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by MULLARD, TEXAS, MOTOROLA, SIEMENS, I.T.T., R.C.A.

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AAZ17 30p
AC121 30p
AC126 19p
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AD162 40p
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AF115 22p
AF116 22p
AF117 22p
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AF125 25p
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AF239 45p
ASY26 40p
BA114 9p
BA121 9p

BA138 16p
BA148 16p
BA154 12p
BA157 15p
BA173 15p
BA216 16p
BA316 16p
BAX13 5p
BAX16 5p
BB105A 35p
BB110 45p
BC107 10p
BC108 10p
BC108C 15p
BC109 10p
BC109C 14p
BC113 12p
BC117 19p
BC125 20p
BC126 15p
BC146 12p
BC147 10p
BC148 10p
BC148C 14p
BC149 10p
BC157 10p
BC158 10p
BC159 10p
BC167A 12p

BC168B 14p
BC168C 15p
BC169C 15p
BC171 12p
BC172C 12p
BC178A 16p
BC182 10p
BC182L 12p
BC183 10p
BC183L 12p
BC184 10p
BC184L 12p
BC186 24p
BC205 14p
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BC212L 12p
BC213L 12p
BC214 13p
BC214L 14p
BC258 13p
BC294 35p
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BC323 60p
BC328 13p
BC338 12p
BC547 12p
BC547B 13p
BC548 12p

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BC557 13p
BCY34 80p
BCY70 15p
BCY71 20p
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BD121 85p
BD123 100p
BD124 85p
BD131 36p
BD132 39p
BD133 45p
BD135 40p
BD136 40p
BD137 40p
BD139 38p
BD140 40p
BD181 80p
BD182 80p
BD207 70p
BD233 50p
BD263 65p
BDY10 100p
BDY62/01 90p
BF120 50p
BF121 45p

BF123 45p
BF125 45p
BF127 50p
BF166 30p
BF167 25p
BF173 25p
BF179 35p
BF179C 40p
BF180 30p
BF181 35p
BF182 30p
BF183 30p
BF186 25p
BF194 10p
BF195 10p
BF196 10p
BF197 10p
BF198 25p
BF199 25p
BF200 30p
BF224 20p
BF225 20p
BF241 16p
BF244B 35p
BF257 26p
BF258 26p
BF259 30p
BF274 15p
BF324 30p

BF336 35p
BF337 35p
BF363 60p
BFS94 30p
BFW58 20p
BFX29 30p
BFX81 130p
BFX84 25p
BFX85 30p
BFX87 25p
BFX88 25p
BFY50 20p
BFY51 20p
BFY52 20p
BFY90 125p
BR101 35p
BRY39 35p
BRY56 35p
BSX20 20p
BSY40 25p
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BT100A 80p
BU105 150p
BU133 75p
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BY100 20p
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BYX94 8p
C1120 30p
C1164 20p
E100 42p
E300 47p
E430 125p
MJE340 45p
MPSA06 25p
OA10 40p
OA47 15p
OA90 6p
OA91 6p
OA202 8p
OC23 200p
OC25 100p
OC28 75p
OC35 75p
OC42 35p
OC43 35p
OC45 35p
OC71 25p
OC72 30p
OC75 30p
OC81 30p
OC81D 25p
OC83 50p
OC84 50p

OC140 150p
OC171 40p
OC200 80p
ORP12 70p
R1039 150p
TIP29 45p
TIP29A 47p
TIP29C 75p
TIP30 55p
TIP30A 58p
TIP30B 65p
TIP30C 80p
TIP31 55p
TIP31A 58p
TIP31B 65p
TIP31C 70p
TIP32 60p
TIP32A 65p
TIP32B 85p
TIP32C 90p
TIP33 100p
TIP33A 105p
TIP33B 115p
TIP33C 130p
TIP34 115p
TIP34A 118p
TIP34B 145p
TIP35 225p

TIP35A 230p
TIP35C 280p
TIP36A 350p
TIP41A 70p
TIP41B 75p
TIP41C 80p
TIP42A 80p
TIP42B 85p
TIP2955 70p
TIP3055 55p
TIS90 25p
TIS91 25p
IN914 5p
IN3754 10p
IN4001 5p
IN4002 5p
IN4003 5p
IN4004 5p
IN4005 5p
IN4006 6p
IN4007 7p
IN4148 4p
IS44 4p
2N456A 90p
2N697 15p
2N929 20p
2N930 20p
2N1302 25p

2N1305 30p
2N1306 38p
2N1308 50p
2N1711 22p
2N2219A 25p
2N2483 30p
2N2906 18p
2N2907 20p
2N3053 20p
2N3054 50p
2N3055 60p
2N3439 50p
2N3702 11p
2N3703 12p
2N3704 11p
2N3705 12p
2N3706 11p
2N3711 12p
2N3715 300p
2N3772 175p
2N3819 25p
2N3866 95p
2N3904 15p
2N4062 14p
2N4126 20p
2N5061 35p
2N5163 35p
2N6027 50p
2SD234 50p

BZY88
400M.W.
Zeners
OV7 10p
2V4 10p
2V7 10p
3V0 10p
3V3 10p
3V6 10p
3V9 10p
4V7 10p
5V1 10p
5V6 10p
6V2 10p
6V8 10p
7V5 10p
8V2 10p
9V1 10p
10V 10p
11V 10p

BZY88
12V 10p
13V 10p
15V 10p
18V 10p
20V 10p
22V 10p
27V 10p
30V 10p
33V 10p
100 Mixed Zeners 850p
BZY88 Zeners 850p

SAD1024 1250p
SN76013ND 125p
SN76013N 180p
SN76023ND 125p
SN76023N 180p
SN76227N 160p
SN76228N 180p
SN76666N 100p
2N414 120p
ZN414 120p

CA3090AQ 400p

TAA300 150p
TAA350 190p
TAA550 50p
TAA570 220p
TAA661B 140p
TAA700 390p
TAD100 250p
TAD110 200p
TBA120S 125p
TBA120T 125p
TBA540 300p
TBA540Q 400p
TBA550Q 400p
TBA560 400p
TBA641A12 250p
TBA720 230p
TBA800 100p
TBA820 100p
TBA990 250p
TCA270Q 250p
TCA270S 250p

LM301A 65p
LM307N 65p
LM308TO5 130p
LM308 8 DIL 130p
LM309K 180p
LM317K 325p
LM348N 200p
LM380N 110p
LM555 35p
LM710 TO5 60p
LM710 P 65p
LM723 TO5 60p
LM723 14 DIL 75p
LM741 25p
LM748 45p
LM1303N 155p
LM3900 90p

NE555 35p
NE556 100p
NE562B 400p

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μF/V
·47/25 5p
1/16 5p
1/25 5p
1/50 5p
2·2/25 5p
2·2/35 5p
3·3/25 5p
4·7/10 5p
4·7/16 5p
4·7/25 5p
4·7/50 5p
6·8/25 5p
10/10 5p
10/16 5p
10/25 5p
10/35 5p
10/50 5p
22/6V3 5p
22/10 5p
22/16 5p
22/25 5p
22/35 5p
22/50 6p
33/6V3 5p
33/16 6p
33/25 6p
33/40 6p
33/50 7p
47/10 6p
47/16 6p
47/25 6p
47/35 6p
47/50 7p
100/10 6p
100/16 6p
100/25 6p
100/50 8p
100/63 10p
125/15 6p
220/16 10p
220/25 12p
220/50 20p
330/25 15p

330/35 16p
330/50 18p
470/10 12p
470/25 16p
470/35 18p
470/50 22p
680/25 25p
1000/16 25p
1000/35 30p
1000/63 50p
2200/10 28p
2000/35 50p
2200/16 35p
2200/63 75p
2200/100 120p
3300/16 40p
3300/25 42p
3300/63 80p
4700/25 45p
4700/40 50p
4700/63 120p

POLY'TER CAP'ITORS
Mullard or Erie
μF
·001 5p
·0022 5p
·0033 5p
·0047 5p
·0068 5p
·01 5p
·022 5p
·033 5p
·047 5p
·1 6p
·22 7p
·33 9p
·47 12p
1·00 20p
2·2 25p
4·7 35p
6·8 40p

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BC148
BC149
BC157
BC158
BC159
BF194
BF195
BF196
BF197
100 ASSORTED FOR £7·50p

IN4148
100 for 150p

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100 for £20

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100 for £30

RELAYS
24V 3 C.O. H.D.
11 Pin Plug 1N
£1·00 Each

ASSORTED POLYESTER CAPACITORS
100 for £3·00

BYX94 DIODES
1250 PIV 1 Amp.
100 for £6·00

MULLARD
4500/64V C.432
Screw Terminal 75p

RESISTORS CARBON FILM 5%
·25 W
2·2Ω–4·7M 2p
·5 W
2·2Ω–4·7M 2·5p
1 W
2·2Ω 10 MEG 3·5p

POTENTIOMETERS
1K Lin 30p
5K Lin 30p
10K Lin 30p
25K Lin 30p
50K Lin 30p
100K Lin 30p
250K Lin 30p
500K Lin 30p
1 Meg Lin 30p
2 Meg Lin 30p
5K Log 30p
10K Log 30p
25K Log 30p
50K Log 30p
100K Log 30p
250K Log 30p
500K Log 30p
1 Meg Log 30p
2 Meg Log 30p

ROTARY SWITCHES BY LORLIN
1P 12W 40p
2P 6W 40p
3P 4W 40p
4P 3W 40p

MULLARD POT CORES
LA3 100–500 KHz 75p
LA4 10–30 KHz 100p
LA5 30–100KHz 100p
LA7 < 10KHz 100p
LA13 FOR W.W. OSCILLOSCOPE 200p

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SEMICONDUCTORS. ALL BRANDED NAMES E.G. MULLARD, TEXAS, SIEMENS, VALVO. BC107B, BC108B, BC108C, BC109B, BC109C, £8·50 PER 100 CAN BE ASSORTED

WESTINGHOUSE THYRISTORS
300 Volts 16 Amp 250p

CMOS

4000	20p	4023	20p	4055	140p
4001	20p	4024	100p	4056	145p
4002	20p	4025	20p	4060	130p
4006	120p	4026	200p	4066	55p
4007	20p	4027	85p	4069	30p
4009	70p	4028	155p	4071	30p
4011	20p	4029	130p	4072	30p
4012	20p	4030	60p	4081	20p
4013	55p	4032	150p	4082	30p
4015	90p	4043	220p	4510	145p
4016	55p	4046	150p	4511	200p
4017	110p	4047	115p	4516	140p
4018	250p	4049	70p	4518	110p
4020	140p	4050	50p	4528	130p
4022	180p	4054	130p		

BRIDGE RECTIFIERS

		V/REG.	
1A 50V	25p		
1A 100V	30p	7805	140p
1A 200V	30p		
1A 400V	35p	7812	140p
1A 600V	40p	7815	140p
2A 50V	35p		
2A 100V	50p	7818	140p
2A 200V	55p	7824	150p

SKELETON PRE-SET POTENTIOMETERS
0·1W 50N–5M mini vert & horiz 7p
·25W 100N–3·3M horiz. 7p
·25W 200N–4·7M vert. 8p

TANTALUM BEAD CAPACITORS
35V: 0·1μF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2, 3·3, 4·7, 6·8, 25V 1·5, 10, 16V 4·7, 10, 22, 47, 10V 4·7, 15, 25, 33
Price 14p each

LEDS
RED ·125 15p
GREEN ·125 25p
YELLOW ·125 25p
RED ·2 15p
GREEN ·2 23p
YELLOW ·2 25p
DL747 Display 200p

DIL SOCKETS
8 Pin 13p
14 Pin 14p
16 Pin 15p

BZX61
Zeners 1·3W
6V8 15p
9V1 15p
11V 15p
13V 15p
15V 15p
22V 15p
30V 15p
39V 15p
43V 15p
47V 15p
51V 15p
56V 15p
68V 15p
72V 15p
160V 15p

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ISSUE 847

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SEPTEMBER 1977 · VOLUME 53 · NUMBER 5

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News and Views

For our Constructors

General Interest

RSC 100 WATT DISCO SYSTEM

ALL RSC PRICES INCLUDE VAT

Consisting of
(1) TWIN T/TABLE CONSOLE with PRE-AMP, and POWER OUTPUT STAGES
(2) & (3) PAIR 100 WATT LOUD-SPEAKERS including 12" UNITS

Rec. Mic. UD 150 Cardioid **£9·95** extra with system only

- ★ DISCOMAJOR 200 POWER DISCO CONSOLE with integral Power Amplifier.
- ★ TWIN FULL SIZE GARRARD turntable with cueing device.
- ★ CARTRIDGES with Diamond Styli
- ★ 3 SEPARATE VOLUME CONTROLS for each turntable and Mic.

FULL HEADPHONE MONITORING FACILITIES
CONSOLE COMPLETE WITH LID

Terms: Deposit £40·00 and 12 monthly payments £15·60 (Total £227·20) Carr. £7·50 **£199·95**

Also available **100 WATT SYSTEM** with Dynamic Stick MICROPHONE **£169·95**

TD1 DISCO CONSOLE

Incorporating twin BSR 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 **£109·95**
Or Dep £16·49 & 18 f'tntly pymts. £6·11 (Total £126·47) Carr. £3.
TD2S STEREO VERSION OF ABOVE £125·00
Terms DEPOSIT £20 and 18 fortnightly payments £6·89 Total £144·02) Carr. £3

40W SYSTEM £99·95. 100W SYSTEM £169·95

WRITE OR PHONE for Free Catalogue

OTHERS UP TO 300 WATTS AT UNBEATABLE PRICES

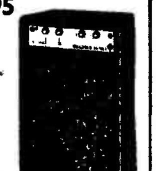
DISCOMAJOR/100 TWIN TURNTABLE POWER CONSOLE £129·95

Twin Full size BSR turntables. Sonotone or Acos Carr. £3·00 Cartridges with Diamond Stylii. Facilities as TD1 Console but with built-in 100 watt Power Amplifier complete with lid. Terms: Deposit £19·95 and 18 fortnightly payments £7·03 (Total £146·49).

DISCOMAJOR/200 £149·95

200 watt version of above. Terms: Dep. £29·95 and 18 fortnightly payments £7·87 (Total £171·61)

RSC PHANTOM 50 COMBO AMP. £69·95



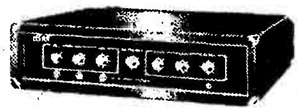
Rating 50 watts. 3 inputs, 2 vol controls— Carr. £1·50. Bass, Treble Presence. Suitable for Lead or Rhythm Guitar, mic., Radio, Tape, etc. Inc. High Flux 12" 50w Speaker. Dep. £10·95 & 8 mthly payments £8·71 (Total £80·63).

100W POWER (SLAVE) AMPLIFIER

Suitable for use with DISCO-Consoles. Also for increasing output of lower-powered Amp. Dep. £9·00 and 8 mthly pyts of £6·05 (Total £57·40) Carr. £1·50 **£49·95**

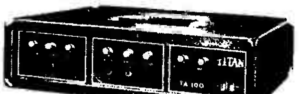
100 + 100W MODEL £69·95 Carr. £1·50

TITAN TA/50A 50W AMPLIFIER



Solid state, 3 sep. controlled inputs plus Master control. Bass, Treble & Presence Controls. Vynide covered cab. with corner protectives. List price £60. Terms: Dep. £9 & 8 monthly payments £6·05. (Total £57·40) Carr. £1. **£49·95**
Matching Cabinets 1 × 12" £29·95 2 × 12" £49·95

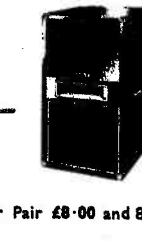
TITAN TA/100A 100W AMPLIFIER



TWIN CHANNEL—4 INPUTS (NORMAL OR BRIGHT) **£69.95** Carr. £1·50
A De-luxe professional unit with many facilities. R.M.S. Rating. Matching 2 × 12" 120w Cabinet speaker £49·95 with above only. Carr. £1·50

INTEREST REFUNDED on Credit Purchases settled in 3 mths

TITAN 100W BASS BINS £99·95



High quality 15" high flux Bass Unit and J104 Horn Tweeter in folded horn enclosure providing amazing level of sound output. Terms Dep. £14·95 and 18 fortnightly payments. £5·58 (Total £115·39) Carr. £3.

FANE HIGH POWER SPEAKERS

Power ratings R.M.S. Cont. 2 YRS GUARANTEE
*Gauss 14000 Imp 8–15 ohms. CARR FREE.

POP 33T 12" 33w £13·95 Dual cone.
***POP 50/2 12" 50w £15·99** Dep for Pair £8·00 and 8 monthly pymts £3·54 (Total £36·32)
***POP 75 12" 70w £19·99** Gauss 17,000 lines. Dep £5·00 and 8 mthly pymts £2·38 (Total £24·04)
***POP 60 15" 60w £25·95** Dep £7·00 & 8 monthly pymts £2·87 (Total £29·96)
***POP 100 18" 100w £44·95** Dep £10·00 & 8 monthly pymts £5·17 (Total £51·36)

TITAN GROUP/DISCO SPEAKERS

Rating RMS Imp 8-15 ohms

Carr. £1, under £18, over this add 5p per £1.

GUARANTEED FOR 5 YEARS

	List	RSC Price
T12/45 12" 45w	£15·80	£11·95
T12/60A 12" 60w	£21·00	£13·95
T12/100 12" 100w	£36·00	£24·95
T15/60 15" 60w	£26·00	£18·99
T15/70 15" 70w	£28·00	£19·95
T15/100 15" 100w	£41·00	£29·95
T18/100 18" 100w	£47·00	£35·95

CABINETS FOR ABOVE SPEAKERS Heavy duty. Beautifully finished in black Vynide with Vynair fronts fitted protective corner pieces. Various sizes and cut-outs. TE1 1 × 12" £10·95. TE2 2 × 12" £16·95
Low Deposit Terms on orders over £20

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Equipment by CARLSBRO
Full range of speakers by FANE

TITAN TA/100C COMBO

100w R.M.S. Amp. incorporating a fabulous Fane Crescendo 12" 100 watt spkr for really superlative results with Lead Guitar **£119·95** Carr. £5
Or Dep £17·95 & 18 f'tntly payts £6·69 (Total £138·37)

TITAN 'ADD-ON' HIGH FREQUENCY HORN UNITS

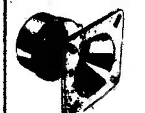
MODEL TS2H
Inc. Pair of highly sensitive Horns. Range 3-15 kHz Imp 16Ω. Use with 8 or 15Ω 2 × 12" or 1 × 15" or 18" Drive Unit for increased sound clarity and projection. Rating 100 watts.

MODEL T1H
With single super efficient Horn. Range 3-15 kHz. Imp 8Ω. Use with max 8Ω 2 × 12" or single 15" or 18" 8Ω Drive Units. Maximum amplifier power output to be 100 watts. Comparable with units at twice the cost.

Either model **£27·95** Carr. 75p
Terms: Dep £6·95 & 8 mthly pyts £3·12 (Total £31·91)

FANE HIGH FREQUENCY HORNS 'J' SERIES

All Carr Free



MODEL J44 Imp 8Ω
Size approx. 3½" × 3½" × 3" Rating 30-50 watts Range 3-15 kHz
£7·95

MODEL J73 Imp 8Ω
Size approx 7¼" × 3" × 6¼" Rating 50 watts Range 2-20 kHz
£11·75

MODEL J104 Imp 8Ω
Size approx 10½" × 3½" × 7¼" Rating 50-70 watts Range 2-15 kHz
£15·50

FAL DISCO LIGHTING SYSTEMS from £58.95

Incl 2 Spotbanks and bulbs

JINGLE MACHINES from	£37·95
ECHO CHAMBERS from	£53·95
COLUMN SPEAKERS from	£29·95
GROUP DISCO SPKRS in CABINETS from	£11·95

FREE FANE HIGH POWER 'CROSS-OVER' WITH ANY OF ABOVE
Impedance or total impedance of 12", 15" or 18" Drive units must not exceed impedance of single horn or pair in series. Pair J44, Single J73 or J104 suitable for amplifier power up to 100 watts subject to above and with HPX2 'Cross-over'

RSC MAINS TRANSFORMERS

TYPES FOR VALVE RADIOS & AMPLIFIERS (Inc. L.F. CHOKES & OUTPUT TRANSFORMERS. As previously advertised still available.

FILAMENT OR TRANSISTOR POWER PACK 12v. 1a. £1·10, 6·3v. 1·5a £1·06, 6·3v. 2a £1·10. 6·3v. 3a £1·70 6·3v 6a £2·60. 12v. 3a or 24v. 1·5a £2·60 0-9-18v. 1½a. £2·26, 0·12·25-42v. 2a £3·19. **CHARGER TRANS** 0-9-15v, 1½a. £2·08; 2½a. £2·26; 3a. £2·32; 5a. £2·84. 6a. £3·19; 8a £3·48.

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New Branches at **HANLEY WOLVERHAMPTON and LIVERPOOL**

RSC

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TERMS C.W.O. or C.O.D. No. C.O.D. under £3. POSTAGE 50p PER ORDER OR AS QUOTED. Phone or Write for FREE CATALOGUE.

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All items subject to availability.
Prices correct at 18.7.77 E. & O.E.

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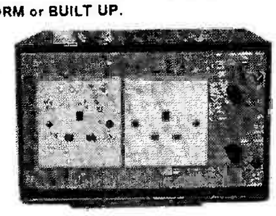
WOLVERHAMPTON 6, Wulfrun Way (Cl'd Thurs.) Tel. 26612

INVERTORS

KIT FORM or BUILT UP.



240v-50Hz from your 12v car battery.

O/P Powers available. 25W-40W-75W-150W-300W-400W-500W-1kW-1·5kW. Various battery I/P voltages available.

AUTOMATIC INVERTORS

These units have built-in battery charger which functions whilst mains are healthy. Upon mains failure unit automatically switches to invertor operation ensuring no interuption of supply. Send S.A.E. for price lists.

RHYTHM GENERATOR

15 different rhythms, 9 percussion instruments. Tempo range 15 to 100 bars/min. Full kit of parts available at £39·50 + £1·20 P. & P. + VAT at 8%. Price assembled and tested add £12. Parts available separately, send S.A.E.

We reserve the right to alter published prices in the event of component or postal increases.

P.E. ORION STEREO AMPLIFIER & TUNER

May be mounted slim line or stacked as above. Parts available separately for both units.

20 + 20 Watts r.m.s. into 8 ohm load. Distortion less than 0·1% 100Hz–10kHz. Frequency response ± 1dB 20 Hz to 20kHz. Hum level virtually nil with volume full on. This is a power amplifier of superb quality incorporating the very latest design features. Professional hi-fi enthusiasts have classed it as fantastic and real value for money. The CCT incorporates a low flux transformer and inputs for disc, tape, tuner, etc.

TUNER UNIT

May be purchased separately in matching slim line case. As full kit or individual parts.
Send S.A.E. for price list and specification sheets.

LOUDSPEAKERS

8 inch system

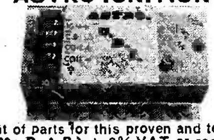
This system is designed for use with above amplifiers rated up to 25W r.m.s. per channel at 8Ω. May be incorporated in an enclosure 295 x 490 x 295mm (11·5 x 19·3 x 11·5in) approx. external, constructional details of which are given with each bass unit, to provide an overall frequency response of 50Hz to 22kHz. Four-element cross-over, ready constructed on p.c.b. Output leads have push-on receptacles to suit speaker tags. Cross-over frequency is 2·8kHz approx.

POWER UNIT

Regulated

Voltage adjustable from 1–35v at 2 amps. Short circuit protected. Voltage and current meters incorporated. Full Kit of parts £48 + 8% VAT or assembled and tested £58 + 8% VAT.

ASTRO IGNITION



SAVE FUEL

Complete kit of parts for this proven and tested system. (£11·90 + 60p P. & P.) + 8% VAT or ready built with only two connections to alter.
(£14·90 + 60p P. & P.) + 8% VAT.
Consider the advantages:
Fuel economy. Faster acceleration. More power. Excellent cold starting. Smoother running. No contact breaker burning. Less exhaust gases.

TRANSFORMERS

SPECIAL OFFER
Miniature Mains Trans.
6–0–6v–6VA.
12–0–12v–6VA.
(£1·29 + 25p P. & P.) + 8% VAT
Transformer and coils manufactured to customer specifications both in High Volume and Small Order capacity.

TRADE AND EXPORT ENQUIRIES WELCOMED ON ALL PRODUCTS:

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N.B.—DELIVERIES ON ALL ITEMS MAY TAKE UP TO 28 DAYS, DEPENDING ON AVAILABILITY AND DEMAND. CASH IN REGISTERED ENVELOPE OR POSTAL ORDERS CAN REDUCE TIME by NOT HAVING TO CLEAR CHEQUES

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★ LARGE RANGE OF COMPONENTS NOW STOCKED. SEND LARGE S.A.E. FOR FREE LISTS.

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QTY.		
12	4.7μF, 25V, BEAD TANT	£1·00
50	·01μF, 50V, MIN DISC CERAMIC	£1·00
1	TGS 105 GAS SENSOR	£2·25
Any 10	BC 107, 147, 148, 182, 183	£1·00
Any 10	BCY 70, 71, 72	£1·50
8	SN 7400	£1·00
15	1μF, 250V, C280 CAPACITOR	£1·00

ALL PRICES INC. VAT. PLEASE ADD 20p P.P.

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★ WALK-ROUND SELF-SERVICE SHOP NOW OPEN MON-SAT 9.30–5.30.

★ MANY SURPLUS COMPONENT BARGAINS FOR PERSONAL CALLERS.

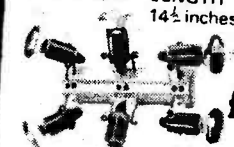
★ RESISTORS, CAPACITORS, TRANSISTORS, DIODES, TRIACS, DIACS. IC's, POTS, ALI BOXES, VERO, COPPER CLAD BOARD, CABLE, AUDIO CONNECTORS, SPEAKERS, MICROPHONES, P.A. TRANSFORMERS, KNOBS, ETC, ETC.

Random FLASHER UNIT

Wired ready for use
Complete with three 100 watt coloured lamps that flash independently at random.
£18·95

TWIN BANK 6 LIGHT UNIT

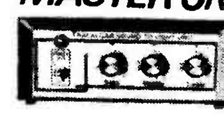
(less lamps) LENGTH 14½ inches



B.C. Fitting £9·55 EACH
E.S. Fitting £10·35 EACH

Sound to Light MASTER UNIT

600 WATTS PER CHANNEL



£30·95
INCLUDING CHANNEL OUTPUT PLUGS AND MAINS INPUT SOCKET.

TYPE A SPOT

(less lamp)

B.C. Fitting £1·95 EACH | E.S. Fitting £2·12 EACH

TYPE B 3 BANK UNIT

(Less Lamps)

B.C. Fitting £6·90 EACH | E.S. Fitting £7·26 EACH

100 WATT SPOT LAMPS
RED, YELLOW, GREEN, BLUE, CLEAR £1·40 each B.C. or E.S. Fitting
Minimum 3 lamps £4·20

TWIN BANK 12 LIGHT UNIT

Length 31¾

(less lamps)
B.C. Fitting £15·60 EACH | E.S. Fitting £17·00 EACH

ALL PRICES INCLUDE V.A.T. and POST & PACKING (These prices apply to the United Kingdom only)

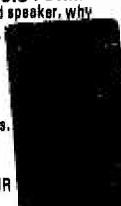
Send 20p for illustrated leaflet & price list.

ALBEN ENGINEERING CO. LTD.,
DEPT. PW THE CRESCENT, WORSTHORNE, BURNLEY. LANCS. Tel Burnley 20940

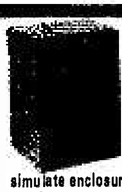
DIY SPEAKER KITS

15-WATT KIT IN CHASSIS FORM

When you are looking for a good speaker, why not build your own from this kit. It's the unit which we supply with the enclosures illustrated below Size 13" × 8" (approx.) woofer (EMI), tweeter, and matching crossover components. Power handling capacity 15 watts rms. 30 watts peak.



£17.00 PER STEREO PAIR + P & P £3.40



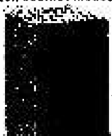
EASY-TO-BUILD WITH ENCLOSURE

Specially designed by RT-VC for cost-conscious hi-fi enthusiasts, these kits incorporate two teak-simulate enclosures, two EMI 13" × 8" (approx.) woofers, two tweeters and a pair of matching crossovers. Easily constructed, using a few basic tools. Supplied complete with an easy-to-follow circuit diagram, and crossover components. Input 15 watts rms. 30 watts peak, each unit. Cabinet size 20" × 11" × 9½" (approx.).

£25.50 PER STEREO PAIR + p & p £5.50

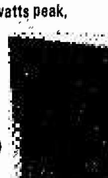
COMPACT' FOR TOP VALUE

How about this for incredible bookshelf value from RT-VC! A pair of high efficiency units for only £7.50 – just what you need for low-power amplifiers. These infinite baffle enclosures come to you ready mitred and professionally finished. Each cabinet measures 12" × 8" × 5" (approx.) deep, and is in wood simulate. Complete with two 8" (approx.) speakers for max. power handling of 7 watts.



per stereo pair **£7.50** + p & p £1.70

SPEAKERS Two models – Duo IIb, teak veneer, 12 watts rms, 24 watts peak, 18½" × 13½" × 7½" (approx.).

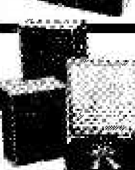


★ **£34** PER PAIR + p & p £6.50

Duo III, 20 watts rms, 40 watts peak. 27" × 13" × 11½" (approx.)

★ **£52** PER PAIR + p & p £7.50

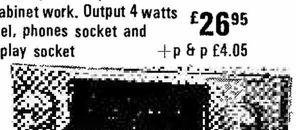
EASY TO BUILD RECORD PLAYER KIT



Ideally suited for the constructor who requires a complete stereo unit at a budget price, comprising ready assembled stereo amp. module, Garrard auto/manual deck with cueing device, pre-cut and finished cabinet work. Output 4 watts per channel, phones socket and record / replay socket

£26.95 +p & p £4.05

CAR RADIO KIT



Complete with speaker, baffle and fixing strip. The Tourist IV for the experienced constructor only. The Tourist IV has five push buttons, four medium band and one for long wave band. The tuning scale is illuminated and attractive small aluminium control knobs are used for manual tuning and volume control. The modern style fascia has been designed to blend with most car interiors and the finished radio will slot into a standard car radio aperture. Size approx. 7" × 2" × 4¼". Power Supply Nominal 12 volts positive or negative earth (altered internally) Power Output 4 watts into 4 ohms.

MOTOR TOP 10 AWARD

£12.50 + p & p £1.50

PERSONAL SHOPPERS ONLY

Viscount IV 20 x 20 Amplifier as illustrated, plus 1 pair of speakers finished in teak with melamine panels 8" drive unit and 3½" approx tweeter. 22" × 13" × 10½" size approx.

£45.00

SPECIAL OFFER

illustrated **20 x 20 WATT STEREO AMPLIFIER** ★

Superb Viscount IV unit in teak-finished cabinet. Silver fascia with aluminium, rotary controls and pushbuttons, red mains indicator and stereo jack socket. Function switch for mic, magnetic and crystal pick-ups, tape, tuner, and auxiliary Rear panel features two mains outlets, DIN speaker and input sockets, plus fuse. 20 + 20 watts rms, 40 + 40 watts peak.

£29.90 + p & p £2.10

FREE 'Limited Period' A Free 4 Channel Stereo Adaptor to all purchasers of the Viscount Amplifier. Available separately. £3.95 + p & p £1.00

SPECIAL OFFER For example- Duo speaker system II or III Viscount Amplifier, MP60 type turntable complete

DEDUCT 10% DEDUCT 15%

★ on complete stereo systems using starred Products ★

PERSONAL SHOPPERS ONLY

PLINTH & COVER BSR OR GARRARD TEAK FINISH	£4.95
GOODMAN 5" approx., 7 watt bass speaker	£2.70
AM. FM. TUNER P.C.B. with Mullard L.P. 1186, 1185, 1181 modules	£9.50
CROWN 5 push button car radio, LW. MW. 12v Pos. neg. earth 5 watts output, tone control complete with speaker and fixing kit, in dash type	£15.95
STEREO CASSETTE TAPE PLAYER Negative earth only, 3 watts per channel output	£16.50
AM. FM. STEREO MULTIPLEX CAR RADIO/cassette player in dash fixing Negative earth 5 watts output	£36.00
I.C. Stereo 8 Track to Cassette adaptor converts, any 8 track player to cassette player.	£18.95
GLOBAL Spherical speaker 8 ohms, 5 watts	£3.50
100K Multiturn Varicap tuning pots 6 for	£1.00
HEAVY DUTY FIBRE GLASS COPPER CLAD BOARD 27" x 17" x $\frac{1}{16}$" Approx. per sheet only	£1.00
DECCA DC1000 Stereo Cassette Record deck P.C.B. complete with switch oscillator coils and tape-heads and circuit diagrams.	£2.95

VISCOUNT COMBI £65.00

For personal shoppers only, this unit comprises: The 20 × 20 Viscount amplifier BSR MP60 Type turntable housed in an attractive teak finished console with smoked acrylic cover. Approx. 30¼" × 14½" × 7½" complete ready to connect to the speaker system of your choice.

BSR TURNTABLES

BSR MP60 TYPE Single play record player (Chassis form) **£15.95** less cartridge. P & P £2.00

BSR automatic record player deck (Chassis form) with cueing device and stereo ceramic head. **£9.95** P & P £2.00

Cartridges to suit above ACOS MAGNETIC STEREO ...... £4.95 CERAMIC STEREO £1.95

TURNTABLE illus. Popular BSR MP 60 type, complete with magnetic cartridge, diamond stylus, and de luxe plinth and cover. Ready wired ★ **£29** + p & p £4.50

30 x 30 WATT AMPLIFIER KIT

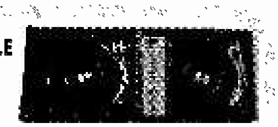
Specially designed by R T-VC for the experienced constructor, this kit comes complete in every detail. Same facilities as Viscount IV amplifier. Chassis is ready punched, drilled and formed Cabinet is finished in teak veneer. Silver fascia and easy-to-handle aluminium knobs.

Output 30 + 30 watts rms, 60+60 peak. **£29.00** +p & p £2.10

DECCA 20 WATTS STEREO SPEAKER

This matching loudspeaker system is hand made, kit comprises of two 8" diameter approx. base drive unit, with heavy die cast chassis laminated cones with rolled P.V.C. surrounds, two 3½" diameter approx. domed tweeters comp with crossover networks + £4.00 p & p stereo pair **£20.00**

PORTABLE MONO DISCO



with built-in pre-amplifiers

Here's the big-value portable disco console from RT-VC! It features a pair of BSR MP 60 type auto-return, single play professional series record decks. Plus all the controls and features you need to give fabulous disco performances. Simply connects into your existing slave or external amplifier.

p & p £6.50 **£64.00**

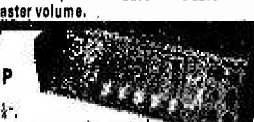
35-WATT MONO DISCO AMP

£27.50 + p & p £2.50

Size approx 13⅜" × 5½" × 6"

Here's the mono unit you need to start off with. Gives you a good solid 35 watts rms, 70 watts peak output. Big features include two disc inputs, both for ceramic cartridges, tape input and microphone input. Level mixing controls fitted with integral push-pull switches. Independent bass and treble controls and master volume.

100 WATT MONO DISCO AMP



Size approx. 14" × 4" × 10½".

Sloping facia, you can use the controls without fuss or bother. Brushed aluminium fascia and rotary controls. Five smooth acting, vertically mounted slide controls – master volume, tape level, mic. level, deck level, PLUS INTER-DECK FADER for perfect graduated change from record deck No. 1 to No. 2, or vice versa. Pre-fade level control (PFL) lets YOU hear next disc before fading it in. VU meter monitors output level. Output 100 watts RMS 200 watts peak.

£65.00 p & p £4.00

PRACTICE GUITAR AMPLIFIER WITH BUILT-IN SPEAKER

This budget practice amplifier, has been specially designed for the amateur, who requires a quality self-contained unit with all facilities. 2 inputs – 1 for mic or guitar, the 2nd for record player or cassette deck, it also can be used for cine-sound amplification. 2 volume controls, 1 for each input, also base and treble controls. Power output with internal speaker, 10 watts RMS, with remote speaker (not supplied) 20 watts RMS. Size approx. 17" + 9" × 11".

£32.50 + p & p £3.00

HOME 8 TRACK CARTRIDGE PLAYER

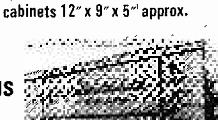
Automatically switches programmes monitored by indicators, with manual override track selection. This unit will match with the Unisound modules and is compatable with the Viscount IV amplifier with Sim teak cabinet. approx. 9" · 8" · 3½". p & p £1.50 **£14.60**

4 x 4 STEREO AMP KIT £14.50 P & P £2.00

For the experienced constructor who wants to design his own stereo. Kit includes all necessary components including constructors manual. Plus Pair of easy to build 4 watt speakers in kit form, with teak simulate finish cabinets 12" x 9" x 5" approx.

PYE STEREO GRAM CHASSIS

(Complete with circuit-diagrams)



Complete ready to install–Wave bands LM, VHF STEREO, VHF MONO. Controls for tuning volume, balance, bass and treble. Power output 7 watts R.M.S per channel 14 watts peak 8 ohms. 2" × 8" approx chassis speakers and BSR auto record player deck.

PERSONAL SHOPPERS ONLY **£35.00**

Order giving your credit card number ONLY

ALL PRICES INC. VAT AT 12½%
GOODS NOT DESPATCHED OUTSIDE UK
All items subject to availability. Price correct at **4/7/77** and subject to change without notice
We are unable to show all our products, so Send stamped addressed envelope for our fully descriptive catalogue and any further information.

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SAXON ENTERTAINMENTS LTD

SYSTEM 7000—GUARANTEED MODULES FOR ALL DISCO/PA APPLICATIONS

POWER AMPLIFIER MODULES 30—240 WATTS

- Fully tested & guaranteed.
- Full RMS Sine Wave output.
- Distortion typically 0·2%
- 10 Transistors, 4 Diodes.
- Response 30HZ-30KHZ
- Fully short & open circuit proof
- Sensitivity suits most mixers
- Built-in surge suppression & compensation
- Twin D.C. & output fuses.
- Top-grade components throughout.

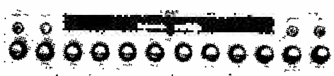
30 Watts rms	60 Watts rms		120 Watts rms		240W rms
SA308 30W rms/ 8 ohms £9·50	SA604 60W rms/ 4 ohms £12·50	SA608 60W rms/ 8 ohms £13·50	SA1204 120W rms/ 4 ohms £14·50	SA1208 120W rms/ 8 ohms £21·00	SA2404 240W rms/ 4 ohms £25·50

POWER SUPPLIES FOR THE ABOVE MODULES—READY WIRED & FUSED ON GLASS FIBRE PCB

PM301 For 1/2 SA308 £9·90	PM601/4 For 1/2 SA604 £12·50	PM601/8 For 1/2 SA608 £12·50	PM1201/4 For 1 SA1204 £12·50	PM1201/8 For 1 SA1208 £12·50	PM1202/4 For 2 SA1204 £19·50	PM1202/8 For 2 SA1208 £19·50	PM2404/1 For 1 SA2404 £19·50

SYSTEM 7000 COMPLETE DISCO MIXERS (with Autofade)

Mono or Stereo



The choice of the professional D.J.

- Ready to plug in & use
- Automatic Mic override
- Two tone panel
- Twin deck & mic & tape inputs
- Left/Right deck fader
- 20Mz-20kHz Noise —77dB

Controls: Mic volume, Bass, Treble, A/Fade Depth, Tape, L/Deck, R/Deck volumes, Bass, Treble, Master, Headphone volume, Selector & On/Off.

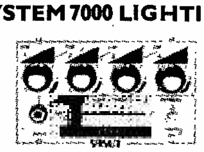
Mono 18v **£37·50** Mains **£43·50** Stereo 16v **£53·50** Mains **£59·50**

IN MODULAR FORM—All you require is front panel (see below) knobs & sockets etc. All electronics are assembled & tested.

- Specification as for complete mixer
- All Potentiometers supplied & fitted
- Low cost do it yourself with step by step easy to follow Instructions.

Mono **£19·50** Stereo **£29·50** Panel **£3·50** Supply unit **£8·50**

SYSTEM 7000 LIGHTING CONTROL UNIT MK II (Four channel)



Has your light unit got?

- 4,000 W handling
- Sequence facility
- Smart 2 tone panel
- Advanced IC circuitry
- Top grade components
- Integral dimmers
- Automatic audio level

OURS HAS!

All your needs in one superbly designed unit

ONLY **£42·50**

IN MODULAR FORM—THE QUADRAFECT £29·50

(Panel £2·50)

As with the mixers the MK II L.C. unit may be purchased in module form with all controls, requiring only a panel, case & knobs etc. There are 13 simple connections

- 1-240w Audio
- 8A RCA triacs
- 0·5-20Hz Sequence
- Fully suppressed

CUSTOM MIXER MODULES (Complete or in printed circuit form only)

Make your own mixer, mono or stereo, up to 2 channels, with full monitoring facilities. and provision for echos end/return etc.

- Inputs for low and high 2 mic, ceramic & magnetic cartridge etc.
- Up to 20 input modules per single mixing module
- Feed most types of amplifier—accepts all Inputs
- Professional low noise circuitry 20Hz-30kHz
- Infinitely adaptable—Extremely economical

COMPLETE MODULES With facia panel, Knobs & sockets, Monitor buttons, Ready wired & tested

- 0·5W headphone circuit
- Full range bass/treble controls
- Noise—80dB

Mono input **£8·50** Mono mixing stage **£8·50**
Stereo input **£12·00** Stereo mixing stage **£12·00**

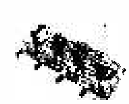
PRINTED CIRCUIT MODULES With controls fitted, requires only sockets, facia & knobs

Mono Input **£5·50** Mono mixing stage **£5·50**
Stereo Input **£9·00** Stereo mixing stage **£9·00**

Power supply for up to 20 channels—PPM18—£8·50.

SYSTEM 7000 SOUND—LITE (3-CHANNEL)

IN COMPLETE OR MODULAR FORM
(Modular form illustrated)



- Complete unit similar to Mk II unit above
- Long established & proven design
- 3 Channels—100W per channel
- RCA 8A Triacs—individual channel fuses
- 1-240 W Input—master audio level plus Bass/Middle/Treble

COMPLETE UNIT—Fully cased with rear terminations—just plug plug in and go! **£24·75**

MODULAR FORM Facia & knobs etc. Needs only 11 simple connections **£16·50** (Panel £2·50)

COMPLETE DISCO SYSTEMS FROM ONLY £16·06 DEPOSIT

WITH TWO YEAR GUARANTEE—LOW INTEREST CREDIT

CENTAUR 100W STEREO

with TWIN LOUDSPEAKER, SOUND to LIGHT SEQUENCER PLUS DISPLAY. £225 + £10 carr. (Dep. £28·80, 12 months at £21·33 or 24 months at £12·01)

SUPER CENTAUR 200W STEREO

As above but with 200 WATTS OUTPUT and larger TWIN CABINETS. £275 + £10 carr. (Deposit £32·80, 12 months at £29·39 or 24 months at £15·21).

GXL CENTAUR 200W STEREO

As the SUPER CENTAUR but with extra large twin 200 WATT CABINETS, DECK LIGHTS, DECK STARTS & SUPERIOR DECKS.
£349 + £10 carr. (Deposit £42 72, 12 months at £36·58 or 24 months at £20·54)

- Cue Light + Head Phone monitoring
- Mic & Tape Inputs
- Crossfade & Override
- Logic Circuitry Lightshow
- Complete and ready to use
- Extremely Rugged construction
- Twin BSR Decks

Send today for Free Illustrated Leaflet on Saxon Complete Discos & Package PA Systems.

All Equipment subject to a Two Year Guarantee.

Deliveries in the UK by our own vans.

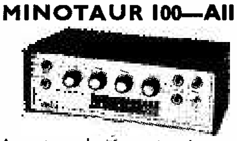
50W MINI DISCO £139·50 + £5 carr. (Dep. £16·05, 12 months at £13·30 or 24 months at £7·46)
100W MINI DISCO £159·50 + £5 carr. (Dep. £22·66, 12 months at £14·73 or 24 months at £8·27)
Two extremely compact mono systems complete with loudspeakers and leads.

- TWIN BSR DECKS
- HEADPHONE MONITORING
- MIC INPUT

100W PACKAGE P.A. £145 + £7·50 carr. with twin loudspeakers and PIEZO HORNS Dep. £19·70, 12 months at £13·70 or 24 months at £7·73)

SEND YOUR SPECIAL REQUIREMENTS FOR A CUSTOM DISCO QUOTATION

SYSTEM 7000 MINOTAUR 100—All Purpose Wide Range Amplifier



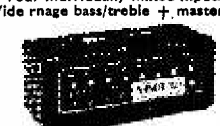
- 100W rms ± 1dB
- Standard 8 ohm output
- Twin mixed inputs accept a wide range of signals
- 30HZ-30KHZ ± 2dB
- 23dB base/treble

An extremely compact and versatile amplifier with full protection and a clean, attractive appearance. Ideal for all groups, disco's & clubs

£49·50

A four input, high power amplifier which will deliver up tp 150 watts output. An absolute must where multiple mixing & power are required

- Four individually mixed inputs
- Wide rnage bass/treble + master



- Vynide covered case
- Fully short proof
- Superb value for money

SAXON 150 HEAVY DUTY AMPLIFIER £59·00

STROBES & PROJECTORS (We stock the full Pluto range)

Send for details

SUPERSTROBE £19·75

- 2-3 Joules
- 80W Tube for long life
- Compact 4" X 4" X 4"

PRO-STROBE £32·50

- 6-8 Joules
- External trigger
- Long Life tube timer circuit

150 WATT LIQUID WHEEL PROJECTOR

- Accepts all accessories
- C/w with wheel & motor plate
- Sturdy steel construction

Remarkable value—Sold elsewhere at £39·50. Our price is only: **£33·00**

ACCESSORIES Condenser mics ECM77 600 ohms £13·50 ECM81 Dual Impedance £14·95 Crown headphones £6·75 Heavy duty boomstand £14·50

All prices subject to VAT @ 8% except SA308/PM301, mics, and headphones (12½%
Add 50p post & packing on all orders except where already shown.
Ordering: By Telephone —Access, Barclay Card or COD Ring (01) 684 6385/0098
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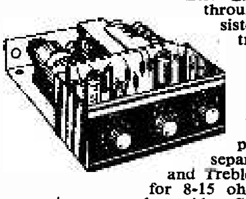
327-333 Whitehorse Road, Croydon, Surrey CR0 2HS
24 Hour Ansafone service (01) 684 6385

PIEZO HORNS!! UP TO 150 WATTS HANDLING. NO X-OVER REQUIRED £7·50 ea.

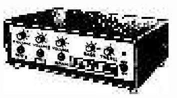
Exporters to 17 countries—enquiries welcomed
Ring Sue Abegg on (01) 684 6385 for U.K. trade enquiries

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 £13·75. P. & P. £1·20.

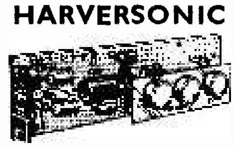
HARVERSONIC MODEL P.A. TWO ZERO



An advanced solid state general purpose mono amplifier suitable for Public Address system, Disco, Guitar, Gram., etc. Features 3 individually controlled inputs (each input has a separate 2 stage pre-amp.). Input 1 5mv into 47k. Input 2 5mv into 47k. (suitable for use with mic. or guitar etc.). Input 3 100mv into 1 meg. suitable for gram. tuner, or tape etc. Full mixing facilities with full range bass & treble controls. All inputs plug into standard jack sockets on front panel. Output socket on rear of chassis for an 8 ohm or 16 ohm speaker. Output in excess of 20 watts R.M.S. Very attractively finished purpose built cabinet made from black vynil covered steel, with a brushed anodised aluminium front escutcheon. For ac mains operation 200/240 volts. Size approx. 12¾" w. × 5" h. × 7¼" d.

Special introductory Price £28·00 + £2·50 carriage & packing.

HARVERSONIC STEREO 44



A solid state stereo amplifier chassis, with an output of 3-4 watts per channel into 8 ohm speakers. Using the latest high technology integrated circuit amplifiers with built in short term thermal overload protection. All components including rectifier smoothing capacitor, fuse, tone control, volume controls, 2 pin din speaker sockets & 5 pin din tape rec./play socket are mounted on the printed circuit panel, size approx. 9½"×2¾"×1" max. depth. Supplied brand new & tested, with knobs, brushed anodised aluminium 2 way escutcheon (to allow the amplifier to be mounted horizontally or vertically) at only **£9·00** plus 50p P & P. Mains transformer with an output of 17v a/c at 500m/a can be supplied at **£1·50** + 40p P & P if required. Full connection details supplied.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Our price **£1·50** yd. length. P. & P. 50p per yd. (min. 1 yd.). S.A.E. for samples.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0–210–240v. Secondary combinations 0–5–10–15–20–25–30–35–40–60v. half wave at 1 amp. or 10–0–10, 20–0–20, 30–0–30v. at 2 amps full wave. Size 3in. long × 3½in. wide × 3 in. deep. Price £2·90 P. & P. £1·00.

MAINS TRANSFORMER. For power supplies.
Pri. 200/240v. Sec. 9–0–9 at 500 mA. £1·50. P. & P. 65p.
Pri. 200/240v. Sec. 12–0–12 at 1 amp. £1·65. P. & P. 65p.
Pri. 200/240v. Sec. 10–0–10 at 2 amp. £2·35. P. & P. 95p.
Pri. 200/240V Sec. 23V at 1·5 amp, 6V at ·6 amp, 8V at 50mA. £2·00 + 65p P. & P.

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" × 3½" × 2¼". Ready built and tested. Price £6·75 P. & P. 95p.

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. £5·62 plus 20p. P. & P. Stereo beacon light if required 40p extra.

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 £7·00. P. & P. £1·25. ALSO AVAILABLE mounted on board with output transformer and speaker. PRICE £8·00, P. & P. £1·30.

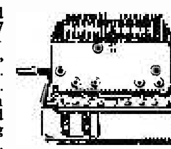
MAINS OPERATED SOLID STATE AM/FM STEREO TUNER

200/240V Mains operated Solid State F/M A/M Stereo Tuner. Covering M.W. A.M. 540-1605KHz VHF/FM 88-108MHz.
Built-in Ferrite rod aerial for M.W. Full AFC and AGC on AM and FM. Stereo Beacon Lamp Indicator. Built in Pre-amps with variable output voltage adjustable by pre-set control. Max o/p Voltage 600m/v RMS into 20K. Simulated Teak finish cabinet. Will match almost any amplifier. Size 8¼"w × 4"h × 9½"d approx.

LIMITED NUMBER ONLY at £28.00 + £1·50 P. & P.

SPECIAL OFFERS

Mullard LP1159 R.F.–I.F. Double Tuned Amplifier Module for nominal 470 KHz. Size approx. 2¾" × 1¼" × ¾" 7·6 Volt + earth. Brand new pre-aligned. Full specification and connection details supplied. **£2·25**, P. & P. 20p.



Pye VHF/FM Tuner Head covering 88-108 M/Hz. 10·7 M/Hz I.F. output. 7·8 Volt + earth. Supplied pre-aligned, with full circuit diagram. Connection details supplied. Beautifully made with precision-geared FM gang and 323Pf + 323Pf A.M. Tuning gang only **£3·15** + P. & P. 35p.

PRECISION MADE
Push Button Switch bank. 8 Buttons giving 16 S/P C/O interlocked switches plus 1 Cancel Button Plus 3 d/p c/o. Overall size 5" × 2½" × 1". Supplied complete with chrome finished switch buttons. 2 for **£1·50** + 20p P & P.

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). Handling power 10 watts R.M.S.
OUR PRICE £12·80 each. Carr. £2·20 ea.
Cabinet Available Separately **£7·60**, Carr. £1·60 each. Also available in 8 ohms with EMI 13" × 8" bass speaker with parasitic tweeter **£11·10**, Carr. £2·20 each.

LOUDSPEAKER BARGAINS
5in. 3 ohm **£2·00**, P. & P. 35p. 7 × 4in. 3 ohm **£2·35**, P. & P. 48p. 10 × 6in. 3 or 15 ohm **£3·20**, P. & P. 75p. 8 × 5in. 3 ohm with high flux magnet **£3·00**, P. & P. 60p. Tweeter. Approx. 3½". Available 3 or 8 or 15 ohms, **£2·00** + 30p, P. & P. 2" Plastic Cone HF Tweeter 4 ohm **£3·50** per matched pair + 50p P. & P.

HIGH POWER HI-FI 8 OHM DOME TWEETER. 1" voice coil, magnet size 3" dia. suitable for use in up to 50 watt systems **£4·50** ea + 60p P. & P.

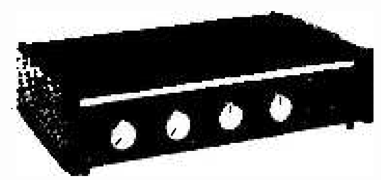
SPECIAL OFFER. 6½" long throw, roll surround, ceramic magnet 8 ohm 10 watt speaker chassis. Specially suitable for HiFi **£3·95** + 75p P. & P.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER
Size 11¾" × 14⅝" × 1³⁄₁₆" 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 **£8·40** each + p. & p. (one 90p, two £1·10).
Now available in either 8" round version or 4½" × 8½" rectangular. 10 watts RMS 60Hz-20KHZ **£5·25** + P. & P. one (65p, two 75p).

SPECIAL LINES OFFERED SUBJECT TO STOCK AVAILABILITY
Limited number of British manufacturer's surplus professional 100 watt RMS slave amplifiers. Special features, 2 separate power modules, 1 for Bass response and 1 for mid-range/tweeter. 5 stage LED display for power o/p indication. A/C mains i/p switchable for 110 or 240v. Can easily be converted to Stereo. AVAILABLE TO PERSONAL CALLERS ONLY, PLEASE PHONE TO CONFIRM AVAILABILITY. Brand new & tested only **£33·75**.

Prices include VAT at Current Rate

HARVERSONIC SUPERSOUND 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. Integral 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 1M Ω: 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. × 2¾"h.

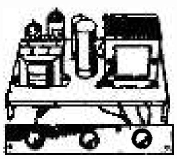
Fully detailed 7 page construction manual and parts list free with kit or send 25p plus large S.A.E.

AMPLIFIER KIT	£13·50	P. & P. 80p
(Magnetic input components 33p extra)		
POWER PACK KIT ..	£5·50	P. & P. 95p
CABINET	£5·50	P. & P. 95p

SPECIAL OFFER—only £23·75 if all 3 items ordered at one time plus £1·25 p. & p.

Full after sales service
Also available ready built and tested **£31·25**. P. & P. £1·50

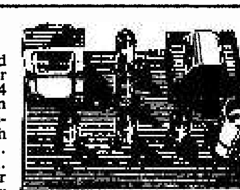
3-VALVE AUDIO AMPLIFIER HA34 MK II



Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½"w. × 4"d. × 4¾"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 **£8·20**. P. & P. £1·40.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. **£7·60** P. & P. £1·40.

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. £1·40.
Also available ready built and tested **£16·50** P. & P. £1·40.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER
For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz—25KHz. Gain 26dB. Solid encapsulation size 1¾" × 1¼" × ½". Brand new complete with instructions. Price **£1·80** P. & P. 15p.

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.

For personal callers only we can now offer a full repair service on all Hi-Fi Equipment, Disco, Cassettes, Car Radio etc. SEND S.A.E. WITH ALL ENQUIRIES

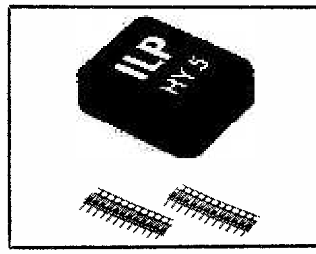
(Please write clearly)

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

15—240 Watts!

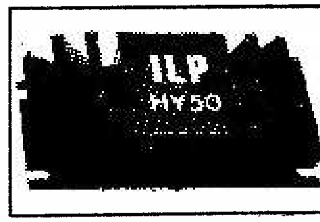
HY5
Preamplifier

The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag Cartridge, tuner, etc) are catered for internally. The desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.
FEATURES: Complete pre-amplifier in single pack—Multi-function equalization—Low noise—Low distortion—High overload—Two simply combined for stereo.
APPLICATIONS: Hi-Fi—Mixers—Disco—Guitar and Organ—Public address
SPECIFICATIONS:
INPUTS. Magnetic Pick-up 3mV; Ceramic Pick-up 30mV; Tuner 100mV; Microphone 10mV; Auxiliary 3-100mV; input impedance 4·7kΩ at 1kHz.
OUTPUTS. Tape 100mV; Main output 500mV R.M.S.
ACTIVE TONE CONTROLS. Treble ± 12dB at 10kHz; Bass ± at 100Hz.
DISTORTION. 0·1% at 1kHz. Signal/Noise Ratio 68dB.
OVERLOAD. 38dB on Magnetic Pick-up. SUPPLY VOLTAGE ± 16-50V.
Price £5·22 + 65p VAT P&P free.



HY30
15 Watts into 8Ω

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of I.C., heatsink, P.C. board. 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up-to-date technology available.
FEATURES: Complete Kit—Low Distortion—Short, Open and Thermal Protection—Easy to Build.
APPLICATIONS: Updating audio equipment—Guitar practice amplifier—Test amplifier—audio oscillator.
SPECIFICATIONS:
OUTPUT POWER 15W R.M.S. into 8Ω: DISTORTION 0·1% at 1·5W.
INPUT SENSITIVITY 500mV. FREQUENCY RESPONSE 10Hz-16kHz—3dB.
SUPPLY VOLTAGE ± 18V.
Price £5·22 + 65p VAT P&P free.

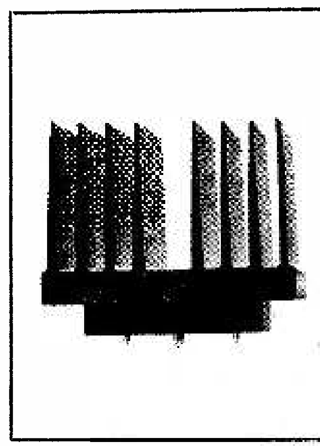


HY50
25 Watts into 8Ω

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.
FEATURES: Low Distortion—Integral Heatsink—Only five connections—7 amp output transistors—No external components
APPLICATIONS: Medium Power Hi-Fi systems—Low power disco—Guitar amplifier
SPECIFICATIONS: INPUT SENSITIVITY 500mV
OUTPUT POWER 25W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·04% at 25W at 1kHz
SIGNAL/NOISE RATIO 75dB FREQUENCY RESPONSE 10Hz-45kHz—3dB.
SUPPLY VOLTAGE ± 25V SIZE 105 50 25mm
Price £6·82 + 85p VAT P&P free

HY120
60 Watts into 8Ω

The HY120 is the baby of I.L.P.'s new high power range. Designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.
FEATURES: Very low distortion—Integral heatsink—Load line protection—Thermal protection—Five connections—No external components
APPLICATIONS: Hi-Fi—High quality disco—Public address—Monitor amplifier—Guitar and organ
SPECIFICATIONS
INPUT SENSITIVITY 500mV.
OUTPUT POWER 60W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·04% at 60W at 1kHz
SIGNAL/NOISE RATIO 90dB FREQUENCY RESPONSE 10Hz-45kHz—3dB SUPPLY VOLTAGE ±35V
SIZE 114 50 85mm
Price £15·84 + £1·27 VAT P&P free.

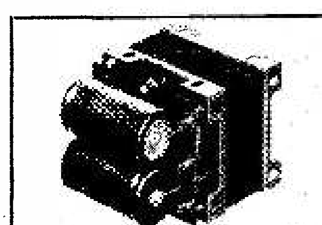


HY200
120 Watts into 8Ω

The HY200 now improved to give an output of 120 Watts has been designed to stand the most rugged conditions such as disco or group while still retaining true Hi-Fi performance.
FEATURES: Thermal shutdown—Very low distortion—Load line protection—Integral heatsink—No external components
APPLICATIONS: Hi-Fi—Disco—Monitor—Power slave—Industrial—Public Address
SPECIFICATIONS
INPUT SENSITIVITY 500mV
OUTPUT POWER 120W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·05% at 100W at 1kHz.
SIGNAL/NOISE RATIO 96dB FREQUENCY RESPONSE 10Hz-45kHz—3dB SUPPLY VOLTAGE ±45V
SIZE 114 50 85mm
Price £23·32 + £1·87 VAT P&P free.

HY400
240 Watts into 4Ω

The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω! It has been designed for high power disco address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.
FEATURES: Thermal shutdown—Very low distortion—Load line protection—No external components.
APPLICATIONS: Public address—Disco—Power slave—Industrial
SPECIFICATIONS
OUTPUT POWER 240W RMS into 4Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·1% at 240W at 1kHz
SIGNAL NOISE RATIO 94dB FREQUENCY RESPONSE 10Hz-45kHz—3dB SUPPLY VOLTAGE ±45V
INPUT SENSITIVITY 500mV SIZE 114 100 85mm
Price £32·17 + £2·57 VAT P&P free.



POWER SUPPLIES

PSU36 suitable for two HY30's £5·22 plus 65p VAT. P/P free.
PSU50 suitable for two HY50's £6·82 plus 85p VAT. P/P free.
PSU70 suitable for two HY120's £13·75 plus £1·10 VAT. P/P free.
PSU90 suitable for one HY200 £12·65 plus £1·01 VAT. P/P free.
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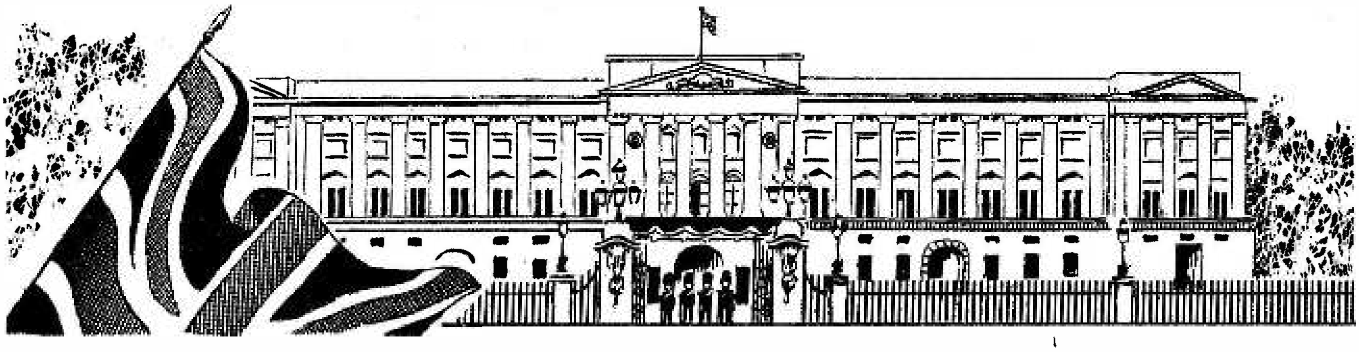

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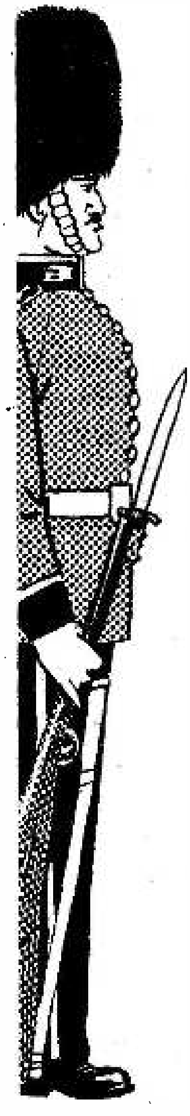

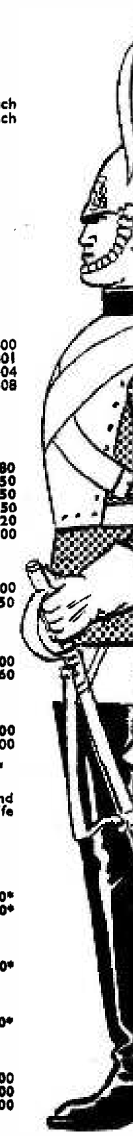

74 SERIES TTL IC's

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7401	0·11	0·10	7450	0·12	0·10	74123	0·65	0·62
7402	0·11	0·10	7451	0·12	0·10	74141	0·68	0·65
7403	0·11	0·10	7453	0·12	0·10	74145	0·75	0·72
7404	0·11	0·10	7454	0·12	0·10	74150	1·10	1·05
7405	0·11	0·10	7460	0·12	0·10	74151	0·65	0·60
7406	0·28	0·25	7470	0·24	0·23	74153	0·70	0·68
7407	0·28	0·25	7472	0·20	0·19	74154	1·20	1·10
7408	0·12	0·11	7473	0·26	0·22	74155	0·70	0·68
7409	0·12	0·11	7474	0·24	0·23	74156	0·70	0·68
7410	0·09	0·08	7475	0·44	0·40	74157	0·70	0·68
7411	0·22	0·20	7476	0·26	0·25	74160	0·95	0·85
7412	0·22	0·20	7480	0·45	0·42	74161	0·95	0·85
7413	0·26	0·25	7481	0·90	0·88	74162	0·95	0·85
7416	0·28	0·25	7482	0·75	0·73	74163	0·95	0·85
7417	0·26	0·25	7483	0·88	0·82	74164	1·20	1·10
7420	0·11	0·10	7484	0·85	0·80	74165	1·20	1·10
7422	0·19	0·18	7485	1·10	1·00	74166	1·20	1·10
7423	0·21	0·20	7486	0·28	0·26	74174	1·10	1·00
7425	0·25	0·23	7489	2·70	2·50	74175	0·85	0·82
7426	0·25	0·23	7490	0·38	0·32	74176	1·10	1·00
7427	0·25	0·23	7491	0·65	0·62	74177	1·10	1·00
7428	0·36	0·34	7492	0·43	0·35	74180	1·10	1·00
7430	0·12	0·10	7493	0·38	0·35	74181	1·90	1·80
7432	0·20	0·19	7494	0·70	0·68	74182	0·80	0·78
7433	0·38	0·36	7495	0·60	0·58	74184	1·50	1·40
7437	0·26	0·25	7496	0·70	0·68	74190	1·40	1·30
7438	0·26	0·25	74100	0·95	0·90	74191	1·40	1·30
7440	0·12	0·10	74104	0·40	0·35	74192	1·10	1·00
7441	0·60	0·57	74105	0·30	0·25	74193	1·05	1·00
7442	0·80	0·70	74107	0·30	0·25	74194	1·05	1·00
7443	0·95	0·90	74110	0·48	0·45	74195	0·80	0·75
7444	0·95	0·90	74111	0·75	0·72	74196	0·90	0·85
7445	0·80	0·75	74118	0·85	0·82	74197	0·90	0·85
7446	0·80	0·75	74119	1·30	1·20	74198	1·90	1·80
7447	0·70	0·68	74121	0·28	0·26	74199	1·80	1·70

Devices may be mixed to qualify for quantity price. Data is available for the above series of IC's in booklet form **Price 35p**

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CD4007	£0·18	CD4026	£1·85	CD4054	£0·95
CD4008	£0·80	CD4027	£0·48	CD4055	£1·60
CD4009	£0·50	CD4028	£0·80	CD4056	£1·15
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CD4013	£0·42	CD4035	£1·40	CD4072	£0·20
CD4015	£0·80	CD4037	£0·78	CD4081	£0·20
CD4016	£0·42	CD4040	£0·78	CD4082	£0·20
CD4017	£0·80	CD4041	£0·68	CD4510	£1·10
CD4018	£0·85	CD4042	£0·68	CD4511	£1·25
CD4019	£0·45	CD4043	£0·78	CD4516	£1·10
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J12 2 x BF115—BF167—BF173 each
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J14 2 x BF258
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BINDERS

Binders, for either the old or the new format, are £2·10 and Indexes are 45p (Inc VAT) and can be obtained from the Post Sales Department, IPC Magazines Ltd., Lavington House, Lavington Street, London SE1 0PF. Remittances with overseas orders for binders should include 60p to cover despatch and postage.

BACK NUMBERS

We are very glad to announce the re-establishment of a PW Back Numbers Service for our readers. In future back numbers dated from June 1977 only will be available from our Post Sales Department for 65p, which includes postage and packing. Cheques and Postal Orders should be made payable to IPC Magazines Ltd.
Send your orders to:- Post Sales Department, IPC Magazines Ltd., Lavington House, Lavington Street, London SE1 0PF.

Our Face~lift

Well, here it is! The new and, we hope, more attractive, larger version of **Practical Wireless**, as promised last month. PW has gone through other changes of size in the 45 years that it has been around and when it was first published in 1932 the page size was just the same as our 'new' format! So we seem to have gone through the whole cycle! In the 60's PW was quite small, about 9 × 6in., with correspondingly more pages but it was quite popular since one could roll or fold it up to fit the coat pocket, and I would imagine that there are many readers who would still prefer it that way!

Those that know all about these things have now been able to produce a bigger page area from the same size reel of paper, although the printing costs are marginally higher. We trust that you will like the slightly larger type face, being easier to read. Anyway, if you do favour the new-look **Practical Wireless** do not hesitate to let us know. No doubt the disapprovers will also be in touch but their letters will be equally welcome.

As the compiler of the amateur bands section of our monthly feature "On the Air" I know something of the problems that can be encountered by the very keen listener to the amateur bands who wants to get on and obtain the amateur transmitting licence. Although many schools, colleges and radio clubs run classes for the Radio Amateur's Examination there are many potential candidates who just cannot reach such places and who must rely on their own studies at home.

This month sees the start of a new series aimed not only at the the person who, perforce, has to be a loner, but all those who aspire to the RAE. Remember, it is unlikely that any two candidates will be starting from precisely the same level. There is the newcomer to electronics, who, by sheer enthusiasm, will spend every possible moment studying both the theoretical and practical side of our hobby, and there is the electronic engineer, with degrees after his name, who needs to swot up on certain aspects of the subject before sending in the rather exhorbitant entrance fee. Today, it behoves every candidate for the RAE to be really sure that he is prepared for the exam. Whatever his capabilities may be on the technical side he must still swot up on the legislation governing the issue of an amateur licence. Part 1 of the exam is not in the least difficult but a failure in this part means a failure of the whole paper, even if you are a veritable genius at electronics!

So we hope that our RAE course will help readers of all technical abilities and, probably, many other readers too, who may never have heard of the RAE!

Eric Dowdeswell *Assistant Editor*

PLEASE NOTE

We do not operate a Technical Query Service except on matters concerning constructional articles published in PW. We do not supply service sheets or information on commercial radios, TV's or electronic equipment.
All queries must be accompanied by a stamped self-addressed envelope otherwise a reply cannot be guaranteed.

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

New catalogue

Bi-Pak has announced the publication of its latest catalogue containing over 120 pages of electronic component listings. There are numerous, albeit rather small, pictures and line drawings. The semiconductor section generally includes pinout details and limited operational parameters. The cost is 50p + 15p postage.

Bi-Pak Semiconductors, The Maltings, 63A High Street, Ware, Herts SG12 9AD.

Audio Fair '77

Don't forget that the Audio Fair '77 is coming shortly and promises to be the most comprehensive ever staged. Displays will range from the most sophisticated BBC/IBA/GPO Data transmission modes to the more mundane HiFi equipment, TV games and home movie apparatus.

The show which is at London's Olympia will open from 2pm-9pm on September 13th, from 10am to 9pm on September 14th, 15th, 16th and 17th, and from 10am to 8pm on Sunday, September 18th. Admission will be 70p for adults, and children under 14, 30p.

New distributor

Plessey Aerospace has appointed Sasco as sole stockist for their complete range of Plessey miniature relays. Products covered by this agreement include half-crystal-can and full-crystal-can types (sealed and unsealed), hermetically sealed 10A crystal-can versions, and rotary armature Type II relays.

Sasco, PO Box 2000, Crawley, Sussex.

New service

Audio Workshops Ltd., have now opened their new showroom at 33 London Road, Southborough, Tunbridge Wells, Kent, where they will be stocking a wide variety of FM aerials, aerial accessories, cables, rotators and electronic car aerials.

The showroom also displays a wide variety of aerial amplifiers from simple low-cost single transistor amplifiers to high quality semi-professional low noise masthead amplifiers.

Full advice as to which aerial or accessory should be purchased to obtain optimum performance will be available from the founder of Audio Workshops, Mr Peter Dunkley. And as a small incentive to go along and see what's available, the firm is offering a high quality 8 element FM aerial at £12·75—for a limited period.

A winner

Marshall's have produced a brand new catalogue in a much larger format than before, a bit bigger than this issue of PW. Many new lines include microprocessors and supporting devices, a range of Digital Multi Testers and a pull-out Transistor Guide for the shack wall. Cost is 25p to callers or 35p by post.

A Marshall (London) Ltd., 42 Cricklewood Broadway, London NW2 3ET.

Talking show

An exhibition to commemorate Thomas Edison's invention in 1877 of the Talking Machine is to be held in conjunction with the British Institute of Recorded Sound during August. Comprising some 125 exhibits, the theme of the displays will be the evolution of the phonograph and gramophone from the original hand turned models to today's HiFi. Early original records together with some interesting accessories complete the displays.

Spare parts manufactured by the organisers of the exhibition for collectors will also be available, as will reprints of early catalogues, posters and instruction manuals.

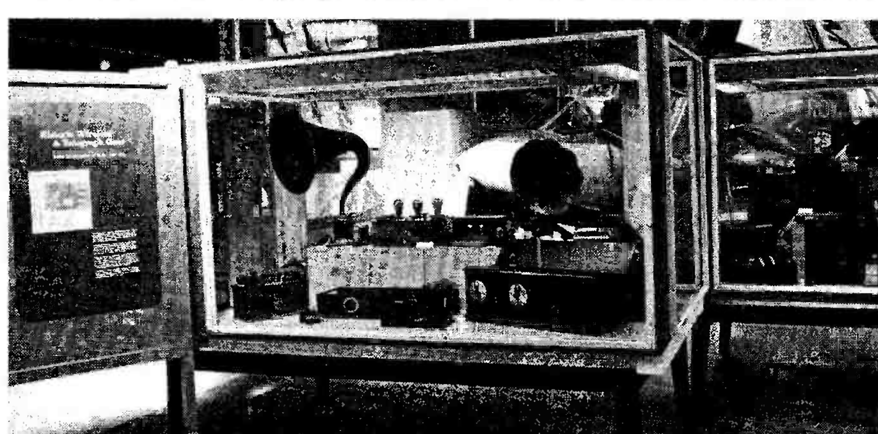
Called "100 years of Recorded Sound" the exhibition will be open to the public from Saturday 13th August to Saturday 27th August (excluding Mondays). Opening times will be 10am until 6pm.

Further information from Goodwin Eve, City of London Phonograph & Gramophone Society, Farm Cottage, High Road, Chipstead, Surrey. Tel: 07375 54827.

Jermyn gen

Jermyn Distribution have now made available the new National Semiconductor MOS/LSI Databook. Containing 400 pages divided into 14 sections, this Databook lists details of electronic organ and TV circuits; A/D converters; communications/CB radio circuits; watches, calculators and keyboard encoders.

In each section, complete characteristics, connection details, function descriptions, and block diagrams are all covered, while the last chapter gives physical dimensions of all National Semiconductor products together with a definition of terms. Priced at £5·95, it can be obtained from *Jermyn Distribution, Sevenoaks, Kent.*



Part of Ron Ham's early wireless collection which is on display at The Cornwall Aircraft Park, Helston, Cornwall until October 31st. Some of the items on exhibition were featured in *Practical Wireless*, September 76. On the left hand side of the show case is a copy of the article which was published in The Times newspaper, September 26, 1975 about the collector and his historic pieces. Ron is a very fervent supporter of the new industrial museum that is to be built at Houghton in Sussex and which, he expects, will be the permanent home of his collection that dates back to 1900.

So you want to pass the R.A.E. (Radio Amateurs' Examination)? No. 1

John Thornton Lawrence GW3JGA & Ken Mc Coy GW8CMY

The passing of the Radio Amateurs' Examination, set by the City and Guilds, requires a certain level of theoretical technical knowledge. Whether one considers that this level is too high or too low is beside the point. The course that follows is intended, with the help of certain external aids, to prepare the reader to pass the examination. It will not teach him all about electronics!

The Radio Amateur is a privileged person indeed, he has access to various parts of the radio frequency spectrum which enable him to talk to other amateurs near to him or in any other part of the world. The Radio Amateur has his own international language, he belongs to a worldwide brotherhood of Radio Amateurs whose "Ham Spirit" takes no account of race, colour, political or social outlook. To ensure that these privileges are not abused, the Licensing Authority (the Home Office) require some test of the would-be amateur's technical competence and knowledge of the radio "Highway Code", before giving him a licence to drive on the frequency motorways of the world, in short, the Radio Amateurs' Examination.

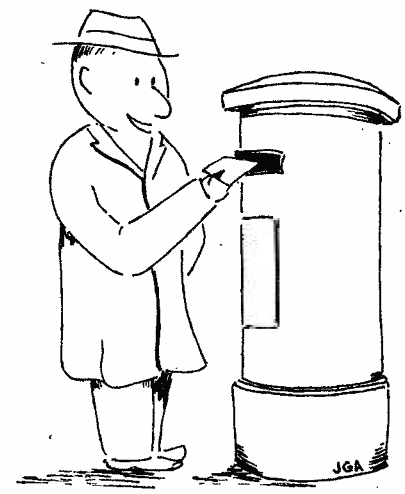
ABOUT THE AUTHORS

John Thornton Lawrence. T.Eng. (C.E.I.), F.S.E.R.T., *is a Senior Scientific Officer concerned mainly with electronic instrumentation, measurements and calibration. He obtained his licence GW3JGA in 1953 and his amateur TV licence GW3JGA/T (later GW6JGA/T) in 1958. He is a Committee member of the British Amateur Television Club and a Founder of the University College of North Wales ARS.*

His hobbies include amateur VHF, UHF and TV equipment, collecting antique radio gear, particularly valves, wine and beer making and helping the local Scout Group. He is married with two sons, 19 and 9.

Ken McCoy *holds an HNC in Electrical and Electronic Engineering and is concerned with instrumentation and electron microscopy. He is a part-time lecturer for the Radio Amateur's Examination course at the Gwynedd Technical College.*

He obtained his licence GW8CMY in 1967 and his main interest is in building portable 2m equipment. His other hobbies include mountaineering in the UK and on the Continent, photography and DIY home improvements. He is a team leader in the Ogwen Valley Mountain Rescue Organisation. He is married with a son, 14, and two daughters, 12 and 6.



. . . 'writing to the City and Guilds'

Maybe you are one of those whose interest in Amateur Radio has been building up steadily for some time and the point has now been reached where you have to decide whether or not to enter for the R.A.E. If you are dithering on the brink, you may be interested to know that this is the first of a series of articles concerned with preparing for and successfully taking the Radio Amateurs' Examination. It is not intended to be a complete course leading up to the R.A.E. but more of a progressive clarification of some of the problem areas which can be the undoing of many candidates.

The main core of information is best obtained from books specially written for the Radio Amateur and for the R.A.E. in particular and these will be referred to from time to time. Practical work is an important part of preparing for the R.A.E. and suggestions for this will be included where necessary. If by now you have decided to proceed, then please read on.

Taking stock

We are very pleased to see that you have now made up your mind to have a go at the R.A.E. Before we do anything else, let's take stock of the situation. You say that you did the usual basic arithmetic in school (but that seems a while ago!) and you naturally feel a bit rusty in that area and with electrical theory, even more so. OK, so some work is definitely required to bring these up to scratch.

How about circuits? You're able to follow some of the simple circuits without much difficulty but find it quite a struggle to explain, in so many words, how they work. Well, perhaps this is just because you are not looking at them in the right way, so more about that later.

Now the practical side. You say that you have built up the odd electronic circuit from *PW* and have got it working OK, fine! By the way, do you go to the local Amateur Radio Club meetings? No? Pity! You see, it's very helpful if you can do some practical work in connection with the R.A.E. and membership of the local Radio Club is very useful in this respect as it will give you the chance to see amateur radio equipment being used and to obtain some guidance and help when you are building things for yourself. Write to the R.S.G.B. for details of your local club as many clubs are affiliated to the R.S.G.B.

Preparations

You will need to get some books and information on the examination, past R.A.E. papers and so on. These take a little time to come so I suggest that you order these now. First write to: The City and Guilds of London Institute, 76 Portland Place, London W1N 4AA, for Pamphlet 765 Radio Amateur's Examination 1976-1978, including a set of Question Papers for the last three years. Remember to enclose a cheque or P.O. for 40p. This represents very good value, as usually each set of City and Guilds Question Papers is extra.

The Home Office publishes a useful document about becoming a Radio Amateur and this is available free of charge. Write to: The Home Office, Radio Regulatory Dept., Waterloo Bridge House, Waterloo Road, London SE1 8UA, for leaflet "How to become a Radio Amateur".

Now, moving on to textbooks and booklets, these can be roughly divided into two categories, the essential, and the desirable but not essential. The essentials, which are all published by the Radio Society of Great Britain, can be obtained from your local bookshop (if you want to use up that birthday book token from auntie!) or, cash with order, from: R.S.G.B. Publications (Sales), 35 Doughty Street, London WC1N 2AE.

They are:

"A Guide to Amateur Radio" by Pat Hawker G3VA. £1·35.

"The Radio Amateurs' Examination Manual" by G. L. Benbow G3HA. £1·35.

"Radio Amateurs' Revision Notes" by G. L. Benbow G3HA. 61p.

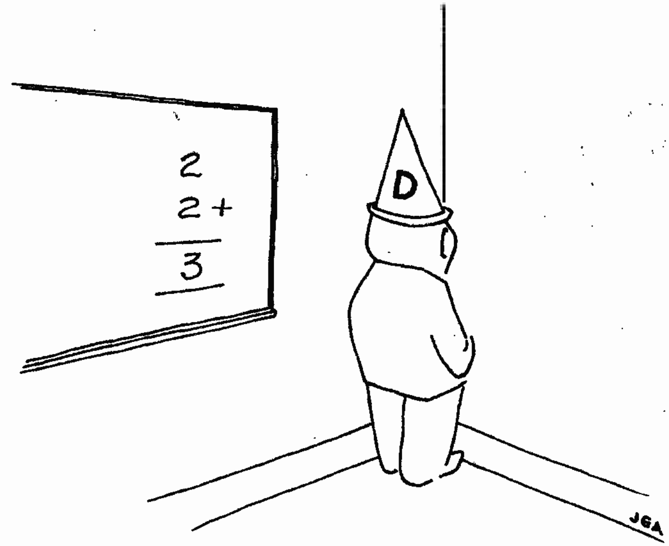
The books in the second category are much more comprehensive and naturally cost more. These are also available from R.S.G.B. Publications (Sales) but as an alternative to immediate purchase, they may be obtained from your local library. They are: Radio Communication Handbook (R.S.G.B.) 5th Edition Vols. 1 and 2, or Radio Amateurs' Handbook 1977 (A.R.R.L.).

Getting down to it

The method of studying for the R.A.E. depends on your personal circumstances. The various ways are:

(a) Evening classes.
(b) Correspondence course.
(c) Home study, with or without some tuition.

If you live near a technical college or school which runs evening classes, then this is probably the best way for you to study. A direct approach to the college or school will provide you with full details. Correspondence courses or home study for the R.A.E. require continuous and regular work sessions. Home study requires a lot more personal discipline to get through the more difficult items as you will find it a great temptation to leave them until the end, when it is usually too late!



... 'mathematics a bit rusty?'

It is always useful, and particularly so in the case of home study, if you can enlist the help of a local Radio Amateur or suitably qualified friend, who will talk-through any problems you may have.

Here we are then, you have registered at your local evening institute for the R.A.E. course, the books are ordered and you are ready and waiting to get down to the "nitty gritty".

Arithmetic

Let's start with arithmetic (we always think that the word arithmetic is less daunting than mathematics). There are going to be some calculation questions in the R.A.E. and if you can do these correctly, you can gain full marks on each question in a matter of minutes. Even fairly straightforward electrical calculations can present very real difficulties if you have not seen the sharp end of a blackboard pointer since you left school, so the purpose of this section is to remind you of the basics involved in these sums and to suggest a few tricks to make them easier to execute and remember.

If you have read through the instruction book of a pocket calculator you will know that there are four "basic arithmetical functions", namely, addition, subtraction, multiplication and division.

Addition and Subtraction—So far as the problems that you will meet in the R.A.E. are concerned, addition and subtraction will take care of themselves, for example, $3+7=10$ and $4-2=2$. Multiplication and division may be written down in several different ways, so here are a few alternatives.

Multiplication—$A \times B$ can also be written as A.B. or simply AB.

Division—$A \div B$ can also be written as $\frac{A}{B}$. Thus $1 \div 2$ is the same as $\frac{1}{2}$ ("one upon two" or "one over two").

Now for the not-so-basic arithmetic functions, reciprocals, squares and square roots.

Reciprocals—The reciprocal of A is $\frac{1}{A}$ or from division $1 \div A$ or "one upon A", and to put it numerically, the reciprocal of 4 is $\frac{1}{4}$ and of 100 is $\frac{1}{100}$.

This function, together with the squares and square roots, occurs often in resonance and frequency calculations.

Squares—If a number is multiplied by itself the answer is known as the square of the number. For example, $A \times A$ is written as A^2 or "A squared". Thus A^2 is the square of A. And, to put it numerically, 9 is the square of 3, since $3 \times 3 = 9$.

Square Roots—The square root of a number is a figure which, when multiplied by itself, is equal to the original number. For example, the square root of 9 is 3 because when 3 is multiplied by itself, it equals 9, written $\sqrt{9}=3$ because $3 \times 3 = 9$. Similarly, $\sqrt{25}=5$ (because $5 \times 5 = 25$) and $\sqrt{4}$ or "Root 4" = 2 ($2 \times 2 = 4$) and so on.

Incidentally, not all square roots are whole numbers. For instance, $\sqrt{2}$ has been calculated to at least 50 decimal places, but is used most often as 1·41. Finally, $\sqrt{2} \times \sqrt{2} = 2$ and $\sqrt{5} \times \sqrt{5} = 5$ and $\sqrt{25} \times \sqrt{25} = 25$.

Problems in the actual R.A.E., which involve finding the square roots of numbers, can be dealt with by looking up the value in the square root tables which are provided.

Multiples and sub-multiples

Some of the electrical units that are used in radio are inconveniently small for practical purposes and so a multiple of the unit is used. Some others, for example, the Henry and the Farad, are inconveniently large. A one Farad capacitor having a particular dielectric between its plates, might occupy a volume similar to that of a block of flats!

The capacitors and inductors used in radio work have values which are sub-multiples of the Farad and the Henry. You will, therefore, need to be able to recognise multiples and sub-multiples in words and in figures.

Multiples—Multiples are described by a prefix to the unit in question. For example, 1 Megohm = 1,000,000 ohms. A list of multiple prefixes is given below.

Prefix	Letter			Index Form
tera	T	one million million	1,000,000,000,000	10^{12}
giga	G	one thousand million	1,000,000,000	10^{9}
mega	M	one million	1,000,000	10^{6}
kilo	k	one thousand	1,000	10^{3}
hecto	h	one hundred	100	10^{2}

Sub-multiples—Sub-multiples are described by a letter prefix in a similar fashion. For example, 0·000,001 Farad = 1 microfarad = 1μF. A list of sub-multiple prefixes is given below.

Prefix	Letter			Index Form
deci	d	one tenth	0·1	10^{-1}
centi	c	one hundredth	0·01	10^{-2}
milli	m	one-thousandth	0·001	10^{-3}
micro	μ	one millionth	0·000,001	10^{-6}
nano	n	one thousand millionth	0·000,000,001	10^{-9}
pico	p (or $\mu\mu$)	one million millionth	0·000,000,000,001	10^{-12}

Indices

You will notice from the previous sections that the multiplier and sub-multiplier are written as a figure followed by or preceded by a number of noughts. This number, when expressed in what is known as "index form", uses a special notation which is best shown by example:

mega = 1,000,000 In index form 10^6
giga = 1,000,000,000 In index form 10^9

In the case of multiples, the index number is equal to the number of noughts following the figure, so that, for example:

2·2 Megohms is written as $2{\cdot}2 \times 10^6$
and 7·3 Gigahertz is written as $7{\cdot}3 \times 10^9$ Hertz.

Sub-multiples use the same notation but with a slight difference:

pico = 0·000,000,000,001 = 10^{-12}
micro = 0·000,001 = 10^{-6}

You will notice that in the case of sub-multiples, the index number is **minus** and equivalent to the **number of noughts** plus one following the decimal point. For example:

2·2 picofarads = $2{\cdot}2 \times 10^{-12}$ Farads.
7·3 microhenrys = $7{\cdot}3 \times 10^{-6}$ Henrys.

It is often desirable to convert from one multiple of an electrical unit to a different multiple and this can be done by moving the decimal point and at the same time changing the index number accordingly. For example:

2·2 Megohms = 2,200,000 ohms
= $220{,}000 \times 10$ ohms
= $22{,}000 \times 10^2$
= $2{,}200 \times 10^3$ ohms (kilohms)
= 220×10^4 ohms
= 22×10^5 ohms
= $2{\cdot}2 \times 10^6$ ohms (Megohms)

Similarly,

0·000,000,002 Farads = $0{\cdot}002 \times 10^{-6}$ Farads
= 0·002 microfarads (μF)
= 2×10^{-9} Farads
= 2 nanofarads (nF)
= $2{,}000 \times 10^{-12}$ Farads
= 2,000 picofarads (pF)

Multiplying—When **multiplying** figures in index form it is only necessary to **add** the indices. For example:

$$10^4 \times 10^6 = 10^{10}$$
$$10^4 \times 10^{-6} = 10^{-2}$$
$$10^{-4} \times 10^6 = 10^2$$
$$10^{-4} \times 10^{-6} = 10^{-10}$$

Dividing—when **dividing** figures in index form it is only necessary to **subtract** the indices. For example:

$$\frac{10^6}{10^4} = 10^6 \div 10^4 = 10^2$$

$$\frac{10^{-6}}{10^{-4}} = 10^{-6} \div 10^{-4} = 10^{-2}$$

$$\frac{10^{-6}}{10^4} = 10^{-6} \div 10^4 = 10^{-10}$$

Also

$$\frac{10^{-6}}{10^4} = 10^{-6} \times 10^{-4} = 10^{-10}\,*$$

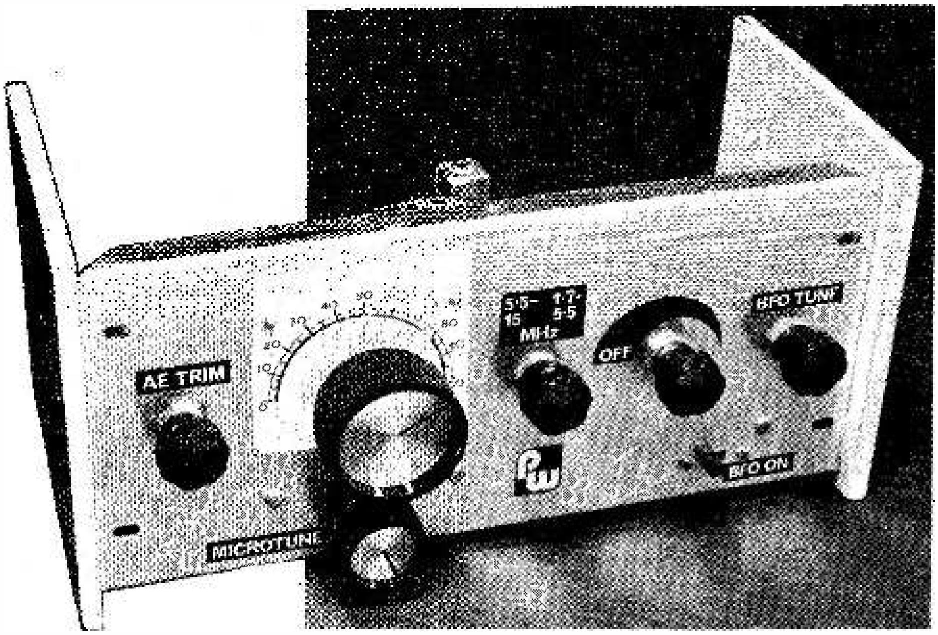
* An alternative way to deal with an index quantity that you are dividing by is to change the sign of the index and multiply, by adding the indices.

continued on page 342

GENERAL PURPOSE SW RECEIVER

Part 1

F.G.RAYER G3OGR



A frequency coverage of approximately 1·7MHz to 15MHz includes many useful bands and is obtained in this receiver by two switch-selected ranges. The tuned circuits comprise the four coils shown in **Fig. 1**, and a few points should be noted.

As an intermediate frequency of 1·6MHz is used, greater freedom from second channel interference is obtained than with a 470kHz IF. Despite this, it is not possible to avoid such interference with a single tuned circuit, especially at higher frequencies, so a matching tuned RF preselector unit is advisable and this can be added later if wished (Part 2). With the RF preselector connected the RF stage drain is supplied via R1, to make use of the primaries of the coils L1 and L2. **C1 is external to the receiver.** If it is not intended to add the RF unit, C2 and R1 can be omitted, and pins 9 of L1 and L2 connected to chassis.

Circuit Description

The 4-pole switch S1a-d selects the appropriate pair of coils. These are tuned by the ganged capacitor VC1/2. Instead of having four pre-set trimmers, TC1 is provided across VC2, and VC3 is a panel control. This provides much more latitude in alignment. VC4 is the oscillator bandspread or fine tuning capacitor, which is useful for precise tuning or listening over a narrow band.

Data for the coils used specify a 960pF padder CP1 for L3, and 340pF padder CP2 for L4 using a 2 x 315pF gang. However, 1000pF and 330pF will be suitable and are more easily obtainable. The larger capacity gang is also a standard item and simply increases coverage slightly.

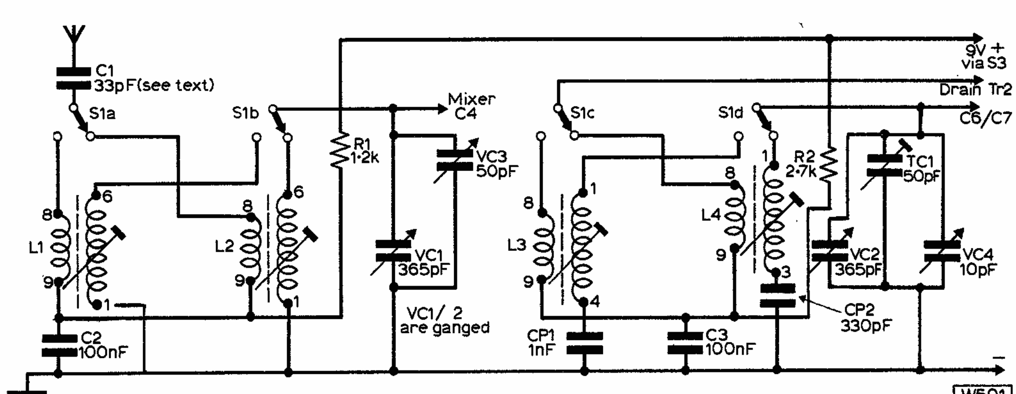
In **Fig. 2**, Tr1 is the mixer with L1/L2 switched to gate 1 and the oscillator coupled to gate 2 via C6. Tr2 is the oscillator with C7 going to L3/L4 and drain feedback via S1c. As Tr1 is a protected gate device no particular care is needed beyond that generally taken to avoid overheating while soldering.

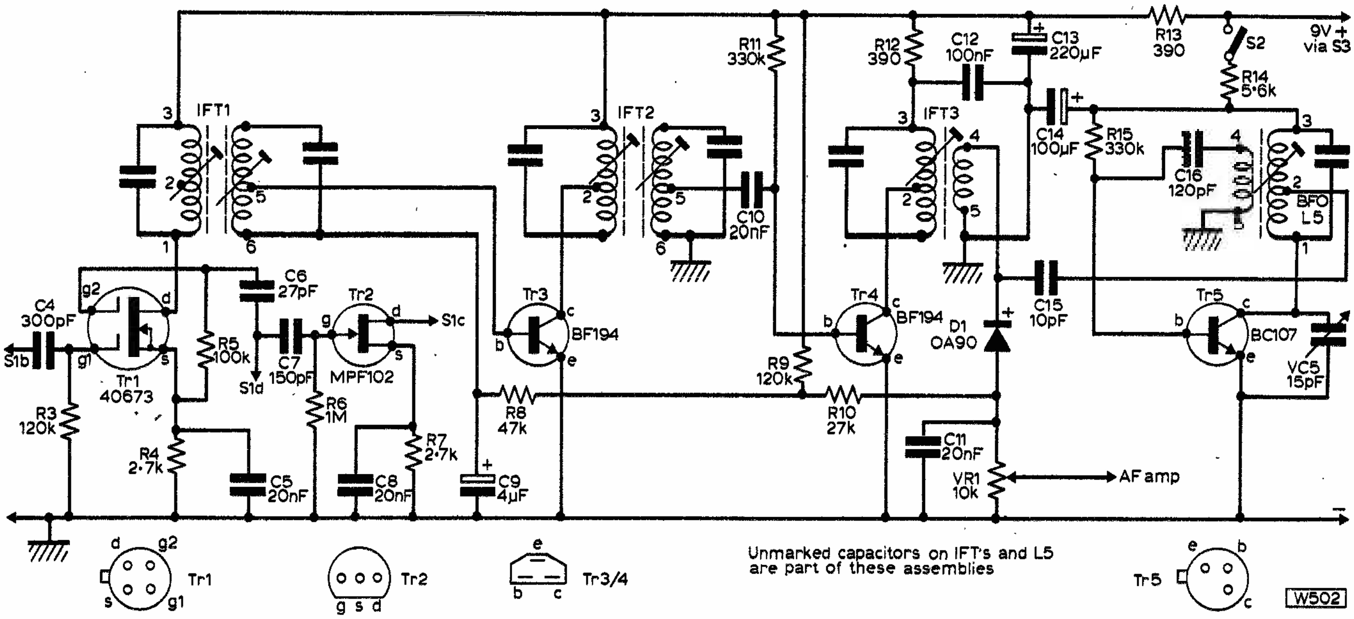
IFT1 couples the mixer output to the first IF amplifier Tr3, which also receives AGC base bias through R8 and R10, from D1. Tr4 is the second IF stage. D1 provides AGC and the audio signal developed across the volume control VR1. When S5 is closed, the BFO oscillator Tr5 is on and it is coupled to D1 by C15. This allows reception of CW (Morse) and SSB (single sideband) signals. The panel control VC5 is for adjusting the BFO frequency. Should the receiver be required for ordinary SW broadcast reception only, then S5, R14, R15, C14, C15, C16 and Tr5 and the associated circuitry may be omitted as this stage is not used for AM reception, but this is not recommended.

This circuit is assembled on a single board, with the exception of controls VR1 and VC5.

The audio amplifier consists of a TBA800 IC, **Fig. 3**, and provides useful gain and output without too much

Fig. 1: The circuit diagram is shown in three parts. This circuit is of the four-coil switched aerial and mixer input section. Two bands, 1·7 to 5·5 and 5·5 to 15MHz are provided.





drain on the battery. It is intended for use with a 16Ω speaker but may be used with phones for individual listening.

The audio amplifier is wired on its own board which fits under the chassis. R19 can be two 2·2Ω resistors in parallel if any difficulty arises in obtaining 1Ω.

Metalwork

Flanged "universal chassis" members from Home Radio allow an inexpensive case to be made easily. The panel used is 9 x 4in and the chassis 8 x 4in so that it may fit inside. It is secured 1in up, with three bolts. If panel and chassis members are the same length, two corners of the chassis part must be cut away so that it will fit inside the flanges on the panel.

A clearance hole is required for the ganged capacitor which has an integral ball drive. The BFO switch S2 occupies a slot, which can be made by drilling a few small holes and filing. The mixer-IF board has four fixing bolts, and the AF board two bolts. To assure an easy fit, boards and chassis can be drilled together before mounting any components.

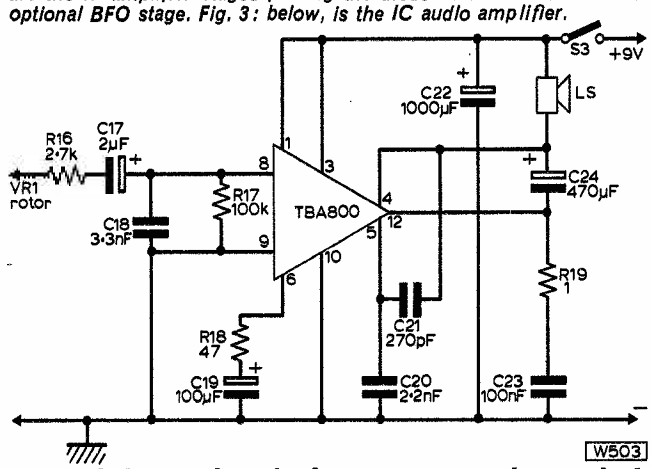
Construction

Two 4BA bolts secure the ganged capacitor. Solder a lead to the central frame tag of this before fixing it in place. It is necessary to use washers or other spacers between it and the chassis, and to watch that the bolts do not project very far inside the front of the capacitor. VR1 and other controls can then be fixed to the panel. When placing the coils on the chassis, tighten their fixing nuts **with the fingers only**. Most of the wiring in Fig. 1 can then be finished, keeping leads reasonably short and direct. If the coil pins are dull clean them before soldering. It is necessary to avoid lengthy heating of the pins and to see that they are not displaced.

Fig. 4 will assist in wiring. One tag of S6 is used as a point for R1, R2, S2 and R13 positive connections. The AF amplifier positive circuit is made at S2, under the chassis. VC4 is directly under the ganged capacitor, so a lead passes down through a hole to it from VC2. **Fig. 5** will allow the switch wiring to be checked.

Fig. 6 shows both sides of the mixer-IF board. It should first be drilled for the IFTs, including the

Fig. 2: above, shows the mixer stage Tr1 and oscillator Tr2. Tr3 and 4 are the IF amplifier stages feeding the diode detector D1.Tr5 is the optional BFO stage. Fig. 3: below, is the IC audio amplifier.



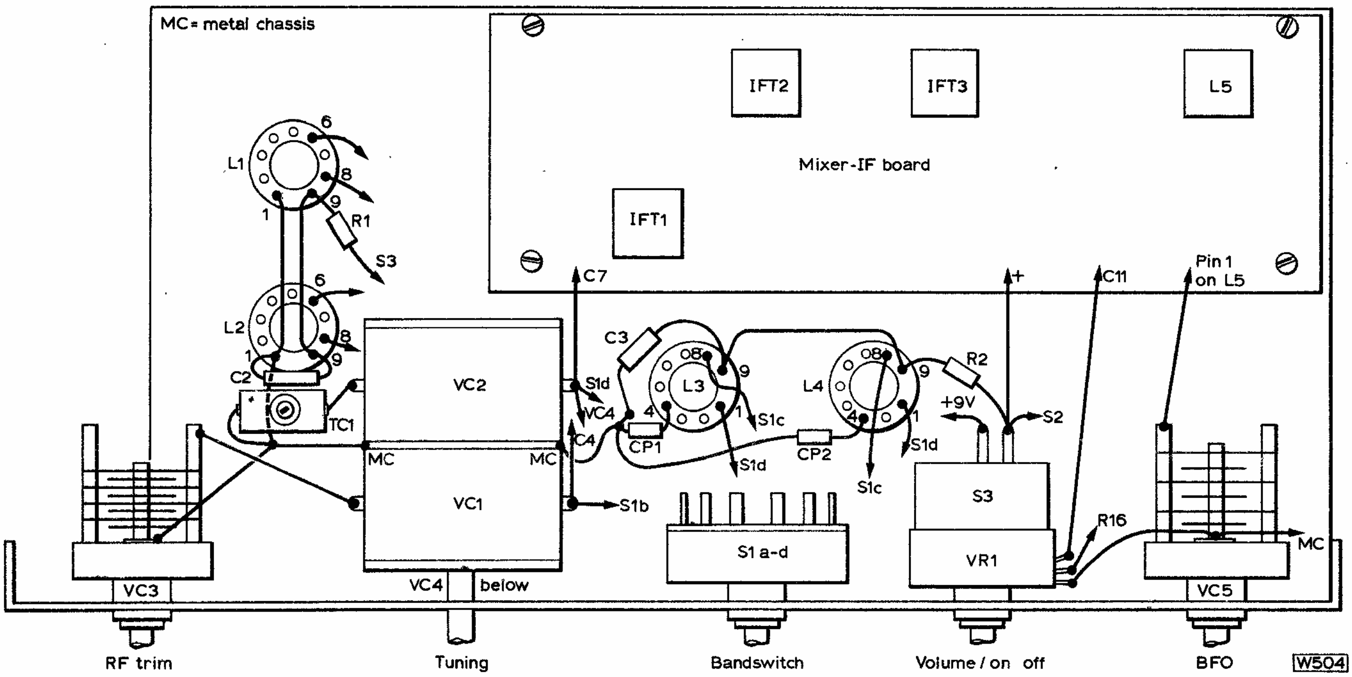
centre holes so that the lower cores can be reached. Each of the points MC is a tag secured with a ½in 6BA bolt. Later, extra nuts allow the board to be mounted by these bolts, with clearance for wiring. Sleeving should be put on the positive circuit wiring to pins 3 of the IFTs, but is not needed elsewhere.

Provide coloured insulated leads for all external connections. These can be yellow for VC1 (S1b), black for VC2 (S1d), brown for S1c, red for positive, pink for S2, and yellow-green for VR1. When the board is fixed with lock nuts, cut these leads as required and solder them to the capacitor and other components.

The audio board is wired as in **Fig. 7**, and is mounted in the same manner as described for the other board. Connect R16 to VR1 wiper and positive to the positive line at S2. The board is placed under the chassis, at the right. It is important to note that both sides of the speaker circuit are insulated from the metal and negative line.

IF Alignment

As the IFTs are pre-tuned by the manufacturer they should not be adjusted until reasonable reception is being obtained. They can then be set for maximum volume, by rotating the cores with a proper trimming tool. Choose a weak, steady signal for this



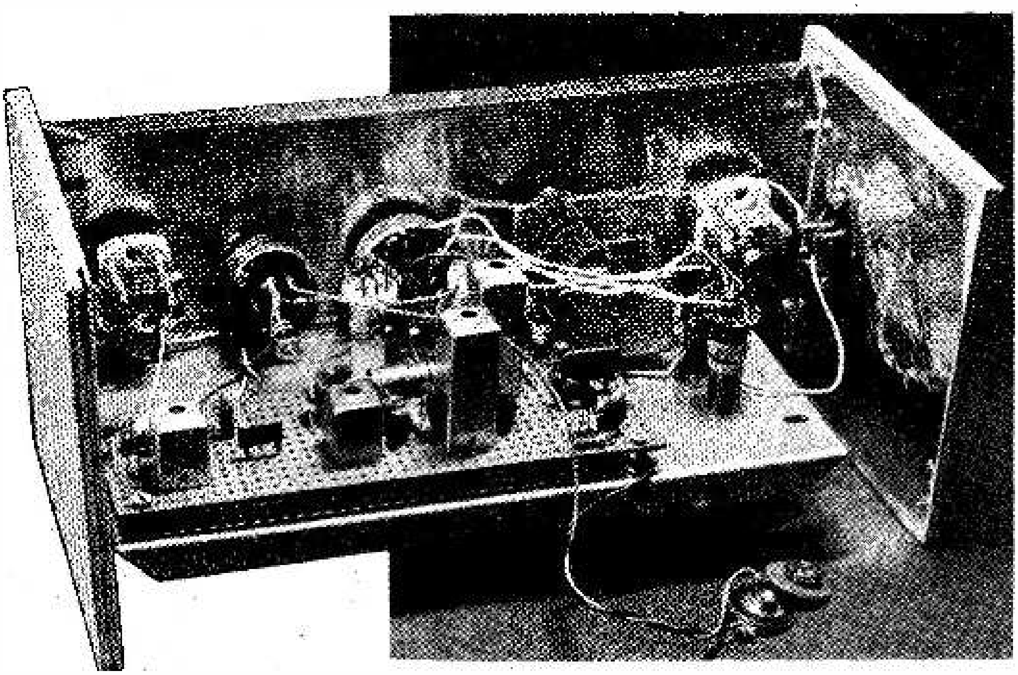
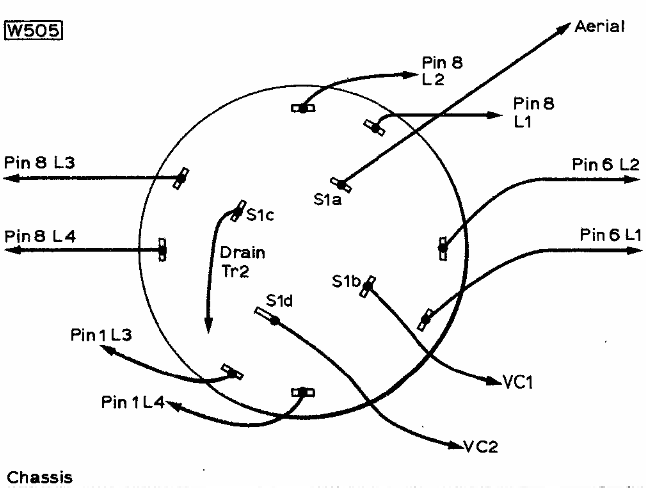


Fig. 4: above, shows the layout of the panel-mounted controls and the position of the mixer-IF board on the chassis. The photograph of the back of the receiver complements Fig. 4 and also shows the piece of aluminium foil stuck to the inside of the case to shield the coils when the pre-selector is used with the receiver.
Fig. 5: below left, is the wiring between the band switch and the four coils.



operation. It is a good idea to place the audio board so that the lower cores of IFT1 and IFT2 can be reached through holes in the chassis, or to raise the IF board sufficiently to reach these cores. If the latter method is used, provide a return lead from the negative line to chassis. When the five cores have been peaked up for best results, they need no further adjustment. Alternatively, a signal generator, set to 1·6MHz, may be used for precise alignment **after** the set is working.

BFO Adjustment

Initially tune in a steady AM signal precisely and set VC5 half closed, then switch on the BFO with S2. Set the core in L5 so that a strong audio heterodyne is heard and rises in pitch when VC5 is turned either way from the central, zero beat position. This oscillator is never in use for AM reception, only for CW

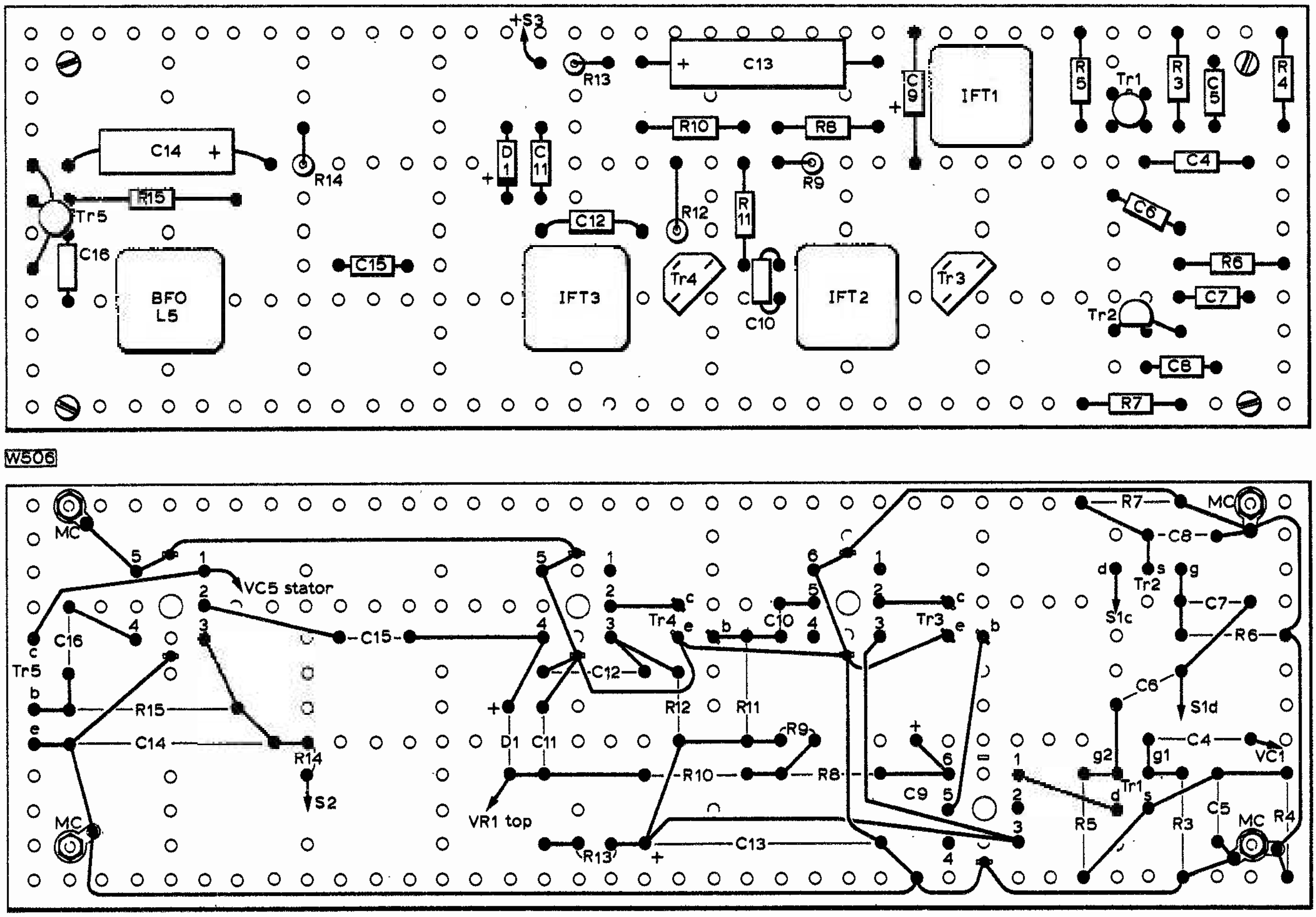


Fig. 6: Wiring and component location on the mixer-IF board is given here, from above and below. The drawings are not to scale.

★ components

Resistors

R1 1·2kΩ
R2 2·7kΩ
R3 120kΩ
R4 2·7kΩ
R5 100kΩ
R6 1MΩ
R7 2·7kΩ
R8 47kΩ
R9 120kΩ
R10 27kΩ
R11 330kΩ
R12 390Ω
R13 390Ω
R14 5·6kΩ
R15 330kΩ
R16 2·7kΩ
R17 100kΩ
R18 47Ω
R19 1Ω
VR1 10kΩ log pot with switch S3

All ¼ or ⅛W 5%

Capacitors

C1 33pF see text
C2 100nF
C3 100nF
C4 300pF silver mica
C5 20nF
C6 27pF silver mica
C7 150pF ,, ,,
C8 20nF
C9 4µF 4V
C10 20nF
C11 20nF
C12 100nF
C13 220µF 10V
C14 100µF 10V
C15 10pF silver mica
C16 120pF ,, ,,
C17 2µF 10V
C18 3·3nF
C19 100µF 10V
C20 2·2nF
C21 270pF silver mica
C22 1000µF 10V
C23 100nF
C24 470µF 10V

CP1 1nF silver mica
CP2 330pF silver mica
VC1/2 2 x 365pF with slow motion (Jackson type O2)
VC3 50pF variable (Jackson type 804)
VC4 10pF ,, ,,
VC5 15pF ,, ,,
TC1 50pF compression trimmer

Note:—1 nanofarad (1nF) = 1000pF

Semiconductors

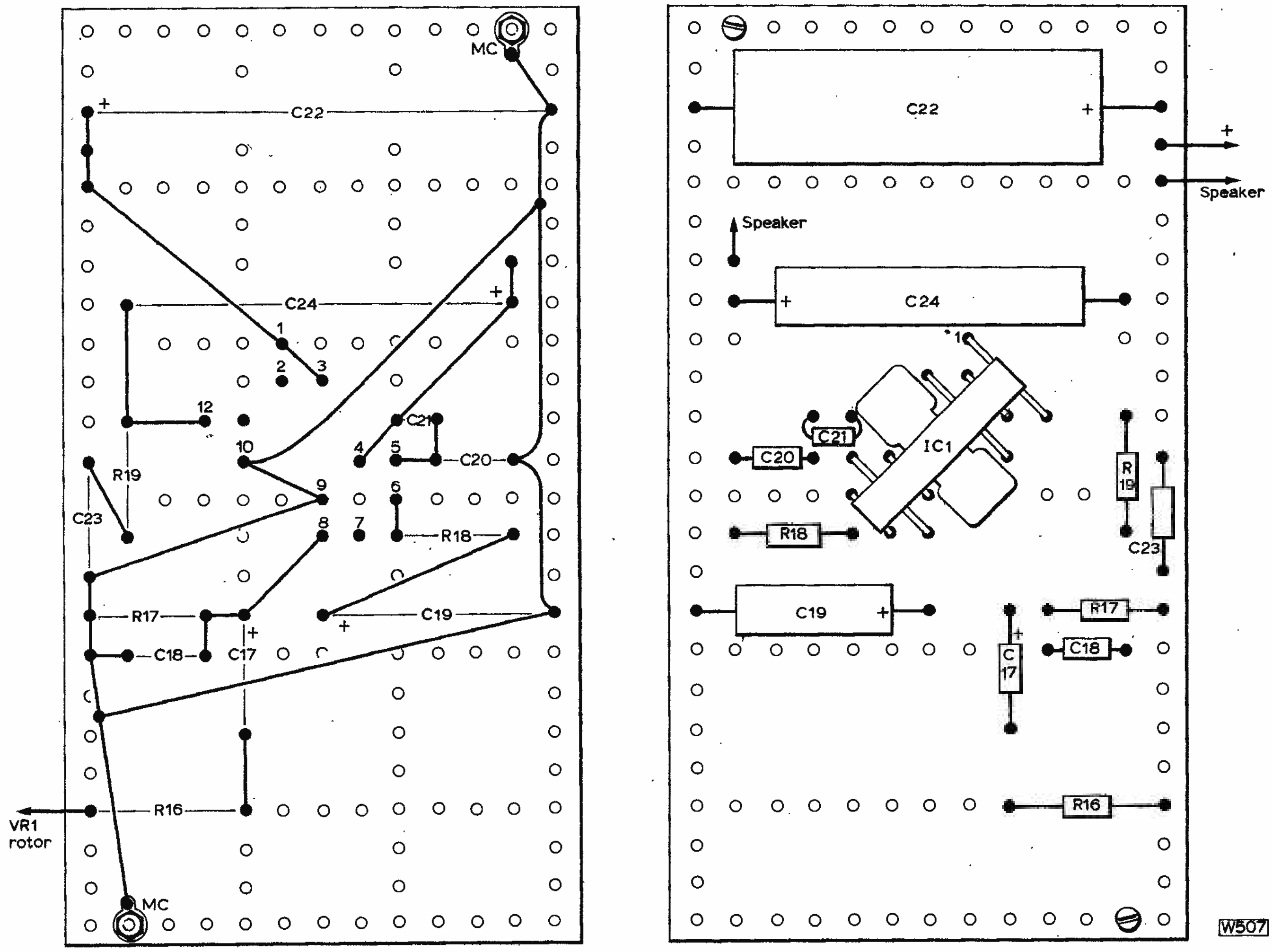
Tr1 40673
Tr2 MPF102
Tr3 BF194
Tr4 BF194
Tr5 BC107
D1 OA90
IC1 TBA800

Inductors

IFT1 Denco type IFT18/1·6
IFT2 Denco type IFT18/1·6
IFT3 Denco type IFT17
L5 Denco type IFT17
L1 Denco range 4, blue, valve type
L2 Denco range 3, blue, valve type
L3 Denco range 4, white, valve type
L4 Denco range 3, white, valve type

Miscellaneous

S1, 4-pole 2-way rotary switch. S2, on-off slide switch. S3, on-off switch, part of VR1. Perforated board 0·15in. matrix 5¾ x 1⅞ and 3¾ x 2in. Knobs. Flanged members for panel and chassis (Home Radio). Battery PP6 9V with terminal connectors. Material for cabinet.



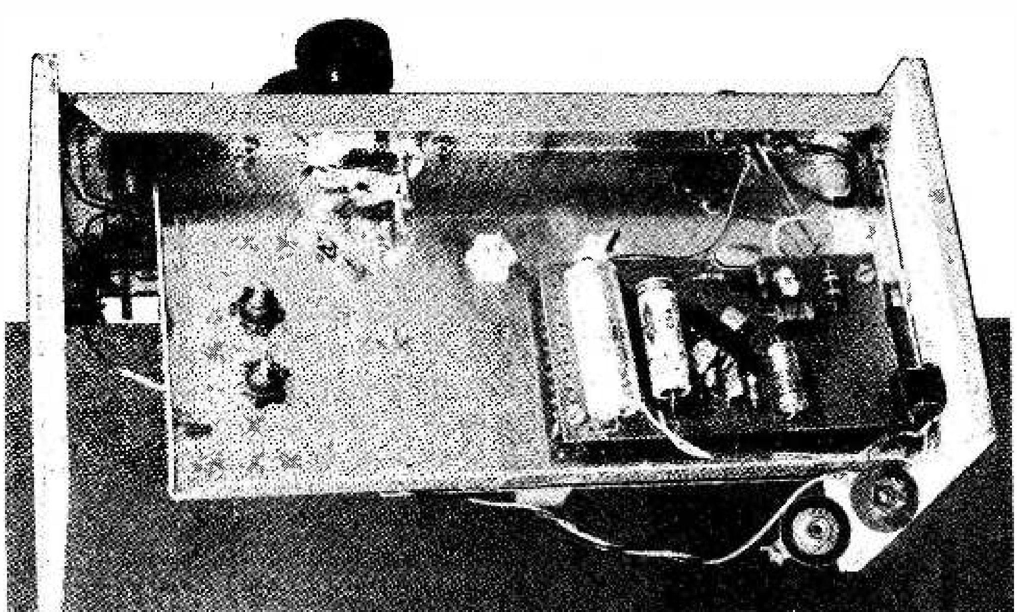


Fig. 7: above, is the piece of Veroboard, 0·15in. matrix, carrying the IC audio amplifier stage. Again, this is not to scale. This board is mounted underneath the chassis as can be seen in the photograph, left. The variable capacitor, top left, is the Microtune or bandspread tuning control, VC4.

or SSB. For CW, set VC5 to produce the wanted audio pitch. With SSB, more critical adjustment of VC5 is necessary, to obtain the best resolution of speech. Remember that lower sideband is used below 10MHz and upper sideband above.

Due to the way in which D1 operates, satisfactory resolution on SSB makes it necessary that the signal at the diode should not be too strong. When the RF stage is built, a control on this allows gain to be reduced. However, when the receiver is operated without this stage other means of reducing the input from strong SSB signals will have to be employed. Trouble from excessively strong signals at D1 will be unlikely with weak stations and a short aerial, but will certainly occur with a better aerial, and with strong transmissions. A 50pF or similar variable capacitor in the aerial lead will then be worth while, or a small fixed capacitor as in Fig. 1.

Aerial/Oscillator Tuning

Trimmer TC1 is screwed down about half way so that when the coil cores are adjusted, signals peak up with VC3 about one-third to two-thirds closed. Band coverage is adjustable between quite wide limits and depends largely on the positions of the cores. For approximately 1·7MHz to 15MHz, set them so that about $\frac{1}{2}$in of the 6BA screwed rod projects. Subsequently, adjust the aerial coil cores, one for each band, so that VC3 allows peaking up of signals throughout each range.

Should alignment here be somewhat in error, it will be necessary to re-adjust VC3 for best reception when tuning. This will not cause any lack of efficiency, provided VC3 is neither fully open nor fully closed. Adjust the aerial coil cores near the low frequency end of the bands to minimise this. The bands covered are approximately 1·7 to 5·5MHz and 5·5 to 15MHz.

Operating Notes

Space is left inside the receiver for a PP6 9V battery. Any wire aerial, including an indoor wire, may be used. Long wire aerials should be coupled with a trimmer or other capacitor, as described, to help reduce the second channel interference which will otherwise arise. (This is greatly reduced by the RF preselector mentioned.) An earth connection will sometimes increase the volume of weak signals, especially at the lower frequencies. It is possible to arrange the coverage to tune to 1·5MHz if required, but whistles must be expected around 1·6MHz (the receiver IF).

A fairly large speaker in a suitable cabinet is best. High resistance or high impedance headsets can be used, provided a resistor is connected across them, about 16Ω. The combination is much less sensitive than when using 16Ω phones, but this is not too important because of the high audio output available. **Note that C1 cannot be left in circuit when using the preselector.**

Tuning dial

The main tuning dial cursor is made from a small piece of thin clear plastic sheet. A hairline is scribed length-wise on the back. A hole is drilled to take a $\frac{1}{4}$in. internal diameter grommet which is pushed on to the spindle of the tuning capacitor before the knob is fitted. The tuning scale is also clear plastic sheet, backed with white card.

Cabinet

The cabinet can be made from universal chassis members, or some parts may be of wood. Using 6mm ply, the sides should be $4\frac{1}{2}$ x $4\frac{1}{2}$in each, and the top and back each 9 x 4in. The side near L1/L2 is lined with an aluminium plate or kitchen foil 4 x 4in to avoid coupling with the preselector coils when this unit is adjacent to the receiver.

Part 2 next month will give full details of the RF preselector for use with this receiver.

R.A.E.—*continued from page 336*

Squares and square roots

If you wish to square an index quantity it is necessary to double the index figure. For example:

10^3 squared $=10^6$ and 10^{-6} squared $=10^{-12}$

If you wish to find the square root of an index quantity it is necessary to half the index figure. For example:

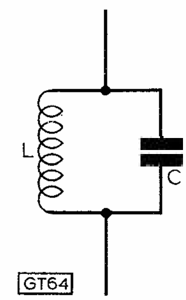
$\sqrt{10^6}=10^3$ and $\sqrt{10^{-6}}=10^{-3}$

If the index quantity contains a number, for example:

$\sqrt{81\times10^6}$ this may be represented by $\sqrt{A\times B}$. First, square root part A, second, halve the index figure of B, thus: $\sqrt{81\times10^6}=9\times\sqrt{10^6}=9\times10^3=9{,}000$.

Indices in calculations

Let's look at a typical problem that might arise in the examination, such as finding the resonant frequency of a capacitor—inductor combination,



L = 1 microhenry (1μH)
C = 1 microfarad (1μF)

$$f=\frac{1}{2\pi\sqrt{LC}}$$

If this equation is written out in figures, it is rather large and cumbersome, as shown below:

$$f=\frac{1}{2\times3\cdot142\times\sqrt{0\cdot000{,}001\times0\cdot000{,}001}}$$

By using indices it is possible to make the whole calculation much simpler. So now re-write in index form:

$$f=\frac{1}{6\cdot284\times\sqrt{1\times10^{-6}\times1\times10^{-6}}}$$

add the indices:

$$f=\frac{1}{6\cdot284\times\sqrt{1\times10^{-12}}}$$

square root by halving the indices:

$$f=\frac{1}{6\cdot284\times10^{-6}}$$

rearrange:

$$f=\frac{1\times10^6}{6\cdot284}=\frac{1}{6\cdot284}\times10^6$$

$$f=0\cdot16\times10^6 \text{ Hertz}$$

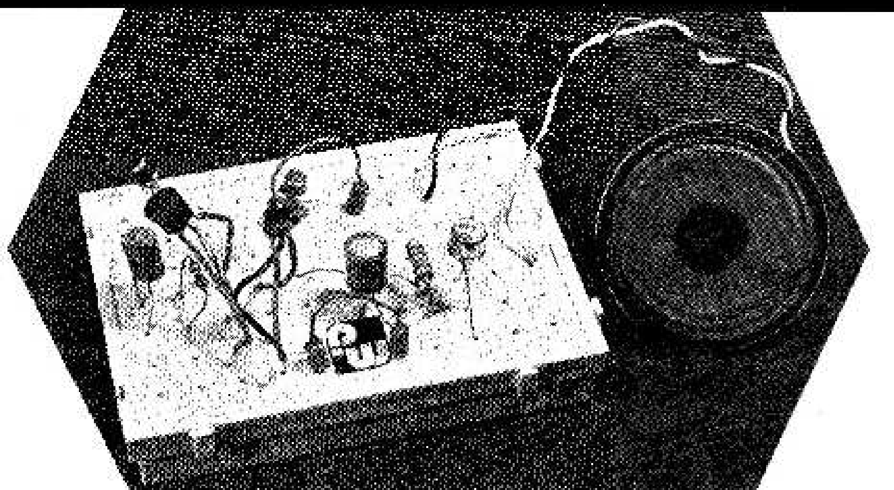
$$f=160\times10^3 \text{ Hertz}$$

$$f=160 \text{ kilohertz (kHz)}$$

The values of L and C used in this example are not typical for this frequency but were chosen to demonstrate the use of indices in calculations.

Next month a start is made on Electricity and Magnetism, reviewing the characteristics of common components such as resistors, capacitors, transformers and magnets.

S-DeCnology



DAVID GIBSON

10

THIS MONTH

'Record Player Amplifier'

This month's project is a simple record player amplifier which is suitable for use with a ceramic cartridge. Although the output could not be fairly described as hi-fi, it does give useful volume which is acceptable in terms of quality.

The prototype used a small 58mm diameter 80Ω loudspeaker but a larger diameter unit would undoubtedly improve the apparent volume and quality, particularly in the base notes. Any speaker with an impedance from 60Ω to 80Ω will be satisfactory.

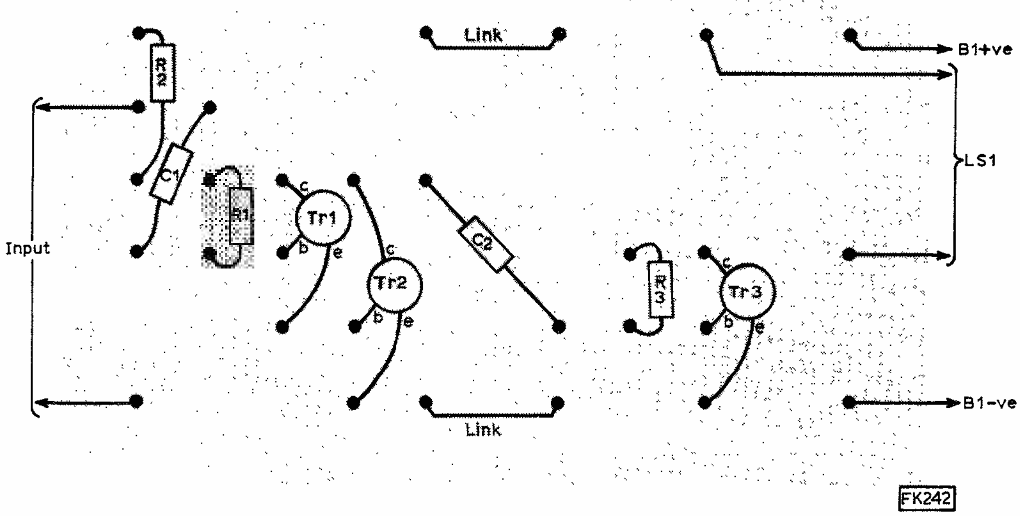
Circuit description

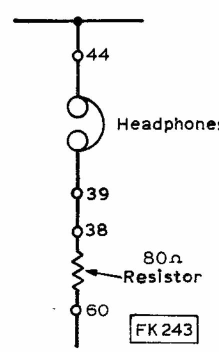
The circuit, **Fig. 1**, is basically a two-stage amplifier. Transistors Tr1 and Tr2 connected in a Darlington pair configuration form the first stage. This useful arrangement has two main advantages. The first is that a great deal of amplification is possible. The total current gain from such a circuit is found by multiplying the gain of Tr1 by that of Tr2. In practice it is difficult to calculate exactly what the gain will be because individual transistors have quite a spread in their gain characteristics.

Secondly, the Darlington stage also keeps the input currents very small indeed. In terms of power consumption the two Darlington connected transistors drew less than one fortieth of the total current of the whole amplifier.

Resistor R2 forms an audio load for the Darlington pair while base bias and DC stabilisation is provided by negative feedback resistor R1.

The first stage is capacitor coupled to the output stage, Tr3 via capacitor C2. Again, in the interests of simplicity, a lone resistor R3 provides bias and





The left-hand drawing is a full-size S-DeC layout showing component locations The smaller drawing (above) shows how a series resistor of about 80Ω must be used when operating the amplifier with low impedance headphones.

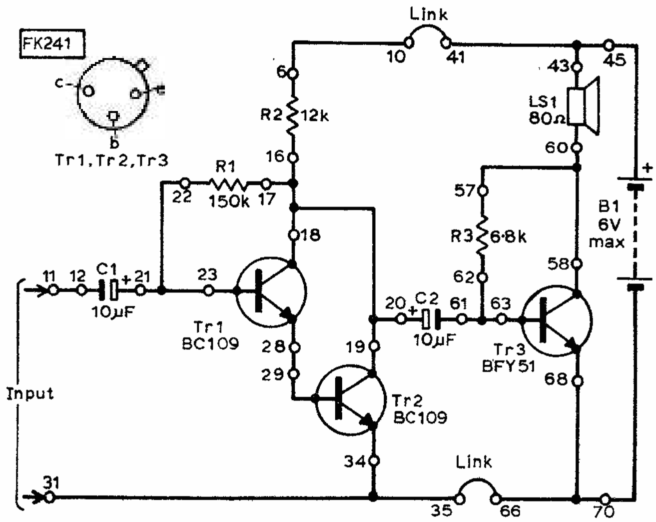


Fig. 1: Circuit diagram of amplifier.

stabilisation. There are two important points to note. First, do not use very low impedance speakers in this circuit, i.e. 3, 4, 8 or 16Ω units. Secondly, note that both capacitors are electrolytics and must be connected with correct polarity. The positive lead of C1 must go to S-DeC hole 21 and the positive lead from C2 must be pushed into hole 20.

Remember the two shorting links which connect together holes 10/41 and holes 35/66 respectively. It is all too easy to forget these since they are not actual components.

This little amplifier works well from any voltage between 1·5V and 6V although sensitivity and output are lower at the lower voltages. At 1·5V the circuit draws approximately 6·5mA; at 3V it is 16mA, at 4·5V it is 25mA and at 6V, 34mA. With 6V applied, the current taken by Tr1 and Tr2 was found to be well under 1mA.

The lead from the record player pick-up should be of the screened variety. The centre conductor should be connected to hole 11 while the screening wire mesh goes to hole 31.

you will need . . .

R1 150kΩ	R3 6·8kΩ	Tr1 BC109
R2 12kΩ		Tr2 BC109
C1 10µF		Tr3 BFY51
C2 10µF		LS1 60 – 80Ω loudspeaker
One S-DeC		6V Battery

The amplifier provides an excellent and inexpensive general purpose unit and to this end is probably well worth transfering to a piece of Blobboard to form a permanent piece of equipment.

A crystal microphone connected to the input (holes 11 and 31) worked well; the unit would make a very useful intercom amplifier by using another, similar speaker as a microphone and connecting this to the input. The amplifier could also be used as the audio section of a radio receiver—even a crystal set—and headphones may be connected if required. Most types offered for hi-fi and record monitoring purposes are of the low impedance kind and it would be wise to insert an 80Ω resistor in series with the phones if this application is envisaged. ●

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100 polyester, ·01-2·2uF	£1·00
200 PC resistors	75p

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Data Tape Deck by D-Mac. Reel-to-reel, takes 3" spool. 2 heads, 12V motor. 3 position switch. 17 transistors, R's, C's 200V 6A SCR, min 6V relay, etc. In good condition but not new. Size 225 × 165 × 120mm high. Reduced to clear **£4.**

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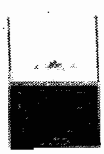
All have mains primaries, secondaries as follows: 6-0-6V 100mA **95p**; 9-0-9V 75mA **£1**; 12-0-12V 50mA **95p**; 12-0-12V 100mA **£1·10**; 6·3V $1\frac{1}{2}$A **£1·95**; 6-0-6V $1\frac{1}{2}$A **£2·30**; 9-0-9V 1A **£2·55**; 12-0-12V 1A **£2·85**; 12V 5A **£3·85**; 12V 8A **£4·35**; 20V 55mA **90p**; 22V 100mA **£1·00**; 29V 50mA **30p**. Multi-tapped types, 0-12-15-20-24-30V 1A **£3·50**; 2A **£5·00**; 20-0-20V 2A **£4·40**; 24V 500mA **£1·85**; 20V $2\frac{3}{4}$A **£4·15**; 14V 1A **£2·00.**

MULTIMETER MODEL LT 22

AMAZING VALUE !!



Probably one of the lowest priced meters featuring a mirror scale, overload protection and 20000 ohms per volt sensitivity. A modern styled meter with unusually clear scale markings. Ranges: DC Volts 0-0·5-2·5-10-50-250-1000 AC Volts 0-10-50-250-1000 DC Current 0-50uA-25mA-250mA. Resistance 0-50k-500k-5M (Mid scale 300-3k-30k) db's 4 ranges 20db o +42dB. Size 130 × 90 × 42mm **£12·70.**

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Type 1410	205 × 140 × 40mm	£3·70
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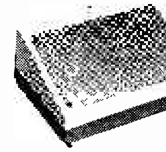

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Type 2523	220 × 174 × 100/52mm	£6·90
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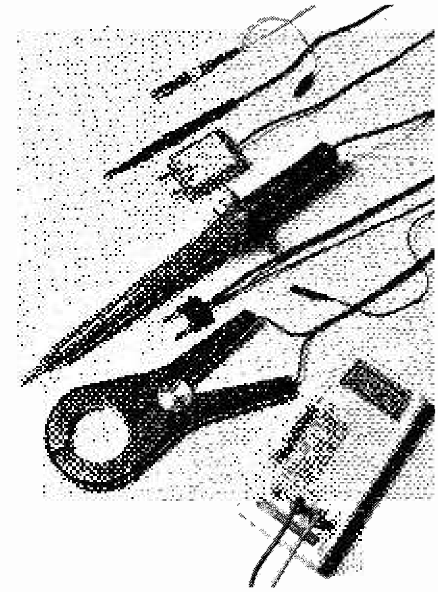
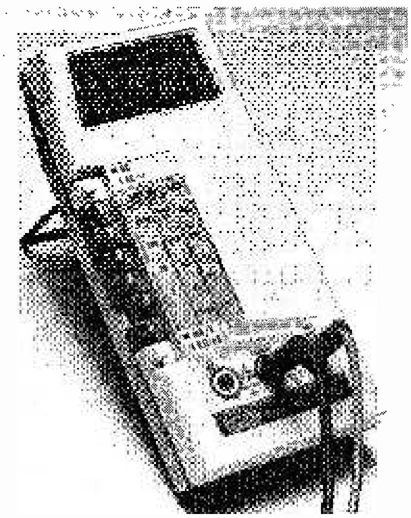


A free hand from Fluke

Possibly a little on the expensive side for a lot of our readers, but if you are in the market for a new multimeter, don't rush out and buy the first you see, think about the new Fluke model 8020A digital multimeter.

Incorporating a ½in 3½ digit LCD, the various functions and range push-button selectors are so arranged as to allow one-handed operation. The latest CMOS/LSI circuitry is used throughout, and this together with an LCD, ensures that the small 9V alkaline cell lasts for up to 200 hours.

Apart from the usual features of a multimeter such as ten voltage ranges, six resistance ranges, and current measurement up to 2A, the 8020A incorporates three diode test functions and two conductance ranges. In the case of the former of these two functions, the meter applies sufficient voltage to turn on a semiconductor junction, so that diodes and transistors can be tested for the correct forward bias voltage in situ. Individual paralleled resistors can also be checked without the need to disconnect them from the circuit.



The two conductance ranges enable measurement of resistance as high as 10,000M ohms, thus making possible the checking of HV dividers, leakage in capacitors, PCB's and cables.

Overload protection is also part of this new meter, with full protection against 300V DC continuous, or 6kV transients on any range. Priced at £99 and guaranteed for 2 years the 8020A is complete with test leads and instruction manual, although the versatility of this meter could be extended by purchasing a high voltage probe, RF probes, temperature probe and external battery eliminator.

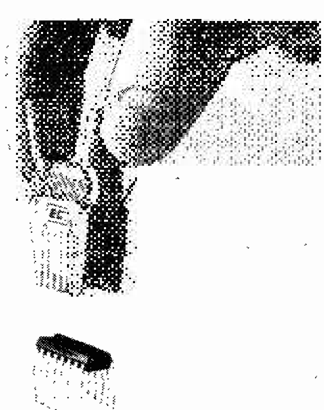
ITT Instrument Services, Edinburgh Way, Harlow, Essex. Tel: 0279 29522.

IC test clip

Walmore Electronics have introduced a unique DIP test clip which is designed to provide positive contact to eliminate the possibility of accidental disconnection from a device. Called the DIP/LOC it has contacts which provide a wiping action with the DIP leads and end-contacts hook under the DIP's end-leads in a lock-on action.

14 and 16 pin versions are available, while cable connections can be made quickly and easily with barrier strips between contacts to prevent lead shorting.

Walmore Electronics Ltd., 11-15 Betterton Street, Drury Lane, London.



Cassette centre

Not everyone wants a mini-recording studio in their sitting room as would appear from the complexity and price of many of the commercially available cassette decks. Plustronics, who have recently acquired the Aiko brand, are now marketing the Aiko ATP-711 stereo cassette recorder which is complete with twin speakers and microphones, and would suit the person who requires a good quality recording system, and yet is not too expensive.

Power output into the 8 ohm speakers is claimed to be 5W per channel while frequency response is 50 to 12,000Hz. Controls are of the slider type, with recording level monitored

by twin VU meters. Priced at around £117 the Aiko ATP-711 can be obtained from the usual Plustronics stockists.

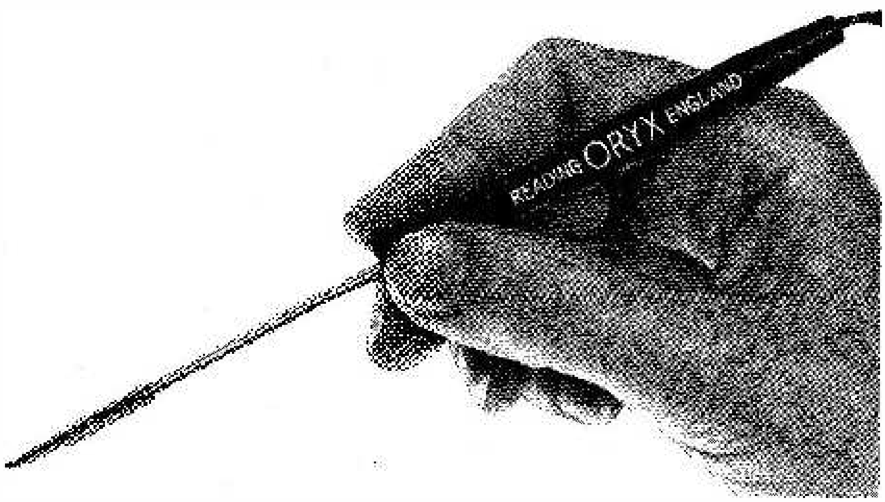
Plustronics Ltd., Hempstalls Lane, Newcastle, Staffs. Tel: 0782 615131.

Flyweight iron

Components seem to be getting smaller and smaller these days, and this coupled with the fact that many of todays IC's are extremely heat and voltage conscious makes the job of soldering a hazardous affair. Now, thought to be the smallest iron in the world, comes the Oryx model 9 low voltage iron that weighs in at only 6 grammes.

Manufactured by Greenwood Electronics, the element is claimed to give an improved and longer working life, and is available in either 6V, 12V or 24V models. The maximum tip temperature reaches 325°C while power consumption is about 8·3W. The complete iron is only 160mm long and costs £3·02 from the manufacturers or from the usual retail stockists.

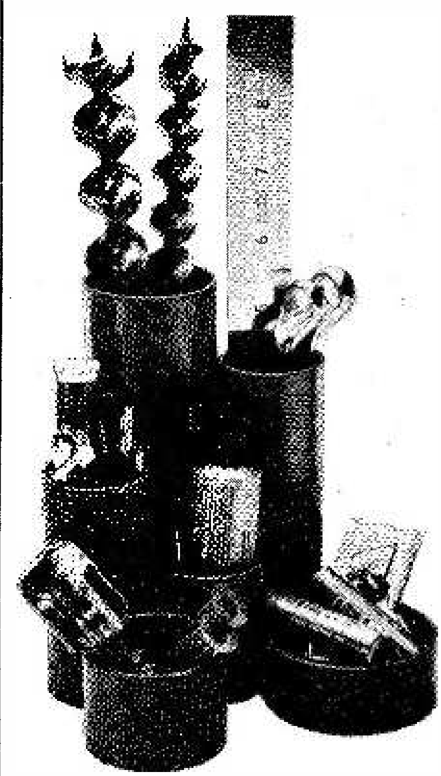
Greenwood Electronics, Portmann Road, Reading, Berkshire, RG3 1NE. Tel: Reading 595844.



Tidy tubs

Take a look in one of your drawers in the kitchen, the chances are that if not all of them, at least one of them will be full to overflowing with bits and pieces, pens, pencils, clips and other things which may "come in handy" at some future date. Any attempt to tidy up results in the mess being transfered to another draw, but it's just possible that a new device produced by Platignum (the pen people) will solve this age old problem. Called Tidy-Tubs, it comprises six plastic tubs of varying dimensions joined together to form a "hold-all" for all those small bits that lie in the bottom of draws.

Tidy-Tubs come in six colours, cost £1·50 each, and should be available from all good department stores and stationers.

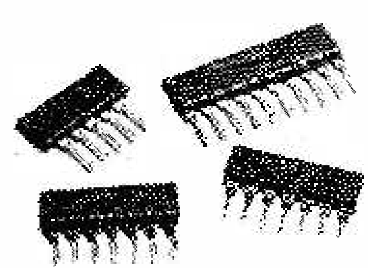


Multi-pin resistor

A new style of resistor recently to enter the UK market, has been launched by National Semiconductors. The resistors comprise 0·1in pitch SIP resistor networks available in 6, 8, and 10pin epoxy coated packages, with two styles being offered for each size package. In styles 605, 807 and 109, pin 1 is common to all resistors in the package, whereas in styles 603, 804 and 105 each individual resistor is brought out to a separate pin.

Line terminating resistor networks are available in 8 and 10pin styles with resistor values R1/R2 being 180/390 ohms or 220/330ohms respectively. All styles are rated at 0·125W, and have a tolerance of ±2%.

Any further information from National Semiconductors Ltd., Stamford House, Stamford New Road, Altringham, Cheshire. Tel: 061-928 3417.

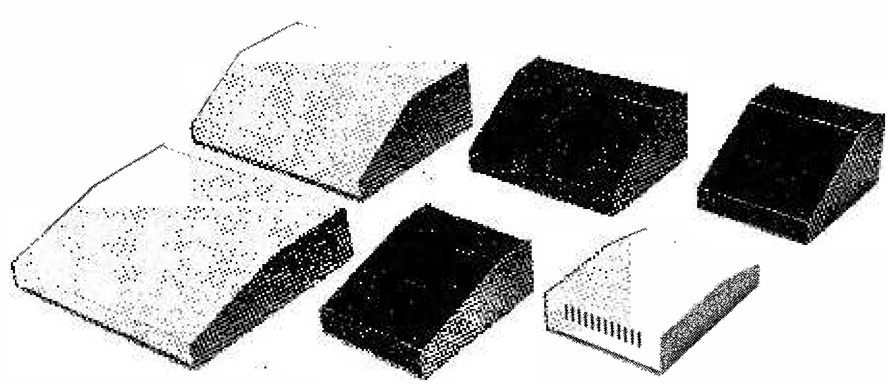


A good case

Recently introduced by Boss Industrial Mouldings is a new range of aluminium containers, notated the BIM7000 range with a choice of either 15° or 30° sloping front panels. They comprise two sections each and are supplied in blue/off white, green/sand and gold/satin black colour combinations for base and sloping panels respectively.

16 sizes are available, all of which have ventilation slots in both the base and rear vertical panels.

Boss Industrial Mouldings Ltd., Higgs Industrial Estate, 2 Herne Hill Road, London, SE24. Tel: 01-737 2383.



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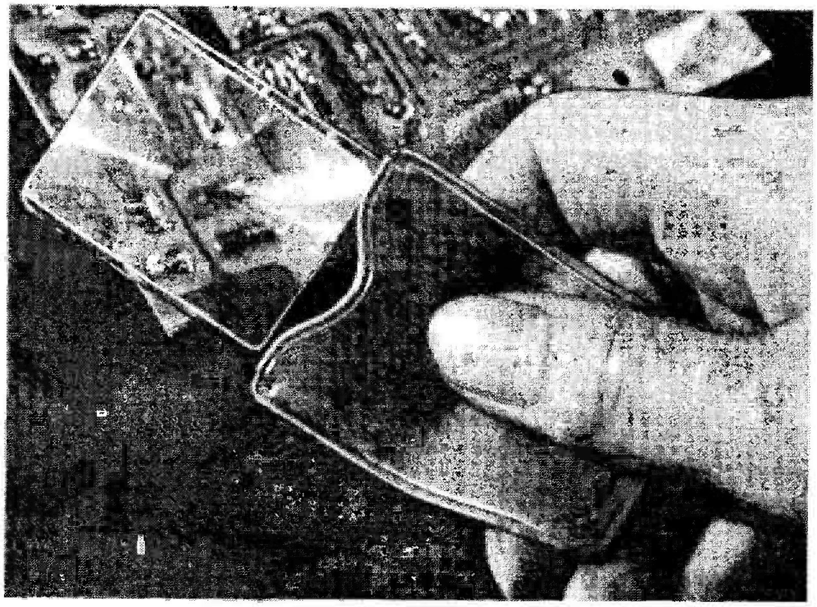


Now! You can avoid disappointing results with that new project by checking for dry joints and solder bridges on your printed circuit boards with our FREE Pocket Magnifier. Inspect your handiwork in detail. There's a dozen other uses for this handy gadget.

ALSO

SOLO SUPERMIND

Losing a few friends through boredom seems to be a hazard of some current "logical" games. October PW features SOLO SUPERMIND, which not only makes the "codemaker" redundant, but permits you to set and break your own codes. Simple circuitry, using readily available transistors disposes of the need for expensive "chips". It's effective, engaging, and cheap to build.

and:

Audio Level Indicator

Inexpensive Sine~Square Wave Generator

PW presents THE 'jubil

The Jubilee is an electronic chord organ with automatic vamping coupled to a three instrument rhythm section. It incorporates a number of features normally found only on the more expensive commercial instruments such as variable sustain length, percussion and other effects. Although automatic organs of this type have been available on the commercial market for a few years they have previously been put out of court for the home constructor because of their inherent complexity and high cost. Nevertheless we have overcome some of the problems with a novel design; simplicity of construction has been obtained by using three specially designed organ integrated circuits—developed for the professional manufacturer by General Instrument Microelectronics. These revolutionary integrated circuits are now available to the amateur.

M.J. HUGHES, MA, C.Eng.,

★ specifications

- Three octaves for melody line with three principal tone colours plus any combination of these.
- Variable length sustain.
- Variable depth Vibrato.
- Percussion effect.
- Repeat percussion effect (for banjo and mandolin sounds—by judicious use of length sustain can also simulate xylophone, glockenspiel etc.).
- Variable repeat rate.
- Two octaves of accompaniment.
- Automatic chording giving all major, minor, and seventh chords.
- Two principal tone colours plus their combination.
- Percussion effect gives piano, guitar or banjo accompaniment.
- Automatic vamping with alternating and walking bass.
- Rhythm section comprising bass drum, snare drum, and cymbals.
- Six selectable rhythms—synchronised with vamping accompaniment.
- Rhythms may be mixed.
- Variable rhythm speed.
- Independent volume controls for melody, accompaniment and drums.
- Internal 1W amplifier drives loudspeaker direct or phono output.
- Single board construction—no wiring loom needed for keyboard.

Vamp playing

The author, like many readers, is fascinated by electronic organs and the sounds that they produce but, unfortunately, is not sufficiently dextrous to get the best out of a conventional instrument. For this reason every effort has been made to design an instrument that will produce a wide variety of sounds and which can be played by the absolute novice. In practice the melody of a tune is picked out by one finger of the right hand and a four or five note chord (Major, Minor, Major 7th or Minor 7th in any key) is selected by one or two fingers of the left hand (the latter depends on the constructional method adopted as will be seen from reading on). The left hand chords can be played in a static form or can be vamped with an alternating bass note by selecting a suitable rhythm on the tab switches.

A vast range of music is available that enables the person with no previous experience to learn to play in a few minutes. Perhaps the best examples are those written with the Lowrey and Farfissa automatic organs in mind; these scores are sometimes referred to as 'Minute Music' or 'Speed Music'. Apart from these specially written music sheets it is easy to play any music that contains guitar chord notation. The Jubilee will capture the interest of any child and, although it is no substitute for proper music lessons, it provides an incentive to learn to play a more conventional instrument in due course. For those of us with somewhat longer teeth it is a superb fun instrument providing hours of relaxation which can be appreciated by other members of the household!

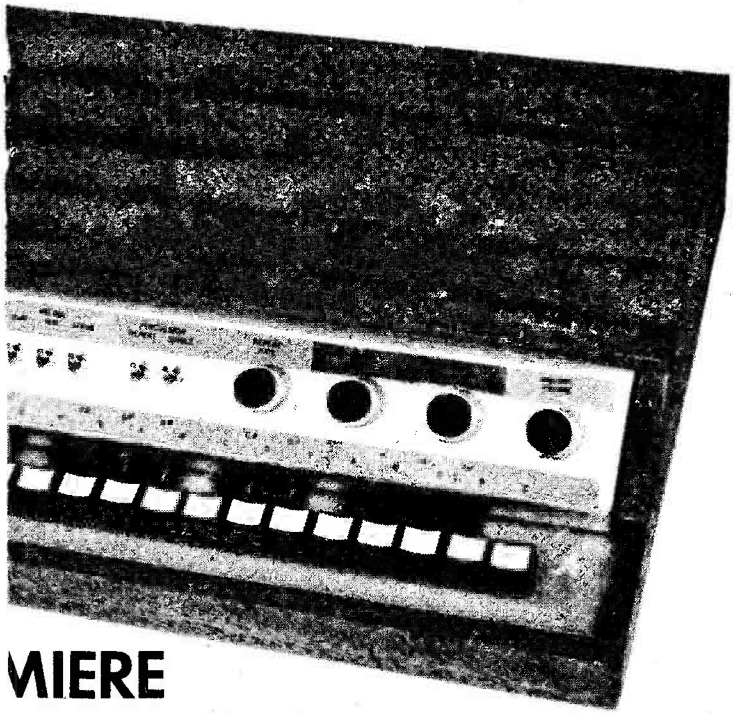
Keyboards

Again, like many readers, the author dislikes messy constructional projects which involve lots of discrete point-to-point wiring. This is usually typical of organs and, apart from leaving plenty of scope for error, it turns an interesting project into a bit of a chore. For this reason we have tried to keep construction to the assembly of components on a single printed circuit board and this includes the novel keyboard arrangement suggested for the *Mark I* version. In this example we have used calculator keys instead of a normal keyboard which would need a wiring loom. Calculator keys can be used quite satisfactorily because generally speaking only one has to be depressed at a time and slick fingering is not necessary because of the built-in sustain facility.

ELECTRONIC ORGAN

e'

Part 1



MIERE

★ collated components list

Resistors

1 off 5·6Ω ½W	34 off 10kΩ
3 off 220Ω	1 off 12kΩ
1 off 330Ω	11 off 22kΩ
1 off 470Ω	1 off 33kΩ
3 off 680Ω	1 off 68kΩ
2 off 1kΩ	10 off 100kΩ
2 off 1·2kΩ	2 off 470kΩ
1 off 2·2kΩ	3 off 1MΩ
4 off 3·3kΩ	2 off 3·3MΩ
11 off 4·7kΩ	

All 10% ¼W except where stated

Capacitors

5 off 1nF Polystyrene	1 off 1μF
3 off 33nF Polysytrene	2 off 2·2μF 16V Electrolytic
2 off 10nF	1 off 10μF 25v Electrolytic
1 off 15nF	1 off 47μF 25V Electrolytic
3 off 22nF	1 off 100μF 25V Electrolytic
1 off 33nF	1 off 1000μF 25V Electrolytic
10 off 100nF	1 off 2200μF 25V Electrolytic
5 off 220nF	2 off 4700μF 25V Electrolytic
10 off 470nF	

All polyester 10% (voltage greater than 25V) except where stated

Transistors	**Diodes**
1 off BFY51	6 off 1N914 (or 1N4148)
8 off BC148	1 off 3V 400mW zener
	2 off DIL 1 Amp bridge type VM18 (Marshalls)

Preset potentiometers	**Spindle potentiometers**
1 off 5kΩ	2 off 5Ω lin
3 off 10kΩ	3 off 10 kΩ log*
3 off 100kΩ	1 off 100 kΩ lin
5 off 500kΩ	1 off 1 MΩ lin
All sub miniature horizontal	* One of these should have ganged mains switch for conventional keyboard version.

Integrated circuits

7 off 741	1 off AY-1-0212 (Top octave generator
1 off NE555	4 off AY-1-5050 (7 stage divider)
1 off 4011	3 off AY-1-1313 (Priority latches)
1 off LM380	1 off AY-5-1317A (Chord generator)
1 off 7812	1 off AY-5-1315 (Rhythm generator)
1 off LM320-12	Specify, 'Pattern 004—Jubilee' for the latter

NOTE: All devices prefixed 'AY' are by General Instruments. These devices are available from Technomatic Ltd., Watford Electronics and other advertisers in the magazine.

Miscellaneous

1 off mains transformer (Double 12V 1A secondary)—Douglas type MT71-AT
*13 off single pole one way sub-min toggle switches
*1 off double pole change over sub-min toggle switch
*51 off AB Metals low profile calculator buttons (0·6" square)—available from WKF Electronics, Whitwell, Near Worksop, Notts.
1 off 1A mains fuse and panel mounting holder
*1 off mains slide switch
1 off indicator lamp and holder (optional)
1 off printed circuit board (Reader's PCB Service)
DIL sockets or Soldercons for IC mounting
Board pins (quantity depends on version being built)
Standard jack socket ¼" (for loudspeaker output)
5-pin 180° DIN socket (for phono output)

* If the conventional keyboard version is built the 14 toggle switches can be replaced by organ rocker tabs and the calculator keys by a four octave keyboard with single pole make contacts having common busbars. The mains slide switch is replaced by a ganged switch on melody volume potentiometer. Extra components required for the conventional version are:
stereo jack socket ¼" (for link to foot controlled Minor and Seventh switches)
Pair of foot operated push-to-make switches

Maplin Electronic Supplies are able to supply suitable foot switches. They also have limited stocks of 4 octave keyboards having the lowest octave in reversed colours (white accidentals). They can supply gold wire for making single pole contacts or, alternatively, low cost contact blocks can be obtained from Harmonics (Bromley) Ltd., Oakley Grange, Plaistow Road, Kirdford, Billingshurst, West Sussex. The latter require palladium busbars which Harmonics can also supply.

Some people might feel that they would prefer a conventional keyboard—certainly the sound of the instrument warrants the extra cost and trouble involved—and if so they can use the same printed circuit board with no changes except for the omission of the calculator keys. Flying leads are taken from each key position to the respective single-pole single-way contacts under each note of the keyboard.

In this part we shall describe the overall workings of the instrument and pay special attention to the large scale integrated circuits used. Constructional details will start next month and in order to allow time for ordering and delivery we are publishing a collated components list immediately. This might enable constructors to obtain components on favourable terms if they are purchased as a package deal.

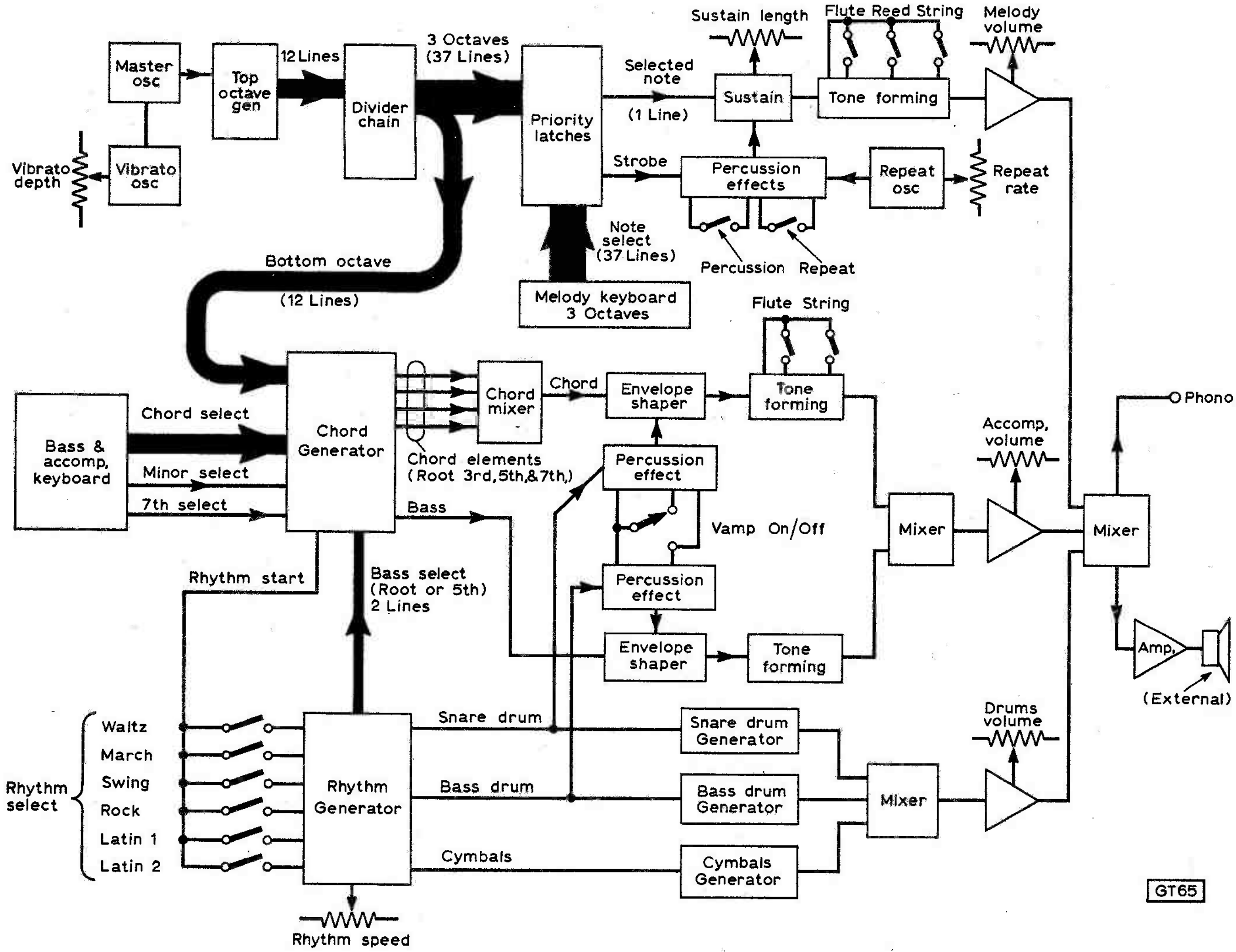


Fig. 1: Block diagram of the complete organ.

System organisation

Constructors who are more inclined to build a conventional organ, or who have already built our previously published *Easibuild Organ*, might find this single board useful in providing an additional keyboard for solo or special effects. In this application some economy can be effected because the tone generator circuitry would already exist.

A block diagram of the complete organ is shown in **Fig. 1.** A master oscillator, frequency modulated at variable depth to give vibrato, drives a conventional top octave generator. Each output of this is fed to a two stage divider except for 'C' which is followed by three stages of division to provide a total of three complete octaves plus 'Bottom C'. These notes are used to drive the priority latches for the melody keyboard and the bottom of the three octaves is fed to the chord generator.

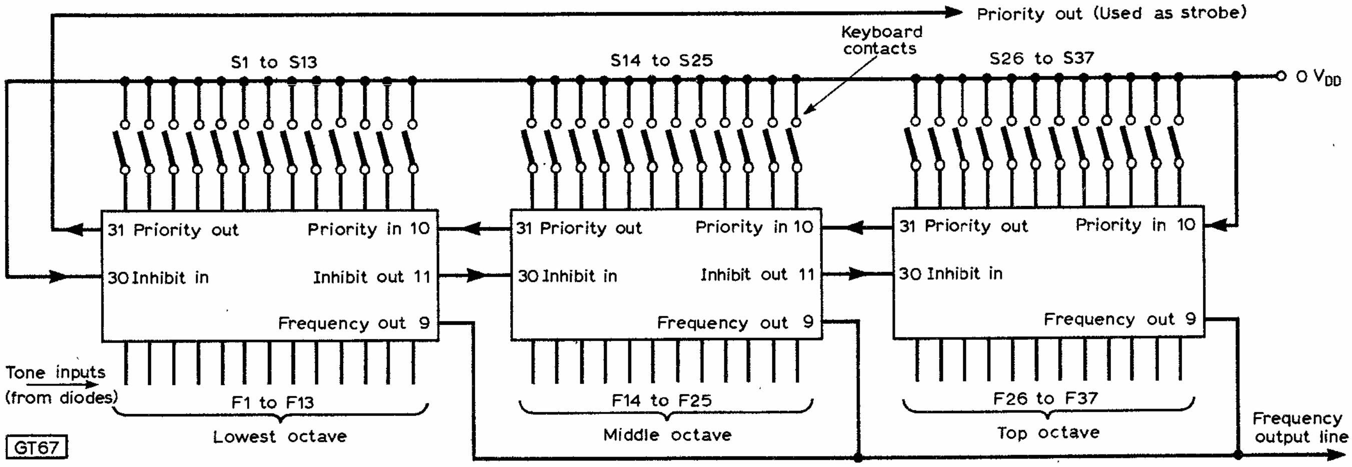
The priority latches are contained in three integrated circuits and in simple terms they are flip-flops which control a gate for each note. Each key of the melody board has its own flip flop/gate arrangement with the associated note fed from the tone generator to that gate. When the key is pressed the flip-flop opens the gate and allows the note to appear at the single line output. At the same time any other flip-flop is reset. This means that only one note at a time can be selected by the melody keyboard—it is monophonic. This, at first, sounds as though the scope of the organ is immediately limited. On the contrary. If the key just selected is released the flip-flop remains in its set state and the note remains active at the output and enables the envelope generator (built into the sustain circuitry) to hold the note over an adjustable period. This allows one note to die away slowly until a second key is pressed.

In order to synchronise the Sustain circuitry with the note selection operation we have to tell it whenever a new key has been depressed. This is easily done by making use of the internally generated 'Priority Output' signal for the priority latches. This signal in conjunction with the 'Inhibit Output' line is used within the priority latches to carry out the reset operation already referred to.

The three priority latch integrated circuits are coupled together in such a way that if two keys are pressed at the same time only the higher note will be selected. A pin connection diagram for this integrated circuit and an illustration to show how the three are coupled together in this application are shown in **Fig. 2.**

Sustain

The synchronising signal from the priority latches is called a 'Strobe'. This is fed to the percussion effects stage which changes the nature of the signal. Normally the signal is high for as long as a key is pressed—thus allowing a continuous tone through the



sustain circuit. The percussion effect, when switched in, allows only a short pulse from the strobe line and this occurs on the instant of pressing the key. The effect of this is that the note is generated for a very short period (even though the key is held pressed) and dies away according to the setting of the sustain length. Depending on the setting of the tone forming circuit the sound so produced could be like a drum stick hitting a wooden block if there is zero sustain length or like a bell being struck if there is a long sustain.

Another feature of the percussion circuit is the ability to repeat the pulse, just referred to, at an adjustable rate for as long as the key is depressed. By careful setting of the various controls one can produce sounds ranging from a xylophone to a banjo being strummed. With the repeat rate set close to the vibrato frequency very weird sounds can be produced!

Voicing

The shaped signals from the sustain stage are then fed to the tone forming circuits. We used the absolute minimum of circuitry here to keep construction simple but have managed to provide three basic tone colours. In electronic terms these are a heavily filtered square wave which gets close to sinusoidal, a straight square wave, and a spike waveform. These closely resemble the tone colours usually referred to as Flute, Reed and String respectively. The apparently small choice of tone colours is deceiving. By modifying their envelopes, they provide a wide range of sounds

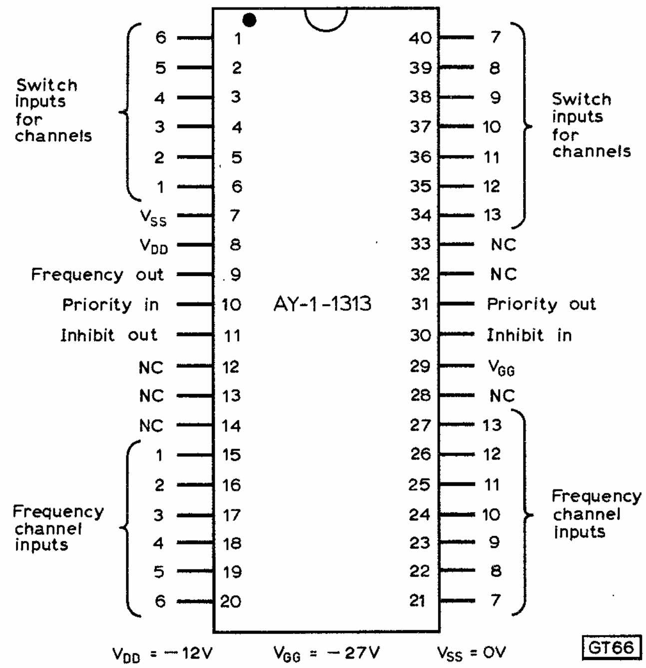
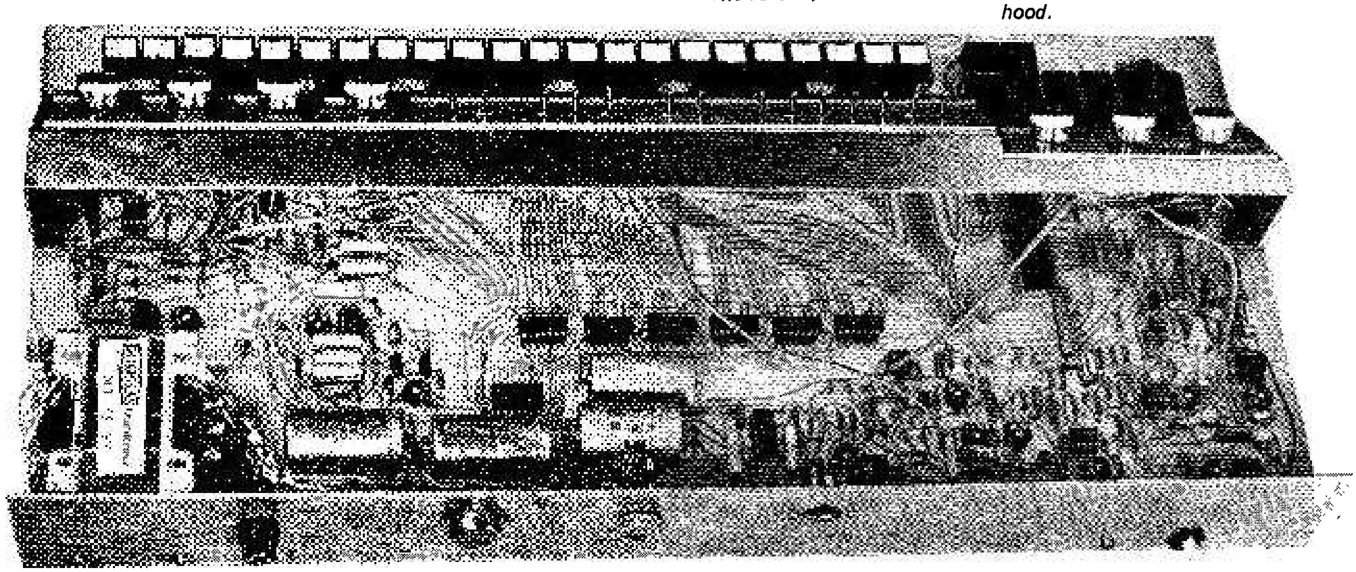


Fig. 2 (above and top): Pinout and simplified interconnection diagram for the three priority latch IC's AY-1-1313. Among other functions, these circuits ensure that, if two notes are pressed at the same time, only the higher one will sound.

The picture (below) shows a prototype organ and has been included solely to give readers some idea of the work entailed in construction. The IC's referred to above are hidden from view under the front panel hood.



ranging from ecclesiastical to modern plus the instrumental effects, some of which have already been mentioned. The signal is then fed to a pre-amplifier where its volume is independently controlled prior to joining with other signals at the power amplifier.

Chord and rhythm generator

The more complex part of the instrument is the accompaniment section which is built around General Instrument's chord and rhythm generator ICs.

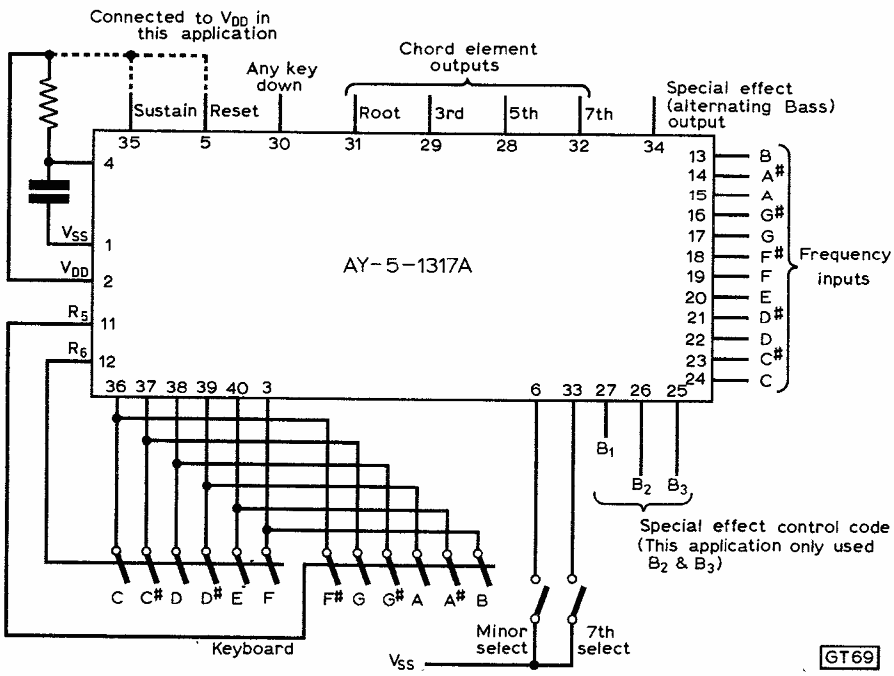
As the chord generator concept is relatively new to the amateur it is worth spending a few paragraphs describing how this chip works. Its pinning diagram is shown in **Fig. 3.** The generator can be used in two configurations. One requires 36 separate keys to select the major minor and seventh chords for a complete octave. The alternative configuration requires 12 contacts to select one of the major chords and utilises two extra switches to convert the selected chord to minor and seventh respectively. The latter configuration is used to economise on keyboard facilities. This means that not all the input pins of the package are utilised. The schematic stage shown in **Fig. 4** might be of more help in describing how the device functions in our configuration.

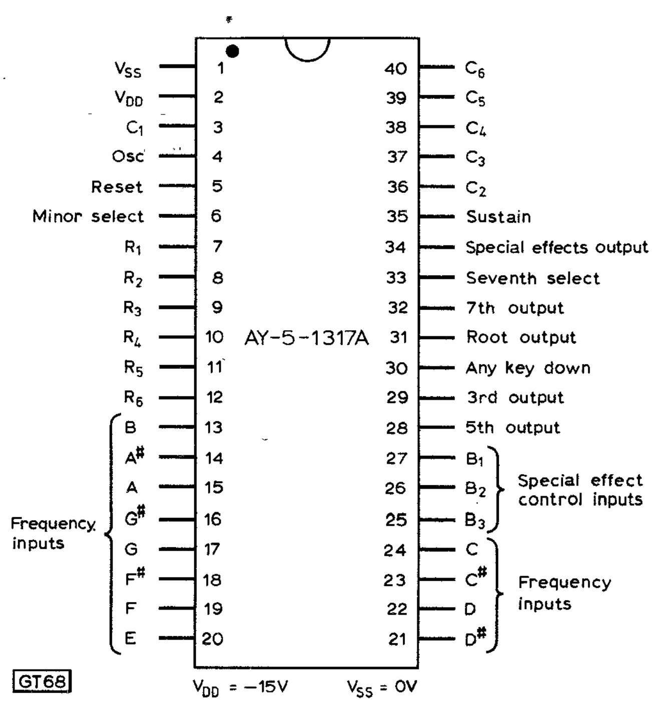
The twelve notes of the bottom octave from the tone generators are connected directly to input pins 13 to 24 and a capacitor and resistor are needed to set the frequency of the internal keyboard multiplexing oscillator. If the key designated 'C' is pressed the generator switches the respective notes of the bottom octave that go to make up the chord of 'C Major' on to the chord element output lines. 'C' would appear at pin 31 being the root note, 'E' at pin 29 as the third and 'G' at pin 28 as the fifth. These three elements are externally mixed together to produce the chord. If the key designated 'G' were selected the unit would present the notes 'G', 'B' and 'D' at these outputs respectively. If the 'Minor Select' key were depressed at the same time as the chord select, the third element at pin 29 would be changed to a note a semitone lower. If '7th Select' were depressed an extra note would be presented at pin 32. This would be the note a full tone below the root of the chord in question (in both major and minor keys). When this extra note appears it is mixed with the three others producing a very pleasing chord that is frequently used in music notation.

Fig. 3 (below): Pinout details of the AY-5-1317A chord generator.

Fig. 4 (right): Simplified interconnection diagram of the chord generator. This chip operates in conjunction with the AY-5-1315 rhythm generator IC to produce both chords and walking bass effects.

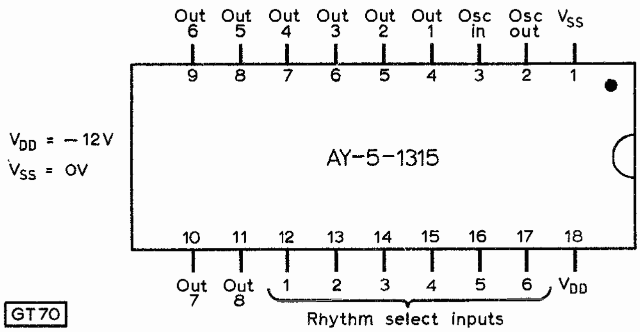
Although we intend to publish reduced scale artwork for the PCB in the next issue, full size etching artwork will be available from the editorial address at the front of the magazine, price 40p. Send a cheque/postal order for 40p together with a large (at least 13" × 11") stamped and self-addressed envelope. Ready-made boards will be available from the Readers PCB service as usual, see ad.





The output designated 'Any Key' is very important. It is made active whenever a key is pressed. It is therefore used to start the rhythm generator in synchronism with a key depression. In the main block diagram this link is anotated 'Rhythm Start'.

Pin 34 is called the 'Special Effects Multiplex Output'. Its effect is not quite so difficult to understand as its name implies. For a given chord selection we can obtain either the root, third, fourth, fifth, sixth or seventh element at this output but naturally only one of these six options at a time. The option is set by the binary code being fed to the control inputs at pins 25, 26 and 27 according to Table 1. If the codes



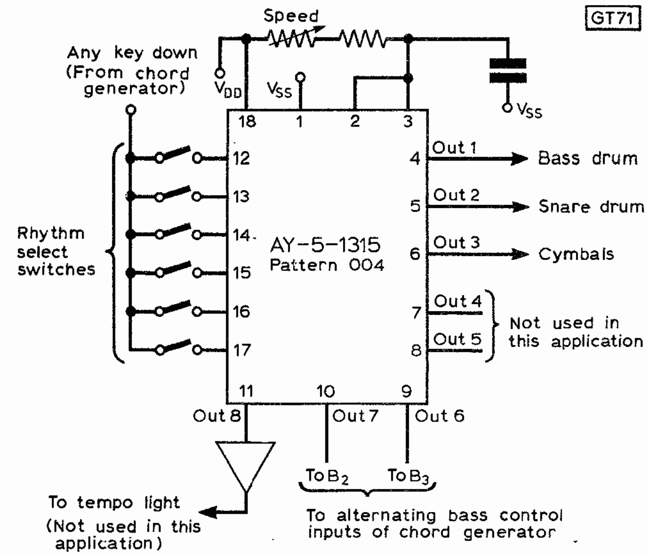


Fig. 5 (above and right): The pinout and simplified connection diagram of the AY-5-1315 rhythm generator. Readers should specify 'pattern 004' when purchasing this IC.

were generated sequentially, it would create an output sequence of the elements comprising the chords. The chord generator chip divides these elements by 1, 2 or 4 so that they fall at least one octave lower than the chord outputs, thus producing a bass note. If the selection were sequenced while a chord was being held it would have the essentials of a walking bass.

Table 1

Pin 27 (B1)	Pin 26 (B2)	Pin 25 (B3)	Note Selected
0	0	0	No change from last note
0	0	1	Root
0	1	0	Fifth
0	1	1	Third
1	1	1	Seventh
1	1	0	Fourth
1	0	1	Sixth

In our application we do not make full use of all the special effect options—we only use two of the control inputs (pins 25 and 26). These are coupled to the rhythm generator which is pre-programmed to change the code in synchronism with the rhythm patterns. This gives an alternating bass which is sounded at the same moment as the bass drum beat.

Vamp

It should now become easier to understand the details shown in the main block diagram for the accompaniment section. If one assumes that the vamp switch is off, the percussion effect circuits can, for the moment, be ignored. When an accompaniment key is pressed the selected chord elements are presented to the mixer, pass straight through the envelope shaper and on to the tone forming circuits producing two voices 'Flute' and 'String' (Sine and spike respectively). With none of the rhythm select switches closed and the rhythm generator chip outputting the correct code on the bass select lines, there will be a continuous note on the bass output line. This will be the root note of the chord in question.

The bass line from the chord generator is fed to its own envelope shaper and thence to a single tone colour filter. This provides a filtered square wave which sounds reasonably mellow and full. Both the chord and the bass line are mixed before being fed to a volume control and pre-amplifier.

When the Vamp switch is on, the bass note and chord are produced in exactly the same way but do not get through their respective envelope shapers until these receive trigger pulses from the snare drum and bass drum outputs of the rhythm generator. These pulses are short and give a fast attack to the accompaniment which is followed by a decay set by the sustain circuit within the envelope shapers.

Component values are pre-determined to make the bass note sound like the string of a bass guitar being plucked. Depending on whether flute, string or both are selected, the chords will sound as if played on a piano, banjo or guitar. The bass guitar sounds on the bass drum beat while the chord is struck in synchronism with the snare drum.

When switched to Vamp mode, the accompaniment signals will only appear at the output if the rhythm generator is running; ie if one of the rhythm select switches is on.

Rhythm

The GI rhythm generator used in this project **(Fig 5)** is mask programmable so that manufacturers can design their own rhythm patterns. It is not economic to do this for small quantity purchasers so we have settled on one of the standard patterns already being produced by GI. This gives a reasonable selection of six beats, as shown on the figure, but a feature of this circuit is that the rhythms can be mixed by selecting two or more at the same time. Although the chip produces five instrument outputs (plus the alternating bass control signals) we are only using those for bass drum, snare drum and cymbals. These pulses are fed to noise generator circuits which are coupled in a mixer before being fed to their own preamplifier. This, again, has its own volume control.

By having separate volume controls on the melody, accompaniment and drum lines the overall balance may be adjusted to individual preference. It also means that the drums can be reduced to zero level while maintaining operation of the rhythm unit which keeps the vamp going. One can operate the accompaniment and drums section in various modes depending on the set of the instrument tabs. For example one can have straight chords with a static root base note; one can have static chords with an alternating bass and drums or a complete vamp—alternating bass syncopated with the chords and drums.

Next month we shall start on constructional details and describe the various circuits as we go along.

If you take delivery of the GI Integrated Circuits before the next part do not remove them from their protective packing unless you take steps to prevent damage from static electricity!

DESIGN YOUR OWN PROJECTS

No.1 LIGHT TRIGGER

TOBY BAILEY & BOB WHITAKER

This series describes how to design experimental projects for yourself. Each month we hope to set ourselves a reasonably simple problem, produce a set of specifications to which we want our circuit to conform, and design an appropriate circuit. We will give an account of the possibilities we explored and the thought processes we used to arrive at the final circuit, together with details of how we calculated (or guessed!) component values and why we chose particular component types. Last, but not least, we will provide an honest report of what happened when we built our circuit.

One point requires particular emphasis. These are meant to be one-off projects and the methods used to design the circuits will, in some cases, be more casual in approach than they might be if the circuit were, for instance, being designed for mass-production or in the form of a kit or completed unit. This is not because we want to be condescending or that we think that you might need protecting from some of the complexities. It is simply because this is the method of design used by almost all amateurs of some experience when they are experimenting.

Problem

For the first circuit we decided to tackle the well-worn problem of producing a device which will turn on a light when the evening becomes dark enough. This old favourite often appears under names such as "electronic candle" or "automatic nightlight" or some similar title. With a bit of luck we will try to show that designing one of these devices for your own specific requirements is not as daunting a task as it might appear at first. Of course designing your own circuit from scratch is not as easy as ferreting out a published design in the back issue of a magazine, but that is not the point.

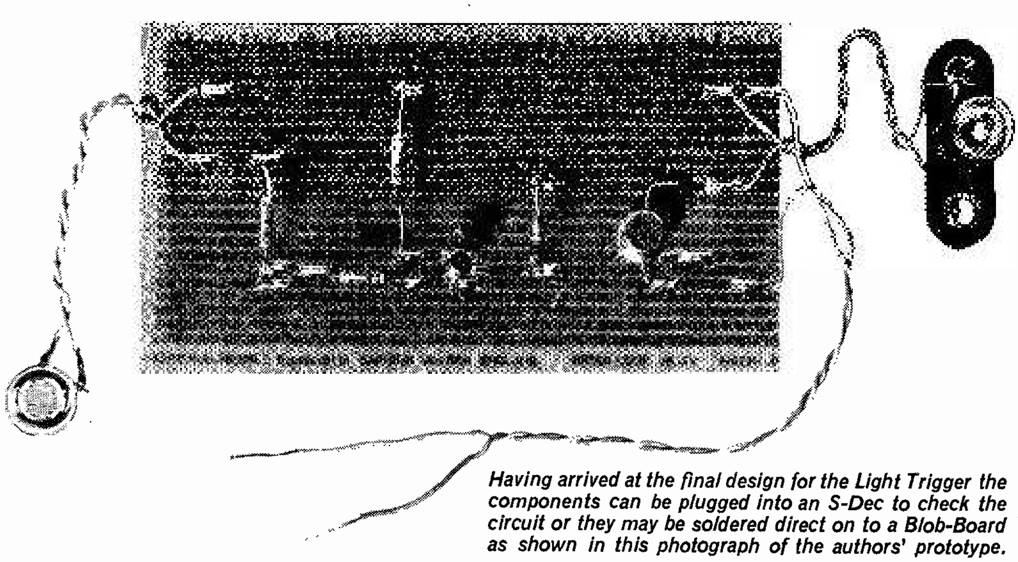
Specification

So, what exactly are we trying to do? Let's not be overly ambitious, and stick to driving an ordinary torch bulb. The first one we unearthed from the bottom of a drawer has the markings "6V-60mA" still barely decipherable on the side. This seems a pretty reasonable one to use as it doesn't require a terribly unusual power supply anyway. We also need something to sense the light intensity so a light-dependent resistor (LDR) should be just the job. Bob happened to have one of dubious origin attached to a piece of equipment of even more dubious function, from which it was duly severed.

It seemed that the most sensible way of finding out the charactertistics of this LDR was to measure its resistance with a meter. A couple of minutes later we possessed the facts that when it was so dark that we could hardly read the meter the resistance was at least 100kΩ and with rather dingy lighting the value decreased to about 10kΩ. We decided fairly arbitrarily that the circuit should switch somewhere between these points and that we didn't particularly mind where.

Design

It would seem pretty perverse to use anything but 6V for the power supply and, short of using a relay which would be absurdly expensive for our modest



Having arrived at the final design for the Light Trigger the components can be plugged into an S-Dec to check the circuit or they may be soldered direct on to a Blob-Board as shown in this photograph of the authors' prototype.

★ components

R1	2·2kΩ	¼ or ⅛W 5%
R2	2·2kΩ	
R3	220Ω	
R_F	100kΩ	
LDR	ORP12	Bulb 6V 60mA and holder
Tr1	BC109	Blobboard ZB-1V
Tr2	BFY51	(PB Electronics Ltd.)

requirements, we are going to end up by driving the bulb directly from a transistor. So, let's start from that end and see how we get on. The next question that needs to be answered is "does the bulb go in the emitter or the collector?" If we put it in the emitter circuit we shall have to drive the base between about 0·5V and 6V to turn the transistor off and on, whereas if the bulb is in the collector circuit then a much smaller voltage swing is required to get the same effect. As the textbooks more formally put it: "Emitter-follower and common-emitter amplifiers have about the same current gain but the latter has a much higher voltage gain than the former."

So let us accept the extra voltage gain as a bonus, it's free and there does not appear to be any obvious disadvantages associated with our choice of the common-emitter circuit. We now have a circuit like that of **Fig.1.**

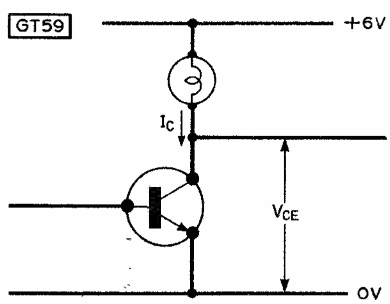


Fig. 1: The use of NPN transistors in the design was determined more by the contents of the junkbox than anything else.

You may have noticed that we have tacitly assumed that we are going to use an NPN transistor. The reasons for this are by no means deep and not entirely unconnected. Firstly, we both have rather more of the NPN type than PNP and, secondly, they tend to be marginally cheaper. Now we need to decide which particular transistor to use, especially since a collector current of 60mA is not small enough to ensure that any transistor we try won't blow up. The highest power dissipation in the transistor is when the collector is at half the supply voltage, i.e. V_{CE}= 3V. This enables us to calculate the dissipation, given by V_{CE} x I_C, and we get P=3 x 60=180mW. Now the allowable dissipation for most common small transistors (e.g. BC109, 2N3704 etc.) is around 300mW so we seem to be fairly safe here.

But wait a minute! When a light bulb is just turned on the resistance of the filament is much lower than it is after the filament has had a chance to heat up. This means that the current and hence the dissipation will be rather larger at turn-on. We measured the cold resistance and found that this meant that the peak collector current would be about 150mA, giving a dissipation of 450mW for a short time. To be on the safe side let us use a BFY51 which can take up to 800mW. Our catalogue tells us that the minimum gain is 40 but neglects to specify the current to which this figure refers. Oh! well, let's say 30 then. This means that we need 2mA at the base of our BFY51 to turn on the light. The stage we have now reached is summarized in **Fig.2.**

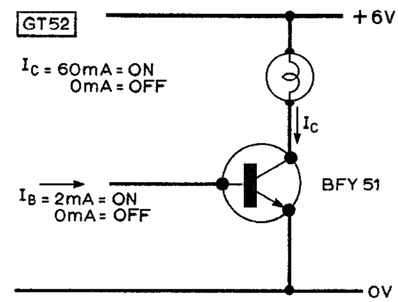


Fig. 2: Already a BFY51 has been chosen in place of a BC109 type because of dissipation problems.

At this point it now becomes abundantly clear that we are going to need another transistor. Since the minimum resistance of the LDR at which the bulb must be turned on is 10kΩ we would need 20V to pass 2mA through the LDR. So how do we connect the second transistor? It can be either NPN or PNP and can be driven from either the emitter or the collector, giving the four possible circuits shown in **Fig.3.**

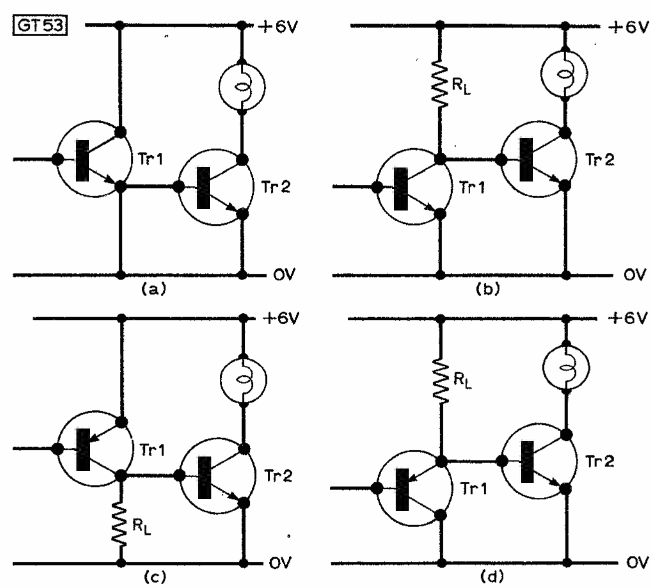


Fig. 3: A second transistor is added but there are four possible ways in which it could be used.

Well, (d) is utterly hopeless since it won't drive the base of Tr2 any lower than around 0·6V so we cannot even guarantee to turn it off. In (c) Tr2 is not going to last very long if Tr1 turns on heavily since Tr1 will then supply a large base current to Tr2. We now have to choose between (a) and (b) both of which use a NPN Tr1. (a) suffers a similar defect to (c) in that we are going to have to be very careful that we do not supply too much base current to Tr1 in order to protect Tr2. Also it is conceivable that when Tr1 is turned off the leakage current might be high enough to upset Tr2, especially if the latter has rather more gain than our conservative estimate.

Circuit (b) seems to be best and we shall now proceed, using this one.

Practical Values

The next thing to work out is the value of R_L. When Tr1 is turned off there will be about 5·5V across R_L which then has to supply 2mA to the base of Tr2 (we are ignoring the leakage of Tr1 which should be negligible). For this condition we get $R_L = \frac{5\cdot5}{2} = 2\cdot75k\Omega$ so let's use a 2·2kΩ resistor to be on the safe side. Having fixed this value we can now work out that Tr1 will have to sink a current of $\frac{6}{2\cdot2} = 2\cdot7mA$ in order to turn off Tr2. So we want a nice little low power high gain device for Tr1, something like the ubiquitous BC109 should be sufficient, **Fig.4.**

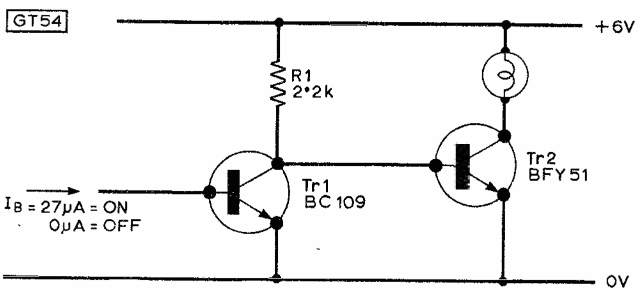


Fig. 4: The value of the load resistor for the BC109 has been decided upon.

The gain of a BC109 is stated as lying in the range 200 to 800. If we assume a value of 100 at worst we're going to need a base current of up to 27µA to turn on Tr1. Well, we want the BC109 to turn on when the resistance of the LDR drops to a low enough value so we are going to have to connect the LDR from the base up to the positive power supply line as shown in **Fig.5.**

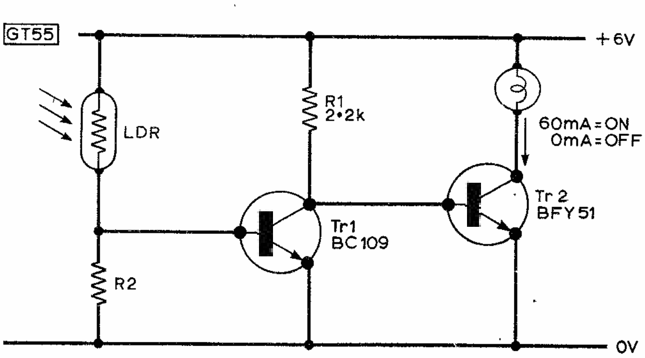


Fig. 5: Safety resistor R2 and the LDR are introduced into the circuit.

Why have we added the extra resistor R2? Well, the LDR with a resistance of say 100Ω is still conducting 60µA (note that in calculating bias resistance it's almost always convenient to ignore the resistance of the base-emitter junction: more correctly the input resistance). Let's assume that if the LDR is at 100kΩ then we want to pull the base of Tr1 down to a 3V to leave a good safety margin. For this condition R2 has to have a value of at most $\frac{0\cdot3}{5\cdot7} \times 100 = 5\cdot3\Omega$ so 4·7kΩ seems safe enough. Now if the value of the LDR drops to 10kΩ the base voltage will rise to $\frac{4\cdot7}{4\cdot7 + 10} \times 6 =$ 1·9V. We had better just check that the 27µA base current now being drawn by Tr1 does not effect this too drastically. Well, the current being drawn by the bias network of the LDR and R2 is over 400µA so the 27µA not required by the base is going to make hardly any difference and we have a good margin of error with a base voltage of 1·9V.

Moment of truth

Right, now comes the moment of truth when we have to wire up the components and see if we have made any drastic mistakes with the design. After a brief flurry of activity with an S-Dec the circuit was assembled and it worked first time. Well no, to be honest it worked second time, we had a resistor in the wrong hole!

The only problems are that it switches rather slowly if the change in light intensity is not relatively fast and that it has a tendency to get caught in a half on/half off state. What can be done about this state of affairs? The answer is positive feedback and this will have several beneficial effects. It will make the switching faster and it will tend to hold the circuit in the state in which it happens to be. This means that the circuit will not 'jitter' around the switching point. If it becomes dark enough to switch on then it has to get considerably lighter before it will switch off again. This effect is known as 'hysteresis'. How can we achieve this desirable characteristic? Well, the only convenient place from which to take the feedback seems to be at the collector of Tr2, as shown in **Fig.6.**

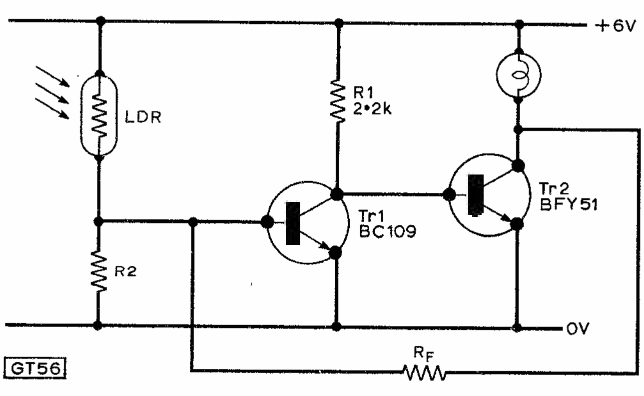


Fig. 6: Positive feedback has been introduced by R_F which improves the switching characteristics of the circuit.

Is this OK? If the base voltage of Tr1 rises it will turn on further, cutting off Tr2 even more. The collector voltage of Tr2 will hence rise which will tend to cause the base voltage of Tr1 to rise via the feedback resistor. So far, so good then. Oh dear, we shall have to recalculate the value of R2 again as well as that of R_F. As is often the case when choosing the values of two interacting resistors the easiest thing to do is guess the value of one of them and see how it goes. How can we go about guessing a reasonable value for R_F then? Looking at the circuit it is apparent that if R_F has a much lower value than that of the LDR then the LDR will never be able to change the state of the circuit. If R_F is too large its effects will be reduced and we won't get enough hysteresis. Hence we shall choose a value of R_F comparable with that of the LDR, say 100kΩ.

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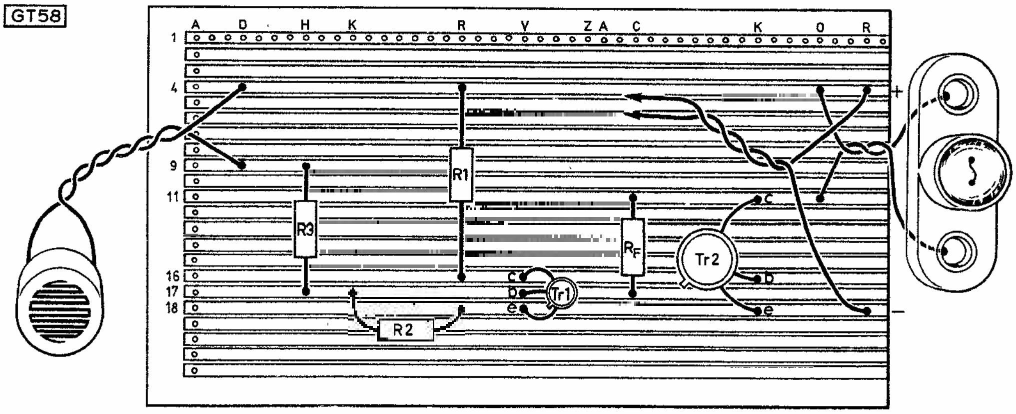
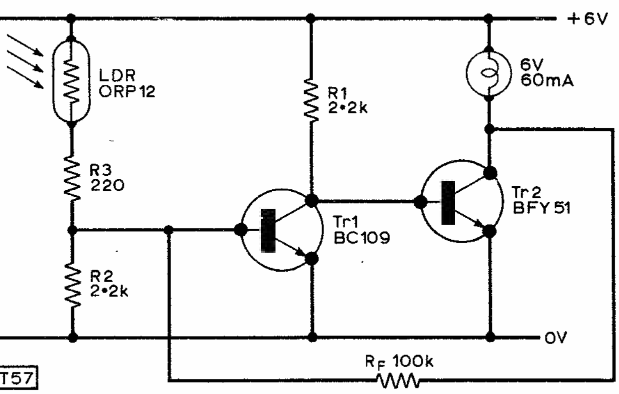


Fig. 8: Layout of components on a Blob-Board, if this method of construction is adopted. A photograph of this board appears on the first page of this article.

Now when the collector of Tr2 is at 6V RF must not be able to turn on Tr1 without the aid of the LDR. Let us aim to try and get the base voltage down to 0·3V, at least. With an LDR resistence of 100kΩ we have an effective resistance between the base and the 6V line of 50kΩ (100kΩ+100kΩ in parallel) so we can calculate R2 to be $\frac{0\cdot3}{6\cdot0 - 0\cdot3} \times 50 = 2\cdot63\text{k}\Omega$, so let's say 2·2kΩ. We have now got to check that



GT57

Fig. 7: Final circuit with values of all the components.

when the LDR has a value of 10kΩ the circuit has turned off. If Tr2 is on then RF will effectively be in parallel with R2 and hence the former may be ignored as its resistance is fifty times higher. So, ignoring the base current again, we find that the base voltage of Tr1 is $\frac{2\cdot2}{10 + 2\cdot2} \times 6 = 1\text{V}$ so this is plenty to turn on Tr1. We can now draw the final circuit as in **Fig.7.**

You will see that a 200Ω resistor has been added in series with the LDR. The truth of the matter is that neither of us noticed until we constructed this stage that there is the possibility that if the LDR resistance drops down to the 100Ω region (in very bright light) then we would have about 6mA of base current in Tr1. Whilst little harm is likely to come to our BC109 because of this it seems wasteful and the series resistor will protect Tr1 if one of us manages to short out the LDR in an aberrant moment.

The circuit now switches cleanly and quickly regardless of the slowness of change of the light intensity and it is impossible to get the output into an intermediate state.

If you wish, you can build the circuit on a PB Electronic's 'blob board' such as the ZB1V as shown in **Fig.8** and the photograph.

Postscript

Well, we have finished now. You may wonder why at each stage we took fairly pessimistic values for the gain of our transistors and chose our resistor values so as to give something in hand over the value we actually calculated. The idea is that all this gives us sufficient in reserve to deal with all the little things we did not consider such as running the transsiistors at voltages and currents different from those at which the gain is specified, resistor tolerances or variation of battery voltage.

We hope that it is going to be one of the main messages of this series. For experimental projects you can ignore all these minor effects providing that you design sensibly with "power in reserve"!

Next month's contribution will describe the design procedure for the circuit of a power supply intended to operate a cassette recorder in a car.

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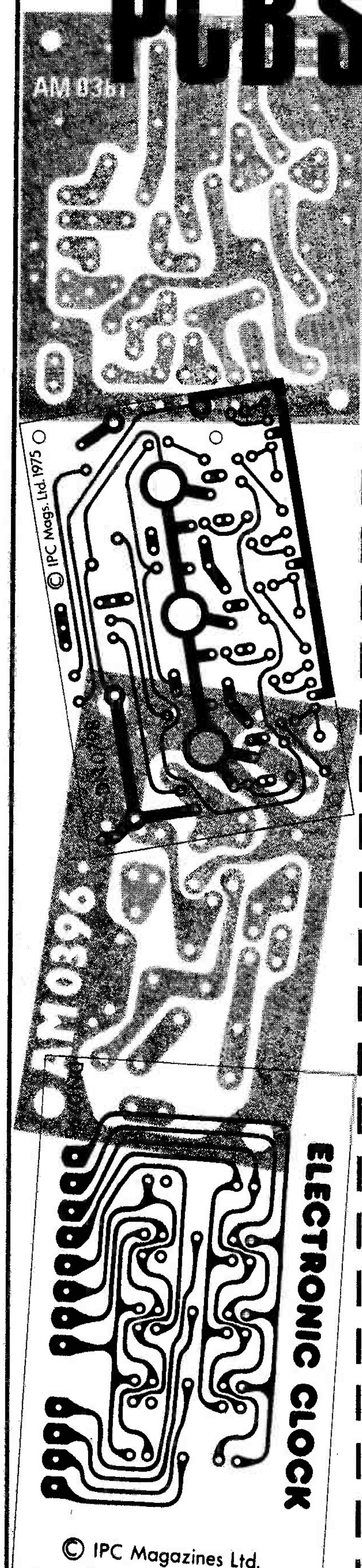

All boards, except SRBP, are glassfibre, drilled and roller-tinned

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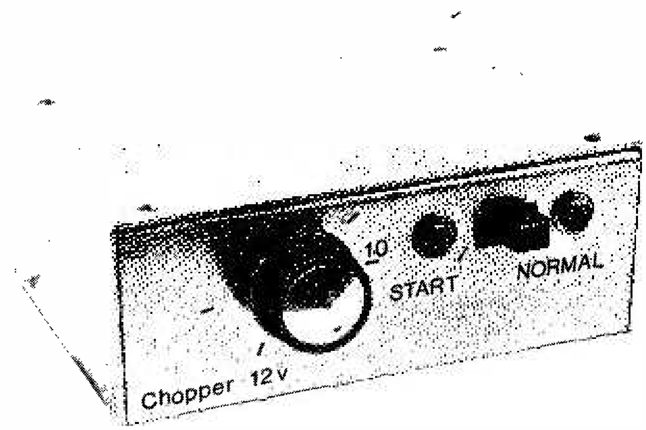
electronic CAR VOLTAGE REGULATOR

C.GRAYSON B.Sc

In this age of sophisticated electronics in the car the traditional method of regulating the supply voltage by a pair of vibrating contacts with all the associated pitting, arcing and electrical noise, is, to put it mildly, outmoded. Therefore, this simple but reliable electronic regulator was designed.

The 'chopper' was originally designed to be a regulator for motorcycles but it can be calibrated for any DC field and armature, dynamo generating system. A CMOS integrated circuit was chosen for the heart of the circuit because of its high immunity to electrical noise, of which there is a great deal in car systems, and its ability to operate at a variety of supply voltages, of which there is precious little on a motorcycle.



The one control on the Regulator adjusts the voltage while the slide switch enables the system to be started up if the car battery is flat.

IC Details

Some readers may be unfamiliar with the integrated circuit used in this project. It is the RCA CD4007A described as a 'dual complementary pair plus inverter' and its internal configuration is shown in **Fig. 1.** Basically the device consists of three CMOS inverters in various stages of dismemberment. Consider the inverter comprising p1 and n1. These are, respectively, a 'p' channel and an 'n' channel enhancement mode MOSFET. These may be considered as a resistive bar of 'p' or 'n' type silicon overlayed with an insulated metal electrode. The potential on the electrode (gate), controls the number of holes or electrons allowed to pass along the bar from source to drain. Thus, each MOSFET is basically a voltage controlled resistor with an R_{ds} on of about 500Ω and an R_{ds} off of greater than ten thousand megohms! Now if pins 13 and 8 are connected together on the CD4007A and a positive voltage is applied to pin 6 then the 'n' channel MOSFET is in the ON state and the 'p' channel is OFF. Thus, the output at pins 13 and 8 is the inverse of the input. In the 'chopper' two inverters are formed with the inputs at pins 6 and 10. The third 'p' channel device is not used but the 'n' channel is used in isolation as a voltage controlled resistor.

The Circuit

Now we can consider the circuit **Fig. 2**, of the 'chopper' in greater detail. Transistor Tr1, diodes D1 and D2, and resistors R1 and R2 form a constant current source of about 8mA which feeds D7 and C1 to give a regulated voltage of about 4V, which is fed to the supply pins of the IC. In the final analysis, this is the reference voltage for the whole system as the voltage-resistance characteristic of the feedback MOSFET is not absolute but relative to the substrate potentials.

The heart of the circuit is a CMOS oscillator with the halves of its cycle separately set in duration. The basic CHOS oscillator is shown in **Fig 3.** If, say, the output of N2 is high then C_{tc} becomes charged positive, consequently the input to N2 is high and its output is low, thus C_{tc} is discharged to ground through R_{tc}. When the voltage on the input of N1 passes through its transfer point, the output goes high and

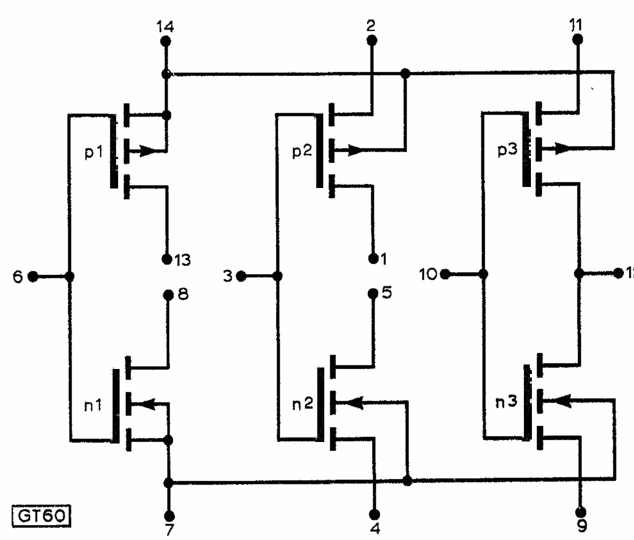


Fig. 1 : Basic circuit of the CD4007 IC used in this project as a 'chopper'.

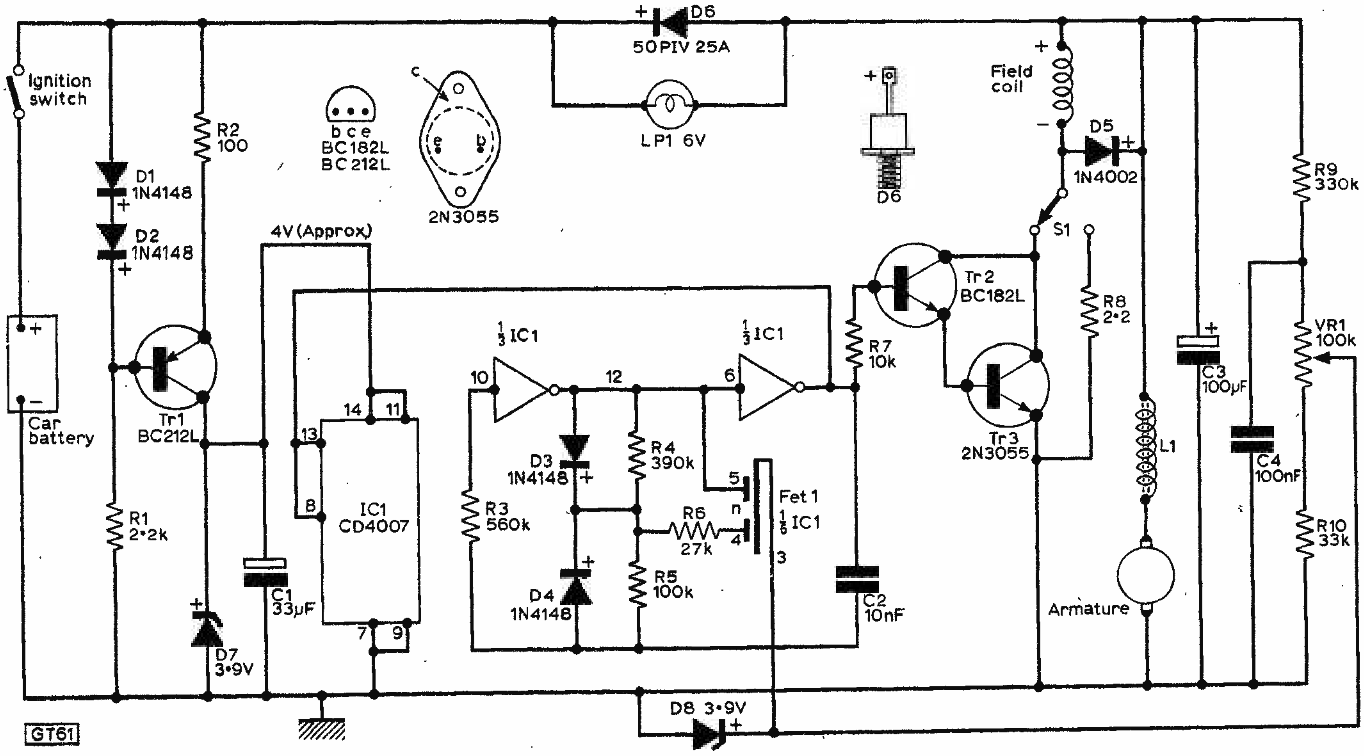


Fig. 2: The complete circuit of the Regulator. It is essential that the transistor Tr3 and Diode D6 are insulated from the metal case with the proper insulating kit or washers.

as a result the output of N2 goes low charging C_{tc}. Now R_{tc} provides a charging path for C_{tc} until the transfer point is again passed and the cycle repeats. For an ideal transfer point of 50% of the supply rails the time period of each half of the cycle is about $0{\cdot}7R_{tc}C_{tc}$ but this rises to around $1{\cdot}1R_{tc}C_{tc}$ when R_x is included to limit the current through the input protection diodes of N1 and to make the frequency of the oscillator relatively free from supply voltage variations.

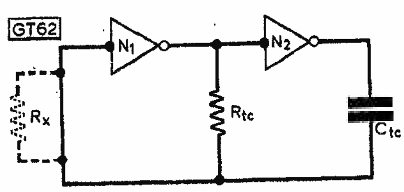


Fig. 3: Basic circuit of the CMOS oscillator, the operation of which is described in the text.

In the voltage regulator the oscillator is used to chop the supply to the field coil of the dynamo. Obviously, the longer the current is allowed to flow in the field coil via Darlington pair Tr2, Tr3, then the higher will be the armature voltage. Accordingly, the OFF period is set at 1·25ms by C2 charging through R5 when the output of N1 is high and the ON period is variable from 350µs to 5ms depending on the combination of R4, R6 and the D_{ds} of FET1.

The action of the circuit is as follows; when the machine is started up there is no voltage fed back by potential dividing chain R9, R10 and VR1. Hence, the R_{ds} of the FET is almost infinite and the field coil is energised with a 4:1 mark-space ON waveform and the armature voltage rises to feed the vehicle battery, light, etc through power diode D6 (which is necessary to prevent current feeding back from the battery into the armature winding). A proportion of this voltage is fed back to the gate of the 'n' channel FET to lower the total resistance presented to C_{tc} as an ON time discharge path. Thus, the field coil is excited for a lower proportion of the time and the voltage tends to fall. The converse is true, and a state of equilibrium is reached and the voltage is stabilised irrespective of engine speed or load. If VR1 is set to tap off less voltage then the regulated voltage at the anode of the power diode will rise to maintain the equilibrium thereby giving a wide range of control. The inductance of the field and armature coils combine to integrate the pulsed drive waveform to give a smooth output voltage.

★ components

Resistors

R1	2·2kΩ	R5	100kΩ	R9	330kΩ
R2	100Ω	R6	27kΩ	R10	33kΩ
R3	560kΩ	R7	10kΩ	VR1	100kΩ
R4	390kΩ	R8	2·2Ω 5W		linear pot

All resistors ¼W 5% except R8

Capacitors

C1	33µF 16V electrolytic	C3	100µF 25V electrolytic
C2	10nF paper foil	C4	100nF disc ceramic

Semiconductors

Tr1	BC212L	Tr3	2N3055
Tr2	BC182L	IC1	CD4007A
D1/4	1N4148	D6	50V PIV 25A
D5	1N4002	D7/8	Zener 3·9V (BZY88C3V9)

Miscellaneous

Insulating kit for 2N3055. Insulating washers for D6. Aluminium case approx 100 × 70 × 40mm or larger. S1, slide switch DPDT (connect contacts in parallel). LP1, lamp 6V 40mA. L1, 50 turns 26SWG insulated copper wire on 10mm dia. ferrite rod. PCB from PW Readers PCB Service.

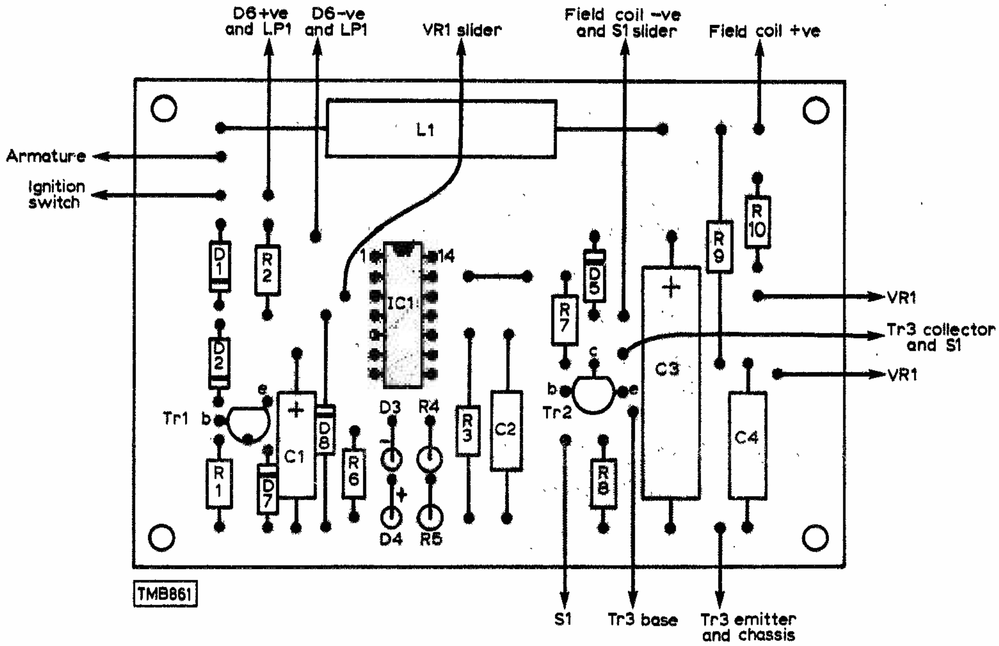


Fig. 5: The components mounted on the PCB are fitted as shown here. Check the lengths of the leads required for fitting the unit to a particular vehicle before soldering them to the board.

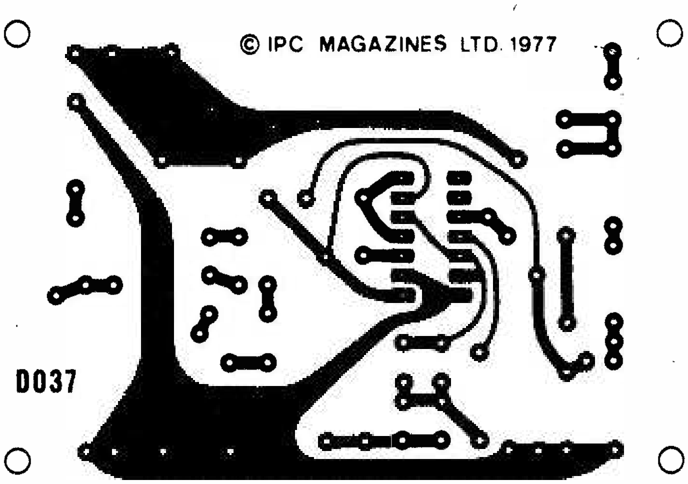


Fig. 4: Foil pattern of the printed circuit board, shown here actual size.

Anyone who has looked at the output of a car dynamo armature will attest to the apparent lunacy of connecting a delicate CMOS input directly to it. The 'chopper', however, incorporates a second order L-C low-pass filter comprising L1, C3 followed by a first order R-C low pass with R9, C4 to eliminate the hash from the output. Further protection is afforded by D8 which prevents any voltage greater than 4V appearing at the input which would forward bias the internal protection diodes and damage the integrated circuit. Finally, D5 protects the driving transistors from induced high reverse voltages. LP1 is the dashboard discharge lamp which glows when there is a reverse voltage across D6, and S1, R8 provides the facility to start the system up if the battery becomes very flat or disconnected.

Construction

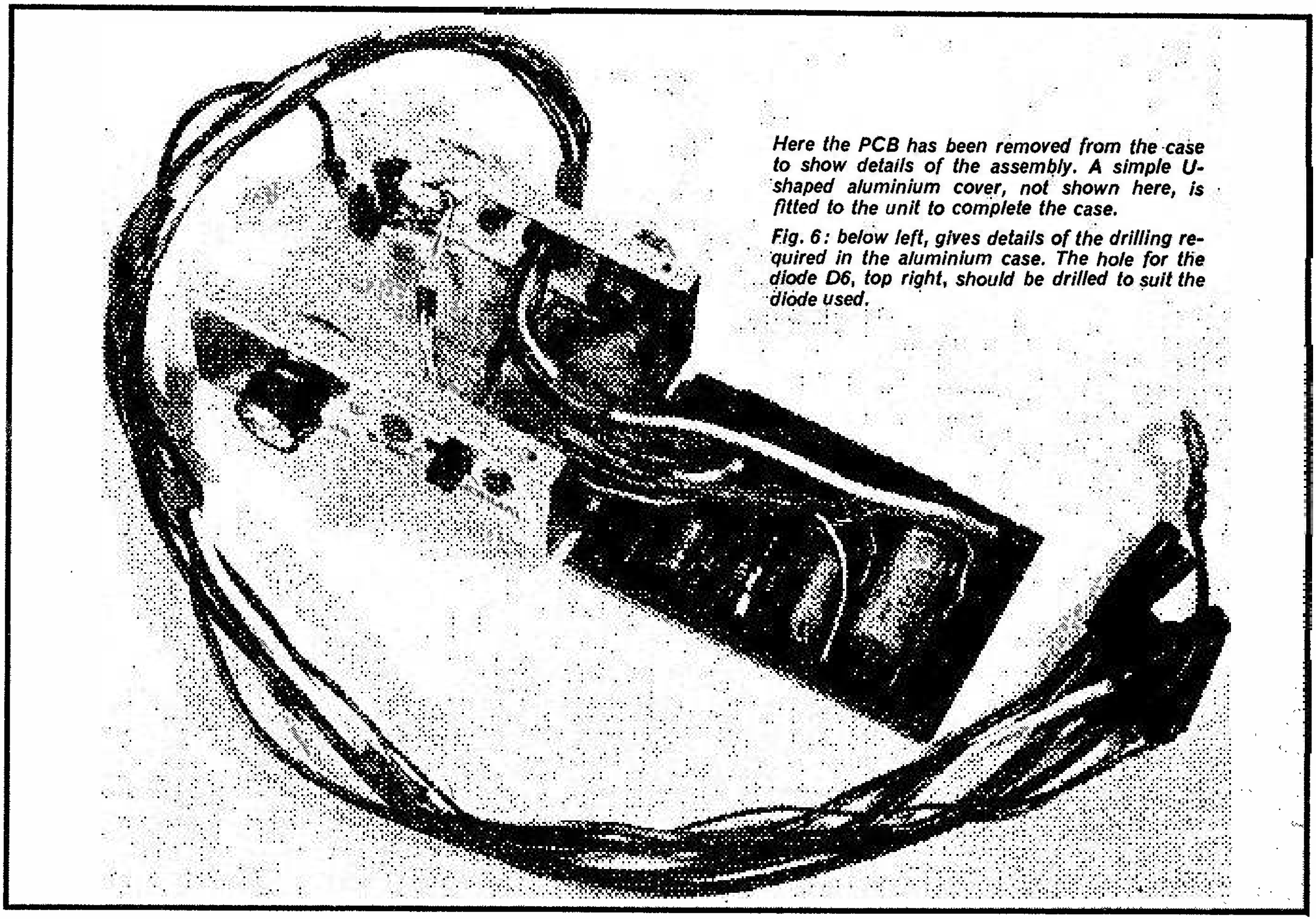
Good solid construction is of the greatest importance where the circuit is to be exposed to the hot, dirty and vibrating environment of the road. Assembly is greatly eased by the use of the PCB shown in **Fig. 4.** Coil L1 is formed by winding about 50 turns of 26 SWG insulated wire on a 70mm length of 10mm diameter ferrite rod. The whole assembly may be conveniently secured to the board with epoxy resin. After L1, mount the passive components followed by the semiconductors and finally the integrated circuit. Care should, of course, be taken in handling CMOS. The supply pins should be soldered first with a well-earthed iron followed by the remaining pins. Component layout is shown in **Fig. 5.**

The board is mounted in a standard 100x70x40mm aluminium box. Tr3 and D6 are mounted on the rear face as shown in **Fig. 6.** S1 and VR1 are similarly mounted on the front face. As the power transistor operates in the switched mode very little power is dissipated and the aluminium serves more as a convenient mounting than a heatsink. The collector of the transistor is electrically isolated from the earthed chassis by a mica washer and bushes. The power diode is similarly mounted through a 10mm hole, again, under all but the most exceptional of circumstances, no heatsink is required. Wiring is quite straightforward but care should be taken to use heavy gauge copper wire in the high current section of the circuit.

Setting Up

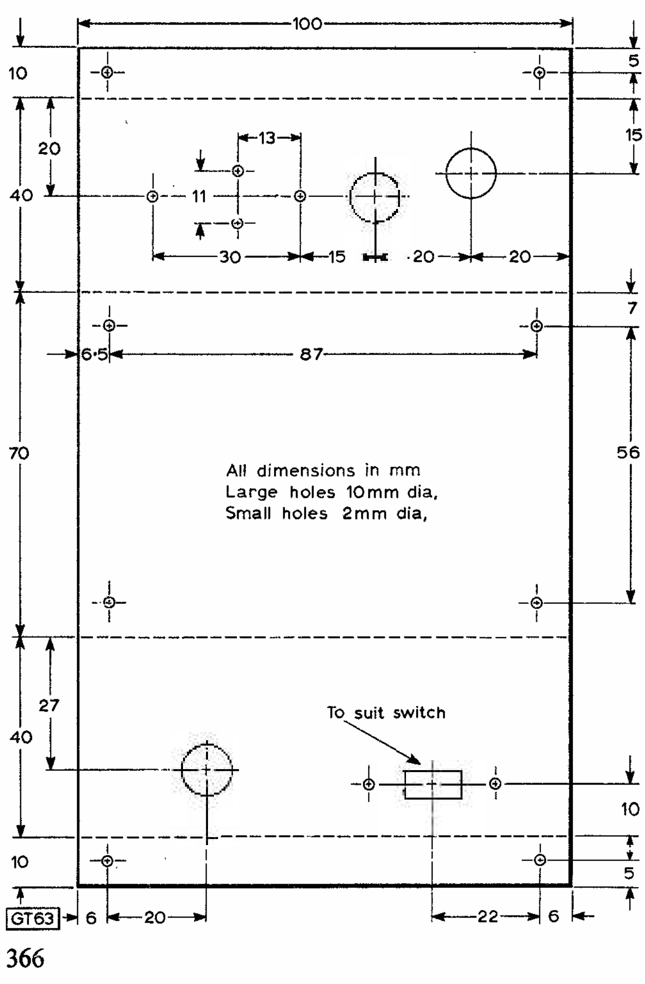
The usual configuration in the electromechanical regulator situation is for one end of the field coil and one brush of the armature to be connected to the chassis while the other ends (usually marked F and D) go off to the regulator where they are joined by a resistor of some 3 to 4Ω. Now the earthy end of the field coil must be disconnected and wired into the circuit with the other two terminals as shown in **Fig. 2.** A little trial and error may be necessary with the values of R9, R10 and VR1 to give the correct range of adjustment and voltage.

As the characteristics of dynamos and CMOS devices vary so much a greater degree of control may be required. To achieve this the value of R4 may be increased to 1MΩ while R6 is decreased to 10kΩ to give a 10:1 variation in mark-space. With



Here the PCB has been removed from the case to show details of the assembly. A simple U-shaped aluminium cover, not shown here, is fitted to the unit to complete the case.

Fig. 6: below left, gives details of the drilling required in the aluminium case. The hole for the diode D6, top right, should be drilled to suit the diode used.



the values as shown the range of adjustment is from 10V to 16V on a Lucas type C40-1 generator. For a 6V system reducing R9 to 100kΩ and R10 to 10kΩ should prove to be about right.

When adjustments are complete the unit should be securely bolted to some convenient earthed part of the chassis with the leads to the dynamo, ignition switch and charging lamp taken out through a hole in the rear of the case and terminated in standard bullet connectors.

Positive Earth

Finally, it might be added that a positive earth version of the 'chopper' is quite possible and would merely involve reversing all polarised components except D3 and D4, together with transposing Tr1 and Tr2. A 2N2955 or similar pnp power transistor must be substituted for Tr3 and finally the track to the negative supply pin of the integrated circuit must be broken and the supply voltages transposed.

Now, the voltage feedback to the FET acts on the R_{ds} in the opposite sense, but the pnp transistors require the complementary logic level to turn them ON. Thus the two phase inversions cancel themselves out and the PCB layout given can still be used. However, with the advent of more electronics in the car many readers will probably wish to do as the author did and take the opportunity of fitting the 'chopper' to convert a positive earth system to the more convenient negative earth. This consists of removing both field and armature coils from the chassis and reconnecting both in the opposite sense, not forgetting to reverse the connections to the vehicle battery and any other polarity sensitive items already fitted. ●

HOTLINES

A REVIEW OF RECENT DEVELOPMENTS
In general, the author does not have any more information on products than appears in the article.

Measured charge

One or two items currently launched on the electronics market tend to remind us of the advances made in the field. Solid state relays, for example, have edged their way up the power-handling capability curve with almost monotonous regularity. I see that one of the very latest to appear (the GB15000 type) can handle a continuous current of 40A with a peak voltage rating of 600V.

Another item is a capacitance meter. Not much bigger than a small hand-held calculator it has a universal socket arrangement for the input(s), a push-to-read button, and a liquid crystal readout. To measure the value of your capacitor, you just poke its leads into the appropriate socket holes and press the button. The unit will give capacitance values from 0·1pF right up to 0·2 Farads. The meter is auto-ranging in that a LED illuminates to show that the reading is in pF, nF, μF or mF.

Viva la weed

It used to be said that the Chinese were "damned clever", but the French seem to be making a bid for this title: would you believe an electronic greenhouse?

Heart of this system is a thing called Firmin which is contained in an area less than 5 × 5 × 8in. Firmin carefully measures things like the soil conditions, the ambient light level, evaporation rates etc. It also computes just how thirsty each plant is and then supplies it with just the right amount of water. The system operates from solar cells as a power source.

Firmin has a calculator and a memory plus a section associated with a motor which controls a valve regulating the water flow. It is continually monitoring and comparing the plants' requirements with the environment so it's quite a precise system. It must be nice for the computer in Firmin to receive an order from hollyhock number five, "A large water—and leave the bottle!"

Open sesame!

Popular electronics construction journals have often published details of ultrasonic control systems. Those interested in this area will be pleased to hear that a German semiconductor manufacturer is to launch a set of three ICs which will allow hobbyists to make an infra red control system; useful for things like opening and closing garage doors, TV control, light dimmers etc.

The system employs pulse-code modulation and is initiated by simple push buttons. Up to 60 (sixty) command signals are possible from a hand-held, battery-operated transmitter. The receiver can be built into a space about 3 × 3 × 1in.

High hopes are held for the infra red system since it has certain advantages over its ultrasonic brother. For example, in the application of opening and closing garage doors the ultrasonic system could not work efficiently from a hand held device inside the car because the "sound" waves would not penetrate the car body etc. The infra red waves, however, can pass through glass and the IR system could be simply pointed through the cars' front windscreen.

Please note: these ICs are not available as yet.

Powerful FET

The arguments regarding semiconductor devices and valves at UHF still rages, with the semiconductor people edging a little closer each year. A new device just launched is a FET which can generate 1W at 8GHz with a 9·2dB gain. Impressive though this might be for a gallium-arsenide FET, it does have rather a long way to go to compete with the VTS-5753A1. This is a travelling wave tube which has a power gain of 47dB and a peak output at 3·3GHz of 120kW. I have to smile at the valve manufacturer who said of the semiconductor manufacturers of devices at these frequencies, "Ah yes, they make Watt-nots".

Get it taped

Video cassette recorders for the home haven't really taken off as yet in the UK, probably on account of the cost. But I am pleased to learn of sensible co-operation between two European manufacturers. Although individually developed, a close consultation between them during development has resulted in two systems that are compatible. Both will now record over two hours of colour TV programmes without a cassette change. In real terms this long recording time means that an entire football match could be recorded (or even a full length feature film) all on one cassette.

A useful (?) feature on one system is a highly accurate digital clock which allows its owner to select the turn-on and turn-off times of the equipment up to four days ahead of the time that recording is required.

Interesting to note that one manufacturer claims some 90,000 video recorders are in use in West Germany, and over 250,000 in the US.

Interested?

Good news for computer enthusiasts—cheaper items are on the way. One of the newer systems costs only $495 in the US and consists of a 73-key keyboard, 9in CRT, an 8-bit microprocessor, and 4,096 bits of random access memory which operates with Basic programme language. A built-in cassette player allows easy entry of recorded programmes.

Anyone interested in this area of electronics should drop a line to Mike Reeve. He is the secretary of the Amateur Computer Club and you can reach him at 6 Limes Avenue, North Finchley, London N12 8QN. Letters should be written in Basic English!

The write beam

Print-out devices are commonly offered on the electronics market, but one just mentioned in Japan seems to be something else. It uses a laser beam to do the "writing" on a photo-sensitive drum. The letters/characters are made up to a resolution of ten "dots" per millimetre. Printout is at six lines/inch but the twist in the tail is that this printer will printout 10,000 lines every minute! Perhaps it might be called "Print Sprint"?

Ginsberg

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

The Torbay ARS let their hair down at their AGM with no less than eleven complaints on the current operation of the RSGB. Most are long-standing, such as too-technical articles in Radcom and nothing for the newcomer to amateur radio, late and varied posting of Radcom resulting in some readers not being able to take advantage of the 'For Sale' columns. The alleged delay on book orders etc. surprises me in view of the success of the new computer system. However the 1977 President's Committee may come up with some answers in due course, although I doubt it, as the reasons for the complaints are too deep-seated to admit of a simple solution. But one of TARS complaints, that the Society's AGM is always held in London instead of being allowed to 'go on tour', should not be difficult to solve!

First item this month must concern **Barry Harper** of Wednesbury, West Midlands, who was playing around with an old radiogram when he picked up a distress message from an Italian ship in trouble off Rome. Barry alerted his local police who contacted the coastguard authorities who passed a message to Rome. Their coastguards did in fact then locate the fishing vessel in distress. Barry's local press gave him a write-up but, not unusually, got most of the facts wrong! Apparently, Barry is going to rebuild the radiogram and adapt it for SW transmission! And study for a licence to broadcast! Actually, Barry has a No. 19 set that he has been playing with, mostly on 80m, but he's not too happy with the results on SSB.

Brian Harrison in Ore, Hastings continues to find plenty of daytime activity on 10m including KV4 and 8P6, while 20m turned up an HH which is not all that common on any band. In Dringhouses, York, **John Hague** continues to swot up the code so let's hope we shall be getting some interesting CW logs from you soon, John. Scottish reader **John Overton** BRS36909 of Glasgow has been lucky enough to enlist the help of two local amateurs GM4CNF and GM4EAW and now sports a BC348 receiver in place of his old CR100. John plans to sit the RAE in December and has not forgotten to keep up with the code. Talking of the code, I hope that the Morse Tutor in the August issue of PW proves of interest, especially in the clubs, where it would make an interesting project. This month sees the start of a series for those interested in studying for the RAE, which, I hope, includes most of the readers of this column!

John Reynolds, Bridgend, still plays around with his TRF in lieu of anything better. Being still at school limits the cash available. Well, John, be patient, stick to the 'A' level studies which are, by far, the most important item at the moment and perhaps everything will come right 'ere long.

Changes at the West of Scotland ARS where **Tom Wylie** GM4FDM is now the Hon. Sec. Write to him at 38 Rosedale Avenue, Paisley, if you'd like details of their summer programme. Another reminder of the North West Amateur Radio Convention to be held on 17 and 18 September and organised by the University of Lancaster ARS. Contact P. L. Jones c/o Dept of Physics, Univ. of Lancaster, Bailrigg, Lancaster for details.

Peter Page of Epping, Essex is yet another who has returned to the bands after a long break. He has an Eddystone 840 which still worked when the cobwebs were removed! A dipole for 20m suffices for the moment but plans are afoot to improve this situation. **John McFadden** keeps going in Belfast finding plenty of South Americans on 15m in the evenings. John mentioned W7ALD/MM. I normally refrain from commenting on these maritime mobile calls since by the time it appears in print the ship is thousands of miles away somewhere else or in dock and the operator paid off!

Once a reader of this column gets his/her own licence I don't normally expect to hear from him/her again! Quite understandable, of course, since the first flush of enthusiasm lasts quite a while and every spare moment is spent on the air, not writing letters but QSL's! So it was good to have a note from **Jeremy Hinton** who now signs G4EZE (was A8962 and G8LIZ) from Newcastle in Staffs. He used the GE special prefix during the Jubilee celebrations and generated a pile-up of Europeans, just for a change. Nice for the G's to get in the act at last! Jeremy uses an FT200 transceiver into a W3DZZ multi-band trap dipole. He's getting the knack of working the DX but sometimes feels he'd like a kW and a multi-element beam! Then where would the fun be, OM?? It would all be too easy, like working through repeaters!

Another pair of fellows enjoying the DX by sharing a KW201 receiver between them are **Paul Pasquet** A9105 and **Iain Christie** A9201, near Farnham, Surrey. They have another set, built by G4DPP, kept for the BC bands. Back on the amateur bands, they have amassed 160 countries so far this year. Another event on which a reminder would not be out of place is the RTTY lecture and demonstration by G3MFJ and G3WWF on 16 August by the Wakefield and District Radio Society at Holmfield House. Ring Bob Firth G3WWF on Leeds 825519 for details.

Alan Doherty reports from Portrush, N. Ireland, that he had little response from his appeal for readers in his area to contact him with a view to forming a club. His success with stations in the Pacific has been mostly over the long path in the mornings. He reports poor returns from QSLs sent out but that is not an unusual situation. Personally speaking, I think the average listener to the amateur bands is wasting his time getting QSLs, not to mention the expense. Much better to spend the time studying for the RAE and then to get QSLs that represent much more of an achievement, a two-way QSO!

The Midland ARS is mourning the loss of Bob Palmer G5PP a past President and long established member of the club, giving lectures and organising constructional projects for other members. He was a great contest man and frequently combined holidays with a DX-pedition. This, of course, meant a great interest in mobile rallies which often meant a lot of hard work for him. After his retirement he was able to spend even more time on his hobby. I remember working him myself on many occasions in CW contests and so I know that the Midland ARS has lost a fine operator.

Good news from **Paul Barker** in Sunderland who says that he is intending to sit the RAE in December next. He is one of many studying at home so I sincerely hope that our news course on the RAE, starting in this issue, will be of some use to him. Paul, you may remember, is a very keen SSTV type and has not entirely deserted the DX bands in search of new countries to log. Just think, Paul, you will soon be able to answer back! Paul was third in his category in the 1st. Worldwide SSTV contest but still feels he did not do as well as he might have done due to QRM. Paul now has an 18AVT vertical multiband aerial which should have gone up by now.

An interesting letter arrived at the last moment from Harry Leeming G3LLL who tells me that, provided there is sufficient support, he will once again be running an RAE course, later in the year. Send your enquiries to the Principal, The College of Technology and Design, Feilden Street, Blackburn.

Late News, page 374.

Log extracts

P. Barker:— **20m** AP5HQ C6ANO (Bahamas) KZ5JM TA1MB VP8SM YB6ACV **20m SSTV** DK2ZX LZ1MH OK1KO OZ3WP WA2PCY YU1CS 9G1JX

A. Doherty:— **20m** JY25YJ KA6ML KP6AL KP6BD (Kingman Reef) KX6BU TU2EF VP8HZ VR1X YS1ESH 9M8HG **10m** A9XBC PY2HY ZP5SD

P. Pasquet:— **20m** PJ3BW TT8SM 3D6BE 6W8LZ **15m** VP2GAH VP8PC TR8GB 9V1SW

J. Hinton:— **worked 20m** JY25MB KA6SS

J. McFadden:— **15m** CP5AO EA8LD EP2RL HI8XBH HK1ZF KZ5KS LU5MBC PY2FMP PZ1DR VP2LL 6Y5GB

C. Page:— **20m** CT3BO HR3JJR 6Y5KD

J. Overton:— **20m** HC2CG HR1JAG KH6BTD KS6FL

B. Harrison:— **20m** HH2MC OY5NS ZD8RR **15m** HM5HB YN7NI 6W8FZ **10m** KV4CI YV5ATX 8P6AJ

J. Hague:— **15m** EP2RR JY4JW 9H4F

All reports are SSB unless indicated otherwise.

BROADCAST BANDS

MEDIUM WAVE DX

by Charles Molloy

Broadcasts from the Near East present quite a problem to the medium waxe DXer. The time zones of this part of the world are some two to four hours ahead of GMT which means that many of the medium wave stations there have already signed off for the night by the time European QRM starts to clear at 2300. There are a few exceptions. Bagdad is a regular on 760kHz sandwiched between West Germany on 755 and Switzerland on 764 and it can be heard throughout the evening. Another is Kuwait on 1345 which lies between the BBC on 1340 and France on 1349. Others than can be located in this way are Kermanshah, Iran on 895 just below Milan on 899, Ahwaz Iran on 1390 between European channels 1385 and 1394, Sharjah in the United Arab Emirates on 1575, between East Germany on 1570 and Norway on 1578.

An alternative is to listen between 0300 and sunrise when stations can be heard signing on for the day but the best time of all for DXing the Near East is during the month of Ramadan, the ninth month in the Moslem calendar which starts this year on the 16th August. During this period broadcasting goes on for most of the night, many stations staying on the air all night and presenting the listener with the opportunity of hearing DX that otherwise would be difficult or impossible to hear. Listen for Basra on 692; Damman, Saudi Arabia on 885; Antalya, Turkey on 890; Cairo 4 on 940; Damascus 944; Izmir, Turkey on 962; Taiz, Yemen on 1000; Istanbul 1016; Teheran 1088; Radio Oman 1240; Radio Afghanistan 1280; Aleppo, Syria 1313; Kirkuk, Iraq on 1360 and Hyderabad, Pakistan on 1010kHz. Broadcasts from the North African coast should be conspicuous during the late evening. Algeria is on 529, 548, 575 and 980; Tunisia on 584, 629, 719 and 962, Libya on 674, 827, 1124 and 1250 and Morocco on 593, 611, 701, 827 and 1232. On the long waves try for Istanbul on 182, Azilal, Morocco on 209 and Tebessa, Algeria on 251kHz.

"I was wondering if there is any publication available listing the addresses of the lower powered US stations, mainly the 5kW outlets, as I have logged a few" writes **Denis Taylor** from Preston in Lancashire. No need to worry about station addresses in North America. Use the station call letters and the location as announced over the air. For example Radio WEAN Providence, Rhode Island, USA will certainly find this 5kwatter. Denis uses a Realistic DX160 and MW loop and a few of his latest loggings are La Voz de Antioquia, Colombia on 750; WEAN on 790; All India Radio, Rajkot on 1070; Radio Tiempo, Caracas in Venezuela on 1200; Radio Coro, Venezuela 1210 and WVOJ Jacksonville, Florida on 1320.

A large souvenir QSL card issued by KDKA Pittsburg (1020) mentions that their signal has been heard at some time or other in every country in the world and Denis thinks this must confirm world-wide MW reception as mentioned recently in this column. Worldwide reception depends both on the location of the listener and on the level of local QRM. In western Europe QRM is the main problem but it is unlikely, QRM permitting, that Hawaii and parts of the Pacific will be logged in the UK in other than freak conditions, as the Great Circle path between the UK and that part of the world passes over the north magnetic pole, a region of high absorption of medium wave signals.

"Freetown on 1205kHz is quite a good signal here around 2300, and I have just sent a report to them" says **Roy Patrick** whose QTH is in Mackworth near Derby. This station is the medium wave outlet of the Sierra Leone Broadcasting Service and it goes off the air at 2335 daily with a half hour extension on Saturday. Programming is largely in English. This station does QSL and the address is simply Radio Freetown, New England, Freetown, Sierra Leone.

Roy mentions that the long wave Algerian outlet on 251kHz has been off the air for a few weeks but is now back in service and transmits the French programme of RTA. Another item from Roy concerns MEKO 2 which is now testing from a harbour in Libya, presumably with the permission of the Libyan Government. It has been heard in Derby on 773kHz with announcements in English until it goes off at 2300 (0100 local time).

A letter from **Paul Griffith,** who lives at St James', in Barbados, refers to a MW loop he is constructing. "I ran into a snag in that I am unable to locate a 500pF tuning capacitor in Barbados and have had to order one from the UK" says Paul. This problem has faced some DXers in the UK as well since 500pF variables do not seem to be in demand, other than by constructors of a medium wave loop! Twin-gang capacitors of around 300pF per section are readily available though and one solution to the problem is to use a single section of a twin-gang to tune the HF end of the band and to switch-in the second section in parallel to cover the LF end. There will be some overlap but the additional capacitance when both sections are in use and the vanes closed, will extend the range by only a few kHz, perhaps to 500kHz instead of 540kHz.

The maximum value (vanes closed) of the tuning capacitor is not at all critical. It is the minimum value (vanes open) that is important as it is this amount plus the self-capacitance of the loop and wiring that will determine the highest frequency at which the loop will resonate. For this reason it is not a good idea to use a twin-gang with the two sections in parallel to cover the whole band. If the loop cannot be tuned to a low enough frequency with the vanes closed then the total capacitance is too low and will have to be increased by switching in additional capacitance. This can either be a fixed capacitor or the second section of a twin-gang variable. There is ample scope for the experimenter who can use a twin or triple-gang capacitor from an old radio or a single gang of lower value than 500pF. One design of loop seen by the writer used a 365pF variable, a switch and a 220pF fixed capacitor to cover the band in two sections, thus getting round the difficulty some DXers experience in constructing a loop that will cover the entire range from 540kHz to 1600 kHz.

My original article, 'Medium Wave DXing', which dealt with a practical loop aerial, appeared in PW for April 1970. Back numbers are not available but Eric Dowdeswell, Asst. Editor, is arranging for reprints to be made. Send an SAE **to me** if you are interested.

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

It is with regret that these paragraphs that I write are the last. Over the many years, since December 1974, that I compiled the Short Wave News I have made many friends and, I trust, have helped and entertained many more. I started writing the column with the firm intention of serving all aspects of our hobby from aerials to QSL card collecting. It was never my intention to be a "Radio Times" section and I hope that the items of news and information that were put in helped to broaden my readers' horizons. Indeed it is to these very readers that I owe a debt of gratitude since, were it not for their letters, there would have been no column to write, so if anyone can employ a redundant typewriter jockey any offers will be gratefully received!

Having got that out of the way we will pass on to this month's letters and start with **Roy Patrick** from Derby who passes on the information that Radio Canada is now airing a short DX show on Sundays at 2043. Is this a sign that they are at last reinstating their formerly highly active DX section? Roy also tells me that Radio Nacional Brazilia is to cease its international service due to "technical reasons".

While on Latin Americans, **Alan Proctor** of Bristol has sent an interesting letter on the best verifiers on that continent. He nominates Radio Nacional Bogota and Radio Guaiba, and says that they replied in less than three weeks. Alan does say however that he enclosed two IRCs and, in one case, some Jubilee stamps. These seemed to attract the attention of a staff member who sent a personal reply and Alan is now a firm advocate of the personal touch.

My recent remarks concerning the oldest DXer prompted a reply from **Arthur Leir** of Belfast. While not, let me hasten to add, a candidate for that title, Arthur has been an addict since 1939 when he started with an Eddystone 504. He has QSL cards dating from pre-war which must be something to see. After a lull Arthur had the urge to re-enter the hobby and has purchased a VEF204, and asks about the various publications on the market. Well, Arthur, Short Wave Magazine is still extant but personally I would buy World Radio and TV Handbook from Argus Books, Station Road, Kings Langley, Herts.

It is one of life's ironies that DX strikes in the strangest places. **Andrew Brade**, aged 13, has an old domestic Ferguson 391T with a forty-foot long wire hung on the end. Added to this the cord drive to the dial has broken and so Andrew has to rely on verbal IDs but despite this he has two loggings that deserve a mention, Radio Grenada on 15105 at 2015 and this month's star prize for Voice of the Malayan Revolution on 15790 at 0940 and Andrew logged it for a week. It is reported in WRTVH as a 120kW from Hengyang, China, but I have never seen it reported before.

Recently this column arranged for the delivery of a number of spare speakers to a group of bedfast

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100V	0·60	0·60	0·70	0·70	0·78	0·78	0·83	0·83	1·01	1·01
200V	0·64	0·64	0 75	0·75	0·87	0·87	0·97	0·01	1·17	1·17
400V	0·77	0·78	0·80	0·83	0·97	1·01	1·13	1·19	1·70	1·74
600V	0·96	0·99	1·01	1·10	1·21	1·26	1·42	1·50	2·11	2·17

N.B.—(a) without internal diac. (b) with internal diac.

NEWS FLASH

Lynx will be holding a seminar this autumn on microprocessors, microcomputers and their applications. There will be a free competition for a system based on Z80. More details next month.

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7473 0·30
7474 0·32
7475 0·47
7476 0·36
7480 0·55
7482 0·75
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7489 2·02
7490AN 0·44
7491AN 0·69
7492 0·47
7493 0·45
7494 0·85
7495 0·67
7496 0·82
74100 1·07
74107 0·35
74121 0·35
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BC109B 0·12
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BC117 0·19*
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BC141 0·28
BC142 0·23
BC143 0·23
BC147 0·09*
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BC157 0·09*
BC158 0·09*
BC159 0·09*
BC160 0·32
BC161 0·38
BC168 0·09*
BC169 0·12*
BC169C 0·14*
BC182 0·11*
BC182L 0·12*
BC183 0·10*
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BC212 0·11*
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BC213 0·12*
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BC214L 0·15*
BC237 0·16*
BC238 0·16*
BC300 0·34
BC301 0·32
BC302 0·40
BC303 0·46
BCY30 0·55
BCY31 0·55
BCY32 0·60
BCY33 0·55
BCY34 0·55
BCY38 0·50
BCY39 1·15
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BD182 0·92
BD183 0·97
BD184 1·20
BD232 0·60
BD233 0·48
BD237 0·55
BD238 0·60
BD410 0·60
BDX32 2·30
BDY10 1·50
BDY11 2·00
BDY20 0·80
BDY38 0·60
BDY60 1·70
BDY61 1·65
BDY62 1·15
BDY95 2·14
BDY96 4·96
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BF185 0·20
BF194 0·10*
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BF197 0·12*
BF224J 0·18*
BF244 0·17*
BF257 0·30
BF336 0·35*
BF337 0·32*
BF338 0·45*
BFW30 1·25
BFW59 0·30
BFW60 0·36
BFX29 0·26
BFX30 0·30
BFX845 0·23
BFX8 0·25
BFX86 0·25
BFX87 0·20
BFX88 0·20
BFX89 0·90
BFY11 1·10
BFY18 0·50
BFY40 0·50
BFY41 0·60
BFY50 0·20
BFY51 0·18
BFY52 0·19
BFY53 0·25
BFY64 0·35
BFY90 0·90
BSX19 0·16
BSX20 0·18
BSX21 0·20
BSY52 0·28
BSY53 0·39
BSY54 0·33
BSY55 0·74
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MJE520 0·45
MJE521 0·55
OC43 0·95
OC44 0·32
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OC46 0·20
OC70 0·30
OC71 0·35
OC72 0·22
OC84 0·40
OC139 1·30
OC140 1·30
OC170 0·23
TIP29A 0·44*
TIP30A 0·52*
TIP41A 0·54
TIP32A 0·64
TIP41A 0·68
TIP42A 0·72
2N404 0·40
2N696 0·20
2N697 0·20
2N706 0·15
2N1131 0·15
2N1132 0·16
2N1302 0·40
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2N1304 0·45
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2N1306 0·50
2N1307 0·50
2N1308 0·60
2N1309 0·60
2N1711 0·24
2N2102 0·44
2N2217 0·30
2N2369 0·14
2N2369A 0·14
2N2483 0·20
2N2484 0·16
2N2646 0·50
2N2711 0·20
2N2712 0·15
2N2904A 0·20
2N2905 0·18
2N2905A 0·22
2N2906 0·18
2N2925 0·14*
2N2926O 0·09*
2N2926R 0·10*
2N2926Y 0·09*
2N2926G 0·10*
2N3053 0·20
2N3055 0·50
2N3137 1·10
2N3440 0·56
2N3442 1·20
2N3570 3·60
2N3702 0·10*
2N3703 0·10*
2N3704 0 10*
2N3705 0·10*
2N3706 0·10*
2N3707 0·10*
2N3708 0·09*
2N3709 0·09*
2N3710 0·10*
2N3711 0·10*
2N3715 1·70
2N3716 1·80
2N3771 1·60
2N3772 1·90
2N3773 2·10
2N3819 0·28*
2N4347 1·10
2N4348 1·20
2N4870 0·35*
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4025BE 0·20
4026BE 1·55
4027BE 0·62
4028BE 0·91
4029BE 1·10
4030BE 0·55
4041BE 0·80
4042BE 0·83
4034BE 1·00
4044BE 0·94
4046BE 1·32
4049BE 0·54
4050BE 0·54
4069BE 0·30
4070BE 0·50
4071BE 0·26
4072BE 0·26
4081BE 0·20
4082BE 0·26
4510BE 1·42
4511BE 1·50
4516BE 1·35
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Sonic

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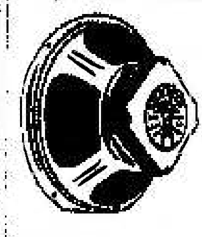

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Mail Orders & Export enquiries to Middlesbrough Branch. Add 55p carr. on Hi-Fi spkrs. or kits. Otherwise add 85p (12" spkr.) £1·25 (15") £2 (18") enthusiasts and it is a pleasant duty to thank Mr. and Mrs. Owen of Dollgellan who took the trouble to take these speakers and other components to Bedford.

J. Hilditch of Nantwich has sent the basic brass tacks letter asking "how do I start DXing"? The answer to this is in two parts. The first is decide which sort of DXing takes your fancy, Latin American, North American, Asian, etc. Then, secondly, the thing to do is to decide which of the technical aspects of DXing interests you, aerials, receivers or perhaps it might be propagation. Having decided we can then move on to study these. This can be done by getting hold of a good set of leaflets on your chosen themes. Many stations offer these, generally free of charge, or at worst for the cost of return postage or a few IRCs. The best I know are distributed by Radio Nederland, PO Box 222, Hilversum, Holland, and are free. These leaflets will lead you on to thinking and planning your DX rather than random listening and hoping to catch that elusive station. After all, a fisherman who goes for a particular fish arranges his tackle to suit. It is no good trying for a special station when the darkness path does not suit or your aerial is all wrong!

Some DXers concentrate on collecting QSL cards and in order to do this a knowledge of how to write a letter in a foreign tongue may help and this perhaps will lead to a visit to a reference library. So it can be seen that every aspect of our hobby has a spin-off into some other activity.

With that I fear that I must close down and thank you all for your support and to the readers in all the overseas countries that took the trouble to write, I wish you good DX and best 73s to you and yours.

Reports on SW BC bands should now be sent to Charles Molloy, see box for details.

VHF BANDS

by Ron Ham BRS15744

Members of the Brighton And District Radio Society were sporting their Jubilee callsigns at the Peacehaven Carnival on June 6th where they gave the visitors an insight to amateur radio. Their 2m station, an FT221 and a 10-element Sky-Beam, installed on the balcony of the Youth Centre was operated periodically by Brian Fenwick GE8BTC, Nigel Hewitt GE8JFT and Alan Baker, GE8LGQ. The Sky-Beam, mounted on a 15ft mast above the balcony, had a mechanical rotator and an electronic beam-heading indicator.

Among the stations worked during the afternoon were F1DZP and a YL operator F1CSW. The group used their own PA system so that visitors could hear the VHF traffic, which took on a special interest when Alan left the station to give a mobile demonstration. A specially prepared leaflet about amateur radio, listing four local clubs, was given to interested people.

During the early hours of the 4th, GE8LGQ took advantage of a lift and worked PE, ON and F on 2m SSB and at 0330 he contacted GE8DJR the station installed at Windsor Castle. Alan worked 36 stations on 2m and the last one was F6DGU/MM operating a hand-held set on board the Newhaven Ferry 'Vilandry'.

The major sporadic-E disturbances of the 1977 season began on May 25 when strong signals from east-European FM broadcast stations were received between 65 and 73MHz on a dipole feeding my R216 receiver. Similar events, lasting a few hours occurred on May 27 and periodically each day from June 8 to 15th inc., and each time strong vision pulses on Ch.R1 (49·75MHz), warned of the forthcoming event. The frequency range 40 to 75MHz was open all day on the 9th reaching a climax around 1800 when I counted 42 east-European broadcast signals between 65 and 73MHz. However, the most intense disturbance so far occurred around 1800 on the 14th when I heard 46 of these broadcast stations, and for about an hour the sporadic-E extended it's influence to 2m giving G4FUT, G8LIC and G8LZM the opportunity to work YU, YO, HB, LZ and I0SVS in Rome. Sporadic-E upset Band II during the evening of the 7th and 8th, according to **Ken Smith** BRS20001 Horsham, who heard several continental FM signals between 95 and 100MHz. Ken's report was soon followed by a postcard from "dampest Devon" where **John Wilson** G8KIS and **Richard Lambley** G8LAM were on holiday with their families. Richard wrote "We were listening to North Hessary Tor (R4) on my Beolit 600 portable about 1700GMT when the set started being 'captured' by German speaking stations. The whole band was alive with Austrian, Italian and Yugoslav stations until 1800 when it went flat again; all at ground level with a whip aerial and heavy local screening".

Almost every day from May 26th to June 19th there was activity on 10m. **Nigel Golds** BRS36910 West Chiltington, Sussex heard South-American stations on the 5th in addition to the short skip signals from Scandinavia to Africa which were predominant on most days. Like many of us, Nigel looked first for the International Beacon Project stations hearing 5B4CY on June 1st and 2nd and strong signals from DL0IGI for some period every day. **Alan Baker** G8LGQ Newhaven, heard the German beacon around midnight on several occasions and on the 8th he just heard the Canadian beacon VE3TEN.

To add to the fun, the sun went "active" on the 4th, **Cmdr. Henry Hatfield**, Sevenoaks, using his spectrohelioscope, found a sunspot group in the northern hemisphere, a bright plage in the southern hemisphere and a spray of gas on the east limb. Although overcast skies hampered visual observation, **Robert Mackenzie**, Dover, who projects the sun's image through his telescope, saw the sunspot group on the 8th. **John Smith**, Cranleigh, reported a marked increase in solar radio noise at 142MHz on the 5th and G8LGQ heard the "seashore" sound on both 2m and 10m indicating the wide frequency coverage of some of the solar bursts.

Both Henry and myself recorded several bursts and a mild solar noise storm at 136MHz on June 5th, 7th, 8th and 9th and the largest individual burst occurred on the 9th and lasted for six minutes. I hope to have reports soon from **Kelvin Lake**, Edgbaston, Birmingham, who, with the aid of a friend, has just completed a corner reflector interferometer, with a 25 wavelength baseline, operating at 143MHz, for radio astronomy work.

The prevailing high atmospheric pressure, 30·4" began to fall on June 2nd and 3rd causing a tropo-opening toward the north; during this period I received a 569 signal from GB3SUT 432·890MHz, a picture from Lichfield on 189MHz, and several continental FM stations in Band II with a dipole feeding the receivers in each case. Another tropo-opening began during the evening of the 16th and **Barry Ainsworth** G8HYN Sompting, Sussex, worked PA0's, F's and GU4EON/M on 2m SSB and at 2330 he contacted G8HVY in Weymouth on 70cms. At the same time, I heard 8 continental FM stations in Band II and a PA0 working EI on 2m. GB3SUT came up at 2130 and was frequently heard in Sussex until the small hours of the 20th. During the afternoon of the 19th G8LGQ had a contact with G2BAR in Bristol and at 1816 he worked GW4FPX/P in Gwent. As if these were not enough to satisfy a VHF man's ego for one day, Alan heard a very weak GM pop up from the noise around 2000 and he stuck on that frequency until 2315 when, for the first time from his home in Newhaven, he worked GM6UW/P just north of Aberdeen, a distance of 560 miles which is not bad going on 2m!

Owing to the prevailing sporadic-E disturbance to the 4m band I was unable to make a satisfactory observation of the June Lyrid meteor shower which reached it's peak on the 15th. However, the next event to look out for are the Perseids which reach their maximum on August 12th. I would also like to remind you all about the 4m Open Contest on August 13th/14th and the 2m Open Contest on September 3rd/4th and in both events SWLs are welcome to take part.

Ivan Davies G3IZD took advantage of the good conditions and worked OZ1OQ and ON6AG on 2m SSB, from Arundel, Sussex during the evening mobile rally organised by Worthing and District ARC on June 21st. Among the visitors to the rally was Ernie Hoare G8BDJ from Brighton who learned recently that he was the winner of the 3cm section of the IARU Region 1 contest held last October. Ernie told me that he hopes to get going on 24GHz soon.

Thanks again to all of you who send me reports, I really do look forward to hearing from you and putting this feature together.

Reports on the various bands are welcome and should be sent direct, by the 15th of the month, to:-

AMATEUR BANDS Eric Dowdeswell G4AR, Silver Firs, Leatherhead Road, Ashtead, Surrey KT21 2TW. Logs by bands, each in alphabetical order.

MEDIUM and SW BANDS Charles Molloy G8BUS, 132 Segars Lane, Southport, PR8 3JG. Reports for both bands must be kept separate.

VHF BANDS Ron Ham BRS15744, Faraday, Greyfriars, Storrington, Sussex RH20 4HE.

Amateur Bands—continued

You won't be able to make the next meeting of the Wessex AR Group, on 5 August, because it's too late! But because it will be a very interesting talk perhaps G6MB and G4AMW might consider repeating it, if you ask them nicely! Title is 'Problems encountered in building and operating HF transceivers using the SL600 IC's. You will be able to make the following date on 19 August when Power Supply Units will be discussed followed by a talk on studying for the RAE. Details from Geoff Cole G4EMN, 6 St. Anthonys Road, Bournemouth (Tel: 20027).

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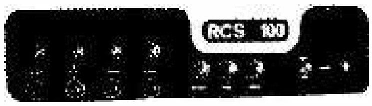

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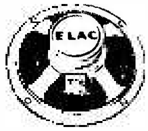

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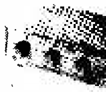

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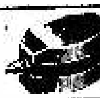

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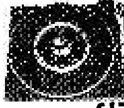

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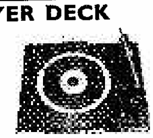

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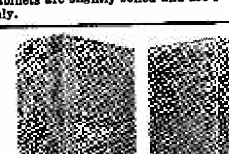

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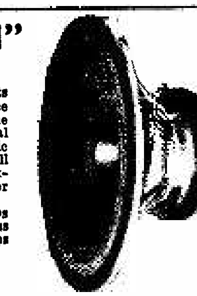

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A high wattage loudspeaker of exceptional quality with a level response to above 8,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home Hi-Fi.
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Useful response 20-14,000cps
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With tweeter. And crossover. 10W. State 3 or 8 ohm. As illustrated. **£7.95** Post 45p
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Postage on above microphones 11p.

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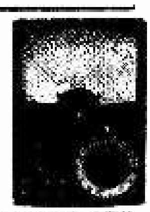

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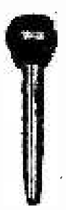

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Primary 240V

6–0–6V	100mA	£0·75
9–0–9V	75mA	£0·75
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15–0–15V	1A	£2·36
30–0–30V	1A	£3·10
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Detecknowledgey

Detecknowledgey - the survey of metal locator theory and principles of operation. £1 post paid.

Bionic Ferret 4000 - the VCO system detector with Fe/NonFe discrimination, meter, loudspeaker, low power drain and high sensitivity. Price now reduced due to volume of demand to £34.26 (inc PP & VAT)
More details in catalogue - demonstrations available

TOKO MFL455 Sideband Mechanical Filter:
SSB filter with 2.1kHz 6dB BW. By popular demand, we now offer this superbly smooth sideband filter - designed for receiver or generator applications. With input/output matching transformers: only £9.95.
Convert our EF5801 to an ultra hi-gain 2m converter: Crystal locked oscillator - details SAE please.

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Ambit is pleased to announce the addition of sets of specially designed **TOKO** coils for applications in model radio control and shortwave receivers, to our unique range of coils and filters.

7E High stability IFs for 455-470kHz, 1st, 2nd and 3rd IFs in three basic impedance ranges. 33p each unit or 75p per set of three. Full details in catalogue.
7KN High stability RF coils for 27MHz band. Spiral wound units with tap and secondary windings. 33p each.
10K Coils for short wave, new leaflet available, or see catalogue.

New modular Elektrick Wireless
7122 -A three stage tuned superhet AM radio module, with 80dB AGC, varicap tuning, ceramic IF filter, meter output. For LW, MW, and now short wave - with the correct coil pack. Not band switched, but using a separate module for each desired band. Better than 10uV sensitivity, and a new easy DIY approach to radio building. SAE for full info. Each module (inc. varicaps and coil pack) £9.00 -kit.
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Components as previously advertized, including

CA3089	1.94	EF5800 6cct tunerhead FM	14.00
MC1310	2.20	~~EF5801 as 5800 with osc op~~	~~17.45~~
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LM381	1.81	FAMOUS TOKO COILS/FILTERS	
LM3900*	0.75	10mm IFTs 1st, 2nd or 3rd for	
TDA2020	2.99	455-470kHz	30p
TCA940	1.80	10mm IFTs for FM and detectors	
TBA810S	1.09	such as CA3089E	33p
ICL8038C	4.50	7mm IFTs for radio control	33p
NE561B*	3.50	CFU series ceramic 470kHz	60p
NE566V*	2.50	CFT series ceramic 455/470	55p
NE567*	2.50	MFHT series mechanical 455	1.95
uA723*	0.80	MFHK series mechanical filters for	
MEM616*	0.57	455kHz now stocked	1.65
MEM680*	0.75	CFSE/SFE10.7 FM ceramics	0.50
BF256S	0.34	BBR3132 FM linear phase	2.25
MVAM series		BLR3107N stereo 19/38kHz	1.90
2	1.35	SFD455 and SFD470	0.75
115	0.95	SFE6.0MA TV SIF	0.80
125	0.90	NEW comprehensive choke range	
BB104	0.45	1uH to 100mH see list in catalogue	

We would like to say more, but space has run out. Please remember p&p (25p) and VAT (12½% except where *) The catalogue has much new info since April. The new sheets will be sent on receipt of an A4 SAE. Or 40p for the complete catalogue and information package. SAE with ALL enquiries please. Callers welcome.

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TAM1000	100W 4 OHMS 65V	£9·80
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- Suits loads 4-16 ohms
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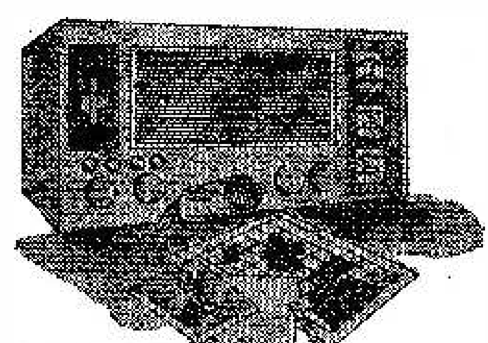

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TV GAMES CHIP
AY-3-8500 £9·95. Printed circuit and kit of extra parts black and white version £10·95. Colour model £24·95. Rifle kit £4·95. Send sae for data.

NEW COMPONENT SERVICE
Resistors 5% carbon E12 1 Ω to 10M ½W 1½p. 1W 3p. **Preset pots** subminiature 0·1W 100 Ω to 4M7 9p. **Potentiometers** ¼W 4K7 to 2M2 log or lin. Single 30p. Dual 95p. **Polystyrene capacitors** E12 63V 22pf to 8200pf 3½p. **Ceramic Capacitors** 50V E6 22pf to 47000pf 3p. **Mylar Capacitors** 100V ·001, ·002, ·005 4p. ·01, ·02, ·025 4½p. **Polyester Capacitors** 250V E6 ·01 to ·1mf 5½p. ·15, ·22, ·33mf 7p. ·47mf 11p. **Electrolytics** 50V ·47, 1, 2mf 5p. 25V 5, 10mf 5p. 16V 22, 33, 47mf 6p. 100mf 7p. 220, 330mf 9p. 470mf 11p. 1000mf 18p. **Zener Diodes** 400mW E24 3V3 to 33V 8½p.

MAINS TRANSFORMERS
6-0-6V 100mA 94p 9-0-9V 75mA 94p. 0/12/15/20/24/30V 1A £3·85. 12-0-12V 50mA 94p. 0/12/15/20/24/30V 2A £5·15. 6·3V 1½A £2·30. 6-0-6V 1½A £2·75. 9-0-9V 1A £2·39. 12-0-12V 1A £2·69. 15-0-15V 1A £2·89. 30-0-30V 1A £3·59.

PRINTED CIRCUIT KITS, ETC.*
Contains etching dish, 100 sq ins of pc board, 1lb ferric chloride, etch resist pen, drill bit and laminate cutter £3·85. 100 sq ins pc board 80p. 1lb FeCl £1·05. Etch resist pen 75p.

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S-DeC £1·94. T-DeC £3·61.
u-DeCA £3·97. u-DeCB £6·97.
IC carriers with sockets:
16 dil £1·91. 10T05 £1·79.

SINCLAIR CALCULATORS AND POCKET TV
Sinclair pocket TV £165. Cambridge Scientific Programmable £13·95. Prog. library £4·95. Cambridge Scientific £8·45. Oxford Scientific £10·60. Mains adaptors £3·20.

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3-WAY MODELS
With switched output and 4-way multi-jack connector. Type 1:—3/4½/6V at 100mA £2·30. Type 2:—6/7½/9V 300mA £2·90.
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With press-stud connectors. 9V £3·45. 6V £3·45. 9V + 9V £5·45. 6V + 6V £5·45. 4½V + 4½V £5·45.
CASSETTE MAINS UNIT
7½V with 5 pin din plug 150mA £3·65.
FULLY STABILIZED MODEL £6·40.
Switched output of 3/6/7½/9V 400mA stabilized.
CAR CONVERTORS 12V INPUT
Output 9V 300mA £1·80. Output 7½V 300mA £1·80.

BATTERY ELIMINATOR KITS
Send s.a.e. for free leaflet on range.
100mA radio types with press stud battery terminals. 4½V £2·10. 6V £2·10. 9V £2·10. 4½V+4½V £2·50. 6V+6V £2·50. 9V+9V £2·50.
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Transistor stabilized 8-way type for low hum. 3/4½/6/7½/9/12/15/18V. 100mA £3·20. 1Amp £6·40.
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PZ5 £4·95. Z40 £5·75.
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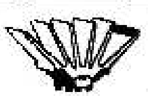
S450 tuner £21·95. AL60 £4·86. PA100 £14·95. MK60 audio kit £36·45. Stereo 30 £17·95. SPM80 £3·75. BMT80 £4·25. Send sae for free data.

SINCLAIR IC20
IC20 10W+10W stereo integrated circuit amp kit with printed circuit and data £6·95.
PZ20 Power supply kit for above £3·65
VP20 Volume, tone control and preamp kit £8·95.
Send sae for free leaflet on the whole system.

JC12 AND JC40 AMPLIFIERS
JC12 6W IC audio amp with free data and printed circuit £1·95.
Also new JC40 20W model with pcb £3·95.
Send sae for free leaflet on both models and associated power supply and preamp kits.



FERRANTI ZN414
IC radio chip £1·44. Extra parts and pcb for radio £3·85. Case £1. Send sae for free data.

SWANLEY ELECTRONICS
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7433	43p	74161	130p
7437	37p	74162	130p
7438	37p	74163	130p
7440	16p	74164	140p
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7442	75p	74166	180p
7443	120p	74167	320p
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7454	18p	74181	324p
7460	18p	74182	150p
7470	38p	74185	190p
7472	32p	74186	990p
7473	36p	74190	160p
7474	37p	74191	160p
7475	48p	74192	130p
7476	37p	74193	130p
7480	54p	74194	160p
7481	108p	74195	110p
7482	90p	74196	130p
7483	99p	74197	130p
7484	120p	74198	270p
7485	120p	74199	270p
7486	36p	74221	175p
7489	340p	74251	150p
7490	43p	74265	97p
7491	90p	74278	320p
7492	58p	74279	150p
7493	43p	74283	220p
7494	80p	74284	475p
7495	75p	74285	475p
7496	90p	74290	160p
7497	290p	74293	160p
74100	140p	74298	220p
74104	75p	74365	160p
74105	75p	74366	160p
74107	36p	74367	160p
74109	60p	74390	220p
74110	60p	74393	245p
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4000	21p	4040	150p
4001	21p	4042	97p
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4007	21p	4047	120p
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4011	21p	4050	58p
4012	23p	4054	120p
4013	55p	4055	140p
4014	90p	4056	145p
4015	90p	4060	130p
4016	54p	4069	30p
4017	120p	4071	30p
4018	110p	4072	30p
4019	57p	4081	30p
4020	140p	4082	30p
4021	120p	4093	104p
4022	140p	4510	140p
4023	23p	4511	140p
4024	90p	4516	130p
4025	23p	4518	140p
4026	200p	4528	140p
4027	64p	14433	£14
4028	110p	14533	540p
4029	120p	14583	£1
4030	67p		

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8 pin	12p	22 pin	36p
14 pin	13p	24 pin	40p
16 pin	14p	28 pin	48p
18 pin	30p	40 pin	60p

MEMORY I.Cs

1702A EPROM	1000p
2102-2 RAM	216p
2107 RAM	864p
2112-2 RAM	470p
AY-5-1013P UART	725p
C8080A CPU	1400p
RO3-2513 ROM	850p

OP. AMPS

LM301A	40p	741	25p
LM318N	225p	747	78p
LM324N	120p	748	40p
LM339N	175p	776T	216p
NE531V	140p	MC1458	75p
709	38p	CA3130	108p
733	150p	CA3140	108p
		LM3900	70p

LINEAR I.Cs

AY-1-212	650p	NE556	100p
CA3028A	112p	NE561B	450p
CA3046	85p	NE562B	450p
CA3048	250p	NE565	200p
CA3053	75p	NE566V	200p
CA3065	200p	NE567V	200p
CA3080E	97p	SN72710N	54p
CA3089E	250p	SN76003N	275p
CA3090AQ	425p	SN76008	280p
ICL8038CC	400p	SN76013N	175p
LM377N	200p	SN76013ND	160p
LM380N	112p	SN76018	280p
LM381N	190p	SN76023N	175p
LM389N	160p	SN76023ND	160p
M252AA	850p	SN76033N	275p
MC1310P	150p	SP8515	710p
MC1351P	110p	TAA621A	310p
MC1495L	490p	TAA661B	150p
MC1496G/P	112p	TBA120	97p
MC3340P	180p	TBA641B	300p
MC3360P	160p	TBA651	225p
MFC4000B	120p	TBA800	112p
MFC6040	200p	TBA810S	125p
N5596	112p	TBA820	100p
NE540L	160p	TDA2020	405p
NE555V	40p	ZN414	140p

VOLTAGE REGULATORS—Fixed
Plastic—TO220—3 Terminals

1 Amp	+ ve		— ve	
5V	7805	130p	7905	215p
8V	7808	130p	—	—
12V	7812	130p	7912	215p
15V	7815	130p	7975	215p
18V	7818	150p	7918	215p
24V	7824	150p	7924	215p
100mA — TO92				
5V	78LO5	70p	79LO5	80p
6V	78LO6	70p	—	—
12V	78L12	70p	79L12	80p
15V	78L15	70p	79L15	80p

LM309K (TO3) 1A 5V 150p
LM323K (TO3) 3A 5V 700p
LM327N (16 DIL) 100mA +5 —12V 275p
MC1468 (16 DIL) 100mA ±15V 300p
(Adj. by Rs from ±8V to ±20V)
TBA625B (TO5) 0·5A 12V 120p
7805 (TO3) 1A 5V 150p

VARIABLE
723 14 pin DIL 2V-37V 150mA 45p
LM317T TO220 1A—2V-37V 325p
TL430 TO92 100mA 2V-30V 75p
78MGT2C 4 pin DIL 5V-30V 500mA 145p

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		LEDS:		
OCP 71	130p	TIL209	Red	14p
ORP 12	75p	TIL211	Green	36p
ORP 60	90p	TIL32	Infrared	81p
ORP 61	90p	0·2"	Red	16p
2N5777	48p		Green	20p
			Yellow	36p

DISPLAYS

3015F	Minitron	175p	FND500	Red	130p
DL704	Red/Green	160p	FND507	Red	130p
DL707	Red/Green	160p	TIL321	Red	130p
DL747	Red/Green	250p	TIL322	Red	130p

DRIVERS: 75491 84p; 75492 104p; 9368PC 216p

SCR-THYRISTORS

1A 50V TO5	65p
1A 400V TO5	95p
3A 400V stud	120p
7A 400V TO5	120p
12A 400V TO220	180p
16A 400V TO220	220p
16A 600V TO220	270p
BT 106 stud	150p
C106D	70p
2N3525	130p
2N4444	200p

TRIACS
Plastic

3A 400V	85p
6A 400V	107p
6A 500V	120p
10A 400V	140p
10A 500V	160p
15A 400V	200p
15A 500V	225p
40430	130p
40669	130p
T2 302D	130p
BR100	32p

HEAT SINK for Plastic
TO220
TRS. or VR 22p

BRIDGE RECTIFIERS

1A 50V	25p
1A 100V	27p
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INDEX TO ADVERTISERS

RADIO EXCHANGE LTD.

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- ★ 4 Transistor Earpiece Radio
- ★ Signal Tracer
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- ★ Transistor Tester NPN-PNP
- ★ 4 Transistor Push Pull Amplifier
- ★ 5 Transistor Push Pull Amplifier
- ★ 7 Transistor Loud-speaker Radio MW/LW
- ★ 5 Transistor Short Wave Radio
- ★ Electronic Metronome
- ★ Electronic Noise Generator
- ★ Batteryless Crystal Radio
- ★ One Transistor Radio
- ★ 2 Transistor Regenerative Radio
- ★ 3 Transistor Regenerative Radio
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Components include: 24 Resistors ★ 21 Capacitors ★ 10 Transistors ★ 5" × 3" Loudspeaker ★ Earpiece ★ Mica Baseboard ★ 3 12-way connectors ★ 2 Volume controls ★ 2 Slider Switches ★ 1 Tuning Condenser ★ 3 Knobs ★ Ready Wound MW/LW/SW Coils ★ Ferrite Rod ★ 6½ yards of wire ★ 1 Yard of sleeving, etc. Complete kit of parts including construction plans.

Total Building Costs £9·00
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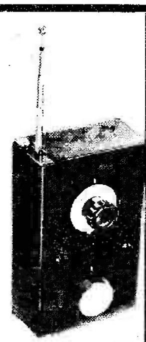

Build this Converter Kit and receive the Aircraft Band by placing it by the side of a radio tuned to Medium Wave or the Long Wave Band and operating as shown in the instructions supplied free with all parts. Uses a retractable chrome plated telescopic aerial, Gain Control, V.H.F. Tuning Capacitor, Transistor,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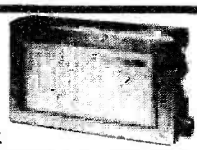

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3 Tuneable wavebands. M.W., L.W., and Trawler Band, 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, attractive black and gold case. Size 5½" × 1¼" × 3½" approx.
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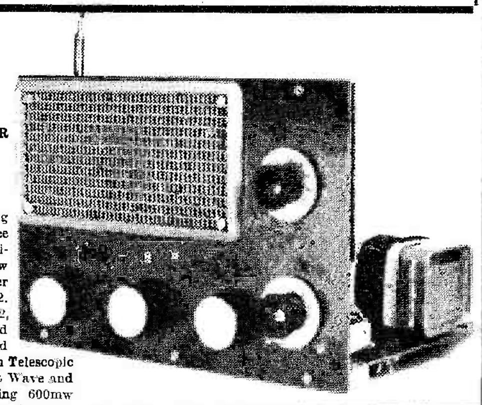

MULTIBAND V.H.F. AND A.M. RECEIVER
13 TRANSISTORS AND FIVE DIODES
QUALITY 5" × 3" LOUDSPEAKER

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Complete kit of parts including carrying strap. Building Instructions and Operating Manuals.

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Case Enclosure Kit (if required) £1·90 inc. P & P.

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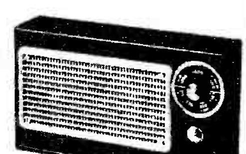

Build this exciting new series of designs.

E.V.5. 5 Transistors and 2 diodes. MW/LW. Powered by 4½ volt Battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" × 5½ × 2¾" approx. All parts including Case and Plans.

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

Total Building costs **£4·95** P & P + Ins. 90p.

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

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ELECTRONIC CONSTRUCTION KITS

ECK2 Self Contained Multi-Band V.H.F. Receiver Kit. 8 Transistors and 3 Diodes. Push/Pull output. 3" Loudspeaker. Gain Control. 7 section chrome plated telescopic aerial, V.H.F. Tuning Capacitor, Resistors, Capacitors, Transistors, etc. Will receive T.V. Sound, Public Service Band, Aircraft, V.H.F. Local Stations, etc. Operates from a 9 Volt PP7 Battery (not supplied with kit). Complete kit of parts including construction plans.

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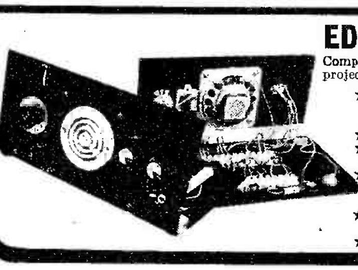
ECK4 7 Transistors, 6 tuneable wavebands, MW, LW, Trawler Band, 3 Short Wave Bands. Receiver Kit. With 5" × 3" Loudspeaker. Push/Pull output stage, Gain Control, and Rotary Switch. 7 Transistors and 4 Diodes. 6 section chrome-plated telescopic aerial. 8" Sensitive Ready Wound Ferrite Rod Aerial. Tuning Capacitor. Resistors, Capacitors, etc. Operates from a 9 Volt PP7 Battery (not supplied with kit). Complete kit of parts including construction plans.

£7·25 P & P and Ins. 90p.

EDU-KIT JUNIOR



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- ★ 3 Transistor Earpiece Radio Medium Wave Coverage.
- ★ 4 Transistor Medium Wave Loudspeaker Radio.
- ★ Electronic Noise Generator
- ★ Electronic Metronome.
- ★ 4 Transistor Push/Pull Amplifier.

All parts including Loudspeaker, Earpiece, MW Ferrite Rod Aerial, Capacitors, Resistors, Transistors, etc. Complete kit of parts including construction plans.

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