PRACTICAL WIRELESS

AUGUST 1973

20p

PW 'Student' OSCILLOSCOPE

also:

MINI-COMM RECEIVER

VHF BAND LOCATOR

Henry's

YOUR COMPLETE AUDIO-ELECTRONIC STORES

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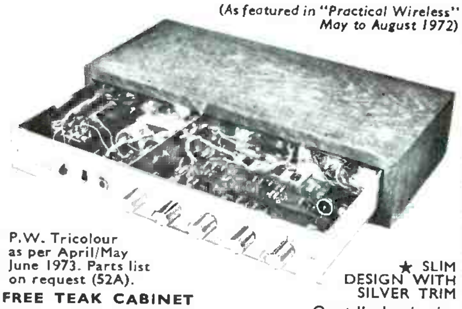
20 + 20 WATT INTEGRATED I.C. STEREO AMPLIFIER

★ **FREE TEAK CABINET** with complete kits!

(As featured in "Practical Wireless" May to August 1972)



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Constructional details Ref. No. 21 30p

P.W. Tricolour as per April/May June 1973. Parts list on request (52A).

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Overall chassis size 14½" x 6" x 2" high

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Designer approved kits distributed by Henrys!

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Henry's introduce new huge range of audio and electronic kits now in stock, everything supplied, tremendous value. Detailed list Ref. No. 14 on request.

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ZN414 Radio integrated circuit as featured in Practical Wireless, January 1973. Article Reprint Ref. No. 19 10p. Price £1·20.

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Warehouse prices with BIG DISCOUNTS plus demonstrations (for callers) and GUARANTEES. FREE—24 page detailed brochure (Ref. No. 17). **You can see the savings!**

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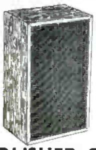

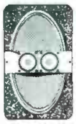

E.M.I. Size 13¼" x 8¼". Large Ceramic Magnet.
TYPE 150 6 watt, 3, 8 or 15 ohms £2·20. Post 22p.
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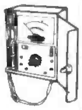

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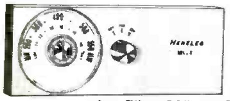
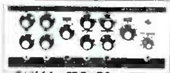


Uses Mullard Module. Slow motion tuning. Built in battery. Ferrite aerial. Overall size 7" x 2¼" x 3¼". TOTAL COST TO BUILD £4·85. Post 15p. All parts sold separately. Leaflet No. 6

PA-Disco-Lighting



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FIBRE OPTICS LIGHTING. — MICS. EFFECTS. PROJECTORS. SPOTS. DIMMERS — STANDS. MIXERS. SPEAKERS.
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FREE Stock List Ref. No. 18
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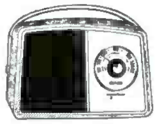

Printed circuit all transistor design using Mullard RF/IF Module. Medium and Long Wave bands plus Medium Wave Bandspread for extra selectivity. Also slow motion geared tuning, 600 mW push-pull output, fibre glass PVC covered cabinet, car aerial. Attractive appearance and performance.
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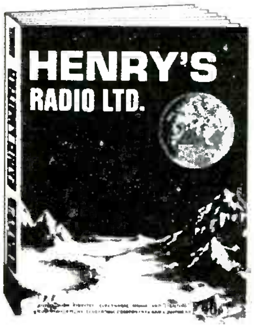

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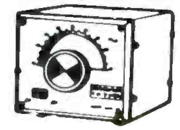
BUILD THIS VHF FM TUNER



5 TRANSISTORS 300 kc/s BANDWIDTH, PRINTED CIRCUIT, HIGH FIDELITY REPRODUCTION. MONO AND STEREO
A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately. Free Leaflet No. 3 & 7.
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PACKAGE DEALS Post 25p
2xZ30, Stereo 60, PZ5 £15·95
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2xZ50, Stereo 60, PZ8 £20·25
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Miniature Amplifier
5 transistor. 300mW o/p. Fitted volume and sensitivity control, 9 volt operated. £1·75 each P/P 15p.

Quality Slider Controls
60mm stroke singles and ganged. Complete with knobs. 5K, 10K, 25K, 100K, 250K, 500K. 1 meg. Log and Lin. 40p each, 10K, 25K, 50K, 100K, 250K, Log and Lin ganged. 60p each.

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See earlier page of this magazine for transistors, I.C.'s and Semi Conductor prices—latest list Ref. no. 36 on request.
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PRACTICAL WIRELESS

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AUGUST 1973

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

NEWS & COMMENT

CONSTRUCTIONAL

OTHER FEATURES

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TOTAL	£49·41

SEND S.A.E. FOR FREE COLOUR BROCHURE

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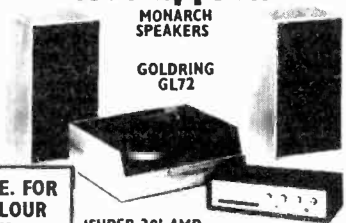

HIGH FIDELITY UNITS

PACKAGE PRICE **£108·25** Carr. £1·75

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£9·96 post free

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RSC G66 MkII 6+6 WATT high quality STEREO AMPLIFIER

Individual Ganged Controls: Bass, Treble, Volume and Balance. Printed circuit construction employing 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20-20,000 c.p.s. Bass Control ± 12db. Treble Control ± 13db. Selector switch for P.U. or Tape/Radio. For loudspeaker output impedances of 3 to 15 ohms. For standard 200-250v. A.C. mains operation. Attractive Black and Silver finished metal fascia plate and matching control knobs.

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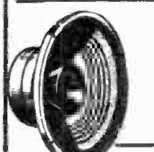
AUDIOTRINE HIGH FIDELITY SPEAKERS



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

Exceptional performance at low cost.

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PLEASE STATE IMPEDANCE WHEN ORDERING

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HI-FI SPEAKER ENCLOSURES MODERN DESIGN

Teak veneer finish. Acoustically lined. Sizes approx. Carr. 35p. per enc.

JE8 Size 16" × 11" × 9". Pressurised. Gives pleasing results with any 8in. Hi-Fi speaker. **£5·50**

SE8 For optimum performance with any 8in. Hi-Fi spkr. Size $19 \times 10\frac{1}{2} \times 9$in. **£6·50**

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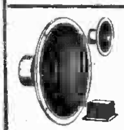
SE12 For excellent performance with 12in. Hi-Fi speaker and tweeter Size $25\frac{1}{2} \times 16 \times 9$in. **£7·95**

AUDIOTRINE HI-FI SPEAKER SYSTEMS



Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£6·50** Carr. 33p

OR SENIOR 15 WATT INCLUDING HF126 15,000 LINE SPEAKER **£7·65** Carr. 39p

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200-250v. AC mains operated. Frequency Response 30-20,000 c.p.s. −2dB. Harmonic Distortion 0·3% at 1,000 c.p.s. Separate Bass and Treble 'lift and cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3-15 ohm spkrs. Max. sensitivity 5mV Output rating I.H.F.M. Fully enclosed enamelled case, $9\frac{1}{2} \times 2\frac{3}{4} \times 5\frac{1}{4}$in. Attractive brushed silver finish facia plate $10\frac{1}{2} \times 3\frac{1}{2}$in. and matching knobs.

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300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·45
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250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	£2·45
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All 6/12v. D.C. output. Max. A.C. input 18v.
1a, 28p. 2a, 39p. 3a, 55p. 4a, 72p. 6a, 88p.

SMOOTHING CHOKES
150mA, 7-10H, 250 Ω 77p; 100mA, 10H, 200 Ω 66p; 80mA, 10H, 350 Ω 55p; 60mA, 10H, 400 Ω 28p.

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

BUILD AN AMPLIFIER WORTH APPROXIMATELY DOUBLE THE KIT PRICE INCLUDING CABINET
Only high grade components by leading manufacturers

- Push Button Selector Switching
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- Neon Indicator
- Satin Silver Finish Metal Fascia
- Solid State Circuitry
- Twenty Silicon Transistors
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COMPLETE KIT (less cabinet). Carr. 70p. Cabinet if req. £5 extra. **£27·50**

R.S.C. STEREO FM III TUNER. in cabinet Visually matches Super 30 Mk. III **£37·50**

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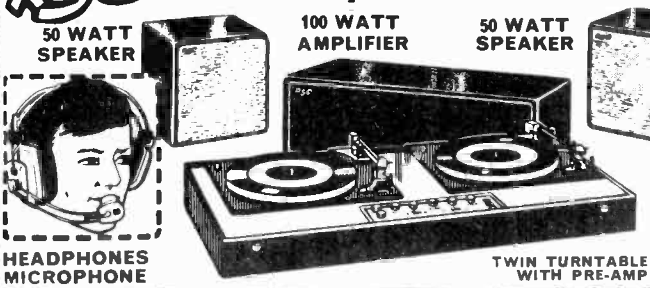
RSC GROUP/DISCO UNITS



PACKAGE OFFER
Units listed below
(a) 100w POWER AMPLIFIER
(b) PAIR OF HI-FI HEAD-PHONES
(c) MATCHING DYNAMIC 'MIKE' (attached to h'phone)
(d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18" × 18" × 8"
(e) RSC TDI DISCO CONSOLE

(a) (b) (c) (d) & (e) **£145** Carr. £2·50

Terms Deposit £30 and 18 monthly payments of £8·00 (Total £174·00).

RSC TDI DISCO CONSOLE

Incorporating twin Garrard SP25 Mk.III turntables and Sonotone or Acos Cartridges with diamond styli. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control switch. Black Vynide covered Cabinet with lid. see illustration on left

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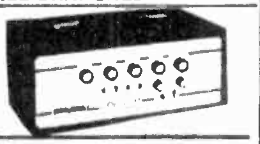

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GROUP/DISCO EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 MK.III AMPLIFIER PR. FANE POP 25/2 25W L/SPEAKERS Terms: Deposit £7·50 and 9 monthly payments of £5·86 (Total £55·74)	£37·95 £15·90 £53·85	PACKAGE PRICE **£49·50** carr. £1·10
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F.A.L. PHASE 50 MK.III AMPLIFIER PAIR L12/20 25W L/S in cabinets Terms: Deposit £10 and 9 monthly payments of £6·52 (Total £68·68)	£37·95 £26·30 £64·25	PACKAGE PRICE **£61** carr. £1·35
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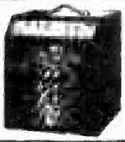
RSC PHANTOM '50' Combined 50W Amplifier and 12in. Loudspeaker.



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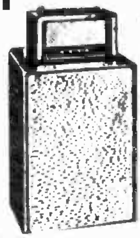

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SPECIFICATION OF UNITS

	Model 803	Model 303
Overall Diameter	8″	3″
Natural resonance	30Hz	—
Main resonance	*35Hz	1200Hz
Magnet Pole Diameter	1″	¾″
Magnet Flux Density	13,000 gauss	10,000 gauss
Frequency response	30Hz–8kHz	10kHz–17kHz
Impedance	8–15 ohms	8–15 ohms
Power Handling	*15 watts	*15 watts

Very easy to assemble, this boxed kit comes with acoustic foam damping material, panels, screws, wire, wiring diagrams and instructions to provide a remarkable loudspeaker assembly—a pair is ideal for stereo.

CABINETS for the 'Mode One' are available in Teak veneer finish. **SIZE** 15¾″ x 10¾″ x 9″.

**When used with above cabinet.*

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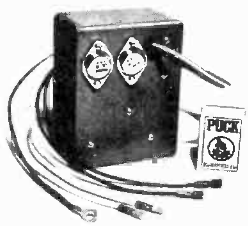

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100 cfm 4½ x 4½ x 2 in **£3·50** (28p)
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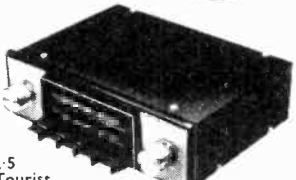

The Tourist PB is suitable for 12 volt working on both negative and positive earth vehicles. It covers the full medium and long wave bands. It is permeability tuned and sturdily constructed. Output is a full 2·5 watts into an 8 ohms speaker. But the Tourist PB will operate into any loud-speaker from 8 to 15 ohms.
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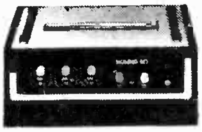

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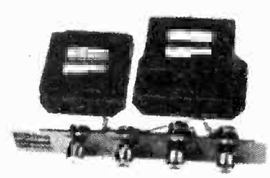

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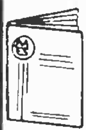

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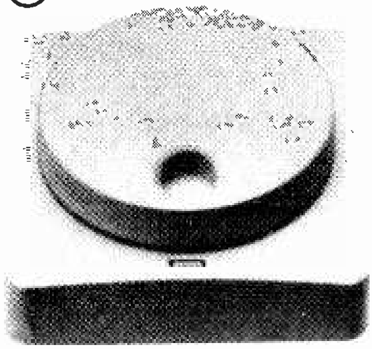

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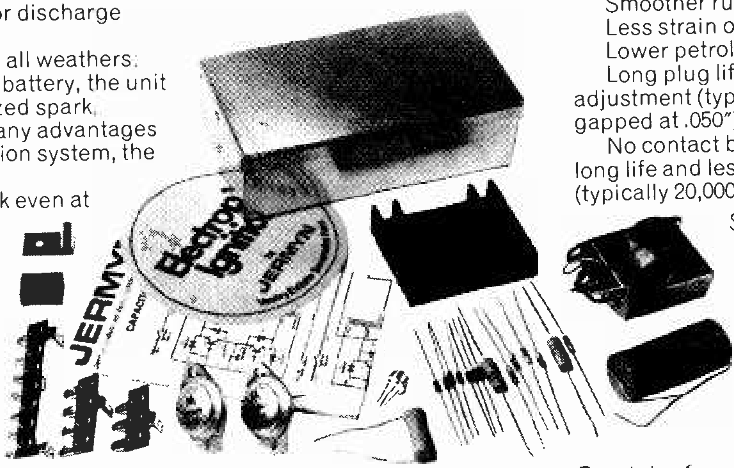

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AC126	19	AF116	27	BC152	19	BD140	66	BF195	13
AC127	19	AF117	27	BC153	31	BD155	88	BF196	16
AC128	19	AF118	39	BC154	33	BD175	66	BF197	16
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AC166	22	ASY26	28	BC175	24	BD197	99	BFX29	30
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AC176	22	ASY50	28	BC180	27	BD205	88	BFX87	27
AC177	27	ASY51	28	BC181	27	BD206	88	BFX88	24
AC178	31	ASY52	28	BC182	11	BD207	1·05	BFY50	22
AC179	31	ASY54	28	BC182L	11	BD208	1·05	BFY51	22
AC180	19	ASY55	28	BC183	11	BDY20	1·10	BFY52	22
AC180K	22	ASY56	28	BC183L	11	BF115	27	BFY53	19
AC181	19	ASY57	28	BC184	13	BF117	50	BPX25	94
AC181K	22	ASY58	28	BC184L	13	BF118	77	BSX19	17
AC187	24	ASZ21	44	BC186	31	BF119	77	BSX20	17
AC187K	22	BC107	10	BC187	31	BF121	50	BSY25	17
AC188	24	BC108	10	BC207	12	BF123	55	BSY26	17
AC188K	22	BC109	11	BC208	12	BF125	50	BSY27	17
ACY17	28	BC113	11	BC209	13	BF127	55	BSY28	17
ACY18	22	BC114	17	BC212L	12	BF152	61	BSY29	17
ACY19	22	BC115	17	BC213L	12	BF153	50	BSY38	20
ACY20	22	BC116	17	BC214L	16	BF154	50	BSY39	20
ACY21	22	BC117	17	BC225	28	BF155	77	BSY40	31
ACY22	18	BC118	11	BC226	39	BF156	53	BSY41	31
ACY27	20	BC119	33	BCY30	27	BF157	61	BSY95	14
ACY28	21	BC120	88	BCY31	29	BF158	61	BSY95A	14
ACY29	39	BC125	13	BCY32	33	BF159	66	Bu105	2·20
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ACY31	31	BC132	13	BCY34	28	BF162	44	C400	33
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ACY35	23	BC135	13	BCY71	20	BF164	44	C424	22
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ACY40	19	BC137	17	BCZ10	22	BF167	24	C426	39
ACY41	20	BC139	44	BCZ11	28	BF173	24	C428	22
ACY44	39	BC140	33	BCX12	28	BF176	39	C441	33
AD130	42	BC141	33	BD121	66	BF177	39	C442	33
AD140	53	BC142	33	BD123	72	BF178	33	C444	39
AD142	53	BC143	33	BD124	66	BF179	33	C450	24
AD143	42			BD131	55	BF180	33	MAT100	21
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MAT121	22	2G309	39	2N2160	66	2N3054	51	2N4060	13
MPF102	46	2G339	22	2N2192	39	2N3055	55	2N4061	13
MPF104	41	2G339A	18	2N2193	39	2N3391	16	2N4062	13
MPF105	41	2G344	20	2N2194	39	2N3391A	18	2N4284	19
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OC20	70	2G371	18	2N2218	22	2N3393	16	2N4286	19
OC22	42	2G371B	13	2N2219	22	2N3394	16	2N4287	19
OC23	46	2G373	19	2N2220	24	2N3395	19	2N4288	19
OC24	62	2G374	19	2N2221	22	2N3402	23	2N4289	19
OC25	42	2G377	33	2N2222	22	2N3403	23	2N4290	19
OC26	28	2G378	18	2N2368	19	2N3404	31	2N4291	19
OC28	55	2G381	18	2N2369	16	2N3405	46	2N4292	19
OC29	55	2G382	18	2N2369A	16	2N3414	17	2N4293	19
OC35	46	2G401	33	2N2411	27	2N3415	17	2N5172	13
OC36	55	2G414	33	2N2412	27	2N3416	31	2N5457	35
OC41	22	2G417	28	2N2646	52	2N3417	31	2N5458	35
OC42	27	2N388	39	2N2711	23	2N3525	83	2N5459	44
OC44	16	2N388A	61	2N2712	23	2N3646	10	2S301	55
OC45	14	2N404	22	2N2714	23	2N3702	11	2S302A	46
OC70	11	2N404A	31	2M2904	19	2N3703	11	2S302	46
OC71	11	2N524	46	2N2904A	23	2N3704	12	2S303	61
OC72	16	2N527	54	2N2905	23	2N3705	11	2S304	77
OC74	16	2N598	46	2N2905A	23	2N3706	10	2S305	93
OC75	17	2N599	50	2N2906	17	2N3707	12	2S306	93
OC76	17	2N696	14	2N2906A	20	2N3708	8	2S307	93
OC77	28	2N697	15	2N2907	22	2N3709	10	2S321	62
OC81	17	2N698	27	2N2907A	24	2N3710	10	2S322	46
OC81D	17	2N699	39	2N2923	16	2N3711	10	2S322A	46
OC82	17	2N706	9	2N2924	16	2N3819	31	2S323	62
OC82D	17	2N706A	10	2N2925	16	2N3820	55	2S324	77
OC83	22	2N708	13	2N2926(G)	14	2N3821	39	2S325	77
OC84	22	2N711	33	2N2926(Y)	12	2N3823	31	2S326	77
OC139	22	2N717	39	2N2926(O)	11	2N3903	31	2S327	77
OC140	22	2N718	27	2N2926(R)	11	2N3904	33	2S701	46
OC169	28	2N718A	55	2N2926(B)	11	2N3905	31	40361	44
OC170	28	2N726	31	2N3010	77	2N3906	30	40362	50
OC171	28	2N727	31	2N3011	16	2N4058	13		
OC200	28	2N743	22						
OC201	31	2N744	22						
OC202	31	2N914	16						
OC203	28	2N918	33						
OC204	28	2N929	23						
OC205	39	2N930	23						
OC309	44	2N1131	22						
OCP71	48	2N1132	24						
ORP12	48	2N1302	16						
ORP60	44	2N1303	16						
ORP61	44	2N1304	19						
P346A	22	2N1305	19						
P397	46	2N1306	23						
ST140	14	2N1307	23						
ST141	19	2N1308	26						
TIS43	33	2N1309	26						
UT46	30	2N1613	22						
2G301	21	2N1711	22						
2G302	21	2N1889	35						
2G303	21	2N1890	50						
2G304	27	2N1893	41						
2G306	44	2N2147	79						

DIODES AND RECTIFIERS

AA119	9	BY133	23	OA70	8
AA120	9	BY164	55	OA79	8
AA129	9	BYX38/30	46	OA81	8
AAY30	10	BYZ10	39	OA85	10
AAZ13	11	BYZ11	33	OA90	7
BA100	11	BYZ12	33	OA91	7
BA116	23	BYZ13	28	OA95	8
BA126	24	BYZ16	44	OA200	7
BA148	16	BYZ17	39	OA202	8
BA154	13	BYZ18	39	SD10	6
BA155	16	BYZ19	31	SD19	6
BA156	15	CG62 (OA91 Eq.)	6	1N34	8
BY100	17	CG651 (OA70-OA79 Eq.)	7	1N34A	8
BY101	13	OA5	39	1N914	7
BY105	19	OA5SL	23	1N916	7
BY114	13	OA10	39	1N414B	7
BY126	16	OA47	8	1S021	11
BY127	17			1S951	7
BY128	17				
BY130	18				

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C 4	75	⅛th W Resistors mixed preferred values	0·55
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C 6	2	Tuning Gangs, MW/LW VHF	0·55
C 7	1	Pack Wire 50 metres assorted colours	0·55
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BP 702—72702	59p	50p	44p
BP709—72709	40p	38p	33p
BP 709P—μA709C	40p	38p	33p
BP 710—72710	50p	46p	44p
BP 711—μA711	50p	48p	44p
BP 741—72741	55p	50p	45p
μA703C	31p	29p	27p
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Type No.	Price 1	25	100+
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BP933	14p	13p	12p
BP935	14p	13p	12p
BP936	14p	13p	12p
BP944	14p	13p	12p
BP945	28p	27p	24p
BP946	13p	12p	11p
BP948	28p	27p	24p
BP951	72p	66p	61p
BP962	13p	12p	11p
BP9093	44p	42p	39p
BP9094	44p	42p	39p
BP9097	44p	42p	39p
BP9099	44p	42p	39p

Devices may be mixed to qualify for quantity price. Larger quantity prices on application. (DTL 930 Series only).

NUMERICAL INDICATOR TUBES

MODEL	CD66	GR116	3015F Minitron
Anode voltage (Vdc)	170min	175min	5
Cathode Current (mA)	2·3	14	8
Numerical Height (mm)	16	13	9
Tube Height (mm)	47	32	22
Tube Diameter (mm)	19	13	12 wide
I.C. Driver Rec.	BP41 or 141	BP41 or 141	BP47
PRICE EACH	£1·87	£1·70	£1·50

All indicators 0-9 + Decimal point. All side viewing. Full data for all types available on request.

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Epoxy TO-5 case	Price each 1–24	25–99	100 up
uL900 Buffer	38p	36p	29p
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uL923 J-K flip-flop	55p	51p	49p

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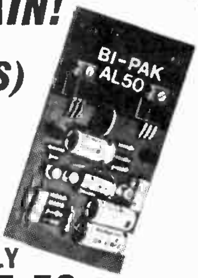

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★ Overall size 63mm × 105mm × 13mm.

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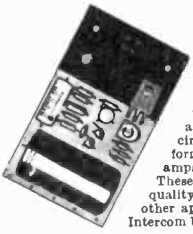

STABILISED POWER MODULE SPM80

AP80 is especially designed to power 2 of the AL50 Amplifiers, up to 15 watt (r.m.s.) per channel simultaneously. This module embodies the latest components and circuit techniques incorporating complete short circuit protection. With the addition of the Mains Transformer MT80, the unit will provide outputs of up to 1·5 amps at 35 volts. Size: 63mm × 105mm × 30mm.
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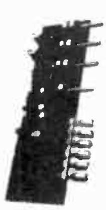
TRANSFORMER BMT80 £2·15 p. & p. 28p.

STEREO PRE-AMPLIFIER TYPE PA100

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



SPECIFICATION

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

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

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

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ECC81	12p	PCL84	15p	6BW7	12p
ECC82	12p	PL82	10p	6U4	20p
EF91	5p	PL83	10p	6F23	15p
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STEREO AMPLIFIERS	Rec. Retail Price £ p	Comet Price £ p
AKAI AA5200	87·45	64·95
AKAI AA5500	109·45	80·95
AKAI AA5800	164·45	121·95
AKAI SS1 Quadraphonic Decoder	54·45	42·95
ALBA UA 700	41·72	27·95
AMSTRAD 8000 MK. II	30·75	16·50
AMSTRAD IC 2000	50·88	28·25
AMSTRAD Integra 4000	39·05	23·95
FERROGRAPH F307 Mk. II (cased)	74·80	49·95
GLIXOR MW3000, 15 watts RMS per channel	54·45	25·95
GOODWIN RH 25 25	65·95	49·95
JVC Nivico VN 300	69·85	55·95
VN 700 SEA	140·25	112·95
VN 900 SEA	169·40	135·95
MCA 104Z	93·50	74·95
4DD5 Demodulator for CD4	67·10	52·95
MCA V5E/VN550 Quadraphonic	104·50	83·95
MCA V9E/VN880 Quadraphonic	170·50	136·95
VN 990 Quadraphonic	236·50	189·95
KELETRON KSA 700 Mk. II	34·10	21·95
KELETRDN KSA 1500 Mk. II	45·10	29·50
LEAK Delta 30 (cased)	76·89	50·95
LEAK Delta 70 (cased)	94·49	63·20
METROSOUND ST20 Mk. II	46·20	32·95
METROSOUND ST40	59·40	42·95
METROSOUND ST60	77·00	50·95
PHILIPS RH 520	85·00	66·95
RH 521	119·90	89·95
PIONEER SA500A	55·96	38·95
SA600	113·43	73·95
SA800	150·34	103·95
SA1000	185·12	121·95
SA6200	114·40	78·95
SA7100	144·10	99·95
SA8100	202·40	139·95
SA9100	248·60	171·95
QL600A Quadraphonic Convertor	141·32	96 95
QD210 Quadraphonic decoder	50·91	33·95
QA800A Quadraphonic	249·92	172·95
QC800A Pre-amp Quadraphonic	178·31	122 95
QM800A Pow. amp. Quadraphonic	212·14	146·95
Reverberation 202w	65·25	44·95
RANK ROTEL 310	57·20	37·95
RANK ROTEL 610	66·35	56·75
RANK ROTEL RA 810	116·05	78·95
RANK ROTEL RA 1210	141·90	96·50
ROGERS Ravensbrook Mk. III (cased)	63·25	49·95
ROGERS Ravensbourne	77·00	59·50
Ravensbourne (cased)	82·50	64·95
SINCLAIR 2000	38·50	26·95
3000	49·50	34·95
SOLARVOX 20. 10 watts RMS per channel	43·95	26 95
SOLARVOX 30. 15 watts RMS per channel	51 65	35 95
SOLARVOX MA801 2 x 8 watts RMS plus MATRIX 4 channel	42·30	29 75
SOLARVOX MA813 2 x 18 watts RMS plus MATRIX 4 channel	56·52	42·95
TANDBERG TA300 (Teak)	86·32	67·95
TANDBERG TA300M (Teak)	96·24	79·95
WHARFEDALE Linton amplifier	71·50	51·95

All take both ceramic and magnetic cartridges.

TUNERS		
AKAI AT550 AM/FM/MPX/FET	84·10	64·95
AT580 AM/FM/MPX/MOS FET	131·09	102·95
AMSTRAD Multiplex 3000 FM	37·90	23·95
JVC Nivico MCT V5E/FT500 AM/FM	82·50	65·95
VT 700	126·50	101·50
MCT V7E AM/FM	115·25	94·95
LEAK Delta FM	74·43	52·95
Delta AM/FM	83·79	62·25
METROSOUND FMS 20 MKk II	54·45	38·95
FMS 40	56·10	40·62
PHILIPS RH 690	45·66	33·50
RH 621	103·06	78·80
PIONEER TX 500A AM/FM	79·72	54·95
TX600 AM/FM	110·39	75·95
TX6200	94·60	65·50
TX7100	111·10	76·95
TX8100	150·70	103·95
TX9100	204·60	139·95
RANK ROTEL 320	55·91	36·20
620	87·86	59·95
ROGERS Ravensbourne Series II (cased)	61·05	47·50
Ravensbrook Series II (cased)	46·75	36·95
SINCLAIR 2000	42·44	28·95
3000	42·44	28·95

All the above Tuners are complete with MPX Stereo Decoder

TUNER/AMPLIFIERS		
AKAI AA8030	130·54	99·95
AKAI AA8080	178·07	128·50
AKAI AS8100S Quadraphonic	243·85	189·95
AKAI 6300	129·21	69·95
AUTOMATIC RADIO CHX 9912 AM/FM: MPX stereo tuner/amplifier with built-in stereo cassette recorder	107·25	49·95

TUNER/AMPLIFIERS—*continued*	Rec. Retail Price £ p	Comet Price £ p
GOODMANS Module 80, 35w. RMS	87·55	60·25
Module 80 Compact	158·16	112·50
Module 90	112·04	75·75
Module 110 FM/MW/LW/SW/ 100w. RMS	130·86	88·50
GOODMANS Module 110, Compact	230·65	169·95
JVC Nivico 4MM 1000 Quadraphonic	161·15	128·95
4VR 1006 Quadraphonic with CD4 demodulator	229·35	183·50
VR 5501 AM/FM	108·35	85·95
VR 5521L AM/FM and SEA	172·70	138·95
4VR 5414 Quadraphonic SEA	229·35	183·50
4VR 5445 Quadraphonic SEA	308·00	246·50
KYOTO 1000 AM/FM Tuner/Amplifier with built in Stereo Cassette Recorder. Complete with two speakers and two microphones	79·90	57·95
LEAK Delta 75 AM/FM MPX	163·83	112·95
PHILIPS RH 702	90·38	67·95
PHILIPS RH 720	202·41	152·95
PIONEER SX 424 AM/FM/MPX	116·70	78·50
PIONEER SX525 AM/FM/MPX	148·36	101·95
PIONEER SX626 AM/FM/MPX	203·21	138·95
PIONEER SX727 AM/FM/MPX	244·63	168·95
PIONEER SX828 AM/FM/MPX	313·74	216·95
PIONEER QX 4000 Quadraphonic AM/FM/MPX	238·50	164·95
PIONEER QX 8000A Quadraphonic AM/FM/MPX	339·23	233·95
PIONEER QX 9900 Quadraphonic AM/FM/MPX	473·26	327·50
ROTEL RX 150A	65·68	45·95
ROTEL RX 200A	84·10	60·95
ROTEL RX 400A	101·01	69·95
ROTEL RX 600A	140·01	98·95
ROTEL RX 800A	178·07	126·25
ROTEL RX 154A Quadraphonic	121·68	86·95
SOLARVOX TAM 1105 2 x 5 watts RMS AM/FM Multiplex comp. with 2 speakers and featuring Matrix 4 channel	37·06	29·75
TANDBERG TR200 MPX (Teak)	112·20	93·95
TANDBERG TR1000 FM MPX (Teak)	163·71	138·95
TANDBERG TR1010 AM/FM MPX (Teak)	177·33	148·95
TELETON CR55	116·63	64·95
WHARFEDALE LINTON WE40 AM/FM MPX	107·66	79·95

All the above take magnetic cartridges except Kyoto 1000 and Automatic Radio CHX 9912 which take ceramic only. All include MPX Stereo Decoder.

TURNTABLES		
CONNOISSEUR BD1 Kit Chassis	12·65	10·50
CONNOISSEUR BD2 Chassis	31·02	24·95
CONNOISSEUR BD2 P/C/SAU2	39·16	32·25
GARRARD SP25 Mk. III Chassis	15·25	9·05
GARRARD 40B Chassis	12·85	9·50
GARRARD SL65B Chassis	18·78	12·95
GARRARD SL95B Chassis	46·40	30·60
GARRARD 401 Chassis	40·43	25·95
GARRARD SL72B Chassis	30·73	20·25
GARRARD AP76 Chassis	26·82	18·95
GARRARD Zero 100A Chassis	51·57	33·25
GARRARD Zero 100S Chassis	47·44	30·70
GOLDRING G101P/C	31·35	21·50
GOLDRING GL72 Chassis	34·65	23·95
GOLDRING GL72P	45·87	31·50

The following Turntables are complete with base, plinth, cover and cartridge. Fully wired and ready for use.

McDONALD MP60 with G800		Sp. Price 15·95
McDONALD HT70 with G800		Sp. Price 20·95
GARRARD 2025 TC with Sonotone 9TAHC ceramic		Sp. Price 12·10
GARRARD SP25 Mk. III with G800		Sp. Price 15·95
GARRARD AP76 with G800		Sp. Price 25·95
GOLDRING GL72 with G800E		Sp. Price 33·95
GOLDRING GL75 with G800E		Sp. Price 41·95
GOODMANS TD100 with G800E cartridge	77·29	52·95
JVC Nivico SRP 473 with Nivico magnetic cartridge	71·50	56·95
LEAK Delta deck with Shure Cartridge	65·07	49·95
PHILIPS GA407 with GP400 mag. Cartridge	45·00	34·95
PHILIPS GA212 Electronic with GP400 cartridge	64·95	50·95
PIONEER PLA35 with PC50 Magnetic Cart.	100·62	69·95
THORENS 160/C with Ortofon M15E Super cartridge	99·00	78·95
THORENS TD125 AB Mk. II with Ortofon M15E Super Cart.	154·00	122·50
WHARFEDALE Linton with Shure Cartridge	35·11	25·95

TURNTABLES—*continued*	Rec. Retail Price £ p	Comet Price £ p
GOLDRING GL75 Chassis	43·89	29·95
GOLDRING GL75P	56·76	38·95
GOLDRING GL78 Chassis with auto stop	53·46	36·95
GOLDRING GL78P/Cover with auto stop	76·89	52·95
GOLDRING GL85P/Cover with auto stop	98·34	65·95
McDONALD MP60 Chassis	13·96	8·40
McDONALD 610 Chassis	17·71	11·50
McDONALD HT70 Chassis	19·49	12·50
McDONALD 710 Chassis	33·44	21·50
McDONALD 810 Chassis	41·80	27·50
PIONEER PL12D with base and cover	51·90	35·95
PIONEER PL61 with base and cover	180·33	124·95
THORENS TD125 Mk. II Chassis	83·60	66·50
THORENS TD125AB	109·04	72·50
THORENS TD 125AB Mk. II with TP 16 arm	126 50	99·95
THORENS TD 165/C including base and cover	60·50	48·50
THORENS TD 160/c including base and cover	71·50	56·95

SPEAKERS		
AMSTRAD ACOUSTA 1500 (Pair)	44·00	27·95
ACOUSTA 2500 (Pair)	55·00	31·95
138 (pair) Teak	28·60	13·95
B and W Model 70	175·45	125·95
B and W DM2	65·89	46·95
B and W DM4	46·75	35·95
B and W D5 (pair)	55·99	41·95
CELESTION HADLEIGH (pair)	43·34	30·95
COUNTY (pair)	48·44	34·95
Ditton 15	36·95	26·50
Ditton 25	71·50	51·50
Ditton 44	59·40	40·50
Ditton 66	108·90	78·75
FERROGRAPH S1 inc. stand	104·50	74·50
GOODMANS Minister (pair)	46·33	31·75
Havant (pair)	53·77	34·95
Magister	72·19	42·20
Double Maxim (pair)	63·45	42·25
Mezzo 3	39·27	25·60
Magnum K2	50·82	32·40
Goodwood	60·50	39·50
Dimension 8	79·68	51·50
PLANAX 2 Teak or White	46·20	32·95
DIN 20 NT Kit (pair)	22·95	16·50
KELETRON KS4 (pair)	22·66	13·95
KS6 (pair)	28·16	17·50
KS8 (pair)	36·30	22·75
KS10 (pair)	46·86	29·95
KS15 (pair)	69·85	43·50
KS20 (pair)	78·76	49·25
LEAK 150 (pair)	46·82	35·95
LEAK 250 (pair)	60·86	46·50
LEAK 600	54·45	38·50
MARSDEN HALL		
NH110 (Pair)	35·20	23·95
NH150 (Pair)	42·90	28·95
NH200 (Pair)	53·90	35·95
NH300 (Pair)	99·00	64·95
METROSOUND HFS 103 (pair)	27·50	19·25
202	23·65	16·95
Duplex 15	35·20	26·95
Duplex 25	61·60	42·95
PIONEER CS53	56·52	38·95
ROGERS Ravensbourne Compact (pair)	61·60	49·95
SINCLAIR Q16	8·47	6·20
SOLARVOX TK19S twin speaker 20 watts Teak (pair)	40·65	29·95
TANDBERG TL 12 Teak (pair)	55·80	45·95
TL 25 Teak (pair)	75·16	60·95
TL 50 Teak	79·70	61·95
THORPE GRENVILLE TG100 (pair)	31·85	19·50
TG200 (pair)	46·15	28·50
TG300 (pair)	61·55	34·50
WHARFEDALE Denton Mark II (pair)	39·33	27·95
Linton Mark II (pair)	48·89	33·95
Triton III (pair)	60·85	41·95
Melton Mark II	38·50	26·95
Dovedale 3 Mark II	52·25	35·95
Unit 3 speaker kit (pair)	23·40	16·50
Unit 4 speaker kit (pair)	41·80	29·25
Unit 5 speaker kit (pair)	60·50	42·50

CHASSIS SPEAKERS		
GOODMANS Twin-Axiom 8	8·58	6·25
Twin Axiom 10	9·47	6·90
Axiom 401	19·45	13·95
Audiom 8P	5·17	3·75
Audiom 10P	5·62	4·10
Audiom 12P	14·30	10·40
Audiom 15P	23·10	16·50
Audiom 18P	39·27	27·95
Audiom 100 40 watts din.	13·20	9·50
ARU 172	4·95	3·60
Axent 100	7·59	5·40
Midax 650	14·95	9·60
Attenuator	4·10	2·95
Crossover network XO/950	8·55	5·95
WHARFEDALE 8 in. Bronze/RS/DD	4·44	3·20
Super 8/RS/DD	7·95	5·75
Super 10/RS/DD	13·11	9·45

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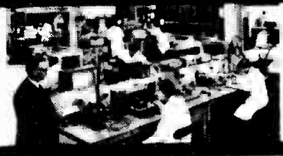

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	Rec. Retail Price £ p	Comet Price £ p
CARTRIDGES		
ADC 10E Mk. IV	Sp. Price	15·95
AUDIO TECHNICA AT 66	5·98	3·30
AUDIO TECHNICA UM35F for CD4	53·36	39·50
*CONNOISSEUR SCU1	5·78	4·75
GOLDRING G850	5·78	2·95
GOLDRING G800 Boxed	Sp. Price	4·20
GOLDRING G800E Boxed	Sp. Price	6·90
GOLDRING G800 Super E. Boxed	Sp. Price	10·95
GOLDRING G820	11·00	7·50
GOLDRING G820E	16·50	11·40
GOLDRING G820 Super E	22·00	15·20
EMPIRE 1000ZE/X	58·87	37·95
EMPIRE 999VE/X	42·05	26·95
EMPIRE 999TE/X	24·73	16·25
EMPIRE 999SE/X	19·98	12·70
EMPIRE 999E/X	15·48	9·95
EMPIRE 909E/X	12·10	7·95
EMPIRE 90EE/X	9·41	6·20
SHURE M3D	5·81	3·30
SHURE M44-G	7·91	4·40
SHURE M44-7	7·52	4·25
SHURE M-44C	7·52	4·25
SHURE M44E	8·18	4·60
SHURE M55E	9·24	5·25
SHURE M75G	14·00	7·90
SHURE M75-6 (S)	8·18	4·95
SHURE M75B	12·95	7·34
SHURE M75EJ	14·66	8·30
SHURE M75ED	18·10	10·25
SHURE M75E/95G	Sp. Price	12·15
SHURE M91ED	18·10	9·20
SHURE V15-11	37·52	24·95
SHURE V15-Mk. III	39·00	28·95
*SONOTONE 9TAHC Diam/Saph	3·58	1·30

Starred cartridges above are ceramic—all others are magnetic.

	Rec. Retail Price £ p	Comet Price £ p
BASES AND COVERS		
CONNOISSEUR Plinth BD1	5·28	4·30
CONNOISSEUR Cover	3·96	3·20
CONNOISSEUR P.U. Mount Board	0·88	0·70
GARRARD WB1 Base	3·56	2·70
GARRARD WB4 Base	5·28	3·90
GARRARD SPC1 Cover	3·47	2·60
GARRARD SPC4 Cover	4·13	3·00
Special Offer of Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500	Sp. Price	2·50
Special offer of base and cover to fit McDONALD MP60 and 610	Sp. Price	3·50
GOLDRING Plinth 75	12·87	8·90
GOLDRING Plinth 72	11·22	7·80
GOLDRING Covers for 72P	4·62	3·20
Cover for 75P De Luxe	5·28	3·64
Cover for 78P	7·26	5·00
Cover for 85P	7·26	5·00
McDONALD Plinth for 710/810	9·35	6·50
McDONALD Cover for 710/810	4·40	2·95
THORENS TX 25 (for TD125AB)	8·25	6·40
THORENS TX11 Cover	4·18	3·40
SME Plinth System 2000 with motor-board	43·56	34·95
MOTORBOARDS only	5·51	4·00
SME P1 Spacer	0·92	0·70
HEADPHONES		
AKG K180	30·80	18·50
AKG K60	16·50	9·75
AKG 100	8·80	5·40
AMSTRAD HPS5A	8·25	3·95
HPS6A with volume control	11·77	6·95
KOSS HV1	22·00	16·95
KOSS ESP-9 Electrostatic	75·90	58·25
KOSS ESP-6 Electrostatic	49·50	38·50
KOSS K2 plus 2 Quadrafone	49·50	38·95
KOSS PRO 5 L/C	33·00	26·50
KOSS PRO-4AA	30·80	22·95
KOSS KO-727B	18·15	13·75
KOSS 747	22·00	16·50
KOSS K-711	11·00	7·95
KOSS K6	13·75	10·25
KOSS K6/LC (with volume control)	15·40	11·50
KOSS K6/LCQ Quadrafone	22·00	18·50
PIONEER SE 50	26·02	17·95

	Rec. Retail Price £ p	Comet Price £ p
HEADPHONES—*continued*		
PIONEER SE 30A	15·02	10·25
PIONEER SE 20A	9·37	6·40
PIONEER SEL 20	12·52	8·50
PIONEER SEL 40	20·71	14·25
SOUND MD806	7·15	3·10
WHARFEDALE DD1	13·75	9·75
WHARFEDALE Isodynamic	21·95	16·50
HI-FI STEREO SYSTEMS—COMPLETE		
ALBA 852	37·87	27·95
BUSH A1005	66·25	47·95
BUSH 1006 with radio	89·06	64·95
DANSETTE 4010	58·25	39·95
DANSETTE 4005	67·73	44·95
DANSETTE 4020	45·50	29·95
DECCA SOUND 613	63·95	47·95
DECCA COMPACT 2 with radio	96·03	72·95
DECCA COMPACT 3 with radio	127·09	99·95
DECCA 403	54·45	42·95
FERGUSON 3450 B with Radio (new Model)	75·40	55·50
FERGUSON 3451 B with Radio (new Model)	101·50	79·95
FERGUSON 3454	39·36	28·50
FIDELITY UA1 Music Master with Radio	94·81	67·95
FIDELITY UA2 Music Master	41·23	27·95
FIDELITY UA3 incl. stereo radio	59·73	41·95
FIDELITY Stereo Nine	Sp. Price	22·95
G.E.C. 2810	74·89	56·95
GROSVENOR MPX 8400 AM/FM/MPX Tuner/Amplifier, magnetic input, built-in 8-track cartridge player with speakers	65·75	33·95
HMV 2451	115·70	89·95
HMV 2452	62·57	43·95
HMV 2455	165·90	119·00
I.T.T. KB1025 with 662 speakers	45·65	35·95
I.T.T. KB2250 with 659 speakers and radio	136·83	105·95
MURPHY 920	45·50	35·95
MURPHY 940	66·25	47·95
PHILIPS 808	99·53	71·95
PHILIPS 825	46·92	33·50
PHILIPS 826	71·09	45·95
PHILIPS 835 with radio	65·88	46·50
PHILIPS 836 with radio	90·05	62·95
ULTRA 6027	54·55	39·50
ULTRA 6028	56·85	41·50
ULTRA 6450 B (new model) with radio	75·40	58·95
ULTRA 6451	75·40	54·95
ULTRA 6454	36·80	25·95
ULTRA 6455	39·20	29·95
TAPE RECORDERS		
AKAI 1721L	93·87	66·95
AKAI 4000 DS	93·50	68·95
AKAI X201D	168·30	123·95
AKAI X1810	215·18	159·95
AKAI GX221D	215·18	159·95
AKAI GX1900D	224·57	166·95
AKAI GX370D	328·95	244·95
AKAI CR80D 8-track stereo tape deck	79·90	53·95
AKAI CR80 8-track stereo recorder	117·02	66·95
AKAI CR80DSS Quadraphonic	149·88	103·00
AKAI CR30T 8-track stereo recorder and tuner amplifier	140·78	84·95
AKAI CR81T 8-track cartridge stereo recorder and tuner/amplifier	145·65	102·00
AKAI CR81	102·89	71·95
AKAI CR81D	84·10	58·95
FERGUSON 3258 4-track	66·85	45·50
FERROGRAPH 702/704 Dolby	267·30	226·95
FERROGRAPH 702H Dolby	278·30	235·95
FERROGRAPH 722/724 Dolby	305·80	258·95
FERROGRAPH 722H Dolby	316·80	268·95

	Rec. Retail Price £ p	Comet Price £ p
TAPE RECORDERS—*continued*		
FERROGRAPH 702/704	220·00	167·95
FERROGRAPH 722/724	258·50	194·95
FIDELITY Braemar 4-track	32·64	18·59
GROSVENOR 900 8-track record, play-back deck	51·15	36·95
GRUNDIG TK 121 (twin-track)	52·95	38·95
GRUNDIG TK 141 (4-track)	58·47	43·95
GRUNDIG TK 147 (4-track auto)	92·87	72·95
GRUNDIG TK 148 (4-track auto 2 speed)	69·76	53·95
GRUNDIG TK 246 4-track stereo deck	126·78	94·95
GRUNDIG TK 3200 Hi-Fi (Battery)	135·15	99·95
MARCONI 4248 4-track, 2 speed	49·66	35·95
PHILIPS 4416 4-track stereo recorder	137·45	99·95
PHILIPS 4418 4-track stereo	189·59	137·95
TANDBERG 3321X 2 track stereo deck (Teak)	137·38	114·95
TANDBERG 3341X 4-track stereo deck	137·38	114·95
TANDBERG 6041X 4-track stereo	187·62	153·95
TANDBERG 9021X 2-track stereo deck	236·00	198·95
TANDBERG 9041X 4-track stereo deck	236·00	198·95
THORPE GRENVILLE TD145 8-track player deck	20·28	13·50
TAPE RECORDERS (CASSETTE)		
AKAI CS35D tape deck	75·13	48·95
AKAI CS35 Stereo incl. Speakers	105·71	77·95
AKAI GXC 40D tape deck	89·74	62·95
AKAI GXC 40	105·71	73·95
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AKAI GXC 46D Dolby tape deck	131·09	91·95
AKAI GXC 65D Dolby auto-reverse deck	145·18	101·95
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JVC Nivico 1710 Radio/Cassette, AM/FM	Sp. Price	37·95
PHILIPS RR 322 AM/FM Radio/Cassette Recorder Batt/Mains	43·36	32·95
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PYE 9140	20·24	14·50
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Using grouped pairs of inputs and outputs (high Z and low Z inputs) with individual bass, treble and volume controls on each pair, plus master control. These low-noise units will feed all makes of amplifiers, making them ideal for clubs, discos etc. Standard jack sockets. Compact design. In strong metal cases. All units guaranteed for 3 years.

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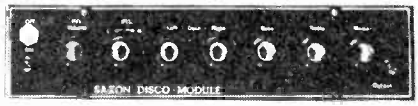
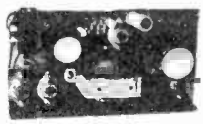
- Channel section modules, for building your own mixer. Gain—16 x (24dB). Tone controls—18dB swing. Carr. pd. £3·50 + V.A.T.

SAXON CONTROL UNITS
Mono (as shown) Carr. 20p. **£6·50**
Stereo. Carr. 30p. **£15·80**



Two decks, and full headphone monitoring. The unit is mains operated and measures 17½" x 3" x 4" deep and is finished with a smart white on black facia. The controls are: Left/Right deck fader, volume, bass, treble, Headphone Selector and volume, Microphone volume, bass, treble, mains on/off.
COMPARABLE TO UNITS AT OVER TWICE THE PRICE. (N.B.—Stereo only has mic Input.)



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Rugged class A driver stage, this module will run from all our mixers, etc., and most other makes. Delivers 120 watts into an eight ohm load and employs 4 T03 can (115 watt) output transistors. These are the modules where extra power is demanded.

Power output	120 watts into 8 ohms
Freq. response	20-20,000 HZ ± 2dB
Input sensitivity	200 mV into 10K
Construction	Fibreglass board
Size	8" x 4" x 4" (5" with supply)

Low distortion parallel push-pull output stage.

Module only (Carr. 20p) **£13·90**
Module & power supply (Carr. 40p) **£18·95**

160 watt version with power supply (Carr. 50p) ~~£27·90~~ **£27·50**

SOUND AND LIGHT UNITS

Our popular 3 channel model handles up to 3KW (3000 watts) of lighting and incorporates versatile sound control arrangement to enable professional standards to be achieved. Both units are excellent examples of Saxon quality and value.

3 CHANNEL UNIT
Includes bass, middle and treble as well as master controls. 2 amplifier sockets eliminate need for split leads. Up to 3KW lighting load. Smartly finished steel case. Carr. 30p. **£19·75**

SINGLE CHANNEL UNIT
Operates from 5 to 100 watt amplifiers. Supplied for bass note operation, is easily adapted for treble or mid-range at a cost of about 5p. Carr. pd. **£8·90**

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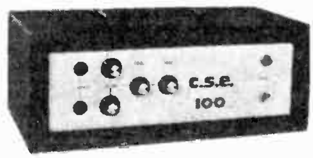
CSE 100. £34·90 carr. free



This versatile unit is now available in a black vynide case and so represents even better value than ever delivering speech and music powers of up to 100 watts RMS and continuous signal outputs of 70 watts. Two individually controlled inputs with wide range bass and treble controls.

SAXON 100 £48·50 carr. free

With an RMS output of 120 watts speech and music, 100 watts continuous power, four individually controlled FET input stages and wide range bass and treble controls, this amplifier has established itself as a unit offering quality and reliability at low cost.

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THE SMALL PRINT

AT some time or other, in hire purchase agreements, forms of guarantee, or simple purchases, most people encounter a moment of uncertainty and often wonder if the forms are really worth the paper they are printed on. What are the buyer's rights under signed guarantees or the Supply of Goods Act?

To go some way to tidying up the situation the "Supply of Goods (Implied Terms) Act 1973" has been introduced. The purpose is to make it a criminal offence to use misleading or invalid guarantees or exclusion clauses in any contract or guarantee, including hire purchase, credit sales and cash sales. Goods must compulsorily correspond with their descriptions, whether in advertisements or on the package, be of merchantable quality and "fit for the purpose intended". The phrase in quotes is often a disputable factor and does not sufficiently define how it is to be applied to technical products. If the magistrate is presumably the deciding authority in the event of such a case being brought to court, he will need authoritative technical advisors to sort this one out, but it is very common for suppliers to exercise their initiative in offering substitute components if the requested item is not currently available. These often serve to enable a project to be made operational but will not necessarily guarantee the optimum performance as achieved with quoted component types. It can be found that faulty conditions occur in a circuit which can cause chain reaction damage to other components. If substandard or substitute components are used, one takes this risk, but the constructor has no redress on the supplier unless the supplier has stated that the substitute component is suitable for that project.

The act stipulates that where redress is justified, the onus is on the seller, usually the retailer. The manufacturer is only responsible for supplying the seller with products that correspond with their trade descriptions. If such a description is inadequate then it is the responsibility of the purchaser to satisfy himself that the goods are what he wants.

Exclusion clauses are made void but not illegal, so that customers should not be led to think that his rights are adversely influenced by such statements. Guarantees should now make clear to the consumer that *additional* rights are being given; no guarantee that offers less than the implied rights of the Supply of Goods Act will be valid.

M. A. COLWELL—*Editor.*

The September issue, on sale 3rd August, will be the first of our special series of Autumn issues. Special attractions include the very easy-to-make two-i.c. radio that uses a choice of popular speakers from 8 to 16 ohms, and only a handful of other components; no complicated alignment is needed. Also featured will be a multi-purpose low voltage power regulator and a short-wave converter for insertion between aerial and receiver to convert signals in the short-wave bands into one fixed frequency of 1600kHz or 190 metres on the MW band. Also in the September issue there will be a special announcement on Q4 and other extra attractions for Issue Number 800.

Further details on page 335.

NEWS...

Practical Wireless and Television in Berlin

FOR the first time *Practical Wireless* and *Television* will be taking part in an overseas exhibition at the end of August. The "International Radio and TV Exhibition," to be held in Berlin August 31 to September 9, is one of the largest commercial and public exhibitions of its kind. Of special significance is the celebration of 50 years since the first German radio station began transmitting officially in the former Reich capital.

This will be the 29th national and second international exhibition organised by the "Division Radio and Television" in the German Electrical and Electronic Manufacturer's Association (ZVEI).

There will be 88,000 sq metres of space in 23 halls and 4 pavilions, as well as 40,000 sq metres of open-air grounds. The truly international flavour is due to participation by 20 countries including Hong Kong, South Korea, China, Norway, U.S.A. and several European countries.

Displays will embrace all aspects of electronic home entertainment systems including associated equipment for servicing, studios and transmission installations. Programmes will also be transmitted from a 2,100 seat hall that will be converted into a television studio.

Practical Wireless and *Television* magazines will participate in the Technical Press section and visitors will be able to see much of the recent work that these two magazines have published as well as some new ideas for the autumn.

We cannot possibly tell you everything about this gigantic operation in just a few lines but we hope to be able to publish much of the exciting events that will take place in a future issue. So if you are around West Germany about that time we cordially recommend a visit to this show.

Texas Instruments Seminar

TEXAS Instruments Ltd. held their successful Interface 73 technical seminar at the Talk of the Town, London on June 12, 13 and 14.

Richard Mann of "Texan" amplifier fame introduced delegates to the programme. Bob Spoeneman, Marketing Manager (Northern European Semiconductor Div.) then gave a short talk entitled "Market Overview."

A lecture on the TTL system followed and Mick Mimmack and Bob Parsons reviewed new TTL products especially the range of low power Schottky devices.

The next talk was given by Roger Banks, Senior Product Marketing Engineer for military ICs, who spoke on Beam Lead ICs.

Adrian Tarr, Product Marketing Engineer for Metal Can Power Products and Bryan Norris, Applications and Contracts Manager lectured on Power Devices and discussed practical applications of Plastic Power, and High Voltage Transistors, SCRs and Triacs.

A lecture on Optoelectronics followed. This was presented by Millis Miller, a specialist in optoelectronics who also gave a demonstration of solid state targets for low light level TV applications.

Lunch followed at 13.05 and when delegates had finished their steak and tutti fruitti, the lectures continued.

All delegates were presented with a data pack which comprised:

Semiconductor Circuit Design vol. 2, over 200 pages hard bound.

A totally new TTL Data Book providing comprehensive coverage of Texas Instruments 5 families of 54/74 TTL ICs. 640 pages hard bound.

A Seminar Data wallet containing a selection of the very latest product information, together with a book reproducing all the Seminar Slides.

Delegates being presented with data packs, by Mrs Gina Penman.

BSR Award

BSR Limited of Warley, the manufacturer of record changers has received an award for the 810 transcription turntable.

The "Component Design Award" presentation was made recently at a conference held at the Excelsior Hotel, Birmingham Airport. Viscount Caldecote, Chairman of the Design Council presented the Design Award Certificate to Mr. G. R. Wooldridge, Director of BSR Limited.

BSR introduced the 810 transcription turntable into the range of Hi-Fi record changers in late 1971. Its pre-programmed sequential cam system introduces a new experience in featherlight push-button operation.

Logic design for Digital systems

A one week residential Vacation School intended for practising engineers scientists and teachers, who need have no previous knowledge of, but are interested in the fundamentals of logic circuit design is being organised by the Electronics Division of the Institution of Electrical Engineers. The School "Logic design—for digital systems" is intended to give an appreciation of both formal techniques and their application in practice and will be held at the University of Kent at Canterbury from 23-28 September 1973.

Lectures will cover the following subjects: historical and mathematical background; design of memoryless (combinational) circuits; design of circuits with memory (sequential); introduction to automata theory; microcircuit logic; array networks; complete design of a system; CAD techniques; testing and diagnostics; and recent advances in logic design.

Further details are available from *Senior Divisional Secretary (Electronics), IEE, Savoy Place, London, WC2R 0BL.*

Northern Hi-Fi

THE Northern International Hi-Fi Festival, called "Audio 73" will be held at the Hotel Majestic, Harrogate, from August 31 to September 2.

Mobile rally diary

August 19—The Bristol "Mobile Picnic" will be held at Ashton Court, Bristol.

August 19—Preston Amateur Radio Society will be holding their rally at Kimberley Barracks, Deepdale Road, Preston, Lancs. There will be a free car park, trade stalls, bring-and-buy stalls and refreshments. Talk-in stations will be operating on Top Band and 2m. All the gen from G. W. Earnshaw, G3ZXC, 12 Withy Parade, Fulwood, Peston, Lancashire, PR2 4JN.

August 26—The Town and Country Festival Mobile Rally will be held at the National Agricultural Centre, Kenilworth, Warwickshire.

MINI-COMM RECEIVER

F. G. RAYER

You do not have to leave this receiver behind when going camping, caravanning, or when pressed for space, as it is small in size, with internal battery and loudspeaker. Despite this, it has a very good performance for the reception of AM, CW and SSB on the short wave bands, in addition to normal medium wave reception.

CIRCUIT

Fig. 1 is the complete circuit, except for the BFO which is necessary for receiving CW and SSB. As this section is not required for general listening it is wired as a separate unit.

Sockets A1 and A2 are alternative aerial input points. A1 is most suitable for a reasonably long wire aerial, while A2 is better for a telescopiç rod or short aerial. The "Blue" aerial coil is tuned by its own 365pF variable capacitor VC1, so that it can always be peaked up for best results with any aerial, no separate trimming being needed with this arrangement.

Tr1 is the OC170 RF amplifier, with the RF gain control VR1. The "Yellow" mixer coil is tuned by VC2, which is one section of a 2-gang tuning capacitor. The panel trimmer VC4 allows this circuit to be trimmed when coils are changed, or at any point of the band covered.

The "Red" oscillator coil is tuned by the second section of the ganged capacitor, VC3. VC5 is the bandspreading capacitor, which greatly simplifies accurate tuning on the congested SW bands. A 3-gang component, giving simultaneous tuning of aerial, mixer and oscillator circuits could have been used, but was felt to be unnecessary because aerial and mixer circuits can be peaked up for any setting of VC5, by means of VC1 and VC4, if necessary. There is thus no loss of efficiency with this simplified arrangement—in fact, all circuits can be tuned for best results at any frequency.

Bands are covered by inserting a set of three coils for each waveband. Provision is made for four wavebands. The "Red" oscillator coils require series padders of 350pF, 1000pF (or 1100pF) and 3000pF for the lower frequency ranges, and a direct connection for the highest frequency range. These padders, CP1, CP2 and CP3 are wired to separate holder tags

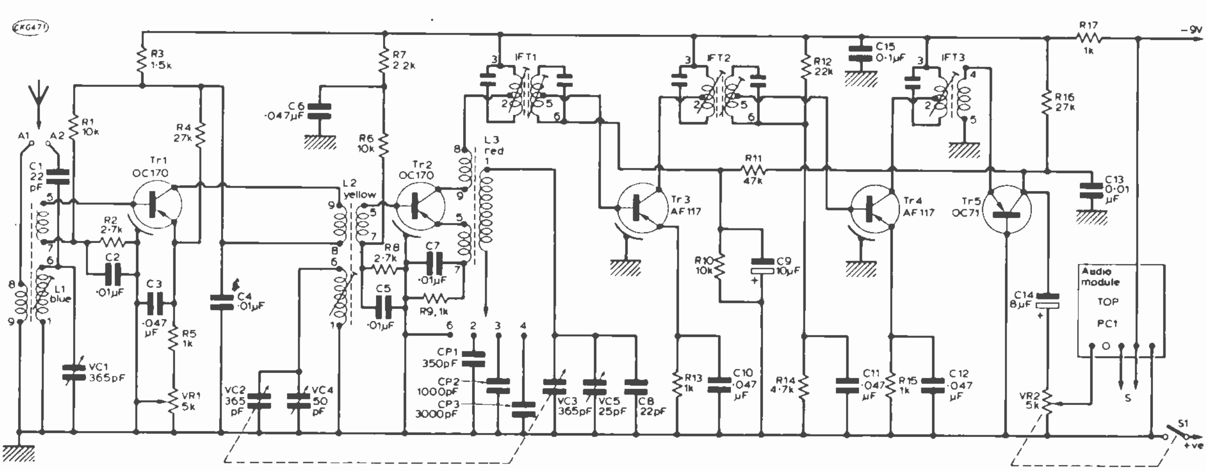


Fig. 1: Circuit of the Mini-Comm receiver. The circuit of the optional BFO is shown in Fig. 6. The photograph above shows the complete receiver, the speaker being mounted on the righthand side panel.

as in Fig. 1, so the correct padder is automatically included in circuit when the "Red" coils are changed.

The 2-stage IF amplifier has five tuned circuits in all, and although more complicated amplifiers were tried, this one was adopted on the grounds of easy construction, good gain and selectivity. Transistor Tr5 is a grounded base emitter detector with AGC fed from the collector through R11 to Tr3.

A 150mW packaged audio amplifier is fed from the volume control VR2 and gives sufficient output for most circumstances using the small internal speaker. A panel jack allows headphones to be plugged in when preferred.

Using the circuit in Fig. 1, the receiver gives AM reception over all usual short wave and medium wave bands. For the reception of CW and SSB signals on amateur or other frequencies a beat frequency oscillator has to be added, and this is covered later. Should CW/SSB reception be omitted, two panel holes for the BFO "pitch" capacitor and AM-CW/SSB switch will not be necessary.

Capacitor VC1 is mounted with three countersunk 4BA bolts, washers or spacers about $\frac{1}{8}$in. thick being placed between the capacitor and panel, the spindle passing through a $\frac{3}{8}$in. or $\frac{1}{2}$in. dia. clearance hole. Take care that the bolts do not penetrate beyond the thickness of the capacitor front frame. Before mounting VC1, solder a lead to its rotor (chassis) tag, to go to a tag MC bolted at the "Blue" coil holder as in Fig. 2.

Gang VC2/3 is mounted in the same way and two leads are soldered to its central rotor tag. One runs directly to a tag at the "Yellow" coil holder and the other to a tag at the "Red" coil holder. The small drive used for VC5 is fixed to the panel with two 8BA bolts while VC5 itself is fixed to a bracket cut from scrap. Drive and capacitor should be lined up carefully.

The controls are positioned as in Fig. 3. As mentioned, S2 and VC6 will be required for the BFO only so if these items are not wanted VR1 can be moved to the VC6 position, for a symmetrical layout.

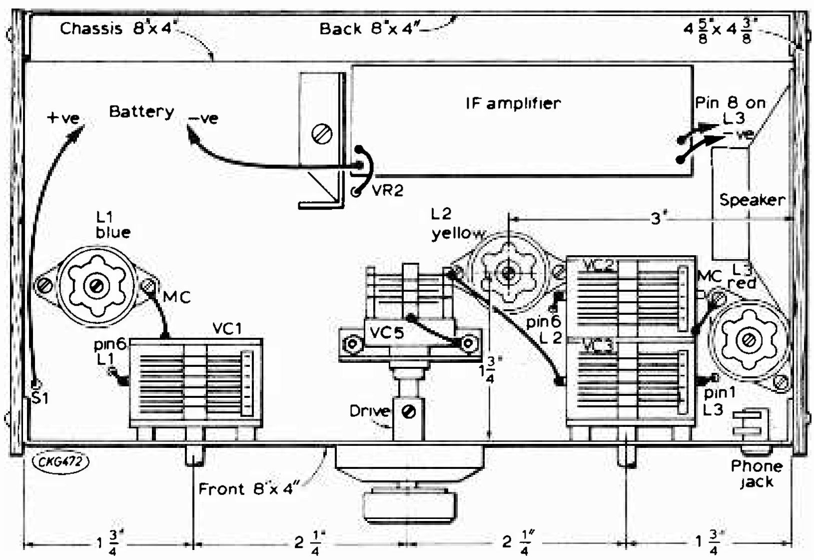


Fig. 2: Layout of the major components on top of the chassis.

GENERAL CONSTRUCTION

The receiver chassis is an 8 x 4in. "universal chassis" flanged member punched to take the coil-holders as in Fig. 2. A second 8 x 4in. flanged member forms the panel. The end flanges of the chassis member are cut so that they fit inside the flanges of the panel and bolts pass through the front flange to secure the chassis at a height of $1\frac{1}{4}$in.

Both sides are $\frac{1}{8}$in. or similar hardboard, $4\frac{3}{8}$ x $4\frac{5}{8}$in. Bolts hold the sides to the chassis and panel flanges. The right side has an aperture for the speaker with perforated zinc or speaker material placed behind the opening. It is as well to leave the speaker off until construction is otherwise finished.

The case back is a third 8 x 4in. member. A bracket is cut from scrap or a spare member so that a PP9 battery can be placed as shown. Both top and bottom are 8 x $4\frac{1}{2}$in. and can be metal or other material such as hardboard, paxolin sheet, or plywood. Self-tapping screws hold these parts to the front and back flanges.

As there is not much spare space under the chassis, the panel holes for these items come almost against the front flange of the chassis. In order that the controls are not tilted by this, it is necessary to fit one or more washers on each bush and to cut the flange to clear these. Alternatively, use five washers such as those punched out for the coil holders and cut a flat on each to clear the chassis flange.

Most of the wiring in Figs. 2 and 3 can then be done, mounting resistors and capacitors directly on the coil holder tags, as shown. Some 20 or 22swg tinned copper wire is suitable for other connections, with insulated sleeving.

The leads from Tr1 and Tr2 are left almost full length. It may be preferred to use coloured sleeving on the wires say green for emitter, blue for base, and orange for collector, with the shield wire bare or red.

The small circuit board in Fig. 3 carries the components shown in Fig. 4 and is wired separately. For external connections, insert Veropins or leave a projecting wire.

★ components list

Resistors

R1	10kΩ	R8	2·7kΩ	R15	1kΩ
R2	2·7kΩ	R9	1kΩ	R16	27kΩ
R3	1·5kΩ	R10	10kΩ	R17	1kΩ
R4	27kΩ	R11	47kΩ	R18	1kΩ
R5	1kΩ	R12	22kΩ	R19	22kΩ
R6	10kΩ	R13	1kΩ	R20	4·7kΩ
R7	2·2kΩ	R14	4·7kΩ	R21	390Ω

All 10% ½ watt

VR1 5kΩ linear VR2/S1 5kΩ log. with switch

Capacitors

C1	22pF SM	C12	0·047μF
C2	0·01μF	C13	0·01μF
C3	0·047μF	C14	8μF 6V W
C4	0·01μF	C15	0·1μF
C5	0·01μF	C16	0·1μF
C6	0·047μF	C17	0·01μF
C7	0·01μF	C18	0·01μF
C8	22pF SM	C19	5pF SM
C9	10μF 6VW	CP1	350pF SM
C10	0·047μF	CP2	1000pF SM
C11	0·047μF	CP3	3000pF SM

VC1 365pF variable (Jackson type O with slow motion drive)
VC2/3 365 + 365pF variable (Jackson type O with slow motion drive)
VC4 50pF variable (Jackson type C804)
VC5 25pF variable (Jackson type C804)
VC6 15pF variable (Jackson type C804)

Semiconductors

Tr1	OC170	Tr3	AF117	Tr5	OC71
Tr2	OC170	Tr4	AF117	Tr6	OC45

D1 Zener diode 6·8V

Miscellaneous

L1/2/3, Transistor miniature plug-in-coils, 'Blue', 'Yellow' and 'Red' for ranges required (Denco). L4, BFO coil (Denco IFT14). Valveholders B9A for coils (3). Audio module, PC1 (Newmarket). Slow motion dial 1½in. (Eagle). Output jack. AM-CW/SSB switch, 2 pole 2-way wafer. Speaker, 2½in. 30–60Ω. Veroboard 0·15in. matrix. Universal flanged chassis members, 8 × 4in. (Home Radio). Hardboard, knobs, etc. IFT1/IFT2 (Denco IFT18/465). IFT3, (Denco IFT14/465).

A ½in. 6BA bolt is fixed to the chassis in the position shown in Fig. 3 and an extra nut put on it, so that the board will be clear of the metal. The board is then placed as in Fig. 3, and fixed with a further nut.

The tag MC (Fig. 4) under the board is the chassis return.

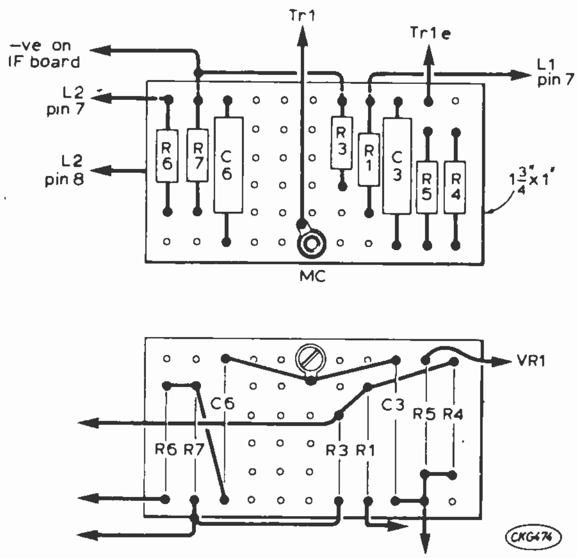


Fig. 4: Layout of the RF board.

IF AMPLIFIER

A piece of Veroboard is cut having 7 rows of holes one way, and 23 rows the other way, or 3½ x 1⅛in. Components and leads can then be placed exactly as in Fig. 5 with the minimum of difficulty.

Drill holes for 6BA bolts to fix tags MC, place the board on the chassis as in Fig. 2, and drill matching holes in the chassis. Holes have to be drilled for the IFT's so that the pins are located as in Fig. 5. Probably the easiest method is to secure the board by one long edge in a vice and drill the holes, then if some do not match the pins with sufficient

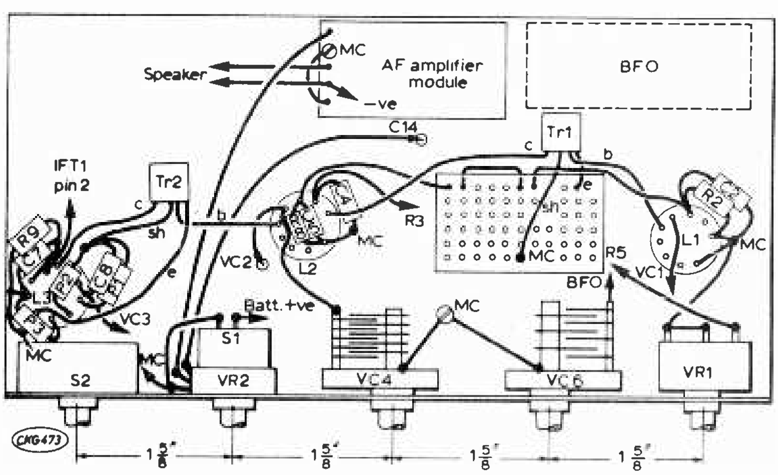


Fig. 3: Arrangement of parts and wiring underneath the receiver. Top centre is seen the audio module and to its right the BFO board. The board at centre right carries some of the RF components and wiring.

accuracy, to use a very small round file to enlarge the holes until the IFT's fit. A central hole is necessary under IFT1 and IFT2 to reach the lower cores.

Components can then be placed as in Fig. 5. In most places the wire ends of resistors and capacitors are long enough, so they are bent over, soldered and snipped off. Sleeving is put where needed to avoid shorts. The tags MC are secured tightly with $\frac{1}{2}$in. 6BA bolts and nuts and one screening can tag of each IFT must also be wired to this earth circuit.

Fit four Veropins or wires as shown. At the right-hand end of the board "9V negative" has a black flexible lead and negative battery clip. A lead from C14 positive will run to VR2, as shown. At the other end of the board, IFT1 pin 2 will be connected to tag 8 of the "Red" coil holder. A wire from the pin "negative for RF and mixer" will run to R3 and R7 on the under-chassis board.

Pieces of sleeving about $\frac{3}{8}$in. long on the transistor wires will prevent shorts here and raise them a little above the board. Solder these wires directly to the points in Fig. 5 and snip off excess wire.

The IF amplifier can be tested by connecting a battery and phones (or AF amplifier) and injecting a signal at pin 2 of IFT1 from a signal generator. As the IFT's are pre-aligned by the maker, the cores should be left as they are until proper results are obtained, and only touched up as required afterwards.

The IF amplifier is mounted with lock nuts, making sure that there is no possibility that leads or joints will touch the chassis. Leads can then be connected as shown.

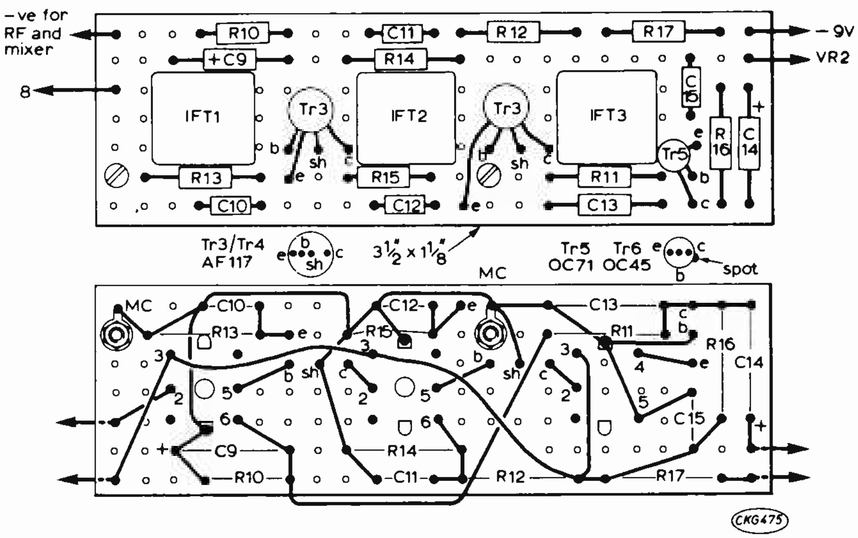
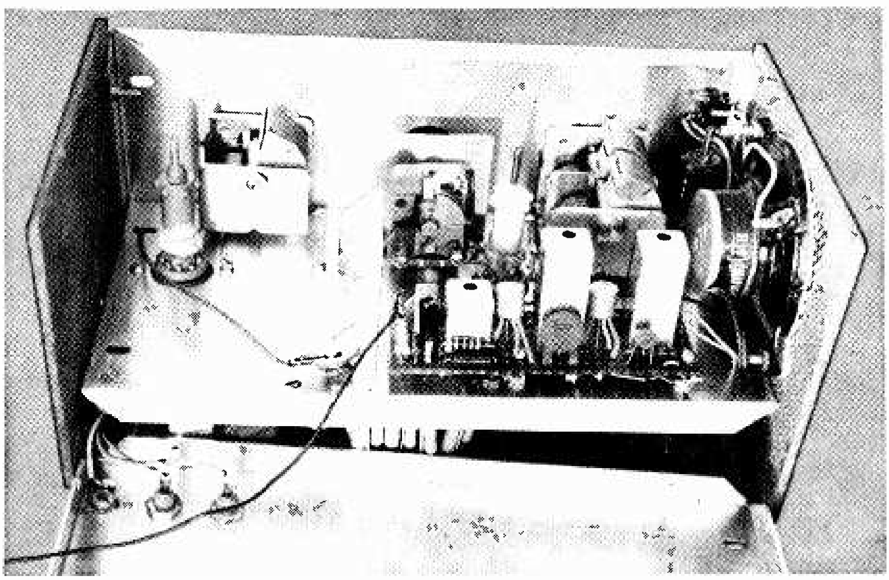
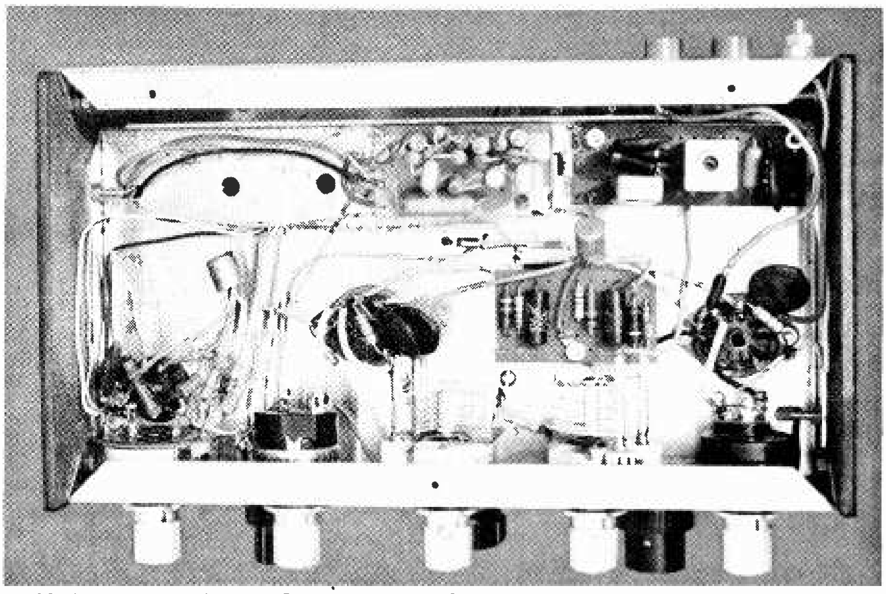


Fig. 5: Details of the wiring and construction of the IF strip. This can be tested and roughly aligned before being fitted into the chassis.



A useful view of the receiver with the back removed to enable the IF strip to be seen.



Most components shown in Fig. 3 can be identified in this photograph of the underside of the receiver.

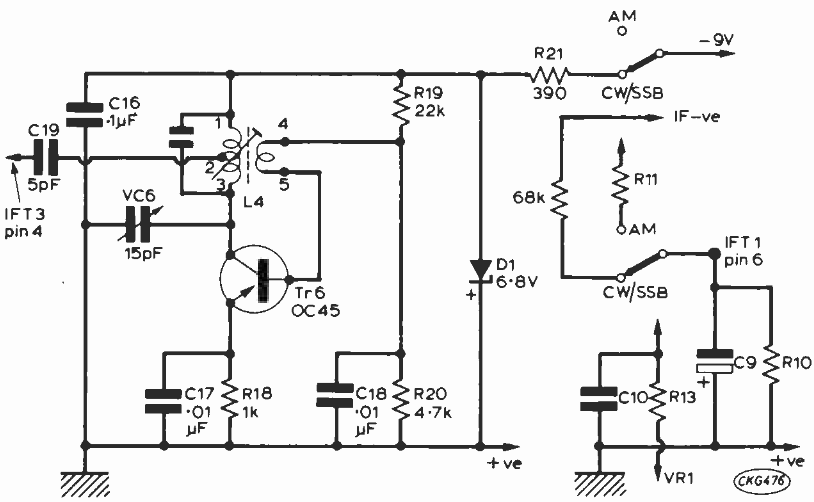


Fig. 6: The circuit of the optional BFO. The leadout connections for the OC45 can be found on Fig. 5.

AF AMPLIFIER

Figs. 1 and 3 show the packaged amplifier from the top. It is mounted clear of the chassis by a ½in. 6BA bolt with extra nuts, also securing a tag which forms the positive or chassis return connection as in Fig. 3.

Run the lead to VR2 slider (centre tag) against the chassis. Take two blue wires as shown for the speaker circuit. The one connecting point here also has a black lead, which passes to the 9V negative pin of the IF board, and thus to battery negative.

IF ALIGNMENT

This is carried out with a weak but stable signal, from a signal generator, or from a BBC MW station. VR2 should be at maximum, but signals can be reduced with VR1 so that the AGC action does not mask adjustments.

Adjust each core, if necessary, using a properly fitting tool (such as the Denco TT5 trimmer tool). Each core should have a quite sharp peak, but much adjustment ought not to be necessary.

Once this has been done, no further adjustment to the IF amplifier is necessary.

TUNING

As the coil cores are screwed right in for packing purposes they require adjusting so that some length of brass thread projects. Band coverage is set by means of the core of the "Red" coil. This adjustment is made at the low frequency end of the band.

Tune in a signal near the high frequency end of the band, and rotate VC4 for best volume. Now tune to a signal near the LF end of the band. Leave VC4 untouched and rotate the core of the "Yellow" coil for maximum volume. It should then be found that VC4 will require only a little adjustment, for best volume, at any frequency in the band. To retain dial calibration, the core of the "Red" coil is locked with a 6BA nut.

In all cases VC1 should peak up signals when in a similar position to VC2/3. Adjust the core of the "Blue" coil at the LF end of the band so that this condition is obtained. It is then only necessary to keep VC1 approximately in step with VC2/3, while tuning, and to adjust VC1 for maximum signal strength with the wanted station, or for the narrow bánd of frequencies to be tuned by VC5.

The listed single capacitor VC1 and 2-gang capacitor VC2/3 have integral reduction drives and direct and slow-motion ¼in. shafts. An "Electrovalue" type CK4 knob was fitted to the direct drive part of each spindle, by tapping out the metal insert or disc. A type JV18 knob was then fitted to the slow-motion part of the shaft. An alternative is to fit pointers to the direct drive part of each shaft, or to use direct drive (not slow motion) capacitors, with pointer knobs or scales.

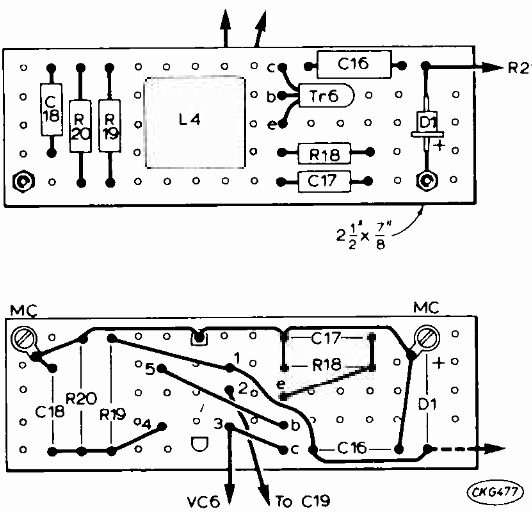
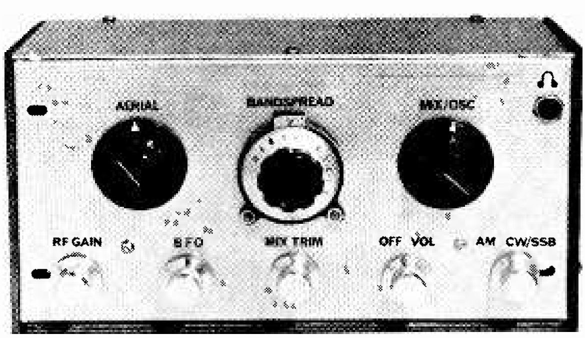


Fig. 7: The two sides of the board for the BFO components.

Coverage of the sets of "Blue", "Yellow" and "Red" coils is approximately as follows, and only those coils necessary for the frequencies wanted need be obtained.

Range 2T 515—1545kHz (580-195m)
Range 3T 1·67—5·3MHz (180-57m)
Range 4T 5—15MHz (60-20m)
Range 5T 10·5—31MHz (28-9·7m)



BEAT FREQUENCY OSCILLATOR

The circuit for this is shown in Fig. 6. When switched on, it produces an oscillation which can be tuned to approximately the receiver's intermediate frequency by the panel control VC6. This signal is coupled into the IF amplifier.

When CW is being received VC6 is adjusted so that the difference between the signal received and the BFO frequency will produce the wanted audio tone. With VC6 tuned to the receiver IF, no tone is produced. Moving VC6 either way produces a tone which rises in pitch. In some cases placing the BFO one side or the other of the IF may give greater freedom from interference.

When receiving SSB (single sideband) the BFO frequency is adjusted with VC6 so that it simulates the carrier which was removed before transmission. The speech will then be resolved. For this purpose, VC6 has to be adjusted carefully as required, for if the BFO (or carrier oscillator) is the wrong side the SSB signal, the latter cannot be resolved.

As the receiver has no separate product dètector, it is essential to keep the level of the received signal down on SSB, as required, by means of the RF gain control VR1. For AM reception, VR1 will usually be at near maximum, while volume is controlled by VR2. But for SSB, VR2 will usually be at maximum (except when using phones) and gain will be reduced by VR1. (An exception is when strong AM signals cause cross-modulation of other AM signals, when VR1 should be turned back.)

The stabilising diode D1 is not absolutely necessary but as the current drawn by the AF amplifier varies considerably with audio level this can tend to cause modifications to the oscillator frequency due to fluctuations in oscillator voltage. A 100μF or 250μF capacitor from battery negative to chassis will help reduce this. For a similar reason, connections to Tr2 can be modified so that this stage is supplied from the regulated 6·8V line, though this again is not by any means essential.

BFO CONSTRUCTION

Fig. 6 shows wiring and components on the small BFO board. This is positioned as in Fig. 3, so that a short, stiff lead can run from pin 3 of the BFO coil to VC6. When first setting up the BFO, tune in a weak but stable AM signal. Put VC6 half closed, switch on the BFO, and rotate the VFO coil core until a strong audio heterodyne is produced, which is then adjusted to zero. Turning VC6 either way from this position should then cause an audio tone which rises in pitch.

When the BFO is in use, this produces some AGC voltage which reduces the IF gain. The second pole of the 2-way switch is wired as in Fig. 6 to avoid this. R11 is disconnected from the pin of IFT1 and colour coded leads are run from R11 and pin 6 through the chassis. A 68kΩ resistor is added at the IF board, connected to the IF board negative line. These circuits are connected as in Fig. 6 so that AGC is only applied to the first IF amplifier when the switch is in the AM position.

At the same time R13 can be disconnected from the positive line and a lead can be soldered on to run to VR1, as also in Fig. 6. This gives manual control of the gain of both the RF and the IF stages. ■

BBC ENGINEERING 1922-1972
By Edward Pawley, OBE, M.Sc.Eng., C.Eng., CIEE
Published by the British Broadcasting Corporation,
35 Marylebone High Street, London, WIM 4AA.
569 pages 10 × 7½in. Price £7.00

THIS book is one of those "Bibles" that should be on the bookshelf of any man whose interest is in the earlier days of radio.

Chapter 1 explains what broadcasting is and takes the reader through the pioneering days of radio transmission. Chapter 2 tells of the period between 1922 and 1926 and is sub-divided into sections which include such things as transmitters and reception, studios, outside broadcasts, international relations and the Keston Receiving Station.

The years 1927 to 1939 are covered in chapter 3 and such items as the forming of the Corporation and short wave broadcasting are covered together with the story of the regional scheme of transmitters and the beginnings of television. There is also a section covering the BBC's preparation for the war.

The whole of chapter 4 is devoted to the war years and chapter 5 covers the post-war reconstruction of the BBC from 1946 to 1955.

The sixth and final chapter is entitled "The Years of Expansion" (1956-1972) and tells how the Corporation has progressed to the present day. A rather interesting section in this chapter deals with research and development.

Mr. Pawley has comprehensively covered the growth and progress of broadcasting throughout the six chapters of this book and traces the history from the experiments of Hertz, Marconi, Oliver Lodge and other great pioneers right through to the present day.

This is a text that it is well worth putting on the "birthday present" or "Christmas present" list as it will, I am sure, provide many many hours of interesting reading to anyone who regards radio as his hobby.

CRR

TELEVISION INTERFERENCE MANUAL
By B. Priestley G3JGO
Published by Radio Society of Great Britain
35 Doughty Street, London, WC1
92 pages, 8¼ × 6in. spiral bound. Price: 80p

THE average transmitting amateur in this country is beset by two major problems—the complaints of neighbours who will persist in wanting to watch interference-free TV programmes and, having reluctantly agreed that the neighbours have a point, finding the relevant technical information to enable him to fix his transmitter and/or the TV set and live in peace ever more.

Unlike the United States, TV set manufacturers here are under no legal obligation to fit any kind of filter to their sets so the poor amateur is forced to do a PR job for them by visiting the complainant and, hopefully, finding a solution. The amateur soon finds out that every TV set has its own particular problems and that the filter that clears the X model set is useless on the Y model. So far, information on the subject for the amateur has only appeared in dribs and drabs, mainly in "Radio Communication" the monthly magazine for members of the RSGB and not on general sale. However, this new RSGB publication, long overdue, is a welcome collation of such information from many sources on just about every method of TV interference suppression that has ever been tried on transmitters and TV sets.

The eight chapters of the manual are packed with practical information ranging from an all-important explanation of the nature of TV signal through preliminary investigation of TVI to the design of transmitters. With the deluge of hi-fi gear that has now descended on the populace the amateur is often faced with the problem of audio breakthrough and this has been given a chapter to itself. The author makes much, and rightly so, of the great tact and diplomacy needed between the parties involved if there is to be a successful conclusion to TV breakthrough investigations. The Radio Interference Service of the Post Office usually comes into the act and their actions and responsibilities when investigating complaints are very clearly laid down in this manual.

So far, very little concerted effort has been made to form effective TVI investigation groups among the amateur fraternity and those that do exist are no doubt sitting on masses of useful information. For the amateur who must go-it-alone, this excellent manual will be his greatest ally. With some 18,000 licensed amateurs in the UK the RSGB should be able to sell at least that number of copies without any trouble at all.

AED

I.C. OF THE MONTH

L.A.J. IRELAND

Number 40 — LP1000 STORED ENERGY REGULATOR

VISUAL power indication in battery operated equipment is usually absent so as to conserve power, except in the case of equipment incorporating high capacity or re-chargeable batteries. In some cases the power drain from a small filament incandescent bulb would be greater than the total consumption of the set. With the advent of the LED with its far greater light output efficiency it was possible in some cases to incorporate these as visual indicators but even here a 30mW or so power drain would be quite typical.

An alternative approach to reduce power drain even further to a mere 300 microwatts or so would be to pulse operate the LED every few seconds in addition to keeping it in operation only for a specified portion of the peak pulse thereby giving rise to maximum light output for minimum energy consumption.

A new monolithic integrated circuit type LP1000 manufactured by the Lithic Systems Inc. Co. of America performs just this function and is described as a 'Stored Energy Regulator' or 'Miser' for short, due to its extremely low power drain. This, however, is only one of a number of very interesting applications of this particular IC to be considered this month.

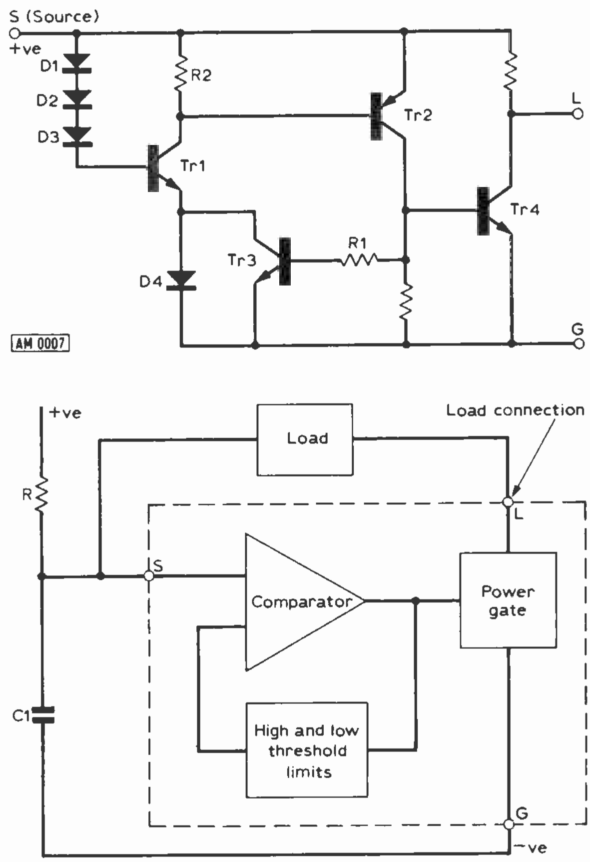


Fig. 1: Circuit diagram of the LP1000, together with a functional block diagram. The IC is produced in a TO-18 package.

Circuit

A circuit diagram of the LP1000 IC together with a functional block diagram is illustrated in Fig. 1. Power for the device is usually obtained through a resistor capacitor network. The output power gate consisting of Tr4 is kept biased off as long as Tr1 is kept in a non-conducting state set by the voltage drop across D4 which is in series with the D1-D3 diode chain. As soon as Tr1 conducts the voltage drop produced across R2 saturates Tr2 which in turn forces the power gate Tr4 to change state.

The feedback signal to the base of Tr3 via R1, reduces further the voltage drop across D4 as it saturates Tr3 which is connected in parallel with D4 and this accentuates the turn-on time resulting in a sharply rising output pulse at the collector of Tr4.

As the LP1000 then discharges the capacitor C1 through the load, the voltage across C1 begins to drop but before it can reach zero level Tr3 will be biased off giving rise to an equally abrupt turn-off pulse. The peak and valley voltages for the LP1000 lie between 2·4-1·9V so peak power is only consumed with the inherent advantage of maximum efficiency. This sequence of events continues so long as power is suppled to the device with the flashing rate set by the external RC time constant.

A high intensity light flash visible even in direct sunlight is possible using a 500μF capacitor. However, as the maximum voltage applied across this capacitor is in the region of 3 volts, the actual physical dimensions of the capacitor can be kept quite small. Less intense flashes are produced with smaller value capacitors with a corresponding increase in the flashing rate provided the charging resistor remains constant.

Other uses

Due to the built in load resistor in the collector circuit of Tr4 the IC can also act as a free-running multivibrator with the frequency again controlled by the RC time constant. Frequency rates from as low as one cycle per minute to as high as 20kHz are possible using this simple arrangement with a typical power consumption of a mere 500 microwatts. Fig. 2 shows the LP1000 connected as a 1kHz oscillator.

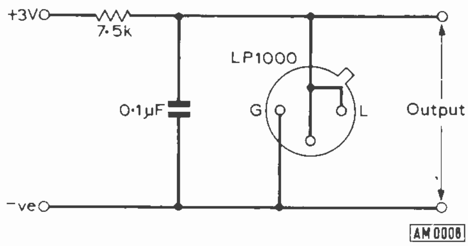


Fig. 2: LP1000 in a multivibrator circuit at 1kHz.

A further development from the oscillator application above is to power the IC from a solar cell giving rise to a self-contained unit which could find interesting applications as an aid to the blind. By replacing the load resistor with a miniature earphone an audible tone is available as a light indicator with the frequency of the note indicating the intensity of the light. Turning the cell towards brighter areas will be reflected by a corresponding increase in the pitch of the note. Solar cells capable of delivering 500 microwatts are relatively inexpensive and the light-to-sound indicator could prove to be a invaluable asset to any blind person, Fig. 3.

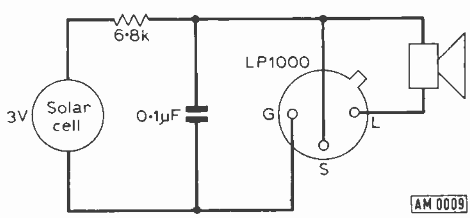


Fig. 3: Circuit using the LP1000 in a light-to-sound indicator.

Finally the last application to be considered is again a rather unusual one but the experimental possibilities it opens up are intriguing. If the load is replaced by a small step-up transformer voltages as high as 90 volts or so are obtainable. Naturally the available current from such a source is small but it does offer the possibility of trickle charging small capacity batteries from solar energy in a pretty efficient manner.

The Lithic Systems Inc. Co. have also recently released one of the first monolithic microtransmitters—a complete radio transmitter on a single chip with a 100 mW output. In the near future it is hoped that an article featuring this IC type LP2000, will be published in this column. ■

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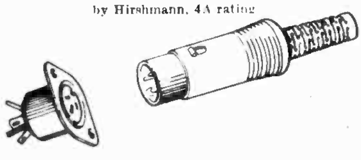

2 way LS—socket 10p; plug 12p. 3 way scr. socket 10p; plug 12p. 5 way scr. socket 12p; plug 15p.

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Heat sinks 1°C/w, type 6W1, undrilled 60p

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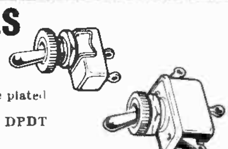

1011C SPST toggle 20p:
409 DPDT toggle 29p. (These are chrome plated 2·5A rating)
7201 Sub-miniature DPDT 250V a.c/2A 48p

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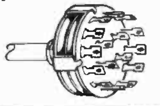
Radiospares Miniature Maka-switch (in assembly kit form) Shaft 48p.
Wafers, MBB-2P5W, 1P11W: BBM-1P12W, 2P6W, 3P4W, 4P3W, 6P2W, each, 6p.

WAVECHANGE SWITCHES



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

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AXIAL LEAD Prices subject to amendment by the manufacturer.

Rated voltage: / Capacity µF	3V	6·3V	10V	16V	25V	40V	63V	100V
0·47							10p	7p
1·0						10p		7p
2·2					10p		7p	8p
4·7				10p		7p	8p	7p
10					7p	8p	7p	8p
22			7p	7p		7p	7p	9p
47	7p		8p	7p	8p	7p	9p	12p
100	8p	7p	7p	7p	7p	9p	11p	19p
220	7p	8p	8p	8p	9p	10p	17p	27p
470	8p	9p	9p	10p	12p	17p	24p	43p
1000	10p	12p	12p	17p	20p	24p	40p	
2200	14p	17p	22p	25p	36p	40p		
4700	25p	28p	37p	41p	54p			
10,000	40p	43p						

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250V up to 0·1µF: 100V/0·1µF and above.
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0·068; 0·082; 0·1; 0·12; 0·15 **each 4p.**
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C	1/8W	5%	4·7 Ω–470K Ω	E24	1	0·9	0·75 nett
C	1/4W	5%	4·7 Ω–10M Ω	E12	1	0·9	0·75 nett
C	1/2W	5%	4·7 Ω–10M Ω	E24	1·2	1	0·9 nett
C	1W	5%	4·7 Ω–10M Ω	E12	2·5	2	1·8 nett
MO	1/2W	2%	10 Ω–1M Ω	E24	4	3	2 nett
WW	1W	10% ± 1/20 Ω	0·22 Ω–3·9 Ω	E12	7	7	6
WW	3W	5%	1 Ω–10K Ω	E12	7	7	6
WW	7W	5%	1 Ω–10K Ω	E12	9	9	8

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MO—metal oxide, Electrosil TR5, ultra low noise.
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Values:
E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
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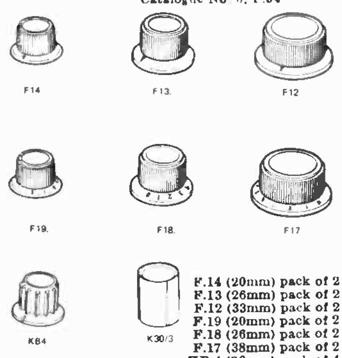

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F.19 (20mm) pack of 2 32p
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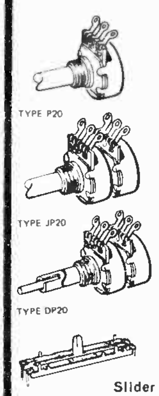

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LOW POWER CLASS A AMPLIFIER

R. A. Pen

IN some applications, such as in small pocket receivers, only comparatively small output powers are required, and small modern loudspeakers produce adequate volume for a small room from only a few milliwatts of power. In fact most miniature speakers have a maximum power handling capability of only 100-200mW.

While in the interests of battery economy class B amplification is usually used in the output stage of battery operated equipment, where only low output powers are involved, a simple class A circuit is quite suitable. Bearing these points in mind, the simple amplifier described below was constructed.

Circuit Explanation

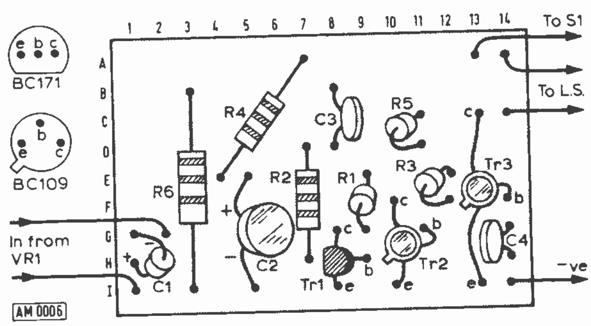
A circuit diagram of the amplifier constructed by the author is shown in Fig. 1. This uses three inexpensive silicon n.p.n. transistors.

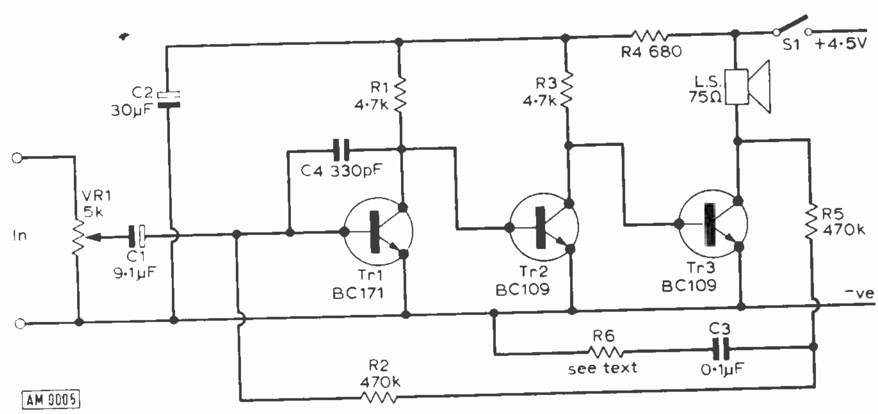
VR1 is the volume control, and C1 the input coupling capacitor. Tr1—Tr2—Tr3 are direct coupled. R2, and R5 bias the input transistor (Tr1) so that the voltage present at its collector (approximately 0·65V) is at the correct level to in turn bias Tr2. Likewise, Tr2 is biased to just the right level to produce a voltage at its collector which is suitable to bias the output transistor, Tr3. In effect Tr1—R1 form a potential divider which biases Tr2, and Tr2—R3 form a potential divider which biases Tr3.

As each transistor inverts the signal between its base, and collector terminals, the input and the output of the entire amplifier are 180° out of phase. The two biasing resistors, R2, and R5 being connected between the input and the output therefore introduce a considerable amount of d.c., and a.c. negative feedback. While the d.c. feedback is very desirable as it gives stable biasing to a system which would otherwise be very critical, the a.c. negative feedback decreases the gain of the amplifier. This does however, give the amplifier improved quality (hi-fi).

The gain of the amplifier can be increased by connecting a capacitor of a suitable value between the junction of R2—R5, and earth. This decouples the a.c. signals through the biasing resistors, and virtually eliminates the a.c. feedback at audio frequencies.

A compromise between gain, and output quality can be achieved by placing a feedback limiting resistor in series with the decoupling capacitor. In Fig. 1, C3 is the decoupling capacitor, and R6 the feedback limiting resistor. The value of R6 is the highest one which gives adequate gain for the amplifiers intended purpose, a value of 22kΩ being used on the prototype. Its value can be varied to suit individual requirements, the required value being found by experimentation.





▲ *Fig. 2: Component layout on the Veroboard.*

◀ *Fig. 1: The low power class A amplifier.*

R4, and C2 are the supply decoupling components. The loudspeaker itself forms the collector load for Tr3. Speakers of other impedances can be used, but must have an impedance of at least 35Ω. Due to the large amount of d.c. negative feedback used in the circuit, altering the speaker impedance should not drastically change the operating parameters of the circuit.

The low value capacitor, C4, is required in order to reduce the upper frequency response of the circuit, and so maintain good stability. Without this component, direct pick-up of radio signals can become a problem.

S1 is the on-off switch, and can be ganged with VR1 if preferred.

The unit requires a 4·5V supply, an Ever Ready 1289 battery being a very economical source of power for the amplifier, although if small size is required, three U16 batteries connected in series can be used.

As the amplifier uses only a few components all of which are of a small size, it is easily miniaturised. A diagram giving a suitable Veroboard layout for the unit is shown in Fig. 2. The prototype built to this layout measures only 1·4 x 0·9 x 0·75in. For obvious reasons miniature resistors, and components must be used. On the prototype a tantalum bead capacitor was used in the C1 position, but a miniature electrolytic of 8-10μF can be used providing it will fit into the available space.

There is only one break which has to be made in the copper backing strips, this being between the negative side of C1, and the collector of Tr1. A soldering iron with a fine bit is required when soldering the components to the board, and a continuity tester should be used to ensure that no excess solder is shorting two adjacent copper strips together.

One cannot expect too much in the way of output quality from the amplifier, mainly because such a small speaker is used, but the unit is economical to run, small, inexpensive to build, and sensitive, and is very useful for many purposes. ■

CASSETTE RECORDER IN THE CAR

M. Vlietstra

On a long trip it is often desirable that one can play one's cassette tape-recorder, but then it's battery life becomes very short. Since most cars use a 12 volt battery, the tape recorder cannot be run directly from the car's electrical system. One often used method is to connect a heavy resistor in series with the tape-recorder, but on a radio-cum-tape-recorder this method does not work since the tape recorder draws far more current than does a radio.

This problem can be overcome by using a very simple stabilising voltaged supply consisting of only three components—a transistor, resistor and a zener diode. Before one selects any components, one must know exactly what one's requirements are—the figures given at the end of this article are for a typical cassette tape-recorder that draws a maximum of 350mA. It is however easy to modify one's design to cope with almost any portable tape-recorder.

Firstly, what is the voltage of the machine? This is easily determined by counting the batteries and multiplying by 1·5,—most recorders are either 6, 7·5 or 9 volts. Once the voltage has been determined, it is neccessary to find the maximum current that the machine will draw. To do this, remove one battery and solder wires onto the ends of it. Connect an ammeter in series with the battery and by dabbing the wires where the battery was and by playing the tape recorder with it's volume fully turned up, the maximum current can be determined.

Our next job is to choose a transistor. The only specifications that need concern us are it's power and current rating and it's current gain (h_{fe}). For a tape recorder, a 2N3054 is normally sufficient, but for a large machine, a 2N3055 might be neccessary, while for a small radio, a 2N1611 might suffice. To determine the power rating, we use the formula

$$\text{Power} = I \times V = I(V_{in} - V_{out})$$

The zener diode is a low power device (250mW) and it's breakdown voltage is the required output voltage plus 0·6 volts, the latter being the emitter-base voltage of a silicon transistor. The zener need not be specially selected, since a volt either way will have very little effect on the tape-recorder.

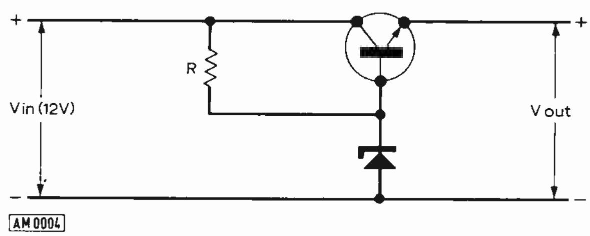


Fig. 1: Stabilising circuit for cassette recorders.

The resistor (R) is the most difficult to calculate. The current that passes through it performs two functions:

i) A current of normally at least 5mA to maintain the voltage across the zener diode.

ii) The base current of the transistor. As a rule of thumb, this should be twice the maximum required output current divided by the current gain of the device.

Adding these two we get that the current through the resistor is $(5+2\, I_{out}/h_{fe})$ mA and assuming that the car uses a 12 volt battery, the value of the resistance, using Ohm's Law, is found to be:

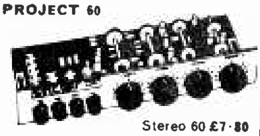
$$R = \left(\frac{(12 - V_{out} + 0\cdot6)}{(5 + 2\, I_{out}/h_{fe})}\right) \text{k}\Omega \quad \left(R = \frac{V}{I}\right)$$

The components given below are for a typical tape-recorder that draws 350mA. No list of prices is included as a person who can't build this for less than £1 just isn't trying!

Components.	6V	7·5V	9V
Resistor (½W)	330Ω	270Ω	180Ω
Zener diode	6·6V	8·1V	10V
Transistor.		2N3054	

■

SINCLAIR PROJECT 60



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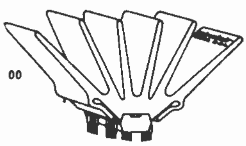

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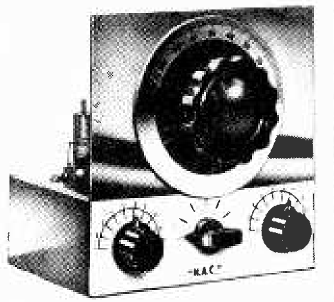

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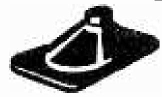

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HOTLINES ON RECENT DEVELOPMENTS

A COMMON circuit arrangement in the popular construction journals is that which allows temperature to control something—a sort of electronic thermostat.

Perhaps the most featured circuitry is that which has some form of temperature sensor (say, a thermistor) followed by a transistor or two which, in turn, drives a meter (for temperature to be read from a pre-calibrated dial) or a relay to actuate some form of control circuit.

Out on to the electronics market has come a new type of reed switch which can perform this kind of function—and without the need for any further electronic circuitry.

Basically, the reed switch has two contact blades which form a simple on-off switch. Around the glass tube which houses these contacts is a coil. Energising the coil causes the contacts to open (or close) while remova of the energising source causes the blades/contacts to return to their original state.

The new devices have the glass capsule and reed relay blades. Instead of a simple coil of wire, the capsule is surrounded by torroidal magnets which are separated by a ferrite material. Because the ferrite material separates the magnets, it also has the effect of separating their individual magnetic fields.

However, the particular make-up of the ferrite employed is such that there is a certain critical temperature point called the Curie point. Below this point, the ferrite no longer isolates the magnetic fields of the separate magnets and thus the switch can be caused to activate.

Once the temperature rises above the Curie point, the magnetic fields are again separated. Thus there is a complete switching action actuated only by temperature, and the reed blades themselves can be used to form a switch. There are many uses which will come to mind; standard units in the range extend from 0°C to 100°C in 5°C steps.

LIGHTS UP

Turning to the "lighter" side of smoking, solar cells are being used in electronic lighters to keep the batteries charged. One set of experiments shows that some 50 cigarettes a day can be lit for a month before the batteries need recharging by exposing the light-cells to a light source. It seems reasonable to assume that one could leave such a lighter out in the open for various periods of time and thus the batteries would remain charged for far longer than a month.

Work is proceeding to improve the efficiency of solar cells as a means of supplying energy from ordinary daylight, i.e. without any sunshine at all. This should be a useful project for people living in or around Manchester on a rainy day.

ALL TOGETHER

Electronic calculators have become very real practicalities over the past few years. Progressing from the realms of theory they are now offered by the van load in a wide variety of shapes and sizes. Many things have contributed to the progress of electronic calculators not the least of which is the development of the i.c. which does all the calculating. The aim has been to be able to boast "A calculator on a chip".

Well, the dream gets closer every hour. A company has now brought out a chip which very, very nearly achieves this title. The low power calculator circuitry is on the same glass panel as the liquid crystal display. Thus the thing is literally a complete calculator on a single substrate.

But what of the buttons or keys which input the information? Well, the manufacturers have thought of that too—yes, and it's on the same panel. The inter-digitised contacts are shorted by a conductive rubber button whenever a key is depressed. Standby power is only 12mW and the calculator runs for about 100 hours from a single pen-sized cell. Sorry, they are not for sale in the U.K. as yet.

VERY HIGH-BROW

Capacitors are one type of component which seems to be getting ever smaller. The photograph on this page shows five tantalum chip capacitors from the range manufactured by Union Carbide. The T400 series has nine case sizes; values range from 0·1μF and can withstand temperatures of up to 300°C. Those

shown in our photograph are for a very "high-brow" application — at least, "eye" think they are.

Down in the forest something stirred, so we're told. In a certain Bavarian forest it is more than stirring. Laser equipment, supplied by Siemens, measures the trajectory of survey satellites. Power of this laser is 100MW (100 megawatts or one hundred million watts). One wonders if, in the decades to come, this type of equipment will be towed away from Lisle Street shops as surplus stock by delighted Amateurs who may have just given £1·75 for them. If this happens one must ask whatever will replace such equipment?

LITTLE THINGS

Little things please little minds so we're told, but sometimes it's not that cynically simple, Cramming a few thousand semiconductors into a dual in-line package is a common occurrence today, but what of the devices which are very difficult to integrate? Items such as tuned circuits are a problem. However, solutions are on the way, in the form of subminiature inductors or "coils".

Described as monolithic chip inductors, these minute devices are made by stacking U-shaped conductor patterns which have been screened onto a special ferrite tape. The U-shaped patterns are stacked such that when the individual ends of each U are connected to the U's above and below, a continuous "coil" pattern is achieved. When this has been done, the complete stack is "fired" resulting in a monolithic structure.

Ginsberg

LOOKING AT THE London ELECTRONIC COMPONENT SHOW

THE four-day London Electronic Components Show at Olympia, London opened on Tuesday 22nd May, the guest of honour at the inaugural luncheon being H.R.H. The Duke of Kent, who later made quite an extensive tour of the Show.

The Show's sponsors, the Radio and Electronic Components Manufacturers Federation, celebrating their 40th anniversary this year, managed to get no less than 480 companies to exhibit the very latest developments in electronic components and associated instruments, equipment and services.

Olympia's two main halls were utilised for this massive event and special preparations were made to receive and attend to the needs of the many visitors from abroad. Almost one-fifth of the stands belonged to exhibitors from overseas with representatives from more than sixteen countries including Australia, Austria, Belgium, Canada, Denmark, Hungary, Japan, West Germany, Spain, Sweden and the USA.

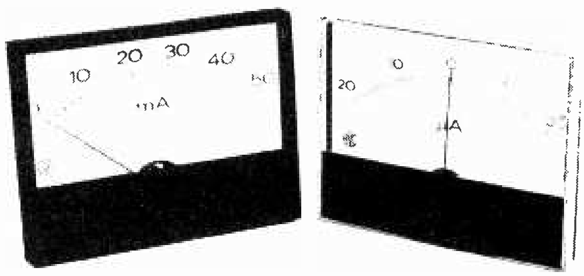
During the Show three discussion and question sessions were held outside at the Royal Westminster Hotel, being arranged jointly by the RECMF and the Institution of Electronic and Radio Engineers. The subject "European Component Survey" covered the aspects of component testing, evaluation and development.

Visitors to the Show were invited to try their luck in various competitions in which very attractive prizes such as an 8-track tape recorder, a £100 watch and even bottles of whisky could be won, not to mention a holiday for two in Rome!

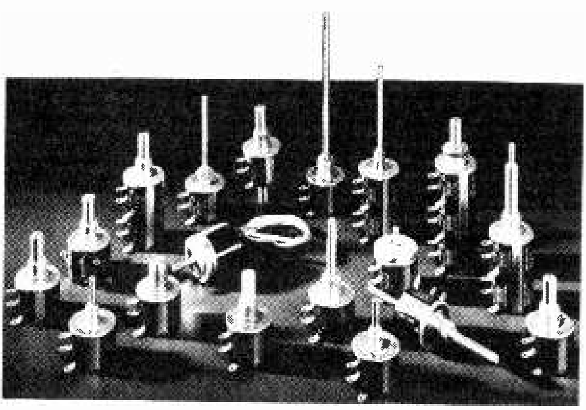
All the components in the world would not be of much use if the many units into which they are fitted could not be connected together by means of efficient connectors. In 1971 over £22 million of the electronic components market was accounted for by the sale of just such connectors.

About every possible variation of connector was on show with **Amphenol** making them their main theme on their stand together with switches, lamps, relays and indicators. **Ultra Electronic Components** featured a new range of connectors and accessories for use with printed circuit boards as well as an improved version of their 0·1in. pitch modular edge connector. Other products on their stand included plugs and sockets, terminal blocks, rotary wafer switches and water activated batteries.

AMP of Great Britain also had a wide range of low cost pin and socket and flat flexible cable connectors. They manufacture just about everything needed in solderless, crimped terminations and can supply everything from a single terminal to computer-plotted wiring system components.



In spite of their long and world wide reputation for testmeters, only now have AVO Ltd. started producing a line of panel mounting meters. Two of the new Dinline series are shown above.



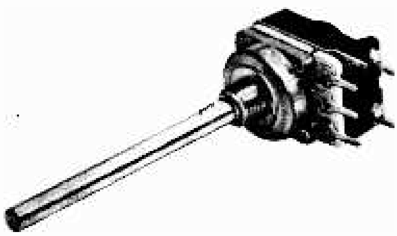
Spectrol Reliance Ltd. were justifiably proud of this large number of permutations of their Model 534 'Universal' potentiometer.

AVO celebrated their Golden Jubilee with the introduction of their first-ever range of panel mounting meters. The new Dinline Fifty range marks, not only fifty years of Avo, but also their entry into Europe, with styling based on the rectangular DIN (IEC 51) specification. The matching series of eight models is available in two presentations, a moulded black finish and glass window or clear Macralon ensuring entirely shadow-free readings.

Sealectro's stand had their complete range of products which includes RF connectors, multi-pin connectors, plugboards, insulated terminals, rotary switches and punched card readers. Centre piece of this display was the new series of punched card readers, the new 4mm grid plugboard system and the new FR/SR series of two-piece insulated terminals. New items in the RF range include a high isolation coaxial switch and a range of 75 ohm connectors to

DIN 47295. Sealectro's technical staff demonstrated a miniature RF connector assembly using flexible and semi-rigid cables.

Piher International Limited, were exhibiting in the United Kingdom for the first time. Piher are already among the world's leading suppliers of carbon film resistors with a daily output of some seven million resistors from their headquarters at Badalona near Barcelona. Over 90 per cent of their production goes to export markets, principally the United States, Germany and the United Kingdom. On Piher's stand could be seen many samples from their range of carbon film resistors, trimming potentiometers, small signal and medium power transistors and capacitors, and particular interest centred on a new range of preformed resistors.

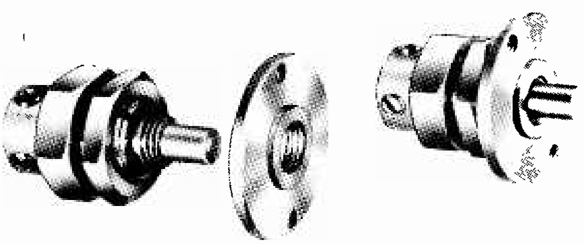


One of the Series C16 Cermet potentiometers by AB Electronic Components Ltd. Standard models range from 100Ω to 2·5MΩ, linear, but special models down to 50Ω and up to 10MΩ are available, with soldering tags or printed circuit terminals.

Hungary was represented by **Elecktromodul** who were showing components for telecommunication, engineering and electronics. Products on display included ferrites, electrolytic capacitors and ceramic capacitors.

Audax SA, from France, exhibited examples from a wide range of loudspeakers, while **Societe Francaise de l'Electro-Resistance** had on display metal film and hi-rel resistors, carbon and cermet track potentiometers and trimmers, plastics potentiometers and cermet film micro-circuits.

Cosmocord-Stolec Limited were showing, for the first time in the United Kingdom, a range of low-cost multimeters and insulation testers, plastics mouldings and audio transcription transducer equipment.



One item from the vast range of drives, dials and tuning capacitors from Jackson Bros. Ltd., a miniature ball drive with a 10:1 reduction, Type 5870.

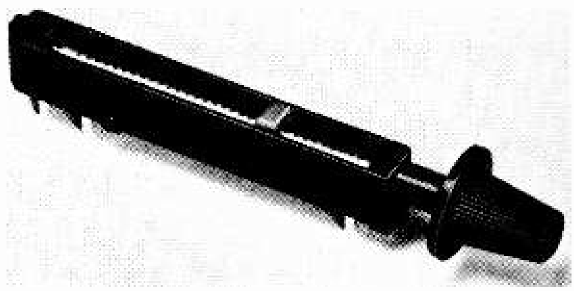
New ranges of DIN plugs and sockets and instrument components were featured by **Tape Recorder Spares Limited.** Audio and electronic components, switches, mains units, wire measuring and storing equipment and wire cutting and stripping equipment were among other products shown.

Watson Anodising Limited had a range of nameplates, labels, instrument panels, plain and printed chassis as well as examples of the general printing they undertake for the electronics industry.

Rectifiers, thyristors and triacs from **Raytheon-TAG Components Limited** included glassivated and planar plastics encapsulated thyristors and triacs, plastics encapsulated 10A rectifiers to 1300V, fast turn-off rectifiers and diffused SCRs up to 35A and triacs up to 25A RMS.

Radiatron Components Limited stand had a display of components and accessories ranging from collet knobs, instrument cases and housings to relays, connectors, switches and automation modules.

For visitors to the show interested in television, **AB Electronic Components Limited** makers of the only touch tuner made in the United Kingdom, which, when announced last year was the only one made anywhere in the world, is perhaps the best known of their products. Connectors, potentiometers, switches and thick film microcircuits are among others. Sharing AB's stand was **Wolsey Electronics,** a division of AB, showing various aerials and their range of radio and television master aerial and amplifier systems.



This 25-turn preset potentiometer by AB Electronic Components Ltd. is of carbon composition construction intended for use with varicap tuners. Resistance ranges up to 100kΩ in linear, logarithmic or diode characteristic law.

Solder, one of the most important materials used in electronics, was shown in all its forms by **Multicore Solders Limited.** Cored solder, solder creams, bar solders as well as liquid fluxes and chemicals for hand and wave soldering were included in their display. Some 50 per cent of Multicore products are exported to 107 countries throughout the world—one-quarter of the exports going into the competitive U.S.A. market.

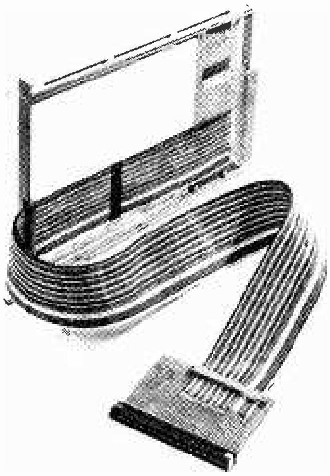
Soft solder, fluxes, chemicals, solder preforms and samples from a wide range of solder products were to be seen on the stand of **Enthoven Solders Limited.**

A heavy duty aerial rotator was among communications, marine, television and radio aerial equipment featured by **J-Beam Engineering Limited.**

Communications cables, instrumentation cables, equipment and connecting wires, winding wires, mineral insulated heating cables and thermocouples, solder coated copper wire, silicone insulated fine wires and connectors were displayed by **BICC.**

The wire-wound component is one of the oldest devices used in electronics and remains an important adjunct in the industry. **Gardners Transformers Limited,** who specialise in this field, have orders currently valued at £450,000—a quarter of which come from overseas. They were displaying transformers, inductors, filters, delay lines, inverters, converters, power supplies and modules.

Having recently merged with the Allen-Bradley Company of Wisconsin, USA, **Morganite Resistors Limited** had a wide range of resistors, potentiometers, switches, thin film and thick fiim networks, capacitors,

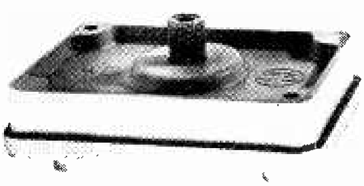


A Tekdata Ltd. flat flexible cable in FibaTEK p.v.c. material. This custom-made cable uses 7/0·193 and 14/0·193 wires.

filters and industrial controllers from both of their product lines. Not previously shown in the United Kingdom, the Morganite cermet single turn potentiometer, type 90, with a power rating of 0·5 watt and a resistance range of 10 ohms to 2 megohms, is designed for commercial and industrial applications. New from Allen-Bradley is the "Mod-Pot", a variable resistor available in single, dual, triple and quadruple construction plus potentiometers, line switches and vernier drive modules.

A. F. Bulgin & Company Limited commemorate 50 years as electrical and electronic component suppliers. During the last 12 months some 40 new products have been introduced, the complete range now containing over 15,000 items. Examples on show included fuses, fuseholders, knobs, switches, signal lamps, and plugs and sockets.

Custom-built specialists in MOS, bi-polar and hybrid thick film technologies, **GEC Semiconductors Limited** had a new phase control circuit for controlling triacs when driving small electric motors. One interesting device also on display was the MA1705, a MOS integrated circuit developed for use in electronic musical instruments and synthesisers. It generates four notes on an equally tempered scale by dividing successively by 1·0595



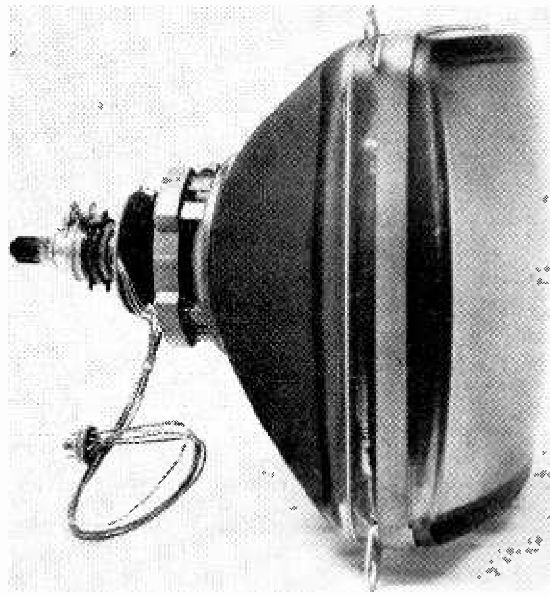
The Series 880 focus control has been specially designed by AB Electronic Components Ltd. for colour TV receivers and can be mounted on a metal chassis. The maximum continuous operating voltage is 10kV.

from a single master oscillator. Three packages can be cascaded to produce a complete octave of semitones, while further octaves can be generated by using compatible six-stage binary divider circuits.

Among new transistors by **Mullard** for use in high-power, high-quality audio amplifiers are families of complementary pairs that can give outputs of up to 100W. For example, in applications where an output of 6 to 15W is required, pairs from the transistor family BD433 to BD438 are suitable. (Odd numbers are n-p-n types, and even p-n-p.) These have a maximum V_{CEO} rating of 22 to 45V and a total dissipation of 36W.

Silicon power transistors type BD266 and BD267 form a complementary pair that can give a high-quality, audio output of 25W; they are also suitable for use in general purpose amplifiers and switching applications. Both are monolithic epitaxial-base Darlington transistors.

Other new Darlington devices seen were types BDX62 to BDX67, which are power transistors with TO-3 encapsulations. Complementary pairs selected from these for use in audio amplifiers will give outputs of 25 to 100W.

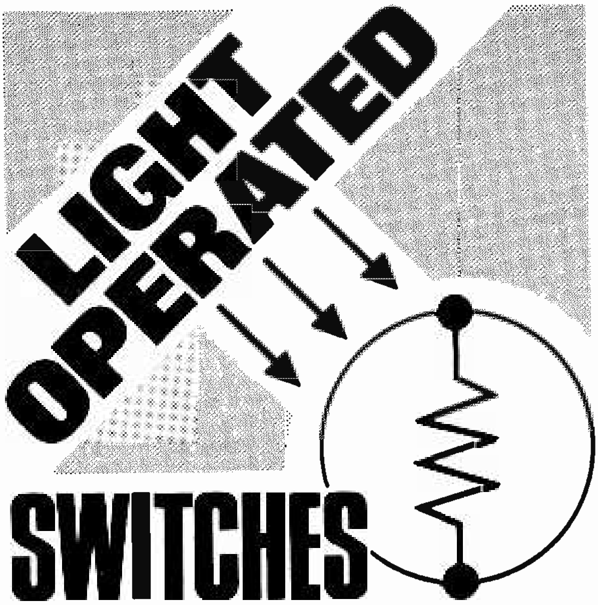


Rather large, but a component never-the-less! The A51-160X Precision In-Line colour TV tube assembly features a slotted shadow mask, integral neck components and factory-set static/dynamic convergence and purity adjustments. The June issue of our companion magazine Television featured a technical article on the new Thorn tube.

The use of Mullard circuit modules and integrated circuits can reduce the design costs and assembly times of good radio receivers, a.m. and f.m. Different arrangements, demonstrating the ease with which a variety of receivers can be designed, were shown.

New to the United Kingdom and exhibited by **Bird Electronic Limited,** was the Bird model 4370 wide-band Thruline wattmeter and model 4342 combined power meter and VSWR monitor. Coaxial load resistors, attenuators, coaxial switches, filters and calorimeters were also shown.

Included in the **Spear Engineering Company Limited**'s display were power transistor holders, connectors, valve and tube base mouldings and printed circuit assembly fixtures. ■



LIGHT OPERATED SWITCHES

R.PENFOLD

LIGHT operated switches are extremely useful devices which have a number of uses in burglar alarms, automatic parking lights, etc. Most designs for these switches work along the lines of the circuit shown in Fig. 1. The ORP12 photo-resistor is a device which in total darkness has a very high resistance (usually a few megohms), but when light falls upon it, the resistance will fall to a very low level (usually a few hundred ohms).

It will be seen that in the circuit shown in Fig. 1, when there is no light falling on the ORP12, there will be very little base current flowing. In consequence very little collector current will flow and so the relay will not operate. However, when a small amount of light falls on the photocell, its resistance will drop, and a larger base current will flow, causing a larger flow in collector current, which will operate the relay.

Latch on circuit

The relay will only remain on for as long as light is falling on the photocell. This renders this type of circuit unsuitable for many applications. For example, if a burglar alarm which is meant to be triggered by the light from the torch of an intruder is required, if the circuit of Fig. 1 is used, the alarm will only sound for the period the torch is aimed at the photocell. This is of course of no use. A circuit which will remain operative once it is triggered is required.

A suitable circuit is shown in Fig. 2, based on a bistable multivibrator. When the circuit is turned on, as there is a far lower resistance to the base of Tr1 through the relay and R2 than there is through R1 and R3 to the base of Tr2, Tr1 is switched hard on. This causes the voltage at the collector of Tr1 to be at a very low level, and Tr2 receives only a very small amount of base current through R3. This means that Tr2 is turned off, and the relay will not operate.

When light falls on the ORP12, its resistance will decrease and it will have an earthing effect on the base of Tr1. This will cause a decrease in the current flowing through Tr1, and the voltage at the collector will swing to a high level. Tr2 can now obtain quite a heavy base current and will turn on, operating the relay. The voltage at the collector of Tr2 will now be at a low level, and it is Tr1 that is unable to obtain any appreciable base current, and will thus be turned off. Even if the light is now taken off the photocell, the circuit will still remain in the same state, as Tr1 will still be unable to draw sufficient base current due to the low voltage at the collector of Tr2.

The circuit may be reset by two methods. A push-button switch may be connected between Tr2 base and earth. When this is operated it will have the same effect as when light fell upon the photocell, except it will have the opposite result. Alternatively the unit may be turned off, and then turned on again.

A protective diode is connected across the relay in all the circuits shown. This is to prevent the high reverse voltage, which is induced into the relay coil by the collapsing magnetic field as the relay is turned off, from damaging the transistor. Almost any diode will work in this position.

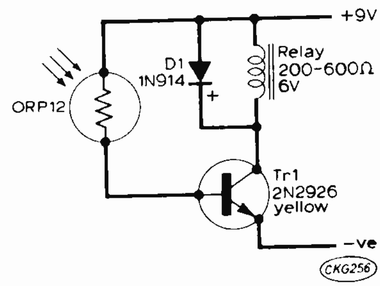


Fig. 1: Typical photoelectric switch.

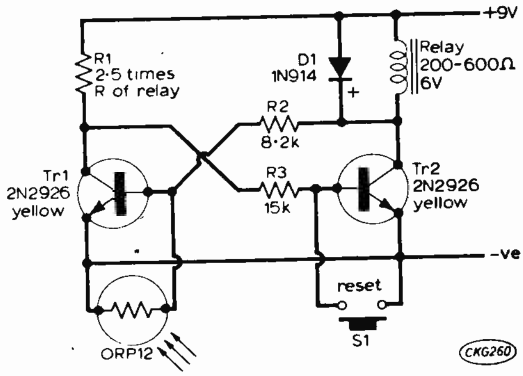


Fig. 2: Circuit suitable for applications where the relay must remain on once operated.

Higher sensitivity

The circuit of Fig. 2 does lack sensitivity and the ORP12 has to be almost fully illuminated before the relay is triggered. A more sensitive circuit is shown in Fig. 3. This circuit requires an extra transistor, and although BC183L is specified, the circuit should work equally well with any high gain, silicon, n.p.n. transistor.

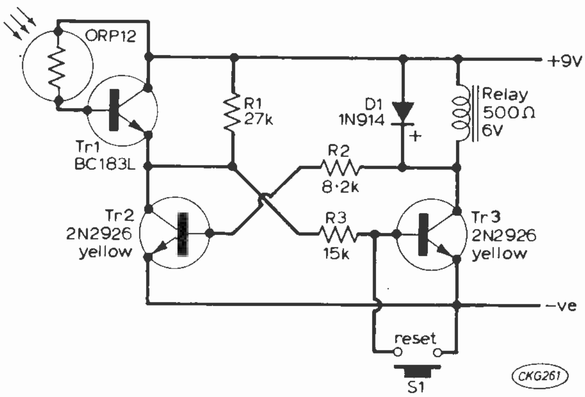


Fig. 3: Sensitive circuit using three transistors. A 25kΩ potentiometer may be placed in series with the ORP12 to control sensitivity.

With no light falling on the photocell it will have a high resistance. Tr1 will receive very little base current, and will have a high resistance between the collector and emitter. R1 also has a fairly high resistance and this will prevent much current flowing to the base of Tr3. This transistor will cut off while Tr2 is turned on, as occurred in the circuit of Fig. 2 when a small amount if light falls on the photocell, its resistance will fall, causing the resistance of Tr1 to fall by a far greater amount.

When this resistance reaches a low enough value, the voltage at the collector of Tr2 will be at a fairly high level. A large base current will now flow, turning on Tr3, and operating the relay. The voltage at the collector of Tr3 will drop, turning off Tr2. If the light is now taken away from the photocell, the resistance between the collector and the emitter of Tr1 will again be very high. The resistance of Tr1 and R1 will be just sufficient to give enough base current to Tr3 to hold the relay on.

Broken light beam alarm

Another type of alarm sometimes used is one in which a beam of light is aimed from one side of a room, or a doorway, to a photocell the opposite side. If anyone then passes between the two, breaking the beam, the alarm is sounded. A suitable circuit for an alarm such as this is shown in Fig. 4.

This works in very much the same way as the two previous circuits. When light is falling on the photocell it will have a resistance very similar to that of R2 in Fig. 2, and the circuit will behave in the same way initially. When the light to the photocell is

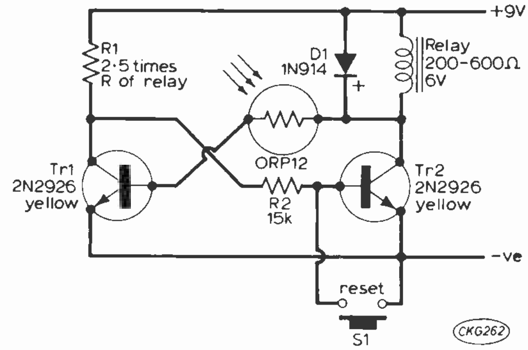


Fig. 4: Circuit for operating in a dark room.

interrupted, it will exhibit a high resistance. Tr1 will receive very little base current, the voltage at its collector will rise, Tr2 will be able to obtain a large base current, and will turn on. The voltage at the collector of Tr2 will drop and, even if light is now restored to the photocell, Tr1 will be unable to draw any appreciable base current. Thus Tr2 is able to draw a heavy base current and the relay remains on.

The circuit may be reset in the same way as the two previous circuits. For the circuit to function correctly, the room in which the photocell is situated has to be fairly dark, of course, or the light in the room will keep the relay off, regardless of the light beam.

These circuits are all fairly simple, and inexpensive, but should prove useful and interesting. With a little imagination a number of uses, other than those mentioned, may be found for the circuits. ■

IN NEXT MONTH'S PRACTICAL WIRELESS

THE FIRST OF OUR SPECIAL AUTUMN ISSUES....

. . . will give full details of how to make our two-band, two-i.c. "pop" radio receiver,
. . . will give *full* details of the PW Datacard System announced elsewhere in this issue.
. . . will reveal the identity of Q4,
. . . will contain straightforward constructional projects designed around integrated circuits,

PW POP STAR ★

Specially designed to simplify construction, this smart looking radio uses two integrated circuits: a ZN414 for processing radio signals and an SL403D as the amplifier to drive an 8- or 15-ohm loudspeaker. Medium wave stations and Radio 2 (long wave) are covered with a very simple aerial coil; no alignment problems arise. The amplifier is designed to give 1 to 3 watts of output power and is ideally suited for a teenagers' room, kitchen, bathroom, in fact almost anywhere.

* SIMPLE 2–BAND RECEIVER

I.C. ANALOGUE D.C. VOLTMETER

This very simple instrument is based on the popular 741 i.c. and with a minimum of other components is capable of voltage measurements up to 100 volts d.c. in five ranges. Accuracy on low voltage ranges is very good and the input sensitivity is much greater than in the conventional multimeter.

Also:

Short-Wave Converter for your MW receiver & I.C. POWER REGULATOR MODULE

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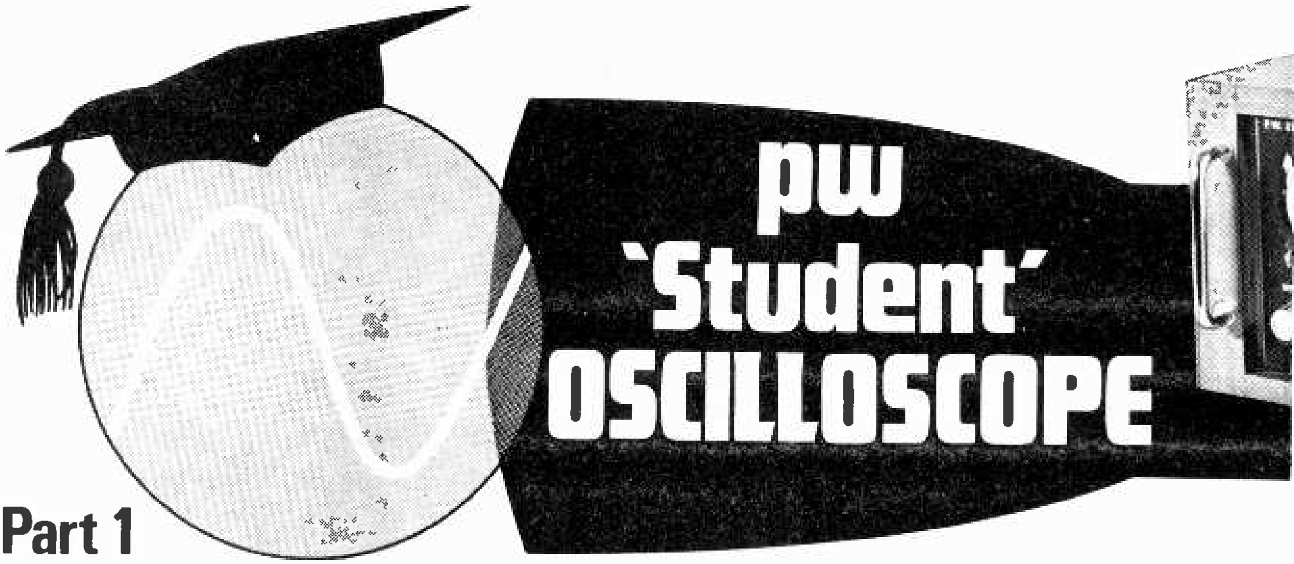


pw 'Student' OSCILLOSCOPE

Part 1

SIMPLE TO BUILD • INEXPENSIVE • ONE

IT occurred to the writer that many readers, being 'brought up' on transistors, would not have had the opportunity to learn about the oscilloscope from the 'bottom up' and that a basic transistorised design, with modern construction methods, would be welcomed.

An oscilloscope should be a substantial piece of equipment, and in view of the high voltages employed (700V for the e.h.t. and 300V for the deflection amplifiers) it must be emphasised that the rather solid nature of the model is deliberate.

Another feature is the simplification of the controls on the front panel, these being; brilliance, focus, Y attenuation (Y amp), Y shift, timebase coarse control in 6 ranges, timebase fine control (fine), timebase amplitude (X amp), and sync on/off.

There is a Y input socket and an external timebase input socket.

The writer has noticed that it is usually necessary to attenuate the input signal rather than amplify it, and with transistorised equipment the signal which is being examined can be dealt with quite effectively by an attenuator of the 'volume control' type. This makes it necessary to turn the Y attenuator down to zero before connecting a signal to the Y input socket but once this habit has been formed, the simplification of having just one continuously variable gain control with a d.c. amplifier is evident. The d.c. amplifier is necessary to maintain a good low frequency response, especially with square wave signals.

The Cathode Ray Tube

The cathode ray tube (c.r.t.) itself is a form of valve, having a heater and a cathode, a control grid and anode—which must be at a high positive potential (e.h.t.) with respect to the cathode.

For a 3in. c.r.t. the e.h.t. should be of the order of 900/1000V.

Between the control grid and the final anode are the first and focusing anodes. There are also two pairs of deflection plates, one pair—the Y plates—for vertical deflection, and the other pair—the X plates—for horizontal deflection. The deflection plates are usually operated in push-pull and with 1000 volts across the c.r.t. the push-pull voltage swing needs to be about 150V. This makes it necessary to have a 300V supply to the deflection amplifiers and the deflection transistors must be able to withstand this voltage.

The design utilises the 3BP1, c.r.t. which has a heater requirement of 6·3V at 0·6A. The c.r.t. has a 14 pin base with a locating spigot and the base connector should be obtained (if possible) when purchasing the c.r.t.

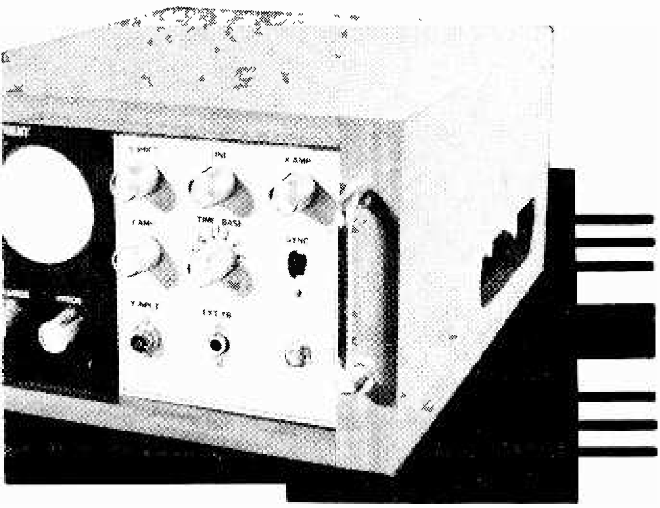
The tube gives a green trace of medium short persistence and a useful trace height is 5cms. The c.r.t. is approximately 10 inches in length including the base.

Cathode ray tubes are sensitive to stray magnetic fields, such as those produced by mains transformers, and even when a mu-metal shield is utilised to screen the c.r.t., transformers on the same chassis usually cause some interference to the spot. Mu-metal shields are quite expensive (when available).

In the present design, the mains transformers are fitted on a separate chassis, connected together by a multiway lead. By using this method, the problem of interference from the mains transformers was eliminated.

The Y (Vertical) Amplifier

The input to the Y amplifier is through a 'volume control' type attenuator VR1, and it is taken directly to the base of Tr1, which with Tr2 forms a boot-



G.A.COZENS ASSEMBLY BOARD

SPECIFICATION

Y Signal
Input via co-axial lead
Attenuator continuously variable
Input Impedance 1MΩ
Sensitivity on full gain 100mV r.m.s. gives trace height of 3cms p. to p.
Bandwidth d.c. to 1MHz.
Useful trace height 5cms.

X Deflection,
Sensitivity on external timebase 100mV r.m.s. gives trace width of 1cm p. to p
Useful trace width 5 cms.
Timebase in 6 ranges.
Range;
1. 10—100Hz
2. 32—170Hz
3. 150—550Hz
4. 520Hz—3·5·kHz
5. 3·0—20kHz
6. 6·0—40kHz

Controls
Front Panel
Brilliance — *Y gain*
Focus — *Y shift*
Timebase fine frequency, *Timebase range (course)*, *Timebase amplitude* — *X Signal*
Sync on/off
Side of Chassis
X linearity — *Astigmatism*
X shift

strapped amplifier with an input impedance of about 1mΩ. If the reader wishes, a 0·1μF capacitor (Cx) can be inserted in the lead from the slider of VR1 to the base of Tr1, with a shorting switch across it, to give a.c./d.c. facilities, but it must be pointed out that this is a sensitive part of the circuit, and all leads must be kept as short as possible to avoid stray pick up.

The output from the signal amplifier is passed through a resistor network to the long tailed pair which form the vertical deflection amplifier Tr3 and Tr4. This stage performs two functions:

1. To give two outputs which are 180° out of phase and supply the push-pull voltages to the vertical deflection plates.
2. To provide a voltage swing of 150V at each deflection plate.

When the base of Tr3 goes positive its collector goes negative. That is, the signal is inverted at Tr3 collector.

Also Tr3 emitter goes positive. This means that Tr4 emitter goes positive. The base bias of Tr4 is held at a fixed level by the bias network VR2 R15. As the potential difference between Tr4 base and emitter is decreasing the base of Tr4 is in effect going negative.

This causes the collector of Tr4 to move in a positive direction, which is the same as the original signal at Tr3 base. Thus Tr3 collector is the inverting output and Tr4 collector is the non inverting output.

The network R7, R8, R9 is designed to bias the base of Tr3 and prevent overloading, and the base bias of Tr4 is made variable to balance with Tr3 base and centre the trace on the screen. VR2 is therefore the Y shift. C2 by-passes any a.c. signals present at Tr4 base.

The collectors of Tr3 and Tr4 are connected directly to the Y plates. The values of the collector resistors were chosen by trial to balance the collector outputs, and the emitter resistors R11 and R14, and the coupling resistor R12, which controls the gain of the stage, may also be altered to match the transistors. When the trace is centred and no signal is present the collector voltages shoud be 180V. The maximum height of the Y trace when using a 100mV input signal (VR1 at maximum) is 3cms.

The Timebase Generator and X Amplifier

The timebase waveform generator Tr7 is a unijunction transistor (TIS43) with Tr6 acting as a constant current device to regulate the charging of the timing capacitors (C5, C6, C7, C8, C9 and C10) and to give a linear rise time.

The fine frequency control (VR3) should be wirewound and it should be possible to steady the trace at any part of the frequency range without using synchronisation. There is some loss of amplitude on the upper timebase range.

The sawtooth signal is taken from the emitter of Tr7 to the base of Tr8, via a closed circuit jack JK1 and a 0·1μF capacitor C12. The output signal from Tr8 collector is fed via capacitor C13 to the timebase amplitude control VR4.

The horizontal deflection amplifiers Tr9 and Tr10 are a long tailed pair with a common emitter resistor R31. Bias for Tr9 is by potentiometer network R28 R29 and as in the Y amplifier, the base bias of the second transistor Tr10 is made variable to act as a shift control to centre the trace on the c.r.t. screen. C17 by-passes any a.c. signals and stabilises the trace.

Synchronising

The purpose of synchronisation is to lock the timebase frequency to the Y signal and so hold a given number of complete waveforms steady on the screen.

The Y signal is taken from the emitter of Tr3 and is passed via C4 to the base of Tr5. Tr5 is driven hard by the Y signal and this produces a square wave at the collector of Tr5.

C3 and R16 form a pulse shaper and the diode D1 passes the positive going pulse to b2 of the unijunction sawtooth generator Tr7.

The d.c. potential to b2 is stabilised by the zener diode D2. R24, C11 and the decoupling resistor R23 all contribute to improved synchronisation of the timebase.

The Power Supplies

Five a.c. supplies are required from the mains transformers, they are:

1. 6·3V at 0·6A for the c.r.t. heater (T2)
2. 250V at 2mA for the e.h.t. multiplier circuit (T2)
3. 15 to 22V at 500mA for the low voltage line (T3)
4. 250V at 50mA for the high voltage 300V d.c. line (T1)
5. 6·3V 0·6A for indicator lamps (T1)

The leads from the oscilloscope chassis are taken to the transformer subchassis and terminate in a multiway plug. It is suggested that constructors utilise a 10 way Jones plug and socket, for the inter-connection.

★ components list

Resistors

R1	4·7kΩ	R25	10MΩ
R2	2·2kΩ	R26	12kΩ
R3	47kΩ	R27	12kΩ
R4	100Ω	R28	3·3MΩ
R5	8·2kΩ	R29	18kΩ
R6	1kΩ	R30	47kΩ 1W
R7	8·2kΩ	R31	120Ω
R8	2·2kΩ	R32	47kΩ 1W
R9	1·8kΩ	R33	3·3MΩ
R10	68kΩ	R34	2·2MΩ
R11	390Ω	R35	2·2MΩ
R12	56Ω	R36	10kΩ 1W
R13	82kΩ	R37	10kΩ 1W
R14	470Ω	R38	1·2kΩ 1W
R15	5·6kΩ	R39	390Ω 1W
R16	1MΩ	R40	1·2kΩ 1W
R17	22kΩ	R41	1·2kΩ 1W
R18	1·5MΩ	R42	390kΩ 1W
R19	10kΩ	R43	8·2kΩ
R20	82kΩ	R44	1MΩ
R21	8·2kΩ	R45	680kΩ
R22	47Ω	R46	100kΩ
R23	470Ω	R47	100kΩ
R24	680Ω		

All ± 10% ¼W carbon except where stated otherwise.

Transistors:

Tr1, Tr2, Tr5, Tr8 BC109
Tr3, Tr4, Tr9, Tr10 MJE340
Tr6 ASY26
Tr7 TIS43

Diodes:

D1 1N4148 or 1N914
D4, D5, D6 1N5054 or PL4007
D7, D8 400 p.i.v. 1A
D2 12V 1W
D3 18V 1W

Transformers:

T1, T2 Primary 200–250V 50Hz
Sec. 250V 60mA, 6·3V 2A

T3 Primary 200–250 50Hz
Sec. 18V 1·25A

Capacitors:

C1 100μF elect 25V
C2 0·47μF 250V
C3 0·1μF
C4 0·022μF
C5 0·68μF
C6 0·1μF
C7 0·02μF
C8 0·005μF
C9 0·001μF
C10 0·0005μF
C11 100μF elect 25V
C12 0·1μF
C13 100μF elect 25V
C14 100μF elect 25V
C15, C16, C17 0·47μF 250V
C18, C19, C24 50μF + 50μF + 50μF elect 350V
C20, C26 32μF + 32μF elect 350V
C21, C22 500μF elect 25V
C23, C25 250μF elect 50V
C27, C28, C29, C30 0·47μF 1000V
Cx see text

Potentiometers:

VR1 2MΩ carbon
VR2 2·5kΩ w.w. linear
VR3 50kΩ w.w. linear
VR4 25kΩ w.w. linear
VR5 25kΩ w.w. linear
VR6 250kΩ carbon
VR7 250kΩ carbon
VR8 250kΩ carbon
VR9 50kΩ carbon
$\left.\begin{matrix}VR6\\VR7\\VR8\\VR9\end{matrix}\right\}$ good quality well insulated

CRT: 3BP1

Switches:

S1 2 pole c/o slide
S2 1 or 2 pole 6 way rotary. Only 1 pole used
S3 On/off mains toggle switch
JK1 Closed circuit p.o. type jack

Miscellaneous:

Veroboard, 0·15in matrix 3¾ins. x 17ins. Veropins. 2, 4, 6BA screws, nuts, washers and spacers, panel lamps, coaxial sockets, systoflex, cleats, grommets, chipboard, laminated plastic sheet, 4 instrument handles, 8 rubber feet, aluminium for metalwork.

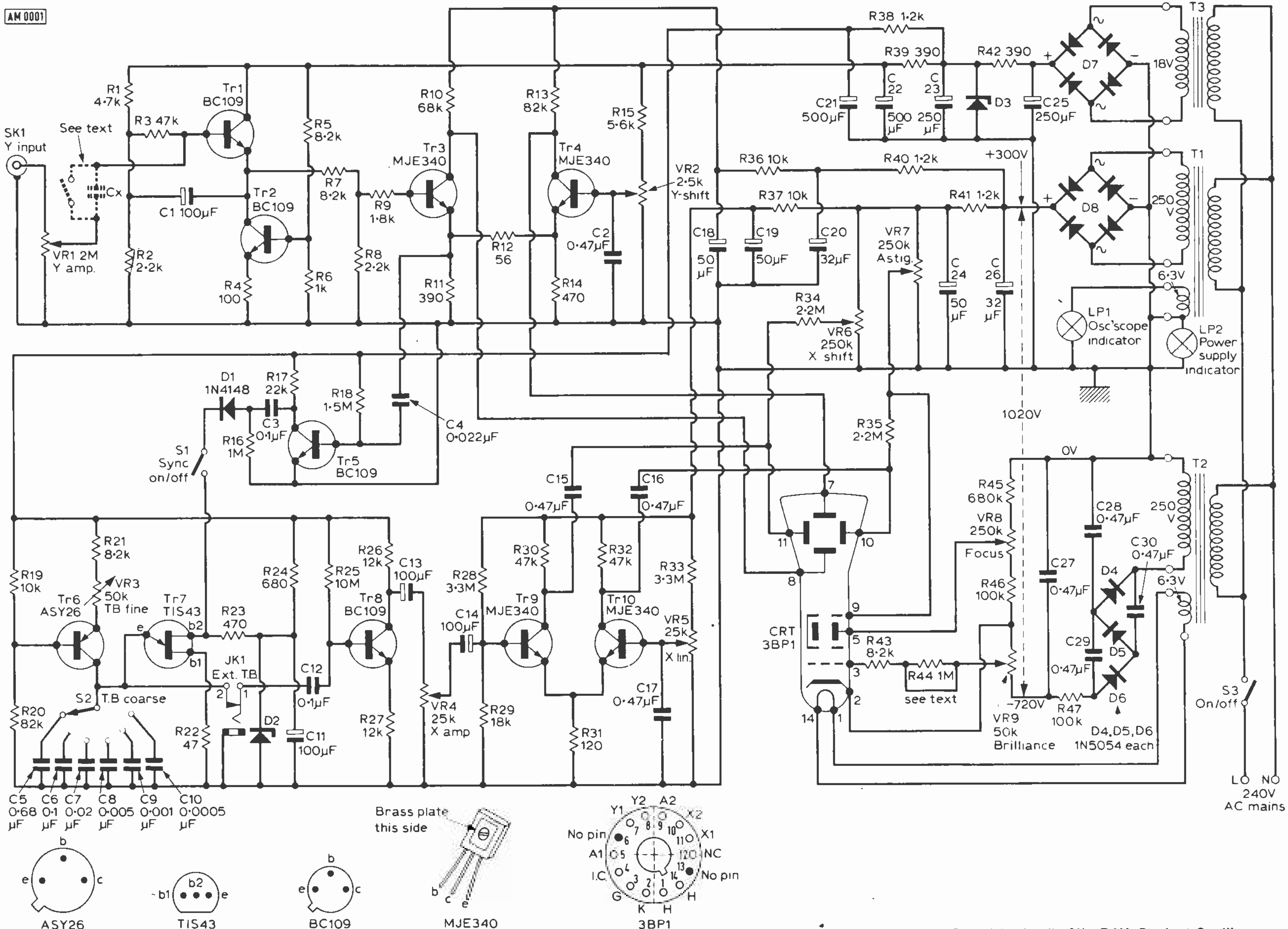


Fig. 1: Complete circuit of the P.W. Student Oscilloscope.

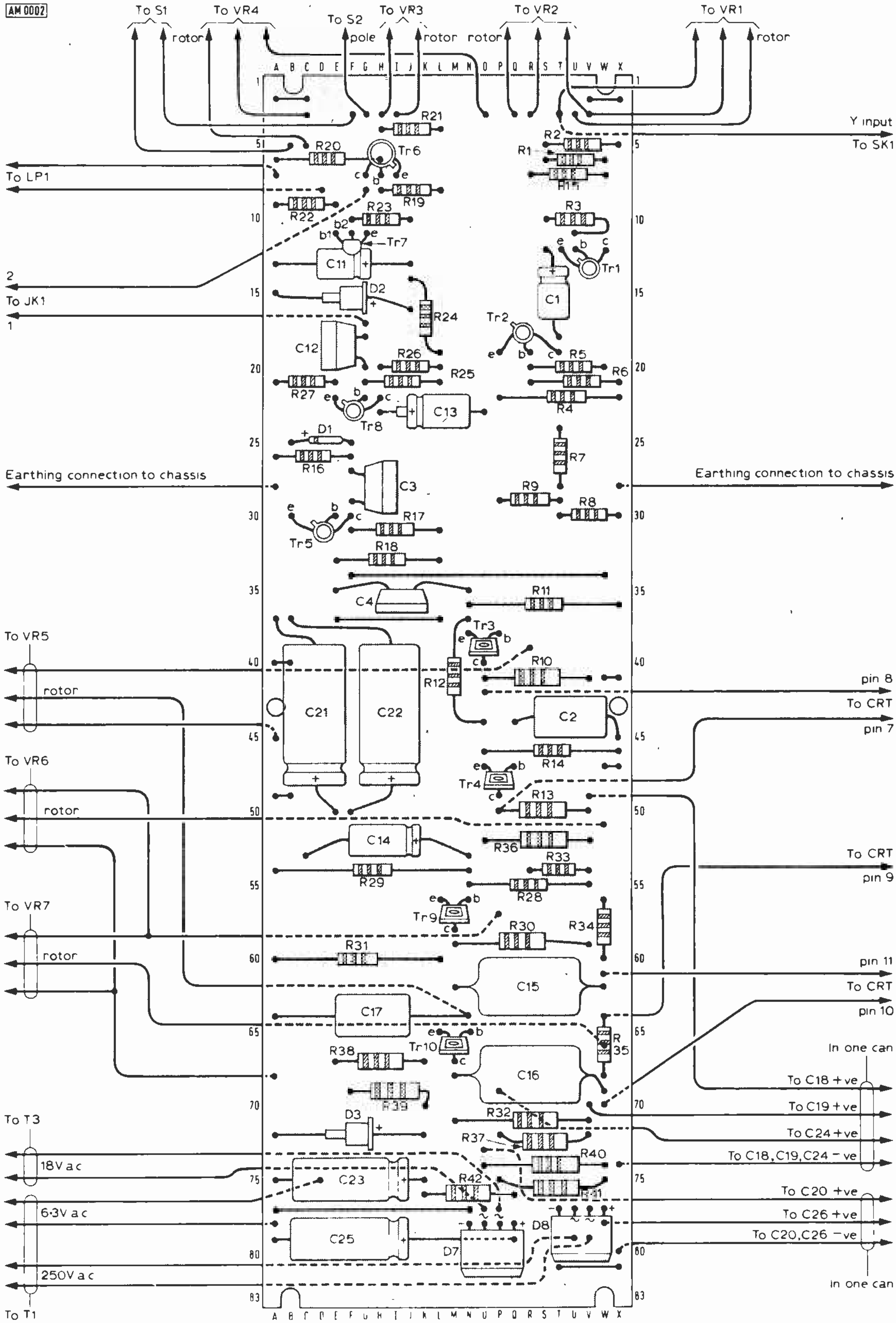


Fig. 2 The complete Veroboard layout for the oscilloscope.

The tube heater winding must withstand 1000V to the chassis. If the insulation breaks down it will put the whole e.h.t. voltage between heater and cathode of the c.r.t. The writer has not had this fault occur on any standard mains transformers that he has used. Well insulated twin flex of the type used for mains wiring is suitable for the c.r.t. heater leads.

Three rectifier diodes are used in the e.h.t. multiplier circuit. Although this type of circuit suffers from poor regulation, in this case, where the current required is only about 1mA it is quite stable.

The capacitors C28, C29 C30 help to maintain good regulation. The diodes are arranged to give a negative output, the positive end of the chain is at earth potential.

The circuit is so arranged that the 700V e.h.t. supply and the 300V line are in series. Therefore the voltage across the c.r.t. from the grid to the final anode, is equal to the sum of the two voltages.

The c.r.t. resistance network acts as a bleeder across the e.h.t. and the smoothing resistor R47 and the network should be fitted before the circuit is tested. It will limit the e.h.t. voltage and prevent possible damage to the smoothing capacitor C27.

The 1MΩ resistor R44 may be included in the circuit if flyback blanking is to be added later. Because of the unusual layout of the e.h.t. multiplier circuit extra care must be taken in layout and wiring.

The low voltage line is supplied from transformer T3 which gives an output of between 15 and 22 volts, the bridge rectifier being rated at 400V p.i.v. at 1A and the reservoir and smoothing capacitors at 50V. The smoothing resistor R42 has a value of 390Ω and the zener diode D3 stabilises the line at 18V. The Y amplifier and the timebase circuit have separate smoothing components to reduce inter-action.

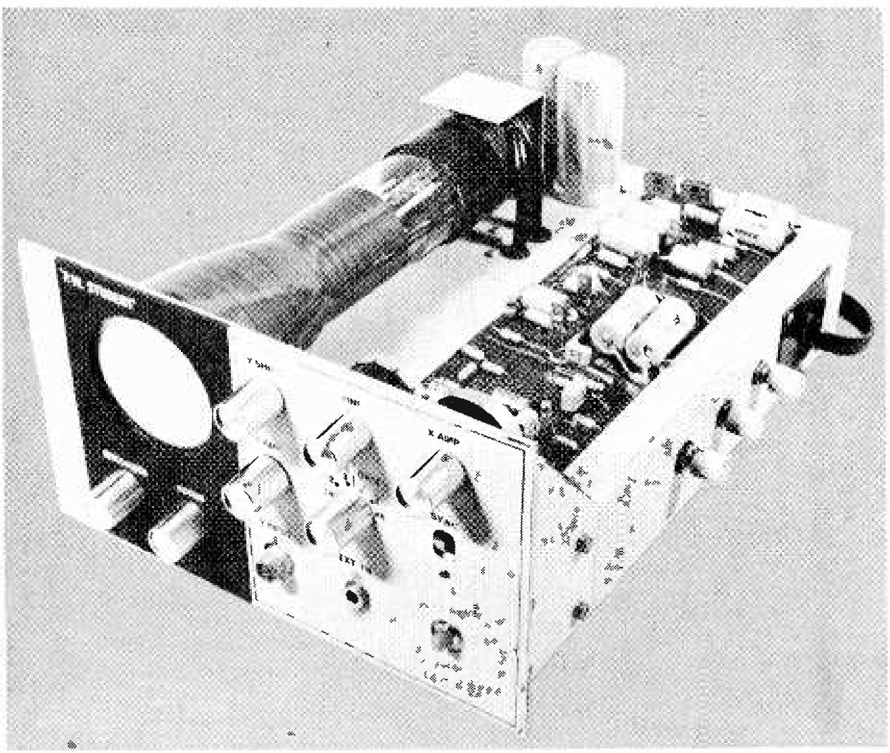
The high voltage 300V d.c. line is supplied by the bridge rectifier D8 which is rated at 400V 1A. The reservoir capacitor C26 is 32μF and is of the can variety. Each deflection amplifier has its own decoupling components to prevent crosstalk and the astigmatism and X shift potentiometers are in parallel across the 300V d.c. line and act as bleeders.

When the writer commenced his experiments with this oscilloscope, the method used for X and Y shift was similar to that employed in valved instruments, where the deflection plates were coupled to the valve anodes through capacitors and the shift voltages were determined by potentiometers across the positive end of the network. This method has been retained for the X deflection plates, the X amplifier being a.c. coupled throughout.

The Y amplifier is d.c. coupled and the Y shift is determined by the potential at the collectors of Tr3 and Tr4. This means that the signal level at Tr3 base must be matched by that at Tr4 base to keep the trace on the screen. The X shift can be set and needs no further attention, but the Y shift must be adjusted for positive or negative going signals and for changes in amplitude.

The Veroboard Panel

The Veroboard panel is 24 holes (or strips) wide and 83 holes long. This is cut from a standard 17in. x 3¾in. Veroboard panel. The matrix is 0·15in. When working on the panel it is essential to make all joints with the minimum of solder. Where flexible leads are taken to components on the Veroboard, Veropins or the wire ends of components already attached to the copper strips should be used as anchoring points.



Photograph showing the completed oscilloscope. The three controls on the right hand side of the chassis are X linearity, X shift and astigmatism.

—to be continued—

ON THE AIR

SHORT WAVE DX

by MALCOLM CONNAH

JUDGING from some of the letters and enquiries that I receive it would appear that many of you do not know of the existence of The World Radio and TV Handbook.

The book contains a list, by countries, of all the Broadcasting stations in the world. Each entry shows details of the station schedule including frequencies and language used; other details given are the station address and its QSL policy. The interval signal of the station is given along with the opening announcement which is the easiest way of identifying the station.

The first section of the book has various articles on Broadcasting subjects, which are useful to beginners and experienced DXers alike. The final pages of the book contain a listing, by frequency, of all the stations complete with call-sign and transmitter power.

The book is available through most good bookshops, the price is £3 which is a small price to pay for such a mine of information.

DX News

BANGLADESH: Radio Bangladesh now starts the English service at 1700 instead of 1715 on frequencies of 11650 and 15520kHz.

GABON: Plans are afoot for the installation of several 300kW shortwave transmitters to be used by both ORTF and Radiodiffusion TV Gabonaise. Libreville has been heard on the new frequency of 7130 from 1230 to 1430.

GRENADA: Radio Grenada, formerly Windward Islands Broadcasting Service, has moved from 11930 to 15105kHz for its transmissions to the U.K. at 1945-2130.

MONGOLIA: Radio Ulan Bator now also broadcasts programmes in English and French to Africa at 2000-2030 on 17780 and 17860kHz. The programmes in English are broadcast every Wednesday and Saturday, and in French every Tuesday and Friday. There are also programmes in English daily, except Sunday evening and Monday morning, at 1200-1250 on 17780 and 17860, and at 2200-2230 on 11810 and 11860kHz.

Readers' Logs

The first log this month comes from **Roy Patrick** of Derby who returns to the page after a considerable absence, Welcome back OM. Roy's equipment consists of a Trio 9R59D receiver and an Eddystone 840. Stations logged included:

3240 *R. Baghdad, Iraq* in Arabic at 2000.
4945 *R. Colosal, Colombia* at 0700.
4980 *Ecos del Torbes, Venezuela* at 0605.
4995 *R. Brazil Central* at 2200.
11650 *R. Bangladesh* in English at 1700.
11710 *RAE, Argentina* noted at 2300.
11720 *R. Nacional, Brazil,* fair at 2100.
11725 *R. Ceylon* in English 1800-1830.
11790 *R. Australia* to SE Asia at 1800.
11800 *R. Ceylon* in Hindi, good at 1830.

Michael Johnson of Hockley in Essex describes his equipment as follows: "I use an ex-radiogram, 6 valve, Ferguson receiver; coupled with the dipole of an old 405 line TV aerial which works better than my 50 foot dipole on 31 metres!" This equipment enabled him to hear the following stations:

6050 *RAI, Italy* in English at 1935.
6070 *R. Sofia, Bulgaria* in English at 1930.
6185 *R. Norway* in English at 1700.
6580 *R. Pyongyang, N. Korea* at 1900.
7290 *Trans World Radio* in English at 1045.
9545 *R. Ghana, Accra* in English at 2145.
9670 *R. Trans-Europe* in English at 2000.
9840 *Voice of Vietnam* at 1915.
11880 *Voice of Turkey, Ankara* noted at 2200.
15185 *R. Finland* in English at 1800.
15415 *R. Kuwait* in English at 1645.

Messrs. **Wormleighton** and **Fletcher** of Rencomb College, Cirencester have sent in another excellent log using the following equipment: HRO with 8 metre folded dipole; Astrad-Altair with 150 foot long-wire, Bush PB63 with 35 foot long-wire.

5990 *HCJB, Quito, Ecuador* in English at 0825.
6050 *RAI, Italy* in English at 2030.
7235 *R. Australia* in English at 1500.
9525 *RSA, South Africa* noted at 2215.
9710 *HCJB, Quito, Ecuador* in English at 0715.
9715 *R. Nederland, Bonaire,* English at 0845.
9805 *R. Cairo, U.A.R.,* in English at 2200.
11745 *HCJB, Quito, Ecuador* in English at 0730.
11880 *Voice of Turkey, Ankara.* English at 2200.
11920 *RNE, Spain* in Spanish at 1300.
11945 *R. Voice of the Gospel, Ethiopia* at 1930.
11970 *RSA, South Africa* at 1900, News in English.
15415 *R. Kuwait* in English at 1730.
21545 *R. Ghana, Accra* in English at 1500.
21595 *R. Canada International* noted at 1640.

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1U5	.80
2D21	.44
2GK5	·55
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3D6	.19
3Q4	.49
3Q5GT	.55
3S4	.26
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5CG8	·55
5T4	·30
5U4G	·30
5V4G	.35
5Y3GT	.30
5Z4G	.34
5Z4GT	·38
6/30L2	.55
6A8G	.44
6AC7	.15
6AG5	.27
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6AJ5	.75
6AK5	.25
6AK6	.30
6AM8A	·50
6AN8	·49
6AQ5	·21
6AR5	·30
6AS7	1·00
6AT6	.18
6AU6	.19
6AV6	.28
6AW8A	.54
6AX4	.39
6B8G	.13
6BA6	.19
6BC8	.50
6BE6	.20
6BH6	.43
6BJ6	.39
6BQ7A	.38
6BR7	.79
6BR8	.63
6BS7	1·25
6BW6	.72
6BW7	.50
6BZ6	.31
6CB6A	.26
6C4	·28
6C9	.73
6CD6G	1.06
6CG8A	.50
6CH6	.55
6CL6	.43
6CM7	·50
6CU5	.30
6CW4	.63
6DE7	.50
6DT6A	.50
6EW6	.55
6E5	.55
6F1	.59
6F6G	.35
6F13	.33
6F14	.40
6F18	.45
6F23	.65
6F24	.68
6F25	.51
6F28	.60
6F32	.15
6GH8A	.50
6GK5	·50
6GU7	.50
6H6GT	.15
6J5GT	.29
6J6	.18
6J7G	.24
6J7(M)	.38
6JU8A	·50
6K7G	.12
6K8G	.33
6LI	.98
6L6GT	.50
6L7	.38
6L18	.44
6L19	1.38
6LD20	.48
6N7GT	.40
6Q7G	.35
6Q7GT	.43
6Q7(M)	·43
6R7G	.35
6R7M	·55
6SA7M	.35
6SC7GT	.33
6SG7	.33
6SH7	.53
6SJ7	.35
6SK7GT	.23
6SQ7GT	.38
6U4GT	.60
6V6G	.17
6V6GT	.27
6X4	.20
6X5GT	.25
7B6	.58
7B7	.32
7H7	.28
7R7	.65
7Y4	.60
7Z4	.50
9BW6	·50
9D7	.78
10C2	.49
10DE7	.50
10F1	·75
10F9	.45
10F18	.35
10LD11	.53
10P13	.54
10P14	1.08
12A6	.63
12AC6	.40
12AD6	.40
12AE6	.48
12AT6	.23
12AU6	.21
12AV6	.28
12BA6	.30
12BE6	.30
12BH7	.27
12J7GT	.33
12K5	.50
12K7GT	.34
12Q7GT	·28
12SC7	.35
12SG7	.23
12SH7	.15
12SJ7	.23
12SK7	.24
12SQ7	·50
14H7	.48
14S7	.75
19AQ5	.24
19G6	.50
20D4	1·05
20F2	.65
20L1	.98
20P1	.50
20P3	.76
20P4	.89
20P5	1.00
25A6G	.29
25L6G	.20
25Y5G	.43
25Z4G	.28
25Z5	.40
25Z6G	.43
30A5	.44
30C15	.55
30C17	.74
30C18	.69
30F5	.61
30FL1	.58
30FL2	.60
30FL12	.67
30FL13	.47
30FL14	.66
30L15	.55
30L17	.65
30P4MR	.95
30P12	.69
30P19/30P4	.65
30PL1	.57
30PL13	.75
30PL14	.75
30PL15	.87
35A3	.48
35D5	·70
35L6GT	.42
35W4	.23
35Z4GT	.24
35Z5GT	.30
50B5	·35
50C5	·32
50CD6G	2·17
50EH5	·55
50L6GT	.45
85A2	.43
85A3	·40
90C1	.59
90CG	1·70
150B2	.58
807	.59
5702	·80
5763	.50
7475	·70
AC/PEN	·98
AC2/PEN/DD	.98
AC6PEN	.38
AC/TH1	·50
AC/TP	.98
AL60	.78
ATP4	.40
AZ1	.40
AZ31	.46
AZ41	.53
CL33	.90
CV63	.53
CY1C	.55
CY31	.29
DAF91	.22
DAF96	.36
DC90	.60
DF91	.14
DF96	.34
DH76	.28
DK40	.55
DK92	.50
DK96	.45
DL92	·26
DL96	.38
DM70	.30
DM71	.50
DY87/6	.22
DY802	.29
E80CC	1·65
E80F	1.20
E83F	1.20
E88CC	.60
E92CC	.40
E180F	.90
E182CC	1.00
E1148	.53
EA50	.27
EA76	.88
EABC80	.29
EAC91	.38
EAF42	.48
EAF801	.50
EB34	.20
EB91	.10
EBC41	.48
EBC81	.29
EBF80	.30
EBF83	.38
EBF89	.26
EBL21	.60
EC86	.59
EC88	.59
EC92	.34
ECC33	1.50
ECC35	·95
ECC40	.68
ECC81	.16
ECC82	.19
ECC83	.21
ECC84	·28
ECC85	.32
ECC86	·40
ECC88	.35
ECC189	.48
ECC807	1·00
ECF80	.27
ECF82	.25
ECF86	.64
ECF804	2.10
ECH21	.63
ECH35	.50
ECH42	.57
ECH81	.25
ECH83	.38
ECH84	.34
ECL80	.28
ECL82	.28
ECL83	.52
ECL84	.54
ECL85	.54
ECL86	.38
EF22	.63
EF40	.49
EF41	.58
EF42	.33
EF73	·75
EF80	.21
EF83	.54
EF85	.25
EF86	.27
EF89	.23
EF91	.17
EF92	.28
EF97	·55
EF98	.65
EF183	.25
EF184	.27
EH90	.34
EL32	·18
EL34	.48
EL35	1.00
EL37	·74
EL41	.53
EL81	.50
EL83	.38
EL84	.21
EL85	.40
EL86	.38
EL91	.23
EL95	.32
ELL80	·75
EM80	.37
EM81	.37
EM83	.75
EM84	.31
EM85	1.00
EM87	.49
EY51	.35
EY81	.35
EY83	.54
EY84	.50
EY87/6	.27
EY88	.40
EZ40	.40
EZ41	.42
EZ80	.19
EZ81	.20
GY501	.75
GZ32	.39
GZ33	.70
GZ34	.47
GZ37	.67
HABC80	.44
HL23DD	.40
HL41DD	.98
HL42DD	.50
HN309	1·40
HVR2	.53
HVR2A	.53
KT2	.25
KT41	.98
KT44	1.00
KT66	·80
KT81	2.00
KTW61	.63
KTW62	.63
KTW63	.50
MHLD6	.75
P61	.40
PABC80	.32
PC86	.44
PC88	.44
PC95	.53
PC97	.36
PC900	.29
PCC84	.27
PCC85	.24
PCC88	.39
PCC89	.42
PCC189	.46
PCF80	.26
PCF82	.30
PCF84	.40
PCF86	.44
PCF200	.67
PCF801	.28
PCF802	.37
PCF806	.55
PCH200	.62
PCL82	.29
PCL83	.54
PCL84	.32
PCL805/85	.37
PCL86	.36
PD500	1.44
PEN4DD	1.38
PEN45	.40
PEN45DD	.75
PEN46	.20
PEN453DD	.98
PENDD-4020	.88
PFL200	.50
PL33	·38
PL36	.46
PL81	.42
PL81A	.48
PL82	.28
PL83	.30
PL84	.28
PL504/500	·60
PL508	·90
PM84	.31
PY33/2	.50
PY80	.33
PY81	.24
PY82	.23
PY83	.26
PY88	.31
PY800	.31
PY801	.31
PZ30	.48
QQV03/10	1.20
QS75/20	.63
QS95/10	·49
QV04/7	.63
R19	.28
SP61	.75
TH233	.98
TP2620	.98
UABC80	.30
UAF42	.49
UBC41	.45
UBC81	.40
UBF80	.33
UBF89	.33
UBL21	.55
UC92	.35
UCC84	.33
UCC85	.33
UCF80	.31
UCH21	.60
UCH42	.57
UCH81	.29
UCL82	.30
UCL83	.54
UF41	.50
UF42	.60
UF80	.35
UF85	.34
UF86	.63
UF89	.27
UL41	.54
UL84	.28
UM80	.33
UY41	.38
UY85	.23
U10	.45
U12/14	.38
U19	1.73
U22	.39
U25	.65
U26	.60
U191	65
U251	.62
U301	·40
U403	.33
U404	.38
U801	.76
U4020	.55
VP23	.40
VP41	.38
VT61A	.35
VU111	.44
VU120	.60
VU120A	.60
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W729	.60
X65	.50
X66	·50
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2N966	·58
2N1756	·55
2N2147	·94
2N2297	·25
2N2369	·24
2N2613	·43
2N3053	·36
2N3121	2·75
2N3703	·21
2N3709	·22
2N3988	·55
2S323	·55
AA119	·17
AA120	·17
AA129	·17
AAZ13	·20
AC107	·17
AC113	·28
AC126	·14
AC127	·19
AC128	·22
AC132	·22
AC154	·28
AC156	·22
AC157	·28
AC165	·28
AC166	·28
AC168	·42
AC176	·61
AC177	·31
ACY17	·28
ACY18	·22
ACY19	·21
ACY20	·20
ACY21	·21
ACY22	·17
ACY28	·20
AD140	·40
AD149	·55
AD161	·50
AD162	·50
ADT140	·69
AF106	·55
AF114	·28
AF115	·17
AF117	·21
AF121	.33
AF124	·28
AF125	·19
AF126	·20
AF139	·72
AF178	·75
AF180	·53
AF186	·61
AF239	·42
BA102	·50
BA115	·15
BA116	·28
BA129	·14
BA130	·11
BA153	·17
BC107	·14
BC108	·14
BC113	·28
BC115	·17
BC116	·28
BC118	·25
BCY10	·50
BCY12	·55
BCY33	·22
BCY34	·25
BCY38	·25
BCY39	·28
BCZ11	·42
BF158	·32
BF159	·28
BF163	·22
BF173	·42
BF180	·33
BF181	·44
BF185	·44
BF194	·17
BFY50	·25
BFY51	·21
BFY52	·22
BY100	·20
BY105	·20
BY114	·20
BY126	·17
BY127	·20
BYZ10	·28
BYZ11	·28
BYZ12	·28
BYZ13	·28
CG12E	·22
FSY11A	·25
FSY41A	·25
GD9	·22
GET113	·22
GET118	·22
GET119	·27
GET573	·42
GET587	·47
GET873	·17
GET887	·25
GET897	·25
GET898	·25
M1	·17
OA5	·31
OA9	·14
OA10	·47
OA47	·11
OA70	·17
OA73	·17
OA79	·10
OA81	·10
OA85	·09
OA90	·14
OA91	·10
OA95	·10
OA200	·10
OA202	·11
OC22	·42
OC23	·42
OC24	·42
OC25	·42
OC28	·66
OC29	·69
OC35	·35
OC36	·47
OC44	·11
OC45	·12
OC46	·17
OC70	·14
OC71	·12
OC72	·12
OC74	·25
OC75	·12
OC76	·17
OC77	·30
OC78	·17
OC78D	·17
OC81	·12
OC81D	·12
OC82	·12
OC82D	·12
OC83	·22
OC84	·26
OC123	·25
OC139	·25
OC169	·25
OC172	·39
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ON THE AIR

MEDIUM WAVE BROADCASTS
by CHARLES MOLLOY

JOHN THORBURN (Glasgow) has used his Vasco Gold Star radio to hear CHER Sydney, Nova Scotia on 950kHz; WBT Charlotte, North Carolina on 1110kHz; Radio Bermuda 1340kHz; Voice of America Kavalla, Greece 791kHz; Radio Zagreb, Yugoslavia 1133kHz. John also logged the BBC local radio outlets at Blackburn on 850kHz. Sheffield 1034kHz; Leeds 1106kHz; Newcastle 1457kHz; Stoke 1502kHz; Bristol 1546kHz and Manx Radio, Isle of Man on 1594kHz.

Dominic Glynn (East Grinstead) has a Philips transistor receiver and a 100ft. longwire antenna. He reports hearing programmes in English from Radio Sweden 1178kHz at 2300hrs GMT; Trans World Radio Montecarlo 1466kHz at 2230hrs and Radio Berlin International 1511kHz at 1815hrs. Dominic has also logged Radio Tirana, Albania 1394kHz at 2230hrs and BBC Radio Stoke 1502kHz at 1045hrs.

From the BBC comes news that Radio Solent is now broadcasting on two frequencies, 998kHz and 1594kHz. The new outlet on 1594kHz brings the service to Bournemouth, Poole and Wimborne Minster while the existing service on 998kHz for the Southampton and Portsmouth areas is unaffected

Medium wave DXers who go abroad for their holidays have the opportunity to try the band from a new location. In Spain there are many low power local stations, some of which would be rarities if heard in this country and even a pocket sized transistor portable will pull them in. For those interested in keeping in touch with events at home there is the BBC Radio 2 transmission on 200kHz (1500m) on the long waves which can be heard over a large part of Europe after dark. Visitors to Majorca can hear Radio Mallorca (EAJ13) on 800kHz; Radio Popular de Mallorca (EAK18) on 1268kHz; Radio Juventud de Palma Mallorca (EFJ45) on 1385kHz. On the Costa Brava there are Radio Barcelona (EAJ1) on 827kHz; Radio Juventud Barcelona (EFJ15) on 1025kHz; Radio Espana de Barcelona (EAJ15) on 1124kHz; Radio Sabadell (EAJ20) on 1475kHz; Radio Gerona (EAJ38) on 1520kHz. At Benidorm there are Radio Popular de Alicante (EAK31) on 1394kHz; Radio Gandia (EAJ23) on 1457kHz; Radio Alicante (EAJ31) on 1520kHz and La Voz de Alicante (EFE8) on 1570kHz. Those going to the Costa del Sol have the opportunity to hear Radio Gibralter on 1484kHz which broadcasts in English and Spanish; Radio Ceuta (EAJ46) on 1106kHz which is located in a Spanish enclave in Morocco; Radio Juventud de Malaga (EFJ56) on 1133kHz; Radio Popular de Malaga (EAK11) on 1430kHz and Radio Costa del Sol (ECS15) on 1570kHz.

VHF/FM by SIMON DAVID

HAVE you been suffering from "Sporadic—E" lately? If so we would like to hear from you. Sporadic—E is the name given to a disturbance in the "E" region of the ionosphere. It is most likely to occur in the summer months (U.K.) and gives rise to some odd goings-on on the v.h.f. bands up to about 100MHz.

Although almost impossible to predict accurately, such manifestations are in long distance reception, interference on television and radio and interaction between signals from one source and another, often several hundreds or even thousands of miles apart. Stations operating on close frequency allocations are susceptible and in particular those on v.h.f. mobile radio systems often fall victim.

Greetings in particular this month to listeners who can now pick up local radio on their portables and in cars in Leeds, Huddersfield, Barnsley, Dewsbury, Wakefield, Castleford, parts of Halifax, Bradford and Harrogate, Barnsley, Doncaster, Worksop, East Retford and Rotherham. In case you are not aware, you should now be able to *drive* to the lilt of BBC Radio Leeds (92·4MHz) or Radio Sheffield (97·4MHz).

The old Meanwood Park transmitter on 94·6MHz and Boston Park, Rotherham, transmitter on 95·05MHz have closed and all transmissions from these two stations now come from Holme Moss near Huddersfield. Sheffield listeners can still tune in on 88·6MHz, but all others tuning to 97·4MHz may need to turn their aerial round so that it is directed at Holme Moss (also home of BBC television). Aerials that are already rigged on the roof or chimney outside and directed at Holme Moss for Radios 2, 3 and 4 are likely to be suitable for the local radio stations also.

Some transmitters use slant polarisation to assist where vertical receiver aerials are used (such as on cars). One such is used for Radio Derby which is transmitted from Sutton Coldfield, Birmingham, on 96·5MHz. If you are not sure on the polarisation for your area you can ask at any local BBC radio offices or write to the Engineering Information Dept., BBC, Broadcasting House, London W1A 1AA; please enclose a stamped addressed envelope.

Now for some quick quotes from some of the letters received: **W. F. Kitching** in Shropshire has a Grundig "Yacht Boy" 210 with telescopic aerial and has picked up Radio Telefis Eirean 95·3MHz. He looks forward to police inactivity so that he can hear Radio Na Gaeltachta, Eire, on 97·0MHz.

On the other side of the Irish Sea, **Des Walsh** in Tipperary uses a Leak Troughline-3 and a BASF CC9300 Radio recorder and points a J-Beam FM6S and FM4S at South Wales and South West England. He has bagged Wenvoe, Haverfordwest, Blaen-plwyf, North Hessary Tor, Redruth and Radio Bristol. Turning north-east he can pick up Belfast and Radio Merseyside. Here's the crunch! With the help of tropospherics he can hear ORTF from N. W. France.

D.J. is a 14-year-old from Egham, Surrey, and is one of many who has heard the London Independent Radio transmissions on Radio Classic 94·4MHz. Hope his parents won't get annoyed when they find out that he was listening to "an extra programme" at 01·05 Easter Sunday morning. Was this a "Jolly Roger" operation?

Anybody heard broadcasts from the North Sea Radio Telephone Company? **Graham Wilson** has in Bordon Hampshire and wonders who was responsible. The transmission was heard on much of the 88-108MHz band (but was strongest at 91MHz) on March 5th.

ON THE AIR

SHORT WAVES

by DAVID GIBSON, G3JDG

IT'S getting hotter in more senses than one. The summer season brings great hotness with it and it is known in this scribe's shack as the Equinox of the molten ear'ole—a disease common to all wearers of headphones during periods of great warmth.

The other sense is a rumour to ban a.m. from the Amateur bands, notably the l.f. regions of 1·8 and 3·5MHz. What do readers think about this? Shall we settle for s.s.b. and c.w. only?

A staggering piece of news for professional callsign changers. The latest act in the callsign circus is to change it just for a particular contest. The result is CR6 becoming CQ6 (a really clever choice—CQ) for the WPX contest. A little bird also tells me that MP4TEE is now A6XF.

Best piece of news on the callsign front, and one for some genuine rejoicing in Amateur circles, is that the People's Republic of China will probably be allowing/issuing callsigns in the not too distant future. It'll make the bands even more crowded but a big welcome to the Chinese Amateurs as and when they appear on the bands.

In the April issue, mention was made of photographs showing readers' stations. First person to take up the gauntlett is **Graham Bleakley** who is 15 and lives in Cumbernauld New Town, Scotland. The gear shown is a "trusty old CR100". Graham is the one on the left with all the hair, and the CR100 is on the right, with all the knobs. No mention of what the tape recorder is for but Graham does say he reckons to become a G8 with a bit of help from the May 1974 RAE. No word of the antenna, but whatever it is, it pokes out of the windows of 82 Ash Road.

Info from G3RPJ that the Stratford on Avon Radio Club will have rigs working on 1·8MHz, 14MHz and 144MHz (a.m. f.m. and r.t.t.y.) at the Town and Country Festival on August 25/26/27. Place is the Royal Showground, Stoneleigh, Kenilworth, Warwickshire. The stations will stay on the air in the evenings after the show.

Karl Muller (Mbabane, Swaziland) has a JR-500SE 7MHz inverted V and a lot of patience. Rewards for same has given him 148 countries heard on 7MHz. On 7MHz c.w. Karl bagged; CE3ED, CE5HP, CX1BBL, CX9BT, FC9VN, FG7TG, FH8CY, KØALL, KH6AQ, KH6RS, SV1DO, TI2PZ, VP9GR, WN3TGR, WNØHYN, ZP5AL, 4K1A, 9F3USA, 9L1GC. On s.s.b., the latest log reads; CT2AJ, KC6SK, MP4BJP, OY7BD, WB6VGI/VQ9, ZC4EJ, ZD9GC, 4W1AF, 6W8DY.

Before going on with logs, I see that the May 1973 issue of Radio Communication, the journal of the RSGB, publishes a full list of intruder stations complete with all sorts of information; frequency, date, location, source etc. This seems a useful coincidence in view of previous remarks made in this column. Single copies of the journal are available to nonmembers at 30p plus postage.

J. Wright (Loughborough) homebrew converter, 960 receiver, 3-element beam at 30ft. sends in a log for 70MHz (Yippee). Stations bagged include: G3CDG/P, G3HCW/P, G3HVI, G3LVP/P, G3NQV/P, G3ONP, G3SFT/P, G3TOM/P, G3VER/P, G3VPF/P, G3VPK, G3WMR/P, G3ZVK, G4ALE/P, G4BEZ/P, G4BLQ, G4BPY, G4BZO, G5DF, GD2HDZ, GW3MHR, GW30BD/P, GW3WOS, GW4ABR/P, GW4BGG/P.

P. Newman (Thame) sends in a "Heard in the 144MHz and 70cm Contest" log. Pickings on 70cm; G8DOR/P, G88GHR/P, G3NNG/P, G5DF, G8FBG/P. Two meter goodies were; G8DWC/P, G2DRT/A, G8CIB/P, G8GSX/P, G8GTD, G8FBG/P, G8FTL, G8FZL/P, G3FZL/P, G3KIN/P, G3OSS, G3NNG/P, GW4ABR/P.

Contests for the month of July include: July 7/8, v.h.f./u.h.f. Jubilee contest (R.S.G.B.); 14/15, s.s.b. field day; 15, DF qualifying round at Coventry; 22, 432MHz portables contest; August 4/5, YO DX Phone and c.w. contest; August 5, DF qualifying round (Salde).

BROADCAST BANDS

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

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

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

AMATEUR BANDS

Short Wave/VHF

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

CALIBRATING SW RECEIVERS

M. CONNAH

WITH the Short Wave Bands becoming more crowded every year it becomes increasingly necessary for the listener to be able to determine the frequency to which his receiver is tuned. Conversely, if the receiver is accurately calibrated the listener is able to tune to a desired frequency to listen for a particular station.

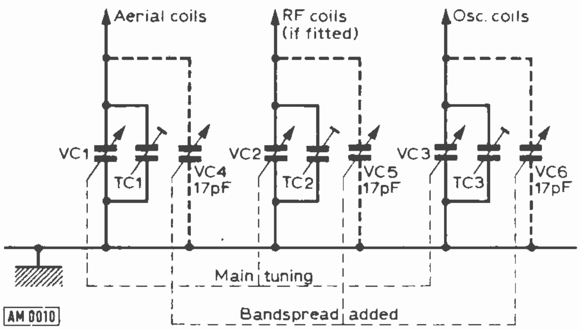

Fig. 1 Circuit showing the bandspread ganged capacitor added to the existing circuit.

The latter part of this article deals with a method of receiver calibration which costs less than a pound. The only requirement is that the receiver has a bandspread control with a reasonable scale. The first part of the article, therefore, deals with adding a suitable bandspread control to a receiver which is lacking in this respect.

ADDING BANDSPREAD

The addition of a bandspread control to a receiver which does not have this facility is probably the most effective, yet simple, method of improving the performance of the set. The total cost is little more than £1 so the project is well within the means of the average listener.

All superhet receivers have a main tuning control which is either a two or three gang variable capacitor. This is shown as VC1/VC2/VC3 in Fig. 1. The bandspread control required for the project is a two or three gang (depending upon the number of gangs of the main tuning) miniature variable capacitor each section having a capacitance of approximately 15 to 20pF. The most suitable type is that often used for the tuning of v.h.f. receivers, usually having a capacitance of 17pF per section.

The bandspread control is represented by VC4/VC5/VC6 in Fig 1. Each section of the bandspread

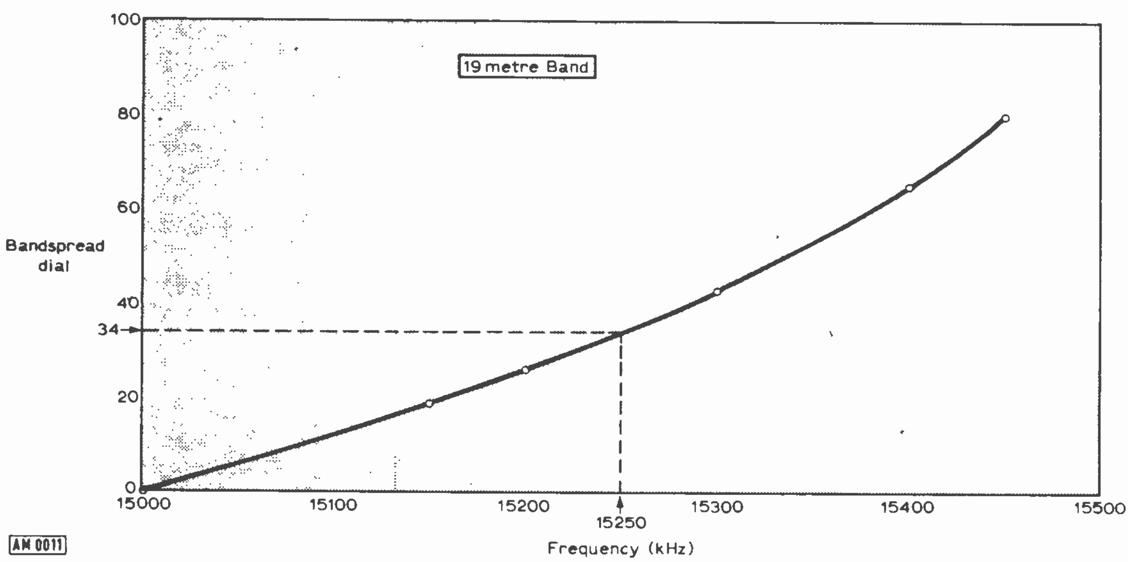

Fig. 2 A typical calibration chart produced by the method described in the article.

capacitor is wired in parallel with a section of the main tuning control. The new control should be mounted as near as possible to the existing variable capacitor with the wiring as short and straight as possible. In order to retain the previous calibration of the receiver, the bandspread control should be half closed and the trimmers TC1/TC2/TC3 unscrewed slightly to compensate for the additional capacitance of the bandspread control.

BANDSPREAD CONTROL

The bandspread control should be fitted with a knob which has a 0 to 100 scale; the larger the knob that can be accommodated on the receiver the better the tuning performance will be. A knob with integral slow motion is better still.

CALIBRATION

The lowest cost method of calibrating a receiver is by drawing calibration charts for the various frequency ranges of interest, using the bandspread control. The best graph paper to use is that which has each large division sub-divided into ten smaller divisions. A separate chart should be drawn for each band but some of the wider bands will require two charts as the bandspread control will not cover the entire band with one setting of the main tuning.

The main tuning is adjusted so that the bandspread will cover the band being calibrated. This position of the main tuning is noted by sticking a piece of tape on the dial or by reference to the receiver's logging scale if one is fitted. As an example, the author's receiver was calibrated on the 19 metre band, being fitted with a 0-100 logging scale, and with the main tuning set at 37 the bandspread control covered the whole band.

The next stage is to do some concentrated listening on the band, trying to hear those stations of which the frequency is known and plotting these on a graph similar to Fig. 2. The stations heard by the author were as follows:

Station	*Frequency*	*Bandspread Setting*
WWV	15000 kHz	0
Radio Cairo	15150 kHz	19
RSA, S. Africa	15200 kHz	26
VOA, Tangier	15300 kHz	43
RAI, Rome	15400 kHz	65
Radio Moscow	15450 kHz	80

When all these points have been plotted a smooth curve is drawn between them giving the result shown in Fig. 2. This procedure is repeated for all the bands required by the listener.

The method of calibration by plotting frequencies is tedious but, once done, the graph can be used again and again very simply. One of the basic ideas behind the article was that the minimum of expense was involved. The reader will have to spend some time drawing up the graphs but will have spent very little money.

The use of a crystal calibrator would, of course, speed up the process of drawing the charts. The The 3-range Crystal Marker by R. F. Graham was published in the February 1973 issue of PW and this is ideal for the job, being both simple and inexpensive.

USING THE CHARTS

It is possible to use the charts by simply returning the main tuning to the marked position from which the chart was drawn. This is not very accurate however, and the following method is recommended. When returning to a given band a search is made for one particular station the frequency of which is known, say 15250 kHz. Reference to the graph shows that this should appear at 34 on the bandspread scale. Both the main tuning and the bandspread are then adjusted until the station appears at this bandspread setting. The controls are now set for accurate listening on the band.

Having set up the receiver it is possible to use a chart in two ways. First, it is possible to determine the frequency of a station which has been tuned in by converting the bandspread reading to frequency, secondly, it is possible to tune to any particular frequency, to look for a station, by determining the correct bandspread setting for that frequency and adjusting the control accordingly. ■

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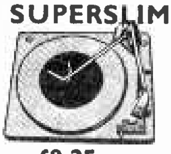

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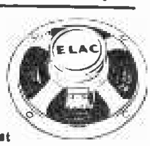

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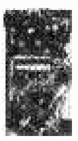

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32/450V	20p	8+8/450V ..	18p	350+50/325V ..	50p
25/25V ..	10p	8+16/450V	20p	32+32+32/350V	48p
50/50V ..	10p	16+16/450V	25p	100+50+50/350V	48p
100/25V	10p	32+32/350V	25p		

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. 17p; 25V. 35p; 50V. 47p; 100V. 70p.
2000mF. 6V. 25p; 25V. 42p; 50V. 57p.
2500mF. 50V. 62p; 3000mF. 25V. 47p; 50V. 65p.
5000mF. 6V. 25p; 12V. 42p; 25V. 75p; 35V. 85p; 50V. 95p.

CERAMIC 1pF to 0·01mF, 4p. Silver Mica 2 to 5000pF, 4p
PAPER 350V–0·1 4p, 0·5 13p; 1mF 15p; 2mF 150V 15p.
500V-0·001 to 0·05 4p; 0·1 5p; 0·25 8p; 0·47 25p.
SILVER MICA. Close tolerance 1% 2·2-500pF 8p; 500-2,200 pF 10p; 2,700-5,600pF 20p; 6,800pF-0·01m F 30p; each.
TWIN GANG. "0-0" 208pF+176pF, 65p; 500pF standard 45p; 365+365 with 25+25pF Slow motion drive 50p.
SHORT WAVE, SINGLE. 10pF 30p; 25pF 55p; 50pF 55p.
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RESISTORS. ¼ w., ½ w., 1 w., 1p; 2 w., 5p 10 ohms to 10 meg.
HIGH STABILITY. ½ w. 2% 10 ohms to 6 meg., 10p.
Ditto 5% Preferred values 10 ohms to 10 meg., 4p.
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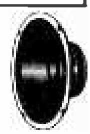

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GOING BACK...

1970 60 50 40 30 20

COLIN RICHES
ARTHUR DOW

MR. J. TURNER tells us that he managed to purchase a Marconiphone model V2 receiver at a local auction. He has restored it to working order and it performs very well—especially on long waves. Tuning is accomplished by sliding in various ebonite slabs—each covering a different range. Each contains an "embedded" coil which is tuned by copper "spades." There is a "regenerator unit" which does not seem to fulfil any useful purpose and Mr. Turner would like to hear from any readers who can comment on this. The valves are of the D.E.R. type (dull emitters). The h.t. supply is 90V and l.t. 3V. The set still bears its original transfers and is in very good condition throughout. Inside the lid there is an ivorine plate giving the serial number of the set as "installation no. S/A 2535.

Mr. Turner would like any information on this set that readers could supply.

We found a reference to the V2 in a catalogue kindly lent to us by Dr. Brodribb—another vintage radio collector. It reads: "The Marconiphone V2 gives excellent results as a long-range instrument. By its reflex circuit, two valves do the work of three. It holds a remarkable record of results from overseas stations, including America. Cost of upkeep is comparatively negligible, and is perfectly simple to operate."

In c1926 the V2 could be obtained from Upfield and Sons (Motors) at Hastings, for the sum of £10.5s. The receiver complete with accessories, including two D.E.R. valves cost £14.11s.2d and a dry cell combination including two D.E.3. valves cost £14.13s.8d. There was also a Marconi royalty of £1.5s to pay.

Our old friend Chris Petsikopoulos from Greece tells us he has recently returned from holiday and writes:

"During that time I had the opportunity to make a great search which brought great finds, the most important of all was a French radio-set of the era 1917-1918, made by "DUCRETET", Paris, providing a 100 watt spark Transmitter and crystal detector receiver connected in a common tuning circuit through a change-over switch.

The tuning circuit consists of an Oudine coil with a slider for the aerial and a variable capacitor used only for reception, this meaning that the transmitter works on a standard wave length (450m). The whole unit is housed in a compact wooden case 17 x 12 inches, and is in nice condition. In the case are housed the tuning coil, variable capacitor, send-receive switch, mica condenser, high tension coil with interrupter, and a 10 amp. meter. Also connectors for key and headphones. On top of the set are aerial-earth connectors, crystal detector, and spark-gap. Connectors for 12V d.c. are on the right side of the case.

Connecting a 12V battery, a 100 foot aerial and an earth, the set was able to work. The aerial was

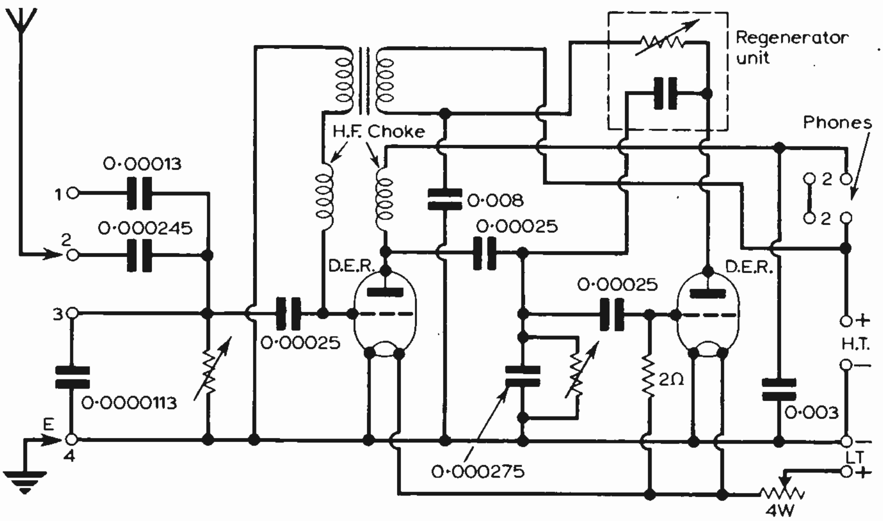
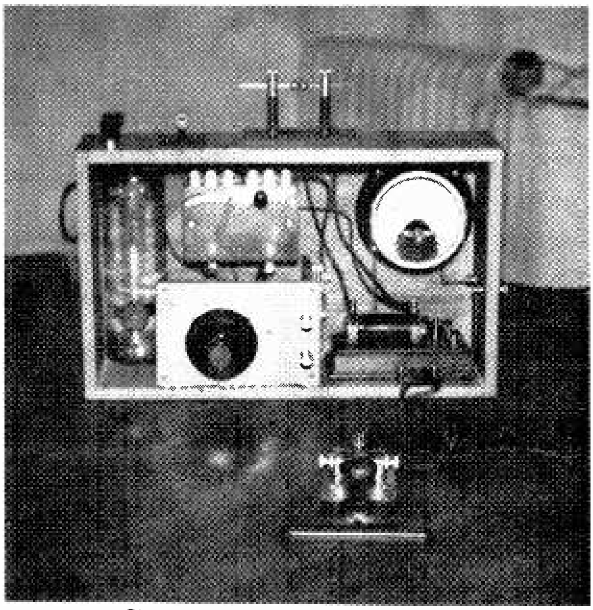
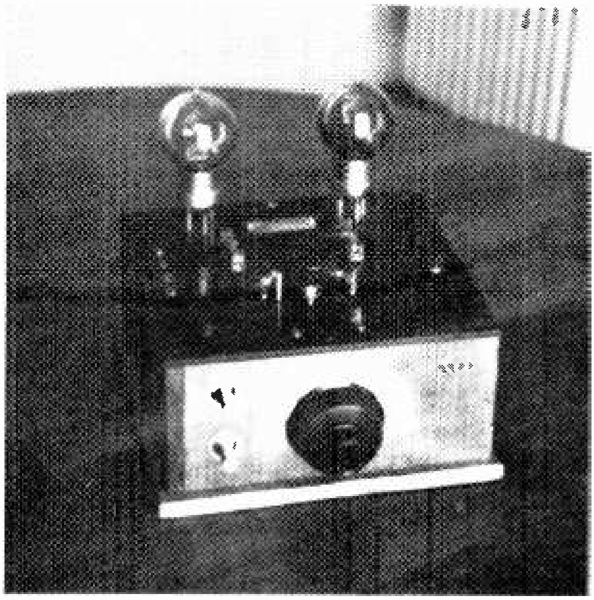


Fig. 1: The circuit of the Marconi V2 receiver re-drawn from the information supplied by Mr. J. Turner.



Chris Petsikopoulos' "Ducretet" Tx/Rx.



The "Thomson-Houston" receiver.

tuned with the slider for maximum current, 5-6 amp., giving a nice audible buzzing signal in a range of about 5-8 miles depending on the position of the car which was used for checking the range. The receiver has a range from 250-600m and the reception of several broadcasting stations was able with good volume, the only difficulty being in finding a sensitive position on the crystal although the change-over switch provides a third position where the tuning circuit is off and the buzzing of the interrupter is then used to adjust the detector.

Shown are pictures of the above set and of a 1922 two valve Heterodyne made by "Thomson-Houston", Paris, valves are type R-5 of "La Radiotechnique" still working. The set is accompanied with a band switching frame aerial covering a wave length from 400m to 3,000m in three ranges."

Mr. H. E. Hunt, 68 Oundle Road, Thropston, Northants, quotes some prices he noticed for making one's own components.

"Your feature "Going Back" has caused me to reach for Vol. IV of "The Amateur Mechanic" whose mildewed covers contain the inspiration that set me building my first "Wireless Telegraph" set (1920-21).

There is no "Components List" because there were no components in those days but a "Specification of Materials" and I quote that portion for the variable condenser only:—

	s.	d.
1 sq. ft of ¼ inch teak (to make box)		6
1 sq. ft. of thin sheet zinc		2
2 small nuts and bolts		2
1 knob (off rubber stamp or screwdriver)		-
2 small brass terminals		3
8 ins. electric light flexible wire		2
6 old quarter plate negatives		-
Total cost	1	3

(The last item was for di-electric, not P.C.Bs.) These were the days of ebonite, teak, brass turning and 2lb. soldering irons (gas heated).

Such was the success of this "Long Distance Receiver"—Poldhu, Eiffel Tower and numerous spark transmitters were received—using a 6ft. twin spreader aerial, 50ft. long and 30ft. high, that I was able to obtain parental financial backing (30/-) to build a single valve receiver.

The valve was an ungettered one of Dutch manufacture (15/-) which not only furnished sufficient light to work to but formed the nucleus of a receiver that occupied one half of the work bench.

But what a new world it opened up, the Hague concerts on Sundays, and England's first and unsurpassed compere P. P. Eckersley from 2.MT. at Writtle, Essex on Tuesday evenings.

There were also at this time some excellent telephony transmissions from local Northampton amateurs (2.TV.-5XH-5XG).

I started using the d.c. mains for h.t. long before eliminators were on the market, except that one had to put up with a complete loss of signals every time a tram passed 200 yards away.

One could write a book on the early days of amateur "wireless' but for myself I must hurry off to change an under-rated thyristor in the speed control of my wheel chair (or something like that). Tempus fugit!!

FUTURE PLANS

Let us tell you why you should know about some of our future plans in *Practical Wireless*.

First, our autumn issues are being planned as the best yet; secondly, we will be doing what no other magazine has ever done before; thirdly, if you don't find out about these and order your copies in advance, your newsagent is very likely to sell out before you get there.

Naturally, we cannot tell you everything now, but we can tell you what to look for next month, and in the following issues. Want to know more? Then keep your eyes on our "Leader" page and turn to pages 320, 334, 335 and 350 for further details in this issue.

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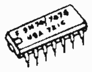
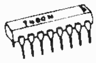
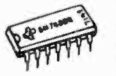

Type	1/11 p	12/24 p	25/99 p
SN7400	0·20	0·18	0·16
SN7401	0·20	0·18	0·16
SN7402	0·20	0·18	0·16
SN7403	0·20	0·18	0·16
SN7404	0·20	0·18	0·16
SN7405	0·20	0·18	0·16
SN7406	0·30	0·27	0·25
SN7407	0·30	0·27	0·25
SN7408	0·20	0·19	0·18
SN7409	0·45	0·42	0·35
SN7410	0·20	0·18	0·16
SN7411	0·23	0·22	0·20
SN7412	0·42	0·40	0·35
SN7413	0·30	0·27	0·25
SN7416	0·30	0·27	0·25
SN7417	0·30	0·27	0·25
SN7420	0·20	0·18	0·16
SN7422	0·48	0·44	0·40
SN7423	0·48	0·44	0·40
SN7425	0·48	0·40	0·35
SN7427	0·42	0·39	0·35
SN7428	0·50	0·45	0·42
SN7430	0·20	0·18	0·16
SN7432	0·42	0·39	0·35
SN7433	0·70	0·61	0·44
SN7437	0·65	0·60	0·50
SN7438	0·65	0·60	0·50
SN7440	0·20	0·18	0·16
SN7441AN	0·75	0·72	0·70
SN7442	0·75	0·72	0·70
SN7443	1·00	0·95	0·90
SN7445	2·00	1·75	1·60
SN7446	2·00	1·75	1·60
SN7447	1·75	1·60	1·45
SN7448	1·75	1·60	1·45
SN7450	0·20	0·18	0·16
SN7451	0·20	0·18	0·16
SN7453	0·20	0·18	0·16
SN7454	0·20	0·18	0·16
SN7460	0·20	0·18	0·16
SN7470	0·30	0·27	0·25
SN7472	0·30	0·27	0·25
SN7473	0·40	0·37	0·35
SN7474	0·40	0·37	0·35
SN7475	0·55	0·52	0·50
SN7476	0·45	0·42	0·39
SN7480	0·80	0·75	0·67
SN7481	1·25	1·15	1·10
SN7482	0·87	0·80	0·70
SN7483	1·00	0·90	0·85
SN7484	0·90	0·85	0·80
SN7486	0·45	0·41	0·38
SN7490	0·75	0·70	0·65
SN7491AN	1·00	0·95	0·90
SN7492	0·75	0·70	0·65
SN7493	0·75	0·70	0·65
SN7494	0·80	0·75	0·70
SN7495	0·80	0·75	0·70
SN7496	1·00	0·97	0·95
SN7497	6·25	5·50	5·00
SN74100	2·50	2·30	2·00
SN74104	1·45	1·35	1·20
SN74105	1·45	1·35	1·20
SN74107	0·50	0·45	0·40
SN74110	0·80	0·70	0·60
SN74118	1·00	0·95	0·90
SN74119	1·90	1·78	1·65
SN74121	0·60	0·55	0·50
SN74122	1·35	1·25	1·10
SN74123	2·70	2·55	2·47
SN74141	1·00	0·95	0·90
SN74145	1·50	1·40	1·30
SN74150	3·35	2·95	2·15
SN74151	1·10	0·95	0·90
SN74153	1·35	1·27	1·20
SN74154	2·00	1·75	1·55
SN74155	1·55	1·47	1·35
SN74156	1·55	1·47	1·35
SN74157	1·80	1·70	1·50
SN74160	2·60	2·40	2·25
SN74161	2·60	2·40	2·25
SN74162	3·40	3·25	2·70
SN74163	3·40	3·25	2·70
SN74164	2·75	2·30	2·10
SN74165	4·00	3·50	3·00
SN74166	4·00	3·50	3·00
SN74167	6·25	5·60	5·10
SN74170	4·10	3·55	3·05
SN74174	2·00	1·75	1·30
SN74175	1·35	1·27	1·15
SN74176	1·60	1·35	1·20
SN74177	1·60	1·35	1·20
SN74180	1·55	1·30	1·20
SN74181	7·00	6·00	5·50
SN74182	2·00	1·80	1·60
SN74184	2·40	2·00	1·80
SN74185A	2·40	2·00	1·80
SN74190	1·95	1·85	1·75
SN74191	1·95	1·85	1·75
SN74192	2·00	1·90	1·80
SN74193	2·00	1·90	1·80
SN74194	2·50	2·25	1·90
SN74195	1·85	1·70	1·60
SN74196	1·50	1·40	1·30
SN74197	1·50	1·40	1·30
SN74198	4·60	3·70	3·35
SN74199	4·60	3·70	3·35

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AC176	25p
AC187	25p
AC188	25p
ACY17	30p
ACY20	20p
ACY21	20p
ACY39	55p
AD140	50p
AD149	50p
AD161	35p
AD162	35p
AF117	20p
AF118	50p
AF124	25p
AF139	30p
AF186	40p
AF239	40p
ASY27	30p
ASY28	25p
BA102	30p
BA115	7p
BA145	15p
BAX13	5p
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BC109	10p
BC109C	12p
BC113	15p
BC117	20p
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BCY71	20p
BCY72	15p
BCY87	2·99
BCZ11	60p
BD124	80p
BD131	75p
BD132	80p
BF115	25p
BF167	25p
BF173	25p
BF179	30p
BF180	30p
BF194	15p
BF195	15p
BF861	25p
BF898	25p
BFX13	25p
BFX34	75p
BFX37	30p
BFX88	20p
BFY50	20p
BFY51	20p
BFY52	20p
BFY64	50p
BFY90	59p
BLY36	8·00
BSX20	15p
BSY27	15p
BU105	2·25
BY100	15p
BY126	15p
BY127	15p
BYZ13	35p
C106D	65p
GET111	55p
GET115	55p
GET880	45p
LM309K (T03)	1·87
MAT121	25p
MJE340	50p
MJE370	70p
MJE520	75p
MJE2955	1·10
MJE3055	75p
MPF105	40p
NKT214	20p
NKT216	40p
NKT217	40p
NKT403	70p
NKT404	50p
OA5	50p
OA10	35p
OA81	10p
OA91	7p
OA200	7p
OA202	10p
OC16	75p
OC20	95p
OC23	85p
OC25	40p
OC28	65p
OC35	50p
OC36	65p
OC42	40p
OC44	15p
OC45	15p
OC57	50p
OC71	15p
OC72	25p
OC77	45p
OC81	25p
OC83	25p
OC140	55p
OC170	25p
OC171	30p
OC200	45p
OC201	75p
OC202	80p
OC203	50p
OCP71	1·25
ORP12	50p
ORP60	40p
P346A	20p
RAS310AF	45p
RAS508AF	55p
TAA263	75p
TIL209	39p
TIP29A	50p
TIP30A	60p
TIP31A	60p
TIP32A	70p
TIP33A	1·00
TIP34A	1·50
TIP35A	2·50
TIP36A	3·00
TIP41A	75p
TIP42A	85p
TIS43	35p
V405A	25p
ZTX108	12p
ZTX300	12p
ZTX301	15p
ZTX302	18p
ZTX341	20p
ZTX500	15p
ZTX503	17p
2G301	30p
2N404	20p
2N527	35p
2N696	15p
2N697	15p
2N706	10p
2N930	20p
2N987	45p
2N1131	25p
2N1132	25p
2N1302	18p
2N1304	22p
2N1305	22p
2N1307	25p
2N1308	25p
2N1613	20p
2N1671	1·00
2N2147	75p
2N2160	59p
2N2217	25p
2N2221	20p
2N2222A	25p
2N2369A	15p
2N2906	20p
2N2926 (all cols)	10p
2N3053	20p
2N3054	50p
2N3055	55p
2N3440	75p
2N3442	1·25
2N3525	75p
2N3614	59p
2N3615	75p
2N3702	10p
2N3704	10p
2N3705	10p
2N3714	1·80
2N3771	1·75
2N3773	2·00
2N3790	2·25
2N3819	35p
2N3820	50p
2N3866	85p
2N3903	15p
2N3906	12p
2N4061	12p
2N4062	12p
2N4126	15p
2N4871	35p
2N5457	30p
2N5777	55p
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IN4003	200	8
IN4004	400	8
IN4005	600	10
IN4006	800	12
IN4007	1000	15
1·5 amp miniature		
PL4001	50	8
PL4002	100	9
PL4003	200	10
PL4004	400	10
PL4005	600	12
PL4006	800	15
PL4007	1000	16

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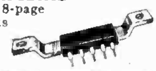

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SC45B	200	£1·00
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15 Amp T048

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B1/10	100	25p
B1/20	200	30p
B1/60	600	35p
ONE AMP (G.I.) TUBULAR		
W005	50	30p
W01	100	35p
W02	200	40p
W06	600	45p
TWO AMPS ¼ H × ⅜ L × $\frac{5}{16}$		
B2/05	50	35p
B2/100	100	40p
B2/200	200	45p
B2/600	600	50p
B2/1000	1000	60p
FOUR AMPS ⅜H × ⅜L × $\frac{3}{16}$		
B4/100	100	60p
B4/200	200	65p
B4/400	400	70p
B4/600	600	75p
B4/800	800	£1·00
SIX AMPS ⅜H × ⅜L × $\frac{3}{16}$		
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B6/200	200	75p
B6/400	400	90p
B6/600	600	£1·00



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CRS 1/20	200	30p
CRS 1/40	400	35p
CRS 1/60	600	45p
THREE AMP (TO48)		
CRS 3/05	50	30p
CRS 3/10	100	30p
CRS 3/20	200	35p
CRS 3/40	400	45p
CRS 3/60	600	55p
FIVE AMP (TO66)		
CRS 5/400	400	60p
SEVEN AMP (TO48)		
CRS 7/100	100	60p
CRS 7/200	200	65p
CRS 7/400	400	70p
CRS 7/600	600	95p
SIXTEEN AMP		
SCR 16/100	100	65p
SCR 16/200	200	70p
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1 Amp T05

3 Amp T048

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TAKE 20

DAVID ANDREWS

No. 51
TOUCH-SENSITIVE SWITCH

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

Nowadays there is a tendency to veer away from electro-mechanical switches to electronic versions which have no moving parts. The reason is twofold; first there is less likelihood of failure and secondly there is a strange fascination in setting something in motion or switching on something without any apparent mechanical intermediary. This is already happening in applications such as lift control buttons and desk calculator keying so why not in a few domestic situations, or as a replacement for the Morse operator's key?

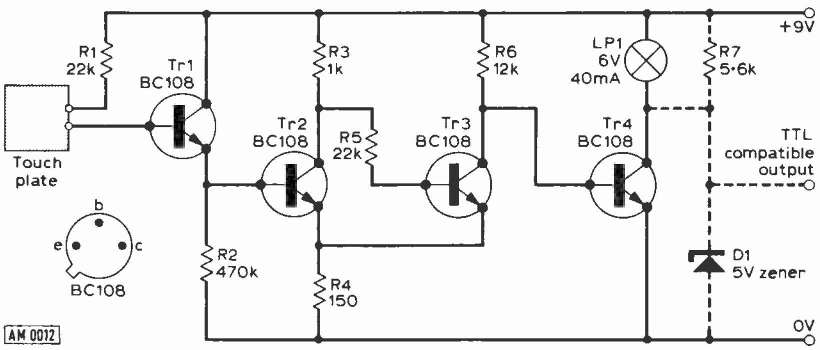
This month's circuit is a very simple way of providing touch sensitive keying and is capable of several types of output including an output that illuminates a low voltage lamp but the circuit can be quite easily modified to provide a relay drive (rather negating the original sentiment of avoiding mechanical components!) or, better still, a logic (TTL) compatible output.

Operation

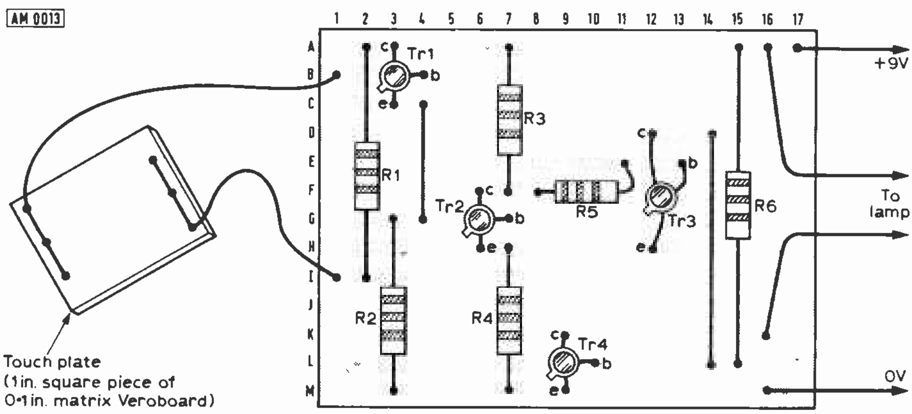
Touch sensitivity is achieved by detecting the minute current that passes through the finger when a pair of contacts is bridged by the touch of the operator. The touch transducer in the prototype was made from a 1 in. square of 0·1 in. pitch Veroboard, with alternate copper strips paralleled together to form a contact pattern.

A more attractive touch plate could be made by printed circuit techniques and if this is done it is better to use a fibre-glass base. In either case the copper contacts need some protection from corrosion and this can be effected by lightly tinning the strips with solder.

The touch plate is connected between the supply



Circuit of the touch-sensitive switch, with alternative TTL output circuit.



Layout of components on the Veroboard with details of the touch plate.

rail (through R1) and base of Tr1 which should have low leakage current (beware of cheap "reject" transistors). When the plate is touched a very small current flows in the base/emitter circuit of Tr1 and this in turn permits a much higher current to flow between collector and emitter. Tr2 and Tr3 are connected as a Schmitt Trigger circuit; the emitter current from Tr1 flows mainly into the base of Tr2 and turns it on; this causes Tr3 to turn off and the potential at its collector starts to rise until base current in Tr4 is established. When this occurs the lamp LP1 lights. Alternatively, considering the TTL version, the output level falls to "0".

Removing the finger from the touch plate causes the base current to stop flowing in Tr1; current into the base of Tr2 thus stops and the latter starts to turn off. As this occurs Tr3 starts to draw base current through R3 and R5 and begins to turn on. As this happens the potential at Tr3's emitter starts to rise slightly and this (due to the feedback inherent in a Schmitt Trigger) causes Tr2 to turn off faster. At the same time the potential at Tr3's collector falls until sufficient base current into Tr4 can no longer be maintained. Tr4 thus turns off and the lamp goes out. Alternatively the TTL output goes to a logic level "1".

★ components list

R1	22kΩ	1p
R2	470kΩ	1p
R3	1kΩ	1p
R4	150Ω	1p
R5	22kΩ	1p
R6	12kΩ	1p
Tr1	BC108	10p
Tr2	BC108	10p
Tr3	BC108	10p
Tr4	BC108	10p
LP1	6V 40mA	10p
Veroboard		20p
		76p

No allowance is made for minimum order costs or for postage and packing and these points should be checked carefully before ordering.

TTL Output

To obtain the TTL output version R7 and zener diode D1 should be in circuit and lamp LP1 omitted For relay operation LP1 should be replaced by a 6 volt relay. The components list has not taken the alternative versions into account.

Note

A word of warning—the touch plate should not be used out of doors or with wet fingers because droplets of moisture bridging the conductors will provide sufficient current to make the circuit switch. Possibly this problem could be overcome by carefully painting in the gaps between the strips with a good quality water repellent paint having a high gloss finish. ■

VHF BAND LOCATOR

A. SYDENHAM

144 145 146 MHz

The easily built unit to be described is used to provide a signal in the 2 metre Amateur band (144-146MHz). When constructing or modifying apparatus for 2 metre use it can be very difficult indeed to locate the band or any part of it. Indeed in some areas, amateur activity is so low that many hours of experimenting may be wasted in tuning for non-existent transmissions. Experienced constructors will know to their cost that at v.h.f. finicky adjustments are often required and in the case of a tuning coil for example just one half turn too little or too much may result in the circuit being so far off frequency as to be useless for the purpose required. To overcome problems such as these this unit was quickly assembled—and at small cost.

The circuit of the device is shown in Fig. 1; it is by no means unique but rather the practical outcome of some earlier experiments. Basically a crystal-controlled oscillator—Tr1 and associated items—provide harmonic output which is lightly audio modulated due to Tr2 circuitry. The modulating section is by no means essential but it does enable the user to aurally recognise the v.h.f. signal being generated which is, in the case of the 6025kHz crystal utilized, the twenty-fourth harmonic (6025 x 24 = 144·6MHz). Whether or not the final generated frequency is exactly at this figure is not too important provided it is in the 2 metre amateur band.

Inductor L1 is tuned by trimmer TC1 to the crystal harmonic frequency, L2 merely being a low impedance untuned output link closely coupled to L1. In the f.e.t. source circuit inductor L3 is tuned to the crystal frequency by capacitor C1, final fine tuning being accomplished by means of the dust core which when once set can be so left. The drain current taken by Tr1 when oscillating correctly is approximately 2mA from a 9V d.c. supply.

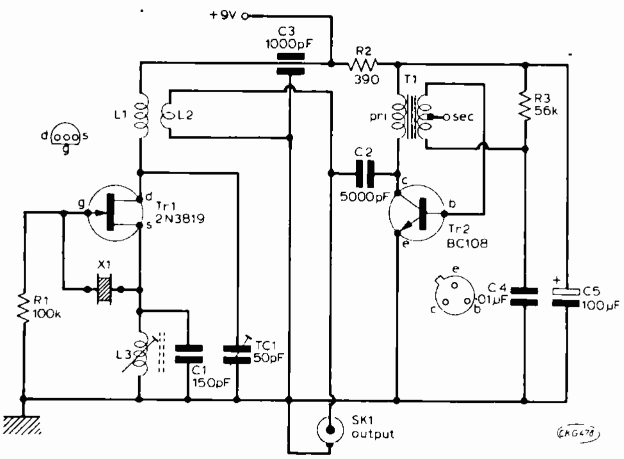


Fig. 1: Circuit of the complete unit.

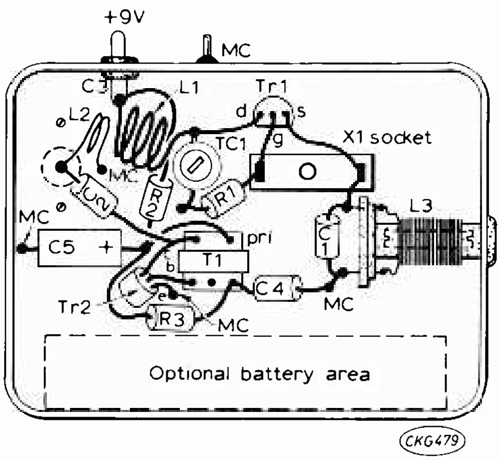


Fig. 2: Component layout and wiring.

The circuitry around Tr2 enables audio oscillations to be generated, transformer T1 providing the required collector-base feedback. The transformer used is a sub-miniature type driver transformer removed from a defunct broadcast band receiver. Such items are not difficult to come by and in any case the type is not critical provided the primary and secondary windings have measured resistance values approximating to 500 and 150 ohms respectively. If difficulty exists in finding a suitable surplus transformer for T1 a readily available item is the Ardente type T1079 interstage model. In some cases—and particularly if the Ardente transformer is used—it may be necessary to increase the value of resistor R3 to say 100kΩ. The frequency due to the audio generator is of little consequence provided it is recognizable.

Constructional

Since it is essential to screen the apparatus the ubiquitous 2-oz tobacco tin provides a cheap and convenient housing which also leaves sufficient internal space for a small battery if desired. The location of components is shown in Fig. 2 which is

★ components list

Resistors
R1 100kΩ
R2 390Ω
R3 56kΩ

Capacitors
C1 150pF
C2 5000pF
C3 1000pF feed-through
C4 0·01μF
C5 100μF 10V electrolytic
CT1 50pF miniature trimmer

Miscellaneous
Coil former, $\frac{1}{4}$in. diameter with dust core, 2-oz. tobacco tin, 9V battery, wire, solder, etc. X1, quartz crystal 6025kHz with holder to suit—see text. T1—see text.

Transistors
Tr1 2N3819
Tr2 BC108

self-explanatory. As will be appreciated only the crystal, output socket and supply connectors exist outside when the tin lid is placed in position. In the prototype the negative supply lead is soldered direct to the case, the nearby positive supply being taken inside via a small feed-through capacitor.

The inductors are home-made, L1 consisting of 3 turns of 24 s.w.g. copper wire wound on to a $\frac{3}{8}$in. diameter 'former" and allowed to spring off; L2 is similarly made using but $1\frac{1}{2}$ turns. Both windings are spaced wire thickness. Some 24 turns of fine d.s.c. wire (30-38 s.w.g.) are close-wound on to a $\frac{1}{4}$in. dust-cored former to make L3.

Testing

With one end of R2 temporarily disconnected and a crystal plugged in, a meter set to read 0-10mA placed in series with a 9V battery supply may initially read full scale or thereabouts, this indicating, as is likely, a non-oscillating condition. The core of L3 is then carefully adjusted until the current being monitored falls suddenly to around 2mA, this indicating correct functioning.

With R2 reconnected the current reading obviously increases whereupon the secondary winding of T1 is briefly short-circuited with a metal blade whilst carefully noting the test meter pointer. If no current change is detected as the short-circuit is made and broken the audio oscillator is not working and it will be necessary to reverse the connections to either the primary or the secondary windings of T1—but not both—to phase the feed-back correctly.

If a short rod aerial is then plugged into the output socket, SK1, and is brought close to a 2-metre receiver—or as is more likely a 2-metre converter working with a receiver—a signal due to the unit should be tunable whereupon trimmer TC1 may be peaked for maximum output.

Thereafter crystals in the frequency range of 6005-6083kHz may be used to give harmonic output between 144-146MHz. Alternatively crystals in the frequency range of 8005-8111kHz may be utilized provided inductor L3 is retuned to this region thus affording eighteenth harmonic output. ■

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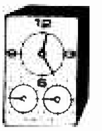
TIME SWITCH



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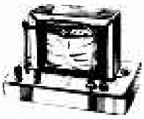

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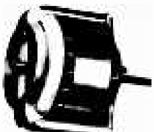
PAPST MOTORS



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For the control of lighting on stage or in a studio or for control of portable equipment in workshops, etc. This has two 13 amp socket outlets each is controlled by a 5 amp solid state regulator. The overall length is 17in., width 3½in. and depth 1½in. In the end is fitted a master On/Off switch indicator, lamp and fuse. Price **£8 25.**

STANDARD WAFER SWITCHES

Standard size 1¼" wafer- silver-plated 5 amp contact, standard ¼" spindle 2" long—with locking washer and nut.

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

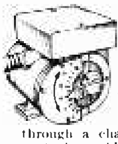
CAPACITOR DISCHARGE CAR IGNITION

This system which has proved to be amazingly efficient and reliable was first described in the *Wireless World* about a year ago. We can supply kit of parts for an improved and even more efficient version (*Practical Wireless*, June). Price **£6·55** plus 30p post. When ordering please state whether for positive or negative systems. Also available, ready made ignition systems for 6V. vehicles **£7·95** plus 20p.

MULLARD UNILEX

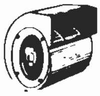
This D.I.Y. Stereo Amplifier is still available complete at **£7·00** for the four Mullard Modules, or Modules can be bought separately as follows:—
4 watt amplifier module (2 required) Mullard Ref. No. E.P.9000—**£1·60.**
Pre amp module Mullard Ref. No. E.P.9001—**£1·98** each.
Power Module—Mullard Ref. No. E.P.9002—**£2·53** each.
In addition and made to Mullard specification we offer:—
Standard Control Unit with escutcheon and knobs—**£3·30**
Knobs—Set of 4—**50p.**
Special offer the complete Unilex with control panel at Pre VAT price **£10·00** post paid.

ZPM MODULATION MOTOR



Could also be used to open ventilators, doors, valve, damper, etc. particularly suitable for remote control. Made by Satchwell Essentially a reversible geared motor fitted with internal limit switches to stop it at the end of its travel. Size approx. 6in. × 6in. × 5½in. and weighing approx. 10 lb. This is extremely powerful and would lift a heavy door or open a long line of ventilators. To operate this motor you put the 50 cycle supply through a changeover switch. For instance a thermostat with changeover contacts could automatically regulate the temperature in a growing house, chicken hatchery, etc. An indicator on the motor graduated 0-10 shows the state of open or close. Also internally fitted is a variable resistor, wires from this to a volt meter would give a remote indication of the open or close position. A very expensive motor if both direct from Satchwell, our price complete with step down Transformer is **£16 50.**

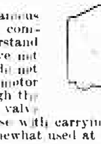
CENTRIFUGAL FAN



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

THIS MONTH'S SNIP

TAPE PLAYBACK UNITS



Mains operated. Made by Rediffusion the famous "music in background people". These are complete units ready to work and we understand that they are in good going order. We have not tested them but would exchange any that do not work properly. These have a superior motor driven fly wheel to control the tape through the capstan and also an even equally useful valve amplifier with ECL84 output. In a steel case with carrying handle. Two models offered, good as new **£6 50** and somewhat used at **£3 50**, 75p carriage up to 200 miles then 50p per 100 miles extra

24-HOUR TIME SWITCH

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

MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied.
Model 1153 500mW power output **72p.**
Model 1172 750mW power output **94p.**
Model EP9000 4 watt power output **£1·60.**
EP9001 twin channel or stereo pre amp. **£1·99**
10% discount if 10 or more ordered.

NEW ITEMS THIS MONTH

MINIATURE SEALED RELAY

American made. Our Ref.: REL A1. Measures only ⅞" wide × ⅜" thick and ⅞" high and it's a double change over, we don't know the contact rating but estimate this at 3/5 amps. The coil resistance is 600 ohms and 9-12 volt will close it. Ideal for models and miniaturised equipment. It's a plug in relay but we supply complete with base. Price **28p** including base.

SUB. MINIATURE MICROSWITCH

Made by Burgess, their ref. V4T6 —our ref. MS. A1. These measure only ⅞" × ⅜" × ¼" thick—have change over contacts and tag connection. Price **16p** each or 10 for **£1·44.**

3 CORE MAINS FLEX

Metric size ·5mm which is approx. equivalent to the old 14/36 rating. Suitable therefore for mower or similar portable tools. Cores are colour coded to the new European standard. Brown—live; Blue—neutral; Yellow/Green—earth. Grey P.V.C. covered overall. 100m coils **£5.** 50m coils **£3** and 25m coils **£1·75.** Post 40p on 100m. **25p** for 50m coils and **20p** for 25m coils.

PANIC SWITCHES

Tough enough to be foot switches and elegant enough to be panel switches. Bakelite construction with white push rod. Price **40p** less quantity discounts. Switch is rated 250v—2 amp.

20 WATT CAMPING LIGHT

Also makes good car emergency light. This uses a standard 2 ft 20 watt tube and operates from a 12v car battery drawing approx. 1A. This gives illumination per amp/hour of battery life far in excess to filament lamps and in fact to the miniature 8-13 watt camping lights often offered. Complete unit ready to operate, in strong white enamelled metal frame. These would normally sell at £6 are unused but slightly soiled and we offer these at **£3·50** plus 40p post and packing.

6 MAINS TRANSFORMERS

Our Ref.: MTM1 27 volt at 8 amp. Upright mounting fully shrouded—flying leads—fully tapped primary. Price **£3·30.**

Our Ref.: MTM2 12v at 1 amp. Upright mounting with fixing lugs, tag connection. 240v primary—12v 1 amp secondary. Price **82p.**

Our Ref.: MTM3 6·3v 2 amp upright mounting with fixing lugs, tag connections. 240v primary 6·3v 2 amp secondary. Price **77p.**

Our Ref. MTM4 18v—½ amp with thermal cut-out, upright mounting with fixing lugs-tag connections. Primary 240v—secondary 18v at ½ amp. Price **88p.**

Mains Isolation MTM5 350 watts earth shielded—flex leads—upright mounting lugs for fixing. Price **£4·40** each.

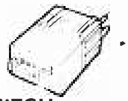
6 VOLT RELAYS

Our ref.: REL M1. Removable clear plastic enclosed two screw fixing. Have a 6 volt D.C. operated coil but two change-over contacts. each rated to make and break 240v A.C. at 15 amps. Price **66p** each.

P.O. TYPE 3000 RELAY

Our ref.: REL M2—100 ohms coil and 2 pair normally open heavy duty contacts. Price **75p** each.

6 DIGIT COUNTER



Resettable. 440 ohm coil up to 25 impulses per second. Ex-equipment but guaranteed perfect. **£2·20** each.

COMBINATION SWITCH

This comprises of 12 miniature change - over micro switches. Joined in banks of 3 and mounted on frame with four digital numbered thumb wheels and a removable lever for locking the thumb wheel — the thumb wheel operates 3 banks. Over 4,000 combinations are possible but by re-wiring the switch connections underneath then thousands more variations are possible. If you are making equipment which you don't want switched on accidentally or without authority then this is a switch to consider—this can also be used as a coding switch for many other operations. Very neat and compact and measuring approx. 4" × 1¾" × 1½" deep. Priced at **£3·03.**

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Type 14 D.M.G. A very fine switch made by Honeywell. The switch is intended for mounting on panel through oblong hole. No screws required for fixing its sprung clips secure it quite firmly. The operating button is approx. 1" dia. round and dished for ease of operation. Has 2 sets of 10 amp change-over contacts. Spring loaded, returns to normal when pressure is released. Ideal for instrument or quality gear. Price **50p** each. 10 for **£4·50.** 100 for **£40.**

PHOTO-MULTIPLIER TUBE

American R.C.A. type No. 4555. These tubes have a gain of a million or more. Regular Price—over £16. We have a limited quantity and offer these at **£4 50.**

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MAGNETIC AMPLIFIERS

PART 2

I. R. SINCLAIR

SELF-SATURATING MAGNETIC AMPLIFIERS

(continued)

If the control current is zero, the core is taken through a small magnetisation cycle and has an inductance determined by the average flux contributed by the secondary current. If the control current is in the *opposite* direction, the flux due to control current opposes it and the core can be made to change from negative to positive saturation when signal current flows. In this state, flux change is maximum and inductance is large so that the voltage drop across the secondary winding is large.

In a core operated in this way, the amplification obtained depends mainly on the shape of the magnetisation B—H curve, and a steep sloped curve with a very low value of saturation magnetic field strength is desirable. To obtain this shape of curve, cores are usually made by winding tapes of suitable material (permalloy etc.) round a former to form a toroid and winding the coils round these cores.

When such materials are used in such a core, the B—H curve is of the type shown in Fig. 6, where the scales of the graph are such that the values of B are large and those of H small. Saturation occurs at such a low value of flux (measured in milliamps of current X turns of coil) that the cores will saturate with the output current even with no control current applied, and so the control current must be applied so that its flux *always opposes* the output flux.

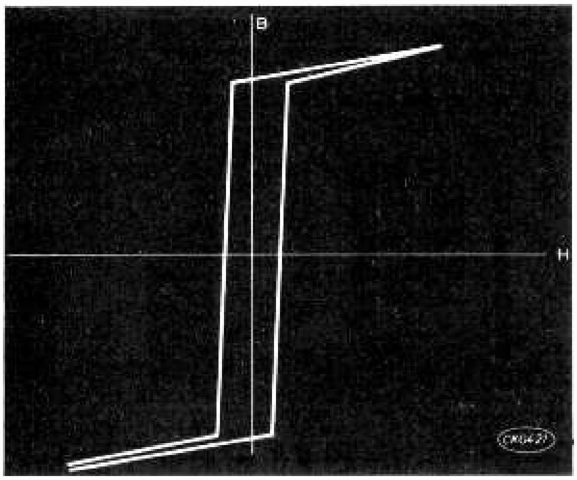

Fig. 6: B-H curve for material used for cores of magnetic amplifiers.

The circuit of a full-wave self-saturating magnetic amplifier is shown in Fig. 7. Since the secondary current in each core must be in one direction, a rectifier is used in series with each secondary winding and two windings are used so that control can be exerted over the whole of one cycle. Note that the voltage across the load is alternating, despite the rectifiers. The output waveform of such an amplifier is also shown in Fig. 7; except for the value of voltage at minimum signal, the waveform is similar to that obtained from a thyristor circuit.

The transfer characteristic (voltage out plotted against *current* in control winding) is shown in Fig. 7. The precise form of this curve can be calculated if the B—H curve for the core in use is known, and it is one of the considerable achievements of core manufacturers that cores and core materials can now be made with reproducible values of B—H curve. The greatest sensitivity can be obtained if the control current is biased to the point 0 on this control curve, and for this purpose, if the bias signal cannot be obtained from the source, a separate bias winding may be used.

The self-saturating magnetic amplifier will give an a.c. voltage output across a load almost independent

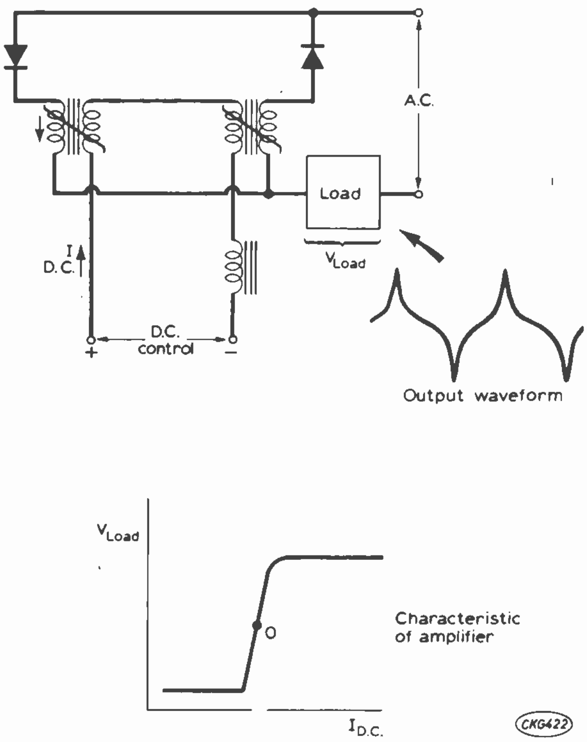

Fig. 7: Circuit of fullwave self-saturating magnetic amplifier with output waveform and amplifier characteristic curve.

of load impedance and determined only by the d.c. control current, so that a d.c. signal at the control winding produces an amplified a.c. output. The output power obtained depends on the size and type of core used.

DC OUTPUT FEEDBACK

The magnetic amplifiers described so far give an a.c. output for a d.c. input. Where the load of the amplifier must be supplied with d.c., or where one magnetic amplifier feeds a second (as when very large power amplification is required) the output of the magnetic amplifier must be rectified. This may be done by taking the output terminals to a bridge rectifier and connecting the load across the other two terminals of the rectifiers (Fig. 8a). A more economical method is to make use of the rectifiers which feed the cores, and add two more to form a bridge rectifier circuit (Fig. 8b) or to use a centre tapped transformer as power source and use the core rectifiers to provide the d.c. output (Fig. 8c).

When linearity of control is particularly important, this may be improved by feedback. To apply feedback to a magnetic amplifier a direct current must be obtained from the output and applied to a feedback winding in the direction opposite to the current in the control winding. The feedback ratio which by the usual feedback theory is approximately the new gain of the amplifier, is the ratio of control winding ampere-turns to the feedback ampere-turns.

DESIGN AND CONSTRUCTION OF PRACTICAL AMPLIFIERS

Because magnetic materials vary so much, it is not easy to give a "circuit" for a magnetic amplifier for home construction; it is rather like giving a circuit for a radio in which all the transistors had to be made at home as well! We can, however, outline the steps in design, so that the experimenter can construct reactors, determine their characteristics and make use of them in the circuits shown earlier. Since commercially obtainable reactors are £10 and upwards, there is a strong incentive for home construction!

CORES

The type of core material which can be used depends on the power available to drive the control winding. When large powers (about 1kW) are being controlled, and several watts can be used to drive the amplifier, an old transformer core can be rebuilt, provided that the transformer was rated to take such power loads. This requires some trial and error unless the core *material* is known and information on it is available. If this is not the case, the best cut-and-try method is to keep the original windings on the bobbin and reassemble the core with no gap, by replacing the **E** and **I** sections facing alternatively in opposite directions. The inductance of the main winding should then be checked for saturation point; this is easily done if an oscilloscope is available by feeding the winding from an a.c. supply through a large variable resistor and checking the voltage across the winding with an oscilloscope. As the current is increased, the voltage waveform becomes flat-topped when saturation point is reached, and the current flowing at this point is saturation current (the saturation current here is peak current$=1{\cdot}4\times$rms meter reading). Alternatively an a.c. voltmeter and ammeter can be used and voltage plotted against current on a graph, saturation being when the graph becomes flat-topped. Note that the a.c. current must be varied by a resistor, if a constant voltage source such as an auto-transformer is used, the *current* waveform will be the one which appears distorted.

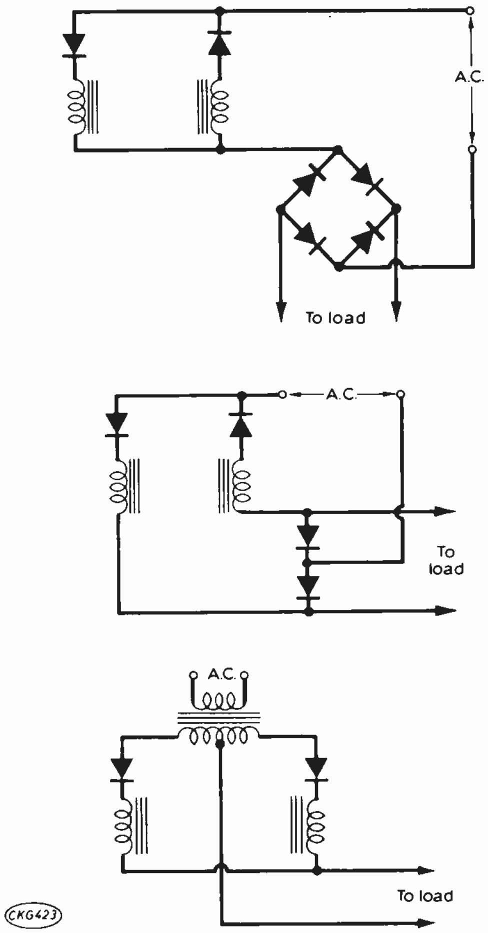

Fig. 8a, top, shows rectifiers needed to rectify AC output of amplifier when the load requires a DC supply. Fig. 8b, centre, and Fig. 8c, bottom, illustrate alternative methods of achieving DC output.

Once saturation current in the main winding is known, the saturation current in the other windings can be calculated, for it is inversely proportional to the voltage of the winding when used as a transformer. For example, if the saturation current in a 250V winding is 100mA the saturation in a 350-0-350 winding, total 700V is $100 \times \frac{250}{700}\,\text{mA} = 36\text{mA}$ and this 700V winding can be used as the control winding. If the control winding has resistance of 100Ω, the voltage across it at saturation is 36V and this will be able to control currents of ±100mA at 250V in the other winding. The voltage gain in this case is not impressive, but the power gain is fairly high and is achieved at less cost than many comparable devices.

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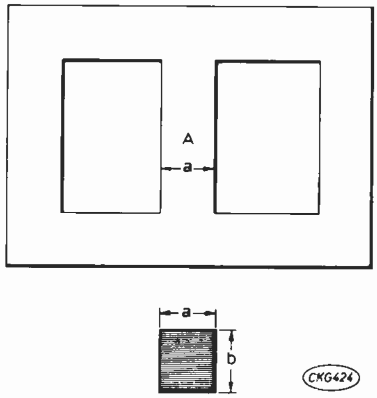


Fig. 9: The cross sectional area of the core can be obtained by multiplying 'a' and 'b' measured in cms.

(in sq.cm) in the bobbin, B is the saturation flux density of the core in Teslas (Weber per sq.m) and f is the frequency in Hertz (cycles per second).

The wire size may then be selected if the output current is known. Using a table of wire size which shows area in "circular mils" choose a wire size of about 1 circular mil for each milliamp of output current. The number of turns for the voltage required at the output is then $\frac{25V}{A}$ where the area of cross-section of the core (Fig. 9) in sq.cm and V is the voltage of the winding in volts.

After this, the design depends on the core material used, whose characteristic must be known. The ampere-turns for control should be obtained from the maker's information, and the control winding designed to suit amplification required and to fill the available bobbin shape.

In the case of a commercial design, considerably more would be done to calculate leakage flux, winding thickness, etc. but a cut-and-try approach is better for the amateur who is more interested in making a working device than in establishing a production line.

FINAL NOTES

Voltage gains are of the order of 8-40 with straight saturating circuits and up to 1200 with self-saturation. Feedback lines should include a choke to prevent a.c. feedback.

The frequency of the input signal should not be more than one-tenth of the frequency of the operating a.c.; for 50Hz operation, the input signal bandwidth is d.c. to 5Hz. ■

PRODUCTION LINES

colin riches

STEREO 21

I didn't think it was possible, but, for the amazingly low price of £17·95, Radio and TV Components are marketing a stereo record playing outfit.

In kit form, it comprises a BSR C129R 3-speed record deck with cartridge, a pre-assembled amplifier module, giving 2·7W per channel, two 8in. x 5in. speakers, easy-to-assemble woodwork for the plinth, cover and speaker cabinets and all the wire, nuts and bolts, etc.

The "Stereo 21" is particularly suitable for beginners to home construction because no soldering is required. All electrical connections are made through push-on tags. The plinth and speaker enclosures employ pre-mitred, wood grain covered chipboard sections, the mitres being cut in such a manner that a hinge is formed. Glue is applied to the mitred sections which are then simply folded over to form a cabinet.

Another new item from the R & TV stable is an 8-track cartridge player retailing at £9·90. Housed in a smart wooden cabinet, the unit claims a frequency range better than 50-10kHz. Four track-indicator lights show which track is being played and the unit switches automatically from one channel to the next. This unit can easily be played through the Stereo 21 system, making it a comprehensive good-value-for-money stereo set-up.

Further information by sending s.a.e. to *Radio & TV Components (Acton) Ltd., 21 High Street, London, W3 6NG.*

ADVANCE TIMER/COUNTER

Mentioned last month, the TC17 measures frequencies from d.c. to 50MHz with resolution of 0·1Hz.

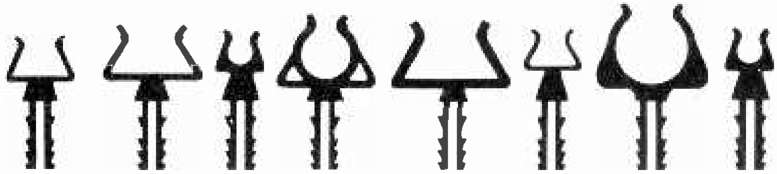
GL78/P/C

This is the latest addition to the range of Goldring/Lenco Turntable Units. The Model GL78/P/C incorporates an automatic shut-off switch which stops the motor at the end of the record and simultaneously raises the pick-up. A manual override control is built in, in case the shut-off facility is not required. *Goldring Ltd., 10 Bayford St., Hackney, London, E8 3SE.*

NEW 'TERRY' CLIPS

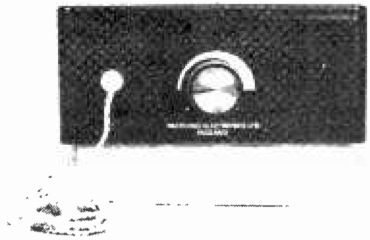
The picture shows the range of 'clipco' securing clips. 'Clipco' is versatile, easily fixed and no screwing is required. It is made of unbreakable, resilient rust-free nylon, which prevents damage to articles. 'Clipco' solves many fixing problems around the home and is a specially designed dual purpose plug which ensures efficient fixing to walls, tiles, wood and pegboard etc.

The clips are available in three choices of visual blisters, containing 8, 9 or 10 clips dependent on size and shape. The recommended retail price of blisters is 21p to 23p. They are also available in bulk—100 at £2·18p. *Herbert Terry and Sons Ltd., Redditch, England.*



S.W. CRYSTAL SET

Partridge now market a short wave crystal set (see picture). Further information from: *Partridge Electronics, Broadstairs, Kent.*



VACUUM RECORD CLEANER

The manufacturers, R.I. Audio, claim that their new "Groovac" record cleaner is the only unit available which removes dust from records by vacuum cleaning.

A tracking force of only 0·7 gram has been achieved by using a lightweight design with lubricated-for-life bearings throughout. This is considerably below the 3 to 6 grams force of simple brush cleaners. Low tracking force allows fine hairs to be incorporated in the Groovac cleaning nozzle which ensure efficient removal of dust from the bottom of record grooves—most brush cleaners have hairs with a diameter which is larger than the width of the record grooves. Low tracking force also means an almost immeasurable reduction in turntable speed, a reduction which is at least 3 times less than that caused by brush cleaners.

The Groovac consists of a precision lightweight arm, and a suction

unit which is acoustically isolated in a special enclosure. The suction unit has been designed to be inaudible at a distance of 2 metres; it has a mains switch and indicator, and is attractively finished in teak. Price is £6·90p plus V.A.T. and it is available from hi-fi retailers or direct from *RI Audio, Kernick Road, Penryn Cornwall.*

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AC127	25p
AC128	24p
AC128/AC176	44p
AC151	20p
AC152	25p
AC153	26p
AC176	20p
AC153/176K	52p
AC187K	17p
AC188K	23p
AC187/188K	40p
ACY17	27p
ACY18	20p
ACY19	20p
ACY20	20p
ACY21	19p
ACY22	10p
AD140	55p
AD149	50p
AD161	37p
AD162	37p
AD161/162	74p
AF106	32p
AF114	25p
AF115	25p
AF116	25p
AF117	25p
AF118	44p
AF124	25p
AF125	24p
AF126	17p
AF139	47p
AF186	40p
AF239	50p
AF279	55p
ASY26	25p
ASY27	30p
ASY28	22p
ASY29	30p
BA138	15p
BAX16	8p
BB103	16p
BB104	28p
BB105	32p
BC107	13p
BC107/BC177	33p
BC108	12p
BC108/BC178	28p
BC109	13p
BC109/BC179	33p
BC109C	14p
BC117	15p
BC140	30p
BC147	10p
BC148	9p
BC149	10p
BC157	12p
BC158	11p
BC159	12p
BC147/157	22p
BC148/158	20p
BC149/159	22p
BC167	11p
BC168	10p
BC169	11p
BC169C	12p
BC177	20p
BC178	16p
BC179	20p
BC182	10p
BC182L	10p
BC183	9p
BC183L	10p
BC184	13p
BC184L	12p
BC212	12p
BC212L	12p
BC238	10p
BC238/308	20p
BC257	9p
BC258	8p
BC259	9p
BC307	12p
BC308	10p
BCY30	25p
BCY31	48p
BCY32	50p
BCY33	20p
BCY34	25p
BCY38	30p
BCY58	18p
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BF195	15p
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BFX29	25p
BFX84	25p
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BZY88C3V3	13p
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BZY88C4V7	13p
BZY88C5V1	13p
BZY88C5V6	13p
BZY88C6V2	13p
BZY88C6V8	13p
BZY88C7V5	13p
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BZX61C16V	23p
BZX61C18V	23p
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CA3014	£1·52
CA3018	88p
CA3018A	£1·19
CA3020	£1·55
CA3028A	88p
CA3035	£1·52
CA3043	£1·73
CA3044	£1·42
CA3046	86p
CA3048	£2·34
CA3052	£1·80
CA3065	£1·42
CA3088E	£1·38
CA3089E	£2·19
CA3090Q	£4·70
CD4001AE	54p
CD4009AE	£1·16
CD4011AE	54p
CD4012AE	54p
CD4013AE	£1·11
CD4015AE	£2·92
CD4017AE	£2·92
CD4018AE	£2·92
CD4020AE	£3·25
CD4024AE	£2·09
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MC1466L	£4·20
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MFC4000B	65p
MC4024P	£2·20
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MFC6030	£1·63
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OC35	60p
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OC41	40p
OC42	40p
OC44	20p
OC45	20p
OC71	20p
OC72	20p
OC75	25p
OC76	25p
OC77	40p
OC81	20p
OC81D	20p
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OC84	25p
OC139	25p
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2N1304	24p
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2N1308	34p
2N1309	34p
2N1559 (CR1/401C)	60p
2N1613	15p
2N1711	15p
2N1893	54p
2N2218	33p
2N2218A	44p
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2N3053	24p
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2N3228	£1·10
2N3391A	29p
2N3525	£1·04
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2N441	70p
1N4001	7p
1N4002	7p
1N4003	10p
2N4444	£2·20
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2N5457(MPF103)	49p
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2N5777	45p
2N6027(D13T1)	45p
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3N128	73p
3N140	92p
3N152	92p
3015F	£2·00
3015G	£2·00
7400	16p
7401	20p
7402	20p
7403	20p
7404	25p
7405	25p
7408	25p
7409	25p
7410	20p
7413	30p
7420	20p
7425	30p
7430	20p
7440	24p
7442	£1·16
7443	£1·45
7444	£1·45
7445	£2·06
7446	£1·45
7447	£1·25
7450	20p
7451	20p
7453	20p
7454	20p
7460	20p
7470	45p
7472	32p
7473	45p
7474	46p
7475	45p
7476	45p
7480	67p
7482	87p
7483	£1·32
7486	33p
7490	70p
7491A	£1·28
7492	85p
7493	75p
7494	£1·13
7495	80p
7496	£1·48
74100	£1·64
74107	52p
74121	43p
74141	£1·00
74150	£3·35
74151	£1·10
74153	£1·35
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74190	£1·80
74191	£1·80
74192	£1·74
74193	£1·74
74196	£1·50
74197	£1·50
40250	66p
40309	40p
40310	60p
40311	42p
40312	62p
40320	42p
40360	56p
40361	45p
40362	45p
40406	52p
40407	40p
40408	54p
40409	62p
40410	62p
40430	£1·13
40432	£1·60
40468A	44p
40511	£1·92
40512	£1·88
40575	£1·54

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Mfd.	Working Voltage	Price	Mfd.	Working Voltage	Price
1·0	40v	7p	100	16v	6p
1·0	100v	5p	100	25v	6p
2·2	25v	7p	100	40v	7p
2·2	63v	5p	100	63v	10p
4·7	40v	5p	220	25v	8p
10	25v	5p	220	40v	9p
10	63v	6p	470	25v	12p
22	25v	6p	1000	25v	16p
22	40v	6p	2200	25v	30p
47	25v	6p	4700	16v	33p
47	40v	6p			

CAPACITORS—METALLISED POLYESTER

Stock values: MFD	Price each
0·01, 0·015, 0·022, 0·033	3p
0·047, 0·068, 0·10	4p
0·150, 0·220	5p
0·33	7p
0·47	8p
0·68	11p
1·0	14p
1·5	20p
2·2	24p

Order as "Polyesters" + Capacitance.

CAPACITORS—POLYSTYRENE

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

Stock values	Price each
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Ordar as: "Polystyrenes" + Capacitance.

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10DN **34p** (Plain All undrilled)
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14 pin Dil **18p**, 16 pin Dil **26p**, 8 pin Dil **10p**.

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Cheese head screw bolts. Nuts with integral washer. Moulded in high density nylon. Ideal for mounting "live" assemblies, power transistors, etc.
Each pack consists of four nuts and four screw bolts.

Pack No.	Thread	Length	Quantity	Pack Price
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Probably the best test probes ever made. When you push a plunger a spring steel forked tongue pushes out and holds the components, wires etc., while you take readings etc. It won't let go until you release it.
KLEPS 30 Black and Red, per pair **£1·30**

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Metal Oxide resistors by Electrosil. Ultra low noise, ½ Watt, 2%. Available in the range E24 between 10 ohms and 1 Meg.
E24 series=1·0, 1·1, 1·2, 1·3, 1·5, 1·6, 1·8, 2·0, 2·2, 2·4, 2·7, 3·0, 3·3, 3·6, 3·9, 4·3, 4·7, 5·1, 5·6, 6·2, 6·8, 7·5, 8·2, 9·1, and their decades.
Type No. TR5 Price: **4p each**
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RESISTORS—CARBON FILM

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

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

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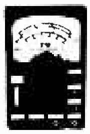
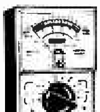
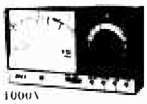
ARROW ELECTRONICS LTD.

DEPT. PW 8; 7 COPTFOLD ROAD BRENTWOOD ESSEX

GWS G.W.SMITH & CO (RADIO) LTD

TS60 POCKET MULTIMETER

High-precision at low-cost. Ranges: D.C. 15V, 150V, 1,000V (10,000 opv). A.C. 15V, 150V, 100V (1,000 opv). D.C. Current 150mA. Resistance 100k ohms. £1·85. Post 15p.

AUDIOTRONIC MODEL ATM.1

Top value 1000 o.p.v. pocket multimeter. Ranges: 0/10/50/250/1000v AC and DC. DC Current 0-1mA/100mA. Resistance 0/150k ohms. Decibels −10 to +22dB. Size 90 × 60 × 28mm. Complete with test leads. £2·50. Post 15p.

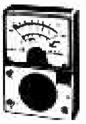
LT601 MULTIMETER

New style 20,000 o.p.v. pocket multimeter. 5/25/50/250/500 / 2500 V. D.C. 10 / 50 / 100 / 500 / 1000V A.C. 50μA / 250mA. 6K / 6 meg ohms. −20 to + 22 dB. £3·75. Post 20p.

MODEL TH-12

20,000 o.p.v. Overload protection. Slide switch selector 0 / ·25 / 2·5 / 10 / 50 / 250 / 1000V. D.C. 0 / 10 / 50 / 250 / 1000V. A.C. 0 / 50μA / 25 / 250mA. D.C. 0 / 3K / 30K / 300K / 3 meg − 20 to + 50dB £4·97. Post 15p.

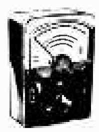
RUSSIAN 22 RANGE MULTIMETER

Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2·5/10/50/250/500/1000v D.C. 2·5/10/50/250/500/1000v A.C. DC Current 100wA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3mΩ. Complete with batteries, test leads, instructions and sturdy steel carrying case. OUR PRICE £5·97. P. & P. 25p.

HIOKI MODEL 730X

30,000 O.P.V. Overload protection. 6/30/60/300/600/1200 VDC. 12/60/120/600/1200 VAC. 60μA/30 mA/300 mA. 2K/200K/2 megohm. −10 to +63dB. £7·50. P. & P. 15p.

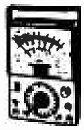
MODEL PL436

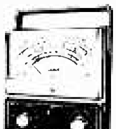
20k Ω/Volt D.C. 8k Ω/Volt AC. Mirror scale. ·6/3/12/30/120/600 V D.C. 3/30/120/600 V A.C. 50/600μA/60/600 mA. 10/100K/1 Meg/10 Meg Ω −20 to +46db. £6·97. P. & P. 12p.

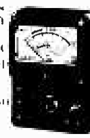
MODEL 500

30,000 O.P.V. with overload protection mirror scale 0/·5/2·5/10/25/100/250/500/1,000v. D.C. 0/2·5/10/25/100/250/500/1,000V. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60/K/6 Meg./60 Meg Ω. £9·95. Post paid. Leather Case £1·75

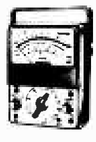
U4312 MULTIMETER

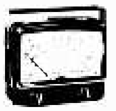
Extremely sturdy instrument for general electrical use. 667 o.p.v. 0/·3/1·5/7·5/30/60/150/300/600/900 VDC and 75mV. 0/·3/1·5/7·5/30/60/150/300/600/900 VAC. 0/300μA/1·5/6/15/60/150/600MA/1·5/6 AMP. D.C. 0/1·5/6/15/60/150/600MA/1·5/6 AMP. AC. 0/200 Ω/3K/30K Ω. Accuracy DC 1%. AC 1·5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. £9·50. P. & P. 25p.

HIOKO MODEL 700X

100,000 O.P.V. Overload protection. Mirror scale. ·3/·6/1·2/1·5/3/6/12/30/60/120/300/600/1200V DC 1·5/3/6/12/30/60/150/300/600 1200 V. A.C. 15/30μA/3/6/30/60/150/300mA 6/12 AMP. DC. 2K/200K/2 Meg/20 Meg ohm −20 to +63dB. £13·50. P. & P. 20p.

MODEL C-7080 EN

Giant 6" mirror scale 20,000 o.p.v. 0 / ·25 / 1 / 2·5 / 10 / 50 / 250 / 1000 / 5000V. D.C. 0 / 2·5 / 10 / 50 / 250 / 1000 / 5000V A.C. 0 / 50μA / 1 / 10 / 100 / 500mA / 10 amp. D.C 0 / 2K / 200K / 20 meg −20 to + 50 dB. £13·95. Post 35p.

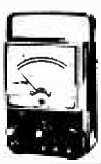
370 WTR MULTI-METER

Features A.C. current ranges 20,000 o.p.v. 0/·5/2·5/10/50 250/500 1000 V. D.C. 0/2·5/10/50/250/500/1000V AC 0/50uA/1/10/100mA/1/10 Amp D.C. 0/100mA/1/10 Amp AC 0/5K/50K/500K/5 MEG/ 50 MEG. −20 +62db. £15. P. & P. 25p.

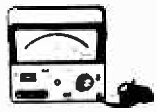
KAMODEN 72.200 MULTITESTER

High sensitivity tester 200,000 o.p.v. Overload protection. Mirror scale. Ranges 0 / ·06 / ·3 / 3 / 30 / 120 / 600 1200V. D.C. 0 / 3 / 12 / 60 / 300 / 11,200V A.C. 0 / 6μA / 1·2mA / 120mA / 600mA / 12A. D.C. 0 / 12A. A.C. −20 to +63dB. 0 / 2K / 200K / 2 meg / 200 meg ohms. £16·95. Post 30p.

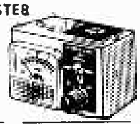
TMK LAB TESTER.

100,000 O.P.V. 6½in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K/Volt A.C. D.C. Volts: ·5, 2·5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 25, 50, 250, ·500, 1,000V. D.C. Current: 10, 100μA, 10, 100, 500mA, 2·5, 10 amp. Resistance: 1K, 10K, 100K, 10MEG, 100MEG Ω. Decibels: −10 to +49 db. Plastic Case with Carrying Handle. Size: 7½in. × 6¾in. × 3¼in. £18·95. P. & P. 25p.

Model S-100TR MULTIMETER TRANSISTOR TESTER

100,000 o.p.v. mirror scale/overload protection. 0/·12/·6/3/12/30/120/600 V DC. 0/6/30/120/600. V AC. 0/12/600μA/ 12/300mA/12 AMP DC. 0/10 K/1 MEG/100MEG. −20 to +50db. 0·01–·2 MFD. Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. £13·50. P/P 25p.

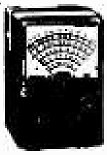
KAMODEN HM.350 TRANSISTOR TESTER

High quality instrument to test Reverse Leak current and DC current. Amplification factor of NPN, PNP, transistors, diodes, SCR's etc. 4" × 4¾" clear scale meter. Operates from internal batteries. Complete with instructions, leads and carrying handle. £12·50. Post 30p.

MODEL 449A IN CIRCUIT TRANSISTOR TESTER

Checks true A.C. beta in / out. Checks Icbo. Checks diodes in / out. Checks SCR, etc. Beta HI 10 − 500, LO 2 − 50. Icbo 0-5000μA. 220/240 V A.C. operation £17·50. Post 25p.

LB3 TRANSISTOR TESTER

Tests ICO and B. PNP / NPN. Operates from 9v battery. Complete with all instructions, etc. £3·95. P. & P. 20p.

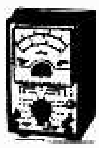
MODEL U4311 SUB-STANDARD MULTI-RANGE VOLT AMMETER

Sensitivity 330 ohms/Volt AC and DC. Accuracy 5% D.C. 1% AC. Scale length 165mm. 0/300/750μA 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5AMP DC 0 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750mA / 1·5 / 3 / 7·5 AMP AC 0 / 75 / 150 / 300 / 750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 / 750V DC 0/750mV / 1·5 / 3 / 7·5 / 15 / 30 / 75 / 150 / 300 /750V AC. Automatic cut out. Supplied complete with test leads, manual and test certificates. £49·00. Post 50p.

TE-65 VALVE VOLTMETER

28 ranges. D.C. volts 1·5-1,500v. A.C. volts 1·5-1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. £17·50. P. & P. 30p. Additional probes available: R.F. £2·12½; H.V. £2·50.

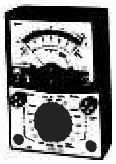
KAMODEN HM. 720B F.E.T. V.O.M.

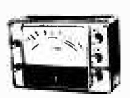
Input impedance 10 meg ohms. Ranges: 0 / ·25 / 1 / 2·5 / 10 / 50 250 / 1000V. D.C. 0 / 2·5 / 10 / 50 / 250 / 1000V. A.C. 0 / 25μA / 2·5 / 25 / 250 MA D.C. − 20 to + 62dB 0 / 5K / 50K / 500K / 5meg 500meg ohms. £14·95. Post 30p

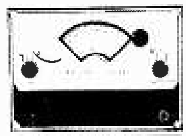
TE–40 HIGH SENSITIVITY A.C. VOLTMETER

10 meg. input 10 ranges 01/·003/·1/·3/1/3/10/30/100/300V. R.M.S. 4cps.-1·2 Mc/s Decibels −40 to +50dB. Supplied brand new complete with leads and instructions Operation 230V. A.C. £17·50 Carr. 25p.

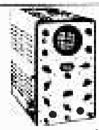
TMK MODEL 117 F.E.T. ELECTRONIC VOLTMETER

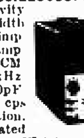
Battery operated. 11 meg input. 26 ranges. Large 4½" mirror scale. Size 5¼" × 4¾" × 2½". DC VOLTS 0·3-1200V AC VOLTS 3-300V RMS. 8·0-800V P-P. DC CURRENT ·12-12MA. Resistance up to 2000M ohm. Decibels −20 to +51dB. Complete with leads/instructions. £17·50. P. & P. 20p.

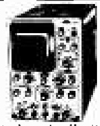
MODEL L-55 FET V.O.M.

Input impedance 10 meg ohms. 0 / ·3 / 1·2 / 6 / 30 / 120 / 600V. D.C. 0 / 3 / 12 / 60 / 120 / 600V. A.C. 0 / 120μA / 120mA D.C. 0 / 1K / 100K / 10 meg /100 meg ohms £15·97. Post 15p.

KAMODEN HMG-500 INSULATION RESISTANCE TESTER

Range 0-1000 Megohms, 500 Volt. Battery operated. Wide range clear meter 4½" × 4". Complete with deluxe carrying case, batteries, instructions. £19·95. Post 30p.

BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR

Sine 18 × 200,000 Hz Square 18 × 50,000 Hz Output max + 10 dB. (10 K ohms) Operation Internal batteries Attractive 2-tone case 7½" 5" × 2". Price £17·50 Carr. 17½p.

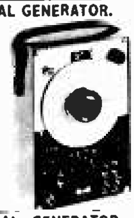
CI-5 PULSE OSCILLOSCOPE

For display of pulsed and periodic waveforms in electronic circuits. VERT. AMP. Bandwidth 10MHz. Sensitivity at 100KHz VRMS/mm. ·1-25; HOR. AMP. Bandwidth 500KHz. Sensitivity at 100KHz. V RMS/mm. ·3-25. Preset triggered sweep 1-3,000usec.; free running 20-200,000Hz in nine ranges. Calibrator pips. 220 × 360 × 430mm. 115-230V. AC operation. £39·00. Carr. paid.

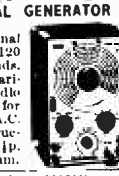
TO-3 PORTABLE OSCILLOSCOPE

3in. tube, Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps-1·5 MHz. Input imp 2 meg Ω 25pF X amp sensitivity 0·9v. p-p/CM Bandwidth 1·5cps-800kHz Input imp. 2 meg Ω 20pF Time base. 5 ranges 10 cps 300 kHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½lb. 220/240V. A.C. Supplied brand new with handbook. £47·50. Carr. 50p.

RUSSIAN CI-16 DOUBLE BEAM OSCILLOSCOPE

5 mc/s Pass Band. Separate Y1 and Y2 amplifiers. Rectangular 5in. × 4in C.R.T. Calibrated triggered sweep from ·2 u/sec. to 100 milli-sec. per cm. Free running time base 50 c/s-1 mc/s. Built-in time base calibrator and amplitude calibrator. Supplied complete with all accessories and instruction manual £87. Carr. Paid.

MODEL AT201 DECADE ATTENUATOR

Frequency range 0-200KHz. Attenuator 0-111db, 0·1db step. Impedance 600 ohms. Max. input power 30dbm. Size 180 × 90 × 55mm. £12·50. Post 37p.

ARF-300 AF/RF SIGNAL GENERATOR.

All transistorised, compact, fully portable. AF sine wave 18 Hz to 220 KHz. AF square wave 18 Hz to 100 KHz. Output sine / square 10v. P-P. RF 100 KHz to 200 MHz. Output 1v. maximum. Operation 220/240v. AC. Complete with instructions and leads. £29·95. Post 50p.

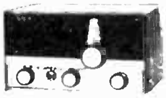
TE-20D RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s 500 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator, audio output. Xtal socket for calibration. 220/240V. A.C. Brand new with instructions £17·50. Carr. 37½p. Size 140 × 215 × 170 mm.

TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20cps to 200 kc/s on 4 bands. Square: 20cps to 30 kc/s. Output impedance 5,000 ohms. 200/250V. A.C. operation. Supplied brand new and guaranteed with instruction manual and leads. £17·50. Carr. 37½p.

GWS G.W.SMITH & CO (RADIO) LTD

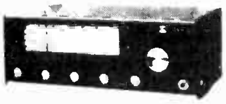
UNR 30 RECEIVER



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

Our Price £15·75 Carr. 37p

UR-1A RECEIVER



4 Bands covering 550 kc/s-30 mc/s FET, S Meter. Variable BFO for SSB. Built-in Speaker, Band-spread, Sensitivity Control. 220/240 v. A.C. or 12 v. D.C. 12½in. × 4½in. × 7in. Brand new with instructions.

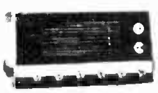
Our Price £25·00 Carr. 37p

SKYWOOD CX203 RECEIVER

Solid state, 5 bands covering 200-420 KHz and ·55 to 30 MHz. Illuminated slide rule dial. Band-spread. Aerial tuning. BFO, AVC, ANL, "S" meter, AM/CW/SS B. Integrated speaker and phone socket. 220/240 v. A.C. or 12 v. D.C. Size 325 × 266 × 150 mm. Complete with instructions and circuit.

Our Price £32·50 Carr. 50p

LAFAYETTE HA-600 RECEIVER



General coverage 150-400 kc/s. 550 kc/s-30 mc/s, FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter, S Meter Bandspread. RF Gain. 15in. × 9½in. × 8½in. 18 lb. 220/240 v. A.C. or 12 v. D.C. Brand new with instructions.

Our Price £50·00 Carr. 50p

TRIO 9R59DS RECEIVER

4 bands covering 550 kc/s to 30 mc/s continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW, ANL. Variable BFO. S meter. Sep. bandspread dial. IF frequency 445 kc/s. audio output 1·5w. Variable RF and AF gain controls 115/250 v. A.C. Size: 7in. × 13in. × 10in. with instruction manual.

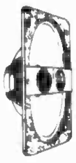
Our Price £49·50 Carr. Paid.

FULL RANGE OF TRIO STOCKED

GWS

AL O EE PREVIOUS PAGES

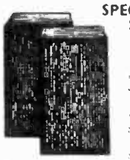
EMI LOUDSPEAKERS



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

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

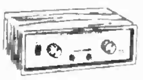
SPECIAL OFFER ! STEREO SPEAKERS



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

Our Price £12·95 Carr. 50p

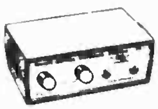
HA-10 STEREO HEADPHONE AMPLIFIER



All silicon transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and separate volume controls for each channel. Operates from 9v battery. Inputs 5MU/100MU. Output 50MW.

Our Price £5·97 P. & P. 15p

1021 STEREO LISTENING STATION



For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" × 4" × 2¼".

Our Price £2·25 P. & P. 15p

MP7 MIXER PREAMPLIFIER

5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9½" × 5" × 3". Inputs Mics: 3 × 3mV 50K: 2 × 3mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K.

Our Price £8·97 P. & P. 20p

HAND HELD 2-WAY WALKIE TALKIES

Industrial quality in robust metal cases. Battery operation. Volume and squelch controls. Call button and press to talk button. Telescopic aerial. Complete carrying cases.

100mW £24·95 pair. Packing & Post 50p.

2 channel 300mW **£52·50** Pair. Post 50p.

3 channel 1 watt **£71·25** Pair. Post 50p.

Licence required for operation in U.K.

AUDIOTRONIC RANGE OF HIGH QUALITY EQUIPMENT

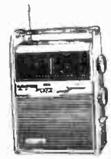
Audiotronic Products are manufactured exclusively for the Audiotronic Group of Companies and as a member of the group we are pleased to offer you this fabulous range of high quality equipment. Made to our own specifications each item provides outstanding performance and reliability at a value for money price!

ACR.14 Battery Mains Cassette Recorder

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

OUR PRICE £10·50 P. & P. 50p.

AR.1000 Sportsman AM/FM Portable Radio



5 wavebands covering AM 535 1605KHz FM 88-108MHz. AIR 108 135MHz PB 147 174MHz WB 162. 5MHz. Large horizontal slide dial with logging scale. Slider volume and squelch controls. 7 section telescopic aerial for FM and built in ferrite bar for AM. AFC. 3in. speaker. Earpiece socket. Green leatherette covered cabinet with metal side panels. Size 152 × 79 × 219mm. Battery/mains operation.

OUR PRICE £11·50 P. & P 35p.

AMR-9000 Global AM/FM Portable Radio

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

OUR PRICE £36·00 P. & P. 50p

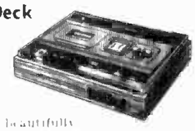
Stereo Headphones

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

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

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

ACD.660 Stereo Cassette Deck



A beautifully styled 4 track stereo deck with an outstanding specification offered at a remarkably low price. Incorporates a host of features including switchable noise filter normal/chrome tape selector, twin VU meter, slider record/playback level controls, front panel headphone socket, recording indicator lamp, phono/Din line input sockets, 3.5mm mike input sockets etc. etc. Frequency response 100-8KHz (100-12KHz CrO2) S/N-45dB. Crosstalk 45dB. Separation-35dB. Noise limiter-6dB at 10KHz. Complete with phono connecting leads.

Our Price £39.50 Carr. & Ins.50p.

AUDIOTRONIC DOLBY 'B' NOISE REDUCTION UNITS

Reduce tape hiss by 3dB at 600Hz, 6dB at 1200Hz and 10dB for all frequencies above 3000Hz. Size 16½" × 8" × 3½". AC 200/250v.

PROCESS TWO

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

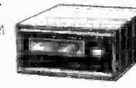
Our Price £34·50 P & P 50p

PROCESS FOUR

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

Our Price £50·00 P & P 50p

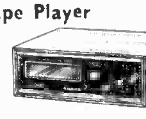
AHP-8D 8 Track Stereo Tape Deck



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

OUR PRICE £11·95 P. & P. 50p.

AHP-8A 8 Track Stereo Tape Player



Incorporates built in amplifiers giving 4½ + 4½ watts rms output. Push button track selector, illuminated track indicators, slider controls for volume, balance and tone. Attractive cabinet with black and silver trim. Output impedance 8 ohms. AC 220/240v.

OUR PRICE £17·25 P. & P. 50p.

LOW NOISE TAPE CASSETTES

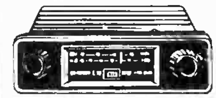
Top Hi-Fi quality in library cases

TYPE	5	10	25	
C60	£1·29	£2·53	£5·99	Cassette
C90	£1·85	£3·62	£8·59	Tape Head
C120	£2·29	£4·48	£10·63	Cleaner 30p
P. & P. 15p.		post free		

ACP-8 8 TRACK CAR PLAYER

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

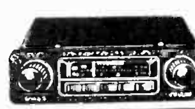
ONLY £12·50 P & P 40p



ACR 3500 CAR RADIO

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

Our Price £6·50 P & P 50p

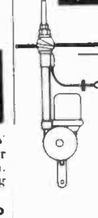


ACR1 PUSH BUTTON CAR RADIO

Push button tuning of one LW and five MW stations of your choice. 12v pos. or neg. earth. Complete with speaker, mounting brackets and instructions.

Our Price £8·95 P & P 50p

ACA 5SE ELECTRIC CAR AERIAL



5 section. Fully automatic. 12v DC. Extends to approx. 40". Complete with switch, all leads and instructions.

Our Price £5·95 P & P 50p

SAVE UP TO 33⅓% OR MORE! GWS

RECORD DECK PACKAGES

Carriage and Packing 75p.

Complete units with Stereo cartridge ready wired in plinth cover.

GARRARD
2025 TC/9TAHCD .. £10·65
SP25 111/G800 .. £15·95
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SP25 111/M44-7 .. £16·10
SP25 111/M55E .. £16·90
SP25 111 Module/M75-6 £18·99
AP76/G800 .. £23·95
AP76/G800E .. £25·95
AP76/M44E .. £24·95
AP76/M55E .. £25·65
AP76/M75ED .. £31·70
AP76/M75EJ .. £27·85
AP76 Module M75-6 .. £26·95
AP96 Module M75-6 .. £30·40
ZERO 1008 Module/M93E £41·85

B.S.R. McDONALD
210/SC7M .. £6·85
MP60/G800 .. £15·50
MP60/TPD1/G800 .. £15·20
MP60/M44-7 .. £16·60
HT70/TPD1/G800 .. £18·60

GOLDRING
GL72/G800 .. £30·90
GL75/G800 .. £33·60
GL75/G800E .. £36·75

GOODMANS
TD100/G800 Teak .. £46·85
TD100/G800 White .. £48·60

LEAK
Delta/M75-6 .. £43·95

PHILIPS
GA105/GP200 .. £13·80
GA160/GP200 Teak .. £19·50
GA212/GP400 .. £45·25
GA308 (less cartridge) .. £23·95
GA308 P.U. .. £32·75

PIONEER
PL12D (Less cartridge) £29·60
PL15C (Less cartridge) £41·25
PL41D (Less cartridge) £95·25
PL50 (Less cartridge) £89·90
PL61 (Less cartridge) .. £102·75
PLA35 (Less cartridge) .. £68·60

THORENS
TD160C/Ortofon M15ES £66·95
TD125 AB/11/Ortofon M15E Super .. £104·25
TD165/Ortofon M15E Super .. £59·60

WHARFEDALE
Linton/M44-7 Teak .. £23·70
Linton/M44-7 White .. £23·90

SINCLAIR PROJECT 60 PACKAGE DEALS

2 × Z30 Stereo 60/P/Z5 £15·95 P. & P. 37p.
2 × Z30/Stereo 60/PZ6 £18·00. P. & P. 37p.
2 × Z50/Stereo 60/PZ8 £20·25. P. & P. 37p.
Transformer for PZ8 £3·65.
Active Filter Unit £4·45.
Pair of Q16 Speakers £10·70
Project 60 FM Tuner £14·95
Sinclair Project 605 £20·97. P. & P. 37p.
All other Sinclair Products in stock
2000 Amplifier £22·95
3000 Amplifier £28·95
2000/3000 Tuner £26·30
Q830 Speakers £23·98 pair
P. & P. 50p each of above items

RECORD DECKS

Carriage and Packing 50p

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C129 Mono .. £5·50
C137 .. £7·00
510/TPD1 .. £13·95
610 .. £9·90
610/TPD1 .. £14·85
710 .. £19·20
810 .. £24·50
MP60 .. £7·65
MP60/G800 .. £10·25
MP60/TPD1 .. £12·60
MP60/TPD2 .. £11·25
HT70 .. £10·97
HT70/G800 .. £13·60
HT70/TPD1 .. £15·95

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2025 T/C Stereo .. £6·40
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SP25 III Acos GP104C £8·50
SP25111/9800 .. £10·95
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AP76 .. £15·40
SL65B .. £11·15
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401 .. £23·50
ZERO 100A .. £30·30
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GOLDRING
G99 .. £16·85
G101P/C .. £16·85
GL69/2 .. £15·75
GL72 .. £17·85
GL72/P .. £23·20
GL75 .. £23·75
GL75P .. £29·30
GL78P/C .. £46·55
GL85P/C .. £49·50

SPECIAL GARRARD OFFERS!

STEREO 1025T

4 speed autochanger unit fitted with stereo ceramic cartridge.

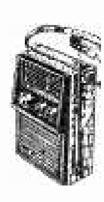
Our Price **£4·95** Carr. 50p

SP25 III WITH ACOS GP104

SP25 MK.II. 4 speed single record player fitted with Acos GP104 stereo ceramic cartridge.

Our Price **£8·50** Carr. 50p

Audiotronic AMB.500 Multiband Radio



5 wavebands covering MW 535–1605KHz and FM 88–175MHz. All transistor. Battery or mains operation. Built in aerial and 3 section telescopic aerial. Complete with batteries, shoulder strap and earpiece.

OUR PRICE **£6·95** P & P 35p

FANTASTIC OFFER!

AKAI CS35

CASSETTE RECORDER with a pair of OS88 Speakers. List £96·10.

OUR PRICE **£56·50** P & P 50p

CASSETTE (P. & P. 50p)
CS35D Deck .. £44·45
CS35/CS88 Speakers .. £67·95
GXC40D Deck .. £57·20
GXC40 Recorder .. £67·20
GXC40T Deck/Receiver £99·05
GXC45 Deck .. £78·25
GXC46D Dolby Deck .. £83·55
GXC46 Recorder .. £89·95
GXC60D Deck .. £87·65
GXC65D Dolby Deck .. £92·65

CARTRIDGE (P. & P. 50p)
CR81 Deck with amps. £65·40
CR81D Deck .. £53·60
CR81T Recorder/Receiver £92·75
CR80SS 4 channel Recdr. £114·25
CR80DSS 4 channel Recdr. £93·65

TAPE (P. & P. 75p)
4000DS Deck .. £59·95
4000DS Dust Cover .. £3·95
1721L Recorder .. £60·35
X5000 Recorder .. £82·50
X201D Deck .. £108·20
GX220D Deck .. £123·95
GX221D .. £138·40
GX280D Deck .. £196·50
GX370 Deck .. £211·50

TAPE/CASSETTE (P. & P. 75p)
GX1900D Deck .. £144·50

MICROPHONES (P. & P. 50p)
ADM.11 Dynamic (pair) £7·50

STEREO RECEIVERS (P. & P. 75p)
AA6300 20+20 watt .. £61·95
AA8030 25+25 watt .. £92·50
AA8080 40+40 watt .. £117·50
AA8100S 2 × 36 or 4 × 18 w. £175·00
AA8500 65+65 watt .. £150·50

STEREO AMPLIFIERS (P. & P. 50p)
AA5200 20+20 watt .. £61·75
AA5500 30+30 watt .. £78·50
AA5800 45+45 watt .. £117·50

STEREO TUNERS (P. & P. 50p)
AT550 AM/FM .. £60·50
AT580 AM/FM .. £94·50

4-CHANNEL UNIT (P. & P. 50p)
SS1 Synthesiser .. £39·95

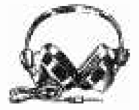
SPEAKERS
SW155 (each) £51·00

STEREO HEADPHONES
ASE11 £4·75
ASE20 £7·30
ASE22 £8·25

HOMER INTERCOMS

Ideal for home, office, stores, factories, etc. complete with batteries, cable and instructions.
2 Station £2·97, P. & P. 15p.
3 Station £5·25, P. & P. 15p.
4 Station £6·62, P. & P. 17p.

SH628 STEREO HEADPHONES



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

Our Price **£1·87** P. & P. 30p

LHO2S STEREO HEADPHONES

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

Our Price **£1·95** P. & P. 30p

TE1018 DE-LUXE MONO HIGH IMPEDANCE HEADSET

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

Our Price **£2·25** P. & P. 30p

BH.001 HEAD SET AND BOOM MICROPHONE

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

Our Price **£4·95** P. & P. 30p

FM TUNER CHASSIS

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

Our Price **£5·95** P. & P. 12p

Stereo multiplex adaptors £4·97

SPECIAL PURCHASE!

FERGUSON EXPORT MODELS

FERGUSON 3408 STEREO TUNER AMPLIFIER

Covers FM 88-108 MHz. Five push button tuning scales. 8+8 watts rms. Inputs for stereo ceramic cartridge and tape etc. Separate bass treble, balance and volume controls.

Our Price **£31·50** P. & P. 50p

3416 STEREO TAPE DECK

4 track. 7½, 3¾, 1⅞ i.p.s. Stereo/mono record/play. 7" reels. Inputs for dynamic mikes, radio, gram. Complete with cover.

Our Price **£41·95** P. & P. 75p

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Order with confidence by post – but remember to add 10% VAT (10p in the £) to total value of goods including carriage/packing and send cash with order. PLEASE PRINT NAME & ADDRESS CLEARLY.

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PART OF THE AUDIOTRONIC GROUP OF COMPANIES

Sinclair Project 60

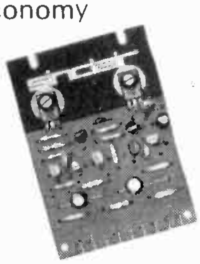
Now–the Z.50 Mk.2

with built-in automatic transient overload protection

When originally introduced, the Sinclair Z.50 proved how it was possible to design and produce a popularly priced modular power amplifier having characteristics to challenge the world's costliest amplifiers. Many thousands of Z.50's are now giving excellent service day in, day out. But we have also learned that constructors do not always use their Z.50's ideally. That is why we have introduced modifications whereby risk of damage through mis-use is greatly reduced and performance further enhanced. The Z.50 Mk.2 has improved thermal stability, more accurately regulated D.C. limiting to ensure more symetrical output voltage swing and clipping and still less distortion at lower power. Z.50 Mk.2 is compatible with all other Project 60 modules, and may be incorporated to advantage in existing systems. Eleven silicon epitaxial planar transistors are now used, two more than in the original Z.50, circuitry has been re-designed, making this versatile high performance amplifier better than ever.

with free manual
£5.48

Z.30 the power amplifier for quality and economy

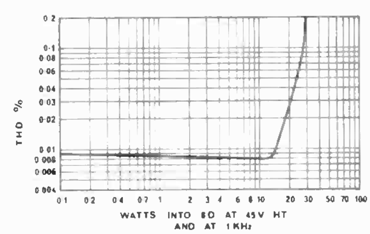


with free manual
£4.48

The Z.30 provides excellent facilities for the constructor requiring a high fidelity audio system of less power than that available from Z.50's. Using a power supply of 35 volts, Z.30 will deliver 15 watts RMS into 8 ohms, or 20 watts RMS into 3 ohms using 30 volts. Total harmonic distortion is a fantastically low 0.02% at 15 watts into 8 ohms with signal to noise ratio better than 70 dB unweighted. Input sensitivity 250mV into 100K ohms. Size 80 x 57 x 13 mm ($3\frac{1}{8}$ x $2\frac{1}{4}$ x $\frac{1}{2}$) Z.30, Z.50 and Z.50 MK.2 modules are compatible and interchangeable.

Brilliant new technical specifications

Input impedance 100 KΩ
Input (for 30w into 8Ω) 400mV
Signal to noise ratio, referred to full o/p at 30v HT 80dB or better
Distortion 0.02% up to 20W at 8Ω. See curve
Frequency response 10Hz to more than 200 KHz ±1dB
Max. supply voltage 45v (4Ω to 8Ω speakers) (50v 15Ω speakers only)
Min. supply voltage 9v
Load impedance – minimum : 4Ω at 45v HT
Load impedance – maximum : safe on open circuit



Guarantee

If, within 3 months of purchasing any product direct from Sinclair Radionics Ltd., you are dissatisfied with it, your money will be refunded at once. Many Sinclair appointed Stockists also offer this same guarantee in co-operation with Sinclair Radionics Ltd.

Each Project 60 module is tested before leaving our factory and is guaranteed to work perfectly. Should any defect arise in normal use, we will service it at once and without any charge to you, if it is returned within two years from the date of purchase. Outside this period of guarantee a small charge (typically £1.00) will be made. No charge is made for postage by surface mail. Air Mail is charged at cost.

Typical Project 60 applications

System	The Units to use	together with	Units cost
Simple battery record player	**Z.30**	Crystal P.U., 12V battery volume control, etc.	**£4.48**
Mains powered record player	**Z.30, PZ.5**	Crystal or ceramic P.U. volume control, etc.	**£9.45**
12W. RMS continuous sine wave stereo amp. for average needs	**2 x Z.30s, Stereo 60; PZ.5**	Crystal, ceramic or mag. P.U., F.M. Tuner, etc	**£23.90**
25W. RMS continuous sine wave stereo amp. using low efficiency (high performance) speakers	**2 x Z.30s, Stereo 60; PZ.6**	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc.	**£26.90**
80W. (3 ohms) RMS continuous sine wave de luxe stereo amplifier. (60W. RMS into 8 ohms)	**2 x Z.50s, Stereo 60; PZ.8, mains transformer**	As above	**£34.88**
Indoor P.A.	**Z.50, PZ.8, mains transformer**	Mic., guitar, speakers, etc., controls	**£19.43**

F.M. Stereo Tuner **(£25)** & A.F.U. **(£5.98)** may be added as required.

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the world's most advanced high fidelity modules

Stereo 60 Pre-amp/control unit

Designed specifically for use on Project 60 systems, the Stereo 60 is equally suitable for use with any high quality power amplifier. Since silicon epitaxial planar transistors are used throughout, a really high signal-to-noise ratio and excellent tracking between channels is achieved. Input selection is by means of press buttons, with accurate equalisation on all input channels. The Stereo 60 is particularly easy to mount.

SPECIFICATIONS—Input sensitivities: Radio – up to 3mV. Mag. p.u. 3mV: correct to R.I.A.A. curve ±1dB 20 to 25,000 Hz. Ceramic p.u. – up to 3mV. Aux – up to 3mV. **Output:** 250mV. **Signal to noise ratio:** better than 70dB. **Channel matching:** within 1dB. **Tone controls:** TREBLE +12 to —12dB at 10KHz; BASS +12 to —12dB at 100Hz. **Front panel:** brushed aluminium with black knobs and controls. **Size:** 66 x 40 x 207mm.

Built, tested and guaranteed. **£9.98**

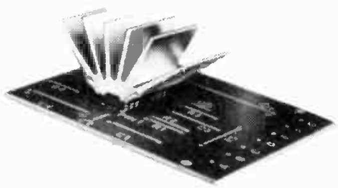
Project 60 Stereo F.M. Tuner

The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. tuner with fantastically good results. Other advanced features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stero decoder and switchable squelch circuit for silent tuning between stations. In terms of high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with most other high fidelity systems.

SPECIFICATIONS—Number of transistors: 16 plus 20 in I.C. **Tuning range:** 87.5 to 108MHz. **Sensitivity:** 7µV for lock-in over full deviation. **Squelch level:** Typically 20µV. **Signal to noise ratio:** >65dB. **Audio frequency response:** 10Hz – 15KHz (±1dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2µV. **Cross talk:** 40dB. **Output voltage:** 2 x 150mV R.M.S. maximum. **Operating voltage:** 25–30VDC. **Indicators:** Stereo on; tuning. **Size:** 93 x 40 x 207mm.

Built and tested. Post free. **£25**

Super IC.12 Integrated circuit high fidelity amplifier



Having introduced Integrated Circuits to hi-fi constructors with the IC.10, the first time an IC had ever been made available for such purposes, we have followed it with an even more efficient version, the Super IC.12, a most exciting advance over our original unit. This needs very few external resistors and capacitors to make an astonishingly good high fidelity amplifier for use with pick-up, F.M. radio or small P.A. set up, etc. The free 40 page manual supplied, details many other applications which this remarkable IC make possible. It is the equivalent of a 22 transistor circuit contained within a 16 lead DIL package, and the finned heat sink is sufficient for all requirements. The Super IC.12 is compatible with Project 60 modules which would be used with the Z.50 and Z.30 amplifiers. Complete with free manual and printed circuit board.

SPECIFICATIONS

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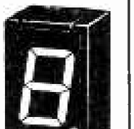

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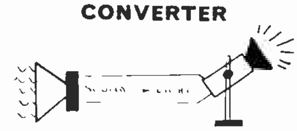

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GZ32	0.50
GZ34	0.60
HABC80	0.55

HK90	0.50
KT66	2.35
KT77	1·00
KT88	2·25
N78	1·60
PABC80	0.40
PC86	0.60
PC88	0.60
PC92	0.50
PC97	0.50
PC900	0.48
PCC84	0.40
PCC85	0.40
PCC88	0.55
PCC89	0.55
PCC189	0.60
PCC805	0.95
PCC806	0.95
PCF80	0.30
PCF82	0.35
PCF84	0.60
PCF86	0.60
PCF87	1·10
PCF801	0.50
PCF802	0.50
PCF805	0.90
PCF806	0.75
PCF808	0.90
PCH200	0.70
PCL81	0.50
PCL82	0.35
PCL83	0.65
PCL84	0.45
PCL86	0.45
PCL88	1.25
PCL200	0.75
PCL800	1.10
PCL801	0.95
PCL805	0.50
PD500	1.80
PF86	0.70
PF818	1.00
PFL200	0.65

PL33	0.40
PL36	0.55
PL81	0.50
PL82	0.45
PL83	0.45
PL84	0.40
PL302	0.95
PL504	0.75
PL508	0.90
PL509	1.10
PL801	1.00
PL802	0·95
PM84	0.60
PY31	0.35
PY33	0.63
PY80	0.40
PY81	0.30
PY82	0.35
PY83	0.38
PY88	0.40
PY500	1.00
PY800	0.47
PY801	0.50
PZ30	0.38
QQV02-6	2.25
QQV03-10	1.25
TT21	3.80
TT22	4.00
U18/20	0.75
U25	0.35
U26	0.35
U31	0.70
U37	6.50
U52	0.40
U76	0.40
U78	0.40
U191	0.75
U201	0.50
U281	0.55
U282	0.55
U301	0.55
U403	0.70

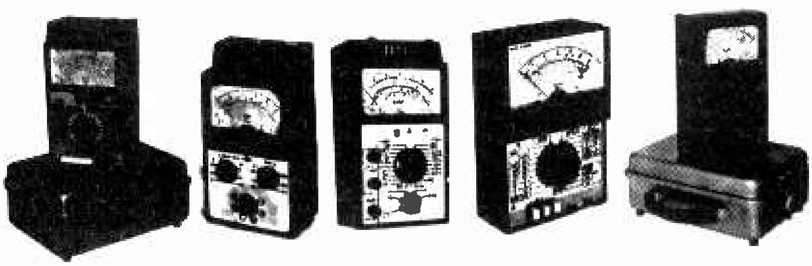
U404	0.70
U801	0.80
UABC80	0.40
UAF41	0.70
UAF42	0.60
UB41	0·65
UBC41	0.55
UBC81	0.45
UBF80	0.40
UBF89	0.40
UBL1	0.70
UBL21	0.70
UC92	0.45
UCC85	0.45
UCF80	0.70
UCH21	0.60
UCH42	0.70
UCH81	0.40
UCL81	0.60
UCL82	0.35
UCL83	0.65
UF9	0.65
UF11	0.60
UF41	0.65
UF42	0.65
UF43	0.65
UF80	0.35
UF85	0.40
UF89	0.40
UL41	0·65
UL84	0.43
UM84	0.30
UY1N	0.50
UY11	1.00
UY41	0.48
UY82	0.50
UY85	0.40
W729	0.75
XC12	0·60
Y63	0·75
Z759	3.60
Z504S	4.50
Z505S	7.00
Z803U	1.35

TRANSISTORS

2N696	0.15
2N697	0.15
2N698	0.80
2N705	0.70
2N706	0.10
2N708	0.15
2N753	0.25
2N929	0.20
2N930	0.20
2N987	0.30
2N1131	0.25
2N1132	0.25
2N1164	1.25
2N1302	0.17
2N1303	0.17
2N1304	0.20
2N1305	0.20
2N1306	0.25
2N1307	0.25
2N1308	0.25
2N1309	0.25
2N1613	0.17
2N1711	0.20
2N1756	0.75
2N2147	0.75
2N2160	0.60
2N2217	0.25
2N2218	0.20
2N2219	0.20
2N2369A	0.15
2N2477	0.65
2N2646	0.40
2N2905	0.25
2N2923	0.12
2N2924	0.13
2N2926	0.10
2N3053	0.20
2N3054	0.50
2N3055	0.60
2N3133	0.25
2N3134	0.25
2N3391	0.17
2N3392	0.17
2N3393	0.15
2N3394	0.15
2N3395	0.20
2N3402	0.15
2N3403	0.15
2N3404	0.32
2N3414	0.20
2N3415	0.15
2N3417	0.25
2N3702	0.10
2N3703	0.10
2N3704	0.12
2N3707	0.12
2N3709	0.10
2N3710	0.10
2N3819	0.35
2N3906	0.25
2S702	0.50
2S746	0.25
AC113	0.15
AC125	0.30
AC126	0.20
AC127	0.17

AC128	0.15
AC132	0.35
AC153	0.20
AC154	0.15
AC157	0.17
AC169	0.10
AC176	0.17
AC187	0.25
AC188	0.25
ACY17	0.25
ACY18	0.20
ACY19	0.25
ACY20	0.20
ACY21	0.20
ACY22	0.10
AD140	0.50
AD149	0.45
AD161	0.35
AD162	0.35
ADZ11	1.25
ADZ12	1.25
AF114	0.17
AF115	0.17
AF116	0.17
AF117	0.17
AF118	0.30
AF125	0.20
AF127	0.20
AF180	0.35
AF181	0.35
AF186	0.40
AF239	0.38
AFZ11	0.45
AFZ12	1.00
ASY26	0.25
ASY27	0.30
ASY28	0.25
ASY29	0.30
ASY54	0.25
ASZ15	0.70
ASZ16	0.70
ASZ17	0.75
ASZ18	0.75
ASZ20	0.25
ASZ21	0.40
AUY10	1·00
BC107	0.10
BC108	0.10
BC109	0.10
BC113	0.10
BC118	0.20
BC134	0.20
BC147	0.10
BC148	0.10
BC149	0.12
BC152	0.15
BC158	0.15
BC175	0.20
BC186	0.25
BCY30	0.25
BCY31	0.30
BCY33	0.25
BCY34	0.30
BCY72	0.15
BCZ10	0.30
BCZ11	0.40

BD121	0.65
BD123	0.80
BD124	0.60
BD131	0.75
BD132	0.80
BF115	0.20
BF167	0.18
BF173	0.20
BF179	0.30
BF180	0.30
BF181	0.30
BF184	0.20
BF185	0.20
BF194	0.14
BF195	0.14
BF196	0.12
BF197	0.12
BF200	0.35
BFW87	0.25
BFW88	0.20
BFW89	0.20
BFW91	0.20
BFX88	0.20
BFY17	0.40
BFY19	0.25
BFY50	0.20
BFY51	0.20
BFY52	0.20
BSY26	0.17
BSY27	0.15
BSY28	0.17
BSY65	0.20
BSY95A	0.12
OC16	0.50
OC22	0.50
OC23	0.60
OC24	0.60
OC25	0.35
OC26	0.25
OC29	0.60
OC35	0.50
OC36	0.45
OC42	0.20
OC44	0.15
OC45	0.12
OC70	0.10
OC71	0.12
OC72	0.12
OC73	0.30
OC75	0.15
OC76	0.15
OC78	0.25
OC78D	0.20
OC81	0.20
OC81D	0.20
OC83	0.20
OC139	0.30
OC140	0.35
OC141	0.60
OC170	0.25
OC171	0.25
OC200	0.30
OC201	0.60
OC202	0.65
OC203	0.40
OC204	0.40



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3-in tube fitted with telescopic viewing hood, giving bright display in full daylight. Sensitivity 10mV/mm (narrow band) to 30mV/mm (wide band).
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Free-running time base 20 c/s to 200kc/s with built-in crystal calibrator providing timing marks at ·05-.2-1-5-20-100 μ sec.
Amptitude calibrator directly calibrated in volts.
Input attenuator 1-10-100.
Power supplies 127/230v AC.

PRICE £39·00. Packing and carriage £1·50.

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Available in: 7·5-8·2-11-15-16-24-27-30-33-36-62-68 volts. £0·20 each.

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OA6	0·12	OA85	0·07
OA7	0·15	OA86	0·15
OA10	0·20	OA90	0·07
OA47	0·08	OA91	0·07
OA70	0·07	OA95	0·07
OA79	0·07	OA200	0·07

MINIATURE SILICON HALF-WAVE WIRE-ENDED RECTIFIERS

IN4002	100 p.i.v.	1A	0·07
IN4004	400 p.i.v.	1A	0·08
IN4006	800 p.i.v.	1A	0·12
IN5399	1000 p.i.v.	1·5A	0·25
IN5408	1000 p.i.v.	3·0A	0·50
BY101	450 p.i.v.	1·1A	0·15
BY105	800 p.i.v.	1·1A	0·15
BY127	1250 p.i.v.	1A	0·12
DD000	50 p.i.v.	500mA	0·15
DD006	400 p.i.v.	500mA	0·25
DD058	800 p.i.v.	500mA	0·35

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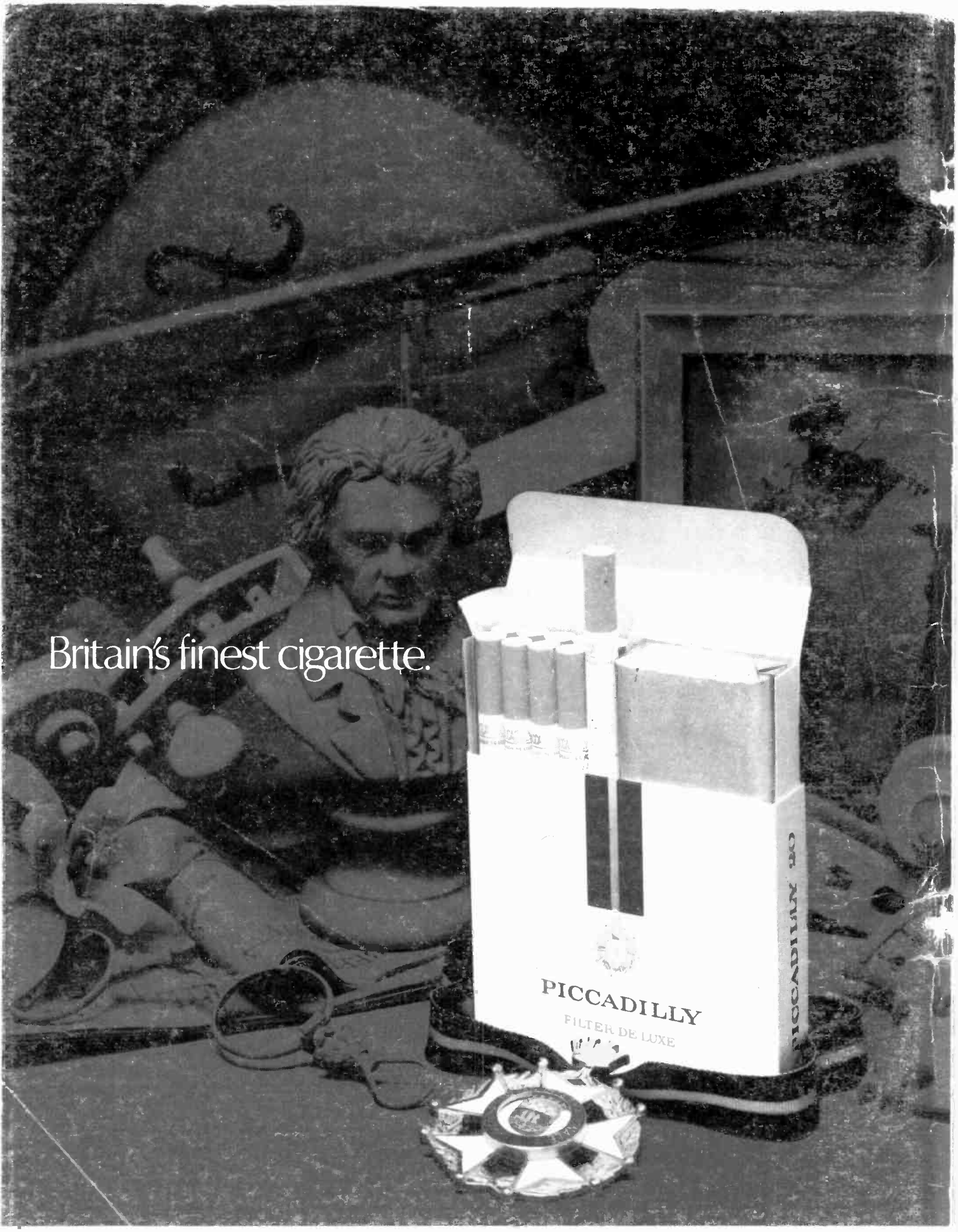

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