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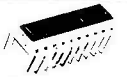

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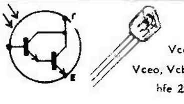

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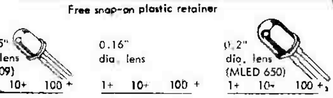

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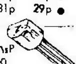

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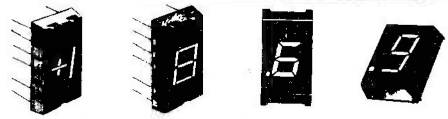

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VOL. 51 NO. 5
ISSUE 823
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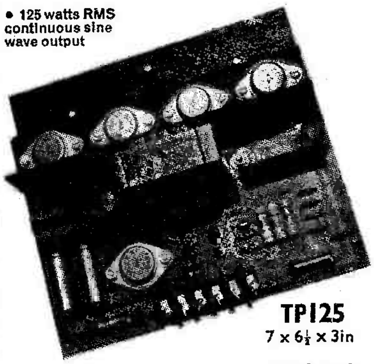

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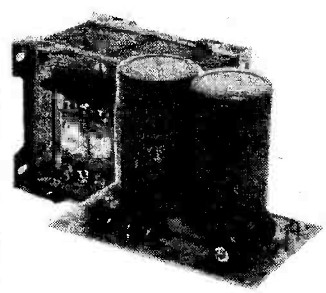

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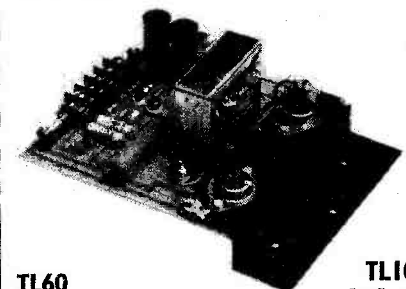

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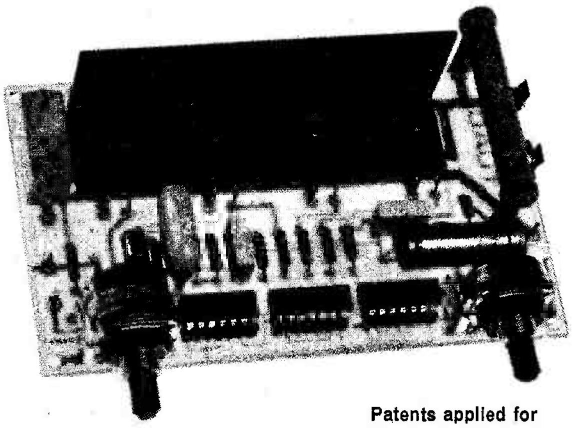

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- Full wave control
- 13 easy connections

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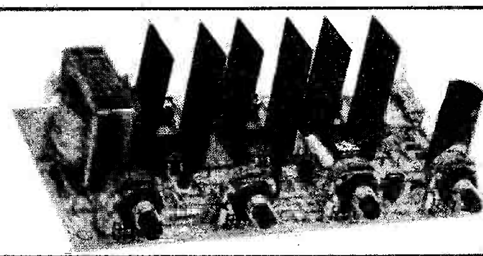
Single Channel Version 1500 watts **£7·25** **£15·50**



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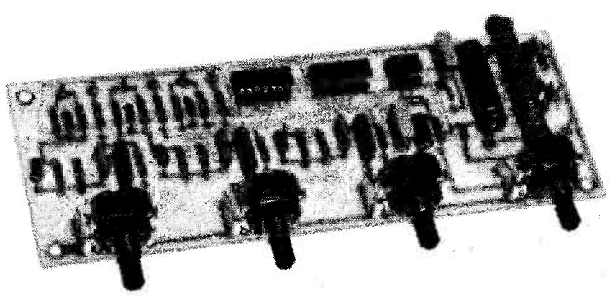

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Full logic integrated circuitry
Dimmer control to each channel
9 easy connections

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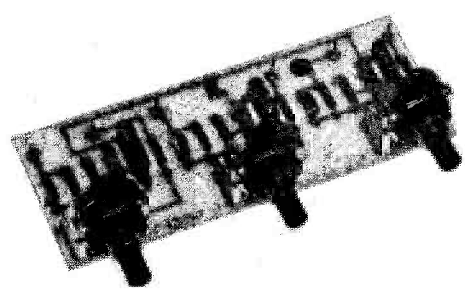

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160V: 0·01μF, 0·15μF, 0·022μF **3½p.** 0·047μF, 0·068μF, **4p.** 0·1μF, **4½p.** 0·15μF, **5½p.** 0·22μF, **6p.** 0·33μF, **7p.** 0·47μF, **9p.** 0·68μF, **13p.** 1μF, **15p.**

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50V: (pF) 22, 27, 33, 39, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 820, 1K, 1K5, 2K2, 3K3, 4K7, 6K8, (μF) 0·01, 0·015, 0·022, 0·033, 0·047, **2½p.** each. 0·1, 30V, **5p.**

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

W.	Type	Range	1–99	100–499	500–999	1000+	Size mm
¼	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
¼	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
1	MF	10–10M	3	1·98	1·81	1·65	6·6x13
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MINIATURE 0·25W Vertical or horizontal **7p** each 1K, 2K2, 4K7, 10K, etc. up to 1M Ω
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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			
100μF	10V	7p			

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IN4003	9p
IN4004	90p
IN4005	12p
IN4006	14p
IN914	7p
IN916	7p
BA100	10p
OA5	42p
OA47	9p
OA81	11p
OA200	8p

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Std. Jack	20p
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Phono	7p
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22 Ranges plus AF/IF Oscillator 20,000Ω/Volt.
Vdc—0·5—1000V in 7 ranges
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Resistance—5Ω—1MΩ in 4 ranges.
Accuracy—5% of F.S.D.
OSCILLATOR—1 KHz and 465 KHz (A, M.) at approx. 1 Volt.
Size—160 x 97 x 40mm.
Supplied complete with carrying case, test leads and battery.
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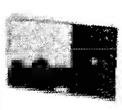
U4323

MULTIMETER U4341
27 Ranges plus Transistor Tester.
16,700Ω/Volt. Overload protected.
Vdc—0·3—900V in 8 ranges.
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Idc—0·06—600mA in 5 ranges.
Iac—0·3—300mA in 4 ranges.
Resistance—2KΩ—2MΩ in 4 ranges.
Accuracy—dc—2½%, ac—4% of F.S.D
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Size—115 x 215 x 90mm.
Complete with steel carrying case, test leads, and battery.
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Idc—0·06—3A in 6 ranges.
Iac—0·3—3A in 5 ranges.
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U4324

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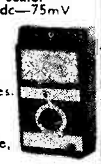
Vdc—1·5—600V in 9 ranges.
Vac—1·5—600V in 9 ranges.
Idc—60—120 microamps in 2
Idc—0·6—1500mA in 6 ranges.
Iac—0·6—1500mA in 6 ranges.
Resistance—1KΩ—1MΩ in 4 ranges.
db scale—10 to + 12db.
Accuracy—dc—1½%, ac—2½%
Size—115 x 215 x 90mm.
Complete with steel carrying case, test leads, and battery.
PRICE **£14·90** net p & p 50p.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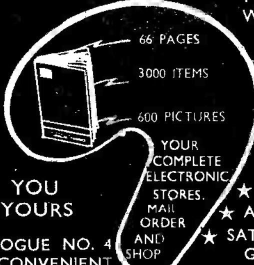

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R.C.S. DISCO DECK
SINGLE RECORD PLAYER

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 13½ × 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-burglar 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..35p
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

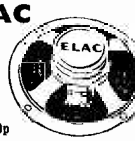
VOLUME CONTROLS

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. 50p; 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 20W 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

18'000 cps. 25 watts. 8 ohm. Price **£3·75**

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" × 1¾" × ½". 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

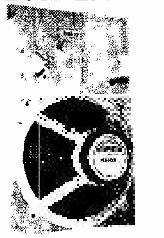
LOW VOLTAGE ELECTROLYTICS
1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF. 15V. 10p.
500mF. 12V. 15p; 25V. 20p; 50V. 30p.
1000mF. 12V. 20p; 25V. 35p; 50V. 47p; 100V. 70p.
2000mF. 6V. 25p; 25V. 42p; 50V. 57p.
2500mF. 50V. 62p; 3000mF. 25V. 47p; 50V. 65p.
5000mF. 6V. 25p; 12V. 42p; 25V. 75p; 35V. 85p; 50V. 95p.

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. **£14·50**

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

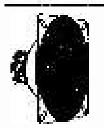
'Group 25'	'Group 35'	'Group 50'
12 inch 25 watt **£8·80**	12 inch 35 watt **£10·50**	15" 50 w **£19·80**
3 or 8 or 15 ohm	3 or 8 or 15 ohm	8 or 15 ohm

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 12 × 8 × 6" £4·60 Post 35p
LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft

GOODMANS 6½in. HI-FI SPEAKER

8 ohm, 10 watt. Large ceramic magnet. Special cone surround. Frequency response 30-15,000 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 £3·50
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. £2·40; 10in. £2·95.
SPECIAL OFFER: 80 ohm, 2¾in.; 2½in. 35 ohm. 8in., 25 ohm. 2½in. dia., 5 × 3in. 6" × 4" 15 ohm, 3½in. dia.; 6 × 4in.; 7 × 4in.; 5 × 3in. 3 ohm, 2½in.; 2¾in.; 3½in.; 5in. dia. (6 × 4in. 8 ohm £1·50) **£1·25** 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 **£2·20**

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 20p; 3·5mm Chrome 12p. 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.

SPECIAL OFFER 95p. Post 25p.
100 Ohm 20 watt Rheostat 2½in. dia. Ceramic Former. Screw Terminals ¼in. dia. spindle.

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.

R T V C *

NEW!

VISCOUNT IV STEREO SYSTEM

System 1a. £65.00

The new 20+20 watt Stereo Amplifier incorporating the latest silicon transistor solid state circuitry, the RT-VC VISCOUNT IV gives you a powerful 20 watts RMS per channel into 8 ohms. Superb teak-finished cabinet; with anodised fascia to harmonise with any decor. Polished trim and knobs.
The VISCOUNT IV has a comprehensive range of controls – volume, bass, treble, balance, mono/stereo, mode selector, and scratch filter.
Front panel socket for stereo headphones. And a host of sockets at the rear – for left and right speakers, tape recorder, auxiliary, tuner, disc and microphone.
SPECIFICATION: 20 watts RMS per channel 40 watts peak. Suitable 8-15 ohms speakers. Total distortion @ 10 watts better than 0.2%. Six switched inputs: 1. Magnetic P.U. – 3 millivolts @ 47 K ohms (R.I.A.A.); 2. Crystal/ceramic P.U. – 50 millivolts @ 50 K ohms (R.I.A.A.); 3, 4, 6. Tape Tuner/Aux. – 140 millivolts @ 50 K ohms (flat frequency response); 5. Microphone – 3 millivolts @ 50 K ohms (flat frequency response).
CONTROLS: Push button ON/OFF, stereo/mono, scratch filter. 6 position rotary selector. Individual rotary controls for treble, bass, balance and volume. Headphone socket, tape out socket. Aux. mains output. **Frequency response:** 25 Hz to 25 KHz @ full rated output. **Signal to noise ratio:** better than –50 dB on all inputs. **Tone control range:** Bass ±15 dB @ 50 Hz; Treble ±12 dB @ 10 KHz. **Power requirements:** 200-250V A.C. mains @ 60 watts. **Approx. size:** 15¾" × 3" × 10".
MP60 type deck with magnetic cartridge, de luxe plinth and cover.
Two Duo Type IIa matched speakers – Enclosure size approx. 19½" × 10¾" × 7¾" in simulated teak. Drive unit 13" × 8" with 3" tweeter. 15 watts handling. 30 watts peak.
Complete System with these speakers £69.00 +£6.50 p & p.

System 2. £81.00

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

PRICES: SYSTEM 1a

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

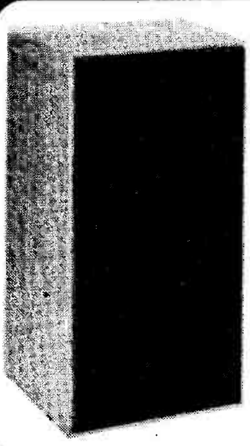
PRICES: SYSTEM 2

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

20x20 SYSTEM

Scotland and the Orkneys 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 each
(normally £66.00)+£5.80 p & p.
Scotland and the Orkneys
P & P Surcharge £3.50

EASY TO BUILD SPEAKER KITS

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

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

EMI 350 KIT

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

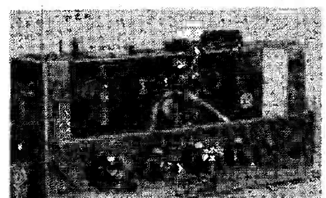
£6.50 +£1.20 p & p.

Complete with crossover Components and circuit diagram

DECCA STEREO AMPLIFIER CHASSIS

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

£6.90 +£1.20 p & p.



Everest Instruments Ltd.

34, Shakespeare St., Nottingham.
Tel. (0602) 45466

All prices quoted include p. & p., & VAT, min. order £1, CWO only.

Transformers

All 240v 50hz primaries

Volts	Amps	£ p
6·3	1·5	1·83
6·3	3·0	2·09
9·0	1·0	1·83
12·0	0·5	1·83
12·0	1·5	2·09
12·0	3·0	3·02
6-0-6	0·5	1·96
9-0-9	0·5	1·96
9-0-9	1·0	2·23
10-0-10	2·0	3·00
12-0-12	1·0	2·23
12-0-12	2·0	3·13
12-0-12	3·0	4·32
15-0-15	1·0	2·88
15-0-15	2·0	3·78
18-0-18	2·0	4·32
20-0-20	1·0	3·03
20-0-20	2·0	4·32
30-0-30	1·0	4·32
0-10-12-14-16-18	4·0	4·58
0-12-15-20-24-30	2·0	4·45
0-5-20-30-40-60	2·0	6·54

Bulk tape eraser 3·53

15-8-3 ohm 12 watt matching 1·71
Transistor driver 4:1+1 0·27

P.C. Board

Single sided fibre glass 0·70 sq ft
Double sided fibre glass 1·00 sq ft
Cut in multiples of 6" i.e. 6 x 6, 6 x 12, 12 x 12, 12 x 18, etc.
Circuit etchant 250ml 0·55
1 lb ferric chloride 0·50
250ml plastic bottles 0·16

Speakers £ p

3" Goodman tweeter 8 ohm 51CD4 1·47
3" Audax tweeter 8 ohm 15 watt 1·60
5" Audax bass 8 ohm 10 watt 3·23
6½" Audax 8 ohm 15 watt 2·95
6½" EMI d/cone 8 ohm 10 watt 3·59
8 x 5 EMI d/cone 8 ohm 10 watt 3·67
8" Celestion d/cone 8 ohm 10 watt 2·76
10 x 6 EMI 8 ohm 20 watt 7·36
13 x 8 EMI 8 ohm 20 watt 6·75
13 x 8 EMI 8 ohm 25 watt 7·84

Semiconductors

Diodes

IN4001	6p
IN4002	7½p
IN4003	9½p
IN4004	9½p
IN4006	12p
IN4007	13p
OA70	6p
OA81	7½p
OA90	6p
OA91	6p
OA202	7½p
BA154	9½p
BA156	13p
IN914	4p
400mw zeners 3v to 33v	10p

Silicone bridge rectifiers
2a 50v rms 40p
2a 100v rms 47p

Thyristors
1a 100v piv 30p
1a 400v piv 45p
3a 400v piv 57p

Triacs
2a 400v piv 66p
6a 400v piv 85p
10a 400v piv 122p
Diac 25p

Linear I.C's
709P 8p D.I.L. 30p
741P 8p D.I.L. 42p
748P 8p D.I.L. 45p

74 series T.T.L.

7400	15p
7402	15p
7404	15p
7413	43p
7447	123p
7473	46p
7475	58p
7490	69p

7 segment led numeral display
16p D.I.L. 115p

D.I.L. sockets
8 pin 15p
14 pin 15p
16 pin 16p

Electrolytics. Tubular with axial leads except where stated.

Mfd.	Volts	Pence	
47	4	7	
330	4	7	
68	6·3	7	
470	6·3	9	
1000	6	11	single end p/c fitting
25	10	7	
47	10	7	
220	10	7	
330	10	9	
15	16	7	
33	16	7	
68	16	7	
220	16	9	
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	
32	63	7	
800	63	32	single end can
2500	63	80	single end can
4700	63	140	single end can

RECHARGEABLE BATTERIES

CAN SAVE YOU A FORTUNE !

Bush & Meissner's two purpose-built battery chargers for economy minded enthusiasts:

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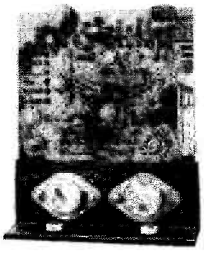

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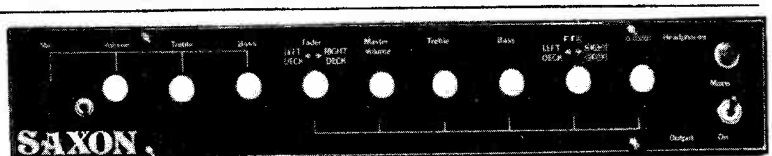
N.B. PS70 is not suitable for the SA50

Mk II STEREO DISCO MIXER £29·50

Carr. 60p

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



DISCO MODULE £12·50 Carr. 50p

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

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

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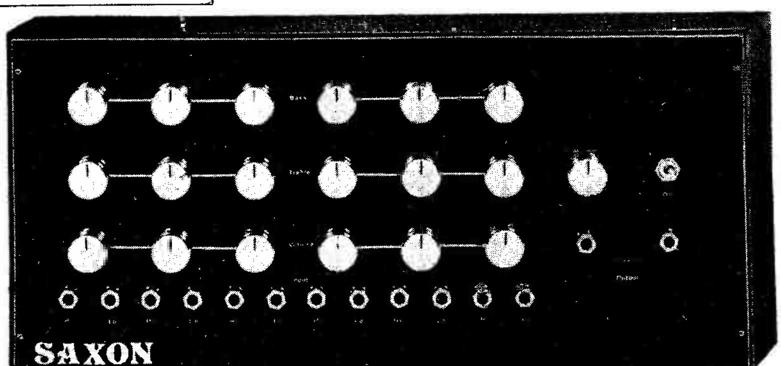
This is the basic channel module in the above mixers and may also be used for extra imputs on either the mono or stereo mixers. Fitted with volume, bass and treble controls, requires just a jack and supply (9–100V)



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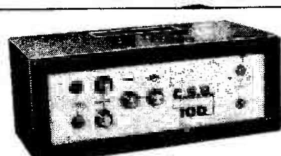

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100W rms four inputs *slider* controls *plus* master slider. Wide range bass and treble controls. Fantastic value, ideal for complete disco's, groups, clubs etc.

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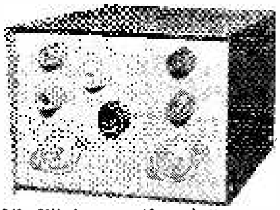

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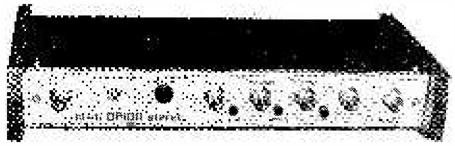

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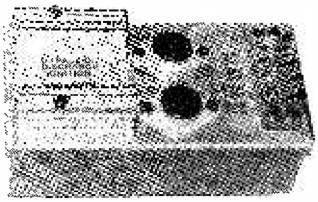
The bookend case, I.C.s & semiconductors, P.C. board, Transformer, etc. may be purchased separately if desired. Send S.A.E. for further information

ASTRO IGNITION



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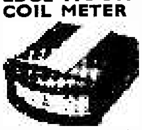

Size 2½" x 1" by Weston, 100µA movement scaled DB, unused still in original maker's cartons. £2·50 each + post and VAT 50p.

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M.W. two stage ideal for use with ZN414 or similar circuit. Price 15p each + post and VAT 15p.

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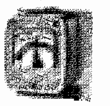

panel mounting with glass window, this measures approx. 5½" x 4" x 5", triggering current can be varied from a fraction of a milliamp to 5 milliamps by removing the front and adjusting the setting level. Price £8 each + post and VAT 95p.

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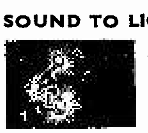

Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450w). Unit in Box all ready to work. £7·95 plus 80p VAT and postage.

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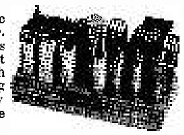

Part of the famous Reditune background music system, secondhand, but believed in good order. However, no guarantee; we are selling for spares value only. These are 6 valve amplifiers, the output valves are 2×EL 84 in push/pull, complete with mains transformer, rectifier and ample smoothing equipment. The mains transformer alone, today would cost at least £4. Size is 9½"×5½"×4½". Price only £2·00+postage and VAT £1.50.

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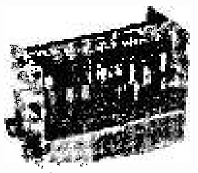

Contains hundreds of useful parts some of which are as follows–66 silicon diodes equivalent OA 91. 68 resistors mostly ½ watt 5% covering a wide range of values. 4×1 mfd 400v infd condensers. 15×.01 mfd 100v condensers. 2 RF chokes. 8×B9 valve holders. 1×4H choke. 1×115v transformer. 1 boxed unit containing 4 delay lines also tag panels, trimmer condensers, suppressors, etc., on a useful chassis sized approx. 9"×5"×7". Only 75p (the 66 diodes would cost at least 10 times this amount). This is a snip not to be missed. Post and + VAT 75p.

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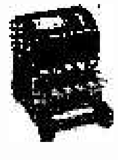
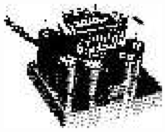


Will take the place of the mormal rotating dial, has 10 numbered keys, so suitable for other digital systems. A desk mounting unit with rubber feet, this is a very intricate and expensive piece of apparatus. New and unused—our price only £9 each+£1.36 post and VAT.

24V POWER PACK



Normal mains input with a thermal safety device, 800 mA output, 4000 mfd of smoothing and full wave rectification, completely enclosed in plastic box and with flex for mains and terminal block for output Price £1·75+£1 post and VAT.

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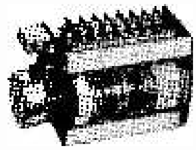
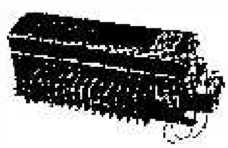


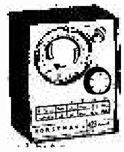
Mains motor driving a drum with adjustable trips operating 8 changeover 10 amp switches, so a total of 40K watts of lighting can be controlled enabling an unlimited variety of effects to be achieved and changed with the minimum of effort. This is a real snip a £7·50+£1.15 post and VAT.

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 £9·95 £1·00 Post and VAT. Don't miss this terrific bargain.

HORSTMANN 24-HOUR TIME SWITCH

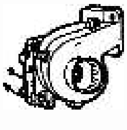


With 6 position programmer. When fitted to hot water systems this could programme as follows:

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

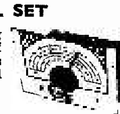
Suitable, of course, to programme other than central heating and hot water, for instance, programme upstairs and downstairs electric heating or heating and cooling or taped music and radio. In fact, there is no limit to the versatility of this Programmer. Mains operated. Size 3in×3in×2in deep. Price £5·50. 80p Post and VAT. as illustrated but less case.

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. 55p Post and VAT.

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. 60p Post and VAT.

TERMS:
Where order is under £5 please add 30p surcharge to offset packing expenses.

J. BULL (ELECTRICAL) LTD.
(Dept. PW), 103 TAMWORTH RD. CROYDON CRO IXX

NEW ITEMS THIS MONTH

EHT transformer. American made, sealed in a steel case measuring 6¼" x 6" x 5¼" high with large porcelain stand-off insulators; it is extremely well-made, looks good enough to give 10 kv at .1 amp. intended for American mains, its primary would have to be fed through a variac or similar. With 90v input EHT output is 6.5v. Price £15 each+carriage and VAT £3.

Sticker strip inter-phone. This is 4 copper wires mounted on an adhesive tape intended for telephone extensions, it can also be used for FM aerials, etc. It is invisible under thick wallpaper and of course carpet or other floor coverings. Price £5 per 100' reel+postage and VAT 60p.

2½" panel meter, 0-9 amps, flush mounting. these were made for military applications, probably measurements of RF power. They work on the hot wire principle so they are suitable for AC or DC measurements. These instruments have a considerable interest and they are seldom on offer these days. Consequently they are very suitable for school labs, museums and exhibitions. Price £1·50 each+post and VAT 40p.

Instrument Mains Transformer, 6.3v at ½ amp and 115v at 100mA. This is an upright mounting open construction, small size (2" x 2¼" x 2¼"). Price £1·40+postage and VAT 60p. DITTO. 6.3v at 1 amp nad 150v at 200 mA. This is a fully shrouded upright mounting transformer. size approx. 2¼" x 3"x 3". Price £1·95+post and VAT 88p.

Instrument power supply mounted on a chassis size 9" x 2¼" x 4¼". This is suitable for instruments which use valves and has AC output of 6.3v at 1 amp and a fully smoothed DC outputs of 150v and 200v. Price £2·50+post and VAT 74p.

FM Band amplifier. This is a 4 valve amplifier tunable to cover FM and nearby frequencies. Tuning is by lecherlines in fully screened compartments and the whole is mounted on a heavy metal chasssis size 9" x 2" x 2¼" x 3". This requires a separate power supply of 150v DC at 100 mA and 6.3V at 1 amp. Price £3·75+post and VAT £1·58.

Instrument case, grey steel finish size 9¼" x 3¾" x 2¼". These cases are not secondhand but come from partly assembled equipment. so the front panel has a few holes already punched through. However, these are very suitable for toggle switches, etc. There are no really big holes, 50p each+post and VAT 36p.

Instrument case, size 9" x 9" x 5¼", made from sheet steel grey hammer finish. No holes in these 75p+post and VAT 49p.

Holidays are coming, don't forget you can fool the thieves with our completely automatic daytime off, nightime on switch; it is simplicity itself to fit—just put in parallel with landing light switch Price this month and September is only £3+post and VAT 50p; after this the price has to up. probably to £4·50 owing to increased costs to us.

Pilot lamp bargain. Box of 10 x 24v .05 amp tubular MES lamps made by Philips, the selling price of which is 25p each—our price only 50p per box.

Last chance for this wire bargain. Heavy duty 3 core waterproof flex 1.5 mm (8-10 amp) very heavy insulation, ideal for running down the garden, will take a heater as well as power tools; would cost 30p per metre in your local shop—our price, 100 meter coil only £7·50+£2.00 carriage and VAT per coil.

Micro Switches. Standard size and type made by Honeywell, Burgess, Pye, Plessey or similar famous makers, two tag type normally open. 12p each less usual quantity discount which makes them 8p each if you buy 1,000 or over. DITTO, change over switching. 15p each or 10p for 1,000 or over.

Relay by STC—8 pin octal base, plug-in with perspex cover over contacts, an expensive and well-made relay for 24 volt working. £1 each+ VAT & post 10p.

0-1 mA panel meter, Eagle 1¾" square full vision, perspex cover, current price over £3 each—sale price £2+post & VAT 30p.

Solenoid 230v mains operated. A small (1¼"×1½"×1") solenoid metal encased with plunger. Sale price 40p each+post & V.A.T. 15p.

Reversible motor with gear box which rotates a splined shaft causing a carrier to travel backwards and forwards along same shaft; limit switches fitted at each end stop the motor. It is an extremely well-made device which could be used for opening and closing a door remotely, or similar. We nave one only and the price is £25+carriage and V.A.T. £4.

Instrument motor with electro brake made by Evershed & Vignibles Ltd. This is described as a hysteresis motor, maker's ref. FEX 25 CO30; the electric brake is easily removed. Sale price £4·50 each+post & V.A.T. 100p.

6 switch disco lamp controller. This is a mains motor driving a rotating drum made up of discs with cut-outs. As the cut-outs engage on the switch levers, contact is made via 10 amp switches. A large variety of lighting effects can be obtained. A real bargain at £2·75+post & V.A.T.

9"×4" loudspeaker ceramic magnet 12 ohm coil so suitable for 8-15 ohms outputs, a good performer. Sale £1+post & V.A.T. 60p.

Microswitches 10 amp changeover, ex GPO equipment, but little used and any not received in perfect order would be exhcanged. Price, 10 for 75p+post & V.A.T. 18p.

Clock switch for Tricity cooker, made by Smiths and probably a replacement in many other cookers. This has clock in the centre and the two control switches on the right-hand side. The top control switch sets the on-off times and is infinitely adjustable over the 12 hours; the lower switch selects manual or automatic. No glass front, but you could take this off you existing clock. Price £1·75 each+post & V.A.T. 35p.

BI-PAK SEMICONDUCTORS

TRANSISTORS

BRAND NEW FULLY GUARANTEED

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AC107	0·20	BSY40	0·29	AF118	0·36	ORP61	0·41*	BC172	0·15
AC113	0·19	BSY41	0·29	AF124	0·31	P20	0·51*	BF167	0·22
AC115	0·20	BSY95	0·13	AF125	0·31	P346A	0·20	BF173	0·22
AC117K	0·30	BSY95A	0·13	AF126	0·29	P397	0·43	BF176	0·36
AC122	0·12	BU105	£2·04	AF127	0·29	ST140	0·13	BF177	0·36
AC125	0·18	C111E	0·51	AF139	0·31	ST141	0·18	BF178	0·31
AC126	0·18	C400	0·31	AF178	0·51	TIP29	0·44	BF179	0·31
AC127	0·19	C407	0·26	AF179	0·51	TIP30	0·52	BF180	0·31
AC128	0·19	C424	0·26	AF180	0·51	TIP31A	0·56	BF181	0·31
AC132	0·15	C425	0·51	AF181	0·51	TIP32A	0·68	BF182	0·41
AC134	0·15	C426	0·36	AF186	0·51	TIP41A	0·68	BF183	0·41
AC137	0·15	C428	0·20	AF239	0·38	TIP42A	0·81	BF184	0·26
AC141	0·19	C441	0·31	AL102	0·68	TIS43	0·31*	BF185	0·31
AC141K	0·30	C442	0·31	AL103	0·68	UT46	0·28*	BF187	0·28
AC142	0·19	C444	0·36	ASY26	0·26	ZN414	1·11	BF188	0·41
AC142K	0·26	C450	0·22	ASY27	0·31	2G301	0·19	BF194	0·12
AC151	0·16	MAT100	0·19	ASY28	0·26	2G302	0·19	BF195	0·12
AC154	0·20	MAT101	0·20	ASY29	0·26	2G303	0·19	BF196	0·15
AC155	0·20	MAT120	0·19	ASY50	0·26	2G304	0·25	BF197	0·15
AC156	0·20	MAT121	0·20	ASY51	0·26	2G306	0·41	BF200	0·46
AC157	0·25	MJE521	0·56	ASY52	0·26	2G308	0·36	BF222	0·98
AC165	0·20	MJE2955	0·88	ASY54	0·26	2N2926 G	0·13	BF257	0·46
AC166	0·20	MJE3055	0·57	ASY55	0·26	2N2926 Y	0·11	BF258	0·61
AC167	0·20	MJE3440	0·51	ASY56	0·26	2N2926 O	0·10	BF259	0·87
AC168	0·25	MPF102	0·43	ASY57	0·26	2N2926 R	0·10	BF262	0·56
AC169	0·15	MPF104	0·38	ASY58	0·26	2N2926 B	0·10	BF263	0·56
AC176	0·20	MPF105	0·38	ASY73	0·26	2N3010	0·71	BF270	0·36
AC177	0·25	OC19	0·36	ASZ21	0·41	2N3011	0·15	BF271	0·31
AC178	0·29	OC20	0·65	BC107	0·08	2N3053	0·18	BF272	0·81
AC179	0·29	OC22	0·47	BC108	0·08	2N3054	0·47	BF273	0·36
AC180	0·20	OC23	0·49	BC109	0·08	2N3055	0·42	BF274	0·36
AC180K	0·30	OC24	0·57	BD136	0·41	2N3319	0·15	BFW20	0·61
AC181	0·20	OC25	0·39	BD137	0·46	2N3391 A	0·17	BFX29	0·28
AC181K	0·30	OC26	0·30	BD138	0·51	2N3392	0·15	BFX84	0·22
AC187	0·22	OC28	0·51	BD139	0·56	2N3393	0·15	BFX85	0·31
AC187K	0·23	OC29	0·51	BD140	0·61	2N3394	0·15	BFX86	0·22
AC188	0·22	OC35	0·43	BD155	0·81	2N3395	0·18	BFX87	0·25
AC188K	0·23	OC36	0·51	BD175	0·61	2N3402	0·21	BFX88	0·22
ACY17	0·26	OC41	0·20	BD176	0·61	2N3403	0·21	BFY50	0·20
ACY18	0·20	OC42	0·25	BD177	0·67	2N3404	0·29	BFY51	0·20
ACY19	0·20	2N918	0·31	BD178	0·67	2N3405	0·43	BFY52	0·20
ACY20	0·20	2N929	0·21	BD179	0·71	2N3414	0·16	2G309	0·37
ACY21	0·20	2N930	0·21	BD180	0·71	2N3415	0·16	2G339	0·20
ACY22	0·17	2N1131	0·20	BD185	0·67	2N3416	0·29	2G339A	0·17
ACY27	0·19	2N1132	0·22	BD186	0·67	2N3417	0·29	2G344	0·19
ACY28	0·19	2N1302	0·15	BD187	0·71	2N3525	0·77*	2G345	0·17
ACY29	0·36	2N1303	0·15	BD188	0·71	2N3614	0·69	2G371	0·17
ACY30	0·29	2N1304	0·18	BD189	0·77	2N3615	0·76	2G371B	0·12
ACY31	0·29	2N1305	0·18	BD190	0·77	2N3616	0·76	2G373	0·18
ACY34	0·21	2N1306	0·21	BD195	0·87	2N3646	0·09	2G374	0·18
BC173	0·15	2N1307	0·21	BD196	0·87	2N3702	0·12	2G377	0·31
BC174	0·15	2N1308	0·24	BD197	0·92	2N3703	0·12	2G378	0·17
BC175	0·22	2N1309	0·24	BD198	0·92	2N3704	0·13	2G381	0·17
BC177	0·19	2N1613	0·20	BD199	0·98	2N3705	0·12	2G382	0·17
BC178	0·19	2N1711	0·20	BD200	0·98	2N3706	0·12	2G401	0·31
BC179	0·19	2N1889	0·32	BD205	0·81	2N3707	0·13	2G414	0·31
BC180	0·25	2N1890	0·46	BD206	0·81	2N3708	0·08	2G417	0·26
BC181	0·25	2N1893	0·38	BD207	0·98	2N3709	0·09	2N388	0·36
BC182	0·15	2N2147	0·73	BD208	0·98	2N3710	0·09	2N388A	0·56
BC182L	0·15	2N2148	0·58	BDY20	£1·02	2N3711	0·09	2N404	0·20
BC183	0·15	2N2192	0·36	BF115	0·25	2N3819	0·29	2N404A	0·29
BC183L	0·15	2N2193	0·36	BF117	0·46	2N3820	0·51	2N524	0·43
BC184	0·20	2N2194	0·36	BF118	0·71	2N3821	0·36	2N527	0·50
BC184L	0·20	2N2217	0·22	BF119	0·71	2N3823	0·29	2N598	0·43
BC186	0·29	2N2218	0·20	BF121	0·46	2N3903	0·29	2N599	0·46
BC187	0·29	2N2219	0·20	BF123	0·51	2N3904	0·31	2N696	0·13
BC207	0·11	2N2220	0·22	BF125	0·46	2N3905	0·29	2N697	0·14
BC208	0·11	2N2221	0·20	BF127	0·51	2N3906	0·28	2N698	0·25
BC209	0·12	2N2222	0·20	BF152	0·56	2N4058	0·12	2N699	0·36
BC212L	0·13	2N2368	0·18	BF153	0·46	2N4059	0·10	2N706	0·08
BC213L	0·13	2N2369	0·15	BF154	0·46	2N4060	0·12	2N706A	0·09
BC214L	0·17	2N2369A	0·15	BF155	0·71	BC113	0·10	2N708	0·12
BC225	0·26	2N2411	0·25	BF156	0·49	BC114	0·16	2N711	0·31
BC226	0·36	2N2412	0·25	BF157	0·56	BC115	0·16	2N717	0·36
BC301	0·28	2N2646	0·48	BF158	0·56	BC116	0·16	2N718	0·25
BC302	0·25	2N2711	0·21	BF159	0·61	BC117	0·19	2N718A	0·51
BC303	0·31	2N2712	0·21	BF160	0·41	BC118	0·10	2N726	0·29
BC304	0·37	2N2714	0·21	BF162	0·41	BC119	0·31	2N727	0·29
BC440	0·31	2N2904	0·18	BF163	0·41	BC120	0·81	2N743	0·20
BC460	0·37	2N2904A	0·21	BF164	0·41	BC125	0·12	2N744	0·20
BCY30	0·25	2N2905	0·21	BF165	0·41	BC126	0·19	2N914	0·15
BCY31	0·27	2N2905A	0·21	OC44	0·16	BC132	0·12	2N4061	0·12
BCY32	0·31	2N2906	0·16	OC45	0·13	BC134	0·19	2N4062	0·12
BCY33	0·22	2N2906A	0·19	OC70	0·10	BC135	0·12	2N4284	0·18
BCY34	0·26	2N2907	0·20	OC71	0·10	BC136	0·16	2N4285	0·18
BCY70	0·15	2N2907A	0·22	OC72	0·15	BC137	0·16	2N4286	0·18
BCY71	0·20	2N2923	0·15	OC74	0·15	BC139	0·41	2N4287	0·18
BCY72	0·15	2N2924	0·15	OC75	0·16	BC140	0·31	2N4288	0·18
BCZ10	0·20	2N2925	0·15	OC76	0·16	BC141	0·31	2N4289	0·18
BCZ11	0·26	ACY35	0·21	OC77	0·26	BC142	0·31	2N4290	0·18
BCZ12	0·26	ACY36	0·29	OC81	0·16	BC143	0·31	2N4291	0·18
BD115	0·63	ACY40	0·18	OC81D	0·16	BC145	0·46	2N4292	0·18
BD116	0·81	ACY41	0·19	OC82	0·16	BC147	0·10	2N4293	0·18
BD121	0·61	ACY44	0·36	OC82D	0·16	BC148	0·10	2N5172	0·12
BD123	0·67	AD130	0·39	OC83	0·20	BC149	0·12	2N5194	0·56
BD124	0·70	AD140	0·49	OC139	0·20	BC150	0·19	2N5294	0·56
BD131	0·51	AD142	0·49	OC140	0·20	BC151	0·20	2N5296	0·56
BD132	0·61	AD143	0·39	OC169	0·26	BC152	0·18	2N5457	0·32
BD133	0·67	AD149	0·51	OC170	0·26	BC153	0·29	2N5458	0·32
BD135	0·41	AD161	0·36	OC171	0·26	BC154	0·31	2N5459	0·41
BFY53	0·18	AD162	0·36	OC200	0·26	BC157	0·19	2N6122	0·69
BSX19	0·16	AD161 &		OC201	0·29	BC158	0·12	2S301	0·51
BSX20	0·16	AD162(MP)		OC202	0·29	BC159	0·12	2S302A	0·43
BSY25	0·16		0·69	OC203	0·26	BC160	0·46	2S302	0·43
BSY26	0·16	ADT140	0·51	OC204	0·26	BC161	0·51	2S303	0·56
BSY27	0·18	AF114	0·25	OC205	0·36	BC167	0·12	2S304	0·71
BSY28	0·16	AF115	0·25	OC309	0·41	BC168	0·12	2S305	0·80
BSY29	0·16			OCP71	0·44*	BC169	0·12	2S306	0·80
BSY38	0·19	AF116	0·25	ORP12	0·44*	BC170	0·12	2S307	0'80
BSY39	0·19	AF117	0·25	ORP60	0·41*	BC171	0·15	2S321	0·75

* 74 SERIES T.T.L. I.C's

BI-PAK STILL LOWEST IN PRICE. FULL SPECIFICATION GUARANTEED. ALL FAMOUS MANUFACTURERS.

Type	Quantities 1	25	100+	Type	Quantities 1	25	100+	Type	Quantities 1	25	100+
7400	0·14	0·13	0·12	7448	£1·02	0·99	0·97	74122	0·65	0·63	0·60
7401	0·14	0·13	0·12	7450	0·14	0·13	0·12	74123	0·08	0·68	0·65
7402	0·14	0·13	0·12	7451	0·14	0·13	0·12	74141	0·70	0·76	0·73
7403	0·14	0·13	0·12	7453	0·14	0·13	0·12	74145	£1·20	£1·16	£1·11
7404	0·14	0·13	0·12	7454	0·14	0·13	0·12	74150	£1·39	£1·30	£1·20
7405	0·14	0·13	0·12	7460	0·14	0·13	0·12	74151	£1·30	[illegible]	0·93
7406	0·36	0·31	0·29	7470	0·30	0·27	0·25	74153	0·93	0·88	0·83
7407	0·36	0·31	0·29	7472	0·30	0·27	0·25	74154	£1·67	[illegible]	[illegible]
7408	0·23	0·22	0·21	7473	0·38	0·36	0·32	74155	£1·11	£1·06	£1·02
7409	0·23	0·22	0·21	7474	0·38	0·36	0·32	74156	£1·11	£1·06	£1·02
7410	0·14	0·13	0·12	7475	0·56	0·54	0·52	74157	0·93	[illegible]	[illegible]
7411	0·23	0·22	0·21	7476	0·41	0·40	0·39	74160	£1·30	£1·25	£1·20
7412	0·26	0·25	0·24	7480	0·56	0·54	0·51	74161	£1·30	£1·25	£1·20
7413	0·30	0·29	0·28	7481	1·02	0·97	0·93	74162	£1·30	£1·25	£1·20
7416	0·28	0·27	0·26	7482	0·83	0·79	0·74	74163	£1·30	£1·25	£1·20
7417	0·28	0·27	0·26	7483	£1·11	£1·06	0·97	74164	£1·67	£1·62	£1·55
7420	0·14	0·13	0·12	7484	0·93	0·90	0·88	74165	£1·67	£1·62	£1·55
7422	0·28	0·27	0·26	7485	£1·48	£1·44	£1·39	74166	£1·48	£1·44	£1·39
7423	0·37	0·36	0·35	7486	0·32	0·31	0·30	74174	£1·48	£1·44	£1·39
7425	0·37	0·36	0·35	7489	£3·70	£3·47	£3·24	74175	£1·02	0·97	0·93
7426	0·37	0·36	0·33	7490	0·60	0·58	0·56	74176	£1·16	£1·11	£1·06
7427	0·37	0·35	0·33	7491	£1·02	0·97	0·93	74177	£1·16	£1·11	£1·06
7428	0·42	0·38	0·37	7492	0·69	0·66	0·59	74180	£1·16	£1·11	£1·06
7430	0·14	0·13	0·12	7493	0·69	0·66	0·59	74181	£3·66	£3·56	£3·47
7432	0·37	0·35	0·33	7494	0·79	0·76	0·69	74182	£1·16	£1·11	£1·06
7433	0·39	0·37	0·35	7495	0·79	0·76	0·69	74184	£1·67	£1·62	£1·55
7437	0·32	0·30	0·28	7496	0·89	0·86	0·80	74190	£1·81	£1·76	£1·71
7438	0·32	0·30	0·28	74100	£1·39	£1·34	£1·30	74191	£1·81	£1·76	£1·71
7440	0·14	0·13	0·12	74104	0·56	0·54	0·51	74192	£1·81	£1·76	£1·71
7441	0·60	0·88	0·59	74105	0·56	0·54	0·51	74193	£1·81	£1·76	£1·71
7442	0·60	0·88	0·50	74107	0·41	0·39	0·37	74194	£1·20	£1·16	£1·11
7443	£1·11	£1·00	£1·02	74110	0·56	0·51	0·46	74195	£1·02	0·97	0·93
7444	£1·11	£1·00	£1·02	74111	0·85	0·81	0·78	74196	£1·11	£1·06	£1·02
7445	£1·48	£1·44	£1·39	74118	0·92	0·88	0·83	74197	£1·11	£1·06	£1·02
7446	£1·11	£1·06	£1·02	74119	£1·39	£1·30	£1·20	74198	£2·55	£2·50	£2·45
7447	£1·02	0·99	0·97	74121	0·46	0·44	0·41	74199	£2·31	£2·21	£2·11

Devices may be mixed to qualify for quantity price. (TTL 74 series only) data is available for the above series of I.C's in booklet form. PRICE 35p.

* D.T.L. 930 SERIES

Type	Quantities 1	25	100+	Type	Quantities 1	25	100+	Type	Quantities 1	25	100+
BP930	0·14	0·13	0·12	BP944	0·15	0·14	0·13	BP962	0·14	0·13	0·12
BP932	0·15	0·14	0·13	BP945	0·28	0·26	0·23	BP9093	0·42	0·40	0·38
BP933	0·15	0·14	0·13	BP946	0·14	0·13	0·12	BP9094	0·42	0·40	0·38
BP935	0·15	0·14	0·13	BP948	0·28	0·26	0·23	BP9097	0·42	0·40	0·38
BP936	0·15	0·14	0·13	BP951	0·65	0·60	0·56	BP9099	0·42	0·40	0·38

* TRIACS

	Case	100V	200V	400V
2 Amp	TO5	0·31	0·51	0·71
6 Amp	TO66	0·51	0·61	0·77
10 Amp	TO48	0·77	0·92	£1·12

* D.I.L. SOCKETS

		1	25	100+
TSO14	14 pin type	0·31	0·28	0·25
TSO16	16 pin type	0·35	0·32	0·30
TSO24	24 pin type	0·69	0·64	0·62
BPS 8	8 pin type (low cost)	0·14	0·12	0·10
BPS14	14 pin type (low cost)	0·15	0·13	0·11
BPS16	16 pin type (low cost)	0·16	0·14	0·12

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LINEAR I.C's

Type	Quantities 1	25	100+	Type	Quantities 1	25	100+	Type	Quantities 1	25	100+
72702	0·46	0·44	0·42	SL701C	0·46	0·42	0·37	uA723C	0·45	0·43	0·40
72709	0·23	0·21	0·19	SL702C	0·46	0·42	0·37	76003	£1·39	£1·34	£1·30
72709P	0·19	0·18	0·17	TAA263	0·74	0·65	0·56	76023	£1·39	£1·34	£1·30
72710	0·32	0·31	0·28	TAA293	0·93	0·88	0·83	76660	0·88	0·86	0·83
72741	0·28	0·27	0·26	TAA350A				LM380	0·93	0·90	0·88
72741C	0·26	0·25	0·24		£1·71	£1·67	£1·57	NE555	0·45	0·43	0·40
72741P	0·28	0·27	0·26	uA703C	0·26	0·24	0·22	NE556	0·88	0·86	0·83
72747	0·79	0·74	0·61	uA709C	0·19	0·18	0·17	TBA800	£1·39	£1·34	£1·30
72748P	0·35	0·33	0·31	uA711C	0·32	0·31	0·28	ZN414	£1·11	—	—
SL201C	0·46	0·42	0·37	uA712C	0·32	0·31	0·28				

SILICON RECTIFIERS

PIV	300mA (DO 7)	750mA (SO 16)		1 Amp Plastic	1·5Amp (SO 16)	3Amp (SO 10)	10Amp (SO 10)	30Amp (TO 48)
50	0·05	0·06	1N4001	0·05	0·07	0·14	0·19*	0·56*
100	0·05	0·07	1N4002	0·06	0·09	0·16	0·21*	0·69*
200	0·06	0·09	1N4003	0·07	0·12	0·20	0·23*	0·93*
400	0·07	0·14	1N4004	0·08	0·14	0·28	0·35*	£1·25*
600	0·08	0·16	1N4005	0·09	0·16	0·33	0·42*	£1·76*
800	0·11	0·18	1N4006	0·10	0·18	0·35	0·51*	£1·94*
1000	0·13	0·28	1N4007	0·11	0·23	0·44	0·60*	£2·31*
1200	—	0·32			0·28	0·54	0·69*	£2·88*

PO BOX 6 WARE HERTS

SUPER UNTESTED PAKS

Pak No.	Description	Price £p
U 1	120 Glass Sub-min. General purpose Germ. diodes	0·60
U 2	50 Mixed Germanium transistors AF/RF	0·60
U 3	75 Germanium gold bonded sub-min. like OA5, OA47	0·60
U 4	30 Germanium transistors like OC81, AC128	0·60
U 5	60 200mA sub-min. silicon diodes	0·60
U 6	30 Sil. Planar trans. NPN like BSY95A, 2N706	0·60
U 7	16 Sil. rect. TOP-HAT 750mA VLTG. RANGE up to 100	0·60
U 8	50 Sil. planar diodes DO-7 glass 250mA like OA200/202	0·60
U 9	20 Mixed voltages, 1 Watt Zener Diodes	0·60
U10	20 BAY50 charge storage diodes DO-7 glass	0·60
U11	20 PNP Sil. planar trans. TO-5 like 2N1132, 2N2904	0·60
U13	30 PNP-NPN Sil. transistors OC200 & 2S104	0·60
U14	150 Mixed silicon and germanium diodes	0·60
U15	20 NPN Sil. planar trans. TO-5 like 2N696, 2N697	0·60
U16	10 3Amp sil. rectifiers stud type up to 1000 PIV	0·60
U17	30 Germanium PNP AF transistors TO-5 like ACY 17-22	0·60
U18	8 6 Amp sil. rectifiers BYZ13 type up to 600 PIV	0·60
U19	20 Silicon NPN transistors like BC 108	0·60
U20	12 1·5 Amp sil. rectifiers top hat up to 1000 PIV	0·60
U21	30 AF. Germ. alloy transistors 2G300 series & OC71	0·60
U23	25 MADT's like MHz series PNP transistors	0·60
U24	20 Germ. 1 Amp rectifiers GJM series up to 300 PIV	0·60
U25	25 300 MHz NPN silicon transistors 2N708, BSY27	0·60
U26	30 Fast switching silicon diodes like IN914 Micro-Min	0·60
U29	10 1 Amp SCR's TO-5 can. up to 600 PIV CRS1/25-600	£1·20*
U32	25 Zener diodes 400 mW DO-7 case 3-33 volts mixed	0·60
U33	15 Plastic case 1 Amp sil. rectifiers IN4000 series	0·60
U34	30 Silicon PNP alloy trans. TO-5 BCY26 2S302/4	0·60
U35	25 Silicon planar transistors PNP TO-18 2N2906	0·60
U36	20 Silicon planar NPN transistors TO-5 BFY50/51/52	0·60
U37	30 Silicon alloy transistors SO-2 PNP OC200, S2322	0·60
U38	20 Fast switching silicon trans. NPN 400 MHz 2N3011	0·60
U39	30 RF. Ger. PNP transistors 2N1303/5 TO-5	0·60
U40	10 Dual transistors 6 lead TO-5 2N2060	0·60
U43	25 Silicon trans. plastic TO-18 A.F. BC113/114	0·60
U44	20 Silicon trans. plastic TO-5 BC115	0·60
U45	7 3A SCR. TO66 up to 600 PIV	£1·20*
U46	20 Unijunction transistors similar to TIS43	0·60*
U47	10 TO220AB plastic triacs 50V 6A	£1·20*
U48	9 NPN Sil. power transistors like 2N3055	£1·20
U49	12 NPN Sil. plastic power trans. 60W like 2n5294/5296	£1·20

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

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uA.7812/L130 12V (Equiv. to MVR12V) £1·25p

uA.7815/L131 15V (Equiv. to MVR15V) £1·25p

uA.7818 18V (Equiv. to MVR18V) £1·25p

* THYRISTORS

PIV	0·6A TO18	0·8A TO92	1A TO5	3A TO66	5A TO66	5A TO64	7A TO48	10A TO48	16A TO48	30A TO48
10	0·13	0·15	—	—	—	—	—	—	—	—
20	0·15	0·18	—	—	—	—	—	—	—	—
30	0·19	0·22	—	—	—	—	—	—	—	—
50	0·22	0·28	0 20	0·25	0·36	0·36	0·48	0·51	0·54	£1·18
100	0·25	0·30	0·25	0·25	0·48	0·48	0·51	0·57	0·58	£1·43
150	0·31	0·38	—	—	—	—	—	—	—	—
200	0·38	0·44	0·25	0·30	0·50	0·50	0·57	0·62	0·62	£1·63
400	—	—	0·30	0·39	0·55	0·57	0·62	0·71	0·77	£1·79
600	—	—	0·39	0·48	0·69	0·69	0·78	0·99	0·90	—
800	—	—	0·58	0·65	0·81	0·81	0·92	£1·22	£1·39	£4·07

DIODES

Type	Price	Type	Price	Type	Price	Type	Price
AA119	0·08	BY101	0·12	BYZ16	0·41	OA85	0·09
AA120	0·08	BY105	0·18	BYZ17	0·36	OA90	0·07
AA129	0·08	BY114	0·12	BYZ18	0·36	OA91	0·07
AAY30	0·09	BY124	0·12	BYZ19	0·28	OA95	0·07
AAZ13	0·10	BY126	0·15	CG62		OA200	0·07
BA100	0·10	BY127	0·16	(OA91Eq)	0·06	OA202	0·07
BA116	0·21	BY128	0·16	CG651 (OA70-		SD10	0·06
BA126	0·22	BY130	0·17	OA79)	0·07	SD19	0·06
BA148	0·15	BY133	0·21	OA5 Short		1N34	0·07
BA154	0·12	BY164	0·51	Leads	0·21	1N34A	0·07
BA155	0·15	BYX38/30	0·43	OA10	0·14	1N914	0·06
BA156	0·14	BYZ10	0·36	OA47	0·07	1N916	0·06
BA173	0·15	BYZ11	0·31	OA70	0·07	1N4148	0·06
BB104	0·15	BYZ12	0·31	OA79	0·07	1S021	0·10
BY100	0·16	BYZ13	0·26	OA81	0·07	1S951	0·70

QUALITY TESTED PAKS

Pak No.	Quality Tested Paks	Price
Q 1	20 Red spot transistors PNP	0·60
Q 2	16 White spot R.F. transistors PNP	0·60
Q 3	4 OC 77 type transistors	0·60
Q 4	6 Matched transistors OC44/45/81/81D	0·60
Q 5	4 OC 75 transistors	0·60
Q 6	5 OC 72 transistors	0·60
Q 7	4 AC 128 transistors PNP high gain	0·60
Q 8	4 AC 126 transistors PNP	0·60
Q 9	7 OC 81 type transistors	0·60
Q10	7 OC 71 type transistors	0·60
Q11	2 AC 127/128 Complementary pairs PNP/NPN	0·60
Q12	3 AF 116 type transistors	0·60
Q13	3 AF 117 type transistors	0·60
Q14	3 OC 171 H.F. type transistors	0·60
Q15	7 2N2926 Sil. Epoxy transistors mixed colours	0·60
Q17	5 NPN 2 × ST.141 & 3 × ST.140	0·60
Q18	4 MADT'S 2 × MAT 100 & 2 × MAT 120	0·60
Q19	3 MADT'S 2 × MAT 101 & 1 × MAT 121	0·60
Q20	4 OC 44 Germanium transistors A.F.	0·60
Q21	4 AC 127 NPN Germaniun transistors	0·60
Q22	20 NKT transistors A.F. R.F. coded	0·60
Q23	10 OA 202 Silicon diodes sub-min	0·60
Q24	8 OA 81 diodes	0·60
Q25	15 IN 914 Silicon diodes 75PIV 75mA	0·60
Q26	8 OA95 Germanium diodes sub-min IN69	0·60
Q27	2 10A 600 PIV Silicon rectifiers IS425B	0·60*
Q28	2 Silicon power rectifiers BYZ 13	0·60
Q29	4 Sil. transistors 2×2N696, 1×2N697, 1×2N698	0·60
Q30	7 Silicon switch transistors 2N706 NPN	0·60
Q31	6 Silicon switch transistors 2N708 NPN	0·60
Q32	3 PNP Sil. trans. 2×2N1131, 1×2N1132	0·60
Q33	3 Silicon NPN transistors 2N1711	0·60
Q34	7 Sil. NPN trans. 2N2369, 500MHz (code P397)	0·60
Q35	3 Silicon PNP TO-5 2×2N2904 & 1×2N2095	0·60
Q36	7 2N3646 TO-18 plastic 300 MHz NPN	0·60
Q37	3 2N3053 NPN Silicon transistors	0·60
Q38	5 PNP transistors 3×2N3703, 2×2N3702	0·60
Q39	5 NPN transistors 3×2N3704, 2×2N3705	0·60
Q40	5 NPN transistors 3×2N3707, 2×2N3708	0·60
Q41	3 Plastic NPN TO18 2N3904	0·60
Q43	5 BC 107 NPN transistors	0·60
Q44	5 NPN transistors 3×BC 108, 2×BC 109	0·60
Q45	3 BC 113 NPN TO-18 transistors	0·60
Q46	3 BC 115 NPN TO-5 transistors	0·60
Q47	4 NPN high gain transistors 2×BC 157, 2×BC 168	0·60
Q48	3 BCY 70 PNP transistors TO-18	0·60
Q49	3 NPN transistors 2×BFY 51, 1×BFY 52	0·60
Q50	7 BSY 28 NPN switch transistors TO-18	0·60
Q51	7 BSY 95A NPN transistors 300MHz	0·60
Q52	8 BY 100 type silicon rectifiers	£1·20
Q53	25 Sil. & Germ. trans. mixed all marked new	£1·50
Q54	6 TIL 209 Red LED	£1·20*

* UNTESTED T.T.L. PAKS

Manufacturers "Fall Outs" which include Functional and part Functional Units. These are classed as 'out-of-spec' from the makers' very rigid specifications, but are ideal for learning about I.C.'s and experimental work.

PakNo.	Contents	Price	Pak No.	Contents	Price
UIC00 =	12 × 7400	0·60	UIC72 =	8 × 7472	0·60
UIC01 =	12 × 7401	0·60	UIC73 =	8 × 7473	0·60
UIC02 =	12 × 7402	0·60	UIC74 =	8 × 7474	0·60
UIC03 =	12 × 7403	0·60	UIC75 =	8 × 7475	0·60
UIC04 =	12 × 7404	0·60	UIC76 =	8 × 7476	0·60
UIC05 =	12 × 7405	0·60	UIC80 =	5 × 7480	0·60
UIC06 =	8 × 7406	0·60	UIC81 =	5 × 7481	0·60
UIC07 =	8 × 7407	0·60	UIC82 =	5 × 7482	0·60
UIC10 =	12 × 7410	0·60	UIC83 =	5 × 7483	0·60
UIC13 =	8 × 7413	0·60	UIC86 =	5 × 7486	0·60
UIC20 =	12 × 7420	0·60	UIC90 =	5 × 7490	0·60
UIC30 =	12 × 7430	0·60	UIC91 =	5 × 7491	0·60
UIC40 =	12 × 7440	0·60	UIC92 =	5 × 7492	0·60
UIC41 =	5 × 7441	0·60	UIC93 =	5 × 7493	0·60
UIC42 =	5 × 7442	0·60	UIC94 =	5 × 7494	0·60
UIC43 =	5 × 7443	0·60	UIC95 =	5 × 7495	0·60
UIC44 ×	5 × 7444	0·60	UIC96 =	5 × 7496	0·60
UIC45 =	5 × 7445	0·60	UIC100 =	5 × 74100	0·60
UIC46 =	5 × 7446	0·60	UIC121 =	5 × 74121	0·60
UIC47 =	5 × 7447	0·60	UIC141 =	5 × 74141	0·60
UIC48 =	5 × 7448	0·60	UIC151 =	5 × 74151	0·60
UIC50 =	12 × 7450	0·60	UIC154 =	5 × 74154	0·60
UIC51 =	12 × 7451	0·60	UIC193 =	5 × 74193	0·60
UIC53 =	12 × 7453	0·60	UIC199 =	5 × 74199	0·60
UIC54 =	12 × 7454	0·60	UIC X1	25 Assorted 74's	£1·50
UIC60 =	12 × 7460	0·60			
UIC70 =	8 × 7470	0·60			

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Manufacturers "Fall Outs" which include Functional and part Functional Units. These are classed as 'out-of-spec' from the makers' very rigid specifications, but are ideal for learning about I.C.'s and experimental work.

Pak No.	Contents	Price
ULIC709 =	10 × 709	0·60
ULIC710 =	7 × 710	0·60
ULIC741 =	7 × 741	0·60
ULIC747 =	5 × 747	0·60
ULIC748 =	7 × 748	0·60

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Containing 75 of the C280 range of capacitors assorted in values ranging from ·01uF to 2·2uF. Complete with identification chart.

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300 mW 40 PIV (min) SUB-MIN FULLY TESTED
Ideal for Organ builders

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TO18 SIM. TO 2N706/8 BSY27/28/95A

All usable devices. No open and shorts. ALSO AVAILABLE IN PNP similar to 2N2906, BCY 70

20 for 50p, 50 for £1, 100 for £1.80, 500 for £8, 1000 for £14.

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30 WATT GERMANIUM TO3 METAL CASE

Vcbo 80V, Vceo 50V, IC 10A, Hfe 30-170 replaces the majority of Germanium power Transistors in the OC, AD NKT range.

1–24	25–99	100+
44p	41p	37p

G.P. 300

115 WATT SILICON TO3 METAL CASE

Vcbo 100V, Vceo 60V, IC 15A, Hfe, 20-100 suitable replacement for 2N3055, BDY11 or BDY20

1–24	25–99	100+
50p	48p	46p

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MAN 3M L.E.D. 7 SEGMENT DISPLAY 0.127" High Characters £1·76p*

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400 mw	1·5 w	10 w*
8p	17p	30p

CAUSE FOR ALARM!

AT a recent press conference *New Scientist* magazine demonstrated just how easy it is to bug an MP's private conversation within the House of Commons. A simple bugging device (miniature radio transmitter) was planted in the MP's office, without his knowledge, by a member of the staff of *New Scientist*. His conversation was not only bugged but recorded in another office within the House of Commons and outside the House, on Westminster Bridge!

It appears that the sole purpose of the *New Scientist* exercise* was to publicly demonstrate just how easy it is to bug any building or person, and that even strict security is not a defence against bugging. The alarming extent to which the magazine was proven right was confirmed by photographs and tape recordings of the House of Commons bugging operation.

It will surely come as a surprise to many of our readers that the only offence that appears to have been committed was contravention of the Wireless Telegraphy Acts—operating a radio transmitter without a licence! There is no doubt whatsoever that the Radio Regulatory Department of the Home Office would certainly not have issued a licence for the operation of this device, which operated within the 88-108 MHz FM broadcast band.

Anti-bugging equipment is used in the House of Commons for the detection of bugging devices, but with its vast number of rooms and also the large daily influx of thousands of people, it would therefore be quite easy for an individual or organisation to plant one or more bugging devices, which could go undetected indefinitely. The bugging/electronic surveillance industry both in this country and abroad produces some highly sophisticated devices, many operating on frequencies and principles which make their detection by current anti-bugging equipment virtually impossible. There certainly appears to be a recent proliferation by companies in the UK, of electronic surveillance devices.

Advertisements offering micro or miniature VHF transmitters to all and sundry appear regularly in newspapers and periodicals. Anyone can purchase these devices by post and there is no doubt whatsoever that they are certainly in widespread use as bugging or surveillance devices not only in the UK but also in other countries. No boardroom, office, laboratory, workshop, vehicle or person for that matter, is free from the threat of electronic bugging.

The next time you go out for your "evening pint at the local," beware of what you say. Someone up to several hundred yards away may be "tuned-in" to you!

Think about it.

* *"How we bugged the Commons"—New Scientist 10th July 1975*

LIONEL E. HOWES—*Editor*

NEWS...

CMOS book

MOTOROLA have just published a comprehensive 48-page new CMOS brochure which is available free of charge to all electronics engineers. The brochure lists the entire Motorola CMOS family and is complete with a full set of logic diagrams and family technical data. Advanced information is given on nearly 40 new CMOS devices that will be introduced by Motorola during 1975, including some functions that have never been available before in integrated circuit form.

Of particular value is the section devoted to equivalents of Motorola CMOS devices. This includes an 'other manufacturers' to Motorola interchangeability guide, a complex function (MC14500 family) equivalents chart listing devices from ten different manufacturers, and a list of TTL/CMOS functional equivalents.

The brochure also includes a CMOS interface guide, design hints and a bibliography of applications notes and technical articles. *Motorola Ltd., Semiconductor Products Division, York House, Empire Way, Wembley, Middlesex.*

Low-cost solar cells

BELL Telephone Laboratories have announced two new electronic devices which may provide a cheap means of providing electrical power from the sun's energy.

Should it be possible for the new devices to be manufactured using thin-film techniques—like those employed for making integrated circuits—they should be much cheaper to manufacture than silicon solar cells.

The new devices are an offshoot of studies involving the finding of new photodetectors for converting light into electrical signals. One of them has an efficiency of 12·5% in converting sunlight into electricity. This compares with the efficiency of the silicon solar cells used in space vehicles and satellites.

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

Osmor coils

OSMOR Limited tell us that they still receive numerous requests from constructors all over the world for coils. The Company ceased production of RF coils some 7 years ago to concentrate on their main products, reed relays.

Error

Due to an error, the Linear I.C. section of the Chromasonic Electronics advert in the July 1975 issue of Practical Wireless, was incorrectly priced. The magazine apologizes for any inconvenience caused to readers.

Sir Edward Fennessy

THE Council is pleased to announce that Sir Edward Fennessy has accepted an invitation to become a Vice President of the Society of Electrical and Radio Technicians.

Sir Edward's career in electronics goes back to 1934 when he joined Standard Telephones & Cables Limited development laboratories after graduating from London University. In 1938 he moved to the Air Ministry research establishment at Bawdsey where he joined the team working on the development of radar. In 1940 he entered the Royal Air Force where he was immediately involved in the planning and construction of radar defences. When he left the RAF in 1945, he was a group captain and chief engineer of No. 60 Group. He joined the Board of Decca Navigator Company and between 1946 and 1949 established the system as an international marine aid to navigation. His next appointment was Managing Director of Decca Radar, a position which he held for fifteen years. He became Managing Director of Plessey Company Electronics Group in 1965.

He joined the Post Office as Managing Director Telecommunications and a member of the Board in 1969. In 1973 he was appointed additionally as Board member for data processing and was reappointed Managing Director Telecommunications for a further three years.

He received a knighthood in the New Year's Honours List and became Deputy Chairman of the Post Office in March of this year.

Design guide

A 36-PAGE GUIDE to the range of digital products available has been produced by Semicomps Ltd., and is obtainable free of charge. The guide covers not only the main general purpose logic families but also the large area of MOS memories, shift registers and special purpose LSI circuits. Products from leading manufacturers such as Motorola, R.C.A., Signetics, G.I.M., Mostek and Ferranti are included to make this one of the most comprehensive aids available for the digital designer. *Semicomps Ltd., 5c Northfield Industrial Estate, Beresford Avenue, Wembley, Middlesex HA0 1SD.*

Richard Arbib

RICHARD ARBIB, who has died aged 65, was Chairman of Kelsey Industries Ltd. He was also Chairman of Multicore Solders Limited since that Company started in 1939. He built Multicore up into the largest manufacturer of flux-cored solder wires in the world and the Company was one of the first winners of the Queen's Award to Industry for outstanding export achievement in 1966.

In recent years he made a considerable contribution in establishing BIB Hi-Fi Accessories Limited, the manufacturers of Europe's largest range of hi-fi accessories for audio equipment, and many products within the range were his own invention.

Mr. Arbib served on the Radio Industry's Council and the Council of the Radio and Electronic Component Manufacturers Federation for over 30 years and was been closely associated with the electronics industry during his whole career.

Books received

World Radio/TV Handbook

A complete directory of international radio and television. Contains details of every short-wave station around the world, frequencies used by each country, foreign broadcasts, long and medium wave stations together with domestic programming.

Price £3·50 (soft cover)
£5·00 (hard cover)

Billboard Limited, 7 Carnaby Street, London, W1V 1PG. Telephone: 01-437 8090.

Ernie and 'Irene'

THAT machine which selects Premium Bond numbers up at Lytham St. Annes, namely ERNIE (Electronic Random Number Indicator Equipment) now has a sister.

Plessey Telecommunications is producing for the Central Bank of the Philippines a sister installation which has been christened IRENE. (Indicating Random Electronic Numbering Equipment).

IRENE is a complex of electronic units controlled by a computer. Winning numbers are generated at random and stored in the computer memory for checking and subsequent transfer to magnetic tape machines.

RAE Course

THE City of Bath Technical College, Avon St. Bath, will be offering a course of instruction to prepare for the May 1976 City & Guilds Radio Amateurs Exam.

The tutor is P. A. Bubb G3UWJ.

Further details and enrolment at the College 11th and 12th September.

A RADIO Amateur Course will be held at the North East Essex Technical College, Sheepen Road, Colchester, Essex. For further information please contact D. Mason, Electrical Engineering Department, at the College, Sheepen Road, Colchester, Essex, CO3 3LL or telephone Colchester 70271 ext. 66.

ON-SCREEN SCORING for TELE-TENNIS

E.A.PARR B.Sc, C.Eng., M.I.E.E.

THE P.W. Tele Tennis game is an excellent starting point for anyone wishing to experiment with TV games. Most games require some form of scoring and this article describes a method similar to the commercial version seen in arcades where the score is displayed on the screen itself.

MODIFICATIONS TO CIRCUITRY

As originally described there are no signals inside the game which indicate which player has won or lost. These signals are provided by new serve/lose logic on Board G which replaces the serve/lose logic on Board D of the original game. (To avoid confusion with existing boards and components, all items in the modifications are numbered sequentially from the existing game.)

The logic of Board G is shown on Fig. 1.

This is very similar to the original logic on Board D except that a "lose" signal is generated and stored separately for left and right players. The score counter counts on a negative-going (1 to 0) edge.

Suppose the left hand player misses the ball. A coincidence between "ball" and "left base" will be detected by IC34a and its output will go to 0. This will set the bistable formed by IC33a and IC33b, the output of IC33b going to 0. This blanks the ball, and at the same time the 1 to 0 edge is used to step the counter. This output is therefore labelled "count right". (As the left hand player lost, the right hand player's score is incremented.)

The ball, meanwhile, is still bouncing around the court even though it is blanked, so detection of a miss must be prevented on the right hand side. The "count right" output, which is still at 0 is taken to IC34c to inhibit the detection of the coincidence of the ball and right base. The blanked ball can now bounce round the court indefinitely without further effect on the count outputs.

The sequence of events if the right player misses the ball is similar. The bistable formed by IC33c and IC33d is set, the ball is blanked and IC34a inhibited by "count left".

The serve logic is also similar to that on Board D. The two serve buttons are gated with (right base + right bat) and (left base + left bat) signals and the resulting 0 output from IC32b or IC32a used to reset both of the "lose" bistables. The ball is unblanked and the game starts. The normally closed contacts on each serve button inhibit the "miss" that could be generated at the moment the ball is served.

GAME IN PROGRESS

The on-screen display circuit requires a signal indicating that a game is in progress to turn off the display during a game. This is provided by IC35a which gives a 0 out when both "count right" and "count left" are at 1. This will occur when both "lose" states are reset, i.e., a game is being played.

The modifications required on Board D are quite straightforward. First, ICs 28 and 29 are removed. If sockets have been used on Board D these ICs can be reclaimed for use elsewhere.

Next the two signals "left bat OR left base" and "right bat OR right base" are brought out. This is best done by connecting to the wire links on Board D as shown in Fig. 7.

The serve button connections are transferred or linked to Board G. Note that the two normally closed contacts are now used independently.

Finally on Board D, the "ball" and "blanked ball" pins are linked to the same pins on Board G.

The other signals required by Board G are "left base" and "right base". These are already provided on Board B.

These interconnections are summarised on Fig. 2. When Board G is connected to Board D the game can be played as before; it is not necessary to complete the display circuits at the same time.

SERVE INDICATOR

Board G also contains logic to indicate which player is to serve. Tele Tennis is usually played to a rough adaptation of table tennis, i.e., first to 21 wins.

In table tennis, the players change serves after

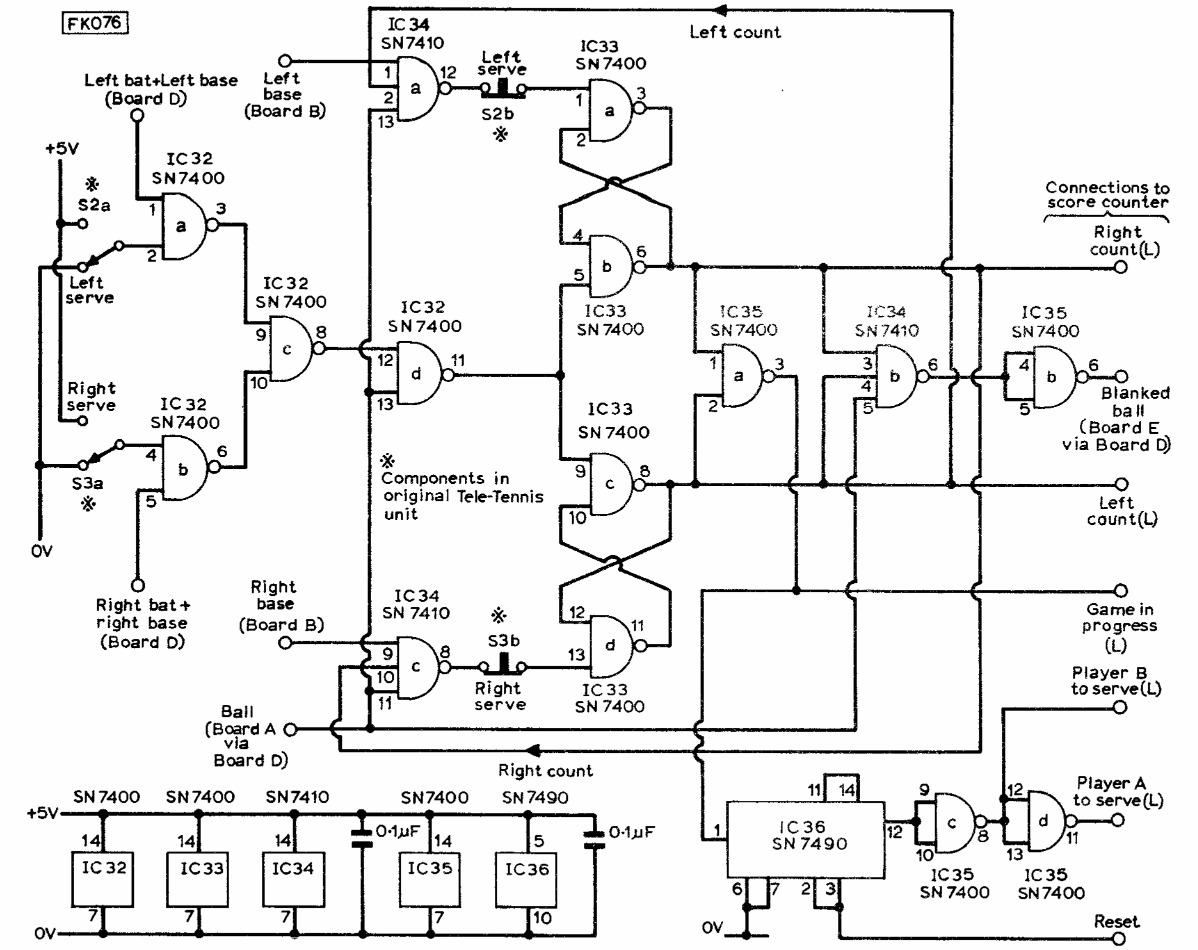
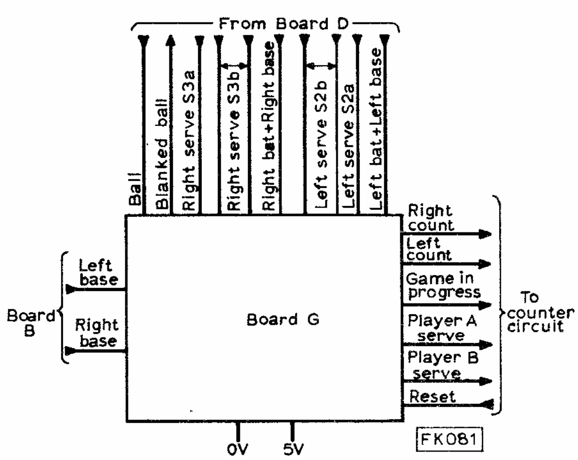


Fig. 1: Logic diagram of Board G which contains the new Serve/Lose logic. The (L) after some of the signals indicates negative logic (logic 1 = 0V).
Fig. 2: below, Summary of connections to Board G from the original Tele Tennis Boards B and modified Board D (see Fig. 7).



five serves. A counter is included on Board G to count serves and indicate which player is to serve next.

The counter used is IC36, a 7490 decade counter which conveniently consists of a ÷5 counter and an independent ÷2 counter.

The ÷5 counter counts the serves from the "game in progress" signal and after five serves the ÷2 counter changes state indicating that the service passes to the other player. After another five serves the ÷2 counter changes back. The serve indicators are displayed on the screen itself.

The serve counter is reset by the button used to reset the score counters.

If it is required to add the serve indicators only without the scoring, a suitable signal exists within Board D. The output of IC27d goes from 1 to 0 on each serve, and this signal can be used to step the 7490.

The format of the on-screen display is shown in Fig. 3. As can be seen, the numbers are formed from seven segments identical to a conventional seven-segment display.

As in the original game, generation of the ball, bats and base lines is a question of timing to give a bright-up on the screen at the correct time.

The timing of the character generation is shown on Fig. 4. Delay Q1 is fired by the line sync pulse, and Delay Q4 by the field sync pulse. These determine horizontal and vertical position of the characters respectively.

Delay Q1 starts an oscillator consisting of two delays Q2 and Q3. These determine the width and separation of the characters respectively.

Delay Q4 fires Delay Q5 which on completion of its delay fires Delay Q6. These determine the height

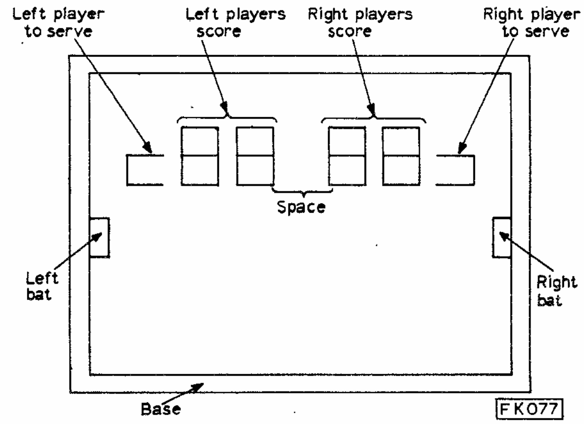


Fig. 3: Format of the scoring display on the TV screen. Only one of the serve indicators will appear at a time and the whole display is blanked during the course of a game.

of the top and bottom halves of the character respectively.

At the end of delays Q2 to Q6 a narrow strobe pulse is generated. These strobe pulses are labelled SP2 to SP6 and determine the width of the lines in the character.

It can be seen that

Segment a occurs at (SP2 OR Q2) AND SP4
Segment b occurs at (SP5 OR Q5) AND SP2
Segment c occurs at (SP6 OR Q6) AND SP2
Segment d occurs at (SP2 OR Q2) AND SP6
Segment e occurs at (SP6 OR Q6) AND SP3
Segment f occurs at (SP5 OR Q5) AND SP3
Segment g occurs at (SP2 OR Q2) AND SP5

In practice, segments b and f do not occur alone, and these can be simplified to (Q5 AND SP2) for segment b and (Q5 AND SP3) for segment f.

The circuit diagram for the timing is shown in Fig. 6. This is quite straightforward and needs little examination. Note that the line sync pulse clears Q2 and Q3, stopping the oscillator. This allows Q1 to start the oscillator again via IC55a at the same point in each line.

GATING

Having obtained the timing waveforms we must now gate the characters with them.

The order in which the characters are displayed is:

1. L.H. player to serve.
2. L.H. player most significant digit.
3. L.H. player least significant digit.
4. Space.
5. R.H. player most significant digit.
6. R.H. player least significant digit.
7. R.H. player to serve.

These signals are gated in turn to the character generation by a counter triggered by the oscillator Q2 and Q3. The circuit of the score counting, gating and character generation is shown in Fig. 5.

SCORE COUNTERS

The score is counted on the four decade counters IC37 to IC40 giving a two decade count for each player.

The outputs from each decade counter are gated in turn along with the serve indicators and the middle space to the seven segment decoder (IC46)

★ components list

BOARD G SERVE/LOSE LOGIC

Integrated Circuits
IC32 SN7410N
IC33 SN7400N
IC34 SN7410N
IC35 SN7400N
IC36 SN7490N

BOARD H CHARACTER GENERATION

Resistors
R69 1kΩ
R70 1kΩ
R71 100Ω
R72 100Ω
R73 1kΩ

Switch
S5 Single pole biased changeover

Integrated Circuits
IC37–IC40 SN7490N (4 off)
IC41–IC44 SN75151N (4 off)
IC45 SN7493N
IC46 SN7448N (not 7447)
IC47–IC49 SN7412N (3 off)
IC50 SN7404N
IC51 SN7400N

BOARD J TIMING

Resistors
R74–R84 1kΩ (11 off)
R85 2·2kΩ
R86 1kΩ
R87 2·2kΩ
R88 1kΩ
R89 2·2kΩ
VR15–VR17 10kΩ (3 off) } skeleton
VR18–VR20 100kΩ (3 off) } presets

Capacitors
C41 2200pF
C42 1000pF
C43 1000pF
C44 0·22μF
C45 0·1μF
C46 0·1μF
C47 470pF
C48 470pF
C49 0·33μF
C50 0·33μF
C51 0·33μF

Diodes
D29–D39 1N914 (11 off)

Integrated Circuits
IC52–IC54 SN74123N
IC55–IC57 SN7400N

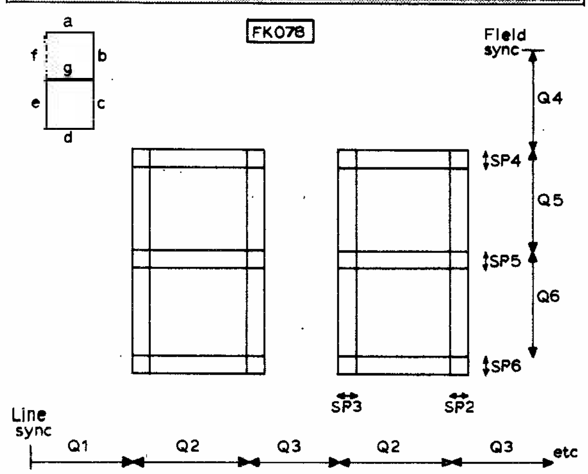


Fig. 4: An enlarged section of the score display which shows the timing of the various segments which go to make up the characters. The smaller character at top left shows the segment designation referred to in the text.

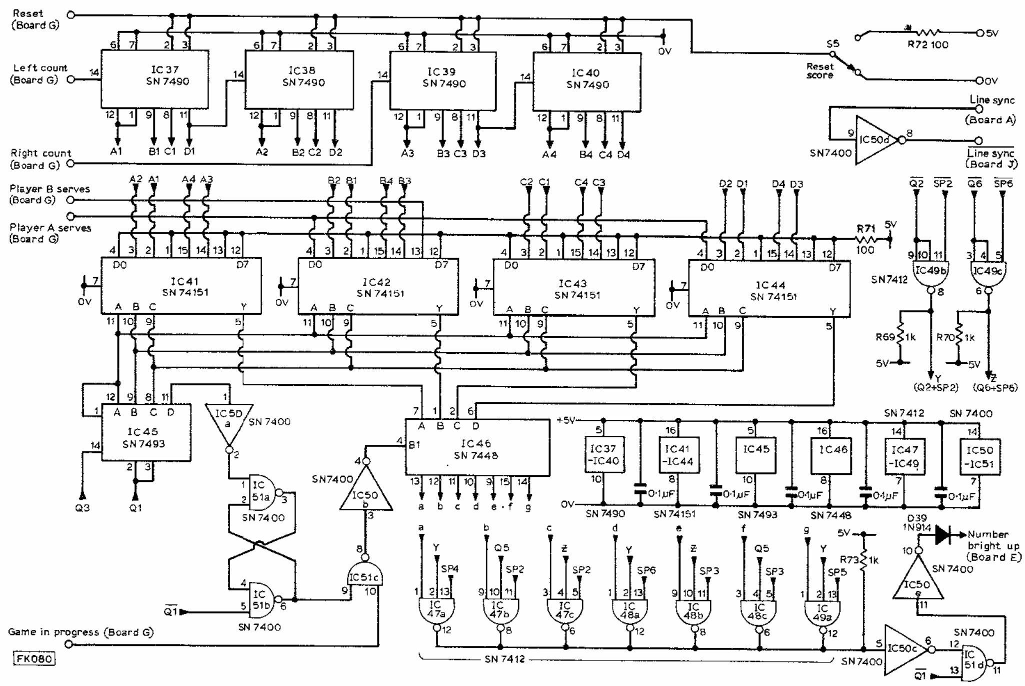


Fig. 5: Logic diagram of Board H, the character generation board. S5 is a new component which can be mounted on the front panel.

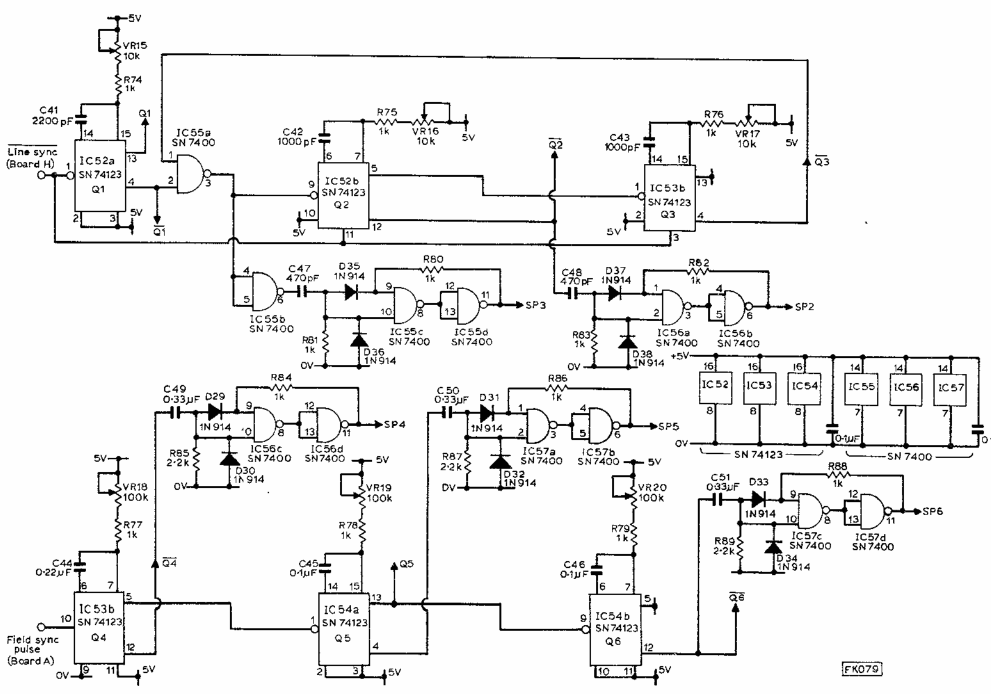


Fig. 6: Logic diagram of Board J which contains the timing logic.

by the four multiplexer circuits IC41 to IC44. The operation of the multiplexer circuits as as follows.

Each IC has eight data inputs, labelled D0 to D7, three gate inputs labelled A, B and C, and two outputs labelled W and Y. The IC simply takes the binary address on A, B and C and gates the data on the corresponding input in true and complement forms to the outputs Y and W respectively.

Thus, for example, if A, B, and C are at 110 (binary 3, A being the least significant digit) the data on D3 will appear on output Y and its complement on output W.

If ABC are fed from a binary counter, each of the inputs in turn will be selected as the counter counts from 000 to 111.

In this application, four multiplexers are used to gate the four binary coded outputs from each decade counter to the seven segment decode matrix IC46. The sequencing is done by the four bit binary counter IC45. Only the first three digits are used for the selection, the fourth being used for display blanking as described later.

The counter is stepped at the end of Delay Q3, and is reset to zero at the start of each line by Delay Q1.

There are therefore seven segments for each character appearing in turn at the outputs of IC46. All that is necessary now is to gate these with the timing pulses as described earlier.

The outputs from IC46 are positive going (unlike the conventional seven segment decoder) and can be gated by NAND gates. The gating is done by the open collector NANDS IC47, IC48 and IC49. The gating signals (Q2 OR SP2) and (Q6 OR SP6) required for segments a, c, d, e, and g are generated by IC49b and c. The picture will bright up if any of the seven outputs from the NAND goes to a 0. These are Wired-ORed together and the resulting signal inverted by IC50c to be fed to Board E for mixing with the other video signals.

CHARACTER SIZE

If the characters on the screen are made fairly small it is possible for the binary counter IC45 to reach full count and start again, giving a second score at the right hand side of the screen. To prevent this, after eight counts the bistable constructed of IC51a and b is set. This is used to inhibit the seven segment decoder via its blanking input. This bistable is reset at the start of each line by Q1.

Unfortunately the characters have to be displayed quite large in order to avoid the inherent flicker of horizontal lines on a random interlace system.

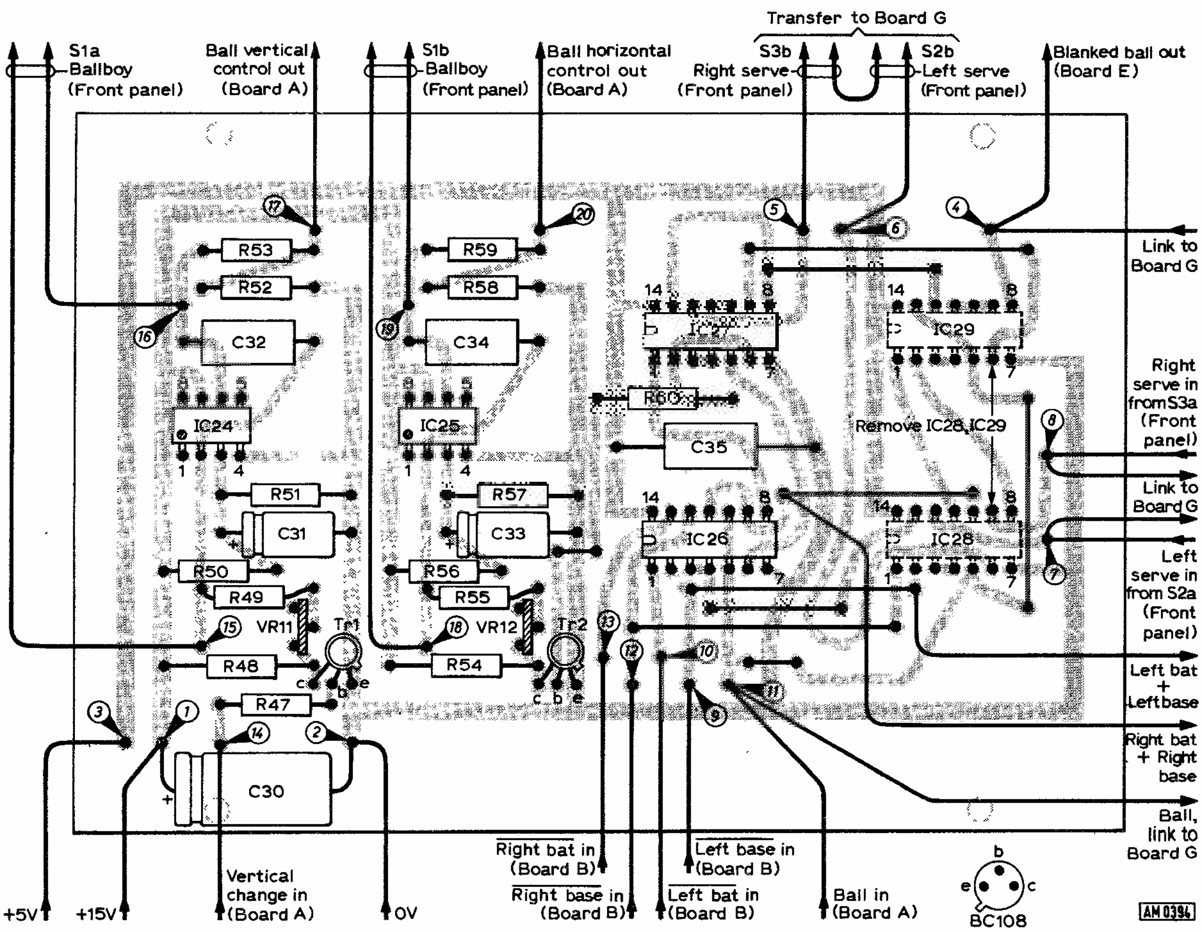


Fig. 7: Modifications to be made to the Board D in the original Tele Tennis unit.

This means that if the characters were left on during a game the screen would be rather cluttered. The "game in progress" signal on Board G is therefore used to blank the displays during the game.

Invalid codes are used to generate the serve indicators and the space between the two scores.

Decimal 10 (1010) generates the "left hand player to serve" signal in position D0; decimal 11 (1011) generates the "right hand player to serve", signal in position D6; decimal 15 (1111) generates a space in position D3 and in position D0 and D6 when the serve indicators are not lit.

The score counter is reset by the reset button. This also initialises the serve counter.

Because all the gates on Board J are utilised, the inversion of the line sync pulse required to fire Delay Q1 and clear Delays Q2 and Q3 on Board J is done by inverter IC50d on Board H.

SETTING UP

The interconnections between Boards H and J are straightforward and self-explanatory, as are the connections from Boards G and A to H and J.

The bright-up signal from Board H has to be ORed with the other signals coming to Board E. This is done by adding an additional diode to D17-D23.

The additional diode (D39) is mounted on Board H, and is connected to the common junction of D17-D23. This is best done by removing R61, putting through pins in its two mounting holes and reconnecting R61 to the through pins. The lead from Board H can then be soldered neatly to the through pin at the junction of R61 and the diodes.

Setting up the displays is done as follows:

(1) Set trim pots VR15-20 to mid positions.
(2) Turn on the game. Press the reset score button.
(3) Somewhere on the screen there should be a "player A to serve" and two zero symbols although they will probably be distorted and may even run off the sides of the screen.
(4) Adjust VR15 (horizontal) and VR18 (vertical) to bring the display roughly to the middle.
(5) Adjust VR16 and VR17 to give the required character width and gap respectively.
(6) Serve the ball until one character shows the symbol for 2. Adjust VR19 and VR20 to give the required heights for the top and bottom halves.
(7) Adjust VR15 and VR18 again to position the display as required.
(8) Try playing the game. The display should go off during a game and come on when a player loses. After five serves the serve indicator should change sides.

The sizes of the lines that make up the characters are determined by C47 and C48 for the two vertical lines and C49, C50 and C51 for the three horizontal lines. The sizes of the lines can be increased or decreased by increasing or decreasing the size of the corresponding capacitor.

POWER SUPPLIES

The Tele Tennis game obtains its 5V supply from a 7805 regulator. This is rated at 600mA, and is not capable of driving both the game and the scoring. It is therefore necessary to improve this supply, add another separate supply for the scoring or add a completely separate supply to drive both the game and the scoring.

Having two separate supplies for the game and the scoring logic is not good practice. Because logic signals pass between them there is a danger that some integrated circuits could be damaged if the two supplies differed by more than about 0·5V. The 7805 regulator has a tolerance of 0·25V so there could be 0·5V difference between two regulators. This difference could be increased during turn-off and turn-on as the supplies ramp up and down. It is not recommended that two supplies are used.

RS have recently introduced an uprated version of their MVR5V regulator. This is the RS309K which is rated at 1·2A. This is capable of supplying the needs of both the game and the scoring.

Fortunately this is pin compatible with the 7805 regulator although the heatsink originally fitted is not adequate. The recommended heatsink needs a thermal resistance of about 4°C/W. The regulator should therefore be mounted on to a suitable heatsink on the cabinet, and leads extended to it from Board F.

The transformer now needs to supply 12-15V at 1A. If a 0·5A transformer was fitted this will need changing.

The rectifier diodes D25-D28 are rated at 1A and are theoretically capable of handling the current needed. The author has had nasty experiences with rectifier diodes and likes to see them loaded at no more than half their rated current. Pessimists like myself should change them for 3A diodes such as 1N5401.

If it is intended to add any more modifications to the Tele Tennis, adding a substantial five volt supply to power the game should be considered now. This could be done either by using a higher power regulator such as the RS HPV regulator which will supply 2A or even purchasing a commercial fixed voltage power supply.

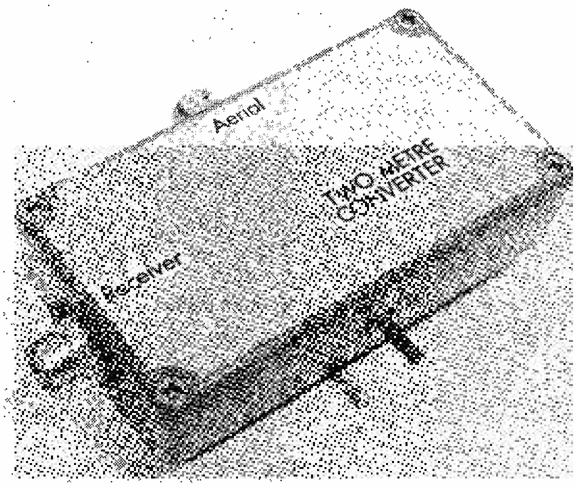
People who wish to design their own power supplies should be careful. You have probably spent a significant amount of money on TTL integrated circuits and commercial supplies have over-voltage protection and other features to look after your investment. Failures of logic power supplies can be very expensive.

It is recommended that at least one 0·1μF capacitor be used for decoupling every three integrated circuits. PW

Miniature 2m EQUIPMENT

part 1: converter

W. H. Bond F.R.C.S. G3XGP



THIS 2m CONVERTER IS INTENDED TO BE USED WITH AN EXISTING HF BANDS RECEIVER. LATER WE SHALL DESCRIBE AN RF AMPLIFIER TO GO WITH IT, FOLLOWED BY A LOW POWER FM TRANSMITTER. ALL THREE UNITS ARE HOUSED IN SIMILAR SMALL DIECAST ALUMINIUM BOXES TO MAKE UP A COMPLETE STATION FOR THE 2m BAND.

THIS miniature converter is designed to complement the small transmitter to be described in PW, and has an output of 28-30MHz. This IF is chosen because of the peace and quiet on that band, requiring no input filter, and although the gain of most receivers falls at this frequency, the lack of breakthrough ensures a quiet band and a good S/N ratio. Construction is considerably eased

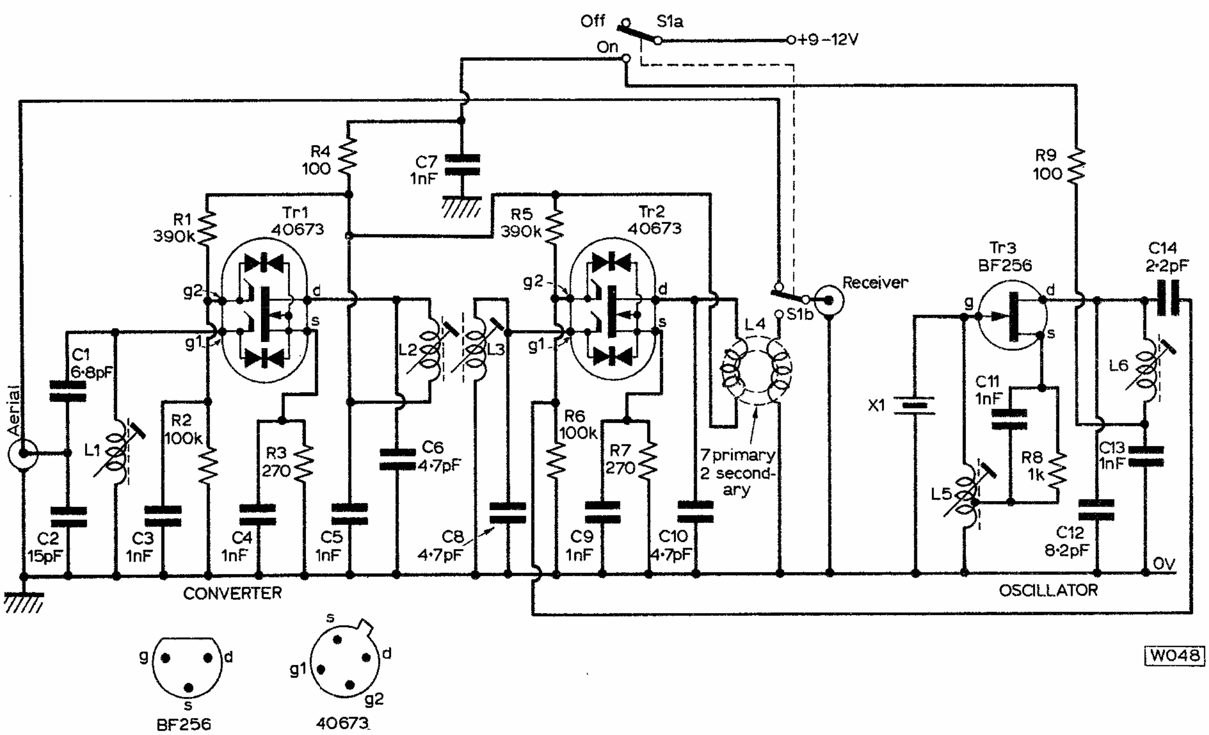


Fig. 1: The complete circuit diagram of the converter. The oscillator circuit uses a crystal on 116MHz for easy calibration, while the output from the converter is via a wideband toroidal transformer.

by the use of commercial coils of high Q and excellent stability; gate-protected MOSFETS simplify construction and the risk of damage in use is largely eliminated.

The crystal oscillator is unconventional and is the only part of the circuitry requiring any care in setting up. Results are comparable with other converters, the S/N ratio is good and it can be optimised by the adjustment of two resistors.

THE CIRCUIT

The circuit Fig. 1, follows modern popular practice, Tr1 being a gate-protected MOSFET which has internal zener diodes to protect against static from handling and from any excessive RF applied during use. The double channels isolate input and output circuits to give excellent separation so that neutralization is not required. These circuits are tuned by L1 and L2 respectively. To avoid the need for a tap on the input coil L1, C1 and C2 provide a match for a 50 to 75Ω aerial. Further tuning is

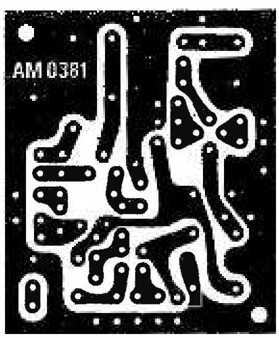


Fig. 2: Full size drawing of the printed circuit board viewed from the underside. Owing to its small size, considerable care should be taken in the drawing and etching of this board.

achieved by the slug in L1. L1 also provides a DC return for gate 1 of Tr1, forward bias for the second gate being provided by R1 and R2, decoupled by C3.

The channel current of Tr1 is controlled by R3 with C4 as bypass, and since the channel current varies the S/N ratio, R3 may be varied to suit the characteristics of the particular MOSFET employed. The drain load of Tr1 is L2 and C6, the whole of the RF input stage being decoupled by R4 and C5. L2 is inductively coupled to L3 and C8, while L3 provides a DC return for gate 1 of Tr2. Gate 2 of Tr2 is forward biassed by R5 and R6 and receives the oscillator injection voltage via C14 at 116MHz. This gives the required mixer product of 28-30MHz from the drain load of L4, broadly tuned to these frequencies by C10. The channel current of Tr2 is controlled by R7, bypassed by C9 and some control of mixer noise is available by variation in the value of R7. C7 serves to decouple the whole circuit.

OSCILLATOR

The oscillator circuit is unusual, in as much as the high frequency crystal employed requires an inductance to tune out the capacity of the crystal and its mounting. This same inductance, connected in parallel with the coil, is employed in a Hartley circuit to supply the necessary feedback to maintain oscillation. The crystal is connected between earth

★ components list

Resistors

R1	390kΩ	R6	100kΩ
R2	100kΩ	R7	270Ω
R3	270Ω	R8	1kΩ
R4	100Ω	R9	100Ω
R5	390kΩ	All resistors 10% ¼W	

Capacitors

C1	6·8pF	C8	4·7pF
C2	15pF	C9	1nF
C3	1nF	C10	4·7pF
C4	1nF	C11	1nF
C5	1nF	C12	8·2pF
C6	4·7pF	C13	1nF
C7	1nF	C14	2·2pF

Semiconductors

Tr1	40673	Tr3	BF256
Tr2	40673		

Miscellaneous

L1, L2, L3 and L6, MC6S Toko coils, type 503HS 04BY5A (4½ turns). L5, S18 Toko coil 4½ turns tapped at 2½ turns. L4, Toroid core type CR0218A. Coils and core available from Ambit International, 37 High St., Brentwood, Essex, CM14 4RH. Eddystone diecast box 115 x 64 x 32mm (4½ x 2½ x 1¼in.) type 7134P. 2 Coax sockets. Stand-off bushes. DPDT switch. 116MHz crystal, type HC18/U, available from PM Electronic Services, 7A Arrowe Park Road, Upton, Wirral, Merseyside L49 0UB. Fibre glass PCB, 41 x 34mm (1⅝ x 1$\frac{5}{16}$in.)

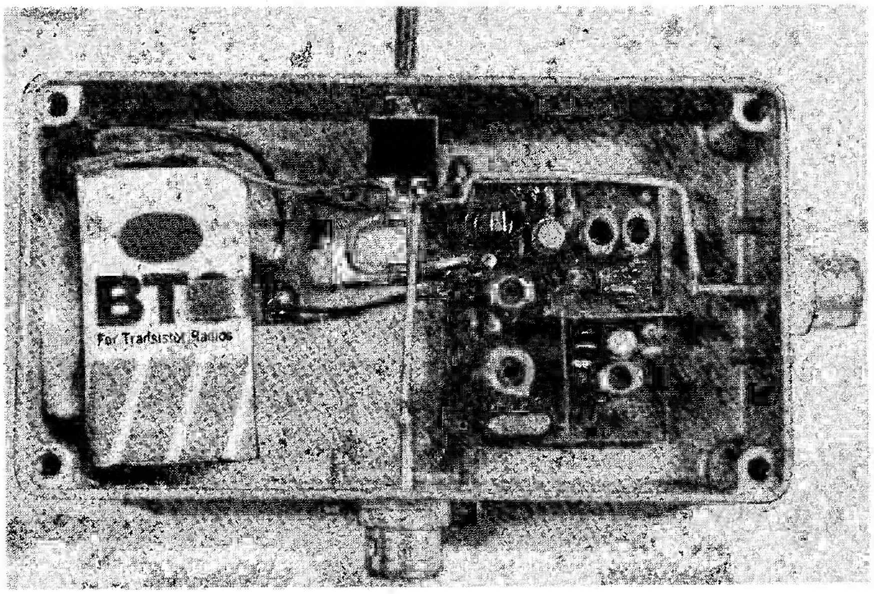
and gate of Tr3, which is in parallel with L5 tapped to provide feedback from the emitter. R8 limits current flow through the oscillator, by-passed by C11 with neutralization of the crystal capacity obtained by careful adjustment of L5. The output from the oscillator is taken from the drain, the load being L6 tuned by C12 and the slug in the coil. C12 also decouples to earth, with the output being passed to the second gate of the mixer through C14.

The circuit is designed for operation between 9 and 12V without zener stabilization. These circuit facts, together with the additional capacity across the crystal, result in slightly inaccurate frequencies although the error should not be more than 15kHz. For average amateur use such an error is immaterial.

CONSTRUCTION

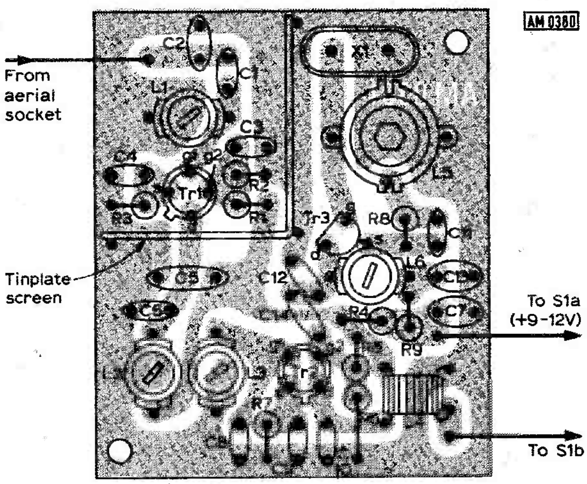
The circuit is made on a printed circuit board and the technique of preparation is worth repeating. Using Fig. 2, make a tracing, stick it to a suitable piece of single sided copperclad board and dot punch each of the component mounting holes. Drill each point with a No. 60 drill and file off the burrs on each side. Following Fig. 2, link the holes using either a Dalo pen or a Staedtler Permawriter making the gaps between the copper lands as narrow as possible. Etch in ferric chloride or ammonium persulphate and common salt (much cleaner), both slightly warmed. When completed, remove the etch resistant with Brillo or steel wool. Examine with a magnifying glass and remove any excess copper remaining between lands.

Construction is considerably simplified by the use of suitable Toko coils and only the output toroid need be wound, (7 turns primary, 2 turns secondary



Interior view of the unit, showing position of PCB in relation to the coaxial sockets and double pole switch. Notice the screening around the input stage of the converter. This can be constructed from 20SWG tinplate, and soldered to pins in the board and earthed.

of about 22SWG copper wire), taking care the windings terminate over the PCB connections. Because of the small spacing of components on the recommended circuit board, start at the centre and work outwards making all component leads as short as possible and mounting the coils and screen last of all. Omit R9 until the oscillator has been placed on frequency.



Component side view of the PCB, shown approximately 1½ times actual size. For components to fit the hole spacings correctly, the leads should be kept as short as possible.

SETTING UP

The omission of R9 allows the oscillator to be put on to frequency without energizing the converter. Give the oscillator a power supply by temporarily connecting 9 to 12V via a milliammeter to the C12 end of R9, and adjust L5 and L6 for minimum current. A frequency meter makes this adjustment easy, but failing this an RF 'sniffer' placed near L6 will show maximum output and the milliammeter minimum current, when the coils are correctly adjusted. Now insert R9 and connect power to the correct point; the consumption should be 10mA. Adjust L3 and L2 for maximum current. Connect the aerial to the input, or, alternatively, supply a 144-146MHz signal from a signal generator, and adjust L1. Meanwhile, feed the output into a receiver tuned to 28-30MHz, looking for maximum gain, and readjusting all three coils approximately. After acquaintance with the unit it is worth while altering the values of R3 and R7 to obtain the best signal-to-noise ratio.

CONCLUSIONS

As a straightforward converter to 28-30MHz this very small unit gives excellent results with a 9 to 12V supply, the optimum behaviour depending on adjustment of the voltage supply or the two emitter resistors R3 and R7.

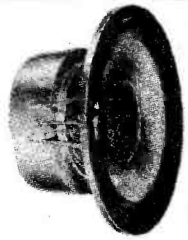
Although this converter contains an expensive crystal it is easy to construct and adjust, and is further enhanced by the quiet IF selected and the certainty that, using commercial coils, only minor adjustment is required for satisfactory operation.

THE SECOND ARTICLE IN THIS SERIES WILL BE PUBLISHED IN THE OCTOBER ISSUE AND WILL DESCRIBE THE CONSTRUCTION OF A 2m PRE-AMPLIFIER.

points arising...

PW TEXAN II AMPLIFIER JULY 1975

p202 In Fig. 10, R41 should be R42 and R42 should be R41. Accordingly in the components list R41 should be 15kΩ and R42 should be 100kΩ. The changes apply to the other channel resistors as well. The buffer stages will work but not as well as intended. Briefly, for those who have made the modifications, change over the 15kΩ and 100kΩ resistors.



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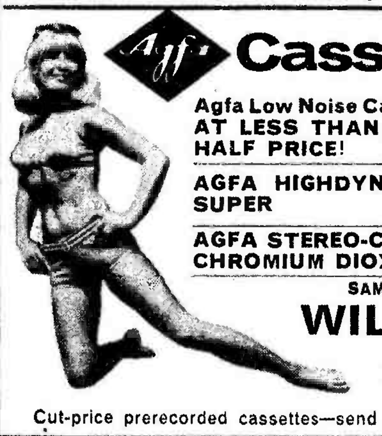

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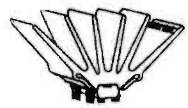

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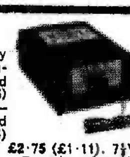

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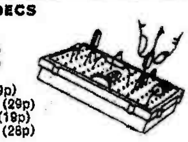

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PART 16—TRF RADIO RECEIVERS

WHEN a radio signal is transmitted it comprises what is called a "carrier" on which is superimposed the audio signals we wish to receive. The carrier can be one of a vast range of frequencies which cover the radio frequency spectrum from a hundred kilohertz to several hundred megahertz. The audio frequency signals are superimposed on the carrier by a process known as "modulation" and there are several forms. The oldest form is AMPLITUDE MODULATION (AM). As its name suggests the audio frequencies are used to make the carrier's amplitude vary in exact relationship to the amplitude of the audio signal, as shown in Fig. 112.

All frequencies are suitable for amplitude modulation but generally speaking we think of the long, medium and short waves as being the primary domain for AM. Within the same bands there are other modes of modulation which are used for specific commercial or technical reasons. For example, most amateurs using telephony now operate on SSB (single sideband) as this enables them to radiate power more efficiently while, at the same time, using only half the bandwidth. However, SSB is still only another form of AM.

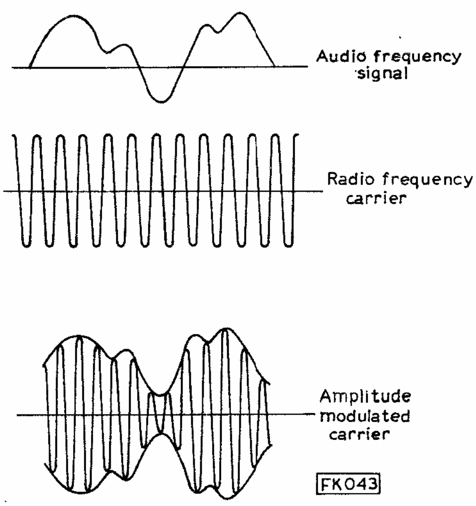


Fig. 112: Formation of an amplitude modulated (AM) signal from audio and RF sources.

Facsimile transmission of photographs and weather maps is carried out on the short waves using a process resembling FREQUENCY MODULATION (FM) although not in its normal form. We normally associate FM with the VHF bands, ranging from about 80MHz and upwards in frequency. With frequency modulation the carrier is modulated by shifting its frequency up and down in proportion to the amplitude of the audio signal impressed upon it. It should be clear that when frequency modulation is applied to a carrier the receiver has got to be capable of receiving a range of frequencies when it is tuned in, the maximum positive and negative-going excursions of the frequency being set by the maximum amplitude of the audio signals. Therefore the receiver has to have a certain bandwidth centred on the nominal frequency of the carrier. Although this seems obvious for FM signals the same argument applies to the reception of amplitude modulated signals, but the reason is not quite so obvious.

When a signal is amplitude modulated the carrier is modified to become (1) sum of the carrier plus the frequency of the audio signal and (2) difference between the carrier and the audio frequency, plus (3) carrier frequency. Thus if a carrier frequency of 1,000,000Hz is used to carry an audio tone of 1,000Hz the frequencies transmitted would be 1,001,000Hz and 999,000Hz, plus the original carrier. These extra signals are called the upper and lower sidebands. The frequencies of the sidebands depend on the frequencies of the audio signals but one can limit the excursion of these sidebands by preventing audio signals greater than a certain frequency reaching the modulator.

On the medium waveband the width of the sidebands becomes critical in so far as they might cause one station to overlap another, so the more one limits the frequency range of the audio signal the more stations, theoretically, can be accommodated in a particular waveband. This is one of the reasons why one does not expect the same high-frequency response from a station received on the medium waveband as one received on FM at VHF where, at present, there is less problem with station crowding and a wider bandwidth can be used.

We can experiment with a straightforward medium wave transistor portable radio to experience the presence of the sidebands. Try tuning in a station, making sure to obtain the best setting of the dial to give a good quality signal. Now very gently offset the tuning upscale and downscale. Notice that the sound quality becomes more shrill as it losses its bass frequencies. This is simply moving the tuning of the receiver to pick up the higher frequency side-bands, at the expense of the lower frequencies which are nearer to the carrier and consequently move out of the bandwidth of the radio.

Clearly a radio receiver MUST have a bandwidth that allows the reception of the carrier as well as the maximum excursions of the sidebands, for every setting of the dial, if we wish to get the best quality signal. A receiver having too narrow a pass-band will cause high frequency audio signals to be lost, even on tune but, on the other hand, a receiver having too wide a pass-band will suffer from interference from stations on adjacent channels.

We have dived into the deep end of this kind of explanation although all we are going to describe are a few experiments on T-Dec. The answer is, simply, that the bandwidth of tuned circuits is most important and we hope to instil a better appreciation of how good quality tuned circuits and good matching can make or mar a radio receiver.

We shall limit ourselves to receiving amplitude modulated signals on the medium waveband, approximately 525kHz to 1·605MHz. The signal transmitted from the broadcasting station is broadly described as an electromagnetic wave. To be more precise, there are two signals radiated by a transmitter, one is rather like a magnetic field which can induce small currents in coils wound on ferrite rod aerials and the other is an electrostatic field which needs a long wire aerial or a dipole for reception. One signal always goes with the other but the range of the electrostatic signal is usually greater.

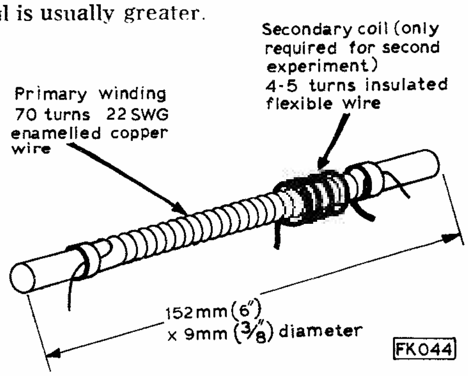


Fig. 113: Construction of aerial coil on ferrite rod, used in experiments shown here.

In practice most modern transistor radios embody ferrite rod aerials and operate by picking up the magnetic field; usually we are only interested in receiving local stations on the medium waves. Because of this we shall use a ferrite rod, Fig. 113, aerial for all our experiments this month. When winding this make sure that the turns are tight and try to separate one turn from the next by about the thickness of the wire. Sellotape can be used to hold the ends of the wire in place.

If this coil is placed with its axis perpendicular to the line between the receiver and a transmitter the radiated magnetic field, oscillating at the carrier frequency, will induce small voltages across the windings, just like a transformer in which the secondary has been moved away from the primary. Obviously the induced voltages are going to be very small indeed, in reality a microvolt or two. More important is the fact that ANY radio stations lying on the right line will induce voltages irrespective of the frequency. A transformer will operate, in theory, with any frequency of input voltage if one ignores problems involving power dissipation. Off the perpendicular line the induced voltages will be lower.

If we place a capacitor in parallel with the coil we alter the state of affairs significantly by making a frequency selective, or tuned, circuit. The impedance of the parallel circuit becomes low for all except one particular frequency, the resonant frequency, given by $f = \frac{1}{2\pi\sqrt{LC}}$. The impedance of the circuit rises to a maximum value depending on

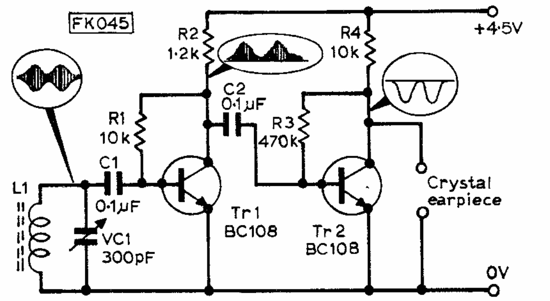


Fig. 114: First experiment, demonstrating effect of loading on coil Q.

the Q, or efficiency, of the coil. The higher the Q the sharper will be this tuning.

There are two main factors which control the Q of a coil. One, which we can do very little about, is the internal resistance of the coil itself. This should be as low as possible for maximum Q, hence the use of reasonably thick 22 SWG wire. The second factor is the effect of parallel resistance across the tuned circuit, which is directly influenced by connecting into another stage. This latter effect is something we definitely can control.

The first two experiments demonstrate very effectively the effect of loading on the Q of the tuned circuit. Use the coil to make up the circuit of Fig. 114 on T-Dec, Fig. 115. The tuned circuit is connected via C1 to the relatively low input impedance stage of Tr1 which is operating as a detect-

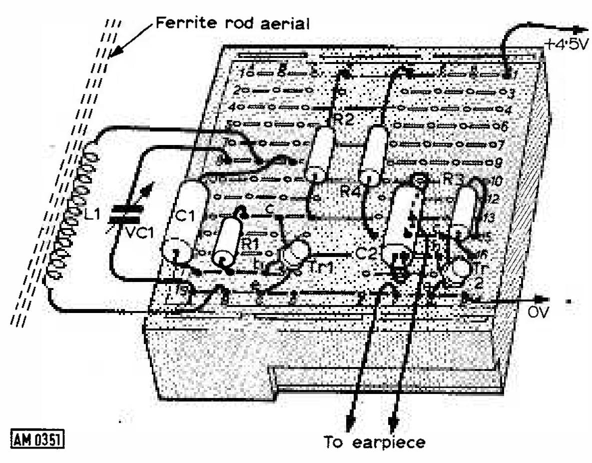
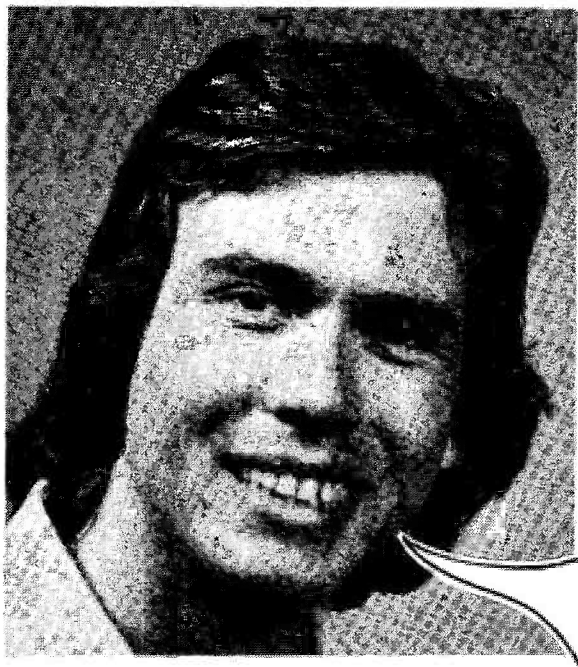
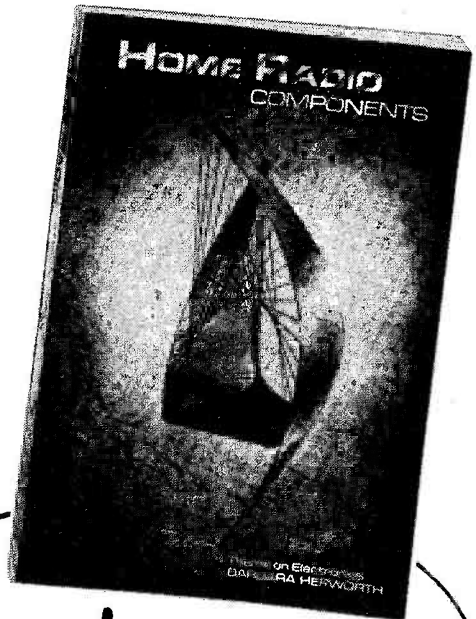


Fig. 115: Arrangement of Fig. 114 on T-Dec.





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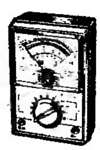

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100	150	9·15	0·88	4·90	0·64
200	151	11·45	0·88	8·14	0·80
250	152	12·90	0·88	9·80	0·88
350	153	15·50	0·88	11·88	0·95
500	154	17·25	0·88	13·62	1·13
750	155	27·10	1·10	20·59	O.A.
1000	156	35·40	1·10	29·15	O.A.
1500	157	42·00	1·10	33·37	O.A.
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3000	159	73·15	2·64	58·55	O.A.

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0·5	0·25	111	1·38	0·34
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4	2	18	2·96	0·56
6	3	70	4·18	0·56
8	4	108	4·58	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

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VA Watts	Ref. No.	Price Cased £	Price Plugs 2 & 3 pin	Price Open £	Post £
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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.

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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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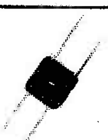

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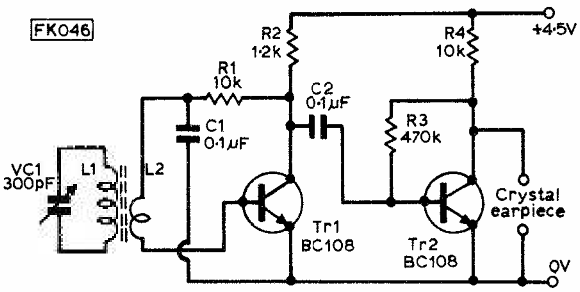
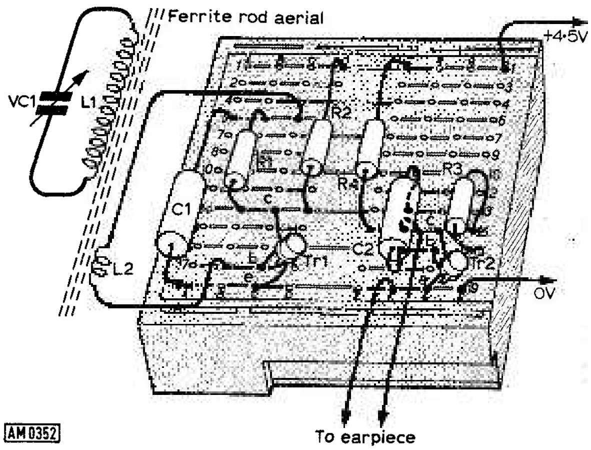


Fig. 116: Circuit modification to retain high Q of tuned circuit.

of the signal leaving only the audio frequency "envelope" which should be heard as an audio signal in the earpiece.

You will be fortunate if you can hear anything very much with this circuit until VC1 is set to its minimum capacitance, i.e. the vanes are fully open, and then you should hear a conglomeration of local stations all on top of each other. The signals will be weak and almost impossible to separate from one another. The reason for this is that the input impedance of Tr1 is very low and has lowered the Q of the tuned circuit, as well as being so low that we are getting anything but optimum power coupling between the two stages.

To prove the point use the same components in the slightly different circuit shown in Fig. 116. Notice that you need to put about four turns of flexible insulated wire on the ferrite rod over the top and at the end of the basic 70 turn coil. This secondary



AM0352

Fig. 117: Layout of circuit of Fig. 116.

coil has a much lower output impedance and while the voltages developed across it will be less than the main coil there is a greater current drive ability. We have made, in effect, a simple transformer which allows the current sensitive input stage of Tr1 to draw the current it wishes without reflecting its impedance across the main tuned circuit. If this theory is correct the Q of the main tuned circuit should not be so adversely effected. Make up the circuit Fig. 117 and you should be pleasantly surprised by the vast improvement in signal level obtained as well as the improved ability to separate the stations, or selectivity.

We should, perhaps, add a note of sympathy for those who live in the more remote parts of the country because, although we imply good reception

FK047

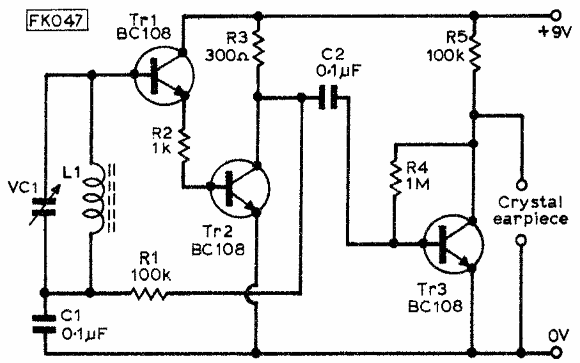
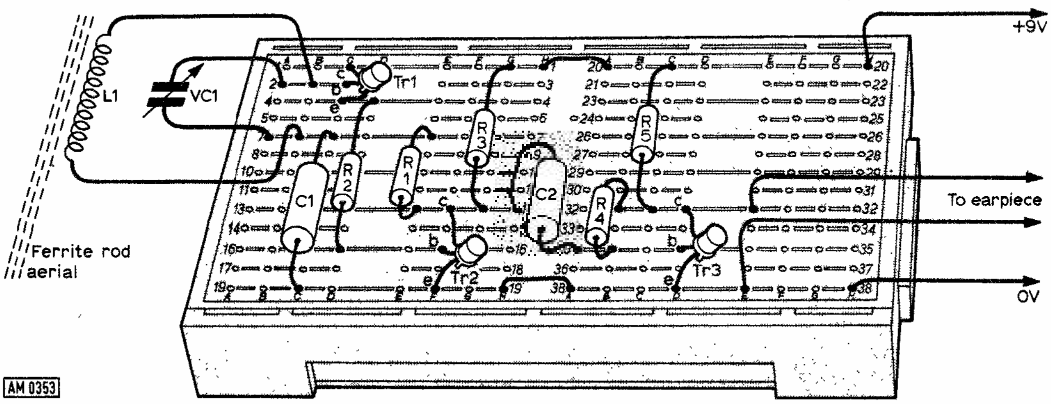


Fig. 118: above, shows addition of emitter follower stage to provide feedback.

Fig. 119: below, practical layout of circuit of Fig. 118.



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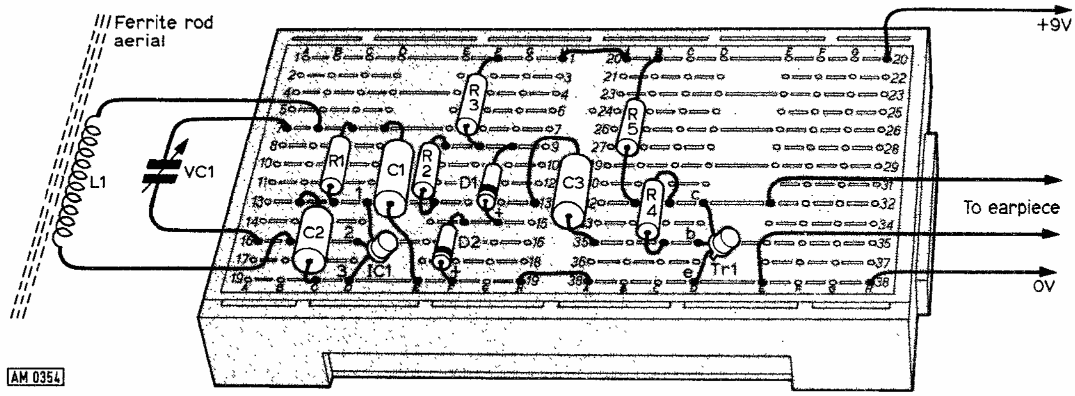
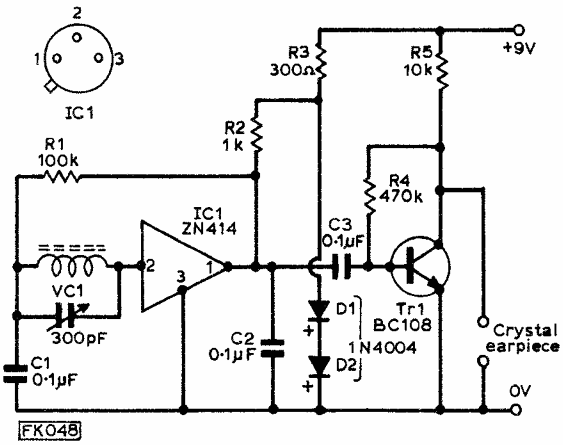


Fig. 121: above, suggested arrangement for Fig. 120.

Fig. 120: below, alternative TRF circuit arrangement using the ZN414 integrated circuit.



from this circuit, it would be fairer to add that it is only suitable for reception of stations within a fifty to hundred mile radius!

For those who do not like having to wind an extra coil on the aerial there are other ways of improving the Q. If the output impedance of the tuned circuit cannot be reduced than the alternative is to increase the input impedance of the subsequent amplifiers. The circuit of Fig. 118, layout in Fig. 119, shows how this can be done by using an emitter follower. This has a very high input impedance and is biased into conduction by the 100kΩ resistor, R1, feeding its base through the coil. The bias current is obtained by negative feeback from the collector of Tr2 and C2 bypasses any radio frequency signals to earth. Tr2 acts as an amplifying detector just as before and Tr3 provides a greater degree of amplification. Note the high value of collector load for Tr3, which is necessary to prevent instability. You can reduce this value down to about 10kΩ in easy stages but at some point you might find that the circuit starts to oscillate.

While this latter circuit does work we have included it to demonstrate, in a simple way, the principle of operation of a very well known integrated circuit which, these days, is by far the best way of making a TRF radio. It is the ZN414, well worth the investment of about a £1, if nothing else, for the satisfaction of getting a radio to work when outside the range of the preceding experiments! The integrated circuit, Fig. 120, contains a very high input impedance amplifier which is biased in much the same way as our preceeding experiment, with R1. The IC contains a much higher degree of amplification than we could possibly obtain with conventional components without instability creeping in and as a bonus contains the detector and a degree of automatic gain control as well.

Apart from the obvious advantages of the extra gain and added refinement of AGC there is little difference between the principle of operation of this device and the preceding circuits. Resistor R2 corresponds to the collector load which goes to the positive rail. In the case of the ZN414 it only needs 1·2V to drive it and we have obtained this by using the forward voltage drop across two diodes, D1 and D2, in series with R3. C2 acts, in place of the internal capacitance of the earpiece, to filter out the RF carrier and we have added a conventional audio amplifier stage to bring up the level for comfortable listening. When using this little radio note the high degree of selectivity given by its high input impedance. The layout is given in Fig. 121.

Finally, a brief point about having too narrow a bandwidth which would limit high frequency audio response. This problem did not crop up at all in our experiments, apart from the earlier reference to it. The reason is that normally the Q of simple tuned radio frequency circuits is never likely to give too narrow a bandwidth, consequently a TRF receiver such as the one described, will give as high a quality output as is possible when operating on medium waves. The only drawbacks which would force one to more sophisticated circuits are the lack of sensitivity and the problems of overcrowding on the waveband which necessitate narrower bandwidth receivers giving poorer quality associated with narrow bandwidth.

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points arising . . .

REACTION TIMER

April 1975. In the circuit diagram Fig. 1 page 1098, R3 should be shown as 27kΩ and R4 as 47kΩ. The component list is correct.

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No. 71 MOTOR SPEED CONTROLLER

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

BEFORE describing this project, a word of warning. Although exceedingly simple and easy to make, this device operates directly from the mains and has its components connected to the live mains without isolation from a transformer. This circuit is probably not suitable for less exprienced constructors. The project should definitely **NOT** be made unless the constructor is prepared to go all the way and make a **fully insulated and earthed metal case** similar to that which will be described.

Speed control

The circuit makes possible the speed control of series wound brush electric motors as found in small portable electric drills such as the Black and Decker D520 and D720 series. When the device is in circuit speed control is effective from about 20 r.p.m. to half the drill's normal speed and at low speeds very little of the normal torque is lost; this constant torque effect is produced by making use of a feedback signal developed across the windings of the electric motor during the portion of the mains cycle when the thyristor is not conducting. Because the non-conducting cycle is necessary it is not possible to insert a triac instead of a thyristor to obtain speed control up to maximum speed. Almost any thyristor having minimum ratings of 3 amp and 400V breakdown can be used in the circuit.

Thyristor operation

To make the thyristor conduct it is necessary to pass a current between the gate and the cathode while a potential difference exists across the anode and cathode of the device. This trigger current is produced when the gate is made positive with respect to the cathode.

Referring to Fig. 1, R1 in conjunction with VR1 and D1 form a potential divider and rectifier across the mains so that the signal at the wiper of VR1 is a positive going half wave signal, the amplitude of which can be varied with VR1. If there was a normal resistive load across the output instead of a drill motor, the signal at the gate of the thyristor would rise in a positive direction in exact phase with the rise of the mains across the normally switched off device.

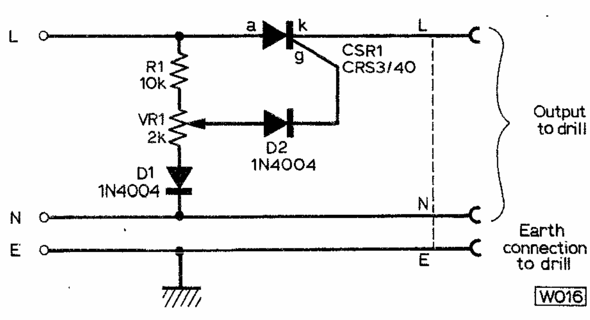

Fig. 1: Circuit diagram of the Motor Speed Controller.

★ components list

R1	10kΩ 5W
VR1	2kΩ 2W wirewound
D1	1N4004
D2	1N4004
CSR1	CRS3/40 or similar 3A, 400V thyristor

Metal case, MK socket, terminal blocks, cable clamp, wide bezel knob, bracket for thyristor, good quality insulating board, stand off spacers. Rubber grommet for mains lead

When the gate current so produced reaches its trigger threshold the thyristor will turn on and hold on for the duration of that positive mains cycle—the power being dissipated in the load. At the end of the mains cycle the thyristor switches off because its "holding current" falls to zero. During the negative half cycle which follows, the thyristor will not turn on but at the same moment in the next positive half cycle the first conduction cycle will be repeated.

Motor action

This explanation assumes a resistive load which guarantees that at the start of each positive half cycle the potential at the cathode of the thyristor is zero with respect to the gate, hence it is not difficult for the potential of the triggering voltage—set by VR1—to drive sufficient trigger current into the gate.

If, however, a drill motor is connected across the output, the drill will start to rotate as soon as the first positive half cycle is applied, but at the end of the cycle—when the thyristor switches off—the motor will "coast" on without extra power being applied.

During this coasting action the armature of the motor behaves like a generator and produces a positive voltage at the cathode of the thyristor so when the next conducting cycle begins the potential at the gate has to reach a higher absolute value before the trigger current flows. This occurs later on in the cycle so consequently less energy is applied to the motor and it will not receive such a great "kick" of power. The effect is that the motor slows up slightly.

This operation will, of course, occur repetitively over consecutive cycles and after a small period of time the system reaches equilibrium and the motor runs at a speed set by the potential at the wiper of VR1.

If torque is applied to the motor it will naturally try to slow down during the negative half cycles so a lower reverse voltage will be generated and the "kick" of the next positive cycle will be greater, thus maintaining the near constant torque.

At slow speeds when no load is applied to the motor the speed may hunt up and down—a process known as "skip cycling" because the coasting action of the motor may prevent a further power kick over several cycles; as soon as torque is applied, however, the skip cycling effect stops.

Assembly

When assembling the device take great care over insulation—sleeve the leads of all the components which should be mounted on a good quality insulated board, see Fig. 2.

Remember that all connections are live to mains voltages **INCLUDING** the bracket for the thyristor and its mounting screw on the reverse side of the board. Because of this the board should be mounted on a metal front panel with stand-off spacers (Fig. 3), and the metal panel must be earthed.

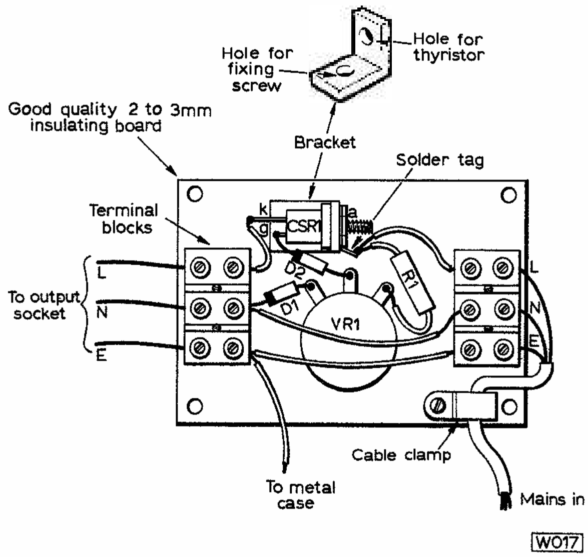

Fig. 2: Layout of the components in the Motor Speed Controller. Note that the bracket holding the thyristor will be live.

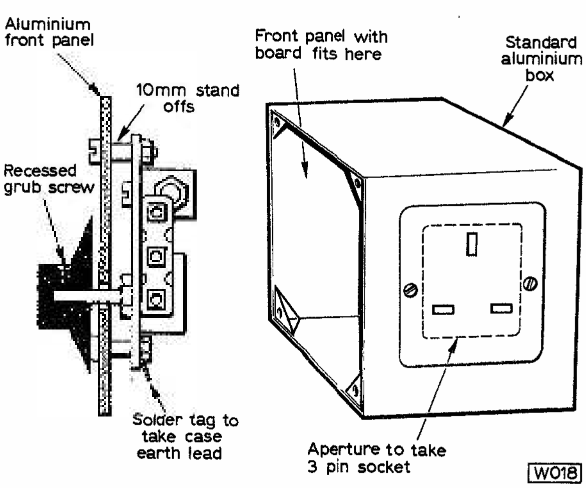

Fig. 3: Suggested "safe" method of housing the Motor Speed Controller.

Do not rely on the insulation of the spindle of the potentiometer. Use flush knobs which are either collet fixing or have a deeply recessed grub screw. Input and output leads are taken to standard electrical terminal blocks screwed to the board and the mains input lead should be anchored securely with a cable clamp.

The output can be connected from within the earthed case to a standard flush mounting MK wall socket which is screwed to the outside of the case if a suitably sized aperture is cut to take the terminations of the socket. DO NOT FORGET THE EARTH CONNECTION TO THIS SOCKET.

Note that R1 **must** be a five watt device and VR1 a two watt wirewound potentiometer.

PW TECHNICROSS PUZZLE No.10

presented last month

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

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

THIS project is a wonderful example of how modern technology can bring what was a super-sophisticated project into the realms of anyone who is reasonably competent at wielding a soldering iron. At the same time mass production of the complex integrated circuit used has brought down the cost to an amazingly low figure. Some people might complain that the introduction of modern large scale integrated circuit technology takes all the fun out of amateur electronic construction. This may, perhaps, be the case in some instances but there are many constructors who may not have the time to embark on lengthy projects and who like to get down to a job and see it through in one or two sittings.

It should not take the experienced constructor more than an hour or two to put this project together. Because of the simplicity of the electronic assembly it could, perhaps, be considered more as an exercise in neatness of construction and, for the real enthusiast, could be a useful exercise in producing a "do-it-yourself" printed circuit board.

PERFORMANCE

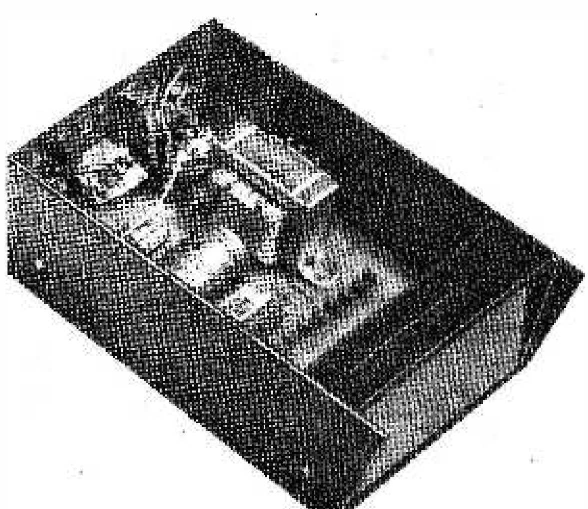
Having sounded the fanfare perhaps we had better say a few things about the end product itself. On the face of it the device is "yet another" digital clock but there are a few significant differences. For a start, use is made of the popular General Instrument Microelectronics device the AY-5-1224. This is one of the lowest priced digital clock IC's on the market, readily available from several advertisers in this magazine. Being a 16 pin DIL (dual-in-line) package there is not the usual high cost of a specialised socket. The small number of output pins clearly inplies that there are no fancy options such as alarm or six digit capabilities. By clever design the manufacturers have made amazing use of the few pins by giving them duplex functions from a strobe signal.

For example, by adding a few diodes to the external circuitry one has the option of 12 or 24 hour display (in the 12 hour mode the higher significant zeros of the hours presentation are blanked). The internal dividers can be pre-selected to operate from 50Hz or 60Hz inputs. In this project we have limited the design to 50Hz operation from 240V mains. The clock can be set to display minutes and seconds instead of hours and minutes, by the introduction of a further diode. There is a very unusual feature in the "reset to zero" facility which resets the display to "All Zeros" whether counting in the 12 or 24 hour mode, in hours and minutes or minutes and seconds. This reset clears the early stages of the counter chains completely giving a true zero. An extra diode in the circuitry will give a BCD output instead of the seven segment output (we shall not make use of this facility in this project) and, if desired, the segment drive outputs can be complemented by means of a single diode operating from the strobe line.

For those who have not come across the device before we show the typical general purpose application circuit in Fig. 1. We have deliberately left out component values on this drawing to avoid confusion with the circuit we shall be adopting for the project. A big attraction of the device is that it requires so few external components to get it to function. Its supply voltage is comparatively flexible, between 12 and 18V, and this means one does not have to make use of a sophisticated power supply. A half wave rectified supply is adequate. This means that with a carefully designed printed circuit layout the whole clock can be made very compact without introducing too many constructional problems. The mechanical construction is rather novel, using three printed circuit boards in a "bedstead" structure. Pins are used to route connections from one board to the next and there is the absolute minimum amount of free wiring.

Because of the "reset to zero" facility of the IC it seemed a pity to miss the obvious application of using the device as a stop clock (it will operate in "start/stop/reset" mode when counting in hours and minutes or minutes and seconds). Rather than include the necessary push buttons and switches in the basic clock it was felt wiser to offer this facility

ONIC CLOCK
~RANGE TIMER



with an external plug-in control. This means that those who just wish to make a simple clock can omit the extra components. Having the external control means that the user has remote control of the clock and this in itself could be a very useful feature for some applications.

A very important application, which seems to have been missed out on in previous clock designs, is that in a photographic darkroom. What better than a red

★ components list

Resistors

R1	470kΩ	R6	2·2kΩ	R11	1kΩ
R2	1kΩ	R7	1·5kΩ	R12	1·5kΩ
R3	2·2kΩ	R8	1·5kΩ	R13	1·5kΩ
R4	2·2kΩ	R9	1·5kΩ	R14	1·5kΩ
R5	2·2kΩ	R10	1·5kΩ	R15	1kΩ

All ¼ or ⅓W 5%

Capacitors

C1 1000μF 25V C2 0·022μF polyester
C3 1000pF polyester

Semiconductors

D1 1N4001 D2/3/4 1N4148
LED1/2/3/4 MAN3640 LED5 General purpose LED
Tr1 to 11 inc ZTX108
IC1 AY-5-1224
All available from PW advertisers

Miscellaneous

T1, Transformer 240V/12V 100mA, see text. SK1/PLG1, 5 pin DIN plug and socket. S3, SP on/off slide switch. S4, 2P changeover pushbutton unit. S5, SP push-to-make switch. 3-way mains lead with grommet and clamp. Cabinet material. Feet, plastic or rubber. Set of PCB's (3). Timer control box, 75 x 50 x 25mm (3 x 2 x 1in.) with lid. Veroboard pins, 0·1in. (18). Sockets for LED's and IC1, see text.

A specially wound transformer is available from Foresight Electronics, 62 High Street, Croydon, Surrey for £1·54 inc. VAT/pp. The same firm can supply the three PCB's for £2·04 inc. VAT/pp.

LED display in a darkroom when printing on black and white paper? More will be said about stop clock applications when the control unit is described. Another advantage of keeping the extra stop clock components outside the main clock is that the overall size can be kept down.

For the same reason it was felt desirable to keep the current drain of the clock to a minimum, allowing use of a small transformer, and to this end, high efficiency seven segment LED displays are used. These are MAN3640 manufactured by Monsanto. Other types that have the correct pin configuration could be used but they will not give as much illumination.

FINAL CIRCUIT

The circuit for the complete clock, including the switch and DIN socket for the stop clock facility, is shown in Fig. 2. Notice that only three external diodes are used in association with the strobe line of the IC. These allow fast setting of hours and minutes at pins 1 and 16 respectively when the specific switch is closed. The diode going to pin 13 selects a 24 hour display. If a 12 hour display is required this diode should be left out.

The 1000pF capacitor between pin 3 and earth sets the multiplexing frequency and the 50Hz reference signal is fed to the input of the clock (pin 4) via a 470kΩ and a 1kΩ resistor. The junction of these resistors is taken to the DIN output socket so that an external switch can earth the signal at this point thus stopping the clock. In order to reset the clock to zero, from the remote unit, it is necessary to take an output from the strobe line and pin 15 to the

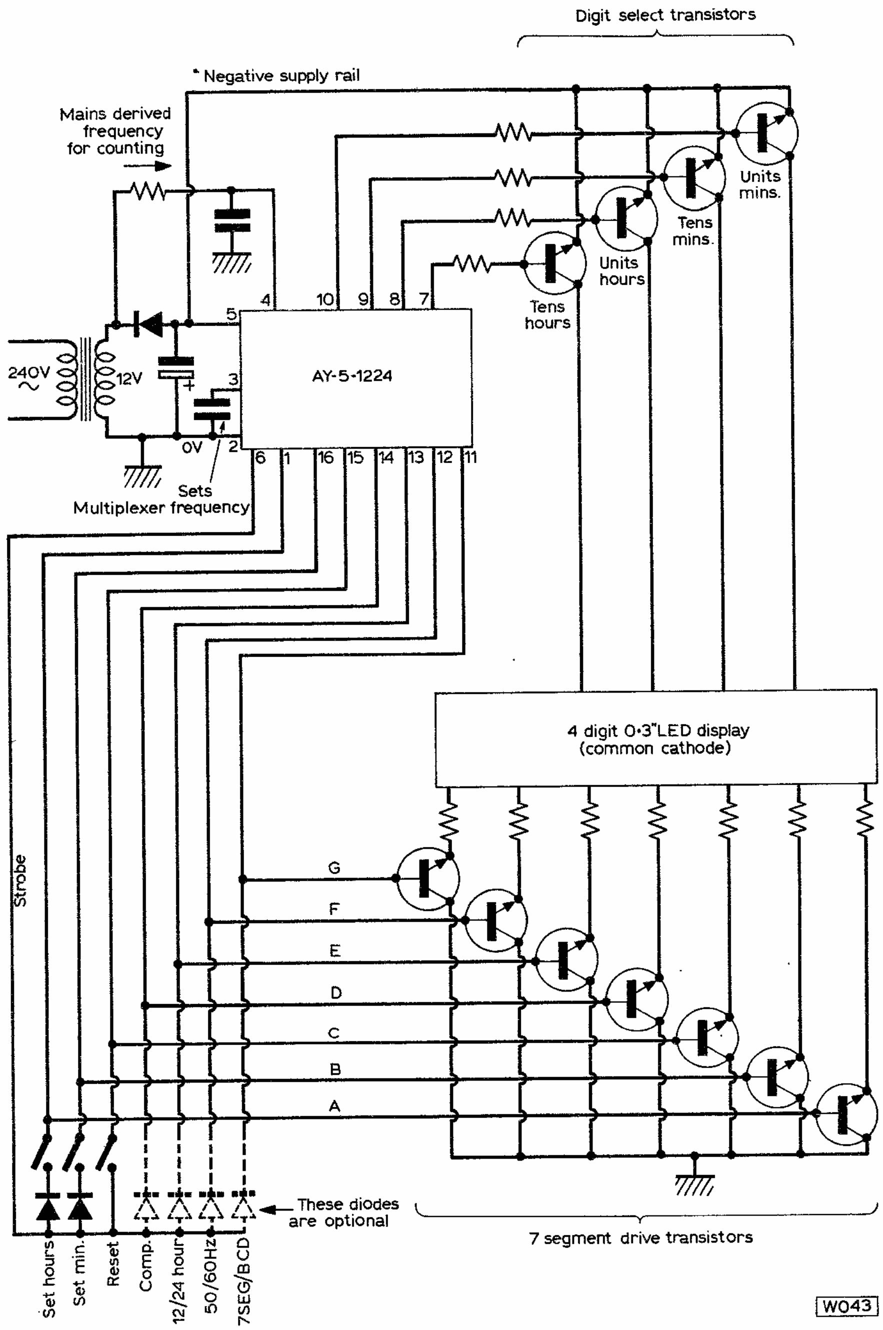


Fig. 1: General application circuit for the AY-5-1224 integrated circuit, emphasising the few components needed externally.

DIN socket. The rest of the circuitry is associated with the LED display.

ZTX108 transistors are used for digit select and segment drive. With the component values given the maximum current per segment is 10mA thus the common cathode digit select transistor never has to carry more than 70mA, well within the capabilities of the ZTX108. As the digits are multiplexed 70mA represents the total display current apart from the decimal point (a further 15mA). Note that to get a balance in illumination level it is necessary to drive the decimal point of the units of hours digit through 1kΩ while the rest of the digit segments are driven through 1·5kΩ. The IC itself draws 10mA. This gives a MAXIMUM current for the whole circuit of 95mA hence the transformer has to be rated at 10mA at 12V rms to be on the safe side.

Unfortunately there are transformers and transformers! There are several types available on the market which will serve the purpose but they are either large and will not fit the circuit board or they are rather optimistically rated and tend to get hot

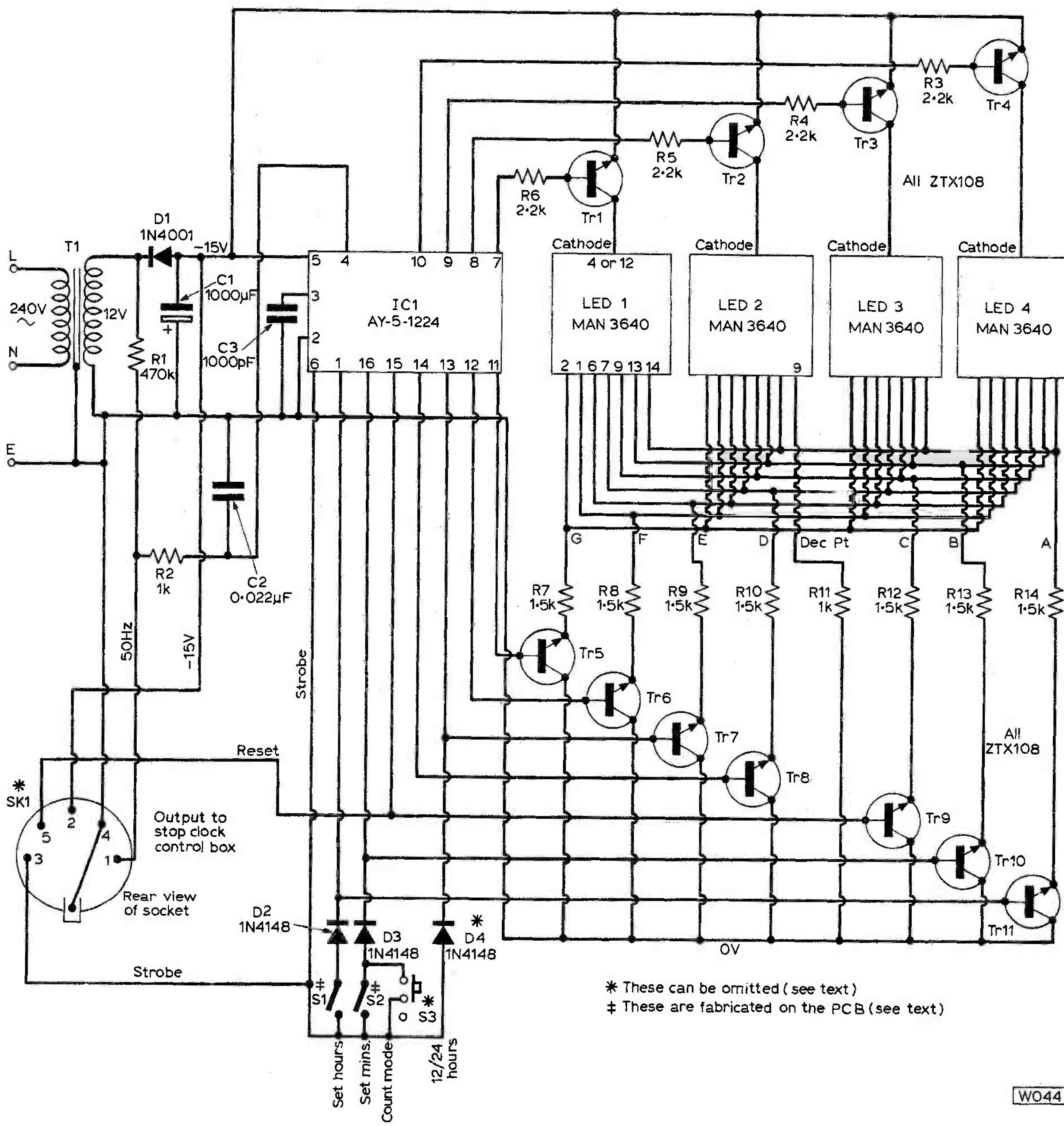
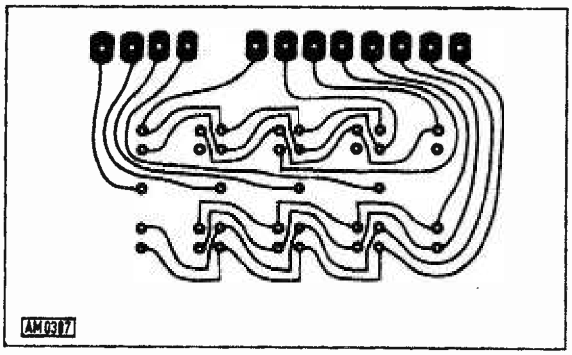


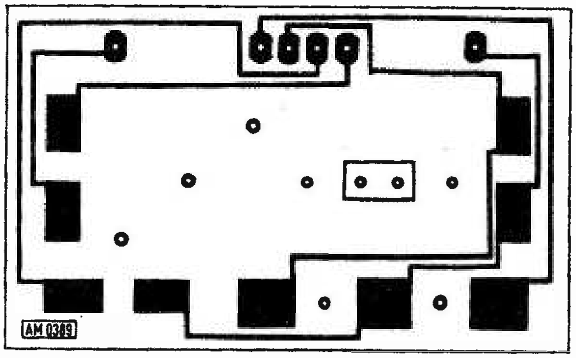
Fig. 2: Circuit of the clock described in the article, including the switch and socket required for the stop-clock facility.

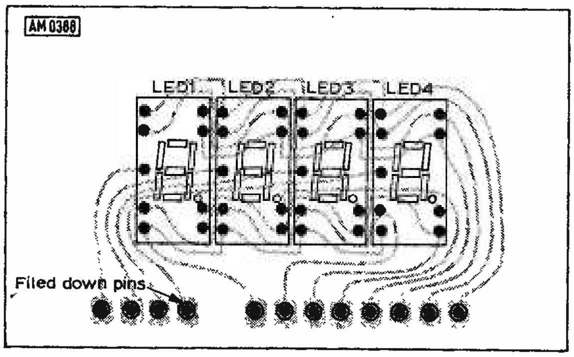
when operating continuously at the full circuit current. It is for this reason that we have arranged for a special transformer to be wound. It can be operated at the maximum current in the unventilated cabinet without overheating and has been specially designed to plug directly into our printed board layout. Before using other 100mA rated transformers check their temperature rise when operated over a period of half an hour or more at full load.

CONSTRUCTION

The circuit is built on three printed circuit boards which are designated:—the front panel, Fig. 3, which carries the LED displays; the rear panel Fig. 4, carrying the external connecting socket and switches; and the main board Fig. 5, which embodies the rest of the circuitry. At an early stage the constructor must decide whether or not he wants to use the stop clock option. If this is not necessary and only a desk or mantlepiece clock is required items SK1 and S3 can be omitted. At the same time it is not necessary to cut the fixing holes for them in the rear panel. If it is decided to keep the option open, drill out the fixing holes for these components and drill and file the small slot for S3. The fixing holes and slot are marked in the printed circuit layout for the rear panel. Make sure that the two holes between the copper lands near the top of the rear panel are







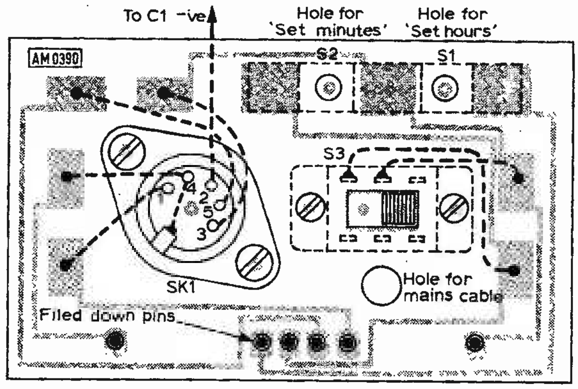
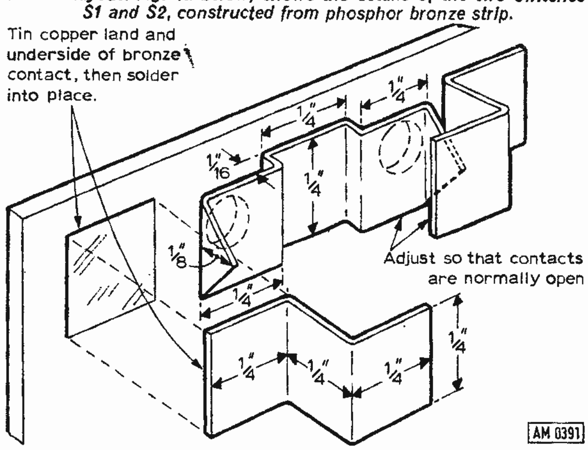


Fig. 3 left, and Fig. 4 above, show the end PCB's actual size and component layout. Fig. 4a below, shows the details of the two switches S1 and S2, constructed from phosphor bronze strip.



drilled out to about 1/8 inch (enough for a matchstick to slide through). These holes are to facilitate operation of the hours and minutes set switches S1 and S2.

Once all the holes are drilled start assembly by inserting all the Veroboard pins into their holes on the front and rear panels. Pins for 0·1in veroboard were used in the prototype and these require a suitable hole to ensure a tight fit. They should be inserted from the COPPER side of the board and pressed gently into place until they are firmly gripped in their holes. DO NOT SOLDER THEM IN AT THIS STAGE. If improvised pins are used trim off any excess which protrudes on the top side, with a pair of strong side cutters or a fine hacksaw blade, and then carefully file the cut end flush with the board. Try not to make file marks on the board surface.

Finish off the top side (non copper side) of the front and rear panels by painting with a matt black paint.

When the paint is dry insert and solder the LED sockets into place. The LEDs themselves are inserted later. Notice that only 9 of the 14 possible locations are drilled for each socket. This is to allow space on the foil side of the board for the large number of conductors. Because of this remove, or bend flat, the pins of the socket which are not required. Be very careful with the soldering because the lands are not very large and it is very easy to get a blob of solder bridging across the narrowly spaced conductors. Note that the spacing between socket locations has been set with the Texas Instruments "Low Profile" DIL socket in mind. Other types of sockets might be too wide in which case it might be necessary to file material off the sides of each socket until the four fit neatly together. Put the front panel aside and start assembly of the rear panel.

Insert and bolt into place SK1 and S3 then connect their tags to the copper lands of the board as shown in Fig. 4. With reference to Fig. 4a, cut and bend springy phosphor bronze (a piece of draught excluder strip will do nicely) into the shape of the contacts for S1 and S2. These contacts should be soldered on their respective copper lands having first tinned the underside of each contact where it comes into contact with the land. Now proceed to assemble the main board.

When installing the transformer make sure to cut the spills off short after they have been soldered into place, to prevent any possibility of them shorting against the bottom of the case on final assembly. Now decide on whether 12 or 24 hour display is required. For stop clock operation is might be best to go for 24 hour display so that one can time up to 23 minutes 59 seconds when switched to time in minutes and seconds mode. For a 24 hour display insert D4 but this diode can be omitted if a 12 hour

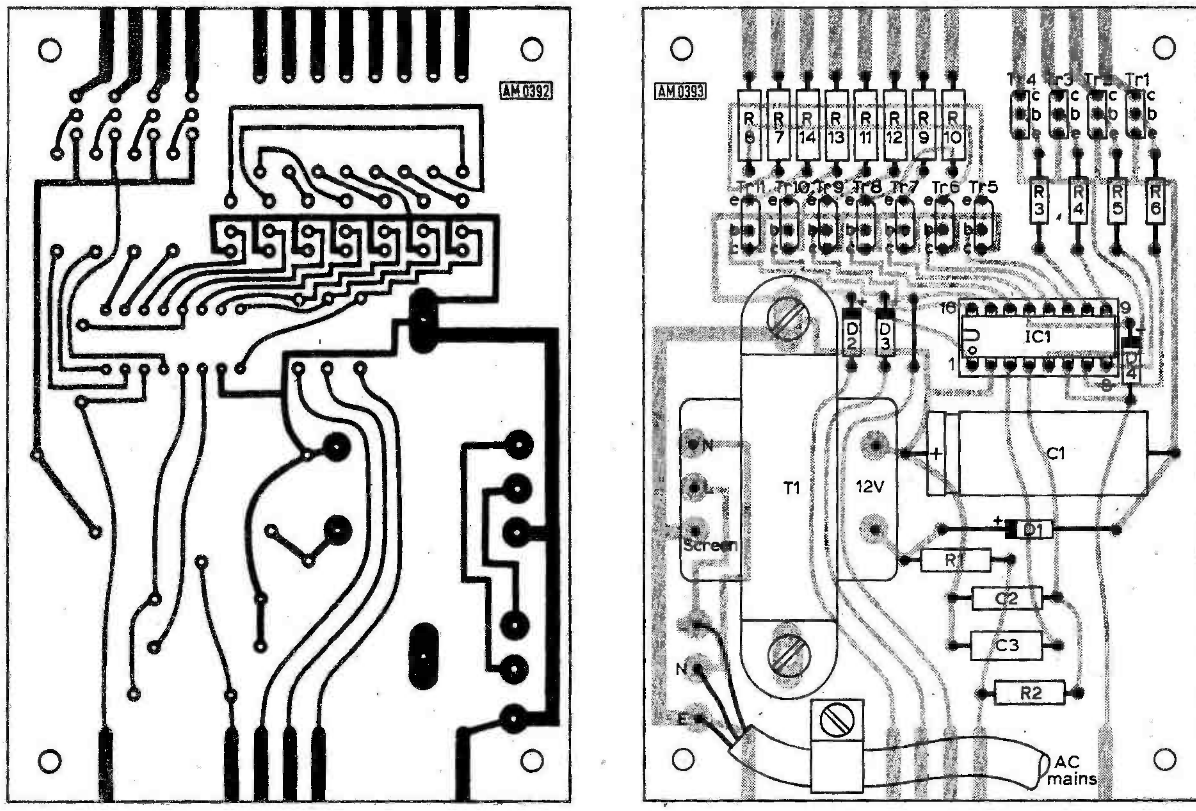


Fig. 5: Main PCB, left, actual size and component layout, right.

version is required, with preceding zeros ripple blanked.

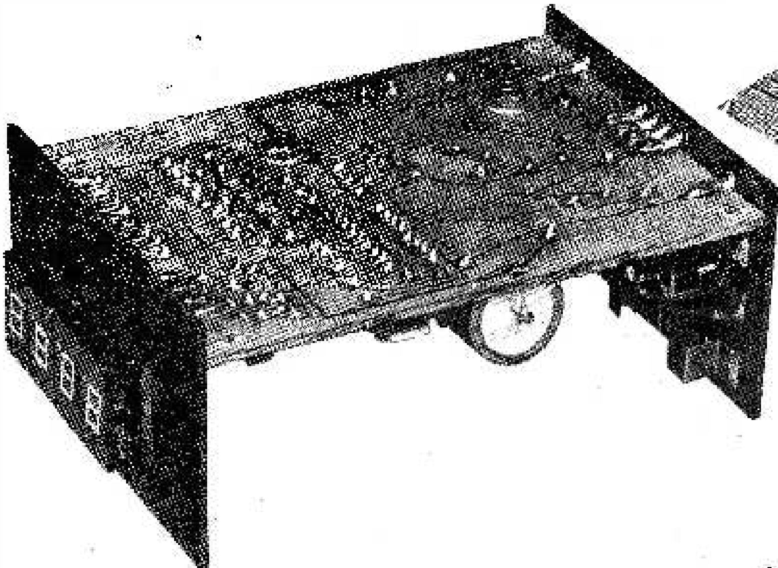
Be careful about the polarity of the small diodes and in particular make sure that the transistors are connected correctly. It should be noted that the four digit select transistors, which are on their own, are orientated differently from the rest of the transistors! Ideally, use a 16 pin socket to carry IC1 otherwise one may invalidate any manufacturer's guarantee. If it is decided to solder it into place take all the necessary precautions to prevent damage from static charges. When installing IC1 be especially careful that it is inserted the correct way round! See Fig. 5. As already said, take care not to allow any solder to bridge the gaps between the narrowly spaced conductors in the vicinity of the transistors. Do not solder the mains cable into place just yet.

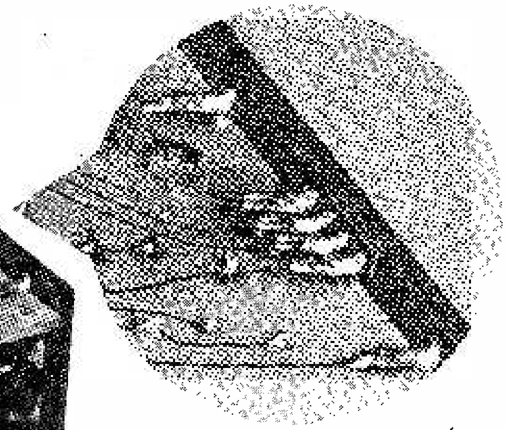
It is now necessary to join the three boards together. The three boards should be brought together by supporting on books so that the pins on the front and rear panels register exactly with the lands on the main board, see photograph. Make sure that the end panels are at right angles to the main board and then apply a generous amount of solder to each pin, ensuring that the pad on the end panel is wetted at the same time as the length of the pin is soldered to the main board. This operation should be done very carefully as the pins carry the electronic signals round the corner on to the end panels as well as providing mechanical support to the main board.

It only remains to fix the mains cable into place with the cable clamp and solder the three cores into their respective holes on the main board. Use the smallest diameter three core cable available and make sure that the inlet hole is suitably grommetted. Apart from testing and assembly into the final case the clock itself is now finished. Plug in IC1 and the four LED displays, taking very great care that they are the right way round. If in doubt make sure that that the decimal point can be seen at the bottom right hand corner of the device when viewed from the front.

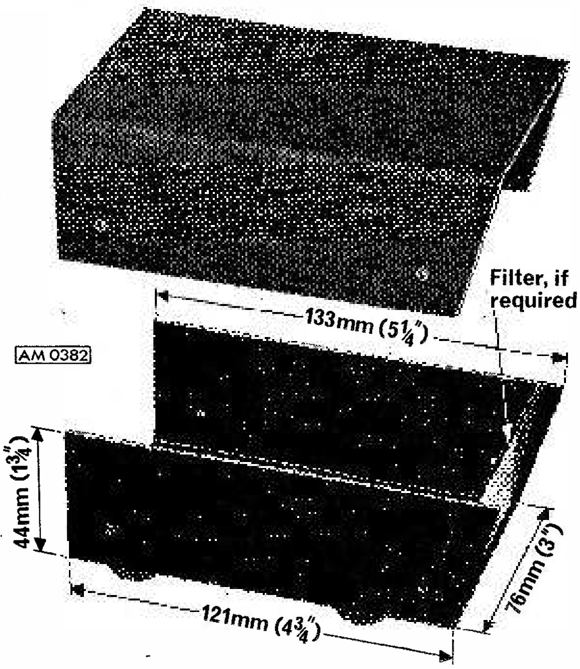
Apply power and the LEDs should display a group of digits. If S3 is switched to count in minutes and seconds the right hand digit should immediately start counting at second intervals. If this is the case put S3 into Hours and Minutes display mode and the rapid counting should stop and the right hand digit should change once a minute. Try the 'hours' and 'minutes' set switches by pushing a matchstick into each hole in turn until the respective contacts are brought together. Check that the connections going to SK1 are functioning correctly. Firstly set S3 to count minutes and seconds and then using a short piece of wire short pins 3 and 5 (of SK1) together; the display should reset to "All Zeros". Remove this shorting link and then short pins 1 and 4;

Photograph of the underside of the electronic clock with an enlargement to show how the printed circuit board lands are soldered to the pins in the end boards.





The illustration below is of the two simple shapes forming the cabinet for the clock. Inside dimensions are given for the inner lower part, the upper outer part being made to fit. In this prototype the metal used was 16SWG aluminium.



this should stop the counting as the 50Hz input is effectively earthed.

There is the option of using the fifth terminal (No. 2), and in the prototype this was connected, via a short wire, to the negative rail of the clock (the negative lead of C1) as it was felt that a small current in the remote control unit could be used to light an LED showing that all was well and that the clock was working.

THE CABINET

The cabinet is made from two pieces of folded aluminium which slide over each other and held in place with self-tapping screws. A piece of red perspex is Araldited in a vertical position at the front end of the narrower channel to form the front "window". This should be so positioned that the LED displays just touch it when the rear panel of the clock is JUST inside the back end of the channel. The assembled "bedstead" chassis should be fixed into position with self-tapping screws but do not forget the earthing solder tag which has to be connected with a flexible lead to the point where the mains inlet cable is connected on the underside of the board. This earthing of the case is MOST IMPORTANT because it is metal and we suggest that in some applications one could be in a photographic darkroom where there is always a certain amount of dampness present!

TIMER OPERATION

As a photographic enlarger timer, the mode switch should be set to count in minutes and seconds when the clock can be stopped or started with a remote switch across pins 1 and 4 of the DIN socket. A simple single-contact push switch connected across pins 3 and 5 will reset to zero. It would be very simple to use a ganged switch to start and stop the clock which would also switch the enlarger lamp on and off. One can use a spare contact on the simple remote control unit, Fig. 6, to switch an LED on and off. When it is on it reminds the operator that the clock is timing. This is where the −15V source came in useful. It is quite conceivable that one could use this same current source to operate a relay. But be careful, do not draw more than 10 or 20mA from the supply. This should be intermittent with a duty cycle of about 50/50 to avoid overheating the transformer.

The clock could prove very useful in school

continued on page 414

DUAL CONVERSION receiver

PART: 2

F. G. RAYER

AUDIO BOARD

Fig. 7 shows both sides of this board, which is prepared and wired in a similar way to the earlier boards already described. Solder a red flexible lead from C29 for battery positive and a lead from C28 negative for the speaker the other side being returned to chassis. A jack socket is fitted to allow a speaker or phones to be plugged in. A 15Ω speaker is most suitable, being attached to a baffle or enclosed within the cabinet.

The amplifier is tested by connecting C23 to an audio signal, or VR2. The unit has considerable gain so that it is easy to overload with strong signals. This is useful for weak signals, but naturally means that VR2 **must** be turned well back for stronger transmissions. The amplifier alone will draw about 10 to 12mA with no signal, rising to 25 to 50mA with full volume. The quiescent current can be adjusted by changing R24, for a 39Ω resistor with a 100Ω pre-set in series, if particular transistors should require this sort of adjustment.

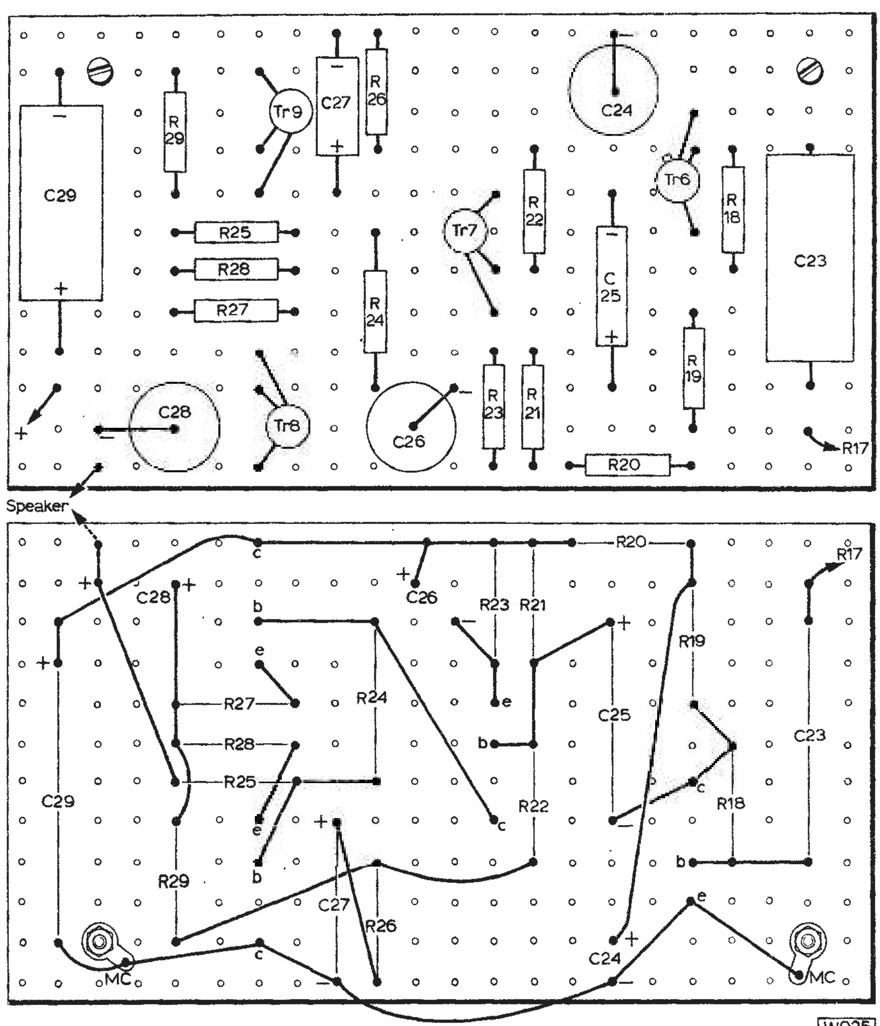


Fig. 7: Audio amplifier board, showing both component side and wiring side. Recommended speaker impedance for this circuit is 15Ω, although a jack socket is provided for head-phones should they be preferred.

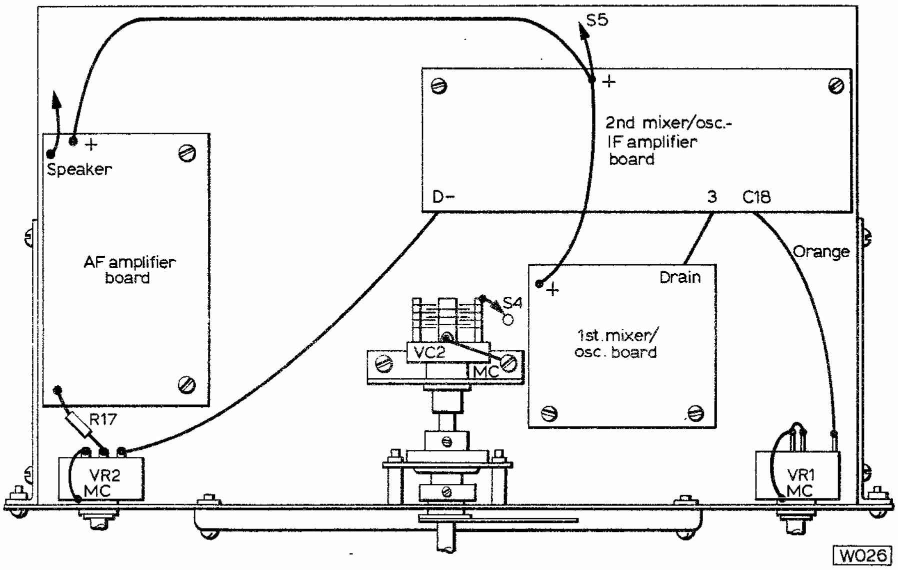


Fig. 8: Topside view of the chassis, giving positions of boards in relation to VR1, VR2 and VC2. Holes for the front dial are made by following the paper template supplied by the dial manufacturer.

GENERAL CONSTRUCTION

For a rigid assembly, panel and chassis are fixed together with side brackets, as in Fig. 8. This also shows the position of the circuit boards. Holes for the dial are made by following the paper template provided. VC2 is supported on a strong bracket to avoid any movement and it should line up correctly with the drive. If necessary, a little adjustment to the position of the spindle can be obtained by making the bracket hole larger than necessary and placing a washer each side the bracket. The dial cursor is fixed to a collar which can be moved. This and the shaft are locked with the cursor at zero on the dial and VC2 fully closed.

Connect all board positive leads as shown and run a lead down, (Fig. 9), to S5 which has 3 positions, CW/SSB, AM and OFF. S6 is wired so that the circuit to R33 is completed in the second "on" position only. The receiver can be tested on AM reception only with the BFO and VC3 omitted.

Fig. 9 shows the layout and connections under the chassis. Check that VC1 is mounted just clear of the side and that the fixing nuts of the aerial coils are only done up finger tight. The pins should be cleaned if necessary, and not 'cooked' with the iron when soldering connections to them.

Ceramic pre-sets are used for the oscillator circuit and mounted with 8BA bolts. The beehive air-spaced type of trimmers would probably be better as several turns are needed to move them from maximum to minimum value. As each trimmer proved to be set near half value, 30pF, 50pF or 60pF trimmers would also appear to be suitable.

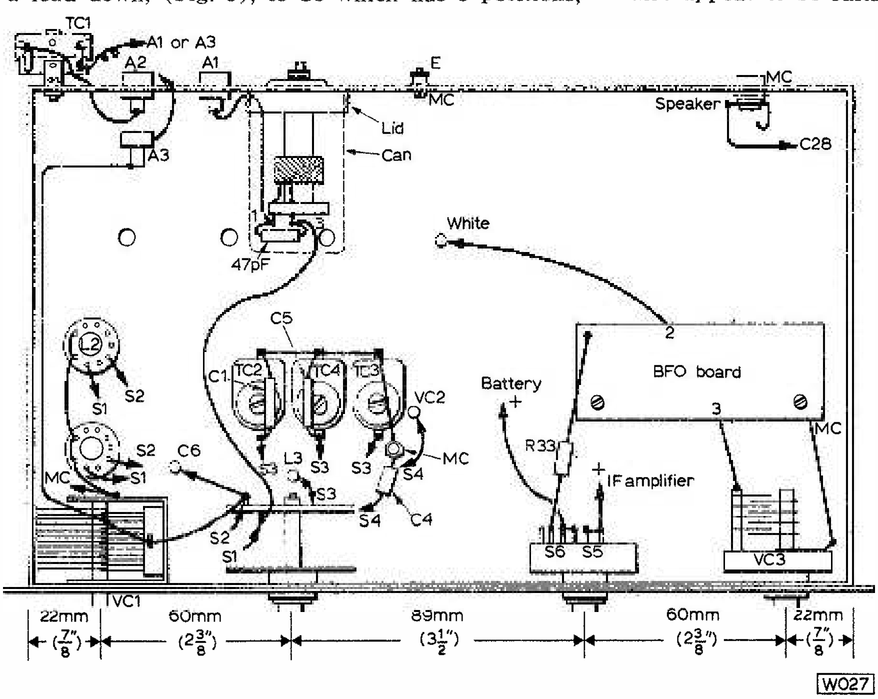


Fig. 9: Aerial tune (VC1), BFO pitch (VC3) and trimmers viewed from underneath. The diagram also shows the positioning of the BFO board and the three alternate aerial sockets, A1, A2 and A3.

BANDSWITCH

The bandswitch is of a type in which contacts are fitted both sides of an insulated wafer. Switch connections are shown in Fig. 10, contacts S1 and S4 are separated from S2 and S3, for clarity.

If reference is also made to Fig. 1, no error should arise here as, with this type of switch, contacts can be easily seen. Somewhat similar rotary switches with hidden contacts are also available, and with these a check should be made with a meter.

If a fully-insulated speaker jack is used the outer or sleeve tag must be connected to the chassis or negative on the audio amplifier.

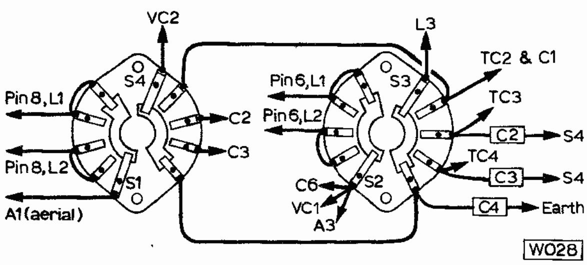


Fig. 10: Bandswitching for the Dual Conversion receiver is achieved with the wafer switch shown above. In the prototype only one wafer was used with contacts mounted both sides.

ALIGNMENT

A signal generator or accurately calibrated receiver will prove useful when adjusting the various circuits, but satisfactory alignment is possible without either.

465kHz IF. If a generator is available, couple it loosely to Tr3, placing an insulated lead near Tr3 should be sufficient. Adjust the five cores of IFT2, IFT3 and IFT4 for best results. Each core should have a definite peak and need little movement. A correctly shaped tool, such as that available from the IFT maker, should be used, as a wedge-shaped metal blade would probably crack the cores and upset the adjustments.

If no generator is available, wait until some signal can be accurately tuned in, then peak up the cores for best results. The signal should be relatively weak, with VR1 turned back and VR2 well towards maximum, so that adjustments are not masked by the AGC action.

Second Mixer. Rotate the core of L4 until the oscillator carrier is found at about 6MHz with a receiver. Alternatively, set the core with about 6mm (¼in) of thread projecting. Now peak both cores of IFT1 for best volume with a 5·5MHz signal from the generator loosely coupled to pin 3, slightly adjusting L4 as necessary to peak up the signal.

If no generator or receiver is available tune in any signal and adjust IFT1 and L4. Do this a little at a time to peak the signal, meanwhile rocking the tuning control from side to side if necessary. Should no signals be received, temporarily connect an aerial through a 100pF capacitor to pin 3 of IFT1. Breakthrough is almost certain to arise, and the signal can be peaked up by adjusting IFT1 and L4. Subsequently, shift each core slightly to avoid this unwanted signal and later peak up these cores when signals can be tuned in.

First Oscillator. If a receiver is available, it is easy to set the core of L3, on 160m first, as described. The trimmers can then be adjusted to give the coverages listed. Alternatively, adjust the core of L3 until some Top Band signal is received. When L3 and L4 are suitably adjusted lock each with a fixing nut. The other trimmers are then adjusted, with the bandswitch in the appropriate position, until the other amateur bands are found.

Aerial Circuit. This is peaked with VC1 for best volume. If necessary, adjust L1 or L2 until both bands fall within the swing of VC1. It will be apparent that it is possible to obtain four other bands by deliberately tuning the aerial circuit to the second channel, or image frequencies. The second channel is IF x 2 from the wanted signal, that is 11MHz, if the IF is 5·5MHz. For example, the oscillator tunes 7·15 to 7·55MHz for Top Band so the second channel for this range is 12·65 to 13·05MHz, which is remote from the wanted frequencies but which may provide some signals if VC1 is deliberately set to minimum capacitance. A similar effect is observed with some commercial equipment using this method of tuning but it does not indicate a fault.

IFT1 is actually set to some frequency near 5·5MHz, which avoids interference, and L4 adjusted to convert this to 465kHz. Such adjustments are easily made a little at a time when the receiver is working and it should be clear that the operation of the receiver does not depend on IFT1 being tuned to exactly 5·5MHz.

Dial calibration is best made with a crystal marker or similar after finishing alignment adjustments. The scale is marked 0 to 100 will be useful when first checking the band coverage.

BFO CIRCUIT

Fig. 11 shows the circuit of the BFO with Tr10 an oscillator working on approximately 465kHz, the frequency being adjusted by the BFO pitch control VC3. Switch S6 brings the BFO into operation in its last position only, for CW (Morse) and SSB (single sideband) reception. The value of VC3 is not too critical as long as sufficient shift of the BFO frequency is possible. Note that connections to 4 and 5 must be as shown, for the circuit to operate.

If, however, the circuit of the BFO appears not to be oscillating, evidenced by the lack of a beat note on AM or CW signals or inability to resolve SSB signals, the connections to pins 4 and 5 on the coil should be reversed.

ASSEMBLY AND ADJUSTMENT

The BFO is assembled as in Fig. 12. A lead from the MC tag is provided for the moving plates tag of VC3 and the lead coded brown is for the fixed plates.

The lead coded white runs up through a hole, near IFT3. Coupling or injection is to the base of Tr5 so that the BFO level is raised for diode D1.

Coupling was found to be suitable when the thin insulated lead from the BFO looped around the body of C19. Coupling is not in any way critical. However, if coupling is too tight, sensitivity to all signals is unnecessarily reduced. On the other hand, if coupling is very small, strong SSB signals will sound like badly over-modulated AM, or will not be resolved at all. If VR2 is near maximum and VR1 is turned back to obtain reasonable volume, and SSB and CW signals are then received well, the amount of coupling to the base circuit of Tr5 is optimum.

To obtain a satisfactory frequency range for VC3 it is necessary to adjust the core of the BFO inductor which can be done by tuning in an AM signal,

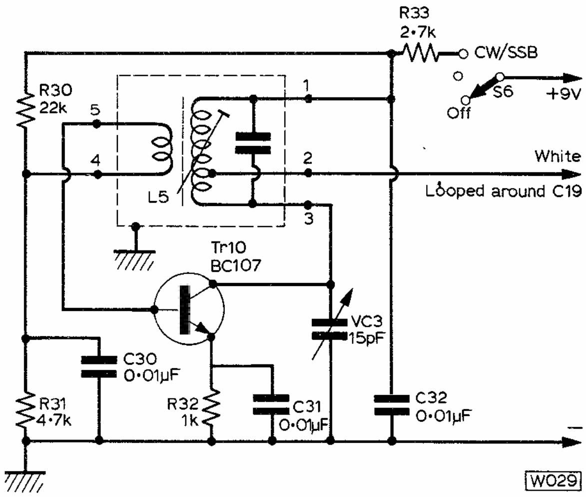


Fig. 11: Complete circuit of the BFO. The oscillator transistor Tr10 works at approximately 465kHz, frequency being varied by VC3, after rough adjustment of the core in L5.

with VC3 half open, and adjusting the BFO coil until a loud heterodyne whistle is heard. The correct position is the zero-beat or middle setting. An audio tone, rising in pitch, is then obtained if VC3 is rotated either way. Check with one or two other signals to make sure that a harmonic of the BFO, reaching the aerial circuit, is not responsible.

When receiving CW, adjust VC3 to the position

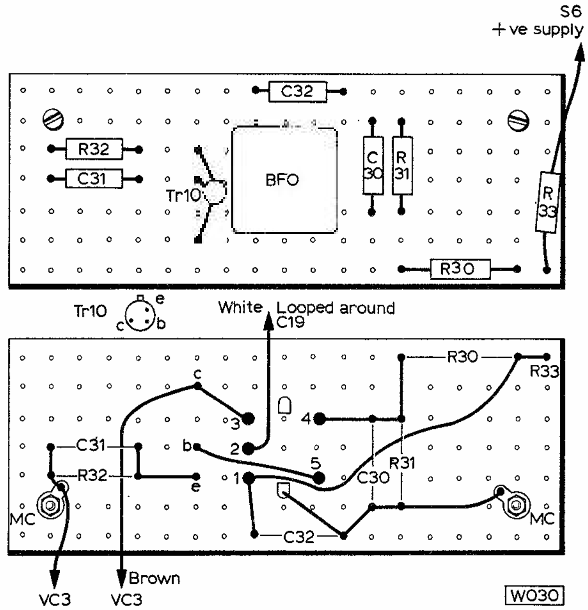
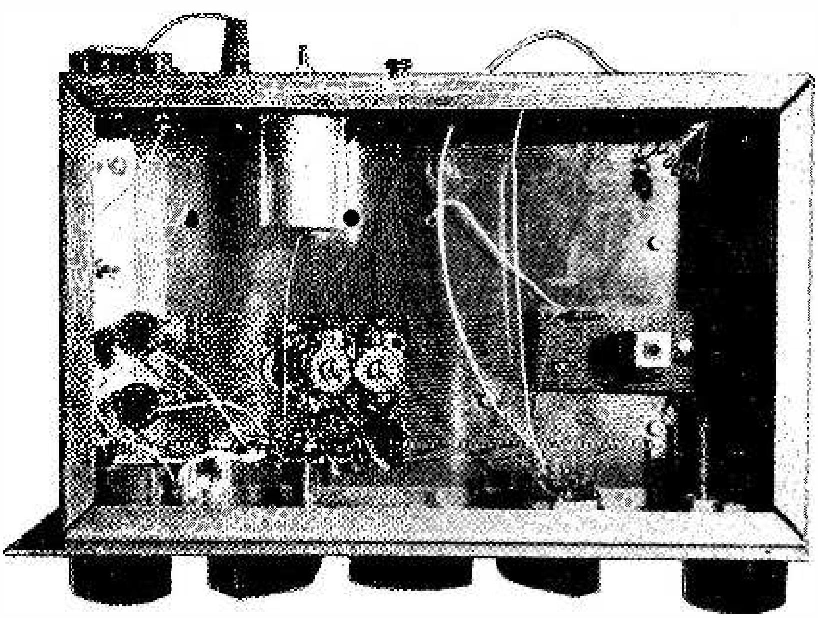


Fig. 12: Underside and topside of BFO board. The output signal is taken via an insulated lead, looped around C19.

giving best reception, which may prove to be either side of the zero position. To receive SSB it is essential to adjust VC3 carefully, and to the required side of its zero position. The off-set used for 20m is the opposite to that on 40, 80 and 160m. The way in which this control operates will soon become clear in use. Remember that for all but weak signals it is essential to reduce gain prior to the detector, by turning back VR1.

5·5MHz TRAP

This is an optional item which can be added at any time. Its purpose is to reduce the strength of any unwanted signals which may be using frequencies near to that of the first IF, and which are



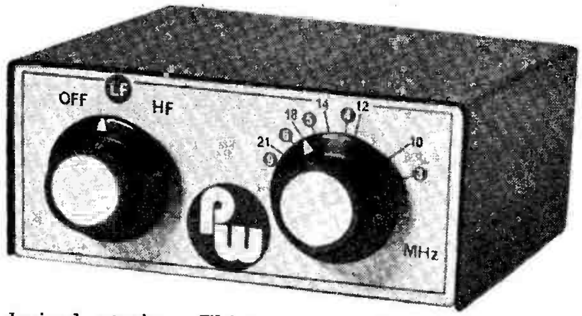
Underside photograph showing details of the universal chassis used and the 5·5MHz trap, situated on the rear drop of the receiver.

continued on page 403

SW Pre-Amplifier

STEVE MONEY G3FZX

IN the less expensive versions of the communications type receiver the more commonly met deficiencies in short wave performance are lack of sensitivity and poor front-end selectivity on the higher frequency bands. With such a receiver the bands above about 12MHz may well appear to be completely dead at a time when a more expensive receiver can still produce a lively selection of signals. As a result the listener using the cheaper receiver may be failing to hear many stations simply because of the poor performance of his receiving equipment.

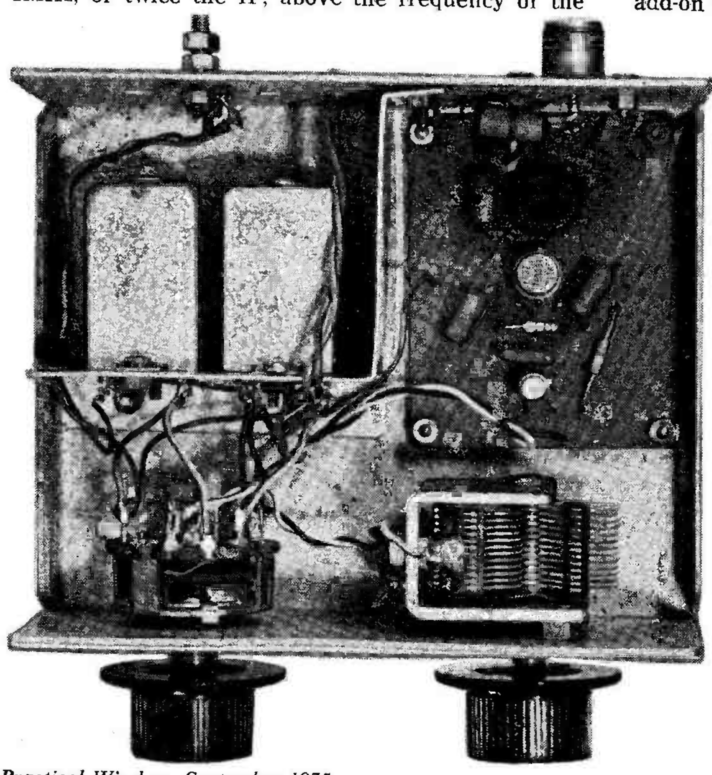


SELECTIVITY

In the simpler receivers the selectivity of the main IF amplifier is generally adequate for the separation of signals on adjacent channels, but the selectivity of the tuned circuits ahead of the mixer stage often leaves a lot to be desired. Since this type of receiver is usually a single conversion superheterodyne having an IF of around 465kHz, the effect of poor HF selectivity will be severe second channel or "image" interference on the high frequency bands. Thus, on the 14MHz amateur band severe break-through from broadcast stations operating in the 15MHz band is frequently experienced. On the other bands, reception may be marred by CW or tele-printer interference from stations operating roughly 1MHz, or twice the IF, above the frequency of the desired station. This assumes that the receiver follows the usual practice in which the local oscillator for the mixer stage is operated at a frequency above that of the signal.

The problem of lack of receiver sensitivity on the higher frequencies can be readily solved by merely adding a pre-amplifier stage to the main receiver. However, this solution is likely to aggravate the second channel interference problem unless some additional selectivity is provided in the pre-amplifier unit. This add-on unit would then effectively become a preselector amplifier and, with its aid, the performance of the receiver, in terms of both its sensitivity and selectivity, can be greatly improved.

For the relatively small cost of making a suitable add-on unit the user of a simple inexpensive receiver,



Interior view from above, of the 'U' shaped chassis, showing details of the PCB, coils and switch layout. The two coils, L1/L2 are mounted on a small screen with their bases towards the front panel to facilitate short wiring.

is able to compete on rather more favourable terms with other listeners fortunate enough to have more expensive equipment.

INTEGRATED AMPLIFIER

In this article a pre-amplifier unit is described which makes use of an integrated circuit amplifier to provide the additional gain. This gives the advantage of simplicity in construction since few external components are needed with the IC. A Fairchild type μA703 RF/IF amplifier was chosen for this purpose since it is inexpensive and is readily obtainable.

Basically the μA703, which has six lead wires, is a single stage two transistor amplifier of the emitter-coupled type. A third transistor provides the constant-current feed for the emitters of the differential amplifier stage. The chip also incorporates resistors and diodes to provide the correct bias for the amplifier and allow the supply to be decoupled. Since it is difficult to fabricate large value capacitors on an IC chip, the decoupling capacitors have to be wired externally.

The type of amplifier circuit used and its small physical size ensure that the feedback of signals from output to input, inside the amplifier, is extremely small. This means that stable operation of the circuit is readily achieved without the need for any form of neutralisation. The μA703 has a forward transconductance of some 30 mmhos at the frequencies in use, so there is no lack of available gain.

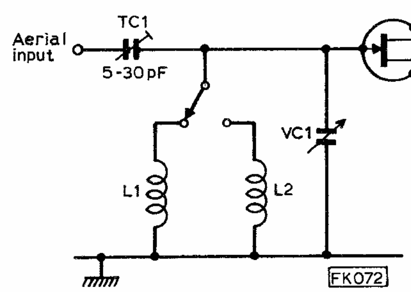


Fig. 1: Alternative aerial coupling circuit to that used in the prototype, but of a simpler design.

MATCHING STAGE

For the short wave bands, the input impedance of the μA703 amplifier is about 1500Ω. If this impedance were connected directly across the input tuned circuit, it would cause severe shunt loading, reducing the effective Q and hence the selectivity of the input tuned circuit.

The effects of loading on the tuned circuit can be reduced by using a coupling winding on the tuning coil to feed the amplifier input. It then becomes possible to provide a rough impedance match over most of the tuning range, although there will be a reduction in the signal voltage fed to the amplifier because of the step-down transformer action of the coupling winding. Also the need to switch the extra winding on the coils makes band changing arrangements more complicated.

An alternative impedance matching technique makes use of a field-effect transistor as a source follower stage between the tuned circuit and the amplifier input. This stage will have a very high input impedance and a low output impedance thus providing the required buffering action between the tuned circuit and the amplifier. Since the gain of the source follower is nearly unity almost all of the signal is passed to the amplifier. The source follower has an input impedance of more than 1MΩ. It will therefore produce virtually no loading effect on the input tuned circuit, permitting maximum operating Q and hence high selectivity to be maintained.

To ensure that the correct bias conditions are maintained within the 703 amplifier, it is recommended that the DC resistance of the external circuit connected between the input terminals of the 703 should be less than 1000Ω. This is achieved here by connecting a 470Ω resistor across the 703 input terminals.

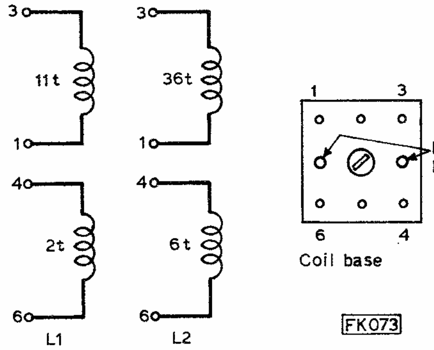


Fig. 2: L1/L2 coil winding details and pin configuration.

If the output of the source follower transistor were connected directly to the input of the 703 some of the current from the transistor would flow into the amplifier input circuit and upset the internal biasing conditions. To avoid this, the source follower output is coupled through a capacitor to the 703 input. Although the 470Ω resistor providing the bias path for the 703 is effectively shunted across the output of the source follower, it has little effect upon the signal level fed to the 703 amplifier.

INPUT TUNING

For most SW listeners the more interesting of the bands lie within the range 3MHz to 25MHz. This range can be covered using only two switched coils. The first coil is used to tune from 3MHz to 10MHz whilst the second covers frequencies from say 9MHz up to about 27MHz. For frequencies below about 3MHz it is likely that the performance of the receiver will be quite adequate without the need for a pre-amplifier. If it is desired to include the 28 to 30MHz amateur band, this should be possible by readjustment of the two tuning ranges. This may, however, involve some loss of coverage at the lower frequency end of the range.

Tuning is carried out by means of a single gang 365pF air spaced variable capacitor. In the present climate of component shortages it may be difficult to obtain the particular type of tuning capacitor specified. As an alternative almost any air spaced variable capacitor of small physical size and with a maximum capacitance of 350 to 500pF should be suitable. A 208+176pF dual gang transistor radio type could be used with the two sections connected in parallel to give 384pF. Although the tuning is fairly sharp at the higher frequencies it should not be necessary to fit a slow motion drive to the capacitor.

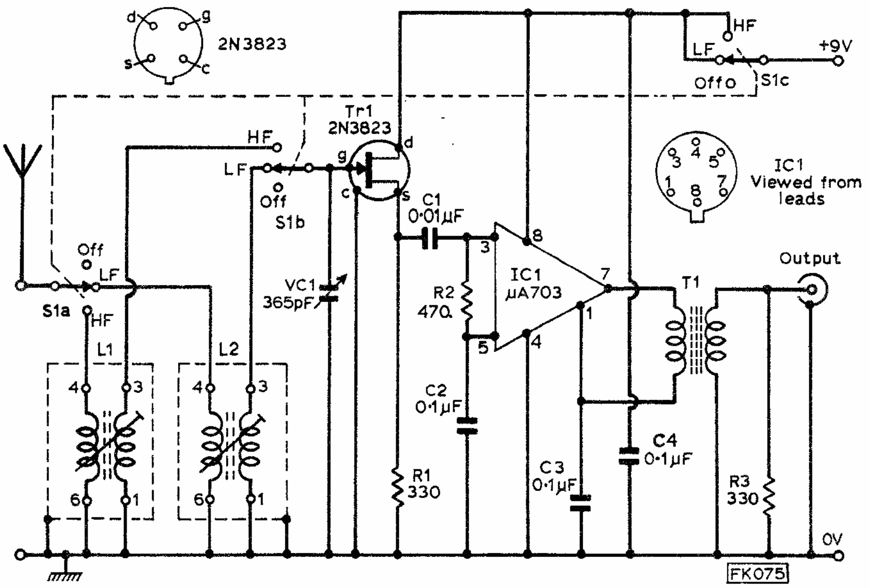


Fig. 3: Complete circuit diagram of the SW Preamplifier giving details of IC1 (µA703) and Tr1 (2N3823) base connections.

The signal from the aerial is coupled to the tuned circuit through a link winding on each of the tuning coils. These windings are switched at the same time as the main tuning coil when the frequency range is selected. An alternative and simpler approach to coupling the aerial circuit is to feed the signal through a capacitor in series between the aerial terminal and the gate of the transistor, as shown in Fig. 1. This simple arrangement however is not as effective as the use of separate switched link windings.

Each of the tuning coils is wound, together with its aerial coupling winding, on to a 6mm diameter coil former. The formers used are Neosid types on a square base as used for the IF strips of older television receivers. The coil former is 35mm long and is mounted inside an aluminium screening can to reduce stray pick-up. Tuning coverage is adjusted by an iron dust core.

For the lower frequency range a tuning inductance of about 6·4µH is required, obtained by a winding of 36 turns of 28SWG enamelled wire close wound. The aerial coupling link consists of 6 turns of the same wire wound on top of the main winding at the end near the coil former base.

The coil used for the high frequency range is wound with 24SWG enamelled wire and consists of 11 turns wound to form a single layer coil about 12·5mm (½in) long. This means that the turns will be spaced out roughly one wire diameter apart. For this coil the required inductance of 0·8µH will be obtained when the iron dust core is inserted. The link winding is 2 turns of 24SWG wire, wound between the turns of the main coil at the base end of the coil former. Figure 2 gives details of the coil windings and also the pin connections on the coil bases. In Fig. 3 the complete circuit of the pre-amplifier unit is shown.

★ components list

Resistors
R1 330Ω
R2 470Ω
R3 330Ω
All resistors 10% ¼W

Capacitors
C1 0·01µF
C2 0·1µF
C3 0·1µF
C4 0·1µF
VC1 365pF air spaced variable

Semiconductors
Tr1 2N3823 (FET)
IC1 µA703 or equivalent

Miscellaneous
L1, L2 see text. S1, 3-pole 3-way wavechange switch. T1, toroidal core type T-50-2 Carbonyl 'E', available from TMP (Electronic Supplies), 3 Bryn Clyd, Leeswood, Mold, Clwyd, CH7 4RU. Equivalent cores (up to 30MHz) also available from other distributors.

OUTPUT TRANSFORMER

Rather than use a second tuned circuit ganged to the input circuit, a broadband untuned transformer is used to couple the output from the pre-amplifier to the main receiver input. This simplifies range switching and reduces the possibility of amplifier instability.

To produce an efficient broadband RF transformer the toroidal type of construction is employed. In this, the core of the transformer takes the form of a doughnut shaped ring of powdered iron material. The windings are wound on the core by looping the turns through the central hole as shown in Fig. 4.

A T-50-2 type core is used for the transformer in

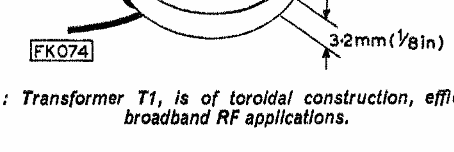


Fig. 4: Transformer T1, is of toroidal construction, efficient for broadband RF applications.

Dear Sir,

letters

10 + 0 = 20?

I would advise Sinclair Scientific owners to be careful if they use Mr. McBriar's "clear last entry" system (Letters, June) as this can give some very surprising results. I suggest they try the following key sequence to illustrate the point: 1,E,1,+,1,E,−, 9,9,+. This gives the answer 2.0000 01 or, in effect, 10 + 0 = 20!!

This incorrect result is caused by an anomaly in the calculator's logic, but it can be avoided by limiting numbers to the range 10^{-50} to 10^{50}. — **R. T. Russell** (Kent).

So now you know!

I have been reading the various letters over the past few months concerning the reception of public service broadcasts and was particularly interested in the selection appearing in the June edition.

I have, for a long time, been concerned about this aspect of the law and, since I am employed in the legal profession, I have been able to go into the matter at some depth.

My first encounter was when I was about to purchase a communications receiver and the typical footnote on the ads. warned that for reception of certain broadcasts a licence "not generally available to the public" was required. Appreciating that a C.R. would cover trawlers, etc., I contacted the, then, Ministry of Posts & Telecommunications to find out about this licence. I was quite surprised to receive a reply stating "I should point out . . . that it is an offence contrary to the Wireless Telegraphy Act 1949 . . . to listen intentionally to broadcasts from . . . police, fire-brigade, etc., and **no** licence **can** be issued . . ." (emphasis marks my own). The letter went on to state that the maximum fine for a first offence was £50, and £100 thereafter.

I, like D. H. Myers, could not accept that merely to listen intentionally was an offence and I buried myself in the statute books to read the Wireless Telegraphy Acts 1949 and 1967, the Marine, etc., Broadcasting (Offences) Act 1967 and the Post Office Act 1969. There was nothing I could find to support the view that to listen intentionally was, in itself, an offence. I was continually bothered by references to "authorised broadcasting stations". Could this, I thought, mean that we could not listen to Hilversum?

Determined to prove that Big Brother was NOT going to tell me what I could or could not listen to, I wrote back to the Ministry quoting what I had read and adding, with some relish, that even the dreaded Marine Broadcasting Offences Act did not prohibit LISTENING to such stations!

The Ministry took considerable trouble with their detailed reply:

(1) An authorised broadcasting station is defined (Statutory Instrument 1970 No. 548. The Wireless Telegraphy (Broadcast Licence Changes and Exemption Regulations 1970)) as "a station for the time being authorised to conduct a broadcasting service pursuant to the International Radiocommunications Regulations for the time being in force".

(2) "Broadcasting service" is defined in those Regulations as "a radiocommunication service . . . where the transmissions are intended for direct reception by the general public".

(3) Section 5(b)(1) of the Wireless Telegraphy Act 1949 makes clear that it is an offence . . . to use . . . any . . . apparatus with intent to obtain information as to the contents, sender or addressee of any message which . . . the person using the apparatus is (not) authorised by the Minister . . . to receive.

Surely, I thought, this had proved my very point—there **had** to be intent to obtain information! I stopped my correspondence with the Ministry at that point feeling somewhat pleased with myself.

A little later, in a legal journal, I found a decision of the High Court which was to shatter this. The case in question was "Paul v Ministry of Posts". The Court had dismissed an appeal, holding that a man who listened to firebrigade messages without authority was guilty of an offence under Section 5(b)(1), although there was no intention to use this information for an improper use. (Anyone who has access to a copy of "The Times" for 6th March, 1973, can read the full facts for himself). It does, though, seem clear from this decision that merely to listen is to intend to "obtain information, etc." and is therefore an offence in itself! Of course, merely to tune to a public service by accident is specifically exempted by the same section but, those who continue to listen do so at their peril! Remembering that ignorance of the law is no excuse.

I STILL find this piece of law totally unacceptable and the day it is repealed will be a day to rejoice. As to whether freedom of choice is being curtailed is a matter of personal belief. I myself think it is. But, to criticise the, now, Home Office for seeking to uphold the law is not, in my opinion, at all fair. Whether the law is just or unjust, it must be accepted to be the law. The Home Office has been given the job of operating this sphere of law and they, like me, have to do their job whether they like it or not. Those of us who do not approve must take all proper steps to change the law not sit back damning a government department which has the unenviable task of operating the law.—*(Name and address supplied)*.

Single handed

I recently built the PW Tele-Tennis by M. J. Hughes, and found it to be a great time-passer. However, one draw-back to the game is that it requires two players. For this reason, I cut the copper track of the OV line, feeding IC23 (NE555). A switch was then inserted, and mounted on the outside panel.

The outcome of this modification, is that the right-hand bat loses height, and provides a wall to bounce the ball off. Also, readers may like to know that it is impossible to beat the machine, when wired in this manner!—**A. O'Brian** (Sunderland).

Calculating danger

The paragraph in "Production lines" about the "Mickey Math" calculator has prompted me to put pen to paper about calculators in general.

As a sixth form student I have so far resisted the temptation to invest in a calculator for two main reasons:

(a) Financial—no elucidation needed!

(b) Not only do I consider that I don't need a calculator—I think that, as far as I, and others in school are concerned, it would be a positively bad thing.

After several years of handling "A" level equations I have acquired a sort of mental agility which is useful, not only in tedius calculations, but also in quick estimations of everyday problems. For example, I never multiply by 5, I divide by 2 and move the decimal point one place to the right. Then there's the old trick of finding whether a number is divisible by 9, by adding the digits —I have recently found this works with 3 as well.

If one used a calculator, these little tricks would not be necessary, which perhaps would detract from one's understanding of the ideas involved. Also, calculators are not allowed in exams, so it's useful to have the practice in calculation before.

To be fair, I do make extensive use of slide rules, logs and other tables, but there are tricks to be learnt or invented with these as well.

Teaching a child to use a calculator certainly isn't teaching it maths. Although children learn processes for addition, multiplication, etc., they do not necessarily understand exactly what they are doing, until years later, after a lot of experience working with numbers. It is only comparatively recently that I realised precisely why, when dividing vulgar fractions, you "turn the second one upside down and multiply."

Will children soon be leaving Junior School who do not really understand what is meant by addition, subtraction, etc., and cannot multiply or divide without their calculators?

Agreed, the pocket calculator is a good thing for the housewife, checking bills, or the businessman or university student; but with programmable calculators (i.e., pocket computers) becoming cheaply available, as I am sure will happen, the range of functions available on calculators will extend to embrace more complex algebraic ideas, even perhaps integral and differential calculus.

Shall we soon see students leaving sixth form college for University who cannot solve a simple quadratic equation without their "Acme Pocket Comput-o-matic"? —**Jonathan Gebbie** (Hants)

Why bother!?

How right you are, dear Editor, in your editorial on Technological Poverty (August). The daughter, aged 24, of a colleague is a temporary shorthand typist with a bank in the City of London and although she admits that 'she is not all that good' has been offered a permanent position in the bank at £70 a week or £3,640 a year! She's 'thinking' about it because it means starting at 9am instead of at 9.30am!

After a lifetime in electronics and communications my present salary as a senior executive on a national monthly electronics magazine is £3,875! I feel like throwing myself into the river! *(Name and address supplied.)*

DUAL CONVERSION RECEIVER—*contd from page 398*

introduced into the receiver through the aerial circuit. If interference of this type is present, it can be easily identified as it is not influenced by tuning.

Whether or not such interference arises depends on the actual aerial and other circumstances. The most likely cause of trouble would be with a long, random length end-connected aerial. The use of some form of resonant amateur band aerial, or aerial tuner, will reduce chances of 5·5MHz breakthrough. Direct pick-up is also largely avoided by using a metal cabinet, while the frequency of the first IF can be shifted one way or the other, if necessary, to avoid a strong transmission.

TRAP CONSTRUCTION

The trap comprises a 13·6μH slug tuned coil, with a 47pF silver mica capacitor in parallel. The Denco "White" Range 3 (valve type) miniature coil is suitable and the maker's can is used for screening. The capacitor is connected across pins 1 and 3, Fig. 9. Pin 1 goes to the aerial or an aerial trimmer if the aerial is very long, and pin 3 is connected to S1. Drill the can lid to take the coil mounting bush. Drill a small hole for a lead high on the side of the lid and cut off a little of the can threaded portion so that the can does not cover the hole when screwed in place. Also drill a small hole in the middle of the bottom of the can.

Use the coil to fix the lid inside the back runner of the chassis, near the aerial socket, and run a lead from pin 1 through the hole to the socket. Solder a lead to pin 3, pass it through the hole in the can bottom, and screw the can in place. The lid must make contact with the chassis runner, so the paper coil identification label should be removed.

The trap can be set by coupling the signal generator to the aerial, tuned to 5·5MHz, and then rotating the core for minimum volume. Alternatively, set the core for minimum interference from any unwanted signal around this frequency.

AERIAL

Many signals should be heard with an indoor wire, or quite short outdoor aerial. For extreme distance reception, an efficient external aerial will be essential. With aerials of medium length, TC1 is unscrewed to reduce loading of the tuned circuit, while with long aerials, TC1 or another series capacitor can with advantage be plugged into socket A1. Though many transmissions can be received without an earth, better reception of weak and difficult signals can be expected when this is provided.

It is necessary to provide holes in the back of the case so that the aerial sockets etc. can be reached. These can be made with a chassis punch, or small holes can be drilled to take a saw blade so that a suitable aperture can be cut. An opening lid was formed in the prototype by cutting out a piece 254×127mm (10×5in) with a saw, and hingeing this at the back. When closed, the lid rests on strips bolted to the case top each side. This lid is not essential.

continued from page 401

the pre-amplifier unit. This type of core has an outside diameter of 12·5mm (½in) and is 3·2mm (⅛in) thick with a central hole of 6·3mm (¼in) diameter. Thus the core is roughly 3·2mm (⅛in) square cross section. These cores are colour coded to indicate the type of material used. In the case of the T-50-2 the colour code is red and the material is effective up to a frequency of at least 30MHz.

A primary winding of 50 turns is wound on the core using 36SWG enamelled wire, each turn being threaded through the central hole in the ring core. Try to wind the turns in an even layer but do not pull the turns too tight otherwise the enamel coating on the wire may be damaged. Make sure that turns do not cross or overlap one another since this can greatly reduce the efficiency of the transformer. When the winding is complete, twist the free ends loosely together to hold the winding in place on the core.

In the remaining space on the core between the ends of the primary winding 16 turns of the same gauge wire are wound on to the core to form the secondary of the transformer. Once more check that there are no crossed turns and that the primary and secondary windings do not overlap. When complete, the windings will be slightly loose on the core but there is no need to worry about this. It is not advisable to cement the windings with coil cement since this can increase the capacitance of the windings and reduce the efficiency of the transformer.

When the unit is connected to a receiver the load impedance presented to it by the receiver input circuits will vary considerably over the tuning range. If the load has a high impedance, and is reactive, it is possible that the 703 amplifier can become unstable at the higher frequencies. To avoid this, and to even out the gain over the complete range, a shunt damping resistor (R3) is connected across the secondary of the output transformer.

One advantage of using the toroidal type transformer is that the magnetic field of the transformer is confined almost entirely to the ring core. This results in very little stray RF field, which makes screening unnecessary.

CONSTRUCTION

The components of the amplifier circuit are mounted on a small printed circuit board measuring 50mm (2in) by 62·5mm (2½in). A suitable layout for the PCB is given in Fig. 5. The output transformer T1 is simply held down on the board by its four wires. If desired the core can be fixed with a nylon or tufnol screw, but NOT a metal one.

A simple inverted "U" shape chassis 125mm (5in) wide, 100mm (4in) deep and 50mm (2in) high is used to carry the tuning components and the PCB. For the cover, another "U" shaped piece of aluminium can be used and is fixed to the main chassis with self-tapping screws. Note that the two tuning coils are mounted on a small aluminium screen with their bases facing the front panel to give short wiring runs to the switch and tuning capacitor. Aerial and earth input sockets, and the output coaxial socket for the feed to the receiver are mounted on the back of the chassis. It is important that the PCB should be spaced from the chassis to reduce stray capacitance to earth from the copper tracks.

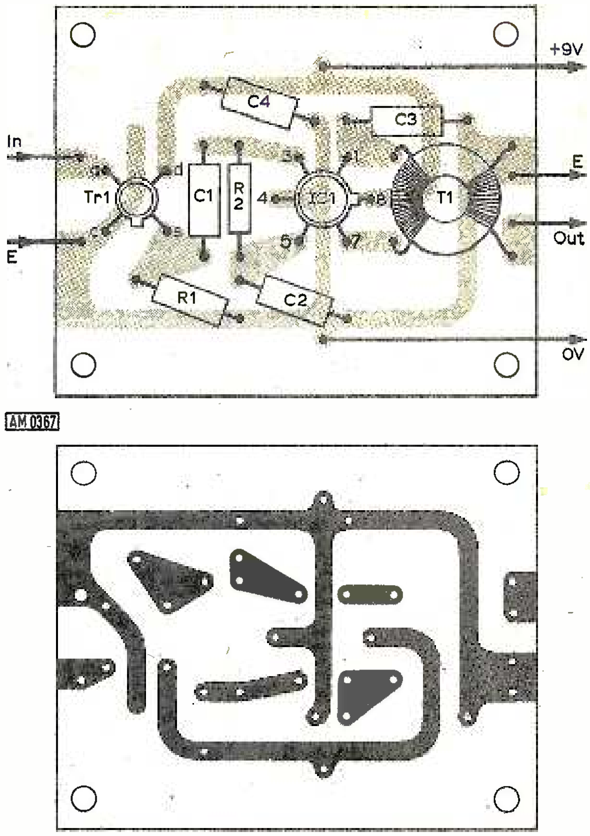


Fig. 5: PCB, full size, showing the component layout above and foil side below.

PERFORMANCE

A gain of some 20 to 30dB in signal level can be expected over the tuning range of the unit. This is equal to about 3 or 4 "S" points in signal strength. The output of the unit is connected to the aerial and earth terminals of the main receiver via the shortest length of coaxial cable possible. Alternatively a twisted pair or balanced twin feeder cable could be used, but the advantage of a screened cable is that there is less possibility of direct pick-up of strong signals on the cable.

Current consumption of the unit is approximately 10mA at 9V. A PP6 type 9V battery can be used to power the unit which should give good battery life. Alternatively a small mains-driven power unit can be used.

OPERATION

Using the pre-amplifier is quite straightforward. First tune the main receiver to the desired frequency band and select the appropriate range on the pre-amplifier. Adjust the unit's tuning capacitor until maximum signal or noise is obtained. In some cases it may be found that there are apparently two signal peaks in the pre-amplifier tuning. One will occur when the pre-amplifier is tuned to the main receiver image frequency. Usually the correct tuning point for the pre-amplifier will be at the lower frequency peak.

Once the unit is tuned for the band it should be possible to operate throughout the band with no further adjustment of the unit's tuning, since the peak is fairly flat over a band of some 200 to 300kHz on the higher frequency bands.

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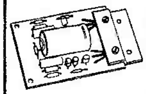

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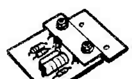

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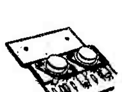

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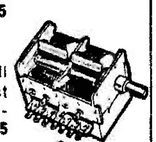

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I.C. OF THE MONTH

Number 53 — **TAA930 IF/FM DETECTOR**

THE TAA930 is a linear integrated circuit containing a four stage IF amplifier-limiter, a balanced coincidence FM detector and a voltage regulator in a single encapsulation. In circuits using this Sescosem device, demodulator tuning requires only one coil with a single winding.

The TAA930 has been specially designed for use in the sound system of television receivers. It is available in two different 14-pin plastic encapsulations. The TAA930A is a dual-in-line device, whilst the TAA930B has its connecting pins bent into the quad-in-line configuration. Electrically the two are identical.

TYPICAL CIRCUIT

A typical circuit for the use of the TAA930 in a television sound section is shown in Fig. 1. The coil L1 consists of 46 turns of enamelled wire (about 22 s.w.g.) with a tapping six turns from the earthed end of the coil. This coil can be tuned with a ferrite slug. The coil L2 consists of 32 turns of the same wire in a close wound coil.

CHARACTERISTICS

The limiting action will commence when the input voltage is only about 50μV; the input resistance is 15 kilohm. When a signal modulated to the $\pm$50kHz deviation level is applied at an amplitude of 10mV, the audio output signal is about 1·4V when a 12V power supply line is used, or about 0·75V r.m.s. with a 9V supply.

The output is taken from an internal emitter follower. The output impedance is about 100 ohms with a 12V supply or 150 ohms with a 9V supply. The minimum recommended load is two kilohm.

The absolute maximum permissible supply voltage is 15V, but the device normally operates from a 9V or a 12V supply line. The power supply current is typically 12 to 17mA.

The AM rejection ratio of the TAA 930 is plotted against the input voltage in Fig. 2. It can be seen that the rejection is over 50dB at normal input levels.

The TAA 930A is available from Phoenix Electronics (Portsmouth) Ltd., 139-141 Havant Rd., Drayton, Portsmouth, PO6 2AA at £1·42 plus 20p postage and packing (V.A.T. included).

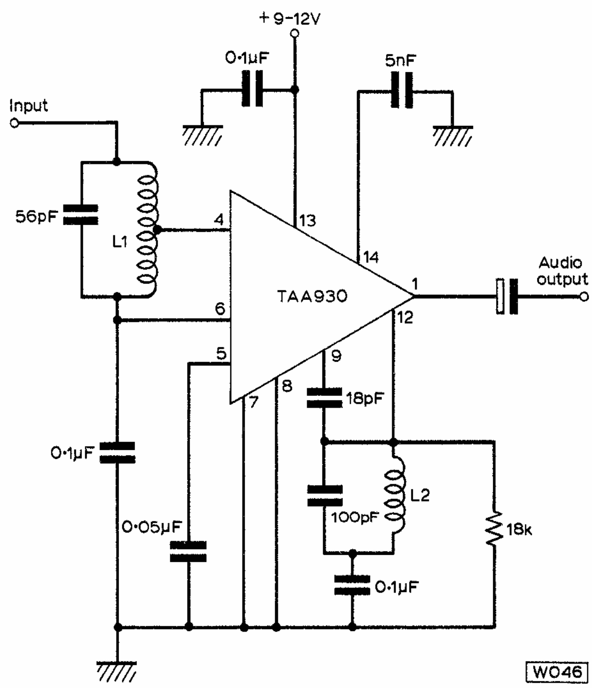

Fig. 1: A typical circuit using the TAA930 integrated circuit in a television sound system.

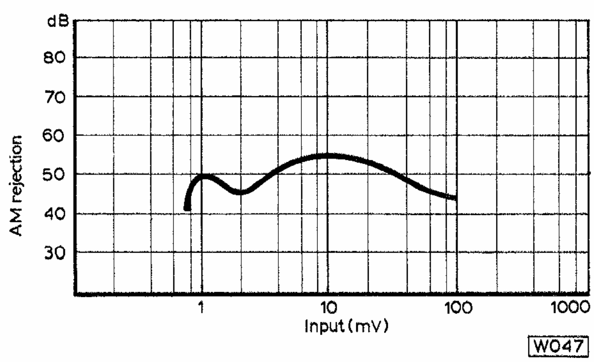

Fig. 2: AM rejection plotted against input voltage.

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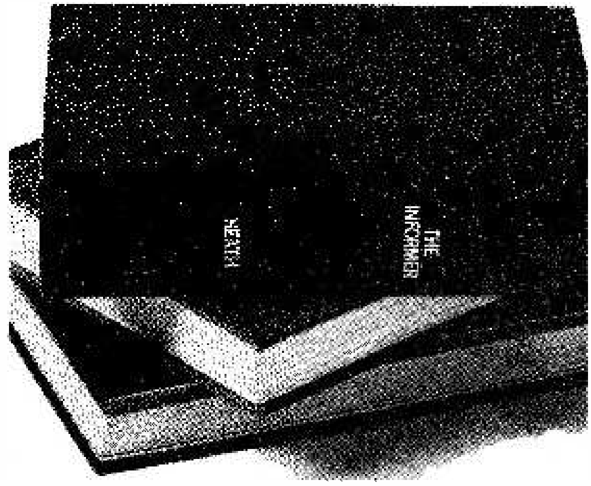

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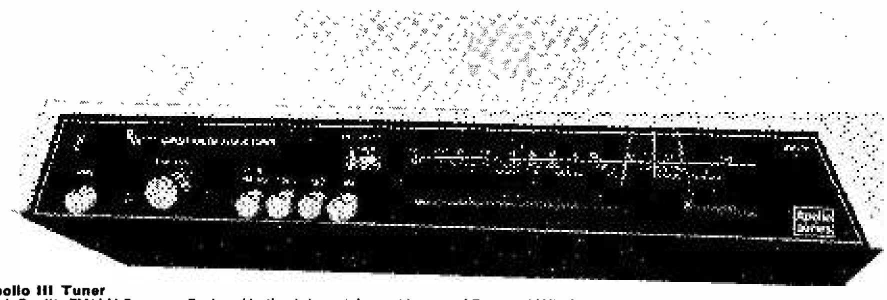

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PROJECTION TELE.

TELEVISION tyros will remember the old projection television sets. A long, cylindrical projection "tube" was used to project the image on to a screen. A problem at the time was the use of very high voltages to run the tube. This idea fell out of favour and never really caught on in the home. It may therefore come as a surprise to learn that a company is manufacturing not just a projection tube, but the whole system, including screen; and suitable for colour. Designated the Videobeam, it will receive colour television transmissions (all u.h.f. channels 21–68) and it will also accept video tape input or a signal direct from a suitable camera. A further input accepts computer data where the system would prove useful for giving direct viewing of a printout in alpha numeric form.

The 1·75m. wide image is projected onto a special screen which is curved. The sound is also "projected" at the screen and is reflected back to the audience. The manufacturers claim that some 40 people can view the screen in comfort.

WATCH THE CALCULATIONS

A few Ginsbergs ago I mentioned a wristwatch/calculator (electronic, of course). Having now seen just what they look like I can only comment, "fascinating". The same remarks apply to the price—about $400. But hope is not lost if you aspire to owning one and haven't got too many pennies. A plastics specialist manufacturer has mentioned that he can see the price dropping to $20! He argues that a huge part of the cost of these miniature marvels lies in the expensive, bespoke metal cases. His answer is to simply switch to special, tough, plastic cases which can be modelled/moulded into some very attractive shapes.

The "buttons" on the watch/calculator are depressed using the point of, say, a ballpoint pen. The proposed plastic cases and keyboards measure 40 x 35 x 3mm. deep. The keys themselves are only 3mm. in diameter. In the basic design of the plastic case, up to seven functions could be accommodated which includes a memory. Readout of the watch I have seen is a liquid crystal type but doubtless LED versions are around too. Not available over this side of the pond—yet.

S.A. TV

Changing channels, back to television, I see that the long awaited South African television transmissions are finding their way into the ether. The official inauguration of these transmissions was back in the early part of this year. One hour test programmes are the order of the day so far with a promise of daily broadcasts from 1800–2300 to follow.

The licence fee is around £25, and the cost of a 26in. colour (PAL) receiver is about £700. Despite this high price it is estimated that some 175,000 sets will be sold this year and that colour receivers will account for 75% of this figure.

I^2L

For the semiconductor enthusiasts, keep a sharp lookout for the new I^2L (injection logic) which seems to be creeping in quietly. Fairchild has recently introduced a 4,096-bit RAM (random access memory) with an access time of only 100ns. Another giant, Texas Instruments, is also working hard on I^2L products although it is playing its cards very close to the chest with not too many details available at present. Philips has already used I^2L in an in-house motor control requirement. I predict that injection logic will have quite an impact once it gets started in a big way.

SWL's NOTE

People who, listen in the radio spectrum from 2–30MHz will be pleased to hear of new equipment just launched on to the market (but not so pleased to hear the price!). Radio signals in this sector rely on reflection from the various ionised layers high above the earth. There are different layers which can affect the signal. At times a signal will just fade, sometimes a band is "open" working well and full of signals. Later, the same band can be almost dead and void of any radio life at all. Which band do you choose, and how long will it stay "open"?

The new equipment tells all. The unit has a c.r.t. display which shows two sets of data. One is a barograph display which shows intensity of the received signals (in dBs) and shows which signals in the spectrum are strongest at a glance. Beneath this display is another which shows via which path these signals are reaching the receiver and taking into account single and multiple path transmissions. Part of the system is a sounder transmitter which sweeps the band over a five minute period.

The band is divided up into various data channels. Another part of the equipment makes seven duplicates of each channel and these are transmitted as a package of tones. These are transmitted and received by the receiver which can then calculate to allow for things like short-term fading, static bursts etc. Just for the record, a sounder transmitter/receiver system costs in the region of 100,000 dollars—then, of course, you may want to purchase the modern unit . . . .

SIG. GENNY

It seems that in the dim distant Ginsberg past, memories of having two small signal generators marked a.f. and r.f. respectively come to light. A separate "box" was required for each job. This seems a far cry from one new signal generator just released which covers, in a single box, from 15Hz to over 1GHz. Needless to say it doesn't end there. The unit has both analog and digital readout, has an a.f. voltmeter built in and does numerous things quite automatically. Accuracy is almost frightening and mention is made of "four options". Grudgingly I must give it best over the ubiquitous BC221 which was the pride and prestige symbol of many a ham station.

Ginsberg

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

ON several occasions in the past I have mentioned the possibility of running a small contest for readers of this page, with a couple of prizes thrown in. Very briefly the idea is to ask you to submit a cassette recording of the best DX that you hear over a period of, say, a month, on any amateur band. The "best" recording will take into account the band, time, mode, clarity of signal etc. If you have a cassette recorder it ought to be alongside your receiver anyway, always ready to record a choice bit of DX, so why not fix up a permanent lead out of your set to take immediate advantage of the recording facility?

Full details next month, I hope, so start practising and don't forget to make an entry in your log at the same time as the recording or you will be wasting your time! Better still, use the microphone to put the details of date, time etc., on the tape immediately after the recording.

Pete Dawson (Westward Ho! N. Devon) may wonder why he hasn't heard from me in reply to his first letter. Unfortunately Pete, you did not give your full address. For those willing to lose a few hours sleep Pete listed quite a few Central American prefixes heard between about midnight and 0400 on 3·5 and 14MHz. His "very ordinary" equipment is an old R107 with a Delta loop (for 14MHz?) and an inverted Vee about 50ft at the top. Pete has 246 countries to his credit and naturally has trouble in finding a new one these days, although he has been looking for the HK0AA and CE0A DXpeditions without success. I suggest Geoff Watts' DX News Sheet is the best and latest source of info on such matters. See July column.

Another first-timer is **Peter Allen** A8677 (Taunton) using a Trio 9R59DS and a G5RV aerial plus a G8AEV converter for 2m aided by an eight element horizontal beam and a five element vertical "for mobiles and repeaters". Not a bad idea, Pete! With the benefit of hindsight it now seems a pity that the early workers on 2m did not go for vertical polarisation in the first place! I have sent my condolences to **Mike Conolly** A8796 (Yeovil) who has had to move from the village of Odcombe to a "terrace house in the centre of Yeovil", losing the lovely countryside and its DX potentialities! However, Pete has had his 2m halo fixed on a TV mast at 45ft plus a pulley for the eventual long-wire. Good thinking!

Neil Whiteside A8859 (Hitchin, Herts) has only been watching the SW bands for a few months with his 50ft wire feeding a CR100/8 and Codar PR40 preselector. He deplores the selfish attitude of amateurs who seem to choose 3·6MHz for tuning up their rigs on a Sunday morning thus QRM'ing the RSGB News Bulletin. Although you are not too far from Chelmsford, I think one of the other transmissions might be better for you, Neil. Try the first one from G2MI in Bromley, Kent. Neil hopes to take his RAE in December plus the Code exam and to get his G4+3 right away. Very wise of you, OM. Top Band enthusiast **Tim Charles** (Colchester) bemoans the usual summer fade out of that band and seems to have gone to the other extreme by concentrating on 2m. Recent lift conditions on 2m have enabled Tim to listen to Europeans working through the GB3BC repeater. In fact, Tim has copied nine repeaters so far, including PA0ALK, DB0SM, DB0WW and DB0ZO.

Andrew Swiffin A8603 (Cheadle) couldn't leave radio alone when he went camping near Ullswater, taking along a transistorised set and loaded whip aerial. He was pleased with VP1PF and several W's on 80m plus some GDX on 160m in daylight. **Colin Fawcett** (Oldham) gets back on the bands after five years' absence but so far has not fixed up a decent aerial for his Eddystone 840C. **Paul Barker** (Sunderland) got back into the SSTV groove again finding plenty of activity from Europe on 20m plus his first-ever reception of SSTV signals on 10m, from three DLs.

"M. C. P. Bennett" reveals that he is Michael, at long last! At Slough he found some nice ones on 15m including three VP8s. Attention, all those in Aberdeen! **Stan Sutherland** GM4BKV, secretary of the Aberdeen ARS, tells me of RAE courses starting at the local Tech College in September but he's short of candidates at the moment. Anyone contemplating taking the RAE next May and living around Aberdeen should write to Stan at 67 Greenfern Road, Aberdeen AB2 6TP. Even if next May seems too soon it is still worth looking into. **John Bennett** (Bristol) is yet another newcomer to the amateur bands and he has a Codar CR70A and a 35ft wire. He has already joined the Western-Super-Mare Radio Club which is a very good way of sorting out the mysteries of our hobby!

I was glad to note that **John Porter** (Baslow Derbys) had a look at the CW end of 15 and 20m for a change. Quite a few countries and prefixes can often be heard for new ones down at the LF end of the bands so why not try it out sometime? There are fast ones and slow ones with straight keys and electronic wonders so the newcomer to code need not fear that he won't be able to copy anything at all, even if it is only call-signs.

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EC90	0·86
EC97	0·60
ECC81	0·47
ECC82	0·44
ECC83	0·47
ECC84	0·58
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EF83	0·98
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EF86	1·16
EF89	1·14
EF91	1·00
EF92	1·37
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EZ81	0·38

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PC88	0·95
PC97	0·42
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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	0·64
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
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ECC83	0·38
ECC84	0·35
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ECH42	0·85
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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
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MU14	1·00
N78	3·50
OA2	0·45
OB2	0·45
PC86	0·65
PC88	0·65
PC97	0·55
PC900	0·55
PCC84	0·45
PCC88	0·62
PCC89	0·55
PCC189	0·65
PCF80	0·40
PCF82	0·42
PCF86	0·65
PCF801	0·60
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	0·85
PL504	0·85
PL508	0·90
PL509	1·55
PL802	1·25
PX25	3·50
PY33	0·63
PY81	0·50
PY82	0·45

PY83	0·50
PY88	0·56
PY500	1·10
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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
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1R5	0·50
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6BA6	0·38
6BE6	0·45
6BH6	0·75
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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
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BF200	0·32
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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	0·09
IN4005	0·10
IN4006	0·12
IN4007	0·12
1N4009	0·06
1N4148	0·06
IS921	0·07
IS2033	0·20
IS2051A	0·20
IS2100A	0·20
IS3010	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	0·22
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	0·33
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
SN74197	1·20
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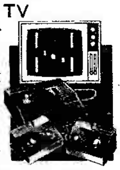

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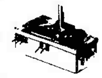

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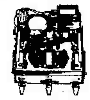

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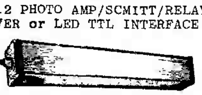

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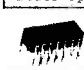

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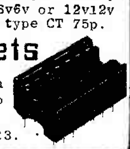

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ON THE AIR

Log extracts

J. Porter:— 15m JA4HG/MM PY2ELV 20m CE6DT FG7AQ KA2AD KV4AAR YS1GW 5L2FH (Liberia) 8P6FU

P. Dawson:— 80m CP1AT EA9FC HP1GD VP2ABC (Barbuda) VP2VBG (Virgin Is) ZP5AL **20m** CE1FA CP1AT FG7AR HR1LM KZ5RT TG9CQ VP1IL VS5MC 9N1MM 9Y4NB

P. Allen:— 20m A4XFX VQ9R 9X5PT

T. Charles:— 80m VP2AYL 8P6CP **40m** HC2JN HK2DBK **VK5QQ ZL4AW 20m FG7XE** FP8CH **HC2IK** HP2BF **OA2BJ** VQ9MC YS1JWD **15m** CE3RC VQ9SS/C (Chagos) **ZS2JL 2m** DR2NO (FM) via DB0SM GC8FBO OZ2BB

M. Connolly:— 80m CE6DP FP8DH JY3ZA PJ8HS **20m** A4XVG C5AG C31LO KZ5JM VE8DC VP2SV 9X5SM

A. Swiffin:— 80m PJ8HS VP1PF **20m** C5AM M1D 5L5F **10m** OJ0MA

P. Barker:— 20m SSTV DJ7IC DL2AE HB9AQU I1MSV K1LEM YZ2CDS **20m** KD4ITU OY8KH ZP5PT **15m SSTV** ON5TB **15m** ZD7FT ZD8RD **10m SSTV** DK4NA DL1WX DL7HT **10m** 8SK2AT

M. Bennett:— 80m 7X4MD **20m** M1D TI2MEF 3B8DO (Mauritius) **15m** M1C TU2FD VP8JC VP8NK VP8ML ZP5VO 7Q7RM 7X0WW

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

SHORT WAVE BROADCASTS

by Derek Bell

A letter arrived "chez Bell" recently from a writer in London, who wishes to remain anonymous, asking "is it really a must to have an expensive communications set to pull in stations like Radio Nacional de Brasil?" On the face of it OM, no, but, and it's that little word that is the crux of the matter, while many SWLs (Short Wave Listeners) and DXers are content with their Astrads and VEFs there are a good many who, after a while, yearn to move on to bigger and better sets. They find that they would like a product detector or that they need the finer tuning that only a more expensive set can give. While we are now in a sunspot minimum and the more far-flung stations are beyond our reach, there will come a time when, as solar activity rises, the transistor portable sets will tend to become cluttered with signals and the AR88, or Trio or Codar with their better sensitivity, selectivity and suchlike refinements will come into their own. A lot of the present licensed amateur operators of today started out as SWLs and decided to seek something a little more complicated. So it seems that if a transistor portable fills your needs then stick with it, but if you seek to probe the far reaches of the bands then a communications receiver is a must.

After having indulged in a little philosophising **Fred Tagg** from Nottingham writes to show us a new wrinkle on DXing. He has hooked his PYE PM128 into a Celestion Ditton speaker and says that it really sounds good. His chimneys look like Jodrell Bank, says Fred, and his logbook has items like:—

Radio Kuwait on 11940 at 1800
Radio Israel on 12025 at 2030
Ghana on 21545 at 1525

Fred also says that being an ex "met" man his main interest is CW transmissions of weather reports and wonders if anyone else has the same interest. **Ian McLean** of Port Glasgow in Scotland has come up against the bane of the SWL, TV timebase interference. Although he is using screened coax cable for his aerial he still gets a "buzzing sound". Ian, I am afraid that there is little that can be done to cure this. In continental countries the TV sets are lined with foil to reduce this nuisance but here in the UK manufacturers do not seem to bother.

Colour TV sets are the worst offenders and they can radiate over several hundred yards. I personally have a "gremlin" that I suspect is a thyristor in a nearby factory, which, on occasions, ruins my medium wave listening with a similar "buzzing sound". Ian says that while in Canada he got a Citizens Band licence and wonders why we cannot have a similar set-up here. Ah! why not, passed to you, Lord Annan.

More "gen" has been sent in regarding the summer changes to schedules. **Geoff. Thompson** from Lincoln reports that Radio Budapest is now airing its DX show on Tuesdays and Fridays at 1515 on 1340, 6025, 7175, 9585, 9833, 11910, 15125 and 17780. This same writer also has logged Radio Argentina al Exterio on 11710 at 2300 using a ITT Euromarine dangling on the end of 12 metres of wire.

Radio Canada International seem to be taking a close look at their mailing list as they are writing to every one of their members asking them to renew for a two-year period. They were kind enough to send a copy of the latest schedule which is as follows:—

0600 to 0800 on 7290 6100 in English, French and German.

1715 to 1800 on 17820, 15325, 7235, 5995 in German.

2005 to 2159 on 15325, 11855, 9685 in French and English.

These details apply to the European target area but the station also has a service for the USSR, Eastern Europe and Africa. I think the DXer here in the UK will be lucky to hear these since the aerial system at Sackville, New Brunswick will not be set to favour us. The World DX Club reports that Radio Pakistan is now asking for reports to be mailed to World Service P.O. Box 443 Karachi. This station runs two 1000 kilowatters at Islamabad and can be heard in English on 15115, 15325, 17700, 17830 and 21730 at various times during the day. They are also noted for dictation speed news broadcasts in English which I think must be unique on the short waves.

"I have also heard Radio Baghdad but I am not sure of the frequency except that it was in the 31m band." These words were penned by **John Higginbotham** of Holyhead and express the feelings of us all. Radio Baghdad is one of the most notorious "floaters" in the short wave spectrum. They were recently reported on 9735 in English at 1955 but their official frequency was announced as 9745 for

ON THE AIR

the English transmission at this time. On another occasion they were logged on 3240 at 1947 while for this time the announced freq. was 9745.

Jon Seddon joins us now, having just built himself a crystal set and fitted it with an ATU. Jon admits that the freqs. he logs are prone to be a little wayward as he only has a "crude tuning scale". He has, however, managed to get some accurate frequencies and these were marked on the dial and the dial then sub-divided with a pair of compasses to give a better readout. I hope, Jon, that you manage to build a more sensitive set, and that we 539kHz, Riyadh in Saudi Arabia on 587kHz with that I will draw the curtain now and wish you and yours best 73s.

MEDIUM WAVE DX

by CHARLES MOLLOY

BABYLON, in Iraq, is the most recent addition to the growing number of megawatt broadcasters on the medium waves. Operating on 1038kHz with a power of 2000kW it beams towards North Africa and can be heard in the UK during the evening between European channels 1034kHz (Milan) and 1043kHz (Dresden). Other high power outlets to search for are Kuwait with 1500kW on 539kHz, Riyadh in Saudi Arabia on 587kHz with 1200kW, Istanbul on 1016kHz with 1200kW and two Libyan stations, El Beida on 1124kHz and Tripoli on 1250kHz each with 1000kW.

The Iberian peninsula is an interesting hunting ground for the medium wave DXer. In Spain there are chains of low power commercial stations spread across the country. Well over 100 of them transmit on 1106kHz, 1133kHz, 1394kHz, 1412kHz, 1430kHz, 1520kHz and 1570kHz and many of them sign-off between 2330 and midnight GMT. The DXer who listens on a single channel at this time can often hear one station after another become dominant only to be replaced after sign-off by a weaker companion. Use a loop to reduce QRM and listen on 1133kHz for ECS8 Sevilla, EFJ19 Castellon, EFJ46 Zaragoza; 1412kHz for EAJ16 Granada, EAJ17 Murcia, EAJ25 Tarrasa, EAJ64 Segovia; 1430kHz for EAK5 Valencia, EAK11 Malaga; 1475kHz for EAJ19 Asturias, EAJ59 Cadiz, EAJ60 Almeria, EAJ72 Zamora; 1570kHz for EFE10 Alava, ECS10 Mancha.

Mark Reddie of Edinburgh, who has been tuning round the medium waves with his Bang and Olufsen 600 receiver, reports hearing Radio Tirana at Durres in Albania on 1457kHz. Mark is building a MW loop aerial and hopes soon to own a communications receiver. **P. Bookbinder** (Shepherds Hill) is astonished to see the results achieved by DXers in reports to this column. He would now like to build a medium wave loop aerial and he wonders where he can obtain plans of one. Articles on loop construction have appeared in *Practical Wireless* issues April 1973 and November 1966. Although these issues are out of print, bound volumes of *Practical Wireless* are usually available in main libraries throughout the UK. A medium wave loop is an indoor aerial that is tunable and directional. It is usually constructed in the shape of a square with a 40in side and has a main winding of seven turns tuned by a 500pF variable capacitor and there is a one-turn coupling winding which is connected to the aerial and earth terminals of the receiver. The windings are supported on a wooden frame. Maximum pick-up is along the plane of the windings and there are two nulls, directions of minimum pick-up, which are at right angles to the windings. When using a loop, peak up the signal with the loop tuning control and rotate the loop for optimum results.

Radio Andorra on 701kHz 300kW broadcasts in French, Spanish and in English (m'nt-0200) and Sud Radio Andorra 818kHz 900kW can be heard in French during the evening. Each station will send a QSL card in return for a correct reception report (and return postage in the form of an International Reply Coupon which is obtainable at main post offices). Andorra, which is a tiny republic in the Pyrenees located between France and Spain does not have a short wave service and the DXer who would like to add this "country" to his verification list will have to turn to the medium waves. The address of both stations is Andorra-la-Vielle, Andorra.

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.

'EASYBUILD' ELECTRONIC CLOCK

continued from page 394

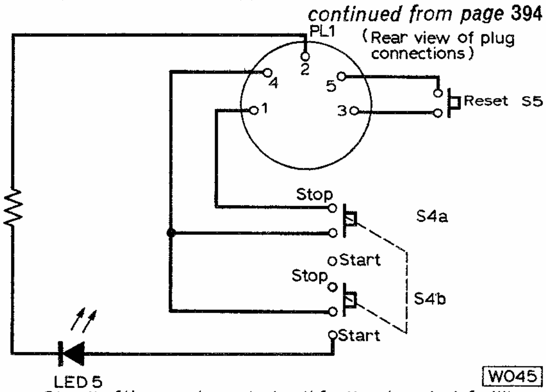

Fig. 6: Circuit of the remote control unit for the stop-clock facility.

physics laboratories for pendulum timing and other applications where timing to the nearest second is sufficient. It could also prove very useful for controlling circuit training activities for athletes and when switched to the Hours and Minutes display mode the stop/start function still operates. Thus the stop clock is perhaps unique in that it allows a stop/start facility over a 23 hour 59 minute period and this could be very useful in biological and biomedical applications. Finally, the beauty is that by simply unplugging the remote control lead the device reverts to a very smart miniature desk clock to impress other executives, an attractive mantlepiece clock to impress your neighbours or a lovely bedroom clock to impress your wife!

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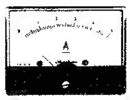
CLEAR PLASTIC MODEL SD640
Size: 85 x 64mm



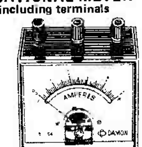
50uA	£4.20	10V DC	£4.05
100uA	£4.15	20V DC	£4.05
200uA	£4.10	25V DC	£4.05
500uA	£4.05	50V DC	£4.05
50-0-50uA	£4.15	300V DC	£4.05
100-0-100uA	£4.10	15V AC	£4.15
1mA	£4.05	300V AC	£4.15
5mA	£4.05	VU Meter	£4.95
10mA	£4.05		
50mA	£4.05		
100mA	£4.05		
500mA	£4.05		
1A DC	£4.05		
5A DC	£4.05		
10A DC	£4.05		
5V DC	£4.05		

CLEAR PLASTIC MODEL SW100
Size: 100 x 80mm

50uA	£5.05	150V AC	£4.90
100uA	£4.95	300V AC	£4.90
500uA	£4.75	VU Meter	£6.25
50-0-50uA	£4.95		
100-0-100uA	£4.90		
1mA	£4.75		
1A DC	£4.75		
5A DC	£4.75		
20V DC	£4.75		
50V DC	£4.75		
300V DC	£4.75		

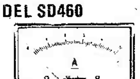
MODEL ED107 EDUCATIONAL METER
Size: 100 x 90 x 150mm including terminals

A range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working.



50uA	£9.35	20V DC	£8.40
100uA	£8.70	50V DC	£8.40
50-0-50uA	£8.70	300V DC	£8.40
1mA	£8.40	500mA/5A DC	£9.50
1-0-1mA	£8.40	5V/50V DC	£9.50
1A DC	£8.40	5V/15V DC	£9.50
5A DC	£8.40	1A/15A DC	£9.50
5V DC	£8.40		
10V DC	£8.40		
15V DC	£8.40		

CLEAR PLASTIC MODEL SD460
Size: 59 x 46mm

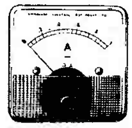


50uA	£3.85	5V DC	£3.65
100uA	£3.80	10V DC	£3.65
200uA	£3.75	20V DC	£3.65
500uA	£3.70	50V DC	£3.65
50-0-50uA	£3.80	300V DC	£3.65
100-0-100uA	£3.75	15V AC	£3.80
1mA	£3.65	300V AC	£3.80
5mA	£3.66	VU Meter	£4.65
10mA	£3.65		
50mA	£3.65		
100mA	£3.65		
500mA	£3.65		
1A DC	£3.65		
5A DC	£3.65		
10A DC	£3.65		

CLEAR PLASTIC MODEL SD830
Size: 110 x 83mm

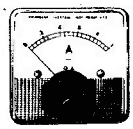
50uA	£4.75	10V DC	£4.50
100uA	£4.65	20V DC	£4.50
200uA	£4.60	50V DC	£4.50
500uA	£4.55	300V DC	£4.50
50-0-50uA	£4.65	15V DC	£4.60
100-0-100uA	£4.60	300V AC	£4.60
1mA	£4.50	VU Meter	£5.60
5mA	£4.50		
10mA	£4.60		
50mA	£4.50		
100mA	£4.50		
500mA	£4.50		
1A DC	£4.50		
5A DC	£4.50		
10A DC	£4.50		
5V DC	£4.50		

CLEAR PLASTIC MODEL MR 45P
Size: 50 x 50mm



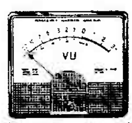
50uA	£3.55	15V AC	£3.40
100uA	£3.50	300V AC	£3.40
200uA	£3.45	5 Meter 1mA	£3.75
500uA	£3.30	VU Meter	£4.30
50-0-50uA	£3.50	1A AC	£3.25*
100-0-100uA	£3.45	5A AC	£3.25*
500-0-500uA	£3.25	10A AC	£3.25*
1mA	£3.25	20A AC	£3.25*
5mA	£3.25	30A AC	£3.25*
10mA	£3.25		
50mA	£3.25		
100mA	£3.25		
500mA	£3.25		
1A DC	£3.25		
5A DC	£3.25		
10V DC	£3.25		
20V DC	£3.25		
50V DC	£3.25		
300V DC	£3.25		

CLEAR PLASTIC MODEL MR 38P
Size: 42 x 42mm



50uA	£3.45	10V DC	£3.05
100uA	£3.40	15V DC	£3.05
200uA	£3.30	20V DC	£3.05
500uA	£3.10	50V DC	£3.05
50-0-50uA	£3.40	100V DC	£3.05
100-0-100uA	£3.30	150V DC	£3.10
500-0-500uA	£3.05	300V DC	£3.10
1mA	£3.05	500V DC	£3.15
1-0-1mA	£3.05	750V DC	£3.15
2mA	£3.05	15V AC	£3.15
5mA	£3.05	50V AC	£3.15
10mA	£3.05	150V AC	£3.15
20mA	£3.05	300V AC	£3.15
50mA	£3.05	500V AC	£3.30
100mA	£3.05	5 Meter 1mA	£3.50
150mA	£3.05	VU Meter	£4.10
200mA	£3.05		
300mA	£3.05		
500mA	£3.05		
750mA	£3.05		
1A DC	£3.05		
2A DC	£3.05		
5A DC	£3.05		
10A DC	£3.05		
3V DC	£3.05		

CLEAR PLASTIC MODEL MR 85P
Size: 120 x 110mm



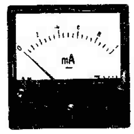
50uA	£6.00	50V DC	£5.75
100uA	£5.95	150V DC	£5.75
200uA	£5.90	300V DC	£5.75
500uA	£5.80	15V AC	£5.85
50-0-50uA	£5.95	300V AC	£5.85
100-0-100uA	£5.90	5 Meter 1mA	£6.65
500-0-500uA	£6.65	VU Meter	£7.10
1mA	£5.75	1A AC	£5.75*
1-0-1mA	£5.75	5A AC	£5.75*
5mA	£5.75	10A AC	£5.75*
10mA	£5.75	20A AC	£5.75*
50mA	£5.75	30A AC	£5.75*
100mA	£5.75		
500mA	£5.75		
1A DC	£5.75		
5A DC	£5.75		
15A DC	£5.75		
30A DC	£5.95		
10V DC	£5.75		
20V DC	£5.75		

EDGWISE MODEL PE70
Size: 90 x 34mm

50uA	£4.55
100uA	£4.50
200uA	£4.45
500uA	£4.30
50-0-50uA	£4.50
100-0-100uA	£4.45
1mA	£4.25
10V DC	£4.25
300V DC	£4.35
VU Meter	£5.50

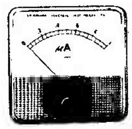
POSTAGE / PACKING & INSURANCE 15p

BAKELITE MODEL S80 Enlarged Window
Size: 80 x 80mm



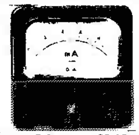
50uA	£4.95
100uA	£4.90
500uA	£4.60
50-0-50uA	£4.80
100-0-100uA	£4.85
1mA	£4.60
1A DC	£4.60
5A DC	£4.60
20V DC	£4.60
50V DC	£4.60
300V DC	£4.60
300V AC	£4.75
VU Meter	£5.95

CLEAR PLASTIC MODEL MR 52P
Size: 60 x 60mm



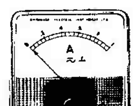
50uA	£4.10	5 Meter 1mA	£4.20
100uA	£3.85	VU Meter	£4.85
500uA	£3.70	1A AC	£3.65*
50-0-50uA	£3.85	5A AC	£3.65*
100-0-100uA	£3.70	10A AC	£3.65*
1mA	£3.65	20A AC	£3.65*
5mA	£3.65	30A AC	£3.65*
10mA	£3.65		
50mA	£3.65		
100mA	£3.65		
500mA	£3.65		
1A DC	£3.65		
5A DC	£3.65		
10V DC	£3.65		
20V DC	£3.65		
50V DC	£3.65		
300V DC	£3.65		
15V AC	£3.75		
300V AC	£3.75		

BAKELITE MODEL MR 65
Size: 80 x 80mm



25uA	£5.80	300V DC	£3.95
50uA	£4.40	30V AC	£3.95*
100uA	£4.35	50V AC	£3.95*
500uA	£4.05	150V AC	£3.95*
50-0-50uA	£4.35	300V AC	£3.95*
100-0-100uA	£4.30	500V AC	£3.95*
500-0-500uA	£3.95	VU Meter	£5.20
1mA	£3.95	1A AC	£3.95*
1-0-1mA	£3.95	5A AC	£3.95*
5mA	£3.95	10A AC	£3.95*
10mA	£3.95	20A AC	£3.95*
50mA	£3.95	30A AC	£3.95*
100mA	£3.95	50A AC	£3.95*
500mA	£3.95	500mA AC	£3.95
1A DC	£3.95	50mV DC	£4.15
2A DC	£3.95	100mV DC	£4.15
5A DC	£3.95		
10A DC	£3.95		
15A DC	£3.95		
30A DC	£3.95		
50A DC	£4.20		
5V DC	£3.95		
10V DC	£3.95		
15V DC	£3.95		
20V DC	£3.95		
50V DC	£3.95		
150V DC	£3.95		

CLEAR PLASTIC MODEL MR 65P
Size: 86 x 78mm



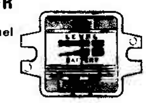
50uA	£4.35	300V DC	£4.10
100uA	£4.25	15V DC	£4.20
200uA	£4.20	50V AC	£4.20
500uA	£4.15	150V AC	£4.20
50-0-50uA	£4.25	300V AC	£4.20
100-0-100uA	£4.20	500V AC	£4.30
500-0-500uA	£4.10	5 Meter 1mA	£4.85
1mA	£4.10	VU Meter	£5.20
1-0-1mA	£4.10	1A AC	£4.10*
5mA	£4.10	5A AC	£4.10*
10mA	£4.10	10A AC	£4.10*
50mA	£4.10	20A AC	£4.10*
100mA	£4.10	30A AC	£4.10*
500mA	£4.10	50A AC	£4.10
1A DC	£4.10	50mA AC	£4.10*
5A DC	£4.10	100mA AC	£4.10*
10A DC	£4.10	200mA AC	£4.10*
15A DC	£4.10	500mA AC	£4.10*
20A DC	£4.20		
30A DC	£4.25		
50A DC	£4.10		
5V DC	£4.10		
10V DC	£4.10		
15V DC	£4.10		
20V DC	£4.10		
50V DC	£4.10		
150V DC	£4.10		

240° Wide Angle 1mA METERS

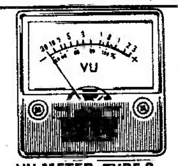
MW1-6 60 x 60 mm
£7.00 P/P & Ins 15p
MW1-8 80 x 80mm
£7.45 P & P Ins.15p

ALL PRICES INCLUDE VAT

BATTERY/LEVEL PANEL INDICATOR



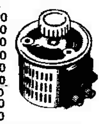
18mm Panel mounting.
OUR PRICE 95p P/P & Ins 15p Discounts for quantity.



VU METER TYPE 3
250uA Size: 33mm × 20mm.
£1.55 P/P & Ins 15p

REDUCED TO CLEAR

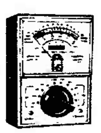
YAMABISHI VARIABLE VOLTAGE TRANSFORMERS
Excellent quality at low cost. Input: 230V 50/60Hz. Output 0–260V.
MODEL S260 BENCH MOUNTING



		P/P & Ins
1A	£7.30	£1.50
2.5A	£10.35	£1.50
5A	£12.95	£1.50
8A	£19.45	£1.50
10A	£23.75	£1.50
12A	£25.90	£1.50
20A	£60.45	£1.50
25A	£64.75	£1.50
40A	£73.40	£1.50

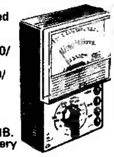
LASKYS make sense of Test Equipment

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 × 10, × 1000 (30Ω centre scale) DC Current 50uA/2.5mA/250mA. –20 to +68 dB.

OUR PRICE £7.50 P/P & Ins 30p

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IT MAKES SENSE TO
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 +63 dB.
OUR PRICE £8.10 P/P & Ins 30p
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 £11.60 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 +17 dB.
OUR PRICE £18.90 P/P & Ins 60p
KAMODEN HM720B FET VOM
Input impedance 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
OUR PRICE £24.30 P/P & Ins 60p
RUSSIAN CI16 Double Beam OSCILLOSCOPE
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.
OUR PRICE £93.95 P/P & Ins £2.00
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 £8.60 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
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
SWR METER Model SWR3
Handy SWR meter for transmitter antenna alignment, with built-in field strength meter. Accuracy 5%. Impedance 52' Indicator 100uA DC. Full scale 5 section collapsible antenna. Size 145 x 50 x 60mm.
OUR PRICE £4.55 P/P & Ins 60p
MODEL TE15 GRID DIP METER
Transistorised. Operates as Grid Dip, Oscillator, Absorption Wave Meter and Oscillating Detector. Frequency range 440kHz−280MHz in six coils. 500uA meter. 9V battery operation. Size: 180 x 80 x 40mm.
OUR PRICE £18.90 P/P & Ins 30p
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.
OUR PRICE £11.85 P/P & Ins 60p
TMK 200 MULTIMETER KIT
Build yourself a quality 20000 opv. multimeter and save money. Complete kit with meter scale, movement and rotary range selector ready mounted in cabinet. All parts, batteries, test prods and instructions. Ranges: 0/0.6/6/30/120/600/1200V D.C. 0/6/30/120/600/1200V A.C. Current: 0/0.6/6/60/600mA. Resistance: 0/10/100K/1/10 Meg ohms. Decibels: −20 to +63db. Size: 90 x 150 x 35mm
OUR PRICE £9.65 P/P & Ins 30p
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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CD4031	£5·19	NE555V	70p	SN7442	65p	SN74151	85p	TBA820	£1·15
CD4037	£1·93	NE556	£1·30	SN7446	95p	SN74153	85p		
CD4041	£1·86	NE560	£4·48	SN7447	95p	SN84154	£1·50		

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2N699	59p	2N4058	18p	AF279	70p	BF117	55p	OC42	50p
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2N3702	12p	AC176	30p	BC328	22p	MJ2955	£1·00	BYZ12	51p
2N3703	13p	AC187K	35p	BCY70	17p	MJE340	48p	OA47	6p
2N3704	15p	AC188K	40p	BCY71	22p	MJE370	65p	OA81	18p
2N3706	15p	AD143	68p	BCY72	15p	MJE371	75p	OA90	6p
2N3708	14p	AD161	50p	BD121	£1·00	MJE520	60p	OA91	6p
2N3714	£1·38	AD162	50p	BD123	82p	MJE521	70p	WO21A200	
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2N3773	£2·65	AF115	35p	BD132	50p	MP8113	47p	ST2diac	20p
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2N3904	27p	AF124	30p	BD138	63p	MPSA55	31p	ORP12	60p

Prices correct at August 1975, but all exclusive of VAT. P. & P. 25p.

SPARKRITE MK2

CAPACITIVE DISCHARGE
ELECTRONIC IGNITION KIT

Voted best of 8 ignition systems tested by a leading Motoring Magazine

Sparkrite Mk. 2 is a high performance, high quality, capacitive discharge, electronic ignition system. Because of the superb design of the Sparkrite circuit it completely eliminates problems of the contact breaker. There is no misfire because contact breaker bounce is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R.P.M. Contact breaker burn is eliminated by reducing the current to about 1/50th of the norm. It will perform equally well with new, old, or even badly pitted points and is not dependent upon the dwell time of the contact breakers for recharging the system.
Sparkrite incorporates a short circuit protected inverter which eliminates the problems of SCR lock on and therefore eliminates the possibility of blowing the transistors or the SCR. (Many capacitive discharge ignitions are not completely foolproof in this respect.)

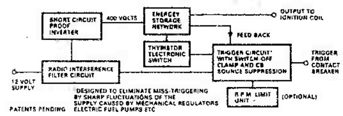
Sparkrite can therefore give you:
up to 20% better fuel consumption, instant all weather starting, cleaner plugs—they last up to 5 times longer without attention, faster acceleration, higher top speeds, longer coil and battery life, efficient fuel burning and less air pollution, smoother running, continual peak performance.

NOTE—FUEL CONSUMPTION:
The fitting of a Sparkrite Mk. 2 should reduce fuel consumption although the amount of the reduction will vary. A fair estimate of the savings which could be expected, based on reports by our customers and upon our own experience, are as follows:

any 4-cylinder vehicle, 10% improvement
any 6-cylinder vehicle, 15% improvement
any 8-cylinder vehicle, 20% improvement

It is worth remembering that while fuel saving is important there are many other advantages to be gained from fitting a Sparkrite ignition system.

THE KIT COMPRISES EVERYTHING NEEDED: Ready drilled pressed steel case coated in matt black epoxy resin, ready drilled base and heatsink, top quality 5-year guaranteed transformer and components, cables, coil connectors, printed circuit board, nuts, bolts, silicon grease, full instructions to make the kit negative or positive earth, and 10 page installation instructions.
WE SAY IT IS THE BEST SYSTEM AT ANY PRICE.



OPTIONAL EXTRAS
Electronic R.P.M. limitation
This can be included in the unit to prevent over revving, an advantage to most companies, hire firms, high performance drivers, etc.
Electronic/conventional ignition switch.
Gives instant changeover from "Sparkrite" ignition to conventional ignition for performance comparisons, static timing, etc., and will also switch the ignition off completely as a security device. Includes: switch, connectors, mounting bracket and instructions. Cables excluded.

PRICES: D.I.Y. assembly kit **£10·93***; Ready built unit **£13·86*** (both to fit all vehicles with coil/distributor ignition up to 8-cylinders).
Switch for instant changeover from "Sparkrite" ignition to conventional ignition **£2·79***, R.P.M. limiting control **£2·42*** (fitted in case on ready built unit, dashboard mounting on kit).
* including VAT, post and packing
We can supply units for any petrol-engined vehicle (boat, motorcycle, etc.) with coil/contact breaker ignition. Details on request.
CALL IN AND SEE US FOR A DEMONSTRATION

ELECTRONICS DESIGN ASSOCIATES of WALSALL

ALUMINIUM BOXES

These project boxes are manufactured from 18-gauge aluminium and come complete with lids and screws.
The prices shown include VAT (at 8%) but 18p should be added to the total order value for postage and packing.

Order No.	Length (in)	Width (in)	Height (in)	Price (inc. VAT)
7	5¼	2¾	1½	**47p**
8	4	4	1½	**48p**
9	4	2¾	1½	**46p**
10	5¼	4	1½	**49p**
11	4	2½	2	**46p**
12	3	2	1	**38p**
13	6	4	2	**58p**
14	7	5	2½	**75p**
15	8	6	3	**93p**
16	10	7	3	**£1·14**

Boxes can be made to any size but the minimum order for special sizes is 500. General trade enquiries welcome.

FLUORESCENT LIGHT KIT

You can build this reverse polarity protected 12 volt, 8 watt, fluorescent light. Everything needed is supplied: white enamelled drilled metalwork, ready drilled heat-sink, printed circuit board, high quality components and transformer, end caps, cable, the fluorescent tube, nuts, bolts, washers, and simple assembly and operating instructions.
When complete the light has many uses: workshop and workbench illumination, garage lighting, emergency lighting, lighting for camping, caravaning, and boating, as an inspection lamp and many more.
If you can't spare ½hour to put the light together then we will supply it ready built (FOR A FEW EXTRA PENCE)
PRICES:
Assembly kit **£3·46** inc VAT post and packing
Ready built **£4·10** inc VAT post and packing.
Diffuser 59p inc. VAT post and packing.

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To: ELECTRONICS DESIGN ASSOCIATES DEPT. PW9
82 Bath Street, Walsall WS1 3DE. Phone 33652

From Name ....

Address ....

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Please Supply

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	SPARKRITE Mk. 2 ready built negative earth at £13·86
	SPARKRITE Mk. 2 ready built positive earth at £13·86
	Ignition changeover switches at £2·79
	R.P.M. Limit systems in the above units at £2·42
	Fluorescent light assembly kits at £3·46
	Fluorescent light built units at £4·10
	Diffusers for the above at 59p
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	of number alum. boxes at
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Bargain component parcels contain Resistors, Capacitors, Potentiometers, Knobs, Tag Strips, Coil Formers, Wire, Grommets, Magnets, Transistor Panels, etc. Save yourself £'s on these well selected parcels, 6lb net weight **£1·00**, p.p 70p.
Brand New Wire-wound Resistors 1-7 watts, mostly Plessey GWS-1-3-5-7. Good selection. 100 for **£1·00**, p.p. 35p.
Mullard Ferrite Cores LA3 **50p**, LA4 **75p**, LA2100 **50p**.
SPECIAL OFFER. Metallised Polyester Capacitors by Erie, Mullard, etc. Values include ·01/160V, ·01/250V, ·015/160V, ·022/160, ·033/160, ·047/160V, ·068/160V, ·1/160–250V, ·22/160V, etc. This is a bargain not to be missed. 100 for **£1·50**, p.p 35p.
Assorted Capacitors, Silver Mica, Tubular and Disc Ceramics, Polystyrene, Tremendously good selection. 300 for **£1**, p.p. 35p.
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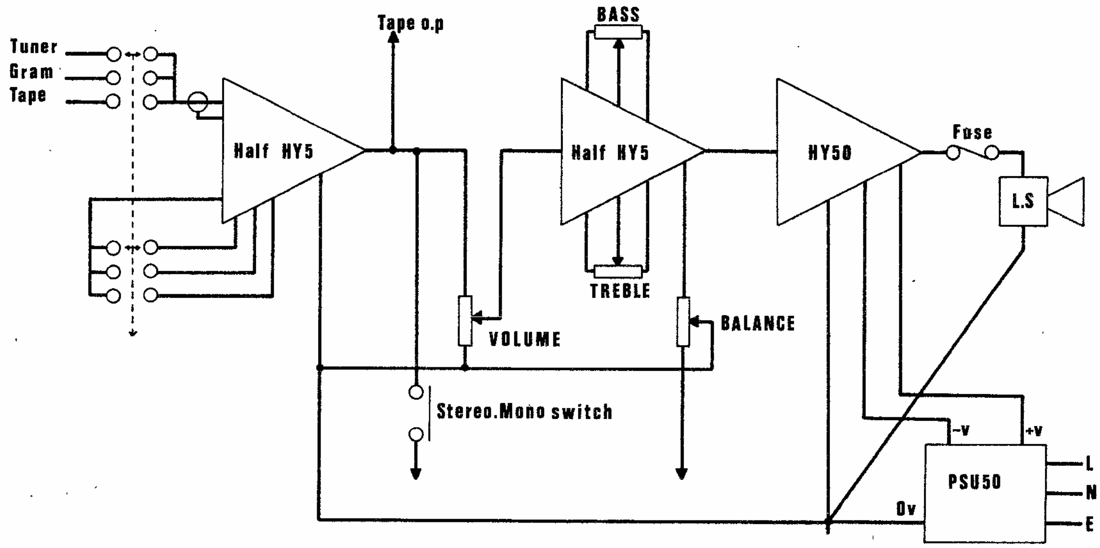
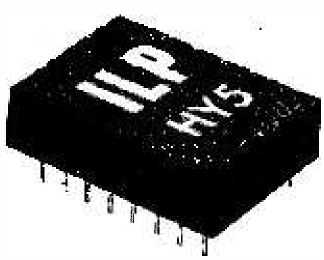


MONO ELECTRICAL CIRCUIT DIAGRAM WITH INTERCONNECTIONS FOR STEREO SHOWN



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

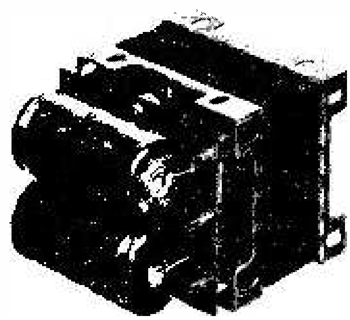
TECHNICAL SPECIFICATION
Inputs: Magnetic Pick-up 3mV RIAA: Ceramic Pick-up 30mV; Microphone 10mV; Tuner 100mV; Auxiliary 3–100mV; input/impedance 47kΩ at 1kHz. **Outputs:** Tape 100mV; Main output 0db (0·775V RMS). **Active Tone Controls:** Treble ± 12db at 10kHz; Bass ± 12db at 100Hz. Distortion: 0·5%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

PRICE £4·50 + 36p VAT P. & P free

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

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

PRICE £5·98 + 48p VAT P. & P. free



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

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

PRICE £6 + 48p VAT P. & P. free

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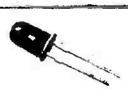
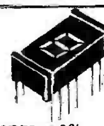
A plastic box with moulded extrusion rails for PC or Chassis panels with metal front plate fitted with four screws (all supplied).
An ideal box to give a small project a professional finish. SIZE (internal) 81mm × 51mm × 28mm.
OUR PRICE **40p.** +8%

JB11D STEREO JUNCTION BOX
The most popular stereo junction box. Facility for two pairs of headphones and two speakers. 3 position switch selects headphones, loudspeakers or both. A bargain at **£2·50** +25%





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	RED	GREEN	YELLOW	AMBER
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For full information on low cost displays please send 15p.

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1 Pole 12 Way
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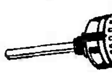
2 Pole 6 Way
3 Pole 4 Way
4 Pole 3 Way
22p each +8%



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All types 1" and less diameter

Singles		Dual	
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50K	17p each	50K	Switch
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FERRIC CHLORIDE
Anhydrous ferric chloride in double sealed one pound poly packs.
Our Price **50p** + P/P + VAT @8% per lb.

MAINS TRANSFORMERS
Open Type Double Wound Continuously Rated, two hole fixing clamp with colour coded flying leads, varnish impregnated. Approx. size: 1¾" × 1½" × 1½" high Fixing centres: 2⁵/₃₂".
TR1 20-0-20v 100 m/a
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TR3 9-0-9 v 100 m/a — 240 Volt
TR4 6-0-6 v 100 m/a — Primary
TR5 3-0-3 v 100 m/a
Our Price **£1·23 each** +8%

MONO/STEREO MICROPHONE MIXER
9 volt. High impedance input. Gold finish with four black plastic chrome tipped level control knobs. On/Off switch and stereo/mono switch. 4 Input sockets.
SPECIFICATIONS:—
Input Imp = For XTAL Mics etc.
Gain = Approx 3.DB.
Max Input Sig = 1 volt
Max Output Sig. = 1·3 volt
Noise Ratio = —60DB
Supply = 9 volt
OUR PRICE = **£5·25p** +25%

POWER SUPPLY UNITS
PP1 switched 3, 4½, 6, 7½, 9 and 12 volts at 500 m/a, with on/off switch and pilot light. Size: 130mm × 55mm × 75mm. **ONLY £4·00.**
PP2 Switched 6 – 7½ – 9 volt Battery Eliminator. Approx. size 2¾" × 2¼" × 3½". Ideal for cassette recorders **£3·25**
PP3 Car converter. From 12v Pos. or Neg. to = 6 – 7½ – 9 volt. Easy to fit and transistor regulated **£3·90**
+8%

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2½ × 3¾	38p	28p	18p
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3¾ × 5	47p	49p	34p
17 × 2½	1·24p	93p	69p
17 × 3¾	1·69p	1·32p	97p
17 × 5	2·16p		1·37p

Pin insertion tool **81p**
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LOUDSPEAKERS +25%
2½" 8 ohm **50p**
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*EMI 13" × 8" 450 Kit
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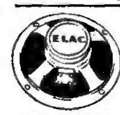

10 inch DUAL CONE L/S
Manufactured by "ELAC" to a very high standard these loudspeakers are a real bargain
SPEC:—Size = 10" Dual Cone.
Power = 10 Watts
Frequency = 40-12000Hz
+25% Our Price = **£3·75p each**

MAINS KEYNECTOR
Keynector connects any Electrical Equipment to the mains supply in seconds. Ideal for bench, garage demonstrations, etc. Multi connections can be made (max. load 13A fused).
£3·25p. +8%

ALUMINIUM BOXES +8%
Metal project boxes give your work a professional finish

	L	W	H	
AB7	2¼	5¼	1½	54p
AB8	4	4	1½	63p
AB9	4	2¼	1½	54p
AB10	4	5¼	1½	63p
AB11	4	2½	2	54p
AB12	3	2	1	45p
AB13	6	4	2	69p
AB14	7	5	2½	84p
AB15	8	6	3	99p
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ABS PLASTIC BOXES +8%
Handy boxes for construction projects. Moulded extrusion rails for P.C. or chassis panels. Fitted with 1mm front panels.
1005 = 105mm × 73mm × 45mm = **51p**
1006 = 150mm × 75mm × 47mm = **66p**
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Fully extended = 43"
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ME6 = 0 to 50 micro amp Full Scale
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ME12 = 0 to 50 m/a Full Scale
ME13 = 0 to 100 m/a Full Scale
ME14 = 0 to 500 m/a Full Scale
ME15 = 0 to 1 amp Full Scale
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OUR PRICE **£3·00** +8%

200/250v MAINS RELAY
Heavy duty contacts 2·500 ohm coil All new and unused D.P.D.T. mains relays **50p.** Carr. Free. Special quantity **£40** per 100 off.

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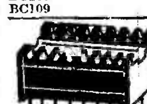

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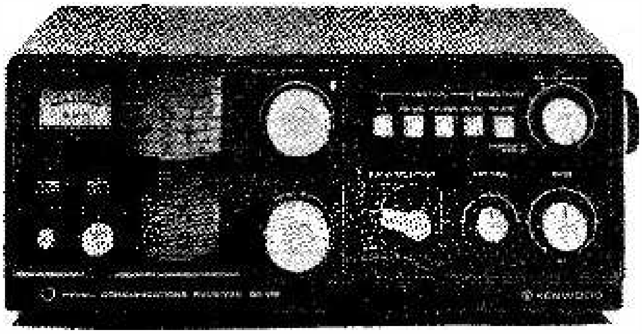

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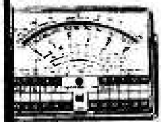

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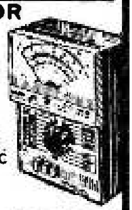

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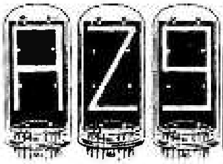

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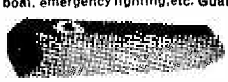

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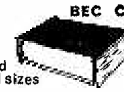

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AF127	30p	BCY70	15p	MPF104	30p	ZTX301	14p	2N2222	20p	2N4061	13p
AF139	33p	BCY71	18p	MPF105	30p	ZTX302	18p	2N2303	25p	2N4062	14p
AF181	45p	BCY72	12p	OC23	144p	ZTX304	22p	2N2369	14p	2N4871	31p
AF186	48p	BD124	75p	OC26	40p	ZTX311	10p	2N2483	30p	2N5457	30p
AF239	38p	BD131	40p	OC28	48p	ZTX341	19p	2N2646	38p	2N5458	30p
BC107	9p	BD132	40p	OC35	48p	ZTX500	15p	2N2904	20p	2N5459	30p
BC108	9p	BD137	45p	OC36	52p	ZTX501	13p	2N2906	15p	3N140	85p
BC108B	12p	BD145	55p	OC41	15p	ZTX502	18p	2N2907	18p	3N141	85p
BC109	9p	BDY60	75p	OC42	15p	ZTX504	42p	2N2926G	10p	40361	40p
BC109C	12p	BDY61	65p	OC44	12p	ZTX531	23p	2N2926O	8p	40362	40p
BC147	7p	BF115	22p	OC45	12p	ZTX550	18p	2N2926R	8p	40673	58p

TTL 74● DIGITAL ICs

Less 5% for 15+ mixed
Less 10% for 25+ mixed

7400	14p	7430	15p	7475	32p
7401	14p	7432	25p	7476	32p
7402	15p	7433	36p	7480	44p
7403	15p	7437	27p	7481	99p
7404	18p	7438	27p	7482	75p
7405	18p	7440	15p	7483	83p
7406	38p	7441	65p	7484	90p
7407	38p	7442	65p	7485	125p
7408	15p	7443	120p	7489	275p
7409	15p	7444	105p	7490	40p
7410	15p	7445	86p	7491	80p
7411	20p	7446	105p	7492	48p
7412	20p	7447	100p	7493	39p
7413	35p	7448	70p	7495	63p
7414	60p	7450	15p	7496	72p
7416	35p	7451	15p	74121	32p
7417	35p	7453	15p	74122	45p
7420	15p	7454	15p	74123	63p
7422	24p	7460	15p	74141	65p
7423	27p	7470	30p	74151	69p
7425	27p	4772	26p	74190	160p
7426	27p	7473	33p	74191	160p
7428	38p	7474	32p		

DIODES

BY100	18p
BY127	11p
OA5	38p
OA9	9p
OA10	36p
OA47	8p
OA70	8p
OA79	8p
OA81	8p
OA85	10p
OA90	6p
OA91	6p
OA100	10p
OA200	6p
OA202	6p
1N914	4p
1N4001/2	5p
1N4003	5p
1N4004/5	6p
1N4006/7	6p
1N4148	5p
1S920	6p
1S921	6p

VIDEO SPORT●

Play the three exciting games, TENNIS, FOOTBALL & HOLE IN THE WALL on your own TV Screen. Just plug the Video Sport to the aerial socket and play the Tele Sport at the touch of the button. Only £30·00 (+8% VAT) p & p 50p

EARPHONES

With Cord and Jack Plug Magnetic

2·5 mm plug	15p
3·5 mm plug	15p
Crystal 3·5 mm plug	28p

LINEAR IC'S

709C 14 pin	29p	LM304H	170p	SN76023	160p
741C	26p	LM305	170p	SN76115	200p
747C	70p	LM380	95p	TAD100	130p
748C	28p	LM381	160p	TBA800	95p
AY-1-0212	5·50p	LH3900	65p	TBA810	150p
AY-1-5051	1·15p	MC724P	55p	ZN414	95p
AY-5-1224●	365p	MC1303L	148p		
AY-5-3500●	610p	MC1304P	360p		
AY-5-3507●	610p	MC1310P	220p		
AY-5-4007●	735p	MC1710CG	55p		
CA3018	72p	MFC4000B	54p		
CA3020	145p	MFC6040	82p		
CA3035	135p	MLM309K	158p		
CA3036	90p	NE555●	48p		
CA3046	55p	NE556DB●	99p		
CA3048	220p	NE565	304p		
CA3075	150p	NE562	315p		
CA3081	150p	NE567	249p		
CA3089E	195p	SL403D	160p		
CA3090AQ	250p	SL414A	160p		
CA3123E	140p				
LM300H	170p				
LM301	42p				

REGULATOR●

723C	45p
7805 (TO3)	150p
7815 (TO3)	160p
LM309K	185p
MVR12	144p

ZENER DIODES

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

BRIDGE RECTIFIERS (plastic case)

1A50V	20p
1A100V	24p
1A200V	26p
1A400V	27p
1A600V	29p
2A50V	30p
2A100V	38p
2A200V	44p
2A400V	48p
2A600V	54p
4A100V	53p
4A400V	80p
4A800V	90p
6A100V	64p
6A400V	80p
BY122	54p
BY164	48p

DIAC

ST2 20p

SCR● (Thyristors)

1A 50V	38p
1A 100V	42p
1A 200V	47p
1A 400V	52p
1A 600V	70p
3A 50V	38p
3A 100V	43p
3A 200V	55p
3A 400V	74p
3A 600V	99p
5A 400V	90p
7A 400V	90p
7A 600V	108p
C106B	37p
MCR101	29p
TIC44	29p
2N4444	191p

THERMISTORS

THB11	135p
THB12	135p

DENCO COILS

Miniature Dual purpose

Rng. 1-5 B,Y,R,W	60p
6-7 B,Y,R	58p
1-5 Green	65p
MAXI-Q Aeriel Coil. Range 2-T. Blue	60p
Transistor Tuning coils Rng. 1-5 B,Y,R,W	70p
IFT 13/14/15	65p each
IFT 18/465	75p
TOC 1	70p
MW F.R. Aerial	70p

FERRITE RODS

⅜" diam.
2" – 8p; 5½" – 15p;
6¾" – 18p

ENAMEL COPPER WIRE (2oz reel)

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

OPTO ELECTRONICS●

LED TIL 209 (red) with socket	18p
LED Larger 0·2" diam. Red	15p
LED Larger Green, Yellow, Amber	19p
7 Seg Display MINITRON 3015F	100p
7 Seg Display MAN 3640	170p
OCP 70 40p ORP 12 58p 2N 5777	41p
OCP 71 85p ORP 61 46p	

FUSES AND HOLDERS

20mm 150mA-5A 3p 5A, 7A, 10A,
1¼" 500mA-15A 3p 13A. 15p
Anti-surge 20mm
100, 250, 500, 800mA, 1A, 1·6, 2, 2·5, 3·15, 5A 7p each
1" Mains, 2A, 3A.

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

ALUM. BOXES with lid●

2¾x5¼x1½"	50p
4x4x1½"	50p
4x2¾x1½"	50p
4x5¼x1½"	58p
4x2¼x2"	50p
3x2x1"	44p
6x4x2"	78p
7x5x2½"	84p
8x6x3"	106p
10x7x3"	122p
10x4½x3"	110p
12x5x3"	120p

SPEAKERS

8Ω 0·5W

3"	62p
2½"	58p

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

400V: 0·001, 0·0012, 0·0015, 0·0018, 0·0022, 0·0033 **3p**; 0·0047, 0·0068, 0·01, 0·015, 0·022 **4p**; 0·033, 0·047, 0·068, 0·1, 0·15, 0·22, **7p**; 0·33, **13p**; 0·47, **17p**; **160V:** 0·1, 0·15, **4p**; 0·22 **5p**; 0·33 **6p**; 0·47 **9p**; 0·68 **13p**; 1·0 **18p**.

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

250V: 0·01, 0·015, 0·022, 0·033 **3p**; 0·047, 0·068, 0·1 **4p**; 0·15 **6p**; 0·22, 0·33 **7p**; 0·47 **9p**; 0·68 **10p**; 1·0 **14p**; 1·5 **22p**; 2·2 **24p**.

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. 18V:** 1000, 1500, **18p.** **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: **11p** 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: 2pf to 10,000pf	2p
0·015µf, 0·022µf, 0·033µf, 0·047µf	3p

QUALITY RESISTORS. ERIE MAKE,

Carbon, Miniature, High Stability, Low Noise

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

JACKSONS VARIABLE CAPACITORS

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

JACK PLUGS / SOCKETS

	Jack Plugs: Screened chrome	Jack Plugs: Plastic body	Sockets: Open metal	Sockets: Moulded with break contacts
2·5mm	10p	8p	8p	
3·5mm	14p	10p	8p	
Standard Mono	19p	13p	13p	15p
Standard Stereo	32p	18p	15p	20p

	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.)	9p
PHONO Metal screened	12p	10p (trpl.)	
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 DC
ME 17	0–300V AC
ME 18	"S" Meter
ME 19	"VU" Meter

Price £2·75, p & p 10p

SWITCHES●

TOGGLE: SPST 20p
DPDT 24p

SUB-MIN TOGGLE

SP changeover	45p
SPST on/off	40p
DPDT 6 Tag	84p

SLIDE:

1A DP 250V	10p
1A DP 250V C/O	12p
½A DP 250V	9p

PUSH BUTTON:
Miniature Non Locking

Push to Make	15p
Push to Break	25p
DP Changeover	40p

ROCKER (white): 10A 250V SP changeover centre off 25p
ROCKER: Illuminated (white) lights when on. 3A 240V 46p
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	6p

(Mica & 2 washers)

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	180p
0–6, 0–6V (MT 280)	280mA	165p
24–0–24V	500mA	220p
30-24-20-15-12-0	1A●	285p
30-24-20-15-12-0	2A●	340p
LT44 Mini. Driv. Pri 20K Sec 1K		65p
LT700 Mini. Output. Pri 1·2K Sec 5Ω		65p

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 6V 12V	7p
NEON: RED round top 250V	21p
NEON: ¼" square top, red, green, Req. ⅜" hole	21p

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

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

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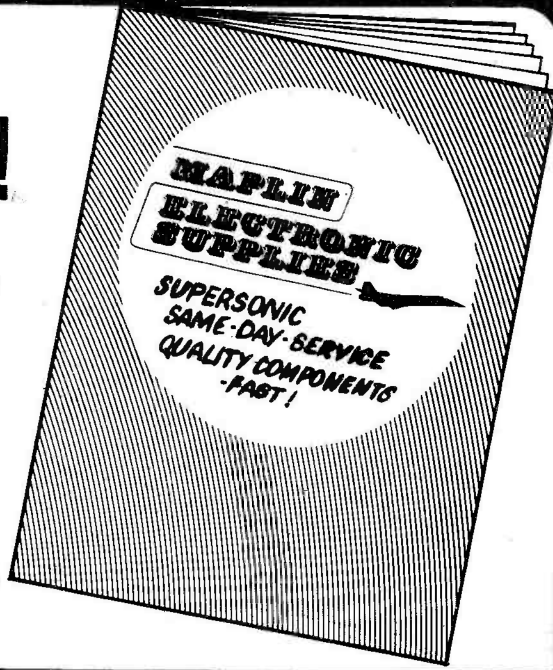


PROJECTS FOR YOU TO BUILD

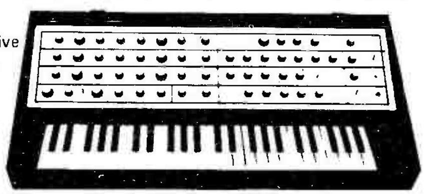
4-digit clock, 6-digit clock, 10W high quality power amp., High quality stereo pre-amp., Stereo Tuner, F.M. Stereo decoder, etc., etc.

CIRCUITS . . . Frequency Doublers, Oscillators, Timers, Voltmeters, Power Supplies, Amplifiers, Capacitance Multiplier, etc., etc. . . .
Full details and pictures of our wide range of components, e.g. capacitors, cases, knobs, veroboards, edge connectors, plugs and sockets, lamps and lampholders, audio leads, adaptor plugs, rotary and slide potentiometers, presets, relays, resistors (even 1% types!), switches, interlocking pushbutton switches, pot cores, transformers, cable and wire, panel meters, nuts and bolts, tools, organ components, keyboards, L.E.D.'s, 7-segment displays, heatsinks, transistors, diodes, integrated circuits, etc., etc., etc. . . .

Really good value for money at just 40p.

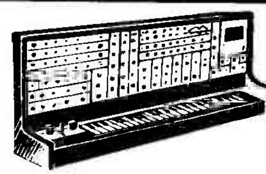
The 3600 SYNTHESISER

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



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

The 4600 SYNTHESISER



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

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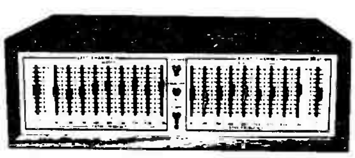

S.A.E. for price list or complete reprint of article – price 15p.

ELECTRONIC ORGAN

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

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

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I enclose Cheque/P.O. value ______________ PW
For ____ copy/copies of your Catalogue
Name ______________________
Address ______________________
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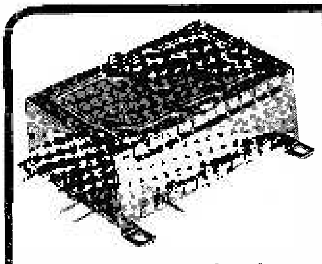
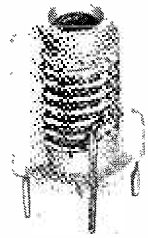
MAPLIN ELECTRONIC SUPPLIES P.O. Box 3 Rayleigh Essex SS6 8LR.

Illustrated below are some of the products that TOKO make for wireless manufacture. These and other TOKO products are available from Ambit, together with many linear and discrete semiconductor devices specializing in radio and audio applications. Full catalogue 40p.

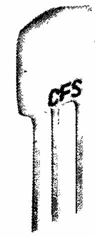
wireless tecknowledgey from TOKO



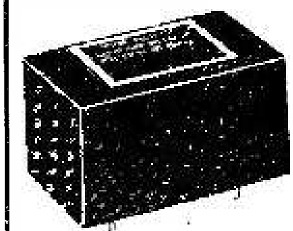
Varicap FM tunerhead:
The EF5603 represents the top o' the range in TOKO FM tuner modules. With 5 double varicap tuned circuits, and dg MOSFET RF stage, the performance is really excellent. (12v supply) 1-24 £9.05 each



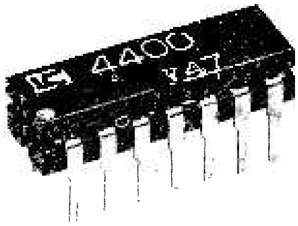
Coils for VHF RX/TX's
S18 are fully molded coils, complete with cores. A wide range of custom types with up to two taps is available - standard types for VHF are avilable ES. 1-24 18p each



Ceramic IF filters
Similar to Murata and Vernitron types, these ceramic filters are the easiest way to achieve FM IF selectivity. Two per set are required. 1-24 40p each

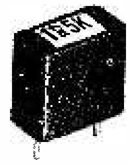


6 pole linear phase filter
Centered on 10.7MHz, this linear phase filter offers all the necessary selectivity for the construction of a Hi Fi FM stereo tuner. 1-24 £2.25 each

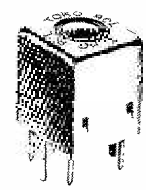


ICs for IF, decoder
The popular 1310, and 3089 types for FM MPX.
1310/4400 1-24 2.20 each
3089/4402 1-24 1.94 each

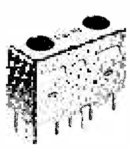
19 & 38 kHz notch filter
BLR3107 filters will remove the interference that causes annoyance when listening to or recording from MPX transmissions on FM. 1-24 £1.60ea



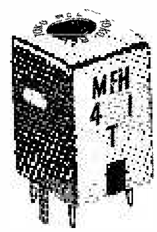
7BA Low cost RF choke
Miniature chokes 1uH to 1mH. Useful for all low power decoupling applications in RF circuits, logic circuits, filter circuits etc. Stock values 1, 4.7 and multiples through to 1mH. Custom orders 1000 min. for other values 1-24 15p ea



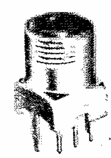
10K coils for HF/VHF
The ideal coil for all FM and TV IF applications. Excellent stability - available from a very broad 'shelf stock' range, and also to exact custom specs., where a min. of 1000 pcs applies. With or without an internal capacitor. 1-24 30p ea



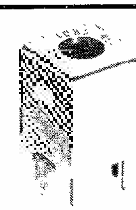
CFT ceramic series AM IF filters
Low cost filters for use with IC or discrete circuits. Each unit includes an input/output matching transformer. For 455 and 470 kHz BW 6kHz. CFT 1-24 50p each, or slightly larger with higher Q: CFU050 (470 kHz only) 1-24 55p each.



MFH mechanical 455kHz IF filters
Bandwidth 4 or 7 kHz, for IC and discrete IF strips. Includes input/output IFT for matching 5k/800 ohms. 1-24 £1.45 each



7P min MF/HF coils
Only 7mm square base area makes the 7P ideal for all miniature receiver circuits. Available as IFs and osc. for AM/FM. (AM IFTs are available ES.) 1-24 30p each



10E coils for AM/FM
The 10E is available in the broadest range of stock types of all TOKO coils, covering applications in MF/HF radio and FM IFTs. Base area 10mm square. 1-24 27p each

Please address all enquiries and orders for 1000 pcs or less to the distributor, AMBIT international.

AMBIT international
37 High Street
Brentwood
Essex, CM14 4RH
tel 216029 tlx 995194

Terms:	Min CWO £1.00, VAT extra Post 20p per order (CWO) Min invoice £7.50 pp 50p.

Please note TOKO UK have moved to larger premises at:
Ward Royal Parade
Alma Road
Windsor, Berks. SL4 3HR
tel 54057 tlx 848095