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MINIATURE 2m EQUIPMENT—Part 3 of this article will be published in the December issue

OTHER FEATURES

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NOTE TO ADVERTISERS—If you wish to have advance information concerning components for P.W. projects, contact Dennis Brough on 01-634-4116 or Christine Dunn on 01-634-4293.

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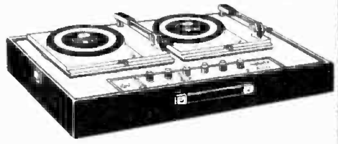
AS ABOVE LESS SPEAKERS

Terms: Dep. £9·00 and 18 fortnightly payments £4·61 (Total £91·98). **£79·95**

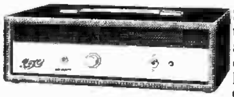
MOBILE DISCO CONSOLE



MIC., JACK, PHONE JACK, MONITOR VOL. CONTROL, MONITOR SELECTOR DECK (1) Vol. Control, DECK (2) Vol. control, Mic. Vol. Control, Treble Control, Bass Control and ON/OFF Switch, Neon Indicator, Twin Turntables. Carr. £3 **£59·95**

Terms: Dep. £7·95 and 18 fortnightly paymts. £3·33 Total £67·89.

POWER (SLAVE) AMPLIFIER 100 WATT



Suitable for use with above or other DISCO-Consoles.

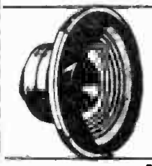
Also for increasing output of lower-powered Amplifiers. Terms: Dep. £5·11 and 8 mthly payments of £5·11 (Total £45·99) carr. £1 **£39·95**

RSC G66 MkII 6+6 WATT high quality STEREO AMPLIFIER

Controls: Bass, Treble, Vol. and Bal. 10 Transistors plus Diodes. Range 20-20,000 c.p.s. Bass Control ± 12db. Treble Control ± 13db. Selector switch for Crystal P.U. or Tape/Radio. 3—15 ohms. Attractive Black and Silver finished metal fascia plate. COMPLETE KIT INC FULLY WIRED PRINTED CIRCUIT and WIRING DIAGRAMS & INSTR Or FACTORY BUILT IN TEAK VENEERED CABINET as illustrated £19·50.

£14·99 Carr 40p

AUDIOTRINE HIGH FIDELITY SPEAKERS



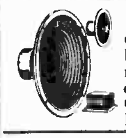
Plasticised Cone surround. "D" or "T" indicates Tweeter Cone providing extended frequency range up to 15,000 Hz. Impedance 3 or 8-15 ohms.

PLEASE STATE CHOICE.

Exceptional performances at low cost.

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

AUDIOTRINE HI-FI SPEAKER SYSTEM



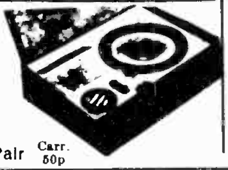
Consisting of matched 12in. 11,000 Gauss 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£7·95** Carr. 45p

OR SENIOR 15 WATT INCLUDING HF123 13,000 GAUSS SPEAKER **£10·25** Carr. 50p

TITAN GROUP/DISCO SPEAKERS

	Rec. Price	RSC Price
T12/35 12" 35w	£13·00	£10·95
T12/60 12" 60w	£20·00	£14·95
T12/100 12" 100w	£35·00	£27·95
T15/70 15" 70w	£27·00	£19·95
T15/100 15" 100w	£38·50	£27·95
T18/100 18" 100w	£42·50	£29·95

AUDIO FIDELITY FR1 SPKR KIT



Response 30 Hz-15 KHz. Rating 15 watts in sealed cabinet. Imp. 8-15 ohms. 8" Bass Unit with P.V.C. Cone surround for ultra low resonance. Pressure Tweeter. Printed Circuit. Inductive/Capacitive Cross-over. Damping Material, Screws. Terminal Panels.

£13-64 each Carr. Free SPECIAL OFFER **£18·50** Pair Carr. 50p

AUDIO FIDELITY MODEL 80 HIGH FIDELITY SPEAKER

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

MODEL 83 8" 15w. with parasitic Tweeter. £7·99 ea. **£12·50** pr.
Response 25 Hz to 15 KHz. Gauss 13,000 Imp 8–15 Ω

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250-0-250v. 100mA 6·3v. 4a. 0-5-6·3v. 3a.	£4·35
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350-0-350v. 100mA 6·3v. 4a. 0-5-6.3v. 3a.	£4·35
350-0-350v. 150mA 6·3v. 4a. 0-5-6·3v. 3a.	£5·20
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425-0-425v. 200mA 6·3v. 4a. 6·3v. 4a. 5v. 3a.	£10·00
450-0-450v. 250mA 6·3v. 4a. C.T. 5v. 3a.	£10·45

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250-0-250v. 100mA 6·3v. 2a. 6·3v. 1a.	£3·20
350-0-350v. 80mA 6·3v. 2a. 0-5-6·3v. 2a.	£3·20
250-0-250v. 100mA 6·3v. 4a. 0-5-6·3v. 3a.	£4·35
300-0-300v. 100mA 6·3v. 4a. 0-5-6·3v. 3a.	£4·35
300-0-300v. 130mA 6·3v. 4a. 0-5-6·3v. 1a suitable for Mullard 510 Amp.	£5·20
350-0-350v. 100mA 6·3v. 4a. 0-5-6·3v. 3a	£4·35
350-0-350v. 150mA 6·3v. 4a. 0-5-6·3v. 3a.	£5·20

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(c) MATCHING 'MIKE'
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(a) (b) (c) & (d) Carr. £3·00 **£169·99**
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Incorporating twin BSR MP60 type turntables and Sonotone or Acos Cartridges with diamond styli. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control. Black Vynide covered Cabinet with lid. Or DEP. £9·95 and 18 fortnightly pymts. £5·11 (Total £101·93) **£89·95** Carr. £1·50

TD2S STEREO VERSION OF ABOVE Terms DEPOSIT £20 and 18 fortnightly payments £6·71 (Total £140·78) **£125·00** Carr. £1·60

DISCOMASTER TWIN TURNTABLE POWER CONSOLE £119·95

Twin McDonald MP60 type turntables. Sonotone or Acos cartridges with diamond styli. Facilities as TDI Console but with built-in 100 watt Power Amplifier, complete with lid. Or Dep. £18·95 and 18 fortnightly pymts £6·78 (Total £185·99) Carr. £2·50

STEREO VERSION £155 or DEPOSIT £25 and 18 fortnightly pymts £8·30 (Total £174·40). Carr. £3

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'POP' 50 12" 50 Watt 13,000 gauss 8/15 ohm **£14·95** Dual Cone. Terms for pairs Dep. £3·90 & 8 mthly pymts £4·24. Total £37·82 PAIR SUITABLE ALL PURPOSES

FOR BASS GUITAR, ELECT. ORGAN, ETC.

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PH 50

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SUPER MINSTREL 10 W GUITAR AMP.

Incorporating Tremolo and 10" Speaker. Output 10 watts R.M.S. Continuous. 3 Jack Inputs for Microphone and Instrument. Mains Neon Controls: Volume, Tone, Tremolo Speed, Tremolo Intensity. Terms: DEPOSIT £7·73 and 8 monthly payments £3·40 (Total £34·93) Carr. free **£29·99**

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FULL RANGE AVAILABLE AT ALL BRANCHES

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COMBINED 80W AMP. AND 12" SPEAKER **£55·95** Carr. Free

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PHANTOM 50

COMBINED AMPLIFIER AND SPEAKER **£59·95** Carr. £1·50

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D40 50 WATT DISCO KIT

ALL PURPOSE FULL RANGE

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HPX1 Crossover

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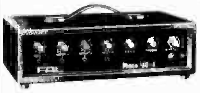
ALL 2-TONE VYNIDE and VYNAIR FINISH L12/2 50-WATT Fitted pair of 12" 30 watt high flux speakers. Imp. 8-15 ohms. Car. £1·50. Terms: Dep. £5·11 and 8 monthly payts. of £5·11. Total £45·99. **£39·95**

L12/50 12" 50 WATT 13,000 lines 15 ohms. Terms: Dep. £3·95 and 8 mthly pymts. £3·37 (Total £30·91) Carr. 55p. **£25.95**



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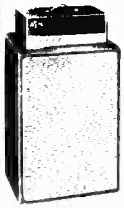

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A powerful high quality unit for lead, rhythm guitar, vocalists, gram, radio, tape. 50w Peak O/P rating. Not for Bass Guitar.
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FAL DISCO PRE-AMPLIFIER

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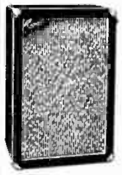

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CD4010	0·46	CD4028	0·74	CD4046	1·10	CD4068	0·18	MC14502	0·65
CD4011	0·17	CD4029	0·94	CD4047	0·74	CD4069	0·18	MC14508	4·20
CD4012	0·17	CD4030	0·46	CD4048	0·46	CD4070	0·18	MC14510	1·26
CD4013	0·46	CD4031	1·81	CD4049	0·46	CD4071	0·18	MC14511	1·95
CD4014	0·83	CD4032	0·88	CD4050	0·46	CD4072	0·18	MC14518	1·03
CD4015	0·83	CD4033	1·14	CD4051	0·77	CD4073	0·18	MC14520	1·03
CD4016	0·46	CD4034	7·83	CD4052	0·77	CD4075	0·18	MC14528	0·87
CD4017	0·83	CD4035	0·97	CD4053	0·77	CD4076	1·27	MC14553	4·07
CD4018	0·83	CD4036	7·47	CD4054	0·95	CD4077	0·18	MC14566	1·21
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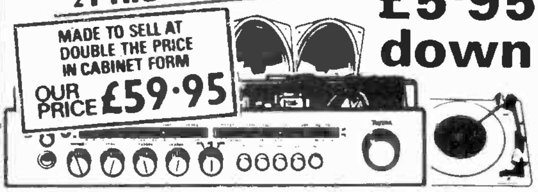

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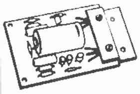

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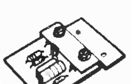

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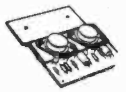

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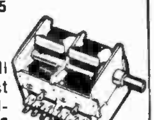

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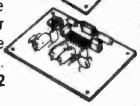

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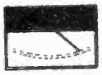

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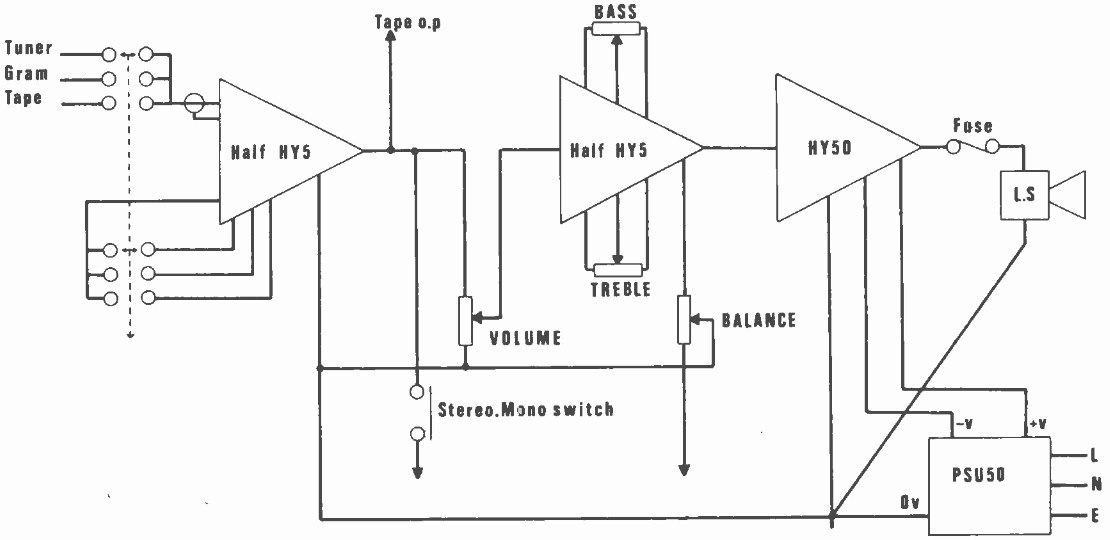
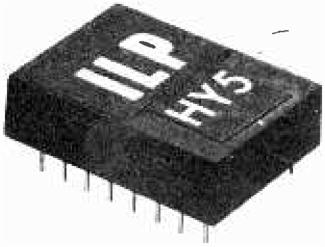


MONO ELECTRICAL CIRCUIT DIAGRAM WITH INTERCONNECTIONS FOR STEREO SHOWN



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

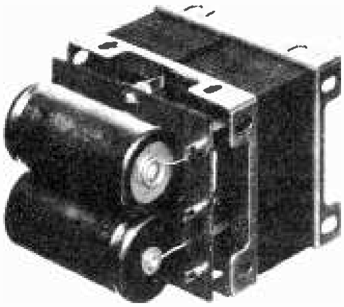
TECHNICAL SPECIFICATION
Inputs: Magnetic Pick-up 3mV RIAA: Ceramic Pick-up 30mV; Microphone 10mV; Tuner 100mV; Auxiliary 3–100mV; Input/impedance 47kΩ at 1kHz. **Outputs:** Tape 100mV; Main output 0db (0·775V RMS). **Active Tone Controls:** Treble ± 12db at 10kHz; Bass ± 12db at 100Hz. **Distortion:**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

PRICE £4·50 + 36p VAT P. & P. free

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

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

PRICE £5·98 + 48p VAT P. & P. free



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

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

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50 Hz clock timebase suggested circuit (single chip design using 3·2768 HMz crystal)—details free.
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(CT 7001 discontinued)

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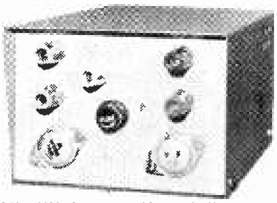
DIODES

IN 4148 **3p***, IN 4002 **5p**, IN 4004 **6p**, IN 4007 **8p**.

CMOS

4001, 4011 gates **15p.**

INVERTORS



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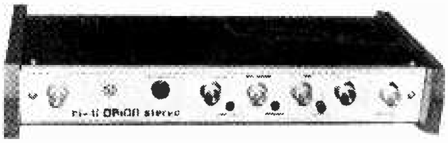

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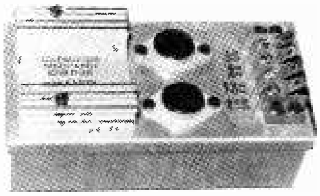

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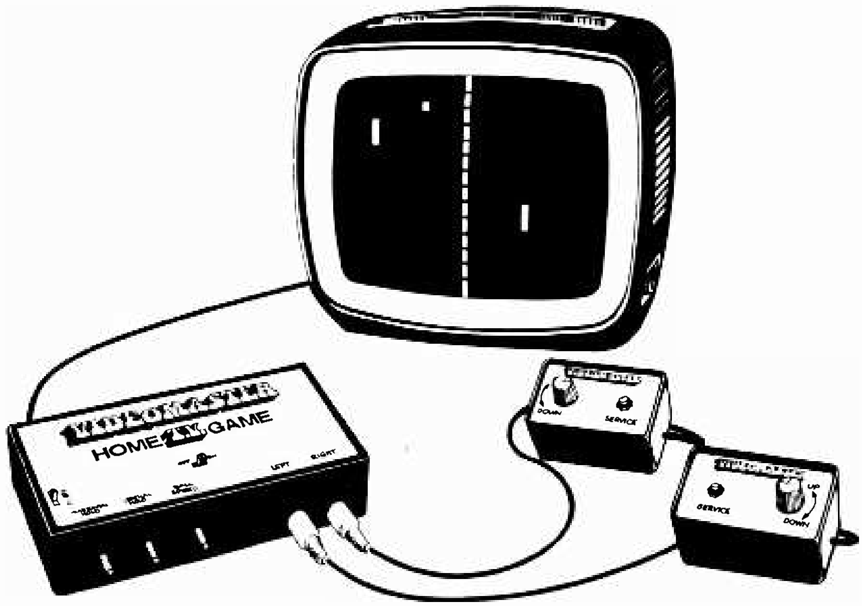

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AC142K	0·26
AC151	0·16
AC154	0·20
AC155	0·20
AC156	0·20
AC157	0·25
AC165	0·20
AC166	0·20
AC167	0·20
AC168	0·25
AC169	0·15
AC176	0·20
AC177	0·25
AC178	0·29
AC179	0·29
AC180	0·20
AC180K	0·30
AC181	0·20
AC181K	0·30
AC187	0·22
AC187K	0·23
AC188	0·22
AC188K	0·23
ACY17	0·26
ACY18	0·20
ACY19	0·20
ACY20	0·20
ACY21	0·20
ACY22	0·17
ACY27	0·19
ACY28	0·19
ACY29	0·36
ACY30	0·29
ACY31	0·29
ACY34	0·21
BC173	0·15
BC174	0·15
BC175	0·22
BC177	0·19
BC178	0·19
BC179	0·19
BC180	0·25
BC181	0·25
BC182	0·15
BC182L	0·15
BC183	0·15
BC183L	0·15
BC184	0·20
BC184L	0·20
BC186	0·29
BC187	0·29
BC207	0·11
BC208	0·11
BC209	0·12
BC212L	0·13
BC213L	0·13
BC214L	0·17
BC225	0·26
BC226	0·36
BC301	0·28
BC302	0·25
BC303	0·31
BC304	0·37
BC440	0·31
BC460	0·37
BCY30	0·25
BCY31	0·27
BCY32	0·31
BCY33	0·22
BCY34	0·26
BCY70	0·15
BCY71	0·20
BCY72	0·15
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BCZ11	0·26
BCZ12	0·26
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BD121	0·61
BD123	0·67
BD124	0·70
BD131	0·51
BD132	0·61
BD133	0·67
BD135	0·41
BFY53	0·18
BSX19	0·16
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BSY27	0·16
BSY28	0·16
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C442	0·31
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MPF104	0·38
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OC19	0·36
OC20	0·65
OC22	0·47
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OC24	0·57
OC25	0·39
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OC29	0·51
OC35	0·43
OC36	0·51
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OC42	0·25
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2N1893	0·38
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2N2923	0·15
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ACY35	0·21
ACY36	0·29
ACY40	0·18
ACY41	0·19
ACY44	0·36
AD130	0·39
AD140	0·49
AD142	0·49
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AD149	0·51
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AD161 & AD162(MP)	0·69
ADT140	0·51
AF114	0·25
AF115	0·25
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AF117	0·25

Type	Price
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AF124	0·31
AF125	0·31
AF126	0·29
AF127	0·29
AF139	0·31
AF178	0·51
AF179	0·51
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AF186	0·51
AF239	0·38
AL102	0·68
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ASY57	0·26
ASY58	0·26
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BC108	0·08
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BD199	0·98
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OC202	0·29
OC203	0·26
OC204	0·26
OC205	0·36
OC309	0·41
OCP71	0·44*
ORP12	0·44*
ORP60	0·41*

Type	Price
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P346A	0·20
P397	0·43
ST140	0·13
ST141	0·18
TIP29	0·44
TIP30	0·52
TIP31A	0·56
TIP32A	0·68
TIP41A	0·68
TIP42A	0·81
TI843	0·31*
UT46	0·28*
ZN414	1·11
2G301	0·19
2G302	0·19
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BC167	0·12
BC168	0·12
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BC170	0·12
BC171	0·15

Type	Price
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BF167	0·22
BF173	0·22
BF176	0·36
BF177	0·36
BF178	0·31
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BFW20	0·61
BFX29	0·28
BFX84	0·22
BFX85	0·31
BFX86	0·22
BFX87	0·25
BFX88	0·22
BFY50	0·20
BFY51	0·20
BFY52	0·20
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2G339	0·20
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2G344	0·19
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2N404A	0·29
2N524	0·43
2N527	0·50
2N598	0·43
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2N743	0·20
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2N914	0·15
2N4061	0·12
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2N5458	0·32
2N5459	0·41
2N6122	0·69
2S301	0·51
2S302A	0·43
2S302	0·43
2S303	0·56
2S304	0·71
2S305	0·80
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7402	0·14	0·13	0·12	7451	0·14	0·13	0·12	74141	0·79	0·76	0·73
7403	0·14	0·13	0·12	7453	0·14	0·13	0·12	74145	£1·20	£1·16	£1·11
7404	0·14	0·13	0·12	7454	0·14	0·13	0·12	74150	£1·39	£1·30	£1·20
7405	0·14	0·13	0·12	7460	0·14	0·13	0·12	74151	£1·02	0·97	0·93
7406	0·36	0·31	0·29	7470	0·30	0·27	0·25	74153	0·93	0·88	0·83
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7408	0·23	0·22	0·21	7473	0·38	0·36	0·32	74155	£1·11	£1·06	£1·02
7409	0·23	0·22	0·21	7474	0·38	0·36	0·32	74156	£1·11	£1·06	£1·02
7410	0·14	0·13	0·12	7475	0·56	0·54	0·52	74157	0·93	0·88	0·83
7411	0·23	0·22	0·21	7476	0·41	0·40	0·39	74160	£1·30	£1·25	£1·20
7412	0·26	0·25	0·24	7480	0·56	0·54	0·51	74161	£1·30	£1·25	£1·20
7413	0·30	0·29	0·28	7481	1·02	0·97	0·93	74162	£1·30	£1·25	£1·20
7416	0·28	0·27	0·26	7482	0·83	0·79	0·74	74163	£1·30	£1·25	£1·20
7417	0·28	0·27	0·26	7483	£1·11	£1·06	0·97	74164	£1·67	£1·62	£1·55
7420	0·14	0·13	0·12	7484	0·93	0·90	0·88	74165	£1·67	£1·62	£1·55
7422	0·28	0·27	0·26	7485	£1·48	£1·44	£1·39	74166	£1·48	£1·44	£1·39
7423	0·37	0·36	0·35	7486	0·32	0·31	0·30	74174	£1·48	£1·44	£1·39
7425	0·37	0·36	0·35	7489	£3·70	£3·47	£3·24	74175	£1·02	0·97	0·93
7426	0·37	0·35	0·33	7490	0·60	0·58	0·56	74176	£1·16	£1·11	£1·06
1427	0·37	0·35	0·33	7491	£1·02	0·97	0·93	74177	£1·16	£1·11	£1·06
7428	0·42	0·39	0·37	7492	0·69	0·66	0·59	74180	£1·16	£1·11	£1 06
7430	0·14	0·13	0·12	7493	0·69	0·66	0·59	74181	£3·66	£3·56	£3·47
7432	0·37	0·35	0·33	7494	0·79	0·76	0·69	74182	£1·16	£1·11	£1·06
7433	0·39	0·37	0·35	7495	0·79	0·76	0·69	74184	£1·67	£1·62	£1·55
7437	0·32	0·30	0·28	7496	0·89	0·86	0·80	74190	£1·81	£1·76	£1·71
7438	0·32	0·30	0·28	74100	£1·39	£1·34	£1·30	74191	£1 81	£1·76	£1·71
7440	0·14	0·13	0·12	74104	0·56	0·54	0·51	74192	£1·81	£1·76	£1·71
7441	0·69	0·66	0·59	74105	0·56	0·54	0·51	74193	£1·81	£1·76	£1·71
7442	0·69	0·66	0·59	74107	0·41	0·39	0·37	74194	£1·20	£1·16	£1·11
7443	£1·11	£1·06	£1·02	74110	0·56	0·51	0·46	74195	£1·02	0·97	0·93
7444	£1·11	£1·06	£1·02	74111	0·83	0·81	0·78	74196	£1·11	£1·06	£1 02
7445	£1·48	£1·44	£1·39	74118	0·93	0·88	0·83	74197	£1·11	£1·06	£1·02
7446	£1·11	£1·06	£1·02	74119	£1·39	£1·30	£1·20	74190	£2·55	£2·50	£2·45
7447	£1·02	0·99	0·97	74121	0·46	0·44	0·41	74199	£2·31	£2·21	£2·11

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

* D.T.L. 930 SERIES

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

* TRIACS

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

* D.I.L. SOCKETS

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

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

SILICON RECTIFIERS

PIV	300mA (DO 7)	750mA (SO 16)		1 Amp Plastic	1·5Amp (SO 16)	3Amp (SO 10)	10Amp (SO 10)	30Amp (TO 48)
50	0·05	0·06	IN4001	0·05	0·07	0·14	0·19*	0·56*
100	0·05	0·07	1N4002	0·06	0·09	0·16	0·21*	0·69*
200	0·06	0·09	1N4003	0·07	0·12	0·20	0·23*	0·93*
400	0·07	0·14	1N4004	0·08	0·14	0·28	0·35*	£1·25*
600	0·08	0·16	1N4005	0·09	0·16	0·33	0·42*	£1·76*
800	0·11	0·18	1N4006	0·10	0·18	0·35	0·51*	£1·94*
1000	0·13	0·28	1N4007	0·11	0·23	0·44	0·60*	£2·31*
1200	—	0·32			0·28	0·54	0·69*	£2·88*

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U 3	75 Germanium gold bonded sub-min. like OA5, OA47	0·60
U 4	30 Germanium transistors like OC81, AC128	0·60
U 5	60 200mA sub-min. silicon diodes	0·60
U 6	30 Sil. Planar trans. NPN like BSY95A, 2N706	0·60
U 7	16 Sil. rect. TOP-HAT 750mA VLTG. RANGE up to 100	0·60
U 8	50 Sil. planar diodes DO-7 glass 250mA like OA200/202	0·60
U 9	20 Mixed voltages, 1 Watt Zener Diodes	0·60
U10	20 BAY50 charge storage diodes DO-7 glass	0·60
U11	20 PNP Sil. planar trans. TO-5 like 2N1132, 2N2904	0·60
U13	30 PNP-NPN Sil. transistors OC200 & 28104	0·60
U14	150 Mixed silicon and germanium diodes	0·60
U15	20 NPN Sil. planar trans. TO-5 like 2N696, 2N697	0·60
U16	10 3Amp sil. rectifiers stud type up to 1000 PIV	0·60
U17	30 Germanium PNP AF transistors TO-5 like ACY 17-22	0·60
U18	8 6 Amp sil. rectifiers BYZ13 type up to 600 PIV	0·60
U19	20 Silicon NPN transistors like BC 108	0·60
U20	12 1·5 Amp sil. rectifiers top hat up to 1000 PIV	0·60
U21	30 AF. Germ. alloy transistors 2G300 series & OC71	0·60
U23	25 MADT's like MHz series PNP transistors	0·60
U24	20 Germ. 1 Amp rectifiers GJM series up to 300 PIV	0·60
U25	25 300 MHz NPN silicon transistors 2N708, BSY27	0·60
U26	30 Fast switching silicon diodes like IN914 Micro-Min	0·60
U29	10 1 Amp SCR's TO-5 can. up to 600 PIV CRS1/25-600	£1·20*
U32	25 Zener diodes 400 mW DO-7 case 3-33 volts mixed	0·60
U33	15 Plastic case 1 Amp sil. rectifiers IN4000 series	0·60
U34	30 Silicon PNP alloy trans. TO-5 BCY26 28302/4	0·60
U35	25 Silicon planar transistors PNP TO-18 2N2906	0·60
U36	20 Silicon planar NPN transistors TO-5 BFY50/51/52	0·60
U37	30 Silicon alloy transistors SO-2 PNP OC200, S2322	0·60
U38	20 Fast switching silicon trans. NPN 400 MHz 2N3011	0·60
U39	30 RF. Ger. PNP transistors 2N1303/5 TO-5	0·60
U40	10 Dual transistors 6 lead TO-5 2N2060	0·60
U43	25 Silicon trans. plastic TO-18 A.F. BC113/114	0·60
U44	20 Silicon trans. plastic TO-5 BC115	0·60
U45	7 3A SCR. TO66 up to 600 PIV	£1·20*
U46	20 Unijunction transistors similar to TIS43	0·60*
U47	10 TO220AB plastic triacs 50V 6A	£1·20*
U48	9 NPN Sil. power transistors like 2N3055	£1·20
U49	12 NPN Sil. plastic power trans. 60W like 2n5294/5296	£1·20

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* THYRISTORS

PIV	0·6A TO18	0·8A TO92	1A TO5	3A TO66	5A TO66	5A TO64	7A TO48	10A TO48	16A TO48	30A TO48
10	0·13	0·15	—	—	—	—	—	—	—	—
20	0·15	0·18	—	—	—	—	—	—	—	—
30	0·19	0·22	—	—	—	—	—	—	—	—
50	0·22	0·23	0 20	0·25	0·36	0·36	0·48	0·51	0·54	£1·18
100	0·25	0·30	0·25	0·25	0·48	0·48	0·51	0·57	0·58	£1·43
150	0·31	0·38	—	—	—	—	—	—	—	—
200	0·33	0·44	0·25	0·30	0·50	0·50	0·57	0·62	0·62	£1·63
400	—	—	0·30	0·39	0·55	0·57	0·62	0·71	0·77	£1·79
600	—	—	0·39	0·48	0·69	0·69	0·78	0·99	0·90	—
800	—	—	0·58	0·65	0·81	0·81	0·92	£1·22	£1·39	£4·07

DIODES

Type	Price	Type	Price	Type	Price	Type	Price
AA119	0·08	BY101	0·12	BYZ16	0·41	OA85	0·09
AA120	0·08	BY105	0·18	BYZ17	0·36	OA90	0·07
AA129	0·08	BY114	0·12	BYZ18	0·36	OA91	0·07
AAY30	0·09	BY124	0·12	BYZ19	0·23	OA95	0·07
AAZ13	0·10	BY126	0·15	CG62		OA200	0·07
BA100	0·10	BY127	0·16	(OA91Eq)	0·06	OA202	0·07
BA116	0·21	BY128	0·16	CG651 (OA70-		SD10	0·06
BA126	0·22	BY130	0·17	OA79)	0·07	SD19	0·06
BA148	0·15	BY133	0·21	OA5 Short		1N34	0·07
BA154	0·12	BY164	0·51	Leads	0·21	1N34A	0·07
BA155	0·15	BYX38/30	0·43	OA10	0·14	1N914	0·06
BA156	0·14	BYZ10	0·36	OA47	0·07	1N916	0·06
BA173	0·15	BYZ11	0·31	OA70	0·07	1N4148	0·06
BB104	0·15	BYZ12	0·31	OA79	0·07	1S021	0·10
BY100	0·16	BYZ13	0·26	OA81	0·07	1S951	0·70

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Pak No.	Quality Tested Paks	Price
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Q 4	6 Matched transistors OC44/45/81/81D	0·60
Q 5	4 OC 75 transistors	0·60
Q 6	5 OC 72 transistors	0·60
Q 7	4 AC 128 transistors PNP high gain	0·60
Q 8	4 AC 126 transistors PNP	0·60
Q 9	7 OC 81 type transistors	0·60
Q10	7 OC 71 type transistors	0·60
Q11	2 AC 127/128 Complementary pairs PNP/NPN	0·60
Q12	3 AF 116 type transistors	0·60
Q13	3 AF 117 type transistors	0·60
Q14	3 OC 171 H.F. type transistors	0·60
Q15	7 2N2926 Sil. Epoxy transistors mixed colours	0·60
Q17	5 NPN 2 × ST.141. & 3 × ST.140	0·60
Q18	4 MADT'S 2 × MAT 100 & 2 × MAT 120	0·60
Q19	3 MADT'S 2 × MAT 101 & 1 × MAT 121	0·60
Q20	4 OC 44 Germanium transistors A.F.	0·60
Q21	4 AC 127 NPN Germaniun transistors	0·60
Q22	20 NKT transistors A.F. R.F. coded	0·60
Q23	10 OA 202 Silicon diodes sub-min	0·60
Q24	8 OA 81 diodes	0·60
Q25	15 IN 914 Silicon diodes 75PIV 75mA	0·60
Q26	8 OA95 Germanium diodes sub-min-IN69	0·60
Q27	2 10A 600 PIV Silicon rectifiers IS425R	0·60*
Q28	2 Silicon power rectifiers BYZ 13	0·60
Q29	4 Sil. transistors 2 × 2N696, 1 × 2N697, 1 × 2N698	0·60
Q30	7 Silicon switch transistors 2N706 NPN	0·60
Q31	6 Silicon switch transistors 2N708 NPN	0·60
Q32	3 PNP Sil. trans. 2 × 2N1131, 1 × 2N1132	0·60
Q33	3 Silicon NPN transistors 2N1711	0·60
Q34	7 Sil. NPN trans. 2N2369, 500MHz (code P397)	0·60
Q35	3 Silicon PNP TO-5 2 × 2N2904 & 1 × 2N2095	0·60
Q36	7 2N3646 TO-18 plastic 300 MHz NPN	0·60
Q37	3 2N3053 NPN Silicon transistors	0·60
Q38	5 PNP transistors 3 × 2N3703, 2 × 2N3702	0·60
Q39	5 NPN transistors 3 × 2N3704, 2 × 2N3705	0·60
Q40	5 NPN transistors 3 × 2N3707, 2 × 2N3708	0·60
Q41	3 Plastic NPN TO18 2N3904	0·60
Q43	5 BC 107 NPN transistors	0·60
Q44	5 NPN transistors 3 × BC 108, 2 × BC 109	0·60
Q45	3 BC 113 NPN TO-18 transistors	0·60
Q46	3 BC 115 NPN TO-5 transistors	0·60
Q47	4 NPN high gain transistors 2 × BC 157, 2 × BC 168	0·60
Q48	3 BCY 70 PNP transistors TO-18	0·60
Q49	3 NPN transistors 2 × BFY 51, 1 × BFY 52	0·60
Q50	7 BSY 28 NPN switch transistors TO-18	0·60
Q51	7 BSY 95A NPN transistors 300MHz	0·60
Q52	8 BY 100 type silicon rectifiers	£1·20
Q53	25 Sil. & Germ. trans. mixed all marked new	£1·50
Q54	6 TIL 209 Red LED	£1·20*

* UNTESTED T.T.L. PAKS

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

PakNo.	Contents	Price	Pak No.	Contents	Price
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UIC01	=12 × 7401	0·60	UIC73	= 8 × 7473	0·60
UIC02	=12 × 7402	0·60	UIC74	= 8 × 7474	0·60
UIC03	=12 × 7403	0·60	UIC75	= 8 × 7475	0·60
UIC04	=12 × 7404	0·60	UIC76	= 8 × 7476	0·60
UIC05	=12 × 7405	0·60	UIC80	= 5 × 7480	0·60
UIC06	= 8 × 7406	0·60	UIC81	= 5 × 7481	0·60
UIC07	= 8 × 7407	0·60	UIC82	= 5 × 7482	0·60
UIC10	=12 × 7410	0·60	UIC83	= 5 × 7483	0·60
UIC13	= 8 × 7413	0·60	UIC86	= 5 × 7486	0·60
UIC20	=12 × 7420	0·60	UIC90	= 5 × 7490	0·60
UIC30	=12 × 7430	0·60	UIC91	= 5 × 7491	0·60
UIC40	=12 × 7440	0·60	UIC92	= 5 × 7492	0·60
UIC41	= 5 × 7441	0·60	UIC93	= 5 × 7493	0·60
UIC42	= 5 × 7442	0·60	UIC94	= 5 × 7494	0·60
UIC43	= 5 × 7443	0·60	UIC95	= 5 × 7495	0·60
UIC44	× 5 × 7444	0·60	UIC96	= 5 × 7496	0·60
UIC45	= 5 × 7445	0·60	UIC100	= 5 × 74100	0·60
UIC46	= 5 × 7446	0·60	UIC121	= 5 × 74121	0·60
UIC47	= 5 × 7447	0·60	UIC141	= 5 × 74141	0·60
UIC48	= 5 × 7448	0·60	UIC151	= 5 × 74151	0·60
UIC50	=12 × 7450	0·60	UIC154	= 5 × 74154	0·60
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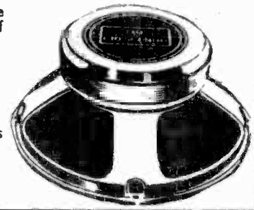

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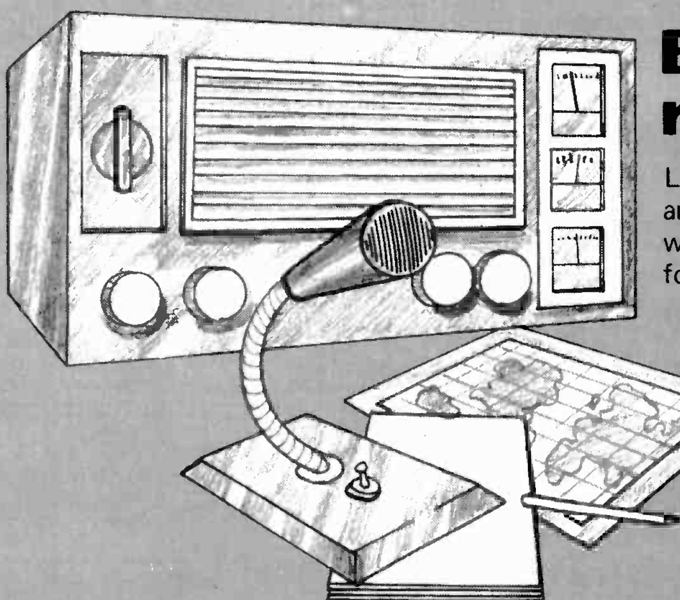

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DY86/7	0·58	EF83	1·10	PCC84	0·63	PL508	1·30	30C17	1·29
DY802	0·58	EF85	0·53	PCC85	0·90	PL509	1·77	30C18/PCF805	1·29
EABC80	1·16	EF86	1·30	PCC88	0·98	PL802	1·77	30F5/PF818	1·35
EB91	0·73	EF89	1·30	PCC89	0·73	PY33	0·78	30FLI/PCE800	0·98
EBC81	0·89	EF91	1·35	PCC189	0·91	PY81/800	0·56	30FL2	1·02
EBF80	0·68	EF92	1·51	PCF80	0·68	PY82	0·70	30FL12	1·44
EBF83	0·66	EF95	1·63	PCF82	1·37	PY88	0·63	30FL14	1·20
EBF89	0·50	EF183	0·69	PCF86	0·73	PY500A	1·15	30L1/PCC84	0·63
EC86	0·82	EF184	0·69	PCF200	1·13	PY800	0·56	30L15/PCC805	1·35
EC88	0·86	EH90	0·91	PCF201	1·18	PY801	0·56	30L17	1·12
EC90	0·94	EL34	1·06	PCF801	0·78	U26	1·22	30P4MR	1·63
EC97	0·69	EL36	1·15	PCF802	0·78	U191	1·17	30P1Z/PC801	1·22
ECC81	0·54	EL84	0·53	PCF806	0·73	U193	0·56	30P19/PC802	1·06
ECC82	0·53	EL86	1·06	PCH200	1·30	UABC80	1·01	30PL1/PCL801	1·35
ECC83	0·53	EL95	0·78	PCL82	0·63	UBC81	0·80	30PL13/PCL800	1·47
ECC84	0·63	ELL80	2·81	PCL83	0·73	UBF89	0·65	30PL14/PCL88	1·72
ECC85	0·78	EM81	1·24	PCL84	0·69	UCC85	0·66	30PL15	1·44
ECC88	0·91	EM84	1·34	PCL85	0·72	UCH81	1·30		
ECC189	0·77	EM87	1·25	PCL86	0·73	UCL82	0·78		
ECF80	0·63	EY51	0·89	PCL805/850	0·73	UCL83	0·78		
ECF82	0·90	EY86/87	0·53	PD500	2·11	UL84	1·03		
ECF86	0·76	EY88	0·81	PFL200	0·91	UY85	0·63		
ECH81	1·29	EZ80	0·68	PL36	1·06	6/30L2/ECC804	1·20		
ECH83	1·06	EZ81	0·53	PL81	0·91	6F23/EF812	1·16		
ECH84	1·17	GY501	1·80	PL81A	1·06	30C1/PCF80	0·63		
ECL80	0·78	GZ34	0·91	PL82	0·48				
ECL82	0·69	PC86	1·05	PL83	1·29				
ECL83	0·72	PC88	1·05	PL84	0·78				
ECL86	0·73	PC97	0·53	PL500	1·02				

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AZ31	0·60	EF80	0·35	MU14	1·00	PY88	0·56	6J5M	0·65
CBL31	1·40	EF85	0·45	N78	3·50	PY500	1·10	6J5G	0·45
CL33	1·50	EF86	0·50	OA2	0·45	PY81/800	0·50	6J6	0·35
CY31	0·60	EF89	0·35	OB2	0·45	PY801	0·55	6J7G	0·30
DAF91	0·40	EF91	0·40	PC86	0·65	SP41	3·00	6J7M	0·65
DAF96	0·60	EF92	0·50	PC88	0·65	SP61	0·85	6K6GT	0·30
DCC90	1·85	EF95	0·45	PC97	0·55	T41	1·00	6K7G	0·35
DF91	0·40	EF98	0·80	PC900	0·55	U14	0·75	6K7M	0·45
DF96	0·60	EF183	0·40	PCC84	0·45	U25	1·00	6K8G	0·45
DK91	0·50	EF184	0·40	PCC88	0·62	U26	0·85	6K8M	0·70
DK92	1·00	EL32	0·60	PCC89	0·55	U191	0·75	6K25	1·00
DK96	0·75	EL33	2·50	PCC189	0·65	UABC80	0·40	6L6G	1·25
DL92	0·50	EL34	0·70	PCF80	0·40	UAF42	0·75	6Q7G	0·40
DL94	0·48	EL36	0·60	PCF82	0·42	UBC41	0·60	6Q7M	0·60
DL96	0·55	EL37	2·50	PCF86	0·65	UBC81	0·50	6SL7GT	0·55
DY86	0·45	EL41	0·90	PCF801	0·60	UBF80	0·50	6SN7GT	0·55
DY87	0·45	EL42	1·65	PCF802	0·55	UBF89	0·50	6SQ7GT	0·40
DY802	0·47	EL84	0·35	PCF805	0·90	UCC85	0·50	6U5G	1·50
EABC80	0·88	EL95	0·60	PCF806	0·80	UCH42	0·80	6V6G	0·30
EAF42	0·70	ELL80	2·00	PCF808	1·00	UCH81	0·50	6V6GT	0·60
EB91	0·30	EM80	0·55	PCL82	0·45	UCL82	0·40	6X4	0·45
EBC33	1·00	EM81	0·60	PCL83	0·70	UCL83	0·70	6X5G	0·45
EBC41	0·75	EM84	0·40	PCL84	0·50	UF41	0·75	6X5GT	0·55
EBC81	0·40	EM85	1·00	PCL85	0·60	UF89	0·50	7B6	0·80
EBF80	0·40	EM87	1·00	PCL86	0·50	UL41	0·85	7B7	0·80
EBF83	0·40	EY51	0·45	PCL805/85	0·60	UL84	0·50	7C5	1·80
EBF89	0·38	EY86	0·45	PD500	1·50	UY41	0·55	7C6	1·00
EBL31	2·00	EZ40	0·60	PEN45	0·85	UY85	0·45	7H7	0·80
ECC81	0·45	EZ41	0·75	PL36	0·68	VR105/30	0·40	7R7	0·80
ECC82	0·38	EZ80	0·30	PL81	0·55	VR150/30	0·45	7S7	2·25
ECC83	0·38	EZ81	0·31	PL82	0·50	1R5	0·50	7Y4	0·80
ECC84	0·35	GY501	0·90	PL83	0·50	1S5	0·40	12AT6	0·45
ECC85	0·45	GZ30	0·65	PL84	0·50	1T4	0·40	12AT7	0·45
ECC88	0·50	GZ32	0·65	PL500	0·85	3S4	0·50	12AU6	0·50
ECH35	1·50	GZ34	0·75	PL504	0·85	3V4	0·85	12AU7	0·38
ECH42	0·85	GZ37	1·25	PL508	0·90	5R4GY	1·00	12AX7	0·38
ECH81	0·35	HN309	1·50	PL509	1·55	5U4G	0·55	12BA6	0·50
ECH83	0·50	KT61	2·50	PL802	1·25	5Y3GT	0·65	12BE6	0·60
ECL80	0·60	KT66	2·95	PX25	3·50	5Z4G	0·65	30C1	0·40
ECL82	0·42	KT81 (7C5)	1·30	PY33	0·63	6/30L2	0·90	30C15	1·00
ECL83	0·75	KT81	1·75	PY81	0·50	6AK5	0·45	30C17	1·00
ECL86	0·55	KT88	3·25	PY82	0·45	6AM5	1·00	30C18	0·90
ECLL800	3·50					6AQ5	0·50	30F5	1·00
EF37A	1·20					6AS7G	1·00	30FL1	1·00
						6AT6	0·60	30FL2	0·75
						6AU6	0·40	30FL14	1·00
						6BA6	0·38	30L15	0·95
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						6BS7	1·40	30PL13	1·10
						6BW6	1·00	30PL14	1·10
						6BW7	1·00	35W4	0·60
						6C4	0·40	35Z4GT	0·70
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AC176	0·25	BF180	0·36
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AC188	0·20	BF194	0·10
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BC148	0·08	MJE370	0·68
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BC182L	0·12	MJE3055	0·75
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BC338	0·15	MPF103	0·36
BCY32	0·85	MPF104	0·35
BCY33	0·38	MPF105	0·36
BCY34	0·45	NKT404	0·66
BCY70	0·18	OA5	0·72
BCY71	0·22	OA10	0·40
BCY72	0·15	OA79	0·10
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OA91	0·07	ZTX500	0·13	2N2904	0·20
OA200	0·08	ZTX501	0·15	2N2904A	0·25
OA202	0·06	ZTX503	0·16	2N2905	0·32
OC16	1·00	ZTX531	0·25	2N2905A	0·25
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OC36	0·60	IN4004	0·08	2N3614	0·65
OC42	0·40	IN4005	0·10	2N3615	0·65
OC44	0·20	IN4006	0·12	2N3702	0·11
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OC71	0·18	1N4009	0·06	2N3704	0·14
OC72	0·28	1N4148	0·06	2N3705	0·15
OC76	0·30	1S921	0·07	2N3706	0·11
OC77	0·55	1S2033	0·20	2N3707	0·13
OC81	0·29	1S2051A	0·20	2N3708	0·07
OC81D	0·28	1S2100A	0·20	2N3709	0·10
OC81Z	0·45	1S3010	0·25	2N3710	0·11
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OC200	0·55	2N1131	0·25	2N3903	0·15
OC201	1·00	2N1132	0·24	2N3904	0·20
OC202	0·90	2N1302	0·18	2N3905	0·25
OC203	0·55	2N1303	0·18	2N3906	0·25
OCP71	1·20	2N1304	0·22	2N4056	0·15
ORP12	0·60	2N1305	0·22	2N4059	0·10
ORP60	0·55	2N1306	0·28	2N4060	0·13
TIC44	0·29	2N1307	0·28	2N4061	0·13
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ZTX107	0·12	2N1613	0·21	3N125	1·75
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ZTX301	0·14	2N2160	0·78	40361	0·45
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SN7412	0·30	SN7460	0·16	SN74118	0·90	SN74191	2·00		
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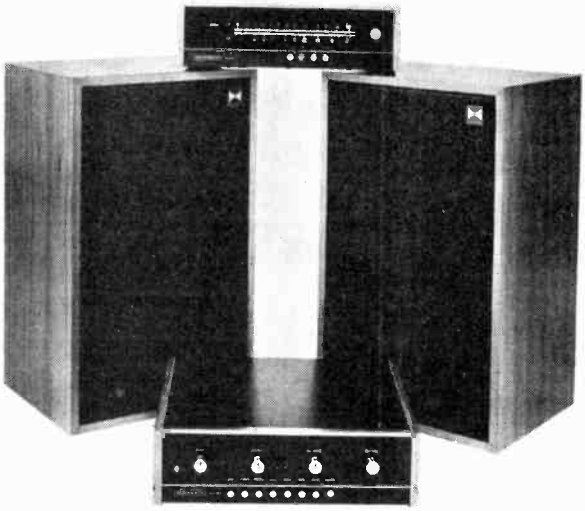

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AC187K	24
AC188	17
AC188K	26
AD142	45
AD149	40
AD161	38
AD162	38
AF114	24
AF115	21
AF116	22
AF117	19
AF118	50
AF139	35
AF178	45
AF180	45
AF181	45
AF239	40
AF240	60
BC107	11
BC108	10
BC109	14
BC109C	14
BC113	13
BC116A	19
BC117	14

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BC149	10
BC153	15
BC154	15
BC157	14
BC158	10
BC159	11
BC173	18
BC178B	20
BC182L	12
BC183L	12
BC187	25
BC214L	15
BC328	28
BC337	19
BD124	75
BD131	45
BD132	39
BD160	£1 39
BD235	49
BD237	52
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BF160	15
BF167	20
BF173	20
BF178	35
BF179	40
BF180	31
BF181	32
BF184	25
BF185	25
BF194	9
BF195	8
BF196	10
BF197	12
BF198	23
BF200	25
BF218	30
BF224	23
BF258	34
BF336	28
BF337	35
BF355	54
BFX86	28
BFY50	19
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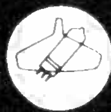

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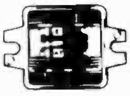
CLEAR PLASTIC MODEL SD830
Size: 110 x 83mm

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

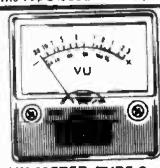
BAKELITE MODEL S80 Enlarged Window
Size: 80 x 80mm

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

BATTERY/LEVEL PANEL INDICATOR
18mm × 18mm Panel mounting.



OUR PRICE 95p P/P & Ins 15p Discounts for quantity.

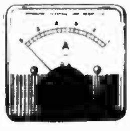


VU METER TYPE 3
250 uA Size: 33mm × 20mm.
£1.55 P/P & Ins 15p

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

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

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



50uA	£3.55	15V AC	£3.40
100uA	£3.50	300V AC	£3.40
200uA	£3.45	5 Meter 1mA	£3.75
500uA	£3.30	VU Meter	£4.30
50-0-50uA	£3.50	1A AC	£3.25*
100-0-100uA	£3.45	5A AC	£3.25*
500-0-500uA	£3.25	10A AC	£3.25*
1mA	£3.25	20A AC	£3.25*
5mA	£3.25	30A AC	£3.25*
10mA	£3.25		
50mA	£3.25		
100mA	£3.25		
500mA	£3.25		
1A DC	£3.25		
5A DC	£3.25		
10V DC	£3.25		
20V DC	£3.25		
50V DC	£3.25		
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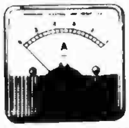
5A	£12.95	£1.50
8A	£19.45	£1.50
10A	£23.75	£1.60
12A	£25.90	£1.50
20A	£50.45	£1.50
25A	£64.75	£1.50
40A	£73.40	£1.50

CLEAR PLASTIC MODEL SD640
Size: 85 x 64mm

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

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



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

BAKELITE MODEL MR 65 Size: 80 x 80mm

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

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AUDIOTRONIC Model ATM1

Top value 1,000 opv pocket multi-meter. Ranges:— 0/10/50/250/1,000 volt AC and DC. DC current 0-1mA/100mA. Resistence: 0/150k ohms. Decibels: –10 to +22dB. Size 90 x 60 x 28mm. Complete with test leads.
OUR PRICE £4.30 P/P & Ins 25p

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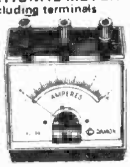
Size: 100 x 80mm

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

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

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



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

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

50uA	£6.40	50V DC	£5.75
100uA	£5.95	150V DC	£5.75
200uA	£5.90	300V DC	£5.75
500uA	£5.80	15V AC	£5.85
50-0-50uA	£5.95	300V AC	£5.85
100-0-100uA	£5.90	5 Meter 1mA	£6.65
500-0-500uA	£5.65	VU Meter	£7.10
1mA	£5.75	1A AC	£5.75*
1-0-1mA	£5.75	5A AC	£5.75*
5mA	£5.75	10A AC	£5.75*
10mA	£5.75	20A AC	£5.75*
50mA	£5.75	30A AC	£5.75*
100mA	£5.75		
500mA	£5.75		
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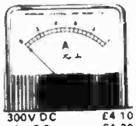
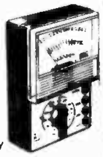
5A DC	£5.75		
15A DC	£5.75		
30A DC	£5.95		
10V DC	£5.75		
20V DC	£5.75		

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



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

AUDIOTRONIC MODEL ATM5



Jewel movement, attractively moulded case with edgwise ohms adjustment. Ranges: 0-3/15/150/300/1200V AC, (2500 opv). 0-6/30/300/600V DC, (5000 opv). 0-300 uA/0-300mA DC. Resistance: x 10 & x 100. –10 to +16dB. Supplied with battery test leads and data booklet. Size: 121 x 73 x 29mm.
OUR PRICE £4.80 P/P & Ins 25p

CLEAR PLASTIC MODEL SD460
Size: 59 x 46mm

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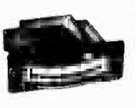
100uA	£3.80	10V DC	£3.65
200uA	£3.75	20V DC	£3.65
500uA	£3.70	50V DC	£3.65
50-0-50uA	£3.80	300V DC	£3.65
100-0-100uA	£3.75	15V AC	£3.80
1mA	£3.65	300V AC	£3.80
5mA	£3.65	VU Meter	£4.65
10mA	£3.65		
50mA	£3.65		
100mA	£3.65		
500mA	£3.65		
1A DC	£3.65		
5A DC	£3.65		
10A DC	£3.65		

EDGWISE MODEL PE70
Size: 90 x 34mm



50uA	£4.55
100uA	£4.50
200uA	£4.45
500uA	£4.10
50-0-50uA	£4.50
100-0-100uA	£4.45
1mA	£4.25
10V DC	£4.25
300V DC	£4.35
VU Meter	£5.50

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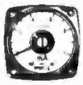
240° Wide Angle 1mA METERS



MW1-8.80 x 80mm
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20,000 o.p.v. DC. 10,000 o.p.v. AC Mirror Scale. 5/25/50/250/500/1000/2500 V. DC. 10/50/100/500/1000 V. AC. DC Resistance x 10, x 1000 (30Ω centre scale) DC Current 50uA/2.5mA/250mA. –20 to +68 dB
OUR PRICE £7.50 P/P & Ins 30p

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U4312 MULTIMETER

extremely sturdy instrument for general electrical use. 667opv. 0/0.3/1.5/7.5/30/60/150/300/600/900V DC & 75mV. 0/0.3/1.5/7.5/30/60/150/300/600/900V AC. 0/300uA/1.5/6/15/150/60/600mA/1/1.5/6A DC. 0/1.5/6/15/60/150/600mA/1.5/6A AC. 0/200/3k/30k ohms. DC accuracy 1%. AC 1.5%. Knife edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions.
OUR PRICE £11.60 P/P & Ins 60p

MODEL 500

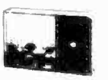
30,000 opv with overload protection. Mirror scale. 0/0.5/2.5/10/25/100/250/500/1000V DC. 0/2.5/10/25/100/250/500/1000V AC. 0/50uA/5/50/500mA. 12A DC. 0/60k/6 meg/60 megohms.
OUR PRICE £15.05 P/P & Ins 60p

KAMODEN HM7208 FET VOM

Input impedance 10 Megohms. Ranges:— 0/.25/1/2.5/10/50/1000V DC. 0/2.5/10 50/250/1000V AC. 0/25uA/2.5/25/250 mA DC. 0/5k/50k/500k/5 M 500 Megohms
OUR PRICE £24.30 P/P & Ins 60p

370WTR MULTIMETER

Features AC current ranges. 20,000opv. 0/0.5/2.5/10/50/250/500/1000V DC. 0/2.5/10/50/250/500/1000V AC. 0/50uA/1/10/100 mA/1/10A DC. 0/100mA/1/10A AC. 0/5k/50k/500k/5 Meg/50 Meg. Decibels: −20 to +62dB.
OUR PRICE £21.50 P/P & Ins 60p

U4323 MULTIMETER

20,000opv. Simple unit with audio/IF oscillator. Suitable for general receiver tuning. Ranges: 0.5/2.5/10/50/250/500/1000V DC. 2.5/10/15/250/500/1000V AC, 0.05/0.5/5/50/500mA DC. Resistance x 10, x 100, x 1,000, x 10,000 (50Ω, 500Ω, 5kΩ, 50kΩ centre scale). Battery operated. Size: 160 x 97 x 40mm. Supplied in carrying case complete with test leads.
OUR PRICE £8.60, P/P & Ins 60p

U4317 MULTIMETER

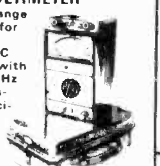
High sensitivity instrument for field and laboratory work. Knife edge pointer, 86mm. mirror scale. Overload protection. Ranges: 100mV/0.5/2.5/10/25/50/100/250/500/1000 V DC. 0.5/2.5/10/25/50/100/250/500/1000V AC. Current: 50uA/0.5/1/5/10/50/250mA/1/5A DC. 0.25/0.5/1/5/10/50/250mA/1/5A AC. Resistance: 0.5/10/100/200 ohms/1/3/30/300k ohms. Decibels: −5 to +10dB Battery operated. Size: 210 x 115 x 90mm. Supplied in carrying case complete with leads.
OUR PRICE £18.35 P/P & Ins 60p

U91 Clamp VOLT AMMETER

For measuring AC voltage and current without breaking circuit. Ranges: 300/600V AC. Current: 10/25/100/250/500A. Accuracy 4%. Size 283 x 94 x 36mm. Complete with carrying case, leads and fuses.
OUR PRICE £15.10 P/P & Ins 60p

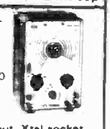
KAMODEN 72.200 Multitester

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

U4315 MULTIMETER

Sturdy 43-range multimeter for current and voltage in DC AC circuits with freq. 45–20kHz and DC resistance, capacitance, etc. Ranges: DC 50 μA/100μA/0.5μA/1/5/25/100/500/2500; DC 75mV/1V/2.5/5/10/25/100/250/500/1000; AC 0.5 mA/1/5/25/100/500/2500; AC 1V/2.5/5/10/25/100/250/500/1000; DC 300Ω. DC 5kΩ/50/500/5000; −15db +2dB. Complete with steel carrying case and leads, manual.
OUR PRICE £10.80 p/p & Ins. 60p

SWR METER Model SWR3

Handy SWR meter for transmitter antenna alignment, with built-in field strength meter. Accuracy 5%. Impedance 52' Indicator 100uA DC. Full scale 5 section collapsible antenna. Size 145 x 50 x 60mm.
OUR PRICE £4.55 P/P & Ins 60p

TE-20D RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 kHz-500 MHz on 6 bands. Directly calibrated Variable R F attenuator audio output. Xtal socket for calibration. 220/240V a c. Brand new with instructions. Size 140mm x 218mm x 170mm.
OUR PRICE £24.30 P/P & Ins 60p

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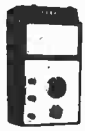
Build yourself a quality 20000 opv multimeter and save money. Complete kit with meter scale, movement and rotary range selector ready mounted in cabinet. All parts, batteries, test prods and instructions. Ranges: 0/0.6/6/30/120/600/1200V D C. 0/6/30/120 600/1200V A.C. Current: 0/0.5/5/60/600mA. Resistance: 0/10/100K/1/10 Meg ohms. Decibels: −20 to +63db. Size: 90 x 150 x 35mm
OUR PRICE £9.65 P/P & Ins 30p

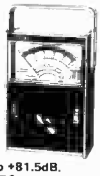
MODEL AS.100D VOM

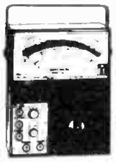
100,000 opv. Mirror scale. Built-in meter protection. 0/3/12/60/120/300/600/1200V DC. 0/6/30/120/300/600V AC. 0/10μA/6/60/300mA. 12 Amp. 0/2K/200K/2M/200 Meg Ohm. −20 to 17dB.
OUR PRICE £18.90 P/P & Ins 60p

U4341 Multimeter & Transistor Tester

27 ranges. 16,700opv. Overload protected. Ranges: 0.3/1.5/6/30/60/150/300/900V DC. 1.5/7.5/30/150/300/750V AC. Current: 0.06/0.6/6/60/600mA DC. 0.3/3/30/300mA AC. Resistance: 0.06/0.6/2/6/20/60/200k ohms/2 Mohms. Battery operated. Supplied complete with probes, leads and steel carrying case. Size: 115 x 215 x 90mm.
OUR PRICE £11.85 P/P & Ins 60p

L84 TRANSISTOR TESTER

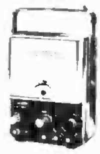
Tests PNP or NPN transistors. Audio indication. Operates on two 1.5V batteries. Complete with instructions etc.
OUR PRICE £4.85 P/P & Ins 20p

TMK MODEL TW50K

46 ranges, mirror scale. 50k/V DC 50k/V AC. DC Volts: 0.125/0.25/1.25/2.5/5/10/25/50/125/250/500/1000. AC Volts 1.5/3/5/10/25/50/125/250/500/1000. DC current 25/50uA/2.5/5/25/50/250/500mA/5/10A. Resistance: 10k/100k/1 Meg/10 Meg ohms. −20 to +81.5dB.
OUR PRICE £13.50 P/P & Ins 60p

KAMODEN 360 MULTIMETER

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

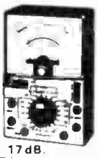
MODEL C7208FM

30,000 opv DC. 15,000 opv AC. 6/3/15/60/300/600/1200 V. DC. 6/30/120/600/1200 V. AC. DC Resistance x 1, x 10, x 100, x 1000 (50Ω centre scale) DC Current 30uA/3/30/600mA. −20 to +63dB.
OUR PRICE £9.65 P/P & Ins 30p

KAMODEN TT35 TRANSISTOR TESTER

High quality instrument to test reverse leak current and DC current. Amplification factor of NPN, PNP, diodes, transistors, SCR's etc. 4" square clear scale meter. Operates from internal batteries. Complete with instructions, leads carrying handle.
OUR PRICE £18.90 P/P & Ins 60p

MODEL TE15 GRID DIP METER

Transistorised. Operates as Grid Dip, Oscillator, Absorbtion Wave Meter and Oscillating Detector. Frequency range 440kHz – 280MHz in six coils. 500uA meter. 9V battery operation. Size: 180 x 80 x 40mm.
OUR PRICE £18.90 P/P & Ins 30p

MODEL AF.105 VOM

50,000 opv. Mirror scale. Meter protection. 0/3/3/12/60/120/300/600/1200V DC. 0/6/30/120/300/600/1200V DC. 0/30μA/6/60/300 mA/12 Amp. 0/10K/1m/10m/100 Meg Ohms. −20 to 17dB.
OUR PRICE £13.50 P/P & Ins 60p

U4324 MULTIMETER

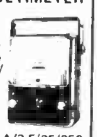
High sensitivity. 20,000opv. Ranges: 0.6/1.2/3/12/30/60/120/600/1200V DC. 3/6/15/60/150/300/600/900V AC. Current: 0.06/0.6/6/60/600mA/3A DC. 0.3/3/30/300mA/3A AC. Resistance: 25/500 ohms/0.5/5/50/500k ohms/5 Mohms. Decibels: −10 to +12dB. Size 167 x 98 x 63mm. Supplied complete with test leads, spare diode and instructions.
OUR PRICE £10.60 P/P & Ins 60p

SINCLAIR DM2 DIGITAL MULTIMETER

Will measure AC and DC volts, AC and DC current, and resistance in a total of 20 ranges. The large light emitting diode display will read up to 1999 and automatically indicate polarity. Indication of positive and negative overload is also provided. The instrument is fitted with a combined carrying handle and bench stand and sockets are provided for the connection of an external power supply.

RANGES
DC VOLTS 1v, 10, 100v, 1000v.
AC VOLTS 1v, 10v, 100v, 1000v.
DC CURRENT 1mA, 10mA, 100mA, 1000mA.
AC CURRENT 1mA, 10mA, 100mA, 1000mA.
RESISTANCE 1k, 10k, 100k, 1000k.

OUR PRICE £63.70 P/P & Ins 50p

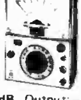
Model HT10084 MULTIMETER

Overload protected, shock proof circuits. 9.5uA Meter with mirror scale. Sensitivity 100kV. Polarity change switch. Ranges: 0.5/2.5/1-/50/250/500/1,000 Volts DC. 2.5/10/50/250/1,000 Volts AC. DC resistence' 0–20/200k/2/20 Meg. ohms. DC current:— 10/250uA/2.5/25/250 mA/10A. AC current: 0–10A. −20 to +62dB. Operates from 2 x 1.5V batteries. Size: 180 x 134 x 79mm.
OUR PRICE £21.50 P/P & Ins 60p

S100TR MULTIMETER TRANSISTOR TESTER

100,000opv. Mirror scale. Overload protection. 0/0.12/0.6/3/12/30/120/600V DC. 0/6/30/120/600V AC. 0/12/600uA/12/300mA/6/12A DC 0/10k/1 Meg/100 Meg. −20 to +50dB. 0.01–0.2 MFD Transistor tester measures Alpha, Beta and ICO. Complete with instructions, batteries and leads.
OUR PRICE £22.65 P/P & Ins 60p

U4313 MULTIMETER

High sensitivity (20,000 opv on DC and 2,000 opv on AC) and accuracy of 1.5% on DC and 2.5% on AC. Ranges: DC and AC current: 0.6mA/3/15/60/300/1.5A; DC and AC Voltage: 1.5V/3/7.5/15/30/60/150/300/600; DC resistance 1kohm/10/100/1,000, −10 to +12dB, etc. Complete with steel carrying case and leads, manual.
OUR PRICE £14.90 p/p & Ins. 60p

HIOKI 750X VOLT-OHM-MILLIAMETER

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

MODEL C7080EN

Giant 6" mirror scale. 20,000 opv. 0/0.25/1/2.5/10/50/250/1000/5000V DC. 0/2.5/10/50/250/1000/5000V AC. 0/50uA/1/10/100/500mA/10A DC. 0/2k/200k/20 Meg. −20 to +50dB.
OUR PRICE £21.50 P/P & Ins 60p

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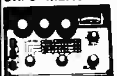

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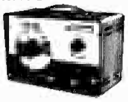
TE22 SINE SQUARE WAVE AUDIO GENERATOR



Sine 20cps to 200kHz on 4 bands. Square 20 cps to 30 kHz. Output impedence 5000 Ohms. 200/250V AC operation. Supplied brand new guaranteed, with instruction manual and leads.
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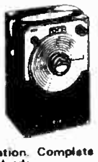
ARF 300 AF/RF SIGNAL GENERATOR

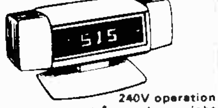


All transistorised compact fully portable. AF sine-wave 18Hz to 220 kHz. AF square wave 18Hz to 100k Hz. Output Square/Sine wave 10V. P.P RF 100kHz to 200MHz. Output 1V maximum. 220/240V AC operation. Complete with instructions and leads.
OUR PRICE £40.50 P/P & Ins 60p

MODEL TE20 RF SIGNAL GENERATOR

Six bands. 120kHz—260MHz. Dual output RF terminals. Separate variable audio output. Accuracy ± 2%. Audio output to 8V. Power requirements: 105—125V, 220—240V AC. Size: 193 x 265 x 150mm. Complete with test leads etc.
OUR PRICE £20.45 P/P & Ins 60p

HANIMEX HOC 1900 DIGITAL ALARM CLOCK



240V operation with large clear numbers, night light and 'snooze' switch. Attractively finished in white and silver.
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All silicon, transistor amplifier operates from magnetic, ceramic or tuner inputs with twin stereo headphone outputs and seperate volume controls for each channel. Operates from 9V battery. INPUTS: 5mV and 100mV. OUTPUT: 50mV per channel.
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7½–7½ watts rms. Inputs for magnetic phono, tuner, tape and aux. Separate base, treble, balance and volume controls. Headphone socket. Teak case. Unrepeatable offer. P/P &
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Z40 Power Amp.	£5.60	P/P & Ins. 15p
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Transformer for PZ8	£5.10	P/P & Ins. 30p

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C60	£2.05	£3.88	£5.50
C90	£2.81	£5.34	£7.57
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A smaller than usual digital clock AM/FM radio, measuring only 8½"w x 3½"d x 4"h. The DCR is finished in simulated teak veneer and is fitted with a pre-set sleep timer switch that will turn on the radio at the precise time chosen (Mains operated) List Price £24.26
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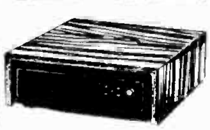
ELIZABETHAN 8/LZ-1



8-Track Stereo Player. Home 8-Track player with automatic and manual programme change and illuminated channel indicators for use with your hi fi system. Size 7½"w x 12"D x 2¾"h. List Price £28.90
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A perfect match for the 4000 amplifier is the 4000 FM tuner, which boasts a capture ratio of 3dB, sensitivity of 3μV for 30dB quieting, stereo beacon, etc.
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The BELTEK C6260 includes AM/FM radio, and stereo 8-track cartridge player, with volume-tone and balance control, cartridge program indicator, automatic head cleaning, comes complete with installation kit, suppressors, and instructions. 12v Neg. (Speakers not included.) p/p & Ins.
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151	200	8·13	53
152	250	9·83	73
153	350	11·88	73
154	500	13·65	91
155	750	20·51	BRS
156	1000	29·15	BRS
157	1500	33·23	BRS
158	2000	37·07	BRS

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

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

Ref. No.	Amps	£	p & p p
112	0·5	1·81	30
79	1·0	2·40	38
3	2·0	3·49	38
20	3·0	4·35	45
21	4·0	5·13	53
51	5·0	6·41	53
117	6·0	7·16	60
88	8·0	9·87	67
89	10·0	9·90	73

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

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

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

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

AUTO TRANSFORMERS

Ref No	VA (Watts)	Auto Taps	£	p & p p
113	20	0-115-210-240	1·67	30
64	75	,, ,,	2·90	38
4	150	0-115-200-220-240	4·12	45
66	300	,, ,,	5·82	53
67	500	,, ,,	8·82	67
84	1000	,, ,,	13·68	91
93	1500	,, ,,	18·11	BRS
95	2000	,, ,,	24·20	BRS
73	3000	,, ,,	35·09	BRS

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1000VA	£17·51	P&P	BRS	Ref 84W

SCREENED MINIATURES

Ref	mA	Volts	£	p&p p
238	200	3-0-3	1·54	10
212	1A, 1A	0-6, 0-6	1·84	30
13	100	9-0-9	1·41	13
235	330, 330	0-9, 0-9	1·56	19
207	500, 500	0-8-9, 0-8-9	1·92	30
208	1A, 1A	0-8-9, 0-8-9	3·30	38
236	200, 200	0-15, 0-15	1·43	19
214	300, 300	0-20, 0-20	1·93	30
221	700(DC)	20-12-0-12-20	2·17	38
206	1A, 1A	0-15-20, 0-15-20	3·46	38
203	500, 500	0-15-27, 0-15-27	3·00	38
204	1A, 1A	0-15-27, 0-15-27	3·85	38
S112	500	12, 15, 20, 24, 30	1·88	37

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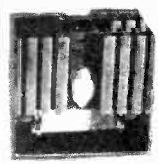

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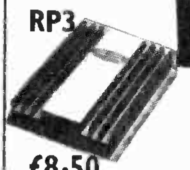

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BC317A BC318B BC319C	NPN NPN NPN	45 30 20	150mA cont. 300 Pk.	110-220 200-450 420-800	18p 18p 20p
BC320A BC321A BC322B	PNP PNP PNP	45 30 20	150mA cont. 300 Pk.	110-220 200-450	20p 20p 20p
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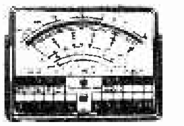

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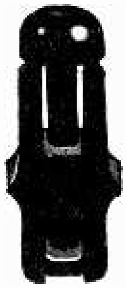

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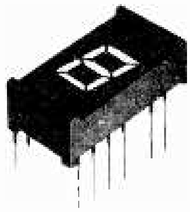

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14 pin DIL sockets 16p

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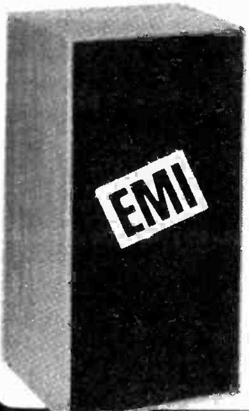

LE-4 SPEAKERS

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

Our Price £34.00 each
(normally £66.00)+£5.80 p & p.
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THE 'COMPACT'

EASY BUILD SPEAKER KIT

A compact bookshelf speaker system giving a high electro accoustic efficiency for the low powered amplifier.
The professional finish can be obtained with the minimum of tools, the infinite baffle type enclosures come ready mitred and professionally finished, simply apply glue, fold up around baffle board, and fix together with masking tape till glue dries.
The cabinet measures 12"x9"x5" deep approx finished in simulated teak, incorporating a quality 7"x4" elliptical speaker, power handling 4 watts, flux density 30,000 maxwells, impedance 8-15 ohms nominal, voice coil dia ¾" magnet size 2⅞" approx.

£6.00
pair inclusive, P & P £1.70

EMI 350 KIT

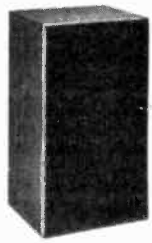
System consists of a 13" × 8" approx. woofer with a 3" tweeter, crossover components and circuit diagram. Frequency response: 20 Hz to 20 KHz. Power handling 15 watts RMS into 8 ohms. (Peak 30 watts.)

£7.25 +£1.20 p & p.

Complete with crossover Components and circuit diagram

EASY TO BUILD SPEAKER KITS

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



£22.00 pair complete +£5.20 p & p.

Complete with crossover Components and circuit diagram

RTVC*

NEW!

VISCOUNT IV STEREO SYSTEM

System 1a. £69.00

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

System 2. £85.00

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

PRICES: SYSTEM 1a

Viscount IV R103 amplifier	£27.50+£1.90 p & p.
2 Duo Type IIa speakers	£30.00+£6.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover	£22.00+£3.30 p & p.
Total if purchased separately:	£79.50

Available complete for only: £69.00 +£6.50 p & p.

PRICES: SYSTEM 2

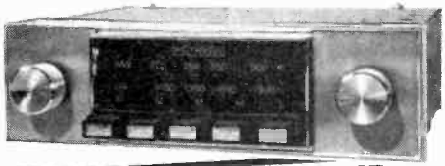
Viscount IV R103 amplifier	£27.50+£1.90 p & p.
2 Duo Type III speakers	£46.00+£7.50 p & p.
MP60 type deck with Mag. cartridge de luxe plinth and cover	£22.00+£3.30 p & p.
Total if purchased separately:	£95.50

Available complete for only £85.00 +£7.60 p & p.

20x20 SYSTEM

Scotland and the Orkneys P & P Surcharge
System 1a £1.75 System 2 £3.50

PUSH BUTTON CAR RADIO KIT—THE TOURIST TT*



NO SOLDERING REQUIRED

NOW BUILD YOUR OWN PUSH BUTTON CAR RADIO

Easy to assemble construction kit comprising fully completed and tested printed circuit board on which no soldering is required. All connections are simple push fit type making for easy assembly. Fine tuning push button mechanism is fully built and tested to mate with printed circuit board.
TECHNICAL SPECIFICATION: (1) **Output** 4 watts RMS output. For 12 volt operation on negative or positive earth. (2) **Integrated circuit** output stage, pre-built three stage IF Module.

Controls volume manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands. Size chassis 7" wide 2" high and 4¾" deep approx. **£9.50** + £1.05 p & p. Speaker including baffle and fixing strip £2.00 + 45p p & p. Car Aerial Recommended — fully retractable £1.60 + 40p p & p.

The Tourist 1 Kit For the experienced constructor. If you can solder on a printed circuit board you can build this model. Same technical specification as Tourist TT. **Price £8.20** + £1.05 p & p.

*STEREO 21 QUALITY SOUND FOR LESS THAN £24.00

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

Complete only £23.20 + £3.00 p & p.

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

*DISCO AMPLIFIER

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

£20.00 + £1.35 p & p.

8 TRACK HOME CARTRIDGE PLAYER

Elegant self selector push button player for use with your stereo system. Compatible with Viscount IV system, Unisound module and the Stereo 21. Technical specification Mains input, 240V, Output sensitivity 125mV.

Yours for only
£16.20 + £1.70 p & p.

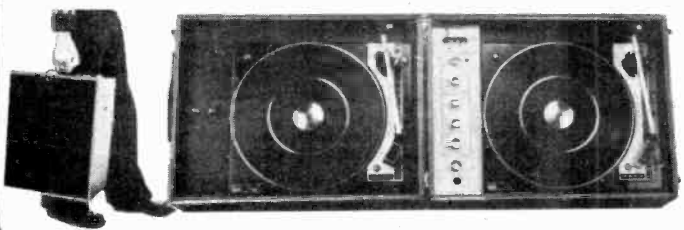
BUILD YOUR OWN STEREO AMPLIFIER*

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

Also available with 2 speakers (7"x4") £10 + £1.75 p & p. **£8.95** + £1.05 p & p.
Also available with the 'Compact' (see opposite page) easy build speaker kit £13.50 + £2 p & p

PORTABLE DISCO CONSOLE*

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



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

Console size —
Unit Closed — 17¾" × 13¾" × 8½" (app.)
Unit Open — 35¾" × 13¾" × 4½" (app.)
This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.
The unit is finished in black PVC with contrasting simulated teak edging, diamond spun control knobs with matching control panel.

Yours for only
£49.00 + £6.50 p & p.

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The future of Amateur Radio

THE life blood of amateur radio is the spectrum space allocated to the amateur service between 1·8MHz and 25GHz. Without these precious frequencies, the radio amateur of today would become just another broadcast station listener. The regulation of the frequencies available to the various services, i.e. aeronautical, amateur, broadcasting, marine and so on, is governed by the conferences of the International Telecommunication Union which is the specialist agency of the United Nations for telecommunications. During the ITU conference the 144 member nations of the ITU vote on the proposals before them and in this way the future of frequency allocations is determined.

The last major ITU conference was in 1959 and there has been relatively little change in the spectrum allocation for amateurs since that time. The next major meeting is scheduled for October 1979 and the agenda will include a review of all frequencies comprising the usable spectrum. This means that each and every amateur service allocation will come under the scrutiny of the conference. On their decision alone will depend whether your present equipment will continue to be usable, or will be just another piece of surplus gear.

The possibilities and dangers arising from the 1979 World Administrative Radio Conference have been known and recognised by national societies and the International Amateur Radio Union for some considerable time. A great deal of preparatory work has already been undertaken and it is now clear that the amateur service will at this conference present a unified plan for its future modified only by minor regional differences. At the conferences of the ITU only the member nations are elegible to vote. However, the IARU is one of the few organisations recognised by the ITU and therefore entitled to attend its conferences as an observer where it may also speak and present papers.

Thus, while the IARU may participate actively in the conference its most essential work must take place in the co-ordination and advice offered to national societies throughout the world. It is the national societies only who can approach their own telecommunication administrations to seek their support for the future of the amateur service. It will be appreciated that in many countries this is a difficult task, never more difficult than in Africa. This is a challenge which has been accepted by the IARU and the national societies and the work of securing support for radio amateurs will continue without slackening until October 1979.

It would be unwise to give publicity to much of the work that has been, and will be done, and it is only the result that can prove its effectiveness or otherwise.

Now, as never before, the amateur service must be seen by all who come into contact with it to be something that is worth retaining and whose work and activity justify the present spectrum space allocated to it. Every radio club in every country has a part to play in this effort. It is the local radio clubs who bring together the individual radio amateurs and who form the backbone of the national societies. Those responsible for the conduct of a radio club should familiarise themselves with the position as it is today and with the steps that must be taken if the future is to be assured. Having done this they can then offer guidance to the individual members and initiate activity which will be of benefit not only to the amateur service but hopefully to the community at large.

continued on page 551

NEWS...

Practical Wireless P. C. Board Readers Service

IN the October issue of Practical Wireless we announced that this magazine will be introducing a 'new' readers service whereby our 'copyright' printed circuit boards for selected PW constructional projects will be offered to readers.

We are anxious this service shall represent good value and our boards to be of the highest standards, therefore we are taking a further month to finalise the details which we hope to publish in full in the near future.

Reprints

WE still have some copies of the Tele-Tennis reprints. If you would like one, send 82p to: Chief Cashier, (P.W. Tele-Tennis, IPC Magazines, Tower House, Southampton St., London, WC2E 4QX.

Special offer

HI-FI enthusiasts buying cassette decks which accept chromium dioxide cassettes will find there is a dearth of prerecorded CrO_2 cassettes. To ensure that purchasers of BASF machines are able to use their machines to the full, BASF is giving them the opportunity to buy BASF prerecorded CrO_2 cassettes at special low prices.

The repertoire contains 22 titles, four of which are double albums. The price of the cassettes is £3·90 for a single album and £5·80 for a double album, but BASF are offering them at £1·99 and £2·99 (inclusive of VAT) respectively. Six of the titles have been recorded in quadraphonic and these are available at no extra cost.

All the purchaser has to do is ask for a BASF Cassette Offer order form when he buys a BASF machine, tick the titles he wants and send the form with a cheque or postal order for the correct amount to BASF at its Knightsbridge, London, address. Customers may only send in one order form so they should ensure that they have all the titles they require.

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

Heathkit Catalogue

MANY interesting new models are introduced in the latest Heathkit Catalogue: They are TM-1626 Stereo Microphone Mixer; TA-1620 Public Address Control Amplifier with optional Booster Amplifier, Speaker Column, or Distribution Transformer; ID-1590E Digital Electronic Wind Speed and Direction Indicator; IM-1212 Digital Multimeter; IO-4560 DC-5MHz, 100mV Oscilloscope; IO-4540 DC-5MHz, 20mV Oscilloscope; IG-4505 Oscilloscope Calibrator; IP-2700 Series of Digital and Analogue Power Supplies; IMA-18-1 Solid-state Conversion Kit for valve-type Heathkit VVm's; SR-205 Single Pen Chart Recorder; SR-206 Dual Pen Chart Recorder.

Heath also tell us that their electronic organ (shown in October "Production Lines") is on show at the Tottenham Court Road showroom.

The latest Heathkit Catalogue is now available: To postal enquiries, enclosing a 10p stamp for return postage, from: *Heath (Gloucester) Ltd., Bristol Road, Gloucester GL2 6EE.*

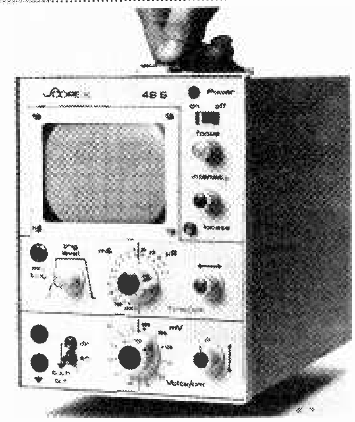
"Radio Exchange"

DUE to a printing error the above advertiser's full page advertisement in the September, 1975 issue was incorrectly priced. The magazine apologises for any inconvenience caused to readers.

British 'Scope

THE only independent British oscilloscope manufacturers, Scopex Instruments, have just launched an addition to their range of low cost oscilloscope. The new 'scope, called the 4S-6, is intended for use in educational, service and amateur areas.

The new instrument follows the design philosophy of other machines in the range with emphasis on ease of use, with controls kept to a minimum and well labelled. Price is only £88 yet the specification is equivalent to similar units costing as much as twice that price. Main features are a maximum sentitivity of 10mV/cm and a bandwidth of 6MHz. The screen is a big 6× 8cm for ease of viewing. The weight of the unit is only 4·5kg making it eminently suitable for field work. One feature of the 4S-6 only found on oscilloscopes



costing about £100 more is the beam locate facility which allows even the most inept operator to locate and return the trace to screen.

For further information contact *Scopex Instruments, Pixmore Industrial Estate, Pixmore Avenue, Letchworth, Herts.*

THE FUTURE OF AMATEUR RADIO

—continued from page 550

There are several forms of scientific activity in which the individual radio amateur can participate and play a valuable part. There is no other organisation in the world that can command the services of so many able technicians capable of carrying out specialist work at no cost to the community. As an example, we cite propagation research, possibly using the beacons already established in several parts of the world. Amateur progress in microwaves has astonished professional workers and this is a fertile field for experiment and development. The amateur satellite programme is another area where the skills of construction or mere observations can vitally assist research activity. In addition to participation in scientific activity the radio amateur must ensure that his transmissions are beyond reproach both in technical characteristics and in the messages conveyed. There are many listeners to amateur radio transmissions and the listener can only judge the quality by what he hears. Regrettably in many cases the quality leaves much to be desired.

The Radio Society of Great Britain* has always played a leading part in the representation of amateur radio at international levels. It is already heavily involved in the preparations for 1979 and will continue to make a maximum effort on behalf of *all* UK radio amateurs.

The future of amateur radio now depends upon the IARU, the national societies, the local clubs and, not least of all, the individual operator. Will you play an active and responsible part in the world wide activity intended to ensure the future of amateur radio?

LIONEL E. HOWES—*Editor*

* *Radio Society of Great Britain, 35 Doughty Street, London, WCIN 2AE*

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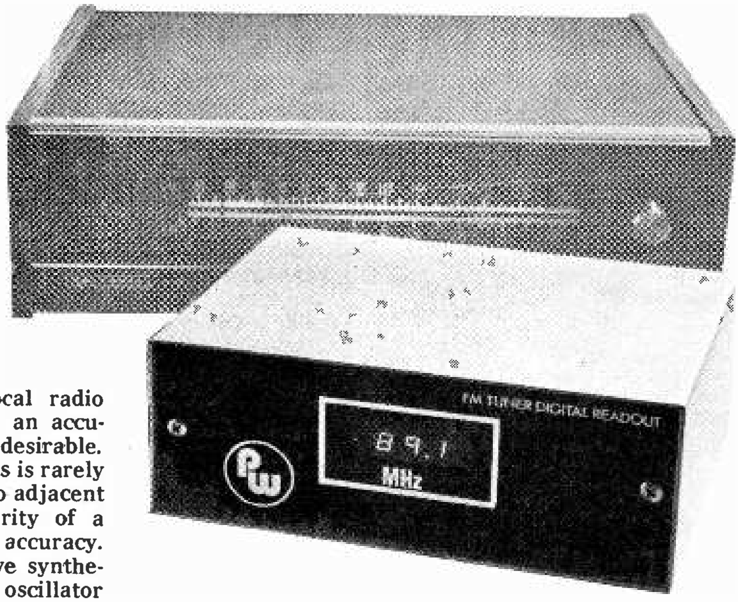
DIGITAL READOUT SYSTEM for FM tuners

PART 1

Martin Oliver*



WITH the increasing number of local radio stations occupying the VHF band, an accurate frequency indication is very desirable. The tuning scale provided on most FM tuners is rarely accurate enough to differentiate between two adjacent stations because it depends on the linearity of a variable capacitor, or a varicap diode for its accuracy. This problem is overcome in very expensive synthesiser tuners by generating the local oscillator digitally using a programmable frequency divider and a reference oscillator.

It is possible to provide the same digital display of frequency with a conventional tuner by counting the local oscillator frequency, and this method does not require much modification of the tuner.

The frequency counter described in this article gives an accurate tuning indication over the 88-108 MHz band, and can be easily modified to cover other ranges. It was designed to be used with a Heathkit model AJ1214, but it should work with most transistor tuners.

ISOLATION

It is important that the tuner chassis is fully isolated from the mains. Most modern tuners use a mains transformer to provide a low voltage supply for transistor circuits, and the chassis is connected to earth through the mains plug or is left floating. Check carefully that the chassis is not connected directly to the line or neutral pin of the mains plug as it is then dangerous to connect external components to it and this circuit **must not be used.**

One problem which usually occurs, when building high frequency circuits is the need for special equipment, such as HF signal generators and oscilloscopes to set the circuit up. To get around this problem, broadband circuits are used in the HF sections of this design so there are no coils to be aligned, and the only equipment needed is a multimeter.

The unit is built on Veroboards contained in a separate metal case, and is connected to the tuner by coax cable. A metal box is needed as a screen between the tuner's sensitive front end and the logic ICs.

FM TUNER OPERATION

Before explaining how the circuit works, a brief description of the operation of an FM tuner may be useful. Fig. 1 shows a simplified block diagram of a

Formerly with Texas Instruments.

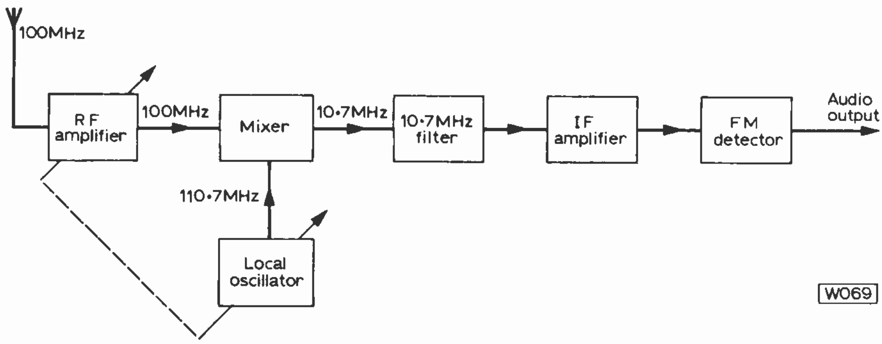


Fig. 1: Block diagram of a typical FM tuner where the oscillator frequency is above that to which the RF amplifier is tuned.

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"conventional" tuner. It is assumed to be tuned to a station on 100·0MHz. A signal picked up by the aerial is amplified by the RF amplifier to a level suitable for the mixer. The local oscillator runs at a frequency 10·7MHz above or below the frequency to which the RF amplifier is tuned. The output from the mixer is the IF frequency which is the difference between these two signals, i.e. 10·7MHz. The mixer feeds the IF amplifier via a bandpass filter which gives the tuner its selectivity.

It is not possible to measure directly the frequency of the signal from the aerial because this consists of many other stations apart from the one being received. Because of this the local oscillator is used, but as this is not the same frequency as the station being received, a correction must be made in the counting circuit. In the example of Fig.1, 10·7MHz must be subtracted from the measured frequency before it can be displayed.

Fig. 1 shows the local oscillator at a higher frequency than the RF amplifier. This is the more usual case, but if the oscillator was lower, i.e. 89·3MHz then 10·7 would have to be added to the count.

SYSTEM OPERATION

A block diagram of the complete system is shown in Fig. 2. The system operates by enabling a 'gate' for an accurately defined sampling period and counting the number of input cycles which occur during that time. TTL decade counters are used, but because the local oscillator frequency can be above 100MHz it must be divided to a frequency which TTL can handle. This is done in the prescaler, which divides the input frequency by three. So if the local oscillator varied over the range 99 to 119MHz the output of the prescaler would be between 33 and 40MHz which is low enough for the TTL counters.

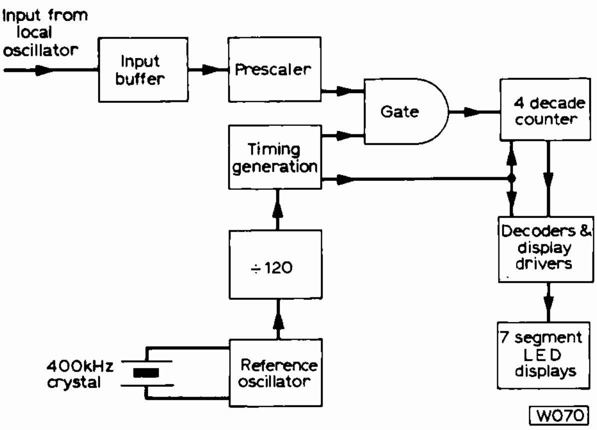

Fig. 2: Block diagram of the complete Digital Readout System.

It is important that the local oscillator is not loaded by the circuit connected to it as this would reduce the output or shift the frequency. To avoid this a high input impedance buffer is used. This is the only part of the circuit which is mounted inside the tuner.

To give the correct display for the number of digits used, a counting period of 300μs is needed. To get the required accuracy a crystal must be used, but to oscillate with a period of 300μs it would be very large and expensive. In this design a 400kHz crystal is used followed by series of counters to divide the frequency by 120.

IF OFFSET COMPENSATION

The adding or subtracting of the IF frequency is accomplished by using presettable decade counters, (one for each displayed digit).

To add 10·7 to the displayed frequency the counters are loaded with this number before counting starts. The output from the counters is in binary coded decimal (BCD) and the decoders convert this to drive the seven segment LED displays. Because the most significant digit (hundreds) can only be 0 or 1, a separate decoder is not needed. The counting and display sequence takes 4·8ms as follows:

1) Load counters with IF offset frequency 300μs
2) Enable input gate to counters 300μs
3) Display result 4·2ms

During 1) and 2) the display is blanked, and this modulates the light output at about 200Hz, but the eye cannot follow this, and the display appears steady.

ELIMINATING JITTER

With counters of this type there is always an uncertainty of ±1 digit depending on the phase difference between the input and the sampling pulse. This normally causes the last digit to jitter, but when the last digit jitters between 9 and 0 the next digit is also affected. This is especially troublesome in this case as nearly all UK stations are on multiples of 100kHz, so the fifth digit (10kHz) would normally be zero and the jitter would pass on to the next digit.

The problem is overcome by adding 50kHz to the number which is loaded into the counter. Now, when a station is tuned in, the last digit reads five instead of zero, and the jitter is confined to this digit. Although it cannot be displayed as tens of kilohertz the last digit is used to indicate how accurately the station is tuned in. If the last digit is 3, 4, 5, 6 or 7 it is blanked. When it is 0, 1 or 2 a minus sign is displayed and for 8 or 9 a plus sign appears. This arrangement eliminates flicker when a station is tuned in, and still gives sufficient accuracy.

INPUT BUFFER

Fig. 3 shows the circuit of the input buffer. which is simply an emitter follower. This has the advantage of a low output impedance, which is needed to drive

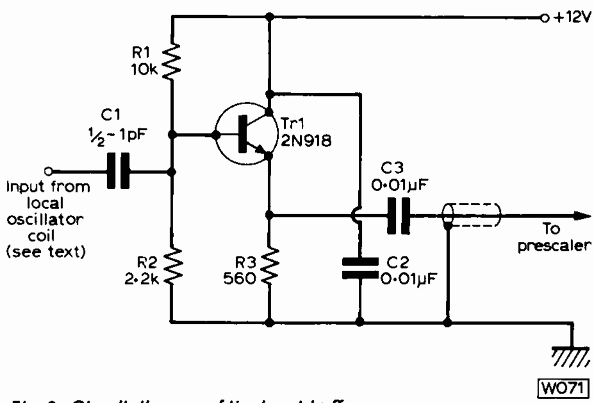

Fig. 3: Circuit diagram of the input buffer.

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★ components list

INPUT BUFFER

Resistors
R1 10kΩ, R2 2·2kΩ, R3 560Ω — All ±5% ¼W

Capacitors
C1 ½—1pF (see text)
C2, C3 0·01μF ceramic

Transistor
Tr1 2N918

PRESCALER

Resistors (All ±5% ¼W)

R4	100Ω	R12	68Ω
R5	47Ω	R13	2·7kΩ
R6	470Ω	R14	220Ω
R7	2·7kΩ	R15	1·5kΩ
R8	82Ω	R16	12kΩ
R9	180Ω	R17	10kΩ
R10	180Ω	R18	2·2kΩ
R11	68Ω	R19	220Ω

VR1 220Ω miniature preset

Capacitors
C4–C8 0·01μF ceramic (5 off)
C9 20pF trimmer (DAU or similar)
C10 0·01μF ceramic

Semiconductors
Tr2–Tr4 2N918 (3 off)
IC1 SN72733N Texas

LOGIC BOARD AND DISPLAY

Resistors
R20, R21 820Ω (2 off)
R22–R30 330Ω (9 off)
R31 680Ω
R32–R45 330Ω (14 off)
R46 180Ω
All ¼W ±5%

Capacitors
C11 0·1μF ceramic
C12 680pF polystyrene
C13 470pF polystyrene
C14–C20 0·1μF ceramic (7 off)

Semiconductors

IC2	SN7404N	IC9	SN74176N
IC3	SN7408N	IC10	SN74176N
IC4	SN7490AN	IC11	SN74176N
IC5	SN7493AN	IC12	SN7410N
IC6	SN7493AN	IC13	SN7447AN
IC7	SN7420N	IC14	SN7447AN
IC8	SN74196N	IC15	SN7447AN

LED1 TIL304, LED2–LED4 TIL302 (3 off), LED5 TIL304 — Texas

Crystal
X1 400kHz (Channel 16, FT241—Interface Quartz Devices Ltd. 29 Market St., Crewkerne, Somerset. Tel. Crewkerne 2578).

the 75Ω coax lead connecting the tuner to the display circuit.

The input is taken from the local oscillator tuned circuit where the signal is about 1V peak-to-peak. A very low value coupling capacitor C1 is used to reduce the loading at this point.

The 12V supply can be taken from the tuner itself as the current drain is only 4mA. If there is no convenient 12V line in the tuner, then a separate wire can be taken from the 13V line in the main unit.

The coax cable couples the buffered local oscillator signal to the prescaler.

PRESCALER CIRCUIT

The basis of the prescaler is an SN72733 video amplifier (IC1 in Fig. 4). This is biased as a Schmitt trigger by connecting the output to the non-inverting input via R13. This is then made to oscillate by the feedback provided by R15, R14 and C9, where C9 sets the frequency.

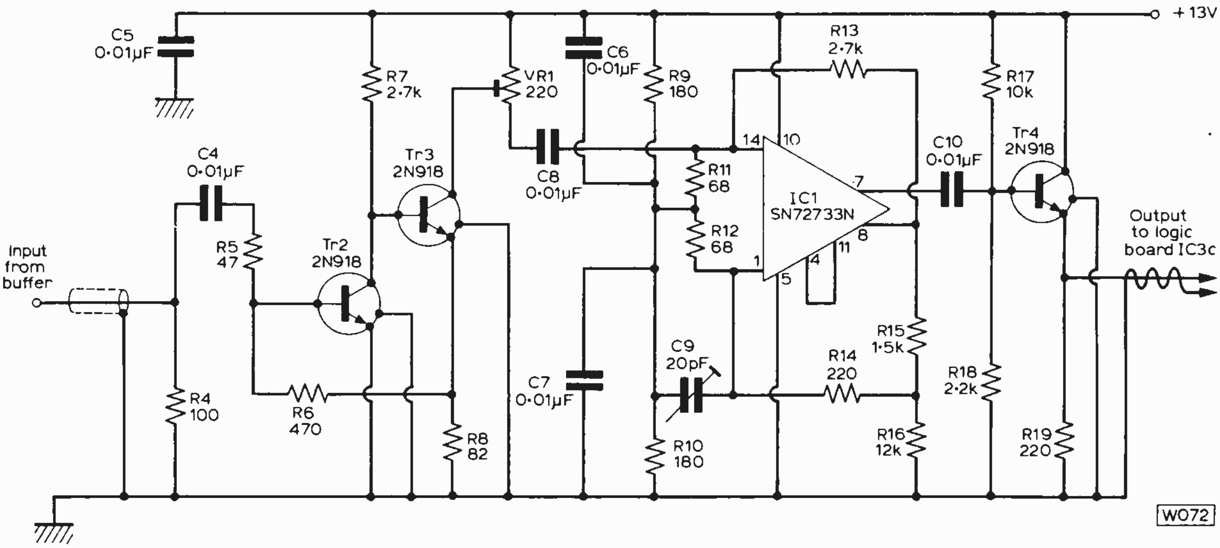

Fig. 4: Circuit diagram of the prescaler unit which uses the Texas SN72733N video amplifier IC.

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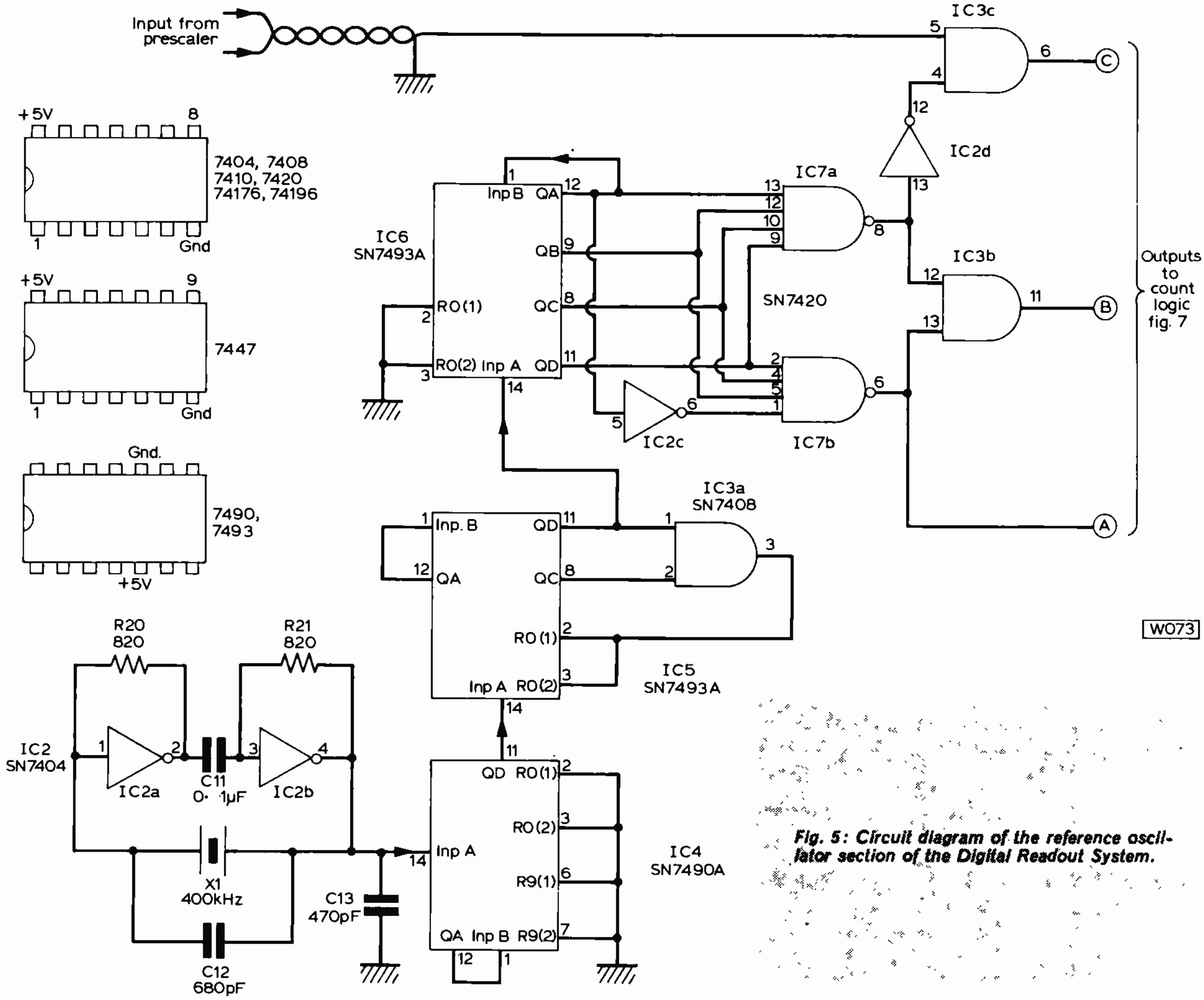

Fig. 5: Circuit diagram of the reference oscillator section of the Digital Readout System.

The signal from the buffer is amplified and coupled to the 733 oscillator which locks to one-third of the local oscillator frequency. The trimmer, C9, is used to adjust the free running frequency to the centre of the band so that the 733 can be pulled higher or lower in frequency.

Tr2 and Tr3 are connected as a DC feedback pair which gives reasonable gain over a wide frequency range. The gain is adjustable with VR1 to allow for variations in the amplitude of the local oscillator signal.

The other output of the 733 is fed to an emitter follower Tr4 which provides a low impedance drive at the correct level for the TTL circuit.

REFERENCE OSCILLATOR

Fig. 5 shows the circuit diagram of this section. The reference oscillator is made from SN7404 inverters which are biased into the linear region by resistors connected from output to input.

Two inverters are needed to give positive feedback. The frequency of 400kHz is determined by the crystal X1. Capacitors C12 and C13 are needed to prevent the circuit oscillating at one of the crystal's harmonic frequencies.

TTL counters are used to reduce the reference frequency. IC4 is an SN7490A which contains divide by two and divide by five circuits. By connecting output QA to input B it will divide the input frequency by 10. IC5 contains a divide by two and a divide by eight circuit. To give the necessary output frequency this must divide by twelve which is

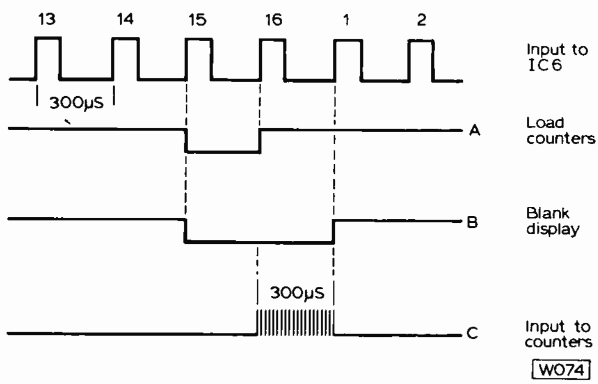

Fig. 6: Waveforms at various positions in Fig. 6.

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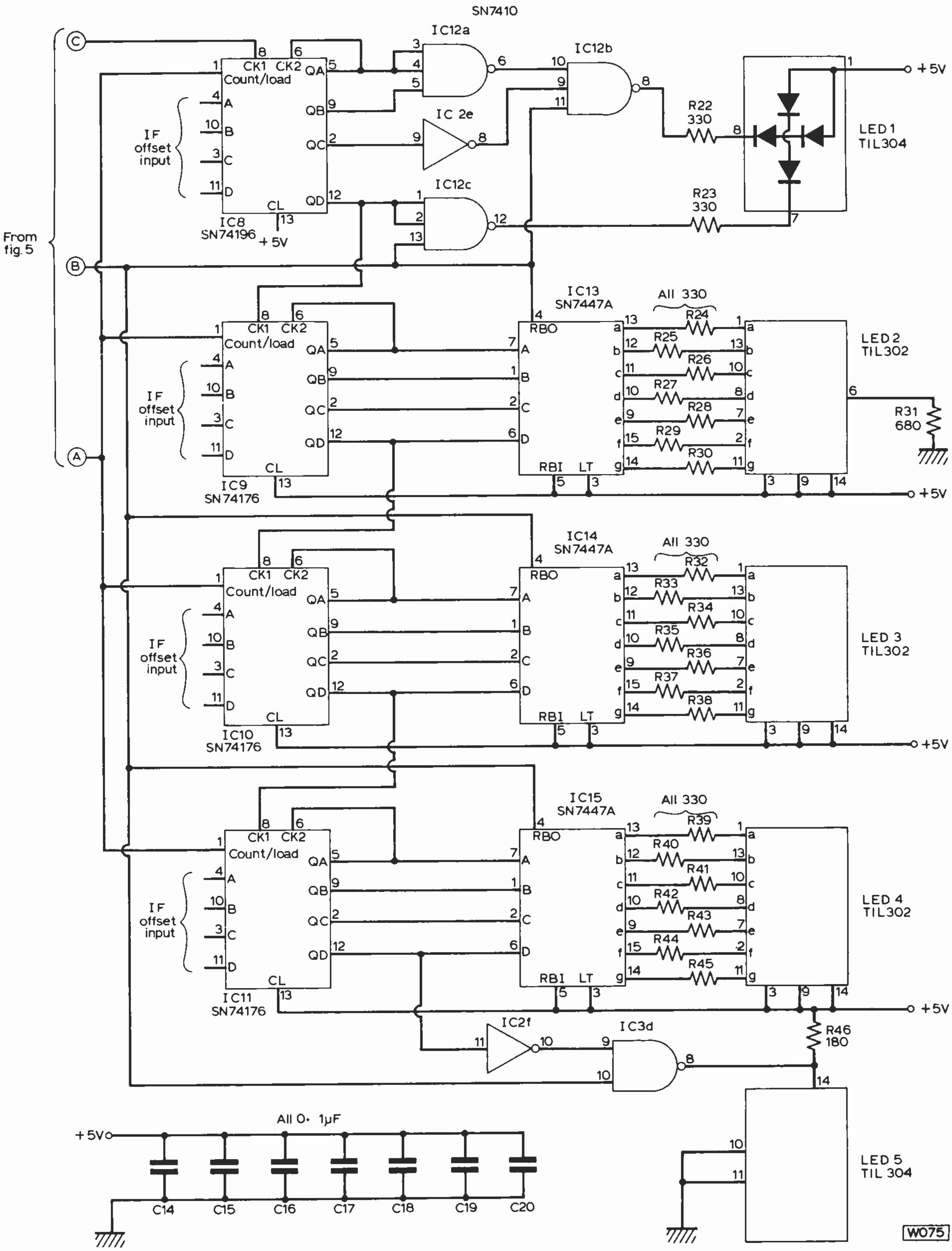

Fig. 7: Circuit diagram of the Counting and Display Logic.

continued on page 558

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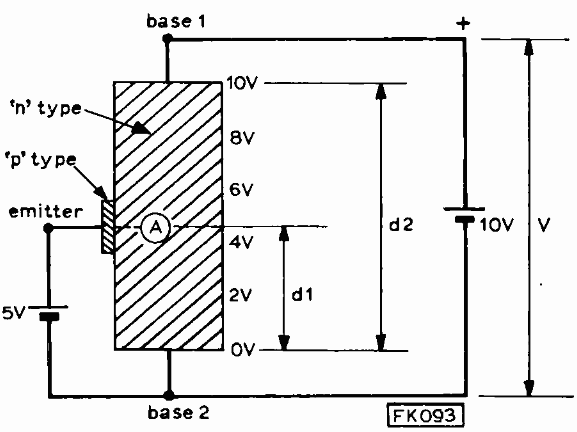
UNIJUNCTION TRANSISTOR TESTER

R. MEREDITH

THE unijunction transistor tester described here is basically a simple go/no-go tester, giving some indication of the intrinsic stand-off ratio. The total cost of components is about 80p, provided a multimeter with a suitable range is available.

Unijunction Theory

To understand the operation of this instrument, a certain basic knowledge of unijunction theory is necessary. A unijunction consists of a bar of N type silicon with contacts at each end. On this bar there is a P-N junction. When a voltage V is applied across the Bar, a voltage which is less than V appears at A. The voltage at A is found by multiplying V by $\frac{d1}{d2}$ When the emitter voltage rises above that at A by about 0·7V, current begins to flow through the now forward-biased P-N junction. This reduces the voltage at A, so that the current continues until the voltage at the emitter falls below 0·7V. The ratio $\frac{d1}{d2}$ is the Intrinsic Stand-Off Ratio.

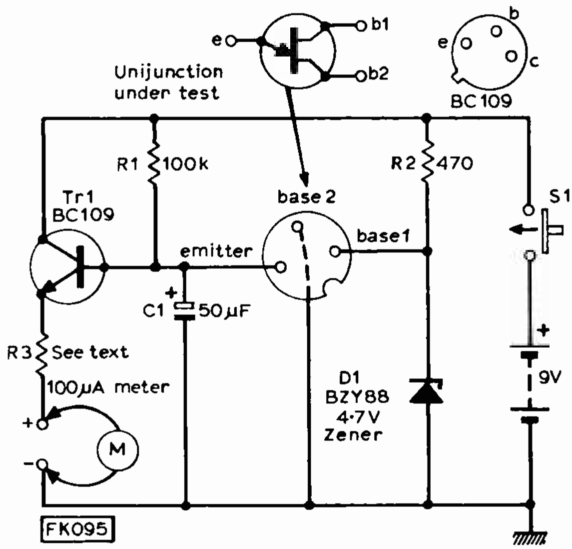


Theoretical circuit of a unijunction transistor with external biasing supplies. In this example, electrons will flow from the emitter, as the potential across base 1 and 2 is greater than that across the emitter and base 2.

Practical Circuit

The device described in this article works as follows: C1 charges through R1 until the voltage at the emitter rises 0·7V above the ISR x 4·7. This figure being the voltage between the bases, kept constant by the zener D1. At this moment the device starts to conduct and the capacitor C1 is rapidly discharged. The cycle now repeats.

Tr1 performs two functions. First, it increases the resistance of the meter by a factor equal to its h_{fe},, and secondly, it removes by reason of its base/emitter drop of 0·7V, the drop of the unijunction when it fires, giving true representation of the ISR.



Circuit of the Unijunction tester, making use of an external meter. If the circuit is to be constructed with an integral meter, then one of about 100μA FSD should be chosen.

Construction

Although details are given for the PCB, layout is not at all critical and comprises only six components. A high gain transistor should be used for Tr1 such as the BC109, as the input impedance should be as high as possible. For the same reason, the meter should have a movement of around 100μA, or if

★ components list

Resistors
R1 100kΩ — R3 See text
R2 470Ω — All ½W 10%

Capacitor
C1 50μF (6V)

Semiconductors
Tr1 BC109 — D1 BZY88 4·7V zener

Miscellaneous
S1, pushbutton switch. PP3 battery. Transistor socket. Two sockets for meter connection. Veroboard 80 x 40mm. Aluminium box 115 x 64 x 30mm.

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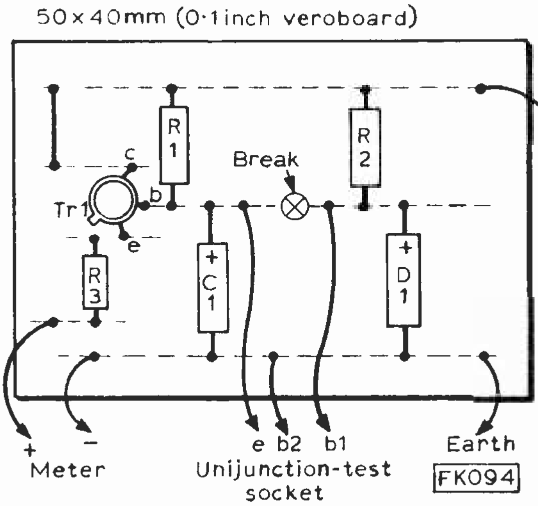
a suitable multimeter is available, then this could be used in place of a permanent meter. The value of R3 can be calculated as follows:

$$R3 = \frac{4{\cdot}7}{\text{Sensitivity for fsd on meter}} - \text{Meter resistance}$$

A 5% resistor should be used here, as no advantage will be gained by the use of a more accurate one, especially as the diode itself is of 5% tolerance. The PCB was fixed inside a small aluminium box with sockets for the meter.



Component layout can be constructed on veroboard as shown above, or on a PCB. As components only number six, layout is not at all critical.

Use

Switch on and plug a unijunction transistor into the socket. The needle on the meter wlil move slowly across the scale, until at one point, the needle should flip back to near zero. If the meter is scaled 0 to 1 linearly, the ISR will be given by the maximum reading on the meter scale. If however, the voltage continues to rise, or does not rise at all. the unijunction is faulty.

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FM TUNER DIGITAL READOUT—*contd from page 556*

achieved by resetting to zero on the twelfth input pulse. IC3a does this by feeding a positive pulse to the reset inputs when outputs QC and QD go high. The output from QD has a period of 300μs which is the correct width for the sampling pulse.

IC6 is also an SN7493N and is used to generate timing pulses for the counting and display logic. It counts up to 16 and then resets to zero and outputs 15 and 16 are selected by the two NAND gates IC7a and b. The output at 15 (A in Fig. 5) loads the pre-settable counters with the IF offset, and the pulse at 16 gates the prescaler output into these counters. The output of IC3b is used to blank the displays. These pulses are shown in Fig. 6.

COUNTING AND DISPLAY LOGIC

The circuit is shown in Fig. 7. ICs 8 to 11 are the decade counters which are cascaded by feeding the QD output to next clock input. Also QA is connected to CK2 of each counter to cascade the two halves of each IC. The most significant digit (100MHz) can only be 0 or 1 so a decade counter is not needed.

The data inputs A-D are either connected to ground or +5V depending on the value of the IF offset. This is loaded into the counters when the count/load inputs are low. The counter outputs are in BCD form so decoder/driver ICs are used to drive the seven-segment LED displays (IC13, 14 and 15). These provide high current output to drive LEDs, and blanking can be achieved by putting a logic low on the RBO pins. The 330Ω resistors between the decoders and the displays determine the LED current, and R31 sets the current for the decimal point. For LED1 (+ or − indicator) a different circuit is used. The arrangement of IC12a, 12b and 2e illuminates the horizontal bar of LED1 when the output of IC8 is 0, 1, 2, 8 or 9. The vertical bar is also illuminated when the count is 8 or 9 due to IC12c. If the count is 3, 4, 5, 6 or 7 neither bar is on and the display is blanked. LED5 only displays 1 if QD of IC11 is low. If the count is 80 or 90MHz then QD is high and LED5 is blanked. The display blanking pulse B is also applied to IC12c and IC3d to blank LED1 and 5 during counting.

The capacitors C14-20 are to decouple the power supply. This is important because of the high edge speeds of the counting logic.

In Part 2 the power supply circuit is described and construction details and setting up procedure are given.

OUR "CQ" COLUMN

On page 603 of this issue, we have some CQ requests for back-numbers. **Please help us to help you,** if you want a "CQ" published, and you can do that by following the style on page 603 when you write to us. Please keep CQ's as short as possible.

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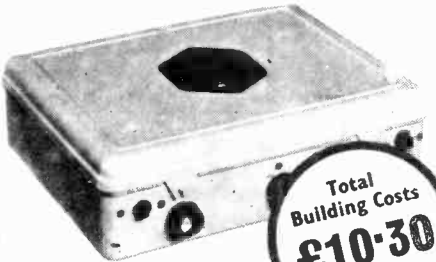

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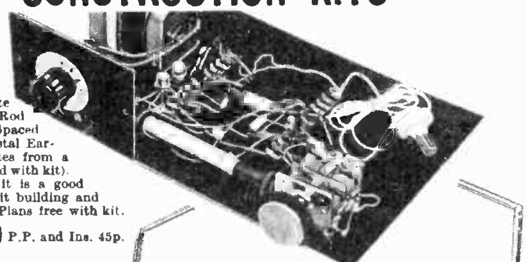
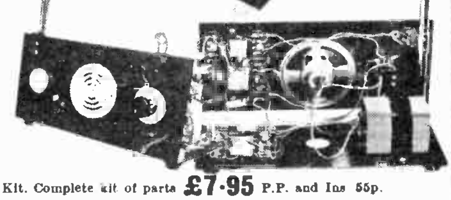
ECK 1



3 Transistor Easy Stage Earpiece Receiver Kit. Full Medium Wave Coverage. Complete with Ready Wound Ferrite Rod Aerial, High Efficiency Air Spaced Tuning Capacitor. Sensitive Crystal Earpiece and Gain Control. Operates from a 9 Volt P.P. 7 Battery (not supplied with kit). This Electronic Construction Kit is a good starter for those interested in kit building and soldering. Parts Price List and Plans free with kit.

Complete kit of Parts **£450** P.P. and Ins. 45p.

ECK 2

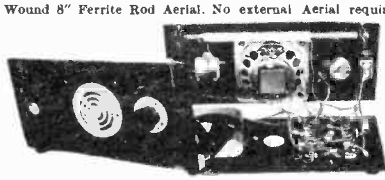


Self Contained Multi-Band V.H.F. Receiver Kit. 8 Transistors and 3 Diodes. Push/Pull Output. 3" Loudspeaker, Gain Control. Superb 9 section swivel ratchet and retractable chrome plated telescopic aerial, V.H.F. Tuning Capacitor, Resistors, Capacitors, Transistors, etc. Will receive (subject to local reception Conditions) T.V. Sound, Public Service Band, Aircraft, V.H.F. Local Stations, etc. Operates from a 9 Volt P.P.7 Battery (not supplied with kit)

Parts Price List and Plans supplied free with Kit. Complete kit of parts **£7·95** P.P. and Ins 55p.

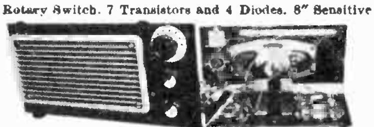
ECK 3

5 Transistor Medium Wave Receiver Kit. Class "A" Output with 3½" Loudspeaker. Simple to operate with full Medium Wave Coverage. Ready Wound 8" Ferrite Rod Aerial. No external Aerial required. 7 stages, 5 Transistors and 2 Diodes, Tuning Capacitor, Gain Control, etc. Operates from a 4½ Volt Battery (not supplied) Parts Price List and Plans free with kit. Complete kit of parts. **£5·40** P.P. and Ins. 45p.

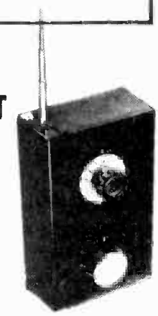


ECK 4

7 Transistors, 6 tuneable wavebands, MW, LW, Trawler Band, 3 Short Wave Bands, Receiver Kit. With 5" × 3" Loudspeaker. Push/Pull output stage, Gain Control, and Rotary Switch. 7 Transistors and 4 Diodes. 8" Sensitive Ready Wound Ferrite Rod Aerial, Tuning Capacitor Resistors, Capacitors, etc. Operates from a 9 Volt P.P. 7 Battery (not supplied with kit). Parts Price List and Plans supplied free with kit. Complete kit of parts. **£7·25** P.P. and Ins. 55p.



VHF AIR CONVERTER KIT



Build this Converter Kit and Receive the Aircraft Band by placing it by the side of a radio tuned to Medium Wave or the Long Wave Band and operating as shown in the instructions supplied free with all parts. Uses a Retractable Chrome plated Telescopic Aerial. Gain Control. V. H. F. Tuning Capacitor, Transistor, etc.

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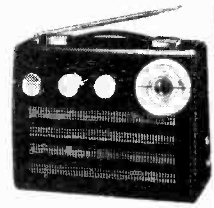
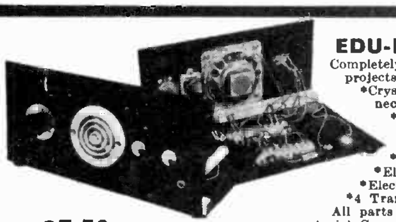


Total building costs **£11·87** P.P. and Ins. 65p.

RADIO EXCHANGE LTD.



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- *Electronic Noise Generator.
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- *4 Transistor Push/Pull Amplifier.

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¼	MF	10–2M7	2	1·7	1·4	1·2	3x7
½	MF	10–2M2	2	1·6	1·3	1·1	4·2x10·8
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10μF 25V	7p	220μF 63V	25p
10μF 63V	7p	330μF 16V	14p
15μF 16V	7p	330μF 63V	28p
15μF 63V	7p	470μF 6·4	8p
16μF 40V	7p	470μF 40V	25p
22μF 25V	7p	680μF 16V	17p
22μF 63V	7p	680μF 40V	28p
32μF 10V	7p	1000μF 16V	25p
33μF 16V	7p	1000μF 25V	28p
33μF 40V	7p	1500μF 6·4V	17p
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Accuracy—5% of F.S.D.
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U4323

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Iac—0·3—300mA in 4 ranges.
Resistance—2KΩ—2MΩ in 4 ranges.
Accuracy—dc—2½%. ac—4% of F.S.D.
hfe—10—350 in 2 ranges.
Size—115 x 215 x 90mm.
Complete with steel carrying case, test leads, and battery.
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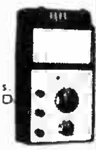

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Iac—0·3—3A in 5 ranges.
Resistance—25Ω—5MΩ in 5 ranges.
Accuracy—dc and R—2½% of F.S.D. ac and db—4% of F.S.D.
Size—167 x 98 x 63mm.
Supplied complete with storage case, test leads, spare diode, and battery.
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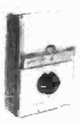

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Vac—1·5—600V in 9 ranges.
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Idc—0·6—1500mA in 6 ranges.
Iac—0·6—1500mA in 6 ranges.
Resistance—1KΩ—1MΩ in 4 ranges.
db scale—10 to +12db.
Accuracy—dc—1½%. ac—2½%
Size—115 x 215 x 90mm.
Complete with steel carrying case, test leads, and battery.
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U4313

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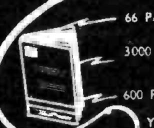

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HOTLINES ON RECENT DEVELOPMENTS

POWER

ON reading past Ginsberg articles it seems that the small, minute marvels have hogged the limelight, probably because they really are remarkable achievements. However, to redress the balance let us take a look at something a shade bigger. It concerns power, and the laser. The generation of power is a problem. Solar cells, wind-driven generators, mirrors which focus the sun's rays have all featured in the news.

Now it just so happens that if you take a very small amount of a material and compress it sufficiently it may just be possible to arrange pressures and densities high enough to support fusion—when lighter atoms get together to form heavy ones and when they do, they give off energy which might be harnessed.

Experts claim that a tiny pellet of deuterium and tritium can, with the aid of a quick pulse from a 1MJ (one mega-joule) laser, be compressed by a factor of up to 10,000.

Another approach finds workers constructing a kind of ring arrangement in which electron beams are individually concentrated on a single pellet of material in the centre. Certainly on the drawing board stage (at least) is such a beasty which treats said pellet to a burst of electron beams whose total combined power amounts to some $2\frac{1}{2}$ trillion Watts (that's $2{\cdot}5\times10^{12}$ Watts).

Just to complete the story, capacitors are used as a means of storing energy for the system. Two banks are employed and each consists of 38, 60kV, $1{\cdot}85\mu F$ capacitors. Oil dielectric transmission lines are employed and these are housed in a tank of transformer oil—40,000 gallons of it!

A final piece of news on the subject is that one particular machine under development produces a 10ns pulse of 40 trillion Watts.

27MHz

If you've ever tuned a radio receiver to around 27MHz you may well have picked up a weird cacophony of callsigns and titles not to mention some very strange conversations. Almost certainly you will have been listening in to conversations on the American "Citizens Band". Although power is (in theory) limited, no formal exams are required in order that one might transmit. Note; this is in America and does NOT apply in the UK.

While the Citizens Band has been a source of debate for some time, a new idea has surfaced and looks like being a 'winner'. The thought is that a particular frequency or channel within the Citizens Band should be an emergency channel. This allows anybody and everybody to have a Citizens Band hand-held transceiver (walkie talkie) in, say, their car. Any accident could be immediately reported and a request for assistance would be almost instantaneous. One voluntary network has already sprouted up in Ohio and others could follow.

It occurs to me that old people living alone could easily have immediate access to help from the outside world. Mountain climbers etc. could also find the system of use. It is almost certain that the scheme would not be permitted in the UK due mainly to the stringent Post Office/Home Office regulations concerning the radiation of energy, a point on which they are quite fussy to say the least. Quick, check the radiation from the local oscillator of your broadcast receiver. And what about those TV timebases?

Speaking of TV reminds me that the central research laboratory of Japanese giant Hitachi has been working on a video disc player using the optical approach. Some half hour recording of colour pictures and sound has been recorded on a 12in. disc. Luminance, chrominance and sound are contained in the 54,000 holograms on the disc each hologram being only one millimetre in diameter. So densely is the information stored that the disc needs to rotate at only 6 r.p.m. It is interesting to note that in systems employed by two other major manufacturers, the discs rotate at 1,800 r.p.m.

BLIMPS ARE COMING

Look out—the Blimps are coming. They may sound like a second class limp but in reality they are huge balloons which are floated up to a certain altitude (around 10,000ft.) and then tethered. The Blimps have with them a large antenna and transceiving equipment. The idea is that it's cheaper to have a balloon that it is to have a satellite in order to transmit and receive information over greater distances, particularly at the very high frequencies. No, it's not hot air, even the American military is increasing its interest in balloon borne radar. Makes you wonder about Amateur radio Hams' reaction. Perhaps Lisle Street will soon be selling Ex. Govt. barrage balloons. What better for portable stations—with a high wind it could get them off to a good start and raise them in the eyes of others!

RAZOR-SHARP TIME-KEEPING

News from abroad informs that there's a newcomer on the digital watch scene—Gillette, the company of razor fame. A research and development agreement has been signed between Gillette and some American electronics companies for carrying out investigations in the field of quartz modules for digital watches.

"MESFETS"

Another newcomer, this time to the semiconductor scene, is a device called the MESFET. Adding another S after the first would be a fair word for some early Ginsberg experiments with FETS! For the technically oriented, these devices are described as Schottky-barrier field-effect transistors. Efficiencies of 68% at 4GHz and over 40% at 8GHz have been claimed so clearly they're not just a pretty face. I hope to have more information shortly on these devices.

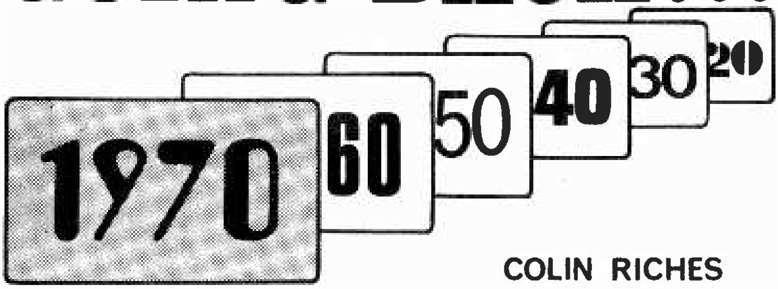
"SAWS"

When one talks about crystal oscillators it's usually about a bulk crystal—a chunk of crystal between two supports. Generally, the higher the frequency, the smaller (and often thinner) the piece of crystal is. There is a limit to how small and fragile one can make a crystal of this kind which is why fundamental frequencies are commonly no higher than 25MHz.

Marconi Research Laboratory has developed the SAW (surface acoustic wave) technology to a point where it can manufacture a compact and rugged crystal oscillator with a fundamental frequency of $1{\cdot}2$GHz.

Ginsberg

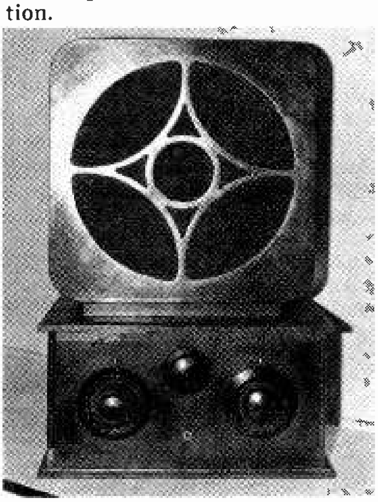
GOING BACK...



COLIN RICHES

Anyone help?

MR. H. F. Mayman of 59 Delamere Street, Crewe, Cheshire has recently come across this interesting receiver, complete with speaker, and wonders if any other readers can help him with more information.



Apparently, the set was purchased in Crewe many years ago. It carries only a dealer's name and no details of a manufacturer. Valves are 2×PM2 and 1×PM1LF. The loudspeaker is simply marked "Blue Spot."

New books

ADAM Hilger Limited, publishers, 29 King Street, London, WC2E 8JH, have recently announced the first three volumes of a set of books entitled "The Story of Radio" by W. M. Dalton, Ch.Eng., M.I.E.R.E.

Volume 1 "How Radio Began" covers the basics from early experiments with electricity and magnetism. An interesting chapter on Wireless Telegraphy describes experiments and discoveries by such pioneers as Clark Maxwell, Hertz and Marconi. A chapter headed The Thermionic Valve contains items on the Edison Effect, Audion Tube, and early valve circuits.

Vol. 2, "Everyone an Amateur" begins the story after World War 1; and contains sections on the British Broadcasting Company and the Rediscovery of Short Waves.

It tells how during the early years of peace after the First World War, the seepage of official information and the knowledge of wartime developments brought home by ex-service men led to an enthusiasm for radio fostered almost entirely by amateurs. They built their own transmitting stations and receivers, compelled Governments to provide public broadcasting services, and eventually astounded the world by their unaided achievements in long distance low-power short-wave communication. This second volume of Mr. Dalton's comprehensive history pays tribute to these devoted pioneers and, in recounting the birth-pangs of the British Broadcasting Company, tells how Everyman carried on building his own receiver in a craze from which, Mr. Dalton has said, 'a few of us never quite recovered.'

Vol. 3, "The World Starts to Listen" takes the story a little further: by the mid-twenties, the early amateurs were ready to turn professional, the world was ready to buy their sets. The B.B.C. had become a Corporation—and respectable—and people had started to listen to its programmes in preference to twiddling dials in a search for distant stations; and so the quality of broadcast sound improved. Valves were already being applied in many other fields, but they were still battery operated. Mr. Dalton thus continues his step-by-step story of the development of radio.

These books are very interesting but also very expensive, for they are priced at £4·50 each volume. It's a pity because I feel that this is a text which has been needed for a long time now. Still, with inflation roaring ahead £4·50 will be the price of half a dozen resistors soon so . . .

Cassette History

SOME while ago I gave mention to the double LP set that the BBC issued to mark 50 years of broadcasting. Well, now they've issued the complete recording on cassette. It's entitled "BBC 1922-1972, 50 Years' of Broadcasting", and comes as a double-play cassette No. HRMC 050.

The tracks are produced by Alan Burgess and narrated by

Rene Cutforth and endeavour to recapture in a hundred minutes many great occasions at home and abroad and people whose voices became known through the medium of 50 years of BBC Radio. Broadcasting pioneers such as Lord Reith and Peter Eckersley can be heard as well as the first Christmas broadcast by King George V and historic broadcasts by famous wartime announcers. The tape also reflects musical events over the years from Twenties syncopation to The Beatles. Please don't try to obtain it from the BBC because they don't have a sales department for records and cassettes, but contact your local record shop. They're sure to be able to get one for you.

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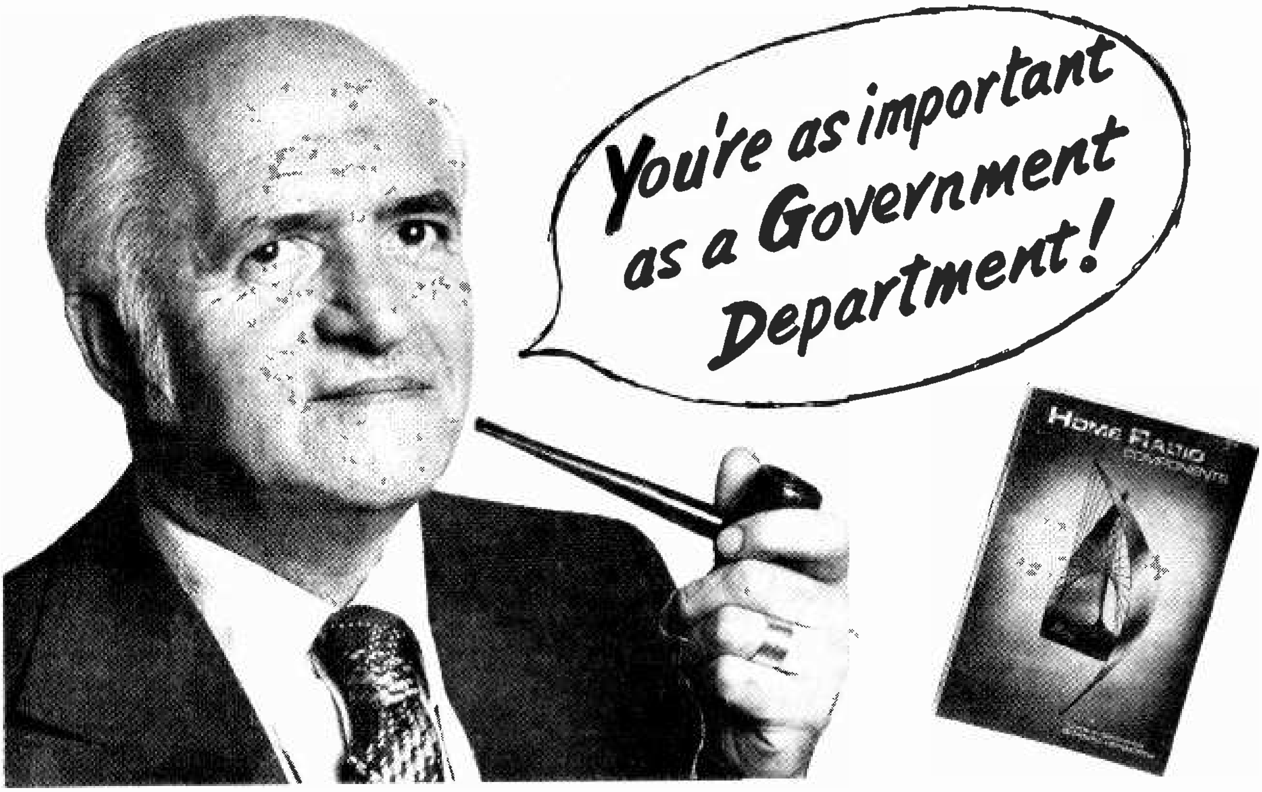

. . . . at least, to Home Radio Components you are. I'm thinking of their Credit Account Service. They have of course always run accounts for supplying firms, colleges and Government Departments, but for years it was impractical to provide the same facilities for individuals. However, Home Radio Components have always looked upon their smallest customers just as important as their biggest, and after much thought and planning they devised a Deposit Credit Account matched to the needs of the small individual buyer.

The service is very convenient in many ways. For instance, thanks to their answerphone service exclusively for the use of Credit Account customers, you can take advantage of the cheap phone rates after 6pm week-nights and any time Saturday and Sunday. You not only save money, but you can often get your components much quicker. Briefly, the Credit Account Service works like this—you pay a deposit (*you* choose the amount) and you immediately get credit for *double* that amount. Home Radio then send you special order forms and pre-paid envelopes, and advise you each month how much you have spent. You save quite a bit on postage costs, and having to draw only one cheque or P.O. a month makes quite a worthwhile additional saving. No wonder nearly 1000 customers are already using this service. Why not join them and save yourself money and frustration? First you will need the Home Radio Components catalogue. No constructor should be without one! For a book having 240 pages, listing about 6000 components, illustrating nearly 2000, the price of 85p is modest indeed. True, postage and packing adds another 33p, but every catalogue contains vouchers to the value of 70p when used against orders.

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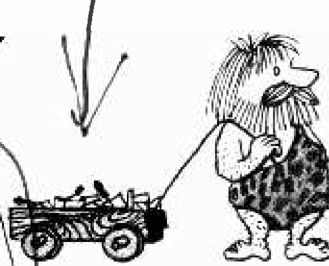

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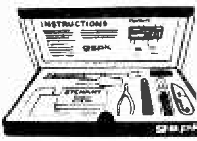

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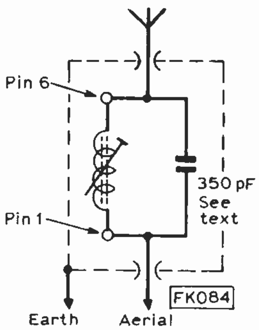


Adjustment of the core in the coil will also extend the range over which the trap will tune. For best rejection of an unwanted signal aim for minimum capacity and maximum inductance (core within the coil), provided the trap still shows a sharp point of rejection.

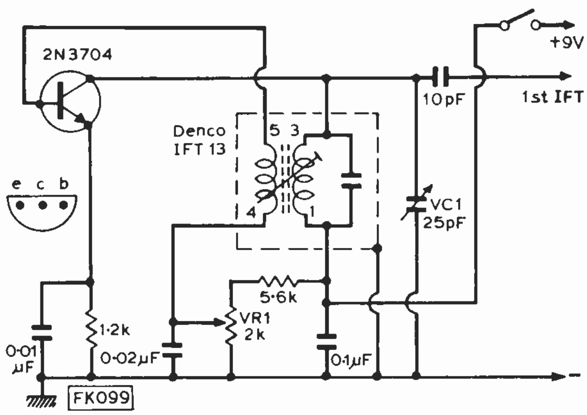
The trap must be connected as close as possible to the receivers aerial and earth terminals if it is to be effective.

'Q'—MULTIPLIER

A circuit having a high "Q" tunes more sharply, and is thus more selective, than one with a lower "Q". The "Q"-multiplier uses a regenerative stage to enhance the "Q" of a coil tuned to the receiver's intermediate frequency.

Potentiometer VR1 controls regeneration but the circuit should not be allowed to oscillate. Variable capacitor VC1 allows the multiplier frequency to be moved across the receiver's IF passband. In use a "Q"-multiplier is sometimes considered difficult to adjust which probably explains why it is not used more often, but, properly set up, it affords a very economic way of providing a substantial increase in IF selectivity.

The output coupling capacitor is connected to the primary of the first IFT of the receiver, to the "hot" end of the coil and not a tapping. The multiplier should be placed as near as possible to this IFT. The coil core is set so that it tunes to the receiver's IF, around 465kHz, with VC1 half way in. Realignment of the particular IFT may be needed on some sets. Potentiometer VR1 is set so that the multiplier is almost oscillating, equivalent to the point of maximum selectivity.



If a particular transistor does not oscillate smoothly reduce the battery voltage or include a resistor of between 100Ω and 1kΩ in series with the switch. The unit can be built in a metal box external to the receiver but the output lead must then be coaxial cable, as short as possible, with the outer screen earthed. The output capacitor should now be placed at the IFT in the receiver.

EXTERNAL AERIAL COUPLING

An external aerial will considerably increase the range of a portable type radio or allow it to be used in circumstances where the internal ferrite rod aerial is unsuitable, such as in a vehicle where the bodywork acts as a screen.

The external aerial is connected to a coupling coil added to the ferrite rod. The winding should be about 35 turns of 36SWG insulated copper wire but neither the number of turns nor the wire gauge are at all important. "Earth" in the circuit is the chassis of the receiver.

A short coaxial cable should be used to connect the external aerial to the receiver in a vehicle, to reduce electrical interference. But do not use screened cable as part of the aerial when the aerial is being added to increase range.

A capacitor C1 can be used as an alternative to

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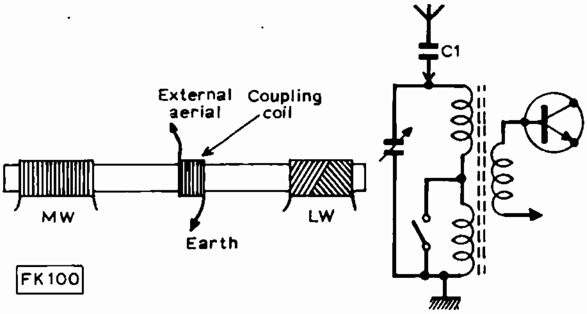
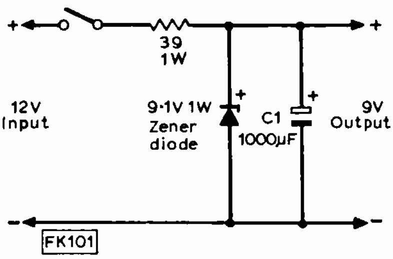


the coupling coil but its value must be kept low or it will detune the receiver's aerial circuit. A trimmer capacitor of a maximum value of about 15pF can be tried. If the receiver has an aerial circuit trimmer control this can be used to maintain correct tuning when an external aerial is connected via C1.

9V FROM 12V

If a 9V battery-operated receiver is frequently used in a vehicle it is more economical to use the vehicle's 12V battery than to replace the dry batteries. With the zener diode the output voltage is substantially constant despite the changes in current drawn by the radio.

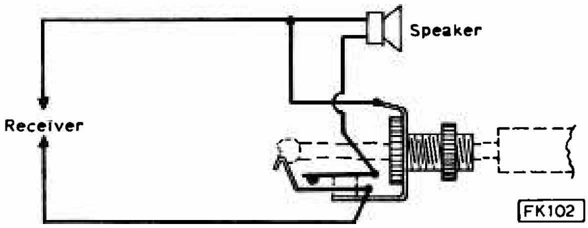


Capacitor C1 should be as large a value as possible with 1000μF as a minimum. The 12V supply can be found at several places in a vehicle but choose one that gives a minimum of electrical noise in the receiver. If the parts are fitted in a box with dry battery terminals on the outside no changes need be made to the receiver which can be plugged in at any time. The terminals can be taken from the top of a defunct battery but be careful to observe the correct polarity.

HEADPHONE SOCKET

This simple modification involves fitting a suitable socket to a receiver to take a headset or earpiece. The circuit is arranged so that the speaker is cut out when the headset is plugged in to the socket. If the receiver's speaker is around 15 to 80Ω the usual low impedance headset will function without any trouble. If the output impedance is low, 3Ω or so, the load can be maintained by wiring a resistance or say 3·3Ω across the headset, It can be fitted inside the headset plug in some cases.

The socket should be suitable for the headphone plug, normally 2·5mm or 3·5mm or ¼in. in diameter,



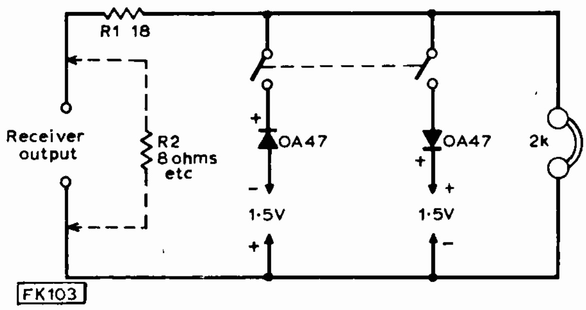
but there is no reason why different sizes should not be connected in parallel to accommodate different headsets or earpieces.

This modification must **NOT** be made to TV equipment, where the chassis is generally alive.

NOISE LIMITER

This small unit prevents sudden and uncomfortable bursts of noise or signal reaching the speaker or headset. It is particularly effective when the receiver is being operated at maximum gain on a weak signal. The diodes, which must be germanium types, shunt strong signals but leave weak signals unaffected.

Values shown are for output circuits of around 15 to 80Ω, but for higher values increase R1 to suit. If a lower impedance load must be maintained, wire a suitable value resistor, such as 3 or 8Ω, across the unit's input, shown dotted.



Headphones of 2kΩ impedance or higher are best for this particular circuit when the limiting voltage is comparatively low. The single cells can be replaced with resistors of about 5·6Ω with only a slight loss of limiting action. In this case no switches are needed. The components can be fitted into a small box with a lead and plug at one end and socket at the other. Alternatively the limiter can be wired round the receiver's output socket or terminals.

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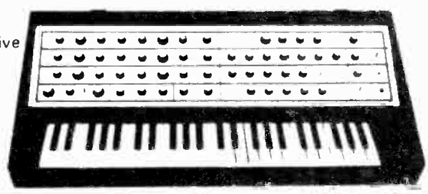

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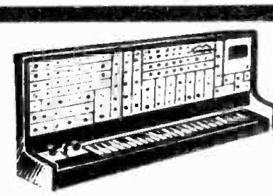
The 4600 SYNTHESISER



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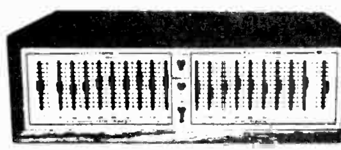

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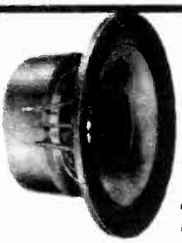

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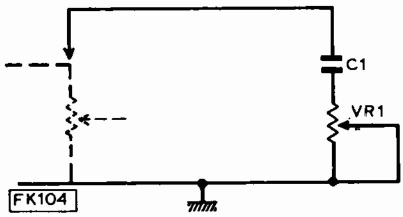
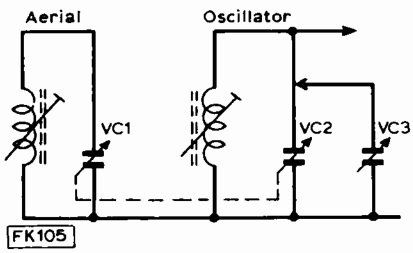


5kΩ potentiometer for VR1 in the case of transistorised receivers, and 0·02μF to 0·05μF with 25kΩ to 50kΩ for VR1 for high impedance circuits, such as are found in valved receivers. The connection is made to the top of the audio gain control but a tone control of this type must not be used in that part of a receiver in which negative feedback is already incorporated.

BANDSPREADING

Bandspreading is very effective at alleviating the critical tuning that is often experienced on the short wave bands. In a simple superhet receiver the aerial and oscillator circuits are tuned by a two-gang variable capacitor VC1/VC2. Simple bandspreading consists of adding a small value variable capacitor VC3 in parallel with the oscillator section VC2. VC3 is typically 5pF, mounted at a convenient point on the front panel and fitted with a slow-motion drive.



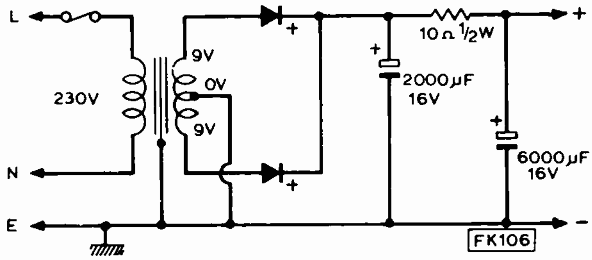
A capacitor similar to VC3, and ganged with it, can be connected in parallel with VC1 to maintain alignment of the aerial circuit but problems of tracking arise, especially if the receiver is band-switched, so VC3 alone is advised.

The degree of bandspreading achieved by VC3 will depend on the frequency involved and the ratio of VC3 to the value of VC2 at any point on the dial. At low frequencies VC3 can be increased to 15 or 25pF.

9V DC MAINS UNIT

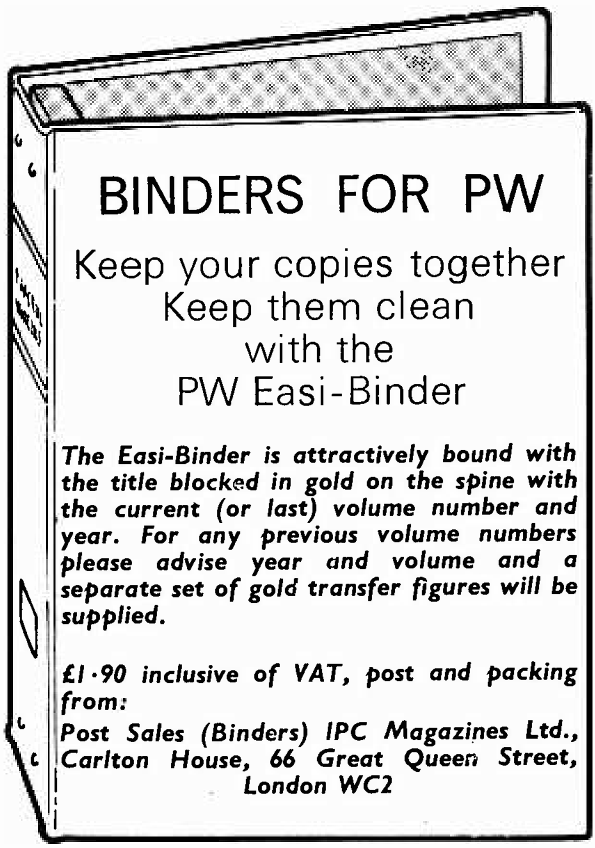
This circuit will provide 9V DC to replace the batteries in transistor radios and similar equipment. A transformer with a secondary of 9-0-9V at 100mA should be sufficient for most purposes. The silicon diodes should have a minimum PIV rating of 50V. Those in the 1N4000 range are suitable.

Output voltage will depend to some extent on the current drawn by the external load but small variations are not usually of much importance with the average receiver. A zener diode could be added to stabilise the output voltage at a particular value.



The core of the transformer should be earthed, as well as the secondary centre tap, and a fuse in the mains supply is highly desirable. If the mains hum level is objectionable, in spite of the large value of smoothing capacitors used in this circuit, try fitting two capacitors, in parallel across the mains input, between fuse and transformer primary. The junction of these diodes should then be taken down to earth. The capacitors should be about 0·1μF each rated at NOT LESS than 750V working. Ensure the unit is disconnected from the mains before trying out this modification.

If an output of opposite polarity is required then reverse the diodes and the electrolytic capacitors.



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IMPROVE YOUR BUDGET STEREO SYSTEM

PART 2

B. BARNARD

READERS who have followed me so far will remember that we have replaced the ceramic pickup with a magnetic one (at the same time, of course, taking out any tone compensating components such as resistors in series or parallel with the pickup), constructed and fitted a preamplifier with its own power pack and have dealt with the problem of mains hum induced into the windings of the magnetic cartridge.

The result is very greatly improved reproduction of gramophone records over the treble range but distressingly "boomy" bass. This poor quality in the bass region is almost sure to be due to shortcomings in the design and construction of the loudspeakers but, before starting on this problem, it is probable that some tidying up is necessary on the work already done.

The first point is in the form of a warning; some makes of integrated circuit used in the preamp are very noisy in operation and for this reason I do not advise buying unknown makes over the counter on the assurance that they are "just as good"—they may be, but it is expensive to find out that they are not. Buy any of the well-known makes and be safe!

'TIZZY' SOUND

After playing several records on my own budget stereo after modification, I became aware of a "tizzy" sound whenever I touched the pickup arm, and, at the same time, I noticed an alarming increase in the pops and bangs whenever our refrigerator or central heating cut in or out. Since this followed the work I had done, it seemed very sensible to examine very closely the earthing arrangements on the input side of the new preamplifiers. In the original arrangement with the ceramic cartridge, the braided earth sleeve of the cartridge leads terminated on a tagboard on the underside of the Garrard deck and from this point another screened lead took over and fed the signal to the first stage of the main amplifier. This is the usual arrangement and is normally perfectly satisfactory. However when the additional amplifier is added with its high gain it may not be, and it certainly was not in the case of my own set-up!

I found it necessary to connect the braid at the tagboard direct to the record deck, which is itself connected direct to chassis by a separate lead from the motor terminal board. This, of course, gives a perfect "hum loop" situation but in this case it did not produce any hum. So that is how I have left it but I feel fairly sure that this will not be the solution in all cases and it may be found necessary to carry out a good deal of patient work on the earthing arrangements before a satisfactory solution is found. However, in my case the live condition of the pickup arm was completely overcome and the pops and bangs reduced to minor proportions

I had to do a lot more work to remove this annoying impulse interference altogether. This applies to a great deal of audio equipment and has been covered in many articles and books. I will not repeat it in this article but content myself by saying that you will probably use quite a few $0{\cdot}01\mu F$ capacitors before you eliminate it completely!

IMPROVING THE LOUDSPEAKERS

The obvious and major criticism of the sound quality from the system so far is loud resonant one-note bass. Any hi-fi expert will tell you that anything on the price of a loudspeaker over £30 has been spent on improving the sound below 50Hz. As our purpose is to spend as little money as possible, it is quite obvious some compromise is essential.

When you remove the back from the budget loudspeaker, do not expect to find much sophistication, it is likely to be basic though fundamentally good value. In my own case, the speaker cabinets were approximately $18 \times 13\frac{1}{2} \times 7\frac{1}{4}$in. deep. This is rather larger than the average and gives a cubic capacity of about 1760in.^{3}, very suitable for an 8in. speaker when the cabinet is totally enclosed. Inside were two units, an 8in. general-purpose speaker and a cone tweeter. Neither unit was very robustly constructed. The tweeter was fed by a $4\mu F$ electrolytic capacitor, there being no crossover unit apart from this.

The inside of the cabinet was bare wood but the cabinet back was lined with a thick covering of foam plastic. The only surprise was a 2in. diameter hole in the front (in addition of course to those for the speakers) through which I assume the bass from inside the cabinet joined that from outside, hopefully in phase, thereby increasing the acoustic efficiency considerably in the lower region. With this arrangement it is not surprising that the modest rated 6W of audio was enough for the noisiest of teenage parties!

AIR TIGHT

The enclosures were constructed from chipboard and close examination of the edges at the back showed a lot of gaps which suggested to me that the quality of board left a good deal to be desired from a hi-fi point of view. Nevertheless, the general construction was solid enough and the backs fitted

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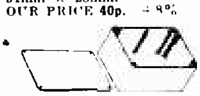

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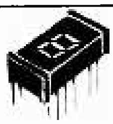

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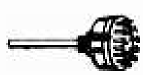

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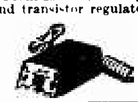

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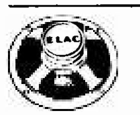

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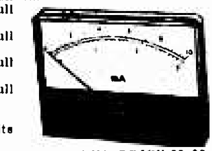

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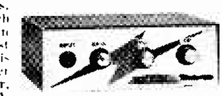

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tightly and securely. The result of all this examination immediately explained the loud and poor quality bass since the cones of the two 8in. speakers had no mechanical damping at all and, once set in motion by a low frequency signal, were free to carry on moving at their resonant frequency for an appreciable time after the signal had stopped.

The only and rather obvious answer to the problem was to set about making the cabinets *enclosures* in the proper meaning of the word, that is to say, make them as air-tight as possible so that the cone movements would be restricted by air pressure. This is, of course, the principle of the "infinite baffle" and most of the smaller good quality speakers are designed on this principle. The first job therefore was to block the unused hole in the cabinet front with a piece of good quality chipboard or 5-ply which was glued and screwed into position.

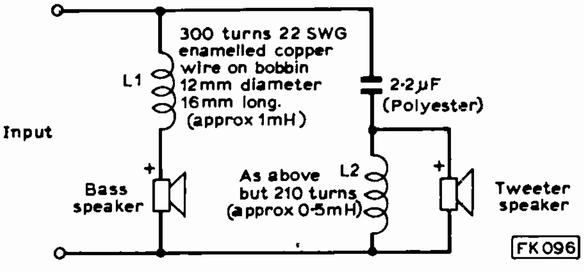

Fig. 1: Circuit details of the cross-over unit. Care should be taken in the winding of the coils, to ensure that the units for both channels are exactly the same.

CROSSOVER UNITS

The first major item of expenditure is a pair of crossover units which I believe are essential. The actual crossover frequency in this application is not critical and anything in the region of 3kHz will be suitable. Shopping around will most likely find a pair for less than £5 but for those who prefer to make their own, and do not mind tedious coil winding, Fig. 1 gives constructional and wiring details. Care must be exercised in connecting these to ensure that both follow the same wiring pattern so that problems do not arise later in getting both loudspeaker systems to operate in phase. Most speaker units have one tag marked with a red dot and if this is connected through the crossover unit to the live speaker lead in both cases, all will be well.

The next job was to line the interior of both cabinets with some soft sound-absorbing material. A good look around the household will usually reveal something suitable which will avoid dipping into the pocketbook. I found some surplus carpet underfelt of the rubberised variety and this is very suitable. Avoid very thick and heavy materials for, although they absorb sound, they also tend to reduce the effective cabinet volume which is undesirable. The material is fixed in place with small tacks and a little glue in strategic places. The photograph shows the interior of one cabinet after this treatment with the crossover unit in position. This photo also shows two other items not yet dealt with. Fixed to the back is a 50Ω wirewound potentiometer and the cone tweeter has been replaced by a superior dome type.

After completing the work and testing for several weeks, although the results were very pleasing, I decided to extend the frequency response in an upward direction and to improve sound dispersion and thus the stereo effect. To do this I bought a pair of good quality dome tweeters (about £6 each). This certainly had the desired effect but I found that the new tweeters were very efficient and, since all the work I had done had tended to reduce the efficiency of the 8in. speakers, the overall effect was out of balance and the tweeters tended to predominate. For this reason, the 50Ω 3W potentiometers are fitted and they are, in effect, volume controls for the tweeters enabling the required balance to be obtained while playing programme material, Fig. 2.

VACANT SPACES

The last job in improving the speakers is to fill in the vacant spaces around the speaker units with more sound-absorbing material. For this, underfelt and similar material is not suitable as it is much too dense. The recommended material is BAF wadding which can be bought from most hi-fi shops for about 80p per sq. yd. I experimented with ordinary domestic cotton wool and found it very effective in this application, readily available in rolls about 12in. wide. It should be very carefully unrolled without teasing it out and then cut to suitable lengths. For my cabinets I inserted two pieces, 18in. long very *loosely* rolled, each side of the 8in. units. A shorter piece similarly rolled fills the spaces above the big speakers and behind the tweeters. The object is to replace some of the air in the enclosure with the wool but not to introduce a solid substance which would effectively reduce the enclosure capacity. For larger or smaller cabinets the actual quantity of BAF wadding or wool must be found by trial and error, too much will have the effect of killing the bass response but the correct amount removes all traces of any unpleasant "boxy" tone.

We are now at the stage where we can replace the backs on to the enclosures and our aim is to make them airtight so as to put a brake on those bouncing cones, so the backs must fit well and be screwed down tight. Pay particular attention to the holes through which the leads are taken as it may be necessary to fill these with putty or some similar substance in order to avoid large air leaks.

By the way, when I say "airtight" I do not mean this too literally! There has to be some escape of pressure or the cones would never be able to move at all. So some leakage is essential and this is almost certain to take place through the gap between the speech coil and polepiece and it is also doubtful if the cone suspension is completely airtight in units of this quality. So in making the enclosure and its

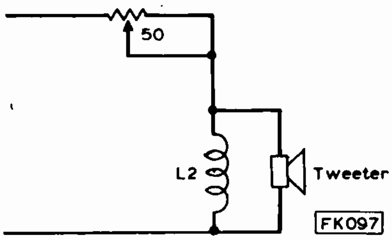

Fig. 2: 50Ω3W potentiometer shown in-circuit, to provide some control over the tweeters.

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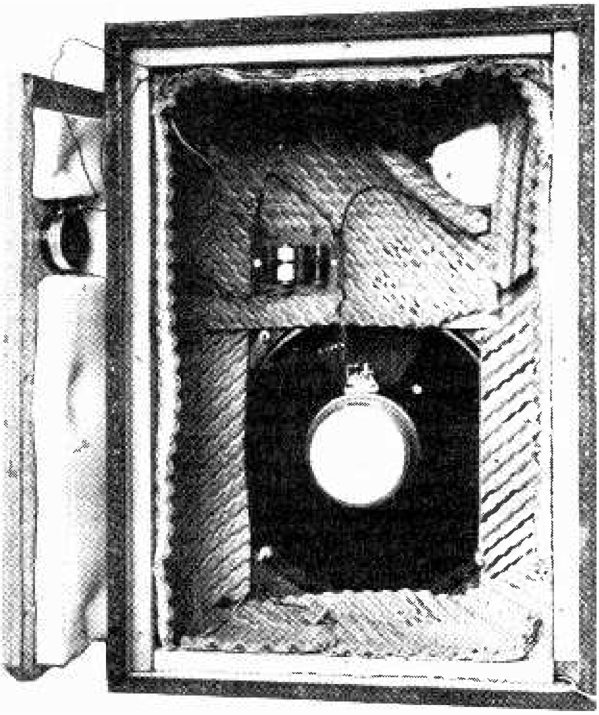


Interior view of the speaker enclosure, showing the rubberised carpet underlay fixed in position. The vacant space should now be filled with BAF wadding.

back as airtight as possible you are very unlikely to overdo it.

The two enclosures (we are fully entitled to call them that) can now be tested out on a signal. It will be obvious that the efficiency has been reduced in the middle and bass areas so the volume control will be further advanced than before this work was done. But the quality of sound should be immensely improved. The bass in particular will be "tight" and musical and it should be possible to advance the bass boost much further than before whilst still maintaining good tonal balance and really pleasant quality.

I believe the foregoing lines of attack will apply with great benefit to almost all budget loudspeakers. It is necessary before starting any work to assess very carefully the shortcomings of the speakers as supplied and to decide what improvements are required and then to examine the interior of the cabinets and the unit or units to decide what work is likely to be most beneficial. This will always reveal problems in the bass area no matter what else and the first answer to this is always cone damping. This inspection must also cover close examination of the cabinets themselves; if the construction seems weak and they sound hollow when tapped with a metal object, it may be necessary to fit wood struts in strategic places to make sure they will not rattle or resonate of their own accord.

FITTING A TUNING METER

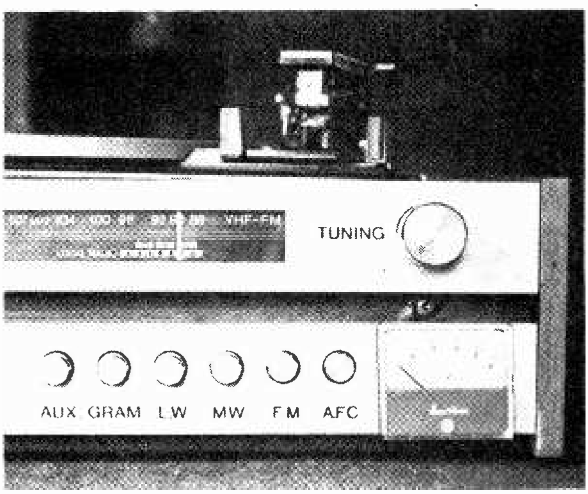
Few budget stereos run to a tuning meter, but they nearly all have an AFC circuit which is intended automatically to adjust for any minor tuning errors and to correct any tendency to drift in the RF oscillator. A reliable tuning indicator which shows when the tuning point of minimum distortion and minimum background noise is found is almost essential to anyone who takes his music seriously.

The circuit arrangements for a meter which peaks at the exact tuning point are very simple. A moving coil meter with FSD of about 100μA connected with about 30 to 40kΩ in series is connected across the large electrolytic in the discriminator circuit. These meters are expensive to buy especially if you want to pick one that fits nicely with the styling of your system. I had a very elegant meter which exactly suited the styling of my unit audio but it required 1mA for FSD. We cannot use such a meter across the discriminator as it has an internal resistance of only 50Ω or so. The answer is to arrange the meter to be in circuit only when tuning and to remove it while we are listening.

One way is to fit a small press-button switch which brings the meter into circuit when made but disconnects it when open. This button is pressed when changing stations, the tuning adjusted until the meter peaks and the button then released, restoring the circuit to normal.

SPACE CONTACTS

Examination of the AFC switch revealed a pair of unused contacts. The usual arrangement is a simple make-and-break single pole switch which joins the AFC line to chassis when it is disabled but since manufacturers of budget stereo seldom design special switches for such a simple function it is very likely that you will find at least one pair of unused contacts which can be used to switch the meter in and out. The position then is that we disable the AFC when we want to tune and then tune for peak reading on the meter. After this we return to the AFC position, leaving the AFC diode to take care of any oscillator drift, the meter remaining out of circuit until we want to change stations.



The photograph above shows the meter fitted on my budget stereo alongside the AFC switch which controls it. It works extremely well and I get dead accurate tuning every time. I had to experiment with various values of resistance in series with the meter and finally fixed on 6·8kΩ which gives between half and three-quarter scale reading on an 800μV signal at my aerial. By a slight circuit modifi-

continued on page **604**

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TV SOUND T

Alan C. AINSLIE

THE transmitted sound quality of television is inherently very high, but due to severe limitations in the audio side of domestic TV receivers, it is rarely heard at its best. This article describes a high performance TV Sound Tuner for feeding into a hi-fi system or tape recorder, enabling full benefit to be gained from the broadcast.

Up-to-date techniques have been used to provide push button varicap tuning and high sensitivity. Three integrated circuits are used and a ceramic filter with quadrature detector ensures easy setting up without instruments.

TV SYSTEM

Television in Britain is transmitted on 625 lines with a line rate of 15·625kHz and 50Hz field rate. The video is transmitted as amplitude modulation of an RF carrier, while the sound channel is broadcast as frequency modulation of a sound carrier spaced 6MHz from the vision carrier. Fig. 1 shows a block diagram of the sound section of a TV receiver.

In all frequency changing operations in the receiver the sound carrier remains spaced 6MHz from the video. After final video detection the result at the output of the video detector is video and a 6MHz FM sound carrier, the vision carrier having been transferred to zero frequency. The audio is simply recovered from the FM carrier by frequency discrimination, using a conventional discriminator or the more recent "quadrature" detector.

CIRCUIT DESCRIPTION

The pre-assembled and aligned IF sub-assembly used in this project performs the function of IF amplifier, vision detector, 6MHz limiter amplifier and 6MHz quadrature discriminator.

The IF amplification and associated bandwidth shaping is performed in two Philips G8 colour receiver modules employing four transistors. The vision detector is included in the second module, giving video and 6MHz sound carrier at its output.

A 6MHz ceramic filter is used as a simple bandpass filter to remove the video and shape the characteristics of the following 6MHz amplifier.

Amplification at 6MHz is carried out in the TAA570 (or similar) IC, which also performs quadrature FM demodulation using only a single tuned circuit.

Fig. 2 shows the circuit diagram of the PW Sound Tuner.

The volume control is connected directly to the sub-assembly audio output and feeds Tr2, which is a simple emitter follower, to ensure that the TV Sound Tuner has a low output impedance. This enables long lengths of screened cable to be used on the output without any significant loss of treble.

The varicap tuner used in the prototype is the Mullard ELC1043, commonly used in contemporary

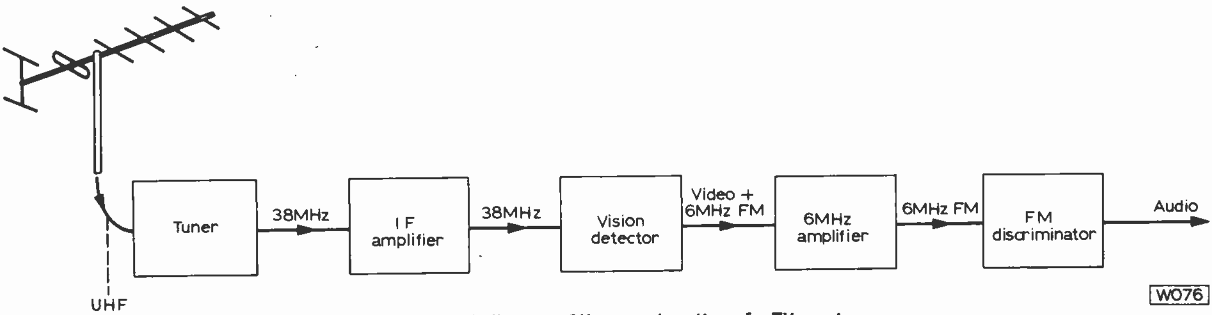

Fig. 1: Block diagram of the sound section of a TV receiver.

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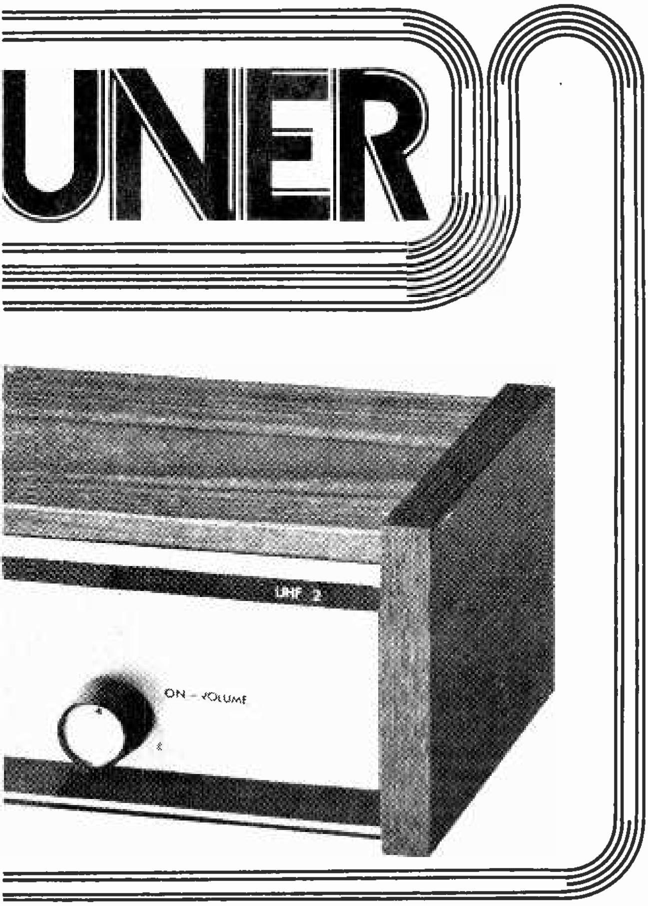

receivers and available at reasonable prices through surplus channels.

The ELC1043 has facilities for AGC but as it is not required in this unit, a potential divider, consisting of R10 and R9 connected across the supply, is used to bias the AGC terminal for optimum gain.

Power for the RF stages and oscillator is taken directly from the 12V supply to the sub-assembly.

To tune the ELC1043, a DC voltage variable between 0·3V and 30V is applied to the "tuning" terminal. This covers channels 21 to 68 for UHF reception. To achieve the necessary tuning resolution, multi-turn pots have to be used, in this case being neatly combined with the channel selection buttons in a commercial varicap push button control unit. These are available to give three, four, five or six preset channels and consist of the requisite number of preset pots connected across a stable 30V supply, with each wiper being selected by a push button and connected to the "tuning" terminal on the ELC1043. A small capacitor (C11) is used to remove any noise introduced by the tuning pots.

The IF output of the tuner feeds directly through a 1000pF capacitor into the first G8 module on the sub-assembly.

POWER SUPPLY

The mains transformer used in this project has two secondaries, one of 40V to feed the varicap diodes, and one of 12V for the IF sub-assembly, tuner and output emitter follower. The complete circuit of the power supply is shown in Fig. 2.

The 12V supply (actually adjusted to 11·5V) is obtained by full wave rectifying 12V AC from the transformer in a bridge made from D4 to D7, and smoothing with C4. Voltage regulation is necessary to prevent oscillator drift in the front end and is performed by IC2, a μA550 regulator package.

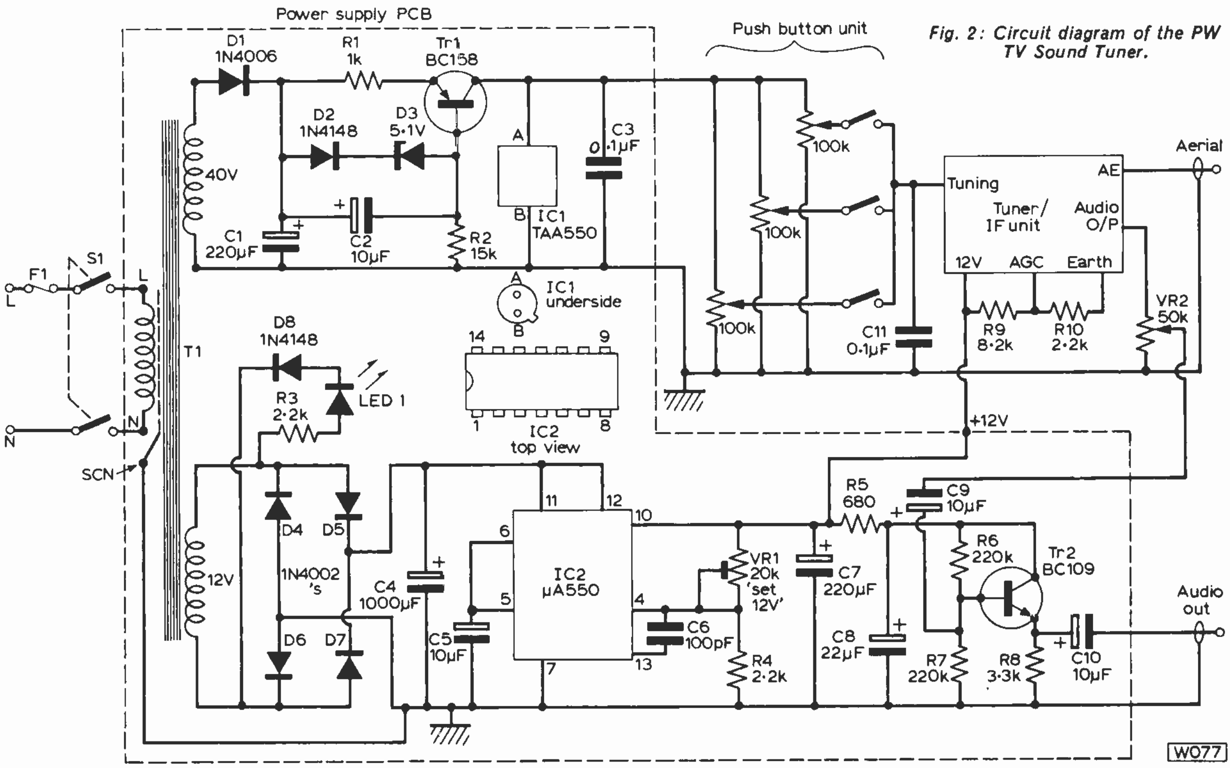

Fig. 2: Circuit diagram of the PW TV Sound Tuner.

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This device works by comparing a reference of 1·63V produced at pin 6 with a fraction of the output voltage on pin 10, determined by R4 and VR1. Pin 4, connected to the junction of R4/VR1, is the inverting input to the comparison amplifier and pin 5 is the non-inverting input (connected directly to the reference).

The regulator acts to maintain the voltage on pins 4 and 5 equal, ensuring that the output is constant. VR1 is variable so that the required 11·5V output may be precisely set.

Capacitor C5 is included to smooth the reference while C6 is high frequency compensation, necessary for stability.

30V SUPPLY

A very high degree of stabilisation is required for the 30V supply as a few tens of millivolts change would cause appreciable detuning. Conventionally, a TAA550 IC regulator is used to stabilise the varicap diode supply in receivers. This is a two terminal device which is connected as a Zener diode, but which has very good temperature stability.

Continuing the analogy with a Zener diode, the dynamic resistance is quite low at around 10Ω but to make this resistance totally negligible compared to the source resistance a constant current source has been adopted in this design to ensure excellent tuning stability even with large mains voltage changes.

Transistor Tr1 in conjunction with Zener D3 and R1 forms a 5mA constant current source, with temperature compensation of Tr1 V_{be} provided by D2 (D3 with a Zener voltage of 5·1V would have a virtually zero temperature coefficient).

The varicap control unit is connected directly across the TAA550 and drains little current as each tuning pot is 100Ω. However, should a five or six button unit be used, R1 should be reduced to 820Ω to maintain an optimum 5mA in IC1.

On-Off indication of the tuner is provided by LED1 mounted on the front panel. R3 serves as a current limiting resistor while D8 is included as reverse voltage protection.

CONSTRUCTION

The IF sub-assembly is purchased fully assembled and aligned so there is no work to do in this area. Both the ELC1043 and a three button unit will mount directly on one end of the PCB which has all the necessary printed wiring on the foil side.

The push button unit is supported by two 38mm 6BA bolts passing through the board and held captive between two units on each bolt. By adjusting these units, the buttons can be made to coincide with the cut-outs in the front panel.

A four station control unit can be accommodated on the PCB but an additional hole would have to be drilled. Larger units would have to be mounted directly on the chassis and the dimensions adjusted accordingly.

The connections for the push button units are shown in Fig. 3.

Before soldering the ELC1043 to the board, R10, R9 and C11, which mount under the tuner, must be soldered in place. R10 is on the copper side of the board and, to ensure that it does not short to the chassis, should be completely covered by a 25mm length of 5mm plastic sleeving.

POWER SUPPLY BOARD

Both the 12V and 30V supplies and the output emitter follower are constructed on a single PCB, the layout of which is shown in Fig. 4.

Constructors who prefer to make their own boards should have no difficulty, the only point to watch being the spacing of the pads for IC2 (0·1in apart, rows spaced 0·3in). As an alternative, fully prepared boards will be made available—details in the component list.

Five mounting holes are drilled in the board, one at each corner and one adjacent to the transformer to prevent the board sagging.

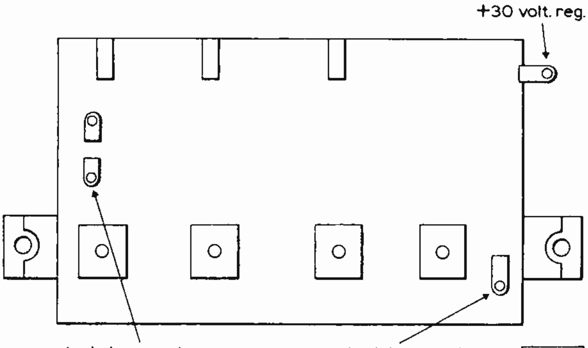
The transformer has two 6BA mounting lugs and when soldered in position, two corresponding holes should be drilled in the PCB and the transformer secured with a couple of short bolts.

Assembly of the board is quite straightforward, with particular care being taken with the orientation of electrolytics, diodes, ICs and transistors.

METALWORK

The complete TV Sound Tuner is mounted in a "U" shaped aluminium chassis with holes for the mains lead, panel mounting mains fuse, output lead and aerial socket on the back panel. The front of the chassis is masked by a front panel, secured with the pot nut on the volume control.

Fig. 5 shows the metalwork for the chassis and front panel. To absorb any tolerances the PCB should be marked from the actual boards held in situ.



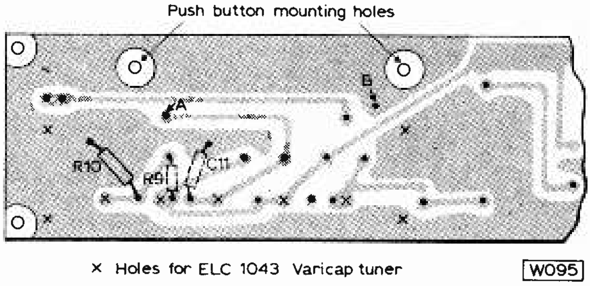


Fig. 3: Connections for the pushbutton tuner unit (left) and details of the mounting of the Mullard ELC1043 tuner on the PCB (above).

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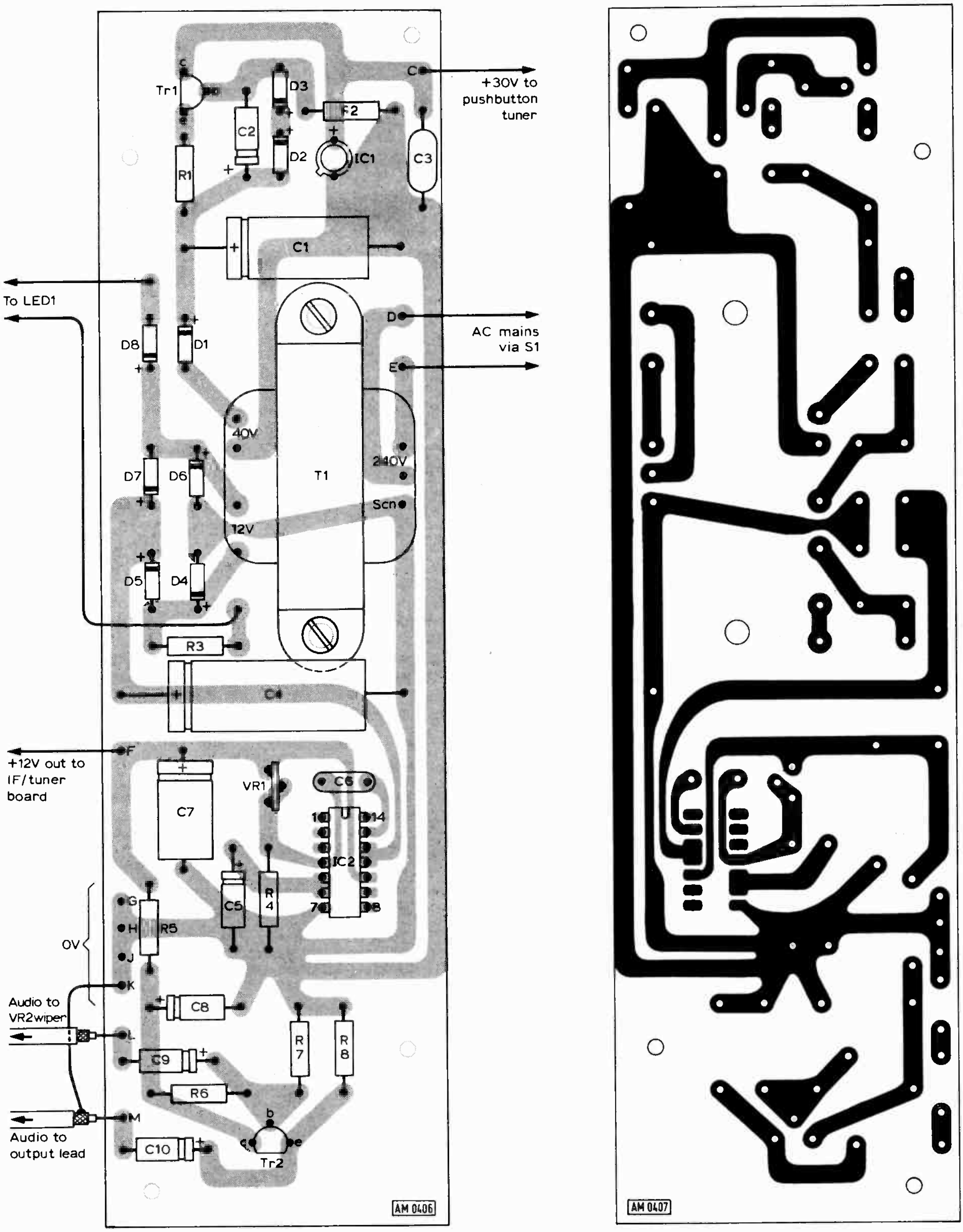

Fig. 4: Layout of the components on the power supply printed circuit board (left) and full size printed circuit master (right).

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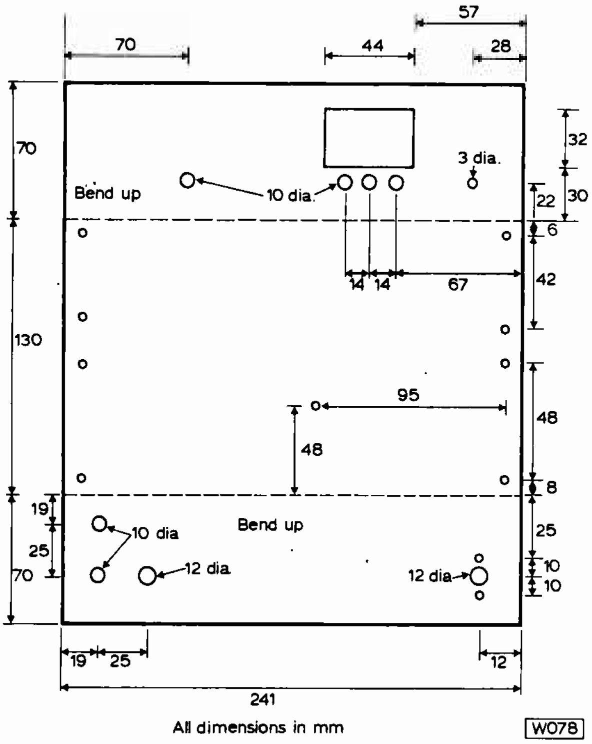

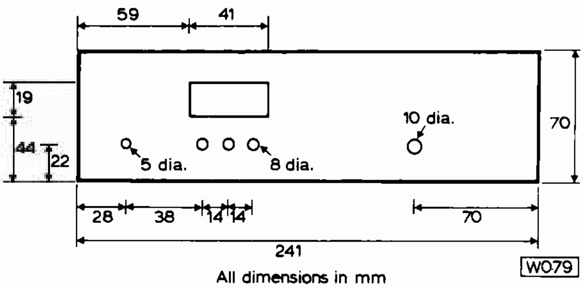

Fig. 5: Drilling details for the chassis (top) and front panel (bottom). Materials can be 18 s.w.g. aluminium.

The two PCB's are supported by 6mm stand-off collars on 6BA bolts. These collars make contact between the earth plane of the IF panel and the chassis, so the screws must be tight, with shakeproof washers used between the collars and the PCB.

VOLUME CONTROL MOUNTING

The ganged volume on-off control is mounted in the hole provided on the front panel which coincides with a clear area of the IF board. Providing that the control is physically small it will fit in without any trouble.

Mains wiring to the control will pass directly over the 6MHz ceramic filter which is very susceptible to RF pickup. To reduce the possibility of interference, a small tinplate shield is soldered to the mounting clip of the second G8 module, to cover the filter and associated components. The photograph shows the details.

★ components list

Resistors (All ½W)
R1 1kΩ (820Ω if 5 or 6 button unit is used)
R2 15kΩ
R3 2·2kΩ
R4 2·2kΩ
R5 680Ω
R6 220kΩ
R7 220kΩ
R8 3·3kΩ
R9 8·2kΩ
R10 2·2kΩ
VR1 20kΩ skeleton preset
VR2 50kΩ log pot with d.p.d.t. switch (S1)

Capacitors
C1 220μF 63V elect
C2 10μF 25V elect
C3 0·1μF polyester
C4 1000μF 16V elect
C5 10μF 25V elect
C6 100pF ceramic
C7 220μF 16V elect
C8 22μF 25V elect
C9 10μF 10V elect
C10 10μF 10V elect
C11 0·1μF polyester

Semiconductors
Tr1 BC158
Tr2 BC109
D1 1N4006
D2 1N4148
D3 5·1V 400mW Zener
D4-D7 1N4002 (4 off)
D8 1N 4148
IC1 TAA550
IC2 μA550 (NE550A)
LED1 TIL209

Miscellaneous
T1 Type M1103
IF Sub-Assembly
Mullard ELC1043 varicap tuner (or ELC1042 for VHF)
Pushbutton control unit (100k per section)
S1 Double pole mains switch (ganged with VR2)
F1 500mA fuse and panel mounting holder
Sk1 Coaxial aerial socket
Screened audio output lead, mains lead, PCB for PSU, chassis, cabinet, front panel, knob.

The transformer is available from Monty Enterprises, 2 Silver St., Doncaster, price £3·95 + VAT. A wooden box is available from Birch & Ridley, Watson Road, Worksop, price £2·25 + VAT + 50p postage and packing. The metal chassis and front panel can be obtained from Richard Friday Ltd., Old Coach House, Greystone Yd., Moorgate, Rotherham, Yorks, price £5·65 + VAT + 35p postage and packing.
The IF Sub-assembly, ELC1043 tuner, and pushbutton unit are all available from Manor Supplies, 172 West End Lane, London NW6, price £6·80 + 45p, £4·20 + 30p and £1·20 + 25p respectively. If all three are purchased p & p is 50p.

WIRING

To avoid earth loops and the attendent difficulties it is important that the only ground connection between the PCB's is that made as part of the power supply wiring. Screened leads should be used for the signal wiring from the IF board to the volume control and from the volume control to the PSU board (input to emitter follower) but the screen of the lead should be cut short and not connected to the PSU panel.

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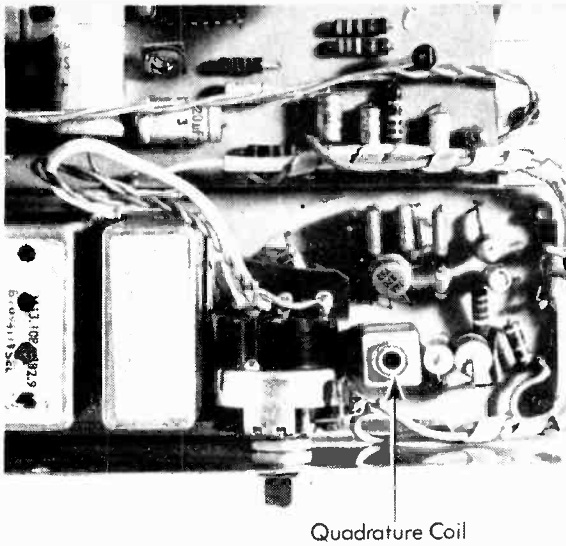
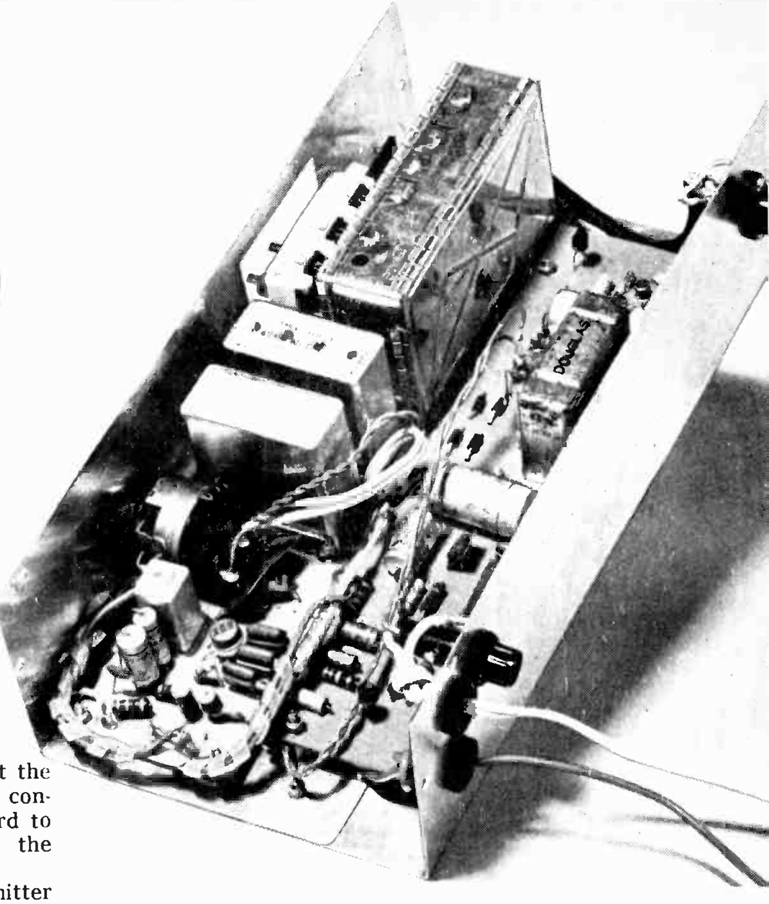


Fig. 6: Position of the quadrature coil which may need adjusting. A photograph of the completed unit is shown right. Note the small metal shield between the volume control and the board.



The screened output lead (with a plug to suit the hi-fi system on the other end) has its braiding connected to the ground terminal of the PSU board to maintain earth continuity with the rest of the equipment.

To keep the mains wiring away from the emitter follower, the switch leads pass between the two panels and under the PSU board near the mains transformer.

By using a transformer isolated supply, no 'live chassis' hazards exist and the aerial connection can be made directly to the aerial terminal on the end of the ELC1043. On most units an earth braiding connection has to be made by soldering directly to the tuner case adjacent to the 'aerial' connector.

FRONT PANEL

The front panel for the prototype was sprayed with car 'touch up' paint and lettering and lines applied using Letraset. A final spray of clear polyurethane protects the lettering from fingermarks and abrasions.

The window for the tuning indicators on the control unit was made from a piece of 6mm clear Perspex carefully filed to size and affixed with a couple of dabs of epoxy cement. A waterproof felt tip pen was then used to mark the window area for each button.

Assembly of a wooden case depends on the facilities available and the skill of the constructor. As a guide, the case for prototype is a simple 'hood' made from veneered plywood. The front panel, of course, covers any screws that may be used to hold the chassis in the cabinet.

SETTING UP

After a thorough check of all wiring, component values, etc., VR1 is set to minimum resistance and power applied. By increasing VR1 it should be possible to set the supply rail to exactly 11·5V.

No adjustment is possible on the tuning diode supply but it is as well to check that the voltage is of the right order.

Plugging the output lead into an amplifier and turning up the volume should give a high level of hiss, with possibly a couple of foreign radio stations as well. Plugging in an aerial and adjusting the tuning controls should give the local region TV stations loud and clear.

Channel numbers are not marked on the push button units but the pointer at the bottom indicates channels at the low end of the UHF band. The three regional stations are always grouped together with BBC1 being the lowest channel number, ITV next, then BBC2.

Tuning will be a little difficult at first without the picture to help. For each station, several tuning points will be apparent, close to each other. The correct one will be towards the higher channel number end of the group, just before a region of 'vision buzz'.

When tuning has been mastered any remaining buzz can be carefully taken out by tuning the quadrature coil (see Fig. 6) with the CORRECT TRIMMING TOOL. No more than one turn adjustment should be needed as it is merely to compensate for the capacitance of the metal chassis, etc. No other tuned circuits (i.e. those in the front end or G8 units) should be touched as specialist gear is needed to set them up again.

The Sound Tuner is very sensitive and, while it would be silly to expect good results from the proverbial "piece of wire", a weak signal (such as would produce a quite noisy black and white picture and very poor colour) would be sufficient. This means that a splitter in the main receiver TV co-ax will furnish plenty of signal or alternatively a second small aerial could be installed.

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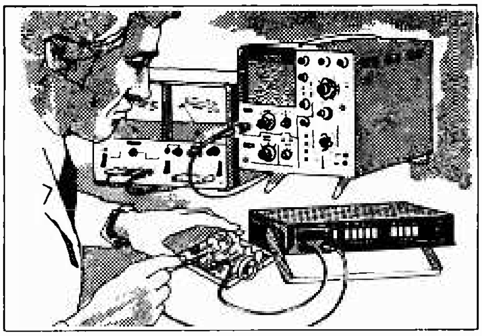
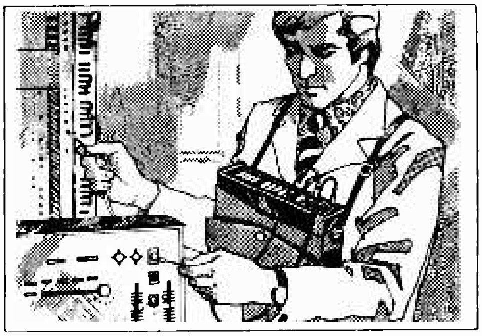
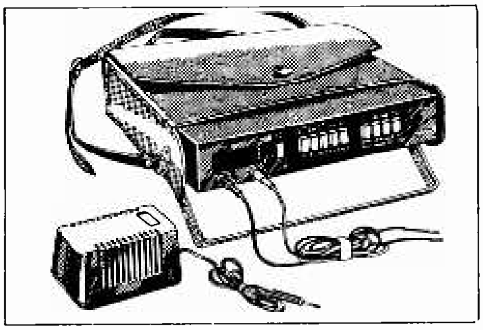


Use it in your laboratory. The DM2 sits rigidly on its combined carrying handle/stand.



Use it on the move. Keep the DM2 in its carrying case – it's always ready for use.



All you need to use the DM2 . . . anywhere. Mains adaptor . . . carrying case . . . multimeter . . . you're ready for quick, efficient metering – whatever the situation.

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sinclair

The Sinclair DM2 Multimeter: full technical story

DC Volts

Range	Accuracy	Input Impedance	Resolution
1 V	0·3% ± 1 Digit	> 100 MΩ	1 mV
10 V	0·5% ± 1 „	10 MΩ	10 mV
100 V	0·5% ± 1 „	10 MΩ	100 mV
1000 V	0·5% ± 1 „	10 MΩ	1 V

Maximum overload – 350 V on 1 V range
1000 V on all other ranges.

AC Volts

Range	Accuracy	Input Impedance	Frequency Range
1 V	1·0% ± 2 Digits	10 MΩ/40 pF	20 Hz–3 KHz
10 V	1·0% ± 2 „	10 MΩ/40 pF	20 Hz–3 KHz
100 V	2·0% ± 2 „	10 MΩ/40 pF	20 Hz–3 KHz
1000 V	2·0% ± 2 „	10 MΩ/40 pF	20 Hz–1 KHz

Maximum overload – 300 V on 1 V range
500 V on all other ranges.

DC Current

Range	Accuracy	Input Impedance	Resolution
100 µA	2·0% ± 1 Digit	10 KΩ	100 nA
1 mA	0·8% ± 1 „	1 KΩ	1 µA
10 mA	0·8% ± 1 „	100 Ω	10 µA
100 mA	0·8% ± 1 „	10 Ω	100 µA
1000 mA	2·0% ± 1 „	1 Ω	1 mA

Maximum overload – 1A (fused).

AC Current

Range	Accuracy	Frequency Range
1 mA	1·5% ± 2 Digits	20 Hz–1 KHz
10 mA	1·5% ± 2 „	20 Hz–1 KHz
100 mA	1·5% ± 2 „	20 Hz–1 KHz
1000 mA	2·0% ± 2 „	20 Hz–1 KHz

Maximum overload – 1A (fused).

Resistance

Range	Accuracy	Measuring Current
1 KΩ	1·0% ± 1 Digit	1 mA
10 KΩ	1·0% ± 1 „	100 µA
100 KΩ	1·0% ± 1 „	10 µA
1000 KΩ	1·0% ± 1 „	1 µA
10 MΩ	2·0% ± 1 „	100 nA

Overload protection – 50 mA (fused).

Readers outside the UK, please write for details of your local distributor to:
Sinclair Equipment International Ltd,
33 Beauchamp Place, London SW1 1NU.

To: Sinclair Radionics Ltd, FREEPOST, St Ives, Huntingdon, Cambs., PE17 4BR.

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AUDIO '75 HARROGATE

MORE than 74 exhibiting firms with over 120 trade names filled the hotels Majestic and Cairn at Harrogate this year, when Audio 75 was held from August 29th to 31st.

To report on every item seen and to mention every firm would fill half-a-dozen issues of Practical Wireless, so we have chosen a few which we think will particularly interest our readers.

Alba

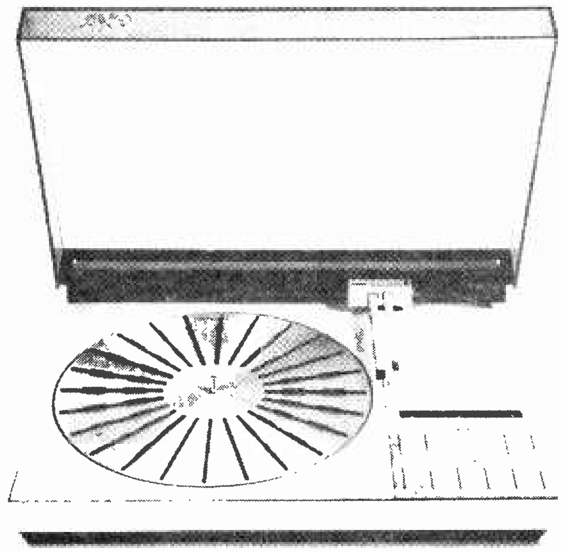
Alba exhibited a portable radiogram, Model 3200. It employs a 2-speed player and an a.m. radio and operates from 6×HP2 batteries or from the mains Also on show was their UA 8080D teak-finished 3-piece suite with a 3-band tuner, stereo 3W per channel amplifier and a BSR autochanger.

Model UA 9070D is a music centre comprising a.m./f.m. tuner, 2×8W amplifier, BSR changer and a cassette recorder—all in a teak cabinet with matching speakers.

Bang & Olufsen UK Ltd

Beocentres 1400 and 1800 were shown along with an impressive range of assorted equipment styled in the unique B & O way.

The 1400 has a stereo. a.m./f.m. radio, 20W per channel amplifier and a built-in cassette recorder. Price in teak. £249·50. The 1800 model has a similar specification but features an automatic record player instead of a recorder.



Bang and Olufsen's 6000 model.

Amongst the range of Beogram record decks on show was the very sophisticated Beogram 6000 electronically controlled 4-channel deck with built-in CD4 decoder and MMC 6000 cartridge. Price is £387·90 but you do get a free copy of Mahler's 5th Symphony recorded in CD4 thrown in!

BASF UK Ltd

This firm was showing at Harrogate for the first time and exhibited their comprehensive range of reel-to-reel tapes and cassettes with a special display on the recently released 'LH Super Range'. With LH tape, the principle is as follows:

The magnetic particles of normal ferric oxide tape are comparatively large and irregularly shaped. Apart from increasing the noise level, this also reduces the sensitivity of cassettes at high frequencies, where the shorter wavelengths approach the length of the particles, because of the slow running speed.

A Low Noise tape overcomes this by using smaller particles. LH Tape (Low noise/High output, invented by BASF in 1967) also uses smaller particles, but at a much greater density, giving a higher output on playback. LH Super is a very recent breakthrough in ferric oxide tapes from BASF. It extends the LH principle by using a new high density coating process and the smaller and more evenly sized particles of Maghemite (the mineralogical name for specially processed gamma Fe_2O_3 oxide).

The result is a full 50 per cent increase in sound quality. This can be seen by recording at OVU level, where the harmonic distortion is just 2·5 per cent—half the figure set by the DIN standard.

Even compared to BASF LH tape, LH Super is said to give a 3dB increase in recording level and over 2dB less tape hiss. Also seen were the automatic switching CrO_2 cassette machines—the Compact CC9110 at £35, the CC902 (£65) and the CC9302 with mixing facilities and a four-band receiver, priced at £90. Cassette decks on show were the 8200 (£180) and the 8100 at £120. See details of the BASF special offer in our News . . . pages.

Bib Hi-Fi accessories

Bib, as is usual at this type of exhibition had their full range of Hi-Fi accessories on show. Of particular interest was the new cassette storage unit Ref 86 which holds 30 cassettes in their containers. Fitted with a tinted acrylic hinged lid, the base of the unit comes in a simulated teak effect and the whole cabinet measures 15in×4¼×10½in wide. Price is £6·60 excluding VAT.

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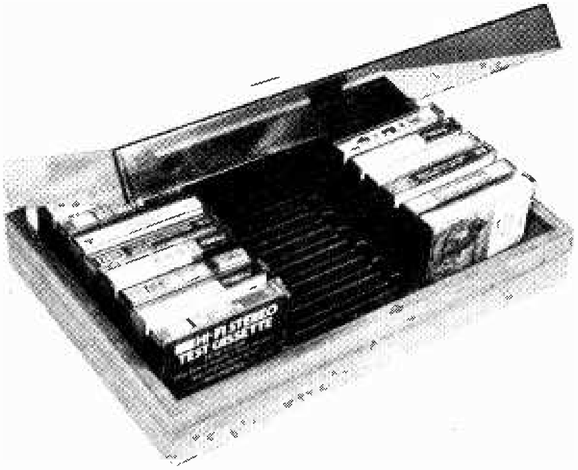

Bib's new cassette storage unit.

BSR Ltd

BSR unveiled a new slimline plinth and cover, made to compliment the company's range of McDonald turntables. The plinth, in teak, is cantilevered out from a matt black base which gives the whole thing an illusion of 'floating' an inch or so above the surface of whatever it is stood upon.

The firm's belt-driven turntables were also featured, and, I feel, represent very good value for money. Top of the range is the BDS 90, upon which we hope to include a review in a later issue of P.W. It has a constant-speed high-torque motor with a heavy non-magnetic turntable. The tubular magnetic pickup arm has a concentric gimbal style mount and is fitted with counterbalance, bias compensation and a silicon-damped cueing device. Wow and flutter figure is quoted as $\pm 0 \cdot 13$ per cent.

The BDS 90 deck from BSR.

Eagle International Ltd

On show for the first time to the general public was the 2000 range, including the A2004 and A2006 amplifiers, turntables D2005 and D2006, headphones type H2008 and H2009, tuner T2008 and the S2002, 2003, 2004, 2005 and 2006 range of speakers.

Some of the Eagle equipment on display.

The 2004 amplifier is rated at 20W per channel. It has a facility for two extra speakers to give simulated quad. The 2006 has a similar spec. with the addition of 'sound effects controllers'. The A2004 costs £65 and the A2006, £85.

Eagle were also exhibiting equipment under the Beltek name and had their M1150 Dolbyised stereo cassette deck priced at £158 on show. Also there was the M1130 deck which was very similar but did not have the Dolby feature.

Fidelity Radio Ltd

The Fidelity range included the UA4 budget stereo system priced at £48·60. Features are a two-speed record deck, 5W per channel amplifier and two white-finish speakers. The UA7 priced at £65·40 uses a BSR three speed record deck. The UA3 system is very similar in styling and priced at £87·96 with BSR changer, 2×4W sine wave amplifier and a.m./f.m. tuner.

One of the latest additions to the range is the UA6 system at £144·68. This comprises Garrard SP25 single play record deck with magnetic cartridge; 10W per channel amplifier, a.m./f.m. stereo radio tuner. A tape socket and a socket for stereo head-phones are provided. Top of the range is the MC2 Music Centre with BSR record changer, a.m./f.m. stereo radio, stereo cassette recorder/player, 2×4W amplifier. Storage is provided for cassettes.

GEC (Radio & Television) Ltd

Music Centre Model 2917 has a.m./f.m. stereo radio, stereo cassette recorder/player and Garrard 6300 auto/manual 3-speed record player. The amplifier is rated at 10W per channel and provision is made for "ambio" sound. Price: £242·75. At £234·09 comes model 2919. It uses Garrard SP25 single play record deck; 4-band tuner with decoder fitted; and has a 15W per channel amplifier with provision for ambio sound. In teak, with matching speakers.

Top of the range is the model 2820, £271·21. Features include: 20W per channel amplifier with ambio facility; f.m. stereo radio tuner with electronic touch tuning, calibrated tuning meter, and interstation quieting; Garrard 86SB single play record deck with Shure magnetic cartridge.

Model 2821 is a combined 4-band stereo radio with BSR C141R record deck and 2×7W amplifier, two speakers, it is priced at £121·66. Model 2816. (£147·72) has 4-band radio with BSR P128R record deck and a 15W per channel amplifier.

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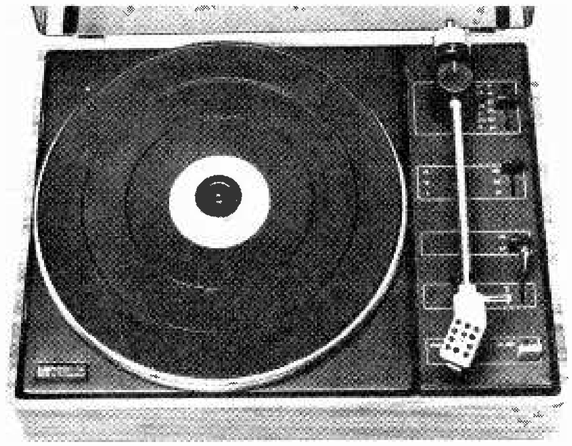

The Goldring L65 deck.

Goldring

Model L65—the latest addition to the Goldring Lenco range was shown. Particular items of interest are the automatic functions of the tonearm, the viscously damped suspension and the anti-skating device which with separate scales is adjustable for elliptical and spherical styli.

Other items in the specification are:
Speed: $33^1{}_3$ and 45 r.p.m. Wow and flutter weighted according to DIN 45507: <+/-0,12% Rumble unweighted according to DIN 45539: >38 dB Rumble weighted according to DIN 45539: >57 dB.
Turntable: Dia. 300 mm Weight 1·4 kg.
Tonearm: With a super light weight aluminium headshell suitable for use with all international standard cartridges. Stylus pressure adjustable 0-5 gm.
Mains voltage: 110V/60Hz, 220V/50Hz Power Consumption: Approximately 2·5 VA.
Measurements: Chassis 405×300×2 mm. Depth required below chassis 54 mm. With plinth and dust cover 426×321×148 mm.
Weight: With plinth and dust cover 6·75 kg, and packing 8·6 kg.

The Goldring Lenco ST800 compact stereo system was also on show. Incorporating the GL78 transcription unit, fitted with a G800E cartridge, it has an f.m. tuner fitted with three pre-set station buttons. Output is 40W per channel and slider controls are provided for volume, bass, treble and balance.

Also shown was the Goldring range of stereo magnetic cardtridges—including the easily replaceable stylus system types 820 and 800 series.

JVC (UK) Ltd

JVC model 1845 shown on the stand features a 3-band a.m./f.m. tuner with 2×15W rms amplifier, front loading cassette deck with CrO_2 facility and noise suppressor. This comes with a belt-drive transcription turntable with magnetic cartridge. The tuner is fitted with tuning meter and loudness control. Price, including speakers, is £280 plus VAT.

Model MC-1820L features a stereo cassette deck of the same design as the company's more expensive ANRS decks, plus an a.m./f.m. stereo tuner 16W per channel amplifier all housed in low profile cabinet. Price, exclusive of speakers, is £145 plus VAT.

JVC have developed a new I.C. for their ANRS (Automatic Noise Reduction System). It is said to improve both performance and reliability and lower the cost of incorporating ANRS in existing equipment.

Compactness is the keynote of the new ANRS circuit now and the relatively few external components used in the unit allows the whole p.c. assembly to occupy half the area previously taken up.

Philips Electrical Ltd

The Philips range on show was so vast that we can only mention a few items of their equipment.

Model RH734 tuner-amplifier covers a.m./f.m. bands and has a 30W per channel output. Price is £207·18. The RH732 tuner-amp has a similar radio specification but a 12W per channel output. It sells at £172·45. A matching record deck for either unit is the new GA427 belt-drive model fitted with a GP400 magnetic cartridge. Price is £62·50.

Another recent addition to the Philips range is the RH741 4-band tuner with a 15W per channel amplifier. An interesting feature of this model is the visual indication on scales for bass and treble response. Price is £167·83.

The GF907 record playing system is in a crackle black and silver finish (something different anyway!) The deck employs the GC007 belt-drive turntable fitted with a GP400 cartridge. The amplifier is rated at 15W per channel output and the price is quoted as £184·61.

Top of the range of music centres is the new RH832 priced at £781·25. The spec. includes: 4-channel pre-amplifier with built-in SQ decoder and connection for CD4 demodulator; 2-speed electronically controlled record playing deck with GP422 magnetodynamic cartridge; a.m./f.m. tuner equipped for stereo f.m. and 4-channel (SQ) transmissions.

Pye Ltd

Pye's Sound Project ZU440 record player/f.m. radio/cassette recorder was on show. It features 'disc jockey' mixing. The cassette unit has DNL (Dynamic Noise Limiter) and the amplifier delivers 15W per channel. The tuner has decoder fitted. Price, including two 2-unit speakers and mono microphone, £364·88.

ZU540 combines f.m. tuner with stereo beacon and four station push buttons; transcription type 2-speed record deck; cassette recorder with Dolby system and CrO_2/Fe_2O_3 automatic sensing. The amplifier is rated at 2×20W. The speaker assemblies use a bass/mid range unit with a line tweeter. Price is £475·48.

Sound Project ZU540 from Pye/Ekco.

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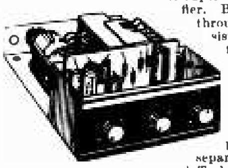
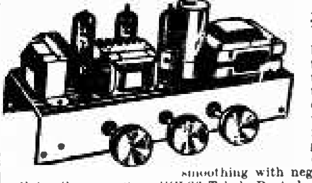
SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume. Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high × 6" wide × 7½" deep. AC 200/250V. **PRICE £15·00.** P. & P. 65p.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:- 2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300m/v for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. **£12·50.** P.&P. 85p.

ALL-PURPOSE POWER SUPPLY UNIT 200/240v. A.C. input. Four switched fully smoothed D.C. outputs giving 6v. and 7½v. and 9v. and 12v. at 1 amp on load. Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" × 3¼" × 2¼". Ready built and tested. **PRICE £6·35** P. & P. 55p.

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

FEW ONLY!
High grade mains transformer with grain orientated lamination. Primary 200/240 Secondary 18·5 volts at 0·6 amps and 4·6 volts at 0·3 amps. Size 2" l × 2¼" w × 2" d overall. **£1·40** plus 35p P. & P.

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Pri. 200/240v. Sec. 9-0-9 at 500 mA. **£1·35.** P. & P. 30p.
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8 VOLT RELAY
100 m/A single pole normally closed. 2 for **60p** + 15p P.& P.

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8 pole 3 way 2 bank low loss Yaxley type switches 1½" sections. Standard spindle. 2 switches **75p** + 15p P. & P.

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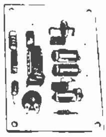
Enjoy fabulous stereo radio at this fabulous low introductory price!

Designed and styled to match our 10 + 10 amplifier but will suit any other standard stereo amplifier. The design incorporates the very latest circuitry techniques with high-grain, low noise IF stages. Automatic frequency control to "lock-on" station and prevent drift. IC stereo decoder for maximum stereo separation. L.E.D. for stereo beacon indicator. Nominal output of tuner 100mV. Approximate size 12½" wide × 8" deep by 2¾" high. Supplied ready built, fully tested and fully guaranteed (not available in kit form).
Price £27·50 Post and Packing £1·00.

STEREO-DECODER



SIZE 2" × 3" × ½" ready built. Pre-aligned and tested. Sens. 20-560 mV for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. **£6·25** plus 15p. P. & P. Stereo beacon light if required **45p** extra.

SPECIAL BARGAIN OFFER!
Limited number of BSR C129/123 Auto Changer De Luxe with lightweight tubular arm and stereo cartridge. **Brand new. ONLY £11·00** + p. & p. 60p.

LATEST Hi Sensitivity Uni-directional slim-line condenser microphone as used by many professionals. Very low acoustic feedback. Available hi impedance or low impedance. State which required. **£16·25** plus 25p P. & P.

LATEST ACOS GP91/18C mono compatible cartridge with t/o stylus for LP/EP/78. Universal mounting bracket. **£1·75**, P. & P. 15p.

CERAMIC STEREO CARTRIDGE. Universal Mounting brackets and turnover stylus. 70mV per channel output. ONLY **£2·06** + 15p P. and P.

SONOTONE 9TAHC COMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78. **ONLY £2·62** P. & P. 10p. Also available fitted with twin Diamond T/O stylus for Stereo LP. **£3·18**, P. & P. 15p.

LATEST CRYSTAL T/O STEREO / COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. **£1·98** P. & P. 15p.

LATEST T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only **£1·75**, P. & P. 15p.

QUALITY RECORD PLAYER AMPLIFIER MK. II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide × 3in. deep × 6in. high. Ready built and tested. PRICE **£6·50**, P. & P. 75p.
ALSO AVAILABLE mounted on board with output transformer and speaker. PRICE **£7·75**, P. & P. 75p.

HI-FI LOUDSPEAKER SYSTEM MK II

Beautifully made, simulated teak finish enclosure with attractive slatted front. Size 16½" high × 10½" wide × 9" deep (approx.). Fitted with E.M.I. Ceramic Magnet 13" × 8" bass unit, H.F. tweeter unit and crossover. **AVAILABLE IN NOMINAL** 4 Ohm, 8 Ohm or 16 Ohm impedance (state which).
OUR PRICE £11·25 each Carr. £1·25.
Cabinet Available Separately £6·25, Carr. £1·10.
Also available in 8 ohms with EMI 13" × 8" bass speaker with parasitic tweeter **£10·00**, Carr. £1·25.

LOUDSPEAKER BARGAINS

5in. 3 ohm **£1·45**, P. & P. 15p. 7 × 4in. 3 ohm **£1·69**, P. & P. 25p. 10 × 6in. 3 or 15 ohm **£2·50**, P. & P. 35p. E.M.I. 8 × 5in. 3 ohm with high flux magnet **£2·06**, P. & P. 25p. E.M.I. 13½ × 8in. with high flux ceramic magnet with parasitic tweeter 3, 8 or 15 ohm **£4·12**, P. & P. 35p. E.M.I. 13 × 8in. 3, 8 or 15 ohm with inbuilt tweeter and crossover network **£5·50**, P. & P. 35p.
E.M.I. tweeter. Approx. 3½". Available 3 or 8 or 15 ohms, **£2·00** + 25p, P. & P.

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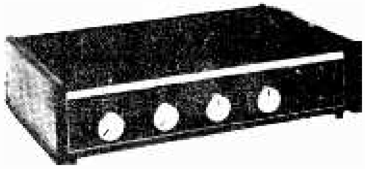
Size 11¾" × 14⅝" × 1₁⁄₁₆" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz-20kHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details. Only **£7·68** each. P. & P. 60p.
NOW ALSO AVAILABLE: 8", 10 watts, r.m.s. 20 watt peak 40Hz-20,000Hz. Overall depth 1". Ideal for Hi-Fi or for use in cars. **£5·18** + 40p P. and P.

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise, level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Very simple to modify to suit magnetic cartridge—instructions included. Output stage for any speakers from 8 to 15 ohms. Compact design, all parts supplied including drilled metalwork high quality ready drilled printed circuit board with component identification clearly marked, smart brushed anodised aluminium front panel with matching knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification; Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response ±3dB 12-30,000 Hz Sensitivity: better than 80mV into 1MΩ. Full power bandwidth: ±3dB 12-15,000 Hz. Bass boost approx. to ±12dB. Treble cut approx. to −16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1·0 amp. Overall Size 12"w. × 8"d. × 2½"h.

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

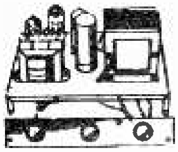
AMPLIFIER KIT	£15·00	P. & P. 50p
(Magnetic input components 33p extra)		
POWER PACK KIT	£5·35	P. & P. 55p
CABINET	£5·35	P. & P. 55p

(Post Free if all units purchased at same time)
Full after sales service

Also available ready built and tested **£32·50.** Post Free.

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

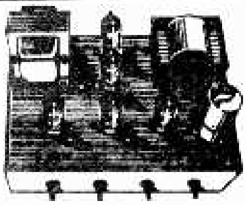
3-VALVE AUDIO AMPLIFIER HA34 MK II



Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½"w. × 4"d. × 4½"h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only **£7·75**. P. & P. 70p.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc **£6·50** P. & P. 70p.

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 25p + SAE (Free with parts)' All parts sold separately. ONLY **£12·00** P. & P. £1·00. Also available ready built and tested **£16·50** P. & P. £1·00.

HI-FI STEREO HEADPHONES

Adjustable headband with comfortable flexifoam ear-muffs. Wired and fitted with standard stereo ¼in jack plug. Frequency response 30-15,000Hz. Matching impedance 8-16 ohms. Easily converted for Mono. PRICE **£4·05**, P. & P. 25p.

Prices include VAT at Current Rate

Open 9.30–5.30 Monday to Friday. 9.30–5 Saturday Closed Wednesday.

All prices and specifications correct at time of press and subject to alteration without notice.

HARVERSON SURPLUS CO. LTD.

(Dept. P.W.) 170 HIGH ST., MERTON, LONDON, S.W.19 Tel.: 01-540 3985

A few minutes from South Wimbledon Tube Station.

SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

(Please write clearly)

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

www.americanradiohistory.com

Model 1570 is a unit audio console in a teak cabinet having record storage facilities. The amplifier is rated at 15W per channel. The tuner is a.m./stereo f.m. and the record deck is a single play unit. Twin 2-unit speaker assemblies are included in the quoted price of £237·58.

Model SXO940 is priced at £199 with a tuner including s.w. band, cassette deck and GC014 single play record deck. The amplifier rating is 2×5W.

Priced at £230·91, which includes speakers and metal stand, is the model 5024 comprising 3-band radio/cassette recorder and 3-speed stereo record player.

Pyser Ltd

On show was the new Marantz 1040 integrated stereo amplifier. Rated at 20W per channel, it features professional type graphic tone controls and main/remote speaker switching with ambience and loudness compensation. Price: £132 plus VAT. Also shown was the new 1070 amplifier and the model 2325, 2×125W stereo receiver with Dolby.

Marantz 1040 stereo amplifier.

Rank Radio International

On view for the first time was the SP range of Wharfedale loudspeakers. Two models make up the range, the Dovedale SP and Airedale SP. Both are floor standing reflex enclosures.

The Dovedale SP is a 60 litre enclosure handling 60 watts DIN whilst the larger Airedale contains 100 litres and accepts 100 watts DIN. The Dovedale has two in-phase bass drivers, one mid-range and one high frequency unit. The Airedale has a bass driver, two mid-range units covering between them the range of frequencies between 300Hz and 5kHz and a high frequency unit.

The Airedale SP has a bass cut-off frequency of 27Hz (−3dB) which represents the lower limit of human audibility. The Dovedale SP is little higher with a bass cut-off of 35Hz (−3dB). Both respond to beyond the limits of audibility at high frequencies.

The Dovedale SP and Airedale SP are available in Teak with removeable speaker grilles at the respective recommended retail prices per pair of £182·71 and £274·10 including VAT.

Skantic (UK) Ltd

Skantic introduced their new model 17532 17W per channel stereo hi-fi music centre. This unit includes an f.m. stereo radio and there are push buttons for selection of five pre-set stations.

The Skantic turntable has a 16 pole synchronous motor, an anti-skating device and easily adjustable stylus pressure. The arm includes a Pickering V15

Rank Radio International's latest models.

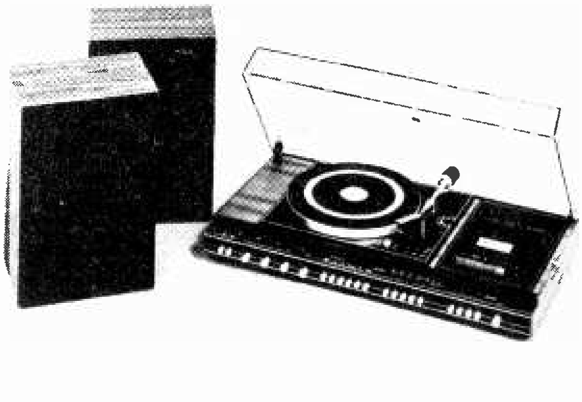
AT2 magnetic cartridge. The cassette recorder is completely designed and manufactured by Skantic's own engineers. The tape deck also has a built-in DNL noise reduction system, an autostop and chrome dioxide switching system. A VU meter for recording and playback levels and a digital counter are also included.

The 17532 exceeds European standard DIN 45·500 and is ready for ambiophonic stereo. The unit is available in Rosewood, teak or walnut high grade veneer as well as white or black lacquer.

Skantic's newly designed speakers, which are included with the 17532, each have a power handling capacity of 30 watts. Each speaker has two units a 20cms unit for bass and middle range and a 2·5cms dome-tweeter.

Features of the unit include loudness compensation filter selector; switchable sockets for headphones and inputs for two microphones.

Price including speakers: Rosewood—£308·78+VAT; Teak—£288·75+VAT; Walnut W/B—£302·33+VAT.



The 17532 music centre from Skantic.

PW

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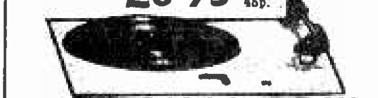
RETURN OF POST MAIL-ORDER SERVICE

£6·95 Post 45p.



R.C.S. DISCO DECK SINGLE RECORD PLAYER

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

COMPLETE STEREO HI-FI

Two full size loudspeakers 13½ × 10 × 8½in. Player unit clips to loudspeakers making it extremely compact. Overall size only 13½ × 10 × 8½in. 3 watts per channel, plays

all records 33 rpm, 45 rpm. Separate volume & tone controls. 240v AC mains.

Attractive Teak finish Weight 13lbs.

Bargain Price £25 85p carriage

SPECIAL OFFER

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

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

WEYRAD P50—TRANSISTOR COILS

RA2W Ferrite Aerial ..35p	Printed Circuit, PCA1 ..35p
I.F. P50/2CC 470 kc/s ..40p	J.B. Tuning Gang ..£1·20
3rd I.F. P50/3CC 40p	OPT1 ......65p
Spare Cores 8p	Driver Trans. LFDT4 ..65p
P50/IAC 60p	

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

VOLUME CONTROLS

5 K. ohms to 2 Meg. LOG or LIN. L/S 25p. D.P. 40p. STEREO L/S 55p. D.P. 75p. Edge 5K.S.P. Transistor 35p

80 Ohm Coax 5p. yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £2; 60 yd. £3. FRINGE LOW LOSS Ideal 625 & colour 10p yd.

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

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

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

E.M.I. 13½ × 8in. SPEAKER SALE!

With tweeter and crossover. 10 watt. State 3 or 8 or 15 ohm. (As illustrated) **£5·25** Post 45p

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

BOOKSHELF CABINET Size 16 × 10 × 7 in. teak finish **£6·95** Post 75p

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

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides 6 × 4in. 55p 8 × 6in. 68p; 10 × 7in. 75p; 12 × 8in. £1·00; 14 × 9in. £1·20; 16 × 6in. £1·26; 12 × 3in. 65p; 16 × 10in. £1·40.

ALUMINIUM PANELS 18 s.w.g. 6 × 4in. 15p; 8 × 6in. 25p; 14 × 3in. 25p; 10 × 7in. 30p; 12 × 5in. 30p; 12 × 8in. 40p; 16 × 6in. 45p; 14 × 9in. 50p; 12 × 12in. 55p; 16 × 10in. 75p

SPECIAL OFFER

100 ohm 20W Rheostat 2½in. diam. Ceramic Former, screw terminals, ¼in. diam. spindle. 95p, post 25p.

ANOTHER RCS BARGAIN!

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

4MFD 800V DC PAPER CAPACITOR

Block Capacitor. Ideal as Filter Unit in 100 watt Loudspeaker Systems, 95p each, post 30. Also 2MFD 800v 90p.

GOODMANS CONE TWEETER

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

8 inch Rubber surround woofer. £5·75

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

Ideal for Mike, Tape, P.U., Guitar, etc. Can be used with Battery 9-12v. or H.T. line 200-300V. d.c. operation. Size 1½" × 1½" × ½". Response 25 c/s. to 25 Kc/s, 26 dB gain. For use with valve or transistor equipment. Full instructions supplied. Details S.A.E. **£1.45** Post 30p

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

RCS 100 watt Valve AMPLIFIER CHASSIS

4 input master volume, treble and bass controls. This professional quality amplifier chassis is ideal for P.A. disco or groups where high power quality sound is required. £85. Carr. £2·50.

RCS "MINOR" 10 watt AMPLIFIER KIT

This kit is suitable for record players, guitars, tape playback, electronic instruments or small P.A. systems. Two versions available: Mono, £12·50; Stereo, £20. Post 45p. Specification 10W per channel; input 100mV; size 9½ × 3 × 2in. approx. S.A.E. details. Full instructions supplied.

MAINS TRANSFORMERS

Postage Small 45p, Large 75p

250-0-250 80 mA. 6·3V 2amp ...... £2·90
250-0-250 80 mA. 6·3V 3·5A 6·3V 1A or 5V 2A ...... £4·60
350-0-350 80 mA 6·3V 3·5A, 6·3V 1A or 5V 2A ...... £5·80
300-0-300V 120mA, 6·3V 4A C.T.; 6·3V 2A ...... £7·00
MIDGET 220V 45mA, 6·3V 2A £1.75
HEATER TRANS. 6·3V ½ amp 85p. 3 amp £1·20
GENERAL PURPOSE LOW VOLTAGE. Trapped outputs at 2 amp, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30V £4·60
1 amp, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £4·60
2 amp, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £7·00
3 amp, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £8·70
5 amp, 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 £11·25
6-0-6V 500mA 90p, 20V 1A £1·85
9V 1 amp 95p 12V 300mA 75p 12V 500mA 85p 12V 750mA 95p. 10, 30, 40V 2 amp £3. 20V 3 amp £2. 40V. 2A £2·75. 22.0.22V 4A D.C. £3. 16V ½ amp. 95p. 16V 2 amp £1·85.
AUTO TRANSFORMERS, 115V to 230V or 230V to 115V 150W £5; 250W £6; 400W £7; 500W £8.
FULL WAVE BRIDGE CHARGER RECTIFIERS; 6 or 12V outputs. 1½ amp 40p; 2 amp 55p; 4 amp 85p.

MAINS ISOLATING TRANSFORMER

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

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

NEW ELECTROLYTIC CONDENSERS

2/350V	14p	100/25V	10p	50+50/300V	50p
4/350V	14p	250/25V	14p	350+50/325	85p
8/350V	22p	500/25V	20p	32+32/350V	40p
16/350V	25p	100+100/275V	65p	32+32/450V	60p
32/350V	35p	150+200/275V	70p	32+32+32/350V	65p
32/500V	50p	8+8/350V	22p	32+32+32/450V	85p
25/25V	10p	8+16/350V	25p	900/350V	95p
50/50V	10p	16+16/350V	40p	4700/63V	95p
				2000+2000/25V	95p

LOW VOLTAGE ELECTROLYTICS
1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF. 15V. 10p.
500mF. 12V. 15p; 25V. 20p; 50V. 30p.
1000mF. 12V. 20p; 25V. 35p; 50V. 47p; 100V. 70p.
2000mF. 6V. 25p; 25V. 42p; 50V. 57p.
2500mF. 50V. 62p; 3000mF. 25V. 47p; 50V. 65p.
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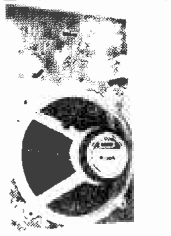
2000 + 2000/25V. 75p.
MICRO SWITCH. Single Pole Change Over. 20p.
MICRO SWITCH. Sub Min 25p.
CERAMIC 1pF to 0·01mF, 5p. Silver Mica 2 to 5000pF, 5p.
PAPER 350V-0·1 7p, 0·5 13p; 1mF 15p; 2mF 150V 15p.
500V-0·001 to 0·05 4p; 0·1 10p; 0·25 13p; 0·47 25p.
TWIN GANG. "0-0" 208pF + 176pF. £1·20; 500pF standard 75p; 365 + 365 with 25 + 25pF Slow motion drive 50p.
TWIN GANG. 120pF 50p. 385pF 50p.
SHORT WAVE, SINGLE. 10pF 30p; 25pF 55p; 50pF 55p.
NEON PANEL INDICATORS. 250V AC/DC Amber 25p.
RESISTORS. ¼W, ½W, 1W, 20% 2p; 2W, 3p. 10 Ω to 10M.
HIGH STABILITY. ½ w. 2% 10 ohms to 6 meg., 12p.
Ditto 5% Preferred values 10 ohms to 10 meg., 4p.
WIRE-WOUND RESISTORS. 5 watt, 10 watt, 15 watt 10 ohms to 100K 10p each.
TAPE OSCILLATOR COIL. Valve Type 35p.

NEW MODEL "BAKER LOUDSPEAKER" 12in. 50 watt GROUP 50/12 8 or 15 ohm high power full range. Professional quality. Post 80p **£14·50**

BAKER MAJOR 12" £11·50

Post 60p



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

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£14·50** Post 50p
Please state 3 or 8 or 15 ohms.

BAKER "BIG-SOUND" SPEAKERS

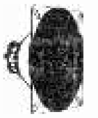
'Group 25'	'Group 35'	'Group 50'
12 inch 25 watt 3 or 8 or 15 ohm **£8·95**	12 inch 35 watt 3 or 8 or 15 ohm **£10·50**	15" 50 w 8 or 15 ohm **£19·80**

TEAK VENEERED HI-FI SPEAKER CABINETS
For 12in. or 10in. dia. speaker 20 × 13 × 12" £12·00 Post 95p
For 13 × 8in. or 8in. speaker 16 × 10 × 7" £7·50 Post 75p
For 8 × 5in. speaker 12 × 8 × 6" £4·60 Post 50p
LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft

GOODMANS 6½in. HI-FI SPEAKER

8 ohm, 10 watt. Large ceramic magnet. Special cone surround. Frequency response 30-15,000 c/s. Ideal P.A. Columns, Hi-Fi Enclosure Systems, etc. **£4·60**
Suitable cabinet 12 × 8 × 6 £4·00.
Suitable Tweeter £2·00.

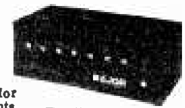
ELAC CONE TWEETER



The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 c/s to 18,000 c/s. Size 3½ × 3½ × 2in. deep. Rating 10 watt, 8 ohm Suitable Crossover £1·60 **£2·20** Post 30p

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

MAJOR 100 WATT ALL PURPOSE GROUP OR DISCO AMPLIFIER



All purpose transistorised. Ideal for Groups, Disco and P.A. 4 inputs speech and music. 4 way mixing. Output 8/15 ohm. a.c. Mains. Separate treble and bass controls. **£59** Carr. £1·00
MAJOR 50 WATT 4 INPUTS. 2-WAY MIXING. IDEAL FOR DISCO OR PA. £49·95. Post £1

3-WAY CROSSOVER 950 CPS and 3000 CPS with leads ready assembled **£2·20**

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

TWO CHANNEL STEREO VERSION **£6·85**

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

COAXIAL PLUG 10p. PANEL SOCKETS 10p. LINE 18p
COAXIAL OUTLET BOXES, surface, 85p.
BALANCED TWIN FEEDER 300 ohms 7p yard. JACK SOCKET Std. open-circuit 15p, closed-circuit 23p. Chrome Lead Socket 45p. Phono Plugs 8p. Phono Socket 8p. JACK PLUGS Std. Chrome 20p; 3·5mm Chrome 12p. DIN SOCKETS Chassis 3-pin 10p; 5-pin 10p. DIN SOCKETS Lead 3-pin 18p; 5-pin 25p. DIN PLUGS 3-pin 18p; 5-pin 25p. VALVE HOLDERS. 5p; CERAMIC 10p; CANS 5p.

RCS SOUND TO LIGHT KIT

3 channel 1000 watts per channel. As featured in recent issue. £12·50 post 30p.

E.M.I. GRAM MOTOR

120v. or 240v. A.C. 2,400 rpm. 2-pole 70mA. Size 2¼ × 2¼ × 2¼ in. **£1·25** Post 30p.

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DRAUGHTSMANSHIP & DESIGN
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TRIPLE RANGE WOBBULATOR

J. G. RANSOME

FREE running oscillators designed around TTL ICs are notorious for poor frequency stability. The most significant factor contributing to frequency drift is variation of the supply voltage, and it is this apparent 'disadvantage' that is exploited in this circuit.

The FM Signal Generator (Wobbulator) is an essential piece of apparatus for setting up the HF circuits of FM receivers, and is extremely useful for the fast, accurate alignment of AM IF strips. In the conventional RF signal generator a continuous carrier is generated at constant frequency. A second signal at (usually) audio frequency is then applied to this RF signal varying the RF output voltage amplitude in direct relationship to the second, modulating frequency. In the FM signal generator the RF waveform is generated at constant amplitude and the modulating tone is used to vary the frequency of the RF signal.

The simple Wobbulator described here provides signals at three selected centre frequencies with provision for wide frequency deviation using external modulating sources. Although the RF signal is based on a square waveform rather than the more conventional sine wave, the effect of this difference is negligible in practice.

Basic circuit

The basic circuit of the free running TTL multivibrator is shown in block form in Fig. 1, and is probably the simplest circuit available to the amateur constructor! If Ct is omitted the oscillator comprises three positive logic NAND gates in series. In this configuration the mode of operation is quite straightforward. If the input at gate 1 is 'low' the output will be 'high'. Gate 3 thus has a 'low' input and a 'high' output and since the output of gate 3 drives the input of gate 1 a self-oscillating loop is created.

The operating frequency of this oscillator is determined by the signal propagation delays through the gates. For the SN7400 gate the propagation delay for the 'low' state is approximately 8·0ns and for the high state 18ns. As the oscillator alternates between two 'low' plus one 'high' state, and two 'high' and one 'low' state the total delay alternates between (8+18+8)ns and (18+8+18)ns. The typical average delay is thus: $\frac{34+44}{2}$ or 39ns, giving typical free-running frequency of $\frac{1}{39\times10^{-9}}$ Hz or 25MHz.

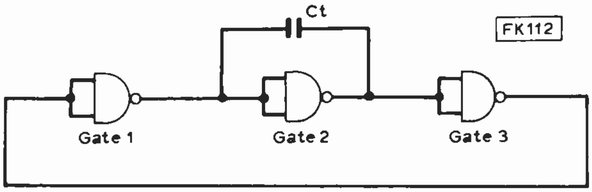

Fig. 1: Block diagram of a basic TTL oscillator.

As the two delays are not equal the output is not a 1:1 mark/space ratio squarewave and in practice stray capacitance and internal inbalances tend to emphasise the delay difference to give a ratio nearer 2:1.

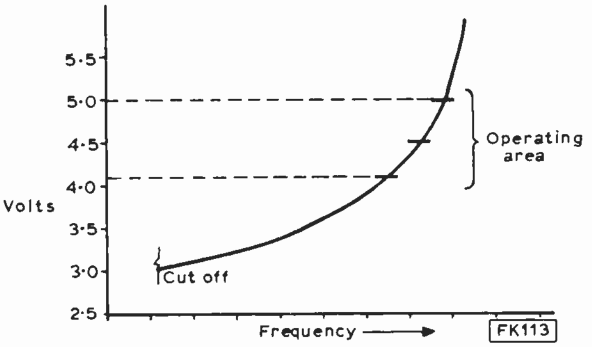

Fig. 2: Frequency plotted against voltage for a TTL oscillator. As can be seen, the relationship is non-linear.

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Frequency variation

The oscillator frequency can be varied by altering the propagation delay time, by modifying the rise time of the transfer pulse. This is the function of Ct. It is possible to use a series of capacitors across one, two or all three of the gates to give a more stable arrangement but in practical circuits this complication is rarely justified. The effect of Ct is surprisingly linear and for the purpose of initial trials the oscillator frequency can be expressed as: If Ct=22pF then F=11MHz and if Ct=500pF, F=500kHz.

These values as calculated should be treated with some caution as tolerances can lead to quite significant modifications to Ct to obtain a given frequency of operation. The equation thus indicates an approximation for Ct, the actual value has to be found by experiment.

The oscillator frequency increases with increasing supply voltage, Fig. 2, and as can be seen the frequency/voltage relationship is non-linear. However, if we consider a relatively small voltage change (±0·5V) the linearity is sufficiently good to make the control of frequency by means of varying the supply voltage a worthwhile proposition.

The simplest arrangement for varying the supply voltage is the series emitter follower shown in Fig. 3 in which the base of the transistor is biassed by means of a potential divider and the collector taken to a suitable positive supply. In this arrangement the voltage appearing at the emitter is equal to the base voltage less the base/emitter voltage drop of the transistor (0·6V in the case of silicon). If a variable voltage is now applied to the base of the transistor the emitter voltage will rise and fall in phase with the base voltage so that the emitter 'follows' the base voltage.

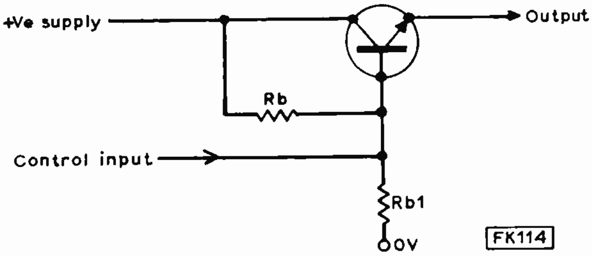

Fig. 3: The theoretical series emitter follower shown here, varies the voltage, and thereby the frequency of the oscillator to which it is connected.

Practical circuit

In the practical circuit Fig. 4, the timing capacitor (Ct of Fig. 1) is switched by means of S1c to provide three spot frequencies, the values shown giving spot frequencies of 455kHz, 1·6MHz and 10·7MHz.

Variable resistors VR2-3-4 are incorporated to set the precise operating frequency. These resistors modify the current flows to the gate inputs and provide a small degree of frequency adjustment on each range. It is important that these resistors should be set to the highest possible value to minimise the gate bias, as overbiassing can lead to erratic running and poor stability. If it is found that the tuning resistor has to be set to a value of less than 2kΩ, then an alternative timing capaictor should be sought.

The SN7400 is a quadruple NAND gate, and since

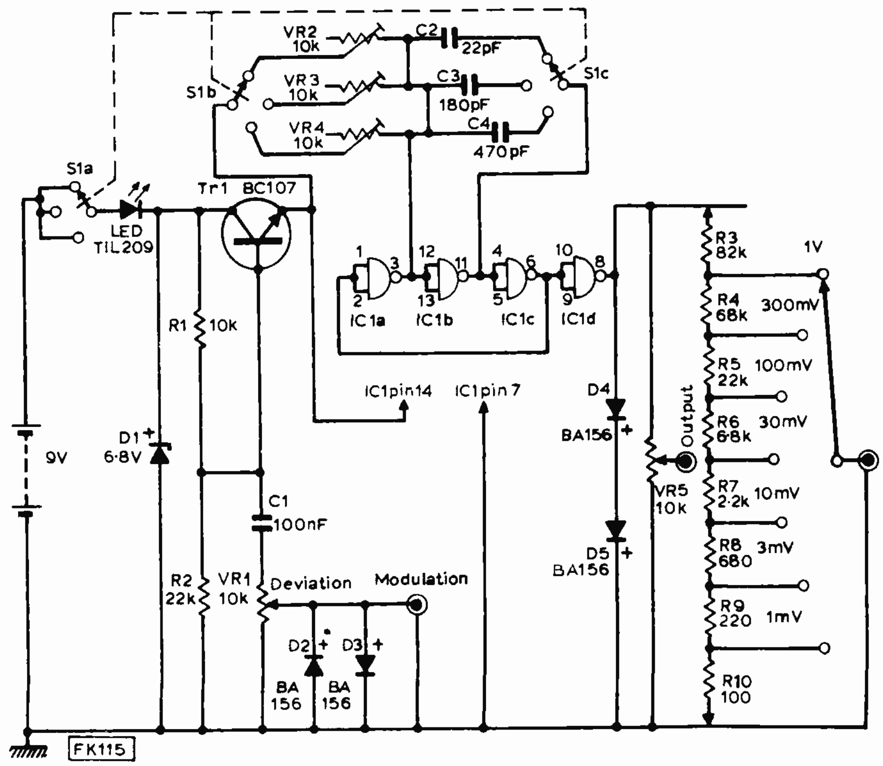

Fig. 4: Circuit diagram of the complete TTL Wobbulator. The output may be taken from either the rotor of VR5, or alternatively from the attenuator network. However only one of these two, should be connected in circuit.

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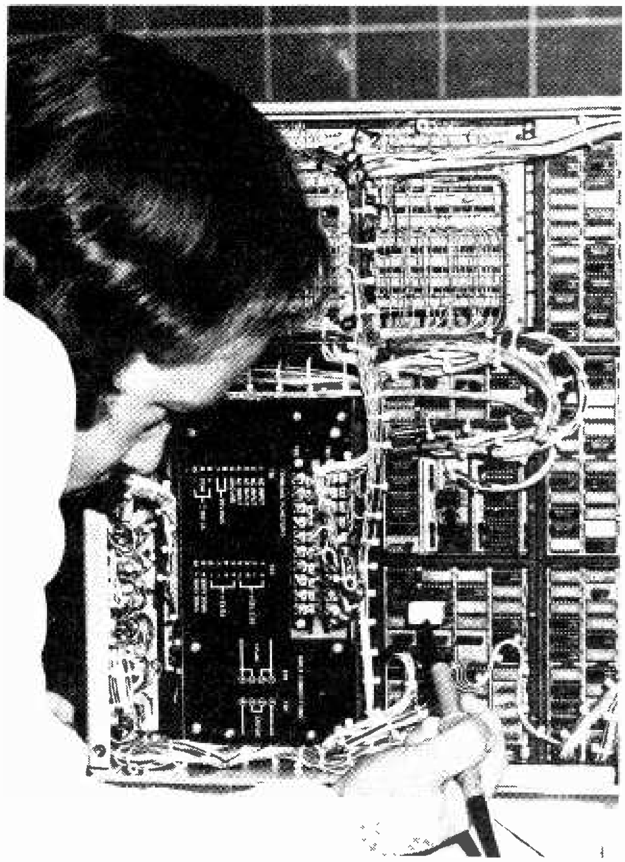

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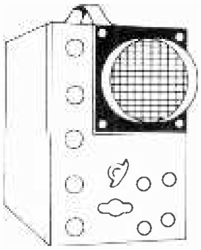

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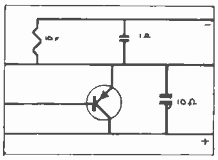

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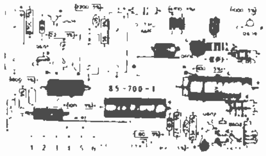

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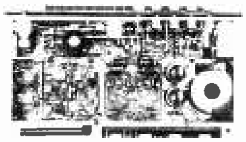

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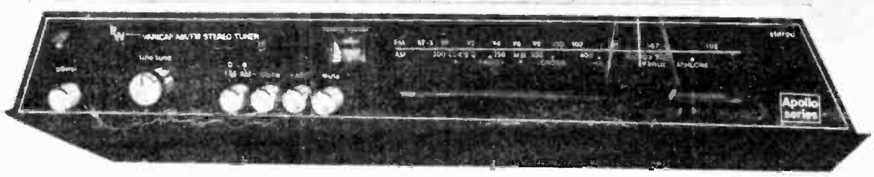

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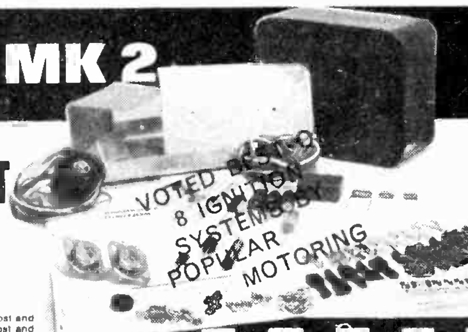

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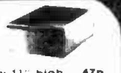

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only three gates are used for the oscillator, the fourth gate can be used as a buffer to prevent the output load from affecting the operation of the oscillator. The output from the buffer gate depends very much on the device used. The cheap, low-noise immunity gates give a swing of about 2V, while the more expensive can manage 3V or so. These output levels are too high for most purposes and the circuit of an optional attenuator circuit is shown in Fig. 4. As the output from the gate is a squarewave the simplest way of maintaining constant amplitude to the attenuator is to clip the signal at a predetermined level. This is the function of the diode network D4/D5 which limits the output to 1·8V. The clipped signal is then fed to VR5 or the resistive ladder network (R3-R10) which makes up the attenuator.

Modulation

The modulating signal is AC coupled to the base of Tr1 to prevent any residual DC component of the waveform from de-tuning the oscillator. The diodes D2 and D3 wired back-to-back limit the modulating signal. Silicon diodes are again used here with a forward voltage drop of 0·6V so that they need at least 0·6V across them before they conduct. If the input signal exceeds this value one or other of the diodes conduct shorting the excess signal to earth.

The potentiometer VR1 determines the level of modulating signal reaching Tr1 base and therefore controls the frequency variation of the oscillator with respect to input voltage. This potentiometer is thus the deviation control. The zener diode D1 limits the rail voltage to 6·8V. An alternative mains power unit is shown in Fig. 5.

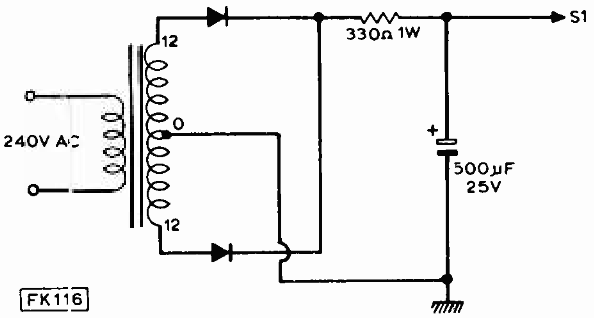

Fig. 5: Alternative mains power supply. This is recommended if prolonged use is to be made of the Wobbulator.

Construction

The oscillator and modulator are built on a piece of 0·1in. matrix veroboard, Fig. 6. The layout is not critical and may be built on any scrap piece of veroboard. The trimming capacitors and resistors are wired directly on the range switch while the resistors comprising the alternative attenuator chain are similarly mounted round the output range switch (not shown in photograph).

Using an aluminium box 130 x 100 x 50mm deep, the battery powered version can be neatly accommodated on the metal panel as shown in the photographs. The mains powered version can be built into the same size box if the Doram transformer specified is used. However, as this involves some rather careful 'packing' of components, the less experienced would be well advised to opt for a larger box.

Calibration

Carefully check the wiring, switch on and check that Tr1 emitter voltage is 4·5V (±0·2V). R1 should be adjusted if necessary to obtain this voltage. The spot frequencies must next be established. During this setting-up procedure the modulation input must be shorted to earth. Using an 'all-band' communications type receiver, feed the attenuated output from the wobbulator into the aerial socket. With the BFO switched on, the wobbulator output can be detected and VR2-3-4 adjusted until the required three spot frequencies are obtained. The attenuator function can also be checked against the 'S' meter.

In the absence of a suitable communications receiver the spot frequencies will have to be set up against known frequency IF strips. The output from the wobbulator should be injected into the first IF transformer, the most convenient point being at the mixer stage. A voltmeter should then be connected across the AGC line and the appropriate VR adjusted until maximum AGC voltage is detected. The spot frequency is then set to the centre frequency of the IF.

★ components list

Resistors

R1	10kΩ	R8	680Ω
R2	22kΩ	R9	220Ω
R3	82kΩ	R10	100Ω
R4	68kΩ	VR1	10kΩ
R5	22kΩ	VR2	10kΩ
R6	6·8kΩ	VR3	10kΩ
R7	2·2kΩ	VR4	10kΩ
All 5% ½ or ¼W		VR5	10kΩ

Capacitors

C1	100nF	C3	180pF
C2	22pF	C4	470pF

Semiconductors

Tr1	BC107	D4	BA156
D1	BZY96 6·8V zener	D5	BA156
D2	BA156	IC1	SN7400
D3	BA156		

Miscellaneous

LED type TIL209. Two coaxial sockets. Four knobs. Four-way three-pole wafer switch. 0·1in. matrix veroboard 40 x 30mm. Metal box 130 x 100 x 50mm. Single pole, seven way wafer switch.

Optional power supply

Mains transformer, sub. miniature 12-0-12V, type 196-274 Doram Electronics. Two rectifier diodes type 1N4001, 330Ω 1W resistor, 500μF 25V electrolytic capacitor.

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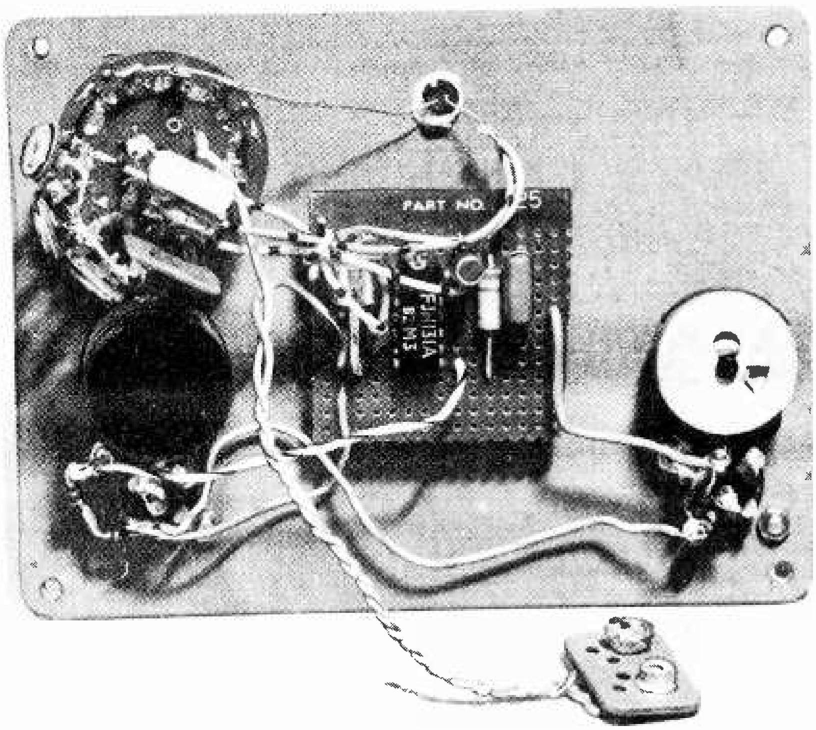

Photograph showing the mounting of the components on the rear of the front facia. Notice the variable resistors and timing capacitors mounted on the wafer switch.

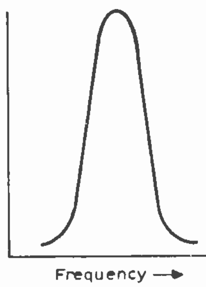

Fig. 7a: Ideal response curve.

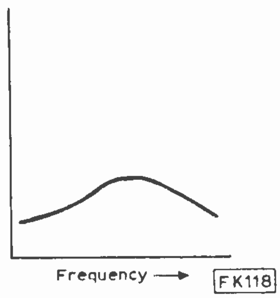

Fig. 7b: Poor selectivity.

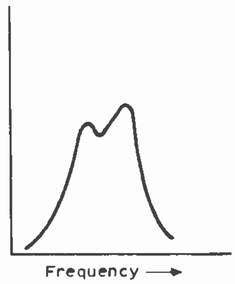

Fig. 7c: Detuning of one or more stages in the IF strip.

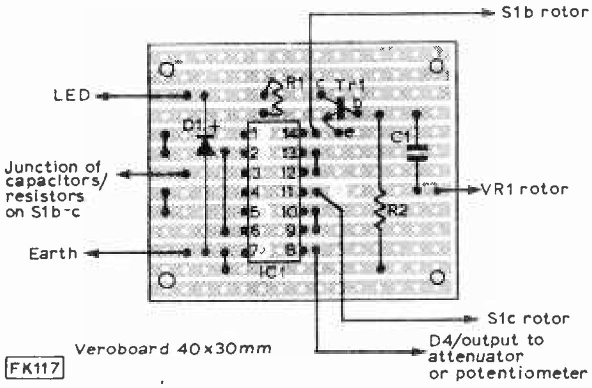

Fig. 6: The circuit should be laid out on 0·1in. matrix Veroboard as shown above.

Operation

To use the wobbulator effectively an oscilloscope with an X deflection output is required which is fed into the modulation socket of the wobbulator and the Y input (vertical deflection) is coupled to the detector of the intermediate frequency strip under test. The wobbulator output is then applied to the IF transformers in turn starting with the last IF and progressing to the first. The response shown on the cathode ray tube should be as Fig. 7a. Figs. 7b and 7c show poor selectivity and detuning of one or more stages respectively. With care it will be found that this technique will give up to 6dB more gain and greater selectivity than the usual method of amplitude modulated signal generator plus ear! PW

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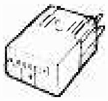
Slide Switch. 2-pole changeover panel mounting by two 6B.A. screws. Size approx. 1in. × ⅜in rated 250V lamp. **15p** + 7p post & VAT.

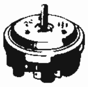
SubMiniatureSlide Switch. DPDT19mm (⅝in approx.) between fixing centres. **28p** + 9p post & VAT each or 10 for **£1·90**. SP Change over spring return 250V 1 amp. **25p** + 8p post & VAT.

6 DIGIT COUNTER



Resettable. 440 ohm coil up to 25 impulses per second. Ex-equipment but guaranteed perfect, **£3·30** + 40p Post & VAT each.
4 digit counter as specified for telephone charge calculator **93p**.

PRESSURE SWITCH



Containing a 15 amp change over switch operated by a diaphragm which in turn is operated by air pressure through a small metal tube. The operating pressure is adjustable but is set to operate in approx. 10in. of water. These are quite low pressure devices and can in fact be operated simply by blowing into the inlet tube. Original use was for washing machine to turn off water when tub has reached correct level but no doubt has many other applications **£2·10** each + 25p post & VAT.

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For dimming up to 250w without heat sink or 750w with heat sink. This comprises quadrac variable control potentiometer, condenser, resistors, tag strip for mounting and data. Price **£1·95** + 30p Post & VAT.

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Type 600 relay, 2 changeover one open and one closed contact. Twin 500 ohm coils make this suitable or closing off DC 6v, DC 12v, DC 24v or AC mains using resistor and rectifier. **40p** each. Resistor and rectifier **20p** extra.. **and Post VAT 20p.**

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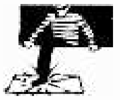
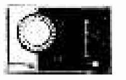
SWITCH TRIGGER MATS



So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc.
24in × 18in **£1·90**. Post & VAT 30p.
13in × 9in **£1·50**. Post & VAT 25p

SMITHS CENTRAL HEATING CONTROLLER



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

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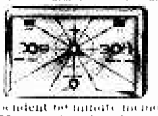
Wall mounting and in a handsome plastic case. (Cream and beige). Adjustable by slider (lockable) and may be set to control temperatures from around freezing through to 50°C. The slide panel is engraved and indicates (frost), (warm), (very warm), etc. The thermostat will control heaters, etc., up to 15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

AUDIO AMPLIFIER

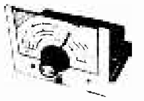
Part of the famous Rediffune background music system, secondhand, but believed in good order. However, no guarantee; we are selling for spares value only. These are 6 valve amplifiers, the output valves are 2 × EL 84 in push/pull, complete with mains transformer, rectifier and ample smoothing equipment. The mains transformer alone, today would cost at least **£4**. Size is 9½" × 5½" × 4½". Price only **£2·00** + postage and VAT £1·50.

15A ELECTRICAL PROGRAMMER



Learn in your sleep: Have radio playing and kettle boiling as you awake—switch on lights to ward off intruders—have a warm house to come home to. All these and many other things you can do if you invest in an electrical programmer. Clock by famous maker with 15 amp. on/off switch. Switch-on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price **£2·95. VAT & Postage 60p**, or with glass front, chrome bezel, **£1·50 extra.**

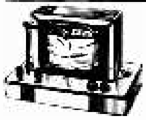
SHORTWAVE CRYSTAL SET



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

THIS MONTH'S SNIP

Smiths 24 hr. timer heart, really the "Autoset" without its plastic case. This is a 24 hr. twice on, twice off, clock switch which will repeat until re-programmed. Switches rated at 15 amps. Limited supplies—£3.95 VAT & post 55p. each

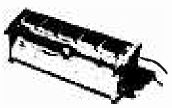


12 VOLT 1½ AMP POWER PACK

This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 mfd smoothing. Price **£3·75** plus VAT and Post £1.

Heavy Duty Mains Power Pack. Output voltage adjustable from 15–40V in steps—maximum load 250W—that is from 6 amp at 40V to 15 amp at 15V. This really is a high power heavy duty unit with dozens of workshop uses. Output voltage adjustment is very quick—simply interchange push on leads. Silicon rectifiers and smoothing by 3·000mF. Price **£10·50** plus £25 VAT & post.

TANGENTIAL HEATER UNIT



This heater unit is most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing £15 and more. Comprises motor, impeller, 2kW element and 1kW element allowing switching 1, 2 and 3kW and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only needs control switch. **£5·82** plus VAT & post £1. 2kW Model as above except 2kW **£4·25** plus VAT & post 75p. Don't miss this. Control Switch **44p**, P. & P. 40p.

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Starterless control gear, complete with tube ends and tube clips for window lighting, signs, fascias, etc. 4 ft. 40 w. **£1·90**; 5 ft. 65w. **£2·00**; 5 ft. 80w. **£2·20**; 6 ft. 80w. **£2·45**; and for pairs as follows:—twin 2 ft. 20w. **£2·55**; twin 3 ft. 30w. **£3·55**; twin 4 ft. 40w. **£3·25**; twin 5 ft. 65w. **£3·25**; twin 5 ft. 80w. **£3·95**; twin 8 ft. 125w. **£5·75**. These are about one half of maker's current prices and can't be repeated once stocks are cleared. Please add 30p per piece to cover postage or carriage and 8% VAT.

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12v	1 amp	1·00
6·5v-0·6 5v	1 amp	1·50
18v	1 amp	1·50
24v	2 amp	2·25
24v	3 amp	3·50
12·0-12v	50mA	1·20
6·0-6v	50mA	1·20
8·0-8v	½ amp	1·50
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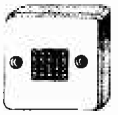
Model EP9000 4 watt power output **£2·40** + 50p post & VAT.
EP 9001 twin channel or stereo pre amp. **£2·50** + 50p post & VAT.

LIGHT SWITCH



Automatically switches on lights at dusk and off at dawn. Can also be used where light and dark is a convenient way to stop and start an operation. Requires only a pair of wires to the normal switch. In bakelite box, normal switch-plate size. 1 amp model **£3·75**.
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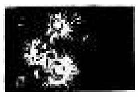
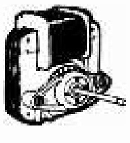
SOUND TO LIGHT UNIT



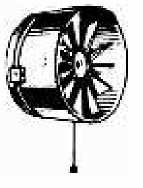
Add colour or white light to your amplifier. Will operate 1, 2 or 3 lamps (maximum 450w). Unit in Box all ready to work. **£7·95** plus 95p VAT and postage.

MAINS MOTOR



Precision made —as used in record decks and tapes recorders—ideal also for extractor fans, blower, heaters, etc. New and perfect. Snip at **95p** + VAT & Postage 20p. Postage 20p for first one then 10p for each one ordered.
1" stackmotor **£1·25** + VAT & postage 25p. 1½" stackmotor **£1·50** + VAT & Postage 30p.

EXTRACTOR FAN



Cleans the air at the rate of 10,000 cubic ft. per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc., it's so quiet it can hardly be heard. Compact, 5½" casing with 5½" fan blades. Kit comprises motor, fan blades sheet steel casing, pull switch, mains connector and fixing brackets. **£4·25 VAT & Postage £1·50.**

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Fit 8mm hole and include spire clip for fixing
RED, AMBER, CLEAR, OPAL —19p ea
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TYPE MF

Fits 6·4mm hole—nut fixing
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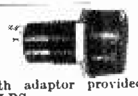
LAMPHOLDER DH



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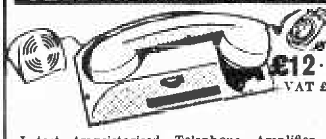
TELEPHONE AMPLIFIER



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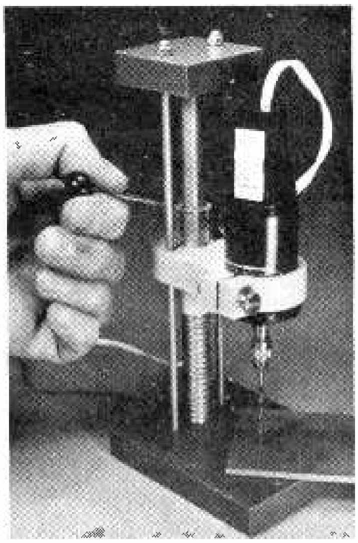
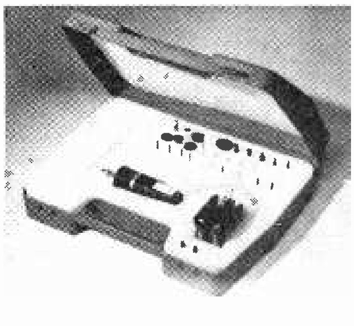


Drill only	**£7·00** p.p. 35p
Stand	**£3·75** p.p. 58p



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KIT 30 TOOLS	**£15·01** p.p. 75p
STAND	**£3·76** p.p. 58p
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ON THE AIR

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

BEARING out my long-held view that the HAC one-valver is the ideal simple set for the beginner, **Andrew McIntee** from Craichie, by Forfar, in Scotland, opens this month's offering with the logging of New Zealand on 11780 at 0900. This is only a 7·5 kW station and to pull it on the HAC is worthy of a round of applause at least. Andrew does admit though that he has a 180ft long wire aerial and has fitted an ATU. Speaking of which, I hear that one of the advertisers in PW is testing a new aerial tuning unit and if it is a success it will be launched in the near future. I have no news on the price as yet but will keep you informed.

This month certainly seems to be rich in unusual loggings, it must be the revivification caused by the summer holidays! This is evidenced by **John Spinks** of Great Moulton, Norfolk who, using his Trio and the old faithful Joystick on the garage roof, he has pulled in the following:—

Radio Bolivar on 4770 at 0120
Radio Bucaramanga on 4845 at 0115
Kinshasa, Zaire on 4880 at 2150
Radio Yaounde, Cameroon on 4972 at 2140
Sibu, Sarawak on 5005 at 2215

In fact John's complete log contains a fistfull of very rarely reported stations and even had me trying for a few of them, nice work, John! **Robert Hill** of Crewe is off to Portugal for his holidays, a little late perhaps but he found time to drop us a line logging ELWA Liberia on 11895 at 0920. Aside from cramming for the dreaded 'A' levels Robert has fitted a reel-to-reel tape recorder to his Invicta 8027 and seems to be set fair to record some station ID's in order to refresh his memory, if need be.

Another old friend of ours is **John Higginbotham** of Holyhead and this worthy gentleman sent a long amusing letter regarding his domestic set-up. It seems that he has the same problem that many DXers face, namely, where to put all the bits and pieces! John says that his mother was "fed up with the bedroom looking like a workshop". Thus it is that he has moved into a garden shed. Fine on the shed John, but remember that radios in the main are precision instruments and do not take kindly to damp. The best thing to do is to keep the sharpest of eyes on the humidity and try to beg, borrow or steal some form of heating. Thanks to this column John has pulled Radio Afghanistan on 15195 at 1130. He also QSL'd Pekin and the score to date on replies is as follows:— One calendar, two books, seventeen(!) magazines, two QSL cards, three skeds, three report forms and one notebook! Personally I can't see what they hope to achieve but they still keep sending out all this literature.

Two writers this month focus the spotlight on Radio Mexico. **Harold Emblem** from Mirfield, Yorks reports them testing on 15285 at 2205 while **Jonathan Marks** of Norwich writes that on 15125 they were asking in English and French for reports at 2258 while 2309 the language changed to Spanish. This indicates to me that they are trying to establish themselves in Europe in competition with Radio Nacional de Brazil. They asked for reports, without IRCs, to be sent to Radio Mexico, PO Box 20/620, Mexico City, Mexico and promise that accurate reports will get a Radio Mexico pennant.

Another address for QSLs comes from **Chris Clarke** of Shipdam who passes on the info that the American religious station WYFR asks for reception reports to be sent to Family Radio, Oakland, California, N 4621 U.S.A. Far across the Indian Ocean both India and Sri Lanka broadcast to their citizens in other lands. One person who reports them is **P. K. Gulati** of Guildford who sends the loggings of Air Delhi on 1110 and 7150 at 1900 plus Radio Sri Lanka on 1200 at 1730.

The popular question of QSL cards is raised by **Jeremy Hinton** who hails from Newcastle, Staffs. He asks what is the average time for a reply? Well Jeremy, this all depends on the station and its eagerness to maintain good relations with its audience. I will not deny that some stations lose reports or are plain lazy, and recently some American DXers got their replies back after ten years! You mentioned, Jeremy, that Radio Nederland refused you a QSL because you omitted to report the frequency. These details are important to the engineers in order that they can judge if their signal is reaching the target area.

A very welcome letter comes from Malta and asks if the writer is justified in sending reports to PW. I regret that I could not decipher the name but I believe it to be **Vincent Canabatt.** Well, Vincent your part of the world is very rich in transmitters and if you can hear them then there is a very good chance that we in the UK will. PW is read in a good many countries overseas and your tips will help them a lot. All that is needed is to write the station name, frequency, and time in GMT. It is also of interest

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ON THE AIR

if you include any unusual details such as addresses or any news of future events that the station may broadcast.

There has been a very heavy post so inevitably many letters have to be left out, so to the writers I can only apologise and say 'keep trying' and to everyone wish best 73s and so close the column for this month.

AMATEUR BANDS

by Eric Dowdeswell G4AR

I am very glad to notice, in the various amateur radio magazines, an upsurge in operating using quite low power. As one would expect, those who try this very interesting work usually get quite a kick out of working stations thousands of miles away when using milliwatts of power and ordinary receiving type transistors. The work is virtually all on CW and the point in mentioning it is to ask those of you who are interested in copying code to have a look at the LF ends of the various bands for those chaps calling 'CQ QRP'.

Needless to say, one can spend a lot of time calling without getting a reply so, for a change, these stations would probably welcome reports from listeners. CQ Magazine runs a regular feature on QRP work which makes very intriguing reading! With the widespread abuse of licence power limitations in various countries it is good to hear of those who have gone in the opposite direction! Let us hope it will be a continuing trend.

The summer hang-up is really showing now with relatively few reports coming in. Readers are no doubt taking every advantage of the sub-tropical weather we have been enjoying for so long. Let's hope they are building up a great reserve of strength for the forthcoming DX season which will be quite tough with the bottom of the sunspot cycle not yet reached.

Fortunately, **Paul Barker** (Sunderland) has kept his nose to the grindstone possibly due to the added incentive of being able to watch slow-scan TV. 'Catch of the Month' for Paul was 9X5AV on 20m SSTV but for sheer excellent picture quality Paul gives full marks to DL7DE in Berlin. (Marks—oh dear!) Paul points out that prefix C9 is now being used in place of the old CR7 reporting C9MIC as active in this strife-torn country. He also notes YR as a special prefix for Rumania but if I went to my very ancient collection of QSL cards I could find one showing YR as the old prefix used by that country! I think someone once said something about "all is change but nothing changes'.

Mike Bennett (Slough) didn't mention too many catches but all are very much worth while, such as C21NI on Nauru and FP0YY on St. Pierre and Michelon and the Mount Athos DXpedition SV1GA/A. **Jeremy Hinton** A8962 (Newcastle, Staffs) had trouble with his Trio 9R59DS, which I hope I have been able to straighten out, so his log is very short this month. Back to Mike Bennett who sends some info on changes to licensing areas in PY land, too long to publish, but first suffix Z indicates a foreign operator such as PY1ZAA while similar suffixes W, X or Y indicate a novice licence. Just in case you ever hear one operating car mobile, his call will add /MT!

Although **Neil Whiteside** has been on holiday with a 160m receiver in Dorset, away from his usual QTH in Hitchin, I am sorry to say he allowed local attractions to divert him from amateur radio! Let's hope he has got back on to the straight and narrow by now!

Ian Jay (Mansfield) has really got the knack now of only listing those stations of real interest including VP2 and ZL2 on 40m SSB. **Tim Charles** (Colchester) apologises for lack of a log last month but his excuse is 'great changes going on in the shack', which, I suppose, is fair enough! Main receiver is now a Heathkit GR64 plus a home-built Q mulitplier. He tried to flog his CR70A at the Anglian Mobile Rally, without success, but I suspect he will be glad, in the long run, to keep it as a second receiver. Can't have too many of them around the place! Tim quotes latest UK calls issued as G8KMM and G4EHT in the middle of August but there will be many more with their hard-earned bits of paper 'ere you read this.

Stephen Budd A8713 (Worthing) has very wisely erected a Lazy-H beam which he thoroughly recommends. He doesn't mention its size but if it has 66ft centre-fed elements then it is a very good performer indeed, with open line feeder and an ATU, for 40m to 10m. The usual problem is getting enough height above earth for the lower elements to be really effective. The bi-directional beam obviously passes through the Pacific because he logs such interesting ones as KB6CU on Canton Is., four KG6's on Guam and KJ6CF on Johnston Is. all of which come into the 'rare' category. That was on 20m SSB but I hope Stephen will try that beam on the other bands in due course.

Log extracts

S. Budd:— 20m HS5AKW KB6CU K1MTJ/KG6 WB4LEE/KG6 KG6JBE KJ6CF KL7BJW KM6EA KS6FF KS6FK ST2SA VR1AT VS5DB ZD8LS

T. Charles:— 40m VK3XB **20m** HC5PC JW5NM VR1PE ZL1EGM **2m** DB0VR PI3VAD (repeater) SP3BUE

I. Jay:— 40m CO2GS OJ0MA VP2MCT ZL2AGY **80m** HZ1AB TR8DG VU2GDG **20m** H18MOG SV0WKK (Crete) TG5YN VP2LBR VP2SN VS5DB 5L2FW 7X2BK

N. Whiteside:— 80m 9X5SP 5Z4LW **20m** XE1APA KZ5RS

J. Hinton:— 15m A4XFW JY5UNM HI6EA

M. Bennett:— 20m C21NI FB8ZG FP0YY FR7ZW PJ8MS SV1GA/A **15m** CX2BE LU6EAU ZP5IL **10m** LU5DBA OJ0MA

P. Barker:— 20m C9MIC JA0AXV YR2KBQ 7X2BK 7X5AB PV0SH (Singapore) 9V0SN 9Y4HM **20m SSTV** DJ9NG DL7DE F3RT 18WAM OH5RM OK2OI 9X5AV

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

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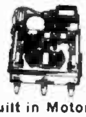

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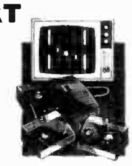

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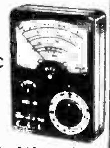

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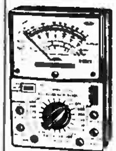

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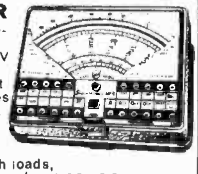

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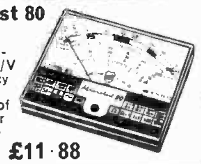

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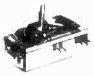

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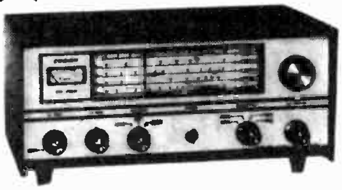

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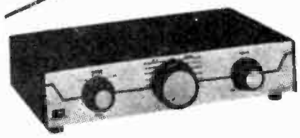

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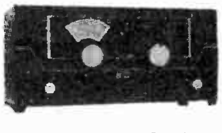

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ON THE AIR

MEDIUM WAVE DX

by CHARLES MOLLOY

NORTH AMERICAN medium wave stations are often heard here in the UK. A path of darkness between transmitter and receiver is required for medium wave propagation and this occurs to North America some five to six hours after sunset in the UK. During the winter months Canadians can be heard as early as 2300, to be followed an hour later by outlets situated on the eastern seaboard of the United States. North Americans operate on channels spaced 10kHz apart and they are allocated callsigns which are used frequently as a means of identification, followed by the city or town where the studios are located. Listen on 930kHz for CJON St. John's in Newfoundland. It is the most consistent North American, its time zone is 3½ hours behind GMT and it can be found on the low frequency side of AFN Berlin on 935kHz.

Other Canadians which are heard regularly when conditions are favourable are CBN St. John's on 640kHz; CHER Sydney, Nova Scotia on 950kHz; CBA Moncton, New Brunswick on 1070kHz. Broadcasts from the United States to look for are WABC on 770kHz, WINS on 1010kHz and WNEW on 1130kHz, all in New York City; WHDH on 850kHz in Boston on 850kHz and WCAU in Philadelphia on 1210kHz.

Steve Whitt (London) reports "I can't wait for winter DX conditions to test my loop aerial and I'm looking forward to a batch of North American goodies". Steven is now using the PW medium wave loop aerial and balanced FET pre-amplifier (April 1973) with his Chapman S6BS communications receiver and he reckons this aerial is far better, more sensitive and more directional, than his 30ft longwire on the roof. Stations logged on this new set-up include Radio Andorra on 701kHz, Radio Dakar in Senegal on 764kHz and CJON St. John's Newfoundland on 930kHz, three continents!

Harold Emblem sends a really outstanding log of summer DX heard at his QTH in Mirfield, Yorkshire, on an Eddystone 730/4 communications receiver using a long wire and a medium wave loop. DX heard includes CBT Grand Falls, Newfoundland on 540kHz; CKVO Clarenville, Nfld on 710kHz; CBNM Marystown, Nfld on 740kHz; WABC New York City on 770kHz; CBH Halifax, Nova Scotia on 860kHz; CJCH in Halifax on 920kHz; CBM Montreal on 940kHz; CHNS Halifax on 960kHz; WINS New York City on 1010kHz; WNEW also in NYC on 1130kHz; WCAU Philadelphia 1210kHz; CKEC New Glasgow, N.S. 1320kHz; WLAC Nashville, Tennessee on 1510kHz and WKBW in Buffalo, N.Y. on 1520kHz.

Peter Bowyer (Kettering) uses a Murphy A168 for DXing on the medium waves and reports hearing AFN Augsburg and Radio Tirana, Albania both on 1394kHz and Trans World Radio, Montecarlo on 1466kHz. Fifteen-year-old **Stephen Boyle** of Auchterarder, Perthshire used a Philips 90RL210 with an externally mounted MW loop. Stations logged include Radio Norway on 1578kHz (in English at midnight GMT) and Radio Tirana, Albania on 1394kHz again.

Joseph Bite (Dublin) and **Derek Vivian** (Jersey C.I.) ask which type of receiver is the most suitable for MW DXing. Communications receivers such as the Trio 9R59DS, AR88, CR100 or the Heathkit GR78 (which operates from batteries or mains) have the sensitivity and selectivity that will bring optimum results. Simpler receivers when connected to a good aerial will, however, pull in a considerable amount of DX on the medium waves.

BROADCAST BANDS

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

AMATEUR BANDS

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

CQ! CQ! CQ! CQ!

ISSUES WANTED

..Television for March, April, May, June 1974.—R. Mehrotra, F-114 D.D.A. Colony, Naraina, New Delhi-28, 110028, India.

..August 1973 issue of P.W.—T. J. Flanagan, 17 Addison Crescent, Old Trafford, Manchester, M16 0WN.

..January to April 1973 P.W. inclusive also June 1973 and March and April 1974 P.W.—K. Hunter, 31 Cwmbath Road, Morriston, Swansea, SA6 7BA.

..1950 March, November, December. 1952 January March, April, August, September. 1953 May—all Practical Wireless. —J. Luxton, Bergheim, Battery Hill, Fairlight, Hastings, TN35 4AP.

..P.W. for February 1974, February 1966, April 1969 and June 1969 plus any subsequent issues dealing with aerials, April 1970, June 1970 plus any subsequent issues dealing with the LF Bands Transceiver, April 1972. Also P.E. for April 1965 and February 1966.—S. A. Rizvi, P.O. Box 2671 Tripoli, Libya.

..December 1970 and January 1971 issues of P.W.—J. M. Bell, 60 Wendover Road, Harlesden, London, NW10.

..all issues of P.W. including December 1971.—B. Disselmann, Skovlyporten 3-1, DK-2840, Holte, Denmark.

..issues of P.W. or the circuits of the P.W. Sound Effects Synthesiser first published in March 1971 (circuits 3-11 wanted).—D. Weeks, S.A.C., K8093975, GESF, R.A.F. Wildenrath, B.F.P.O. 42.

..any back issues of Practical Wireless, Television.—Craig Sellen, Box 853, Wayne, N.J. 07470, U.S.A.

..issues of P.W. containing instructions of the VHF Transistor Receiver with blueprint (around July 1965).—J. W. Cooling, 33 Flat Sorrel Court, 1 The Green, Mt. Sorrel, Leicestershire.

..P.W. May 1971—J. Rendall, 59 Hood Avenue, Southgate, London, N14 4QJ.

..P.W. January 1972 to October 1972 inclusive, P.W. March 1973—June 1973 inclusive and P.W. October 1973.—G. F. McCarthy, Ballymodan Place, Bandon, Co. Cork, Ireland.

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IMPROVE YOUR BUDGET STEREO SYSTEM

—continued from page 574

cation I arranged that the audio is completely muted when tuning. Fig. 3 shows the final arrangement.

Any circuit changes should only be done after reference to the manufacturers circuit diagram to make quite sure that no unpleasant or even disastrous effects will result. The AFC circuit shown is common to almost all budget stereos. The AFC and audio are fed from the discriminator output via a high value resistance (typically 150kΩ) to the AFC switch. The AFC line is decoupled after the switch

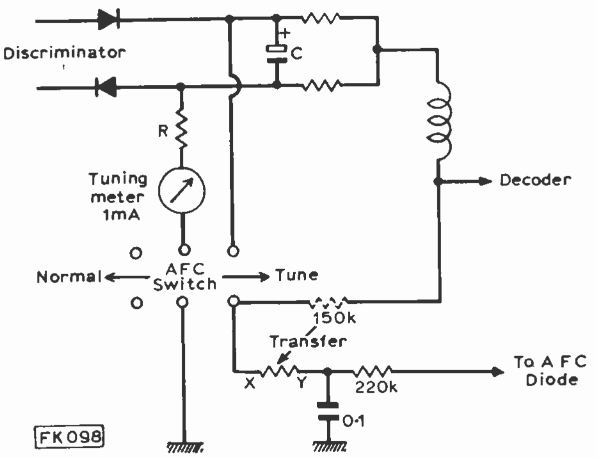

Fig. 3: Spare contacts on AFC switch are used to switch-in an insensitive meter (see text for value of R). Note that the 150kΩ resistor is moved to the new position XY.

(typically 220kΩ and 0·1μF). The 150kΩ prevents the audio from being shorted to chassis when the AFC is disabled. In the new circuit arrangement, however, we want to lose it so that muting takes place when tuning, done by moving the 150kΩ to the diode side of the switch. With printed circuit boards the easiest way of doing this is to short out the existing 150kΩ with a wire link and to carefully cut the foil on the other side of the switch, bridging the gap with a new 150kΩ resistor.

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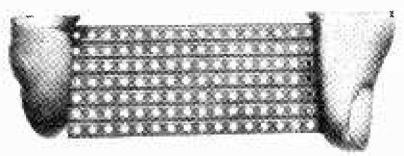

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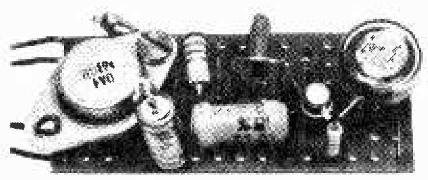
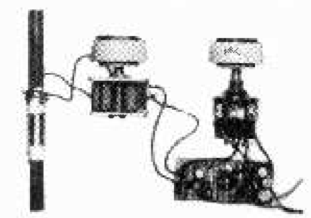


BROADCAST BAND RECEIVER



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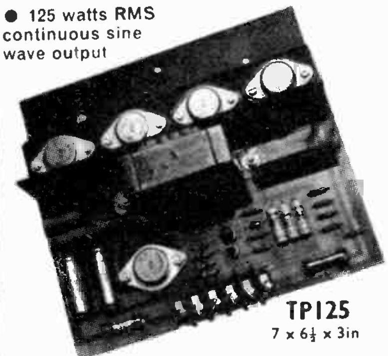

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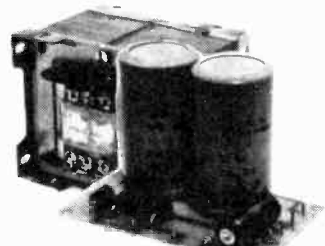

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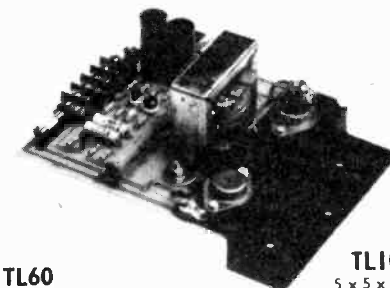

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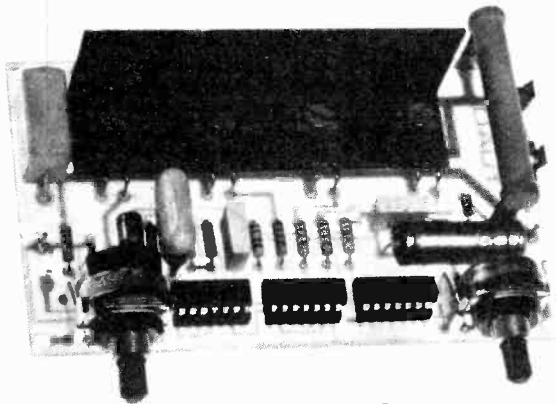

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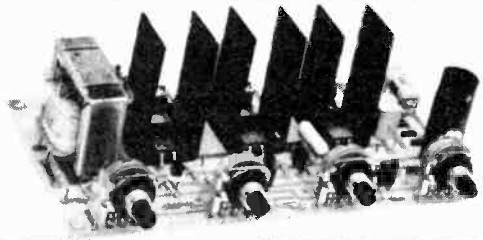

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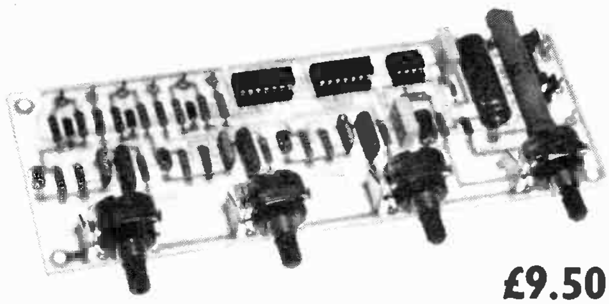

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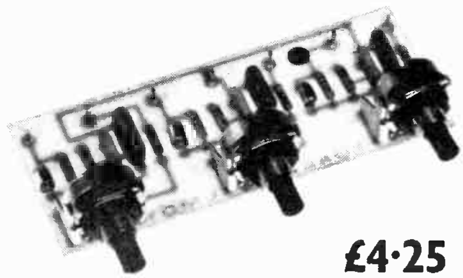

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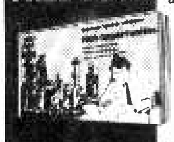

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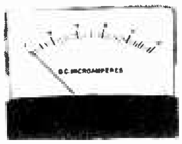

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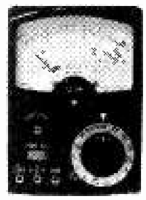

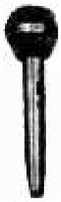

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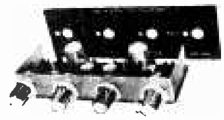

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1000	6	11	single end p/c fitting
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47	10	7	
220	10	7	
330	10	9	
15	16	7	
33	16	7	
68	16	7	
220	16	9	
220	16	9	single end p/c fitting
330	16	12	
1000	16	20	
10	25	7	
22	25	7	
47	25	7	
100	25	7	
150	25	9	
200	25	11	
1250	25	24	single end can
5000	25	55	single end can
1000+1000	30	32	single end can
2500	30	40	single end can
6·8	40	7	
16	40	7	
100	40	9	
1000	50	35	single end can
1	63	7	
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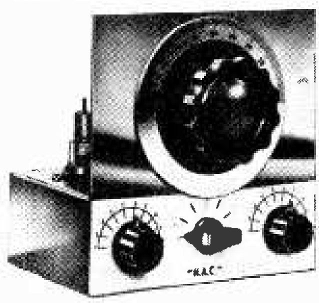

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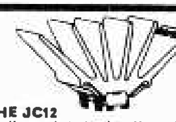

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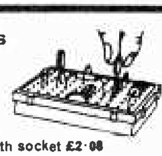

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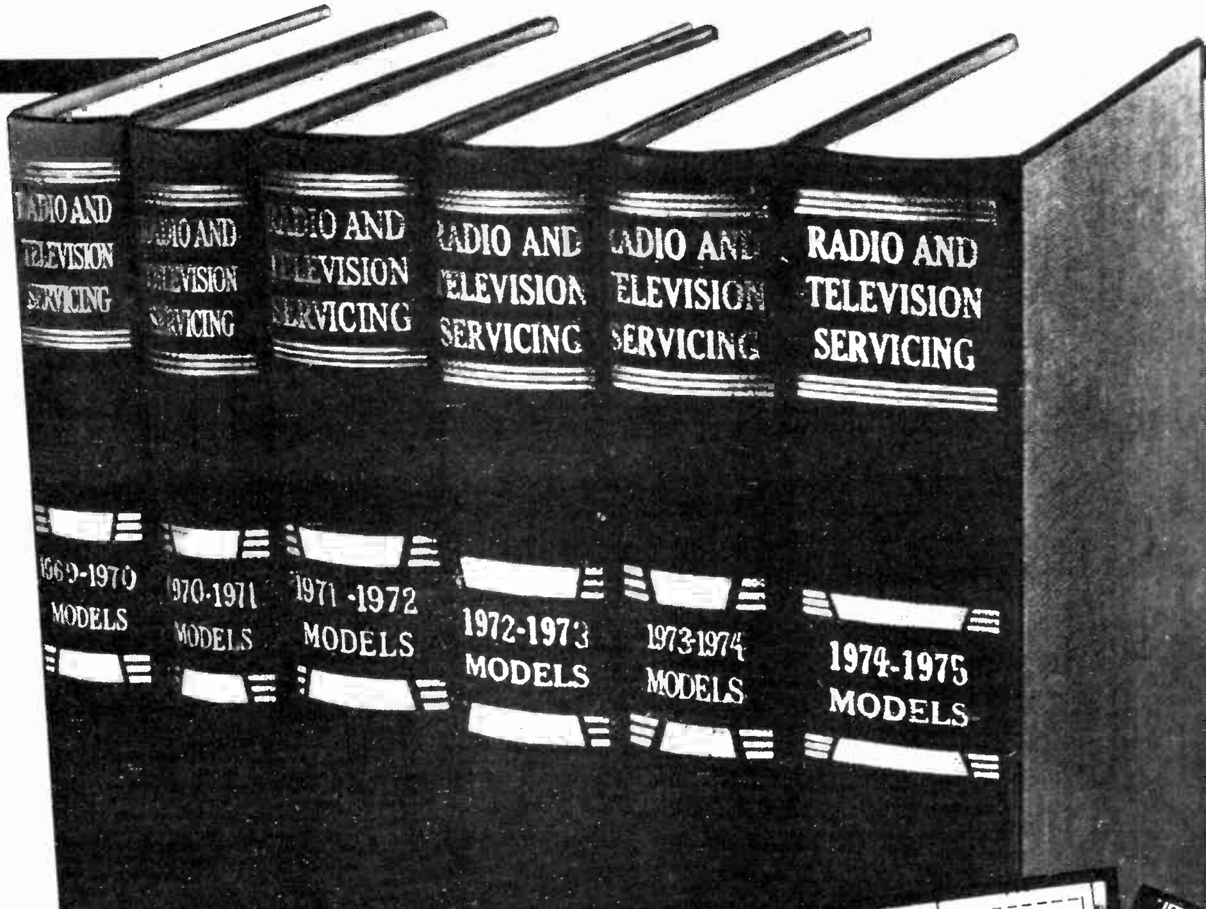

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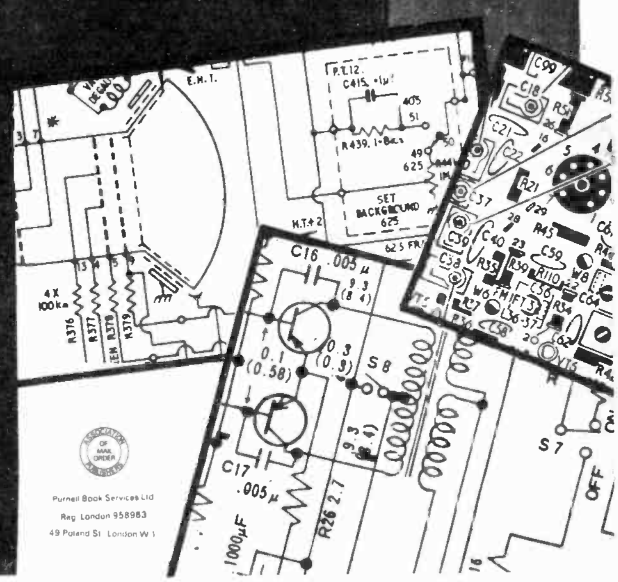

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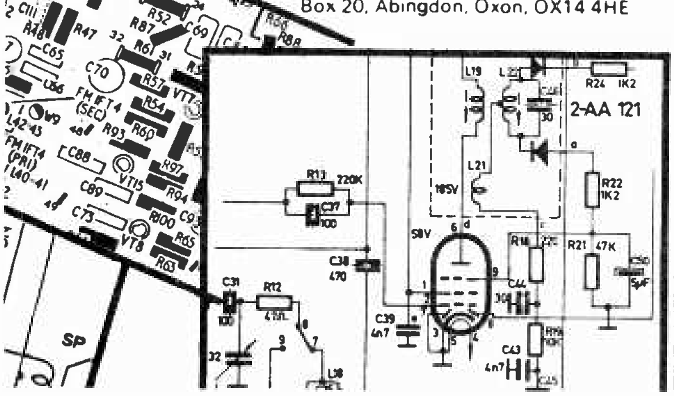

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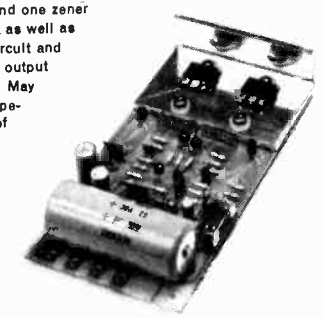


SA608

60 w.r.m.s. into 8Ω; 30 w.r.m.s. into 15Ω Texas 15A output transistors.

£11·50

New features—new performance standards

- ★New 90°C overtemperature cutout (electronic not mechanical).
- ★New integral output capacitor, no external components required for normal operation.
- ★Short circuit load line type protection with twin summing amplifiers.
- ★Inherently open circuit proof.
- ★Input sensitivity −10 dBm (240 mV into 50k) ie suitable for most mixers. Response 30Hz—40KHz ±2dB.
- ★Typical distortion 0·4% Noise −80 dB (as graph in catalogue).
- ★Compact: 15cm x 8 cm x 3 xm
- ★Suitable for all public address, discotheque, and group applications.
- ★Fused supply terminal.
- ★Single supply line (split supply not required).

CONSTRUCTIONALLY & ELECTRONICALLY BETTER : MULTIPLE TESTED : GUARANTEED

SA1208 **£16·00**

120 w.r.m.s. into 8Ω 60 w.r.m.s. into 15Ω Glass fibre printed circuit board. 15A output transistors

SA308 **£9·00**

30 w.r.m.s. intp 8Ω 15 w.r.m.s. into 15Ω basic circuit identical to SA 1208 10A 'Plastic Power' output transistors

THE NEW POWER SUPPLIES

- ★One piece, ready to wire assembly with integral glassfibre pcb.
- ★Grain oriented laminated transformers for compactness.
- ★Facilities for preamp supply.
- ★Fully fused.
- ★Size of all models 10 x 8 x 13cm. (PM1202 16cm)

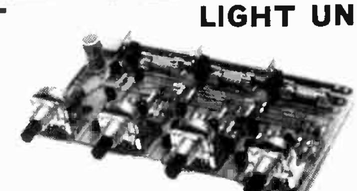
PM1201	95 volts for one SA1208	£11·00
PM1202	95 volts for two SA1208	£14·00
PM602	65 volts for one or two SA 608	£9·00
PM302	45 volts for one or two SA 308	£7·50

SAXON SUPERFECT LIGHT UNIT

(Illustrated)

All these features in ONE UNIT:

No other commercially available module to our knowledge, offers all these facilities in one complete unit.



- ★Sequential display with variable speed.
- ★Frequency dependent channels—individually fused.
- ★Continuously variable function control gives uninterrupted light display in absence of signal.
- ★Electronic override on each channel.
- ★RCA 8 Amp. triacs handling 1000 watts per channel.
- ★Timer circuitry to reduce 'flicker'.
- ★Individually controlled bass middle and treble plus master audio control for ease of adjustment.

£19·75

SAXON SOUND-LITE

£13·50

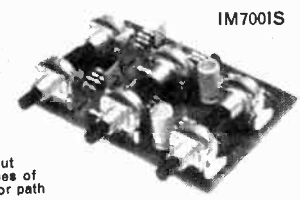
Our ever popular 3000 watt unit is now available in module form at only

- ★Individual control of bass middle and treble plus master control for ease of adjustment.
- ★1000 watts per channel—individually fused.
- ★Negligible load on amplifier.
- ★RCA 8 AMP triacs for reliability.

MODULAR PRE-AMPS

Mono & Stereo

IM7001S



Up to twenty IM7001 input modules may be used with the IM7002 mixer module. Each input module has various types of equalisation and monitor path outlets.

★Equalisation to suit ceramic AND *magnetic* cartridges, low and high imp. mic. and all musical instruments. ★Mono and stereo. ★Mono module may be matrixed into stereo.★low noise circuitry with carbon film resistors.★20 Hz—50 kHz + 1dB. ★Wide range bass and treble controls—zero noise with vol. at min. ★18 volt supply.★Outputs for monitoring and echo send. * May be used in conjunction with the discotheque mixers and Minotaur amplifiers.

IM7001M (mono) **£5·50** IM7001S (stereo) **£9·00**

IM7002 Mixer module with output suitable for most amplifiers PLUS up to 1 Watt of monitoring power.

★Accepts up to twenty IM7001 input modules.★Mono or stereo. ★Up to 3V output—will feed loads down to 600 ohms. ★Up to 1 watt into 8Ω for monitoring (will feed higher impedance). ★Accepts echo and other effects return signals.

IM7002M (mono) **£5·50** IM7002S (stereo) **£9·00**

THE ULTIMATE IN MIXER MODULES

- ★Inputs for two decks (ceramic cartridge) plus tape; overall bass and treble controls
- ★Hi/lo imp. mic input with separate volume bass and treble controls.
- ★Continuously variable autofade depth plus preset threshold control.
- ★Low noise (−80dB) virtual earth mixing circuitry.
- ★Up to 0·5W from low distortion push pull monitor amp.
- ★Response 20Hz—50kHz ± 1dB.
- ★Low power consumption (20mA at 18 volts).
- ★Compact—mono version 40cm x 6cm x 3cm. stereo version 40cm x 10cm x 3cm.
- ★Output −10dBm (240mV) to suit all Saxon amplifiers and most other makes.

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MONO VERSION **£18·50**

STEREO VERSION **£27·50**

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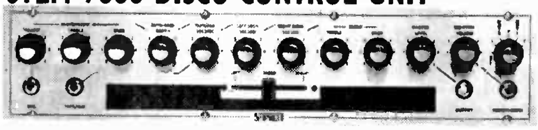
MINOTAUR 100

- ★100 W.r.m.s. into 8Ω.
- ★Two mixed inputs, wide range bass & treble controls.
- ★May be operated as a slave amplifier.
- ★Extremely compact (27cm × 16cm × 10cm).
- ★Fully protected against all incorrect loads and short circuits.

**Except minotaur (anodised aluminium).*

£47·50

SYSTEM 7000 DISCO CONTROL UNIT



- ★Mono or stereo.
- ★2 Deck and one tape inputs, individually controled plus L/R deck fader (ineffective at central).
- ★Wide range bass and treble controls plus separate MIC volume bass and treble controls. Overall master control.
- ★Continuously variable autofade depth and threshold.
- ★Five position monitoring switch with two mute positions—ample headphone power.
- ★Complete, cased with all terminations by plug/socket etc.
- ★Noise −80 dB Response 20Hz-50 kHz ± 1dB.

Mono **£28·50**
Stereo **£45·00**

SYSTEM 7000 MODULAR MIXING—UP TO 20 CHANNELS

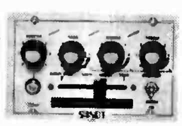
Complete versions of the IM7001 and IM7002 modules shown in our advertisement make a professional quality versatile mixer to *your* requirements using these modules mono and stereo inputs may be combined.

- ★The mixing modules split mono signals.
- ★Each input module has own monitor switch.
- ★Stainless steel panel on 15cm × 5cm matrix (approx.)
- ★Input equalisation for all types of signal inc. magnetic cartridge.
- ★Complete system may comprise twenty channels, mono or stereo with ample monitoring power.
- ★May be patched in with disco mixers or minotaur amplifier.

Mono Input module **£8·50**
Mono Mixer Module **£8·50**
Stereo Input Module **£12·00**
Stereo Mixer Module **£12·00**
Power Supply Unit for up to 20 Modules **£7·50**

SYSTEM 7000 LIGHTING CONTROL UNIT

- ★1000 watts per channel. Sound light *and* SEQUENTIAL *and* OVERRIDE.
- ★Individual control of bass middle and treble.
- ★Master control for easy adjustment.
- ★Plug/socket terminations throughout.
- ★Slider control for function, allows sound/light, sequencing or combination of both.
- ★Stainless steel front panel to match disc control unit.
- ★Compact (17 cm x 10 cm x 10 cm approx.).
- ★Electronic override eliminates clicks.
- ★High sensitivity, negligible input power.



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EF42	·90		·80	PEN453DD		UCH81	·47
EF73	1·76	HL23DD			2·00	UCL82	·45
EF80	·30		·80	PENDD		UCL83	·64
EF83	1·45	HL41DD		4020	1·00	UF41	·82
EF85	·40		1·00	PFL200	·82	UF42	·82
EF86	·58	HL42DD		PL33	·50	UF80	·41
EF89	·35		1·00	PL36	·70	UF85	·52
EF91	·58	HN309	1·76	PL81	·53	UF89	·47
EF92	·60	HVR2	1·00	PL81A	·60	UL41	·75
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EF804	1·75	KT81	2·10		·82	U10	1·17
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EL83	·70	PC86	·70	PY88	·47	U191	·50
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EL86	·60	PC95	·70		1·11	U301	·65
EL360	1·80	PC97	·42	PY800	·45	U403	·90
EL506	1·20	PC900	·30	PY801	·45	U404	·75
EM80	·53	PCC84	·40	PZ30	·50	U801	·80
EM81	·76	PCC85	·50	QQV03/10		U4020	·75
EM83	·64	PCC88	·65		2·10	VP23	·65
EM84	·47	PCC89	·50	QS75/20		VP41	·88
EM85	1·20	PCC189	·60		1·00	VR105	·59
EM87	1·10	PCF80	·47	QS95/10		VU111	·80
EMM803		PCF82	·50		1·00	VU120	1·17
	2·50	PCF84	·70	QS150/15		VU120A	
EY51	·50	PCF86	·50		1·90		1·17
EY81	·50	PCF200	1·00	R19	·75	VU133	·80
EY83	·70	PCF201	1·05	TH233	1·00	W107	·75

W729	1·17	AD161	·59	BYZ12	·33
X65	1·46	AD162	·59	BYZ13	·33
X66	1·46	AF114	·33	FSY11A	·29
X101	2·34	AF115	·20	FSY41A	·29
Z759	5·85	AF117	·25	OA9	·16
		AF121	·39	OA10	·55
Transistors		AF124	·33	OA47	·13
& Diodes		AF125	·22	OA70	·20
1N4744	·18	AF126	·23	OA73	·20
2N404	·23	AF180	·68	OA79	·12
2N966	·68	AF186	·71	OA81	·12
2N1756	·64	BA115	·18	OA85	·12
2N2147	1·10	BA116	·23	OA90	·16
2N2297	·29	BA129	·16	OA91	·12
2N2369	·18	BA130	·13	OA95	·12
2N3053	·42	BA153	·20	OA200	·12
2N3121	3·22	BC107	·16	OA202	·13
2N3703	·25	BC108	·16	OC44	·13
2N3709	·26	BC109	·16	OC45	·14
AA119	·20	BC113	·33	OC46	·20
AA120	·20	BC115	·20	OC70	·16
AA129	·20	BC116	·33	OC71	·14
AAZ13	·23	BC118	·29	OC72	·14
AC107	·30	BCY10	·59	OC74	·29
AC113	·33	BCY12	·64	OC75	·14
AC126	·16	BCY33	·26	OC76	·20
AC127	·22	BCY34	·29	OC77	·35
AC128	·26	BCY38	·29	OC78	·20
AC132	·26	BCY39	·33	OC78D	·20
AC154	·33	BF158	·23	OC81	·14
AC156	·26	BF159	·33	OC81D	·14
AC157	·33	BF163	·26	OC82	·14
AC165	·33	BF173	·49	OC82D	·14
AC166	·33	BF180	·39	OC83	·26
AC168	·49	BF181	·52	OC84	·31
AC176	·71	BF185	·52	OC123	·29
AC177	·36	BF194	·20	OC139	·29
ACY17	·33	BFY50	·29	OC169	·29
ACY18	·26	BFY51	·25	OC172	·46
ACY19	·25	BFY52	·26	OC200	·59
ACY20	·23	BY100	·23	OC201	·59
ACY21	·25	BY114	·23	OC202	·55
ACY22	·20	BY126	·20	OC203	·39
ACY28	·23	BY127	·23	OC204	·39
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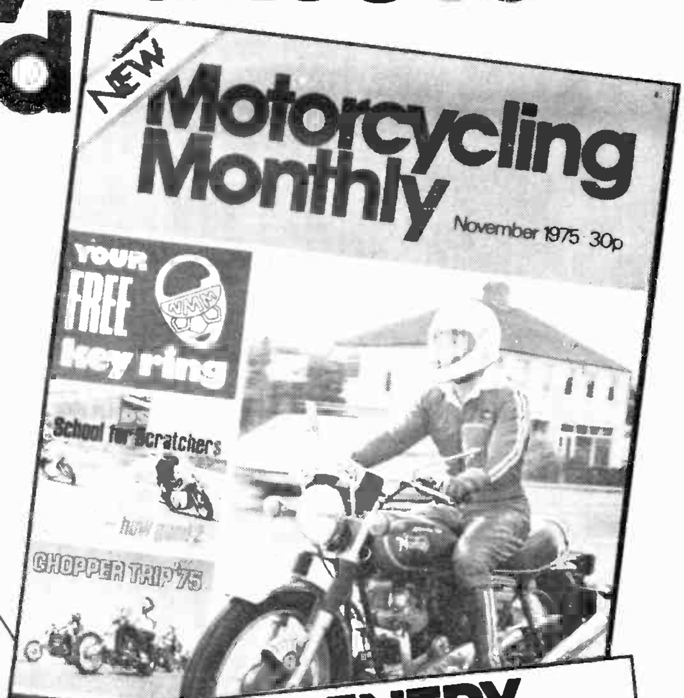

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4″ SIZE: 110mm Wide × 82mm High × 43mm Deep.

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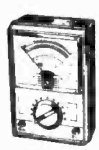

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Prim. 120/240V. Sec. 120/240V. Centre Tap with Screen.

VA (watts)	Ref No.	Price Cased £	Price Plugs 2 Pin + 1 Earth	Price Open £	Post £
60	149	8·60	0·88	4·37	0·56
100	150	9·40	0·88	4·90	0·64
200	151	11·70	0·88	8·14	0·80
250	152	13·15	0·88	9·80	0·88
350	153	15·75	0·88	11·88	0·95
500	154	17·50	0·88	13·62	1·13
750	155	27·35	1·10	20·59	O.A.
1000	156	35·65	1·10	29·15	O.A.
1500	157	42·25	1·10	33·37	O.A.
2000	158	49·95	2·64	37·10	O.A.
3000	159	73·50	2·64	58·55	O.A.

12 & 24 Volts Prim. 200–240V.

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

30 Volts

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

Amps	Ref. No.	Price £	Post £
0·5	112	1·90	0·47
1	79	2·40	0·56
2	3	3·50	0·56
3	20	4·50	0·64
4	21	5·15	0·72
5	51	6·40	0·72
6	117	7·16	0·88
8	88	9·55	0·95
10	89	9·67	0·95

AUTO TRANSFORMERS

VA Watts	Ref. No.	Price Cased £	Price Plugs 2 & 3 pin	Price Open £	Post £
Tapped at 115, 220, 240 Volts					
20	113	4·10	0·20	1·71	0·47
Tapped at 115, 200, 220, 240 Volts					
150	4	6·65	0·20	4·12	0·56
200	65	7·30	0·20	4·95	0·64
300	66	8·25	0·20	5·81	0·72
500	67	11·25	0·20	8·85	0·88
750	83	14·10	0·85	10·80	0·95
1000	84	17·50	0·85	13·68	1·13
1500	93	22·15	0·85	18·31	O.A.
2000	95	33·40	1·60	24·25	O.A.
3000	73	48·20	2·10	35·10	O.A.

50 Volts

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

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

60 Volts

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

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

MINIATURE AND EQUIPMENT

Prim. 240V with screen.

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

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50 P.I.V. 20p	50 P.I.V. 35p	100 P.I.V. 55p	50 P.I.V. 65p
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200 P.I.V. 28p	200 P.I.V. 45p	400 P.I.V. 65p	200 P.I.V. 80p
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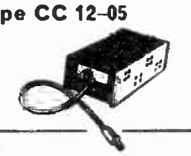

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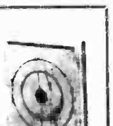

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2N3053	0·14			OP. AMP. IC's	
2N3055	0·38	D.I.L. SOCKETS		709C TO99	0·30
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OC35	0·35	14 Pin	0·12	741C TO99	0·36
OC26	0·45	16 Pin	0·14	741C D.I.L.	0·36
OC36	0·35			723C D.I.L.	0·80
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TIP42A	0·90			748C D.I.L.	0·36
7400N	0·16	74 SERIES TTL		74121N	0·50
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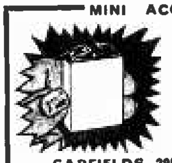

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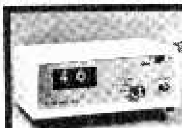

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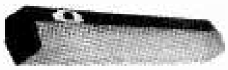

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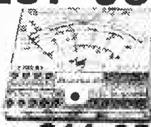

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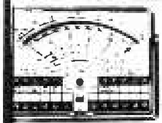

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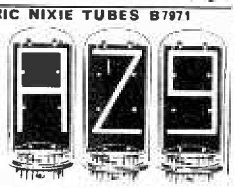

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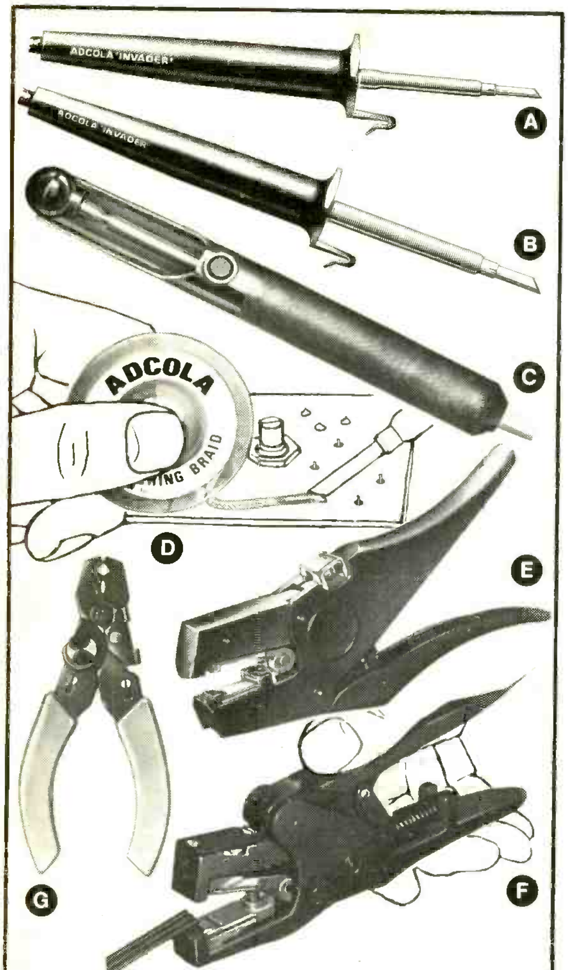

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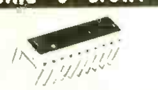

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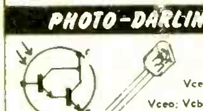

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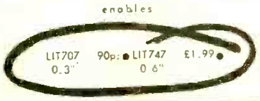

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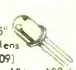
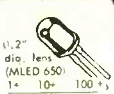
Litronix Double Digit Displays 0.5", Common Anode + 2 R/H D.P.'s
DL721 gives ± 1.9
DL727 gives 0.0. to 9.9
Suitable for Clocks; Instruments; T.V. Channel Indicator
Our Price £4.75 each. ●

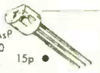
L.E.D.'s

Free snap-on plastic retainer





	0.125" dia. lens (TIL209) 1+	10+	100+	0.16" dia. lens 1+	10+	100+	0.2" dia. lens (MLED 650) 1+	10+	100+
Red	16p	15p	13p ●	27p	24p	22p ●	18p	16p	14p ●
Green	27p	24p	22p ●	33p	30p	27p ●	30p	27p	25p ●
Orange	27p	24p	22p ●	33p	30p	27p ●	30p	27p	25p ●
Yellow	34p	31p	29p ●	35p	32p	29p ●	35p	33p	30p ●



Low Cost Red GaAsP Motorola MLED 500 in a T092 package. 15p ●

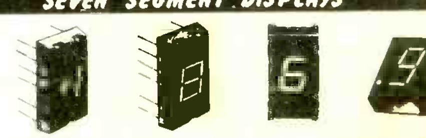
NEW Opto-isolators
IL1 (4N25 or TIL116)
6 pin industry standard package.
2.5KV isolation £1.00 ●

NOTICE
Postage & Packing Charges

With the recent increase in postal charges and a continuing increase in packaging cost we have been forced to review our policy.
Henceforward:
1. Orders valued at £5 or more will be post free.
2. All U.K. 'small package' orders will go first class mail.
3. Minimum postage & packing charge will increase to 20p.

SEVEN SEGMENT DISPLAYS

litronix
Xcitan
Monsanto



		COMMON ANODE R/H Dec. Pt	COMMON ANODE L/H Dec. Pt.	COMMON ANODE ± 1	COMMON CATHODE R/H Dec. Pt.	Our Price
	RED	DL707R	DL707	DL701	DL704	£1.82 ●
0.3"	GREEN	MAN51	MAN52	MAN53	MAN54	£1.82 ●
	RED	MAN71	MAN72	MAN73	MAN74	£1.82 ●
	YELLOW	MAN81	MAN82	MAN83	MAN84	£1.82 ●
	ORANGE	MAN3610	MAN3620	MAN3630	MAN3640	£1.82 ●
	GREEN	XAN51	XAN52	-	XAN54	£1.49 ●
	RED	XAN71	XAN72	-	XAN74	£1.49 ●
	YELLOW	XAN81	XAN82	-	XAN84	£1.49 ●
0.4"	GREEN	MAN4510	MAN4520	MAN4530	MAN4540	£2.32 ●
	RED	MAN4710	MAN4720	MAN4730	MAN4740	£2.32 ●
	YELLOW	MAN4810	MAN4820	MAN4830	MAN4840	£2.32 ●
	ORANGE	MAN4610	MAN4620	MAN4630	MAN4640	£2.32 ●
		C.A L/H Dec. Pt.	C.A ± 1	C.C. L/H Dec. Pt.	C.C. ± 1	
0.6"	RED	DL747	DL746	DL750	DL749	£2.42 ●

NOTE: MAN4000 series pinouts are 14 pin dil the same as MAN50;70 & 80 series.

VAT INCLUDED

Items marked with a ● include 8% VAT
Items unmarked include VAT at 25%

ADVERT. No.1. of Series B.

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