 3 of IFT1 (drain) off, connect VR1 and VR2 and a 9V supply. The audio signal from VR2 can be taken to the audio amplifier or to phones via an isolating capacitor. As the 465kHz IFT's are pre-aligned, little or no adjustment should be necessary at this stage. A signal generator tuned to 5·5MHz can be temporarily coupled to pin 3 of IFT1, and L4 tuned until this is heard. The two cores of IFT1 can then be peaked up for best volume.

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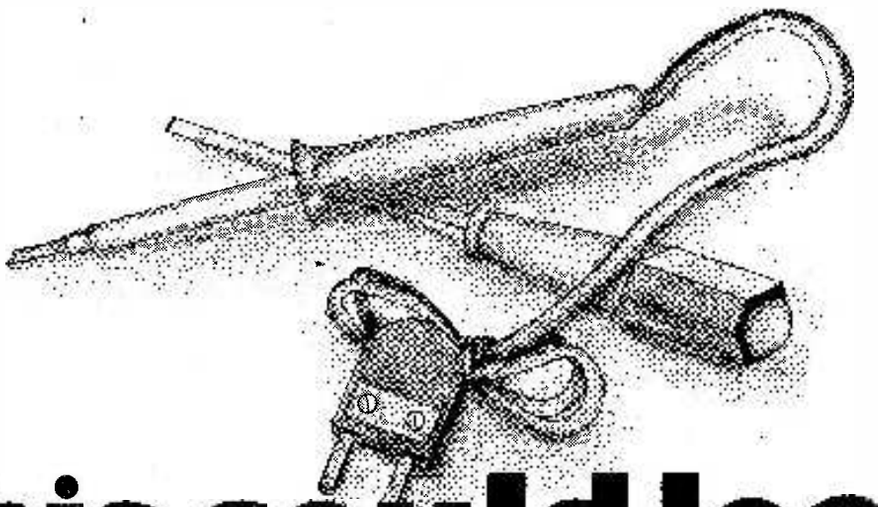

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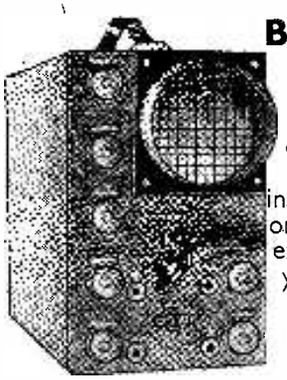

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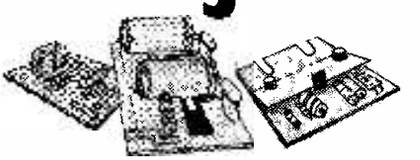

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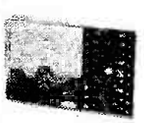
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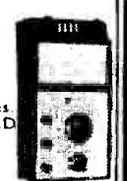
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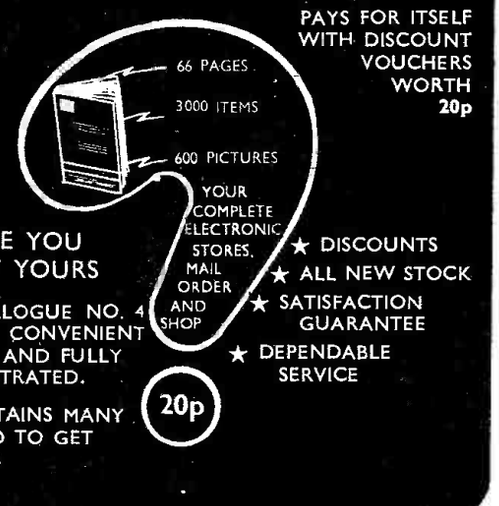

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PW APOLLO series Part 4

VARICAP AM/FM STEREO TUNER (CONSTRUCTION & ALIGNMENT)

W. POEL*

IN THIS, the final part of the P.W. Apollo series, we will look at the construction of the AM/FM Varicap Tuner which was discussed theoretically in Part 3.

CONSTRUCTION

Whenever making a project that employs an integrated circuit, it is always advisable to familiarise oneself with the device from the manufacturer's data sheet. So much has been published on the CA3089E and the stereo decoder that a great deal of knowledge and experience is readily available on their usage.

Integrated circuits need printed circuit boards for radio frequency applications. Veroboard and the like will not suffice for best results, so follow precisely the etching patterns shown in this article or obtain p.c.b.s ready-made before starting the project.

The base board layout allows simple construction practice so follow details for each module and the final assembly will present no difficulties.

THE TUNERHEAD

The tunerhead is available pre-aligned and tested. The resources for manufacturing such an item are generally beyond the average constructor. The only point to note is that the tuning bias supply is externally decoupled with an additional electrolytic capacitor of approximately 10μF and that this capacitor is soldered to the lugs as shown in Fig. 4.8.

THE FM IF AMPLIFIER

Again, since it was felt that the construction of an FM IF strip with only 0·1 per cent THD may be beyond the technical resources of the average constructor a standard unit that is also available ready-built was chosen. However, for the more experienced constructor a kit is also available.

The IF linear phase blocks are pre-aligned and require only a minimum of trimming to ensure best results and this should be no more than a single turn of the input and output transformer cores.

The p.c.b. pattern is shown ready for copying (Fig. 4.1) and also with the components superimposed for positioning (Fig. 4.2). The leadout from the module is taken via some p.c.b. pins to the mother board but there are also some minor modifications to accommodate the switch for the muting circuit so that this function can be defeated when searching around for a weak station.

With the EC3302U tunerhead the a.g.c. facility is not operational though if a tunerhead such as the Larsholt 8319/8321 or the Toko EF5600K were used, this could then be employed by making the appropriate connection. However, the a.g.c. is not a facility that will be missed much in most locations in Britain. Modern limiting amplifiers, especially when preceded by an eight pole filter, will not be adversely affected by its omission.

When soldering always use an iron of adequate heat capacity and remember that more faults occur through "under soldering" than through components damaged by too much heat. Even the IC will not be affected by the amount of heat it takes to leave a really complete smooth and shiny soldered joint.

The pins that are used to fit the module to the mother board can be made from 20 s.w.g. tinned copper wire if desired. Just bend the top across to prevent the pins from dropping through whilst being soldered. The quadrature detector coil can be either single or double tuned as previously mentioned. Provision is made on the board for the use of a single KACSK 586HM, and this transformer can then be aligned without anything more complex than a voltmeter. Full details are given in the section on testing and alignment.

THE STEREO DECODER

The KB4400 requires little in the way of external circuitry and there are few points to note during the construction that are not supplied by reference to the circuit and layout diagrams .(Figs. 4.3 and 4.4.)

The decoder is once again mounted to the base board via pins.

* Ambit International.

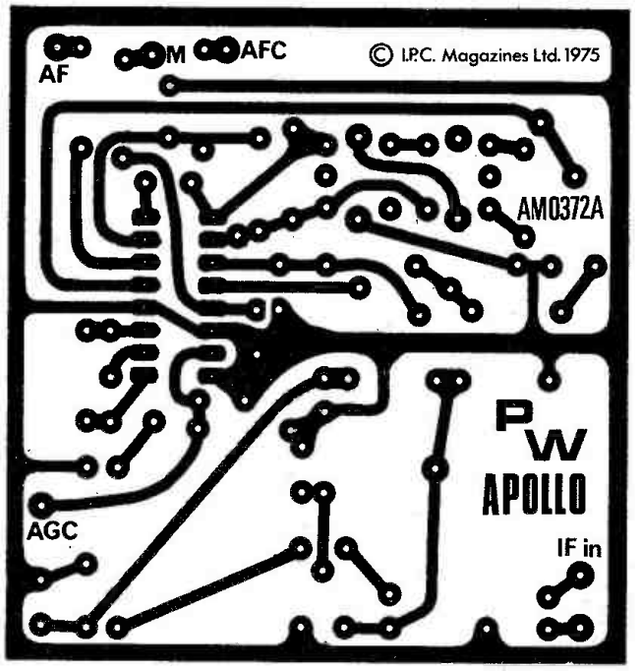


Fig. 4.1: Printed circuit board master for the FM/IF Board shown full size.

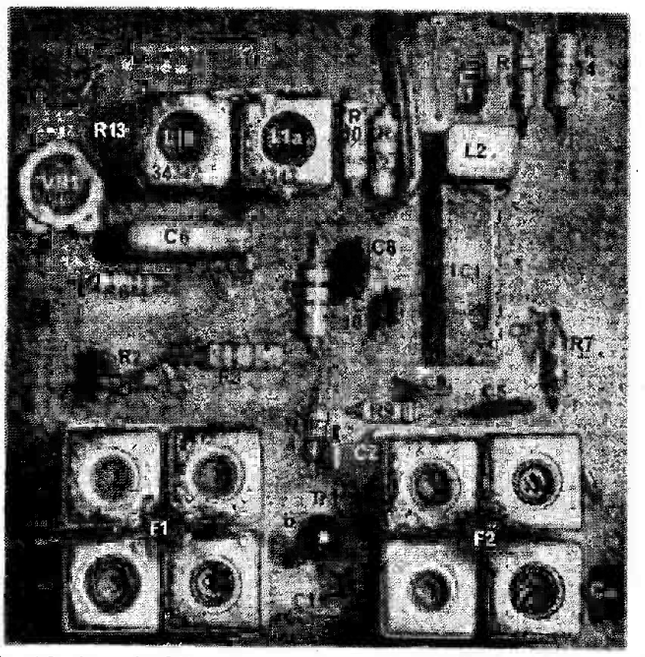


Fig. 4.2: Layout of the components on the FM/IF Board. If a single tuned circuit is to be used instead of the double tuned circuit shown then a KACSK586HM should replace L1a.

THE AM RADIO MODULE

The AM tuner module has been fully documented in Part 1 of the Apollo series. It is quite possible that readers will have constructed such a module and wish to incorporate it in this design, but, if not, the layout and p.c.b. patterns are shown in Figs. 4.5 and 4.6. There have been one or two minor routing changes in the p.c.b. layout to keep the tracks from the tuning diode to the aerial socket away from the output of the RF stage. It is never a good idea to place inputs and outputs in close proximity especially in RF layouts where the mutual coupling is far greater than in audio. A trimmer has also been included across the RF stage in the new layout.

The net results of the improvements is that the positioning and alignment of the ferrite rod aerial is not as critical as previously.

The overall component layout and the pins to and from the AM radio module remain unchanged apart from the alterations mentioned above.

The new coil for the RF stage is the Toko 6A6371 which is electrically the same as the 6A6408 but with the pin connections revised according to the changes in the layout.

THE POWER SUPPLY

A standard Douglas mains transformer can be used in the power supply or maybe the MTC "do-it-yourself" transformer with ready wound primary would be suitable. In any case, remember that the two windings must be separate and that a centre-tapped 40V winding will certainly not be suitable.

The voltage regulator devices are the 78 series fixed voltage regulators but by placing a Zener diode in the earth lead as shown in Fig. 3.4 the output voltage can be increased by the amount of the Zener voltage. This method is a simple means of adapting any 78 regulator in place of the 30V source.

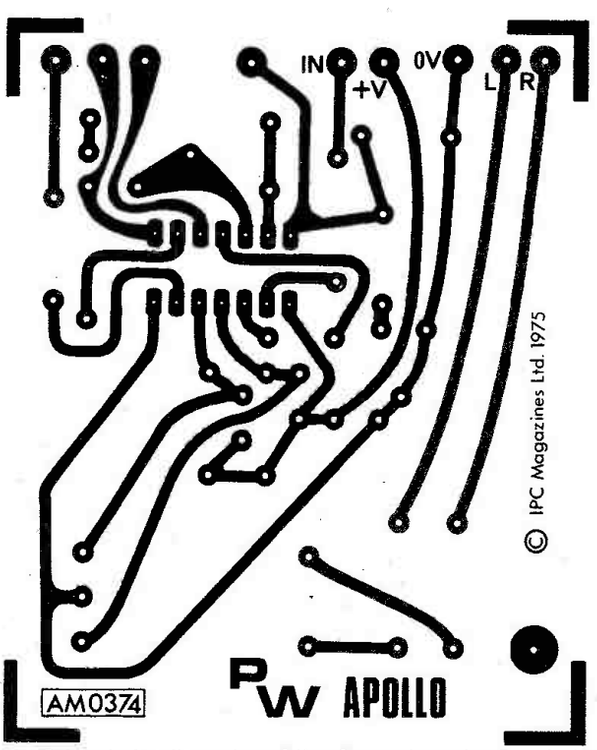


Fig. 4.3: Printed circuit master of the Stereo Decoder Board shown full size.

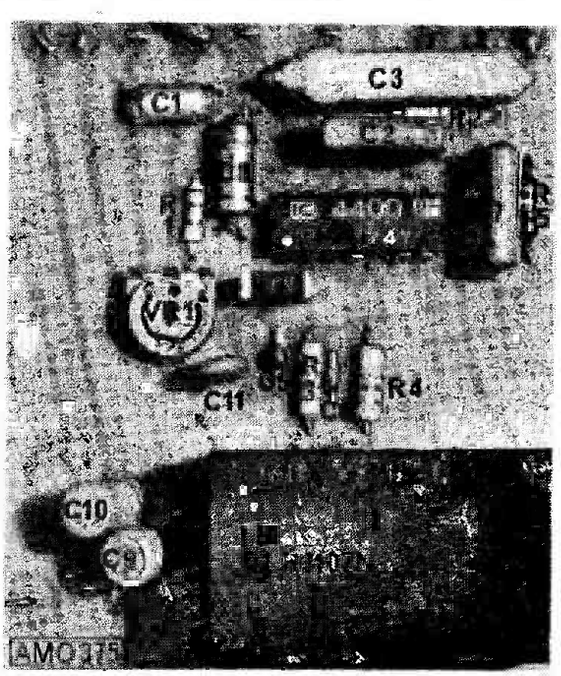


Fig. 4.4: Layout of the components on the Stereo Decoder Board.

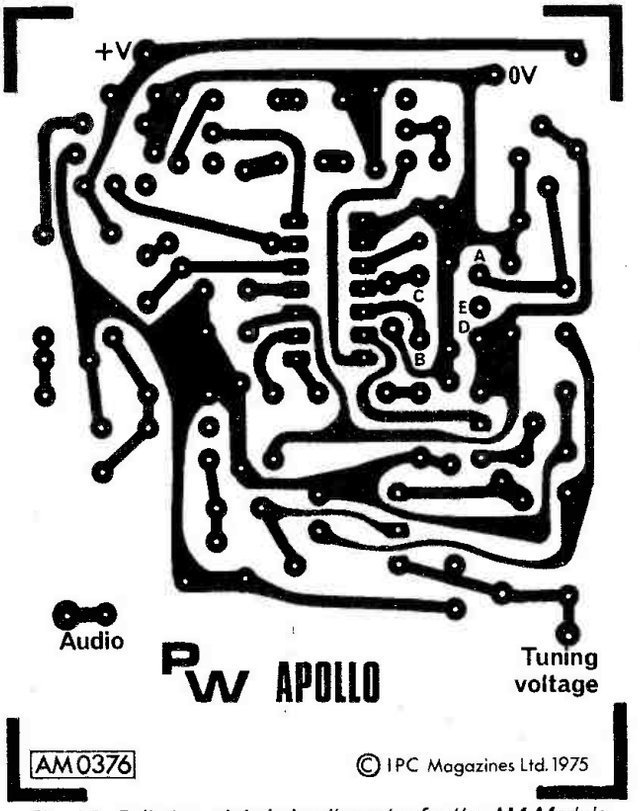


Fig. 4.5: Full size printed circuit master for the AM Module.

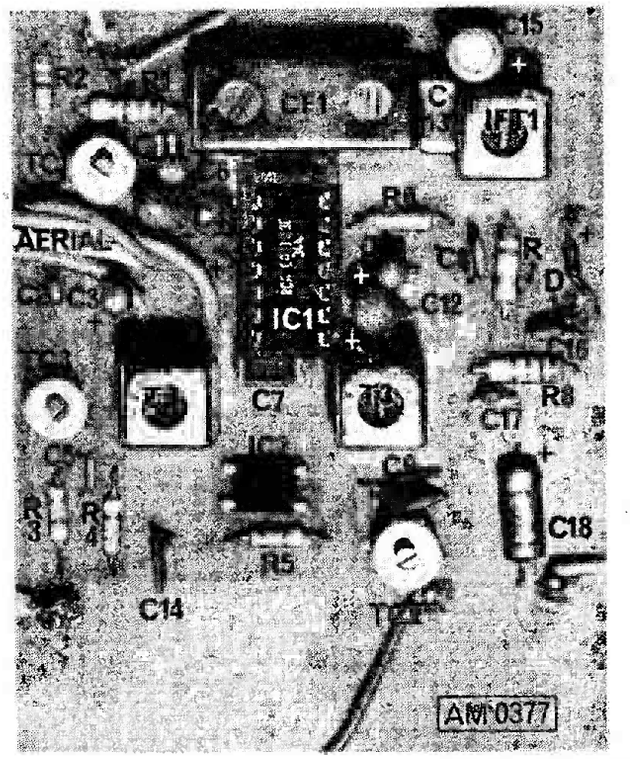


Fig. 4.6: Layout of the components on the AM Module. Note that there is another trimmer capacitor (TC3) on this board, otherwise all components are the same as given in Part 1 of the series, except the RF coil which is now a 6A6371.

TEST PROCEDURES

Before attaching any of the modules to the base board, it is advisable to test them first.

The tunerhead is supplied ready built and tested but if the FM/IF section has been home made then it is advisable to ascertain that the unit is functioning by connecting the units up with an audio amplifier and the outptut from the tunerhead.

Begin by rotating the muting control (VR1) fully anticlockwise, in order to defeat the muting function, and apply the supply to the unit. The meter need not be connected for this test as it is simply intended to provide a go/no go indication.

The tunerhead can be simply connected up via the edge connector terminations to provide an input to the IF.

Some white noise should be heard in the audio amplifier (the output from the IF board is approximately 330mV), and by tuning the front end, a signal should be heard without too much difficulty. The actual degree of success will depend on the strength of the FM signals in each particular location and reference to the BBC FM transmitter area coverage will reveal the relative strength in any particular area.

Provided some recognisable sound is forthcoming, adjust the quadrature detector stage coil (L1) which is assumed to be the KACSK 586HM since the double tuned variety, the TKACS 34342/3, requires a wobbulator for alignment and persons possessing such equipment will not require comment on its application.

The core should be rotated for best audio which is also liable to coincide with maximum off station noise. (Remember that the mute preset has been left untouched in the mute defeat position.) When confident of the functioning of the IF affix to the base board.

POWER SUPPLY UNIT

The power supply is relatively simple in terms of components, but before applying any of its outputs directly to the tunerhead/IF ensure that the voltages are in fact correct. If possible the d.c. line should be examined on an oscilloscope to make certain that there is no hum present.

Check that the operation of the AM/FM switch reverses the tuning voltage in the correct sense.

STEREO DECODER

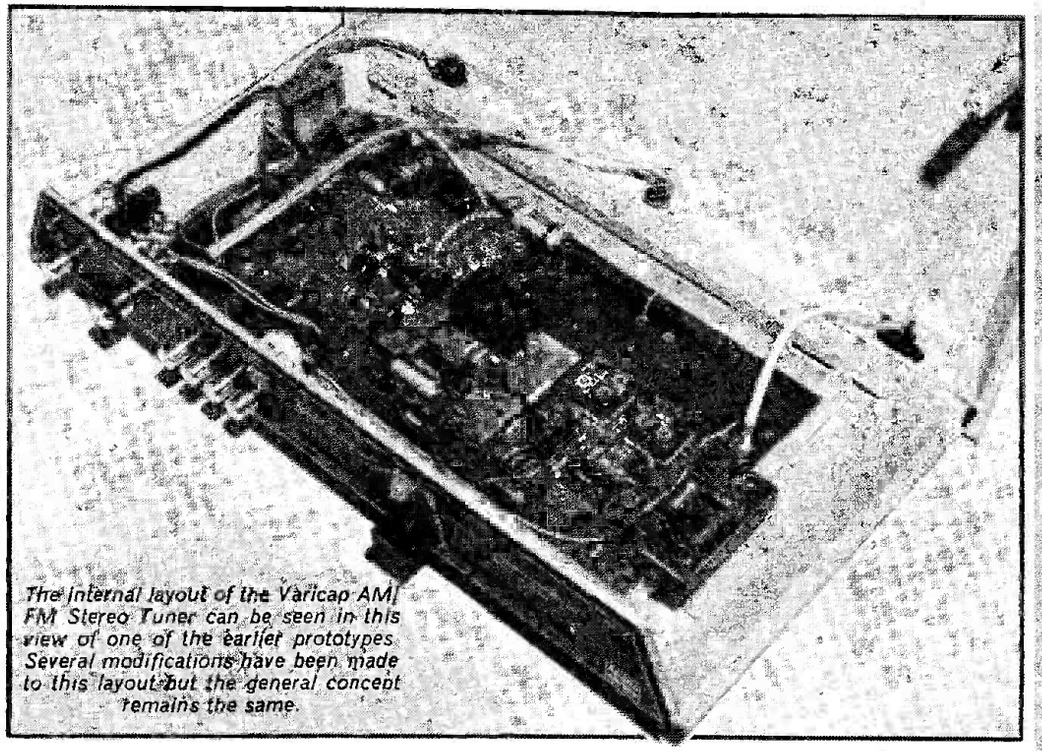
The stereo decoder requires only the adjustment of the preset to align it though before attempting alignment make certain that the tuner is, in fact, tuned to a stereo broadcast (see *Radio Times*) and that the mono/stereo switch is in the stereo position. Alignment is completed when the stereo broadcast beacon LED lights up. Note where the LED extinguishes in the rotation of the preset (VR1) and return the preset to the centre of its travel during the period of the illumination of the LED to set the VCO in the phase locked loop as close to 19kHz as possible.

AM MODULE

The AM module has been described previously (May 1975) but there are a couple of points which should be mentioned here since the demand for the triple diode (MVAM1) has outstripped the capacity that Motorola had set aside for its manufacture.

The two section diode, the MVAM2 has been made in larger quantities and it is possible to employ it in place of the MVAM1 on the Apollo tuner board.

Two MVAM2 are required: one to control the RF and aerial section coils and half the other MVAM2 for the oscillator tuning control. This means that the tracking of the signal frequency circuits will be



The internal layout of the Varicap AM/FM Stereo Tuner can be seen in this view of one of the earlier prototypes. Several modifications have been made to this layout but the general concept remains the same.

largely independent of the dissimilarities which may occur between two different examples of the MVAM2.

In practice, the MVAM2 tend to be quite closely matched between samples from the same batch and the results are indistinguishable from those obtained using the more expensive MVAM1 device.

By the time of publication the supply may have caught up with the demand for the MVAM1 but, as stated, this substitution provides the basis for a lower cost alternative.

FINAL TESTING

When satisfied that the power supply is providing the correct voltages and all sections are soldered down onto the base board, together with the additional components and the various links (see Figs.

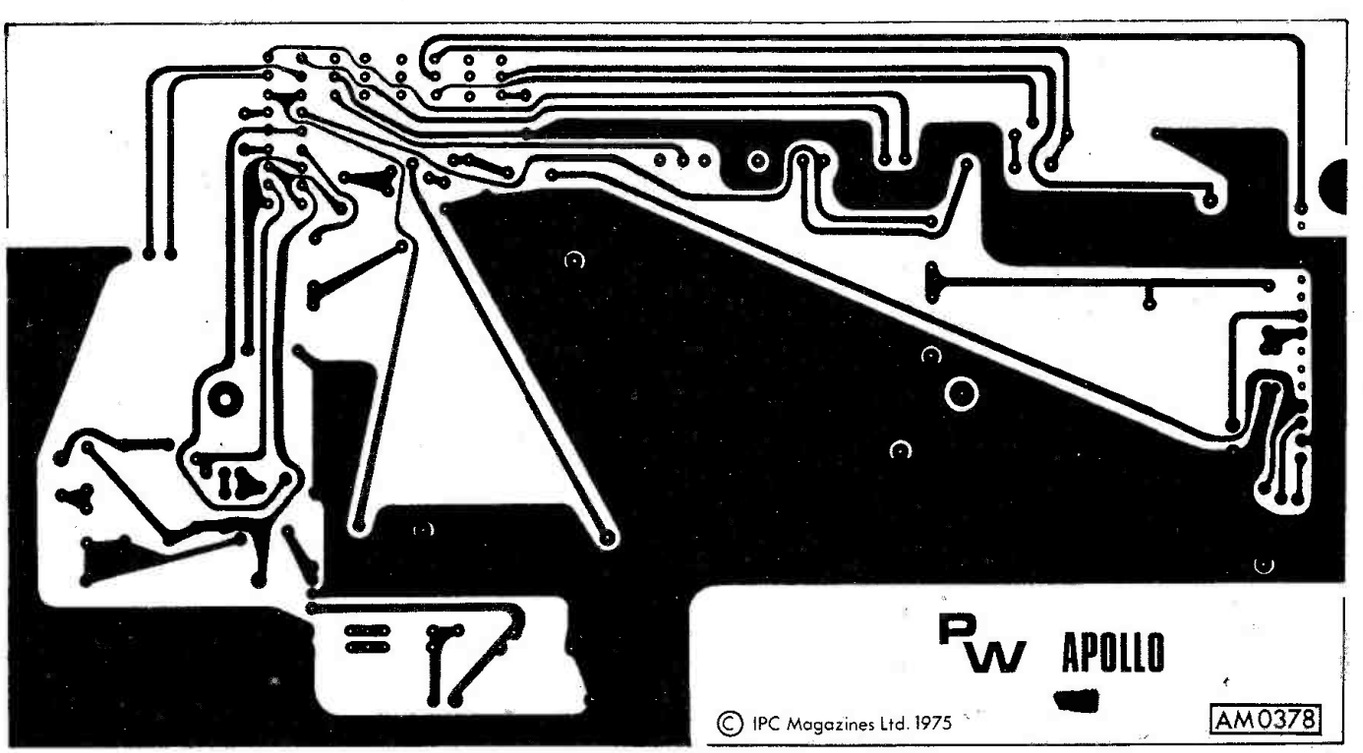


Fig. 4.7: Half scale printed circuit master of the mother board. The three smaller boards and the tunerhead are mounted on this board.

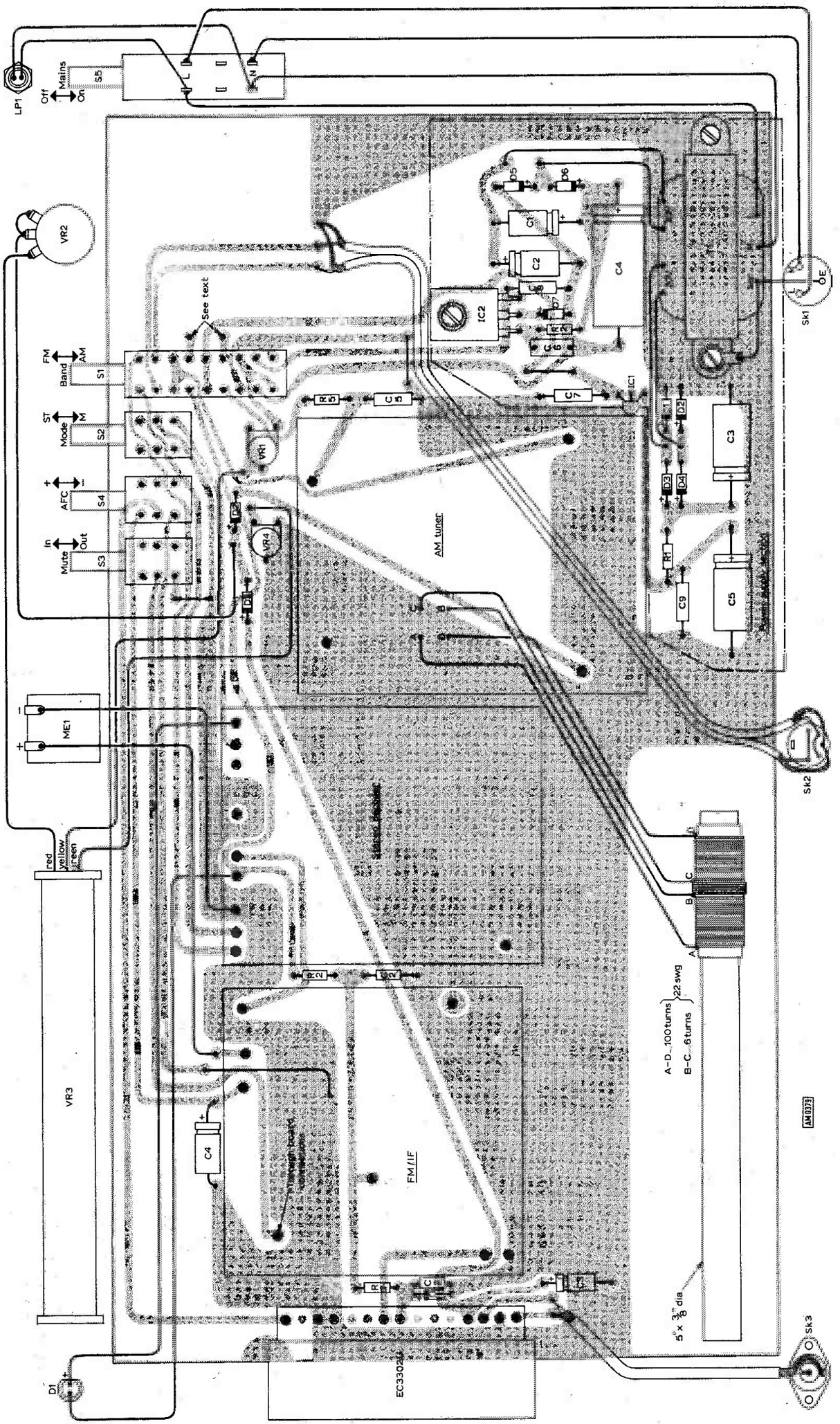
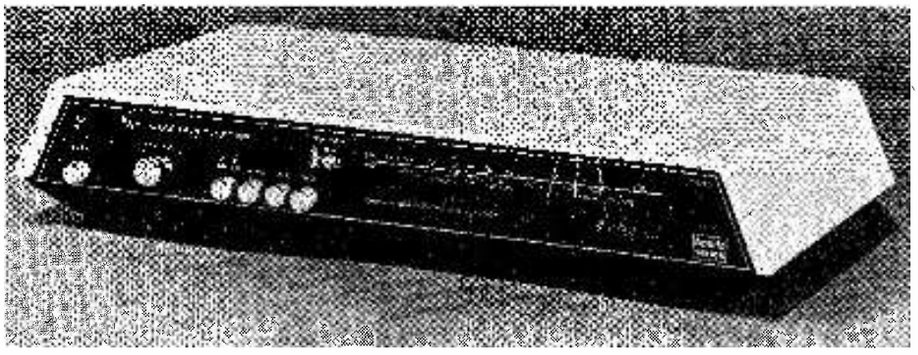


Fig. 4.8: Layout of the three small boards, the tunerhead and the other components on the main board. The interwiring to the front and rear panels is also shown on this diagram. The four leads to the ferrite rod aerial go to the four corresponding points on the AM Board. Note the link from the main board on to the FM/IF Board, and the capacitor mounted on the tunerhead.



The completed tuner. The case was specially designed for this project and has overall dimensions of 420 x 230 x 90mm (16½ x 9 x 3½in).

4.7 and 4.8), switch to FM stereo and turn on the mains.

With an aerial at the rear tune around for a station and peak up using the signal strength meter as a guide.

Slowly rotate the cores in the IF filter—NO MORE THAN HALF A TURN EACH, until the maximum peaking is achieved. In most cases such adjustment will bring about no improvement since the filters are accurately prealigned before despatch.

With the signal strength and fine tune control peaked adjust the detector coil for maximum audio. (Defeat a.f.c. for this operation.)

The IF strip is now aligned and the decoder should be checked for accurate stereo indication.

MEDIUM WAVE RECEPTION

With the AM/FM switch in the AM position and the ferrite rod connected, check that reception of the medium wave is satisfactory. To align the scale rotate the preset at the end of the tuning potentiometer until −27V is present. Adjust the core in the oscillator of the AM section for coverage of 190 to 550 metres from one end of its travel to the other. The simplest means of checking this is to calibrate against existing broadcast stations though a signal generator will naturally be a great help.

Mark the scale on a piece of paper and keep for reference when marking the final scale.

FM ALIGNMENT

FM alignment can be carried out in much the same way. With such a high tuning voltage it may be necessary to reduce the FM range by placing a resistor in the lead from the AM/FM tuning voltage changeover switch to reduce the maximum tuning bias on FM to about 20V otherwise the coverage will extend into the aircraft band to approximately 115MHz.

CONCLUSION

The remainder of the exercise will largely depend on the individual's experience. Fault finding can be a lengthy process to the inexperienced and the only advice is to employ a systematic approach and work back from the audio amplifier stages to determine the section in which the fault lies. Once isolated the modular approach allows for easy breakdown.

A refinement of preset tuning can be added via a six-way pushbutton unit as described in Part 1 of the Apollo series. Perhaps this could be mounted via a 3-pin DIN or similar socket at the front or rear of the tuner cabinet and thus also include a remote tuning facility.

AMENDMENTS

In Part 3, several modifications have been made and now incorporated into the main circuit board. In Fig. 3.1:

Capacitor C3 has been reduced to 4·7μF.

Resistor R3 has been eliminated and replaced by a link.

Resistor R4 has been replaced by a 4·7kΩ preset potentiometer (horizontal skeleton type) which will be referred to as VR4.

Potentiometer VR1 has been moved to be directly in series with VR3 i.e. between VR3 and S1.

Switch S1d has been replaced by two diodes (D2 and D3 Fig. 4.8). The unused switch position has been used to provide outputs which may be used to operate lamps to indicate FM or AM mode.

In Fig. 3.2:

Resistor R1 has been eliminated.

Resistor R15 has been replaced by a wire link on the circuit board.

In Fig. 3.4, resistor R1 has been reduced to 47Ω.

0·1μF capacitor has been placed in parallel with C5. This will be referred to as C9.

Capacitor C6 should be connected to the junction of R2 and IC2 rather than to D7.

In Fig. 3.1 S2 is shown in the "stereo defeat" position and S3 in the "mute" position. S1 is in the "FM" position and S4 in the "AFC on" position.

PRINTED CIRCUIT BOARD

Due to lack of space it is not possible to show the main printed circuit board full size. For constructors wishing to make their own printed circuit board a full-size paper drawing of the main board only is available from:

Practical Wireless
Fleetway House
Farringdon Street
London EC4A 4AD,

Mark the envelope "Varicap Tuner."

A cheque or Postal Order for 20p made out to Practical Wireless and a 10 x 8in s.a.e. **must** be enclosed. **Do not enclose any other correspondence or queries.**

NOTE In Part 1 (May 1975), Fig. 1.4 capacitor C19 should be shown connected to Pin 6 of IC3 whilst pin 2 is unused. Fig. 1.7 is correct in this respect except that the capacitor marked C1 should be marked C19.

The ferrite rod should be ⅜in diameter and about 5in long. 22 s.w.g. wire is suitable for the coils.

PW

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Also:-

TELE-TENNIS-Electronic Scoring Unit

Miniaturised Equipment for the 2m band-Part 1

car ra

A car radio providing pre-set reception of two local stations in addition to manual tuning, is very convenient and the receiver described here is of this type. Though intended for operation from the 12V vehicle supply, the circuit allows satisfactory working from dry batteries.

Fig. 1 is the circuit. The 3-way switch S1/2 provides for manual tuning, or two pre-selected stations. With S1/S2 at A, C1 with TC3 tunes the aerial circuit L2, while TC6 tunes the oscillator coil. The values in use are for 200kHz on long waves, but in some areas LW reception is not wanted, and the capacitors can be modified for an additional pre-set MW station. With the switch at B, TC2 and TC5 provide a pre-selected MW programme. The remaining position is for manual tuning, with the ganged capacitor VC1/VC2. This allows MW coverage, which is useful for alternative programmes, or when driving outside the area for which positions A and B have been set.

Coverage obtained in the aerial circuit with various pre-sets in the TC2 position is approximately as follows:

7 to 60pF	1600-1000kHz
30 to 140pF	1350-750kHz
40 to 250pF	1200-600kHz

The smaller values will not of course tune to the LF end of the MW band, but the larger values cannot always be fitted as their relatively high minimum capacitance prevents tuning to the HF end of the band. However, there should be no difficulty in fitting one of these three values, to suit stations wanted, or local circumstances. Should position A be for an additional MW station, C1 is omitted, and the required value is used for TC3.

In the oscillator section, the padder C4 is necessary for ganged tuning, but is not present in positions A or B. Here, TC5 can be as follows:

7 to 60pF	1600-700kHz
30 to 140pF	1450-550kHz

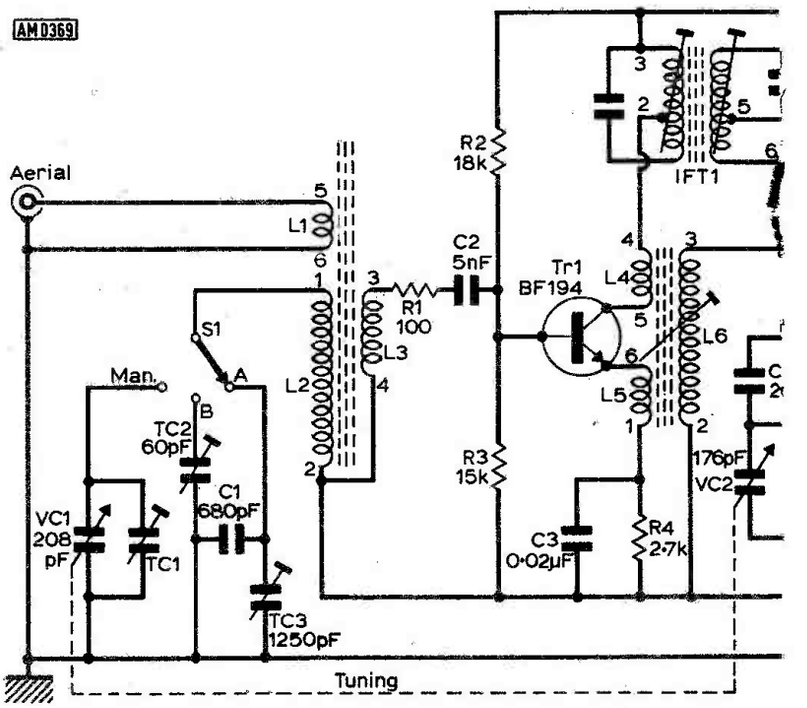
Again, if 200kHz LW is not required, the 450pF trimmer TC6 in Fig. 1 can be replaced by one of the smaller capacitors, as needed. L2 and the oscillator coil are easily obtained for use as a pair and as the receiver is fully screened, L1 is added for aerial coupling. Cascaded IF amplifiers, one double-tuned and one single-tuned IFTs, give a good degree of sensitivity and reasonable selectivity. Mixer and IF stages run from a 6·2V line, stabilised by D1.

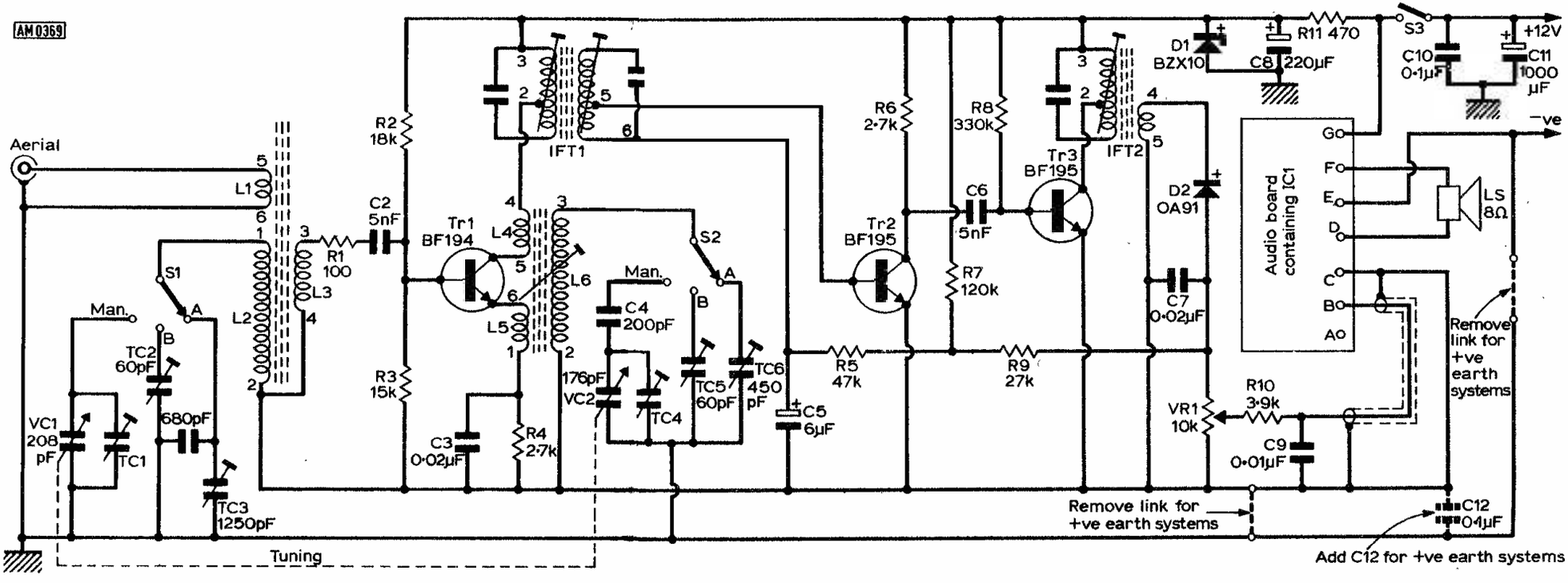
Audio signals from the volume control VR1 pass to a high gain IC amplifier with push-pull output. In the case of a car radio with a large Class A output stage, current drain is too heavy for dry battery working. This is not so with the circuit here, which can be run in this way from a 9V or higher voltage supply, with economy equal to that of a battery portable. Dry battery working may be adopted if it is not wished to make the required connections for a permanent installation, or when testing the circuit, or using it where no accumulator supply is available.

POLARITY AND SUPPLY

The emitter or negative line is isolated from the chassis so that a positive or negative earth is possible. L1 tuning capacitor and trimmers return to the receiver metal case. With a positive earth, C12 provides the RF circuit for these components. With a negative earth, as in Fig. 1, chassis and negative line are connected so C12 is not necessary and may be omitted.

No difficulty will arise if the negative or emitter line is isolated as described, as either positive or negative supply leads can then be connected to the metal case, with no change in results. This isolation





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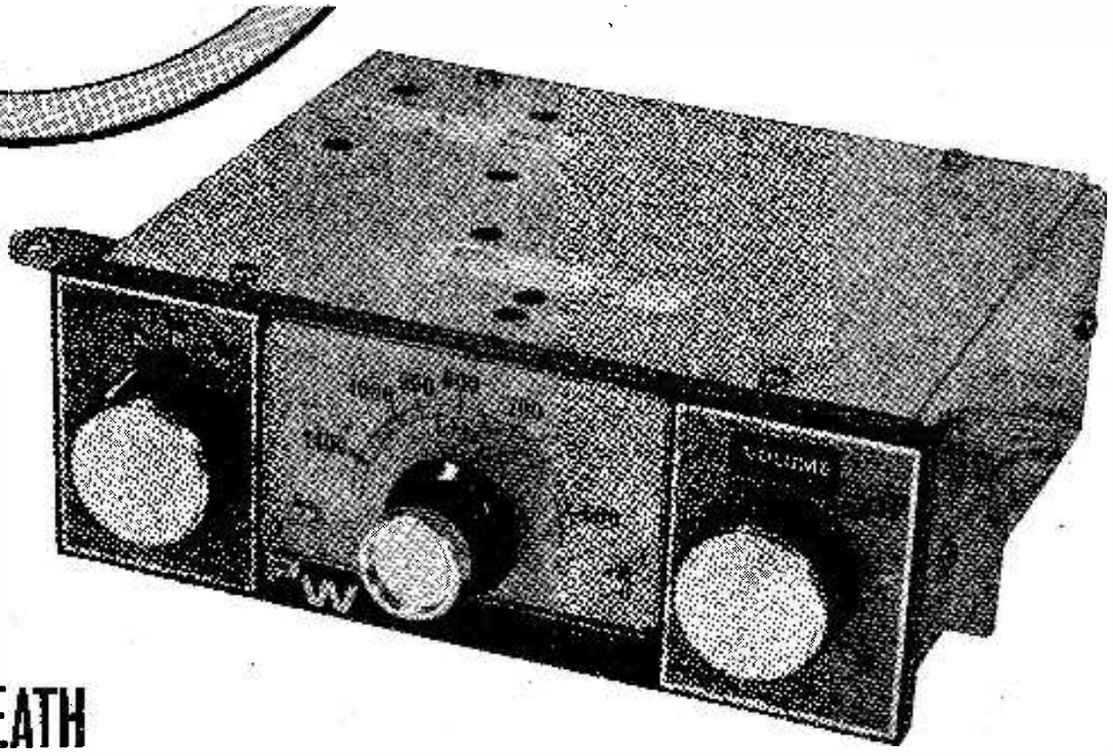


CHARLES HEATH

is of course carried through to include the AF amplifier.

In the vehicle installation used with the receiver, it was found that C10 and C11, with the addition of a 220μF 25V capacitor between positive supply point, and chassis, was enough to avoid interference, even with the engine running. Some car receivers also employ small chokes in the supply. Should interference prove troublesome when first testing the receiver in a vehicle, it is worth trying an alternative and sound return from receiver case to vehicle chassis, especially if this is not done by mounting brackets or other direct contact from case to metal parts. Should interference cease or be much reduced with the aerial unplugged, check its earthing and that it is not unnecessarily close to vehicle wiring, plugs, generator, etc. On the other hand, if interference ceases when temporarily connecting a dry battery, it is introduced through the battery supply, and more suppression is necessary. It is assumed that the vehicle itself has the usual suppressors.

No interference was found to be introduced through the speaker leads. D or F cannot be earthed directly, but could be by-passed by 0·1μF or similar capacitor. Should permanent operation from a 9V dry battery be envisaged a little current can be saved by omitting D1, which is then unnecessary.

SPEAKER AND AERIAL

The speaker may be from 3 to 15 ohms, but around 8 ohms is recommended. A little more power is available however, with a 3 ohm unit, but at increased current drain, whereas a 15 ohm unit will give some extra economy for dry-battery running.

When the metal case is closed, an external aerial becomes necessary, and various car aerials are avail-

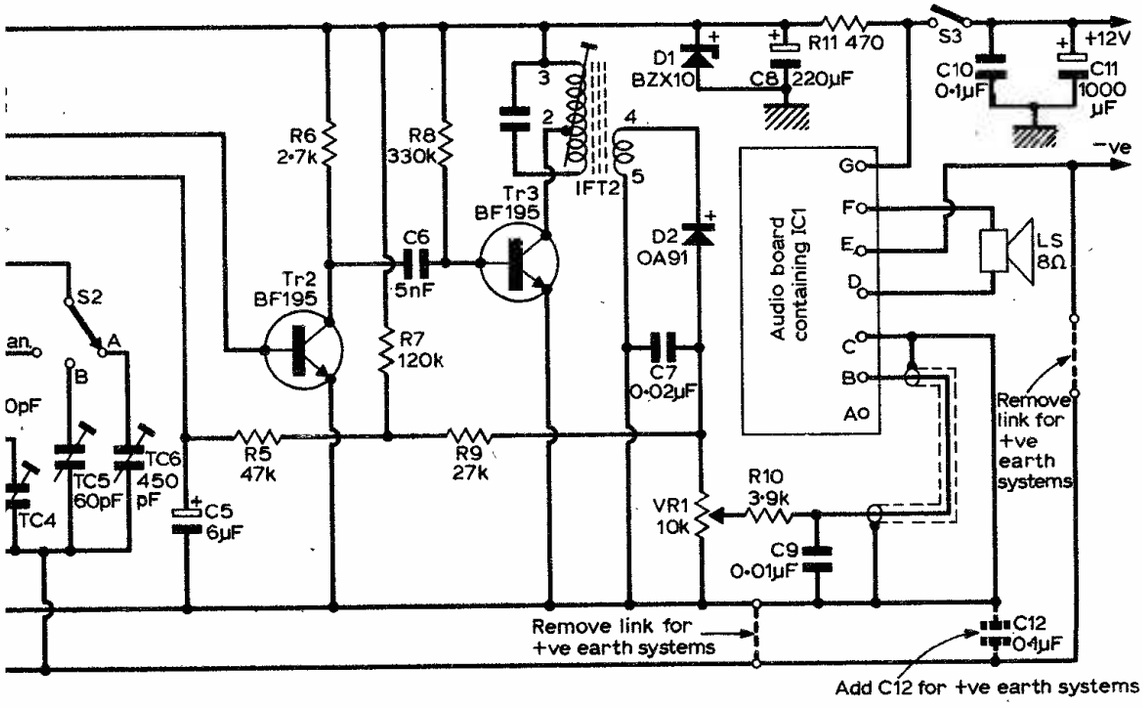


Fig. 1. Circuit diagram for the complete car radio, shown here connected for negative earth systems. Circuit details for the audio amplifier board are shown in Fig. 5.

★ components list

Resistors

R1	100Ω	R7	100kΩ
R2	18kΩ	R8	330kΩ
R3	15kΩ	R9	27kΩ
R4	2·7kΩ	R10	3·9kΩ
R5	47kΩ	R11	470Ω
R6	2·7kΩ	VR1	10kΩ log pot (with S3)

All resistors 5% ¼W

Capacitors

C1	680pF	C7	0·02μF
C2	5nF	C8	220μF (10V)
C3	0·02μF	C9	0·01μF
C4	200pF	C10	0·1μF
C5	6μF (4V)	C11	1000μF (16V)
C6	5nF	C12	0·1μF

VC1/VC2 Jackson 00, 208/176pF slow motion with trimmers (TC1 and TC4)
TC2 and TC5 7-60pF (Home Radio VC29LC)
TC3 400-1250pF (Home Radio VC29SA)
TC6 50-450pF (Home Radio VC29R)

Semiconductors

Tr1	BF194	D1	BZX10 (6·2V 400mW)
Tr2	BF195	D2	OA91
Tr3	BF195		

Miscellaneous

L1, 30 turns 34SWG L2/L3, Denco MW ferrite rod aerl. L4/L5/L6, Denco TOC1. IFT1, Denco IFT18/465. IFT2, Denco IFT14. S1/S2, 2-pole 3-way rotary switch. Metal case, 127 x 153 x 51mm (5 x 6 x 2in) universal chassis and extra 127 x 153mm (5 x 6in) plate (Home Radio). Mixer IF board 121 x 32mm (4¾ x 1¼in) 0·15in plain veroboard. Trimmer board, 51 x 57mm (2 x 2¼in). 3 control knobs, plywood and perspex dial and pointer.

able, including some which avoid any need to drill holes in the vehicle. It will be found that the aerial loading has some effect on tuning. Holes in the receiver allow trimmers to be reached, so that a final alignment of these can be undertaken after the radio is fitted and the aerial connected.

★ components list

Audio amplifier board (Sinclair Super IC12)

Resistors

R1	270kΩ	R4	100Ω
R2	150kΩ	R5	27kΩ
R3	18Ω		

All resistors 5% ¼W

Capacitors

C1	0·1μF	C6	1nF
C2	100pF	C7	470pF or 500pF
C3	10μF (15V)	C8	0·01μF
C4	100μF (15V)	C9	500μF (15V)
C5	100μF (30V)		

Integrated Circuit

IC1 Sinclair Super IC12 (Swanley Electronics)

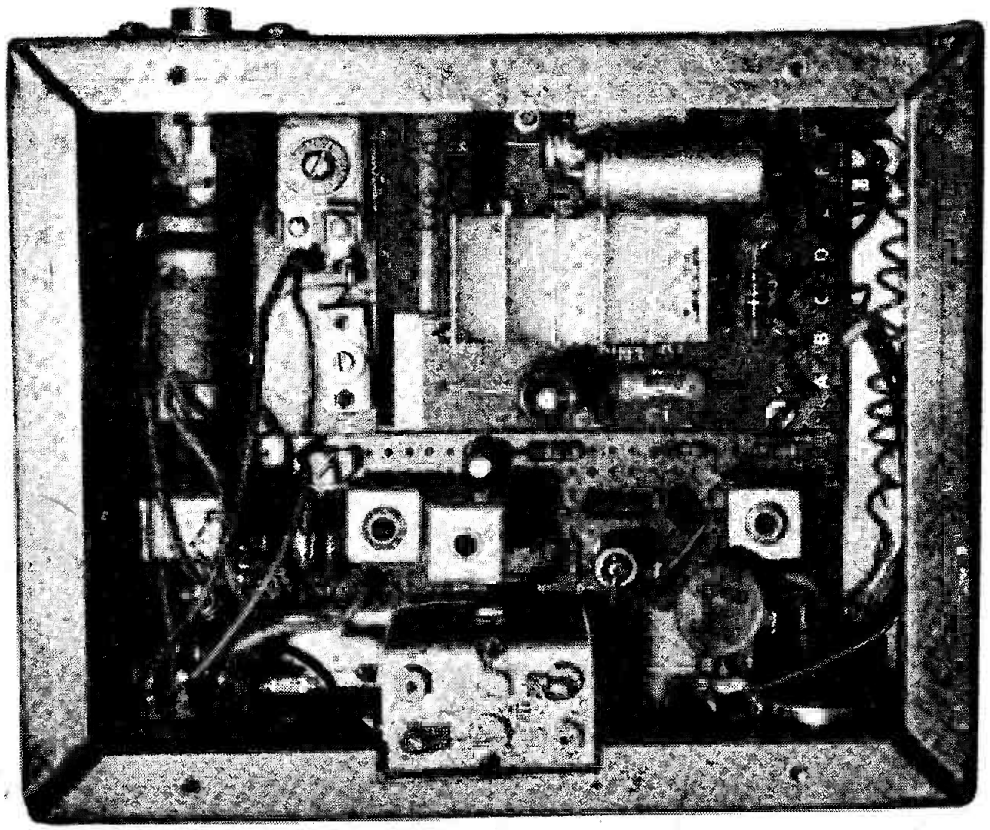
Miscellaneous

Printed circuit board as supplied with the IC12 77 x 66mm (3 x 2½in)

CASE PREPARATION

The case (a) is 127 x 152 x 51mm (5 x 6 x 2in) made up from two 127 x 51mm (5 x 2in) and two 152 x 51mm (6 x 2in) universal chassis flanged members (b and c), and two 127 x 152mm (5 x 6in) flat plates (d). Cut one end flange off each 'b' member. Assemble the box, with the 'c' items inside the 'b' sides. The cut-off ends of the latter are at the front. The 'd' plates are then drilled so that the bottom can be fixed with 6BA bolts, and the top with self-tapping screws. Check that the box is square.

The 'b' front is removed and drilled or punched for



Photograph of the interior of the car radio, also showing the arrangement of the universal chassis members. The vertical members are referred to as 'b' in the text. The front of the receiver is at the bottom.

VR1, the switch and ganged capacitor. The latter is fixed with three 4BA bolts. Do not overlook that these must be cut or filed short, or washers put between gang and front, in order to prevent the screws from projecting inside the gang and bending its plates. Cut the top flange so that the trimmers can be reached, and then bolt the front and bottom plate together. Sides and back are left off until construction is otherwise finished.

Fit the back with a co-axial socket as shown. Speaker leads run from the IC board through a grommet or they can go to a pair of insulated sockets. Power connections can be to a 2-pin non-reversible plug as used for battery connecting, twin insulated leads, or a single lead and chassis as required. To improve the front appearance, a piece of varnished 3-ply approximately 159 x 54mm ($6\frac{1}{4}$ x $2\frac{1}{8}$in) is fixed to the front by two chrome 6BA bolts. These also hold a piece of 1·5mm (1/16in) perspex about 45 x 76mm ($1\frac{3}{4}$ x 3in) which protects a card scale of similar size. The latter is marked for MW tuning. Later, 6mm ($\frac{1}{4}$in) holes are punched in the top plate, to allow the six trimmers and oscillator coil to be reached with a suitable insulated adjusting tool.

MIXER-IF BOARD

This board is approximately 127 x 32mm (5 x $1\frac{1}{4}$in), Fig. 2 and is fitted so that its front edge is 26mm (1in) from the front of the case. Drill the board and bottom to take 6BA bolts for mounting it about 6mm ($\frac{1}{4}$in) clear of the bottom. The board is cut as in Fig. 2 to clear the vanes of the tuning capacitor. Holes now have to be drilled for the oscillator coil and IFTs, with a central hole under IFT1, to reach the lower core. If final IF alignment is done after fitting the board, a matching hole is necessary in the case bottom.

The chassis, as previously mentioned, is isolated from the negative line. If therefore a negative earth is always to be used, C12 can be omitted and the adjacent negative pin wired to the tag MC. Pins or projecting leads are fitted for subsequent connections to R1, negative line, pin 3 of oscillator coil, R11, VR1 and negative adjacent to C8.

AERIAL COIL

No alignment problems can arise with the two preset frequencies. But the manual tuning alignment requires the correct ganged capacitor, and the aerial inductance which is intended for use with the oscillator coil. For this reason, L2 is a MW portable receiver winding, with the ferrite rod reduced to about 76mm (3in). The rod can be snapped by gripping it with a vice or tool at the wanted point, and sharply tapping the projecting end. A 9mm ($\frac{3}{8}$in) hole is drilled in a block of hardwood or other insulated material, to take the end of the rod, which is then glued and mounted at a centre height of 26mm (1in) from the metal case bottom.

L3 which consists of a few turns on L2 is placed towards the receiver front. Join adjacent ends of L2 and L3, points 4 and 2, and take to the pin in Fig. 2. The free end of L3 goes to R1, and the free end of L2 will go to S1.

L1 is 30 turns of 34SWG enamelled or other thin wire, wound on a paper strip around the free end of the rod. It is later connected to inner and outer (case) of the co-axial socket.

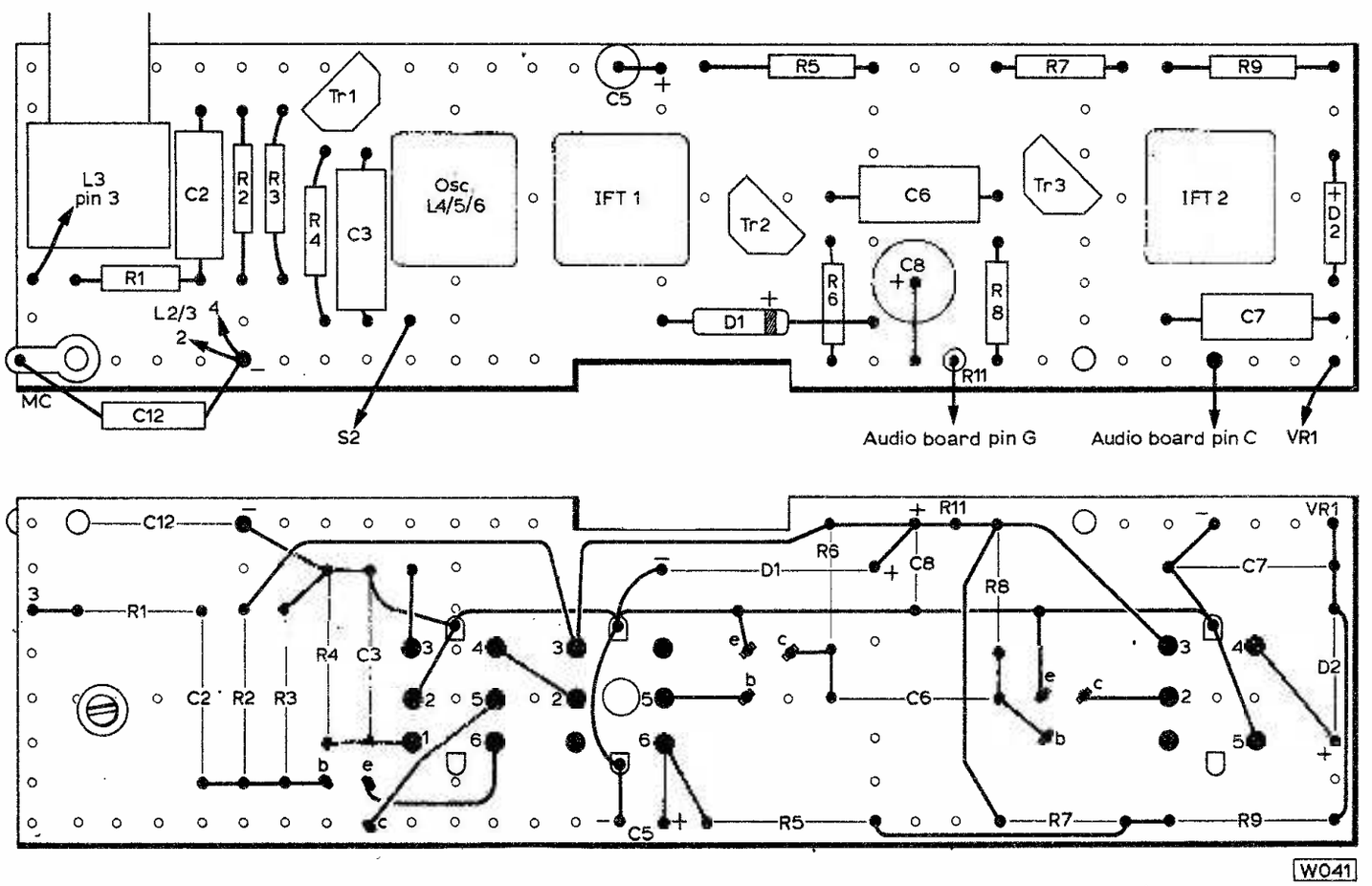


Fig. 2: Mixer/IF board, showing both component side and wiring side. The board is cut away in the centre to accommodate the tuning capacitor.

IF ALIGNMENT

As the IFT's are aligned by the maker, unnecessary adjustment of the cores should be avoided. A final slight re-adjustment may be necessary after wiring, and if this is so, a correctly fitting tool must be used, as a wedge-shaped blade may break the cores so that they jam. If necessary, a suitable tool can be obtained from the IFT maker.

Adjustment can be made with a weak but stable signal tuned in. Each core is slightly adjusted either way, as necessary for best volume. A signal generator can of course be used, and is more convenient. With a modulated signal of this type, the cores can be adjusted for maximum battery current with the audio amplifier working. The signal generator input being reduced to give a current of 30-40mA or so maximum, with VR1 well advanced. Once each of the three IFT cores has been set for best results, no further adjustment is needed here.

TRIMMER BOARD

This is paxolin, about 51 x 57mm (2 x $2\frac{1}{4}$in) in size, fitted as in Fig. 3. Holes take the tags of TC2 and TC5, and the adjusting screws of all trimmers. Two fixing bolts with extra nuts raise the board a little from the metal, and one forms the MC or return connection, as shown.

Connections to the switch are as in Fig. 4. Trimmers TC1 and TC4 are integral with the ganged capacitor. Should a component without trimmers be used, a trimmer must be connected to each section of the gang.

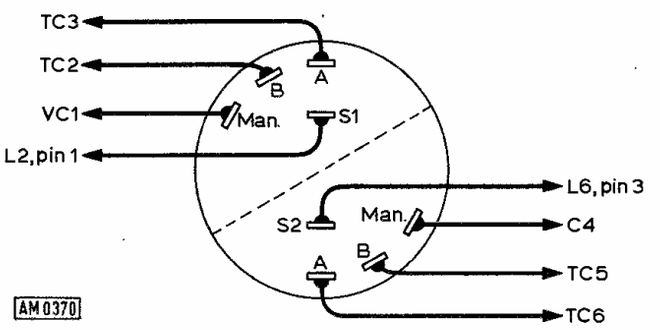


Fig. 4: Connections for the manual/pre-select waveband switch, S1/S2.

AUDIO AMPLIFIER

The Sinclair Super IC12 is a multi-transistor integrated circuit with finned heat sink, providing high gain and adequate audio output from 12V. The associated circuit and component values are shown in Fig. 5. It is assumed that the Sinclair PCB which is drilled with component positions printed on the top side will be used. Assembly then merely consists of forming the wire ends of resistors and capacitors to suit the holes so that they can be soldered in position, and any excess snipped off. It will be noticed that C5 is rated at 30V, as the module is intended for use with up to 28V. In this case, however, 28V will not be reached and C5 can be of a lower rating. It is also advantageous to use a larger

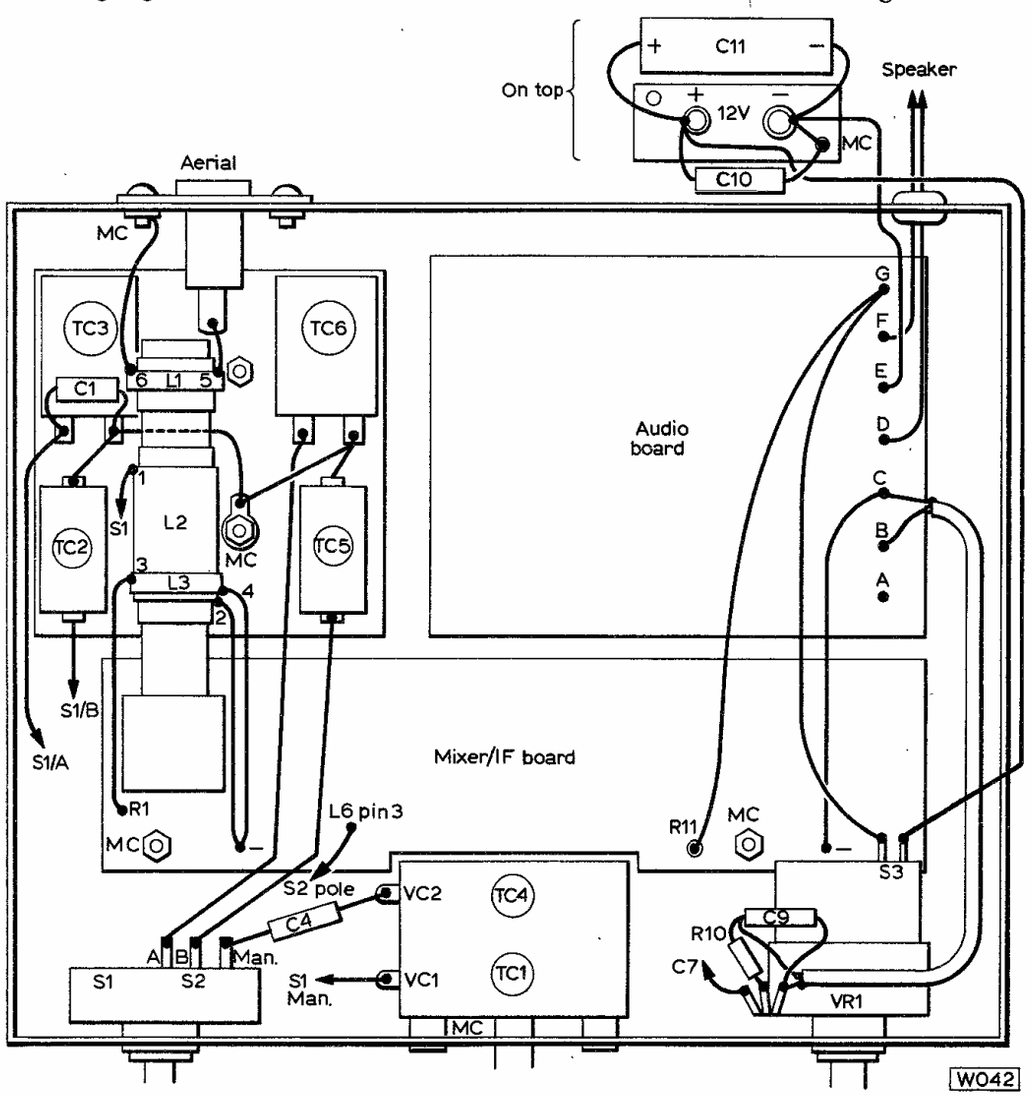


Fig. 3: General layout, showing positioning of the three boards, ferrite rod and controls. The view is from above.

capacitance here and C5 may be 250μF, 500μF or larger.

Referring to Fig. 3. B runs via the screened lead to C9 and R10. The braid is returned to C. A lead also runs from C to negative on the IF board. D and F are for the speaker. E is for the negative power supply. G is for positive, via S3, supplying also R11. Connections are arranged in the way shown to avoid feedback loops in the negative line.

If a positive earth is to be used, remember that the negative line must be disconnected at the supply socket, and must not be completed to the metal case

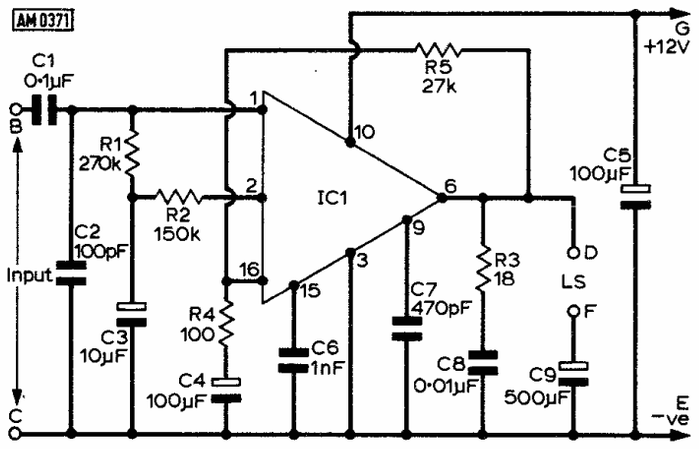


Fig. 5: Audio amplifier circuit using the Sinclair Super IC12 and associated PCB. The audio output is approximately 5W into an 8Ω speaker.

at any point. If the receiver is not to be run from an accessory fuse-way, an in-line fuseholder should be included in the live power lead, to avoid any possible power short in the receiver causing damage or interrupting the supply to other items. The power supply can be a permanently fitted insulated lead and case return, or two such leads, as mentioned. For plug-in connections, the plug should be shrouded or secured with a screw, or pins should be on the receiver end, and sockets on the lead end, to avoid any possible short to metal parts should the plug come out of place.

ALIGNMENT

With the switch at manual tuning, adjustments should be made to obtain a band coverage of about 1500-550kHz. Adjust TC1 and TC4 at the HF end of the band and L2 and the oscillator coil at the LF end of the band. Repeat these adjustments until no further improvement is obtained. The switch can then be set at B and TC5 adjusted to bring in the wanted transmission, TC2 being set for best volume. Now with the switch at A adjust TC6 and TC3.

When the case lid is fitted and the aerial connected slight re-adjustment of trimming will be required for optimum results. As movement of L2 is not feasible, a very slight re-setting of L6 can be made, while rocking VC1/VC2 to tune in a signal near the LF end of the band. Trimmers TC1 to TC6 can then be checked TC4 being left untouched. R1 is to prevent unwanted oscillation which may begin near the HF end of the band, especially with the aerial disconnected. If no such trouble arises with the aerial connected, R1 may be left as shown. Otherwise it can be increased to 150 or 220Ω or so, depending on the actual gain of Tr1. However in most cases values as given should be suitable. PW

PW TECHNICROSS PUZZLE No.10

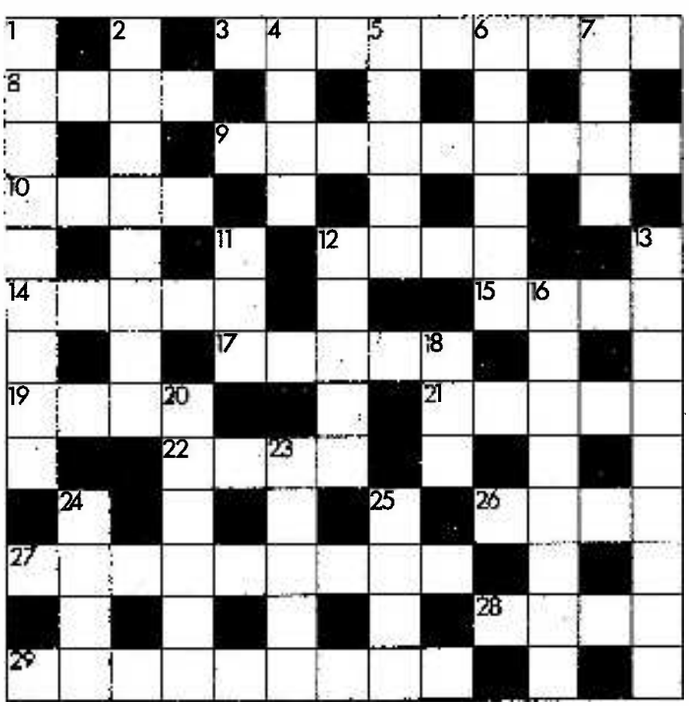
ACROSS

3 It's high on the list with earpieces? (9)
8 Slough not making solid-state? (4)
9 But succumb to pencil for printed circuits? (6, 3)
10 A natural problem in voice reproduction (4)
12 Valve case needed in this bloody channel! (4)
14 It's just bordering on the picture . . . (5)
15 . . . which contains quite a story! (4)
17 A world link for good reception (5)
19 Dawn's way with a set repair? (4)
21 Row in with bus-bar guesswork? (5)
22 Good turnover with this sound part? (4)
26 Cape shape example of 1 Down? (4)
27 Girl with a bike that's a MHz? (9)
28 Set for a smile? (4)
29 Powerless without them? Not in the main! (9)

DOWN

1 A speaker against noise abatement (9)
2 Within a whisker of receiving from them? (8)
4 Mild alloy in some Ekco components (4)
5 Bad home reception led him to it? (5)
6 Nut tea around to get the right wavelength! (6)
7 A pointed piece in broken components (4)
11 This charge may not be electrical (3)
12 Over-selectivity cuts out the poetry! (5)
13 Protecting your coils from interference? (9)
16 You need brass for this amateur lay-out? (8)
18 He's got a swine of a call-sign! (3)
20 Play this unschooled art nut's oscillator! (6)
23 Relay distortion by and egg-producer! (5)
24 Second-rate transistor value? (4)
25 Kept on the air, we hear, from a chimney (4)

FOR AMUSEMENT ONLY
ANSWERS NEXT MONTH



British Justice?

The Editorial—**Thou shalt not listen**—in the March issue of P.W. is interesting. I believe that a Licence for the operation of a Sound only, Broadcast receiver is no longer necessary.

On the back of a Television Broadcast Receiving Licence, section 4 of the Schedule says that if any message is received:—other than that which the apparatus is authorised to receive—unintentionally—the message shall NOT be communicated to anyone—Except to specified authorised persons.

As Section 1 of the Schedule and the accompanying Notes refer specifically to—apparatus for wireless telegraphy—there would appear to be some discrepancy between the terms of the receiving licence and the information which formed the basis of your Editorial.

If, as stated in the editorial, it is an offence to listen, one would be admitting an offence if one passed information which ought to be passed on, to the appropriate authority. The offence would be one of illegal listening. This seems to me to be a travesty of British Justice.

General Coverage Communications receivers are usually capable of receiving many transmissions which are privileged in one respect or another; a standard FM receiver is not difficult to modify, to receive aircraft and public service bands: short of Big Brother, it would be impossible to prevent such transmissions from being listened to.

It is also illegal with certain exceptions, such as Ansaphone, to tape record telephone conversations, yet the same type of inductive coil is used in some T.V. Hi-Fi adaptors.

It would seem that whilst those with criminal intent, could not only listen, but make what use they pleased, of what they heard: a comparatively innocent licensed operator could get done in every sense of the word.

A somewhat difficult field to control, is that of the purchase of the various types of transmitter, including those of the Walkie-Talkie type being used by people who have no knowledge of how to use them. I am not, nor am I likely to be a licensed operator, but the havoc which these sets, in inexperienced hands, can cause, both to licensed operators and the various other authorised users of transmission equipment, is something which I feel strongly about.—**A. D. Crossland** (Portsmouth).

It's free!

I have several good pre-war radio chassis in good condition, together with a workable Grundig tape-recorder (TK2) which I am happy to give away free to any group of under-privileged boys or youth club which would appreciate the equipment. This would have to be collected from Purley, of course.

If you can kindly provide a "link" in this matter, I shall be grateful.—**A. Lorand** (23 Banstead Road, Purley, Surrey).

Unjust VAT

The following is an extract of a letter sent to Mr Sproxton's MP—Mr Bruce Douglas.

I represent a group of 25 business men, though there are many more, who retail electronic components. Our customers, besides the general public are Universities, teaching hospitals, schools, polytechnics, and Government Departments. Although most of us own our businesses we work very long hours, for extremely modest rewards. Our main consolation is the fact that we are interested in what we are doing. We have always co-operated with the Government whatever its colour, and try to be law-abiding citizens.

When VAT was introduced, in spite of difficulties, we made it work. Now, ignoring all the warnings from responsible bodies against bringing in a multiple VAT system, Mr Healey is trying to enforce it. What is the reason for it? Please do not tell me it is to raise revenue. Far more money can be raised far more easily, by simply increasing VAT to 10% or 12%. Was it a sop to the Left Wing, who imagine they are soaking the rich? If so, who are the rich? The medical student building electronic apparatus? The wireless amateur trying to build his experimental transmitter? Was this legislation demanded by the Civil Service, who wanted a valid reason for increasing their ever-proliferating numbers? Whatever the reason, they have produced a scheme that is completely un-workable!

We stock over 6000 different small electronic components, which now carry three different rates of VAT!! In addition to that, on many items we cannot even get a reliable definition of what rate of VAT they carry. Some of us recently had a meeting with Senior Customs and Excise Officials and already many of the rulings they gave us have been turned upside down. When one of our members asked them if we could assume that, if we were charged 25% VAT by our suppliers, that this was a reliable indication of what we charged our customers, we were told "no it has nothing to do with it, you must make up your own mind what you charge"!

To try and work this ludicrous scheme we would need far more staff, at a time when we are hard put to it, to pay the wages of the ones we already employ. Even with unlimited staff we would still have to say to the Customs and Excise, when they ask for their money, "come an examine our stock (all 6000 items) and then give us a written definition of the VAT rate on each one".

It seems to me that Governments, whatever their persuasions are determined to stamp out the small business (and in the case of your own Party, to take over all the big ones) but there are two million of us giving employment to a further four million and patient though we are, we have been needlessly provoked long enough. We are now preparing to fight back. Please bear this in mind.—**A. Sproxton** (Home Radio Ltd).

PRODUCTION LINES

colin riches

HEATSINKS

Conventional high performance heatsinks are large and heavy, but where size and weight are of importance, the Redline series of heatsinks provides an efficient economical alternative. They comprise an assembly of twisted vane surfaces mounted on a tubular heat pipe thereby combining the advantages of both.

Typical of the series is the L2220 heatsink which is 200mm by 60mm and weighs 60gm. It accepts two TO-3 devices and has a thermal performance equal to that of a conventional heatsink three times its weight. Information is available from *Redpoint Associates Limited, Lynton Road, Cheney Manor, Swindon, Wilts SN2 2QN.*

TOROIDAL CORES

TMP Electronic Supplies inform me that they can supply a complete range of toroidal cores for making your own transformers.

All toroidal inductors are highly self shielding, most of the flux lines are contained within the toroidal form thereby keeping the flux density essentially uniform over its entire magnetic path. Stray magnetic fields have little or no effect on toroids. It is seldom necessary to enclose toroids in a screened can to prevent feedback etc, hence multistage filters and amplifiers can be built using them without the worry of coupling between them.

These cores lend themselves easily to use on broadband RF transformers, winding primary and secondary bifilar or trifilar, thereby obtaining an impedance ratio transformation and are particularly effective in interstage applications. The ordinary slug tuned coil can be used in conjunction with a toroid by connecting them both in series, this way the high "Q" of the toroid coil and the convenience of the slug tuned coil are combined.

Further information and prices may be obtained from *TMP Electronic Supplies, 3 Bryn Clyd, Leeswood, Mold, Clwyd, CH7 4RU, North Wales.*

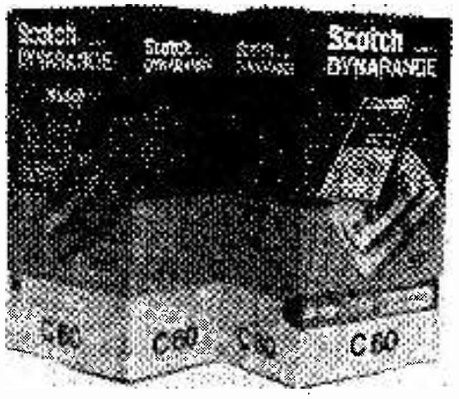
DATAMATH II

In case you thought the write-up on the Texas Instruments calculator seemed a bit strange, the photograph showed the sophisticated model SR-50 while the text described the T1-2500 II. In addition, the address we gave was of the Bedford plant. *The European Calculator Division* is based at *165 Bath Road, Slough SL1 4AD, Berks.* Our apologies . . .

ORGAN KITS

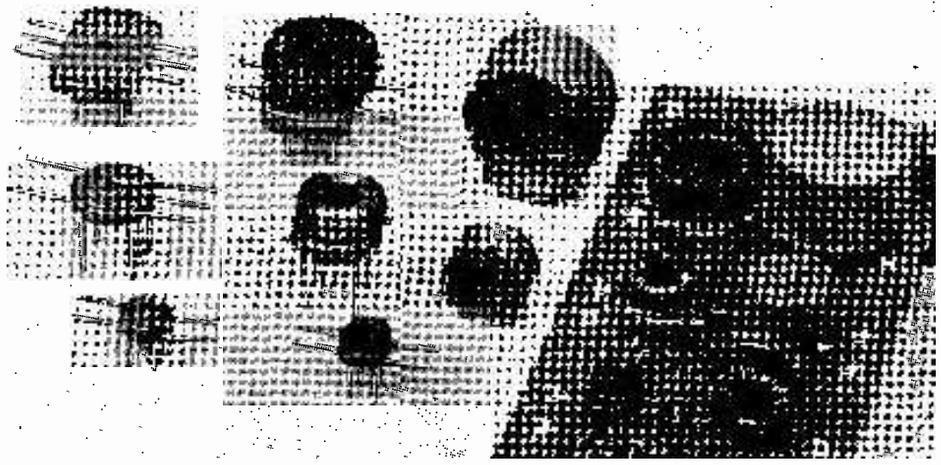
A. Marshall and Son (London) Limited (Dept. P.W.) of 42 Cricklewood Broadway, London, NW2 3HD tell us that they are now able to supply kits of parts (less cabinet) for the P.W. Easybuild Organ. Send a stamped addressed envelope to them for full details.

HIGH-OUTPUT CASSETTES FROM 3M



A new range of medium-priced low-noise, high-output cassettes from 3M is claimed to give an improvement of up to 9dB in high frequency response over standard cassettes. Scotch New High Energy cassettes feature a completely new gamma-ferric oxide tape, not a cobalt tape as employed in previous Scotch High Energy cassettes. The uniformity and size of the acicular (needle-like) crystals is very accurately controlled during the manufacturing process, and this, together with binder improvements, has enabled a high density coating to be produced with optimum surface finish, resulting in extended high frequency response.

The cassettes, available in C45, C60 and C90 versions, have 3M's exclusive Posi-Trak back coating for smooth, even winding and improved speed regulation (less wow and flutter). They are manufactured under clean-room conditions and are ultrasonically sealed to exclude dust and other frequency-robbing contaminants. Ultrasonic welding, says 3M, assures virtually stress-free construction, and this technique, coupled with Posi-Trak treatment, produces cassettes which are highly resistant to jamming under normal play or rewind conditions. *3M Ltd., 380-384, Harrow Road, London, W9 2HU.*



I.C. OF THE MONTH

Number 52 — SGS-Ates TDA2020 POWER AMPLIFIER

IT is only a few years since the first IC audio power amplifiers were introduced, yet now we have quite a wide variety of types and devices becoming available which will handle higher power levels. The TDA2020 device from SGS-Ates is thought to handle more power than any other IC audio amplifier, having a rating of about 20W into a 4Ω load. However, it is not only the high power handling capability which renders the TDA2020 especially attractive. The device incorporates a new type of short circuit protection which automatically limits the dissipated power so as to keep the working point of the output transistors within their safe operating area. Without this protection, any accidental shorting of the loudspeaker leads could destroy the device.

In addition, a thermal shutdown system is included which limits the maximum junction temperature to 135°C. Therefore a large margin of safety in the size of the heat sink is not required, as the risk of thermal runaway, which is found in discrete power amplifiers, does not exist. Special attention has also been given to reducing the 'thump' noise at switch-on and to eliminating cross-over distortion.

PACKAGE AND HEAT SINK

The TDA2020 is encapsulated in a normal 14-pin quad-in-line package, with a copper insert fitted into the back. This insert must be clamped so that it is in good thermal contact with an external heat sink. Heat transfer is best assisted by means of a thin layer of silicone grease or preferably one of the special heat conducting mixtures containing a silicone grease and a metal oxide.

A plastic spacer is supplied with the TDA2020 for spacing the bolts which attach the external heat sink. Various forms of heat sink are possible, but if maximum power is required, the thermal resistance of the heat sink should not exceed 6°C/W. The thermal resistance between the chip and the copper insert is less than 3°C/W, so if the power being dissipated in the device is 10W, the temperature of the chip is $9 \times 10 = 90$°C above the ambient temperature. On a hot day this may be around 30°C, so the chip temperature is then about 120°C, fairly near to the maximum value of 135°C.

The copper insert is connected electrically to the silicon substrate and care must be taken to ensure that the heat sink in contact with the copper does not touch any point of the circuit other than the negative supply line.

CIRCUIT

The TDA2020, like other IC power amplifiers, is basically an operational amplifier, as shown in Fig. 1. The input signal is fed to the non-inverting input of pin 7, negative feedback being taken from the output at pin 14, through R3 to the inverting input at pin 8. Gain is determined by the ratio of R3 to R2 and the HF response by the value of the compensating capacitor C5.

Unlike the circuits employed with most audio power amplifiers, the recommended circuits for the TDA2020 do not employ a capacitor between the output terminal of the device and the loudspeaker. The absence of any large capacitor, therefore, enables a much more compact unit to be built. The omission of this capacitor, however, makes it necessary to arrange that the quiescent potential at the

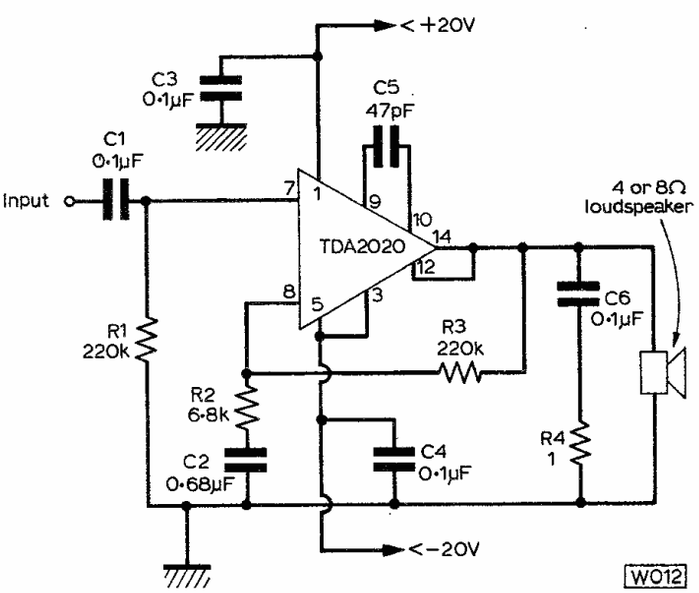


Fig. 1 : Circuit configuration for a single channel high power amplifier, utilising the TDA2020.

output (pin 14) is at earth potential, or a steady current would pass through the loudspeaker. Therefore, in the circuit shown, balanced positive and negative supplies are employed, since the quiescent output voltage is mid-way between the power supply lines.

The absolute maximum voltage rating of the TDA2020 is ±20V. Although higher voltages are likely to damage the IC, it will operate quite correctly from supply voltages down to ±5V. The variation of the maximum output power obtainable from a typical device with the supply voltage is shown in Fig. 2. A stabilised supply of ±17V is used to

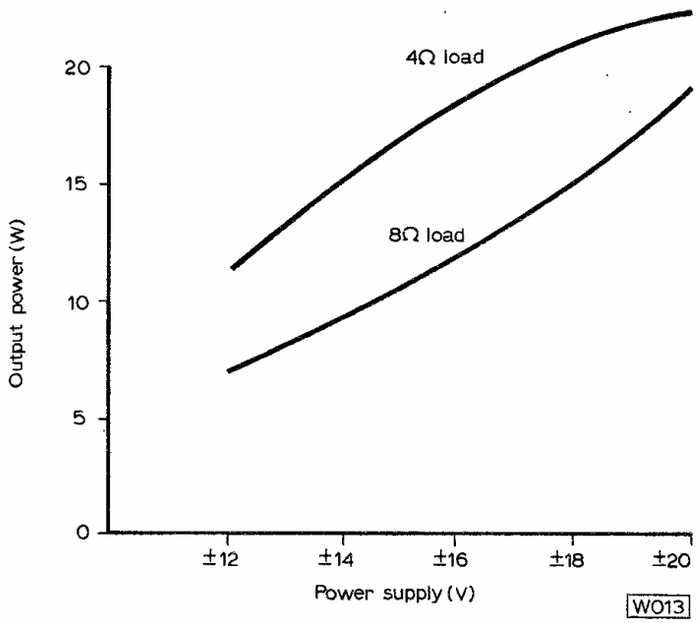


Fig. 2: Graph of maximum output power plotted against supply voltage for the TDA2020.

obtain 20W RMS into a 4Ω loudspeaker at 1% THD (even if the input is a sine wave). Alternatively, 13W RMS into an 8Ω load can be obtained by using a smaller heat sink and the higher impedance speaker.

If a ±15V supply is employed, every TDA2020 device is guaranteed to deliver 15W RMS into a 4Ω load at 1% THD. At lower power levels, less than about 8W, the distortion does not exceed about 0·2% and at most frequencies is about 0·1%.

STEREO OR QUADRAPHONY

Two of the amplifier circuits shown in Fig. 1 can be employed in a stereo system, but R2 and C2 of the two channels should be replaced by the network shown in Fig. 3 to form a balance control. If desired,

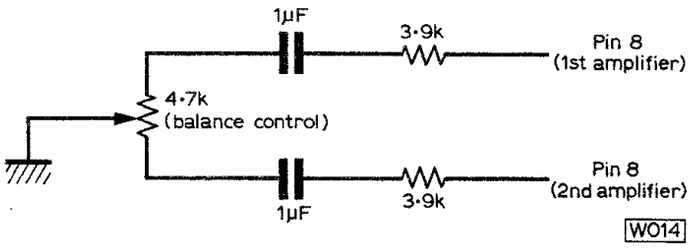


Fig. 3: A stereo amplifier can be made using two of the circuits shown in Fig. 1 with the pin 8 connections replaced with the above network. The feedback resistor R3 remains connected to pin 8.

a common heat sink may be used for both of the devices.

Four TDA2020s can also be utilised in a quadraphonic system, thereby taking full advantage of the circuit simplicity. The only electrolytic capacitors required are those in the power supplies. A common heat sink may be employed for all four channels, although it must obviously have a smaller thermal resistance than the heat sink required for a single channel amplifier.

36W CIRCUIT

A single channel 36W circuit employing an 8Ω loudspeaker is shown in Fig. 4. This type of circuit is known as a 'bridge' or push-pull amplifier and requires two TDA2020 devices. The input signal is fed to the inverting input of the left-hand amplifier and to the non-inverting input of the right-hand amplifier. Thus, as the output voltage of one device rises, the other falls, and one obtains twice the voltage swing across the loudspeaker, than would have been obtained with a single device.

Available from Chromasonic Electronics (for £3·90 inc. VAT and p/p) and other distributors. PW

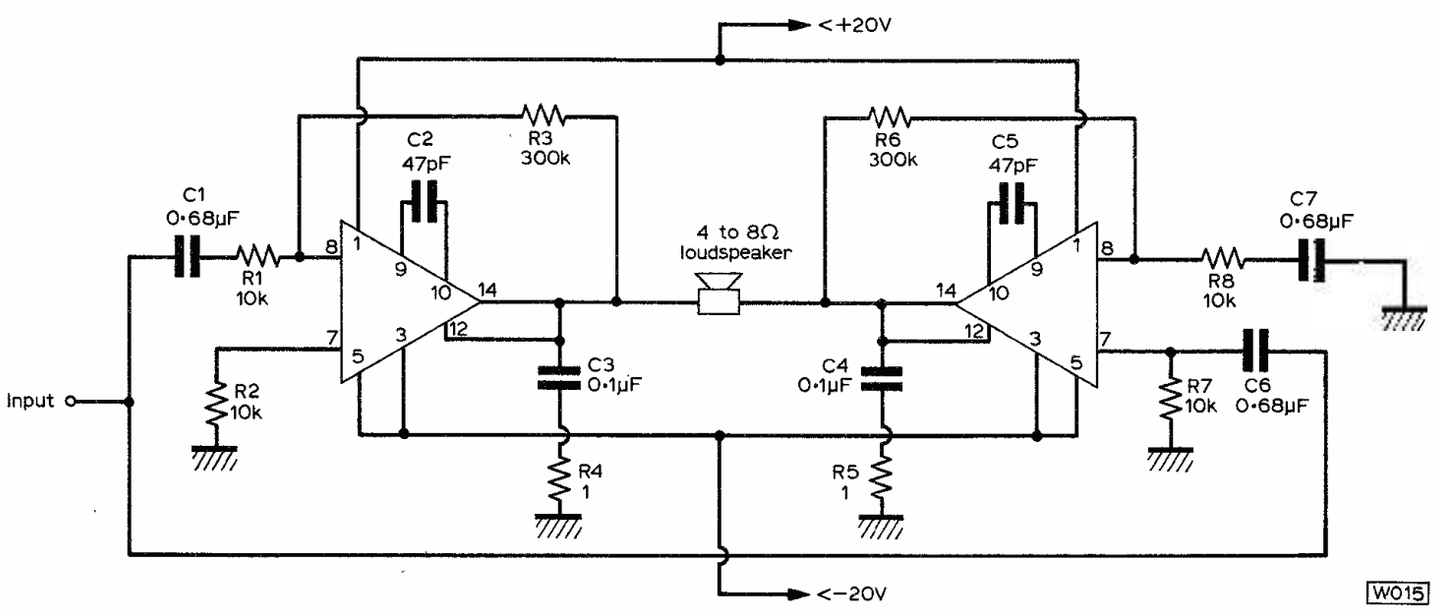
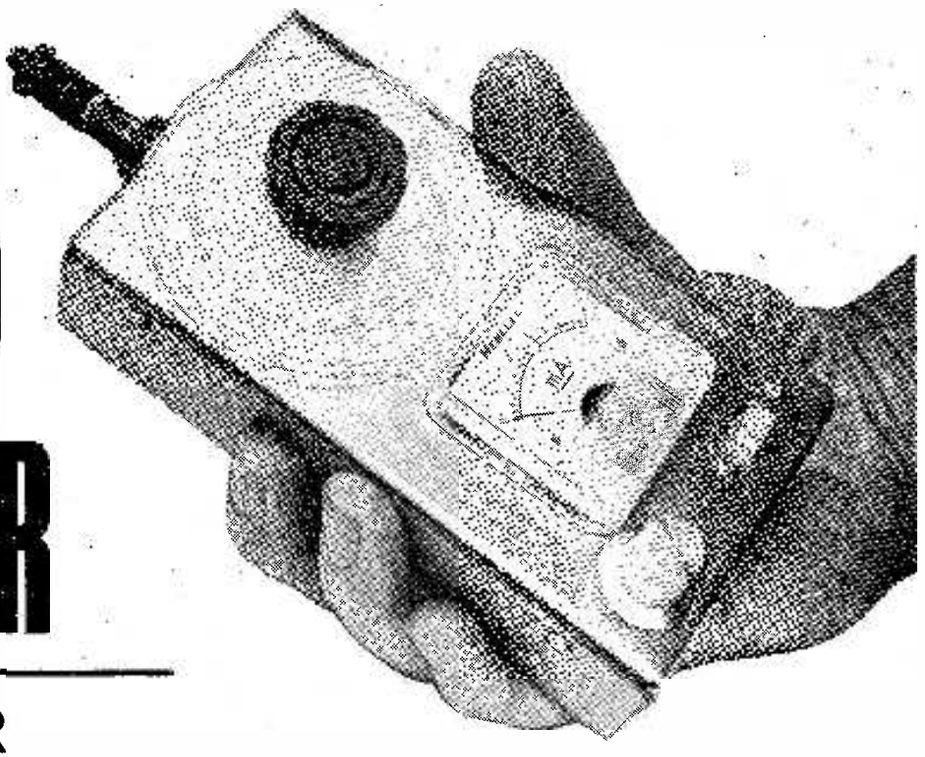


Fig. 4: Circuit diagram of a 36W single channel amplifier using two TDA2020 devices in a bridge circuit.

A DRAIN-DIP OSCILLATOR



F.G.RAYER G3OGR

THIS DDO serves the same purposes as the usual type of grid dip oscillator. Its principle usage is in determining the resonant frequency of a tuned circuit but it can also be used to find unknown values of inductance and capacitance. It employs plug-in coils, having four ranges which cover from 3MHz to 50MHz. This includes frequencies for which a DDO will usually be needed, such as checking multiplier stages and other amateur transmitter circuits, or the resonant frequency of aerials, etc.

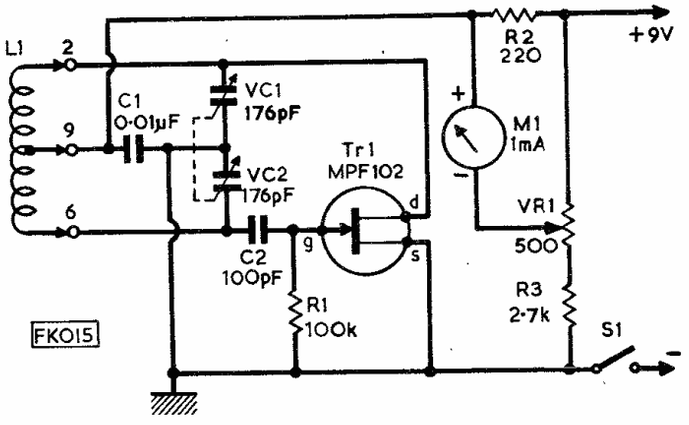


Fig. 1: Schematic diagram of the drain-dip oscillator.

The circuit is shown in Fig. 1, and by using centre-tapped coils it is possible to dispense with the need for any RF choke, which may cause dead spots or reduce efficiency on some frequencies in certain circuits. In fact the upper limit at which the circuit will continue to function depends largely on Tr1; in this case it was near 100MHz. However, at VHF VC1/2 becomes rather large and if there is much need for these frequencies it is better to employ a VHF dip oscillator.

SENSITIVITY

The circuit is designed to give a generous meter indication. The meter is employed in a bridge circuit with Tr1 and R2 in one side and VR1 and R3 in the other side. It was felt that this provides adequate sensitivity without calling for a microammeter as the indicating instrument or a meter amplifier. In operation, VR1 is adjusted so that the meter reads about half-scale. The instrument is held so that L1 is coupled to the resonant circuit of the equipment. Coupling is tight when L1 and the equipment inductor are side by side or end to end on the same axis, and falls as L1 is moved away, or turned at an angle. With L1 near the equipment inductor, the dip indicated can move the meter completely to the zero stop. However, such tight coupling is normally avoided as the accuracy of frequency readings is then reduced.

The usual procedure is to find approximate resonance by putting L1 quite near the inductor then moving the DDO away a little. Readings also depend on the Q or loading of the circuit under test, the frequency, type of coil and other factors. In the case of inaccessible coils, it may be better to make a link with a few turns each end, placing one loop near L1 and the other on or near the equipment coil.

INDUCTORS

Each coil is centre tapped and wound as in Fig. 2. The windings are as follows:

(1) 50-20MHz. 10 turns of 24SWG enamelled wire.
(2) 32-12MHz. 20 turns of 24SWG enamelled wire.
(3) 12-5MHz. 50 turns of 34SWG enamelled wire.
(4) 8-3MHz. 90 turns of 38SWG enamelled wire.

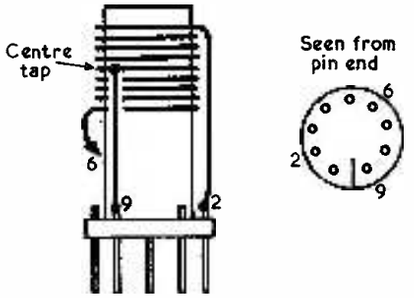


Fig. 2: Each of the four coils required is wound as shown here.

There is no need to employ these exact gauges of wire. It will be noted that three coils will enable the 3-30MHz range to be covered, if this is adequate coverage.

Turns are close wound beginning as near as possible to the threaded end of the formers. The ends can be secured with adhesive or cotton and may run down outside, as in Fig. 2. Alternatively, small holes can be drilled in the formers, so that the leads pass down inside, emerging through further holes near the appropriate pins. The coil formers **must** be fitted in a holder when soldering to the pins and should be left in it until the pins are cool.

CONSTRUCTION

The case is made by taking a single 8×3in. flanged universal chassis member and clipping out 90 degree sections from each flange, $1\frac{1}{4}$in. from the ends. The member is then bent across here, to form a flanged, open box $5\frac{1}{2}\times3\times1\frac{1}{4}$in. in size. A sharp bend is obtained by gripping the metal along the required bending line between pieces of wood in a vice.

The ganged capacitor, meter, S1 and VR1 are positioned as in Fig. 3. The capacitor is fixed with three 4BA bolts. One holds the bracket shown, which keeps the battery in position. Ordinary washers or washers cut from the same thickness metal are put under the capacitor at the other fixing positions. Slide switch S1 occupies a slot and is held with two bolts. A separate switch is more convenient than incorporating one with VR1.

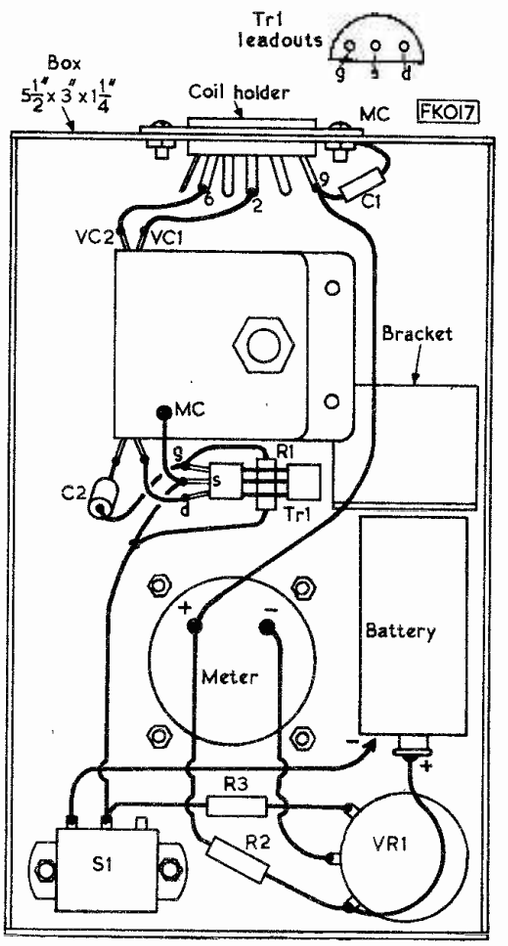


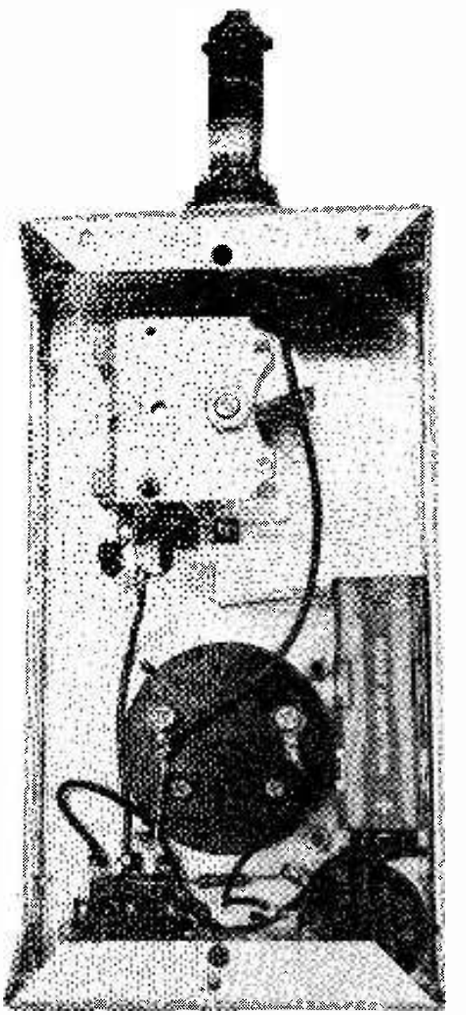
Fig. 3: Layout of components on the front of the case. A corresponding photograph of the oscillator is shown at the right.

A 3-lead transistor holder was used, mainly as a simple means of trying alternative transistors. The MPF102 seemed most generally suitable but the MFP105 and 2N5459 were found to be satisfactory. The Source tag is soldered to VC1, or has a very short lead here, and this secures the holder. Solder C2 and R1 to the Gate tag and connect the Drain tag to VC1 as in Fig. 3.

The battery should fit between the meter and flange, with VR1 and the bracket at the ends, as in Fig. 3, and its connectors must not be able to touch the metal.

CALIBRATION

The dial with four scales is fixed with adhesive and a 3in. diameter disc of thin Perspex was prepared with a washer or tank cutter, scribed with a line, and fixed to the control knob with three screws.



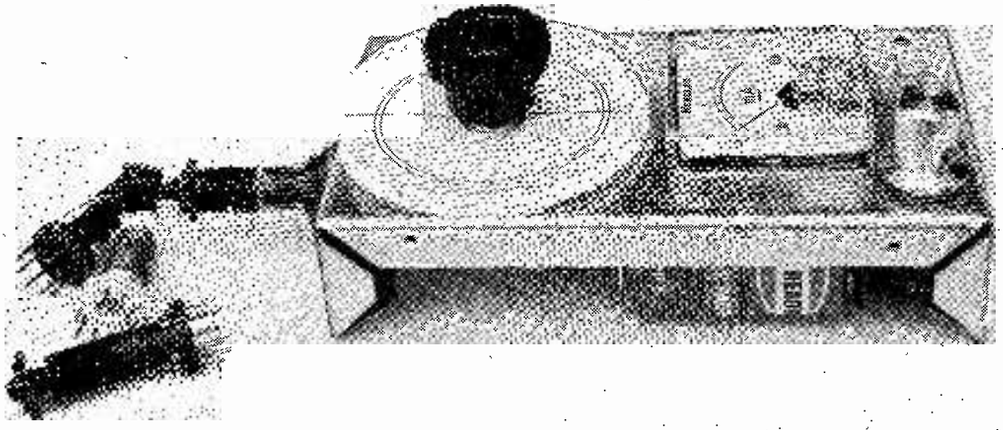
★ components list

R1 100kΩ
R2 220Ω
R3 2·7kΩ
} ¼ or ½W 10%

C1 0·01μF disc ceramic
C2 100pF tub. ceramic
VR1 500Ω linear pot.
VC1/2 176+176pF (Jackson type 00)

Miscellaneous

Tr1, MPF102, with socket. M1, 1mA meter. S1, on/off switch. Knobs (2) and dial (see text). Aluminium box approx. 5½ x 3 x 1¼in. Coil formers (4), miniature 9 pin, without cores (Denco). B9A valveholder. Wire for coils.



Finished oscillator with set of coils covering 3 to 50MHz. No cores are fitted to the coil formers. If any adjustment is found necessary to the number or spacing of the turns on a coil this must be made symmetrically about the centre tap.

If VR1 is set for about half scale on the meter, this should do for most of the band. Readings will tend to fall off near the extreme HF end of the coverage provided. When a short wave receiver covering up to 30MHz is available, place the DDO near a wire attached to the aerial socket and tune it to various frequencies, as indicated by the receiver S-meter, or BFO. These frequencies can then be marked on the DDO scales. If necessary, tune up and down to make sure a harmonic response is not being obtained with the receiver. A calibrated absorption wavemeter may also be used for calibration. There will be no ambiguity in frequency readings due to harmonics with this form of wavemeter.

When checking the frequency of a circuit, avoid unnecessarily tight coupling. This will pull the frequency of the DDO, so that a less accurate reading is obtained. Where transmitter multiplier stages or other circuits are tuned up with no power applied, bandswitches must be in the appropriate position because the resonant frequency will be influenced by stray capacitances thrown across the circuit.

If the design of equipment results in the DDO coil being very near metal parts and inductors other than that being checked, so that no definite indication is readily obtained, it is better to employ a coupling link, as described.

FINDING INDUCTANCE

It may be necessary to check the inductance of unknown short wave coils, or to wind coils to some wanted inductance. The inductance of a winding can be found with reasonable accuracy by connecting a known capacitance across the winding and determining the resonant frequency of the combination with the DDO.

A 100pF 1% silver mica capacitor can be used, and the inductance L in μH can then be found from the following:

$$L = \frac{25330}{100 \times F^2}$$

F is the frequency in MHz, as found with the DDO. For example, assume resonance arises at 10MHz. Then $25330/100 \times 10 \times 10 = 2 \cdot 53 \mu H$.

FINDING CAPACITANCE

By placing the unknown capacitor across a known inductance, the same method can be used to determine the capacitor value. This may be useful with capacitors with obliterated markings, or to find the value of variable capacitors or trimmers.

A 5μH inductor is convenient and can be wound on a 1in. diameter former using 24SWG enamelled wire. Wind six turns closewound leave a space of $\frac{1}{8}$in., and wind a further six turns. The ends are each 1in. long. If maximum accuracy is required, the inductance can be modified slightly by increasing or reducing the space, checking resonant frequency by the formula given.

The value of the unknown capacitor C in pF can now be found from:

$$C = \frac{25330}{5 \times F^2}$$

F is the frequency in MHz, as before. For example, suppose resonance arises at 10MHz. From this, $25330/5 \times 10 \times 10 = 50 \cdot 6$pF.

A check by these means will show the value of a capacitor or inductor with enough accuracy for most purposes. For maximum accuracy, the capacitor or inductor forming the standard should be of close tolerance and the resonant frequency checked with a finely calibrated receiver, tuned to the DDO. PW

CQ! CQ! CQ! CQ!

INFORMATION WANTED

...service manual or circuit diagram for a Grundig Prima Boy. Will refund postage after I've photo-copied it.—Eugene De Mello, P.O. Box 295, Zanzibar.

...circuits to build a VLF 3-30kHz LF 30-300kHz converter.—C. Mahoney, 37 Camp Place, Callander, Perthshire, Scotland.

...buy or borrow circuit details of Bendix RA10, P.W. September 58, R101-B (ARN-6); source for PU head Cosmocord GP19 or similar; surplus conversion manuals Nos. 2 and 3.—A.D. Besford, G3NHU, 49 Blake Road, Gt. Yarmouth Norfolk.

...loan or purchase handbook for Lafayette HA-600A receiver.—B. Harvey, 114 St. Nicholas Drive, Wybers Wood, Grimsby, South Humberside.

...article on DX'ers Processing Unit from P. W. July 1972.—W. E. Philpott, Russell House, East Cliff, Rye, Sussex, TN31 7LP.

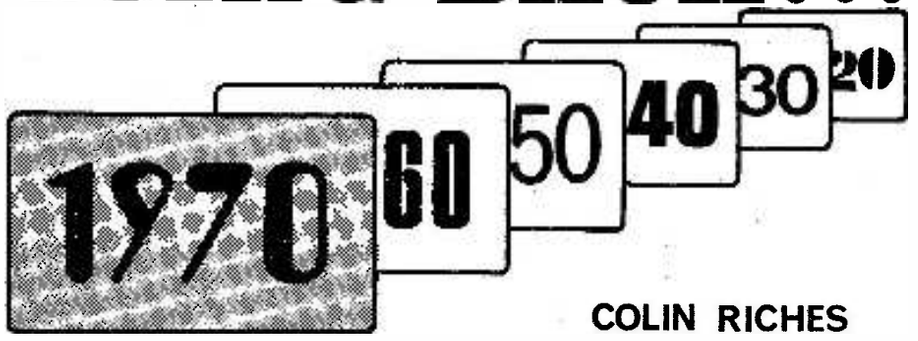
...information and circuit diagrams on modified No. 19 set and B44 Mk. 3.—J. Apollo-Oluoch, Comm. Dept. E.A.P.L., Box 151, Kisumu, Kenya.

...buy or borrow any info. on Avo electronic CT38, especially opv valve.—P. Saunders, 13 Pulteney Gardens, Bath.

...circuit or info on micro voltmeter model No. 10B serial No. 503 (U.S.A.)—F. Higgins, 4 Rural Cottages, Shrawardine, Shrewsbury.

...gen required on manufacturer/importer of Sonora tape recorder. Also cct. diagram required.—K. D. Halliday, 145 Wenlock Road, South Shields, Tyne and Wear.

GOING BACK...



COLIN RICHES

The Fultograph

FIRST, I would like to say a sincere "thank you" to all those readers who have written to me with information on the "Fultograph". I am at present compiling an article on this fascinating machine and hope to publish it in the near future.

A shop for us

I RECENTLY received a copy of the Tudor Rees (Vintage Services) catalogue and was pleasantly surprised on opening it to find vast lists of vintage radio books, service manuals, magazines and equipment offered for sale.

If you are keen on renovating vintage receivers, buying spare parts or complete models, then this is the catalogue for you.

Tudor Rees has a shop at 64 Broad Street, Staple Hill, Bristol BS16 5NL, and as you can see from the photograph it's pretty well stocked.

Tudor tells me that he has always been interested in radio and electronics from his school-days (he's now 31) so was brought up on valves and the early days of transistors (yours truly can remember paying £1 for a "red-spot" type). He was an apprentice at the local aircraft factory and worked there with "things electronic". After leaving that, he spent approximately seven years at the Bristol University as an electronics technician—but with transistor technology becoming "integrated circuit" technology, he realised he was fast becoming bored with the work as it was, to him, more maths than electronics and all the "mystery and mystic" had gone.

Owning a vintage car (1937 Chevrolet) and belonging to various vintage clubs, Tudor was often asked by people to repair old car radios (valve/vibrator jobs). After the first one, he became hooked—valves and components he could see! Marvellous! His repairs to vintage sets soon moved into the domestic field and he did jobs from his home until demand became so great he opened his shop.

The business is now in its third year and Tudor says he's "touching wood" that it will continue to flourish. He comments, "There are easier ways of making a living, but not so many that are so interesting! Every day there is something new and the old designs were so clever!"

He tells me that it really is a form of nostalgia to him. Nostalgia from the days when as a boy he built radios on wooden bases using old *Practical Wireless* circuits and using 2 volt battery triodes, etc. (bring back the PM2!). It's also nostalgia from the golden days of radio, when British wireless sets were British made—and good.

Personally, Tudor Rees now collects early American wireless sets of about the 1930s, the Scott, McMurdo, etc.

His shop stocks most equipment from 1920-1950. He literally gets asked for almost anything from this period and says that there is quite a demand for the early 1930's mains radios. Also, almost everybody he speaks to asks for crystal sets.

Catalogue

The catalogue gives a good insight into the kind of gear for sale in Mr. Rees's shop and he tells me it is his intention to offer a full service to the vintage radio collector and enthusiast.

If you would like to have a copy of the catalogue send 40p plus 7p to the above-mentioned address. If you wish to contact the shop by telephone, the number is Bristol (0272) 565472.

Mr. Rees' 'Aladdin's Cave' of vintage radio equipment.

Did you know?

IN 1926 an Aberdeen court imposed fines of £2 each on two wireless "pirates."

The Sheriff, or magistrate, was told by the prosecution that fines of £10 had been imposed for similar offences "south of the border."

The Sheriff replied that heavier fines might be required to bring Englishmen to their senses but he hoped the Scotsmen, with their appreciation of the value of money, would come to their senses through the imposition of a much smaller fine!

next month in the new style...

Television

ON SALE 21st. JULY

AUGUST 1975

40p

● **VIDEOTAPE RECORDING**

Videotape recorders intended for the domestic and educational markets are now available. To handle such machines it is necessary to understand the specialised circuit techniques used and the mechanical arrangements. This is the first part of a new series.

● **THORN 9000 CHASSIS**

Thorn's new 9000 chassis, built around the PIL colour tube, employs much novel circuitry including the Syclops combined line-output/power supply circuit. How this and the rest of the circuit works will be explained.

● **OVER-VOLTAGE PROTECTION**

With the advent of solid-state chassis using stabilised power supplies came the need for over-voltage protection, to prevent the h.t. or e.h.t. rising excessively in the event of a fault in the regulator circuit. This guide covers many different circuit techniques.

● **ELECTRONIC LOGIC**

Many will already have come across logic circuitry; those now plunging into the peculiarities of Ceefax/Oracle decoding will shortly have to do so. Our guide, mainly in diagrammatic form, covers the various logic elements.

DIGITAL WAVEFORM GENERATOR

John Smith C.Eng PART THREE

READERS not having access to the instrumentation described in Part 2, may nevertheless wish to build a function generator. These readers can make a number of simplifications to the design, without impairing the performance more than their lack of instrumentation dictates.

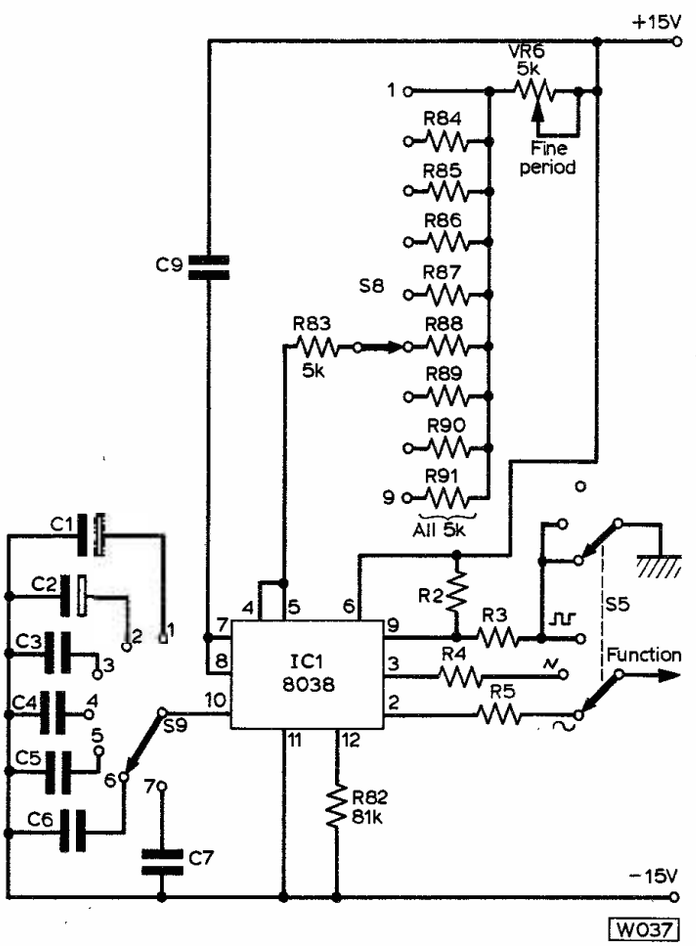


Fig. 10: Circuit diagram of the main generator section of the simplified Digital Waveform Generator.

Consider the circuit diagrams shown in Part 1. The decade switching is unnecessary because calibration inaccuracies make S3 and S4 virtually ineffective. Therefore the first simplification made is to dispense with these two decade switches and employ the coarse steps given by S1 only.

Secondly, it is unnecessary to have two separate banks of resistors. Without instrumentation to select these resistors the up and down strokes of the triangular waveform cannot be made symmetrical. Therefore pins 4 and 5 of the 8038 are linked together and a single-gang nine-way switch is employed instead of the more expensive twin gang unit.

If desired a "fine" adjustment may be incorporated using a 5kΩ potentiometer (VR6) in series with the switch (see the simplified function generator diagram, Figs. 10 and 11).

Thirdly, the removal of the decade switches means that the LED indicators are unnecessary, and these are dispensed with.

Finally, the sine purity potentiometers VR1 and VR2 may be omitted as they have very little effect on the waveform. The rest of the circuitry remains the same, but as a consequence of the simplifications outlined, a very much smaller case may be used to house the instrument.

In the simplified circuit diagram shown in Fig. 10, capacitors C1 to C7 have the design values shown in the early components list, but the front panel should be differently marked. As there are no LEDs to indicate the decimal places, the range switch must be marked thus: Range 1: ×1 second; Range 2: ×100mSec; Range 3: ×10mSec; Range 4: ×1mSec; Range 5: ×100μSec; Range 6: ×10μSec; Range 7: ×1μSec.

Of course range seven is no more accurate in this design than it is in the earlier model.

COMPONENTS

Where marked with the same component number the same component as shown in the first components

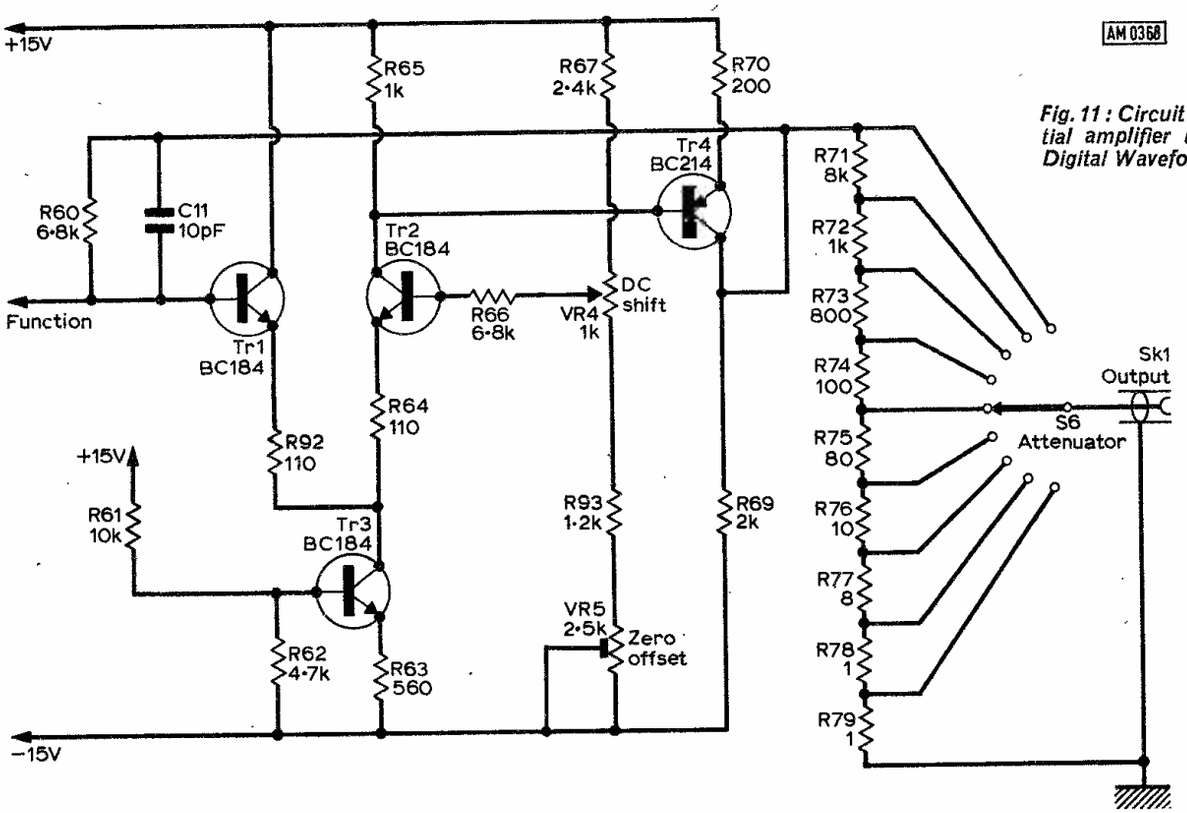


Fig. 11 : Circuit diagram of the Differential amplifier used in the simplified Digital Waveform Generator.

list is used. The components which differ or are added are:

S8 Single-pole nine-way switch.
S9 Single-pole seven-way switch.
R82 81kΩ
R83-R91 5kΩ resistors (10kΩ+10kΩ in parallel).
R92 110Ω
R93 1·2kΩ.
VR5 2·5kΩ.
VR6 5kΩ.

The unnecessary components are: R1, R6 to R59, R68, VR1, VR2, VR3, S1, S2, S3, S4, C12, D1, D2, D3.

PERIOD VERSUS FREQUENCY

This simplified signal generator design is calibrated for *period* in the same manner as the more accurate instrument described in Part 2. However, some readers constructing the simplified instrument may prefer to have switched *frequencies* as an alternative to period calibration. The changes required are quite simple. First the range switch must be marked thus: Range 1: ×0·1Hz; Range 2: ×1Hz; Range 3: ×10Hz; Range 4: ×100Hz; Range 5: ×1kHz; Range 6: ×10kHz; Range 7: ×100kHz.

Switch S8 now becomes a multiplier giving 100, 200, 300, 400Hz etc. up to 900Hz. VR6 cannot be used in this arrangement and must be replaced by a link. Secondly the multiplier switch S8 must be wired with different values of resistor as shown in Fig. 12 to give the preselected frequencies. As with the previous design use of the 8038BC will give much higher accuracy and better waveforms than the cheaper CC model.

USING THE FUNCTION GENERATOR

When using the function generator it may be convenient to convert from period measurement to frequency. The relationship between period (p) and frequency (f) is given simply by $f=1/p$.

Table 1 gives this relationship for the first two significant decades in the form of a four figure number. To use the table find the row given by the first decade and the column given by the second decade and multiply the four figure number by the appropriate factor.

For example, if the decade switches are set to 3, 6, 0 on range 4 (3·6mSec) the frequency is 277·8Hz (divide the number appearing in row 3, P1, column 6, P2, by 10).

Alternatively if a particular frequency is required, 1·8kHz for example, look for the nearest frequency given in the table; 1818 in this case. 1·818kHz is obtainable on Range 5 with the decade switches set to 550. To produce a frequency nearer to 1·8kHz the third decade switch must be used. In this case it gives steps of 3·2 (1818−1786)/10, therefore five or six steps on this third decade are necessary to obtain 1·8kHz.

It must be remembered that the third decade *lowers* the frequency set by the first two switches.

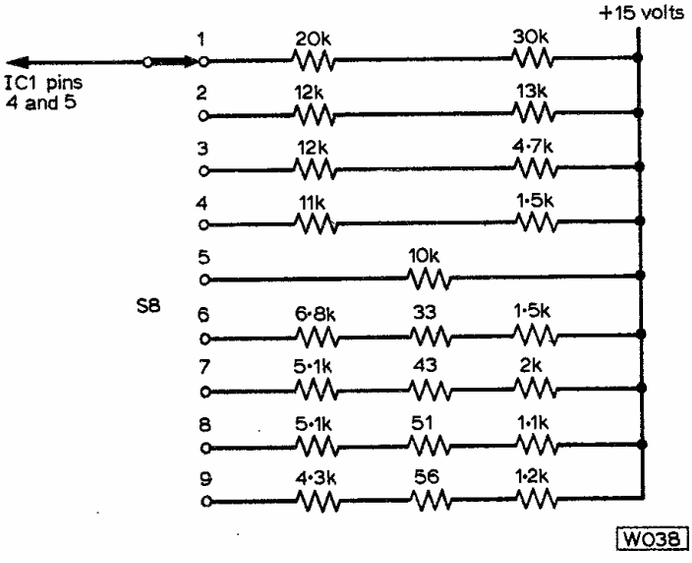


Fig. 12: Values of resistors to be wired to the multiplier switch S8 are shown here.

TABLE I

P1	P2 0	1	2	3	4	5	6	7	8	9
1	10000	9091	8333	7692	7143	6667	6250	5882	5556	5263
2	5000	4762	4546	4348	4167	4000	3846	3704	3571	3448
3	3333	3226	3125	3030	2941	2857	2778	2703	2632	2564
4	2500	2439	2381	2316	2273	2222	2174	2128	2083	2041
5	2000	1961	1923	1887	1852	1818	1786	1754	1724	1695
6	1667	1639	1613	1587	1563	1539	1515	1493	1471	1449
7	1429	1408	1389	1370	1351	1333	1316	1299	1282	1266
8	1250	1235	1220	1205	1190	1176	1163	1149	1136	1124
9	1111	1099	1087	1075	1064	1053	1042	1031	1020	1010

Range 1: ÷10,000 to give Hz
Range 2: ÷1,000 to give Hz
Range 3: ÷100 to give Hz
Range 4: ÷10 to give Hz
Range 5: ÷1,000 to give kHz
Range 6: ÷100 to give kHz
Range 7: ÷10 to give kHz

P3 The third decade lowers the frequency in roughly equal steps. For example, at P1 and P2 setting of 18, P3 reduces frequency in the steps 1019, 1018, 1017, etc.

With a little practice the use of the table for converting period to frequency or frequency to period settings is quick and accurate.

USING SINE WAVES

Apart from their use as a signal source in the development of circuits, sine waves are invaluable for gain-frequency plots of amplifiers. In the case of an audio amplifier a set of characteristics may be plotted showing level response, maximum bass/treble response and minimum bass/treble response.

The fine adjustments possible using the three decade switches makes the generator admirably suited to plotting the characteristics of scratch filters, or indeed any other kind of filter working in the 0·1Hz to 100kHz range.

A further use is in the gain—phase analysis of general feedback amplifier design for stability.

USING TRIANGULAR WAVES

The triangular waveform can be very useful in the investigation of trigger levels for devices like Schmitt trigger circuits, logic circuits, pulse generators, etc. At low frequencies it provides a slowly rising ramp where time and voltage are related. Such a waveform can often be most useful in general circuit design where linearity is important.

The triangular waveform can be used for investigating intermodulation distortion. When examining an amplifier with sine waves, deviation from linearity does not show up very well and with square waves not at all. However, providing there is no distortion due to frequency limitations, deviations from linearity shows itself most clearly on triangular waveforms.

It is well known that non-linear characteristics, such as a diode, can be used for demodulation or frequency changing simply by applying two signals and using the resulting sum and difference frequencies generated. Similarly, if a multiplicity of frequencies are applied to an amplifier which has non-linear characteristics sum and difference (intermodulation) components are produced. This is why some inferior amplifiers can pick up interference from powerful radio stations.

Great care must be exercised in testing to ensure that frequency limitations are not causing distortion, a factor of at least 20 to 25 must be allowed for faithfully reproducing the harmonics.

For example an amplifier of 10Hz to 100kHz bandwidth should be tested with a triangular waveform of less than 4 to 5kHz, 500Hz to 1kHz would be ideal.

In the case of class B output stages any crossover or unbalance in the output amplifiers is immediately apparent when the triangular waveshape is applied. With these tests it is desirable to use a double beam oscilloscope to compare input directly with output signal, however, if this facility is not available the linearity of the generator is good enough to obtain useful results from a single beam instrument.

SQUARE WAVE TESTING

The square wave signal is used as a source for testing digital circuits such as counters, logic, digital frequency meters, etc., but is also used increasingly by hi-fi specialists for testing audio amplifiers.

Gain frequency plotting and linearity checks with sine and triangular waveforms tell little about the *transient* response of amplifiers. Square wave tests are capable of showing unwanted resonances which can spoil an amplifier's ability to reproduce transients, (sharply changing waveforms such as cymbals).

A well-shaped square wave signal consists of the fundamental frequency plus a large number of harmonics, which are necessary to form a precise square wave signal. Therefore when a square wave is applied to an amplifier it is, in effect, producing a whole band of frequencies. This means that when the square wave output is viewed on an oscilloscope its shape is determined by the characteristics of the amplifier.

The characteristics of an amplifier are investigated by connecting it to a resistive load and applying a small amplitude square wave signal to the input. It is essential in this test to ensure that the input signal is small enough to prevent saturation of any stage in the amplifier.

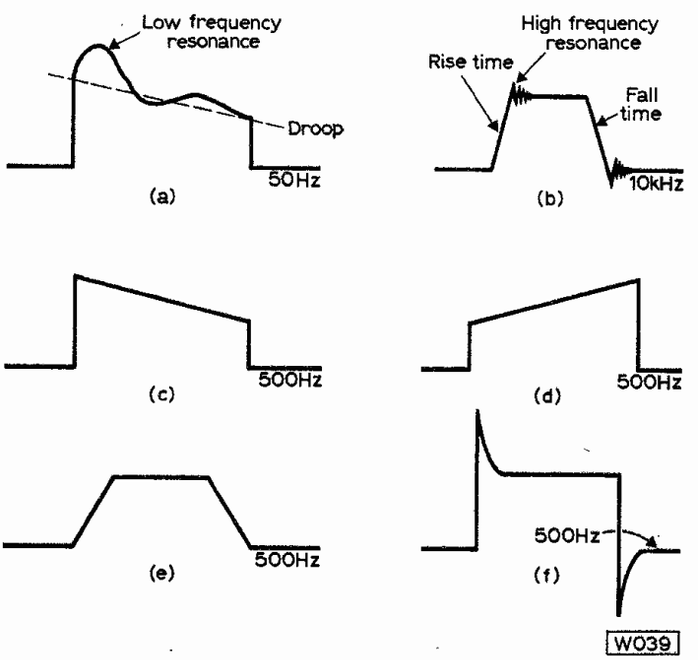
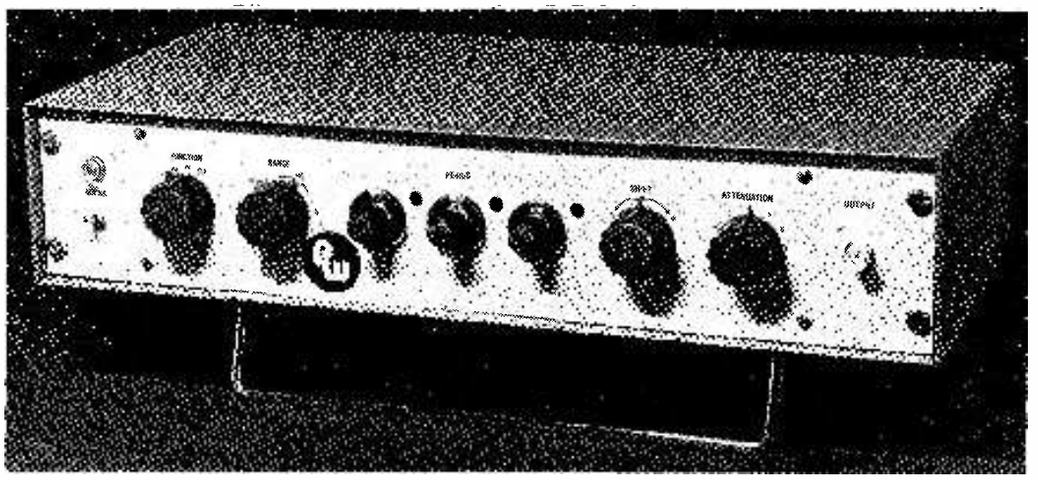


Fig. 13: Typical square wave responses. (a) Pulse with droop and low frequency resonance. (b) Pulse with low rise and fall times and high frequency resonance (c) Effect of bass cut (d) Effect of bass boost (e) Effect of treble cut (f) Effect of treble boost.



The completed Digital Waveform Generator.

SQUARE WAVE RESPONSES

The output signal will not be perfect, Figs. 13a and 13b show the possible responses to low and higher frequency square waves. Fig. 13a shows a pulse with droop and a low frequency resonance, such a resonance could be concerned with the low frequency phase-gain characteristics of the amplifier.

Low frequency resonance is not common, but the pulse *will* droop in any capacitively coupled amplifier, as it is related to the low frequency 3dB point. Strictly speaking it is difficult to relate droop to the 3dB point in an amplifier, because the rate at which the amplifier response falls towards cut off influences the droop. However, many writers assume a single time constant (6dB per octave) and estimate the 3dB point from the droop that this single time constant causes. Droop is also caused by the bass cut control and may be used to evaluate the operation of the bass tone circuits.

Fig. 13b shows the response to a high frequency square wave. Here the rise and fall times are related to the high frequency response and may be used to calculate this response if the 6dB per octave time constant is assumed. The figure also shows some high frequency resonance which may be caused by the overall gain-phase response, alternatively it may be caused by a single faulty stage in the amplifier. Whatever the cause, such resonances must be eliminated.

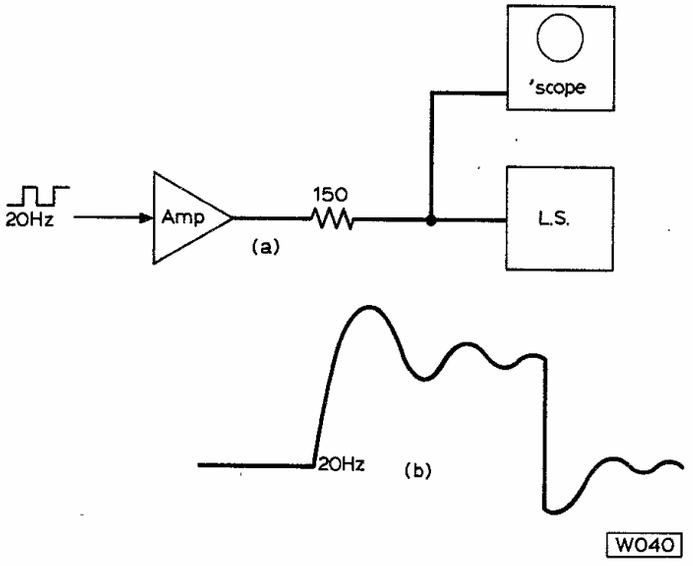


Fig. 14: (a) Test set-up for producing the characteristics of a loudspeaker in its enclosure (b) The response of an underdamped system.

TONE CONTROLS

Figs. 13c, d, e, and f show the effects on a 500Hz signal of the bass cut, bass boost, treble cut and treble boost controls respectively.

The bass cut control increases the droop (c), whilst the bass boost control gives a rising response (d). However, if a very low frequency signal is used the cut off characteristics of the amplifier causes droop which no amount of bass boost can compensate.

In waveform (e) it is apparent that treble cut gives rise to a slowly rising response. (Most of the high frequencies are concentrated in the leading edge of the pulse). Treble boost, on the other hand increases the amplitude of the high frequency components giving rise to the spikes shown in (f). In practice the low frequency characteristics show up better at low square wave frequencies (50 to 100Hz), whilst the high frequency effects are more apparent at the higher frequencies. (1 to 4kHz).

The testing of loudspeaker enclosure damping can also be carried out with the aid of square waves. In this test the square wave generator must drive a powerful amplifier coupled to the loudspeaker through a high resistance. A resistance some ten times that of the loudspeaker will be necessary using an amplifier capable of operating without its loudspeaker load. The amplifier must also be capable of operating at frequencies below that of the speaker resonance under test, and capable of producting satisfactory square waves at 20 to 30Hz.

Fig. 14 shows the test circuit arrangement. A high gain oscilloscope is necessary to see the type of response shown. This response represents an underdamped system where the box or loudspeaker is resonating.

This method provides a means of investigating the effect of various cavities and baffles using a variety of loudspeakers. Removing or omitting the high resistance will cause the amplifier to damp the loudspeaker system (a highly desirable characteristic in practice) which will mask the effects of acoustic damping in the loudspeaker system.

These suggestions represent just a few uses for the function generator, there are many more. Readers constructing the instrument will find that it is an invaluable signal source for testing their various constructional projects.

ERROR In the circuit of Fig. 4, Part 1, the resistor in the bias chain of Tr3 (R61) was shown connected to earth. It should in fact be connected to the +15V line as indicated in the board layout in Fig. 6 Part 2.

PW

HOTLINES

ON RECENT DEVELOPMENTS

RACING ELECTRONICS

WHEN a racing car goes out on to the track, a great number of estimates have to be made. For example, how long the fuel will last. If you pull the car in for refuelling too quickly, you will loose valuable time. If you leave it too late, it may run out of petrol and you'll loose the race alltogether.

At Indianapolis, Indiana, the Gatorade-McLaren racing car is different—it cuts out all the guesswork. Under the bonnet sits an engine plus a radio transmitter. The input of the transmitter accepts signals from various sensors strategically placed, and the output is radioed back to a computer in the pits. A printout or a visual display tells the pit mechanics and engineers exactly what the state of the car is—and the information is never more than one second old! The sensors are scanned 100 times every second by the computer.

A tiny propeller in the fuel lead tells the computer exactly how much fuel is being used and the computer can then display exactly how much is left. It can also time the car each lap.

Some 14 of the car's functions are monitored. These include the "ride height" of each wheel, the oil and water temperature and their pressures, forward and sideways acceleration, manifold pressure, air inlet temperature etc.

Perhaps the ultimate will be where the driver sits on the side of the track and "drives" the car by looking at a tv screen which shows the track immediately in front or the radio-steered car via a small tv camera. Possible, but remote.

OPTICAL COAX?

Have you ever looked at a piece of coaxial cable and thought how much material and effort goes into producing it? All that copper. Now think of the larger coaxial cables used in professional telephone cable systems etc. It could well be that the coax cable will be replaced, gradually, by plastic fibres.

A laser beam can be shone down a plastic light fibre (like the "mare's tail" displays) and the single beam can carry some six different tv channels or a very large number of telephone conversations. Good thing about plastic fibre is that it doesn't rot or corrode, it's light in weight and the system isn't prone to electromagnetic or electrostatic interference.

At the University of London, one experiment has been to pass signals down a light fibre (just one) and it is possible to "tap" off the signal anywhere along the fibre without breaking the plastic. A sensor—so tiny that it can be mounted on the inside edges of a small clothes peg, is simply clipped anywhere along the fibre and the signal can be heard via the tap.

It is interesting to note that two of the large connector manufacturers—Amphenol and ITT Cannon, already offer connectors not for connecting things electrically, but optically. Amphenol has a small "coaxial type" plug and socket, while ITT Cannon has a multi "pin" plug and socket.

20% EFFICIENCY CELL

Another thing not to be taken lightly is the new approach to photocells by Bell Labs. A 5 micron thick gallium arsenide coating is one of the secrets which, it is claimed, assists in the making of a cell which will have nearly 20% efficiency. While 20% may not sound very high to some, it is quite an achievement when comparing it with the 8% efficiency of the current silicon cell.

GIVE US A TUNE!

The world of computers seems to be a place where the smaller and smaller gets ever more complex. We've reached the stage of minicomputers which seem to have amazing versatility when coupled to certain other items. For example I hear of one application where a minicomputer was programmed and coupled to a suitably "voiced" oscillator and tone forming circuits. The net result and point to it all was that the computer played the second instrument in a Beethoven clarinet duet and listeners were unable to tell which was the computer and which was the real man plus proper clarinet.

Perhaps schoolboys will be programming their more advanced pocket calculators to sing Good King Wenceslas outside your door at Christmas thereby allowing them to concentrate on the more important task of collecting and counting the money.

DIAMONDS ARE . . .

Diamonds are supposed to be a girl's best friend so perhaps saphire could do something for the men? It's certainly doing something for the giant US company Hughes Aircraft. This company had been making liquid crystal displays by placing same on a bulk silicon cubstrate. This same substrate also contained the addressing and switching circuitry. Now, Hughes is building the display but using a saphire substrate. Better yield and isolation between elements plus simpler processing are some of the advantages. A 10,000 element display has been fabricated using this type of substrate and it measures only one inch square. Rumour has it that Hughes is now working on a 2 inch square device.

I would think that viewing a single element on the saphire substrate one would see precious little.

TIE-PIN TELLY?

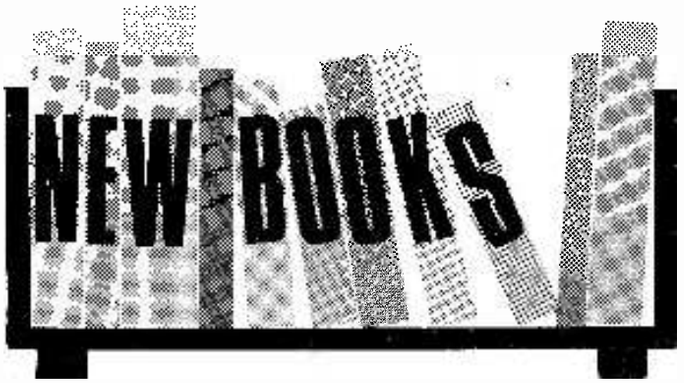
Some time back I commented on a minute calculator which fitted on the wrist. I note that the Optel Corp. in America has just launched a wristwatch which is also a calculator—the whole lot in a single wristwatch case. Prices quoted are between 500 dollars and 1,000 dollars and the watches/calculators have eight digit readouts and employ liquid crystal displays. The batteries are disposable types and should last for a least one year.

About time we saw the tie-pin television isn't it?

BUG-FINDER

In the June issue we referred to the EMI wide-band receiver as the Bloodhound. This should have read 'Bughound.' Our apologies.

Ginsberg



A GUIDE TO AMATEUR RADIO (Sixteenth Edition)
By Pat Hawker G3VA
Published by the Radio Society of Great Britain, 35 Doughty Street, London WC1N 2AE
112 pages 9¾ × 7¼in. (248 × 184mm)
Price 98p (£1.10 inc. p/p)

AS compiler of the Amateur Bands feature every month I receive many letters from would-be listeners to the short wave bands. One question pops up more frequently than any other, "where can I get a book that explains all the jargon I hear and read about concerning the SW bands?" "What's a QSL card?" is another favourite.

Having enjoyed the privileges of a licensed radio amateur for more years than I care to remember I usually try to steer a newcomer's interest towards the amateur bands! I see no point in listening to broadcast stations, frequently using very high power, when I can be talking to another amateur thousands of miles away on gear that I have built myself. One cannot achieve this overnight but it should be the natural target of any short wave listener. It is at this point that I always advise newcomers to write to the RSGB for the Guide!

In reviewing a book it is all too easy to list material that one feels ought to have been included in the interests of completeness. In the Guide this seems to me to be quite impossible! It's all there, page after page of solid information, all the hieroglyphics and jargon carefully explained in much detail. However, since this is the sixteenth edition it is inevitable that much of the material used was already set and the consequent saving in production costs is reflected in the very low cover price.

For year after year the Council of the RSGB has dodged the issue of revising the Guide and the longer it is left the costlier will be the work involved but it will have to be done. Reading the Guide a newcomer could be forgiven for thinking that a new term "Mc/s" had been invented, replacing MHz! Even in the new material it has been persisted with. A note to explain why it occurs at all would not have been out of place on the first page.

There are many other inconsistencies which could be cleared up such as the use of K, ohms, m/ohms and KΩ for resistance instead of Ω, kΩ, MΩ, etc. "Condenser" instead of "capacitor" in places, reference to component suppliers no longer in business, use of metric and Imperial measurements on one diagram!

Chapter One (This is Amateur Radio) answers some of the simpler questions, "what types of licences are available in the UK?, "how much do they cost?", "are the exams difficult to pass?" and perhaps more pertinent "how much does an amateur station cost?". Chapter Two (Getting Started) looks at log-keeping, discusses the characteristics of the amateur bands from 1·8MHz to above 1215MHz, advises on the sending of reports, and reviews amateur equipment in a general way. Although the PA circuit in Fig. 17 is not intended to be a practical one, a blocking capacitor in the anode circuit would not have come amiss! Chapter Three (Communications Receivers) gets down to details on requirements, leading to practical designs for a high stability converter, a Q multiplier and the now famous RSGB Transistor Four simple superhet.

Chapter Four (Amateur Transmitters) discusses the usual types of oscillators found in amateur transmitting equipment, leading on to power amplifier design and the problems of harmonics and parasitics, a much-beloved subject of the Radio Amateurs Examination! CW and telephony operation is followed by aerials, frequency measurement and the RSGB Noviset, a low power transmitter for telephony or CW on the 160/80m bands.

Chapter Five (The Licence Examinations) is perhaps the most important chapter in the Guide! Details of the RAE syllabus, which is very frightening and daunting to the prospective candidate but need not be, a typical exam paper, a summary of licence conditions and a table of frequencies available to the UK amateur. Finally, preparing and passing the RAE, some very useful advice indeed if only candidates would heed it!

Having got a ticket Chapter Six (Operating an Amateur Station) will assume a new significance with notes on the Morse code, RST code, International Q code and Amateur Abbreviations, and, very useful indeed, the list of callsign prefixes. Chapter Seven (Workshop Practice) should convince the newcomer that making one's own equipment is not so very difficult after all, and, very significantly, that it's very much cheaper and certainly much more satisfying. For some strange reason a 3·5MHz direct-conversion receiver design is included in this chapter.

Chapter Eight (Amateur Radio Equipment) is completely new in the Guide and quite invaluable to the would-be purchaser of any amateur gear. A review of receivers from the 30s to the present day runs on to transmitters and transceivers and is followed by an extremely useful listing of equipment, by make, with basic technical data. Finally, Chapter Nine (The RSGB and the Radio Amateur) outlines the work of the Society and the advantages of being a member.

Don't worry about my trivial criticisms! It's still a wonderful publication and worth every penny!

Eric Dowdeswell G4AR

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1L4	·33	6BR7	1·17	6Q7G	·59	12SJ7	·52	43	1·17	DY802	·41	ECL84	·70	EZ41	·64
1N5GT	·76	6BR8	1·76	6Q7GT	·59	12SQ7	·76	50B5	1·00	E80CC	2·57	ECL85	·70	EZ80	·33
1R5	·53	6BS7	1·64	6Q7(M)	·64	12SR7	·88	50C5	·70	E80F	1·64	ECL86	·47	EZ81	·84
1S4	·39	6BW6	·94	6R7G	·70	14H7	·64	50CD6G		E88CC	·88	EF22	1·76	GY501	·82
1U4	·70	6BW7	·82	6R7(M)	·88	14S7	·94		1·46	E92CC	·70	EF80	·29	HABC80	
1U5	·88	6BZ6	·57	6SA7	·52	19AQ5	·59	50EH5	·88	E180F	1·17	EF83	1·17		·70
2D21	·53	6C4	·47	6SC7GT	·89	19G6	7·02	50L6GT	·76	E182CC	1·46	EF85	·35	HL23DD	
2GK5	·64	6C5G	·59	6SG7	·52	20DI	·70	85A2	·70	E1148	·62	EF86	·53		·88
2X2	·70	6C6	·47	6SH7	·52	20F2	·88	85A3	·70	EA50	·32	EF89	·35	HL41DD	
3A4	·59	6C9	1·17	6SJ7	·64	20L1	1·29	90AG	2·93	EA76	1·17	EF91	·43		2·34
3D6	·47	6CD6G	1·46	6SK7GT	·52	20P3	·94	90C1	·88	EABC80	·45	EF92	·59	HL42DD	
3Q4	·70	6CG8A	·88	6SQ7GT	·53	20P4	1·17	90CG	2·81	EAC91	·88	EF97	·94		2·34
3Q5GT	·64	6CL6	·76	6V6G	·20	20P5	1·52	150B2	·88	EAF42	·88	EF98	·94	HN309	1·76
3S4	·47	6CL8A	·94	6V6GT	·53	25A6G	·70	215SG	·59	EAF801	·88	EF183	·35	HVR2	1·17
3V4	·82	6CM7	·88	6X4	·47	25L6G	·70	807	1·17	EB34	·29	EF184	·41	HVR2A	
4CB6	·64	6CU5	·88	6X5GT	·53	25Y5G	·82	5702	1·17	EB91	·23	EH81	·70	MHLD6	
5CG8	·64	6CW4	1·17	7B6	·88	25Z4G	·47	5763	1·76	EBC41	·88	EL32	·59		1·17
5R4GY	·94	6DE7	·88	7B7	·82	25Z5	·94	6057	1·17	EBC81	·41	EL34	1·17	KT41	1·17
5U4G	·47	6DT6A	·88	7H7	·88	25Z6G	·82	6060	1·17	EBF80	·46	EL35	2·93	KT66	2·93
5V4G	·59	6EW6	·88	7R7	·94	28D7	1·17	6067	1·17	EBF83	·50	EL37	2·93	KT81	2·84
5Y3GT	·53	6E5	1·17	7Y4	·88	30A5	·76	7193	·62	EBF89	·38	EL41	·59	KTW61	1·76
5Z3	·88	6F1	·88	7Z4	·94	30C15	·82	9002	·59	EBL21	2·34	EL81	·70	KTW62	1·76
5Z4G	·53	6F6G	·59	9D7	·76	30C17	·94	9006	·35	EC86	·82	EL83	·64	KTW63	1·17
5Z4GT	·53	6F13	·82	10C2	·76	30C18	·82	ACPEN	1·17	EC88	·82	EL84	·36	P61	·59
6/30L2	·70	6F14	·88	10DE7	·88	30F5	·88	AC2/PEN/		EC92	·53	EL85	·52	PABC80	·45
6A8G	1·46	6F15	·76	10F1	·88	30FL1	·78	DD	1·17	ECC33	1·76	EL86	·45	PC86	·70
6AC7	·57	6F18	·64	10F9	·76	30FL2	·78	AC6PEN	·70	ECC35	1·11	EM80	·53	PC88	·70
6AG5	·32	6F23	·82	10F18	·64	30FL12	1·05	AC/TH1		ECC40	1·17	EM81	·76	PC95	·70
6AH6	·70	6F24	·1·00	10LD11	·82	30FL13	·64		1·17	ECC81	·40	EM84	·64	PC97	·41
6AJ5	·76	6F25	1·17	10P13	·88	30FL14	·82	AL60	1·17	ECC82	·39	EM87	·82	PC900	·47
6AK5	·47	6F28	·78	10P14	2·34	30L15	·82	ATP4	·59	ECC83	·39	EMM803		PCC84	·35
6AK6	·70	6F32	·59	12A6	·75	30L17	·76	AZ1	·29	ECC84	·41		2·84	PCC85	·52
6AM8A	·64	6G6G	·59	12AC6	·82	30P4MR		AZ31	·70	ECC85	·47	EY51	·47	PCC88	·70
6AN8	·82	6GH8A	·88	12AD6	·76		1·17	AZ41	·29	ECC86	1·00			PCC89	·58
6AQ5	·53	6GK5	·76	12AE6	·76	30P12	·76	BL63	2·34	ECC88	·52			PCC189	·56
6AR5	·70	6GU7	·88	12AT6	·47	30P19/		CL33	1·87	ECC189	·76			PCF80	·47
6AS7	1·17	6H6GT	·29	12AU6	·53	30P4	·88	CY1C	1·17	ECC807	1·41			PCF82	·47
6AT6	·53	6J5GT	·53	12AV6	·59	30PL1	1·00	CY31	·59	ECF80	·53				
6AU6	·35	6J6	·35	12BA6	·53	30PL13	1·11	DAF91	·35	ECF82	·53				
6AV6	·53	6J7G	·35	12BE6	·59	30PL14	1·29	DAF96	·59	ECF86	·88				
6AW8A	1·11	6JU8A	·88	12BH7	·59	30PL15	·94	DC90	·70	ECF804	2·63				
6AX4	·88	6K7G	·35	12BY7	·88	35A3	·76	DF91	·35	ECH21	2·34				
6B8G	·85	6K8G	·58	12E1	3·51	35C5	·88	DF96	·59	ECH35	1·46				

EY83	·68	PCF86	·56	QV04/7		VU111	·94	AC177	·36	BF181	·52				
EY84	·82	PCF200	1·17		1·17	VU120	1·17	ACY17	·33	BF185	·52				
EY87/6	·39	PCF201	1·17	R19	·70	VU120A		ACY18	·26	BF194	·20				
EY88	·47	PCF801	·59	TH233	1·17		1·17	ACY19	·25	BFY50	·29				
EY91	·68	PCF802	·59	TP2620	1·17	VU133	·94	ACY20	·23	BFY51	·25				
EZ40	·59	PCF806	·59	UABC80	·47	W107	1·17	ACY21	·25	BFY52	·26				
EZ41	·64	PCH200		UAF42	·70	W729	1·17	ACY22	·20	BY100	·23				
EZ80	·33		1·00	UBC41	·70	X65	1·46	ACY28	·23	BY114	·23				
EZ81	·84	PCL82	·45	UBC81	·53	X66	1·46	AD140	·47	BY126	·20				
GY501	·82	PCL83	·53	UBF80	·47	X101	2·34	AD149	·64	BY127	·23				
GZ32	·59	PCL84	·47	UBF89	·47	Z759	5·85	AD161	·59	BYZ10	·33				
GZ33	1·46	PCL86	·55	UBL21	2·34			AD162	·59	BYZ11	·33				
GZ34	·70	PCL805	·64	UC92	·53	**Transistors**		AF114	·33	BYZ12	·33				
GZ37	1·17	PEN45	·94	UCC84	·38	**& Diodes**		AF115	·20	BYZ13	·33				
HABC80		PEN45DD		UCC85	·53	1N4744	·18	AF117	·25	FSY11A	·29				
	·70		·94	UCF80	·52	2N404	·23	AF121	·39	FSY41A	·29				
HL23DD		PEN46	·59	UCH21	2·34	2N966	·68	AF124	·33	OA9	·16				
	·88	PEN453DD		UCH42	·88	2N1756	·64	AF125	·22	OA10	·55				
HL41DD			2·34	UCH81	·47	2N2147	1·10	AF126	·23	OA47	·13				
	2·34	PENDD		UCL82	·45	2N2297	·29	AF186	·71	OA73	·20				
HL42DD		4020	2·34	UCL83	·64	2N2369	·18	BA115	·18	OA79	·13				
	2·34	PFL200	·82	UF41	·82	2N3053	·42	BA116	·23	OA81	·12				
HN309	1·76	PL33	·59	UF42	·88	2N3121	3·82	BA129	·16	OA85	·12				
HVR2	1·17	PL36	·70	UF80	·41	2N3703	·25	BA130	·13	OA90	·16				
HVR2A		PL81	·53	UF85	·52	2N3709	·26	BA153	·20	OA91	·12				
	1·17	PL81A	·53	UF89	·47	AA119	·20	BC107	·16	OA95	·12				
KT41	1·17	PL82	·43	UL41	·70	AA120	·20	BC108	·16	OA200	·12				
KT66	2·93	PL83	·47	UL84	·49	AA129	·20	BC109	·16	OA202	·13				
KT81	2·84	PL84	·47	UM80	·52	AAZ13	·23	BC113	·33	OC44	·13				
KTW61	1·76	PL504/500		UY41	·53	AC107	·20	BC115	·20	OC45	·14				
KTW62	1·76		·82	UY85	·41	AC113	·33	BC116	·33	OC46	·20				
KTW63	1·17	PL505	1·70	U10	1·17	AC126	·16	BC118	·29	OC70	·16				
MHLD6		PL508	1·05	U12/12	1·17	AC127	·22	BC119	·59	OC71	·14				
	1·17	PL509	1·70	U19	2·93	AC128	·26	BCY10	·64	OC72	·14				
P61	·59	PY33/2	·53	U25	·70	AC132	·26	BCY12	·29	OC74	·29				
PABC80	·45	PY81	·41	U26	·77	AC154	·33	BCY33	·26	OC75	·14				
PC86	·70	PY82	·35	U27	1·76	AC156	·26	BCY34	·29	OC76	·20				
PC88	·70	PY83	·45	U33	1·76	AC157	·33	BCY38	·29	OC77	·35				
PC95	·70	PY88	·47	U35	1·76	AC158	·26	BCY39	·33	OC78	·20				
PC97	·41	PY500A		U81	·94	AC165	·33	BF158	·23	OC78D	·20				
PC900	·47		1·11	U191	·59	AC166	·33	BF159	·33	OC81	·14				
PCC84	·35	PY800	·47	U251	·94	AC168	·49	BF163	·26	OC81D	·14				
PCC85	·52	PY801	·47	U301	·76	AC176	·71	BF173	·49	OC82	·14				
PCC88	·70	PZ30	·56	U403	·88			BF180	·39	OC82D	·14				
PCC89	·58	QQV03/10		U404	·64										
PCC189	·56		2·05	U801	·76										
PCF80	·47	QS75/20		U4020	·70										
PCF82	·47		1·17	VP23	·88										
PCF84	·69	QS95/10		VP41	·88										

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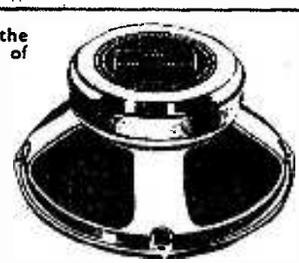

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AMATEUR BANDS

by Eric Dowdeswell G4AR

REPORTS from readers continue to arrive in spite of the competition from many other summer activities. Perhaps I ought to put summer in quotes as snow falls to a depth of several inches in the North! That'll keep the lads glued to their sets! Incidentally, because of changes to our printing schedules you can now hold your reports to me until the end of the month. This ought to get your reports into print a bit sooner after you part with them and generally make the news a bit more up-to-date.

Among the regular publications that come my way is *TARS TALK*, journal of the Torbay Amateur Radio Society, and one that I enjoy reading very much. The Society obviously has a solid core of hard-working members resulting in a healthy membership. Apart from regular meetings the Society organises coach trips from time to time in which wives, girl-friends and children take part, thus showing that radio amateurs do have a human facet, for a short time, anyway! Those interested and lucky enough to live in the Torbay area should contact M. Yates, G3UIQ, 23 Waverley Road, Newton Abbot, Devon, secretary of TARS.

There are dozens of similar societies up and down the country so if you are unattached radio-society-wise (ugh!) why not ask the Radio Society of Great Britain at 35 Doughty Street, London WC1, for the address of your local society? In the larger towns there may well be two or three from which you can choose. While you are at it, why not consider getting a copy of the Society's *Guide to Amateur Radio* (16th Edition) which is a give-away at £1·10 p/p. Hopefully, my review of the Guide should appear elsewhere in this issue.

Tim Charles (Colchester) grabbed the far end of his 132ft aerial wire and pulled it round to form a half wave loop on 80m, and, parallel tuned with 500pF, was delighted to find it tuned to all the HF bands. I feel it must have been mis-matched at times but full marks Tim for experimenting! On 2m Tim now has a Microwaves Module converter feeding his CR70A on 2 to 4MHz. He mentions some very low power work by G8EWC on 2m, heard by Tim when the power was just 10mW, that's milliwatts not megawatts! Distance was only one and a half miles but the 8-element Yagi at EWC must have helped.

Paul Barker (Sunderland) doesn't intend to wear out his bandswitch! He stuck to 20m SSB and SSTV and found CN8HD on the latter mode. Paul praises the conditions into the Middle East and Africa of late on 20m, no doubt due to the change towards summer propagation paths. **Stephen Budd** A8713 (Worthing) also preferred 20m where he found KG6, KS6 and 9N1 for comparatively rare ones. I must say it is nice to see some people getting away from the bedlam on 80m for the relative quiet of 20m! It was always my favourite band and could usually be relied upon to produce something new from time to time.

Colin Fawcett (Oldham) reports back on to the bands after a three-year lapse, starting off again with an Eddystone 840 to which he hopes to add an SSTV monitor before long. We look forward to your reports in this field OM. In spite of several logs from **M. C. P. Bennett** (Slough) I still don't know his first name! Come along OM and reveal all to us! He's now got a Trio JR310 and keeps his CR70A for 160m only. Just to prove he doesn't sleep he reports ZL's on 40m at 0200, VK's on 20m at 0600 but 15m not waking up until around 1400GMT, M.C.P. mentions the activities of one or two DXpeditions but I'm afraid they will have been and gone by the time you read this in print. Finally, he reckons that KC4AF, HS5ABD and ZA3PC are the work of a single phoney operator.

Peter Walton A9002 (Llanfair PG, Gwynedd) has an Eddystone 358X and 87ft of wire plus a 15ft vertical, with an ATU in between and he concentrated on 20m mainly. I often get requests for data on ATU's and as I still have a few copies of the *PW Aerial Data Chart* stashed away anyone interested can send me a SAE, not less than 8 x 6in.

An appeal from **Mark Hill** A9008 (114 Green Lane, Castle Bromwich, Birmingham) to others of similar age group to correspond with him. He has an RA-1 receiver fed from a Microwave Modules converter at 28/30MHz for 2m work, the aerial being the halo type. Other gear includes a Collins TCS8 and Codar T28 together with a G5RV aerial plus a 20m dipole and a base-loaded whip. All that's missing are some of my log sheets and those are already in the post! Welcome to the column, Mark. **Stephen Terry** (Banbury) BRS35669 produced a useful list of things heard but complained of QRM caused by moving his QTH. For the time being he is using 100ft of wire and hopes to get back into the groove very soon. Another enthusiast intent on getting the best aerials he can is **Andrew Swiffin** (Cheadle) who is in the process of erecting dipoles for 10 to 80m. One aim is to get them as far away as possible from his neighbour's colour TV installation and the line time base QRM he is suffering at the moment.

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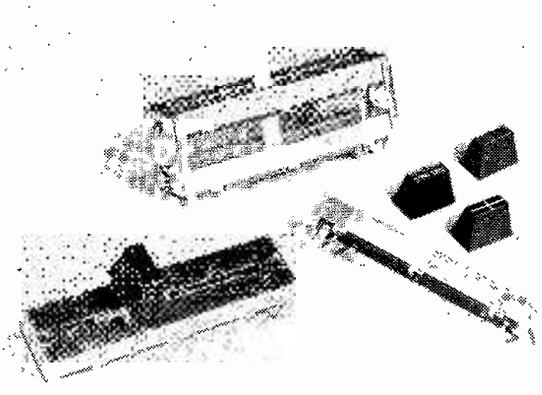

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Log extracts

T. Charles:— 80m PJ9EE TI9DX TR8DG VP2DM **40m EA9FD** HI8FGP HK4DEG **OA4AHV ZL1AUA ZL2FM 20m FG7AE** JR6QZD (Ryukyu Is. Box 377 Tokyo) 8R1AK **2m I5ARS** OE4MFA **SM0ERR SP9EGM 2m via Oscar VII** W2LV W3OMU **W4FJ**

P. Barker:— 20m A6XR (G4CHP) C5AR (G3LQP) OE5CA/YK 5L2DT 8SK2AT (Sweden) **20m SSTV** CN8HD DL3PN HA5KFU

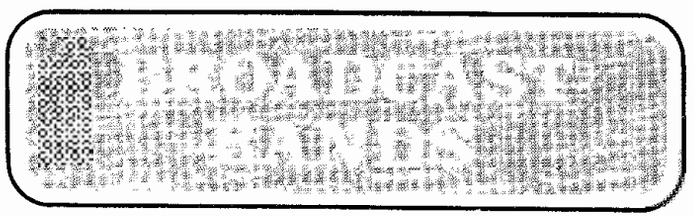
S. Budd:— 20m A4XVF KG6JAR KS6SFA 9N1MM 9X5PT **15m** VS9MB 9M2CJ

M. Bennett:— 80m KP4AN PY3CIQ **40m** ZL4KF **20m** DU7DP KL7USA ST2AY 5U7AB 7X5AB **15m** CX5BK VQ9SS/C (Diego Garcia) ZP5DE 6W8DY

P. Walton:— 80m 4Z4KB **20m** VQ9P VS9MAS

S. Terry:— 20m KH6GDR KL7IEU VP2LBR VQ9P (Mahe Is.) ZD7SD 9M8VLC

A. Swiffin:— 80m 9M2FX **20m** AC3PT FR7ZW VP2LBR VS5MC VU7GV (Andaman Is.) 4W1ED 9M1MM



SHORT WAVE BROADCASTS

by Derek Bell

FROM somewhere in Ireland **Cpl. D. Hardman** writes to this column requesting the times and freqs. of the Singapore radio stations. These are as follows: 5010, 5052, 6000, 6155, 7170, 7250, 9653, 11940kHz. The service runs 24 hours a day and includes a VHF system. It is, however, very seasonal here in Europe, depending on the darkness path. To while away the hours Cpl. Hardman has an HAC one-valver. To show what can be done with this set, **Christopher Midgley** of Cleckheaton has logged:—

Radio Jordan	at 1700 on 9560
Radio Baghdad	at 1930 on 9745
NHK Tokyo	at 0800 on 17855

Christopher had added 90 feet of aerial wire and an ATU to the basic set and says the QSL cards are rolling in thick and fast, numbering 52 at the time of writing.

Moving over the Irish border to Drogheda, **Tomas O'Donghaille** writes for information on his Koyo KTR. Tomas says that when tuning up and down the bands the set "oscillates". My first thought is that these are heterodynes caused by signals on adjacent stations interfering with each other. This type of interference is sometimes called "adjacent channel" interference and the clue to it is that when the tuning is moved from side to side the pitch of the interference changes. The only way out is to have the set checked by an expert. If it is the same on **all** signals then the IF stages could be unstable.

Two readers write asking for more details of the abbreviations used in our radio hobby so I will deal with them separately if I may. **Martin Chapple** of Leamington Spa asks for some frequencies:—

Adventist World Radio is 9670

Radio Berlin International is 7260 and 1151

These, of course, are in English and both have many other slots for transmissions in other tongues.

B. W. Cowie of Telford is the other letter writer and for both a short list is offered:—see box

Barry Clayton from Bristol writes a welcome letter to tell us of a competition being run by Radio RSA in which the listener has to log and report on RSA transmissions on all the freqs. they use up to Nov.1st 1975. These are:— 3995, 5980, 7270, 9525, 9695, 11900, 11970, 15155, 15220, 15175, 17780 and 21535kHz. A formidable task you will agree but if you do manage it send the results to: Contest 75, Radio RSA, Box 4559, Johannesburg, South Africa.

Barry also takes this column to task regarding the amount of attention given to newcomers to the hobby. I can only say that a large percentage of letters come from newcomers and they do deserve help since they are the ones that ensure that the hobby flourishes.

David Lovatt from Stoke-on-Trent is awarded this column's 'Honorary gold tuning knob'! This thirteen-year-old won first prize in Radio Sofia's recent New Year competition, and deserves our congratulations. David writes appealing to us to "save the English transmission of Radio Finland". This is in danger of being dropped in favour of a German language broadcast. If readers care to write to Radio Finland by all means do so but, whether German or English, Radio Finland will still be there to be heard!

Now that the summer schedules frequency changes have taken place and things have settled down we can have an update on the week's DX 'Show list' recently featured in this column. These are provided by **Gary Stevens** from London and the changes to shows noted in the previous item are as follows:—

Tues.	Hungary	now 2130 on 6025 and 7175
Thurs.	Holland	now 1830 on 6045
Sats.	Israel	now 2000 on 12025 and 9009
	Canada	now 2102 on 15325 and 11855

Continuing "across the pond" the summer schedules from Radio Canada have been received by this column and they show a coverage from 0600 to 0800 and from 1715 to 1900 then from 2005 to 2159 on the frequencies 5995, 6100, 7235, 7290, 9685, 11855, 15325 and 17820kHz. It is interesting to hear

BC	broadcast	kW	kilowatt
DX	long distance	MHz	megahertz
GMT	Greenwich Mean Time	Net	network
ID	station identification	m.	metre (band)
kHz	kilohertz (frequency)	Tx	transmitter

Some groups of the International Q Code have been taken over by short wave listeners and amateurs and their meanings adapted:—

QRG	Frequency	QRV	Ready
QRK	Signal strength	QRX	Stand by
QRM	Interference (by other stations)	QSB	Fading
		QSL	Verification card
QRN	Interference (atmospheric/electr'l	QSO	Radio contact
		QSY	Frequency change
QRT	Shut down	QTH	Location or address

A good source of information for both SWLs and listeners to the amateur bands is *A Guide to Amateur Radio* by Pat Hawker G3VA from the RSGB at £1·10 inc.

from overseas since it shows just how far your column voyages and how this hobby of our is truly international.

Time to wrap up now I am afraid. The post this month was exceptionally heavy so apologies to all who were left out and best wishes to you and yours.

MEDIUM WAVE DX
by CHARLES MOLLOY

RADIO South Africa is back on the medium waves following a public protest at the suspension of broadcasting on this band last year. Programmes in Afrikaans/English are transmitted from Johannesburg on 575kHz/638kHz, from Port Elizabeth on 1043kHz/1178kHz, and from Cape Town on 557kHz/656kHz. Listen between midnight and sunrise for the All-Night Service which is broadcast on all frequencies.

A number of West African broadcasters are audible in the UK after dark at this time of year. Enugu in Nigeria can be found on 1320kHz with a programme in English at 2300 while Conakry in the Republic of Guinea is a regular on 1403kHz after the French stations on this frequency sign-off at 2300. Radio Senegal in Dakar shares 764kHz with Sotton in Switzerland but the two are easily separated with a medium wave loop aerial. The RNE outlet at Tenerife in the Canary Islands can be heard with Spanish programming after Belgium clears the frequency. Radio Kinshasa, Zaire is on 692kHz all night and is sometimes found clear of the East German station on that channel.

Glyn Morgan (Tredegar) returns to the medium waves after a long absence due to illness. He is using a Lafayette HA230 connected to a 12ft down lead from an attic TV aerial. His first late night session brought an unidentified Russian on 1070kHz (Ust Kamenogorsk in Kazakhstan signs-on at 0000). A MW loop is now under construction. Welcome back to the band Glyn, hope to hear from you again before long. Fourteen year old **Peter Bouger** (Kettering) uses a very old Bush radio with an aerial tuning unit and a 150ft long outdoor aerial 25ft above ground level. He reports hearing the AFN low power outlet at Heidelberg on 1304kHz and a programme in English from Sweden on 1178kHz at 2250. Radio Sweden carries "Sweden Calling DXers" on this frequency at approximately 2300 every Tuesday while "DX Circle" is broadcast by Deutschlandfunk, West Germany, on alternate Wednesdays at 1900 on 1268kHz. "DX Circle" can only be heard on the medium waves.

N. Taylor (Sunbury-on-Thames) has a PW Medium Wave Loop but is having some difficulty using it with his Pioneer SX737 receiver which has its own internal aerial. A method tried by the writer is to attach the receiver to the centre of the loop so that the nulls of the loop and an internal aerial coincide, i.e., point in the same direction. The loop and the receiver are then rotated together to null out unwanted stations, coupling between the two being by induction.

Harold Emblem writes again from Mirfield in Yorkshire. With his Eddystone 730 and MW loop he has heard CJON in St. John's in Newfoundland on 930kHz, WCBS in New York City on 880kHz, Arkhangelsk with local identification and sign-on at 0200 and Tashkent in Uzbekistan with sign-on at 0300, both stations on 908kHz. Harold mentions that if reception towards the east is good then Arkhangelsk will not be heard, a good pointer to conditions. Three of the Greek Armed Forces (Yened) low power stations have been heard recently by the writer during the evenings. Kavala on 1355kHz was logged at 2115 with news in English with unidentified parallel outlets on 1301kHz (Serrae off frequency?) and on 1291kHz. The transmission on 1301kHz was heard until sign-off at 2200 GMT.

BROADCAST BANDS
Short Wave Reports by the 15th of the month to Derek Bell, c/o Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD. Medium Wave Logs to Charles Molloy, 132 Segars Lane, Southport, PR8 3JG.

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

points arising...

ASCOTT STEREO CASSETTE DECK. FEB/MARCH/APRIL 1975

Some minor points have arisen:-

p919 Recording Amplifier' second para, VR6 should read VR5. Fig. 4. R23 should be between C12 and R21.

p920 Component List. C30 is electrolytic. C30 is tantalum. S6 is SPDT. Add S6 DPDT. Add F3, 250mA cartridge fuse and holder. C32 one off only.

p991 Fig. 5. R36 should be between Tr13(e) and C32.

p992 Fig. 7. add resistor 15kΩ in series with pause switch, between RH end of R63 and + line.

p993 Fig. 8. add 15kΩ between A26 and rail A.

p1087 Fig. 10. S2 should read S4.

p1088 Fig. 11. Unmarked resistor below Tr12 is R38.C28 above Tr8 should read R26.C21, left of Tr7, should read R21.

p1089 Fig. 12.L2 should read L1.

p1093 In Note:—Fig. 5 Part 2 'collector' should read 'emitter'.

UHF WAVEMETER. JULY 1975

p244 Fig. 4. Resistor 'k' should be marked 1kΩ.

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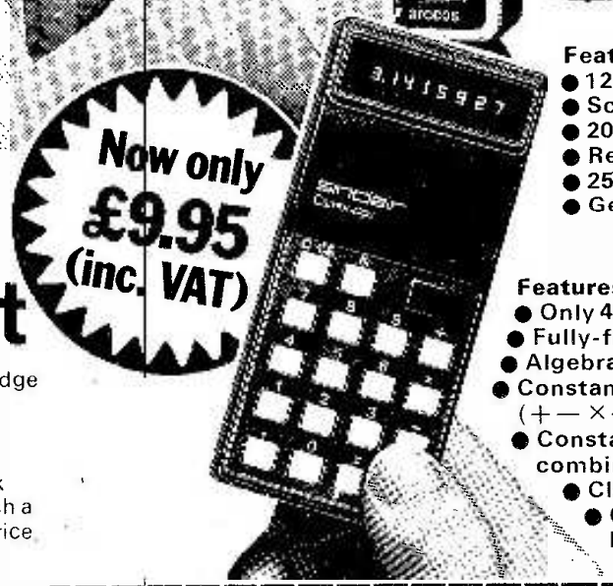

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EC86	0·78	EF183	0·83	PCC189	0·80	PY82	0·57	30FL12	1·13
EC88	0·76	EF184	0·83	PCF80	0·54	PY88	0·56	30FL14	1·00
EC90	0·86	EH90	0·85	PCF82	1·22	PY500A	1·02	30L1/PCC84	0·54
EC97	0·60	EL34	0·92	PCF86	0·64	PY800	0·49	30L15/	
ECC81	0·47	EL36	1·01	PCF200	1·00	PY801	0·49	PCC805	1·03
ECC82	0·44	EL81	0·85	PCF201	1·00	U26	0·88	30L17	0·89
ECC83	0·47	EL84	0·47	PCF801	0·64	U191	0·88	30P4MR	1·27
ECC84	0·58	EL85	0·85	PCF802	0·70	U193	0·54	30P12/	
ECC85	0·71	EL86	0·92	PCF806	0·64	UABC80	0·90	PC80I	1·01
ECC88	0·84	EL91	0·00	PCH200	1·15	UBC81	0·71	30P19/	
ECC189	0·68	EL95	0·72	PCL82	0·56	UBF89	0·58	PC802	0·89
ECF80	0·60	ELL80	2·50	PCL83	0·64	UCC85	0·59	30PL1/	
ECF82	0·86	EY51	0·79	PCL84	0·61	UCH81	1·12	PCL801	1·00
ECF86	0·68	EY86/7	0·40	PCL85	0·64	UCL82	0·72	30PL13/	
ECH81	1·16	EY88	0·72	PCL86	0·64	UCL83	0·72	PCL800	1·15
ECH83	0·94	EZ80	0·54	PCL805/85	0·64	UF89	0·80	30PL14/	
ECH84	1·00	EZ81	0·38	PD500	1·88	UL84	0·92	PCL88	1·35
ECL80	0·67			PFL200	0·83	UY85	0·54	30PL15	1·13
ECL82	0·64			PL36	0·90	6/30L2/			
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DAF96	0·60	EF92	0·50	PC88	0·65	SP61	0·85	6K6GT	0·80
DCC90	1·85	EF95	0·45	PC97	0·55	T41	1·00	6K7G	0·35
DF91	0·40	EF98	0·80	PC900	0·55	U14	0·75	6K7M	0·45
DF96	0·60	EF183	0·40	PCC84	0·45	U25	1·00	6K8G	0·45
DK91	0·50	EF184	0·40	PCC88	0·62	U26	0·85	6K8M	0·70
DK92	1·00	EL32	0·60	PCC89	0·55	U191	0·75	6K25	1·00
DK96	0·75	EL33	2·50	PCC189	0·65	UABC80	0·40	6L6G	0·55
DL92	0·50	EL34	0·70	PCF80	0·40	UAF42	0·75	6Q7G	0·40
DL94	0·48	EL36	0·60	PCF82	0·42	UBC41	0·60	6Q7M	0·60
DL96	0·55	EL37	2·50	PCF86	0·65	UBC81	0·50	6SL7GT	0·55
DY86	0·45	EL41	0·90	PCF801	0·60	UBF80	0·50	6SN7GT	0·55
DY87	0·45	EL42	1·65	PCF802	0·55	UBF89	0·50	6SQ7GT	0·40
DY802	0·47	EL84	0·35	PCF805	0·90	UCC85	0·50	6U5G	1·50
EABC80	0·38	EL95	0·60	PCF806	0·80	UCH42	0·80	6V6G	0·30
EAF42	0·70	ELL80	2·00	PCF808	1·00	UCH81	0·50	6V6GT	0·60
EB91	0·25	EM80	0·55	PCL82	0·45	UCL82	0·40	6X4	0·45
EBC33	1·00	EM81	0·60	PCL83	0·70	UCL83	0·70	6X5G	0·45
EBC41	0·75	EM84	0·40	PCL84	0·50	UF41	0·75	6X5GT	0·55
EBC81	0·40	EM85	1·00	PCL85	0·60	UF89	0·50	7B6	0·80
EBF80	0·40	EM87	1·00	PCL86	0·50	UL41	0·85	7B7	0·80
EBF83	0·40	EY51	0·45	PCL805/85	0·60	UL84	0·50	7C5	1·30
EBF89	0·38	EY86	0·45	PD500	1·50	UY41	0·55	7C6	1·00
EBL31	2·00	EZ40	0·60	PEN45	0·85	UY85	0·45	7H7	0·80
ECC81	0·45	EZ41	0·75	PL36	0·68	VR105/30	0·40	7R7	0·80
ECC82	0·38	EZ80	0·30	PL81	0·55	VR150/30	0·45	7S7	2·25
ECC83	0·38	EZ81	0·31	PL82	0·50	1R5	0·50	7Y4	0·80
ECC84	0·35	GY501	0·90	PL83	0·50	1S5	0·40	12AT6	0·45
ECC85	0·45	GZ30	0·65	PL84	0·50	1T4	0·40	12AT7	0·45
ECC88	0·50	GZ32	0·65	PL500	0·85	3S4	0·50	12AU6	0·50
ECH35	1·50	GZ34	0·75	PL504	0·85	3V4	0·85	12AU7	0·38
ECH42	0·85	GZ37	1·25	PL508	0·90	5R4GY	1·00	12AX7	0·38
ECH81	0·35	HN309	1·50	PL509	1·55	5U4G	0·55	12BA6	0·50
ECH83	0·50	KT61	2·50	PL802	1·00	5Y3GT	0·85	12BE6	0·60
ECL80	0·60	KT66	2·95	PX25	3·50	5Z4G	0·65	30C1	0·40
ECL82	0·42	KT81 (7C5)	1·30	PY33	0·68	6/30L2	0·90	30C15	1·00
ECL83	0·75	KT81	1·75	PY81	0·50	6AK5	0·45	30C17	1·00
ECL86	0·55	KT88	3·25	PY82	0·45	6AM5	1·00	30C18	0·90
ECLL800	3·50					6AQ5	0·50	30F5	1·00
EF37A	1·20					6AS7G	1·00	30FL1	1·00
						6AT6	0·60	30FL2	0·75
						6AU6	0·40	30FL14	1·00
						6BA6	0·38	30L15	0·95
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						6BJ6	0·75	30P12	1·00
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						6BR7	1·20	30PL1	0·95
						6BS7	1·40	30PL13	1·10
						6BW6	1·00	30PL14	1·10
						6BW7	1·00	35W4	0·60
						6C4	0·40	3524GT	0·70
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AC126	0·25	BF167	0·25	OC23	1·25	1N914	0·06	2N2926	0·12
AC127	0·25	BF173	0·28	OC25	0·40	IN4001	0·06	2N3053	0·18
AC128	0·15	BF179	0·33	OC28	0·66	IN4002	0·07	2N3055	0·45
AC176	0·25	BF180	0·36	OC35	0·55	IN4003	0·08	2N3525	0·91
AC187	0·21	BF181	0·35	OC36	0·60	IN4004	0·08	2N3614	0·65
AC188	0·20	BF194	0·10	OC42	0·40	IN4005	0·10	2N3615	0·65
ACY21	0·22	BF195	0·13	OC44	0·20	IN4006	0·12	2N3702	0·11
ACY39	0·75	BF197	0·15	OC45	0·20	IN4007	0·12	2N3703	0·12
AD140	0·50	BF200	0·32	OC71	0·18	IN4009	0·06	2N3704	0·14
AD149	0·50	BF851	0·25	OC72	0·28	IN4148	0·06	2N3705	0·15
AD161	0·44	BF898	0·25	OC76	0·30	1S921	0·07	2N3706	0·11
AD162	0·44	BFW10	0·61	OC77	0·55	IS2033	0·20	2N3707	0·13
AF115	0·25	BFX29	0·28	OC81	0·28	IS2051A	0·20	2N3708	0·07
AF116	0·25	BFX88	0·24	OC81D	0·28	IS2100A	0·20	2N3709	0·10
AF117	0·24	BFY50	0·20	OC81Z	0·45	183010	0·28	2N3710	0·11
AF186	0·48	BFY51	0·20	OC83	0·27	2N696	0·15	2N3711	0·11
AF239	0·44	BFY52	0·20	OC140	1·14	2N697	0·16	2N3819	0·38
ASY27	0·33	BY100	0·27	OC170	0·30	2N706	0·10	2N3820	0·50
ASY28	0·25	BY126	0·14	OC171	0·30	2N706A	0·12	2N3823	0·50
BA102	0·25	BY127	0·15	OC200	0·55	2N1131	0·25	2N3903	0·15
BA115	0·10	BZX61 series	0·20	OC201	1·00	2N1132	0·24	2N3904	0·20
BC107	0·14	BZY88 series	0·10	OC202	0·90	2N1302	0·18	2N3905	0·25
BC108	0·13	CR81-05	0·35	OC203	0·55	2N1303	0·18	2N3906	0·25
BC109	0·12	CR81-40	0·50	OCP71	1·20	2N1304	0·22	2N4058	0·15
BC113	0·15	CR83-05	0·40	ORP12	0·60	2N1305	0·32	2N4060	0·10
BC117	0·21	CR83-05	0·40	ORP60	0·55	2N1306	0·28	2N4061	0·13
BC143	0·30	CR83-40	0·65	TIC44	0·29	2N1307	0·28	2N4062	0·14
BC147	0·10	MJE340	0·47	TIC226D	1·50	2N1308	0·28	2N4289	0·30
BC148	0·08	MJE370	0·68	TIL209	0·20	2N1309	0·30	3N126	1·75
BC169C	0·15	MJE520	0·65	ZTX107	0·12	2N1613	0·21	3N141	0·81
BC182	0·13	MJE2955	1·27	ZTX108	0·08	2N1614	0·45	40360	0·40
BC182L	0·12	MJE3055	0·75	ZTX300	0·13	2N2147	0·78	40361	0·45
BC184L	0·13	MPF102	0·40	ZTX301	0·14	2N2160	0·78	40362	0·40
BC338	0·15	MPF103	0·36	ZTX302	0·18	2N2869A	0·16	40430	0·85
BCY32	0·85	MPF104	0·35	ZTX304	0·24	2N2646	0·50		
BCY33	0·38	MPF105	0·36	ZTX500	0·13	2N2904	0·20		
BCY34	0·45	NKT404	0·66						
BCY70	0·18	OA5	0·72						
BCY71	0·22	OA10	0·40						
BCY72	0·15	OA79	0·10						
BCZ11	0·65	OA81	0·18						
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SN7400	0·16	SN7428	0·40	SN7486	0·47	SN74145	1·26	SN74192	2·00
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SN7403	0·16	SN7437	0·37	SN7492	0·70	SN74154	2·00	SN74195	1·10
SN7404	0·26	SN7438	0·37	SN7493	0·70	SN74155	1·00	SN74196	1·20
SN7405	0·22	SN7440	0·22	SN7494	0·80	SN74156	1·00	SN74197	1·20
SN7406	0·42	SN7441AN	0·92	SN7495	0·80	SN74157	0·95	SN74198	2·77
SN7407	0·42	SN7442	0·78	SN7496	0·95	SN74170	2·52	SN74199	2·52
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SN7411	0·25	SN7454	0·16	SN74110	0·58	SN74190	2·00		
SN7412	0·30	SN7460	0·16	SN74118	0·90	SN74191	2·00		
SN7413	0·36	SN7470	0·36	SN74119	1·68				
SN7416	0·36	SN7473	0·41	SN74121	0·50				
SN7417	0·36	SN7474	0·42	SN74122	0·70				
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6·3	3·0	2·09
9·0	1·0	1·83
12·0	0·5	1·83
12·0	1·5	2·09
12·0	3·0	3·02
6-0-6	0·5	1·96
9-0-9	0·5	1·96
9-0-9	1·0	2·23
10-0-10	2·0	3·00
12-0-12	1·0	2·23
12-0-12	2·0	3·13
12-0-12	3·0	4·32
15-0-15	1·0	2·88
18-0-18	2·0	4·32
20-0-20	2·0	4·32
30-0-30	1·0	4·32
0-10-12-14-16-18	4·0	4·58
0-12-15-20-24-30	2·0	4·45
0-5-20-30-40-60	2·0	6·54
Battery charger transformers 6 & 12V	1·0	2·35
	2·0	3·27
	4·0	4·32
240/110 autos	30 watts	2·88
	50 watts	3·66
	100 watts	5·23
	150 watts	6·33
	200 watts	8·36
	400 watts	13·14
	600 watts	15·54
	1000 watts	23·67
Bulk tape eraser		3·53
15-8-3 ohm 12 watt matching		1·71
Transistor driver 4:1+1		0·27

Speakers

	£ p
3" Goodman tweeter 8 ohm 51CD4	1·47
3" Audax tweeter 8 ohm 6·5TWB18	1·60
5" Audax 8 ohm bass HIF13E8	3·23
6½" EMI d/cone 8 ohm 10 watt	3·59
6½" Audax 8 ohm	2·95
8" Celestion 8 ohm d/cone PS8 9858	2·76
10 x 6 EMI 8 ohm midrange	4·18
10 x 6 EMI 8 ohm 20 watt	7·36
13 x 8 EMI 8 ohm 20 watt	6·75
13 x 8 EMI 8 ohm 25 watt	7·84

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Single sided fibre glass	0·70 sq ft
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Circuit etchant 250ml	0·55
1 lb ferric chloride	0·50
250ml plastic bottles	0·16

250V C280 capacitors

0·01, 0·015, 0·022, 0·047	0·03
0·1	0·04
0·33	0·06
1·0	0·12
2·2	0·20

Miscellaneous

SWR 10 swr single meter	0·00
SWR 50 swr & power twin meter	13·40
Illuminated (12V) edge meter 130a	2·15
BB113 LW/MW/SW triple varicap diodes	0·33
BC177 complimentary to BC107	0·22
AC128	0·12
Dual reed relays 35 ohm coil 2 reeds N.O.	0·44
8280A (74176) BCD decade counter	1·15
12V 400mw Zeners	0·08
10K log pots + SP sw	0·18
10K lin stereo pots L/sw	0·40
100K log stereo pots + DP sw	0·45
250 ohm lin pots + SP sw 8" shaft	0·22
100V A.C. solenoids	0·25
5mH 1 amp chokes	0·18
20mH 2 amp chokes	0·25
80V piv 30 amp diodes S.O. 10 stud case	0·35
Twin tuning 300+ 250pf with ganged 100K pot for varicap tuning	0·40
3·7-70pf disc compression trimmer	0·10
0·47mfd 100V polycarbonate	0·11
1·0 mfd 100V polycarbonate	0·13
0·01mfd 160V tubular polyester	0·04
0·04mfd 600V	0·04
0·0033mfd 1500V	0·04

Electrolytics. Tubular with axial leads except where stated.

Mfd.	Volts	Pence	
47	4	7	
330	4	7	
68	6·3	7	
470	6·3	9	
1000	6	11	single end p/c fitting
25	10	7	
47	10	7	
220	10	7	
330	10	9	
15	16	7	
33	16	7	
68	16	7	
220	16	9	single end p/c fitting
330	16	12	
1000	16	20	
10	25	7	
22	25	7	
47	25	7	
100	25	7	
150	25	9	
200	25	11	
1250	25	24	single end can
5000	25	55	single end can
1000+1000	30	32	single end can
2500	30	40	single end can
6·8	40	7	
16	40	7	
100	40	9	
1000	50	35	single end can
1	63	7	
4·7	63	7	
10	63	7	
800	63	32	single end can
2500	63	80	single end can
4700	63	140	single end can
Oddments to clear			
50mfd @ 50V tubes		6	
250mfd @ 60V cans		10	
300mfd @ 10V p/c		5	
60+250mfd @ 350V cans		30	
0·03mfd @ 200V tantalum		5	

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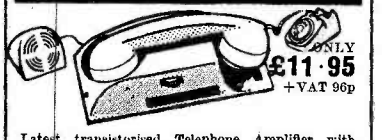

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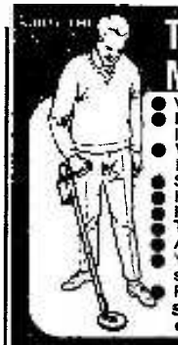

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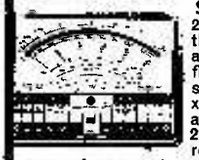

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AF239	38p	BD131	40p	OC35	48p	ZTX500	15p
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2N697	13p	2N3615	65p
2N698	30p	2N3702	12p
2N706	11p	2N3703	12p
2N708	16p	2N3704	12p
2N918	40p	2N3705	12p
2N930	18p	2N3706	10p
2N1131	20p	2N3707	10p
2N1132	20p	2N3708	8p
2N1301	20p	2N3709	8p
2N1302	17p	2N3710	9p
2N1303	20p	2N3771	140p
2N1304	24p	2N3772	160p
2N1305	24p	2N3773	240p
2N1306	24p	2N3819	20p
2N1307	24p	2N3820	47p
2N1893	30p	2N3823	60p
2N1990	45p	2N3824	50p
2N2160	62p	2N3904	15p
2N2217	23p	2N3905	17p
2N2219	20p	2N3906	17p
2N2221	20p	2N4037	35p
2N2222	20p	2N4058	15p
2N2303	25p	2N4061	13p
2N2369A	14p	2N4062	14p
2N2483	30p	2N4871	31p
2N2646	38p	2N5457	30p
2N2904	20p	2N5458	30p
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2N2926G	10p	3N141	95p
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7403	15p	7433	36p	7476	32p	74H08	25p
7404	18p	7437	27p	7480	44p	74H11	25p
7405	18p	7438	27p	7481	99p	74H21	25p
7406	38p	7440	15p	7482	75p	74H22	25p
7407	38p	7441	65p	7483	83p	74H30	25p
7408	15p	7442	65p	7484	90p	74H40	25p
7409	15p	7443	120p	7485	125p	74H50	25p
7410	15p	7444	105p	7489	275p	74H51	25p
7411	20p	7445	86p	7490	40p	74H53	25p
7412	29p	7446	105p	7491	80p	74H54	25p
7413	35p	7447	100p	7492	48p	74H55	25p
7414	60p	7448	70p	7493	39p	74H72	25p
7416	35p	7450	15p	7495	63p	74H73	25p
7417	35p	7451	15p	7496	72p	74H74	25p
7420	15p	7453	15p	74121	32p	74H101	25p
7422	24p	7454	15p	74122	45p	74H103	25p
7423	27p	7460	15p	74141	65p	74H106	25p
7425	27p	7470	30p	74190	160p	74H108	25p
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BY127	11p
BYZ11	25p
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OA9	9p
OA10	36p
OA79	8p
OA81	8p
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OA91	6p
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LED 0·2" diameter, Red	12p
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With Cord and Jack Plug Magnetic	
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747C	70p	LM380	90p	TAD100	130p
748C	28p	LM381	160p	TBA800	110p
AY-1-0212	5·50p	LH3900	75p	TBA810	150p
AY-1-5051	1·15p	MC724P	55p	ZN414	110p
CA3018	72p	MC1303L	130p		
CA3020	145p	MC1304P	360p		
CA3035	135p	MC1310P	220p		
CA3036	90p	MC1710CG	55p		
CA3046	55p	MFC4000B	54p		
CA3048	220p	MFC6040	90p		
CA3075	150p	MLM309K	158p		
CA3081	150p	NE555	55p		
CA3089E	195p	NE556DB	99p		
CA3090AQ	250p	NE565	304p		
CA3123	140p	NE562	315p		
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LM301	42p	SL403D	150p		
		SL414A	150p		

REGULATOR

723C	45p
7805 (TO3)	150p
7815 (TO3)	175p
LM309K	185p
MVR12	170p

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Range	
2·7V–33V 400mW	9p
3·3V–33V 1·3W	17p

BRIDGE RECTIFIERS (plastic case)

1A 50V	20p
1A 100V	20p
1A 200V	24p
1A 400V	21p
1A 600V	25p
2A 50V	30p
2A 100V	35p
2A 200V	40p
2A 400V	44p
2A 600V	45p
4A 100V	48p
4A 400V	60p
4A 800V	90p
6A 100V	56p
6A 400V	73p
BY122	54p
BY164	39p

DIAC

ST2	20p

SCR (Thyristors)

1A 50V	38p
1A 100V	42p
1A 200V	47p
1A 400V	52p
1A 600V	70p
3A 50V	38p
3A 100V	43p
3A 200V	55p
3A 400V	74p
3A 600V	91p
5A 400V	90p
7A 400V	95p
7A 600V	108p
C106B	37p
TIC44	29p
2N3525	90p
2N4444	191p

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THB11	135p
THB12	135p

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Miniature Dual purpose

Rng. 1-5 B,Y,R,W	60p
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MAXI-Q Coil Aerial Coil. Range 2-T. Blue	60p
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IFT 13/14/15	65p each
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FERRITE RODS

⅜" diam.	
2" – 8p; 5½" – 15p; 6½" – 18p	

ENAMEL COPPER WIRE (2oz reel)

16, 18, 20, 22 SWG	32p	P & P
24, 26, 28, 30 SWG	39p	5p per
32, 34, 36, 40 SWG	48p	reel

OPTO ELECTRONICS

LED TIL209 (red) with socket	16p
MINITRON 3015F 7-seg display	100p
OCP70	40p
OCP71	85p
ORP12	58p
ORP61	46p
2N5777	41p

LED larger 0·2" diam. Red 15p; Green, Yellow, Amber & White. only 19p

FUSES AND HOLDERS

20mm 150mA-5A 3p
1¼" 500mA-15A 3p
Anti-surge 20mm 100, 250, 500, 800mA, 1A, 1·6, 2, 2·5, 3·15, 5A 7p each

Holders
Panel Single 6p
20mm Chassis 16p
1¼" Chassis 22p

ALUM. BOXES with lid

2¾x5¼x1¼"	50p
4x4x1¼"	50p
4x2¾x1¼"	50p
4x5¼x1¼"	58p
4x2¾x2"	50p
3x2x1"	44p
6x4x2"	78p
7x5x2¼"	84p
8x6x3"	106p
10x7x3"	122p
10x4¼x3"	110p
12x5x3"	120p

SPEAKERS

8Ω 0·5W	
3"	62p
2½"	58p

QUALITY RESISTORS. ERIE MAKE, Carbon, Miniature, High Stability, Low Noise

POWER	Tol.	RANGE	Val.	PRICE 1-99	PRICE 100+
0·25W	5%	2·2Ω–4·7M	E24	1p	0·8p
0·5W	5%	2·2Ω–4·7M	E12	1p	0·8p
1W	5%	2·2Ω–10M	E12	2·5p	2p

POTENTIOMETERS (AB) Carbon

Track, 0·25W Log & 0·5W Linear values	
1KΩ–2MΩ single gang	14p
5KΩ–2MΩ single gang D/P switch	32p
2KΩ–2MΩ dual gang stereo	45p

SLIDER POTENTIOMETERS

0·25W log and linear values	
5KΩ–500KΩ single gang	35p
10KΩ–500KΩ Dual gang	50p
KNOBS for above Black or Silvered	8p

PRESET POTENTIOMETERS

0·1W 50Ω–1MΩ Vertical only	5p
0·25W 100Ω–2·2MΩ Horizontal	6p
0·25W 1KΩ–2·2MΩ Vertical	6p

TANTALUM BEAD CAPACITORS

25V: 0·1μF, 0·2, 0·47, 1·0, 2·2, 4·7, 6·8
35V: 0·1μF, 0·2, 0·47, 1·0, 2·2, 4·7
20V: 10μF; 16V: 22μF; 10V: 33μF, 22μF.
6V: 33μF, 47μF; 3V: 47μF, 100μF.
Price: 10p each.

MYLAR FILM CAPACITORS

100V: 0·001, 0·002, 0·005, 0·01μF	3p
0·015, 0·02, 0·04, 0·05μF, 0·1μF	4p
0·15, 0·2 50V: 0·47μF	6p

CERAMIC CAPACITORS

50V d.c. Plaquette body 25mm leads.

Range: 5pf–10,000pf	2p
0·015μf, 0·022μf, 0·033μf, 0·047μf	3p

JACKSONS VARIABLE CAPACITORS

Dieletric		02-2x365	240p
100pF	80p	00-208/176	240p
300pF	88p	C804-15pF	118p
500pF	95p	C804-25pF	118p

JACK PLUGS / SOCKETS

	Screened chrome	Plastic body	Open metal	Moulded with break contacts
2·5mm	10p	8p	8p	15p
3·5mm	14p	10p	8p	20p
Standard Mono	17p	13p	13p	
Standard Stereo	30p	18p	15p	

DIN 2PIN LOUDSPEAKER TYPE. 3, 4, 5 (180° & 240°) 6PIN

Plugs	Sockets	Couplers
11p	7p	15p

CO-AXIAL (TV)

Plugs	Sockets	Couplers
10p	8p	15p (f.f.)

PHONO

Plugs	Sockets	Couplers
assorted colours 7p	5p (sgl.)	9p
Metal screened 12p	7p (dbl.)	
	10p (trpl.)	

BANANA

Plugs	Sockets	Couplers
6p	7p	—

PANEL METERS

60mm x 46mm x 35mm requires 1½" hole

FULL SCALE	
ME 6	0–50μA
ME 7	0–100μA
ME 8	0–500μA
ME 9	0–1mA
ME 10	0–5mA
ME 11	0–10mA
ME 12	0–50mA
ME 13	0–100mA
ME 14	0–500mA
ME 15	0–1 amp
ME 16	0–50V DC
ME 17	0–300V AC
ME 18	"S" Meter
ME 19	"VU" Meter

Price £2·65, p & p 10p

SWITCHES

TOGGLE: SPST	18p
DPDT	22p
SUB-MIN TOGGLE SP changeover	45p
SPST on/off	40p
DPDT 6 Tag	64p
SLIDE: 1A DP 250V	10p
1A DP 250V C/O	12p
½A DP 250V	9p
PUSH BUTTON: Miniature push to make or break non locking	15p
ROCKER (white): 10A 250V SP changeover centre off	25p
ROCKER: Illuminated (white) incorporates neon, lights when on 3A 240V	45p
ROTARY SWITCH: 1 pole/12way 2p/6w, 2p/2w, 2/p4w, 3p/3w 3p/4w, 4p/2w, 4p/3w	24p

DIL SOCKETS

8 pin	12p
14 pin	13p
16 pin	14p

HEAT SINKS

TO5/5F	8p
TO18/18F	8p
TO66/TV2	15p
TO3/TV3	15p
Insulation Kit (Mica & 2 washers)	6p

TRANSFORMERS MAINS

Primary 220–240V

6–0–6 (miniature	100mA	90p
9–0–9 (miniature)	100mA	90p
12–0–12 (miniature)	100mA	90p
0–12, 0–12V (MT 150)	150mA	160p
0–6, 0–6V (MT 280)	280mA	165p
24–0–24V	500mA	220p
30-24-20-15-12-0	1A	285p
30-24-20-15-12-0	2A	340p

VEROBOARD

	Pitch 0·1 (copper clad)	Pitch 0·15 (copper clad)	Pitch 0·15 (plain)
2½x3¾"	32p	24p	15p
2½x5"	35p	35p	18p
3¾x3¾"	35p	35p	—
3¾x5"	40p	41p	29p
2½x17"	105p	78p	60p
3¾x17"	145p	115p	75p
4½x17"	185p	—	110p

Pkt of 36 pins	22p
Spot face cutter	52p
Pin insertion tool	72p

LAMP HOLDERS AND LAMPS

LES HOLDER Dome shaped, Red, Blue, Green, Yellow, White	14p
LES BULBS 6v and 12v	7p
MES HOLDERS Chrome cover, Red or Amber, Jewelled top	28p
MES BULBS 3·5V 6V 12V	7p
NEON: RED round top 250V	21p
NEON: ¼" square top, red, green, Req. ⅜" hole	21p

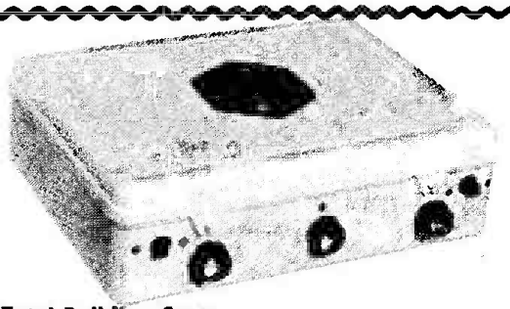
KNOBS (fits ¼" shaft, with grub screw, except K2 (push fit) & K8 (for sliders).

K1 Black pointer type	9p
K2 Slim silvered aluminium	10p
K3 Black 1½" with chrome rim	15p
K4 Black serrated. Metal top with line indicator 33m diam.	18p
K5 Black fluted metal top and skirt calibrated 0–10. 37mm dia.	20p
K6 PK2 as K5 with pointer on skirt	20p
K7 Black, knurled, tapered. Metal top & skirt. Calib. 0–10, 30mm	20p
K8 Black or silvered for slider pot	7p

INDEX TO ADVERTISERS

NEW EDU-KIT MAJOR

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

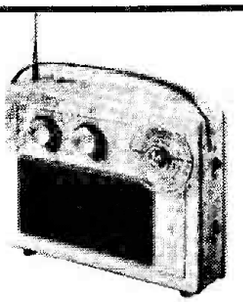


- ★ 4 Transistor Earpiece Radio.
- ★ Signal Tracer.
- ★ Signal Injector
- ★ Transistor Tester NPN-PNP.
- ★ 4 Transistor Push Pull Amplifier.
- ★ 5 Transistor Push Pull Amplifier.
- ★ 7 Transistor Loudspeaker Radio MW/LW.
- ★ 5 Transistor Short Wave Radio.
- ★ Electronic Metronome.
- ★ Electronic Noise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

Total Building Costs
£7·23 PP Ins. 44p (Overseas Seamail P & P £2·35)
(+25% VAT £1·80)

Components Include: 24 Resistors ● 21 Capacitors ● 10 Transistors ● 3½" Loudspeaker ● Earpiece ● Mica Baseboard ● 3 12-way connectors ● 2 Volume controls ● 2 Slider Switches ● 1 Tuning Condenser ● 3 Knobs ● Ready Wound MW/LW/SW Coils ● Ferrite Rod ● 6½ yards of wire ● 1 Yard of sleeving etc. ● Parts Price List and Plans 55p free with parts.

NEW ROAMER NINE

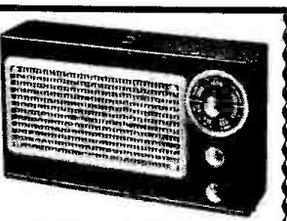


WITH V.H.F. INCLUDING AIRCRAFT

Nine Transistors, 9 Tuneable wavebands as Roamer Ten. Built in ferrite rod aerial for MW/LW. Retractable chrome-plated telescopic aerial for VHF and SW. Push Pull output using 600 mW transistors. 9 Transistors and 3 diodes, tuning condenser with V.H.F. section, separate coil for aircraft, moving coil loudspeaker, volume ON/OFF and wavechange controls. Attractive all white case with red grille and carrying strap. Size 9½" x 7" x 2¾" approx. Parts Price List and Plans free with parts.

Total Building Costs **£6·95** (+25% VAT £1·75) PP & Ins. 44p (Overseas Seamail P & P £2·35)

NEW Everyday Series



Build this exciting New series of designs

E.V.5. 5 Transistors and 2 diodes. MW/LW. Powered by 4½ volt Battery. Ferrite rod aerial. tuning condenser, volume control. and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" x 5¾" x 2¾" approx. Parts Price List and Plans free with parts.

Total Building costs **£3·40** (+25% VAT 85p) PP & Ins. 36p Overseas Seamail (P & P £1·70)

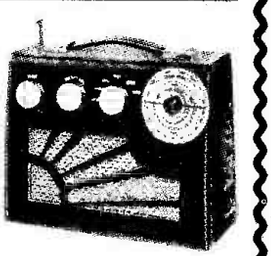
E.V.6. Case and looks as above. 6 Transistors and 3 diodes. Powered by 9 volt battery. Ferrite rod aerial, 3" loudspeaker, etc., MW/LW coverage. Push Pull output. Parts Price List and Plans free with parts.

Total Building Costs **£3·60** (+ 25% VAT £1·00) PP & Ins. 36p (Overseas Seamail P & P £1·70)

E.V.7. Case and looks as above. 7 Transistors and 3 diodes. Six wavebands. MW/LW, Trawler Band, SW1. SW2, SW3, powered by 9 volt battery. Push Pull output. Telescopic aerial for short waves. 3" Loudspeaker. Parts Price List and Easy Build Plans free with parts.

Total Building Costs **£4·48** (+25% VAT £1·12) PP & Ins. 38p (Overseas Seamail P & P £2·00)

ROAMER TEN Mk 2



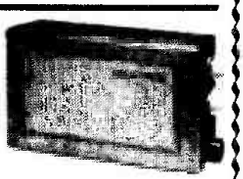
WITH VHF INCLUDING AIRCRAFT

Now with free earpiece and switched socket. 10 Transistors. Latest 4" 2 watt Ferrite Magnet Loudspeaker. 9 Tunable Wavebands, MW1, NW2, LW, SW1, SW2, SW3, Trawler Band, VHF and Local Stations also Aircraft Band.

Built in Ferrite Rod Aerial for MW/LW. Chrome plated 6 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600mW Transistors. Car Aerial and Tape Record Sockets. 10 Transistors plus 3 Diodes. Ganged Tuning Condenser with VHF section. Separate coil for Aircraft Band. Volume on/off. Wave Change and tone Controls. Attractive Case in black with silver blocking. Size 9" × 7" × 4". Easy to follow instructions and diagrams. Parts price list and plans 50p free with parts.

(Total building costs Overseas Seamail P & P £3·50) **£9·50** (+25% VAT £2·37) PP & Ins. 65p

POCKET FIVE

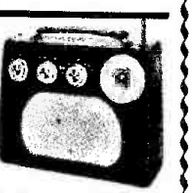


NOW WITH 3" LOUDSPEAKER

3Tunablewavebands.M.W. L.W. and Trawler Band, 7 stages. 5 transistors and 2 diodes. supersensitive ferrite rod aerial, attractiveblack and gold case. Size 5½" x 1½" x 3½" approx. Plans and Parts Price List free with parts.

Total Building Costs **£2·50** PP & Ins. 36p (+ 25% VAT 62p) (Overseas Seamail P & P £1·70)

ROAMER EIGHT Mk I



NOW WITH VARIABLE TONE CONTROL

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Chrome plated Telescopic aerial can be angled and rotated for peak short wave listening. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. 8 transistors plus 3 diodes. Latest 4" 2 watt ferrite magnet loudspeaker. Air spaced ganged tuning condenser. Volume/on/off. tuning wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams. Parts price list and plans free with parts.

Total building costs (Overseas Seamail P & P £3·50) **£6·98** (+25% VAT £1·75) PP & Ins. 65p

"EDU-KIT"

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

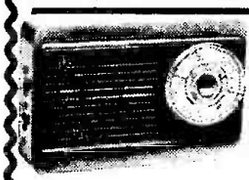
Five units including master unit to construct

Components include:

Tuning Condenser: 2 Volume Controls: 2 Slider Switches: Fine Tone 3"Moving Coil Speaker: Terminal Strip: Ferrite Rod Aerial: Battery Clips: 4 Tag Boards: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ½" Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction.
Parts price list and plans free with parts.

Total building costs **£5·50** (+ 25% VAT £1·37) PP & Ins. 35p (Overseas Seamail P & P £2·35)

TRANSONA FIVE



NOW WITH 3" LOUDSPEAKER

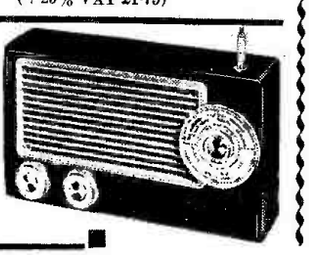
Wavebands, transistors and speaker as Pocket Five. Larger Case with Red Speaker Grille and Tuning Dial. Plans and Parts Price List free with parts.

Total Building Costs **£3·20** PP & Ins. 36p (+25% VAT 80p)

(Overseas Seamail P & P £1·70)

TRANS EIGHT

8 TRANSISTORS and 3 DIODES



6 Tunable Wavebands: MW. LW, SW1 SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts Size 9×5½×2½in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and plans free with parts.

Total building costs **£4·78** PP & Ins. 40p (+25% VAT £1·20) (Overseas Seamail P & P £2·00)

★ **Callers side entrance "Lavella" shop.**
★ **Open 10–1, 2.30–4.30, Mon.–Fri. 9–12 Sat.**

ROAMER SIX

CASE AND LOOKS AS TRANS-EIGHT

6 Tunable Wavebands: MW, LW, SW1 SW2 Trawler band plus an extra Medium waveband for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9×5½×2¾in approx. Plans and parts price list free with parts.

Total building costs **£4·38** (+ 25% VAT £1·10) PP & Ins. 40p (Overseas Seamail P & P £2·00)

To **RADIO EXCHANGE CO., 61a HIGH STREET, BEOFORD, MK40 ISA**
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the wireless tecknowledgey page

Pure Wireless has been the Cinderella of electronic component supplies for some time now. Things like coils, ceramic and mechanical filters, linear phase arrays, complete IF systems and tuners haven't been available from a single source until now. **We call it the Ambit 'One stop Wireless Service'.**

Join the Wireless Set with ambit.

Apollo / The All electric Wireless Set

Ambit carries all the parts for the Apollo project, please send an SAE for free list of components.
Components and PCB for complete AM module as described in part one of the series £8.00.
Rivlin WS150 long slider potentiometer £3.00
IMI 6 button preset bank for varicaps £3.40
MVAM1 £2.75, MVAM2 £1.05, CA3123E£1.40-
see price list for other items.

91200 - Double linear phase filter FM IF strip with muting, meter output etc. £9.00 (built) or £6.20 in kit form.

91310 - Stereo decoder module with pilot tone filter and LED beacon. £5.10 (built) £4.40 (kit)

EC3302 - Varicap tunerhead with AFC £5.00 to suit the CA3089E/TDA1200/HA1137 IF system.

EF5603 - The top quality varicap tunerhead, with 5 tuned circuits, double varicaps, fully moulded VHF coils, MOSFET RF stage. £8.80.

7252 - Larsholt Electronics varicap tuned FM radio receiver module - antenna to audio, with mute, meter drive, AGC, AFC, double varicap front end. Built, tested. £20.00.

7254 - A new tunerset, combining a four stage varicap tuned head, with an IF and PLL stereo decoder. The features include muting, AFC, meter drive, beacon drive. Built and tested £24.00.

EC720 - A new varicap tuned MW radio module, with built in audio stage, and positive bias tuning. Built and tested £10.50. Kit price £8.00.

Meters for wireless and audio equipment:

We supply meters scaled for frequency, and relative signal amplitude; mostly low cost edgewise types.

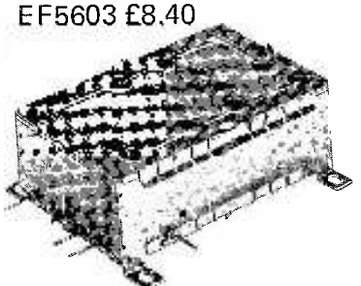
Components for wireless/consumer electronics.

In order to manufacture our wide range of wireless and audio products, we use many types of top quality ICs, coils, filters, transistors etc. So when you buy from AMBIT, you are assured of the experience of a user, not just a seller. It also means that our catalogue contains more useful applications ideas and hints than most. Get yours now. Please note that we sell no seconds, all our ICs are branded types, tested by the manufacturers.

We are prepared to undertake custom projects, and also modification to our existing range to suit particular customer requirements. But please note that the minimum project fee, payable in advance, is £25.00.

Please note that we cannot deal with any enquiries unless accompanied with a stamped addressed envelope of adequate dimensions. Thankyou.

EF5603 £8.40



EC3302 £5.00

A major aspect of our 'one stop' wireless facility revolves around Ambit's association with TOKO- the world's largest coil and filter manufacturer.

As the major source of TOKO information and products in the UK and European consumer electronics market: AMBIT is also pleased to supply and advise professional and OEM buyers. Please ensure that your enquiry is directed to the 'OEM Division'.

TOKO

Illustrated here are various TOKO items, ranging from delay lines, through the famous MFH mechanical filters to the varicap tuner-heads, EF5603, EC3302.

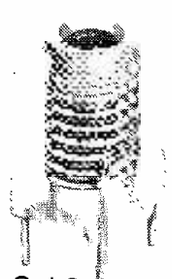
CFT AM ceramic filter
45p (455 or 470 kHz)

RET delay line POA

7BA choke
1μH to 1mH 15p

Variable capacitors

MFH £1.45



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