PRACTICAL WIRELESS

JULY
1975

30p

PW TEXAN II

UPDATING YOUR PRESENT TEXAN AMPLIFIER

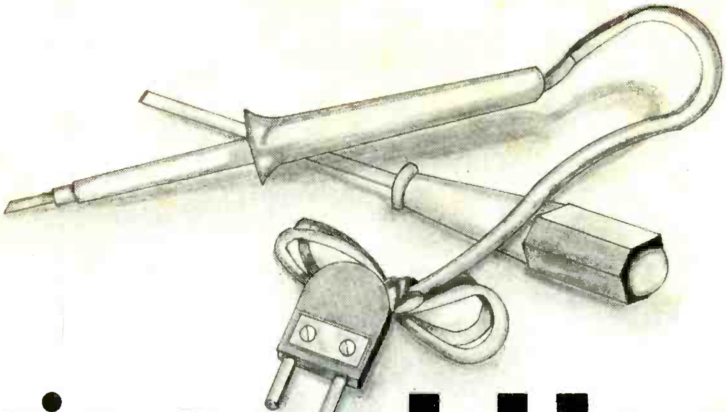
Also

PW TELE-TENNIS ADD-ON SOUND EFFECTS

REPORT ON:-
THE HEATHKIT GR 78 RECEIVER

APOLLO SERIES

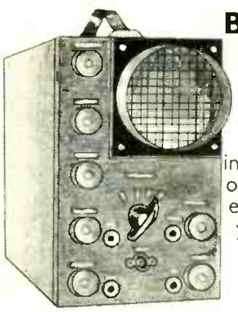
PW VARICAP AM/FM STEREO TUNER



This could lead to something big.

A soldering iron and a screw driver.
If you know how to use them, or at least know one end from the other, you know enough to enrol in our unique home electronics course.
This new style course will enable anyone to have a real understanding of electronics by a modern, practical and visual method. No previous knowledge is required, no maths, and an absolute minimum of theory.
You build, see and learn as, step by step, we take you through all the fundamentals of electronics and show you how easily the subject can be mastered and add a new dimension not only to your hobby but also to your earning capacity.
This course is accepted by and used in a large number of schools and colleges and forms an invaluable grounding for professional training in the subject. All the training is planned to be carried out in the comfort of your own home and work in your own time. You send them in when you are ready and not before. These culminate in a final test and a certificate of success.

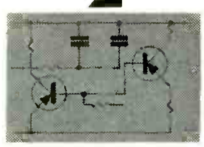
1



Build an oscilloscope.

As the first stage of your training, you actually build your own Cathode ray oscilloscope! This is no toy, but a professional test instrument that you will need not only for the course's practical experiments, but also later if you decide to develop your knowledge and enter the profession. It remains your property and represents a very large saving over buying a similar piece of essential equipment.

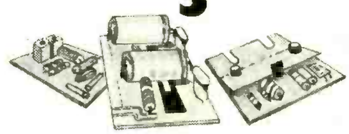
2



Read, draw and understand circuit diagrams.

In a short time you will be able to read and draw circuit diagrams, understand the very fundamentals of television, radio, computers and countless other electronic devices and their servicing procedures.

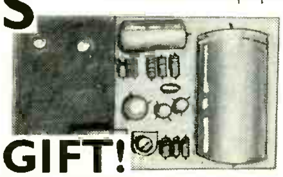
3



Carry out over 40 experiments on basic circuits.

We show you how to conduct experiments on a wide variety of different circuits and turn the information gained into a working knowledge of testing, servicing and maintaining all types of electronic equipment, radio, t.v. etc.

PLUS



FREE GIFT!

ALL STUDENTS ENROLLING IN OUR COURSES RECEIVE A FREE CIRCUIT BOARD ORIGINATING FROM A COMPUTER AND CONTAINING MANY DIFFERENT COMPONENTS THAT CAN BE USED IN EXPERIMENTS AND PROVIDE AN EXCELLENT EXAMPLE OF CURRENT ELECTRONIC PRACTICE

To find out more about how to learn electronics in a new, exciting and absorbing way, just clip the coupon for a free colour brochure and full details of enrolment.

WAA

Brochure without obligation to:
BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL, Dept WL/65
P.O. Box 156, Jersey, Channel Islands.

NAME..

ADDRESS..

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(Block caps please)

PRACTICAL WIRELESS

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

NEWS & COMMENT

CONSTRUCTIONAL

OTHER FEATURES

HEATHKIT COMPETITION — RESULTS — Page 196

HUGE DISCOUNTS

ON LEADING BRAND HI-FI — **ALL RSC PRICES INCLUDE VAT**

Full labour and material guarantees for 12 months — **LOW DEPOSIT CREDIT TERMS**

	Rec. Price	RSC Price
LINEAR 202 Amplifier	£45·40	£28·95
LINEAR 505 Amp 5 + 5w	£22·85	£19·95
AUDIO FIDELITY Model 60 Amp	£69·45	£53·95
WHARFEDALE LINTON Amp	£78·85	£57·95
LEAK 2100 Amplifier	£138·60	£107·95
LEAK 2002 Cassette	£161·46	£125·95
LEAK 2030 L/Speakers	£109·38 Pr	£85·95
LEAK 2060 L/Speakers	£96·65 Ea	£74·95
LEAK 2000 Tuner/Amp	£223·96	£172·95
ROTEL RX150A Tun/Amp	£97·81	£71·95
ROTEL RX152 Tun/Amp	£109·39	£79·95
ROTEL RX202 Tun/Amp	£124·42	£89·95
ROTEL RX402 Tun/Amp	£167·84	£120·95
ROTEL RT222 Tuner	£69·34	£48·95
ROTEL RT322 Tuner	£97·81	£71·95
WHARFEDALE Denton I L/Spkr	£39·10 Pr	£26·95
WHARFEDALE Denton 2XP L/Spkr	£57·29 Pr	£43·95
WHARFEDALE Linton 3XP L/Spkr	£79·69 Pr	£59·95
FANE Ambassador 35 L/Spkr	£103·00 Pr	£79·95
FANE MARQUESS 30 L/Spkr	£86·75 Pr	£57·50
FANE Model One Spkr Kit	£27·75 Pr	£21·95
WHARFEDALE Linton II Kit	£33·45 Pr	£22·50
WHARFEDALE WHD20 Cassette	£120·00	£89·95

BASF CASSETTES (Carr. Free)

	LH CASSETTES in Snap Pack Rec. Price	RSC Price 1	5	10	SUPER SM CASSETTES in Snap Pack Rec. Price	RSC Price 1	5	10
C60	98p	65p	3·00	4·99	1·08	80p	3·50	6·75
C90	1·36	90p	3·99	6·99	1·40	1·05	4·75	8·95
C120	1·87	1·20	5·50	9·90	1·94	1·46	6·75	12·95

Also Shure Cartridges, Basf Tape, Koss H/Phones, etc.
Prices of above correct at May 12 1975

AKAI TAPE UNITS

	Rec. Price	RSC Price		Rec. Price	RSC Price
CS30D	£105·59	£77·50	GXC75D	£242·92	£177·95
CS33D	£128·56	£94·95	GXC510D	£230·77	£166·95
GXC36D	£134·54	£98·95	CR81D	£113·00	£99·95
GXC38D	£166·92	£121·95	GXR82D	£149·04	£109·95
GXC38	£178·85	£129·95	1722L	£164·41	£124·95
GXC40T	£226·10	£164·95	4000DS	£158·09	£114·95
GXC46D	£191·51	£138·95	4000DB	£227·16	£161·95

GOLDRING GL72 T/Table & G800 **£34·95** (Approx. value £53) Carr. 75p
GOLDRING GL75 T/Table & G800 **£40·75** (Approx. value £75) Carr. 85p
PIONEER PL12D T/Table on plinth & cover **£48·50**

T/TABLES with MAGNETIC CARTRIDGE/PLINTH & COVER
GARRARD SP25 MK IV with G850 **Special Price £27·75** (Carr. £1)
RANK BD2000 Rec. Price £77·25 RSC Price **£56·75** (Carr. £1)

FANE HIGH FIDELITY SPEAKERS

Limited number at approximately half list prices.

Model		Special Price	Model		Special Price
5" 501	8 ohms	£5·95	12" 122/14*	8 & 15Ω	£13·30
8" 804*	8 ohms	£4·20	12" 122/14LR	8Ω	£14·95
10" 1005LR	15Ω	£6·65	12" 122/17*	8 & 15Ω	£14·95

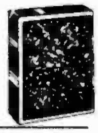
Available by Mail Order carr. free or may be ordered through Branches
*Basic models made to individual specification of equipment manufacturers

ALL RSC PRICES INCLUDE VAT

HI-FI SPEAKER ENCLOSURES

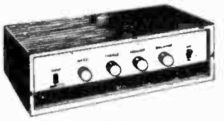
Simulated Teak finish. Sizes approx.

ME8 13 × 9½ × 6½in. £4·50 } Both cut for 8in. speaker
JE8 16 × 11 × 9in. £6·95 }
SE10 25 × 16 × 9in. Cut for 10in. and Tweeter £10·25
SE12 25 × 16 × 9in. Cut for 12in. and Tweeter £10·25
Carr. 50p. per enc.



RSC G66 MkII 6+6 WATT high quality STEREO AMPLIFIER

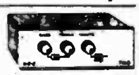
Controls: Bass, Treble, Vol. and Bal. 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Bass Control ± 12db. Treble Control ± 13db. Selector switch for Crystal P.U. or Tape/Radio. For speaker output impedances of 3 — 15 ohms. For standard 200-250v. A.C. mains operation. Attractive Black and Silver finished metal fascia plate and matching control knobs. COMPLETE KIT OF PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT and COMPREHENSIVE WIRING DIAGRAMS & INSTRUCTIONS **£14·99** Carr. 40p
Or FACTORY BUILT IN TEAK VENEERED CABINET as illustrated £19·50.



AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 11,000 Gauss 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£7·95** Carr. 45p
OR SENIOR 15 WATT INCLUDING HF123 13,000 GAUSS SPEAKER **£10·25** Carr. 50p

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



200-250v. AC mains operated. Response 30-20,000 c.p.s. −2dB. Separate Bass and Treble 'lift and cut' controls. 3 Input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3–15 ohm spkrs. Max. sensitivity 5mV. O/P rating I.H.F.M. Enclosed enamelled case 9½ × 2½ × 5½in. Silver finish facia 10½ × 3½in. Complete kit, wiring diagrams and instructions. **£9·20** Carr. 40p. FACTORY BUILT **£12·50**

AUDIOTRINE HIGH FIDELITY SPEAKERS

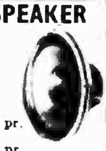
Heavy construction. Latest high efficiency ceramic magnets. Plasticised Cone surround. "D" or "T" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 8-15 ohms. PLEASE STATE CHOICE.

Exceptional performance at low cost.

HF808T	8"	10W	£2·95	HF120D	12"	15W	£7·50
HF102D	10"	10W	£3·95	HF126	12"	15W	£9·25
HF120	12"	15W	£6·95	HF126D	12"	15W	£9·95

AUDIO FIDELITY MODEL 80 HIGH FIDELITY SPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. Roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 30 c.p.s. Tweeter cone is fitted to extend high note response. Frequency range 25 Hz to 15 KHz. Gauss 10,000. Impedance 8-15 Ω. £6·21 ea. **£9·25** pr.
MODEL 83 8" 15w. with parasitic Tweeter. £7·99 ea. **£12·50** pr.
Response 25 Hz to 15 KHz. Gauss 13,000 Imp 8–15Ω.



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

BUILD AN AMPLIFIER WORTH APPROXIMATELY DOUBLE THE KIT PRICE INCLUDING CABINET

Only high grade components by leading manufacturers

- Push Button Selector Switching
- Jack Socket for Headphones
- Neon Indicator
- Satin Silver Finish Metal Fascia
- Solid State Circuitry
- Twenty Silicon Transistors
- Four Diodes, Four Rectifiers

Send S.A.E. for leaflet

For Magnetic or Ceramic Pick-Ups regardless of Price. Output (per channel) 15 watts RMS into 8Ω. Frequency Response 7 Hz to 70 KHz

COMPLETE KIT (less cabinet). Carr. 70p. Cabinet if req. £5·50 extra. **£26·50**

AUDIO FIDELITY FRI SPEAKER KIT

Response 30 Hz-15 KHz. Rating 15 watts in sealed cabinet. Imp. 8-15 ohms. 8" Bass Unit with P.V.C. Cone surround for ultra low resonance. Pressure Tweeter. Printed Circuit. Inductive/Capacitive Cross-over. Damping Material, Screws, Terminal Panels. **£13·64** each. Carr. Free.
SPECIAL OFFER **£18·50** Pair Carr. 50p

R.S.C. TRANSFORMERS, L.F. CHOKES & RECTIFIERS

FULLY GUARANTEED. Impregnated and Interleaved where necessary. Primaries 200-250v. 50c/s. Screened

MIDGET CLAMPED TYPE 2½ × 2½ × 2½in.
250v., 60mA, 6·3v. 2a .... £1·50
250-0-250v., 60mA 6·3v 2a .... £1·60

FULLY SHROUDED UPRIGHT MOUNTING
250-0-250v. 60mA, 6·3v. 2a., 0-5-6·3v. 2a. £2·25
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
300-0-300v. 130mA, 6·3v. 4a. c.t., 6·3v. 1a. For Mullard 510 Amplifier .... £4·50
350-0-350v. 100mA, 6·3v. 4a., 0 5-6·3v. 3a. £3·75
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a. £4·50
425-0-425v. 200mA, 6·3v. 4a., c.t., 5v. 3a. £8·50
425-0-425v. 200mA, 6·3v. 4a., Twice 5v. 3a. £8·70
450-0-450v. 250mA, 6·3v. 4a., c.t., 5v. 3a. £9·00

TOP SHROUDED DROP-THRO' TYPE
250-0-250v. 70mA, 6·3v. 2a., 0-5-6 3v. 2a. £2·25
250-0-250v. 100mA, 6·3v. 3·5a. .... £2·50
250-0-250v. 100mA, 6·3v. 2a., 6·3v. 1a. .. £2·75
350-0-350v. 80mA, 6·3v. 2a., 0-5-6·3v. 2a. £2·75
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
300-0-300v. 130mA, 6·3v. 4a., c.t. 6·3v. 1a. Suitable for Mullard 510 Amplifier ...... £4·50
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a. £3·75
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a. £4·50

FILAMENT or TRANSISTOR POWER PACK Types 6·3v.1·5a.92p; 6·3v. 2a. 95p; 6·3v.3a. £1·45p; 6·3v. 6a. £2 25; 12v. 1a. 95p; 12v. 3a. or 24v. 1·5a £2·25; 0·9-18v 1½a £1·95; 0-12-25-42v 2a £2·75.

CHARGER TRANSFORMERS 0-9·15v. 1½a. £1·75, 2½a. £1·95; 3a. £2·00; 5a. £2·45; 6a. £2·75; 8a. £3·00

AUTO (Step UP/step DOWN) TRANSFORMERS 0-110/120v. 200-230-250v. 50-80 watts £2·50, 150 watts, £4·50 250 watts £5·50; 500 watts £8·50

OUTPUT TRANSFORMERS
Std. Pentode 5000-3 Ω or 700-3 Ω .. 96p
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω .. £1·45
Push-Pull 10 watts 6V6, 3-5-8-15 Ω .. £2·25
Push-Pull EL84 to 3 or 15 Ω 10-12 watts .. £2·25
Push-Pull Ultra Linear for Mullard 510, etc. £3·75
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω .... £3·20
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω £5·50

SELENIUM RECTIFIERS
F. W. (Bridged)
All 6/12v. D.C. output. Max. A.C. Input 18v.
1a, 38p. 2a, 49p. 3a, 65p. 4a, 81p. 6a, 97p.

L.F. CHOKES
150mA, 7-10H, 250 Ω £1·10; 100mA, 10H, 200 Ω 95p; 60mA, 10H, 400 Ω 35p.

RSC 100watt DISCO SYSTEM

Units listed below
(a) DISCOMASTER TWIN TURNTABLE CONSOLE with integral 100W amplifier
(b) PAIR OF HI-FI HEADPHONES
(c) MATCHING DYNAMIC 'MIKE' (attached to h'phone)
(d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18" × 18" × 8"

(a) (b) (c) & (d) Carr. £3·00 **£169·95**

DEP. £19·99 & 18 fortnightly. payments of £9·67 (Total £194·05).

STEREO VERSION

of Above System
Or DEPOSIT £29·95 and 18 fortnightly pymts. £11·11 (Total £229·93) **£199.95** Carr. £3·50

RSC TDI DISCO CONSOLE

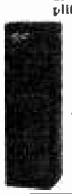
Incorporating twin Garrard SP25 or BSR MP60 type turntables and Sonotone or Acos Cartridges with diamond styli. Separate Vol. controls for each turntable. Also MONITORING FACILITIES. plus Treble and Bass Controls. Separate input for 'mike' with vol. control switch. Black Vynide covered Cabinet with lid. see illustration on left. Or DEP. £9·00 and 18 fortnightly pymts. £4·61 (Total £91·98) **£79·95** Carr. £1·50

TD2S STEREO VERSION OF ABOVE

Terms DEPOSIT £15 and 18 fortnightly payments £6·51 (Total £132·18) **£115·00** Carr. £1·60

DISCOMASTER TWIN TURNTABLE POWER CONSOLE £109·95

Garrard SP25 or McDonald MP60 turntables. Sonotone or Acos cartridges with diamond styli. Facilities as TDI Console but with built-in 100 watt Power Amplifier, complete with lid. Or Deposit £12·95 and 18 fortnightly payments £6·81 (Total £126 53) Carr. £2·50



STEREO VERSION £145 or DEPOSIT £20 and 13 fortnightly pymts £8·15 (Total £166·70). Carr. £3

R.S.C. COLUMN SPEAKERS

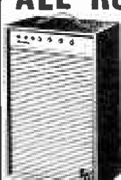
IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

All types 15 Ohms covered in Vynide & Vynair

TYPE C132 40-50 WATTS £27·95
Incorporating three exceptionally efficient 13" × 8" speaker units. Dep. £3·95 and 8 monthly payments £3·50 (Total £31·95) Carr. 65p

TYPE C3/70 70 WATTS. Fitted three 12" 25 watt Highly sensitive high flux speakers with high power voice coils. Size approx. 54" × 14" × 11". Dep. £5·11 & 8 mthly pymts. £5·11 (Total £45·99) Carr. 85p **£39.95**

ALL RSC PRICES INCLUDE VAT



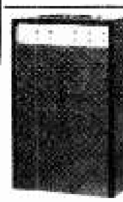
INTEREST on Credit Purchases REFUNDED settled in 3 months

SUPER MINSTREL 10 W GUITAR AMP.

Incorporating Tremolo and 10" Speaker. Output 10 watts R.M.S. Continuous. 3 Jack Inputs for Microphone and Instrument. Mains Neon Controls: Volume, Tone, Tremolo, Speed Tremolo Intensity.
Terms: DEPOSIT £7 73 and 8 monthly payments £3·40 (Total £34·93) Carr. free **£30·94**

FANE CRESCENDO SPEAKERS

FULL RANGE AVAILABLE AT ALL BRANCHES

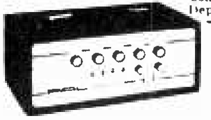


FAL MAESTRO

COMBINED 30W AMP. AND 12" SPEAKER **£48·60** Carr. Free

For Lead Guitar, Mic, Gram, Radio, Tape (Not for use with Bass instruments) Inc. 3 inputs and 2 vol controls plus Treble & Bass, TREMOLO with associated controls. Attractively finished in black with silver-finished fascia. Compact size Fitted carrying handle. Deposit £8·60 and 8 mthly payments £5·75 (Total £54·60)

RSC 'PHANTOM 50' Rating 50 watts. 3 inputs, 2 vol. controls. Bass, Treble, Presence **£55·00** Carr. £1·50 Dep. £8·00 & 8 mthly. pymts. £6·76 (Total £62·08).



FAL PHASE 50 Mk. III AMPLIFIER 50 WATT

Solid state. 4 Sep. controlled inputs Plus master vol. control. Ind. Bass and Treble Controls. Protection against serious o/p overloading. O/p for spkrs. 8 to 15 ohms. Size 17" × 7" × 7½". 200–250v. A.C. mains. O/p 50w Music. Deposit £8·60 & 8 mthly. payments. £5·75. Total £54·60 Carr. Free. **£48·60**

JINGLE MACHINES I.S.E. CA127 £79·95 DEPOSIT £9 and 18 fortnightly payments £4·61. Total £91·98

FANE ULTRA HIGH POWER SPEAKERS & KITS

All power ratings are R.M.S. continuous. 2 YEARS' GUARANTEE High flux ceramic magnets. ALL CARRIAGE FREE.

'POP' 100 18" 100 Watt 14,000 gauss 8/15Ω **£34·50** Dep: £6·80 and 8 mthly payments £4·00 (Total £38·80)

'POP' 60 15" 60 Watt 14,000 gauss 8/15Ω **£18·95** Dep. £4·17 and 8 monthly payments. £2·17 (Total £21·53)

FOR BASS GUITAR, ELECT. ORGAN, ETC.

'POP' 50 12" 50 Watt 13,000 gauss 15Ω **£13·95** Terms for pairs Dep £5·90 & 8 mthly pymts £3·16 Total £31·18 PAIR SUITABLE ALL PURPOSES

'POP' 25/T 12" 25W. Dual cone. 15 ohm Imp. (Not for Bass Guitar use) **£9·95**

'POP' 20/1 10" 20W. Gauss 13,000 Imp. 8–15 Ω **£8·50**

PH50 HIGH POWER TWEETER £6·65
Response 3KHz-20KHz with 2 to 4 mfd. Non elect. filter available 55p. Rating 50 Watt Imp 8 Ω

D40 FULL RANGE 40 WATT POWER SPEAKER KIT £21·00

Consisting of 12" 40 watt Bass Unit, HPX1 200w Cross-over and PH50 Tweeter. Rating 40w R.M.S. Imp. 8 ohms. Terms: Deposit £3·00 and 8 mthly payments £2·75. (Total £25·00).

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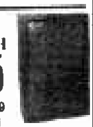

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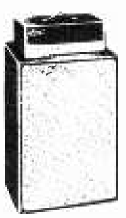
L12/2 50 WATT Fitted pair of 12" 30 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Carr. £1·50 **£39·95**
Or deposit £5·11 and 8 monthly payts. of £5·11. Total £45 99

L12/25G 12" 25 WATT 13,000 lines 15 ohms Terms for Pairs. Dep £3·32 & 8 mthly pymts £3·32 (Total £29·88) **£12·95** Carr. 55p.

L12/10 10-15 Watt Veneered cabinet 12" unit 8-15 ohm. Approx. 14" × 14" × 9". Carr. 65p. Terms for Pairs. Dep. £2·05 & 8 mthly pymts £2·05 (Total £18·45). **£7·95**



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A powerful high quality unit for lead, rhythm guitar, vocalists, gram, radio, tape. 50w Peak O/P rating. Not for Bass Guitar.
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REGENT 50B for Bass Guitar and general purposes. Or Dep. £9·00 & 18 fortnightly payments £4·61. (Total £91·98). Carr. £2·50 **£79·95**

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T/Table mixing inputs. Headphone Monitoring. Mic. Jack & Tape inputs. Independent Vol. Control. Std. 200-250v A.C. Mains operation **£18·50**

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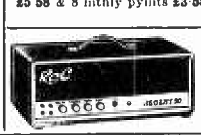

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Ref. No.	VA (Watts)	Weight lb	oz	Size cm.	P & P £	p
07	20	1	8	7·0 x 6·0 x 6·0	2·80	38
149	60	3	12	9·9 x 7·7 x 8·6	4·37	45
150	100	5	8	9·9 x 8·9 x 8·6	4·89	45
151	200	8	0	12·1 x 9·3 x 10·2	8·13	53
152	250	13	12	12·1 x 11·8 x 10·2	9·83	73
153	350	15	0	14·0 x 10·8 x 11·8	11·88	73
154	500	19	8	14·0 x 13·4 x 11·8	13·65	91
155	750	29	0	17·2 x 14·0 x 14·0	20·51	*
156	1000	38	0	17·2 x 16·6 x 14·0	29·15	*
157	1500	46	0	21·6 x 13·4 x 18·1	33·23	*
158	2000	60	0	21·6 x 15·3 x 18·1	37·07	*

AUTO TRANSFORMERS

Ref. No.	VA (Watts)	Weight lb	oz	Size cm.	Auto Taps	P & P £	p
113	20	1	0	5·8 x 5·1 x 4·5	0-115-210-240	1·67	30
64	75	2	4	7·4 x 6·7 x 6·1	0-115-210-240	2·90	38
4	150	3	4	8·9 x 7·7 x 7·7	0-115-200-220-240	4·12	45
66	300	6	4	9·9 x 9·6 x 8·6	,,	5·82	53
67	500	12	8	12·1 x 11·2 x 10·2	,, ,,	8·82	67
84	1000	19	8	14·0 x 13·4 x 14·3	,, ,,	13·68	91
93	1500	30	4	14·0 x 15·9 x 14·3	,, ,,	18·31	*
95	2000	32	0	17·2 x 16·6 x 14·0	,, ,,	24·20	*
73	3000	40	0	21·6 x 13·4 x 18·1	,, ,,	35·09	*

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Ref. No.	Amps. 12V	24V	Weight lb	oz	Size cm.	Secondary Windings	P & P £	p
111	0·5	0·25		8	4·8 x 2·9 x 3·5	0·12V at 0·25A x 2	1·35	23
213	1·0	0·5	1	4	6·1 x 5·8 x 4·8	0·12V at 0·5A x 2	1·74	30
71	2	1	1	12	7·0 x 6·4 x 6·1	0·12V at 1A x 2	2·29	38
18	4	2	2	12	8·3 x 7·7 x 7·0	0·12V at 2A x 2	2·86	38
70	6	3	3	8	8·9 x 8·0 x 7·7	0·12V at 3A x 2	4·12	45
108	8	4	5	8	9·9 x 8·9 x 8·6	0·12V at 4A x 2	4·56	45
72	10	5	6	4	9·9 x 9·6 x 8·6	0·12V at 5A x 2	5·14	53
116	12	6	6	12	9·9 x 10·2 x 8·6	0·12V at 6A x 2	5·52	53
17	16	8	8	12	12·1 x 9·9 x 10·2	0·12V at 8A x 2	7·28	60
115	20	10	11	8	14·0 x 9·6 x 11·8	0·12V at 10A x 2	10·39	73
187	30	15	15	8	14·0 x 12·1 x 11·8	0·12V at 15A x 2	13·59	85
226	60	30	32	0	17·2 x 15·3 x 14·0	0·12V at 30A x 2	16·83	*

30 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	P & P £	p
112	0·5	1	4	6·1 x 5·8 x 4·8	0-12-15-20-24-30V	1·81	30
79	1·0	2	4	7·0 x 6·7 x 6·1	,, ,,	2·40	38
3	2·0	3	4	8·9 x 7·7 x 7·7	,, ,,	3·49	38
20	3·0	4	8	9·9 x 8·3 x 8·6	,, ,,	4·53	45
21	4·0	6	4	9·9 x 9·6 x 8·6	,, ,,	5·13	53
51	5·0	6	12	12·1 x 8·6 x 10·2	,, ,,	6·41	53
117	6·0	8	0	12·1 x 9·3 x 10·2	,, ,,	7·16	60
88	8·0	12	0	12·1 x 11·8 x 10·2	,, ,,	9·90	67
89	10·0	13	12	14·0 x 10·2 x 11·8	,, ,,	9·87	73

50 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	P & P £	p
102	0·5	1	12	7·0 x 6·4 x 6·1	0-19-25-33-40-50V	2·58	30
103	1·0	2	12	8·3 x 7·4 x 7·0	,, ,,	3·38	38
104	2·0	5	8	9·9 x 8·9 x 8·6	,, ,,	4·68	45
105	3·0	6	12	9·9 x 10·2 x 8·6	,, ,,	5·81	53
106	4·0	10	0	12·1 x 10·5 x 10·2	,, ,,	7·60	67
107	6·0	12	0	14·0 x 10·2 x 11·8	,, ,,	12·10	67
118	8·0	18	0	14·0 x 12·7 x 11·8	,, ,,	12·98	85
119	10·0	25	0	17·2 x 12·7 x 14·0	,, ,,	16·99	*

60 VOLT RANGE

Ref. No.	Amps.	Weight lb	oz	Size cm.	Secondary Taps	P & P £	p
124	0·5	2	4	7·0 x 6·7 x 6·1	0-24-30-40-48-60	2·33	38
126	1·0	3	4	8·9 x 7·7 x 7·7	,, ,,	3·41	38
127	2·0	6	4	9·9 x 9·6 x 8·6	,, ,,	5·08	45
125	3·0	8	12	12·1 x 9·9 x 10·2	,, ,,	7·52	60
123	4·0	13	12	12·1 x 11·8 x 10·2	,, ,,	8·75	67
40	5·0	12	00	14·0 x 10·2 x 11·8	,, ,,	9·75	73
120	6·0	15	8	14·0 x 12·1 x 11·8	,, ,,	11·30	85
121	8·0	25	00	14·0 x 14·7 x 11·8	,, ,,	15·00	*
122	10·0	25	00	17·2 x 12·7 x 14·0	,, ,,	17·52	*
189	12·0	29	00	17·2 x 14·0 x 14·0	,, ,,	19·98	*

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Ref.	MA.	Weight		Size cm	VOLTS	P & P £	p
238	200		2	2·8x2·6x2·0	3-0-3	1·54	10
212	1A 1A	1	4	6·1x5·8x4·8	0-6 0-6	1·84	30
13	100		4	3·9x2·6x2·9	9-0-9	1·41	13
235	330,330		4	4·8x2·9x3·5	0-9, 0-9	1·56	19
207	500, 500	1	00	6·1x5·4x4·8	0-8-9, 0-8-9	1·92	30
208	1A, 1A	1	12	7·0x6·4x6·1	0-8-9,0-8-9	3·30	38
236	200, 200		4	4·8x2·9x3·5	0-15, 0-15	1·43	19
214	300, 300	1	4	6·1x5·8x4·8	0-20, 0-20	1·93	30
221	700 (D.C.)	1	8	7·0x6·1x6·1	20-12-0-12-20	2·17	38
206	1A, 1A	2	12	8·3x7·7x7·0	0-15-20, 0-15-20	3·46	38
203	500, 500	2	4	8·3x7·0x7·0	0-15-27, 0-15-27	3·00	38
204	1A, 1A	3	4	8·9x7·7x7·7	0-15-27, 0-15-27	3·85	38

* Carriage via BRS

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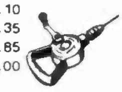
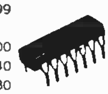
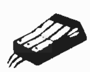



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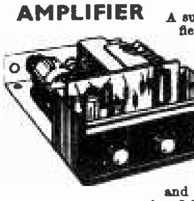

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100 m/A single pole normally closed. 2 for 60p + 15p P.& P.

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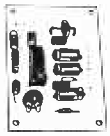

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Fully detailed 7 page construction manual and parts list free with kit or send 25p plus large S.A.E.

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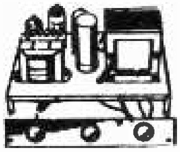
Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc. and will then provide mixing and fading facilities for medium powered Hi-Fi Discotheque use, etc.

3-VALVE AUDIO AMPLIFIER HA34 MK II



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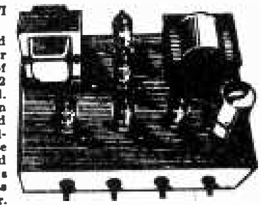

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Ampex (360)	45p	55p	75p	99p
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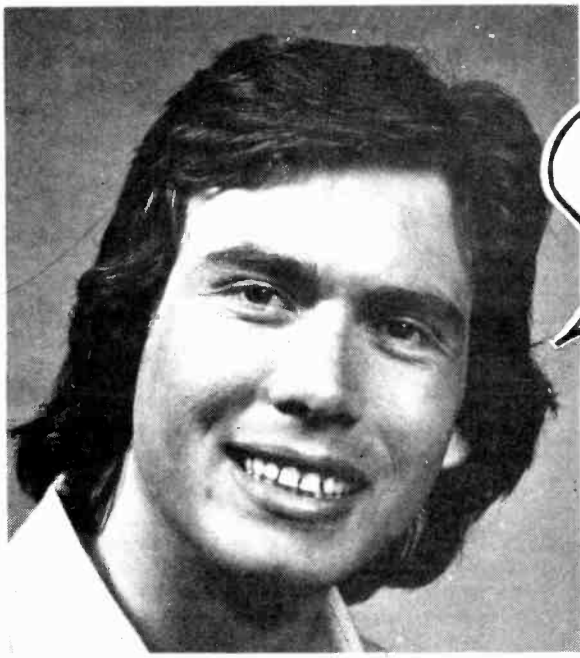

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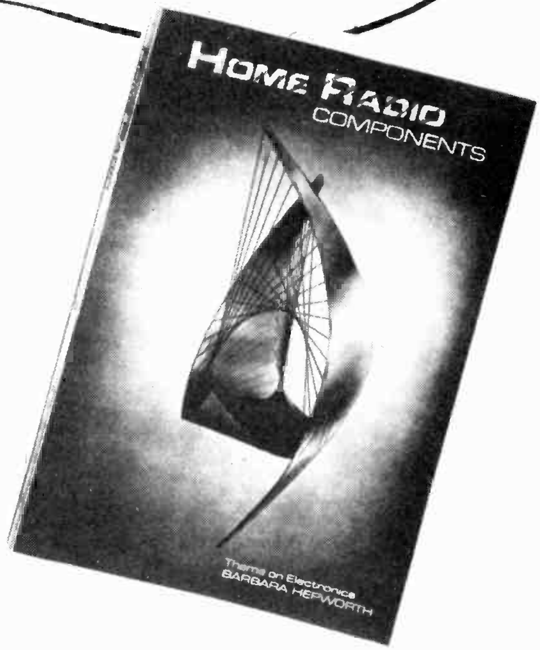

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BC303	0·35
BC304	0·40
BC440	0·34
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BCY31	0·29
BCY32	0·33
BCY33	0·24
BCY34	0·28
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BD133	0·72
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BD136	0·44
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BD139	0·61
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BD155	0·88
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BD176	0·66
BD177	0·72
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BD179	0·77
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BD199	£1·05
BD200	£1·05
BD205	0·88
BD206	0·88
BD207	£1·05
BD208	£1·05
BDY20	£1·10
BF115	0·27
BF117	0·50
BF118	0·77
BF119	0·77
BF121	0·50
BF123	0·55
BF125	0·50
BF127	0·55
BF152	0·61
BF153	0·50
BF154	0·50
BF155	0·77
BF156	0·53
BF157	0·61
BF158	0·61
BF159	0·66
BF160	0·44
BF162	0·44
BF163	0·44
BF164	0·44
BF165	0·44
BF167	0·24
BF173	0·24
BF176	0·39
BF177	0·39
BF178	0·33
BF179	0·33
BF180	0·33
BF181	0·33
BF182	0·44
BF183	0·44

BF184	0·28
BF185	0·33
BF187	0·30
BF188	0·44
BF194	0·13
BF195	0·13
BF196	0·16
BF197	0·16
BF200	0·50
BF222	£1·05
BF257	0·50
BF258	0·66
BF259	0·94
BF262	0·61
BF263	0·61
BF270	0·39
BF271	0·33
BF272	0·88
BF273	0·39
BF274	0·39
BFW10	0·66
BFX29	0·30
BFX84	0·24
BFX85	0·33
BFX86	0·24
BFX87	0·27
BFX88	0·24
BFY50	0·22
BFY51	0·22
BFY52	0·22
BFY53	0·19
BSX19	0·17
BSX20	0·17
BSY25	0·17
BSY26	0·17
BSY27	0·17
BSY28	0·17
BSY29	0·17
BSY38	0·20
BSY39	0·20
BSY40	0·31
BSY41	0·31
BSY95	0·14
BSY95A	0·14
Bu105	£2·20
C111E	0·55
C400	0·33
C407	0·28
C424	0·28
C425	0·55
C426	0·39
C428	0·22
C441	0·33
C442	0·33
C444	0·39
C450	0·24
MAT100	0·21
MAT101	0·22
MAT120	0·21
MAT121	0·22
MJE2955	0·95
MJE3055	0·62

MJE3440	0·55
MPF102	0·46
MPF104	0·41
MPF105	0·41
OC19	0·39
OC20	0·70
OC22	0·52
OC23	0·54
OC24	0·62
OC25	0·42
OC26	0·32
OC28	0·55
OC29	0·55
OC35	0·46
OC36	0·55
OC41	0·22
OC42	0·27
OC44	0·17
OC45	0·14
OC70	0·11
OC71	0·11
OC72	0·16
OC74	0·16
OC75	0·17
OC76	0·17
OC77	0·28
OC81	0·17
OC81D	0·17
OC82	0·17
OC82D	0·17
OC83	0·22
OC139	0·22
OC140	0·22
OC169	0·28
OC170	0·28
OC171	0·28
OC200	0·28
OC201	0·31
OC202	0·31
OC203	0·28
OC204	0·28
OC205	0·39
OC309	0·44
OCP71	0·48
ORP12	0·48
ORP60	0·44
ORP61	0·44
P20	0·55
P346A	0·22
P397	0·46
ST140	0·14
ST141	0·19
TIP29	0·48
TIP30	0·56
TIP31A	0·60
TIP32A	0·73
TIP41A	0·73
TIP42A	0·88
TIS43	0·34
UT46	0·30
ZN414	£1·20
2G301	0·21

2G302	0·21
2G303	0·21
2G304	0·27
2G306	0·44
2G308	0·39
2G309	0·39
2G339	0·22
2G339A	0·18
2G344	0·20
2G345	0·18
2G371	0·18
2G371B	0·13
2G373	0·19
2G374	0·19
2G377	0·33
2G378	0·18
2G381	0·18
2G382	0·18
2G401	0·33
2G414	0·33
2G417	0·28
2N388	0·39
2N388A	0·61
2N404	0·22
2N404A	0·31
2N524	0·46
2N527	0·54
2N598	0·46
2N599	0·50
2N696	0·14
2N697	0·15
2N698	0·27
2N699	0·39
2N706	0·09
2N706A	0·10
2N708	0·13
2N711	0·33
2N717	0·39
2N718	0·27
2N718A	0·55
2N726	0·31
2N727	0·31
2N743	0·22
2N744	0·22
2N914	0·16
2M918	0·33
2N929	0·23
2N930	0·23
2N1131	0·22
2N1132	0·24
2N1302	0·16
2N1303	0·16
2N1304	0·19
2N1305	0·19
2N1306	0·23
2N1307	0·23
2N1308	0·26
2N1309	0·26
2N1613	0·22
2N1711	0·22
2N1889	0·35
2N1890	0·50

2N1893	0·41
2N2147	0·79
2N2148	0·63
2N2160	0·66
2N2192	0·39
2N2193	0·39
2N2194	0·39
2N2217	0·24
2N2218	0·22
2N2219	0·22
2N2220	0·24
2N2221	0·22
2N2222	0·22
2N2368	0·19
2N2369	0·16
2N2369A	0·16
2N2411	0·27
2N2412	0·27
2N2646	0·52
2N2711	0·23
2N2712	0·23
2N2714	0·23
2N2904	0·19
2N2904A	0·23
2N2905	0·23
2N2905A	0·23
2N2906	0·17
2N2906A	0·20
2N2907	0·22
2N2907A	0·24
2N2923	0·16
2N2924	0·16
2N2925	0·16
2N2926(G)	14
2N2926(Y)	12
2N2926(O)	11
2N2926(R)	11
2N2926(B)	11
2N3010	0·77
2N3011	0·16

2N3053	0·19
2N3054	0·51
2N3055	0·45
2N3391	0·16
2N3391A	0·18
2N3392	0·16
2N3393	0·16
2N3394	0·16
2N3395	0·19
2N3402	0·23
2N3403	0·23
2N3404	0·31
2N3405	0·46
2N3414	0·17
2N3415	0·17
2N3416	0·31
2N3417	0·31
2N3525	0·83
2N3614	0·74
2N3615	0·82
2N3616	0·82
2N3646	0·10
2N3702	0·13
2N3703	0·13
2N3704	0·14
2N3705	0·13
2N3706	0·13
2N3707	0·14
2N3708	0·09
2N3709	0·10
2N3710	0·10
2N3711	0·10
2N3819	0·31
2N3820	0·55
2N3821	0·39
2N3823	0·31
2N3903	0·31
2N3904	0·33
2N3905	0·31
2N3906	0·30

2N4058	0·13
2N4059	0·11
2N1060	0·13
2N4061	0·13
2N4062	0·13
2N4284	0·19
2N4285	0·19
2N4286	0·19
2N4287	0·19
2N4288	0·19
2N4289	0·19
2N4290	0·19
2N4291	0·19
2N4292	0·19
2N4293	0·19
2N5172	0·13
2N5294	0·60
2N5457	0·35
2N5458	0·35
2N5459	0·44
2N6221	0·75
2S301	0·55
2S302A	0·46
2S302	0·46
2S303	0·61
2S304	0·77
2S305	0·86
2S306	0·86
2S307	0·86
2S321	0·62
2S322	0·46
2S322A	0·46
2S323	0·62
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BA100	0·11	BYZ10	0·39	OA85	0·10
BA116	0·23	BYZ11	0·33	OA90	0·07
BA126	0·24	BYZ12	0·33	OA91	0·07
BA148	0·16	BYZ13	0·28	OA95	0·08
BA154	0·13	BYZ16	0·44	OA200	0·07
BA155	0·16	BYZ17	0·39	OA202	0·08
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BA173	0·16	BYZ19	0·31	SD19	0·06
BY100	0·17	CG62		1N34	0·08
BY101	0·13	(OA91 Eq)	0·06	1N34A	0·08
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BY114	0·13	(OA70-79)	0·07	1N916	0·06
BY124	0·13	OA5	0·39	1N4148	0·06
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7401	0·15	0·14	0·13	7450	0·15	0·14	0·13	74123	0·75	0·73	0·70
7402	0·15	0·14	0·13	7451	0·15	0·14	0·13	74141	0·85	0·82	0·79
7403	0·15	0·14	0·13	7453	0·15	0·14	0·13	74145	1·30	1·25	1·20
7404	0·15	0·14	0·13	7454	0·15	0·14	0·13	74150	1·50	1·40	1·30
7405	0·15	0·14	0·13	7460	0·15	0·14	0·13	74151	1·10	1·05	1·00
7406	0·39	0·34	0·31	7470	0·32	0·29	0·27	74153	1·20	1·10	1·00
7407	0·39	0·34	0·31	7472	0·32	0·29	0·27	74154	1·70	1·65	1·60
7408	0·25	0·24	0·23	7473	0·41	0·39	0·35	74155	1·20	1·15	1·10
7409	0·25	0·24	0·23	7474	0·41	0·39	0·35	74156	1·20	1·15	1·10
7410	0·15	0·14	0·13	7475	0·60	0·58	0·56	74157	1·00	0·95	0·90
7411	0·25	0·24	0·23	7476	0·44	0·43	0·42	74160	1·40	1·35	1·30
7412	0·28	0·27	0·26	7480	0·60	0·58	0·85	74161	1·40	1·35	1·30
7413	0·32	0·31	0·30	7481	1·10	1·05	1·00	74162	1·40	1·35	1·30
7416	0·30	0·29	0·28	7482	0·90	0·85	0·80	74163	1·40	1·35	1·30
7417	0·30	0·29	0·28	7483	1·20	1·15	1·05	74164	1·80	1·75	1·70
7420	0·15	0·14	0·13	7484	1·00	0·97	0·95	74165	1·80	1·75	1·70
7422	0·30	0·29	0·28	7485	1·60	1·55	1·50	74166	1·60	1·53	1·50
7423	0·40	0·39	0·38	7486	0·35	0·34	0·33	74174	1·60	1·53	1·50
7425	0·40	0·39	0·38	7489	4·00	3·75	3·50	74175	1·10	1·05	1·00
7426	0·40	0·38	0·36	7490	0·65	0·63	0·60	74176	1·25	1·20	1·15
7427	0·40	0·38	0·36	7491	1·10	1·05	1·00	74177	1·25	1·20	1·15
7428	0·45	0·42	0·40	7492	0·74	0·71	0·64	74180	1·25	1·20	1·15
7430	0·15	0·14	0·13	7493	0·74	0·71	0·64	74181	3·95	3·85	3·75
7432	0·40	0·38	0·36	7494	0·85	0·82	0·75	74182	1·25	1·20	1·15
7433	0·42	0·40	0·38	7495	0·85	0·82	0·75	74184	1·80	1·75	1·70
7437	0·35	0·32	0·30	7496	0·96	0·93	0·86	74190	1·95	1·90	1·85
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7440	0·15	0·14	0·13	74104	0·60	0·58	0·55	74192	1·95	1·90	1·85
7441	0·74	0·71	0·64	74105	0·60	0·58	0·55	74193	1·95	1·90	1·85
7442	0·74	0·71	0·64	74107	0·44	0·42	0·40	74194	1·30	1·25	1·20
7443	1·20	1·15	1·10	74110	0·60	0·55	0·50	74195	1·10	1·05	1·00
7444	1·20	1·15	1·10	74111	0·90	0·88	0·85	74196	1·20	1·15	1·10
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100	0·05	0·07	1N4002	0·06	0·10	0·17	0·23	0·75
200	0·06	0·10	1N4003	0·07	0·12	0·22	0·25	1·00
400	0·08	0·15	1N4004	0·08	0·15	0·30	0·38	1·35
600	0·09	0·17	1N4005	0·10	0·18	0·36	0·45	1·95
800	0·12	0·19	1N4006	0·11	0·20	0·38	0·55	2·10
1000	0·14	0·30	1N4007	0·12	0·25	0·48	0·65	2·50
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100	0·28	0·37	0·52	0·52	0·55	0·64	0·70	1·54
200	0·39	0·41	0·54	0·54	0·63	0·67	0·83	1·76
400	0·48	0·52	0·62	0·62	0·74	0·83	1·03	1·93
600	0·59	0·63	0·75	0·75	0·85	1·07	1·38	—
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UIC06 = 8 × 7406	0·54	UIC60 = 12 × 7460	0·54	UIC96 = 5 × 7496	0·54
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UIC10 = 12 × 7410	0·54	UIC72 = 8 × 7472	0·54	UIC121 = 5 × 74121	0·54
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UIC42 = 5 × 7442	0·54	UIC81 = 5 × 7481	0·54	UIC199 = 5 × 74199	0·54
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Size 16 mm × 16 mm.

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250V P.C. Mounting: 0·01μF, 0·015μF, 0·022μF, 0·033μF, 0·047μF, **3½p.** 0·068μF 0·1μF, **4½p.** 0·15μF, **5p.** 0·22μF, **6p.** 0·33μF, **8p.** 0·47μF, **10p.** 0·68μF, **13p** 1μF, **16p.** 1·5μF, **24p.** 2·2μF, **27p.**

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160V: 0·01μF, 0·15μF, 0·022μF **3½p.** 0·047μF, 0·068μF, **4p.** 0·1μF, **4½p.** 0·15μF, **5½p.** 0·22μF. **6p.** 0·33μF, **7p.** 0·47μF, **9p.** 0·68μF, **13p.** 1μF, **15p.**

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

W.	Type	Range	1–99	100–499	500–999	1000+	Size mm
⅛	CF	22–1M	1	0·80	0·65	0·60	2·4x7·5
¼	CF	22–2M2	1	0·80	0·65	0·60	3·9x10·5
½	CF	22–1M	1	0·80	0·65	0·60	5·5x16
⅛	MF	10–2M7	2	1·7	1·4	1·2	3x7
½	MF	10–2M2	2	1·6	1·3	1·1	4·2x10·8
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2·2μF	63V	7p	150μF	16V	7p
3·3μF	63V	7p	150μF	63V	17p
4·0μF	40V	7p	220μF	6·4V	7p
4·7μF	63V	7p	220μF	10V	7p
6·8μF	63V	7p	220μF	16V	8p
10μF	25V	7p	220μF	63V	25p
10μF	63V	7p	330μF	16V	14p
15μF	16V	7p	330μF	63V	28p
15μF	63V	7p	470μF	6·4	8p
16μF	40V	7p	470μF	40V	25p
22μF	25V	7p	680μF	16V	17p
22μF	63V	7p	680μF	40V	28p
32μF	10V	7p	1000μF	16V	25p
33μF	16V	7p	1000μF	25V	28p
33μF	40V	7p	1500μF	6·4V	17p
47μF	10V	7p	1500μF	16V	28p
47μF	25V	7p	2200μF	10V	28p
47μF	63V	8p	3300μF	6·4V	28p
68μF	16V	7p			
68μF	63V	14p			
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BC108	12p	OC44	19p
BC109	13p	OC71	13p
BC148	13p	OC81	17p
BC149	13p	OC170	29p
BC182L	13p	2N2926	13p
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Std. Jack	20p
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U4323

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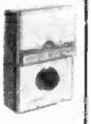

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20,000Ω/Volt. High accuracy. mVdc—75mV.
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U4313

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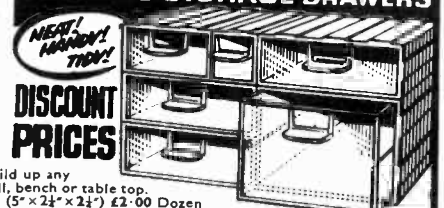

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R.C.S. DISCO DECK SINGLE RECORD PLAYER

Fitted with auto stop complete with cartridge. Baseplate. Size 11in × 8½in. Turntable. Size 7in. diameter. A/C mains. 200/250V motor has a separate winding 14 volt to power a small amplifier. Three speeds. Plays all records.

COMPLETE STEREO HI-FI

Two full size loudspeakers 13½ × 10 × 3½in. Player unit clips to loudspeakers making it extremely compact. Overall size only 13¾ × 10 × 8½in. 3 watts per channel, plays all records 33 rpm, 45 rpm Separate volume & tone controls. 240v AC mains.

Attractive Teak finish Weight 18lbs.

Bargain Price **£29** 85p carriage

SPECIAL OFFER

SMITH'S CLOCKWORK 15 AMP TIME SWITCH 0-60 MINUTES

Single pole two-way. Surface mounting with fixing screws. Will replace existing wall switch to give light for return home. garage, automatic anti-burgular lights, etc. Variable knob Turn on or off at full or intermediate settings. Makers last list price £4·50. Brand new and fully guaranteed. Fully insulated. OUR PRICE £2·50 Post 25p

WEYRAD P50—TRANSISTOR COILS

RA2W Ferrite Aerial	85p	Printed Circuit, PCA1	85p
I.F. P50/2CC 470 kc/s	40p	J.B. Tuning Gang	£1·20
3rd I.F. P50/3CC	40p	Weyrad Booklet	10p
Spare Cores	3p	OPT1	65p
P50/IAC	60p	Driver Trans. LFDT4	65p

Ferrite Rod 8 × ⅜in. 20p 6 × $\frac{5}{16}$in. 20p 3 × ⅜in. 10p

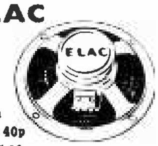
VOLUME CONTROLS

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 Ideal 625 & colour **10p yd.**

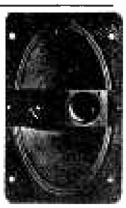
8in or 10 x 6in ELAC HI-FI SPEAKER



Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 c/s. Bass resonance 55 c/s. 8 ohm 10 watt. **£4·35** Each Post 40p

10 inch 12 watt Twin Cone, 8 ohm £5·20

E.M.I. 13½ × 8in. 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 c/s. Flux 10,000 gauss. State 3 or 8 or 15 ohm. Post 35p **£3·45**

BOOKSHELF CABINET Size 16 × 10 × 7in. teak finish **£7·50** Post 45p

E.M.I. 13 × 8 in. BASS WOOFER. 20 WATTS RUBBER CONE SURROUND. £6·50 Post 40p.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides 6 × 4in. 45p; 8 × 6in. 53p; 10 × 7in. 65p; 12 × 8in. 85p; 14 × 9in. 90p; 16 × 6in. 90p; 12 × 3in. 60p; 16 × 10in. £1.

ALUMINIUM PANELS 18 s.w.g. 6 × 4in. 12p; 8 × 5in. 19p; 14 × 3in. 20p; 10 × 7in. 24p; 12 × 5in. 25p; 12 × 8in. 34p; 16 × 6in. 34p; 14 × 9in. 40p; 12 × 12in. 47p; 16 × 10in. 60p

SPECIAL OFFER

100 ohm 30W Rheostat 2½in. diam. Ceramic Former, screw terminals, ¼in. diam. spindle. 95p, post 25p.

ANOTHER RCS BARGAIN!

ELAC 9 × 5in. HI-FI SPEAKER. TYPE 59RM. THIS FAMOUS AND WIDELY USED UNIT NOW AVAILABLE AT BARGAIN PRICE 10 WATT, 8 OHM. CERAMIC MAGNET. **£3.45**

4MFD 800V DC PAPER CAPACITOR

Block Capacitor. Ideal as Filter Unit in 100 watt Loudspeaker Systems. 95p each, post 30p.

GOODMANS CONE TWEETER

15'000 cps. 25 watts. 8 ohm. Price **£3 30**

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

Ideal for Mike, Tape, P.U., Guitar, etc. Can be used with Battery 9-12v. or H.T. line 200-300V. d.c. operation. Size 1¾" × 1¼" × ¾". Response 25 c/s. to 25 Kc/s, 26 dB gain. For use with valve or transistor equipment. Full instructions supplied. Details S.A.E. **£1.45** Post 20p

TEAKWOOD LOUDSPEAKER GRILLS. Will easily fit to baffle board. Size 18½ × 10½in—75p. 10½ × 7½in—45p.

E.M.I. WOOFER AND TWEETER KIT

Woofer 10½ × 6½in. Ceramic Magnet, 44oz. 13,000 lines. Tweeter 3½in. square, 10,000 lines. Crossover condenser full instructions supplied. Impedance 8 ohms. Power 12 watts. **£6·75** Post 45p.

BRITISH FM/VHF TUNING HEART

88 to 108 M/CS British made. 2 Transistors ready aligned requires 10·7 M/CS I.F. Complete with tuning gang. Connections supplied but some technical experience essential **Our price £3·95** 10·7 M/Cs IF Strip £4·95

DECODER = £4·75

MAINS TRANSFORMERS

All post 25p each

250-0-250 80 mA. 6·3V 2amp .... £2·90
250-0-250 80 mA. 6·3V 3·5A 6·3V 1A or 5V 2A .... £4·60
350-0-350 80 mA 6·3V 3·5A, 6·3V 1A or 5V 2A .... £5·80
300-0-300V 120mA, 6·3V 4A C.T.; 6·3V 2A .... £7·00
MIDGET 220V 45mA, 6·3V 2A £1.75
HEATER TRANS. 6·3V ½ amp 85p. 3 amp £1·20
GENERAL PURPOSE LOW VOLTAGE. Trapped outputs at 2 amp, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30V £4·60
1 amp, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £4·60
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
6-0-6V 500mA 90p, 20V 1A £1·85
9V 1 amp 95p 12V 300mA 75p 12V 500mA 85p 12V 750mA 95p. 10, 30, 40V 2 amp £2. 20V 3 amp £2. 40V. 3A £2·50. 22.0.22V 4A £3. 16V ½ amp. 95p. 16V 2 amp £1·85.
AUTO TRANSFORMERS. 115V to 230V or 230V to 115V 150W £4·60; 500W £8·70; 750W £17·50; 1000W £21.
FULL WAVE BRIDGE CHARGER RECTIFIERS; 6 or 12V outputs. 1½ amp 40p; 2 amp 55p; 4 amp 85p.

MAINS ISOLATING TRANSFORMER

Primary 0-110-240V. Secondary 0-240V. 3A. 720W. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. Famous make. (Value £19) OUR PRICE **£13·50** Carr. 95p

Can be used as 800W auto transformers 240-110V.
IDEAL FOR COLOUR T.V. OR GARDEN TOOLS.

NEW ELECTROLYTIC CONDENSERS

2/350V	14p	100/25V	10p	50+50/300V	50p
4/350V	14p	250/25V	14p	350+50/325	85p
8/350V	22p	500/25V	20p	32+32/350V	40p
16/350V	25p	100+100/275V	65p	32+32/450V	60p
32/450V	35p	150+200/275V	70p	32+32+32/350V	65p
32/500V	50p	8+8/450V	22p	32+32+32/450V;	85p
25/25V	10p	8+16/450V	25p	900/350V	95p
50/50V	10p	16+16/450V	40p	4700/63V	95p

LOW VOLTAGE ELECTROLYTICS
1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF. 15V. 10p.
500mF. 12V. 15p; 25V. 20p; 50V. 30p.
1000mF. 12V. 20p; 25V. 35p; 50V. 47p; 100V. 70p.
2000mF. 6V. 25p; 25V. 42p; 50V. 57p.
2500mF. 50V. 62p; 3000mF. 25V. 47p; 50V. 65p.
5000mF. 6V. 25p; 12V. 42p; 25V. 75p; 35V. 85p; 50V. 95p.

MICRO SWITCH. Single Pole Change Over. 20p.
MICRO SWITCH. Sub Min 25p.

CERAMIC 1pF to 0·01mF, 4p. Silver Mica 2 to 5000pF, 4p.
PAPER 350V-0·1 7p, 0·5 13p; 1mF 15p; 2mF 150V 15p.
500V-0·001 to 0·05 4p; 0·1 10p; 0·25 13p; 0·47 25p.
TWIN GANG. "0-0" 208pF+176pF, £1·20; 500pF standard 75p; 365+365 with 25+25pF Slow motion drive 50p.
TWIN GANG. 120pF 50p. 385pF 50p.
SHORT WAVE, SINGLE. 10pF 30p; 25pF 55p; 50pF 55p.
NEON PANEL INDICATORS. 250V AC/DC Amber 25p.
RESISTORS. ¼W, ½W, 1W, 20% 1p; 2W, 5p. 10 Ω to 10M.
HIGH STABILITY. ½ w. 2% 10 ohms to 6 meg., 10p.
Ditto 5% Preferred values 10 ohms to 10 meg., 4p.
WIRE-WOUND RESISTORS. 5 watt, 10 watt, 15 watt 10 ohms to 100K 10p each.
TAPE OSCILLATOR COIL. Valve Type 35p.

NEW MODEL "BAKER LOUDSPEAKER" 12in. 50 watt GROUP 50/12 8 or 15 ohm high power full range. Professional quality. **£16·00**

BAKER MAJOR 12" £11·50

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** Post free
Please state 3 or 8 or 15 ohms.

BAKER "BIG-SOUND" SPEAKERS

'Group 25'	'Group 35'	'Group 50'
12 inch 25 watt **£9·50** 3 or 8 or 15 ohm	12 inch 35 watt **£11·50** 3 or 8 or 15 ohm	15" 50 w **£22·00** 8 or 15 ohm

TEAK VENEERED HI-FI SPEAKER CABINETS

For 12in. or 10in. dia. speaker	20 × 13 × 12"	£12·00 Post 95p
For 13 × 8in. or 8in. speaker	16 × 10 × 7"	£7·50 Post 75p
For 8 × 5in. speaker	16 × 8 × 6"	£5·80 Post 45p
	12 × 8 × 6"	£4·60 Post 35p

LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft

EMI 6½in. HI-FI WOOFER

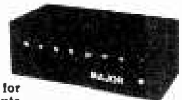
8 ohm, 10 watt. Large ceramic magnet. Special Rubber cone surround. Frequency response 30-12,000 c/s. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. **£4·60**
Suitable cabinet 12 × 8 × 6 £4·00.
Suitable Tweeter £2·00.

ELAC CONE TWEETER

The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 c/s to 18,000 c/s. Size 3½ × 3½ × 2in. deep. Rating 10 watt, 8 ohm Suitable Crossover £1·60 **£2·20** Post 20p

SPEAKER COVERING MATERIALS. Samples Large S.A.E
Horn Tweeters 2-16kc/s, 10W 8 ohm or 15 ohm £2·50
CROSSOVERS TWO-WAY 3000cps 3 or 8 or 15 ohm £1·60
LOUDSPEAKERS 3 OHMS. 7 × 4in. £1·25; 6½in. £1·50. 8 × 5in. £1·60 8in. £1·75; 10 × 6in. £1·90; 10in. £2·00.
SPECIAL OFFER: 80 ohm, 2¾in.; 2½in. 35 ohm. 3in., 25 ohm. 2½in. dia., 5in. dia, 6" × 4" 15 ohm, 3½in. dia.; 6 × 4in.; 7 × 4in.; 8 × 5in. 3 ohm, 2½in.; 2¾in.; 3½in.; 5in. dia. (6 × 4in. 3 ohm £1·50) **£1** EACH TYPE
RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8 in. diameter 4 watt £2·50. 10in. diameter 5 watt £2·95; 12 in. diameter. 6 watt £3·50.
VALVE OUTPUT TRANS. 40p; MIKE TRANS. 50:1 40p. Mike trans. mu metal 100:1 £1·25.

MAJOR 100 WATT ALL PURPOSE GROUP OR DISCO 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. **£59** Carr. £1·00
MAJOR 50 WATT 4 INPUTS. 2-WAY MIXING. IDEAL FOR DISCO OR PA. £49·95, Post £1

3-WAY CROSSOVER 950 CPS and 3000 CPS with leads ready assembled **£1·95**

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt. **£5·20**
TWO CHANNEL STEREO VERSION **£6·85**

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume, treble and bass controls 18v. MAINS POWER PACK £3·45. **£4·50**

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p
COAXIAL OUTLET BOXES, surface, 35p.
BALANCED TWIN FEEDER 300 ohms 7p yard. JACK SOCKET Std. open-circuit 15p, closed-circuit 23p. Chrome Lead Socket 45p. Phono Plugs 8p. Phono Socket 8p. JACK PLUGS Std. Chrome 30p; 3·5mm Chrome 18p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 25p. DIN PLUGS 3-pin 18p; 5-pin 25p. VALVE HOLDERS. 5p; CERAMIC 10p; CANS 5p.

REVERSIBLE 4 POLE MOTOR £2·60

1,400 r.p.m. Reversible 48 Watt, Post 40p spindle 1¼" × 7/32", size 3½" × 3". As illustrated. With Cooling Fan 240V A.C.

E.M.I. GRAM MOTOR **£1·25**

120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2½ × 2½ × 2½ in. Post 30p.

RADIO COMPONENT SPECIALISTS

337 WHITEHORSE ROAD, CROYDON
Open 9—6 Wed. 9—1 Sat. 9—5 (Closed for lunch 1.15—2.30)
Buses 50, 68, 159. Rail Selhurst. Tel. 01-684 1665

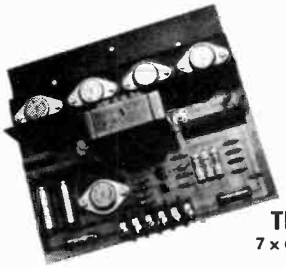
Minimum post 30p. Illustrated Brochure, Radio Books & Components Lists 10p.

TUAC

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

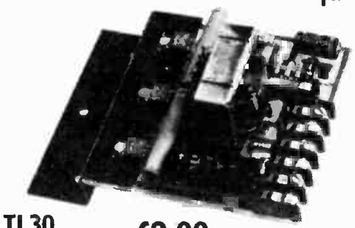
MANUFACTURERS OF ELECTRONIC & AMPLIFICATION EQUIPMENT. ALSO QUALITY TRANSISTOR EQUIPMENT.
OPEN MON.-SAT. 9.30 a.m.-6.00 p.m.

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



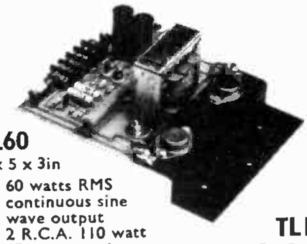
TP125
7 x 6½ x 3in
£22·50

★ 125 watts RMS continuous sine wave output
★ 4 R.C.A. 150 watt 15 amp output transistors



TL30
4 x 5¼ x 2¼in
£9·00

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



TL60
5 x 5 x 3in
★ 60 watts RMS continuous sine wave output
★ 2 R.C.A. 110 watt 15 amp transistors
£14.50

TL100
5 x 5 x 3in
★ 100 watts R.M.S. continuous sine wave output
★ 2 R.C.A. 150 watt 15 amp transistors
£17·50

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

Specification on all power modules: All output power ratings ±0·5dB; Output impedance 8–15 ohms; THD at full power 2% typically 1%; Input sensitivity 60mV into 10kΩ; Frequency response 20Hz–20kHz ± 2dB; Hum and noise better than —70dB.

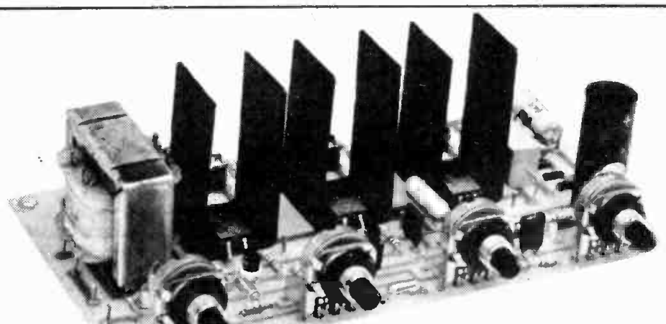
TUAC DISCOTHEQUE MIXER WITH AUTO FADE

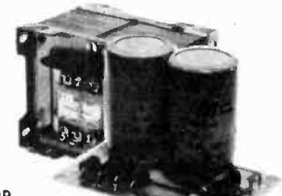
PANEL SIZE
18 x 4½in.
DEPTH 3in.

£36·50

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

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





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

PS 125 ± 50 volts for one TP125	£14·25
PS100 ± 45 volts for one TL100	£13·00
PS60 ± 40 volts for one TL60	£11·50
PS30 + 50 volts for one TL30	£7·00
PSU 2 for supplying disco mixer	£5·50

HOW TO ORDER BY POST

Make cheques/P.O's payable to TUAC LTD. (P.W.4) OR QUOTE ACCESS/BARCLAY CARD NO. and post to TUAC LTD (P.W.4) 163 MITCHAM ROAD, LONDON SW17 9PG

We accept phone orders against ACCESS/BARCLAYCARD Holders Phone 01-672-3137/9080

H.P. arranged through PAYBONDS

NEW! 3 CHANNEL LIGHT MODULATOR

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

£18·00

Single Channel Version 1500 watts £8·50

STOCKISTS—CALLERS ONLY

Arthur Sallis Ltd., 28 Gardner Street, Brighton, Sussex. Tel 65806, **Bristol Disco Centre**, 86 Stokes Croft, Bristol 1. Tel. 41666, **Socodi**, 9 The Friars, Canterbury. Tel. 60948. **Cookies**, 132 West Street, Crewe. Tel. 4739 or 581202. **Calbarrie Audio**, 88 Wellington Street, Luton. Tel. 411733. **Al Music Centre**, 88 Oxford Street, Manchester. Tel. 061-236 0340. **Damon Electronics**, 99 Carrington Street, Nottingham. Tel. 53880. **Mitchell Electronics**, 64 Winchester Street, Salisbury. Tel. 23689 **Wec Lighting**, 10 Commercial Road, Southampton. Tel. 28102.

ALL PRICES INCLUDE V.A.T. (25%) AND POSTAGE AND PACKING

R T V C *

NEW!

VISCOUNT IV STEREO SYSTEM

System 1a. £69.00

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.

Frcnt 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".

Garrard SP 25 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. £85.00

Viscount IV amplifier (As System 1a)
Garrard SP 25 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

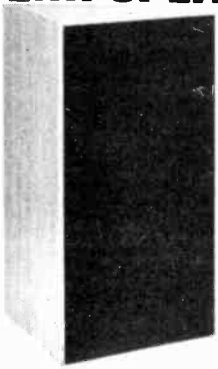
Viscount IV R103 amplifier	£25.00+£1.90 p & p.
2 Duo Type IIa speakers	£30.00+£6.50 p & p.
Garrard SP 25 with Mag. cartridge de luxe plinth and cover	£24.50+£3.30 p & p.
Total if purchased separately:	**£79.50**
Available complete for only	**£69.00** +£6.50 p & p.

PRICES: SYSTEM 2

Viscount IV R103 amplifier	£25.00+£1.90 p & p.
2 Duo Type III speakers	£46.00+£7.50 p & p.
Garrard SP 25 with Mag. cartridge de luxe plinth and cover	£24.50+£3.30 p & p.
Total if purchased separately:	**£95.50**
Available complete for only	**£85.00** +£7.60 p & p.

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

EMI SPEAKERS AT FANTASTIC REDUCTIONS

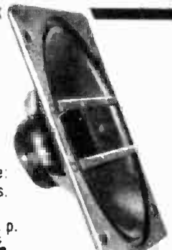


LE-4 SPEAKERS

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.

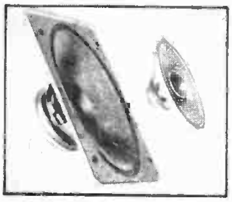


EMI 350 KIT

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.)

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

20 WATT SPEAKER SYSTEM *



System consists of a 13"×8" (approx.) eliptical woofer unit with a 8"×5" (approx.) mid-range unit incorporating parasitic tweeter and crossover components and circuit diagram

Technical Specification: Bass Unit: Flux density — 100 K, speech coil — 1½". Cone. Triple laminated paper with P.V.C. surround. Mid-Range Unit: Flux density — 33 K, speech coil — 1" with parasitic tweeter. Power handling: 20 watts RMS, impedance — 8 ohms, frequency response — 20 Hz to 18,000 Hz.

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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.

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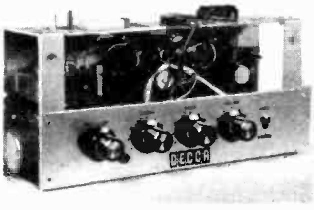

Specification: 4+4 watts into 8 ohms. Input Sensitivity 4mV into 47K (for magnetic cartridges). AC Mains only 240V. Controls — volume, bass, treble, on/off, mono/stereo switch. Chassis size 11"×5½"×3¼" approx.

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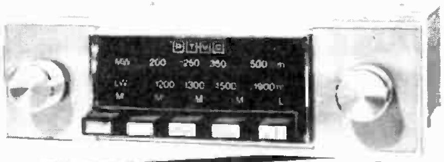

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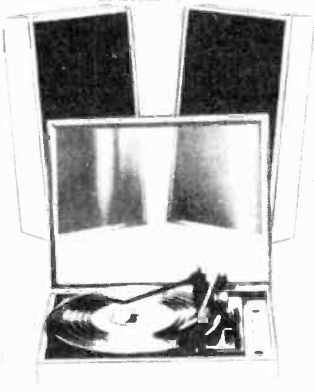

Stereo 21, easy to assemble audio system kit. No soldering required.
The unit is finished in white P.V.C. and the acrylic top presents an unusually interesting variation on the modern deck plinth.
Includes — **BSR 3 speed deck**, automatic, manual facilities together with stereo cartridge.
Two speakers with cabinets.
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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".

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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.

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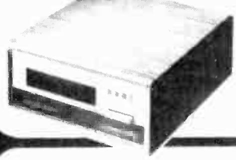

Elegant self selector push button player for use with your stereo system. Compatible with Viscount IV system, Unisound module and the Stereo 21. Technical specification Mains input, 240V. Output sensitivity 125mV. Comparable unit sold elsewhere at £24.00 approx. Yours for only

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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.

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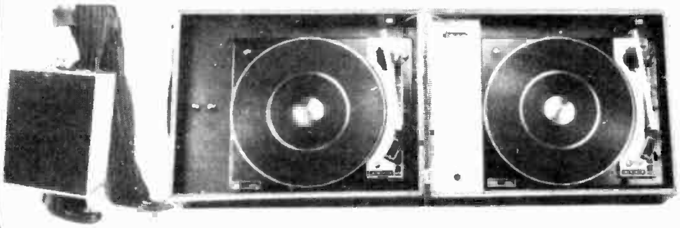
INCORPORATES: Pre-Amp with full mixing facilities, including switched input for mic with volume control, switched input for auxiliary with volume control, bass and treble controls, volume control and blend control for turntables. Two B.S.R. MP60 type single play professional series decks, fitted with 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" × 4¾" (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.

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VAT MUDDLE!

THE ominous expansion of VAT to 25% has indeed brought forth justifiable protests from many quarters of the electronic components industry.

Customs and Excise Notice 742 states that the 25% rate of VAT is applicable not only to assembled radio receivers, amplifiers, TV's etc. but applies also to all component parts, accessories and service in respect thereof. Notice 742 states that the 25% VAT rate applies to all resistors, capacitors, coils, transistors, etc. if they are of a kind suitable for use as parts of goods for the aforementioned items, even when these goods are supplied for the manufacture or service of other equipment not taxed at 25%.

There is considerable uncertainty within the trade and industry over the new VAT schedule. The industry is quite justifiably up in arms over this punitive rate of tax.

The pursuit of our hobby, and the pursuit of many others, could be severely restricted by the extra cost of components. Research, development and experimentation will be throttled and the widespread implications of this should be obvious to anyone.

LIONEL E. HOWES—Editor

NEWS...

Heathkit Competition Result

IN our March issue we invited readers to assess advantages of building one's own electronic equipment over buying ready-made outfits.

Having considered all entries, the judges decided that the best received was that submitted by Mr. Robert Gregory, of Mansfield, Notts, who had listed the featured advantages in the following order: 1st—C; 2nd—A; 3rd—J; 4th—E; 5th—L; 6th—B; 7th—K; 8th—D.

Mr. Gergory wins a £100 voucher to spend on equipment from Heathkit.

The four next best entries were from:—Mr. H. Boland, Armagh; Mr. J. McKeown, Wigtown; Mr. P. Garside, Kings Lynn; Mr. I. Marsden, Nottingham. Each wins a £50 Heathkit voucher.

To complete the prize-list there were a further eight £25 Heathkit vouchers, and these went to Mr. R. Armstrong, Farnborough; Mr. M. Clay, Sevenoaks; Mr. B. Cambray, Croydon; Mr. Pidun, Braintree; Mr. P. Royle, Bristol; Mr. E. Rumble, Haywards Heath; Mr. S. V. Bentall, Buntingford; Mr. P. G. Hazelwood, Brierley Hill.

Advertisers Note

RECENTLY *Practical Wireless* has been able to offer a unique service to its advertisers. On request, advertisers have been given advance information concerning components for *P.W.* projects.

Advertisers should contact *Dennis Brough* on 01-634 4116 or *Christine Dunn* on 01-634 4293.

Essex Repeater Group

THE above group have submitted their application to the Home Office for a 70cm repeater to be sited on Danbury. To assist fund raising a Grand Bring & Buy and Junk Sale will be held at St. John's Hall, Vicarage Road, Chelmsford, on Saturday, June 28th from 11 a.m. to 6 p.m. The Group will be arranging 'talk in' on 433.200 UHF S20/S22 and 4 metres. For further information contact G3VKQ, G3WCO or G3MVV.

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

Sinclair wins Queen's award

SINCLAIR Radionics has won a Queen's Award to Industry, 1975, in recognition of its outstanding export achievement and for technological innovation in scientific electronic calculators.

During a three-year period ending in April 1974 the company, which is Europe's largest manufacturer of electronic calculators increased its exports tenfold to £2,232,040 p.a. or 56 per cent of turnover.

Award for technological innovation has been made for the development of the low cost, Sinclair 'Scientific' pocket calculator.

Picture shows Clive Sinclair, aged 35, founder and Managing Director of Sinclair Radionics of St. Ives, Cambs.

More awards

THE X-Ray Systems Division of EMI Limited and the Telecommunications Division of EMI Sound & Vision Equipment Limited have both won the 1975 Queen's Award to Industry for export achievement.

EMI contract

THE original £1·25 million contract won by EMI Sound & Vision Equipment Limited to supply the complete antenna system for the CN Tower in Toronto, the world's tallest self-supporting structure, has been boosted by £60,000. This latest contract covers the provision of additional antennas for Ch. 70.

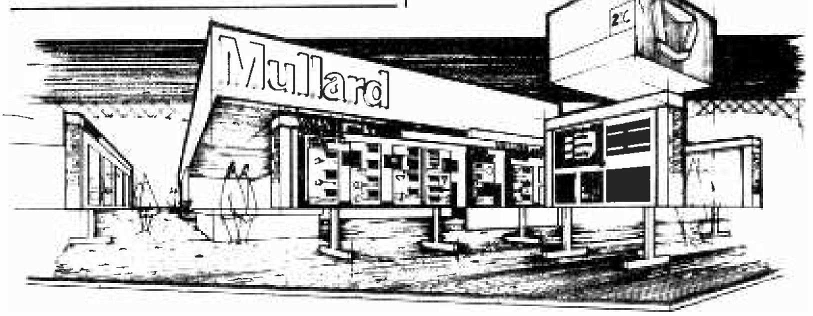
Three Q concept

THE ability to provide **quality** products in **quantity, quickly** has always been the strength behind the Mullard company. At the International London Electronic Components Show at Olympia this 'Three Q' concept was adopted as an overall theme aptly illustrating the company's attitude towards trading in the challenging years ahead.

Eleven major displays on a stand of 300 square metres highlighted what is believed to be the broadest range of components ever shown. In addition to the 'Three Q' components available now to meet equipment production needs, the displays included over a hundred new products for tomorrow's designs, many of them on show for the first time.

A team of Mullard engineers was on hand to discuss all aspects of the displays and a data-bar provided visitors with the latest information on every product in the Mullard range.

Following their participation at the London Electronic Components Show, Mullard took their displays to Edinburgh, Manchester and Bristol. At each centre the displays were backed by a series of lectures from Mullard experts.



Books received

Slide-Tape and Dual Projection
By R. Beaumont-Craggs
Covers all aspects of music and 'chat' with slides. Topics covered include essential equipment, taking pictures, preparing the sound track, dual projection, special effects, audio visual in education and the all-important presentation of the show. It would prove invaluable to tape-recording enthusiasts, photographers, photographic and amateur cine clubs, teachers, sales and publicity personnel etc.
Price £3
Focal Press Limited 31 Fitzroy Square, London, W1P 6BH

Plessey Semiconductors Integrated Circuit Data Book
No author
Contains full information on the continually-growing range of standard products manufactured by the Plessey Company.
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Tape Recording from A to Z
By Doug Crawford
Simple language explanation of how tape recording works—a simple step-by-step account of using reel-to-reel machines; what to look for when buying one etc.
Price £1·85
Kaye and Ward Limited, 21 New Street, London, EC2M 4NT

Questions and Answers on HiFi
By Clement Brown
Q and A in very simple language on most things you need to know about HiFi. All sources are covered — discs, tapes, radio. Guidance on costs is given, specifications, planning requirements, etc. etc.
Price: 75p
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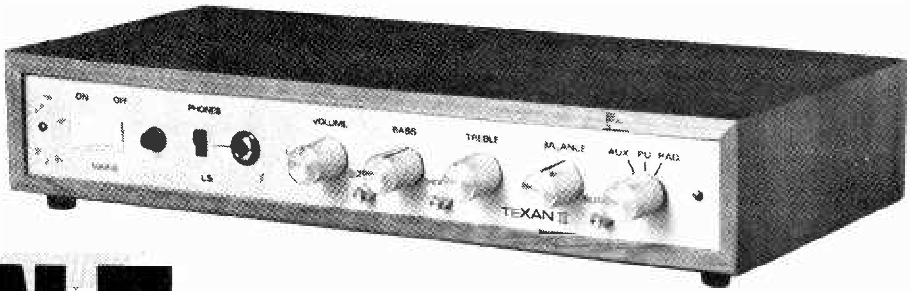


The PW TEXAN II (UP-DATING OUR STEREO AMPLIFIER)

RICHARD MANN*

ALTHOUGH this article is headed The Texan II it would probably be more accurate to describe it as the Texan III/II! Since the first design appeared in these pages about three years ago I am told that approximately 45,000 kits have been sold. (Next time, I'm going to make sure that I have a slice of the action!) With all those Texans knocking around it was inevitable that there should be quite a bit of correspondence on the subject. These notes, therefore, are intended to deal with some of the points which have come up most often and aimed at the man who already has a working Texan and who wants to upgrade it slightly. In the not-too-distant future I hope that *PW* will be able to publish a new design which is currently gestating, but new designs are not much comfort if you have already spent your money.

The three points which have arisen most consistently have been:—

1 Susceptibility to RF interference.
2 How to increase the power output.
3 How to install a Tape Monitor facility.

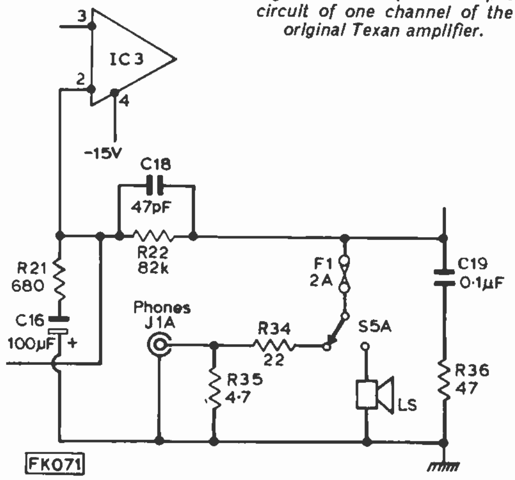
There have been other comments, of course. Some of them are repeatable, but not really within the scope of the Texan concept. The idea of the Texan was to produce a value-for-money design without a lot of frills but which would be very reproducible and would sound really good under normal domestic conditions.

SUSCEPTIBILITY TO RFI

I think this fault was the one real shortcoming of the original design. Unfortunately it is not a very easy thing to test for under laboratory conditions. It's not until 45,000 fridges have clicked on and off a few times that you know you really have a problem on your hands! The weakness was partly due to the rather skimpy screening of the Texan metalwork and partly to the over-simplification of the design so that there were no filtering components in it from input to output.

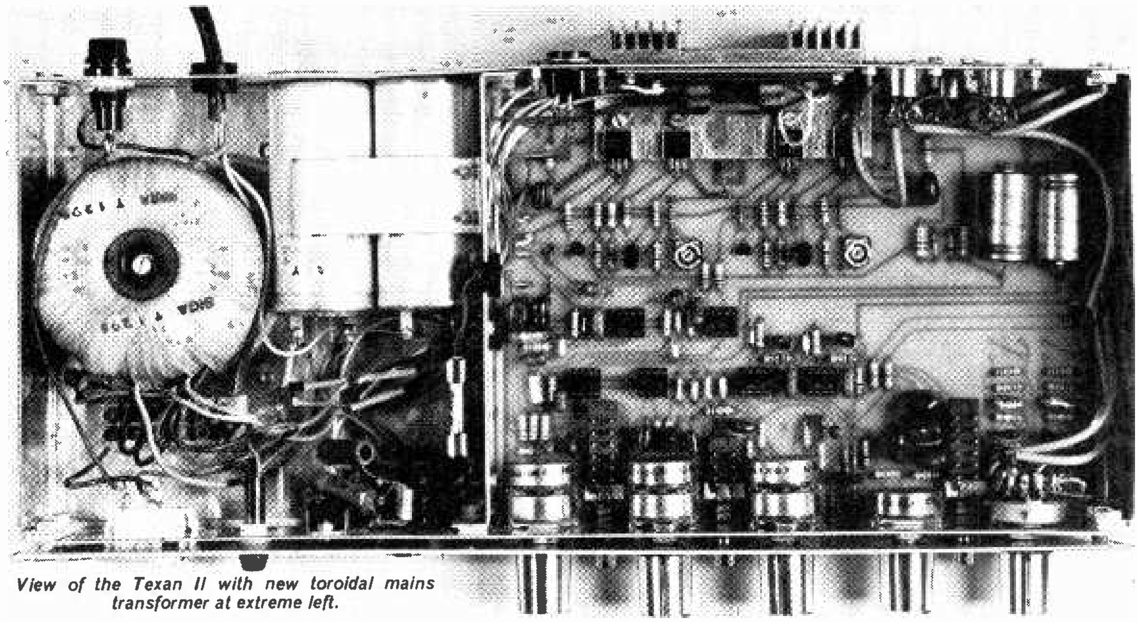
Basically, anything which is wired into the amplifier is capable of introducing interference, the mains lead, the pick-up leads and the loudspeaker leads. I mention the loudspeaker leads last because it appears that these have been the major cause of the trouble. They are usually long for a start, and in the output circuit, which is shown in Fig. 1, it will be noted that there is virtually a short-circuit to RF from the output, through C18 and on to the inverting input of IC3. Now although they are miraculous things, operational amplifiers are not normally noted for the fastness of their slew-rates. Slew-rate being the maximum volts per second that they can deliver. They might give out 100mV at 1MHz or 10V at 10kHz but there is no way they will give 10V at 1MHz! Consequently a fast signal appearing spuriously at an input terminal will tend to be greatly amplified in the early high-gain stages of the op-amp but the later stages will be unable to follow it with the result that there will be distortion and demodulation of the signal and rude noises at the output.

Fig. 1: Part of the output circuit of one channel of the original Texan amplifier.



Two simple high-pass filters have been added, R39/C24 in Fig. 2a and R40/C26 in Fig. 2b. These have a cut-off frequency of 2·2MHz so they do not have any audible effect on the amplifier response. However they filter out most of the spurious RF before it can do any harm. A further capacitor, C25,

* *Texas Instruments Limited*



View of the Texan II with new toroidal mains transformer at extreme left.

is added directly across the input terminals of IC3 in order to provide a shunt for any residual noise which appears differentially at this point. This capacitor causes a slight drop in the high-frequency open-loop gain of the op-amp which consequently causes a slight increase in the high-frequency distortion of the Texan but the audible difference is quite undetectable.

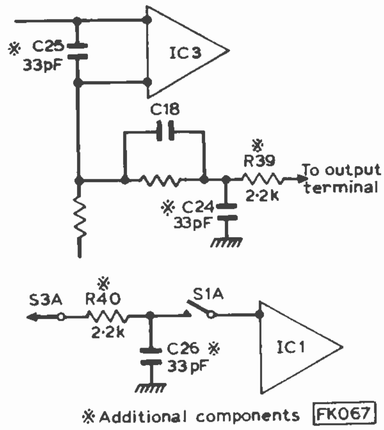


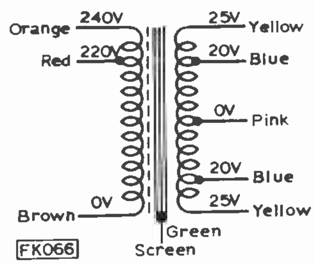
Fig. 2: Circuits of the two high-pass filters added to each channel.

These extra components are very easy to add. Resistor R40, and its complementary resistor in the other channel, R140, are wired in directly between switch S3 and points H and I on the PCB which is shown in Fig. 3. These resistors replace the short wire connections originally there. The PCB can then be drilled to take the remaining filter components. This can be done quite accurately with a sharp drill held in a pin-chuck and twisted in the fingers. If it is a Texan kit with a removable base it is easy to hold the board against a light and drill through from the top. The exact positioning of the holes is not critical but it is obviously important to avoid any damage to existing components. Take care also that the track is not drilled through as the solder joint, when made, may fail to close the gap in the track. It is better to drill just alongside the track and bend the component wire across.

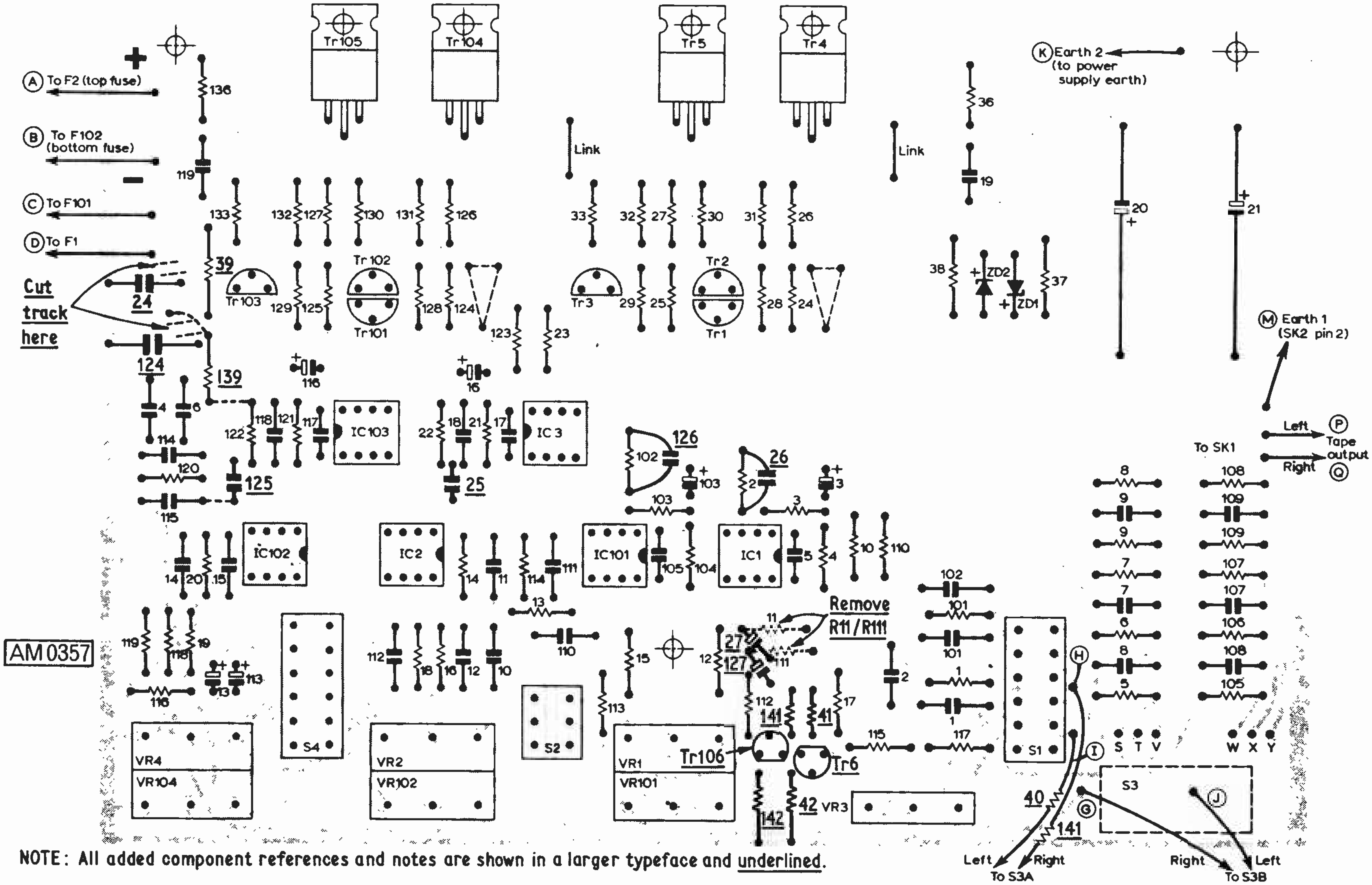
INCREASING OUTPUT POWER

There are two approaches to increasing output power: one is to increase the peak power obtainable under transient conditions; the other is to increase the continuous output power from both channels simultaneously. The first is a function of the power rail voltage while the second is a function of the power supply regulation. Both of these factors, in turn, are primarily a function of the mains transformer used. The transformer used in the original design was chosen for its combination of economy and good performance. It would not, however, give the regulation obtainable from a rather more expensive toroidal transformer, such as that used here in the Texan II. This has been designed to fit in the same space but it has a 75VA rating and has some extra taps. The primary has a tap for 220V input as well as 240V and the secondary is wound to give 25-20-0-20-25V.

The Texan I was capable of delivering 20W+20W into 8 ohms with an intermittent sine wave input but would give only 16W+16W with continuous



Colour coding of the toroidal transformer. A small terminal block is desirable to take extra secondary leads. The block can be seen below the transformer in the photograph above.



NOTE: All added component references and notes are shown in a larger typeface and underlined.

Fig. 3: Original Texan PCB with RFI suppression components added. Tape monitor modifications, centre bottom, are shown from foil side in Fig. 11.

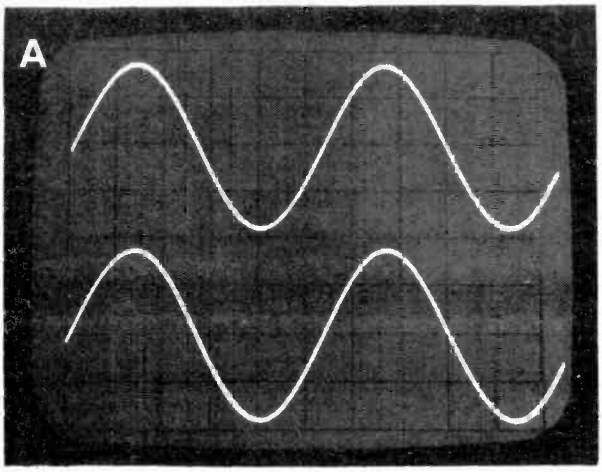


Fig. 4: Sinewave output with amplifier running at 2 x 20W into 8Ω speakers and using 20V taps on transformer.

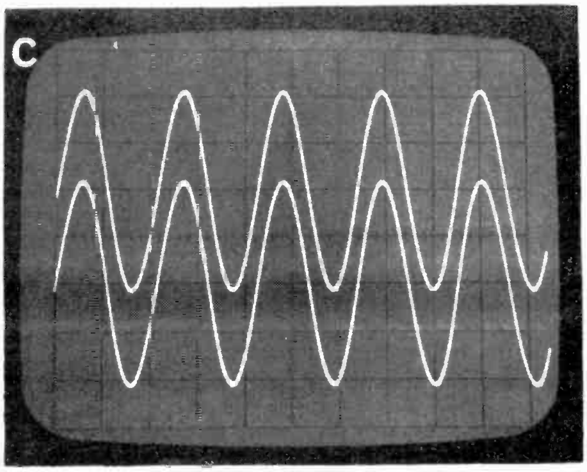


Fig. 6: This time the 25V transformer taps are used, giving 2 x 28W into 8Ω speakers.

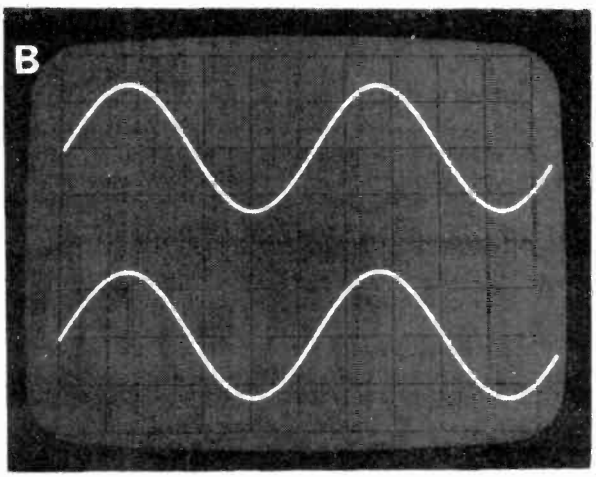


Fig. 5: Output of 22W per channel into 4Ω speakers. Again, 20V taps on transformer.

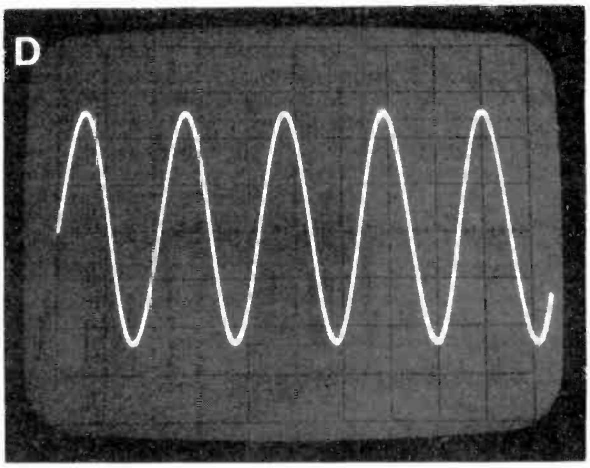


Fig. 7: Output from one channel providing 40W into an 8Ω speaker using 25V taps on mains transformer.

inputs. Simply by replacing the original transformer with a toroidal version, the amplifier will comfortably deliver 20W continuously into 8 ohm loads or 22W+22W into 4 ohm loads. No other circuit changes are necessary except that the two 2A fuses in the supply lines should be increased to 3A rating. The oscillograms in Figs. 4 and 5 show that there is no clipping under these maximum output conditions.

If it is wished to increase the output power substantially then the 25V secondary taps can be used. It then becomes necessary to change the output transistors, Tr4 and Tr5, since the breakdown voltage, V_{CEO}, for the TIP41A and TIP42A is only 60V. The DC rail voltage under quiescent conditions is now ±37V. It is therefore quite possible that the breakdown voltage of the transistors will be exceeded and although there is a chance that they will stand it, it is far wiser to be on the safe side and replace them with TIP41B and TIP42B respectively. These have a breakdown voltage of 80V. It is not necessary to change any other components.

Oscillogram, Fig. 6, shows the clean output of the amplifier, with the higher voltage rails, delivering a continuous sine wave power of 28W+28W in 8 ohm loads. Probably of more significance is the oscillogram shown in Fig. 7 which shows a continuous sine wave power of 40W being delivered to an 8 ohm load. The amplifier will, in fact, give an instantaneous power of about 100W on transient inputs. The effect of this, for normal music listening, is that peaks sound extremely clean. My record of Beethoven's Ninth suddenly seemed much better, and all the time I have been blaming it on the recording company!

In order to maintain these higher powers it now becomes highly advisable to add an extra heat sink. For this I have used a short length of Redpoint M-type Powersink. Unfortunately this is just too wide to fit in between the sockets on the back of the Texan without some modification. One fin section has therefore been sawn off each side of heatsink reducing its size to $3\frac{1}{4} \times 1\frac{3}{4}$in. It can then be drilled and tapped to take the 6BA screws which hold the original heat sink assembly together.

Alternatively it might prove easier to use separate countersunk screws to hold the transistor mounting plate and the heatsink independently on to the back panel of the amplifier. In this case all the screw heads will be "blind" being sandwiched between the parts of the assembly. The screws should therefore be inserted and held in place with a touch of Durofix until they can be tightened up with the nuts, Fig. 8. Although this is rather tricky it does avoid a slight

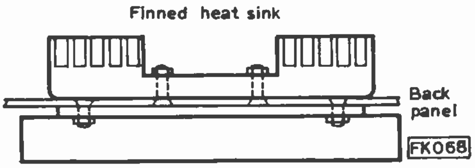


Fig. 8: Suggested method of fixing new heatsink.

"bodge" which is needed to work the screws between the fins of the Redpoint Powersink. Whichever method is used a smear of heat sink compound should be placed on the adjoining surfaces.

TAPE MONITOR

The tape monitor facility is very simple to add from a circuit point of view but it requires rather more care to add mechanically. The function of the tape monitor is to provide a means of breaking the amplifier between the equalization stage and the tone control stage so that a tape recorder with separate record and replay functions can be inserted to "fill the gap". This allows a recording to be made off a disc, for example, using the correct equalization in the first stage. The remainder of the amplifier can then be used to amplify the tape recorder output so that a direct comparison can be made between input and recorded signals.

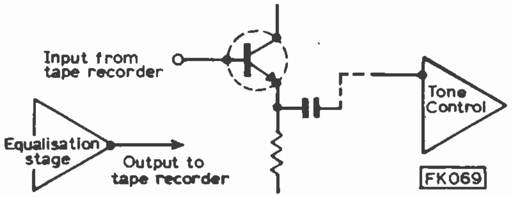


Fig. 9: Emitter-follower buffer stages must be introduced for the tape monitor facility.

The tone control stage in the Texan must be driven from a low impedance source so it is necessary to buffer the tape monitor inputs with a pair of emitter-followers as shown in Fig. 9. This modification can be incorporated by wiring the extra transistors across the back of the Auxiliary Input socket and putting a small switch on the back panel. A neater alternative is to make use of the Mono/Stereo switch. Although it is normal to have this facility on a stereo amplifier I have found that it is very seldom used in practice. Since the switch unit S2 is a 2-pole changeover type it is ideal for its new role.

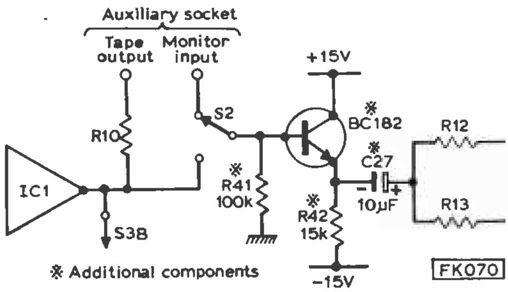


Fig. 10: Circuit of one of the buffer stages.

★ components list

Resistors
R39/139 2·2kΩ R41/141 100kΩ
R40/140 2·2kΩ R42/142 15kΩ
All resistors 10% ¼W carbon film

Capacitors
C24/124 33pF polystyrene
C25/125 33pF polystyrene
C26/126 33pF polystyrene
C27/127 10μF tantalum bead

Transistors
BC182 TIP41B TIP42B 2 off each type

Heatsink
Redpoint M type modified, see text, or similar.
83 x 44mm (3¼ x 1¾in.)

Transformer
Toroidal transformer Type T1295 available from SIGA Electronics Ltd., Sunderland Road, Sandy, Bedfordshire SG19 1QY for £8·88 inc. VAT and p/p.

In the high power version the fuses should be 3A rather than 2A.

The actual circuit modifications are shown in Fig. 10. Resistor R111 is no longer necessary and can be removed from the PCB, making room for the new components. The circuit track connecting to S2 is removed. The easiest way to do this is to cut the track with a sharp razor blade at the ends of the unwanted section and then heat the track with a fine soldering iron so that it can be peeled off with a pair of tweezers. The board should then be drilled very carefully as shown in Fig. 11 and the extra components wired in position. It is, unfortunately, necessary to use a few wire links in order to complete the modification but they fit in quite neatly as shown.

The input connection to the Monitor switch can be made using the existing length of twin screened

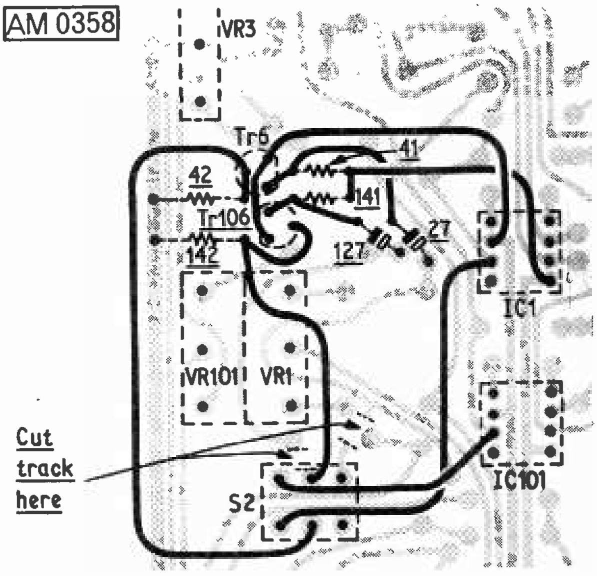
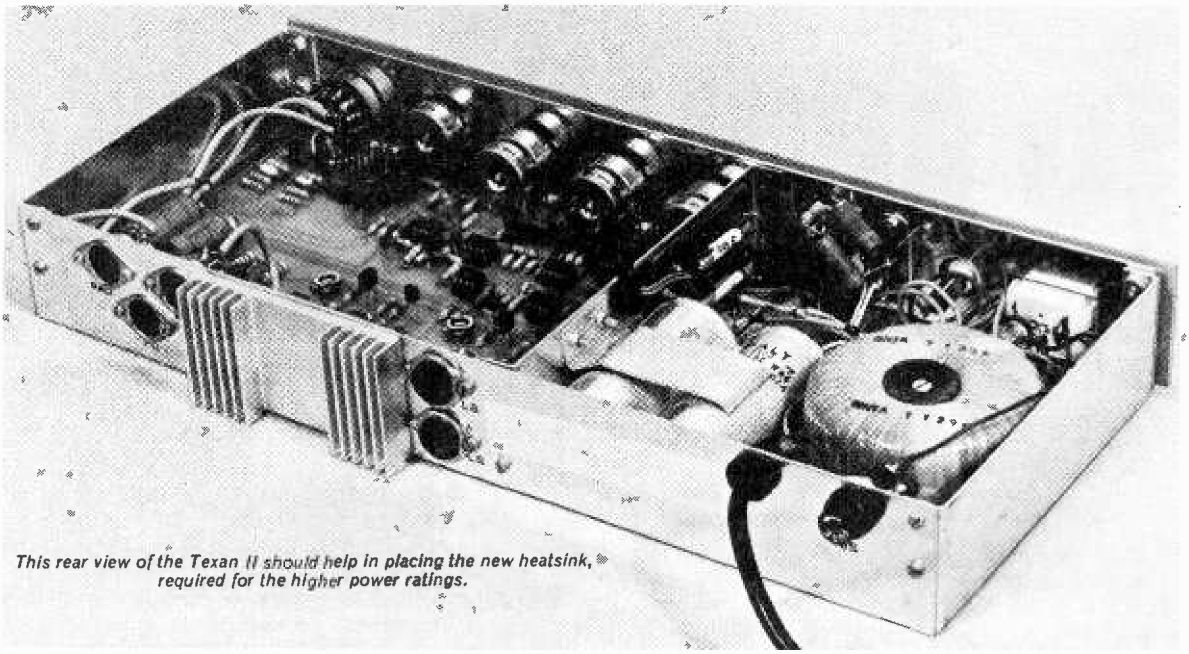


Fig. 11: Area of PCB affected by tape monitor modifications. See also Fig. 3.



This rear view of the Texan II should help in placing the new heatsink, required for the higher power ratings.

cable which normally runs between the AUXILIARY DIN-socket and the AUX. position of S3. In the photograph this wire is shown running underneath the PCB, however it can just as easily be run over the top with the connections being made to the upper leads on S2. The unused contacts on S3 can be left open or, more usefully, can be shorted across to the RADIO contacts so that two different sensitivities could be selected for one source by switching from RADIO to AUX. at the front panel.

Another rather fortuitous point is that the "O" of "MONO" on the front panel can be removed with a little delicate surgery leaving an appropriate "MON" for "monitor".

Adding this tape monitor modification gives an extra advantage in that it AC couples the equalisation stage to the tone control stage. On reflection I think I was rather over-anxious to reduce the number of capacitors in the Texan to an absolute minimum. The result of DC coupling between these two stages is that the DC gain of the tone control stage becomes dependent on the setting of the bass control. Thus, if there is a small offset voltage at the output of IC1 this will be amplified by the following stage. If the bass control is then moved rapidly there can be a rather disconcerting plop in the loudspeakers. If your Texan suffers from this it is well worth while to insert a 10μF capacitor between R11 and the junction of R12 and R13 even if you do not wish to add the tape monitor facility itself.

IN CONCLUSION

I hope that the modifications suggested above will provide the answers to the majority of constructors' problems. They are not very dramatic but, as I said earlier, to do much more would be to change the concept of the Texan's value-for-money design. In spite of the odd bits of "knocking copy" that have since appeared I still think it was quite a good concept. It is clear that the changes can be made singly or collectively according to how much time and money the constructor wants to spend.

To those people who have blown up several sets of output transistors, there is little I can offer but my sympathy. If the specified devices are used it is extremely unlikely that they will have been faulty themselves. However, they are connected across a beefy power supply with no form of current limiting in series with them. Any circuit fault which causes both transistors to turn on at the same time, even momentarily, will almost certainly cause them to blow. It is therefore **vital** to ensure that the greatest care is taken when soldering the output stage components. There is always a reason why things go wrong no matter how sure the unlucky constructor may be that "it just happened." Furthermore, one disaster may well cause a degradation of another component, so if you have an accident make sure you remove and check all the devices before throwing away another good set of power transistors. All the transistors can be checked adequately with an Avo and ICs can be checked by swopping around. If IC3 or IC10 is removed, protect the output devices by breaking the set-up link in the emitter of Tr4 or Tr104 respectively. Finally, if you do not have a fine soldering iron or do not know how to use it, buy one and practice. I have seen some of the plumbing jobs that have been perpetrated! You don't know whether to laugh or cry!

Editorial Note—The author has also supplied some technical information on disc equalisation. Interested readers can obtain a copy of this by forwarding a self-addressed stamped envelope to PW marking the outside of the covering envelope "Texan II." No other correspondence should be enclosed.

Reprints of the original series of articles on the Texan can still be obtained from PW for 40p inc. p/p. Make out cheques/postal orders to IPC Magazines Ltd. and mark covering envelope "Texan Reprint."

PW APOLLO series Part 3

VARICAP AM/FM STEREO TUNER

W. POEL*

IN THIS, the third part of the Apollo series, we will look at the way varicap diodes can be used in an AM/FM system to give simple frequency control using a single long-throw slider potentiometer.

The complete tuner offers a specification compatible with most hi-fi systems, yet it is built from a series of AM/FM modules which are simply interconnected on a base board. This method of construction does away with the uncertainties of various pieces of wire trailing around the chassis and allows the constructor to use ready-built modules for sections such as the FM IF strip which otherwise may be considered beyond one's resources to test and align.

THE COMPLETE SYSTEM

The theme of the Apollo series is the "all-electric wireless" so do not be surprised to find that varicaps abound in all the signal frequency tuned circuits. The tuning is accomplished by means of the long slider pot and the cursor gives direct scale readout. Fig. 3.1 shows a block diagram of the complete unit.

For the front end of the FM section the new Toko EC3302 varicap tunerhead was chosen since it offers a low-cost combination of performance and varicap tuning together with an a.f.c. system that is directly compatible with the output of the IF detector.

The importance of compatibility should not be overlooked since methods of a.f.c. vary considerably and the system used in the LP1186 for example does not suit a quadrature detection system such as that used by the KB4402 IF IC.

The input stage to the tunerhead is an FET with facilities for either 300 or 75 ohm aerials. The mixer stage then feeds the IF signal at 10·7MHz into the IF amplifier block with the local oscillator functioning at the signal frequency plus 10·7MHz in accordance with usual superhet techniques.

The IF amplifier (Fig. 3.2) is worthy of note since it employs two linear phase filters rather than the popular ceramic filters, giving good selectivity at 10·7MHz.

* Ambit International

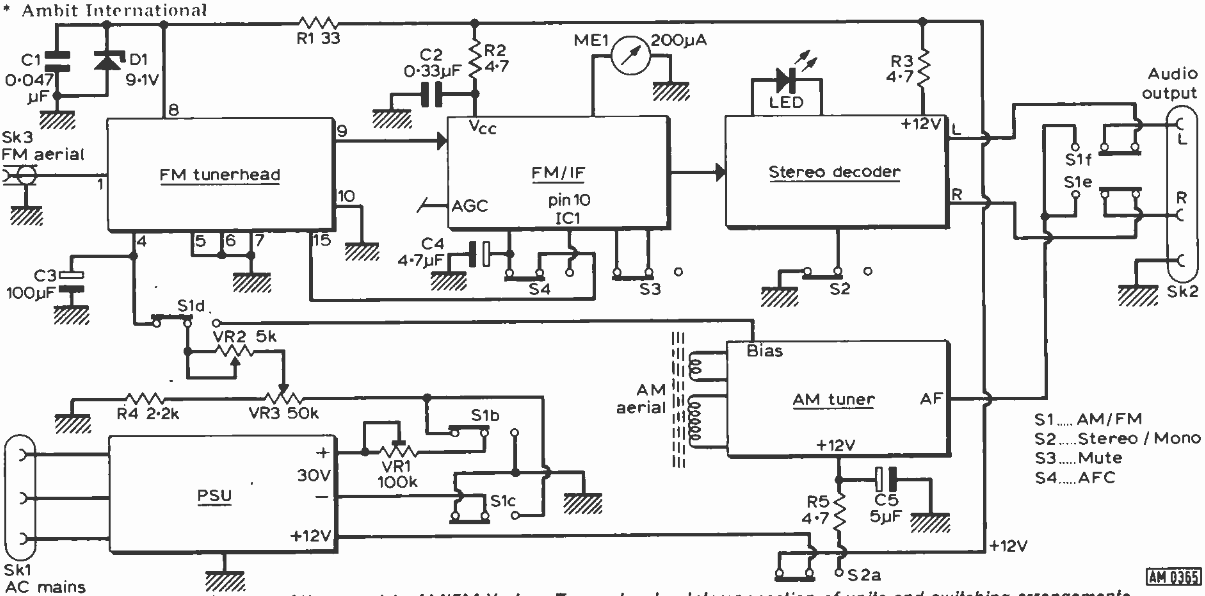


Fig. 3.1: Block diagram of the complete AM/FM Varicap Tuner showing interconnection of units and switching arrangements.

★ components list

FM TUNERHEAD

Toko EC3302U (Ambit)

FM IF MODULE

Resistors

R1	330Ω	R9	10kΩ
R2	470Ω	R10	18kΩ
R3	2·2kΩ	R11	33kΩ
R4	56Ω	R12	4·7kΩ
R5	2·2kΩ	R13	2·7kΩ
R6	120kΩ	R14	4·7kΩ
R7	330Ω	R15	4·7kΩ
R8	470Ω		

All ¼W ±5% carbon
VR1 470kΩ skeleton preset

Capacitors

C1	0·01μF	C7	0·01μF
C2	0·01μF	C8	0·01μF
C3	0·022μF	C9	0·01μF
C4	0·01μF	C10	0·01μF
C5	0·022μF	C11	0·01μF
C6	0·22μF		

Inductors

F1, F2 Toko BBR3125N Linear phase filter (2 off)
L1 Toko TKACS 34342/3 double tuned detector
L2 22μH choke

Semiconductors

Tr1 BF274
IC1 CA3089E or TDA1200

STEREO DECODER MODULE

Resistors

R1	18kΩ	R4	3·9kΩ
R2	1kΩ	R5	390Ω
R3	3·9kΩ		

All ¼W ±5% carbon
VR1 5kΩ skeleton preset

Capacitors

C1	470pF	C7	0·25μF
C2	0·25μF	C8	2μF 16V
C3	0·5μF	C9	10μF 25V
C4	0·05μF	C10	10μF 25V
C5	0·02μF	C11	0·047μF
C6	0·02μF		

Filter

F1 Toko BLR3107N pilot tone filter

Integrated Circuit and LED

IC1 KB4400 (or MC1310P, CA1310E, SN76115N)
D1 TIL209 or similar

AM TUNER MODULE

Resistors

R1	47Ω	R5	100kΩ
R2	330Ω	R6	33kΩ
R3	100kΩ	R7	200kΩ
R4	100kΩ	R8	1kΩ
All ¼W ±5%		R9	2·2kΩ

Capacitors

C1	1500pF	C10	0·047μF
C2	10μF 25V	C11	10μF 16V
C3	10μF 25V	C12	0·1μF
C4	1500pF	C13	0·1μF
C5	10μF 16V	C14	0·47μF 35V tantalum
C6	0·1μF	C15	4700pF
C7	56pF	C16	4700pF
C8	330pF	C17	4μF 40V
C9	0·47μF 35V tantalum		

TC1, TC2 5 to 25pF miniature trimmer (2 off)

Inductors

T1 Toko 6A6371
T2 Toko 6A6372
IFT1 Toko YHCS11100AC2
CF1 Toko CFU050D
L1 Ferrite rod aerial (see text)

Semiconductors

D1 1N4148
IC1 LM1820N (or CA3123E, μA720, NE546)
IC2 MVAM1

POWER SUPPLY

Resistors

R1 100Ω 1W
R2 4·7Ω ½W
VR1 100kΩ skeleton preset
VR2 5kΩ linear carbon
VR3 50kΩ linear 150mm slider (Rivlin WS150)

Capacitors

C1, C2 100μF 25V (2 off)
C3, C5 1000μF 25V
C4 470μF 40V
C6–C8 0·1μF (4 off)

Semiconductors

D1, D2 1N4148 (2 off)
D3–D6 1N4001 (4 off)
D7 9·1V 400mW Zener
IC1 78L12
IC2 MC7818CP

Miscellaneous

T1 Mains primary, 0-20V 0-20V 6VA secondary
LP1 Mains neon indicator

MISCELLANEOUS

Resistors

R1 33Ω
R2, R3 4·7Ω
R4 2·2kΩ
R5 4·7Ω

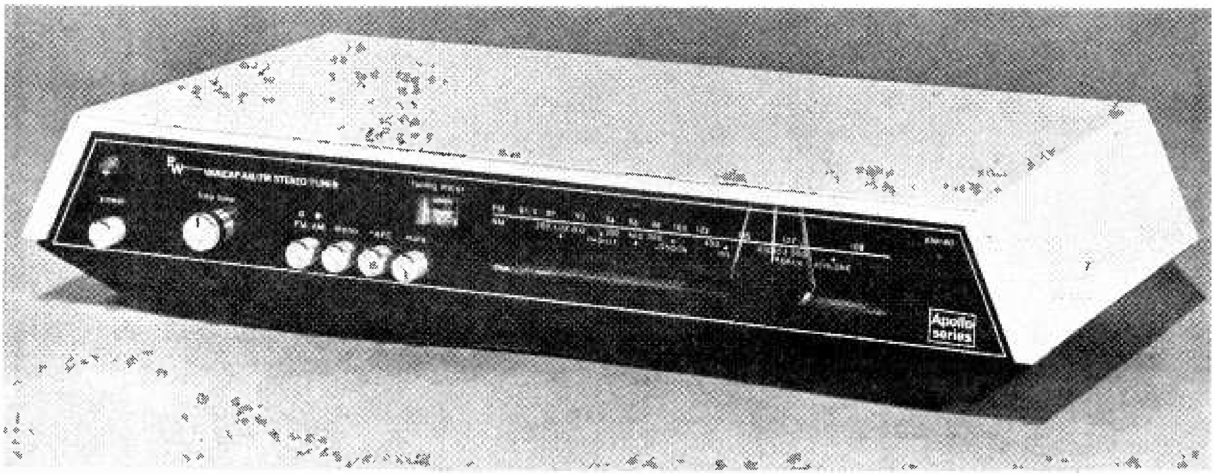
Capacitors

C1 0·047μF
C2 0·33μF
C3 100μF 10V
C4 4·7μF 16V
C5 5μF 16V

Switches, etc

S1–S4 4-way pushbutton unit (6 pole c/o + 2 pole c/o + 2 pole c/o + 2 pole c/o, non-interlocking)
S5 Mains on/off pushbutton
ME1 200μA f.s.d. edgewise meter
Case approximately 400 x 220 x 75mm (16 x 8½ x 3in)
Escutcheon
Printed circuit boards, coaxial cable, twin screened cable
Sk1 Mains input socket
Sk2 5 pin 180° DIN
Sk3 Coaxial socket
D1 7·5V Zener

Complete kits including case and escutcheon are available from T.T.S. Ltd., 7 West Road, Westcliff-on-Sea, Essex. Kits for FM/IF, stereo decoder and AM modules are available from Ambit International. Order numbers are 91200, 91310 and 9720 respectively.



Linear phase filters have certain advantages over the ceramic types and they may be summarised as follows:

Lower intermodulation distortion;

Being LC the temperature stability is better;

The out-of-band attenuation is superior. This means that whereas some of the signal from the local oscillator may leak through ceramic filters from the front end it will be very much more severely attenuated in this eight-stage filter.

Experience has shown that the susceptibility of the IF amplifier device to local oscillator leakage is unpredictable: some chips may not be affected at all whilst others suffer severe muting as a result of instability induced by this leakage signal.

TRANSISTOR STAGE

The transistor gain stage compensates for the loss caused by the two filters and then feeds the IC with a suitably tailored 10·7MHz signal for amplification, limiting, detection and muting.

Much has already been said about the CA3089E, but the other versions (e.g., Kyodo's KB4402, SGS's TDA1200 and Hitachi's HA1137W) all seem to perform similarly except for the muting function. Although there is a preset on the board to set the threshold of muting, the muting variability of different devices leads to problems in predicting the exact effect that any sample will provide.

Most devices tried to date have offered a quite acceptable level of muting and some are quite faultless.

The meter drive facility is fed to the panel meter to provide a guide to fine tuning. Although a facility exists for centre-zero tuning meters it is not necessary unless one is after a tuner that resembles a Concorde flight deck rather than a means of reproducing euphonic sounds.

QUADRATURE DETECTOR

The quadrature detector of the IC is quite simple but can pose problems in alignment where the double

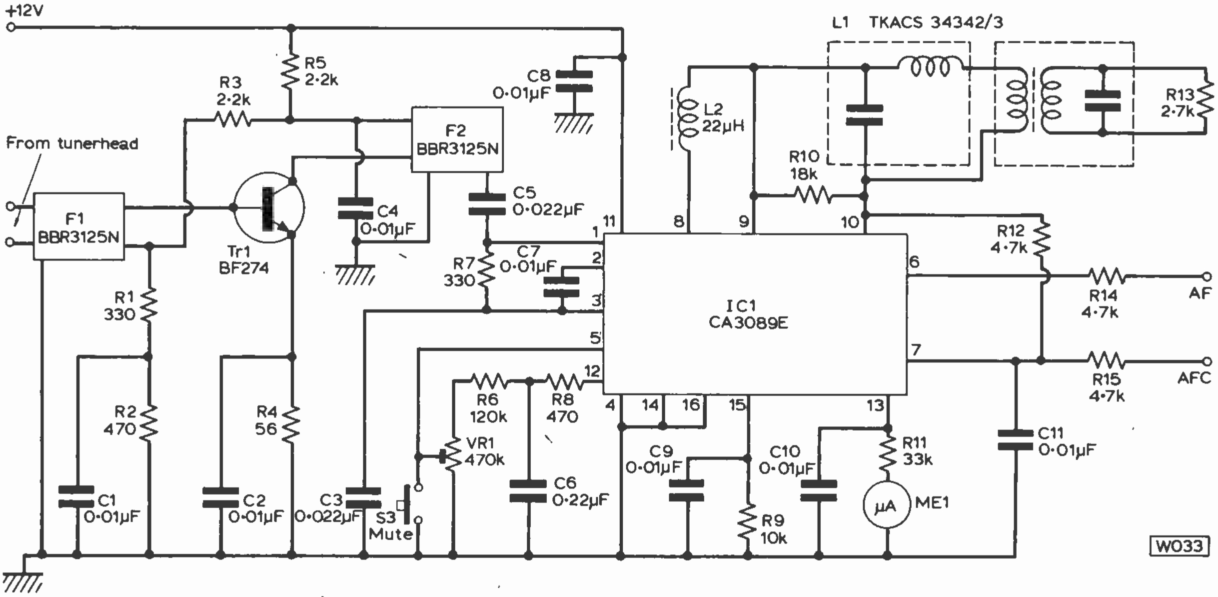


Fig. 3.2: Circuit diagram on the FM/IF section of the tuner. This unit takes its input from the tunerhead.

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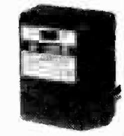

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0–100 micro A.	580	0–100 micro A.	730
0–500 micro A.	170	0–500 micro A.	200
0–1 mA	170	0–1 mA	200
0–5 mA	170	0–5 mA	200
0–10 mA	6	0–10 mA	6
0–50 mA	0·5	0–50 mA	0·5
0–100 mA	0·5	0–100 mA	0·5
0–500 mA	0·5	0–500 mA	0·5
0–1 AMP	0·5	0–1 AMP	0·5
0–2 AMP	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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VA (watts)	Ref No.	Price Cased £	Price Plugs 2 Pin + 1 Earth	Price Open £	Post £
60	149	8·35	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	78·15	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	9·67	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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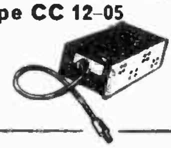

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poly-planar

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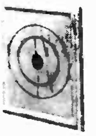

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tuned detector coil option is chosen. It operates by simply mixing the original FM signal and an out-of-phase portion so that the original AM results. A single tuned coil can be aligned by a meter but a double tuned coil can only be set up accurately with aid of a wobbulator to observe the characteristics of the "S" curve while the adjustment is carried out.

A single tuned detector will give 0·5% total harmonic distortion though in practice this is usually only 0·3% with standard broadcast levels. The double tuned circuit gives 0·1% THD when accurately set up. In practice this figure can again be improved to around 0·08% which is rather better than most FM tuners costing over £100 claim in their specification.

Layout is everything with the CA3089E IF amplifier. Deviate from the suggested circuit at your peril since instability can easily be introduced, not easily traced and cured only by revising the track layout until it ceases.

STEREO DECODER

From the detector the audio passes through the mute gate to the stereo decoder (Fig. 3.3). The Kyodo KB4400 (equivalent to the MC1310P) performs the task of decoding a multiplex signal and producing the two discrete channels for power amplification.

Since the various switching signals tend to produce a series of unpleasant waveforms together with the pilot tone at 19kHz and the 38kHz regenerated signal, trouble is removed at source with the Toko pilot tone filter on the module. The block contains two notches: one at 19kHz and one at 38kHz, plus a low-pass filter with a roll-off commencing at 15kHz which is the upper limit of the multiplex bandwidth. When correctly matched only 1dB will be lost at 15kHz which is not likely to spoil listening enjoyment. If allowed through unattenuated the pilot tone and the residual hash could cause amplifier problems of intermodulation and high frequency instability.

Facilities are provided to switch out the muting and to manually defeat the operation of the stereo decoder. On weak stereo signals intermittent operation of the stereo decoder will cause annoyance if left in the automatic mode.

On switching to AM the same power supply is used for the tuning voltage but it is switched to positive earth system to account for the different orientation of the AM tuning diode block.

The 12V supply is fed to the AM module. Operation of this particular unit has been extensively covered on Part 1 of this series. The quality of the AM section is truly excellent providing a very tolerable partner to the FM section. The purity of the oscillator waveform is good and this results in little interstation noise when tuning the medium wave.

POWER SUPPLY

Two windings are required for the secondary of the transformer to accommodate the different earth requirements for the AM tuning voltage from the rest of the equipment. Rectification is carried out in conventional fashion but the stabilisation and smoothing make use of one of the popular 78 series three terminal regulator ICs. Fig. 3.4 shows the power supply circuit diagram.

The Marconi International Marine Co. Ltd., of Chelmsford, has asked us to point out that there is no connection between the Apollo SSB/General Purposes marine communication receiver manufactured by that company and any receiver described by us in our current Apollo series of articles.

TO BE CONCLUDED

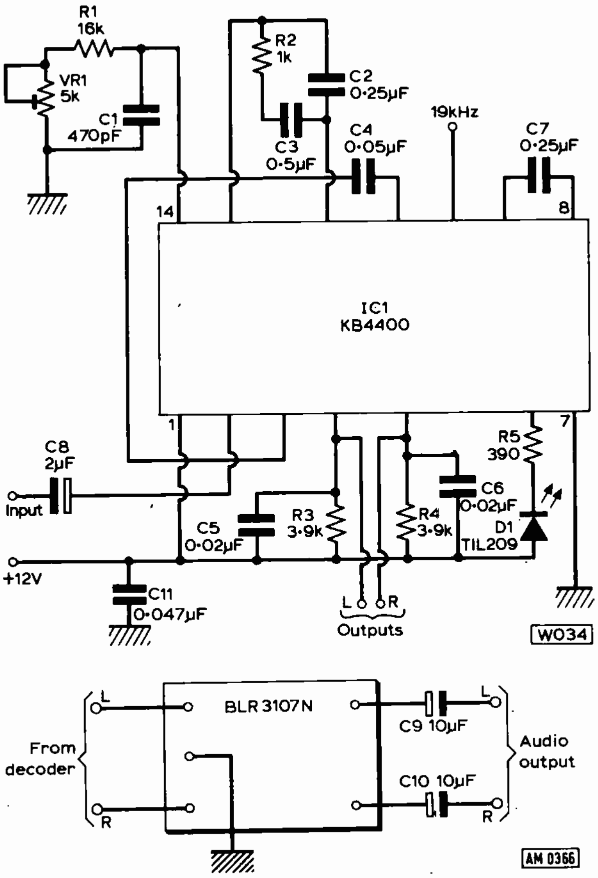


Fig. 3.3: Circuit diagram of the stereo decoder and pilot tone filter.

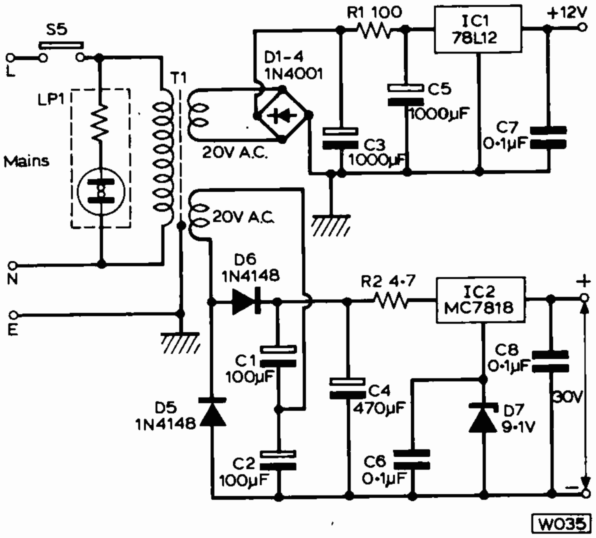


Fig. 3.4: Circuit diagram of the power supply section of the AM/FM Varicap Tuner.

Dear Sir, letters

Equally tempered or Just natural

In reply to P. G. Quatermain (Letters, P.W. May 1975) may I offer one reason why purists might wince at the idea of an organ tuned to the equally tempered scale?

As Mr. Quatermain points out, notes tuned to the equally tempered scale will sound at a slightly different frequency to those of the Natural or Just scale and he correctly observes that within an octave, these tiny errors will not be noticed. However, the Just scale represents the ratios of frequencies which sound most pleasing to the human ear, so the slight errors which arise through equal temperment are in fact small dissonances; if there were circumstances under which these errors could add, a discordant note might result.

Alan Douglas suggests (Electronic Music Production, Pitman 1973, p 31) that when dealing with pure sine waves, results become dubious after adding waves corresponding to a fundamental and its sixth harmonic. If we are adding complex waves, each with its own harmonic series, the chances of discord are more likely. In the case of the "Easybuild" organ with its limited footages and stop-circuits tending to suppress high harmonics, this problem is likely to be negligible, but when considering a large electronic or pipe-organ, the possibility of discord is very real. Thus intervals are "stretched" away from equal temperament to tune out dissonances the rule being to reconcile purity of the octaves with a concordant sound. It is in these circumstances that the skill of an experienced organ tuner really counts.

The fact that notes generated by frequency-division cannot be "stretched" has precluded its use in large electronic organs designed for classical or church use. Examination of these instruments reveal that they usually use individually tuned oscillators, for example the Miller Organ, or alternatively pipe organ sounds are somehow recorded, stored and retrieved electronically. The latter system has been brought to a high degree of perfection in the Allen Computer Organ which uses LSI devices to store digitally encoded pipe organ tones.

Nonetheless, now that CMOS frequency dividers and generators are available, construction of a small organ is at last a practical reality even for the beginner in electronics, and Mike Hughes deserves thanks for his clear and thoughtful instructions on the subject.—**Thomas Weil** (Croydon).

Ouch^n!

The letter from Mr. Rix in the May issue has given me the final prod to write a letter. I have wanted to write for quite some time on the subject of the misuse of certain of the symbols used for the metric system multipliers, namely 'k' and 'm'. As we should all know there is no upper case K used at all, only the lower case k meaning ×1,000. With the M both upper and lower case are in use with the upper case M meaning ×1,000,000, and the lower case m meaning ×1/1,000, respective names are mega and milli.

In a single page advertisement appearing in P.W. one regular advertiser used upper case K no less than 21 times in lieu of lower case k.

In addition we were offered the following interesting items:

Grid Dip Meter—to 280 millihertz
A.C. millivoltmeter—to 1.2 millihertz
R.F. Generator—to 500 millihertz
Portable Radio, MW/LW—600 megawatt output (Rather whacks Mr. Rix!)
L.F. Generator—to 1 millihertz
VHF timer—120-160 millihertz
P.S.U. 6-9V—300 megamps.

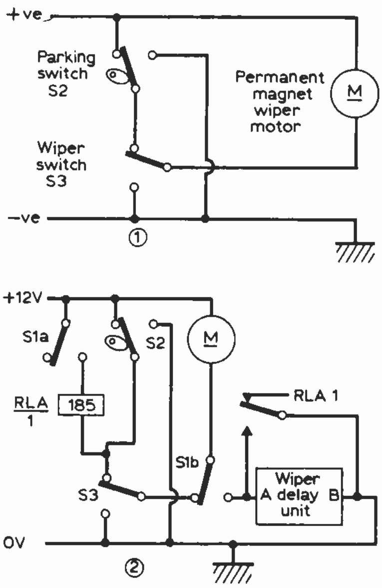
In the current issue, however, things have improved somewhat, as we have K in place of k only eight times.

Turning now to Mr. Quartermain's letter (also of the May issue) there are two numerical misprints in the third paragraph. Line five should surely read the ratio is 1:1·0594 while line seven should read $1\cdot0594^{12}=2$.—**James Livie** (Heston).

Car wiper delay modification

With reference to the car wiper delay unit as featured in the May issue of *Practical Wireless*, I wish to point out that during the last few years permanent wiper motors have been fitted to many cars. These motors are wired up as shown in Fig. 1.

As there were no details in the article concerning fitting the delay unit to this type of motor, I decided to devise a method of my own. The only extra components needed were a miniature relay (12V 185ohm coil) with two pairs of changeover contacts, wired in parallel, and a DPDT switch in place of the one specified, Fig. 2. I find this arrangement works very well and I hope that it will be helpful to other readers.—**Colin Robertson** (*King's Langley, Herts*).



All switches and relay contacts shown in the "off" position. W032

Fig. 1: above, shows the circuit of a permanent magnet car wiper motor, while Fig. 2 shows the connections necessary for the May PW wiper control to be used with this type of motor.

HOTLINES ON RECENT DEVELOPMENTS

ORGAN CHIP

MUSIC lovers and electronic organ tyros can rejoice at the latest offering from Italian-based SGS-Ates, manufacturer of integrated circuits. One of its latest prodigies bears the innocent title of M251. It is claimed to be the first IC ever to integrate bass lines, chords and arpeggios.

You have to actually hear this tiny chip working to appreciate just what it will do. It plays the correct bass notes, the right chord and the right arpeggio accompaniment (if you want it) all in one go, automatically—and it changes key, too.

Having heard this wonder chip, I feel quite sure that organ players of the future will just whisper the tune into a loudspeaker and the organ will reply, "If you can 'um it mate, I'll play it".

D.I.L. SWITCHES

At the Paris Components Show earlier this year many people were exhibiting dual - in - line switches. These seem to be coming on to the market now and could be of use to the amateur constructor who specialises in miniature and sub-miniature projects.

Eight tiny single pole changeover switches can be accommodated in a single 16-pin DIL package with minute switch actuators brought out on top of the case and operated with a rocker action, or at the sides and operated using a slide action. How about a fixed inductance ferrite rod midget radio where you could just switch in (or out) various values of capacitance to tune the stations in?

CHOOSING 'Cs'

Ah, says you, getting exact values of capacitance isn't quite that simple. I can buy a 100pF capacitor, but what if I want an odd value to tune in some station exactly?

Well, you could try using a Vee Cal TrimChip capacitor. It's an adjustable capacitor but its fixed—if you see what I mean? These tiny chip capacitors have a series of minute adjustment points on their sides. By connecting these points in a variety of configurations, it is possible to vary the capacitive value of the fixed capacitor. The amount by which you can vary the capacitance of individual units ranges from 1pF to 20pF per increment. The components are manufactured to a nominal value. As an example, a capacitor with a base value of 100pF and with ten incremental adjustments can be set to any value between 100pF and 152pF. It can be done by rubbing the sides with a soft lead pencil—readers are left to draw their own conclusions!

Typical size of a Vee Cal TrimChip is 0·18in. long by 0·005in. wide. Experimental kits are available which consist of a selection of TrimChips, a metallic epoxy (for setting the final capacitance instead of using pencil), dispenser and a book of instructions.

GETTING TOUCHY

Another interesting new approach (in practical terms, the idea's been there for some time) was talk by one manufacturer/supplier to market touch-sensitive keyboards for things like electronic calculators. The keyboards are not, as I understand it, capacitive and they do need a very slight "push", however, the force is so small that they could be fairly described as touch sensitive.

The touch causes the plastic film itself to move less than four thousandths of an inch and this is sufficient to cause a switching effect since the plastic film back is metallised. The open circuit resistance is around the 10MΩ mark and claims have been made that the contact resistance is only 0·1Ω. A touching story.

ELECTRONIC PATTERNS

When was the last time you bought yourself a decent dress? (So, why shouldn't lady electronics/radio enthusiasts read Ginsberg?). Think of the processes involved in making a double-knit pattern. Sketches through to finished product. A long business.

Not anymore, though. An Israeli company has brought out a machine which seems to do it all in no time. The designer sits comfortably at the console with a colour display. Here, the sketch can be "sketched" and colour varied and/or altered until they suit. The input of the whole system relies for its nourishment on an input of nice fresh sketches. It promptly converts these into a digital code. Needless to say there's a computer hidden in the system somewhere which assures that everything happens in the right order.

The system takes only one hour to change a sketch into colour separations and that used to take 150-200 hours before. (The system can also be used to do wallpaper patterns).

KNITTING LIBRARY

How does it automate things still further? Well, the output, in the case of a double-knit pattern, is simply fed to the knitting machines. A "library" of 999 colours is held in the system which gives quite a choice. Ah well—Ginsberg's going to miss his old spinning wheel.

MINI HENRYS

Earlier, we looked at some variable chip capacitors. I see that some miniature variable inductors are now on the US market. There's 37 standard values in the range which goes from 0·001μH up to 1,000μH—but they're variable, too! A minute threaded core allows a 20% variation from nominal value. But there's still more to come—the size. Each unit measures an almost unbelievable 0·15in. x 0·2in. with a height of 0·16in. It looks as though tweezers and a magnifying glass will become a standard part of the constructor's tool box.

NEW OP AMP

I was interested to hear of the new CA3130 op amp which manufacturers RCA put out. It is an interesting beasty because it combines MOS/FET, bipolar and COS/MOS. The input resistance is $1{\cdot}5 \times 10^{12}\Omega$ or 1·5TΩ, and the signal voltage gain is 110dB.

Ginsberg

SPECIAL PRODUCT REPORT

HEATHKIT GR-78

GENERAL COVERAGE RECEIVER

THE GR78 is basically a portable receiver for the short wave listener and radio amateur although the medium and part of our long wave band are included. The LW band is particularly useful now that the BBC has taken it into its head to broadcast many sports commentaries on this band only!

One of many interesting features of the set is the provision in the kit of two bandspread scales, one for the amateur bands and the other for the short wave broadcast bands, the constructor using the one of his choice. Since most SWL's eventually turn to the amateur bands in the course of time so the scale could be changed accordingly.

If the idea of a portable receiver conjures up thoughts of piles of dead expensive batteries, forget it! The GR78 has an internal nickel-cadmium battery which is automatically charged from the mains when the set is plugged in but switched OFF, or from an external 12 to 15V DC supply if that is all that is available. The internal battery can be expected to maintain a full charge even if it is used for as much as eight hours daily at average listening levels. No need to worry about overcharging either, since the set can be left plugged into the mains but switched off for as long as a month without the trickle charge facility damaging the battery. A spring-loaded switch on the dial lights helps to reduce the load on the battery.

CIRCUIT DETAILS

The internal telescopic aerial, or external aerial, feeds into a 40673 mosfet RF amplifier stage which has its own gain control. Another 40673 is used in the first mixer which derives its injection voltage from an MPF105 Hartley oscillator operating on signal frequency plus 455kHz on Bands A, B, C and D and minus the IF on Band E. On Band F it operates at 4034kHz higher than the signal frequency when it feeds into a second mixer stage, again using a 40673. The 2N3694 conversion oscillator is crystal controlled on 3579kHz also feeding into the second mixer stage, the output of which is again 455kHz, the IF on the lower frequency bands.

The double IF of 455 and 4034kHz on Band F is designed to reduce the interference from images which can be very troublesome on the higher frequencies when a single IF of 455kHz is used. The change from single to double conversion is achieved automatically with the band switching.

The output of the second mixer IF stage is fed to four 455kHz ceramic filters, eliminating any need for IF alignment. Two 2N3694 IF amplifier stages feed into a 40673 product detector for SSB and CW, another 2N3694 being used in the BFO. On AM a simple diode detector circuit is employed. A portion of the IF signal is fed to an AGC amplifier stage providing two control voltages, for the RF amplifier and the first IF amplifier.

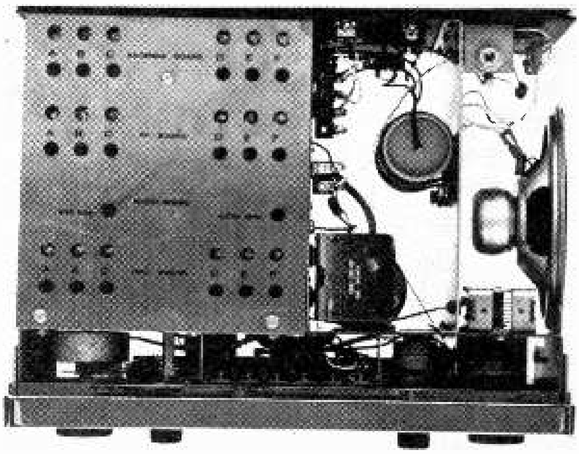
The audio from the PD can be fed direct to the 2N3393 audio pre-amplifier or via a simple automatic noise limiter stage. Another stage of audio precedes the 2N2430/31 complementary pair output stage, feeding either the internal speaker or headphones. The relative signal strength meter is part of the first IF amplifier circuit and is operated by the AGC line voltage.

Instant calibration checks are obtainable from a 500kHz crystal calibrator using a 2N3393, the output being fed into the aerial input circuits.

CONSTRUCTION

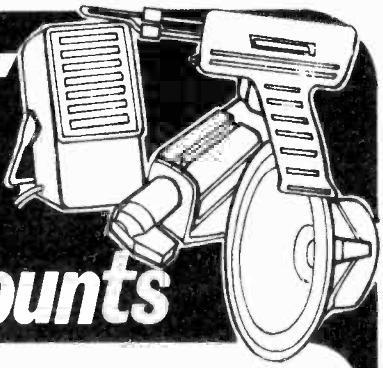
Construction is considerably simplified by the use of six boards; one main board for the power supply and certain auxiliary components, a receiver board for the IF stages, etc. and four switch boards for the aerial, RF, mixer and oscillator stages. The only point of criticism is that holes on the switch boards had to be slightly enlarged to take some of the switch tags but this did not take very long to perform.

Installation of the boards and chassis construction proceeds logically with even the smallest nut and bolt being specified as it is used. There is a line sketch of every item used, down to washers, and this is very helpful, even to the experienced constructor, when faced with a shapeless two-lead blob that turns out to be a 300μH inductor! Where possible components are marked with their part number.



The plate covering the RF and oscillator boards is clearly marked for easy alignment. The capacitor-like object to the left of the speaker is the nickel-cadmium battery.

'BIG' Discounts



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ACY17	28p	BF182	33p	2N916	24p	2N3614	60p	40315	32p
ACY20	19p	BF183	33p	2N918	30p	2N3615	63p	40316	48p
ACY21	20p	BF185	20p	2N920	45p	2N3663	12p	40317	32p
ACY22	15p	BF195	20p	2N929	18p	2N3702	10p	40319	39p
ACY40	21p	BF200	31p	2N961	55p	2N3703	10p	40320	32p
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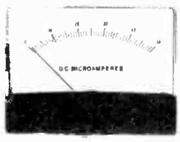
AD162	35p	BFX29	25p	2N1304	18p	2N3709	7p	Stud diodes	
AF114	13p	BFX38	30p	2N1305	23p	2N3710	11p	6 Amp	28p
AF117	13p	BFX87	28p	2N1306	23p	2N3711	11p	15p Am	45p
AF125	24p	BFX88	21p	2N1307	23p	2N3730	90p		
AF139	32p	BFY11	20p	2N1308	27p	2N3771	£1·10	Bridge Rectifiers	
AF178	49p	BFY18	47p	2N1309	27p	2N3773	£2·25		
BC107	10p	BFY19	54p	2N1671	90p	2N3791	£2·25	1A, 50V	24p
BC107B	10p	BFY50	19p	2N1671A	95p	2N3819	25p	2A, 600V	48p
BC108	10p	BFY51	19p	2N1671B	£1·00	2N3866	70p	4A, 200V	55p
BC109	10p	BFY64	33p	2N2217	21p	2N3903	14p	6A, 100V	65p
BC109B	11p	BFY90	72p	2N2218	20p	2N3904	14p		
BC113	18p	BSW70	15p	2N2220	18p	2N3905	15p	S.C.R.s	
BC114	14p	BSX26	22p	2N2297	27p	2N3906	15p	1/05	30p
BC115	13p	BSX67	26p	2N2303	75p	2N4061	12p	1/10	35p
BC116	13p	BY127	11p	2N2369	13p	2N5458	27p	1/20	40p
BC116A	14p	BU105	£1·00	2N2369A	15p	OA81	15p	16/400	80p
BC117	13p	MEF103	35p	2N2411	50p	OC20	£1·00	16/600	£1·20
BC118	10p	MJ480	75p	2N2646	44p	OC28	58p		
BC119	22p	MJ481	95p	2N2846	70p	OC29	50p	Triacs	
BC134	12p	MJ490	85p	2N2894	35p	OC35	48p	SC40D	£1·05
BC136	16p	MJE371	60p	2N2904A	45p	OC36	50p	SC45D	£1·30
BC137	16p	MJE2801		2N2905	22p	OC71	30p	SC45E	£1·45
BC138	16p		£1·15						
BC153	17p	MJE2955		2N2906	14p	OC83	20p	SC50D	£1·50
BC154	17p		£1·00	2N2906A	16p	OCP71	75p	I.C.s	
BC167B	12p	MJE3055	65p	2N2907A	16p	ZTX107	8p	741	25p
BC183L	10p	MPF102	30p	2N2925	14p	PL4005	10p	1310	£2·00

Mullard Hi-Stab ¼ watt resistors, 2½p each



4½in × 3½in **METER.** 30μA, 50μA or 100μA, **£3·85.** P. & P. 13p.

42 x 42mm METERS 100μA, 500μA, 1mA, 500mA **£2·76,** 11p P. & P.

60 x 45mm METERS 50μA, 100μA, 500μA and 1mA **VU METER £2·92,** 11p P. & P.

EDGEWISE METERS, 90mm x 34mm, 1mA **£3·40,** 13p P. & P.

TAPE RECORDER LEVEL METER

500μA, 80p

P. & P. 10p.

MULTI-METER

Model ITI-2

20,000 ohm/volt, **£6·90.**

P.&P. 16½p.

CARDIOID DYNAMIC MICROPHONE

Model UD-130. Frequency response 50–15,000c/s. Impedance Dual 50K and 600 ohms, **£7·40.** P. & P. 13p.

3 WATT STEREO AMPLIFIER

1¼W PER CHANNEL

£4·30. P. & P. 12½p.

All above prices include V.A.T. LARGE S.A.E. for List No. 12. Special prices for quantity quoted on request.

M. DZIUBAS

158 Bradshawgate · Bolton · Lancs. BL2 IBA

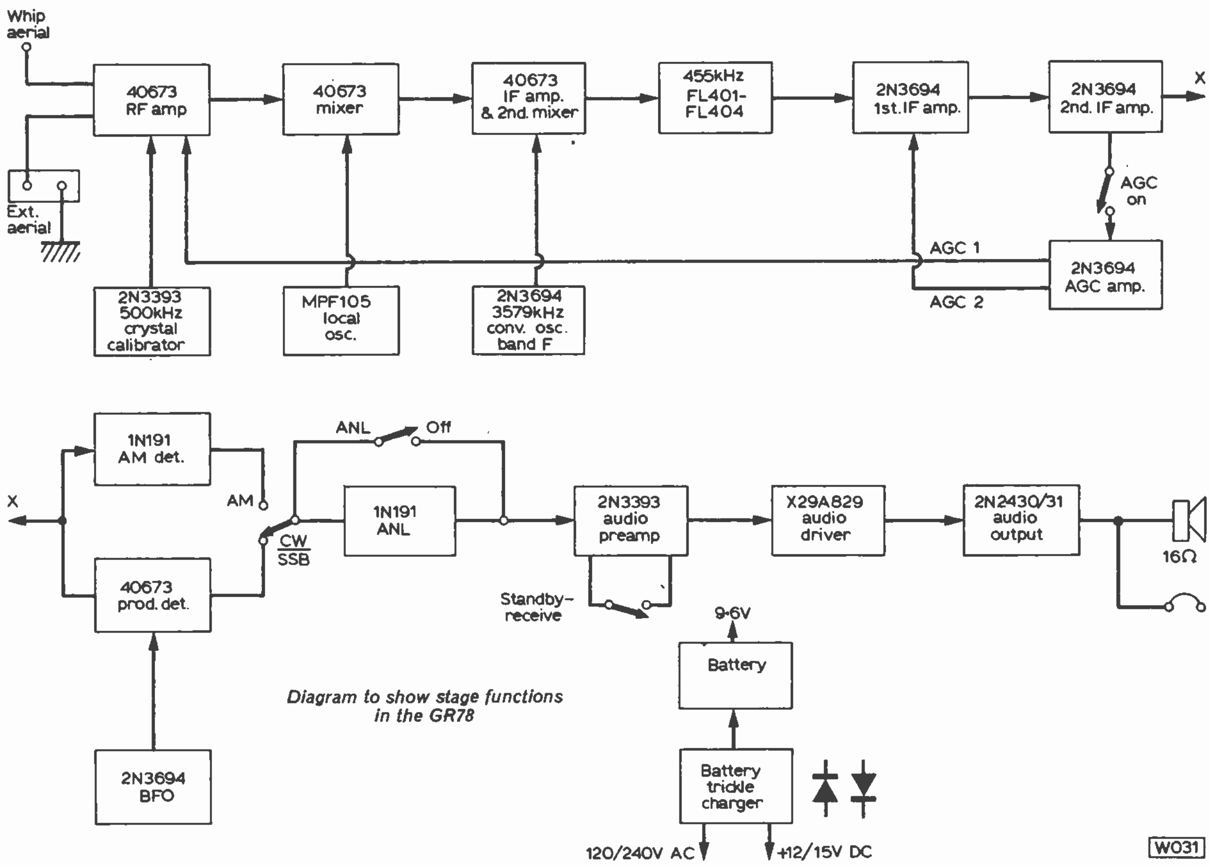


Diagram to show stage functions in the GR78

Frequency Coverage

Band A:	200kHz—400kHz
Band B:	550kHz—1300kHz
Band C:	1·3MHz—3·0MHz
Band D:	3·0MHz—7·5MHz
Band E:	7·5MHz—18·0MHz
Band F:	18·0MHz—30MHz

Sensitivity*	**AM**		**CW/SSB**	
	Low End	High End	Low End	High End
Band A:	10μv	3μv	6μv	2μv
Band B:	3	1	2	0·7
Band C:	3	0·6	1·5	0·4
Band D:	2	0·3	2	0·2
Band E:	3	0·2	3	0·2
Band F:	2	0·3	2	0·2

* Signal level for 10dB signal-plus-noise to noise ratio

Image Rejection

Band A:	65dB or more
Band B:	60dB or more
Band C:	48dB or more
Band D:	35dB or more
Band E:	25dB or more
Band F:	35dB or more

IF's Band A to E: 455kHz
Band F: 455kHz and 4034kHz

Selectivity 7±1kHz wide, 6dB down

Audio Output 300 milliwatts

Crystal Calibrator 500kHz

Meter Indicates relative signal strength

Panel Controls

Bandspread	AM-CW/SSB
AF Gain-Off	AVC-MVC
RF Gain	ANL-OFF
Panel light	Bandswitch
RCV-STBY	Main Tuning
CAL	

Rear Panel
Muting
External aerial
12 VDC Receptacle
120/240 VAC Receptacle
Phone Jack

Battery Drain 65mA at 50mW audio output
40mA at no audio output

Weight 4·5kg (10lbs)

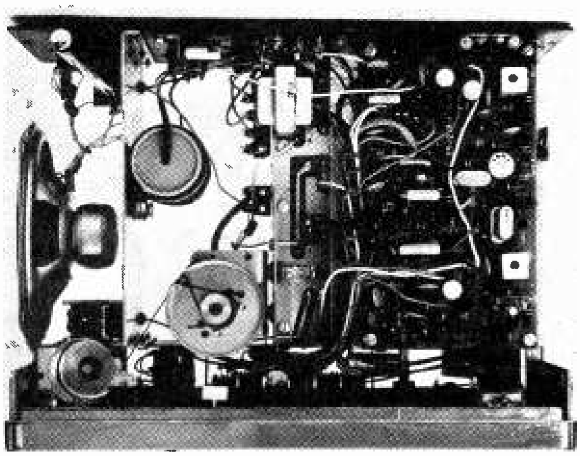
Overall Size 292mm wide, 160mm high, 230mm deep (11½" x 6½" x 9")

Transistor identification proved a little difficult with some devices where the marking was completely missing but a few moments with the drawings soon cleared up the identification.

In check lists the colour code is given for each resistor as well as the actual value. The length of every wire that is used is given, cut from the wire provided. Where necessary the length of leads to be left on components is given and even the lead shape where appropriate!

Everything goes together very well, which perhaps is not surprising when one considers the enormous amount of work that has obviously gone into the preparation of the manual. Nevertheless, it is very satisfying when the pile of bits and pieces has dwindled to almost nothing!

The potential builder of this receiver kit needs two things, time, and the ability to wield a small soldering iron successfully. As is usual with Heathkit the accompanying manual gives every step of the construction with many detailed illustrations, some of which are seemingly much too detailed for the step involved. However for the newcomer to kit construction they are invaluable.



In this top view the main circuit board is on the right, main tuning gang just left of centre-bottom linked to the bandspread dial at extreme left.

A frequent worry of the do-it-yourselfer is the subsequent electrical alignment required and the fear that a workshop full of test equipment will be necessary before the fruits of all the labour can be tasted. But no worries need be entertained here. A short list of tests to be carried out with a simple multimeter coupled with a fault-finding chart obviate any serious faults before switching on.

All the coils in the RF and oscillator stages are pre-aligned enabling stations on known frequencies to be quickly located on each band and cross-checked with the integral 500kHz crystal oscillator, in conjunction with the set's relative signal strength meter. If one has access to a signal generator however then advantage can be taken of the full instructions given, enabling the receiver to be aligned to give of its best on all bands.

Having reassured the potential builder of the GR78 kit that he need have no worries about alignment it should be said that he must be prepared to sit down for quite a few evenings, wading through the manual ticking off each step as it is done. Spaces are even provided for the ticks! The biggest mistake is to jump or anticipate any steps and strangely enough, this is more likely to happen with the experienced constructor who thinks he can beat Heathkit to the finish!

Naturally, some previous experience of the construction of electronic equipment is desirable and the GR78 kit is probably best suited to the hobbyist who has had a go at a few simple projects already, and now feels that he is ready for a serious project.

One or two tips as you open the box! Try to find a workspace where the set and tools can be left out as construction progresses and where the many bits and pieces and components can be sorted out and located within easy reach. Do follow all instructions and check all parts as and when directed, especially at the start, before any attempt is made to begin construction, however great the temptation may be! Tidy up after each session and cover over the set and workspace. In this way even short periods of half an hour can be put to good use, the steps completed to date being clearly shown in the manual.

ALIGNMENT

The set was working after the initial series of simple circuit checks had been carried out and the set had been plugged into the mains and left, with the on-off switch at OFF, for 24 hours while the battery was charged. For peace of mind the set was disconnected from the mains while tests and alignment were carried out, and plugged into the mains again between times.

Alignment is conventional, trimmer capacitors at the HF end of each band and coils at the LF end, but as mentioned before, the coils are prealigned and should need little adjustment. As Radio 2 is on 200kHz it was necessary to cheat a bit on Band A (200 to 400kHz) and alter the oscillator coil to bring 200kHz just inside the end of the scale to ensure that it was possible to tune in Radio 2 properly.

Band B covers part of our MW band, the balance being found on Band C and there are plenty of stations here for calibration purposes. Needless to say, the internal 500kHz calibration oscillator is invaluable during alignment especially on the SW bands. Further adjustments include the BFO, calibration oscillator and 5·5MHz trap circuit.

The kit K/GR78 now costs £125 which includes the new rate of VAT at 25%, from Heath (Gloucester) Ltd., Gloucester, GL2 6EE.

PW TECHNICROSS PUZZLE No. 9

presented last month

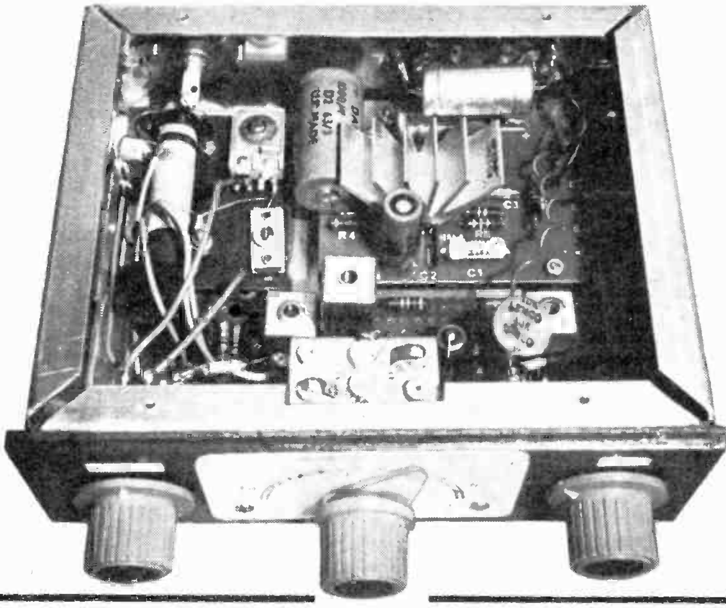
1 R	■	2 W	■	3 P	4 I	L	5 O	T	6 T	O	7 N	E
8 E	X	A	M	■	R	■	L	■	R	■	E	■
F	■	V	■	9 S	I	B	I	L	A	N	C	E
10 L	E	E	R	■	S	■	V	■	C	■	K	■
E	■	F	■	11 A	■	12 R	E	E	K	■	■	13 E
14 C	H	O	I	R	■	U	■	■	15 S	16 P	A	R
T	■	R	■	17 T	U	N	E	18 R	■	I	■	A
19 O	H	M	20 S	■	■	I	■	21 M	U	T	E	S
R	■	■	22 T	W	23 I	N	■	S	■	C	■	E
■	24 L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

THE IN-CAR 'SET'

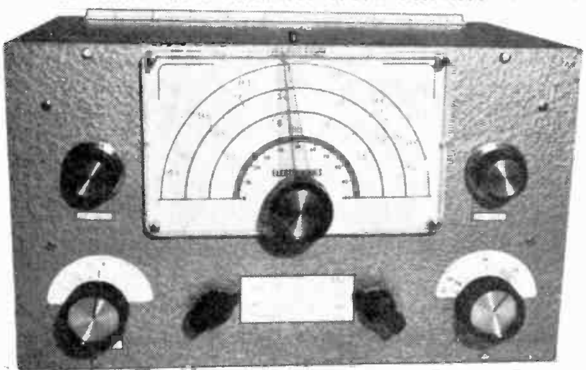
IN NEXT MONTH'S PRACTICAL WIRELESS

PW Car Radio

This easily built receiver provides switch selected stations or manual tuning. Three transistors plus a cheap audio module rated at 5 watts out. Suitable for positive or negative earth vehicles. Economical consumption allows optional operation from dry batteries.



& Dual Conversion Receiver



A reliable design for the 20, 40, 80 and 160m bands, CW/SSB/AM. Conversion at 5.5MHz and 465kHz reduces second channel interference especially at the higher frequencies.

plus

'IC of the Month' looks at the versatile

TDA 2020 audio IC

ON SALE IN JULY

DIGITAL WAVEFORM

THE function generator is constructed in a RS instrument case type 4. This case has a very slim front panel, dimensions 432 x 88mm (17 x 3·5in). Whilst this particular case is not essential (any other type would be suitable), it does lend itself to the construction of an instrument having a very modern appearance. This, together with the in-line layout of the switches and the LED indicators make a very functional instrument.

The instrument is constructed in three parts: the front panel; the centre circuit board; and the rear power supply. The front panel accommodates the switches and most of the switched components. The circuit board in the centre contains the 8038 IC, the transistors, and most of the remaining components. The rear panel is utilised for the power supplies, ±15 volts. An inside view of the general construction was shown last month.

DRILLING

First drill the front and rear panels to take all the necessary components. The front panel is marked with Letraset legends to suit the knobs chosen, then sprayed with a varnish protective.

Fit the four stand-off mountings and screw in the 4BA studding which holds the circuit board.

Some switches may necessitate mounting the circuit board further back. Next, fit all the switches and indicators to the front panel then the circuit board must be drilled with 4BA clearance holes to fit the studding and temporarily fitted.

CAUTION The circuit board is long and thin and cannot be used without adequate support. Therefore it is necessary to fit a metal frame around the board, or two metal strips as fitted to the prototype instrument illustrated in Fig. 6. Any convenient metal bars

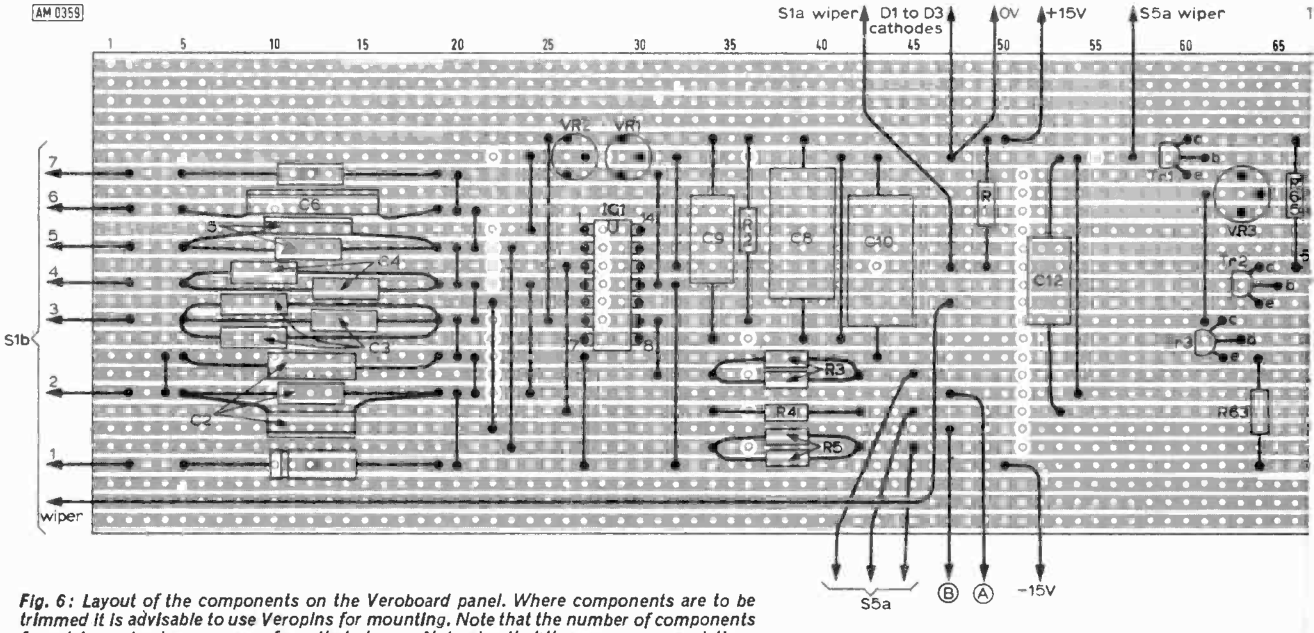
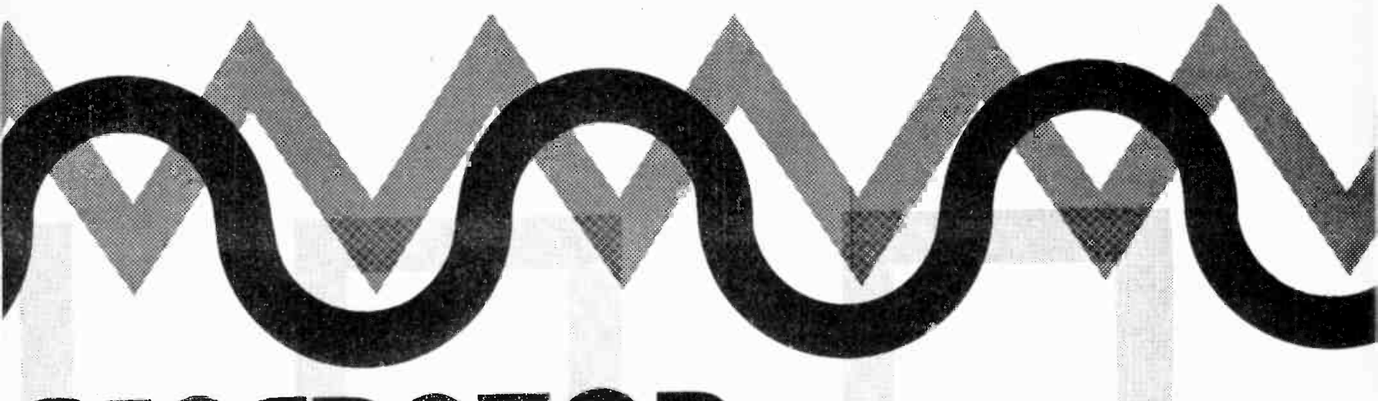


Fig. 6: Layout of the components on the Veroboard panel. Where components are to be trimmed it is advisable to use Veropins for mounting. Note that the number of components for a trimmed value may vary from that shown. Note also that there are some variations between the board shown here and that shown in the photographs.



GENERATOR

John Smith C.Eng PART TWO

may be used here, with the whole assembly bolted to the 4BA studding. Finally the power supply components are mounted on the rear panel as shown in Fig. 7.

The whole unit is then assembled in the case to ensure that there is adequate clearance for all components. The three parts, front panel, circuit board and rear panel are removed from the case for wiring.

WIRING

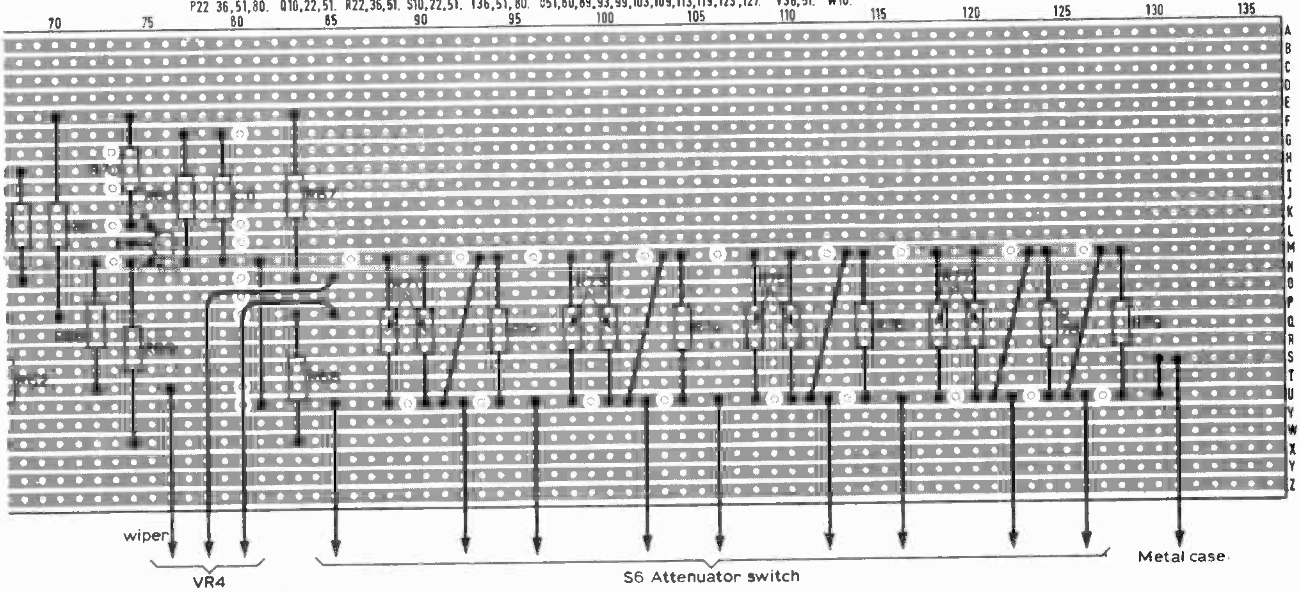
The power supply is wired first as shown in the circuit diagram published in Part 1. Connect the unit to the mains supply and (after checking) switch on. The supply should give ±15 volts. If it does not it will be due either to faulty wiring or to component failure. However, it is essential to check out the power supply before proceeding further, as any trouble in this area can damage the very expensive 8038 IC.

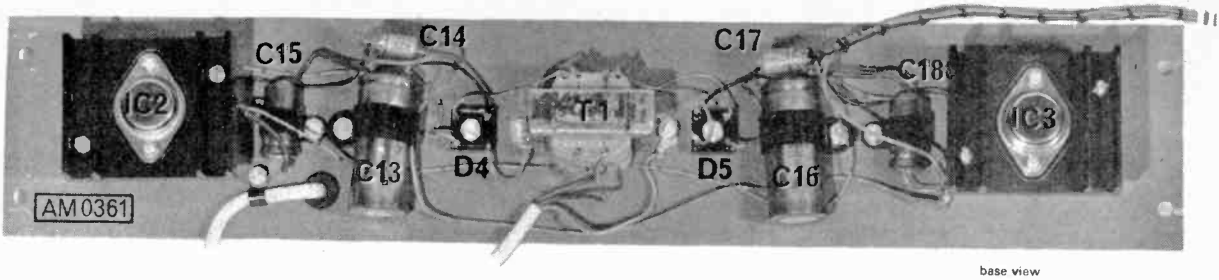
It is desirable to check the supply on a load of about 50 mA. This can be accomplished by monitoring the output voltage with a voltmeter and then connecting a resistor of about 330 ohms across the supply to see that the voltage does not change appreciably. It is also worth checking the ripple.

The output voltage need not be precisely 15 volts; the instrument will function quite well on 15 ±1 volt, but it must be stable and have a low ripple voltage.

The front panel is wired next, fitting all the resistors around switches S3, S4, and S6. Fig. 8 shows the positioning of the switches on the front panel. The components on S2 have to be selected, so R6 and R15 only are temporarily wired into circuit. Of course, readers building option 2 will proceed with the wiring of S2 using the design values.

rack breaks occur at:- F22,28,36,55,80. G51,73. H51,73. I10,51,73. J22,28,51. K10,22,28,51,73,80. L22,28,43,51,80. M10,22,28,51,73,86,92,96,102,106,112,116,122,126. N28,51,80. O10,22,28,51,80. P22 36,51,80. Q10,22,51. R22,36,51. S10,22,51. T36,51,80. U51,80,89,93,99,103,109,113,119,123,127. V36,51. W10.





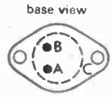


Fig. 7: Layout of the components on the rear panel. The wiring should be completed by referring to the circuit diagram of Fig. 5 in Part 1. Note the polarity of the regulator ICs and the resistor in series with the lead which is hidden behind the heatsink.

CIRCUIT BOARD

The circuit board is wired last. Cut the tracks and fit the components as shown in Fig. 6, with the exception of the components marked "trim" on the circuit diagram. C1 to C7 are not fitted until later, R3 to R5 and R68 are fitted temporarily with the design values. The whole instrument is now wired together with enough spare wire for the component board to lay flat, so that the selected components may be wired to S2 and the capacitors C1 to C7 may be fitted to the component board.

With all the "trim" components it is advantageous to fit a wiring pin onto the circuit board to facilitate removal and rewiring. Carry out a complete and final check of the wiring and the unit is ready to switch on, BUT DO NOT do so until the following instructions have been carried out.

TESTING AND COMPONENT SELECTION

Before starting the test and selection procedures it is necessary to know the function of the selected components. Firstly, frequency is controlled primarily by capacitors C1 to C7, so a high degree of accuracy and stability is necessary here. Resistors R6 to R23 not only control frequency, or period, but also control waveform symmetry. This means that these components must be selected with considerable care, using an oscilloscope to check symmetry.

VR1 and VR2 control the purity of the sine wave signal and must be carefully adjusted at a low frequency. Resistors R3 to R5 control the output voltage of the signal and are adjusted with the aid of an oscilloscope. VR3 and R68 are concerned with the offset control and are also adjusted with the aid of an oscilloscope.

CAPACITOR SELECTION

Before switching on the instrument VR1 and VR2 must be set to the centre of their range. Then fit either C5 3,000pF or C6 300pF; the value chosen will depend upon the accuracy of the oscilloscope used to calibrate the instrument. Range 5 (3,000pF) gives 100µS to 900µS. Range 6 gives 10µS to 90µS so pick the one most suited to the oscilloscope used and fit that capacitor—1% silver mica or Suflex is recommended.

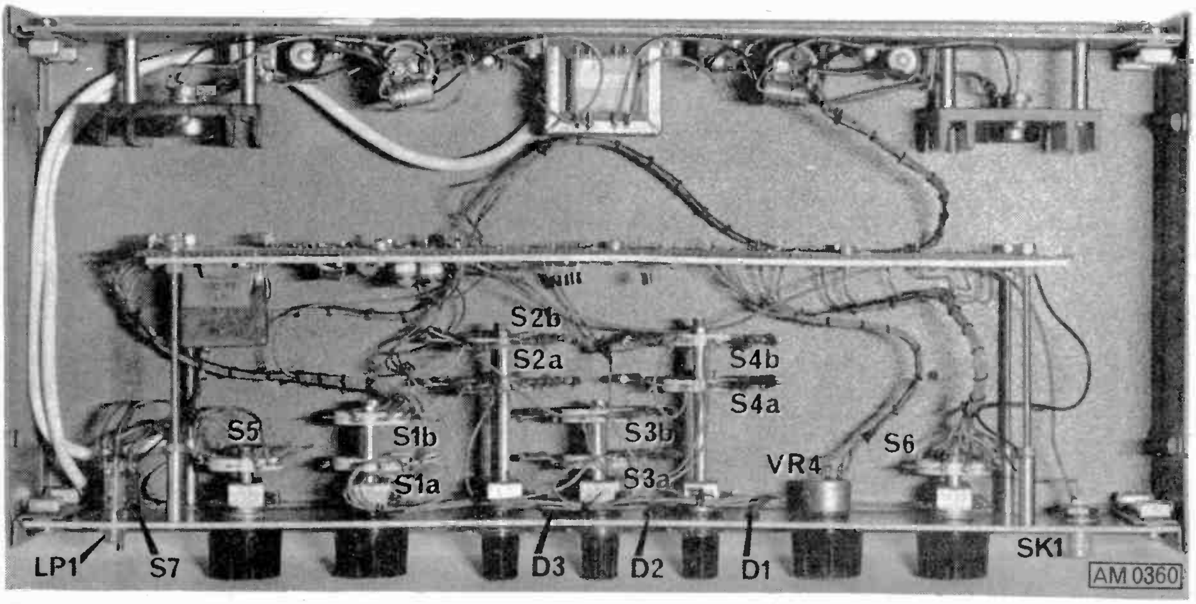


Fig. 8: Layout of the switches and the LEDs on the front panel. Wiring should again be completed by reference to the circuit diagrams in Part 1.

Switch on the instrument, with the range switch set to range 5 or range 6 depending upon which capacitor has been fitted, and set S3 and S4 to zero. Set the DC shift control to the centre of its range, LED B or C should be on. Check that when the range switch is turned from the left (range 7) to the right the LED's go through the sequence (ABCABCA), LED A being the extreme left hand one.

Next, turn the attenuator switch S6 to maximum output and examine the waveform on the coaxial socket. This waveform should be sine, triangle or square as selected by the function switch, ten volts approximately peak amplitude and roughly swinging about zero.

Check that each function gives an output, that the offset control works and the attenuator functions. If any of these facilities do not work there are wiring or component errors or faults which must be corrected before proceeding further.

TRIGGER PULSE

Some oscilloscopes need a trigger pulse to function properly, such a pulse may be obtained from the junction of R2 and R3. This pulse is about 24 volts in amplitude but may be attenuated (÷10 for example), with the aid of a 10kΩ and 1kΩ resistor divider. Some users may consider a trigger output as a useful permanent feature of the function generator, although the prototype shown does not incorporate this feature. Having attended to the trigger pulse, adjusted the oscilloscope and repaired any faults, the calibration procedure may begin.

CALIBRATION

In addition to the oscilloscope a frequency meter is necessary for the highest possible accuracy. If this degree of accuracy is not sought after the instrument may be adjusted to correspond to the oscilloscope time base calibration.

First switch to the triangular waveform and see if the output is asymmetrical as is shown in Fig. 9a. Here the up stroke is shorter than the down stroke. This wave form is made symmetrical by selecting R6 and R15. Shunt each one in turn with a 100kΩ resistor to determine which affects the up and the down stroke.

Symmetry is very important because this form of distortion affects both the sine wave purity and the duty cycle of the square wave, see waveforms b and c Fig. 9. Having adjusted R6 and R15 to give a perfectly symmetrical waveform with an upstroke/downstroke time of 50μSec (100μSec period), the frequency must now be corrected.

FREQUENCY CALIBRATION

Before discussing the frequency calibration a few words about procedure: R6 and R15 are selected by fitting series or shunt resistors to correct their value. It is relatively easy to find out what adjustment is needed if one makes use of the other two decade switches S3 and S4. S3 introduces resistance *increases* of 1kΩ whilst S4 introduces resistance increases of 100Ω. By making use of these two switches the increase *or decrease* in value can be estimated.

Now switch to sine output and measure the frequency. This should be 10kHz (100μSec period) or 100kHz if range 6 is being used. The use of range 5 will be assumed from now on, so readers who have

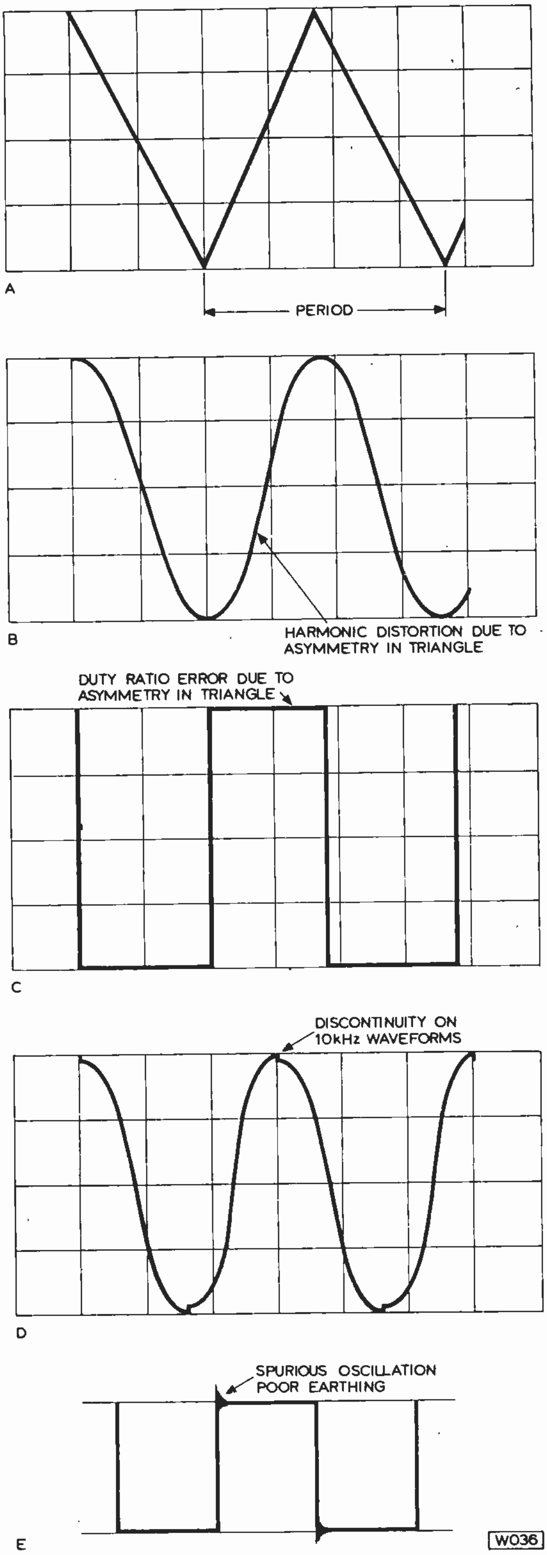


Fig. 9 (a) Asymmetry in the triangular waveform is indicated by a difference in the up and down strokes as shown here (b) Asymmetry in the triangular wave results in a slight flattenning of the sine waveform (c) The mark-space ratio of the square wave will also be asymmetrical (d) If the square and triangular outputs are not earthed discontinuities in the sine wave result (e) poor earthing causes ringing on the square wave.

chosen range 6 must divide period by ten and multiply frequency by 10 whenever they are mentioned. However, it is important to carry out all the calibration on one range if at all possible.

If the frequency meter reads high adjust S3 and S4 until the correct reading is obtained. This shows the value of series resistor needed to correct the frequency. Warning, if more than one step of S3 is necessary (e.g. three steps) fitting 3kΩ in series with both R6 and R15 whilst correcting frequency will also distort symmetry.

In this case it is better to fit values proportional to those already in circuit and re-check to find the final value needed. If on the other hand the frequency were too low R6 and R15 have to be shunted. In this case use S3 and S4 to lower frequency by a corresponding amount to arrive at an estimate of the shunt percentages needed.

All this is rather a long-winded procedure especially as each resistor R6 to R23 must be adjusted, but once the correct procedure is understood it becomes easier with practice. It will take at least a weekend to complete an accurate calibration of this instrument.

SYMMETRY AND PERIOD

Next fit temporarily R7 and R16 (10kΩ). Use the same procedure as before to adjust for symmetry and a period of 200μSec. Switch to sine output and adjust frequency to 5kHz. Work through each component on switch 2 in sequence; R8 and R17 gives 300μSec (3·3kHz), R9, R18 400μSec (2·5kHz), R10, R19 500μSec (2·0kHz), R11, R20, 600μSec (1·66kHz) R12, R21 700μSec (1·43kHz), R13, R22 800μSec (1·25kHz) and R14, R23 900μSec (1·1kHz).

People who have paid the extra for the 8038BC will find that they have a big advantage during calibration due to the higher accuracy of this unit. For those with suitable instrumentation it is well worth spending time on this calibration procedure because the 8038 is a very stable IC. Temperature stability is 50ppm/°C and as the power supplies are also stabilised the instrument will retain its accuracy. Unfortunately if the 8038 needs replacing at any time the instrument will need recalibration.

RANGE SWITCH

Next the range switch is calibrated. Switch to range 6 and adjust the period switches to 10μSec. Switch to sine output and connect the frequency meter. Fit C6 (300pF), switch on, and check frequency. C6 must be adjusted to give 100kHz. Switch to range 5 and adjust C5 (3,000pF) to give 10kHz (this range has of course already been adjusted). Now proceed with each range: Range 4, C4, 30,000pF adjust frequency to 1kHz; Range 3, C3, 0·3μF, 100Hz; Range 2, C2, 3·0μF, 10Hz; and Range 1, C1, 30μF, 1Hz. It may be difficult to find a suitable capacitor for range 1; a 15 volt tantalum is recommended although many electrolytics will perform quite well. Finally fit C7. The 8038 will only oscillate up to 1MHz on the square wave output, the other waveforms being of very poor quality. Fit any value between 5pF and 30pF which is capable of giving a useful range of signals.

ADJUSTING SINE PURITY

If the sine wave output is examined on Range 6 it will be seen that it has a high frequency discontinuity, see Fig. 9. This is caused by breakthrough from the pulse and triangular waveforms. It can be improved by making use of a three pole switch (S5) arranged to short R4 to earth when switched to sine output. It may also be improved by running the sine lead from R5 to S5 separately, or screened from the other function leads.

Discontinuities are made worse by poor earthing. To investigate the earthing, switch to square wave and examine the edges of the waveform. If the edge of the square wave shows oscillations as indicated in Fig. 9e try earthing various parts of the front panel to the Veroboard. Take care to ensure that it is not the oscilloscope giving rise to spurious oscillations on this test.

In practice these oscillations and discontinuities are at a very high frequency and may be ignored providing one is aware of their presence. The final adjustment of sine purity is carried out by switching to Range 5, period 500μSecs (which is a frequency of 2kHz) and adjusting VR1 and VR2 to give the purest sine wave possible.

This may be carried out using an oscilloscope or it may be adjusted by comparing the waveform with another sine wave. Those able to measure harmonic distortion can adjust for minimum second and third harmonic. Those able to hear distortion may be able to pass the signal through an amplifier and adjust by ear.

ADJUSTING OUTPUT VOLTAGE

Adjust the output voltage to give a ten volt swing on each waveform. This is carried out by checking the output with an oscilloscope and adjusting R3 for the correct square wave amplitude, R4 for the triangular wave amplitude and R5 for the sine wave amplitude. The design values should give a voltage quite close to the swing required.

ADJUSTING OFFSET

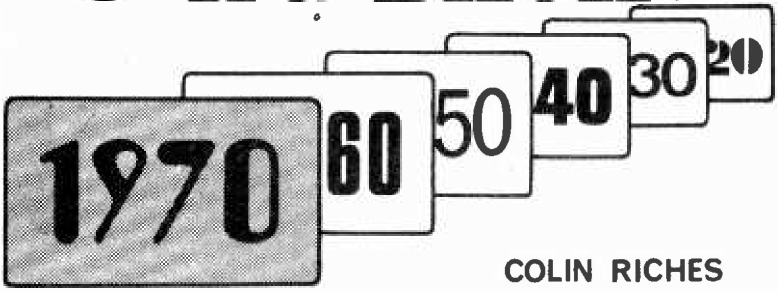
Switch to the triangular waveform and set the offset potentiometer VR4 to its centre position (calibrated zero). Examine the waveform on the oscilloscope and adjust VR3 so that the excursion is ±5 volts. If, due to power supply and component tolerances, VR3 is unable to centralise the waveform, select another value for R68 to give a reasonable degree of control on VR3. Increasing R68 will push the waveform down in a negative direction and decreasing it will push the waveform in a positive direction.

This completes the adjustment and calibration of the instrument which is now ready for use. Fit the instrument into its case and run through all the controls to familiarise yourself with their functions. Examine the DC shift control and attenuator carefully.

These are designed so that the signal can be shifted to all positive, symmetrical about earth, or all negative. This is equally true of all settings of the attenuator. Thus at maximum output the DC shift is ±5 volts, but if the signal is attenuated to 100 mV the DC shift is ±50 mV.

In next month's article we shall discuss how to simplify the instrument and mention some of the uses to which it may be put.

GOING BACK...



COLIN RICHES

Memories

MR. **LESLIE SPENDLA** from Hampshire tells us that after 50 years it still thrills him to know that he was an on-the-spot witness of the early lead taken by Britain in the field of wireless, with the formation of the British Broadcasting Company and the opening of its first transmitter on medium waves at Savoy Hill in November 1922. A few months after this date, a local advertisement stated that a public demonstration of wireless reception by the Marconi Co. was to be given at the Station Road Garage, Winslow, seven miles from his home in Buckingham.

Mr. Spendla was a schoolboy at the time and he went there with some friends to listen.

To introduce wireless reception and Marconi sets to the public, the company organised tours of the country districts—often setting up their equipment in garages—these eventually becoming their first trade outlets. These garages had only just progressed from the practice of dispensing petrol (Pratts Motor Spirit) from 2-gallon cans.

Two tall white masts in the adjoining field carried an aerial similar to those seen in pictures of an ocean liner—its parallel wires being separated by spreaders at each end.

The open garage doors revealed the sloping desk type receiver, with its row of glowing bright emitters, feeding two large upright horn speakers, with whistles, crackles and mush, as the engineers tuned up in preparation for the opening of the evening programme from the London transmitter some 50 miles away.

Then, over the ether, came the magic voice—"Hello! Hello! This is 2LO calling." This thrilled the crowd as much as if it had come all the way from the moon.

In the next few years, Mr. Spendla says he was absorbed by wireless, moving on to one-, two- and three-valve sets.

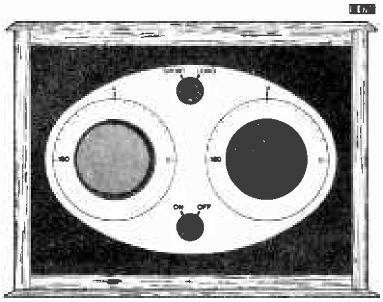
After burning much midnight oil, the success of a DX session on the medium wave in those days was measured by the ability to receive such items as the nightingale from Milan, the cuckoo call from Ljubljana, the musical box notes from Budapest (Buda-Pest as it was then), the trumpet call from Krakow, the rapid metronome from Vienna or the slow one from Munich.

Over are the days when people used to have to cycle to a garage in the next town to hear the wonders of that array of Marconi equipment and know-how, heralding the birth of a new science. These 50 years of progress enable the schoolboy of today to carry around in his pocket the means to receive "London" and many other broadcasts at will—Tempus fugit!

Attic searcher

MR. **M. J. DARBY** of 266 Canley Road, Coventry, Warwickshire, happened to be searching the loft of an old house when he discovered a receiver like that shown in our picture.

The set has two aerial input terminals, one earth, two speaker terminals and wires for a 2V l.t. battery, h.t. battery with two positive tappings, and a grid bias battery.



The valves are an Osram H2 triode detector coupled to a P220 Osram output triode through a Cossor transformer. Two dials are marked from 0° to 180° and one is marked 'A' for tuning. The other is designated 'B' for reaction. There is no volume control—just a short/long wave switch and an on/off switch.

The receiver's wooden case has a hinged top lid, and the speaker with its associated transformer is in its own wooden case.

The set works quite well when connected to suitable power supplies—radio 2 and 3 being received at good strength.

If any readers could tell Mr. Darby more about this set, could they please contact him direct.

Avo 1923

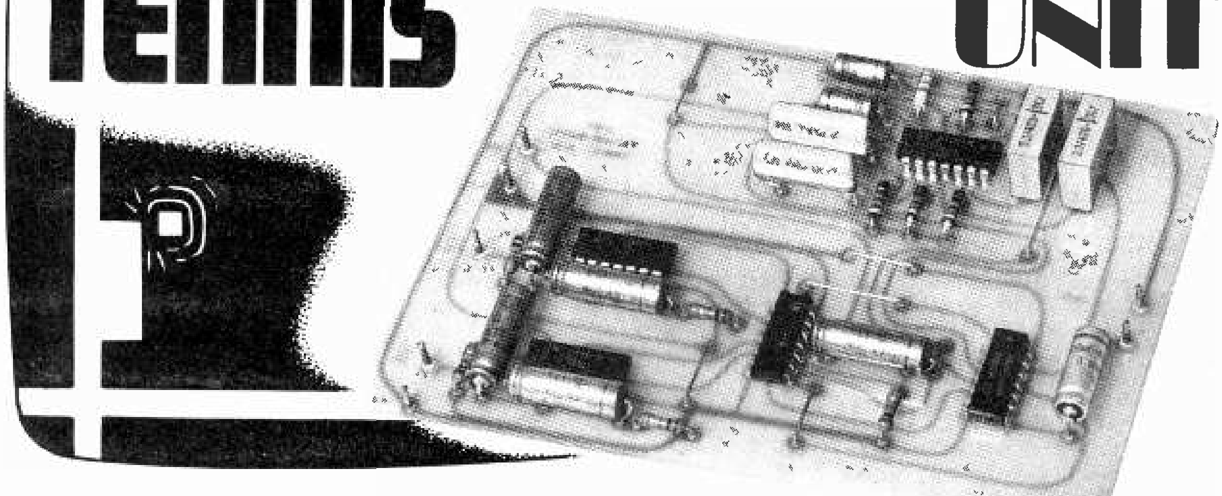
THE year 1973 marked the Golden Jubilee of Avo Limited, the makers of the well-known Avometer.

In 1923 the Automatic Coil Winder and Electrical Equipment Company (as Avo was then known) was formed to manufacture a range of coil-winding machines. Soon afterwards they introduced the first test meter in the world with multi-range facilities. Its picture is shown above.

On the right track

ALL Austrian trains in 1926 were equipped with wireless. A fee of 50 groschen ($3\frac{1}{2}$d. then) was made for a journey of any length.

TELE-TENNIS SOUND EFFECTS UNIT



M. J. HUGHES MA, C.ENG., MIERE

Increase your enjoyment of the game!

IN the original articles describing the construction of our Tele-Tennis game (July to November 1974—reprints of which are still available) reference was made to sound effects, but did not show any circuitry which would provide this function. Since the article first appeared, *PW* has had numerous requests from readers for a sound effects unit which could be a simple attachment to the unit already constructed.

This article describes a simple, and comparatively cheap, sound effects unit which can be wired into the original game without any wiring modifications being made to the constructed unit. All that is required is access to three signal points and the 0V and +5V rails of the Tele-Tennis game. The whole of the attachment is housed on a single PCB which, with care, could be bolted within the existing case. But, as a loudspeaker is required, most readers might prefer to construct a separate enclosure and take off the five lines from the Tele-Tennis game via a multi-pin plug and socket. This can be positioned in the space provided for the "Video" output of the original game.

SUB-CARRIER

Originally a 6MHz sub-carrier suitably frequency modulated and fed to the modulator of the original game was envisaged. This meant that the sound effects would come from the audio channels of the television receiver to which the game was connected. In principle this is quite easy to do, but in practice there are quite a few problems in maintaining the sub-carrier stability, and there was complexity enough in handling the video signals through the modulator without having sub-carriers to contend with. Consequently it was decided to go for the simple expedient of a separate loudspeaker. In actual fact there is no difference in the overall cost and there should be no problems in getting this system to work.

CIRCUIT

The complete circuit is shown in Fig. 1. Three sounds are generated by the free-running multivibrators made from the six inverters of IC5. These tones are continuous at the oscillators, but are gated by the logic to give three different pitches of "bleep" when the ball hits the top or bottom bases, bats, or left and right bases. The frequencies of these bleeps can be set by the values of C7 to C12, and in the prototype a rebound off top or bottom base produces a medium pitch, a successful return off the bats produces a high pitch, and contact of the ball with the left and right bases (which constitutes a "Lose") gives a rather rude low frequency "burp"!

The logic is fairly simple to follow if the production of each audio signal is described in turn. First of all, the rebound from top or bottom bases. As those who have already constructed the original game will know, the ball is in motion around the screen all the time, but is only in play when it is brightened up by the Ball Blanking logic. Consequently the only sounds wanted occur while the Ball

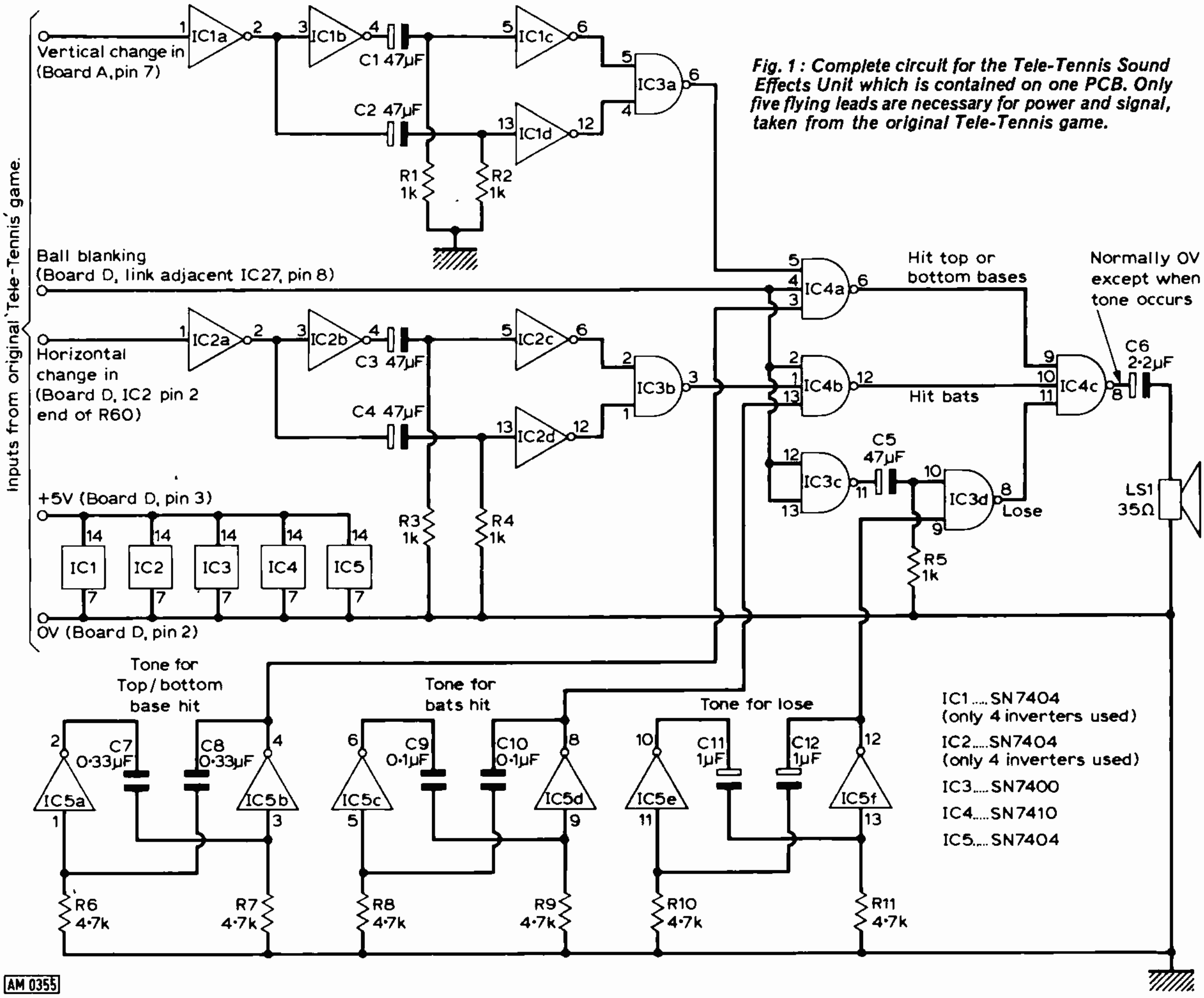


Fig. 1: Complete circuit for the Tele-Tennis Sound Effects Unit which is contained on one PCB. Only five flying leads are necessary for power and signal, taken from the original Tele-Tennis game.

★ components list

Resistors

R1	1kΩ	R7	4·7kΩ
R2	1kΩ	R8	4·7kΩ
R3	1kΩ	R9	4·7kΩ
R4	1kΩ	R10	4·7kΩ
R5	1kΩ	R11	4·7kΩ
R6	4·7kΩ		¼W 10%

Capacitors

C1	47µF (6V)	C7	0·33µF polyester
C2	47µF (6V)	C8	0·33µF polyester
C3	47µF (6V)	C9	0·1µF polyester
C4	47µF (6V)	C10	0·1µF polyester
C5	47µF (6V)	C11	1·0µF (6V)
C6	2·2µF (6V)	C12	1·0µF (6V)

Integrated circuits

IC1	SN7404	IC4	SN7410
IC2	SN7404	IC5	SN7404
IC3	SN7400		

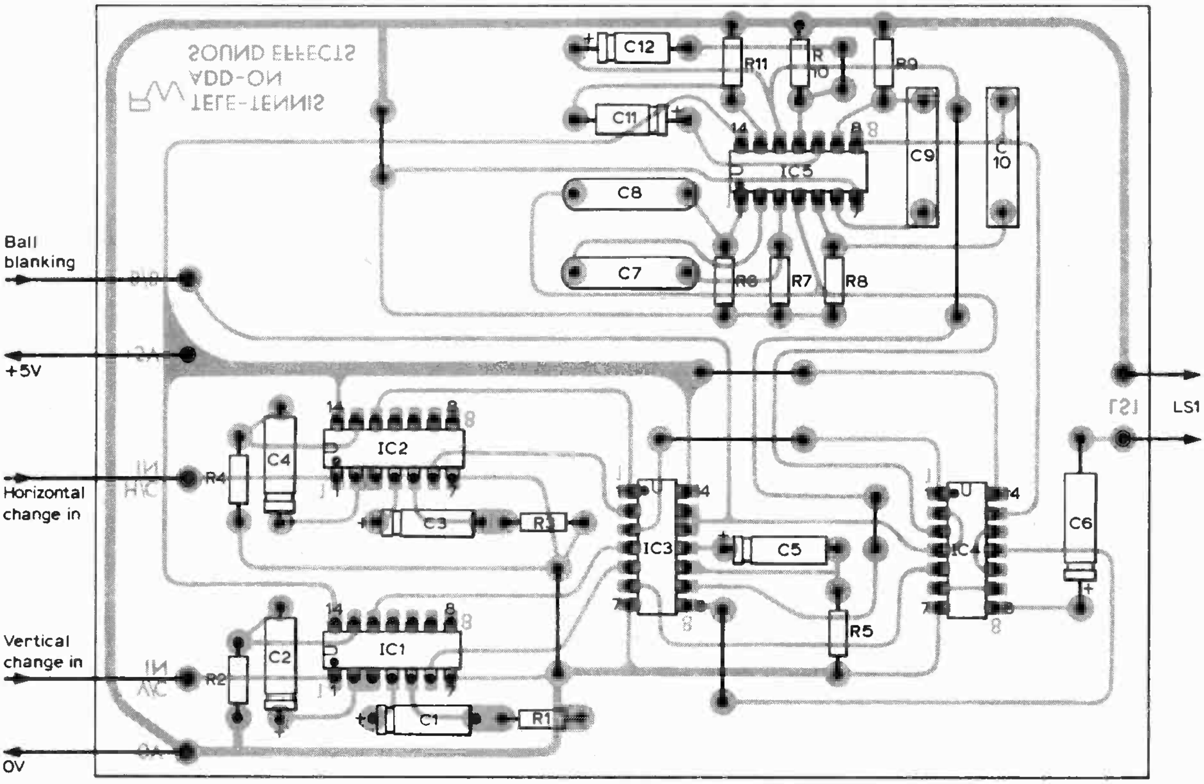
Miscellaneous

LS1, 35Ω loudspeaker. Five, 14 lead DIL sockets. Seven circuit board pins. 5-way panel mounting socket and mating plug. Length of 5-way cable. 140 x 102 mm (5½ x 4in.) fibre glass PCB, available from Crofton Electronics, 124 Colne Road, Twickenham, Middlesex, TW2 6QS. Tel: 01-898 1569. Priced £1·25 including VAT and p & p.

Blanking signal is at Logic Level "1" (i.e. when the ball appears on the screen). When the ball hits top or bottom base the signal, which in the original game was designated "Vertical Change", alternates from a logical "1" to a "0" and vice versa. This signal is therefore ideal to initiate a bleep for a rebound from the top or bottom bases, and can be produced at pin 7 on Board A.

DIFFERENTIATION

IC1a acts as a logic buffer to prevent loading on the original circuitry, so an inverted form of Vertical Change is fed to C2 which differentiates it. Therefore, on the **negative** going edge of Vertical Change, a positive going pulse (having a width set by the value of C2 and R1) is fed to IC1d. The duration of this pulse is a few hundred milliseconds, long enough to give a useful bleep when used to gate the tone oscillator. A pulse like this must be produced for both the positive and negative edges of Vertical Change so that a bleep is produced by a change in either direction. Therefore the signal from IC1a is inverted by IC1b and is used to carry out the same differentiation operation. IC1c and IC1d together with IC3a, give an OR function so



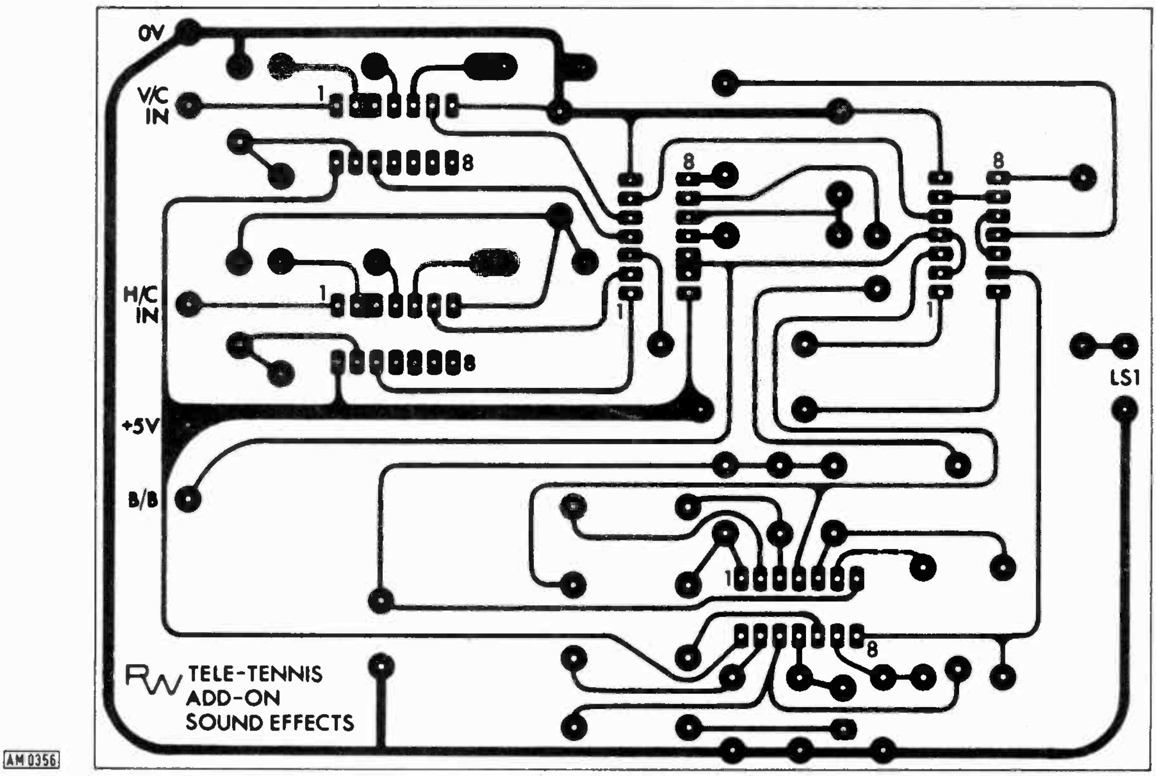


Fig. 2: Top diagram of the PCB gives details of the component layout and flying lead configuration, while the lower drawing shows the foil side only. Both are reproduced full size.

that the output from IC3a will be a positive pulse whenever the ball hits top or bottom base.

This signal is fed to IC4a together with Ball Blanking and the tone from IC5a and IC5b. Provided the ball is bright (i.e. Ball Blanking is "1") the pulse from IC3a will allow the tone to appear at the output of IC4a for the duration of the pulse caused by the contact. This signal is fed to IC4c where it is effectively ORED with the two other signals and fed to the loudspeaker.

A 'GLITCH'

The signal for contact with the bats is produced in exactly the same way except that the Horizontal Change signal is used to initiate it. This signal occurs at pin 2 of IC27 and can be conveniently picked up from the end of R60 going to this pin on board D. A Horizontal Change signal is produced by contact of the ball with either bats or the left and right bases. However, as soon as contact is made with one of the bases, the ball is blanked in a few nanoseconds, and hence the pulse so produced (usually called a "Glitch") is not resolvable as a bleep. The composite stretched pulse, produced by contact of the ball with either bat is fed from IC3b to IC4b, together with Ball Blanking and the tone from IC5c and IC5d. As already mentioned, this signal (the bat hit bleep) is ORED by IC4c before feeding the loudspeaker.

The easiest tone to generate is the rude tone for a lose. It should always occur when the ball is blanked, i.e. on the falling edge of Ball Blanking. Hence Ball Blanking, which is obtained from pin 8 of IC27 on board D, is fed to IC3c which acts as a buffer and an inverter. To gain access to Ball Blanking there is a convenient connection going from pin 8 of IC27 to which a lead can be soldered. The falling edge of Ball Blanking produces a positive-going pulse at the differentiator (C5 and R5) which is used to gate the low frequency from IC5e and IC5f. Some people might like to make the rude tone have a longer duration, in which case the value of C5 can be increased to about 100μF.

It is advisable to use a loudspeaker having an impedance not less than 35Ω, but the prototype has worked on several ranging from 15 to 70Ω without damage to IC4c. Apart from taking note of this point there are not many critical values in the circuit, although the constructor should stick to the recommended resistor values and be within the quite wide tolerances in capacitance values. The prototype board was mounted with spacers, on the bottom of a metal case made to match the original game, with the loudspeaker bolted to the underside of the lid.

CONCLUSION

The output volume is not great but is ample for a living room. The unit was demonstrated to visitors at the International Audio Fair in Olympia last year and amongst the cacophony of sounds there, it could be heard over quite a long distance.

Without doubt the addition of this comparatively small extra, livens up the Tele-Tennis game enormously, and those people who have already made the original unit are recommended to try it. PW

Points arising . . .

PW EASYBUILD ORGAN

It has come to our notice that the 8ft and 16ft pitch switches were reverse connected. Therefore Figs. 12 (May issue) and 17 (June issue) were incorrectly drawn. The corrected drawings are reproduced, in part, below, with the relevant figure numbers.

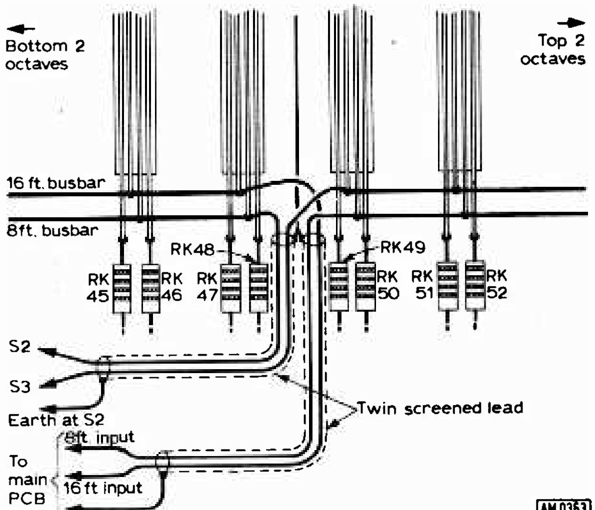


Fig. 12 AM0363

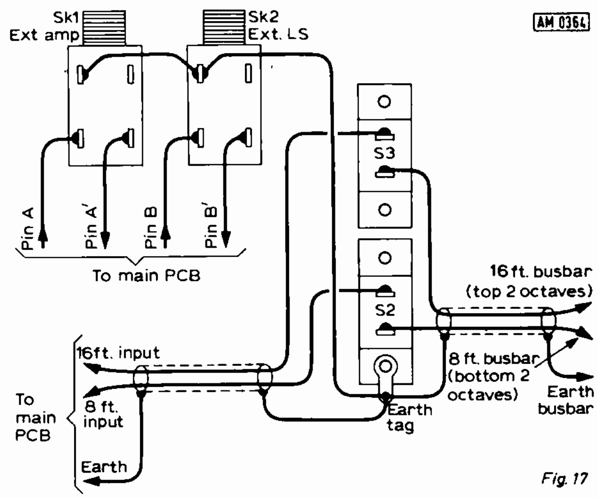
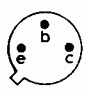


Fig. 17

There has been a number of readers who wanted the base connections of the BCY71's used in the Master osc., Vibrato and Tune circuits. Below is shown the lead configuration of this type viewed from the underside.

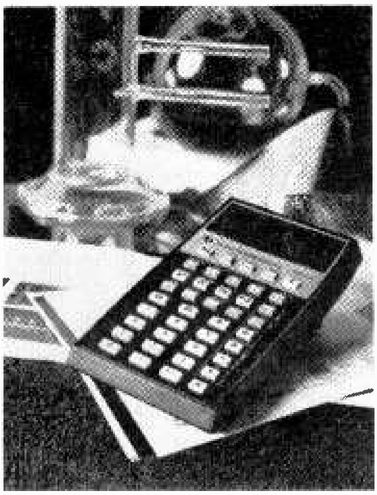


AM0362 Tr1,2 and 3.....BCY71 (viewed on connections)

PRODUCTION LINES

colin riches

TEXAS INSTRUMENTS CALCULATOR



A new version of the popular Datamath TI-2500 portable electronic calculator has been announced by Texas Instruments. Model TI-2500 (II) has a percent key and automatic constant in addition to the four basic functions.

Featuring an eight-digit LED display, the TI-2500 (II) weighs less than nine ounces and fits neatly in a pocket, briefcase or purse. With the percent key, problems such as taxes, discounts, and percentage calculations are easily solved.

The automatic constant allows multiplication or division of a series of numbers by one number and addition or subtraction of a constant number to or from a series of numbers.

Operation is either from two "AA" size alkaline batteries or from two nickel-cadmium batteries. Included with the calculator is an AC adapter/charger for use with nickel-cadmium batteries.

The TI-2500(II) electronic calculator is warranted for a period of one year from the original purchase date under normal use and service against defective materials and workmanship. Price is about £30.

Texas Instruments Limited, Manton Lane, Bedford, MK41 7PA

TELE-TENNIS REPRINTS

These are still available from:
Chief Cashier (P.W. Tele-Tennis) IPC Magazines, Tower House, Southampton St., WC2E 9QX. Price is 75p + 7p postage.

12V DRILL

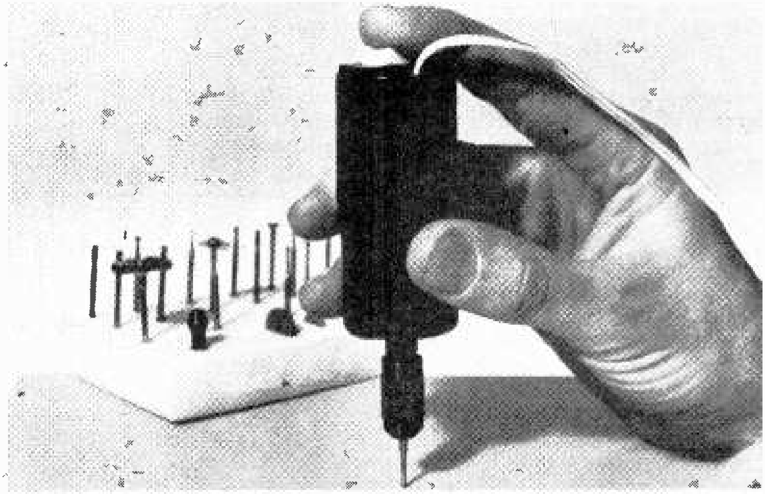
Electroplan Limited, the Royston based distributors of electronic instruments, tools and accessories have introduced a new versatile drill to their range of laboratory bench aids.

Manufactured by EXPO, the 12V operated drill is supplied complete with a full range of accessories which include twist drills, cutting, milling, reaming and grinding tools. Although small, the drill has a high torque with a typical load current between 500mA and 1 Amp.

The chuck rotates at approx. 9000 r.p.m. and has three collets that accommodates the range of accessories.

The new handy drill will saw, grind, de-burr, brush and polish with the efficiency of drills that are more expensive and larger in size and yet, is sufficiently small to reach places where a conventional drill could not be used. Price is £19·17 plus VAT. Available same day despatch by post.

Electroplan Limited, P.O. Box 19, Orchard Road, Royston SG8 5HH, Herts. Tel: Royston (0763) 41171

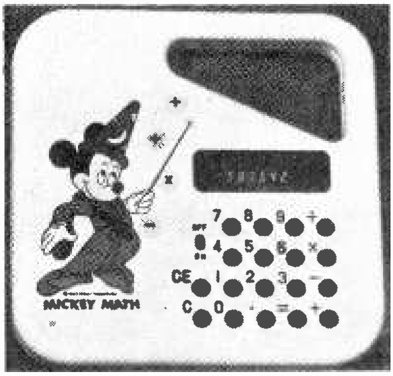


TAKING THE MICKEY?

When I first saw the picture of this new Decimo calculator, I wondered if it was a take-on but I've found it's quite genuine and not such a mickey-taking idea as it at first seems!

Known as the Mickey Math, it is a basic four-function, one-chip calculator with green read-out, powered by four pen-cells and with facilities for an external 6V power supply. It's not pocket-sized (unless you're a poacher) as it's 7½in. square, but it's robust and ideal for being stuffed into a school satchel without being damaged.

Basically, the Mickey Math is a bit of a gimmick but it's a calculator that should appeal to children and perhaps initiate them into the use of a calculator—something which will be very useful to them in these days of scientific advancement (rich Dads take note).



At £17·50 plus VAT it's not cheap for what it does but it'll raise a laugh even if people do think you are a bit Goofy using it!

Further gen from *Douglas Dorsett, Managing Director, Decimo Limited, Park House, 2/16 Chobham Street, Luton, Beds.*

WIRE STRIPPER

The Scotchlok TH 213 tool is a pliers type stripper which operates without adjustment on wires from 0·75 to 6 mm^2 conductor area ($\frac{1}{32}$ to $\frac{1}{4}$ in^2). Quick and easy to use, the tool cuts into the insulation and strips it from the core in one simple action, without risk of damage to solid or stranded conductors. The TH 213 has a spring loaded return action so that it is always ready for immediate use, and has an auxiliary side wire cutter. The 213 wire stripper is 183 mm (7¼in) long and weighs less than 180 g (approximately 6oz). Further gen from: *3M United Kingdom Limited, 3M House, Wigmore Street, London W1A 1ET.*

BSR DECK

BSR Limited have introduced a new series of belt drive transcription engineered turntables. First in the series is the BDS80. The belt gives almost silent power transmission between the constant speed high-torque motor and the 4lb machined, diecast turntable thereby reducing 'rumble' to an insignificant level.

The BDS80 has a low-mass aluminium tone-arm with a calibrated stylus pressure control. There is provision for full counter-balance adjustment and bias compensation. A viscous cueing device ensures a feather-like touchdown of the stylus on a record and the head-shell incorporates a slide-in carrier.

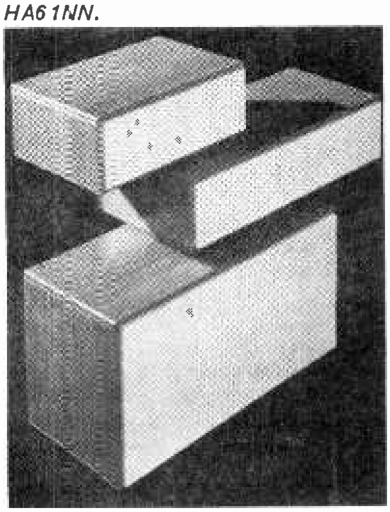
A 'click' suppressor and a muting switch are fitted to eliminate the possibility of unwanted noise through the amplifier while the 'set-down' and 'switch-off' are in operation.

The BDS80 comes complete with an ADC K7E cartridge. Mounted in a plinth with cover, the suggested retail price is £41·00. In chassis form, the price is £25·20. *BSR Limited, Monarch Works, Cradley Heath, Warley, Worcs., B64 5QH.*

BSR BDS80 deck

NEW CASES

West Hyde Developments have announced some useful little cases with a woodgrain finish. They come in 13 sizes and prices range from £4·64 (Mod. 2-A) to £14·63 (Mod 2L), excluding p.p. and VAT. Further information from *West Hyde Developments Limited, Ryefield Crescent, Northwood Hills, Northwood, Middx. HA6 1NN.*



NEW LIFE FOR WHARFEDALE

Rank Radio International Limited are offering their dealers a new XP range of speakers carrying the well-known names of Denton, Linton and Glendale. All will have greater power handling and better performance than their predecessors.

These new speakers were introduced to the Company's dealers at it's Hi-Fi Dealer Conference at the Skyline Hotel, Heathrow on 6th April.

The previous Denton 2 (launched in 1967) and Linton 2 (launched in 1965) have each narrowly approached the half million mark in production and have been successfully sold throughout the world. Succeeding these will be the Denton 2XP and Linton 3XP.

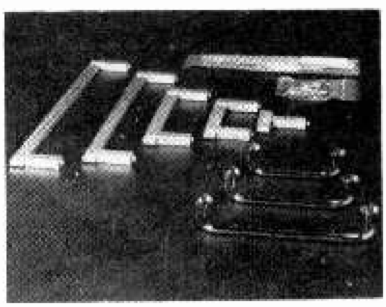
All the three new loudspeakers have been given a new appearance. They can be used with or without their grille cloth which is held in place with simple snap fastenings.

Further information and prices from:—*Rank Radio International, PO Box 596, Power Road, Chiswick, London W4 5PW. Tel: 01 994 6491.*

VERO HANDLES

Vero (the board makers) are marketing a range of handles which help to give a professional look to items of home-constructed equipment, etc.

In addition to the range of chrome "D" handles, an aluminium panel handle with an attractive anodised finish can now be supplied. Handles are available in various sizes suitable for panels from 1¾in to 10½in in height. *Vero Electronics Ltd., Industrial Estate, Chandler's Ford, Eastleigh, Hants.*



CALCULATRICKS

R. STAWICKI

With ever growing numbers of electronic calculators in use the craze of 'calculatricks' just had to come sooner or later! Imagine the scene—there you are, with a calculator in your hand, thinking of a calculation which will put the electronic wizard to a real tough test, at the same time knowing that the answer will come out instantaneously and correct, up to the last decimal point. or will it?

For instance, your calculator will tell you the name of our local barmaid! Try it, as I did. Her phone number 31471, and clearly defined 40, 26, 36 vital statistics were the only data available. Therefore enter 31471+40+26+36 and the result:—

31573

might not mean much to you at first glance but if you turn the calculator upside down the full impact of its hitherto undiscovered potential strikes you and drives you to further tests, and so calculatricks gains another addict.

Want to know what my job is like now? That's easy to work out. I started 12 years ago at a salary of £1,289, but this is now worth only about half. Therefore enter 1289, divide by 2=644·5 and multiply by 12 to find out what my job is like at present. The answer, right enough, is 7734, upside down.

7734

If you use your car travelling 35·5 miles around for a day for 20 working days every month, what should you check?

710

Do you want to find out what could be in my girl-friend's pockets? No names, no telephone exchange given but all data absolutely genuine! We have four known facts on her vital statistics:— B=35, W=24, H=36 and phone number P=4692. Using the formula:

(B×W×H) + (P×Workdays/week) + number of known facts).

Therefore: (35×24×36) + (4692×5) + 4=

53704

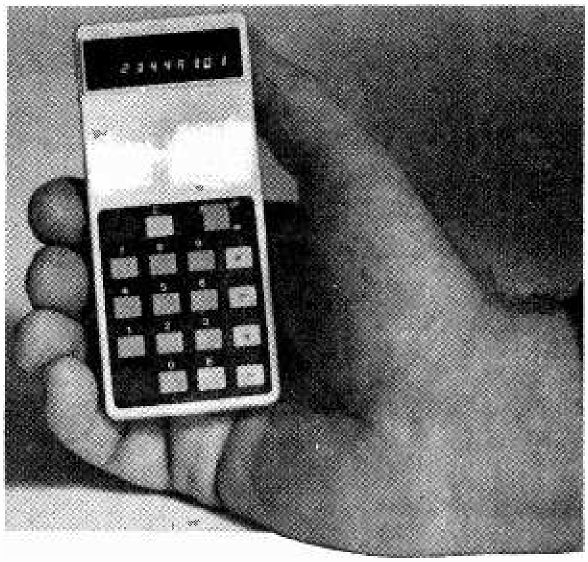
is the answer to your question.

And a topical one? 14215 investors each buy shares worth £469 to buy 5 tankers. So who owns the tankers?

So start by entering 14215469×5, turn it upside-down and hey presto! You have the answer!

71077345

There must be countless other calculatricks still to be discovered so try it yourself. All you need



is an electronic calculator with an eight-digit capacity and seven-segment type of display.

You have paid 81p for two drinks. Where? simply divide £0·81 by 2 to find out the answer which is

0405

This one is more complicated and shows the planned maintenance points of my car, calculated as follows:

Engine number	19249
Number of shifts worked	3
Max. number of days in month	31
Max. number of months between service	6
Number of work days per week	5

Therefore 19249 x 3 x 31 x 6 x 5 =

53704710

which indicates the points needing attention.

Sharing the car with your wife? If you drive to work 9 miles and she drives a further 25·5 miles with return journeys that's twice each day for 5 days a week = 10 journeys. The formula is simply (9 +25·5) × 10 and the answer 345 will tell you who should pay for the petrol.

345

Finally a true calculator addict will not count the people at a party. He will count the legs and divide by two. Much more fun that way and always a chance to prove your calculator wrong if Long John Silver comes along. . . . !

PW

NEW MULLARD & MAZDA VALVES

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

EXPRESS POSTAGE
10p for 1 Valve. Each additional Valve add 2p in UK

DM70	0·61
DY51	0·80
DY86/7	0·41
DY802	0·46
EABC80	1·03
EB91	0·64
EBC81	0·79
EBF80	0·56
EBF83	0·59
EBF89	0·53
EC86	0·73
EC88	0·76
EC90	0·86
EC97	0·60
ECC81	0·47
ECC82	0·44
ECC83	0·47
ECC84	0·58
ECC85	0·71
ECC88	0·84
ECC189	0·68
ECF80	0·60
ECF82	0·86
ECF86	0·68
ECH81	1·16
ECH83	0·94
ECH84	1·00
ECL80	0·67
ECL82	0·64
ECL83	0·66
ECL86	0·64
EF80	0·42
EF83	0·98
EF85	0·42
EF86	1·16
EF89	1·14
EF91	1·00
EF92	1·37
EF95	1·47
EF183	0·63
EF184	0·63
EH90	0·85
EL34	0·92
EL36	1·01
EL81	0·85
EL84	0·47
EL85	0·85
EL86	0·92
EL91	0·00
EL95	0·72
ELL80	2·50
EY51	0·79
EY86/7	0·40
EY88	0·72
EZ80	0·54
EZ81	0·38
GY501	1·18
GZ34	0·80
PC86	0·95
PC88	0·95
PC97	0·42
PC900	0·57
PCC84	0·54
PCC85	0·80
PCC88	0·86
PCC89	0·64
PCC189	0·80
PCF80	0·54
PCF82	1·22
PCF86	0·64
PCF200	1·00
PCF201	1·00
PCF801	0·70
PCF802	0·70
PCF806	0·64
PCH200	1·15
PCL82	0·56
PCL83	0·64
PCL84	0·61
PCL85	0·64
PCL86	0·64
PCL805/85	0·64
PD500	1·86
PFL200	0·83
PL36	0·90
PL81	0·77
PL81A	0·90
PL82	0·48
PL83	1·04
PL84	0·68
PL500	0·90
PL504	0·90
PL508	1·24
PL509	1·56
PL802	1·40
PY33	0·65
PY81/800	0·49
PY82	0·57
PY88	0·56
PY500A	1·02
PY800	0·49
PY801	0·49
U26	0·88
U191	0·88
U193	0·54
UABC80	0·90
UBC81	0·71
UBF89	0·58
UCC85	0·59
UCH81	1·12
UCL82	0·72
UCL83	0·72
UF89	0·80
UL84	0·92
UY85	0·54
6/30L2/ECC804	0·98
6F23/EF812	1·03
30C1/PCF80	0·54
30C15/PCF800	1·01
30C17	1·01
30C18/PCF805	1·00
30F5/PF818	1·03
30FL1/PCE800	1·00
30FL2	0·80
30FL12	1·13
30FL14	1·00
30L1/PCC84	0·54
30L15/PCC805	1·03
30L17	0·89
30P4MR	1·27
30P12/PC801	1·01
30P19/PC802	0·89
30PL1/PCL801	1·00
30PL13/PCL800	1·15
30PL14/PCL88	1·85
30PL15	1·13

NEW VALVES

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

AZ1	0·75
AZ31	0·60
CBL31	1·40
CL33	1·50
CY31	0·60
DAF91	0·40
DAF96	0·60
DCC90	1·35
DF91	0·40
DF96	0·60
DK91	0·50
DK92	1·00
DK96	0·75
DL92	0·50
DL94	0·48
DL96	0·55
DY86	0·45
DY87	0·45
DY802	0·47
EABC80	0·38
EAF42	0·70
EB91	0·25
EBC33	1·00
EBC41	0·75
EBC81	0·40
EBF80	0·40
EBF83	0·40
EBF89	0·32
EBL31	2·00
ECC81	0·45
ECC82	0·38
ECC83	0·38
ECC84	0·35
ECC85	0·45
ECC88	0·50
ECH35	1·50
ECH42	0·85
ECH81	0·35
ECH83	0·50
ECL80	0·60
ECL82	0·42
ECL83	0·75
ECL86	0·55
ECLL800	3·50
EF37A	1·20
EF39	1·25
EF80	0·35
EF85	0·45
EF86	0·50
EF89	0·35
EF91	0·40
EF92	0·50
EF95	0·45
EF98	0·80
EF183	0·40
EF184	0·40
EL32	0·60
EL33	2·50
EL34	0·70
EL36	0·60
EL37	2·50
EL41	0·90
EL42	1·65
EL84	0·35
EL95	0·60
ELL80	2·00
EM80	0·55
EM81	0·60
EM84	0·40
EM85	1·00
EM87	1·00
EY51	0·45
EY86	0·45
EZ40	0·60
EZ41	0·75
EZ80	0·30
EZ81	0·31
GY501	0·90
GZ30	0·65
GZ32	0·65
GZ34	0·75
GZ37	1·25
HN309	1·50
KT61	2·50
KT66	2·95
KT81 (7C5)	1·30
KT81	1·75
KT88	3·25
KTW61	1·50
MU14	1·00
N78	3·50
OA2	0·45
OB2	0·45
PC86	0·65
PC88	0·65
PC97	0·55
PC900	0·45
PCC84	0·45
PCC88	0·62
PCC89	0·55
PCC189	0·65
PCF80	0·40
PCF82	0·42
PCF86	0·65
PCF801	0·45
PCF802	0·55
PCF805	0·90
PCF806	0·80
PCF808	1·00
PCL82	0·45
PCL83	0·70
PCL84	0·50
PCL85	0·60
PCL86	0·50
PCL805/85	0·60
PD500	1·50
PEN45	0·85
PL36	0·63
PL81	0·55
PL82	0·50
PL83	0·50
PL84	0·50
PL500	0·75
PL504	0·85
PL508	0·90
PL509	1·55
PL802	1·00
PX25	3·50
PY33	0·63
PY81	0·50
PY82	0·45
PY83	0·50
PY88	0·56
PY500	1·10
PY81/800	0·50
PY801	0·55
SP41	3·00
SP61	0·85
T41	1·00
U14	0·75
U25	1·00
U26	0·85
U191	0·75
UABC80	0·40
UAF42	0·75
UBC41	0·60
UBC81	0·50
UBF80	0·50
UBF89	0·50
UCC85	0·50
UCH42	0·80
UCH81	0·50
UCL82	0·40
UCL83	0·70
UF41	0·75
UF89	0·50
UL41	0·85
UL84	0·50
UY41	0·55
UY85	0·45
VR105/30	0·40
VR150/30	0·45
1R5	0·50
1S5	0·40
1T4	0·40
3S4	0·50
3V4	0·85
5R4GY	1·00
5U4G	0·55
5Y3GT	0·65
5Z4G	0·65
6/30L2	0·90
6AK5	0·45
6AM5	1·00
6AQ5	0·50
6AS7G	1·00
6AT6	0·60
6AU6	0·40
6BA6	0·38
6BE6	0·45
6BH6	0·75
6BJ6	0·75
6BQ7A	0·55
6BR7	1·20
6BS7	1·40
6BW6	1·00
6BW7	1·00
6C4	0·40
6CD6G	1·60
6CH6	1·50
6CW4	1·00
6F23	0·90
6F25	1·00
6F28	0·75
6J5M	0·65
6J5G	0·45
6J6	0·35
6J7G	0·30
6J7M	0·65
6K6GT	0·80
6K7G	0·35
6K7M	0·45
6K8G	0·45
6K8M	0·70
6K25	1·00
6L6G	0·55
6Q7G	0·40
6Q7M	0·60
6SL7GT	0·55
6SN7GT	0·55
6SQ7GT	0·40
6U5G	1·50
6V6G	0·30
6V6GT	0·60
6X4	0·45
6X5G	0·45
6X5GT	0·55
7B6	0·80
7B7	0·80
7C5	1·80
7C6	1·00
7H7	0·80
7R7	0·80
7S7	2·25
7Y4	0·80
12AT6	0·45
12AT7	0·45
12AU6	0·50
12AU7	0·38
12AX7	0·38
12BA6	0·50
12BE6	0·60
30C1	0·40
30C15	1·00
30C17	1·00
30C18	0·90
30F5	1·00
30FL1	1·00
30FL2	0·75
30FL14	1·00
30L15	0·95
30L17	0·95
30P4MR	1·30
30P12	1·00
30P19	0·95
30PL1	0·95
30PL13	1·10
30PL14	1·10
35W4	0·60
35Z4GT	0·70
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807	1·00
813ITT	14·00
813USSR	6·00
866A	1·20

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AAZ15	0·10
AC107	0·51
AC126	0·25
AC127	0·25
AC128	0·15
AC176	0·25
AC187	0·21
AC188	0·20
ACY21	0·22
ACY39	0·75
AD140	0·50
AD149	0·50
AD161	0·44
AD162	0·44
AF115	0·25
AF116	0·25
AF117	0·24
AF186	0·48
AF239	0·44
ASY27	0·83
ASY28	0·25
BA102	0·25
BA115	0·10
BC107	0·14
BC108	0·13
BC109	0·12
BC113	0·15
BC117	0·21
BC143	0·30
BC147	0·10
BC148	0·08
BC169C	0·15
BC182	0·12
BC182L	0·12
BC184L	0·13
BC338	0·15
BCY32	0·85
BCY33	0·38
BCY34	0·46
BCY70	0·18
BCY71	0·22
BCY72	0·15
BCZ11	0·65
BD121	1·00
BD124	0·65
BD131	0·42
BD132	0·50
BF115	0·20
BF167	0·25
BF173	0·28
BF179	0·33
BF180	0·36
BF181	0·35
BF194	0·10
BF195	0·13
BF197	0·15
BF200	0·32
BFS61	0·25
BFS98	0·25
BFW10	0·61
BFX29	0·28
BFX88	0·24
BFY50	0·20
BFY51	0·20
BFY52	0·20
BY100	0·27
BY126	0·14
BY127	0·15
BZX61 series	0·20
BZY88 series	0·10
CR81-05	0·35
CR81-40	0·50
CR83-05	0·40
CR83-40	0·65
MJE340	0·47
MJE370	0·68
MJE520	0·65
MJE2955	1·27
MJE3055	0·75
MPF102	0·40
MPF103	0·36
MPF104	0·35
MPF105	0·36
NKT404	0·66
OA5	0·72
OA10	0·40
OA79	0·10
OA81	0·18
OA91	0·07
OA200	0·08
OA202	0·06
OC16	1·00
OC20	2·00
OC23	1·25
OC25	0·40
OC28	0·66
OC35	0·55
OC36	0·60
OC42	0·40
OC44	0·20
OC45	0·20
OC71	0·18
OC72	0·28
OC76	0·30
OC77	0·55
OC81	0·29
OC81D	0·28
OC81Z	0·45
OC83	0·27
OC140	1·14
OC170	0·30
OC171	0·30
OC200	0·55
OC201	1·00
OC202	0·90
OC203	0·55
OCP71	1·20
ORP12	0·60
ORP60	0·55
TIC44	0·29
TIC226D	1·50
TIL209	0·20
ZTX107	0·12
ZTX108	0·08
ZTX300	0·13
ZTX301	0·14
ZTX302	0·18
ZTX304	0·24
ZTX500	0·13
ZTX501	0·15
ZTX503	0·16
ZTX531	0·25
ZTX550	0·18
1N914	0·06
IN4001	0·06
IN4002	0·07
IN4003	0·08
IN4004	0·08
IN4005	0·10
IN4006	0·12
IN4007	0·12
IN4009	0·06
1N4148	0·06
18921	0·07
182033	0·20
182051A	0·20
182100A	0·20
183010	0·25
2N696	0·15
2N697	0·16
2N706	0·10
2N706A	0·12
2N1131	0·25
2N1132	0·24
2N1302	0·18
2N1303	0·18
2N1304	0·29
2N1305	0·22
2N1306	0·28
2N1307	0·28
2N1308	0·28
2N1309	0·30
2N1613	0·21
2N1614	0·45
2N2147	0·78
2N2160	0·78
2N2369A	0·16
2N2646	0·50
2N2904	0·20
2N2904A	0·25
2N2905	0·32
2N2905A	0·25
2N2906	0·20
2N2926	0·12
2N3053	0·18
2N3055	0·45
2N3525	0·91
2N3614	0·65
2N3615	0·65
2N3702	0·11
2N3703	0·12
2N3704	0·14
2N3705	0·15
2N3706	0·11
2N3707	0·13
2N3708	0·07
2N3709	0·10
2N3710	0·11
2N3711	0·11
2N3819	0·38
2N3820	0·50
2N3823	0·50
2N3903	0·15
2N3904	0·20
2N3905	0·25
2N3906	0·25
2N4058	0·15
2N4059	0·10
2N4060	0·13
2N4061	0·13
2N4062	0·14
2N4289	0·30
3N125	1·75
3N141	0·81
40360	0·40
40361	0·45
40362	0·40
40430	0·85

SN7400	0·16
SN7401	0·16
SN7402	0·16
SN7403	0·16
SN7404	0·26
SN7405	0·22
SN7406	0·42
SN7407	0·42
SN7408	0·28
SN7409	0·28
SN7410	0·16
SN7411	0·25
SN7412	0·30
SN7413	0·36
SN7416	0·36
SN7417	0·36
SN7420	0·16
SN7422	0·25
SN7423	0·37
SN7428	0·40
SN7430	0·16
SN7433	0·37
SN7437	0·37
SN7438	0·37
SN7440	0·22
SN7441AN	0·92
SN7442	0·79
SN7450	0·16
SN7451	0·16
SN7453	0·16
SN7454	0·16
SN7460	0·16
SN7470	0·36
SN7473	0·41
SN7474	0·42
SN7480	0·60
SN7483	1·10
SN7486	0·47
SN7490	0·55
SN7491AN	1·00
SN7492	0·70
SN7493	0·70
SN7494	0·80
SN7495	0·80
SN7496	0·95
SN7497	3·87
SN74100	1·89
SN74107	0·45
SN74110	0·58
SN74118	0·90
SN74119	1·68
SN74121	0·50
SN74122	0·70
SN74123	1·00
SN74141	0·90
SN74145	1·26
SN74150	1·75
SN74151	1·00
SN74154	2·00
SN74155	1·00
SN74156	1·00
SN74157	0·95
SN74170	2·52
SN74174	1·57
SN74175	1·10
SN74176	1·26
SN74190	2·00
SN74191	2·00
SN74192	2·00
SN74193	2·00
SN74194	1·30
SN74195	1·10
SN74196	1·20
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CD4029AE	£1.12	£1.76	£1.41
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7404	16p	13p	11p
7408	16p	13p	11p
7409	16p	13p	11p
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7417	27p	22½p	20p
7420	16p	13p	11p
7427	27p	22½p	18p
7430	16p	13p	11p
7432	27p	22½p	18p
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7442	65p	55p	43p
7445	85p	71p	57p
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7472	25p	21p	17p
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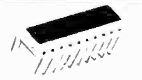

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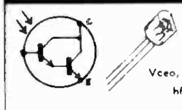

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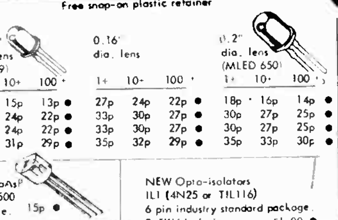

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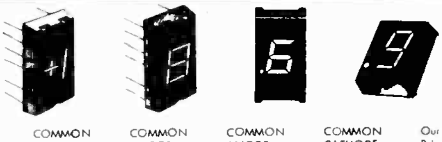

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	RED	XAN71	XAN72	-	XAN74	£1.49●
	YELLOW	XAN81	XAN82	-	XAN84	£1.49●
0.4"	GREEN	MAN4510	MAN4520	MAN4530	MAN4540	£2.32●
	RED	MAN4710	MAN4720	MAN4730	MAN4740	£2.32●
	YELLOW	MAN4810	MAN4820	MAN4830	MAN4840	£2.32●
	ORANGE	MAN4610	MAN4620	MAN4630	MAN4640	£2.32●
		C.A. L/H Dec. Pt.	C.A. ± 1	C.C. L/H Dec. Pt.	C.C. ± 1	
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NOTE: MAN4000 series pinouts are 14 pin dil the same as MAN50;70 & 80 series.

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1·0	—	—	—	—	—	11p	—	8p
2·2	—	—	—	—	11p	—	8p	9p
4·7	—	—	—	11p	—	8p	9p	8p
10	—	11	—	—	8p	9p	8p	8p
22	—	—	8p	—	9p	8p	8p	10p
47	8p	—	9p	8p	8p	8p	10p	13p
100	9p	8p	8p	8p	9p	10p	12p	19p
220	8p	8p	9p	10p	10p	11p	17p	28p
470	9p	10p	10p	11p	13p	17p	24p	45p
1,000	11p	13p	13p	17p	20p	25p	41p	—
2,200	15p	—	—	26p	37p	41p	—	—
4,700	—	—	39p	44p	58p	—	—	—
10,000	42p	46p	—	—	—	—	—	—

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Code	*Watts*	*Ohms*	*1 to 9*	*10 to 99*	*100 up* (see note below)
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C	1/2	4·7-10M	1·3	1·1	0·9 nett
C	3/4	4·7-10M	1·5	1·2	0·97 nett
C	1	4·7-10M	3·2	2·5	1·92 nett
● MO	1/2	10-1M	4	3·3	2·3 nett
WW	1	0·22–0·47 Ω	16	14	11 nett
WW	1	0·56-3·9 Ω	12	10	8 nett
WW	3	1-10K	9	8	8 nett
WW	7	1-10K	11	10	8 nett

Codes:
C = carbon film, high stability, low noise.
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WW = wire wound, Plessey.

Values: All E12 except C ⅓W, C ¾W and MO ½W.
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Tolerances:
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0·068, 0·1, 0·15 — ea. 4p
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A UHF WAVEMETER

R. LONGDEN

A WAVEMETER is an essential item of equipment required to check the order of multiplication obtained in the various tuned circuits of a transmitter. For example, consider a 144MHz transmitter using an 8MHz oscillator. The oscillator is usually followed by a stage tuned to the third harmonic, to obtain 24MHz. This is followed by a 3x harmonic amplifier, then a doubler, giving 24x3x2, or 144MHz. Wrong tuning could give 2x4 or 4x2 in the early stages, providing 64MHz, doubled to 128MHz. Tuning the PA to this would cause out-of-band operation.

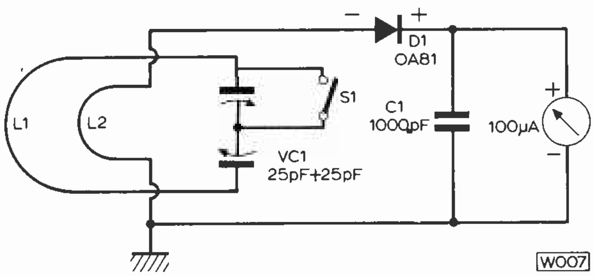
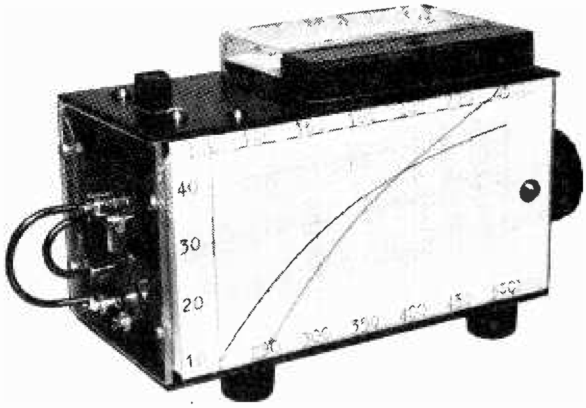


Fig. 1: Simple circuit of the two-range UHF wavemeter.

A calibrated wavemeter will ensure that the output is at 144MHz. It can also be used to check for possible harmonic output on 288MHz, 432MHz, or other related frequencies. A wavemeter is not intended to show the **exact** frequency, but to indicate that the correct harmonic or band is in use. If a large graph is prepared to show wavemeter dial readings and frequency, good accuracy is obtainable, but a much smaller graph is quite adequate for harmonic and similar checks.

For frequencies above about 300MHz, a very low minimum tuning capacitance is necessary and it becomes difficult to use ordinary plug-in coils,



fixed loop L1, but switch S1 allows two ranges to the holder and leads. The circuit in Fig. 1 has a because of the stray capacitance and inductance of be obtained.

For the higher range of approximately 220 to 500MHz, the two sections of the butterfly capacitor VC1 are in series, giving a maximum capacitance of about 12·5pF and a very low minimum. With S1 closed one section of 25pF is in use, and the range is approximately 120-240MHz. VC1 is operated by a small reduction drive. The diode is coupled by the loop L2 to avoid loading L1 and rectification by diode D1 provides current for the 100µA meter. Resonance is indicated by the maximum meter reading.

CONSTRUCTION

The layout is shown in Fig. 2. The sides of the case are 4×2in flanged universal chassis members. A further 4×2in member is cut into two. One part

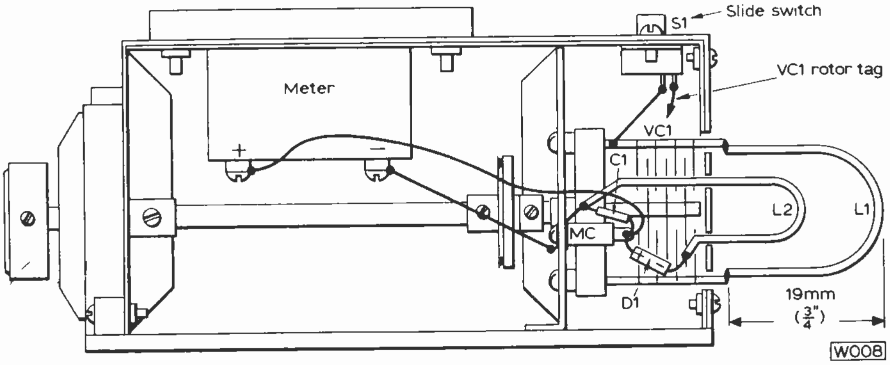


Fig. 2: Constructional details inside the wavemeter. Full dimensions of coils L1/L2 are given in the text.

of this provides the end, on which the ball drive is mounted. The other part is used to mount VC1. The end flanges of the sides are cut off at the ball drive end. The top of the box is paxolin, $4\frac{1}{16} \times 2$in, and cut to take the meter and S1.

Assembly is most easily carried out by fitting together the top, one side, and parts to take VC1 and the drive. A length of $\frac{1}{4}$in rod fits between the drive and insulated flexible coupling. The shaft of VC1 occupies a clearance hole, and VC1 is fixed by two short 6BA bolts into the "dead" bushes provided. As VC1 spindle is slightly smaller, a piece of tinplate is cut and bent round it to bring it up to about $\frac{1}{4}$in diameter. Wiring can then be done as in Fig. 2, except for L1 and L2. C1, D1 and the meter lead are anchored at an insulated tag.

★ components list

C1 1000pF disc ceramic. D1 OA81.
VC1 25 + 25pF butterfly type (Jackson C713).
M1 Meter, 100μA. Universal coupling.
Drive, (Eagle 1½in. dia.) Rod ¼in. dia.
Universal chassis members 4 x 2in. (3) (Home Radio).
S1, miniature slide switch.

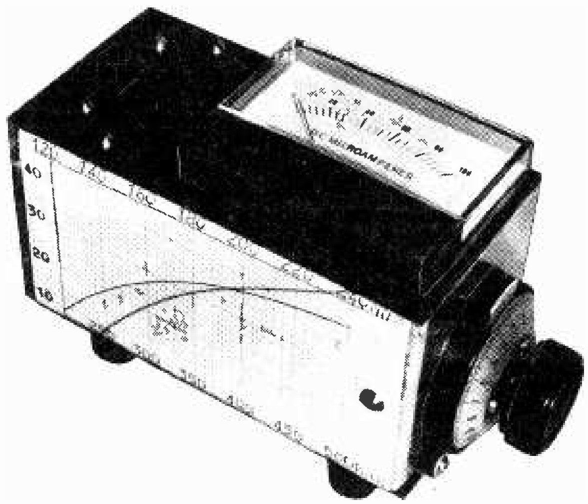
The case end was $\frac{1}{16}$in thick Perspex, so that drilling positions can be seen. Clearance holes are drilled for the four studs of VC1. Two holes are also drilled for the ends of L2. About one-half the width is cut off the end flanges of the metal sides members, and these and the end are drilled for four 8BA bolts. L1 is 16swg or other stout wire and is 22mm ($\frac{7}{8}$in) across and 19mm ($\frac{3}{4}$in) long (Fig. 2). It is soldered to the projecting studs of VC1, near the position for L2. L2 is of similar wire, 13mm ($\frac{1}{2}$in) across and projecting about 13mm ($\frac{1}{2}$in), with ends long enough to reach the MC tag and D1. When L2 is soldered on, the case bottom can be fixed with self-tapping screws. The dial reads zero with VC1 closed.

USE OF WAVEMETER

The wavemeter loop or coil is positioned so that it can pick up RF energy from the oscillator, amplifier or other coil of the equipment, and the wavemeter is tuned to resonance, as shown by maximum meter indication. The frequency is then found from the wavemeter scale.

Best accuracy is secured when coupling is loose, so that only a small meter indication is obtained. So, as the wavemeter tuning position is found, it is moved away from the RF coil where energy is present. With very low power circuits, close coupling is needed to begin with, inductors or windings in line. Coupling is reduced by moving the wavemeter away, or turning it to place its coil at an angle. Where a few watts of RF may be present, a full-scale reading may be obtained at some inches spacing, so care is needed when first testing any circuit, to avoid possible damage to the meter.

Exactly similar methods are used to couple the wavemeter to a circuit for calibration purposes, except that in this case the frequency will be known already.



CALIBRATION

One or more of several methods can be used. As the final calibration is an important aspect, three methods are described. In each case it is wise to plot a graph showing dial readings against frequency, because this gives intermediate readings, and helps avoid any error as a displaced calibration point is suspect.

As the wavemeter is a passive device, it is always necessary to provide an oscillator or other source of RF energy, even if this is not itself the origin of calibration.

Lecher Line. This can be excited by an oscillator whose frequency is not known, and the frequency found by measurement with a ruler, to calibrate the wavemeter. With care it is usually considered that accuracy can be better than 1%. Fig. 3 shows essential features of the line. It can be made on a board about 130×25mm (5×1in) and 1·85m (6ft) long (actual dimensions are not important). X-X can be a strong tag-strip anchoring the wires about 25mm (1in) to 40mm ($1\frac{1}{2}$in) apart. An insulated loop about 13mm ($\frac{1}{2}$in) in diameter with ends some 50mm (2in) long is soldered on here. The wires can be 20SWG tinned-copper, 25mm (1in) or more clear of the board. Points Y-Y can be long screws with nuts, so that the wires can be drawn taut. The wires must be parallel, but fixing details at X-X and Y-Y do not influence calibration.

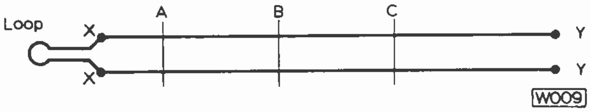
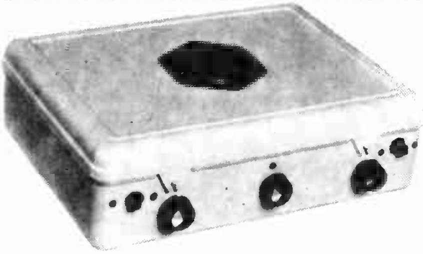


Fig. 3: Arrangement of Lecher line as a means of calibrating wavemeter.

Energy is coupled to the line by positioning the loop near the oscillator inductor. A metal straight-edge, at right-angles to the wires, is then slid along in contact with the wires, from X-X. At some point such as A, resonance causes the line to draw power. This is marked. The straight-edge is moved on, until this is repeated, as at B. The distance A to B is then measured. If measured in cm, 15,000/cm = MHz. E.g., 30cm = 500MHz, or 60cm = 250MHz, and so on.



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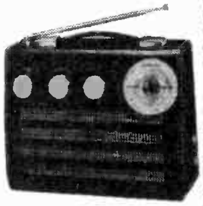

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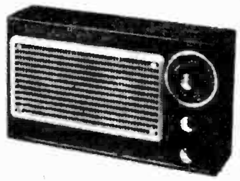

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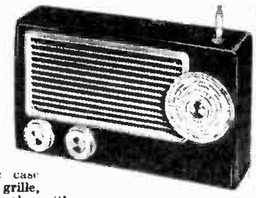

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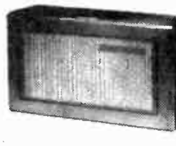

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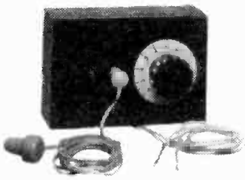

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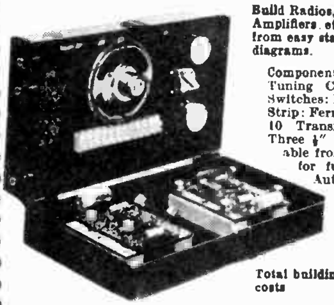

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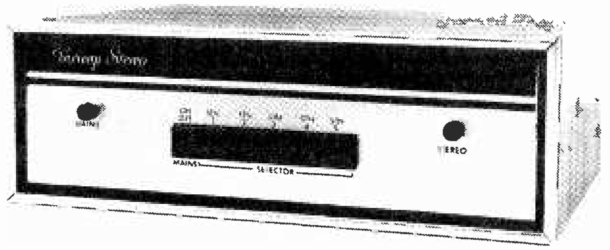

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With low power, resonance with the oscillator is most easily shown by including a meter to show anode or collector current. With the frequency determined, tune the wavemeter to it as described, and mark the graph. The oscillator frequency is then changed, and the procedure repeated for a new point.

Fig. 4 is an oscillator found suitable for up to 500MHz. L1 is three-quarters of a turn 8mm ($^5/_{16}$in) in diameter soldered directly across TC2. TC1 is a miniature tubular pre-set and though this needs to be near minimum capacitance, oscillation was not obtained without it. The whole is assembled in any convenient form, but with very short leads for RF circuits.

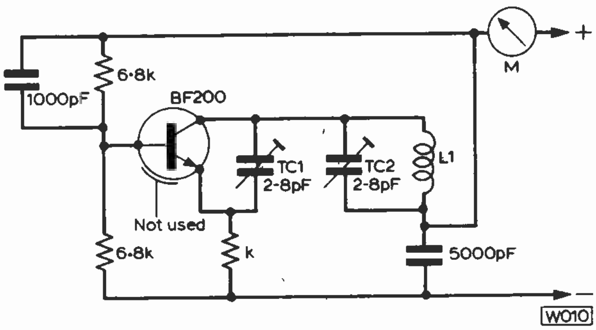


Fig. 4: Circuit of low power oscillator, used as a source of energy at UHF.

Best indication was obtained using a 1mA meter, with the supply voltage reduced for nearly a full-scale reading. Shorting or holding TC2 should cause a drop in current. If not, the circuit is not oscillating.

The line loop is coupled to L1 so that a dip can be seen on the meter for two positions of the shorting bar. The line is then removed, and the wavemeter is loosely coupled and tuned to produce the same dip, and its chart marked with the frequency determined by the line.

Use of GDO. If a calibrated grid dip oscillator can be used, the wavemeter can be easily calibrated within the range available on the GDO. Keep GDO and wavemeter separated so that only a small wavemeter reading is obtained on resonance.

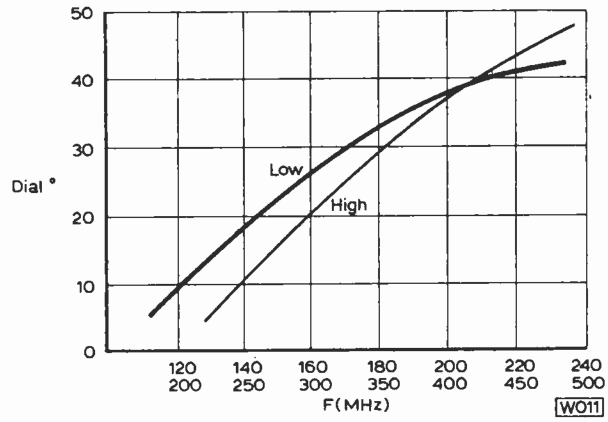
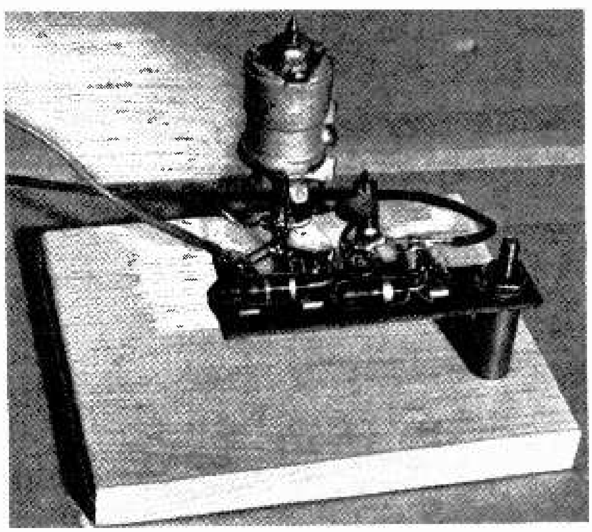


Fig. 5: Typical calibration curves for the two ranges on the wavemeter

Transmitter Harmonics. A 2m transmitter will provide a 144MHz calibration mark. With some circuits, second and other harmonics of this or other frequencies may be found. With a transmitter such as the 10 watt one for 2m (*PW*, October 1973) where RF is generated at 72MHz and followed by three circuits tuned to 144MHz, it may prove impossible to find any harmonic or spurious frequencies, in normal operation, with the wavemeter. Some calibration marks can be obtained by temporarily changing the doubler anode coil for operation on a higher harmonic. HT is reduced so that doubler current cannot exceed some 30-40mA at 200V or so. The PA is removed or similarly kept within its anode dissipation rating, and can be operated as a doubler for this purpose.

Fig. 5 is a guide on what to expect when calibrating the circuit in Fig. 1. A larger graph on graph paper is recommended. Calibration was done using a tunable oscillator, Lecher line, and harmonics. PW



Layout of Fig. 4 on a simple tag strip. A 9V supply should be adequate.

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

AS this copy is being bashed out there will be many hundreds of likely candidates around the country doing their utmost to put on to paper their answers to a few technical questions which, they hope, will result in a 'pass' slip for the Radio Amateurs Examination coming through the post in a couple of months' time. One of the best articles I have ever seen on the subject appeared in Radio Communication for April, entitled "Taking the Radio Amateurs' Examination", by R. G. Marden G3MWF.

Strangely enough, it wasn't technical but it did show how to approach the examination on strictly commonsense lines thus giving a candidate an edge over those who arrive at the examination centre hot and bothered, without pens or pencils and without the faintest idea of how they are going to tackle the questions. I have invigilated at many of these exams and I can tell you it has broken my heart to see the way that some candidates have gone about their task. I would say that the vast majority had sufficient knowledge to pass but many made a complete hash of the written work, entirely through lack of preparation.

Frankly, the amount of technical knowledge required is pretty small and the papers are so similar every time that it doesn't take a genius to assess just what is wanted and to concentrate on learning the essentials. Like any other examination, find out what the questioner wants to know and give it to him, without any frills. And the most important piece of advice, as underlined by Mr. Marden: regardless of having finished the paper or not spend at least ten minutes at the end reading your answers and making corrections, and there will be some, I assure you, and these could make all the difference between a pass and a fail.

Obviously many of you enjoyed copying lots of nice new prefixes in the CQ WPX Contest, some of which were pretty easy to fix but others like XX for CR(6) were not so obvious. **Steve Blake** (Aylesbury) logged some, such as CV0Z, CQ7AZ and PW4. Steve is improving his 2m rig by changing his ground-plane for two five-element quads at around 40ft. **Mark Corrigan** (New Zealand) sent a brief first log but the only ones of possible interest were G8PO and G3WMZ on 80m SSB. Mark has a Heathkit SW717 and ATU with 100ft wire and dipole for 20m. **Paul Heath** of Wolverhampton did well with his 1155 set to get VQ9M on 80m SSB and the address for QSL's is Box 191 Mahé, Seychelles. Paul also mentioned OA4S/P/4X of the UN contingent on the Golan Heights, which must be a DX'ers dream QTH judging by the TV coverage we have seen of those parts! **Mike Green** (Northwich, Cheshire) has not been very active but managed to spend some time in the WPX contest when he captured PJ9UA, VP5B, 3B6DW, among many others on 15m which confirms my long-held theory that it's lack of activity rather than bad conditions that turns people against this band and 10m.

Ian Moore (Leeds) turned in a very brief log for 20m that included YN1WB, a prefix not heard all that often. **Paul Barker** (Sunderland) reports little doing on the SSTV frequencies apart from usual Italians and a few other Europeans. He notes 5L9A, yet another recent prefix, in place of the perfectly respectable EL series! Excuse this time, 10th anniversary of the President!

Stephen Budd A8713 (Worthing) was kind enough to send me a copy of the Geoff Watts DX News Sheet which is the place to get all the gen on these new calls as they come up. The cost is modest and it is posted out every Tuesday. Can't be more up to date than that! Details from Geoff at 62 Belmont Road, Norwich NR7 0PU. On his FRDX400 Stephen has found Asia open from 14 to 1600 and the Pacific from 07 to 0800. **Tim Charles** (Colchester) thought chess players might be interested in the net on 3798kHz around 1700 every evening. He says G3ZYY claims to have worked ZL3RB on Top Band again, 449 both ways. Tim is one of our few stalwarts who actually enjoys listening to the CW ends of the bands. More should try it as it can be very rewarding.

M. J. Connolly A8796 (Yeovil) stuck to 20m SSB trying out an ATU he has now completed. **Paul Heath,** again, had to think quick when he lost a vital guy wire from his mast but saved the day by using one if his dipoles in lieu! **John Porter** (Baslow, Derbys) used his FR50B and two multiband dipoles to drag in stations on 80, 20 and 15m and was pleased to copy VE8RCS of the Polar Amateur Radio Club in the North West Territories, this at 1040 in the morning!

Log extracts

S. Blake:—20m CV0Z VP5B ZY5YZ **15m** CQ6LF FH8CY PW4KL ZZ8JO.

M. Green:—80m YB0ABV **40m** CR4BC HC2BV HZ1AB 9Y4VU **20m** FK8CA PJ9EE YS1JWD ZF1MA 3C1AGD (Expedition to Equat. Guinea by SM0ATD) **15m** CW3BH PW4FL 3B6DW.

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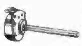
● POTENTIOMETERS



Rotary miniature carbon track ¼" spindle.
Values available: 5k, 10k, 25k, 50k, 100k, 250k, 500k, 1M, 2M.
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Lin, Single-gang (+ 1K) 17p
Log. or Lin. Single-gang with switch 36p
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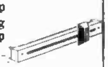

Slider 60mm track. Metal-cased: overall length 86·15mm (knob extra 7p)
Values available: 1k; 5k; 10k; 25k; 50k; 100k; 250k; 500k;
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Log Single Gang 42p
Lin or Log Dual Gang 49p

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3·3	63	6p	100	4	6p			
4·7	63	6p	100	10	6p	470	6·3	8p
6·8	40	6p	100	25	6p	470	10	18p
6·8	63	6p	100	40	8p	470	25	20p
10	25	6p	100	63	20p	470	40	32p
10	63	6p	150	6·3	6p	680	6·3	18p
15	16	6p	150	16	6p	680	16	20p
15	40	6p	150	25	8p	680	25	32p
15	63	6p	150	40	18p	680	40	35p
22	10	6p	150	63	20p	1000	4	18p
22	25	6p	220	4	6p	1000	10	20p
22	63	6p	220	10	6p	1000	16	32p
33	6·3	6p	220	16	8p	1000	25	35p
33	16	6p	220	25	18p	1500	6·3	20p
33	40	6p	220	40	20p	1500	10	32p
47	4	6p	220	63	32p	1500	16	35p
47	10	6p	330	4	6p	2200	6·3	32p
47	25	6p	330	10	8p	2200	10	35p
47	0	6p	330	16	18p	3300	6·3	35p
47	63	8p	330	63	35p	4700	4	35p

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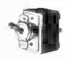
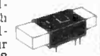


Toggle with ON/OFF plate DPDT 250V 1·5A 26p

BCD OUTPUT SLIDE SWITCH



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5-pin B (240°)	12p	8p
6-pin	12p	9p

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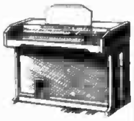

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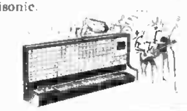

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P. Barker:—80m OE2SCL/YK **20m** M1BS 3B8DR 5L9A 8Q6AC.

S. Budd:—80m C31LO (Box 10 Andorra) EA9EL FC2CD JY3ZH **20m** DU1DCC VS9MB 9V1QM VP5SL PJ3DO YB0AAG ZF1MA KH6OT 5T5ZR (Box 202 Nouakchott) 3D2AJ (Box 1220 Suva) UA9VH/JT1 (Box 639 Ulan Bator) **15m** VQ9HCS 9J2WR.

T. Charles:—160m VO1KE 80m A2CJP A4ANG FL8MF HC2TV HR1AT KG4DS KZ5ZK YN1AZ **40m CO2AM FK8AC VK7GK 20m** JT1KAA KX6LP PZ9AA TR8WR YS1MAE **4W1FZ 6O2AP 8P6BU 15m** CO2FT CX8DI FH8CY HC2AF PJ9EE **VP7RU 5N2GV** 5V4DV ZD7BS **2m** DK6AB F1BUC from Oscar 7 on 70cm. OK30MDB SP9EGM UR2EQ all via Oscar 7.

M. Connolly:—20m A6XR HR3JJR OA42/P/4X VP2AA YS1GMV 3D6AW 6Y5DA 9M2CX.

P. Heath:—80m EA6CE KZ5BC PJ3HM VQ9M ZL4KF **20m** VE8DC VP5B OA4S/P/4X.

J. Porter:—80m FC2CD HZ1AB ZB2A **20m** PZ3EVK VE8RCS 8P6CC **15m** LU9CV ZD7FT ZP5NP.

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

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

I HOPPED over to the other side of the fence recently and went to the North Midlands mobile radio rally at Drayton Manor Park. There I chanced upon three youngsters bent on forming a DX club in the Birmingham area. So in response to their plea for help I would ask anyone interested to write to **Tony Fenton**, 124 Wolverhampton Road, Oldbury, Warley, West Midlands B68 0LW and help them get it off the ground.

Another cry for help comes from **Dave Evered** of Cardiff, he is another of these lucky people who has managed to pick up a communications receiver for a few pence. He would like anyone who can supply any literature or gen on an Eddystone S640 to write to him at 13 Daviot Street, Roath, Cardiff. Dave also wants to know the best frequency for the BBC World Service here in the UK. This is on the Medium Waves in Charles Molloy land, on 1088kHz, radiated from Crowborough. SINPO, by the way Dave, stands for Strength, Interference, Noise, Propagation and Overall Readability. These are ways of measuring a radio signal and are scaled from 0 to 5, with 5 as strongest, 0 weakest, and most stations like to have SINPO ratings on QSL requests.

Tony Rowland from Glorious Devon writes with a beef, and that is because he has waited since November for his 1975 World Radio and TV Handbook. Tony, I am afraid that I had to wait almost as long, and in the end the book came by post from Denmark. Can anyone help Tony identify "Radio Carlos" heard on 5050 at 2245, the programme content was news, documentary items and music, so let us know folks if any of you can pinpoint this station. An answer now to a recent "crie de coeur" comes from **Lawrence Bennett** of Bristol. He provides the info that the station RTV Dominicana has an outlet on 9505 and that Radio Messiah comes from Radio Luxembourg transmitters on 6090. Lawrence sends quite a list of Latin American "goodies," heard on an Astrad 17, among them the following:

11700 Radio Clarin Dominica at 2255
11925 Radio Bandierentes at 2200
11805 Radio Globo Brazil at 2230
15135 Radio Record Brazil at 2135.

Andrew Cope of Southport also fills us in on RTV Dominicana and he says it is a 50 kilowatter using the callsign HISD and is best heard around 0215 to 0230. Andrew recommends very highly his ex-army A510 this being fed by an ATU. It also has a unique earthing system in that Andrew has installed in the ground three large dog meat tins and from these a spider's web of 18SWG copper wire, this is all connected to the set by another length of copper wire!

More unusual happenings are reported by **Robert Hill** of Crewe. These come from the sunny Algarve in Portugal where Robert has been on holiday. It seems that while listening to the Portuguese domestic radio which, Robert says, is controlled by the military, the transmitter signed off with, of all things, the march "A life on the ocean wave"! Has any one else a funny story to tell us? From Kettering, QTH of **Peter Bowyer** comes the question "how can I fit a bandspread capacitor." Well, Peter, I cannot of course speak on your Murphy A168 simply because I do not know the set but the basic theory is that you fix a variable capacitor to the chassis in such a position that the capacitor spindle protrudes through the set "box," then connect it to the chassis of the existing tuner and to the fixed vanes of the oscillator tuning capacitor. Vague, I know, but there it is, there is never a way of doing anything that is common to every set except perhaps fitting a valve or making a soldered joint.

Jonathon Marks of Norwich has an item for all those fans of Radio Canada. He writes to say that RCI have changed their QSL policy and now cease to put date time and frequency details on the card, and, as Jonathon says, have made it like the BBC acknowledgement card. I am sure we wish a "get well soon" to our old mate **James Walker** of Milton Keynes. He has been in hospital for a month and has taken the trouble to drop a few lines to the column. James passes on the tip that Radio Bucharest has in its DX show on Thursdays at 1300 on 15250, 11940 and 9690 a short item for radio amateurs. **Robert Gibson** of Wadhurst asks if it is worth while fitting a preselector. This gadget is an RF amplifier, tunable over the SW bands, and has the job of boosting the signal that comes from the aerial and feeding it into the set. Unfortunately it also boosts the noise as well. However despite my saying this they are undoubtedly a very useful tool especially to anyone who is in an area of weak radio signals.

I recently cast an eye over the latest copy of

ON THE AIR

"Communication" the journal of the newly formed Twickenham DX Club. The editor, namely **Dave Kenny** of 37a Popes Grove, Twickenham gave me permission to quote the fact that one of their members reported Radio Omdurman in the Sudan at 1655 on 11835. This is a 120 kilowatter and is very rarely reported. The service is for Sudanese people abroad and is only on for one hour a day from 1800 to 1900 except Saturday, when it changes to 1900 to 2000, so no wonder it is a rarity.

That, I am afraid, draws the meeting to a close, a very heavy post bag this month for the space allowed so apologies if you were left out and 73s to you and yours.

MEDIUM WAVE DX

by CHARLES MOLLOY

STOKE-ON-TRENT listener **Christopher Owens** uses a Bush BP12 receiver when DXing on the medium waves. His transatlantic successes are WNBC in New York City on 660kHz at 0115, CJON St John's Newfoundland on 930kHz at 0145, WBZ in Boston on 1030kHz at 0150, CBA Moncton New Brunswick on 1030kHz at 0205. Other catches are Radio Algiers on 251kHz on the long waves (this station has a daily programme in English at 1900 GMT), Dakar in Senegal, West Africa on 764kHz carrying an international programme at 0130, Agadir in Morocco on 935kHz at 0030 and the Voice of Tangiers on 1232kHz at 0040.

An excellent log of Latin American DX heard between 0200 and 0300 GMT comes from **Alfred Johnson** of London. Among the more notable are HJND Radio Nacional, Bogota in Colombia on 570kHz, HJHJ Radio Libertad, Barranquilla Colombia on 600kHz, YVLH Radio Giradot, Maracay in Venezuela on 650kHz, YVLL Radio Rumbos, Caracas in Venezuela 670kHz, HJCX Radio Sutatenza, Cali on 700kHz, YVKY Radio Capital, Caracas 710kHz, HJDK La Voz de Antioquia, Medellin 750kHz, YVQQ Radio Puerto La Cruz 760kHz, PJB Trans World Radio Bonaire, Netherlands Antilles 800kHz, HJCY Radio Sutatenza Bogota 810kHz, HJKC Emissora Nuevo Mundo, Bogota 850kHz, PRA3 Radio Mundial, Rio de Janeiro Brasil on 860kHz, Radio Jornal do Brasil on 940kHz, HJHN Radio Sutatenza, Magangue 960kHz, YVTB Exitos 980 in Maracaibo 980kHz, Radio Margarita, La Asuncion 1020kHz, PRE3 Radio Globo in Rio de Janeiro on 1180kHz, YVMN Radio Coro 1210kHz and ZYD74 Radio Tupi, Rio de Janeiro on 1280kHz. Latin Americans are usually at their best here in the UK in summer. Listen during the hour before sunrise for Brazilian stations which peak up at this time, such as Radio Jornal on 940kHz, Radio Nacional 980kHz and Radio Globo 1180kHz all in Rio de Janeiro and Radio Record 1000kHz, Radio Tupi 1040kHz and Radio Nacional 1100kHz in Sao Paulo.

Steve Whitt, who is a recent convert to the medium waves, reports again from London. His shack is equipped with an 8 valve Chapman 6BS communications receiver with the Practical Wireless Audio Processor Unit and his 40ft L shaped aerial strung between three chimneys at 30ft above ground level is connected to the receiver via the PW Aerial Tuning Unit. DX reported includes Sud Radio Andorra on 818kHz, CJON St John's on 930kHz and CBA Moncton on 1070kHz. Steve is building the Practical Wireless medium wave loop aerial including the FET balanced preamplifier.

Dr H. S. Brodribb (St Leonards-on-Sea) asks for information about the ITU LF/MF Conference which was held in Geneva last October. The recommendations made would maintain the 9kHz channel spacing in the European Area but would start at 531kHz instead of 539kHz as at present. This 9kHz spacing is useful to the medium wave DXer since stations in other parts of the world are spaced on multiples of 10kHz and consequently there are parts of the band where DX can be found between European stations. Listen at sunset for Riyadh in Saudi Arabia on 587kHz, Baghdad on 760kHz, Teheran on 1326kHz, Gorgan Iran on 1426kHz, Kuwait 1345kHz, Kirkuk in Iraq on 1360kHz, Ahwaz in Iran on 1390kHz and Dubai in the Persian Gulf on 1480kHz.

An unusual broadcaster can be found on 1095kHz during the evening. This is Radio Bayrak located in the Turkish held part of Cyprus. Heard by the writer at 2030 GMT with Turkish music, on a Marconi Mercury communications receiver and a 90ft outdoor aerial.

BROADCAST BANDS

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

AMATEUR BANDS

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

CQ! CQ! CQ! CQ!

EXCHANGE

...exchange or part-exchange Codar CR70A receiver for other general coverage Rx.—P. Dumpleton, 37 Mountview Avenue, Dunstable, Beds.

...P.E. March 1972 to Jan. 1974. P.W. June 1973 to Jan. 1974: any five for P.W. Oct. 1971, Jan 1972 or April 1972.—R. Sylvester, 8 Poplar Avenue, Johnstone, Renfrewshire Scotland.

ISSUES FOR DISPOSAL

about 150 back numbers of P.W. from Nov. 52 to Nov. 1973.—R. Collins, 35 The Riding, Woking, Surrey.

...back copies of P.W. from 1952 to 1974.—Harry Reilly, 76 Dundela Avenue, Belfast, BT4 3BU, N. Ireland.

...copies of P.W. going back to 1946.—W. C. Brown, GW8A1B, Pendref, Caersws, Montgomery, Wales.

...complete sets of E.E., odd P.W. and P.E. issues.—J. Tobin, 38 Blythwood Road, London, N.4.

...copies of P.W. April 1971 to October 1973 inclusive excepting Aug. 1972, July 1971 and April 1973. Includes all articles by Heilyer on Transistor Circuitry for Beginners.—J. W. Talbot, 58 Colston Avenue, Carshalton, Surrey.

...numerous issue of P.W. from 1959 to 1973.—R. A. Miller, 7 Woodrow Court, Melbourne Road, London, N.17.

...issues from 1958 (P.W.) to 1974.—J. Choppin, 9 Kitchen Avenue, Woodhouse Close Estate, Bishop Auckland, Co. Durham, DU4 6RB.

...P.W. October 1968 to October 1973 inclusive minus 4 issues.—P. Johnson, 158 Radford Road, Coventry, CV6 3BP.

...P.W. June 1969 to December 1973.—J. White, 57 Chandos Ave., Ealing, London, W.5.

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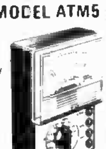
OUR PRICE £9.67 P&P Ins 30p

AUDIOTRONIC Model ATM1

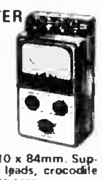
Top value 1,000 opv pocket multimeter. Ranges:– 0/10/50/250/1,000 volt AC and DC. DC current 0 1mA/ 100mA. Resistence: 0/150k ohms. Decibels: –10 to +22dB. Size 90 x 60 x 28mm. Complete with test leads.
OUR PRICE £4.25 P&P Ins. 25p

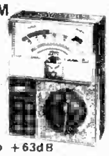
AUDIOTRONIC MODEL ATM5

Jewel movement, attractively moulded case with edgwise ohms adjustment. Ranges: 0-3/15/150/ 300/1200V AC, (2500 opv). 0-6/30/ 300/600V DC, (5000 opv). 0-300 uA/0-300mA DC. Resistance: x 10 & x 100. –10 to +16dB. Supplied with battery test leads and data booklet. Size: 121 x 73 x 29mm.
OUR PRICE £4.85 P & P Ins. 25p

MODEL C7202EN

20,000 o.p.v. DC. 10,000 o.p.v. AC Mirror Scale. 5/25/50/250/500/ 1000/2500 V DC 10/50 100/500/1000 V AC. DC Resistance x 10, x 1000 (30Ω centre scale) DC Current 50uA/ 2.5mA/250mA. –20 to +68 dB.
OUR PRICE £7.51 P & P Ins. 30p

ASK LASKYS about test equipment

U435 MULTIMETER

20,000opv. Ranges: 75mV/2.5/10/25/ 100/250/500/1000V DC. 2.5/10/25/100/ 250/500/1000V AC. Current: 50uA/1/5/ 25/100mA/0.5/2.5A DC. 5/25/100mA/ 0.5/2.5A AC. Resistance: 0.3/3/30/300k ohms. Size: 205 x 110 x 84mm. Supplied complete with leads, crocodile clips and steel carrying case.
OUR PRICE £9.45 P&P Ins. 30p

MODEL C7208FM

30,000 opv DC 15,000 opv AC. 6 3 15 60 300 600 1200 V DC. 6 30 120 600 1200 V AC DC Resistance x 1, x 10, x 100, x 1000 (50Ω centre scale) DC Current 30uA 3/30/600mA. –20 to +63dB
OUR PRICE £9.67 P & P Ins. 30p

U4324 MULTIMETER

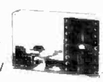
High sensitivity.
20,000opv. Ranges: 0.6/1.2/3/12/30/ 60/120/600/1200V DC. 3/6/15/60/150/ 300/600/900V AC. Current: 0.06/0.6/ 6/60/600mA/3A DC. 0.3/3/30/300mA/ 3A AC. Resistance: 25/500 ohms/0.5/5/50/500k ohms/5 Mohms. Decibels: –10 to +12dB. Size 167 x 98 x 63mm. Supplied complete with test leads, spare diode and instructions.
OUR PRICE £10.64 P&P Ins. 60p

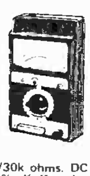
U91 Clamp VOLT AMMETER

For measuring AC voltage and current without breaking circuit. Ranges: 300/600V AC. Current: 10/25/100/250/500A. Accuracy 4%. Size 283 x 94 x 36mm. Complete with carrying case, leads and fuses.
OUR PRICE £15.12 P&P Ins. 60p

HIOKI 730X

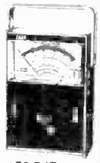
30,000 opv. Overload protection. 6/30/60/300/600/ 1200V DC. 12/60/ 120/600/1200V AC. 60/μA/ 30mA/300mA. 2K/200K/ 2 Meg Ohm. 10 to 63dB
OUR PRICE £8.10 P&P Ins. 30p

U4323 MULTIMETER

20,000opv. Simple unit with audio/IF oscillator. Suitable for general receiver tuning. Ranges: 0.5/2.5/10/50/250/ 500/1000V DC. 2.5/10/15/250/500/1000V AC. 0.05/ 0.5 5 50 500mA DC. Resistance: x 10, x 100, x 1,000, x 10,000 (50Ω, 500Ω, 5kΩ, 50kΩ centre scale). Battery operated. Size: 160 x 97 x 40mm. Supplied in carrying case complete with test leads.
OUR PRICE £8.64 P&P Ins. 60p

U4312 MULTIMETER

extremely sturdy instrument for general electrical use. 667opv. 0/0.3/1.5/7.5/30/ 60/150/300/600/ 900V DC & 75mV. 0/0.3/1.5/7.5/30/ 60/150/300/600/ 900V AC. 0/300uA/ 1.5/6/15/150/60/ 600mA/1/1.5/6A DC. 0/1.5/6/15/ 60/150/600mA/ 1.5/6A AC. 0/200/3k/30k ohms. DC accuracy 1%. AC 1.5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions.
OUR PRICE £11.61 P&P Ins. 60p

HIOKI 750X VOLT-OHM-MILLIAMETER

43 ranges: 0–0.3/0.6/ 1.5/3/6/12/30/60/150/ 300/600/1,200V DC. 0–3/6/15/30/60/120/ 300/600/1,200V AC. Current: 0–30/60uA/ 1.5/3/15/30/150/300 mA/6/12A. Resistance: 0–3/300k/3/30Mohms. Decibels: –10 to +17dB. Output: 0–3/6/15/30/60/120/300V. Accuracy ± 3% DC, ± 4% AC. Sensitivity: 50,000 opv DC, 5,000 opv AC. 4 inch meter. Built in protection. Size: 57 x 102 x 153mm.
OUR PRICE £12.90 P&P Ins. 60p

TMK MODEL TW50K

46 ranges, mirror scale. 50k/V DC 50k/V AC. DC Volts: 0.125/ 0.25/1.25/2.5/5/10/ 25/50/125/250/ 500/1000. AC Volts 1.5/3/5/10/25/50/ 125/250/500/ 1000. DC current 25/50uA/2.5/5/25/ 50/250/500mA/5/ 10A. Resistance: 10k/100k/1 Meg/ 10 Meg ohms. –20 to +81.5dB.
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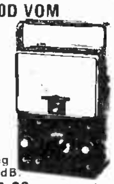
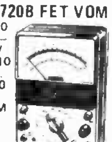
MODEL C7080EN

Giant 6" mirror scale. 20,000 opv. 0/0.25/1/2.5/10/ 50/250/1000/ 5000V DC. 0/2.5/10/50/250/ 1000/5000V AC. 0/50uA/1/10/ 100/500mA/10A DC. 0/2k/200k/ 20 Meg. –20 to +50dB.
OUR PRICE £21.55 P&P Ins. 60p

MODEL 500

30,000 opv with overload protection. Mirror scale. 0/0.5/2.5/10/25/ 100/250/500/ 1000V DC. 0/2.5/10/25/100/ 250/500/1000V AC. 0/50uA/5/50/ 500mA. 12A DC. 0/60k/6 meg/60 megohms.
OUR PRICE £15.07 P & P Ins. 60p

MODEL AS.100D VOM

100,000 opv. Mirror scale. Built-in meter protection. 0/3/ 12/60/120/300/ 600/1200V DC. 0/6/30/120/300/ 600V AC. 0/10μA/ 6/60/300mA/ 12 Amp. 0/2K/ 200K/2M/200 Meg Ohm. –20 to 17dB.
OUR PRICE £18.90 P&P Ins 60p

KAMODEN HM7208 FET VOM

Input impedence 10 Megohms. Ranges:– 0/.25/1/2.5/10/50/ 1000V DC. 0/2.5/10 50/250/1000V AC. 0/25uA/2.5/25/250 mA DC. 0/5k/50k/500k/5 M 500 Megohms
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KAMODEN 360 MULTIMETER

High sensitivity. DC 100kohm/V AC 10kohm/V 5" mirror scale, overload protected. Ranges: 0.5/ 2.5/10/50/250/ 1000V DC. 5/10/ 50/250/1000V AC. Current: 0.01mA/0.5/5/50/ 500mA/10A. Resistance: 0.1/ 1/10/100 ohms/ 1/10/100k ohms/ 10/100M ohms. Decibels –20 to +62dB. Battery operated. Size: 180 x 140 x 80mm. Supplied complete with test leads etc.
OUR PRICE £18.90 P & P Ins. 60p

Model HT10084 MULTIMETER

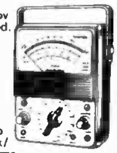
Overload protected, shock proof circuits. 9.5uA Meter with mirror scale. Sensitivity 100kV. Polarity change switch. Ranges: 0.5/2.5/ 1/50/250/500/1,000 Volts DC. 2.5/10/50/ 250/1,000 Volts AC. DC resistence 0–20/ 200k/2/20 Meg. ohms. DC current: – 10/250uA/2.5/25/250 mA/10A. AC current: –0–10A. –20 to +62dB. Operates from 2 x 1.5V batteries. Size: 180 x 134 x 79mm.
OUR PRICE £21.06 P&P Ins. 60p

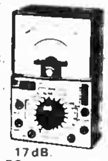
370WTR MULTIMETER

Features AC current ranges. 20,000opv. 0/0.5/2.5/10/50/ 250/500/1000V DC. 0/2.5/10/50/250/ 500/1000V AC. 0/50uA/1/10/100 mA/1/10A DC. 0/100mA/1/10A AC. 0/5k/50k/500k/ 5 Meg/50 Meg. Decibels: –20 to +62dB.
OUR PRICE £21.55 P&P Ins. 60p

U4317 MULTIMETER

High sensitivity instrument for field and laboratory work. Knife edge pointer, 86mm. mirror scale. Overload protection. Ranges: 100mV/ 0.5/2.5/10/25/50/100/250/500/1000 V DC. 0.5/2.5/10/25/50/100/250/ 500/1000V AC. Current: 50uA/0.5/ 1/5/10/50/250mA/1/5A DC. 0.25/ 0.5/1/5/10/50/250mA/1/5A AC. Resistance: 0.5/10/100/200 ohms/1/3/ 30/300k ohms. Decibels: –5 to +10dB. Battery operated. Size: 210 x 115 x 90mm. Supplied in carrying case complete with leads.
OUR PRICE £18.36 P&P Ins. 60p

KAMODEN 72.200 Multitester

High sensitivity tester. 200,000 opv Overload protected. Mirror scale. Ranges: –0/.06/.3 3/30/120/600/ 1200V DC. 0/3 12/60/300/11200 V AC. 0/6uA/ 1.2mA/120mA/ 600mA/12A DC 0/12A AC. –20 to +63dB. 0/2k/200k/ 2 Meg/200 Megohms.
OUR PRICE £24.30 P&P Ins. 60p

MODEL AF.105 VOM

50,000 opv. Mirror scale. Meter protection. 0/3/3/12/60/120/ 300/600/1200V DC. 0/6/30/120/ 300/600/1200V DC. 0/30μA/6/ 60/300 mA/ 12 Amp. 0/10K/ 1m/10m/100 Meg Ohms. 20 to 17dB.
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Tests PNP or NPN transistors. Audio indication. Operates on two 1.5V batteries. Complete with instructions etc.
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High quality instrument to test reverse leak current and DC current. Amplification factor of NPN, PNP, diodes, transistors, SCR's etc. 4" square clear scale meter. Operates from internal batteries. Complete with instructions, leads carrying handle.
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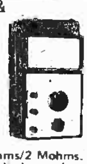
U4341 Multimeter & Transistor Tester

27 ranges. 16,700opv. Overload protected. Ranges: 0.3/1.5/6/ 30/60/150/300/900V DC. 1.5/7.5/30/150/ 300/750V AC. Current: 0.06/0.6/ 6/60/600mA DC. 0.3/3/30/300mA AC. Resistance: 0.06/ 0.6/2/6/20/60/200k ohms/2 Mohms. Battery operated. Supplied complete with probes, leads and steel carrying case. Size: 115 x 215 x 90mm.
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S100TR MULTIMETER TRANSISTOR TESTER

100,000opv. Mirror scale. Overload protection. 0/0.12/ 0.6/3/12/30/120/ 600V DC. 0/6/30/ 120/600V AC. 0/12/600uA/12/ 300mA/6/12A DC 0/10k/1 Meg/ 100 Meg. –20 to +50dB. 0.01–0.2 MFD
Transistor tester measures Alpha, Beta and ICO. Complete with instructions, batteries and leads.
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SWR METER Model SWR3

Handy SWR meter for transmitter antenna alignment, with built-in field strength meter. Accuracy 5%, Impedence 52' Indicator 100uA DC. Full scale 5 section collapsible antenna. Size 145 x 50 x 60mm.
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C15 PULSE OSCILLOSCOPE

For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth: 10MHz. Sensitivity at 100kHz VRMS/mm: 0.1–25; HOR. AMP. Bandwidth: 500kHz. Sensitivity ay 100kHz VRMS/mm: 0.3–25 Preset triggered sweep 1–3000usec. Free running 20–200 kHz in nine ranges. Calibrator pips. 220 x 360 x 430mm. 115–230V AC.
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RANGES:
DC VOLTS: 1v, 10, 100v, 1000v.
AC VOLTS: 1v, 10v, 100v, 1000v.
DC CURRENT: 1mA, 10mA, 100mA, 1000mA.
AC CURRENT: 1mA, 10mA, 100mA, 1000mA.
RESISTANCE: 1k, 10k, 100k, 1000k

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

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MODEL TE15 GRID DIP METER

Transistorised. Operates as Grid Dip, Oscillator, Absorbtion Wave Meter and Oscillating Detector. Frequency range 440kHz—280MHz in six coils. 500uA meter. 9V battery operation. Size: 180 x 80 x 40mm.

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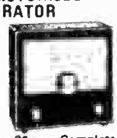
TRANSISTORISED L.C.R. A.C. BR/8 MEASURING BRIDGE

A new portable bridge offering excellent range and accuracy at low cost. Resistance: 6 ranges: 0.1 ohm-11.1 megohm ± 1% Inductance: 6 ranges: 1 microhenry-111 henries ± 2% Capacity: 6 ranges: 10pf-1110 mfd ± 2% Turns Ratio: 6 ranges: 1:1/1000-1:11100 ± 1% Bridge Voltage at 1,000cps. Operated from 9-volt battery. 100 microamp meter indication. Size 7¼" x 5" x 2".

OUR PRICE £29.70 P&P Ins. 60p

TE16A TRANSISTORISED SIGNAL GENERATOR



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

OUR PRICE £9.69 P&P Ins. 30p

TE-200 RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 kHz-500 MHz on 6 bands. Directly calibrated. Variable R.F. attenuator audio output, Xtal socket for calibration. 220/240V a.c. Brand new with instructions. Size 140mm x 215mm x 170mm.

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All transistorised compact fully portable. AF sine-wave 18Hz to 220 kHz. AF square wave 18Hz to 100k Hz. Output Square/ Sine wave 10V. P.P RF 100kHz to 200MHz. Output 1V maximum. 220/240V AC operation. Complete with instructions and leads.

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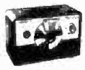
MODEL TE20 RF SIGNAL GENERATOR



Six bands. 120kHz—260MHz. Dual output RF terminals. Separate variable audio output. Accuracy ± 2%. Audio output to 8V. Power requirements: 105—125V, 220—240V AC. Size: 193 x 265 x 150mm. Complete with test leads etc.

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Sine 20cps to 200kHz on 4 bands. Square 20 cps to 30 kHz. Output impedence 5000 Ohms. 200/250V AC operation. Supplied brand new guaranteed, with instruction manual and leads.

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NEARLY 25% OFF GARRARD 86SB MODULE

This complete unit comes fitted in white plinth with hinged cover, shure M75-6SM magnetic cartridge. This 2-speed belt drive deck comes with many features. Bias control, low-resonance arm. Todays value £62.50.

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18mm
18mm Panel mounting.

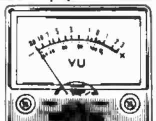
OUR PRICE 94p

P&P Ins. 15p Discounts for quantity.

NEW GOLDRING G102 KIT

Belt-drive 2-speed turntable in kit form complete with pick up arm and head shell.

OUR PRICE £21.20 P & P Ins. £1.00



VU METER TYPE 3

250 uA Size: 33mm 20mm.

£1.57 P&P Ins. 15p

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Feather weight (5 oz) Dynamic stereo headphones providing high quality reproduction at a budget price. Soft removable ear pads and adjustable headband. Speaker size: 28mm. Impedance: 8 ohms. Frequency response: 30–13000 Hz.

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Volume control for each channel. 4/16 ohms impedence. Frequency response 20Hz—18kHz. Complete with 10ft. coiled lead and jack plug.

OUR PRICE £6.22 P&P Ins. 30p

AUDIOTRONIC HEADPHONES

LSH20 Individual volume controls. Mono/stereo switch. 40-19,000 Hz. 8 ohms.

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LSH30 Individual tone and volume controls. Mono/stereo switch. 30-20,000 Hz. 8 ohms.

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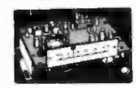
FM TUNER CHASSIS



6 transistor high quality tuner. Size only 153 x 101 x 63mm 3 IF stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Covers 88—108MHz. Ready built, ready for use. Fantastic value for money.

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WALKIE TALKIES

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Size 229mm x 127mm x 64mm

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240V operation with large clear numbers, night light and 'snooze' switch. Attractively finished in white and silver.

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TYPE	5	10	25
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P&P Ins. 3p each.
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All silicon, transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9V battery. INPUTS: 5mV and 100mV. OUTPUT: 50mV per channel.

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Amateur Electronics by Josty-Kit, the professional book for the amateur —covers the subject from basic principals to advanced electronic techniques. Complete with circuit board for AE1 to AE10 listed below.

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Also see previous page

ALL PRICES INCLUDE VAT

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Guaranteed for 5 years

T12/35 Rated Power 35 WATTS

Centre Pole Diam. 1¼" Imp. 8–15 Ω
Twin Cone. Range: 50–17000Hz
Ceramic Magnet
Weight: 600 Gms

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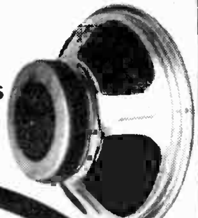

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Range: 40–5000Hz
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Weight: 1250 Gms

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Ceramic Magnet
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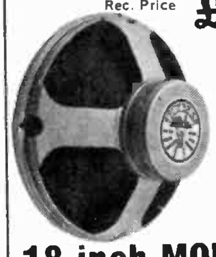

T15/100 Rated Power 100 WATTS

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

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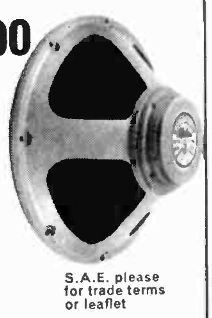
18 inch MODEL



T18/100 Rated Power 100 WATTS

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

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Contains 1lb Ferric Chloride, 100 sq ins copper clad board, DALO etch resist pen, abrasive cleaner, etching dish and instructions. Also included are 2 small drills **£3·50**.

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Anhydrous technical quality in 1lb double sealed packs. 1lb **90p**, 3lb **£1·80**, 10lb **£4·65**, 100lb **£35**.

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Large quantity always available. 3lb assorted **£1·60**, 7lb **£2·85**, 56lb **£15**. Pack with about 500 components inc at least 50 transistors **£1**, Pack with 10 200V 1A SCR's + 120 other parts **£1·10**, Pack with 18 2N2369 etc **50p**.

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Hundreds of new components—resistors, capacitors, pots, switches, + PC boards with transistors & diodes, also loads of odds and ends Contents always changing **£3·00**.

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G101: Mains transformer, 2A thermal cut-out, bridge rect, will give 1·7 to 10·5V output with 2 extra capacitors (provided). With data **£1·30**.

8 PIN DIL 741's

10+ **30p**; 25+ **26p**; 100+ **24p**; 250+ **23p**

555 TIMERS

3+ **69p**; 10+ **57p**; 25+ **53p**; 100+ **49p**

2N3055's—FULL SPEC

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All Mains Primary. 6-0-6V @ 100mA **85p**; 9-0-9V **90p**; 12-0-12V **95p**; 6·5-0-6·5 @ 500mA **£1·50**; 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 or 30V @ 1A. also 12-0-12 or 15-0-15V **£2·70**; 2A version **£3·90**.

RESISTORS & CAPACITORS

400 asstd carbon resistors **£1·50** 250 Hi-stabs, 1, 2 & 5% **£1·40**; 100 wirewounds, 2-15W **£2·00** 200 poly, mica ceramic etc caps **£1·15**; 100 C280 polyesters, ·01-·47μF **£1·30**; 200 miniature electrolytics, but mostly unmarked, so only **£1·50**.

7 SEGMENT LEDS

standard DIL package, 0·33 4 for **£3·60**, 6 for **£5·20**

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100 sq ins, about 8 pieces asstd sizes and pitches. **£1·15**

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9 pole 6 way Yaxley switches **50p**; SPCO 5A microswitch **12p**; 15 asstd pots **75p**; 15 asstd trimmers **£1**; Plug in relay, 2500 Ω 4c/o **25p**; Crystal mic insert **40p**; 4 x 80V 10A rects on heat sink, ideal batt. charger **£1·20**; SN76660N **60p**. Good range of close tolerance resistors—SAE List.

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Brand New Wire-wound Resistors 1–7 watts, mostly Plessey GWS-1-3-5-7. Good selection. 100 for **£1·00**, p.p. 35p.

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Assorted Capacitors, Silver Mica, Tubular and Disc Ceramics, Polystyrene, Tremendously good selection. 300 for **£1**, p.p. 35p.

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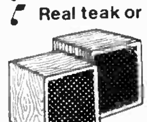

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£17-50
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All models 230–250 volt primaries

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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	1 amp	1·00
12v	2 amp	1·50
6·5v–0–6·5v	1 amp	1·35
18v	1 amp	1·25
20v	1 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 amp	3·50
25v	1½ amp	1·95
50v 2 amp & 6·3v 1 amp		5·50
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
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6v and 12v	2 amps	1·25
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NUMICATOR TUBES

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

OIL PUMP

Driven by Redmond Motor of approx. 1/20th horse power, pump originally intended for oil-fired boilers etc, with normal inlet and outlet pipes and unions. £2·15 plus 30p post and insurance.

LIGHT DIMMER KIT

For dimming up to 250w without heat sink or 750w with heat sink. This comprises quadrac variable control potentiometer, condenser, resistors, tag strip for mounting and data. Price £1·50.

RELAY BARGAIN

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

AM/FM TUNER

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

7 WATT STEREO AMPLIFIER

Again by the American GEC company. This has exceptionally good tone quality. Is complete with pre-amp and treble base, volume and balance controls. Also has mains smoothing circuit and rectifiers so requires only mains transformer. Output for 15 ohm speakers. Inputs for tuner, pick-up, mike, etc.
Special snip price £6 plus 30p post. Three or more post free.

WINDSCREEN WIPER CONTROL

Vary speed of your wiper to suit conditions. All parts and instructions to make. £2·75.

PORTABLE CABINET OFFER

A nicely made portable cabinet, soft padded black finish intended for portable stereo system. Dimensions as sketch. With motor board cut out for Garrard SP 25. This was obviously a very costly cabinet originally made for a de-luxe record player.
Offered at £1·95 plus £1 carriage free if bought with the Garrard or BSR record decks.

CAR CASSETTE POWER SUPPLY

To give stabilized output of 6 or 9v, complete kit contains 2 transistors—zener diode—vero board panel resistors and plastic case to house it with constructional data. £3·50.

PLAY YOUR 8-TRACK CASSETTE FROM MAINS

12v. 700mA unit all assembled and in neat plastic case with mains lead and terminals, full wave rectifier and transformer has overload protection and is double insulated. One of today's best buys at £8·60 + 35p VAT.

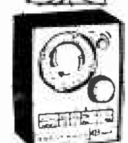
HONEYWELL PROGRAMMER

This is a drum type timing device, the drum being calibrated to equal divisions for switch-setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips, thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control. Boiler firing. Dispensing and Vending machines. Display lighting animated and signs. Signalling, etc. Price from makers probably over £20 each. Special snip price £8·50 plus 25p post and insurance. Don't miss this terrific bargain.

SWITCH TRIGGER MATS

So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc.
24in × 18in £1·80
13in × 0in £1·50

HORSTMANN 24-HOUR TIME SWITCH



With 6 position programmer. When fitted to hot water systems this could programme as follows:

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

Suitable, of course, to programme other than central heating and hot water, for instance, programme upstairs and downstairs electric heating or heating and cooling or taped music and radio. In fact, there is no limit to the versatility of this Programmer. Mains operated. Size 3in × 3in × 2in deep. Price £4·35 as illustrated but less case.

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 in good order. Price £1·95 plus £1 post and insurance.

SHORTWAVE CRYSTAL SET

Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19.25.31.39 metre bands—Kit contains chassis front panel and all the parts. £1·25—crystal earphone 50p.

SPIT MOTOR

200-250V Induction motor, driving a Carter gearbox with a 1½" output drive shaft running at 5 revs p.m. Intended for roasting chickens, also for driving models—windmills, coloured disc lighting effects, etc. £2·50 plus 20p post and ins.

INFRA-RED BINOCULARS

Made for military purposes during and immediately after last war to enable snipers, vehicle drivers, etc. to see in the dark. The binoculars have to be fed from a high voltage source (5KV approx.) and providing the objects are in the rays of an infra-red beam, then the binoculars will enable these objects to be seen. Each binocular eye tube contains a complete optical lens system as well as the infra-red cell, technical data on which is available. The binoculars are unused, believed to be in good working order. In fact they were never issued and are still in original cases, but since they were made a long time ago, they can hardly be called new. Sold without guarantee. Price £16·50 per set + £1 carriage.

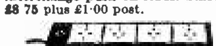
12 VOLT 1½ AMP POWER PACK

This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 mF smoothing. Price £2·50 plus 30p post & packing.

HEAVY DUTY MAINS POWER PACK

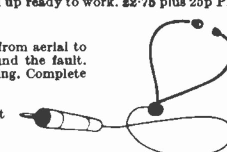
Output voltage adjustable from 15–40V in steps— maximum load 250W—that is from 6 amp at 40V to 15 amp at 15V. This really is a high power heavy duty unit with dozens of workshop uses. Output voltage adjustment is very quick—simply interchange push on leads. Silicon rectifiers and smoothing by 3,000mF. Price £8 75 plus £1·00 post.

DISTRIBUTION PANELS



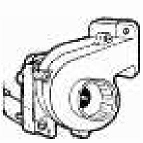
Just what you need for work bench or lab. 4 × 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. £2·75 plus 25p P. & P.

RADIO STETHOSCOPE



Easiest way to fault find traces-signal from aerial to speaker., when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything. Complete kit comprises two special transistors and all parts including probe tube and crystal earpiece, £2·20 twin stetho-set instead of earpiece 83p extra post and ins. 20p.

CENTRIFUGAL BLOWER



Miniature mains driven blower centrifugal type blower unit by Woods. Powerful but specially built for quick running—driven by cushioned induction motor with specially built low noise bearings. Overall size 4½" × 4½" × 4". When mounted by flange, air is blown into the equipment but to suck air out, mount it from centre using clamp. Ideal for cooling electrical equipment or fitting into a cooker hood, film drying cabinet or for removing flux smoke when soldering, etc. etc. A real bargain at £2·50p.

TERMS:—ADD 8% V.A.T. Except where noted
Send postage where quoted—other items, post free if order for these items is £6·00, otherwise add 30p.

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NEW ITEMS THIS MONTH

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

Pre-recorded tapes. Those of you who had our selection of ten tapes last month may wish to order selection 50 which is 50 more reel to reel pre-recorded tapes, new in perspex type storage box, different titles, classical and light music. Our assortment £25 the lot post paid.

50v amplifier transformer made by Parmeko so obviously very well-made, 2 amp, upright mounting with shrouds, a transformer that will enhance the performance of any amplifier. Offered at only £4·50 + 75p post—less than current cost.

3 core waterproof flex, standard pvc, circular, new colour code, 100 metre drums. £5 per drum + 75p post.

Tachometer motor/generator made by the famous Muirhead Co., when driven at 1,000 revs. the voltage generated is exactly 3. At higher or lower revs. proportionately higher or lower voltages result. The motor therefore is the basis of a very useful general purpose revolution counter. Price £1·50 each.

DC high current panel meters, 3½" wound wide angle 240° movement meters, with mounting lips for flush mounting fitted with external shunts, made by Crompton Parkinson or simliar high quality maker for the GPO but brand new, still in maker's cartons. These are a real bargain at £5·50 each. Reasonable quantities available in the following ranges:
0–10 amps 0–20 amps 0–30 amps 0–40 amps 0–50 amps 0–100 amps 0–200 amps.

50 amp fuses, cartridge type, mounted in plug-in fuse carrier with panel mounting fuse holder. Price 50p each. 100 amp ditto, price 85p each. Post 25p each.

100 amp 50 volt silicon rectifier on heat sink for panel mounting. £3·50.

Miniature plug-in uni-selector switches made for the GPO, unused, perfect condition. 50v coil 360° rotation 4 pole 25 way. £6·50.

Edge mounting moving coil meter, size 3" × 2" scaled DB made for the GPO, unused still in original maker's cartons. £2·50 each.

Frequency changing unit. This is another ex GPO item. We do not quite know for what purpose it could be used, but it is designed to change the frequency from 50 cps to 100 cps. output being 75v at 15mA 100 cps. A well-made piece of equipment fitted with mains transformers and rectifiers. A few only at £5 each plus £1 post.

GPO switchboard. We have an assortment of these, the old fashioned type with the winking eyes and lever switches, all mounted in wooden box. Price depends on number of lines, for instance the 8 line 40 extension model is £25.

Highly sensitive moving coil relays, panel mounting with glass window, this measures approx 5¼" × 4" × 5" the actual triggering current can be varied from a fraction of a milliamp to 5 milliamps by removing the front and adjusting the setting level. Few only of these, price £8 each.

100 amp contactors, with auxilliary microswitch. coil voltage 50 volts DC. Price £3·50 each.

Ditto, mounted in a pair with optional selector bar which prevents both contactors closing together; enclosed in perspex cover. Price £7 each.

Figure of eight twin flex wire, 14 strands, suitable for lighting or loudspeaker extension etc. Price £3 per 100 metre coil + post 50p.

Miniature multi-core wire, colour coded cores, 15 core screened overall, then pvc covered. 30p per metre. £25 per 100 metre coil, post 50p.

Mains motor 1½" stack induction type, ¼" spindle of 1½" length, special quiet bearings made by Smiths for fans and blowers etc. £1·25 each, post 25p.

13" × 8" Speakers, E.M.I. good performance 5 watt, mid range unit, very suitable for columns etc., these are 3 ohm coil. We can offer at approx. half price—only £1·95 each plus 50p each post.

Klaxon hooter mains operated, makes loud, shrill noise, ideal as fire alarm. Well-made unit. £2·50 + 50p post.

7 watt amplifier, made in Ireland to American GEC specification, exceptionally good tone, on one panel with all controls and complete with rectifiers and smoothing condenser so requires only mains transformer. Price £5 + 40p post.

AM/FM tuning unit 8 transistor, made by the previous named company complete with tuning condenser but needs scale and pointer. £5, no extra for postage if ordered with amplifier, otherwise add 50p.

White ex GPO telephones, last standard desk model with internal bell and dial. £3 + 75p post.

Black, ditto, £1·50 + 75p.

Black, ditto, less internal bell. £1 + 50p.

Wall mounting with switched hook but not dial or bell. £1·50 + 50p.

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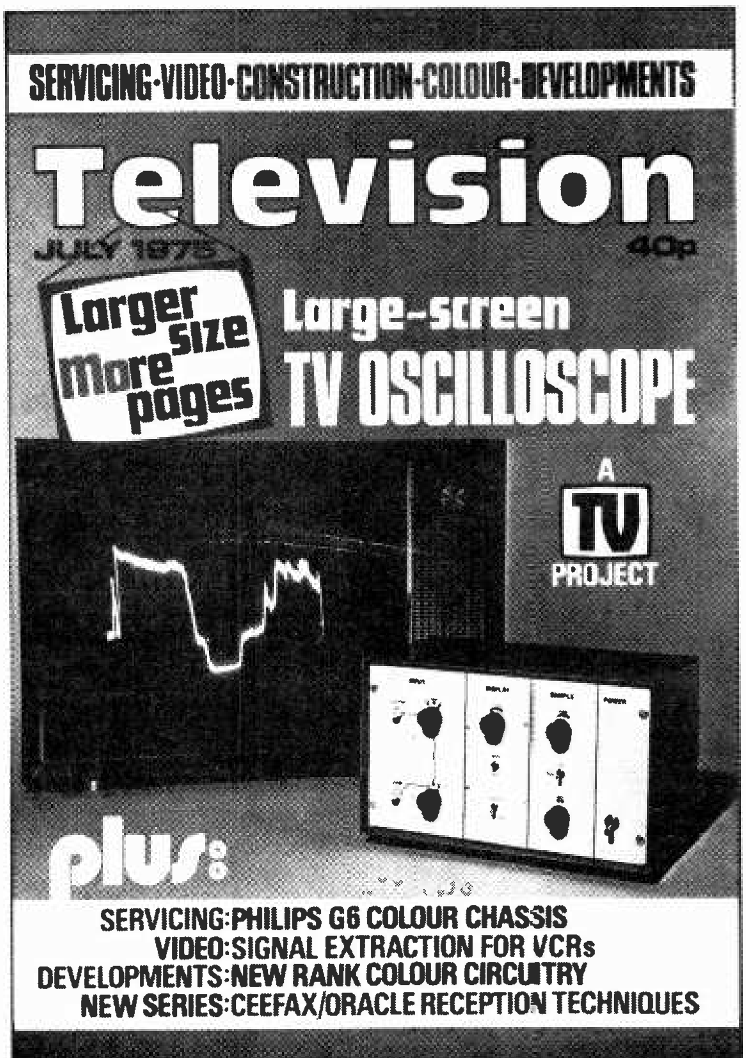

Special Features this month:

LARGE SCREEN TV OSCILLOSCOPE
How a large-screen monochrome receiver can be converted for displaying television waveforms.

CEEFAX/ORACLE RECEPTION
Start of a new series explaining the principles and the practical techniques used for teletext news displays.

LATEST COLOUR RECEIVER CIRCUITRY
An account of the many novel circuit techniques used in the latest Rank colour chassis.

VIDEO SIGNAL EXTRACTION
Many VCRs require a v.f. input. K. Cummins presents a suitable circuit for extracting the video signal from a domestic TV set.

COLOUR RECEIVER SERVICING
Les Lawry-Johns deals with faults experienced on the Philips G6 colour chassis

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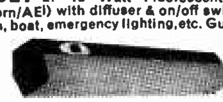

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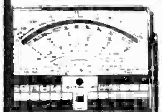

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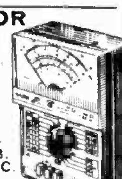

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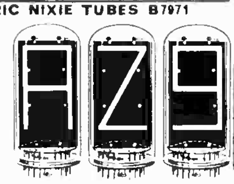

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12·0	0·5	1·83
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12·0	3·0	3·02
6-0-6	0·5	1·96
9-0-9	0·5	1·96
9-0-9	1·0	2·23
10-0-10	2·0	3·00
12-0-12	1·0	2·23
12-0-12	2·0	3·13
12-0-12	3·0	4·32
15-0-15	1·0	2·88
18-0-18	2·0	4·32
20-0-20	2·0	4·32
30-0-30	1·0	4·32
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1·0 mfd 100V polycarbonate	0·13
0·01mfd 160V tubular polyester	0·04
0·04mfd 600V	0·04
0·0033mfd 1500V	0·04

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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
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OA90	6p
OA91	6p
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7805 150p	LM380 90p	SN76033 250p
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CA3018 72p	MC1303L 130p	TBA810 150p
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CA3036 90p	MC1310P 220p	
CA3046 55p	MC1710CG 55p	
CA3048 223p	MFC4000B 54p	
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3A400V 99p
6A400V 120p
6A500V 147p
10A400V 150p
10A500V 164p
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3·3V–33V 1·3W 17p

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1A500V 21p
1A200V 24p
1A600V 25p
2A50V 30p
2A100V 35p
2A200V 40p
2A400V 44p
2A600V 45p
3A600V 91p
4A100V 48p
4A400V 60p
4A800V 90p

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
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(5% discount for complete Kit)

ENAMEL COPPER WIRE (2oz reel)

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

FERRITE RODS: ⅜" diam.

2" – 8p; 5½" – 15p; 6¾" – 18p

OPTO ELECTRONICS

LED TIL 209 (red) with socket 16p
MINITRON 3015F 7 seg display 100p
OCP 70 40p
OCP 71 85p
ORP 12 58p
ORP 61 46p
2N 5777 41p

FUSES AND HOLDERS

20mm 150mA–5A 3p
1¼" 500mA–15A 3p
Panel Holder Single 6p
Chassis Holder 20mm 16p

ALUM. BOXES with lid

2¾x5½x1½" 50p
4x4x1½" 50p
4x2¾x1½" 50p
4x5¼x1½" 58p
4x2½x2" 50p
3x2x1" 44p
6x4x2" 78p
7x5x2½" 84p
8x6x3" 106p
10x7x3" 122p
10x4½x3" 110p
12x5x3" 120p

SPEAKERS

8Ω 0·5W
3" 68p
2½" 65p

POLYESTER CAPACITORS: Axial lead type. (Values are in μf).

400V: 0·001, 0·0012, 0·0015, 0·0018, 0·0022, 0·0033, 0·0047 **3p**; 0·0068, 0·01, 0·015, 0·022, 0·033, 0·047, 0·068, 0·1 **4p**; 0·15, 0·22, **6p**; 0·33, **10p**; 0·47, **13p**; **160V:** 0·1, 0·15, **4p**; 0·22 **5p**; 0·33 **6p**; 0·47 **9p**; 0·68 **10p**; 1·0 **13p**. **250V:** 0·22 **6p**; 0·33 **8p**; 0·68 **12p**; 0·47 **9p**; 2·2 **18p**.

POLYESTER RADIAL LEAD P.C. TYPE (Values are in μf).

250V: 0·01, 0·015, 0·022, 0·033, 0·047 **3p**; 0·068, 0·1 **4p**; 0·15 **4p**; 0·22, 0·33 **5p**; 0·47 **7p**; 0·68 **10p**; 1·0 **11p**; 1·5 **20p**; 1·5 **20p**; 2·2 **22p**.

FEED THROUGH CAPACITORS

1000pF/350V 8p

ELECTROLYTIC CAPACITORS. Axial lead type (Values are in μf)

63V: 0·47, 1·0, 1·5, 2·2, 3·3, 4, 4·7, 6·8, 10, 15, 20, 22, 47, 68, **6p.** 100, **12p. 40V** 100, **6p 50V:** 1000, **42p. 30V:** 3500, **41p. 25V:** 10, 68, 150, **6p**; 220, **11p**; 470, **13p**; 680, **18p**; 1000, **24p**; 2200, **34p.** 3000, **39p**; 4700, **47p. 16V:** 40, 125, 250, **6p. 16V:** 1000, 1500, **16p. 10V:** 4, 100, **5p**; 640, **10p**; 1000, **14p**; 2200, **18p.**

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

QUALITY RESISTORS. ERIE MAKE

Small Size, High Stability, Low Noise

Type	Pwr	Tol.	Range	Val.	PRICE 1-99	100-499	500+
Carbon	¼W	5%	2·2Ω–10M	E24	1p	0·8p	0·7p
Carbon	½W	5%	2·2Ω–10M	E12	1p	0·8p	0·7p
Carbon	1W	5%	2·2Ω–10M	E12	2·5p	2p	—

Quantity price aoplies to resistors of each value not mixed.

JACKSONS DIELECTRIC TUNING CAPACITORS

100pf 80p
300pf 88p
500pf 95p

	JACK PLUGS Screened chrome	Plastic body	SOCKETS Open metal	Moulded with break contacts
2·5mm	10p	8p	8p	
3·5mm	14p	10p	8p	
Standard Mono	17p	13p	13p	17p
Standard Stereo	30p	18p	15p	25p

	Plugs	Sockets	Couplers
DIN 2PIN LOUDSPEAKER TYPE. 3, 4, 5 (180° & 240°) 6PIN	11p	7p	15p
CO-AXIAL (TV)	10p	8p	15p (f.f.)
PHONO assorted colours	7p	5p (sgl.) 7p (dbl.) 10p (trpl.)	9p
BANANA	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 AC
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 2A 340p
30-24-20-15-12-0 1A £2·85

VEROBOARD

	Pitch 0·1 (copper	0·15 clad)	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
4¾x17"	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 12V 7p
NEON: RED round top 250V 21p
NEON: ½" square top, red, green, Req. ⅜" hole 21p

KNOBS (fits ¼" shaft, with grub screw except K2 and K8)

K1 Black pointer type 9p
K2 Slim silvered aluminium 10p
K3 Black 1¼" 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

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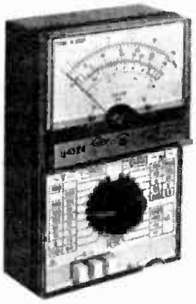
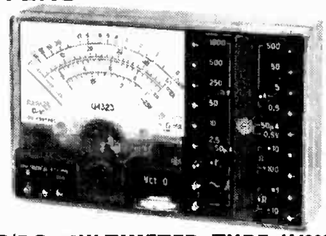


AC/DC MULTIMETER TYPE U4324
33 ranges covering D.C. current 60μA to 3A; AC current 300μA—3A; DC voltage: 0·6—1200V AC voltage: 3—900V Resistance: 500Ω—500kΩ Level: —10 to +12db Sensitivity: 20,000 o.p.v. DC. 4,000 o.p.v. A.C.
Instrument is powered by re-chargeable nickel cadmium batteries.
PRICE £9·85*



AC/DC MULTIMETER TYPE U4323
Apart from usual multimeter facilities the instrument incorporates fixed frequency Audio (1kHz) and I.F. (465kHz) Oscillators. 22 ranges covering AC Voltage 2·5–1000V; D.C. Voltage 0·5–1000V; D.C. current 50μA to 500μA and resistance 0 to 1MΩ. Sensitivity 20,000 o.p.v. Oscillator output voltage—1V minimum.
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Mullard TAA293. Medium frequency amplifier with frequency response of 600kc/s. Nominal supply voltage 6v. Typical power gain 89db. Maximum power dissipation 160 mW. Power output 10 mW. into 150Ω load. TO74 ten lead-encapsulation **£0·65***

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L.E.D. TYPE HP5082/4850

Red Light GASP Light Emitting Diodes giving bright diffused light of 0·8 mcd at forward voltage of 1·6V and DC current of 20 mA. Plastic wide angle lens 0·200in. diameter. Ideal for panel lights, etc.
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7408	16p	7453	16p	7493	40p
7410	13p	7454	22p	7494	75p
7413	32p	7470	30p	7495	70p
7414	60p	7472	25p	7496	78p
7416	30p	7473	32p	74107	35p
7420	14p	7474	32p	74121	34p
7422	25p	7475	45p	74141	65p
7425	30p	7476	32p	74142	250p
7427	37p	7480	65p	74154	150p
7430	14p	7481	95p	74164	120p
7432	25p	7482	76p	74192	120p
7437	27p	7483	95p	74193	120p
7440	16p	7484	95p		

DIL Sockets by Texas
8 pin 12p, 14 pin 13p, 16 pin 14p
Mica + 2 bushes for TO3 & TO66 5p

LINEAR I.C's

CA3046	Transistor Array	50p
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ICL8038	VCO Fun. Gen. 14 pin DIL	275p
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LM3900	Quad Op. Amp.	70p
MC1310	Colless FM Stereo Dec.	225p
MC1312	SQ Quadraphonic Dec.	220p
MC1314	SQ Quadraphonic Dec.	400p
MC1315	SQ Quadraphonic Dec.	480p
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MFC6040	Electronic Attenuator	90p
MFC8070	Zero Voltage Switch	250p
NE536	FET Op. Amp.	250p
NE555	Timer 8 pin DIL	45p
NE556	Dual 555 14 Pin DIL	100p
NE560	PLL 16 Pin DIL	325p
NE561	PLL with AM Demod. 16 Pin	325p
NE562	PLL with VCO 16 Pin	325p
NE563	PLL FM/IF Demod. 16 Pin DIL	300p
NE565	PLL 14 Pin DIL	325p
NE566	Function Generator 8 Pin DIL	200p
NE567	PLL Tone Decoder 8 Pin DIL	250p
TBA570	AM/FM Radio receiver	160p
TBA800	5 Watt Audio Amp.	90p
TBA810	7 Watt Audio Amp.	100p
TBA820	2 Watt Audio Amp.	80p
ZN414	TRF Radio Receiver	110p

Data sheets on above I.C's 10p each.

Popular Op Amps
709 OPA with ext. comp. 8/14 pin DIL 30p
710 Diff. Comparator 14 pin DIL 35p
741 OPA with int. comp. 8 pin DIL 25p
747 Dual 741 14 pin DIL 70p
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PC Keyboard '0–9, decimal, 4 function, C, K, keys. Size: 2·36" x 3·76" x 0·45" 400p

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723 14 pin DIL 45p
Data Sheets on Vol. Regs. 10p each

1amp	+Ve		−Ve	
5v	7805	140p	7905	250p
12v	7812	140p	7912	250p
15v	7815	140p	7915	250p
18v	7818	140p	—	—
24v	7824	140p	7924	250p

SCR-THYRISTORS

	50v	100v	400v	600v
1A	40p	42p	50p	70p
3A	43p	49p	75p	100p
7A	—	80p	84p	—
16A	—	250p	450p	—

Other
BT106 140p, C106D 45p, MCR101 25p

Other
2N3525 91p
2N4444 185p
2N5060 40p
2N5062 45p
2N5064 50p

TRIACS

	100V	400V	500V
3A	85p	95p	120p
6A	88p	120p	150p
10A	109p	154p	165p
16A	145p	180p	200p

Other
40430 90p, 40486 99p, 40669 95p

BR100 BI-DIRECTIONAL TRIGGER FOR SCR's and TRIACS 21p

Transistors

AC126/7	11p	BC213	10p	OC28	55p	2N1893	27p	40362	45p
AC128	11p	BC214	13p	OC35	48p	2N2219	20p	40594	75p
AC176	11p	BD115	55p	OC36	52p	2N2221/2	20p	40595	85p
AC187	12p	BD124	75p	OC41/2	15p	2N2369	14p		
AC188	11p	BD131	42p	OC44/5	11p	2N2484	30p		
AD149	43p	BD132	45p	OC70/1/2	11p	2N2904	20p		
AD161	36p	BF115	22p	OC73	60p	2N2905	18p		
AD162	36p	BF167	23p	OC81/2	12p	2N2926RB	8p		
AF114/5	13p	BF173	25p	OC83/4	28p	2N2926O	8p		
AF116/7	13p	BF184	22p	TIP2955	70p	2N2926YG	9p		
AF139	33p	BF194	11p	TIP41A	65p	2N3053	18p		
AF239	40p	BF195	12p	TIP42A	72p	2N3054	45p		
BC107/8	9p	BF196	14p	ZTX300	12p	2N3055	49p		
BC109	10p	BF197	12p	ZTX500	15p	2N3442	140p		
BC147/8	7p	BFR39/79	28p	2N696	15p	2N3702/3	11p		
BC149	9p	BFX29/30	30p	2N697	13p	2N3704/5	11p		
BC157	10p	BFX84/5/6	25p	2N698	30p	2N3706/7	11p		
BC158	9p	BFX87/8	24p	2N706	12p	2N3708/9	9p		
BC159	8p	BFY50/1/2	15p	2N708	18p	2N3772	161p		
BC169C	12p	BRY39	34p	2N930	18p	2N3773	220p		
BC177	18p	MJE340	45p	2N1131/2	18p	2N3903/4	15p		
BC178	17p	MJE2955	99p	2N1302/3	17p	2N3905/6	15p		
BC179	18p	MJE3055	68p	2N1304/5	21p	2N4058	15p		
BC182/3	10p	MPSU06	58p	2N1306/7	28p	2N4060	13p		
BC184	11p	OC26	47p	2N1308/9	28p	40361	40p		
BC212	11p			2N1613	20p	2N4289	18p		
				2N1711	20p	40361	43p		

UJTS
TIS43 25p
2N2160 70p
2N2646 35p
2N4781 30p

FETS
BF244 36p
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MPF104/5 30p
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2N3820 57p
2N3823 60p
2N5457 30p
2N5458 30p
2N5459 30p

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40673 58p
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3N140 85p
3N141 75p

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LED
TIL209 16p

ZENERS
3·3V to 33V
400mW 9p
1·3W 18p

A Tunnel
AEY11 50p

Varicap
BB105 30p

Noise
ZIJ 75p

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	50V	100V	400V	600V
0·25A	—	20p	—	—
1A	22p	24p	27p	29p
2A	30p	35p	45p	48p
4A	—	55p	—	—
6A	55p	60p	—	—

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CD4000AE	19p
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CD4013AE	63p
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CD4017AE	163p
CD4018AE	229p
CD4022AE	160p
CD4023AE	21p
CD4024AE	116p
CD4027AE	91p
CD4028AE	140p
CD4029AE	196p
CD4046AE	202p
CD4047AE	137p
CD4054AE	196p
CD4055AE	196p
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The All Electric Wireless

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91200: New double linear phase WBFM IF amplifier with double tuned detector stage, mute, meter op, AFC Built £9.00; kit £6.20.
FM1185: Low cost FM IF with ceramic IF filter, CA3089E, muting, meter op, AFC. Built and tested £4.35.
AM/FM 3042: A new FM/AM radio board. FM section contains two ceramic filters, IC IF gain block, IC limiter and ratio detector. AM section uses an IC with ceramic IF filter and Ferrite rod. Can be used with various of our tunerheads to provide a truly high specification low cost AM/FM tuner. There is provision on the board for the CA3090AQ stereo decoder IC for FM.
kit for Mono FM/ AM £14.00
stereo FM/ AM £19.00
Tunerhead extra: AM section may be tuned electronically by the MVAM2, or by a mechanical gang capacitor .
LARSHOLT 7252 Tunerset £20.00 - the complete antenna to audio FM varicap radio system.

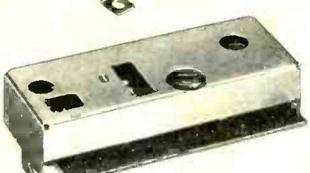
Please note that we cannot deal with any enquiries unless accompanied with a stamped addressed envelope of adequate dimensions. Thankyou.

EF5603 £8.40

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'.

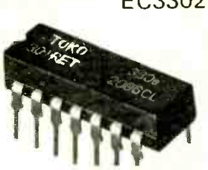
TOKO



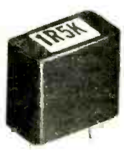
EC3302 £5.00

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)

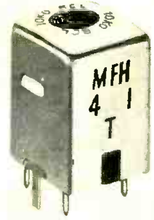


RET delay line POA



7BA choke 1μH to 1mH 15p

Variable capacitors



MFH £1.45

S 18

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