NOV 1977

practical WIRELESS

45p

EXTRA INSIDE

'COMPONENT SOURCE DIRECTORY'

24 PAGES: COMPLETE IN THIS ISSUE

WIDE-RANGE VOLTMETER

RF RESONANCE INDICATOR

& IC OF THE MONTH (ZN1304E TIMER)

ALL-BAND SW CONVERTER

ISSUE 848

NOVEMBER 1977 · VOLUME 53 · NUMBER 7

BRITAIN'S LEADING JOURNAL FOR THE RADIO & ELECTRONIC CONSTRUCTOR

Published by IPC Magazines Ltd., Fleetway House, Farringdon Street, London, EC4A 4AD
Telephone: 01-634 4444

News and Views

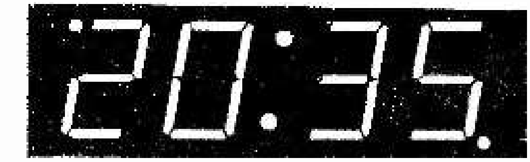
For our Constructors

General Interest

★ Free This Month!

24 PAGE 'COMPONENT SOURCE DIRECTORY'

TIME FOR WIRELESS?



The MA1012 LED digital clock module is a full 12/24 hour format clock unit, operating from 50/60Hz mains and offering a host of features: Hours, minutes display in bright 0.5" LEDs, with optional seconds, sleep and snooze alarms, fast and slow setting, PM indicator, switched output for radio, but the most important feature is the non-multiplexed directly driven display. This means no RFI, so the MA1012 is ideal for use in any type of radio/tuner etc. The neat fitting means it can be slotted into many existing cabinets/chassis - only 1.75 x 3.75 x 0.7 " total!! £9.45 per module - isolating mains transformer £1.50 (8% vat) Two modules and two transformers for £20.00 + 8% VAT.

AMBIT announce a new addition to the catalogue - information on TOKO's new ceramic ladder filters, 2.4kHz SSB filters etc. HF coils, new flat faced low cost panel meters. Catalogue 45p.

DETECKNOWLEDGEY

Metal locator principles and practise, including some of the facts that the manufacturers of £100+ metal locators wouldn't like you to know !! £1.00 The Bionic Ferret 4000 – A little detector technology of our own. The VCO based metal locator for the electronics constructor, including platsic moldings for housings of electronics and search coil, tubing etc. Can be set up using just a test meter. 'All in' price £34.26 inc PP and 8% VAT.

DEMONSTRATIONS AVAILABLE AT OUR OFFICES IN BRENTWOOD HIGH ST.

COMPONENTS ETC:

As usual, Ambit offers a comprehensive range of components and modules for wireless, including over 300,000 types of signal inductors for just about every conceivable RF signal application from 5kHz to 300MHz.

SEMICONDUCTORS

CA3089E	FM IF	1.94
KB4402	FMIF	1.94
HA1137W	FM IF	2.20
TBA120	FM IF	0.75
TBA120S	FM IF	1.00
SN76660N	FM IF	0.75
uA720	AM radio	1.40
CA3123E	AM radio	1.40
HA1197	AM radio	1.40
TBA651	AM radio	1.40
MC1350	agc gain	1.00
uA753	FM gain	1.80
LM1496	Bal mix	1.25
MC1310P	mpx dec.	2.20
CA3090AQ	mpx dec.	4.35
HA1196	mpx dec.	4.20
LM380N	2w AF	1.00
LM381	st. pream.	1.81
tda2020	15w AF	2.99
tca940e	10w AF	1.80
tba810as	7w AF	1.08
LM301an	op amp	0.39*
CA3130T	mos oa	0.85*
uA741	op amp	0.34*
LM3900	op amps	0.68*
7805uc	5v/1A	1.55*
tda1412	12v/.6A	0.95*
78M20uc	20v/.5A	1.20*
78M24uc	24v/.5A	1.20*
uA723cn	variable	0.80*
NE550a	variable	0.80*
TAA550b	32v ref.	0.50*
icl8038cc	sig gen	4.50*
NE555v	timer	0.70*
NE566v	vco	2.50*
NE567v	tone dec.	2.50*
NE560B	hf pll	3.50*
NE561B	hf pll	3.50*
NE565k	lf pll	2.50*
MC1312	quad	1.50
11C90	650MHz	14.00*
ZTX107	50v/.3W	0.14
ZTX108	30v/.3W	0.14
ZTX109	30v/.3W	0.14

BC413	lo noise	0.18
40238	shld.RF	0.25*
BF224	.6GHz RF	0.22
BF274	.7GHz	0.18
ZTX212	50v/.3W	0.17
ZTX213	30v/.3W	0.16
ZTX214	30v/.3W	0.17
ZTX451	60v/1W	0.18
ZTX551	60v/1W	0.18
BD515	45v/10W	0.27
BD516	45v/10W	0.30
BD535	60v/50W	0.52
BD536	60v/50W	0.53
BD609	80v/90W	0.70
BD610	80v/90W	1.20
BF256	1GHz jfet	0.34
E176	p ch. swt.	0.38
MEM614	(40822)	0.38*
MEM616	(40673)	0.57*
MEM680	lo noise	0.75*
BA102	vhf varic.	0.30
BA121	..	0.30
BB104	dual varic	0.45
BB105	uhf varic	0.40
mvam2	dual am	1.48
mvam115	15v/AM	1.05
mvam125	25v am	0.90

TOKO COILS & filters

10mm	
AM IFts with cap.	0.30
FM IFts with cap.	0.33
eg	
YHCS11098AC2	0.30
YHCS12374AC2	0.30
YHCS11100AC2	0.30
KACSK586HM	0.33
7mm IFs for RC	0.33
CFS10.7 ceramic	0.50
BLR3107N mpx	1.90
BBR3132 6pole fm	2.25
~~MFL 2.4kHz/455~~	[illegible]
~~MFHT 4/5/7kHz~~	[illegible]
MFK 7/9kHz	1.65

Modules/tunerheads

EC3302U 3 varicap FM	£7.50
EF5600U 5 varicap FM	£12.95
NT3302UG 3 gang FM	£7.50
EF5800 6 varicap FM	£14.00
EF5801(5800+osc op)	£17.50
8319 4varicap mos mix	£11.45
7252 fm tunerset	£26.50
7253 stereo tunerset	£26.50
7020 cer. filt. fm if	£6.95
7030 linear phase if	£10.95
NBFM1 kit for 455-470kHz nbfm if filter/amp/detector for +12v	£5.95
92310 mpx decoder	£6.95
91196 mpx decoder &birdy filter	£12.99
93090 mpx decder.	£8.36
91197 mw/lw tuner	£11.35
7122 3 varicap am tuner for MW (or LW) kit	£9.00
810k complete TBA810AS module kit	£3.00
940k as above with tca 940E (both kits inc heatsink)	£3.95

NB All our audio ICs are "short circuit" protected as defined by the manufacturer All our mpx decoders are provided with TOKO mpx notch filters. All our FM IF modules use the improved mute version HA1137W.

Others: (from gen. price list)

FX1115 ferrite beads	10/25p
FR1 mw/lw ferrite rod	£0.90
Min. foil trimmers by Dau:	
5/10/20pF swing 7.5	0.18
33/42pF swing 7.5	0.26
60pF swing 10mm dia	0.24
22turn 100k diode law trimpots for varicaps	0.45
1000pF feedthrus	0.05
10000uF/63v	1.15
Chokes 1uH to 124mH OA.	

VAT is extra at 12.5% except where otherwise shown. Postage now 25p per order please. Catalogue 45p inc pp & vat. Please send an SAE with all enquiries (a5 or larger size please) Price list free with an SAE (a5 size)

AMBIT INTERNATIONAL

2, GRESHAM RD., BRENTWOOD, ESSEX, CM14 4HM Tel (0277) 216029

NEWMART ELECTRONICS for all your hi-fi needs.

Stockists of: Amstrad · Teleton · Akai · Sansui · Wharfedale · Pioneer · Rotel · Garrard · Connoisseur

BATTERY ELIMINATORS P&P 25p

240v input 6, 7·5 or 9v output at 00mA .. .. £3·25

CARTRIDGES & STYLI P&P 25p

	Cart.	D—D & RPL Styli
Acos GP91/3CS (ster. comp)	£1·60	£1·20
GP93/1 or 95/1 ster. cryst	£2·00	£1·20
GP94/1 or 96/1 ster. ceram.	£2·00	£1·20
GP101 cryst. comp.	£1·00	—
GP104 ster. ceram	£2·60	£1·20
BSR X5M or X5H cryst. comp.	£1·75	£1·20
SX6M or SX6H cryst. ster.	£2·25	£1·20
Sonotone 9TAHC or 9TAHC/G (Diam.)	£2·60	£1·20
3509	£2·60	£1·20
Audio Technica AT55	£2·25	—
Goldring G850	£3·75	£1·75
G800	£5·50	£1·75
G800E	£9·06	£3·50
Shure Cartridges & Styli		
M44G/M44C	£7·70	£6·20
M55E	£9·20	£7·15
M75ED Type 2	£17·15	£12·65
M75EJ Type 2	£14·30	£8·78

SPEAKERS P&P 85p

EMI 13" x 8", 8 ohm Plain	£3·40
8" x 5" C.Mag. 5 watt, 3.8 or 15 ohm	£2·35
8" x 5" Dualcone .. 8 ohm, 10 watt	£3·70
8" 8 ohm Dualcone	£3·45
10" Dualcone	£4·10
Richard Allen 30w 12" 8 or 15 ohm	£12·20

MICROPHONES P&P 45

UD 130 50K/600 ohm uni-dir. ball metal	£8·35
Cassette Stick Mic. with R/Control	£1·65
Cass. Stick Mic. with R. Control (Philips type) ..	£1·93

CASSETTES P&P 1–3 25p, 4 and over 55p

	C60	C90	C120
Low Noise	£0·37	£0·48	£0·75
Philips	£0·79	£1·08	£1·73
Memorex	£0·81	£1·38	£1·90
Cassette Head Cleaner ..			£0·55
Bib Head Cleaner De-magnetiser			£1·99

TAPES P&P 1-3 35p, 4+65p

	Stnd	LP	Cases
5"	£0·59	£0·70	£0·32
5¾"	£0·70	£0·92	£0·38
7"	£0·92	£1·19	£0·43

RECORD DECKS P&P £1·65

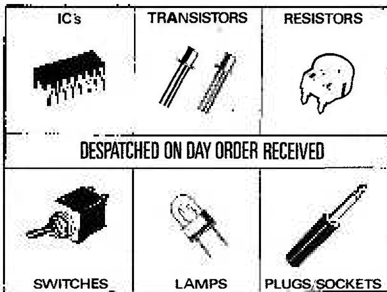
GARRARD SP25 Mk IV/G800 with Plinth & Cover ..	£35·30
BSR MP60 (P128R)	£17·35
Plinth & Cover for Garrard, BSR	£4·95
BD1 Kit	£17·25

M.O. prices only. VAT inc. Subject to Availability & manufs. increase. **Send 30p for Catalogue.** Barclay/Access.

Callers Welcome at **Manchester** 30-32 Shudehill Tel. 061-832 7710. **Leeds** 4 New Market St. Tel. 0532 42708. **Liverpool** 15 Whitechapel. Tel. 051-236 0738

NEWMART ELECTRONICS

Mail Order Dept PW/11
Belmont St, Monton, Eccles, Manchester.
Tel 061·789 5268



ACE

ORDERING IS EASY WITH THE UNIQUE COMBINED CATALOGUE/ORDER FORM

ACE MAILTRONIX LTD
Dept. PW Tootal Street
Wakefield, W.Yorkshire WF1 5JR

SEND STAMP ADDRESSED ENVELOPE NOW FOR THE EASY TO USE ACE ORDER FORM CONTAINING 500 TOP QUALITY POPULAR ELECTRONIC COMPONENTS AT PRICES YOU CAN AFFORD. P&P FREE ON ORDERS OVER £2, OTHERWISE 20p. ALL PRODUCTS GUARANTEED ONE YEAR IF CORRECTLY USED. SOME EXAMPLES FROM THE COMPETITIVE ACE RANGE WITH VAT INCLUSIVE PRICES ARE SHOWN BELOW

BC107/108/109 Metal	13p	¼W Resistors CF ±5%	3 for 6p
BC207/208/209 Plastic	11p	Minpresets Horiz/vert.	8p
2N3055	65p	Electrolytic 100μF 25v	10p
741 Op Amp-8pin	30p	Polyester C280 0·1μF	8p
555 Timer	50p	LED Red 0·2"	15p
W04 1A Bridge	31p	Phono plugs	8p
7400 TTL	15p	Mintoggle SPST	80p
IN4148 Diode	4p	Wire-PVC Stranded 10m	25p
IN4001 Rec	5p	Veroboard 0·1 2·5x3·75	50p
BZY88 Zeners	12p	S-DEC Breadboard	216p

Get an ACE up your sleeve!

ELECTRO·TECH COMPONENTS LTD

315, 317, 364 EDGWARE ROAD, LONDON W2
TEL: 01-723 5667 & 01-402 5580

Shops and mail order dept (mail to 364) open 9 to 6 Mon. to Sat inc.
Prices include VAT, Carr./p. & p. quoted U.K. only

ACCESS & BARCLAY accepted. Minimum order £5 otherwise C.W.O. For credit on approved accounts invoicing costs necessitate a minimum order of £20

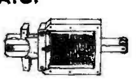
PAPST MOTORS. Noted for advanced design and superb construction. Rotating diecast outer body acts as flyweight and eliminates wow and flutter. 50 Hz capacitor start.

MODEL HSKZ 32 80-6/12 220v. Dual Speed tape deck motor 500/1000 rpm. 12mm drive shaft gives tape speeds of 9·53/19·05 cm/sec. (3¾/7½ ins/sec.) respectively. Size approx. 5½" dia × 3½" plus 1¾" spindle. £16·50, p. & p. £1·10.

MODEL RO 32 65-4 Dual voltage 125/250v. Size 2¾" × 3¼". Spindle 5/16" dia. £12·50, p. & p. £1·10.

MODEL HSZ 20 25-2. Basically 42v, but can be operated from mains with additional capacitor. A magnificent small motor. Size 1¾" × 2¾" Spindle 5/16" dia. £5·95, p. & p. 45p.

SOLENOIDS 240V A.C.



MAGNETIC DEVICES LTD. (No 1) has 20lb pull for 50% duty. 1½" travel, push or pull. Shackle both ends. Size 1¾" wide × 3¼" high × 4" long plus 3" arm travel. £6·75 plus p. & p. £1·00. (No. 2) has 2lb pull continuously rated ⅜" travel. Size 1½" × 1¼" h. × 2¼" plus travel £1·80, 30p p. & p.

PYE ETHER LTD. Thrust operates through spring loaded hinged lever giving a 1lb pull or push. Complete with mounting bracket and push-on connections. Size overall inc. bracket 2¼"w × 3"h × 3½" long. £2·25, p. & p. 45p.

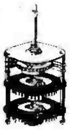
RELAYS

Octal base 2C/O 6 amp contacts. Following voltages: 6v., 12v., 230v., A.C. 12v., 24v., 48v., 110v. D.C. all £1·25 each plus base 15p postage and packing, 15p. 11-pin 3 C/O 6 amp contacts: 48v., 115v., A.C. 24v., 48v., 110v. D.C. all at £1·50 each base 15p plus 15p p. & p.

PRESSURE SWITCH

BY TEDDINGTON CONTROLS. Adjustable. 1 to 2 lbs/sq. in SPDT. Rated 15 amps. 250v. A.C. £1·95, p. & p. 25p.

ROTARY STUD SWITCH



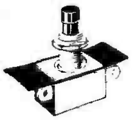
PLESSEY. 30 way, 2 bank. Single pole. Contacts 1 amp. 240v. AC/DC. 005Ω res. Make before break. Stop infinitely adjustable allowing for any desired arc of travel. Ideal for instrument and model switching. Size 2¾" dia. overall × 2½" deep plus 1¾" × ¼" dia. spindle £2·25, p. & p. 20p. 5 off £1·95 each. p. & p. 40p.

REED SWITCHES

Glass encaps N/o contacts. Glass length 1¼" dia ⅛", overall length 1½". 10 off £1·00, p. & p. 25p. 100 off £8·00, p. & p. free, 1000 off £68·00, p. & p. free.

UNI-SELECTOR

240v. AC or DC operation. Split 30-way double bank contacts. Overall size approx. 2¾" dia. × 2¼" deep. Brand new. Bargain at £4·50, p. & p. 65p.



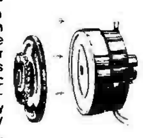
Press on/off. Single hole fixing, SP/ST. Size 1⅛ × ⅞". Stud extends ½". Rated 1 amp at 240v, 2½ amps at 125v. Price for 5 (min.qty.) £1·75, p. & p. 30p. 10 or more 30p each p. & p. 40p.

SYLVANIA SWITCH

10 for £2·50
50 for £11·00
100 for £18·00
Plus 50p p & p any quantity

Complete with magnet contacts N/C 3 amp. Vacuum sealed 1½" × ⅛" dia.

BENDIX MAGNETIC CLUTCH



Superb example of electro-mechanics. Main body in two sections, coil section fixed with ⅜" sleeve, drive section rotating on outer perimeter. United plate has ⅜" ID bearing concentric with main section and 18-tooth cog-wheel. Extremely powerful transmission. 24V DC. 240 m/a £3·75 plus p. & p. 40p.

JABSCO (ITT) ROTARY PUMP

Self-priming. Works from electric drill or suitably powered motor for ¼" drive shaft. ½" hose connections. Throughput 2/3 galls. per min. at 2400 rpm. Dozens of uses in home and workshop. Give-away at £2·75, p. & p. 20p.

NIXIE TUBES

ITT. GN4. Red-Standard numerals 0·9. Complete with ceramic base for PCB mounting. 1·08" dia × 1·38" high plus ½" base depth inc. pins. Operating voltage 170v. DC min. Complete data and connections supplied. Brand new £1·50, p. & p. 20p. 10 off £1·00 each. 100 of more 85p each, p. & p. 40p any quantity. ITT 5870S Special Offer 95p, p. & p. 20p.

MINIATURE LAMPS

A B C D E F G

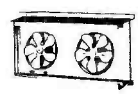
Type	Size (Dia)	Volt/Curr	Type	Size (Dia)	Volt/Curr
A	3MM	5-6V 60 MA	D	3MM	2-5V 360 MA
B	4MM	4V 250 MA			5-6 60 MA
		5V 60 MA	E	4MM	6V 200 MA
		12V 40 MA			6·3 200 MA
		12V 100 MA			14V 40 MA
		14V 75 MA	F	4MM	2·7V 60 MA
		28V 40 MA			12V 160 MA
C	5MM	28V 40 MA			14V 80 MA
G					

Small telephone jack type 6 or 24V
Price: Type A-F £4·00 for 25, 50 and upwards 13p each. Type G 45p each, p. & p. 20p per order

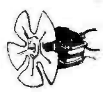
PCB EDGE CONNECTOR

CINCH 15" pitch, 27 way but designed with adjustable fixing endplates enabling connector to be cut and used in any length desired 15p, p. & p. 15p. 10 off £4·00, p. & p. 30p.

FANS



DUAL EXTRACTOR FAN. 240v, 50 Hz. Two thick stack shaded pole motors make this a highly efficient unit producing a powerful airflow. Mounted in heavy steel frame each has five element 6½" blades. Size 22½" × 14" × 5½" deep £8·95, carr. £2·75.



SINGLE FAN with motor similar to above. Very useful in home and workshop. Remember last summer. Keep cool this year. Only £3·95, p. & p. 65p.

LOUDSPEAKERS

Special offer Goodmans 12" Bass Unit. 25 watts RMS 4 ohm, normal round cone but chassis edges are cropped giving near eliptical appearance, only £9·95 ea. plus £1·00 carriage.

Goodmans 6½" heavy Ceramic magnet, rolled surround 8 ohm 15 watts a beautiful speaker £5·25 plus 20p carriage.

Goodmans 4½" mid range unit 8 ohm suitable for systems up to 70 watts £6·75 carriage 90p

Your career in Electronics?

Enrol in the BNR & E School and you'll have an entertaining and fascinating hobby. Stick with it and the opportunities and the big money await you, if qualified, in every field of Electronics today. We offer the finest home study training for all subjects in radio, television, etc., especially for the CITY AND GUILDS EXAMS (Technicians' Certificates); the Grad. Brit. I.E.R. Exam; the RADIO AMATEUR'S LICENCE; P.M.G. Certificates; the R.T.E.B. Servicing Certificates; etc. Also courses in Television; Transistors; Radar; Computers; Servo-mechanisms; Mathematics and Practical Transistor Radio course with equipment. We have OVER 20 YEARS' experience in teaching radio subjects and an unbroken record of exam successes. We are the only privately run British home study College specialising in electronics subjects only. Fullest details will be gladly sent without any obligation.

BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL, WD 11
P.O. Box 156, Jersey, Channel Islands.

NAME ______________________

ADDRESS ______________________

______________________ (Block caps please)

U.K. RETURN OF POST MAIL-ORDER SERVICE ALSO WORLD WIDE EXPORT SERVICE

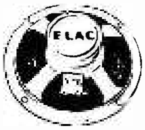
R.C.S. 100 watt MIXER/AMPLIFIER ALL VALVE CHASSIS

Four inputs. Four way mixing, master volume, treble and bass controls. Suits all speakers. This professional quality amplifier chassis is suitable for all groups, disco, P.A., where high quality power is required. 5 speaker outputs. A/C mains operated. Slave output. Produced by demand for a quality valve amplifier. Send for details.
Suitable carrying cabinet £14. Price **£94** carr. £2·50

ANOTHER R.C.S. BARGAIN !

ELAC 9 + 5in. HI-FI SPEAKER TYPE 59RM
This famous unit now available, 10 watts, 8 ohm.
Price **£3·45** Post 40p

10" ELAC HI-FI SPEAKER



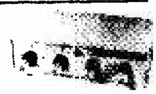
Large ceramic magnet.
Response: 50-18,000 cps.
Bass resonance 55 cps.
16 ohm impedance
10 watts. Post 40p **£4·50**

TEAK VENEER HI-FI SPEAKER CABINETS

MODEL "A". 20 × 13 × 12in. For 12in. dia. or 10in speaker. Illustrated. **14·50** Post £1·60
MODEL "B" BOOKSHELF For 13 × 8in. or 8in. speaker **£8·50** Post £1
R.C.S. BOOKSHELF CABINET Size 16in. × 6in. × 5in. approx. Response 50 to 14,000 cps. 6 watts rms. 8 ohms. **£16 pair** Post £1·30
LOUDSPEAKER CABINET WADDING 18in. wide, 20p ft.

GOODMANS CONE TWEETER

3½in. diam. 18,000 C.P.S. 25 WATTS 8 Ω **£3·25**
8in. Audax 15 watts £4·95.
5in. EMI mid range £5.
10in. 30 watt GOODMANS woofer 4 ohm £10·95.



BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt battery operated. **£6·75**
TWO CHANNEL STEREO VERSION OF ABOVE £8·50

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built with volume, treble and bass controls. 18 volt battery operated or Mains Supply £2·95. **£3·95**

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER
Suitable for cassettes, and all sizes of tape reels. A.C. mains 200/249V. Leaflet S.A.E. **£4·95** Post 40p

WAFER THIN HEATING ELEMENTS

OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size 10½ × 8½ × 1/16in. Operating voltage 200/250V. a.c. 250 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photo-copiers and print drying equipment.
Ideal for home handyman and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails—ideal for airing cupboards. Ideal for anti-frost device for the garage—preventing frozen radiators or acting as oil sump heater. Use in greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

ONLY **40p** EACH (FOUR FOR £1·50)
ALL POST PAID—Discounts for quantity.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides 6 × 4in. 70p; 8 × 6in. 90p; 10 × 7in. £1·15; 14 × 9in. £1·50. 16 × 6in. £1·45; 12 × 3in. 87p; 16 × 10in. £1·70. All boxes, many sizes in stock.

DE LUXE BSR HI-FI AUTOCHANGER

Plays 12in. 10in. or 7in. records Auto or Manual. A high quality unit backed by BSR reliability with 12 months guarantee. A.C. 200/250V. Size 13½ × 11½in.
Above motor board 3¼in.
Below motor board 2½in.
With CERAMIC STEREO/MONO CART RIDGE **£17·50**
Cueing Device, Bias Compensator, Balanced Arm, All Post 75p
GARRARD MINICHANGER. Plays All Records £9·95
BSR P128 with Ceramic Cartridge £19·50

BAKER MAJOR 12" £15·00

Post £1

90-14,500 c/s, 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s rated 25 watts. NOTE: 4 or 8 or 16 ohms must be stated.

MODULE KIT

30-17,000 c/s with tweeter, crossover, baffle 19 × 12½in. Please state 4 or 8 or 16 ohms. **£19·00** Post £1·60

BAKER SPEAKERS "BIG SOUND"

Robustly constructed to stand up to long periods of electronic power. As used by leading groups.
Useful response 30-13,000 cps.
Bass resonance 55 cps.

GROUP "25" 12in. 30 watt 4, 8 or 16 ohms. **£12·00** Post £1
GROUP "35" 12in. 40 watt 4, 8 or 16 ohms. **£14·00** Post £1
GROUP "50/12" 12in. 60 watt professional model. 4, 8 or 16 ohms. With aluminium presence dome. **£21·00** Post £1·60
GROUP "50/15" 15in. 75 watt 8 or 16 ohms. **£26·00** Post £1·60

Send for leaflets on Disco, P.A. and Group Gear.

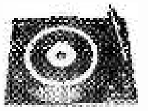
BAKER 150 WATT QUALITY TRANSISTOR MIXER/AMPLIFIER

Professional amplifier using advanced circuit design. Ideal for disco, groups, P.A. or musical instruments. 4 inputs 4 way mixing. Master treble, bass and volume controls. 3 speaker output sockets to suit various combinations of speakers. 4-8-16 ohm. Slave output. A/C mains. Guaranteed. Details S.A.E. **£72** Carr. £1·00

100 WATT DISCO AMPLIFIER

MADE BY JENNINGS MUSICAL INSTRUMENTS **£59**
4 Speaker outputs volume, treble, bass, controls
CAN BE USED AS 100 WATT SLAVE Carr. £1

B.S.R. SINGLE PLAYER DECK



3 speed. Plays all size records, Stereo Cartridge. Cueing device, Ideal Disco Deck.
£13·50 Post 75p

DRILL SPEED CONTROLLER/LIGHT DIMMER KIT. Easy to build kit. Will control up to 500 watts AC mains. Post 35p **£3·25**

STEREO PRE-AMP KIT. All parts to build this pre-amp. 3 inputs for high medium or low gain per channel, with volume control and P.C. Board. Can be ganged to make multi-way stereo mixers. Post 35p **£2·95**

P.W. SOUND TO LIGHT DISPLAY

Complete kit of parts with R.C.S. printed circuit. Three channels. 600 to 1,000 watts each.
As featured in Practical Wireless. Price **£14·00**
Cabinet extra £3.

200 Watt Rear Reflecting White Light Bulbs. Ideal for Disco Lights. Edison Screw Fitting 75p. Each.

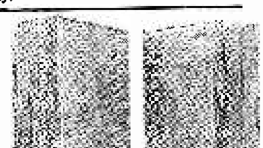
MAINS TRANSFORMERS Post 50p

6 VOLT ½ AMP. £1·00 3 AMP. £1·40
12 VOLT 300 MA. £1·00 750 MA. £1·30
30 VOLT 5 AMP. AND 34 VOLT 2 AMP. C.T. £3·45
20 VOLT 1 AMP. £2·00 3 AMP. £2·20 20-0-20 VOLT 1 AMP. £2·95
30 VOLT 1½ AMP. £2·50 40 VOLT 2 AMP. £2·95
0-20-40-60 VOLT 1 AMP. £3·50 2 × 18 VOLT 6 AMP. £11.

★★ PERIOD LOUDSPEAKER CABINETS ★★

Two styles available. Regency and Queen Anne. Size approximately 34 × 19 × 16in. Then cabinets are slightly soiled and are priced from £10 each. Callers only.

R.C.S. BOOKSHELF SPEAKERS



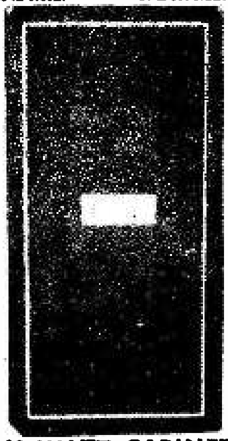
13 × 10 × 6in.
50 to 14,000 cps.
8 watts rms. 8 ohms
£16 pair Post £1·30

BAKER DISCO SPEAKERS

HIGH QUALITY—BRITISH MADE

2 x 12" CABINETS

for Disco or PA all fitted with carrying handles and corners. Black vynide covered. Other cabinets in stock. SAE for leaflet

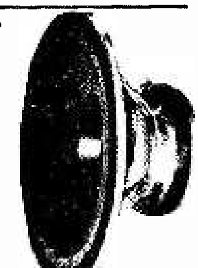


60 WATT R.M.S. **£52** Carr. £3
80 WATT R.M.S. **£56** Carr. £3
100 WATT R.M.S. **£69** Carr. £4

1 x 15" + 1 x 12" 100 WATT CABINET
Size 36" x 24" x 15" £75·00. Carr. £5
Ideal for Disco, Organ or PA work.
High quality. Full range.

"SUPERB HI-FI"

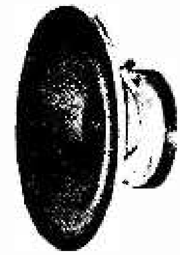
12in 25 watts



A high quality loudspeaker, its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.
Bass Resonance 25cps
Flux Density 16,500 gauss
Useful response 20-17,000cps
8 or 16 ohms models.
£22·00 Post £1·60

"AUDITORIUM"

12in. 35 watts



A full range reproducer for high power, Ideal for Hi-Fi and Discotheques. Electric Guitars, public address, multi-speaker systems, electric organs.
Bass Resonance 35cps
Flux Density 15,000 gauss
Useful response 25-16,000cps
8 or 16 ohms models.
£21·00 Post £1·60

"AUDITORIUM"

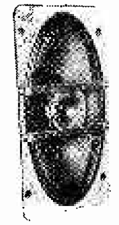
15in. 45 watts

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.
Bass Resonance 35cps
Flux Density 15,000 gauss
Useful response 20-14,000cps
8 or 16 ohms models.
£26·00 Post £1·60

Loudspeaker Cabinet Wadding 18in wide, 20p per ft.

Hi-Fi Enclosure Manual containing plans, designs, crossover data and cubic tables, 68p.

E.M.I. 13½ × 8in SPEAKER SALE!

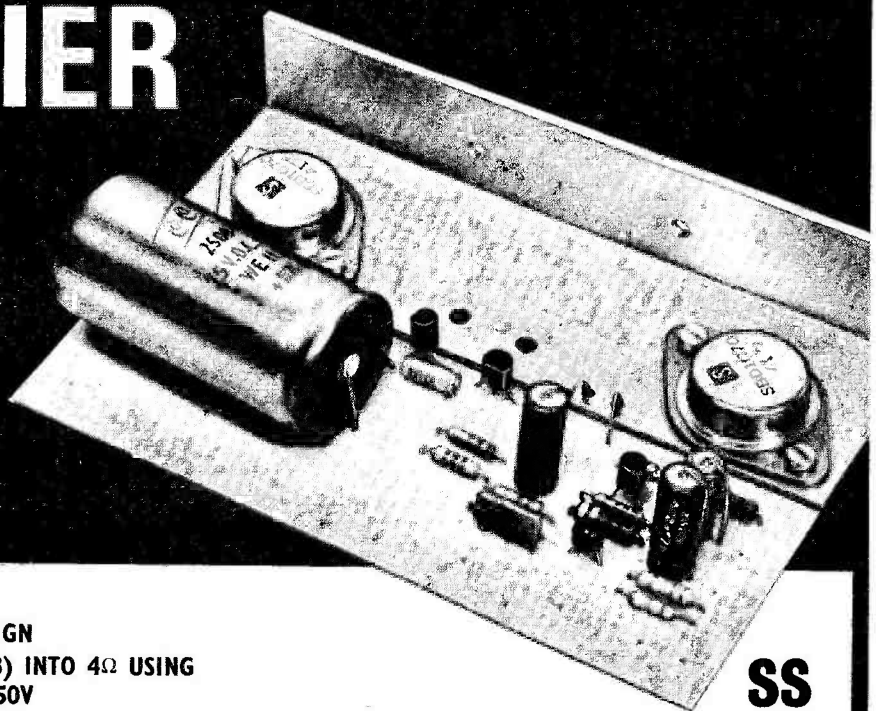


With tweeter. And crossover. 10W. State 3 or 8 ohm. **£7.95** Post 45p
15W model 8 ohms. **£10·50** Post 65p
20W model 4, 8 or 15 ohms. As illustrated. **£11.50** Post 65p

RADIO COMPONENT SPECIALISTS

337 WHITEHORSE ROAD, CROYDON
Open 9—6 Wed. 9—1 Sat. 9—5 (Closed for lunch 1.15—2.30)
Minimum post 30p. Components List 20p. Cash price includes VAT. Access & Barclay cards welcome. Rail Selhurst. Tel. 01-684 1665

A NEW 60 WATT R.M.S AMPLIFIER FROM Stirling Sound



- A COMPLETELY NEW DESIGN
- 60 WATTS R.M.S. (± 1dB) INTO 4Ω USING 50V: 35 WRMS INTO 8Ω/50V
- WILL OPERATE BETWEEN 20 & 65V SUPPLY (Output varies accordingly)
- T.H. DISTORTION BETTER THAN 0·3% (TYPICALLY—0·1%)
- FREQUENCY RANGE 10 to 50,000Hz —3dB AT 10Hz: —3dB AT 50KHz
- INPUT 350mV FOR FULL OUTPUT
- MADE IN OUR OWN FACTORY

SS 160

Another Stirling Sound Winner

Coming between SS.140 and SS.1100, the new SS.160 fills a gap in power amp modules (3 to 100 watts r.m.s.) that will particularly please those wanting a not-so-big disco or P.A. system as well as those with speakers needing plenty of power to drive them. With circuitry developed around a self-centering mid-rail, excellent results will come from using as little as 20 volts power supply. (Power output will vary accordingly). Because we use heavy duty components able to operate beyond our claimed specifications, you can buy and build with confidence. **YOUR SS.160 IS READY NOW AND WE HAVE MADE A NEW POWER SUPPLY UNIT (SS.360) SPECIALLY FOR IT.**

£8·50 INC. V.A.T. POST FREE

Multi-finned large heat sink, post free inc. V.A.T. **75p**

SPECIAL STIRLING SOUND OFFER

Bought separately SS.160 costs £8·50, SS.360 £12·75, heatsink 75p (total—£22·00). Buying all three together, inc V.A.T. it costs you only (post free) **£21·00**

And the SS.1100 money saver

SS.1100—£10·50: SS.370—£14·75: Large heat sink—£1·50 (total—£26·75). Buying all three together saves you £2·00—inc. V.A.T. (post free) **£24·75**

Use coupon for prompt delivery

THE POWER SUPPLY YOU WANT IS HERE

With 13-15 volt take-off points on all models except SS.312. *Outputs stated below are unloaded.*

SS.312	12V/1A	£6·60
SS.318	18V/1A	£6·95
SS.324	24V/1A	£7·65
SS.334	34V/2A	£8·75
SS.345	45V/2A	£10·75
SS.350	50V/2A	£11·75
SS.360	60V/2A	£12·75
SS.370	70V/2A	£14·75

SS.310/60 Stabilised power supply; 10V to 50V/2A £17·75

SS.300 Power stabilising unit 10/50V adjustable for adding to unstabilised supply units. £5·50

POWER AMPS

Outputs rated in watts, R.M.S. + or − 1dB

SS.103	3W./one I.C./mono	£2·85
SS.103-3	Stereo of above/using two I.Cs.	£5·00
SS.105	5W/3Ω/13·5V	£3·95
SS.110	10W/4Ω/24V	£4·65
SS.120	20W/4Ω/34V	£5·15
SS.125	25W/8Ω/50V	£7·25
SS.140	40W/4Ω/45V	£6·50
SS.160	60W/4Ω/50V	£8·50
SS.1100	100W/4Ω/70V	£10·50
TONE CONTROL/PRE-AMPS		
SS.100	Active st. control/bass/treble	£3·00
SS.101	Stereo Pre-amp for ceramic P.U.	£2·75
SS.102	Stereo P.A. for mag. P.U.	£4·45
UNIT ONE	Stereo P.A./Tr./Bass/Vol/Bal.	£9·00
UNIT TWO	As Unit 1 SS.101 but for mag. P.U.	£12·50
FM. STEREO DECODER		
SS.203	Phase lock loop with LED indicator	£5·25

PAY ONLY THE PRICE YOU READ

All prices quoted include V.A.T. Goods sent post free in U.K. Owing to time between sending our ad. to this journal and its appearing to the public, prices may be subject to alteration without notice. E. & O E

Stirling Sound

Dept. PW117, 37 VANGUARD WAY, SHOEBURYNESS, ESSEX
Telephone: (03708) 5543

SHOP—220-240 West Rd., Westcliff-on-Sea, Essex SS0 9DF
Telephone: Southend (0702) 351048

To Stirling Sound, 37 Vanguard Way, Shoeburyness, Essex

Please supply:..
....
....
for which I enclose £........... or by Access/Barclay Card

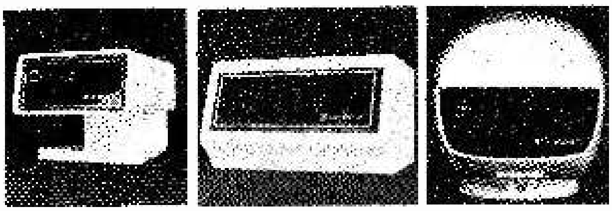
NAME ....
ADDRESS ....
....
P.W.117..

NEW FROM CASIOTRON

A new range of these superb watches, available from October. Full details and photographs are not available yet but they should knock spots off all the competition. All with at least **9 functions** including backlight plus **Stopwatch** to 13 hours. Some will have a **Dual Time Zone** feature and some a full **Chronograph** measuring lap times to **One Hundreth** of a second. Slimmer than ever, around ¼ inch thick in some cases. We will also be having a Casiotron **Alarm Watch** with five way programming of the alarm. These watches will be **all Stainless Steel** with **Mineral Glass** face and **Water Resistant** to 3 atmospheres, 100 feet. We anticipate they will have battery hatches with one battery lasting 15 months or more.

FAIRCHILD TIMEBAND MAINS DIGITAL ALARM CLOCKS

C500 (left) black or white **£14·35.** **C6110** (centre) **£15·90** **C590** (right) **£24·95**



NEW FROM IBICO. Slim 6-digit 6-function watch plus backlight and **CHRONOGRAPH.** 1/100 second to 1 hour. Lap and Net times. In the **all Stainless Steel** 402ES **Water Resistant** case. **451 ES £49·95.** On leather strap **451 ELB £48·50.**

I.C. New low cost 6-digit watch with 1/100 second stopwatch. **£32·50. Solar powered** version with Tritium "Beta Light" night light **£44·50.**

ACCURIST. New slim-line quartz analogue (stepping motor). Round face, Stainless Steel or Gold Plated on strap or matching bracelet. Luminous. R.R. Prices around £55. **CITIZEN.** Once the same Company as Seiko. Wide range of these superb quartz analogue and digitals including Solar Powered analogue. **PRICES ON APPLICATION.**

SPECIAL OFFERS. Spend over £20 on CASIO products and we give you a Brushed Chrome PAPERMATE pen worth £3·90. Casio ST-1 **£24·95.** CQ-1 **£29·95.** MQ-1 **£34·95.** Full range of Casio Scientific Calculators. Last month's prices. Gold Plated Pen & Pencil Set, or two pens, worth **£11·90** with any of these watches: Timeband TC410 **£27·95,** TC412 **£31·95.** TC413 **£28·95.** National Semiconductor DAC5 YS **£25·90,** DAC5 YB **£28·50,** DAB5 WB **£32·50,** DAB5 YB **£36·90,** IBICO 405 ILB **£26·50,** 405 IS **£27·50,** 450 HS Chronograph **£47·50,** INSTAL 2½ function LCD Gold Plated on matching bracelet **£15·50.**

Send 15p for our illustrated catalogue. Car Clock, T.V. games, etc.

Offers subject to availability. All items advertised are in stock or on order at copy date

Prices include VAT, P&P. Send cheque, P.O. or phone your credit card no. to:

TEMPUS

Dept. P.W.
19/21 Fitzroy Street
Cambridge CB1 1EH
Tel. 0223 312866

THIS is the Catalogue you need to solve your component buying problems!

- The finest components catalogue yet published.
- Over 200 A-4-size pages.
- About 5,000 items clearly listed and indexed.
- Nearly 2,000 illustrations.
- Bargain List sent free.
- At £1·40, incl. p. & p., the catalogue is a bargain.

Send the coupon below now.

HOME RADIO (Components) LTD., Dept. PW., 234-240 London Road, Mitcham, Surrey CR4 3HD

POST THIS COUPON with cheque or P.O. for £1·40

Please write your Name and Address in block capitals

NAME ....

ADDRESS ....

....

....

HOME RADIO (Components) LTD., Dept. PW., 234-240 London Road, Mitcham, Surrey CR4 3HD (Regn. No London 912966)

Sparkrite mk2

Capacitive discharge electronic ignition kit

- Smoother running
- Instant all-weather starting
- Continual peak performance
- Longer coil/battery/plug life
- Improved acceleration/top speeds
- Optimum fuel consumption

Sparkrite Mk. 2 is a high performance, high quality capacitive discharge, electronic ignition system in kit form. Tried, tested, proven, reliable and complete. It can be assembled in two or three hours and fitted in 15/30 mins.

Because of the superb design of the Sparkrite circuit it completely eliminates problems of the contact breaker. There is no misfire due to contact breaker bounce which is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R.P.M. Contact breaker burn is eliminated by reducing the current to about 1/50th of the norm. It will perform equally well with new, old, or even badly pitted points and is not dependent upon the dwell time of the contact breakers for recharging the system. Sparkrite incorporates a short circuit protected inverter which eliminates the problems of SCR lock on and, therefore, eliminates the possibility of blowing the transistors or the SCR. (Most capacitive discharge ignitions are not completely foolproof in this respect). All kits fit vehicles with coil/distributor ignition up to 8 cylinders.

THE KIT COMPRISES EVERYTHING NEEDED

Ready drilled pressed steel case coated in matt black epoxy resin, ready drilled base and heat-sink, top quality 5 year guaranteed transformer and components, cables, coil connectors, printed circuit board, nuts, bolts, silicon grease, full instructions to make the kit negative or positive earth, and 10 page installation instructions.

OPTIONAL EXTRAS

Electronic/conventional ignition switch.

Gives instant changeover from "Sparkrite" ignition to conventional ignition for performance comparisons, static timing etc., and will also switch the ignition off completely as a security device, includes: switch connectors, mounting bracket and instructions. Cables excluded. Also available RPM limiting control for dashboard mounting (fitted in case on ready built unit).

CALLERS WELCOME. For Crypton tuning and fitting service — 'phone (0922) 33008.

PRICES INCLUDE VAT, POST AND PACKING.

IMPROVE PERFORMANCE & ECONOMY NOW

Note—Vehicles with current impulse tachometers (Smiths code on dial RV1) will require a tachometer pulse slave unit. £3·35 inc. V.A.T. p & p.

E.D.A. 82 BATH STREET, WALSALL, WS1 3DE.

POST TODAY!

Quick installation No engine modification required

Electronics Design Associates, Dept., P.W.10
82 Bath Street, Walsall, WS1 3DE. Phone: (0922) 33652

Name ....

Address ....

....

	QUANTITY REQD.
Mk. 2 DIY Ass. Kit @ £11.80	
Mk. 2 Ready Built Negative Earth @ £14.97	
Mk. 2 Ready Built Positive Earth @ £14.97	
Ignition Changeover switches @ £4.30	
R.P.M. Limit systems in above units @ £2.42	

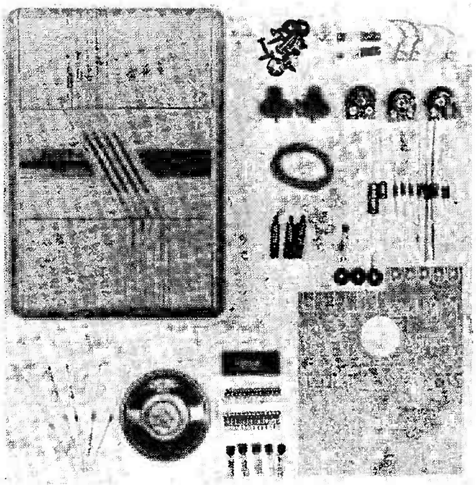
I enclose cheque/PO's for £ ....

Cheque No. ....

Send SAE if brochure only required.

Build a microprocessor electronic musical door chime which can play 24 different tunes!

A complete Chroma-Chime *Kit for only £18 inc. p.&p. & VAT.*



* *A great introduction to the fascinating world of microcomputers.*
* *Save pounds on normal retail price by building yourself.*

Plays:

Greensleeves	Cook House Door
God Save the Queen	The Stars & Stripes*
Rule Britannia*	Beethoven's Ode to Joy
Land of Hope and Glory	William Tell Overture
Oh Come All Ye Faithful	Soldier's Chorus
Oranges and Lemons	Twinkle, Twinkle Little Star
Westminster Chimes*	Great Gate of Kiev
Sailor's Hornpipe	Maryland
Beethoven's "Fate Knocking"	Deutschland uber Alles
The Marseillaise	Bach
Mozart	Colonel Bogie
Wedding March	The Loraline

*These tunes play longer if the push button is kept pressed.

* Handsome purpose built ABS cabinet
* Easy to build and install
* Uses Texas Instruments TMS1000 microcomputer
* Absolutely all parts supplied including I.C. socket
* Ready drilled and legended PCB included
* Comprehensive kit manual with full circuit details
* No previous microcomputer experience necessary
* All programming permanently retained is on chip ROM
* Can be built in about 3 hours!
* Runs off 2 PP3 type batteries.
* Fully Guaranteed

The Chroma-Chime is the world's first electronic musical door chime which uses a pre-programmed microcomputer chip to generate tunes. Instead of boring old buzzes, dings or dongs, the Chroma-Chime will play one of its 24 well known tunes from its memory using its tiny 'brain' to all the music synthesizing! Since everything is done by precise mathematics, it cannot play the notes out of tune.

The unit has comprehensive built-in controls so that you can not only select the 'tune of the day' but the volume, tempo and envelope decay rate to change the sound according to taste.

Not only visitors to the front door will be amazed, if you like you can connect an additional push button for a back door which plays a different tune!

This kit has been carefully prepared so that practically anyone capable of neat soldering will have complete success in building it. The kit manual contains step by step constructional details together with a fault finding guide, circuit description, installation details and operational instructions all well illustrated with numerous figures and diagrams.

To CHROMATRONICS, River Way, Harlow, Essex, U.K.

Please send ☐ Chroma-Chime Kits at £18·00 each including VAT and post and packing

PLEASE USE BLOCK CAPITALS

Name ____________________

Address ____________________

____

____

I enclose cheque/PO value £ ____________________
or debit my ACCESS/BARCLAYCARD account No.

Signature ____________________

N.B. The CHROMA-CHIME is also available, fully assembled, price £24·95 inc VAT and post and packing.

Please allow 7-21 days for delivery.

The CHROMA-CHIME is exclusively designed by

CHROMATRONICS

River Way, Harlow, Essex.

THE 'NUTS & BOLTS' OF THOSE PROJECTS

TRANSFORMERS

MINIATURE MAINS Primary 240V
with two independent secondary windings

No.	Type	Price
2024	MT280 0–6V, 0–6V RMS	£1·30*
2025	MT150 0–12V, 0–12V RMS	£1·30*

MINIATURE MAINS Primary 240V

No.	Secondary	Price
2021	6V–0–6V 100mA	90p*
2022	9V–0–9V 100mA	90p*
2023	12V–0–12V 100mA	95p*

1 AMP MAINS Primary 240 V

No.	Secondary	Price	
2026	6V–0–6V 1 amp	£2·70*	P. & P. 30p
2027	9V–0–9V 1 amp	£2·20*	P. & P. 30p
2028	12V–0–12V 1 amp	£2·60*	P. & P. 30p
2029	15V–0–15V 1 amp	£2·75*	P. & P. 30p
2030	30V–0–30V 1 amp	£3·45*	P. & P. 30p

STANDARD MAINS Primary 240V
Multi-tapped secondary mains transformers available in ½ amp, 1 amp and 2 amp current rating. Secondary taps are 0–19–25–33–40–50V.

Voltages available by use of taps:
4, 7, 8, 10, 14, 15, 17, 19, 25, 31, 33, 40, 50, 25–0–25 V.

No.	Rating	Price	
2031	½ amp	£3·42*	P. & P. 30p
2032	1 amp	£4·40*	P. & P. 50p
2033	2 amp	£5·45*	P. & P. 85p

AUDIO LEADS

S127	5 pin DIN plug to 4 phono plugs length 1·5m	£1·30*
S128	5 pin DIN plug to 5 pin DIN socket length 1·5m	£1·05*
S129	5 pin DIN plug to 5 pin DIN plug mirror image length 1·5m	£1·05*
S130	2 pin DIN plug to 2 pin DIN socket length 5m	68p*
S131	5 pin DIN plug to 3 pin DIN plug 1 & 4 and 3 & 5 length 1·5m	83p*
S132	2 pin DIN plug to 2 pin DIN socket length 10m	98p*
S133	5 pin DIN plug to 2 phone plugs connected to pins 3 & 5 length 1·5m	75p*
S134	5 pin DIN plug to 2 phono sockets connected to pins 3 & 5 length 23cm	68p*
S135	5 pin DIN socket to 2 phono plugs connected to pin 3 & 5 length 23cm	68p*
S136	Coiled stereo headphones extension cord extends to 7m	£1·75*
S124	3 pin DIN plug to 3 pin DIN plug length 1·5m	75p*
S125	5 in DIN plug to 5 pin DIN plug length 1·5m	75p*
S113	3·5mm Jack to 3·5mm Jack length 1·5m	75p*
S114	5 pin DIN plug to 3·5mm Jack connected to pins 3 & 5 length 1·5m	85p*
S115	5 pin DIN plug to 3·5 Jack connected to pins 1 & 4 length 1·5m	85p*

G.P. SWITCHING TRANS.

TO18 SIM. TO 2N706/8

BSY27/28/95A. All usable devices. No open and shorts.

ALSO AVAILABLE IN PNP similar to 2N2906. BCY 70.
20 for 50p, 50 for £1, 100 for £1·80, 500 for £8, 1,000 for £14.

When ordering please state NPN or PNP

SIL G.P. DIODES

300 mW 40 PIV (min) SUB-MIN
FULLY TESTED
Ideal for Organ builders
30 for 50p, 100 for £1·50, 500 for £5, 1,000 for £9

L.E.D.s

Type	Size	Order No.	Colour	Price
TIL209	0·125in	1501	RED	12p
TIL211	0·125in	1502	GREEN	25p
TIL213	0·125in	1503	YELLOW	25p
FLV115	0·2in	1504	RED	12p
FLV310	0·2in	1505	GREEN	25p
FLV410	0·2in	1506	YELLOW	25p

2nd Grade L.E.D.s

A pack of standard sizes and colours which fail to perform to their very ridged specification, but which are ideal for experiments.
Order No. 1507 £0·90

L.E.D. CLIPS

	Size	Order No.	Price
Pack of 5	0·125in	1508/0·125	15p
Pack of 5	0·2in	1508/0·2	18p

NUTS AND BOLTS

BA BOLTS—packs of BA threaded cadmium-plated screws, slotted cheese head.

Supplied in multiples of 100

Type	No.	Price	Type	No.	Price
1in 0BA	839	£1·50	1in 4BA	845	£0·51
½in 0BA	840	£0·83	½in 4BA	846	£0·38
1in 2BA	842	£0·69	¼in 4BA	847	£0·33
½in 2BA	843	£0·54	1in 6BA	848	£0·50
¼in 2BA	844	£0·63	½in 6BA	849	£0·30
			¼in 6BA	850	£0·33

BA NUTS—packs of cadmium-plated full nuts in multiples of 100

Type	No.	Price	Type	No.	Price
0BA	855	£0·90	4BA	857	£0·42
2BA	856	£0·60	6BA	858	£0·36

BA WASHERS—flat cadmium plated plain stamped washers supplied in multiples of 100

Type	No.	Price	Type	No.	Price
0BA	859	£0·20	4BA	861	£0·15
2BA	860	£0·15	6BA	862	£0·12

SOLDER TAGS—hot tinned supplied in multiples of 100

Type	No.	Price	Type	No.	Price
0BA	851	£0·42	4BA	853	£0·30
2BA	852	£0·36	6BA	854	£0·30

CASES

INSTRUMENT CASES. In two sections vinyl covered top and sides, aluminium bottom, front and back.

No.	Length	Width	Height	Price
155	8in	5¼in	2in	£1·40*
156	11in	6in	3in	£1·80*
157	6in	4¾in	1¾in	£1·25*
158	6in	5¼in	2½in	£1·60*

ALUMINIUM BOXES. Made from bright ali., folded construction each box complete with half inch deep lid and screws.

No.	Length	Width	Height	Price
159	5¼in	2¼in	1½in	62p*
160	4in	4in	1½in	62p*
161	4in	2¼in	1½in	62p*
162	5¼in	4in	1½in	74p*
163	4in	2½in	2in	64p*
164	3in	2in	1in	44p*
165	7in	5in	2½in	£1·04*
166	8in	6in	3in	£1·32*
167	6in	4in	2in	86p*

BRIDGE RECTIFIERS

SILICON 1 amp

Type	Order No.	Price
50V RMS	BR1/50	£0·28
100V RMS	BR1/100	£0·30
200V RMS	BR1/200	£0·32
400V RMS	BR1/400	£0·36

SILICON 2 amp

50V RMS	BR2/50	£0·45
100V RMS	BR2/100	£0·48
200V RMS	BR2/200	£0·52
400V RMS	BR2/400	£0·58
1000V RMS	BR2/1000	£0·68

FUSE HOLDERS AND FUSES

Description	Order No.	Price
20mm × 5mm chassis mounting	506	£0·07*
1¼in × ¼in chassis mounting	507	£0·12*
1¼in car inline type	508	£0·15*
Panel mounting 20mm	509	£0·20
Panel mounting 1¼in	510	£0·30

QUICK BLOW 20mm

Type	No.	Type	No.	Type	No.
150mA	611	1A	615	3A	619
250mA	612	1·5A	616	4A	620
550mA	613	2A	617	5A	621
800mA	614	2·5A	618		

All 5p each

ANTI-SURGE 20mm

Type	No.	Type	No.	Type	No.
100mA	622	1A	625	2·5A	628
250mA	623	2A	626	3·15A	629
500mA	624	1·6A	627	5A	630

All 7p each

QUICK BLOW 1¼in

Type	No.	Type	No.	Type	No.
250mA	631	500mA	632	800mA	634

All 7p each

Type	No.	Type	No.	Type	No.
1A	635	2·5A	638	4A	641
1·6A	636	3A	639	5A	642
2A	637				

All 6p each

SWITCHES

Description	No.	Price
DPDT miniature slide	1973	£0·10*
DPDT standard slide	1974	£0·12*
Toggle switch SPST 1½ amp 250V a.c.	1975	£0·33*
Toggle switch DPDT 1 amp 250V a.c.	1976	£0·36*
Rotary on-off mains switch	1977	£0·42*
Push switch—Push to make	1978	£0·13*
Push switch—Push to break	1979	£0·18*

ROCKER SWITCH
A range of rocker switches SPST—moulded in high insulation. Material available in a choice of colours, ideal for small apparatus

Colour	No.	Price
RED	1980	£0·22*
BLACK	1981	£0·22*
WHITE	1982	£0·22*
BLUE	1983	£0·22*
YELLOW	1984	£0·22*
LUMINOUS	1985	£0·22*

Description	No.	Price
Miniature SPST toggle, 2 amp 250V a.c.	1958	£0·50*
Miniature SPST toggle, 2 amp 250V a.c.	1959	£0·55*
Miniature DPDT toggle, 2 amp 250V a.c.	1960	£0·65*
Miniature DPDT toggle, centre off, 2 amp 250V a.c.	1961	£0·85*
Push button SPST, 2 amp 250V a.c.	1962	£0·65*
Push button SPST, 2 amp 250V a.c.	1963	£0·68*
Push button DPDT, 2 amp 250V a.c.	1964	£0·80*

MIDGET WAFER SWITCHES
Single-bank wafer type—suitable for switching at 250V a.c. 100mA or 150V d.c. in non-reactiver loads make-before-break contacts. These switches have a spindle 0·25in dia. and 30° indexing.

Description	Order No.	Price
1 pole 12 way	1965	£0·48*
2 pole 6 way	1966	£0·48*
3 pole 4 way	1967	£0·48*
4 pole 3 way	1968	£0·48*

MICRO SWITCHES	Order No.	Price
Plastic button gives simple on-off action Rating 10 amp 250V a.c.	1969	£0·20
Button gives 1 pole change over action Rating 10 amp 250V a.c.	1970	£0·25

DISPLAYS

Type	Order No.	Price
BDL707 0·3in single	1510	£0·80
BDL747 0·6in single	1511	£1·50
BDL727 0·5in double	1512	£1·80

COLD CATHODE ITT 5087 ST
side viewing indicator tubes. Displays 0–9 and decimal points. Wide viewing angle—operates from 180V with 16k Ω series anode resistors—character height 16·5mm pin connections supplied.
Order no. 1513 Price £0·60

VOLTAGE REGULATORS

Positive Regulators TO220 case

MVR 7805	5V	£1·25	MVR 7815	15V	£1·25
MVR 7812	12V	£1·25	MVR 7824	24V	£1·25

Negative Regulators TO220 case

MVR 7905	5V	£1·85	MVR 7915	15V	£1·85
MVR 7912	12V	£1·85	MVR 7924	24V	£1·85

ORDERING

PLEASE WORD YOUR ORDERS EXACTLY AS PRINTED, NOT FORGETTING TO INCLUDE OUR PART NUMBER.

VAT

ADD 12½% TO PRICES MARKED*. ADD 8% TO OTHERS EXCEPTING THOSE MARKED†. THESE ARE ZERO RATED

POSTAGE & PACKING

Add 25p for postage and packing unless otherwise shown. Add extra for airmail. Min. order £1.

Just a selection from our huge stocks!

SEE OUR 1977 CATALOGUE

126 pages packed with valuable information

ORDER NOW
ONLY 50p
plus 15p p. & p.

BI-PAK

Dept. P.W.11, P.O. Box 6, Ware, Herts

COMPONENTS SHOP:
18 BALDOCK STREET, WARE, HERTS.

SEMICONDUCTORS—COMPONENTS

BABANI BOOK OFFER

Purchase books to the value of £5·00 from the list below and choose any 60p pak from this page FREE.

BP2	Handbook of Radio, TV & Industrial & Transmitting Tube & Valve Equivalents	60p
BP3	Handbook of Tested Transistor Circuits	40p
BP6	Engineers and Machinists Reference Tables	40p
BP7	Radio & Electronic Colour Codes and Data Chart	15p
BP10	Modern Crystal and Transistor Set Circuits for Beginners	35p
BP14	Second Book of Transistor Equivalents	95p
BP15	Constructors Manual of Electronic Circuits for the Home	50p
BP16	Handbook of Electronic Circuits for the Amateur Photographer	60p
BP18	Boys and Beginners Book of Practical Radio and Electronics	60p
BP22	79 Electronic Novelty Circuits	75p
BP23	First Book of Practical Electronic Projects	75p
BP24	52 Projects Using IC741 (or equivalents)	75p
BP26	Radio Antenna Handbook for Long Distance Reception and Transmission	85p
BP27	Giant Chart of Radio Electronic Semiconductor and Logic Symbols	60p
BP29	Major Solid State Audio Hi-Fi Construction Projects	85p
BP32	How to Build Your Own Metal & Treasure Locators	85p
BP34	Practical Repair & Renovation of Colour TVs	95p
BP35	Handbook of IC Audio Preamplifier & Power Amplifier Construction	95p
BP36	50 Circuits Using Germanium, Silicon & Zener Diodes	75p
BP37	50 Projects Using Relays, SCR's and TRIACS	1·10
BP39	50 (FET) Field Effect Transistor Projects	1·25
129	Universal Gram-motor Speed Indicator	8p
160	Coil Design and Construction Manual	50p
161	Radio, TV and Electronics Data Book	60p
196	AF-RF Reactance—Frequency Chart for Constructors	15p
202	Handbook of Integrated Circuits (ICs) Equivalents and Substitutes	75p
205	First Book of Hi-Fi Loudspeaker Enclosures	60p
213	Electronic Circuits for Model Railways	85p
214	Audio Enthusiasts Handbook	85p
216	Electronic Gadgets and Games	85p
217	Solid State Power Supply Handbook	85p
219	Solid State Novelty Projects	85p
220	Build Your Own Solid State Hi-Fi and Audio Accessories	85p
222	Sold State Short Wave Receivers for Beginners	95p
223	50 Projects Using IC CA3130	95p
224	50 CMOS IC Projects	95p
225	A Practical Introduction to Digital IC's	95p
226	How to Build Advanced Short Wave Receivers	1·20
RCC	Resistor Colour Code Disc Calculator	10p

THYRISTORS

600mA TO18 CASE

Volts	No.	Price
10	THY600/10	£0·15
20	THY600/20	£0·16
30	THY600/30	£0·20
50	THY600/50	£0·22
100	THY600/100	£0·25
200	THY600/200	£0·38
400	THY600/400	£0·44

1 AMP TO5 CASE

Volts	No.	Price
50	THY1A/50	£0·26
100	THY1A/100	£0·28
200	THY1A/200	£0·32
400	THY1A/400	£0·38
600	THY1A/600	£0·45
800	THY1A/800	£0·58

3 AMP TO66 CASE

Volts	No.	Price
50	THY3A/50	£0·28
100	THY3A/100	£0·30
200	THY3A/200	£0·33
400	THY3A/400	£0·42
600	THY3A/600	£0·50
800	THY3A/800	£0·65

5 AMP TO66 CASE

Volts	No.	Price
50	THY5A/50	£0·36
100	THY5A/100	£0·46
200	THY5A/200	£0·50
400	THY5A/400	£0·57
600	THY5A/600	£0·69
800	THY5A/800	£0·81

5 AMP TO220 CASE

Volts	No.	Price
400	THY5A/400P	£0·57
600	THY5A/600P	£0·69
800	THY5A/800P	£0·81

7 AMP TO48 CASE

Volts	No.	Price
50	THY7A/50	£0·48
100	THY7A/100	£0·51
200	THY7A/200	£0·57
400	THY7A/400	£0·62
600	THY7A/600	£0·76
800	THY7A/800	£0·92

10 AMP TO48 CASE

Volts	No.	Price
50	THY10A/50	£0·51
100	THY10A/100	£0·57
200	THY10A/200	£0·62
400	THY10A/400	£0·71
600	THY10A/600	£0·99
800	THY10A/800	£1·22

16 AMP TO48 CASE

Volts	No.	Price
50	THY16A/50	£0·54
100	THY16A/100	£0·58
200	THY16A/200	£0·62
400	THY16A/400	£0·77
600	THY16A/600	£0·90
800	THY16A/800	£1·38

30 AMP TO94 CASE

Volts	No.	Price
50	THY30A/50	£1·18
100	THY30A/100	£1·43
200	THY30A/200	£1·63
400	THY30A/400	£1·79
600	THY30A/600	£3·50

No.	Price
BT101/500R	£0·80
BT102/500R	£0·80
BT106	£1·25
BT107	£0·93
BT108	£0·98
2N3228	£0·70
2N3525	£0·77
BTX30/50L	£0·33
BTX30/400L	£0·46
C106/4	£0·60

ORDERING

PLEASE WORD YOUR ORDERS EXACTLY AS PRINTED, NOT FORGETTING TO INCLUDE OUR PART NUMBER

VAT

ADD 12½% TO PRICES MARKED *. ADD 8% TO OTHERS EXCEPTING THOSE MARKED †. THESE ARE ZERO RATED

POSTAGE AND PACKING

Add 25p for postage and packing unless otherwise shown. Add extra for airmail. Min. order £1.

SUPER UNTESTED PAKS

Pak No.	Qty.		Order No.	Price
U50	100	Germ. gold bonded OA47 diode	16130	£0·60
U51	150	Germ. OA70/81 diode	16131	£0·60
U52	100	Silicon diodes 200mA OA200	16132	£0·60
U53	150	Diodes 75mA 1N4148	16133	£0·60
U54	50	Sil rect top hat 750mA	16134	£0·60
U55	20	Sil rect stud type 3 amp	16135	£0·60
U56	50	400mW zeners DO7 case	16136	£0·60
U57	30	NPN trans BC107/8 plastic	16137	*£0·60
U58	30	PNP trans BC177/178 plastic	16138	*£0·60
U59	25	NPN TO39 2N697/2N1711 silicon	16139	£0·60
U60	25	PNP TO59 2N2905 silicon	16140	£0·60
U61	30	NPN TO18 2N706 silicon	16141	£0·60
U62	25	NPN BFY50/51	16142	£0·60
U63	30	NPN plastic 2N3906 silicon	16143	*£0·60
U64	30	PNP plastic 2N3905 silicon	16144	*£0·60
U65	30	Germ. 0071 PNP	16145	£0·60
U66	15	Plastic power 2N3055 NPN	16146	£1·20
U67	10	TO3 metal 2N3055 NPN	16147	£1·20
U68	20	Unijunction trans TIS43	16148	£0·60
U69	10	1 amp SCR TO39	16149	£1·20
U70	8	3 amp SCR TO66 case	16150	£1·20

Code Nos. mentioned above are given as a guide to the type of device in the pak. The devices themselves are normally unmarked.

COMPONENT PAKS

Pak No.	Qty.		Order No.	Price
C1	200	Resistor mixed value approx. (count by weight)	16164	*£0·60
C2	150	Capacitors mixed value approx. (count by weight)	16165	*£0·60
C3	50	Precision resistors. Mixed values	16166	£0·60
C4	80	⅛W resistors mixed preferred values	16167	*£0·60
C5	5	Pieces assorted ferrite rods	16168	*£0·60
C6	2	Tuning gangs. MW/1W VHF	16169	*£0·60
C7	1	Pack wire 50 metres assorted colours single strand	16170	£0·60
C8	10	Reed switches	16171	*£0·60
C9	3	Micro switches	16172	*£0·60
C10	15	Assorted pots	16173	*£0·60
C11	5	Metal jack sockets 3 × 3·5mm 2 × standard switch types	16174	*£0·60
C12	30	Paper condensers preferred types mixed values	16175	*£0·60
C13	20	Electrolytics trans. types	16176	*£0·60
C14	1	Pak assorted hardware—nuts/bolts, gromets, etc.	16177	£0·60
C15	5	Mains slide switches ass.	16178	*£0·60
C16	20	Assorted tag strips and panels	16179	£0·60
C17	15	Assorted control knobs	16180	*£0·60
C18	4	Rotary wave change switches	16181	*£0·60
C19	2	Relays 6–24V operating	16182	*£0·60
C20	1	Pak, copper laminate approx. 200 sq. in	16183	£0·60
C21	15	Assorted fuses 100mA–5 amp	16184	£0·60
C22	50	Metres PVC sleeving assorted size and colour	16185	£0·60
C23	60	¼ watt resistors mixed preferred values	16188	*£0·60
C24	25	Presets assorted type and value	16186	*£0·60
C25	30	Metres stranded wire assorted colours	16187	£0·60

SLIDER PAKS

Pak No.	Qty.		Order No.	Price
S1	6	Slider potentiometers mixed values	16190	*£0·60
S2	6	Slider potentiometers, all 470 ohms	16191	*£0·60
S3	6	Slider potentiometers, all 10kΩ lin	16192	*£0·60
S4	6	Slider potentiometers, all 22kΩ lin	16193	*£0·60
S5	6	Slider potentiometers, all 47kΩ lin	16194	*£0·60
S6	6	Slider potentiometers, all 47kΩ log	16195	*£0·60

CERAMIC PAK

Containing a range of first quality miniature ceramic capacitors Unrepeatable value.

Pak No.	Qty.		Order No.	Price
MC1	24	miniature ceramic capacitors, 3 of each value—22pF, 27pF, 33pF, 39pF, 47pF, 68pF and 82pF	16160	*£0·60
MC2	24	miniature ceramic capacitors, 3 of each value—100pF, 120pF, 150pF, 180pF, 120pF, 270pF, 330pF and 390pF	16161	*£0·60
MC3	24	miniature ceramic capacitors, 3 of each value—470pF, 560pF, 680pF, 820pF, 1,000pF, 1,500pF, 2,200pF and 3,300pF	16162	*£0·60
MC4	21	miniature ceramic capacitors, 3 or each value—4,700pF, 6,800pF, 0·01µF, 0·015µF, 0·022µF, 0·033µF and 0·047µF	16163	*£0·60

Just a selection from our huge stocks!

SEE OUR 1977 CATALOGUE

126 pages packed with valuable information

ORDER NOW ONLY 50p

plus 15p p. & p.

LINEAR PAKS

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

U721—30 Assorted Linear Types 709, 741, 747, 748, 710, 588, etc.
ORDER No. 16227 *£1·50

U76SD FM STEREO DECODER
5 ICs 76110 equivalent to MC1310P–MA767
Data supplied with pak.
ORDER No. 16229 *£1·50

U76A AUDIO POWER OUTPUT AMPLIFIERS
8 assorted types. SL403. 76013, 76003, etc.
Data supplied with pak.
ORDER No. 16228 *£1·00

74 SERIES PAKS

Manufacturer's "Fall outs" which include Functional and part-Functional Units. These are classed as "out-of-spec" from the maker's very rigid specifications, but are ideal for learning about ICs and experimental work.

74G—100 Gates assorted 7400-01-04-10-50-60, etc.
ORDER No. 16224 £1·20

74F—50 Flip-Flops assorted 7470-72-73-74-76-104-109, etc.
ORDER No. 16225 £1·20

74M—30 MSI. Assorted Types. 7441-47-90-154, etc.
ORDER No. 16226 £1·20

VEROBOARDS PAKS

VB1—Approx. 30sq. in various sizes. All 0·1in matrix.
ORDER No. 16199 60p

VB2—Approx. 30sq. in various sizes. 0·15in matrix.
ORDER No. 16200 60p

ELECTROLYTIC PAKS

A range of paks each containing 18 first quality, mixed value miniature electrolytics.

EC1—Values from 0.47mF to 10mF.
ORDER No. 16201 *60p

EC2—Values from 10mF to 100mF.
ORDER No. 16202 *60p

EC3—Values from 100mF to 680mF.
ORDER No. 16203 *60p

C280 CAPACITOR PAK

75 Mullard C280 capacitors, mixed values ranging from 0·01µF to 2·2µF complete with identification sheet.
ORDER No. 16204 *£1·20

CARBON RESISTOR PAKS

These paks contain a range of Carbon Resistors, assorted into the following groups:

R1—60 mixed ⅛W 100–820 ohms.
ORDER No. 16213 *60p

R2—60 mixed ⅛W 1–8·2kΩ.
ORDER No. 16214 *60p

R3—60 mixed ⅛W 10–82kΩ.
ORDER No. 16215 *60p

R4—60 mixed ⅛W 100–820kΩ.
ORDER No. 16216 *60p

R5—40 mixed ½W 100–820Ω.
ORDER No. 16217 *60p

R6—40 mixed ½W 1–8·2kΩ.
ORDER No. 16218 *60p

R7—40 mixed ½W 10–82kΩ.
ORDER No. 16219 *60p

R8—40 mixed ½W 100–820kΩ.
ORDER No. 16220 *60p

R9—60 mixed ⅛W 1–10MΩ.
ORDER No. 16230 *60p

R10—40 mixed ½W 1–10MΩ.
ORDER No. 16231 *60p

WORLD SCOOP!

JUMBO SEMICONDUCTOR PAK

Transistors, Germ: and Silicon Rectifiers, Diodes, Triacs, Thyristors, ICs and Zeners.

ALL NEW AND CODED

Approx. 100 pieces. Offering the amateur a fantastic bargain PAK and an enormous saving—identification and data sheet in every pak.

ORDER No. 16222 £2·25

BI-PAK

Dept. P.W.11, P.O., Box 6, Ware, Herts

SHOP AT: 18 BALDOCK STREET, WARE, HERTS
OPEN 9 to 5.30 Mon./Sat.

EDITOR
G. C. Arnold

ASSISTANT EDITOR
Eric Dowdeswell G4AR

ART EDITOR
Peter Metalli

TECHNICAL EDITOR
Ted Parratt, BA

NEWS & PRODUCTION EDITOR
Bill Tull

TECHNICAL ARTIST
Alan Martin

TECHNICAL SUB-EDITOR
Frank Ogden

SECRETARIAL
01-634 4292 Linda Walji
Belinda Mould

ADVERTISING MANAGER
01-634 4612 Roy Smith

CLASSIFIED ADVERTISING
01-261 5762 Colin R. Brown

BINDERS

Binders, for either the old or the new format, are £2·85 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.

Perseverance

AWAY from any technicalities this month. Just the story of a PW reader's perseverance. Charlie M. is nearly 78. He was a Marconi marine operator in World War 1 and in his latter years has long cherished the idea of joining the radio amateur fraternity and talking to other folk around the world. He'd done all the swotting but a couple of problems confronted him. His wife is a chronic invalid requiring constant attention, and they live in a remote part of Wales, with but one equally lonely neighbour. How could he leave his wife and go anywhere to take the RAE and the code test?

Following up a couple of suggestions Charlie was able to get the nearest technical college, some 20 miles away, to make the necessary arrangements for him to sit the exam last May. His sole neighbour came round for a few hours and off went Charlie to college, the only candidate! The result? A "distinction" in Part 1 of the paper and a "credit" in Part 2. So far, so good, but taking the code test wasn't quite so simple!

A trip to the nearest testing centre would have meant too long away from home and his wife. He contacted the centre, at Cardiff, and eventually the Marine Radio Surveyor there telephoned Charlie to say that he would call round the next time he was in the area on duty. Eventually he turned up and "they did the necessary test on the kitchen table" A few days later a "pass" certificate arrived. Charlie writes "prompt and willing service like this, in these days of 'couldn't care less' is really most heart-warming".

A lovely story, isn't it? A GW4 call ought to be on its way very soon. Another not-so-young amateur has loaned Charlie an AR88 receiver plus a 50 watt transmitter so at long last a dream is about to be fulfilled. Charlie has been reading PW since 1952, "a valuable wireless encyclopaedia that I wouldn't part with for all the tea in China". With the present price of tea, that values PW very highly indeed!

Due to increased production costs, the cover price of your copy of *Practical Wireless* has been increased to 45p. The price for new binders has also been increased, as from the 1st October to £2·85. These price increases have been approved by the Price Commission.

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.

A Century of Recorded Sound

As previewed in the September issue of PW, the City of London Phonograph and Gramophone Society recently held an exhibition of early reproducers and associated items at the British Institute of Recorded Sound, Exhibition Rd., Kensington, which celebrated one hundred years of recorded sound.

1877 was in fact a year of universal significance for the sound recording industry, seeing the parallel but independent emergence of two versions of a world-shattering device—the sound reproducer, or "talking machine". Charles Cros in France and Thomas Edison in the United States had almost simultaneously arrived at the same answer to an interesting problem, and while Edison's was a practical working model, the Cros version although restricted to a set of detailed plans, was every bit as brilliantly conceived. It was largely lack of funds and his failure to convince a prospective backer which prevented Cros from seeing his machine emerge as a reality.

Edison v Cros

The exhibition itself naturally displayed an emphasis upon Edison's machines, although Cros was in a sense acknowledged by the inclusion of an Emile Berliner hand-cranked gramophone; it was Berliner who had eventually developed the reality from the plans Cros had deposited at the Academie Francaise in April 1877.

Whatever the arguments about origins, however, a stroll around this display evoked an atmosphere of warm, pre-electric nostalgia. Delicate cylinder phonographs rubbed shoulders with bluff, aristocratic console gramophones in select veneers. Splendid wooden horns balanced at the end of strange foil contraptions with worm gear drives and irresistible cranking handles peered out at an utterly changed world.

Surprisingly, in spite of their great age, most of the machines on view were still playable, in fact, at the height of its popularity, the gramophone was capable of very good reproduction, even though little scientific investigation of basic principles had accompanied its development. The HMV "Re-entrant" model (console gramophone of about 1930) proved very pleasant to listen to in spite of a relatively narrow audio range.

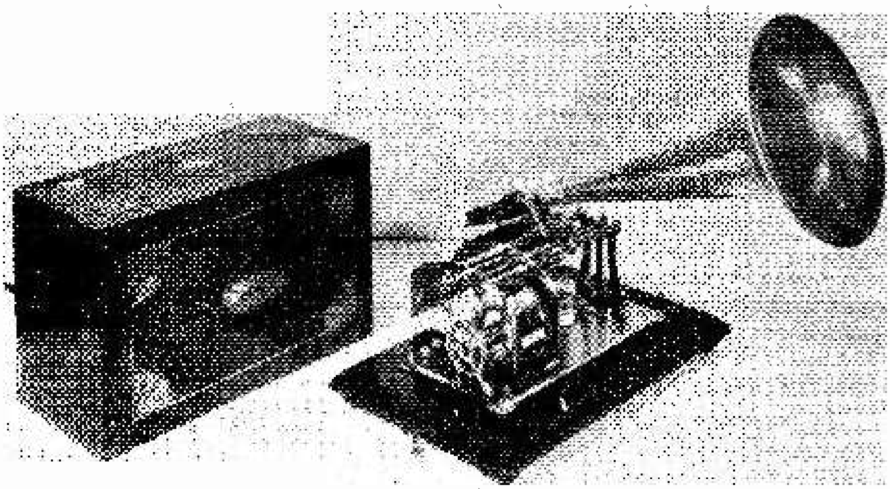
Perhaps a good deal of the interest evident at the exhibition may be dismissed as pure sentimentality, for the machines are somewhat crude by modern standards, but they do represent the beginnings of an immense extension of the range of human experience, and as such they will remain vital informational pieces of equipment. They are additionally interesting as a group of acoustic dinosaurs—they represent the visible and audible end of an era, their electrical counterparts proving unequally effective and competitive in the ensuing conflict.

On the other hand, they had, and still retain, real beauty; a combination of satisfying mechanical symmetry and the atavistic flesh-and-blood appeal of real wood, the voices of Melba and Caruso, and above all, an aura of magic and mystery which characterised an age of real discovery.

Past successes

In terms of the eventual establishment of enterprise in the reproducer field, there was plenty of evidence of the developing "names" in audio devices. Thorens, for example, now heavily committed to quality hi-fi, were represented by an early piece of acoustic precision engineering in the shape of a particularly attractive motor design for a phonograph.

The chronological span of the exhibition was not restricted to the purely acoustic devices, and a selection of early "radio-gramophones" and electrically operated record players was in evidence, including the well-known Decca "Deccalian" with interchangeable heads for 78 or LP. Long-playing records were the "coming thing" in the fifties, and also included in the display was a range of earlier attempts to produce longer playing times, among which was a variable-speed type, designed to exploit the higher speeds at the perimeter of the disc, although this had the disadvantage that a complex device was needed for replay—one which produced a differential slowing towards the centre. Edison's attempts were more practical and saleable—a long player at 78rpm, which clearly necessitated a remarkably close-cut groove, a good deal closer than a modern LP cut on vinyl.



One of the reproducers in the display—a Thorens phonograph circa *1905.*

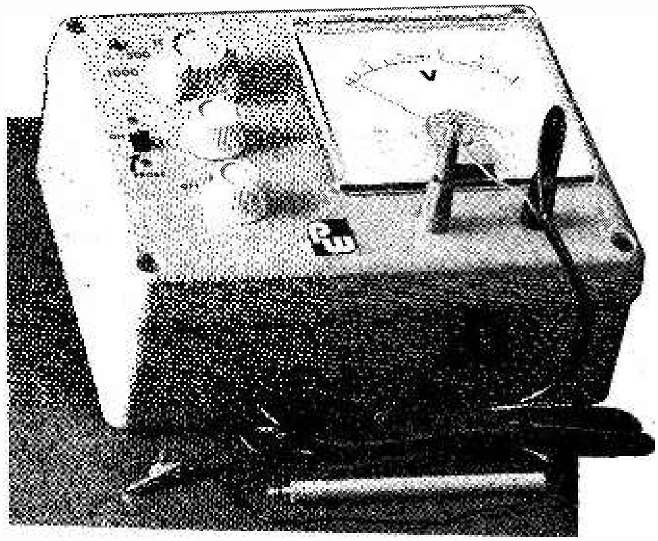
Another century on may well see an exhibition of 1977's music centres and cassette recorders, languishing in chrome and plastic bowers filled with surround sound, but it is questionable whether they will stimulate the imagination or convey as much of the character of the age as these quaint works of wood, metal and mica. They are important because they stirred up the ripples which led to a gigantic tidal wave in human affairs—the crude boxes which paved the way for the world-wide recording industry, and in so doing, opened up one of the most creative extensions of human commercial and artistic endeavour.

Ted Parratt

A WIDE RANGE VOLTMETER FOR AC•DC•RF

M.TOOLEY BA G8CKT

A reliable high-impedance DC and AC voltmeter is an invaluable asset in any enthusiast's workshop. The circuit described is simple to use, exhibits excellent linearity and has a constant input impedance of 11MΩ on all ranges. The basic voltmeter is provided with six DC ranges from 1V to 1000V full-scale. A variety of probe designs is included in order to facilitate further DC, AC and RF measurements. The unit is portable and operates from the mains or alternatively it may be powered from an external DC supply. An automatic diode switch is included for changing over from internal to external power.



Circuit Description

A simplified circuit of the DC voltmeter is depicted in **Fig. 1**. This shows the basic bridge configuration formed by Tr2, Tr3, R9 and R10. A constant voltage is developed across R10, the emitter resistor of Tr3. The input voltage, less approximately 0·6V which is the base-emitter voltage drop for Tr2, is effectively developed across R9, the emitter resistor of Tr2. The difference between these two voltages produces a current in the milliammeter, M. The calibration of the instrument is set by the variable resistor, VR1.

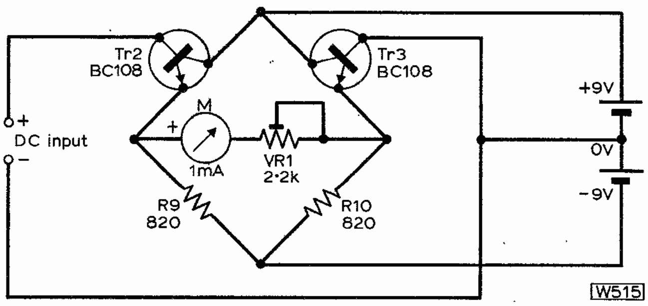


Fig. 1: Simplified circuit of the voltmeter.

The voltage to be measured is applied to the potential divider formed by resistors R2 to R7, see **Fig. 2**. The voltage division ratio is selected by means of the Range Switch, S2. A fixed resistor, R1, is provided in the input lead. To ensure correct calibration this resistor is bypassed by means of S3 when a probe is fitted. The output from the potential divider is fed to the FET transistor, Tr1. This transistor is connected as a source follower and provides a very high input resistance and a voltage gain of very slightly less than one.

Transistors Tr2 and Tr3 operate as a balanced emitter follower pair. This symmetrical arrangement ensures good linearity and a high degree of temperature stability. The base voltage for Tr3 is fixed at approximately half the DC supply by means of the potential divider formed by R11 and R12. The circuit may be balanced by means of VR3 which sets the DC potential at the gate of Tr1 and in turn the potential at the base of Tr2.

The meter connections are reversed to facilitate positive and negative voltage measurements without the necessity of altering the input lead connections. For AC measurements the instrument is effectively used on the DC negative range and a suitable probe must be employed. The probe is designed to produce a negative DC output using a simple half-wave diode rectifier arrangement. The value of probe resistor, R, is chosen so that the instrument is calibrated for RMS AC voltages, see table.

★ specifications

Functions: D.C. positive, DC negative.
AC (by means of suitable probe).

Ranges: 1V (full-scale DC) 100V
10V 500V
50V 1000V

Input Resistance: 11MΩ without probe or 10MΩ with 1MΩ in probe. (DC).

Supply Voltage: 220/240V 50Hz.
external DC 18 to 24V at 40mA.

Typical Accuracy: DC ±2% AC ±5%

Construction

The transistors, Tr1, Tr2, Tr3 and associated components are mounted on a 150 x 115mm 0·1in matrix board, **Fig. 3**. Components and connecting leads are located and soldered on this board by means of press-fit terminal pins. Wire links between pins are made using insulated solid wire. The completed board assembly is mounted below the lid of the plastic box and secured by means of the two meter terminals.

Resistors R2 to R6 are wired directly to the contacts of the Range Switch, S2. Resistor R1 is wired across the contacts of the Probe Switch, S3. Care should be taken to keep wiring as short and neat as possible. The mains transformer is secured to the base of the box, **Fig. 4**, preferably in such a way as to distribute the weight evenly over the base area of the instrument whilst ensuring adequate clearance when the lid and associated components are fitted in place. The external supply sockets are also located in the base of the box, adjacent to the fuseholder. The bridge rectifier and capacitor are fitted to the main circuit board.

Probes

Various probe designs are given in **Fig. 5** together with suitable component values as given in the table. The DC probe of **Fig. 5a** is intended for use when DC voltage measurements are to be made in the presence of AC and RF signals. The 1MΩ probe resistor provides an extra degree of isolation for the circuit under investigation and minimises reactive loading effects. The construction of this probe is shown in **Fig. 6**. The probe circuit is housed in the barrel of a discarded felt-tip pen. The tip contact of the probe makes use of the body of a 3·5mm jack plug which is inserted in the barrel of the felt-tip pen and held in place by means of epoxy adhesive. Only the tip electrical

Table of components for probe designs

Probe	Figure	Component values	Useful voltage range	Useful frequency range
DC	5a	R—1MΩ 0·5 2% high stability metal oxide	0 to 1000V	DC only
AC low voltage	5b	R—3·3 MΩ 2% high stability. C—1μF polyester tubular 250VDC. D—OA91	0·5 to 30V	15Hz to 100kHz
AC medium voltage	5c	R—3·3 MΩ 2% high stability. C—1μF polyester tubular 250VDC D1, D2, D3 OA91	1·5 to 100V	15Hz to 100kHz
RF	5d	R—3·3 MΩ 2% high stability. C—1nF polystyrene 160VDC. D—OA91	0·5 to 30V	100kHz to 100MHz

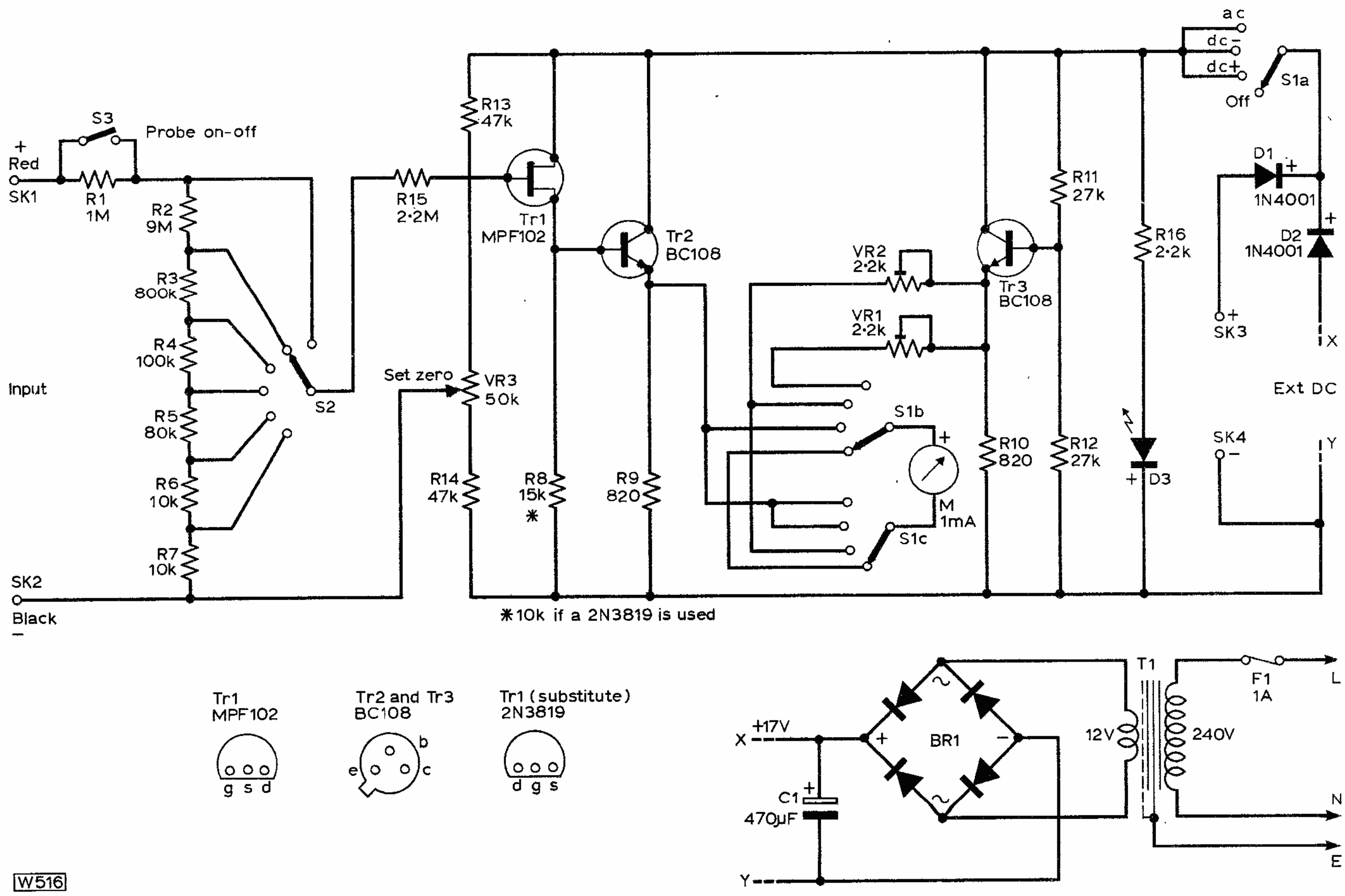


Fig. 2: The detailed circuit diagram, including transistor base connections and optional power supply circuit.

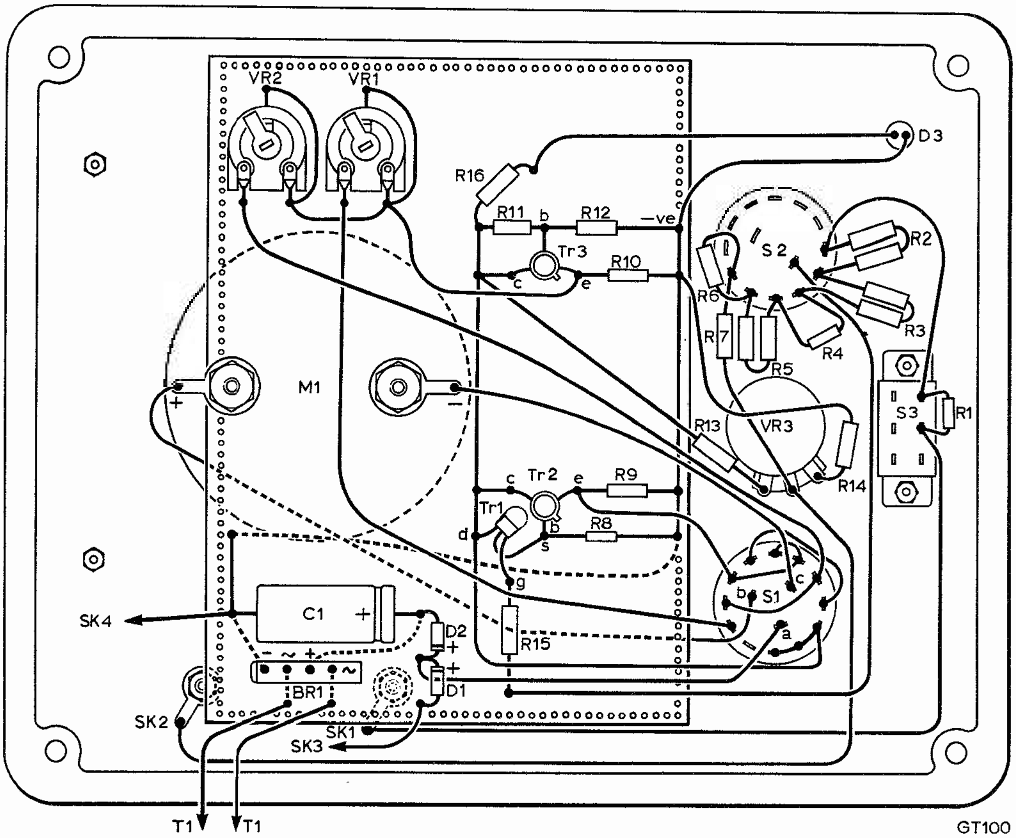
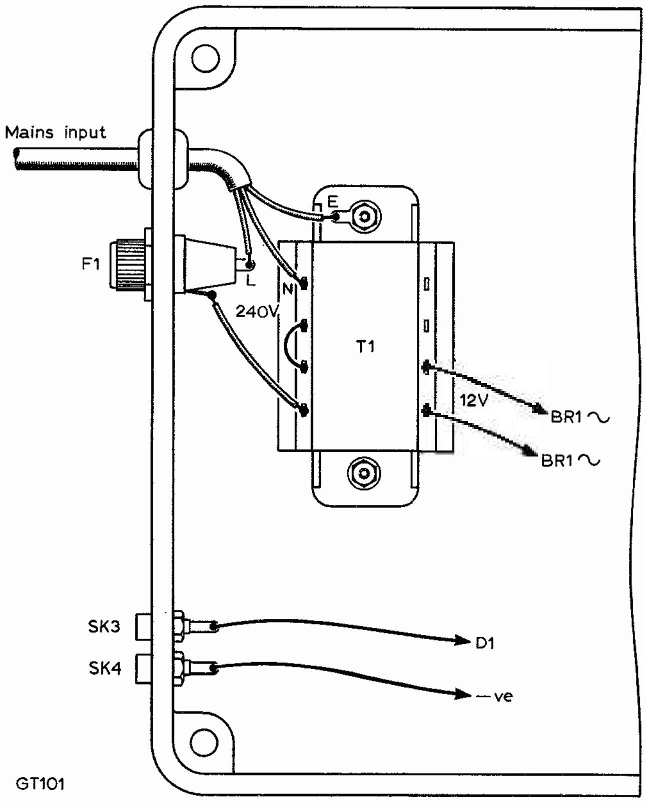


Fig. 3: (above) showing internal layout, and Fig. 4 (below) indicating mains input and transformer details.



★ components

Resistors

R1	1MΩ	R9	820Ω
R2	9MΩ (2·2MΩ + 6·8MΩ)	R10	820Ω
R3	800kΩ (470kΩ + 330kΩ)	R11	27kΩ
R4	100kΩ	R12	27kΩ
R5	80kΩ (47kΩ + 33kΩ)	R13	47kΩ
R6	10kΩ	R14	47kΩ
R7	10kΩ	R15	2·2MΩ
R8	15kΩ	R16	2·2kΩ

R1 to R7 ½W metal oxide high stability 2%
R8 to R16 ¼W carbon film high stability 5%
VR1/2 2·2kΩ horizontal pre-set
VR3 50kΩ linear carbon

Semiconductors

Tr1	MPF102	D1/2	1N4001
Tr2/3	BC108	D3	LED (pushfit)
BR1	Bridge rectifier 100PIV 1A		

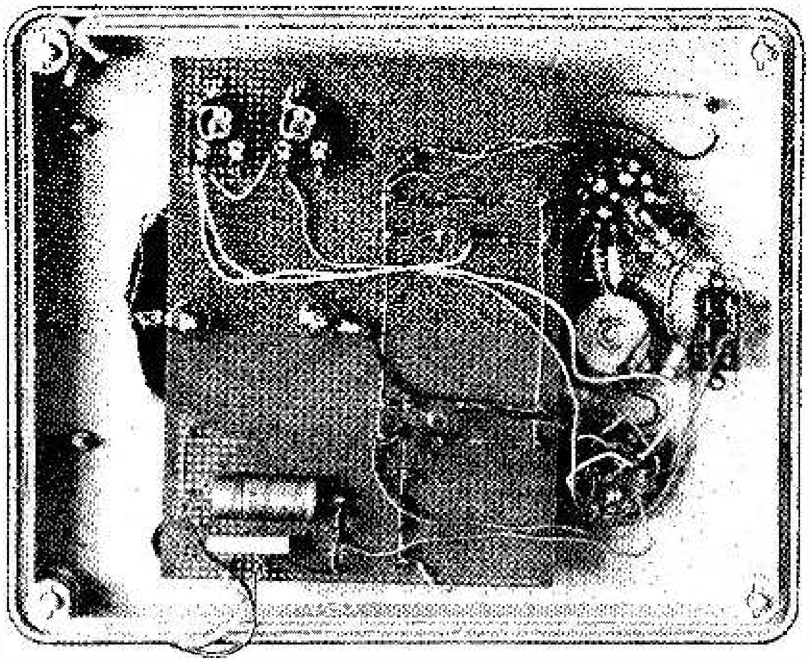
Note: Tr1 may be replaced by a 2N3819 if R8 is changed to 10kΩ. See lead-out connections on Fig. 2.

Switches

S1 3P 4W midget wafer
S2 1P 6W ,, ,,
S3 SPST (or DPDT) slide switch

Miscellaneous

C1, 470μF 25V. Sockets (2), 2mm, red and black. Terminals (2), 4mm, red and black. Mains transformer, 240V to 12V 500mA. Fuse 1A and holder. Meter, 1mA FSD, size depending on readout accuracy required. The author's meter was 117 × 105mm (4½ × 4in. approx.). Plastic case approx. 225 × 175 × 85mm (9 × 7 × 3½in.).



A view of the inside of the voltmeter, to be used in conjunction with Fig. 3, in which the method of connecting resistors in series to form R2, R3, and R5 is clearly shown.

connection of the jack plug is used, the outer connection is ignored.

A short length (approximately 1m) of coaxial cable is used to couple the probes to the voltmeter. This should preferably be a substantial RF type cable with a copper braided screen. The braid terminates in a short length of stranded wire fitted with a crocodile clip. This ensures a low-resistance contact with the chassis or common rail of the circuit under investigation. The voltmeter end of the connecting cable is fitted with two 4mm plugs. The AC and RF probes use a similar construction technique, **Fig. 7**.

Calibration

Calibration on the DC and AC ranges is carried out by means of VR1 and VR2 respectively. Calibration on the DC ranges may be checked either by the application of an accurately known DC voltage or by reference to another DC voltmeter. If neither is available a new 1·5V cell may be connected to the instrument and VR1 accurately set for a reading of 1·5V, after first remembering to set the Probe Switch "off" and zero the meter! Repeat the calibration procedure for the DC negative and AC ranges (but without a probe connected). Calibration can be checked on the AC range if a known source of AC is available. This may conveniently be a low-voltage transformer of known output supplied from the mains. Do not attempt to calibrate the instrument using AC mains voltage directly since this may cause damage to the probe and to the instrument. The AC probes are suitable only for relatively low AC voltages.

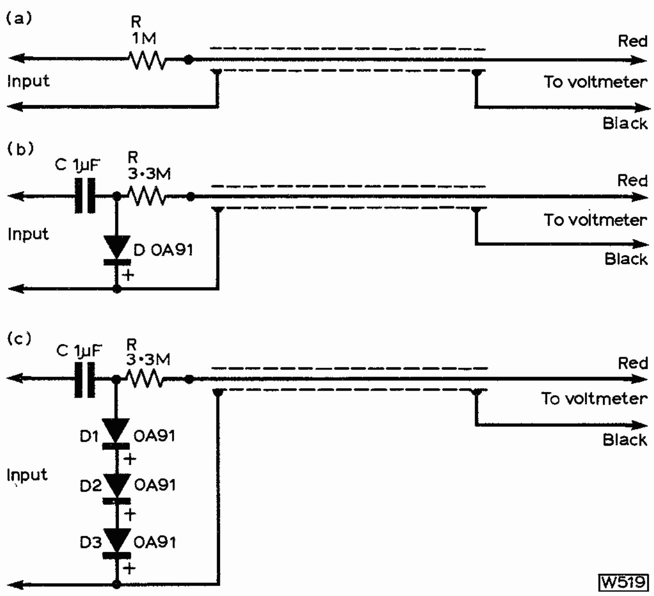


Fig. 5: Suitable probe designs for the unit.

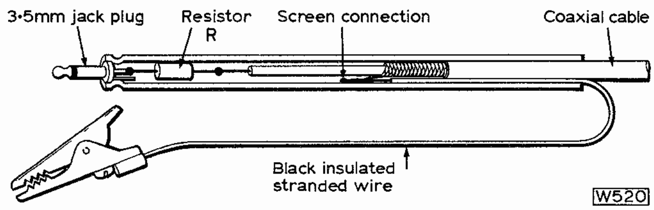
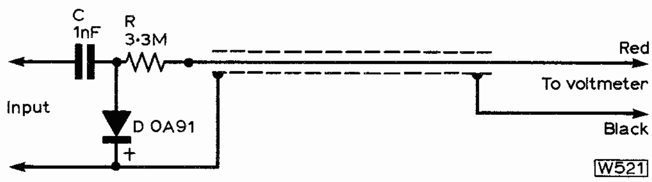


Fig. 6: The construction of the DC probe, (above) and the circuit of the AC and RF probes (below).



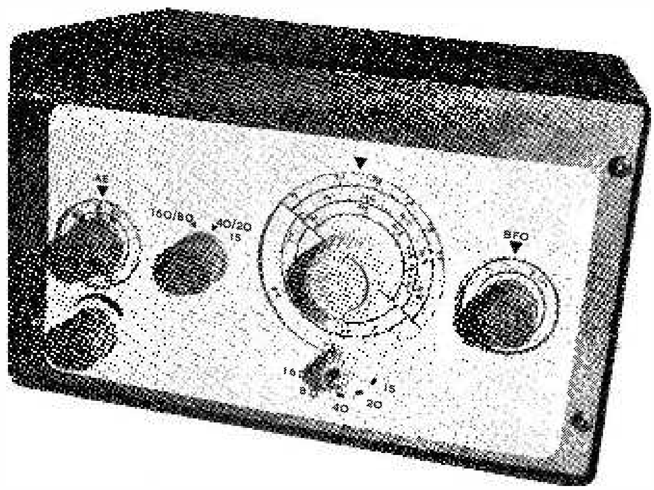
Operation

The voltmeter is switched to the desired Function and the Set Zero control is then adjusted in order to accurately zero the meter. The Range Switch is set to the 1000V range. The input leads are then connected to the circuit under test and the Range Switch is then progressively advanced to the range which produces an easily measurable indication. Note that, for the sake of simplicity, a separate mains switch is not fitted to the instrument. Thus, when the unit is not required for use, it is advisable to disconnect the instrument from the AC supply by removing the mains plug. ●

all band short wave converter

Part 1

F. RAYER G3OGR



The controls are, left to right, RF Tune, Bandswitch, main tuning and BFO Tune. The RF Attenuator/on-off switch is below the RF Tune control at the left.

With a receiver intended particularly for multi-band reception individual coils with parallel and series capacitors are often provided for each range, values being arranged to secure suitable coverage. A band-spreading capacitor suitable for the LF bands is too large in value for the HF bands, so that some ranges need series padders. The number of coils, trimmers and padders for a multi-band receiver of this type becomes large and careful adjustment is needed to track aerial and oscillator tuning.

The converter described here avoids these difficulties, and is in line with the trend to use a high intermediate frequency, to eliminate second channel interference. It is suitable for operation with a receiver tuned to about 5·5MHz, which will be available with many general coverage receivers, and allows 1·8 to 21MHz to be covered with a single converter oscillator coil.

Although this article describes a converter intended for use on the amateur bands there is no reason why it should not be aligned for the SW broadcast bands, since most of these bands are adjacent, in terms of frequency, to the amateur bands.

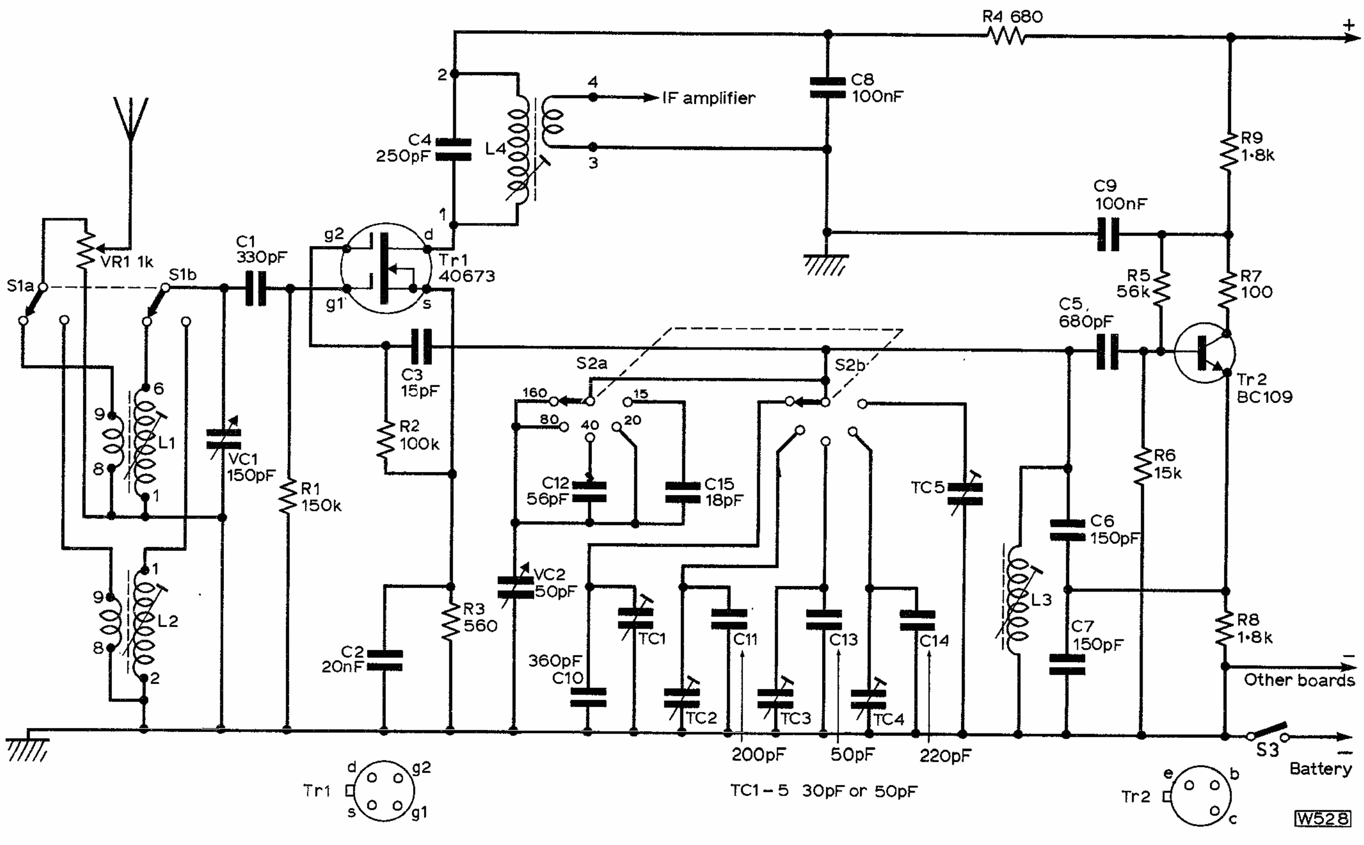


Fig. 1: Circuit diagram showing the mixer and oscillator sections of the converter, together with the lead-outs for the transistors.

Circuit Description

Fig. 1 shows the mixer and oscillator stages. The ganged switch S1a/S1b brings into circuit either L1 or L2 for aerial tuning, L1 covering the 15, 20 and 40m bands, and L2 the 80 and 160m bands. Each band is peaked by the panel control VC1. This provides five bands with two coils, with no trimming or similar alignment difficulties.

L3 is the oscillator coil, tuned by VC2, with the switch S2a/S2b. This switch has five positions, operating as follows:—

160m VC2 has C10 and TC1 in parallel, so that the oscillator coverage is 7·25 to 7·5MHz. With the 5·5MHz IF, this gives reception over the 1·75 to 2·0MHz range.

80m C11 and TC2 are in parallel with VC2, giving an oscillator coverage of 9 to 9·5MHz, or 3·5 to 4·0MHz on reception.

40m C13 and TC3 are across L3, and C12 is in series with VC2. Oscillator coverage is 12·5 to 13MHz, giving reception of signals in the 7 to 7·5MHz band.

20m C14, TC4 and VC2 are in parallel, so that L3 tunes 8·5 to 9MHz and reception is from 14 to 14·5MHz.

15m TC5 is across L3 and C15 is in series with VC2, giving an oscillator range of 15·5 to 16MHz, for reception over 21 to 21·5MHz.

VC2 is operated by a ball drive and is the main tuning, with VC1 peaking signals as mentioned. VC1 is calibrated to avoid tuning to second channel frequencies, which arise at about 11, 13, 15 and 18MHz in the usual way with a 5·5MHz IF. VR1 is an attenuator or aerial input control, enabling the strength of signals to be kept down so that satisfactory CW and SSB reception can be obtained, also preventing the overloading of the receiver with strong AM transmissions. Tr1 is the mixer, with the signal input to gate 1, and the oscillator input to gate 2. Tr2 is the oscillator stage, operating as described. L4 is tuned to approximately 5·5MHz and is followed by an optional FET 5·5MHz stage. This can be omitted with a reasonably sensitive main receiver, or can be added later. A BFO is included to allow CW and SSB reception with the popular type of receivers which may have no beat frequency oscillator incorporated.

★ components

Resistors

R1	150kΩ	R6	15kΩ	R11	2·2kΩ
R2	100kΩ	R7	100Ω	R12	680Ω
R3	560Ω	R8	1·8kΩ	R13	390kΩ
R4	680Ω	R9	1·8kΩ	R14	6·8kΩ
R5	56kΩ	R10	1·2MΩ	R15	2·7kΩ

VR1 1kΩ linear carbon with switch S3

All resistors are ¼ or ⅓W 5%

Capacitors

C1	330pF	C9	100nF	C17	10nF
C2	20nF	C10	360pF*	C18	100pF*
C3	15pF	C11	200pF*	C19	100nF
C4	250pF*	C12	56pF*	C20	10nF
C5	680pF	C13	50pF*	C21	220pF*
C6	150pF*	C14	220pF*	C22	220pF*
C7	150pF*	C15	18pF*	C23	470µF 12V
C8	100nF	C16	220pF		

*2% silver mica preferred

TC1/5	50pF trimmer	VC1	150pF (Jackson C804)
VC2	50pF (C804)	VC3	20pF (C804)

Semiconductors

Tr1	40673	Tr3	2N5459
Tr2	BC109	Tr4	2N2926

Miscellaneous

S1, 2-pole 2-way wafer switch. S2, 2-pole 5-way wafer switch. L1, Yellow, Range 4, valve type (Denco). L2, White, Range 2, valve type (Denco). L3, 4, 5 and 6, see text. 11mm coil former with core, 1 off. 7mm coil former on square base, with core, 3 off (Home Radio). Square screening can for L5. Coaxial sockets, 2 off. Ball drive, 6:36 ratio (Jackson). Knobs. Panel brackets. Chassis, 8 × 6 × 1½". Cabinet, 10 × 8 × 6". Plain veroboard 0·15" matrix, see text.

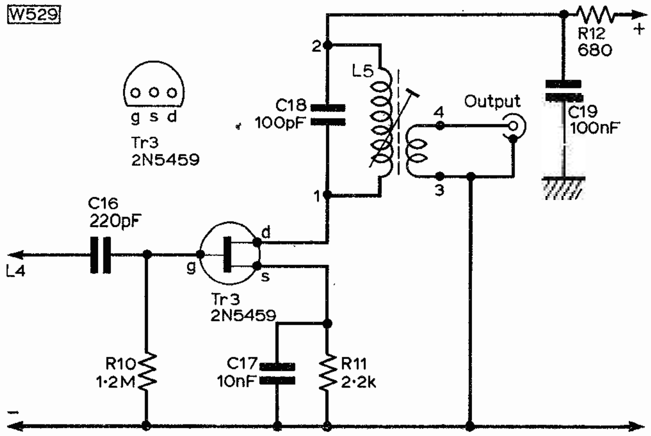


Fig. 2: The optional IF amplifier stage which works at 5·5MHz. This is a separate unit, and may be fitted if the main receiver is relatively insensitive.

Fig. 2 is the circuit of the 5·5MHz optional stage. Signal input is taken from Tr1 coupling coil L4 pin 4, to C16. L5-C18 is a further 5·5MHz coil connected in the drain circuit of Tr3, and coupled to the output socket. This stage is assembled as a separate unit, fitted to the chassis later.

BFO

The beat frequency oscillator is designed for a centre frequency of 5·5MHz and uses the circuit in **Fig. 3**. It is also assembled as a separate unit. Without the BFO, only AM signals can be received, unless a suitable BFO is present in the receiver itself. As AM reception may be required, provision is made to switch off the BFO for this purpose. To do this, the corner of the back moving plate of VC3 is bent so that it contacts the fixed plate when VC3 is fully closed. The stage is then not operative and current is limited to about 1mA by R14 and R15. An on-off switch in series with R15 could be used if preferred.

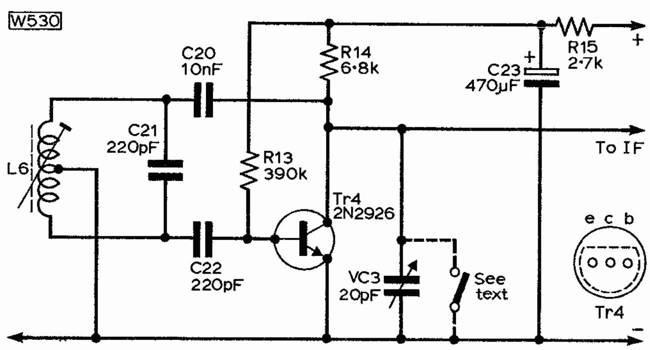
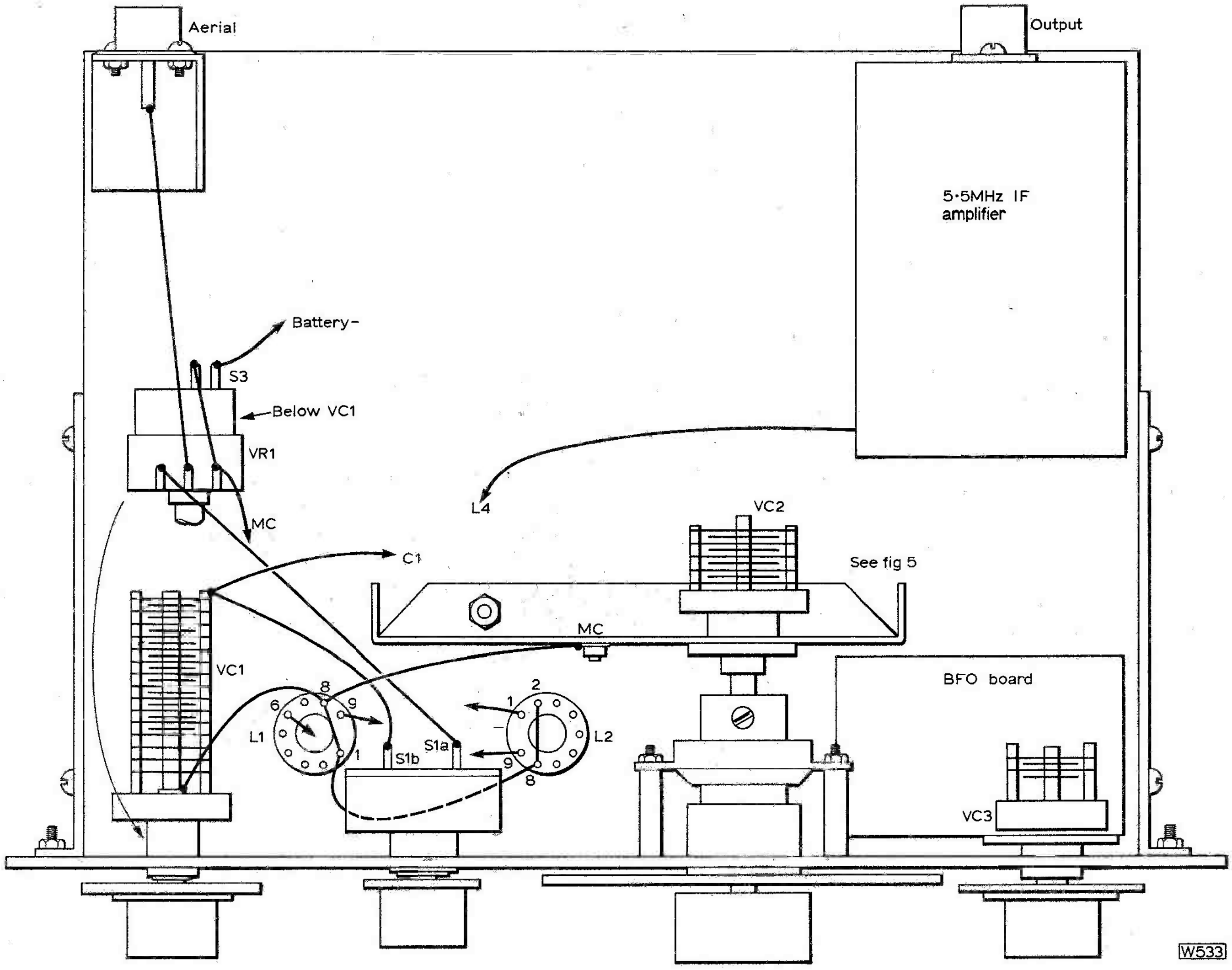


Fig. 3: Another optional unit is the beat frequency oscillator which also operates at about 5·5MHz. If the main receiver has a BFO then this unit is not required.



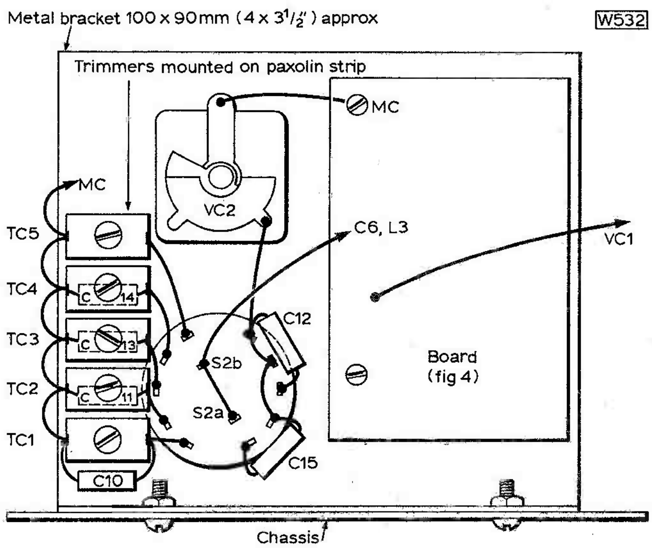


Fig. 5: Details of the assembly mentioned in the photograph. It can be finished completely as shown before mounting on the main chassis.

The positions of components and wiring can be seen from **Fig. 4.** The chassis returns MC are ½in 6BA bolts, with extra nuts and tags, so that the board can be mounted later with clearance for connections and leads. Insulated leads are provided to go to S2a/b, VC1, positive, and output socket or IF stage. Leads of Tr1 and Tr2 are shown in **Fig. 1.**

Fig. 6: Layout of the units and main components on the chassis. After the main tuning dial has been fitted to the panel the remaining panel components can be mounted in the same line.

Osc/Mixer assembly

VC2 and S2a/b are fitted to a bracket approximately 100 x 90mm (4in x 3½in) as in **Fig. 5.** The five trimmers are mounted on a strip of paxolin, which is spaced from the bracket by a long bolt, or similar, to clear the switch. Connect C10 to TC1, C11 to TC2, C13 to TC3, and C14 to TC4 before mounting the trimmer strip, including leads to take to the switch tags on that side.

The board is mounted by the bolts described earlier. The switch requires a spindle 2in long, so that it can project through a ¼in hole in the panel, when the assembly is bolted in place approximately 1½in behind the panel. Alternatively, a shaft coupler can be added, with a length of rod. The exact distance from bracket to panel is arranged so that the spindle of VC2 engages correctly with the ball drive bush.

Fig. 6 shows the positions of components on the chassis, and connections for L1 and L2. VR1 fits directly below VC1. The aerial lead runs direct to VR1, away from the 5·5MHz circuits to avoid unnecessary 5·5MHz breakthrough. The BFO board fits to the right, as shown.

Part 2 next month will deal with the construction of the BFO and final alignment of the converter plus a few hints on using the converter.

NEXT MONTH IN...

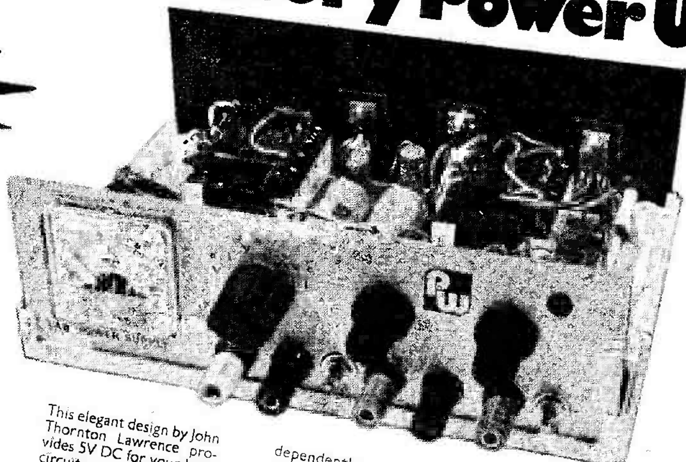
practical WIRELESS

ON SALE NOV. 4TH.

Laboratory Power Unit

SPECIAL OFFER!

A well known make of soldering iron and accessories, your choice of two kits. Don't miss this opportunity to save money.



This elegant design by John Thornton Lawrence provides 5V DC for your logic circuits, up to 0·5A PLUS +15V DC and −15V DC at 150mA each. These 15V supplies can be used independently or linked together from the front panel. Both are adjustable and fully metered. Finally, all three outputs are adequately stabilised.

also:

TRAFFIC LIGHT CONTROLLER
SOLID-STATE TUNING INDICATOR

'SPECIAL OFFER' A LA 1933!

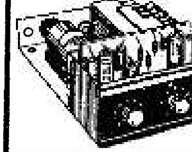
We were delighted to hear from Albert Hedges of Ramsgate, long time reader of *PW*, that he still has in use a tool set that was announced in *Practical Wireless* for September 23, 1933 as a "Great Birthday Offer" on the occasion of *PW*'s first birthday.

A special voucher was issued on which 11 gift stamps were stuck, taken from consecutive issues of *PW*. This completed voucher plus 3s 6d ($17\frac{1}{2}$p) got the complete tool set in an attractive metal case. The set comprised a steel rule, steel scriber and chuck, scribing and cutting trammels, set square, viewing mirror, screwdriver plus a set of BA spanners.

Since *PW* was published weekly at that time, at a cover price of 3d (1p and a bit!) it didn't take long or cost very much to acquire the tool set. We wonder if there are any others still around!

If only we could make such a splendid "special offer" today!

SUPERSOUND 13 HI-FI MONO AMPLIFIER



A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume. Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high × 6" wide × 7½" deep. AC 200/250V. PRICE £15·00. P. & P. £1·20.

HAVERSON MODEL P.A. TWO ZERO

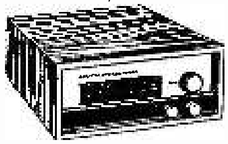
An advanced solid state general purpose mono amplifier suitable for Public Address system, Disco, Guitar, Gram., etc. Features 3 individually controlled inputs (each input has a separate 2 stage preamp). Input 1·5mv into 47k. Input 2·5mv into 47k. (suitable for use with mic. or guitar etc.). Input 3 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 vinyl covered steel, with a brushed anodised aluminium front escutcheon. For ac mains operation 200/240v. Size approx. 12½" w. × 5" h. × 7½" d. Special introductory Price £28·00 + £2·50 carr. & pkg.

Mullard LP1159 RF-IF Module 470 kHz £2·25 + P.&P. 20p. Full spec. and connection details supplied. Pye VHF/FM Tuner Head covering 88-108 M/Hz. 10·7 M/Hz I.F. output. 7·8 Volt + earth. Supplied prealigned, with full circuit diagram with precision-geared FM gang and 323Pf + 323Pf A.M. Tuning gang only £3·15 + P. & P. 35p.

STEREO DECODER

SIZE 2" × 3" × ½" ready built. Pre-aligned and tested for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. £6·00 plus 20p. P. & P. Stereo beacon light if required 40p extra.

MAINS OPERATED SOLID STATE AM/FM STEREO TUNER



200/240V Mains operated Solid State FM AM Stereo Tuner. Covering M.W. A.M. 540-1605 KHz VHF/FM 88-108 MHz. 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 8½"w × 4"h × 9½"d approx.

LIMITED NUMBER ONLY at £28·00 + £1·50 P. & P.

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 £1·80 + 20pP.&P.

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 £13·50 P. & P. £1·40. Also available ready built and tested £18·00 P. & P. £1·40.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER

Size 11¾" × 14$\frac{11}{16}$" × 1$\frac{7}{16}$" 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 OFFER. 6½" long throw, roll surround, ceramic magnet 8 ohm 10 watt speaker chassis. Specially suitable for Hi Fi. £3·95 + 75p P. & P.

2" PLASTIC CONE HF TWEETER 4 ohm, £3·50 per matched pair + 50p P. & P.

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. × 2½"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 avail. ready built and tested £31·25, P. & P. £1·50.

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" × 2½" × 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.

STILL AVAILABLE

3 Valve Audio Amp. 4½ w. output £8·50 + £1·40 P.&P.
Also HSL 'FOUR' amplifier kit. £8·00 + £1·40 P. & P.

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.

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

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. SEND SAE WITH ALL ENQUIRIES.

Get a great deal from

Marshall's

A. MARSHALL (LONDON) LTD. DEPT. P.W.

LONDON—40-42 Cricklewood Broadway, NW2 3ET
Tel. 01-452 0161. Telex 21492
and at 325 Edgware Road, W2. Tel. 723 4242

GLASGOW—85 West Regent Street, G2 2QD
Tel. 041-332 4133

BRISTOL—1 Straits Parade, Fishponds Road, BS16 2LX
Tel. 0272 654201

CALL IN AND SEE US
9-5.30 Mon-Fri.
9-5.00 Saturday

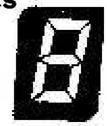
EXPRESS MAIL ORDER
Tel Orders on Credit Cards £10 minimum.

POPULAR SEMICONDUCTORS

								MJE520	·45	LM380-8	·90
								MJE521	·65	LM380N	·98
2N706	28	2N5294	·40	BC178	·20	BF167	35	MPF102	·30	LM381A	2·45
2N708	·28	2N5296	·40	BC179	·23	BF173	·35	MPF105	·40	LM381N	1·60
2N1131	30	2N5298	·40	BC182	·11	BF177	25	MPSA05	·25	LM382N	1·25
2N1132	·37	2N5447	·15	BC182L	·14	BF178	·25	MPSA06	·25	LM384N	1·45
2N1711	·30	2N5448	·15	BC183	·12	BF179	·30	MPSA55	·25	LM386N	·80
2N2102	·60	2N5449	·19	BC183L	·14	BF180	·35	MPSA56	·25	LM387N	1·05
2N2218	·33	2N5457	·32	BC184	·12	BF181	·35	TIP29A	·45	LM388N	·89
2N2219	·35	2N5458	·33	BC184L	·14	BF194	·15	TIP29C	·60	LM389N	1·09
2N2220	·35	2N5459	·29	BC212	·14	BF195	·15	TIP30A	·49	LM702C	·75
2N2221	·25	2N5484	·34	BC212L	·17	BF196	·15	TIP30C	·65	LM709C	·65
2N2222	·25	2N6121	·38	BC213	·14	BF197	·17	TIP31A	·50	LM709N	·45
2N2368	·25	2N6122	41	BC213L	·16	BF198	·18	TIP31C	·66	LM710C	·60
2N2369	·25	2N6123	·43	BC214	·16	BF200	·35	TIP32A	·55	LM710N	·60
2N3053	·26	2N6126	·45	BC237	·14	BF224J	·20	TIP32C	·75	LM723C	·45
2N3054	·60	AC126	·45	BC238	·12	BF244A	·35	TIP41A	·70	LM723N	·75
2N3055	·70	AC127	·45	BC239	·15	BF245A	·40	TIP41C	·90	LM741C	·60
2N3441	·85	AC128	·45	BC257	·17	BF257	·37	TIP42A	·80	LM741N	·40
2N3442	1·35	AC151	·40	BC258	·18	BF258	·45	TIP42C	1·00	LM741-8	·40
2N3702	·13	AC152	·50	BC259	·18	BF259	·49	TIP2955	·65	LM747N	·90
2N3704	·15	AC153	·55	BC307	·15	BF336	·38	TIP3055	·55	LM748-8	·55
2N3706	·16	AC153K	·55	BC308	·15	BF337	·45	TIS43	·43	LM748N	·65
2N3708	·13	AC176	·50	BC309	·15	BF338	·48	TIS50	·55	LM1800	1·76
2N3771	1·95	AC176K	·65	BC327	·20	BFR39	·28	TIS61	·23	LM1808	1·92
2N3772	2·00	AC187K	60	BC328	·19	BFR40	27	TIS62	·45	LM1828	1·75
2N3773	2·90	AC188K	·60	BC547	·12	BFR41	·28	TIS88A	·40	LM3301N	·35
2N3819	·36	AD161	1·00	BC548	·12	BFR79	·28	TIS90	·20	LM3302N	1·40
2N3820	·38	AD162	1·00	BC549	·14	BFR80	·27	TIS93	·33	LM3401	·70
2N3823	·80	AF106	·55	BC557	·13	BFR81	·28	LM301A	·67	LM3900	·75
2N3904	·21	AF109	·75	BC558	·12	BFX29	·39	LM301N	·40	LM3905	1·60
2N4036	·67	AF139	·69	BC559	·14	BFX30	·39	LM304	2·45	LM3909	·68
2N4037	·55	AF239	·65	BCY58	·25	BFX84	·35	LM307N	·66	MC1310	1·91
2N4058	·20	AF240	1·14	BCY70	·25	BFX85	·38	LM308C	1·82	MC1458	·51
2N4059	·15	AF279	·80	BCY71	·28	BFX86	·38	LM308N	·85	NE555	·40
2N4060	·20	AF280	·85	BCY72	·24	BFX87	·30	LM309K	1·85	SN7400	·16
2N4124	·17	BC107	·15	BD115	·80	BFX88	·30	LM317K	3·00	SN7402	·16
2N4126	·17	BC108	·15	BD131	·51	BFY50	·25	LM318N	2·20	SN7404	·20
2N4209	·20	BC109	·15	BD132	·54	BFY51	·25	LM323K	6·46	SN7410	·20
2N4303	·30	BC140	·35	BD135	·27	BFY52	·25	LM339N	1·40	SN7441	1·03
2N4904	1·70	BC141	·40	BD136	·38	BSX21	·32	LM348N	1·50	SN7447	1·10
2N4919	·65	BC147	·12	BD137	·38	BU104	1·65	LM360N	2·75	SN7448	1·10
2N4920	·75	BC148	·12	BD138	·38	BU105	1·40	LM370N	2·50	SN7474	·43
2N4921	·50	BC149	·14	BD139	·40	BU126	1·[illegible]	LM371N	1·70	SN7490	·61
2N4922	·55	BC160	·35	BD140	·40	BU204	2·02	LM372N	1·70	SN7492	·61
2N4923	·70	BC161	·35	BD438	·50	BU205	2·20	LM373N	2·80	SN7493	·61
2N5086	·27	BC167	·12	BD439	·50	BU206	2·50	LM374N	3·10	SN7496	1·03
2N5192	·75	BC168	·12	BDX18N	1·70	MJE340	·58	LM377N	1·75	SN74121	·45
2N5194	·72	BC169	·12	BDY20	1·00	MJE370	·58	LM378N	2·25	SN74141	1·45
2N5245	·34	BC177	·20	BDY56	1·90	MJE371	·60	LM379S	3·95	76023N	1·43

Prices correct at 15 Sept. 1977, but please add VAT p&p 40p

OPTOELECTRONICS



Full range of Opto devices in our new catalogue

LEDS

3mm Red 19p, Gr 25p, Y 25p
5mm Red 21p, Gr 26p, Y 26p
TIL209 19p, ORP12 84p
BPX 25 1·65

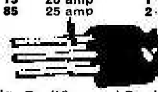
DISPLAYS 7 Segments

	Single	Double	Display
DL704	2·00	[illegible]	0·3in Red
DL707	2·00	[illegible]	0·3in Red
DL747	2·50	[illegible]	0·5in Red
DL750	2·50	[illegible]	0·5in Red

TRIACS Plastic Pack 400V

6 amp	70	16 amp	1·10
8 amp	75	20 amp	1·70
12 amp	85	25 amp	2·00

DIACS



ST2 20p
BR100 48p

BRIDGES

Full range of Bridge Rectifiers and Diodes listed in new catalogue

THYRISTORS Plastic C106 116

4 amp 100V	0·35	8 amp 100V	0·43
4 amp 200V	0·40	8 amp 200V	0·49
4 amp 400V	0·49	8 amp 400V	0·62

WHY NOT PAY US A VISIT AT OUR NEW CENTRAL LONDON BRANCH AT 325 EDGWARE ROAD, W2, ABOUT 100 YARDS NORTH OF THE WESTWAY FLY-OVER. EXTENSIVE STOCK RANGE. MANY SPECIAL OFFERS TO PERSONAL SHOPPERS ONLY.

SPECIALIST CONSUMER

NEW CATALOGUE

Stocking Distributors Officially Appointed

- NATIONAL
- TEXAS
- MULLARD
- SIEMENS
- SESCOSEM
- VERO
- ANTEX
- ELECTROLUBE
- SIFAM
- ARROW HART

MAKES COMPONENTS BUYING EASY

ORDER NOW!

35p Post Paid or 25p To Callers LARGE 32 PAGES packed with over 8500 LINE ITEMS

"What is a microprocessor?"

A complete teach yourself course with cassettes + brochure – £9·95 inclusive of VAT and p&p.

R.F. RESONANCE INDICATOR

D.H.E.KING G3TQN

When designing, building or servicing RF equipment it is sometimes necessary to know the frequency at which a particular coil resonates or tunes. A recent example involved a radio IF stage with very low gain; one of the IFTs seemed suspect and this was removed from the printed circuit and dismantled to expose a small ferrite-enclosed coil and an even smaller capacitor with unreadable markings. Using an RF signal generator and the apparatus described here it was found that a 470pF capacitor tuned the coil to the correct IF; an 'outboard' capacitor was then fitted across the IFT, bringing the radio back to 100 per cent performance, and the test apparatus was returned to the shelf to await the next emergency.

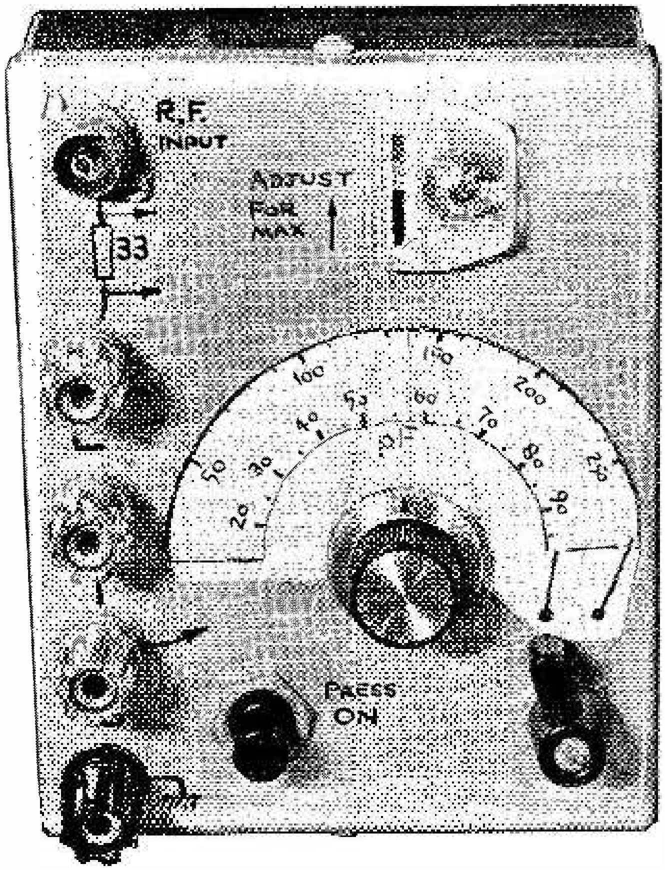
This resonance indicator is not intended to replace more accurate (and more expensive!) apparatus, but rather to provide a rapid method of checking unknown tuned circuits in the range 100kHz to 28MHz. With a given inductor in circuit, the values of unknown capacitors may be found within the range of VC1a and b by resonating the inductor at the same frequency, first with and then without the unknown capacitor between terminals N and M. The change in the value of VC1a or VC1b needed to re-establish resonance is therefore the value of the unknown capacitor.

Circuit operation

In a series tuned circuit **maximum** current flows at resonance and in **Fig. 1** this current through R1 feeds the emitter of Tr1 with an increased RF voltage compared with the voltage at other frequencies. The emitter and base of Tr1, just biased on by R2, VR1, form a detector circuit and the boosted RF thus acts to increase the emitter-base current. The resulting increase in collector current is indicated by the meter so that the resonance of a particular coil with a selected capacitance and frequency is now known.

Construction

Because a variable capacitor usually has the frame earthed, this has to be fitted at the 'bottom' of the circuit and the operational electronics are therefore at the 'live RF' end, as is the push-button on-off switch. All components apart from R1, S1, S2, VC1 and M1 may be fitted to a piece of Veroboard; VR1 is adjusted to give a small (about 20 per cent) pointer deflection when S1 is closed. R1, a carbon type, is fitted directly from the coaxial RF input socket to terminal O to limit excess inductance; the circuit board could be attached across R1 by short stiff wires if one wishes to avoid making additional fixings to the chassis or panel. See **Figs. 2 and 3.**



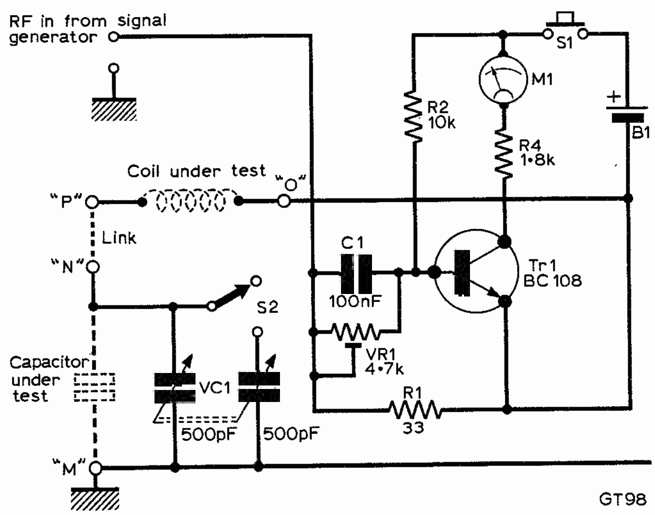


Fig. 1: The circuit diagram of the RF Resonance Indicator.

VC1 is bolted direct to the case. A metal case is recommended rather than a plastic one. A short pointer on the shaft traverses over a card scale glued to the outside of the box. During construction ensure that the link between terminal N and P is easily removed for ease of calibration.

The single Mallory cell (in its holder) may be glued into place, and should last for several years.

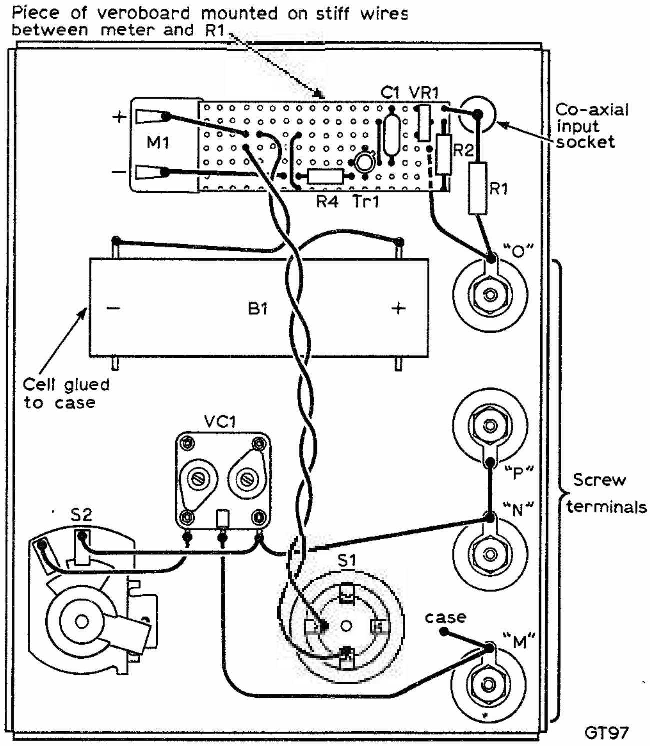


Fig. 2: General wiring inside the aluminium case.

Calibration

Connect a coil (fifteen turns of plastic or enamel covered wire close-wound and taped securely to a ferrite aerial rod will do) between terminals P and O. Temporarily unsolder the link N-P. Connect a close-tolerance 50 or 100pF silver mica or polystyrene capacitor between terminals N and M, keeping S1 closed. Then vary the tuning of the RF signal generator connected to the RF input socket while looking for a peak in meter deflection. Without changing the RF generator frequency, remove the external capacitor, connect N-P and vary VC1 until the meter reading again peaks.

The scale-card may then be marked with its first 50 or 100pF calibration point. Close S2, retune VC1 for peak reading and calibrate the other scale. Depending upon the particular type of variable capacitor available it is possible that the minimum capacitance of both gangs in parallel is more than 50pF and that 100pF will be the first calibration.

Now with VC1 set to the 50pF calibration point, add the external capacitor and vary the input frequency to obtain a peak meter reading. Remove the external capacitor and increase the value of VC1 to regain the peak meter reading, marking this new calibration point on the scale. In this way calibration points may be located at 50 or 100pF intervals around the scales.

It will also be possible to confirm the basic frequency formula that if the 15-turn coil resonates at about 5 to 6 MHz with 50pF, then at 450pF, **nine times** the original capacitance, the resonant frequency becomes **one-third** of its value at about 1·8MHz. This is because resonance is proportional to the **square-root** of the ratio of capacitance change. ●

★ components

Resistors: R1 33Ω, R2 10kΩ, R4 1·8kΩ. VR1, 4·7kΩ preset.

Capacitors: C1 100nF polycarbonate. VC1, 500/500pF gang capacitor

Transistor: BC108

Switches: S1, push-to-make switch. S2, SPDT wafer

Miscellaneous: Screw-type terminals. Co-axial socket. Metal case, 5½" × 4½" × 1¾" (140mm × 105mm × 45mm). (AB10) B1: 1·2V to 1·5V cell (mercury). Piece of Veroboard, 2" × 1" (50mm × 25mm).

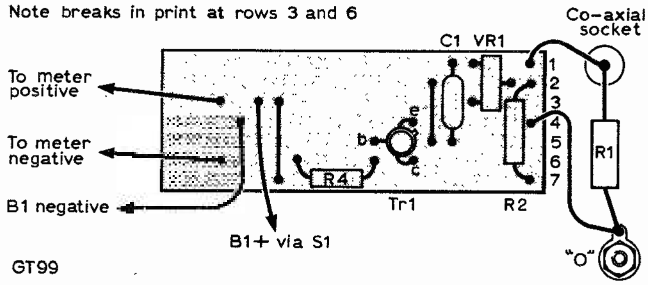
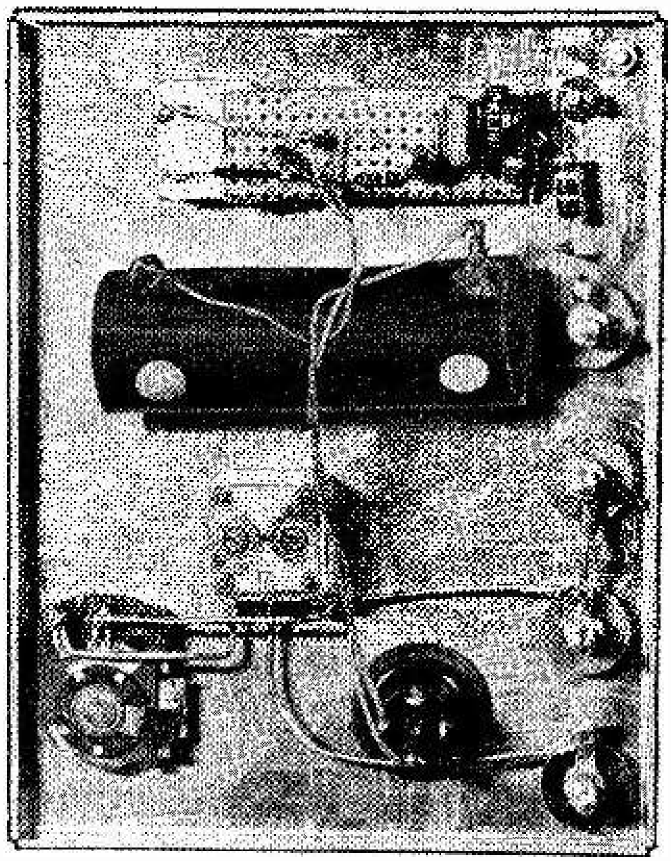
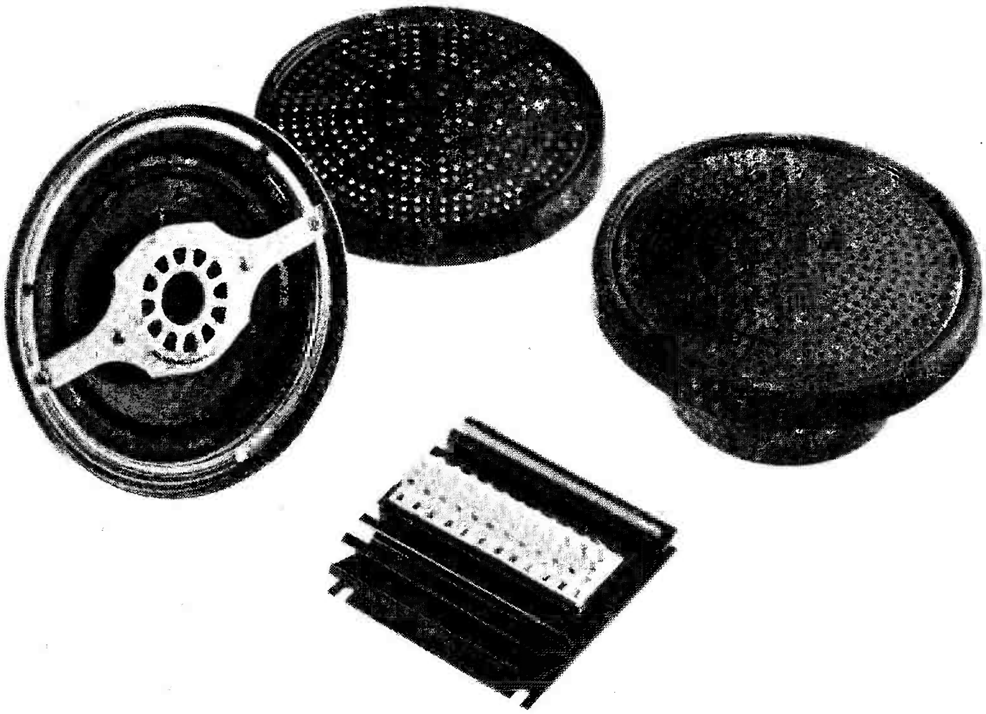


Fig. 3: Showing the component positions on the Veroboard, and meter and battery interconnections.



THE DYNAMIC DUO



The C15/15 is a unique Power Amplifier providing Stereo 15 watts per channel or 30 watts Mono and can be used with any car radio/tape unit. It is simply wired in series with the existing speaker leads and in conjunction with our speakers S15 produces a system of incredible performance.

A novel feature is that the amplifier is automatically switched on or off by sensing the power line of the radio/tape unit hence alleviating the need for an on/off switch.

The amplifier is sealed into an integral heatsink and is terminated by screw connectors making installation a very easy process.

The S15 has been specially designed for car use and produces performance equal to domestic speakers yet retaining high power handling and compact size.

C15/15
15 Watts per channel into 4Ω
Distortion 0·2% at 1KHz at 15 watts
Frequency response 50Hz - 30KHz
Input Impedance 8Ω nominal
Input sensitivity 2 volts R.M.S. for 15 watts output
Power line 10 - 18 volts
Open and Short Circuit protection
Thermal protection
Size 4 × 4 × 1 inches

Data on S15
6″ Diameter
5½″ Air Suspension
2″ Active Tweeter
20oz Ceramic magnet
15 watts R.M.S. handling
50 HZ - 15KHz frequency response
4Ω Impedance

C15/15 Price **£17·74** + £2·21 VAT P & P free

S15 Price pre pair **£17·74** + £2·21 VAT P & P free

TWO YEARS' GUARANTEE ON ALL OF OUR PRODUCTS

I.L.P. Electronics Ltd.,
Crossland House,
Nackington, Canterbury,
Kent CT4 7AD.
Tel. (0227) 63218.

Please Supply ....
Total Purchase Price ....
I Enclose Cheque ☐ Postal Orders ☐ Money Order ☐
Please debit my Access account ☐ Barclaycard account ☐
Account number ....
Name & Address ....
Signature ....

So you want to pass the R.A.E. (Radio Amateurs' Examination)? No. 3

John Thornton Lawrence GW3JGA & Ken McCoy 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!

Practical Ohm's Law

Before we move off Ohm's law and resistance, let us see how it can be applied to calculating the resistor values in a practical circuit. We are going to use an audio frequency amplifier as an example and this is shown in **Fig. 1a.** As we are only concerned with the DC conditions and how they are set up, we can forget about all the AC components, the coupling and de-coupling capacitors, leaving only the DC components as shown in **Fig. 1b.** Most modern small signal transistors have a beta (DC gain) of 100 or more, this implies a very small base current, sufficiently small that it may be ignored altogether if certain "rule-of-thumb" conditions are observed.

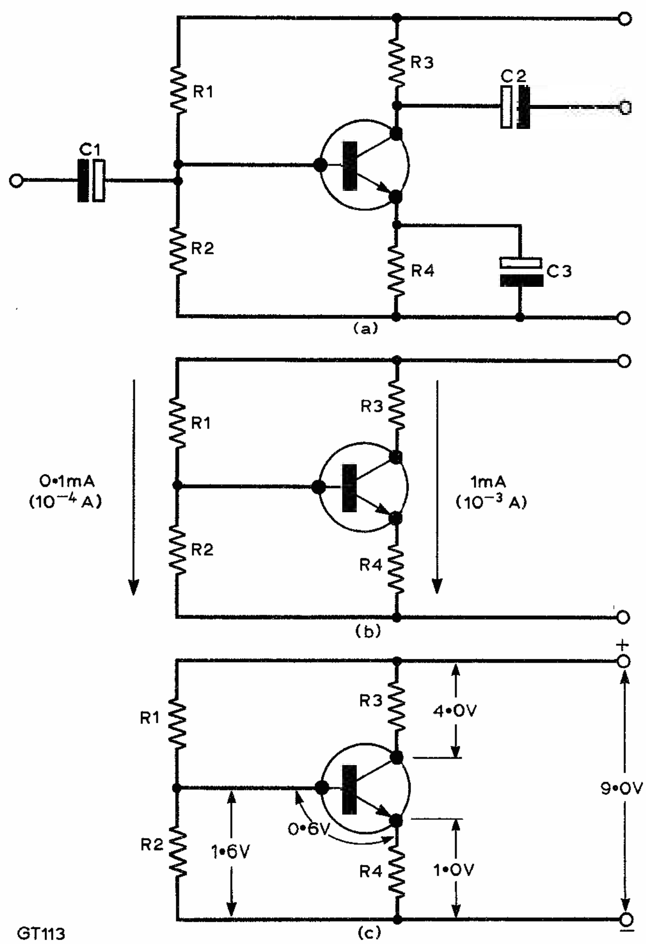


Fig. 1: The application of Ohm's Law to a simple transistor circuit.

In a small signal audio frequency transistor amplifier stage, the collector current for optimum gain, noise performance, etc., would be about 1 to 2mA, so for simplicity we will choose 1mA (10^{-3}A). Now for the current flowing down the base potential divider, R1 and R2. As a rule-of-thumb guide this should be a tenth of the collector current, so in our circuit it would be 0·1mA (10^{-4}A). This ensures that this current is large compared with the small bias current of the transistor. The two currents are shown in **Fig. 1b.**

Now for the voltages in the circuit. First we must know the supply voltage, so for our example we will make this 9V. The emitter resistor R4 provides stabilisation of the operating conditions for Tr1. A typical voltage drop across this would be 0·5 to 1V. So again for simplicity we will choose 1V. The collector voltage should sit midway between the emitter voltage +1V and the supply voltage +9V, that is at +5V. This will allow a signal voltage swing on the collector to go positive by 4V to the supply voltage and negative by 4V to the emitter voltage. Remember, up the page is more positive and down the page is more negative (away from positive)! Finally, the voltage drop across the emitter-base of a silicon transistor is 0·6V so if the emitter is at +1V the base will be at +1·6V.

Now for the sums to work out the value of the resistors, these are taken in reverse order.

. . . some practical experience is desirable!

$$R4 = \frac{V}{I} = \frac{1V}{10^{-3}A} = 10^3\,\Omega = 1k\Omega$$

$$R3 = \frac{V}{I} = \frac{4V}{10^{-3}A} = 4 \times 10^3\,\Omega = 4k\Omega$$

$$R2 = \frac{V}{I} = \frac{1{\cdot}6V}{10^{-4}A} = 1{\cdot}6 \times 10^4\,\Omega = 16k\Omega$$

$$R1 = \frac{V}{I} = \frac{9{-}1{\cdot}6V}{10^{-4}A} = \frac{7{\cdot}4V}{10^{-4}A} = 7{\cdot}4 \times 10^4\,\Omega = 74k\Omega$$

In a practical circuit the value of each resistor would have to be chosen from the list of "preferred" values. There are 12 "preferred" values in each decade of the 10% tolerance range of resistors and 24 "preferred" values in the 5% range.

10% (E12) range:—
1·0, 1·2, 1·5, 1·8, 2·2, 2·7, 3·3, 3·9, 4·7, 5·6, 6·8, 8·2.

5% (E24) range. All the above values plus:—
1·1, 1·3, 1·6, 2·0, 2·4, 3·0, 3·6, 4·3, 5·1, 6·2, 7·5, 9·1.

To complete our exercise let us now specify the preferred values for our circuit.

	R1	R2	R3	R4
Calculated value	74kΩ	16kΩ	4kΩ	1kΩ
5% range (E24)	75kΩ	16kΩ	3·9kΩ	1kΩ
10% range (E12)	68kΩ	15kΩ	3·9kΩ	1kΩ

Magnetism

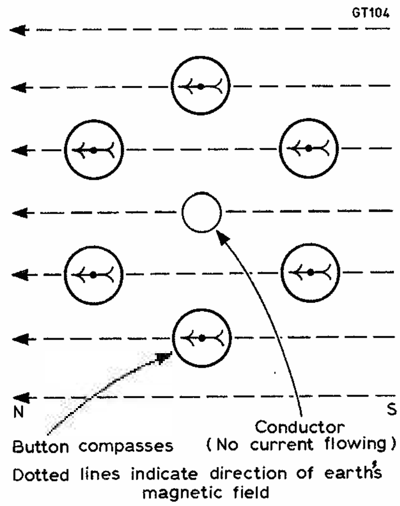
We are not proposing to spend any time on permanent magnets except to say that a permanent magnet has a "north seeking" pole and a "south seeking" pole and that imaginary lines of magnetic field or force run from the north to the south pole of the magnet. If two magnets are brought close together then the poles attract one another if they are dissimilar, N-S or S-N, and repel one another if they are similar, N-N, S-S. (See Radio Amateurs' Examination Manual, page 9).

If you are a family man, perhaps you could borrow your son's copy of the Ladybird Book, "Magnets, Bulbs and Batteries"! Seriously though, it's an excellent little book and illustrates pictorially the effects we are going to discuss.

Magnetic Effect of an Electric Current

In the following section we shall look at the magnetic effects produced by currents flowing in conductors. When illustrating these effects in diagrams it is essential to know the direction in which the current is flowing and the way this is done is shown in **Fig. 2.** A cross on the conductor relates to the flight of the arrow and indicates that the current is flowing **away** from the observer and a dot on the conductor represents the point of the arrow and indicates that the current is flowing **towards** the observer.

Now, let's get down to business and look at a conductor in cross section as shown in **Fig. 3.** The conductor is surrounded by button compasses, no current is flowing and the compasses are taking up a position in line with the earth's magnetic field. When current flows through the conductor away from you, as shown in **Fig. 4a,** a magnetic field is produced and the compasses align themselves with the lines of this field, in a clockwise direction. When the current flows in the reverse direction, towards you, as shown in **Fig. 4b,** you can see that the direction of the magnetic field is also reversed. Remember, reversal of the current produces a reversal of the field.



▲ *Fig. 3*

▼ *Fig. 4*

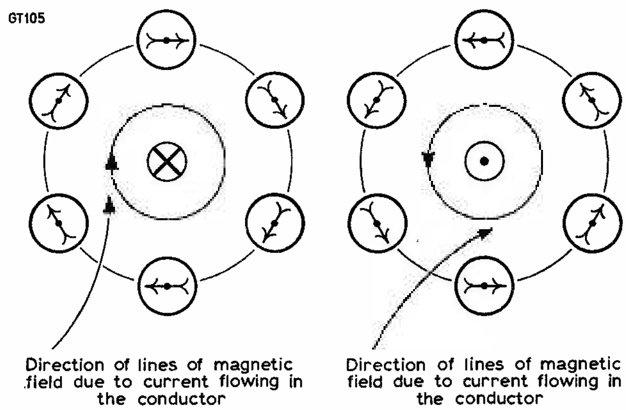
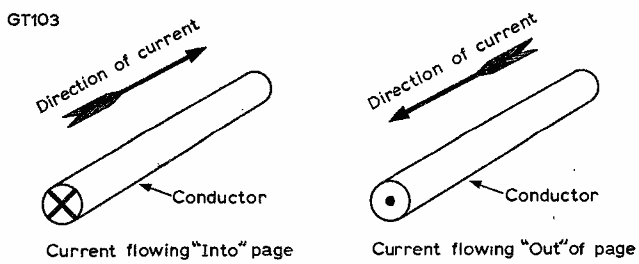
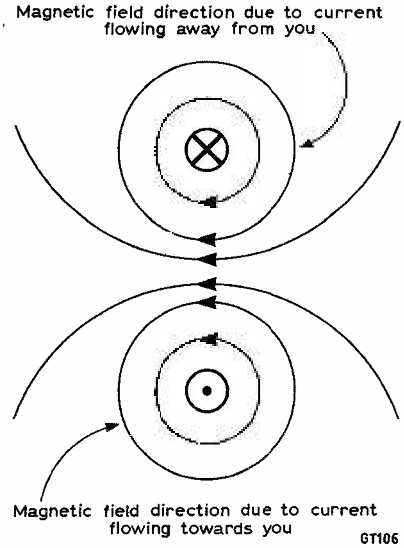


Fig. 2



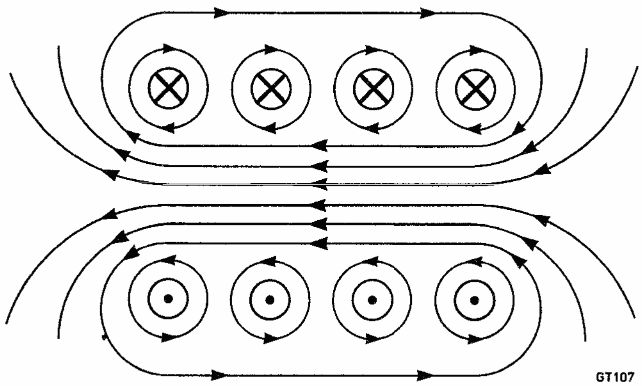
The Solenoid

If a conductor is formed into a single turn coil, a cross-section view would appear as shown in **Fig. 5.** You will now notice that the magnetic fields produced in the centre of the coil are in the same direction and are, therefore, more concentrated. The solenoid is a coil comprising a number of turns, as shown in section in **Fig. 6.** Here you can see the overall effect of the lines of magnetic field around each conductor, combining to produce a concentrated field in the centre of the solenoid, with an overall magnetic field similar to that produced by a permanent bar magnet



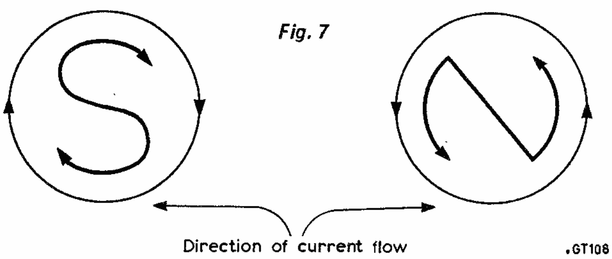
▲ *Fig. 5*

▼ *Fig. 6*



with its "north seeking" pole and "south seeking" pole. The magnetic polarity of the solenoid can be deduced by observing the direction of the current flow when viewing the coil at one end, as shown in **Fig. 7**. *The arrows on the letters indicate the direction of the current and make a useful memory aid.*

Fig. 7



Now, suppose we place a conductor in a magnetic field, with no current flowing, as shown in **Fig. 8a**, there is no disturbance to the field. When a current flows through the conductor, its resultant magnetic field reacts with the existing field, as shown in **Fig. 8b**. You will see that on one side of the conductor the lines of magnetic field are in the same direction as those produced by the current and tend to reinforce the field on that side whilst on the other the fields tend to cancel out. This causes a force to be exerted on the conductor resulting in its moving in the direction indicated. A reversal of current produces a reversal in the direction of movement, as shown in **Fig. 8c**.

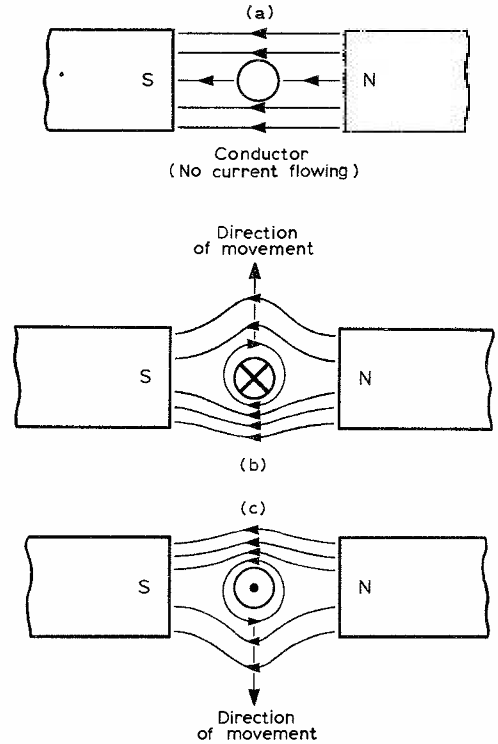


Fig. 8: Physical effect of current flowing in a conductor situated in a magnetic field.

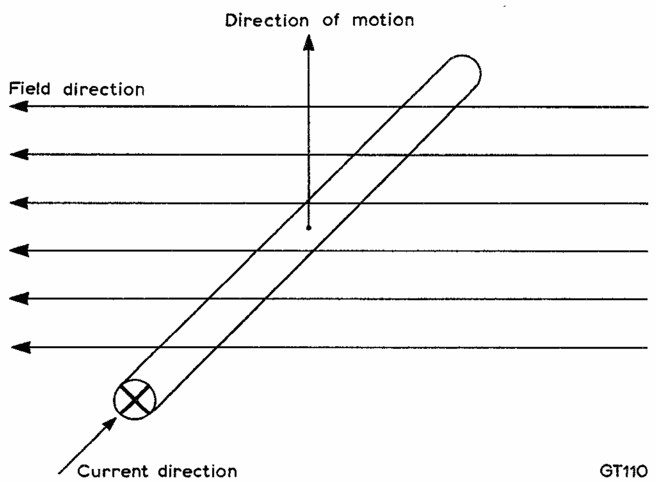


Fig. 9: Effect on a conductor when it is moving in a magnetic field.

Finally, let us look at the converse of this effect where the conductor is moving at right angles to a magnetic field, as shown in **Fig. 9**. Here a flow of current is INDUCED in the conductor and its direction depends on the direction of the motion. *The memory aid for this, which is Fleming's Left Hand Rule, is illustrated in* **Fig. 10**.

The Left Hand Rule

If the thumb, forefinger and second finger of the Left hand are placed at right angles to one another,

(i) The *Forefinger* indicates *Field* direction.
(ii) The *ThuMb* indicates *Motion* direction.
(iii) The *SeCond* finger indicates *Current* direction.

So that, if we know any two of the three directions, the third can be found.

To summarize what we have seen in this section,

(i) If we pass current through a conductor a magnetic field is set up around it.
(ii) The direction of the field depends on the direction of the current flow.
(iii) If the conductor is in a magnetic field and a current is made to flow in it, the conductor will move, the direction of motion being dependent on the direction of current flow.
(iv) If a conductor is moved in a magnetic field, then a current will be *induced* in the conductor, the direction of which is dependent on the direction of motion.

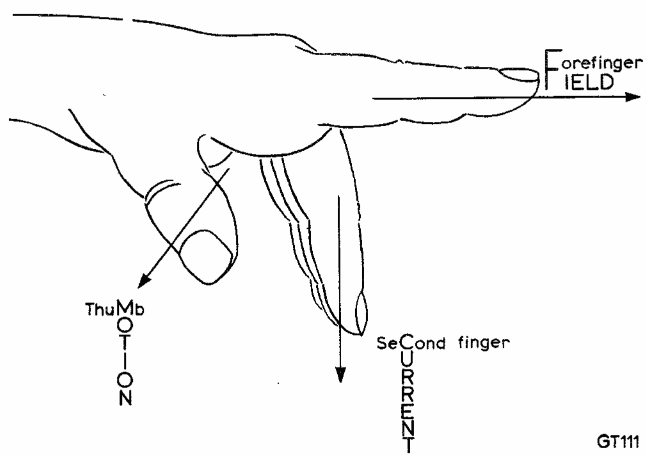


Fig. 10: Illustration of Fleming's Left Hand Rule. The importance of memorising this rule cannot be stressed too strongly.

You may begin to wonder what on earth all this has to do with amateur radio, so we will explain that the relationship between the direction of the current flowing in the conductors and the resulting magnetic field, together with the rate at which a conductor is moved in a magnetic field, are all basic ideas related to the generation of Alternating Current (AC).

Electromagnetic Induction

In the previous section you will have noticed the term INDUCED current, or a current produced by electromagnetic induction. This effect can best be demonstrated by means of the interaction of a bar magnet and a solenoid, **Fig. 11.** If the bar magnet is moved into the solenoid a deflection will be noticed in the meter connected between the ends of the windings. When the bar magnet is removed a deflection will be noticed again, but this time in the opposite direction. *Whilst the magnet is stationary, no deflection will be observed.* As an aside, you will also notice the fact (and by no means an insignificant one) that the faster you move the magnet, the greater the meter deflection.

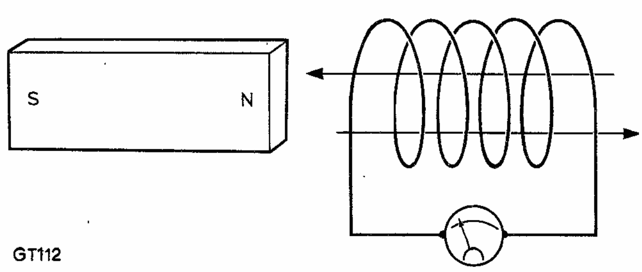
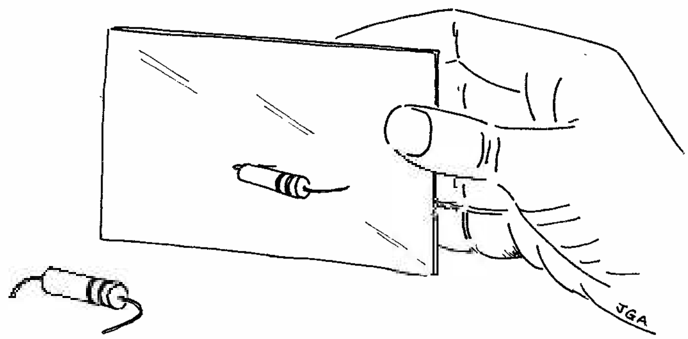


Fig. 11: A practical experiment which will show that a current is generated when a bar magnet is inserted into or removed from a solenoid. Remember:—No movement, no current!

As we have said before, some practical experience is very desirable, so why not wind yourself a solenoid, 50 to 100 turns of insulated wire on a toilet roll tube, connect it to a milliammeter, push in a magnet and see what happens!

The meter deflections indicate the presence of a potential difference between the ends of the solenoid conductors, giving rise to INDUCED current. If we think about this for a minute we will remember that, while current is flowing in the solenoid, that current will produce a magnetic field. Now, the direction of that field will be such as to oppose the motion of the magnet which induces it. Thus, if the north pole of the magnet is pushed inside the solenoid the current flow induced will produce an apparent north pole at that end of the solenoid, thus tending to oppose the magnet's motion. As the magnet is withdrawn the induced current will produce an apparent south pole at that end of the solenoid, again opposing the extraction of the magnet, since a north pole will attract a south pole.



. . . what is meant by "reflected impedance"?

The German physicist Lenz formalised this in his Law in 1834. Basically it means that the direction of the induced potential difference tends to set up a current opposing the motion or change of magnetic field producing that potential difference. Now the magnetic field which is used to induce currents in a solenoid need not come from a permanent magnet. It could come from another solenoid placed in close proximity to the first. In this we have the bones of the TRANSFORMER, but, before we look at that subject, the question of the nature of ALTERNATING CURRENT (AC) arises. Again, the previous sections will be of assistance since AC is best understood when reference is made to the facts relating to conductors moving in a magnetic field.

To be continued next month

Readers are asked to note that the publications mentioned already in this series as recommended reading have recently been increased in price. They are "A Guide to Amateur Radio" and "The Radio Amateurs' Examination Manual" which now cost £1·38 and 86p respectively. They are obtainable from the Radio Society of Great Britain, 35 Doughty Street, London WC1. The prices are inclusive of postage.

THE PW 'jubilee' ELECTRONIC ORGAN

Part 3

M. J. HUGHES MA C.Eng MIERE

Fig. 1 shows the melody keying, percussion, sustain and tone forming circuits in their entirety. ICs 7, 8 and 9 are the priority encoders described in *Part 1*. They receive the 37 tones from the generators on pins 16 to 27 in the case of ICs 7 and 8, and 15 to 27 for IC9. There are 13 inputs to the latter to allow for bottom C. Single lines to each keyboard contact can be seen clearly. When one of these lines is pulled to ground through the respective switch, the note associated with that key is latched and fed out at pin 9. The links between the ICs give priority to the highest note played.

Melody Circuits

The high level signals generated at the outputs of the priority encoders are fed to potential divider (R11 and R12) which reduces them to a level less than Vbe for Tr3 which is connected as an emitter follower. If there is no bias at the base of this transistor the audio signal will not appear at the emitter; the rate of application and removal of bias at this point controls the envelope of the output signal—thence the duration of sustain. If S1 and S2 are closed the priority output from IC9 (pin 31) is routed through the three cascaded gates of IC11b, c and d, and eventually appears, at reduced level, across VR5. A proportion of this is fed through D2 to the base of Tr3 providing the bias necessary to allow the audio signal to appear at its emitter. C6 creates a slight time constant, in conjunction with the setting of VR5, to introduce attack in the envelope.

When the selected key is released the priority signal falls immediately to zero but D2 becomes reverse biased allowing a charge to remain on C6. This charge keeps Tr3 (which can be considered to be an analogue gate) open and the audio continues to appear at its emitter. Over a short period the DC charge on C6 leaks away through Tr3 as base current and the bias is slowly lost. As this happens the audio signal at the emitter dies away. Because the signal is a square wave to start with there is no distortion in this operation. The period of charge leakage sets the sustain duration and this can be controlled by adjustment of VR6 which sets the base current for the transistor. This latter control is brought out to the front panel.

S2 introduces a low-leakage tantalum capacitor into the path of the keying strobe. This differentiates the control signal for Tr3; this opens the analogue gate momentarily allowing a short burst of audio through. The sustain setting controls the rate at which this percussive burst dies away. The burst of audio occurs on the depression of the key and will not sound again until the key is released and pressed again.

IC10 is the repeat percussion oscillator, frequency controlled by VR4 (again a front panel control). When S1 is open the low-frequency pulses of this oscillator are fed through IC11a and pass through the following gate when a key is depressed. Instead of getting a steady DC level at pin 10 of IC11d, the keying signal is now chopped by the repeat signal. This creates note repetition. Using this in conjunction with the sustain control produces effects such as banjo or xylophone sounds. Note that C7 should be a tantalum capacitor.

The RC circuitry following Tr3 creates the voicing. Normally S3, 4 and 5 are closed which shorts the signals to ground. Opening one or more of these switches introduces a particular tone colour. The signals of these three options are mixed by R21, 23 and 26 before being fed to the front panel "Melody Volume" control and thence to the melody buffer amplifier with gain set by VR8. This signal is then fed to the power amplifier or phono output stage.

Use Soldercon sockets for ICs 7 to 9 but do not insert the integrated circuits. Complete the assembly of the rest of this section by reference to **Fig. 2**. To facilitate testing, solder temporary links across the pairs of pins which will eventually go to S1 and S2. At the same time, temporarily wire in VR4, VR6 and VR7. Set the potentiometers and presets as follows to start with: VR4 Midway, VR5 To bottom (ground) end, VR6 To bottom end, VR7 Midway, VR8 Midway.

Insert the tone generator ICs. With a couple of lengths of wire fitted with clips, select one of the tone lines (see last month's circuit) and hook it tem-

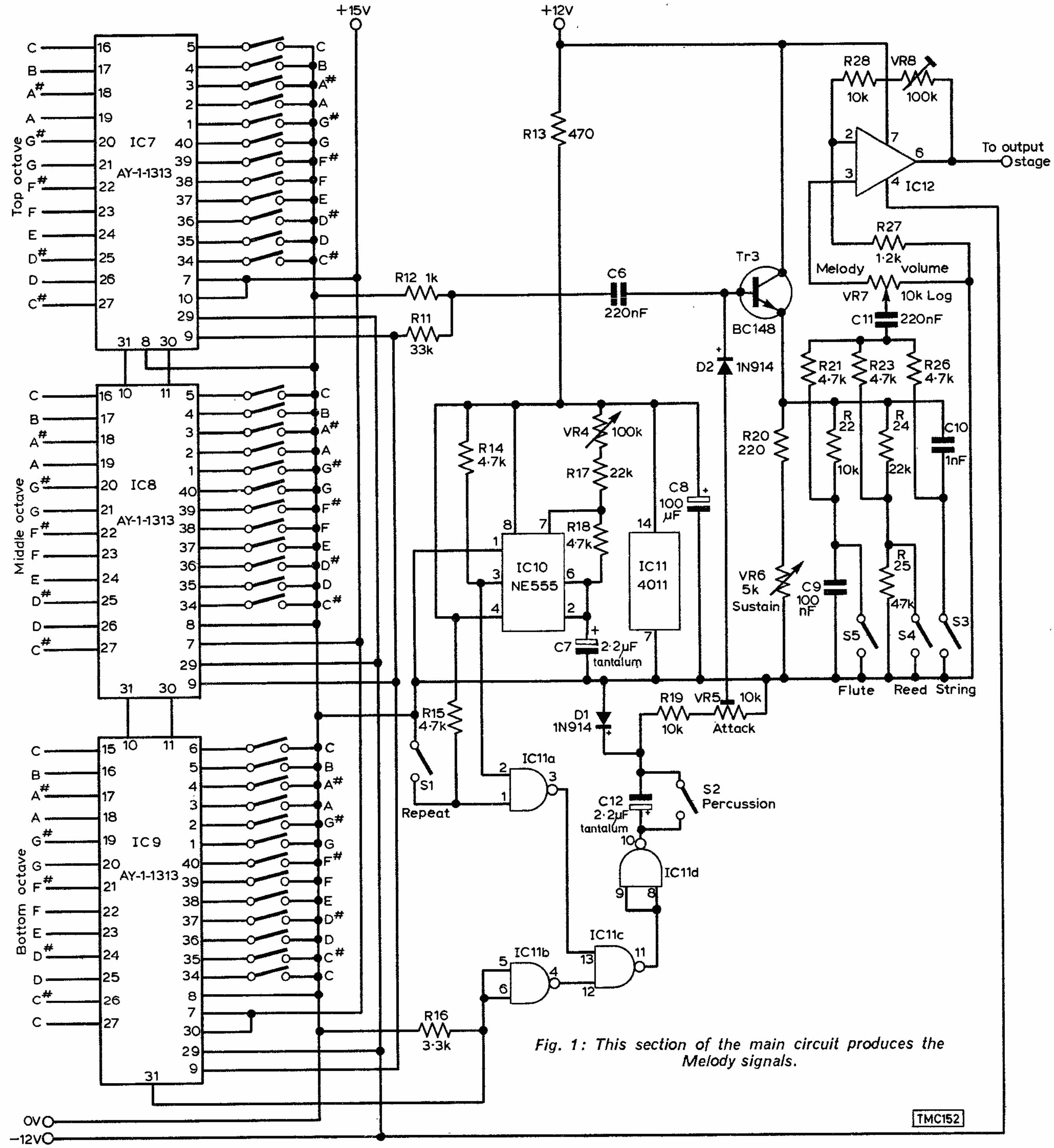


Fig. 1: This section of the main circuit produces the Melody signals.

porarily to the end of R11 which goes to the priority encoders. This will provide a test signal. The other wire should have one end clipped to pins 5 and 6 of IC11 (the end of R16 going to this point will do). The other end of this wire simulates keying by touching it to the +12V rail (at the positive end of C8).

Connect the power supply as described last month plus a loudspeaker. When you apply power you should hear nothing. Next hook the keying wire to +12V and you should still hear nothing. Gently adjust the wiper of VR5 away from the bottom end of its track to produce a tone in the loudspeaker. Adjust VR5 until the tone just reaches a stable level (ie does not get louder with increase of the setting). If, at this stage the volume is uncomfortably loud or is distorting, reduce the value of VR8. Remove the keying wire from the 12V source and the tone should stop immediately. Slowly advance VR6 and tap the keying wire on and off the 12V point. The sustain effect should get greater as VR6 is increased in value. If you get an unpleasant click at each contact with the keying point, you have probably advanced VR5 too much—this setting is fairly critical.

Remove the link across the pins for S2 and try the keying test. You should get the single burst of sound when the keying contact is made. Finally remove the link across the pins for S1. This time, when you key, you should hear repeated percussive bursts of sound—rate adjustable by VR4.

Turn off the power and remove all temporarily connected potentiometers and *also remove IC12 or it will be impossible to test following stages.*

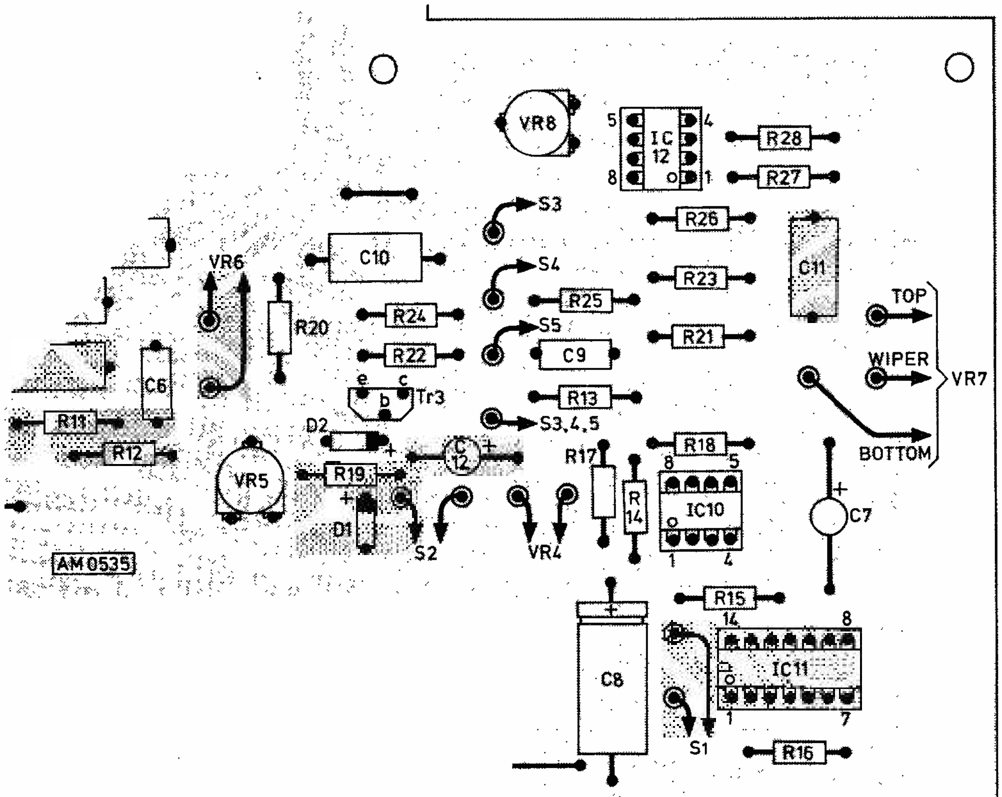
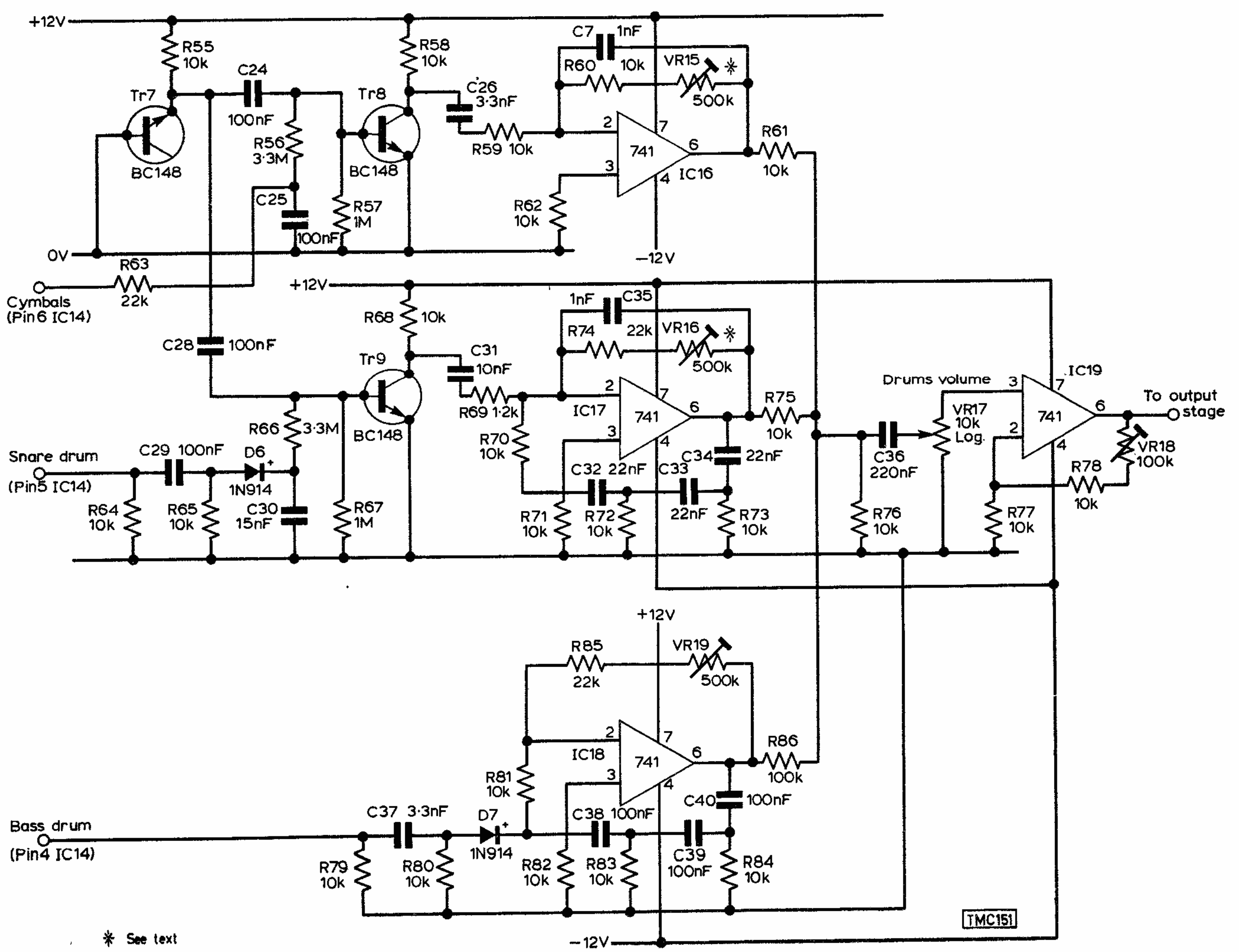


Fig. 2: left, assembly and interwiring diagram for the part of the main circuit shown in Fig. 1.

Fig. 3: below, is the circuit for the Drum and Rhythm part of the organ.



Drum and Rhythm Section

Fig. 3 shows the drum and cymbal voicing circuits. Tr7 is used as a white noise generator and feeds the cymbals and snare drum stages. Cymbal pulses from the rhythm generator IC are used to gate white noise through Tr8. The envelope of the gate is set by C25 with R63 and R56. The noise is filtered at top and bottom by C26 and C27 respectively. VR15 is used to balance the cymbal level with that for the other instruments.

The snare drum circuit is a little more complex. A sharp burst of white noise is generated at the collector of Tr9 when the trigger is received from the rhythm generator. This is fed to IC17 which is connected as a low-frequency phase-shift oscillator. VR16 is set so that the circuit is just NOT oscillating. When the white noise burst arrives it triggers a decaying oscillation in this stage and mixes with the frequency so produced. Some care is needed in setting VR16 for optimum results but the sound is quite realistic. The bass drum sound is produced by using the rhythm pulse to trigger a similar phase shift oscillator which is tuned to a lower frequency. VR19 controls the oscillation point.

Assembly details are shown in **Fig. 4**. Do not insert the rhythm generator chip (IC14) at this stage. Note that this is an 18-pin package. When everything **apart from IC14** has been correctly inserted, temporarily connect VR17 to its pins and set the controls as follows: VR15 Minimum resistance, VR16 Minimum resistance, VR17 Midway, VR18 Midway, VR19 Minimum resistance.

Connect the power supply. Slowly increase the value of VR19 until oscillation just starts then turn it back slightly so that it just stops again. With a flying lead, momentarily touch +12V to the top end of R79. You should hear a "thump" similar to that from a bass drum. Adjust VR19 for the correct amount of decay. Use VR18 to preset the level.

Now test the snare-drum circuit. Apply +12V pulses to the top end of R64 and adjust VR16 for best results. Try to achieve a reasonable balance with the bass drum. A 100kΩ component for VR16 would make for easier adjustment. After building several models it was found that the best setting is very close to the bottom end if the original 500kΩ potentiometer is used.

Finally, test the cymbals by applying +12V to the end of R63 going towards the rhythm generator and adjust VR15 until the sound is realistic. As with the snare drum circuit, adjustment may be easier with VR15 as a 100kΩ component.

The quality of the cymbals is to some extent controlled by Tr8. There is a large variation in gain for this device and a very high gain might saturate the device with the trigger pulse. This can be detected by a kind of "hesitation" at the beginning of the cymbal sound. It is remedied by reducing the value of R58 from 10kΩ to 4·7kΩ.

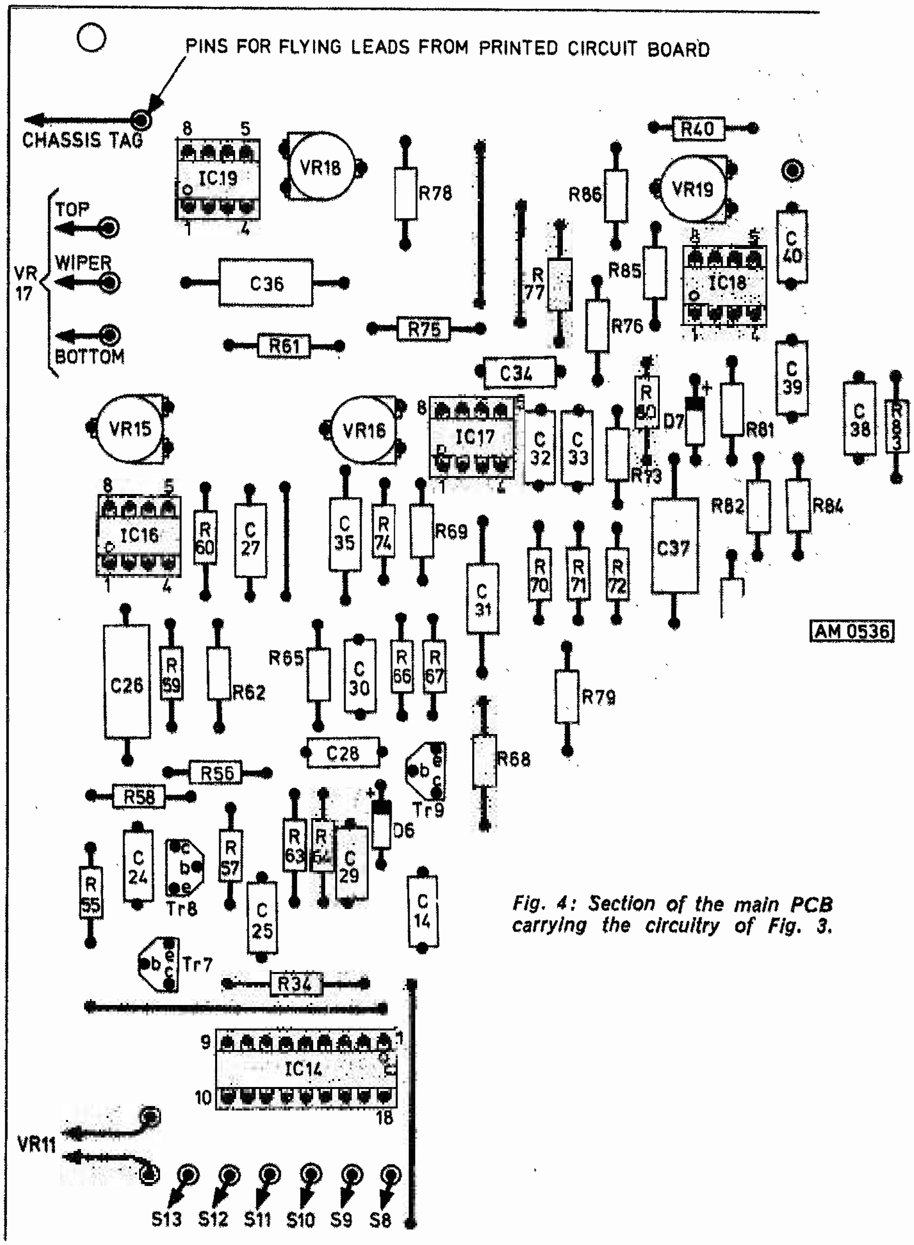


Fig. 4: Section of the main PCB carrying the circuitry of Fig. 3.

Accompaniment Circuits

The Accompaniment circuits are shown in **Fig. 5** and the assembly details of this stage in **Fig. 6**. IC14 is the rhythm generator the speed of which is controlled by VR11. Rhythms are selected by the switches S8 to S13 singly or in any combination. The switches couple the rhythm select inputs with the "Any Key Down" signal produced by the chord generator. This ensures a synchronised start of rhythm at the instant an accompaniment key is depressed.

The chord waveform is different from the simple square

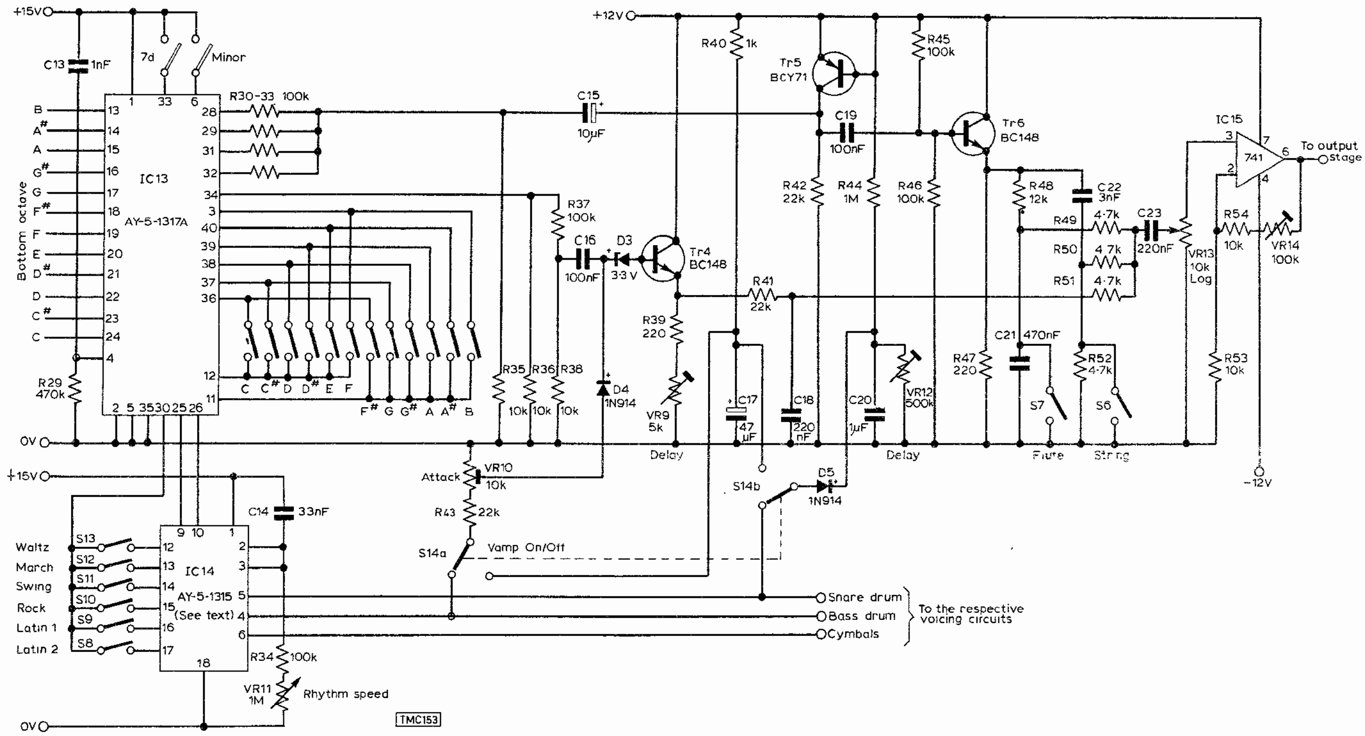


Fig. 5: The last part of the circuit to be described is for the Accompaniment.

★ components

Melody Section

R11	33kΩ	VR8	100kΩ sub miniature preset
R12	1kΩ	C6	220nF
R13	470Ω	C7	2·2μF 15V tantalum
R14/15	4·7kΩ	C8	100μF 25V
R16	3·3kΩ	C9	100nF
R17	22kΩ	C10	1nF
R18	4·7kΩ	C11	220nF
R19	10kΩ	C12	2·2μF 15V tantalum
R20	220Ω	D1/2	1N914
R21	4·7kΩ	Tr3	BC148
R22	10kΩ	IC7/9	AY-1-1313
R23	4·7kΩ	IC10	555
R24	22kΩ	IC11	4011
R25/26	4·7kΩ	IC12	741
R27	1·2kΩ	S1/5	single pole one way toggles (5 off). Rocker Tabs for conventional key-board version. Key-board switches (depending on version being built).
R28	10kΩ		
VR4	100kΩ linear		
VR5	10kΩ sub-miniature preset		
VR6	5kΩ linear		
VR7	10kΩ log. (ganged with mains switch if conventional key-board version is constructed)		

Drums and cymbals section

R55	10kΩ	VR16	500kΩ sub miniature preset but see text
R56	3·3MΩ	VR17	10kΩ log
R57	1MΩ	VR18	100kΩ sub miniature preset
R58	10kΩ* See text; this resistor might need reducing to 4·7kΩ	VR19	500kΩ sub miniature preset
R59/62	10kΩ	C24/25	100nF
R63	22kΩ	C26	3·3nF
R64/65	10kΩ	C27	1nF
R66	3·3MΩ	C28/29	100nF
R67	1MΩ		

R68	10kΩ	C30	15nF
R69	1·2kΩ	C31	10nF
R70/73	10kΩ	C32/34	22nF
R74	22kΩ	C35	1nF
R75/84	10kΩ	C36	220nF
R85	22kΩ	C37	3·3nF
R86	100kΩ	C38/40	100nF
VR15	500kΩ sub miniature preset but see text	D6/7	1N914
		Tr7/9	BC148
		IC16/19	741

Bass and Accompaniment Section

R29	470kΩ	C16	100nF
R30/34	100kΩ	C17	47μF 25V
R35/36	10kΩ	C18	220nF
R37	100kΩ	C19	100nF
R38	10kΩ	C20	1μF
R39	220Ω	C21	470nF
R40	1kΩ	C22	3nF
R41/43	22kΩ	C23	220nF
R44	1MΩ	D3	3·3V 400mW zener
R45/46	100kΩ	D4/5	1N914
R47	220Ω	Tr4	BC148
R48	12kΩ	Tr5	BCY71
R49/52	4·7kΩ	Tr6	BC148
R53/54	10kΩ	IC13	AY-5-1317A
VR9	5kΩ sub miniature preset	IC14	AY-5-1315 (pattern 004—Jubilee)
VR10	10kΩ sub miniature preset	IC15	741
VR11	1MΩ linear	S6/13	single pole one way toggles (8 off)—rocker tabs for conventional key-board version
VR12	500kΩ sub miniature preset		
VR13	10kΩ log		
VR14	100kΩ sub miniature preset	S14	double pole change-over toggle or rocker tab with similar pole configuration
C13	1nF		
C14	33nF		
C15	10μF 25V		

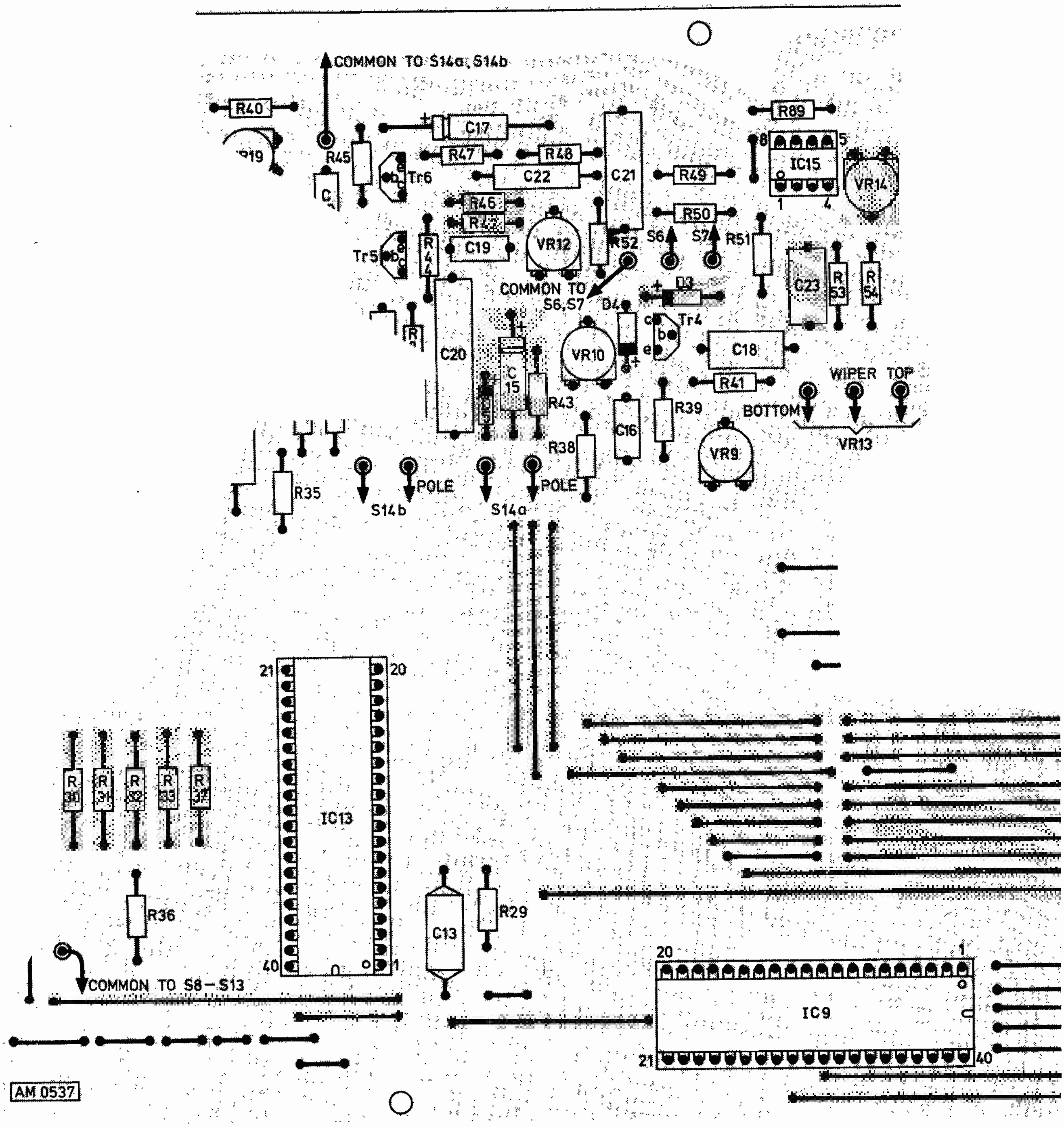


Fig. 6: Assembly details for the circuit shown in Fig. 5.

wave produced in the melody circuits in that it is more akin to a staircase which constantly changes its shape (depending on the harmonic relationships between the three or four elements it comprises). The simple emitter follower type of envelope shaper would introduce asymmetric distortion. Tr5 in conjunction with R42 acts as a voltage controlled attenuator. The mixed chord signal is applied to its collector via C15 and taken from this same point via C19 for further processing. If Tr5 is "turned on" the signal is shunted to the positive rail and its amplitude falls to nearly zero. The transistor is biassed so that this is the usual condition. When it is turned off—by means of the snare-drum pulse—the signal momentarily rises at the collector and then dies away as the charge on C20 is shunted to ground through VR12. This gives a percussive attack and a reasonable sustain; the latter being preset by VR12. If S14b is in the "Vamp OFF" position a steady DC level is maintained on C20 and this holds Tr5 permanently off. In this condition any signals from the chord generator are unaffected by the envelope shaper.

The envelope shaper for the alternating bass is similar to the emitter follower circuit used for the melody rail except that it produces a slightly larger signal (to allow for losses in the heavier filtering which is applied to it). A zener diode (D3) is used to back off the transistor's Veb so that larger signals can be applied without them appearing at the emitter prematurely.

Last Assembly

Complete the assembly of this stage by reference to Fig. 6. Insert Soldercon sockets for IC13 and IC9 but do not insert these ICs yet. Wire in temporary links between the pole pins of S14a and b to the DC level (at the pin adjacent to R45)—this disables the Vamp and will make initial testing easier. Temporarily short out R35 to inhibit chords. Refer to Fig. 4 which shows the position of IC14 and connect a temporary link between the pin labelled "S13" and "Common". This selects the waltz rhythm. Wire VR11 and VR13 to their respective pins. Set all controls as follows: VR9 to minimum resistance, VR10 to "ground" end of track, VR11 midway, VR12 to maximum resistance, VR13 midway, VR14 midway.

Connect the power supply and loudspeaker but *before* turning on insert ICs 13 and 14. *Take great care not to damage the pins.* Double check the orientation of these two ICs (they are expensive!).

You can now apply power and should, initially, hear nothing from the loudspeaker. Depress the key marked for the chord of C or, alternatively, use a piece of wire with clips to bridge the contacts in the position of this switch. Slowly move the wiper of VR10 away from ground to produce the bass note. It will be alternating and its speed should be adjustable with VR11. There should be no percussion or sustain at this stage. Set VR10 so that there is no further increase in volume as it is adjusted. If necessary adjust VR14 for correct level.

Final Steps

Switch off the power and remove the link between the pole of S14a and the DC level pin. Now insert a link between the pole and its adjacent pin (which carries the bass drum pulses).

Re-apply power to hear the alternating bass with percussion and sustain. Adjust VR10 to remove undesirable clicks and then set VR9 for sustain period. Try different chord selections by pressing other keys and you should find that the pairs of bass notes change accordingly.

Removing the shorting link across R35 should produce static chords—depending on the key you are depressing. Try the 7th and Minor select keys in conjunction with the selected chord.

Switch off the power and re-connect the pole pin for S14b to its immediately adjacent neighbour (carrying the snare-drum pulses). Re-apply power and you should now hear rhythmic chords interspersed with the alternating bass. Adjust VR12 for the best duration of chord sustain.

Insert IC9 and then refer to Fig. 2 in Part 2 and insert ICs 7 and 8—at the same time checking all the top side wiring links.

Board assembly is now complete and all the stages have been tested and initially adjusted. Remove all temporary leads. Remember to replace IC12 and IC19.

Next month—the final stages—assembly into the cabinet.

DESIGN YOUR OWN PROJECTS

No. 3

CAR COURTESY LIGHT

TOBY BAILEY & BOB WHITAKER

Courtesy lights in cars can be very annoying. You get into your car at night, sit down, shut the door and the light goes out; leaving you fumbling in the dark trying to insert the ignition key! Most, if not all, of these problems can be solved by an appropriate circuit which keeps the light on for a few seconds after the door is closed—besides, this provides us with an interesting design exercise!

Specification

Assuming that the car has a negative earth power supply, the circuit in the car before modification will consist of a 12V supply driving the light bulb, with a switch, operated by the door, in the positive line. We want our circuit to supply current to the light for about fifteen seconds after the switch is opened. This arrangement is shown in **Fig. 1**.

Design

Well then, how are we going to set about doing this? The only way that springs readily to mind (ours at any rate) is to charge up a capacitor when the switch is on and to let it discharge when the switch is turned off. After all, most timing circuits are based on this principle! Unless we are going to become involved with relays and the like we will need a series pass transistor in parallel with the switch to turn on the light after the switch is turned off. The arrangement will be something like that in **Fig. 2**.

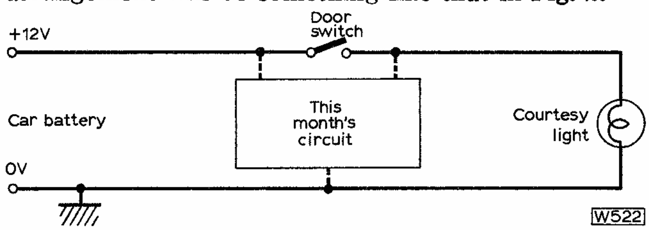
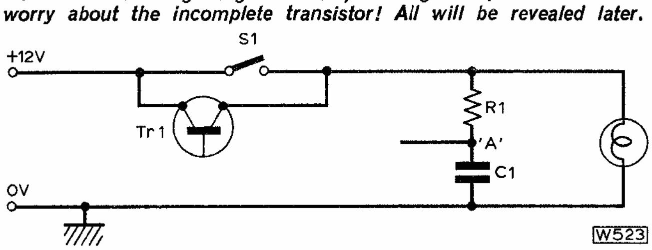


Fig. 1: Above, the normal car courtesy light plus our circuit gives a worthwhile advantage. Fig. 2: below, is the germ of the idea. Don't worry about the incomplete transistor! All will be revealed later.



R1 is the resistor through which we charge up capacitor C1. We haven't drawn an emitter on the pass transistor yet, this is because we've not decided whether it's going to be PNP or NPN! Anyway, there's a slight problem with the circuit as it stands. We want Tr1 to turn on when the voltage at point 'A' reaches a sufficiently high value: we then want C1 to discharge slowly when S1 is turned off. However, C1 will charge up just as effectively through Tr1 as through the switch, so there's no way that we can discharge C1 when S1 is turned off again. Hence, with the present arrangement, the light will never turn off. Somehow we have to isolate the effects of the switch and the transistor for the purpose of charging up C1.

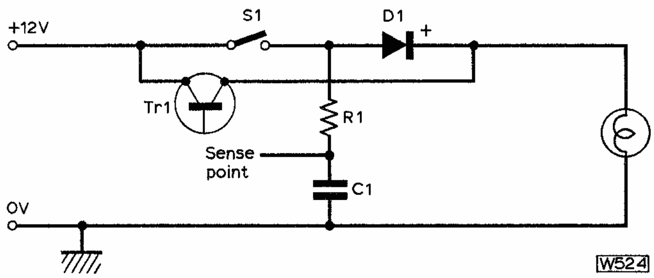


Fig. 3: The diode D1 turns out to be the critical component in this month's circuit.

A small amount of thought produced the following simple modification: we insert a diode between the switch and the light, so that the transistor is in parallel with both. We then take the charging resistor from the switch side, **Fig. 3**. Now when the switch is closed C1 will still charge up and we can use the voltage at the sense point to hold Tr1 on. The difference now is that when S1 is off and Tr1 is on, D1 will be reverse biased and hence no current can pass through R1. This allows us to discharge C1, in some manner yet to be specified!

Having solved that problem, how are we going to fit those two 'dangling wires' in **Fig. 2** together? It's fairly obvious that we're going to need another transistor and that we want it to turn off when the voltage at the sense point becomes low enough. We can then

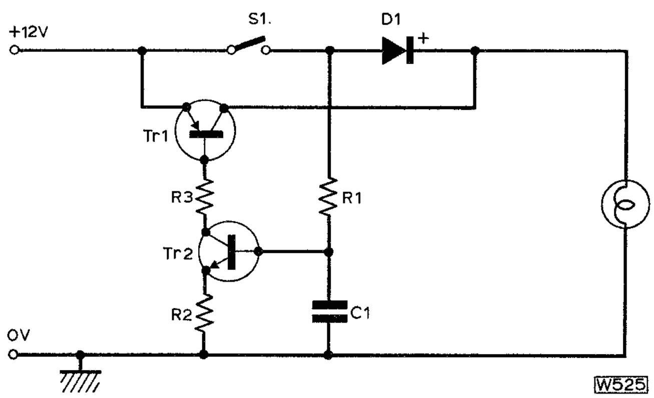


Fig. 4: A second transistor and a working circuit at last.

★ components

R1 100kΩ R2 6·8kΩ both ¼ or ⅓W carbon
C1 2·5μF 25V electrolytic C2 0·68μF
Tr1 OC35 Tr2 2N3702 Tr3 2N3704 D1 1N4001
The lamp and the switch S1 are part of the car wiring

use this transistor to control Tr1. If we use an NPN transistor here then Tr1 will have to be PNP to make them fit together sensibly, as in **Fig. 4.**

You can see that two additional resistors have appeared as well as Tr2. We've included R3 to limit the base current in Tr1—it should stop anything nasty happening! If we don't include R2 then C1 will be discharged very rapidly. This is because Tr2 will saturate and then pass a large current through the forward biased diode of its base-emitter junction. With R2 in the circuit the emitter of Tr2 will just float up to about 0·5V below the capacitor voltage: the current drawn from the capacitor is just the current through the emitter resistor divided by the gain of the transistor. On further consideration, what on earth do we need R3 for? The current that flows in the base of Tr1 is just Tr2's collector current; since R2 will limit this anyway we don't need R3 as well. Also, R3 would be a bit of an embarrassment if it caused Tr2 to saturate so, on second thoughts, let's dispense with it.

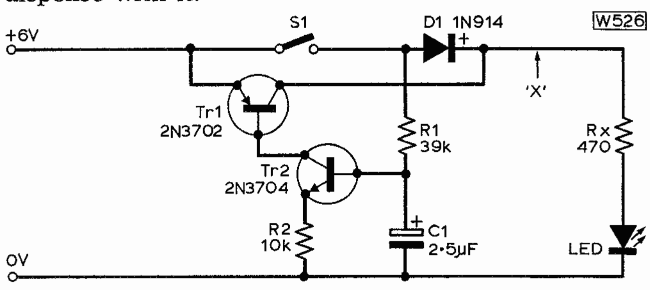


Fig. 5: The test circuit for the idea, using an LED instead of the car's lamp bulb. Note the use of a 6V supply here.

At this stage it's probably a good idea to play with the circuit on S-Dec to make sure that it works. **Fig. 5** shows the circuit we assembled; the 6V supply and the LED were used merely because they were nearest to hand. This arrangement gives a good idea of the feasibility of the circuit so far developed. 10kΩ seems a reasonable sort of value for R2, although we could have used any of a wide range of values equally well. It should keep the current drawn from C1 small and prevent excess base current in Tr1. The choice of 39kΩ for R1 is also fairly arbitrary—it charges C1 quite quickly. Rx limits the current in the LED to around 10mA. With these values the circuit works with a delay of about five seconds: so far so good. However, the light turns off rather slowly, taking a couple of seconds after the light starts dimming before it is completely extinguished. The problem is that at the turn-off point the current being drawn from C1 is very small and so everything happens very slowly. We could try sticking a resistor across C1 to increase the current drawn at turn-off but then we'd need a much larger capacitor, since it would discharge very quickly to start with. We must be able to do better than this!

Surely the way to get fast switching is to use positive feedback, i.e. regenerative switching. The only way to produce positive feedback here is somehow to connect the point marked 'X' in **Fig. 5** to the base of Tr2. We don't want to use a resistor since this will mess up our biasing and the whole business then becomes very confused. What happens if we use a capacitor to provide the feedback? It certainly should speed up the switching in the critical region: as soon as the light starts to turn off the voltage at point 'X' will start to drop and since the voltage drop across a capacitor can't change instantaneously, the voltage at the base of Tr2 will also be forced down. For our first try the use of a 0·68μF capacitor produced rather a strange result—the LED flashed a few times as it turned off. Perhaps something like that was to be expected; after all we have very nearly constructed an oscillator! With further trials we found that a 0·1μF capacitor had little effect, that 0·47μF produced a vast improvement in switching speed without any untoward effects and that larger values (about 2μF electrolytic) also speed up switching with no hint of oscillation. Having reached this stage it's now time to design the complete circuit for a proper light bulb; we can find the optimum value of 'speed-up' capacitor by trial and error.

A quick attack on the car produced the information that the interior light is rated at 12V 6W. From this it doesn't require much mental strain to work out that we will need to supply about 0·5A to keep the bulb alight. Of the selection of power transistors that we possess an OC35 seems to be the most suitable—

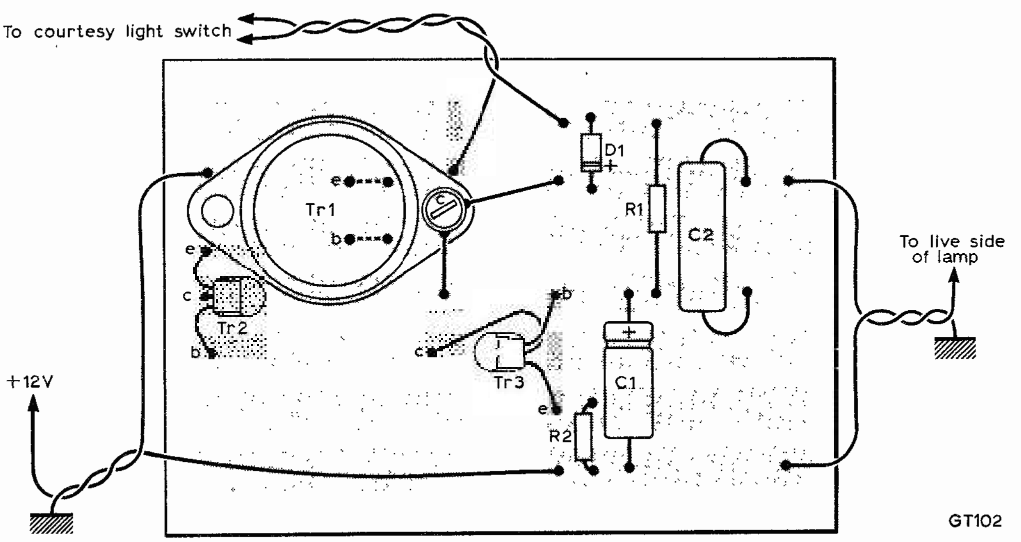


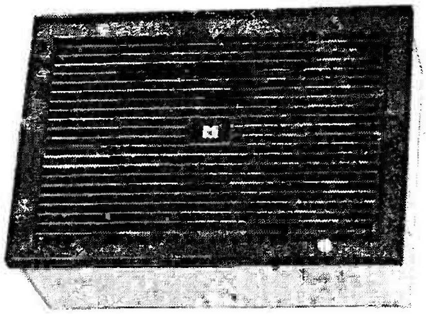
Fig. 7: The final circuit can be built up on a piece of stripboard as shown here. In the author's unit the board was stuck in the bottom of an aluminium die-cast box with flexible leads coming out for the switch, supply and lamp.

PRODUCTION LINES

bill tull

Protection racket

Not a lot to look at is it? but then a burglar alarm should be fairly unobtrusive in order that it can perform its task to the best of its ability. This latest one from ADE (Security) Co. is called the Maxi-guard Mk 4, and is designed around ultrasonics with an operational range of between 6ft and 30ft. When the device is properly set up it transmits a frequency of 40kHz, and provided there is no movement within the room the same frequency is returned to the units built-in re-



ceiver. However, if there is something in the room that moves, the frequency of the returned signal is altered (Doppler effect), activating the alarm.

The Maxi-guard operates from a 12V DC source and draws approximately 100mA. Measuring 181 × 126 × 64mm, it can be obtained from the manufacturers for £35·00 plus 12½% VAT.

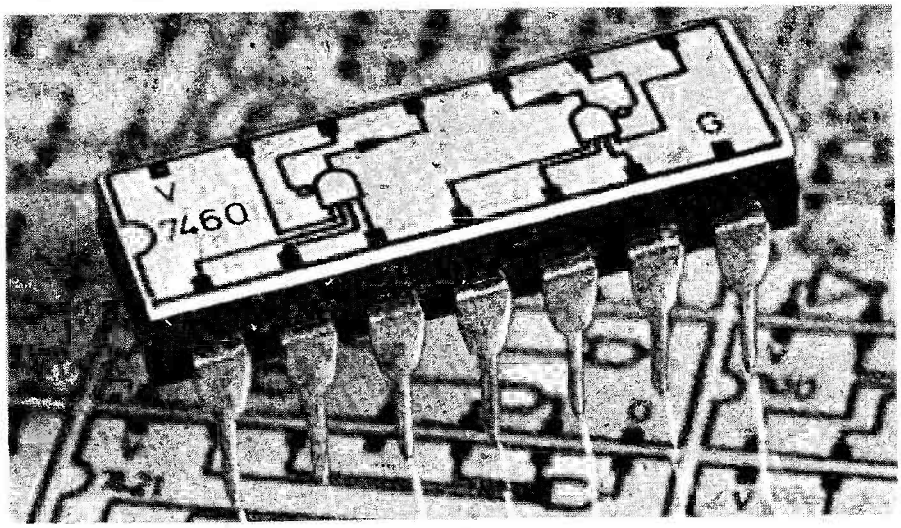
ADE (Security) Co., 217 Warbreck Moor, Aintree, Liverpool. Tel: 051-525 3440.

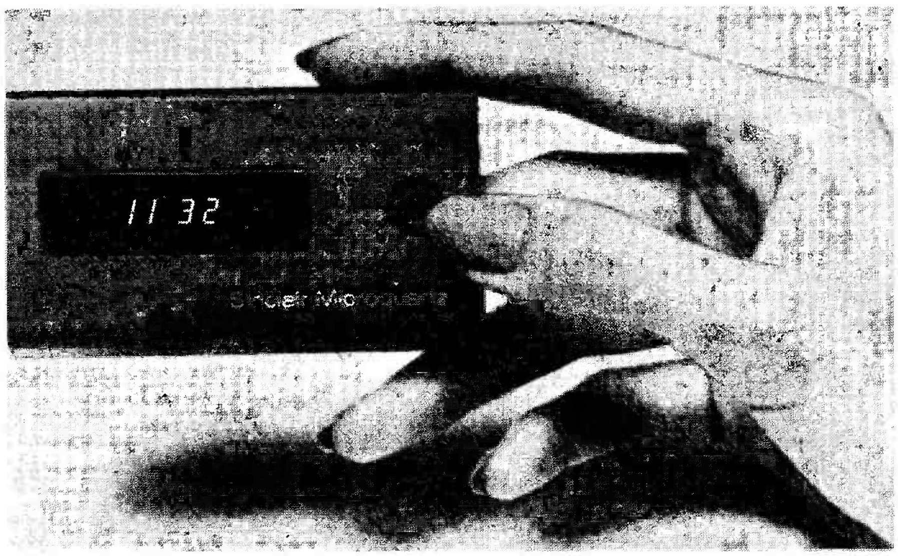
So simple

Unless you happen to possess a photographic memory, the constructor using TTL IC's almost always has to refer to data books for correct pin configuration. A simple, yet highly effective idea from Concept Electronics, is IC-size self-adhesive printed labels showing pin-outs for the 61 most popular 14 and 16 pin ICs. Aptly named Stickies, they are attached to the top of ICs and can be used for constructing and fault finding in prototypes, designing PCB layouts, fault finding on production circuits, and are invaluable as a teaching aid.

Available in sets of 450, they are packed in a re-usable plastic folder complete with comprehensive instructions. Also included in the pack is a list of equivalents which extends the range of Stickies to cover 86 ICs. Priced at £2·80 for the pack, further details can be obtained from:—

Concept Electronics, 8 Bayham Road, Sevenoaks, Kent. Tel: 0293 514110.





Quartz controlled

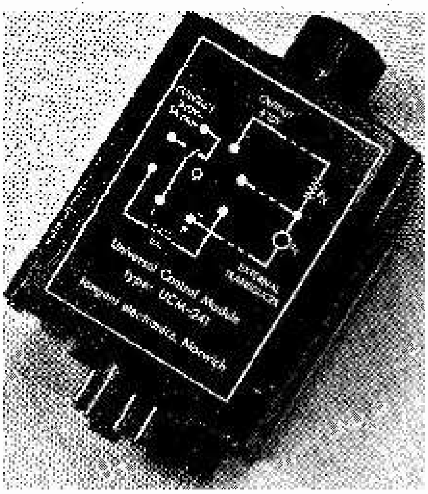
A rather smart looking digital clock has recently been announced by those wizards of miniaturisation—Sinclair Radionics. Finished in matt black, the Microquartz GT is primarily designed for use in the car, although it's equally effective fixed on a desk, bedside table or workbench. Fixing is by means of adhesive pads.

All time settings are adjusted by the touch of a button, and as the unit is quartz controlled, it is claimed to operate for up to two years on two pen light batteries. The black anodised alloy case measures 90 x 45 x 16mm and weighs in at 3oz.

Available from the normal retail shops, the price is £12·95. If trouble is encountered in getting one, then apply direct to *Sinclair Radionics, London Road, St. Ives, Huntingdon, Cambs. Tel: 0480 64646.*

5-way controller

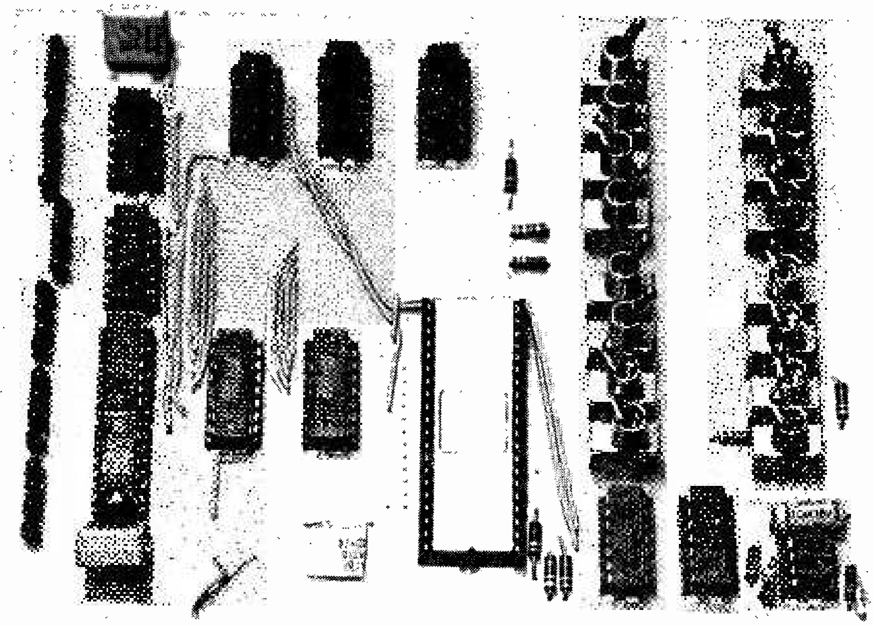
Plug it in, connect an external transducer and 240V AC and what've you got? Well you've got a temperature controller; a light controller; a variable time delay; a liquid level sensor or a touch switch. To perform any of these control functions it is only necessary to connect a transducer between terminals 5 and 6 (thermistor for temperature control, capacitor for timing control, light dependent resistor for lighting control etc.) and a resistor of similar resistance to the transducer between terminals 6 and 8. Also as this



5 in 1 module operates from the mains it generates its own internal isolated supply of +10V DC at terminal 5. Called the Universal Control Module, it contains its own internal comparator and the level required is obtained by adjusting the knob at the top of the module. The internal single pole/change over contact is rated at 240V 5A AC or 30V 5A DC.

For one-off the price is £14·95 plus VAT, and for an extra £4·80 a kit containing resistors, capacitors, a light sensitive resistor, thermistor etc. can be obtained.

Tangent Electronics, 136 Whitehall Road, Norwich, Norfolk. Tel: 0603 28015.



Legal "Scrumping"?

Mention the words Microprocessor system to the average enthusiast and he'll draw in his breath and mention things like the cost of petrol going up, and food isn't getting any cheaper and that he'd like to indulge but just can't afford it. If that person is you—then read on because Bywood Electronics have launched a system, which at £55 is claimed to be more price competitive than any other system available. With the rather unusual and mnemonic name "Scrumpi" it has nothing to do with apples, but is designed for the engineer or student who wishes to obtain experience of using and designing with microprocessors.

All parts are supplied in the Scrumpi kit, which incidentally is based on the National Semiconductor SC/MP eight-bit microprocessor. The switches are soldered to the PCB by their terminals while the circuit needs a power supply of +5V and −7V and these can be derived from a single 12V supply with a five volt Zener diode. Comprehensive instructions and operating data are provided with Scrumpi along with details for the SC/MP microprocessor.

Bywood Electronics, 68 Ebberns Road, Hemel Hempstead, Herts. Tel: 0442 62757

Master meter

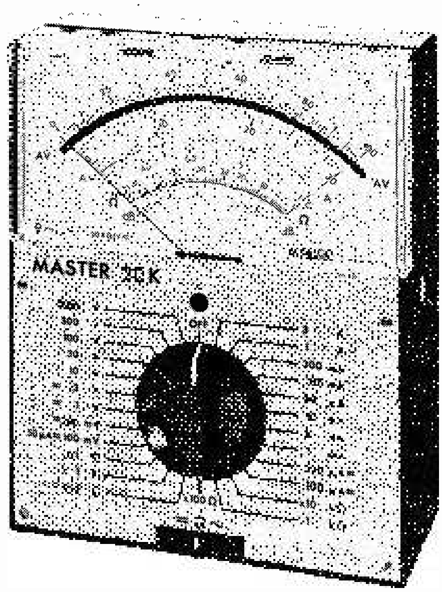
A new arrival from Alcon Instruments is a 20kΩ/V multimeter with claimed accuracy figures of 1·5% on DC and 2% for AC. Called the Master 20 it is available in two versions—standard and USI. The latter model derives its name because it incorporates a Universal Signal Injector capable of supplying a 1kHz-modulated 500kHz 20V output, rich in harmonics and detectable up to 500MHz.

Both models feature a DC range capable of measuring from 100mV to 1kV and currents from 50μA to 3A; an AC range which measures from 10V to 1kV and currents from 1mA to 3A and resistance ranges from 200 ohms to 20M ohms.

Optional extras include a 30kV probe which extends the DC voltage range for servicing TV's, 'scopes etc.

The Master 20 measures 170 x 140 x 62mm and is supplied with leads, prods and instructions. For the standard model the price is £37·15 and for the USI model £41·90. The 30kV probe is £16·95.

Alcon Instruments Ltd., 19 Mulberry Walk, London SW3. Tel: 01-352 1897.



Brian DANCE M.Sc

FERRANTI ZN1034E TIMER

Quite a number of monolithic timer devices are now on the market, the "555" being one of the best-known types. Although the economical 555 can provide a very wide range of delay times from about 5μs up to some minutes, it is not suitable for a long delay time of the order of an hour or a week. The problem of using an analogue timer to obtain very long delays is that the product of the timing resistor value and of the timing capacitor value must be very large. However, one cannot employ a large value electrolytic capacitor if one requires an accurate delay time, since this type of capacitor has a large tolerance in its value and the value can change with time. In addition, the leakage current of such capacitors makes it impossible to employ a large value of timing resistor.

The ZN1034E

A recent device from Ferranti employs an analogue timer, but the same chip also incorporates a 12-stage frequency divider. Thus the basic oscillator must pass through 4095 cycles before the timing period is terminated. One can therefore employ moderate values of the timing components and multiply the oscillator period by a large factor.

It is not usually necessary to employ an electrolytic capacitor to control the timing of the ZN1034E oscillator. Successive timing periods can therefore be repeated very accurately, to within about 0·01 per cent. Similarly the change of the timed period with temperature can be as low as 0·01 per cent per °C if the temperature coefficients of the timing resistor and capacitor are very low.

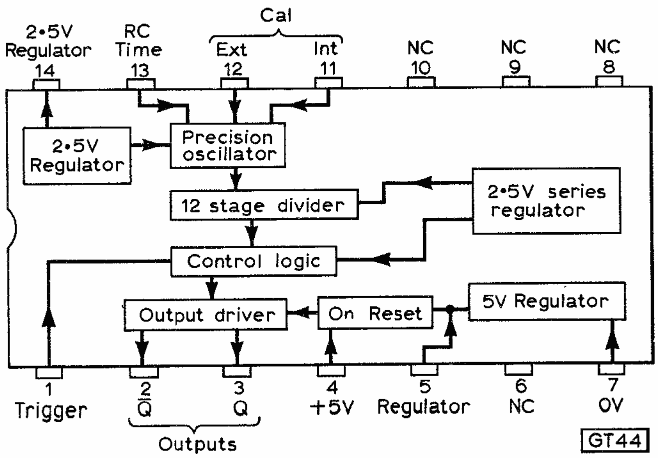


Fig. 1: Connections for the ZN1034E timer IC together with the internal circuit shown in block form.

The ZN1034E device is supplied in a 14-pin dual-in-line package with the connections shown in **Fig. 1**, but electrically similar devices are available in an 8-pin dual-in-line and in a 10-lead circular metal can under the type numbers ZN1034P and ZN1034T respectively.

Power supply

If a 5V regulated supply (as used with TTL circuits) is available, pin 4 should be connected to the +5V line and pin 7 to the 0V line. A 0·1μF capacitor should be connected directly between these pins to provide high frequency decoupling. Alternatively a supply of 6V up to 450V can be used in the type of circuit shown in **Fig. 2**. The positive line is connected through a dropping resistor R_D to pins 4 and 5. The internal regulator connected to pin 5 ensures that the correct voltage of +5V is applied to pin 4.

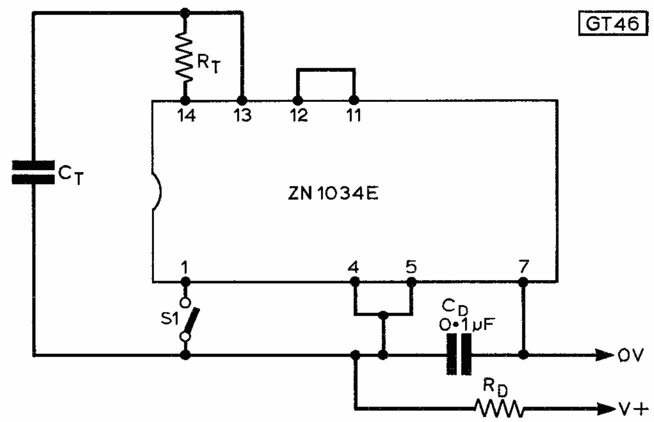


Fig. 2: The ZN1034E with its input and timing circuits and power supply connections.

The value of R_D in kΩ is given by the equation:—

$$R_D = \frac{(V^+ - 5)}{(I + 7)}$$

where I is the load current in mA. Additional decoupling may be required if the supply voltage should exceed 50V. The current consumption of the ZN1034E is about 5mA plus any current taken from either of the outputs.

Timing

The timing resistor (R_T in **Fig. 2**) should have a value of between 5kΩ and 5MΩ, but for optimum linearity and performance, the value should be between 50kΩ and 1MΩ. The product of the values of

R_T and C_T sets the period of the internal oscillator. If the value of C_T exceeds 68nF, the delay period is 2700 multiplied by R_TC_T if pins 11 and 12 are joined so as to bring the internal calibrating resistor of 100kΩ into circuit. Typical values of R_T and C_T and the time delays which can be obtained by multiplying R_TC_T by a large factor are shown in Table 1.

The value of C_T should exceed 0·01μF for optimum performance; although smaller values may be employed when the timed period must be short, the period is then not linearly related to R_TC_T. The minimum recommended value of C_T is 3·3nF. For very long delays, electrolytic capacitors are convenient, but they do not provide such accurate timing.

TIMING COMPONENTS C_T (μF)	R_T (Ω)	R_TC_T	TIMED PERIOD $2736R_TC_T$ (Pins 11 and 12 joined)	$7500R_TC_T$ (300Ω from pin 12 to earth)
0·01	39k	0·39ms	1 sec	2·91 sec
0·1	220k	22ms	1 min	2·74 min
1	100k	100ms	5 min	12·5 min
1	1·2M	1·2 sec	54 min	2·5 hours
10	1·2M	12 sec	10 hours	27 hours
10	3·3M	33 sec	1 day	2·7 days
100	2·2M	220 sec	1 week	2·7 weeks

Table 1: Giving various values of R and C that can be used with the timing circuit of the ZN1034E.

An internal calibration resistor of 100kΩ in value is connected in circuit when pins 11 and 12 are joined; the delay time is then equal to about $2736R_TC_T$. If, however, an external calibrating resistor of 300kΩ is connected between pin 12 and earth (pin 7), the timed period is $7500R_TC_T$. The multiplying factor can also be fixed at 2500 by the use of a 50kΩ resistor between pin 12 and ground or at 4100 with a 150kΩ resistor.

Measuring the period

The basic oscillator period can be measured by connecting a probe to pin 13, but the probe impedance should not be less than $10R_T$ or it will cause a considerable change in the period of oscillation. For short times the output from this pin should be viewed on an oscilloscope, but for long times a stop watch is convenient. The total delay time is 4095 times the period of the oscillator. The measurement of the period of the basic oscillator is much quicker than the measurement of the whole of a long timed period at the output of the frequency divider circuit, but the measurement of the total timed period at the output will normally provide a more accurate value of this period.

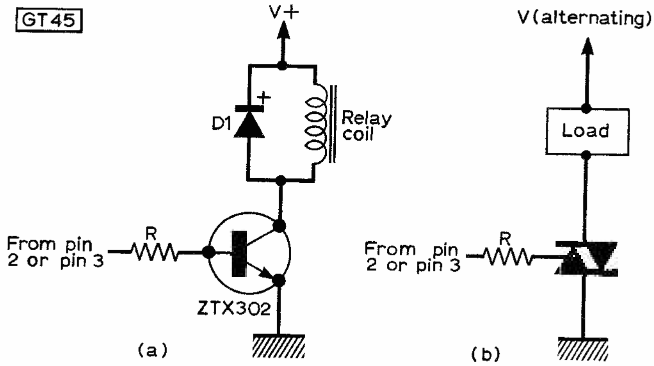


Fig. 3: Two types of output circuit suitable for the timer.

Starting up

The timing in a ZN1034E circuit may be started by joining pin 1 to earth by closing the switch S1 in **Fig. 2** for a moment. The timing process is then unaffected by any further operation of S1. Alternatively, if pin 1 is earthed, timing will begin immediately the power is first applied to the circuit.

Output circuit

Two complementary outputs are provided from the ZN1034E. The output at pin 2 is normally at a low voltage, but rises to +3·6V at the end of the complete timed period. On the other hand, pin 3 is normally at a 'high' voltage, but this voltage falls from about +3·0V to a 'low' value at the end of the

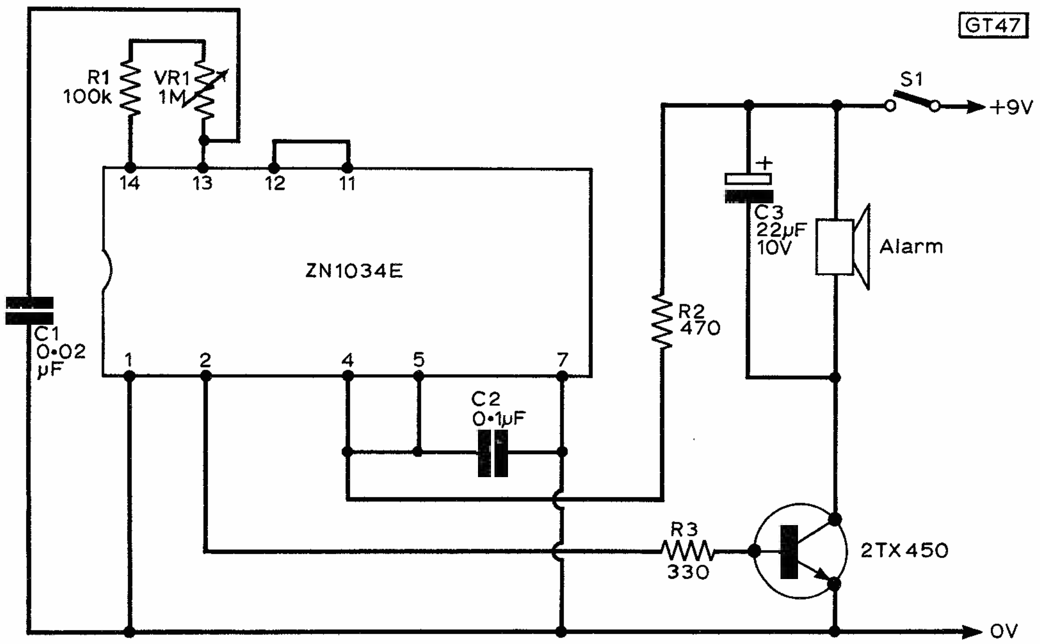


Fig. 4: Here the timer is used in an alarm circuit which can provide delays from 1 to 11 minutes. The transistor type should be shown as ZTX450.

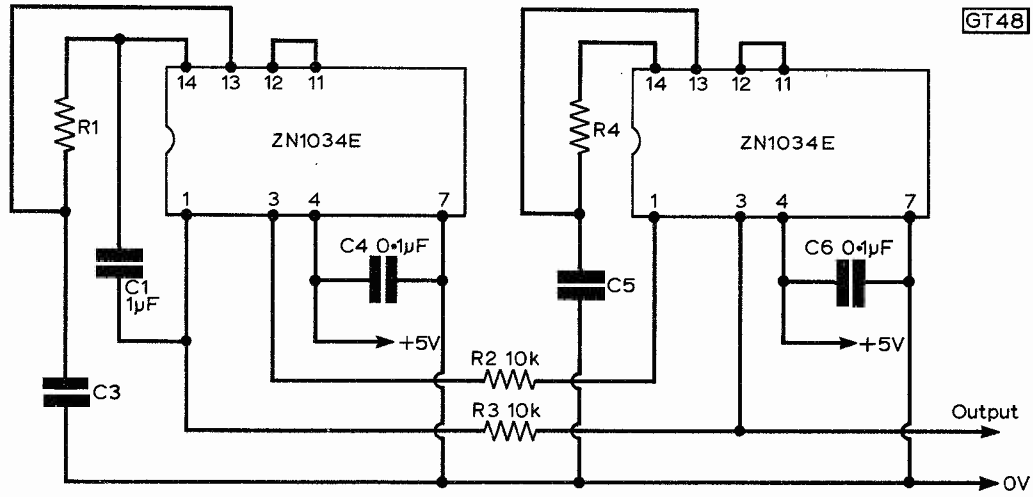


Fig. 5: Two ZN1034E chips are used here to extend the timed period to a week or more.

timed period. Either output can deliver or accept up to 25mA.

A typical output circuit for the operation of a relay is shown in **Fig. 3**(a). At the end of the timed period, the output from pin 2 rises in voltage and this causes the ZTX302 NPN transistor to conduct. A current therefore flows from V^+ through the relay coil and the relay closes. The V^+ supply in **Fig. 3**(a) is chosen to suit the relay used. The diode D1 suppresses transient voltages developed in the relay coil and hence protects the ZTX302 transistor.

If the resistor R of **Fig. 3**(a) is connected to pin 3 of the ZN1034E instead of pin 2, the relay will be closed during the timed interval and will open at the end of the interval. The resistor R of **Fig. 3**(a) must limit the current flowing from the ZN1034E output to a value no greater than 25mA. A value of a few hundred ohms is suitable with a minimum value of about 150Ω. **Fig. 3**(b) shows how the output from a ZN1034E can be used to control a triac device which itself switches the power to a load on or off. As before, R must limit the ZN1034E output current to 25mA.

Minute timer

In **Fig. 4** the product R_TC_T can be varied from 0·02 to 0·22 second by increasing VR1 from 0 to 1MΩ. When multiplied by the 2700 factor, times of 1 to 11 minutes can be obtained. Timing starts when S1 is closed and power is applied to the circuit. The alarm sounds at the end of the timed period and continues to sound until S1 is opened. A suitable alarm is obtainable from Doram Electronics Ltd.

Repetitive timer

The circuit of **Fig. 5** shows how a second ZN1034E can be started at the end of the timed period of the first device. At the end of the period timed by the second device, the timing process is started again in the first device. Thus this timer circuit continues to operate with each device working in turn. The output from pin 3 of either device provides the signal through R2 or R3 which begins the timing in the other device. Thus one has an oscillator with a period which can exceed a week!

A wide selection of other circuits is included in the ZN1034E data sheet including (i) a battery charger which can accurately charge nickel-cadmium cells for a known period at a known current (ii) a metronome (iii) a timer for periods of 1 minute to 1 hour (iv) a 0 to 1 hour industrial timer with suppression against noise pulses (v) a delayed windscreen wiper motor control for vehicles (vi) the use of two ZN1034E devices in cascade to obtain a very large pulse division factor and hence delays of up to a year with an accuracy of 6 minutes after calibration. Other applications include the use of the device on farms for watering, etc, at the required times. ●

KINDLY NOTE!

ATOMIC TIME RECEIVER
August 1977

The author has kindly supplied further information on the coil assembly T1. An alternative to the one specified can be obtained from Hawnt Electronics Ltd., 112 Pritchett Street, Birmingham B6 4EN. This is the 10mm Vinkor LA2936 comprising parts: LA1421 pair of cores, LA1383 adjuster, DT2169 coil former, DT2341 ring, DT2342 clip (4 off) and DT2344 tag board.

The windings required are, Primary: 110 turns of 40 SWG enamelled copper wire. Secondaries: two of 20 turns each centre tapped. There are suitable holes in the PCB for this alternative assembly.

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

Not too many reports this month, with just about everyone away on holiday I suppose. With the appalling weather we are having in the south I thought that a lot of you would have been tied to your sets instead of looking after the leeks! Weather or not, it seems that quite a few of you have been doing the rounds of the rallies and other "do's".

Tom Learmonth of Cwmbran, Gwent, tells me in his first letter to the column that he has now passed his RAE. Congratulations Tom, but I have to remark that it is usually the other way round! Letters first, pass the RAE, and not another word! Tom is not too keen to get the code test over and done with although I have advised him otherwise. He is anxious to get hold of a secondhand transceiver for the 2m band, possibly for mobile work, so any offers to Tom at 10 Glade Close, Coed Eva, Cwmbran, Gwent. Incidentally, Tom studied entirely on his own for the RAE and now his Dad is thinking of having a go!

From Hastings, **Brian Harrison** has stuck to the job in hand and covered 10, 15 and 20m on SSB while **Robin Bayley** A9203, up in Kemberton, Shropshire, patiently awaits his RAE course to begin so that he can take the exam next May. In the meantime he is using his EC10 and Marconi R1475 to good advantage from 15 to 80m.

John Tye G4BYV writes from Dereham, Norfolk, concerning the lads who work continental stations via repeaters and then ask for a QSL! Frequently they have only worked over a couple of miles! John spreads his time over a wide range of bands from 2m down to 23cm where he has worked 107 different stations in 9 countries! A very creditable achievement that really means something, and all with home-made equipment.

From Trowbridge, Wiltshire, comes a complaint from **David Birch,** aged 13, who is fed up with QRM from TV sets, pointing out that according to the TV licence the "apparatus" is not supposed to interfere with other "wireless telegraphy" equipment. You are quite right Dave, but just try to get someone to do something about it! I read recently that there is a possibility of legislation in the US on this matter but I hate to think how long it will take to get it into law and then to implement it. Pity it wasn't done at the beginning, but there, it costs money! Only hope is to try screened twin feeders properly matched and to keep the set and the aerial as far from the source of QRM as possible.

J. Hodgson of Morpeth, Northumberland, comments on some strange calls heard in the "10m" band but I fear that these are rubbish from the adjacent 11m band! Unfortunately, with the improving conditions on the higher frequencies, we shall be able to hear more and more of the overseas Citizens Band stuff.

The organisers of the Worked All Britain Award have now introduced the WAB Counties Award which is also available to listeners. It is issued in two classes, depending upon the number of counties worked/heard. QSLs are not required. A record book to facilitate the "book-keeping" is really a must for this sort of award. Full details from Alec Brennend G4AVA, 76 Deneley Avenue, Todmorden, Lancs. Incidentally, as an added incentive to have a go, all profits from WAB activities go to the Radio Amateur Invalid and Bedfast Club.

Club News. The newly formed Brighton and District Radio Society is well under way and forthcoming events include a talk on Computers by G3XJG on October 12 and on the 26th G3OEM will discourse on Aeronautical Radio matters. Info from the Hon. Sec. **Nigel Hewitt** G8JFT, 74 Carlyle Street, Brighton.

The Cheltenham ARS and the local RSGB group have investigated the possibility of forming a single club and the likely date for the first combined meeting is November 3. Let's hope the move will be beneficial to all concerned. Further info from **Derek Lively** G3KII, 26 Priors Road, Cheltenham.

The very active Wessex AR Group has its AGM on October 7 and on the 21st they will be reviewing the results of their efforts in the VHF NFD. Several members were successful in the last RAE. It is expected that at least a dozen will start the new course at the Bournemouth College. Further info on the Club from **Geoff Cole** G4EMN, 6 St. Anthony's Road, Bournemouth. Meetings in the Club Room at the Dolphin Hotel, Holdenhurst Road, Bournemouth. 7.30 p.m.

Several readers have queried the new prefix P28 now being heard on the bands. This is the Republic of Djibouti previously using FL8 as a French colony. The series starts with J28AA so it's a bit difficult to tie up old calls in use with the new ones.

From Adlington, Lancs, comes a letter from **Paul Farnworth** who is listening and working for the RAE, "then I will leave school and try to get a job". Paul is 15 so let us hope that his plans work out. **John Overton** writes from Glasgow with some nice log entries on CW. He is very frustrated at not being able to answer back but perhaps it will not be for much longer as he is taking the RAE in December. His BC348 only goes to 18MHz so he's thinking of making another set for the 10 and 15m bands. Once again I must point out that a converter is the proper answer. Why not use all the other facilities you have in the 348, John? No point in duplicating them, and you are not likely to get hold of a better dial movement!

Radial, the journal of the RAIBC, reports a healthy growth in the Club membership and activities and a few volunteers are needed for jobs such as Equipment Secretary, Shows and Rallies Manager, Tapes Manager and a Transport Manager. It is not generally appreciated just how much work is involved in the transporting of gear to and from the invalid and bedfast members of the Club, apart from the odd servicing and maintenance chore.

Anyone interested in helping a most deserving cause can contact Harry Boutle G2CLP at 14 Queen's Drive, Bedford MK41 9BQ.

A report from **Alan Doherty** BRS34968 in Portrush, Co. Antrim, just made the dateline. A rare call these days logged by Alan was Libya in the form of K5CO/5A. Not much activity there since the Forces moved out. Alan says not to be fooled by those CY calls, just read VE instead! Two other nice ones that one can go for many years without hearing were VR4DX and VR6TC, Tom Christian on Pitcairn.

Log extracts

J. Hodgson:— 20m FG7XL JW7BK J29AI OJ0MA YB2SV 5W1AU **15m** HK3AMV HR6SWA

J. Tye:— (G4BYV) worked on **23cm** (1296MHz) DF8QK DK3UC PA0FWS PA0VTW PA0EZ ON6AT SM6ESG

R. Bayley:— 80m A2GCO CT2AP KP4EJA VE4BC **40m** HK0COP JA4AKU **15m** VE7DIY 7P8BC

B. Harrison:— 20m F0CH/FC **15m** HM2JV JA1PPC **10m** 7X2DG

A. Doherty:— 80m FG7AN ZS5LB **20m** K5CO/5A TU2GA-VR4DX VR6TC W6OKJ/KS6 ZD7SD 3D2AN, 5W1AU **15m** WA4RQK/VQ9 ZD8RR 5N2AAX

J. Overton:— 20m *A9XBC* C31A *SV1GR* TG9DF VP2AA VP1WS

All calls are SSB except those in italic which are CW.

SHORT WAVE BROADCASTS

by Charles Molloy G8BUS

Solar activity is on the increase according to the Swiss Shortwave "Merry-go-round" which regularly broadcasts the latest sunspot number and gives predictions, which are obtained from the Zurich Observatory. Forecasts of the number of sunspots for the coming months show a gradual rise from 27 in October to 33 in January 1978 and this upward trend is reflected in reports of DX on the higher frequencies. The writer has been listening recently on Sunday mornings at 0840 to the DX programme from Radio Australia on the new frequency of 21570kHz in the 13m band. Although beamed to Asia this transmission comes in better in the UK at this time than the frequencies in the 25m and 31m bands that are beamed to the UK.

Harold Emblem who DXes in Mirfield, in Yorkshire, reports hearing the afternoon transmission of "Sweden Calling DXers" on a new frequency of 21690kHz. HCJB in Quito Ecuador is also on a new 16m channel of 17755kHz, Radio Australia is on 15140 and 15410 in the 19m band and Radio South Africa is on 17780. Harold asks what sort of information should go into reports to this column. The exact frequency (if known) plus the date and time of reception will help readers to search for the station and some information of the gear used and the aerial will help those who intend purchasing or building a receiver or are thinking of putting up an aerial.

An interesting report comes from **Derek Taylor** of Preston in Lancashire who uses a Realistic DX160 receiver, a calibrator and a 30ft. loft aerial when operating on the shortwaves. He reports hearing the International Service of Radio Nacional de Venezuela in English at 2200 on 15400 and he received a confirmation letter from them after one month. Radio Korea (Seoul) was heard in English at 1330 on 11860kHz and the Voice of Nigeria outlet at Benin on 4932 in the 60m band was logged at 2100.

A newsletter has been received from the Bristol Pathfinder DX-Group. This club has about 20 members, mostly in the Bristol area, but DXers from anywhere in the UK are welcome. Enquiries should go to **Lawrence Bennett,** 7 Maple Avenue, Fishponds, Bristol BS16 4HJ. **D. M. Tinker** is a keen DXer who would like to know if there is a DX club in the Rotherham or Sheffield areas. Reply please to 20 Croft Road, Brinsworth, Rotherham, S Yorks S60 5AP.

Roger Fitzpatrick of Roscrea, Co. Tipperary and his friend **Sean Keevey** recovered a couple of old Pye 5-valve receivers from their respective lofts and were surprised, after blowing away the dust, to pull-in between them the following DX:—The Voice of Vietnam on 10040kHz at 1807, Nigeria on 15220 at 1615, Radio Australia on 9570 at 0800. "Have you any information on Radio Rodina?" asks Roger. Radiostantsia Rodina (Radio Station Homeland according to the World Radio Handbook translation) is not a radio station but a radio programme. It is in Russian and is carried by the external service of Radio Moscow and is intended for Russians living abroad.

Michael Walker (BRS 38836) has been listening to Radio Baghdad and he would like to know the address of this station. Write to:—Iraqi Broadcasting and TV Establishment, Salihiya, Baghdad, Iraq. **Frank Hannam** sent in a log from Colne in Lancashire. Using a Fidelity Rad 21 and a 35ft inverted-L aerial he heard the Voice of Turkey on 9515kHz at 2210 (there is a DX programme nightly at 2230), Radio Australia on 21570 at 0815 and Radio South Africa on 21535 at 1400. Frank has just been given a big box of valves and he is looking for details of a valve receiver to build.

Can you suggest a good aerial for indoor use, asks **Ian Radford** (Derby) who reports hearing Radio Australia on 9570 at 0800 and RSA on 21535 at 1700 with his Eddystone EC10 and whip aerial. You seem to be doing very well at the moment, Ian! Why not try the TV aerial? Unplug it from the TV and connect the co-ax lead to the EC10. If results are good then you can get hold of a 2-way outlet with switch from a TV dealer and switch the aerial to either the TV or the EC10 as required. Do not join all three, the TV the EC10 and the aerial together, they may not get on with one another!

"Just received a QSL card from Radio South Africa (on 21535) so it looks like the high bands are coming back" writes **W. G. Holmes-Jones** from Abergavenny, in Gwent. He uses a R209 and a home-brew 16-transistor receiver for the broadcast bands together with the choice of a Joystick, 84ft loft aerial or 45ft longwire plus an ATU and a tunable notch filter. The highlights of a very comprehensive log are Radio 4VEH Haiti on 9779 at 1130, Radio Finland 15260 at 1300 in English, Radio Australia 9570 each day at 0700 but it gets lost before scheduled sign-off at 0900 (try 21570), Radio Iran 17730 at 1930 in English, The Voice of Greece 9760 at 2200, Radio Mozambique on 6115 at 1800. Radio South Africa was heard on 15220 at 1345 with its weekly Wednesday DX programme.

"I have acquired an ex-RAF R1155 receiver which I know you are familiar with" says **Alan Spencer** who lives at Ryhall, in Lincolnshire. When connected to a 45ft long wire it produced ELWA Monrovia, Liberia, on 4770 at 2230 and Radio Nacional Espejo, Ecuador, on 4680 at 0355. Two resistors have now burnt out and Alan is unable to get hold of a circuit or manual. A. J. Brooks, 5 Farrant House, Winstanley Road, London SW11 2EJ can supply diagrams and manuals for most ex-WD and some other communications receivers. An SAE will bring a list. The paper decoupling capacitors in the R1155 are liable to leakage and it is worth doing what the writer did with his and replace the lot with modern $0{\cdot}1\mu F$ 350VW capacitors. If a decoupler does short circuit then a burnt out resistor may follow. An old dodge for testing decouplers is to connect the positive lead of a voltmeter to the HT line, disconnect the wire from the live side of the decoupler and tap-on the negative probe from the voltmeter in place of the wire just removed. A good capacitor will give a kick on the meter as it charges and the needle will then go back to zero. A leaky capacitor may give a kick and the needle will return slowly to some intermediate reading

caused by the current leaking through it. A steady reading on the meter equal to the HT volts indicates that the capacitor is short-circuit and will have to be replaced. Be careful to have the meter switched to the appropriate voltage range (to measure the HT volts) or it will have to be replaced as well!

A large mailbag this month has meant that some letters are being held over to next month. My apologies to those concerned.

BROADCAST BANDS

MEDIUM WAVE DX

by Charles Molloy G8BUS

"Readers will think I am mad, from your remarks about me in the July issue" writes **Harold Brodribb** from St Leonards-on-Sea, who has taken up the challenge of DXing with vintage radio receivers. "I am getting good results with pre-war sets provided they are maintained well and used on this high site with an outdoor aerial and ATU." Harold mentions that his CR100 has many advantages over vintage equipment. He has changed the RF valves for quieter types (the writer used 6BA6) and fitted an S-meter and a stabilised voltage supply for the oscillator. He has adapted the BFO valve to perform a dual function as BFO and product detector. The writer used the CR100, also known as the B28, for MW DXing for a number of years. Even unmodified it is a very good receiver though it too, could now almost be classified as vintage. A large number of CR100s came on the surplus market after the last war and they can still be obtained privately for quite a modest sum. They have an internal power pack and can be run direct from 240V mains. They are not too bulky, rather heavy, like most ex-WD equipment. An external speaker is required though there is space to fit one inside the metal cabinet.

A useful report of Spanish DX comes from **Declan O'Dea** who lives in Ballinasloe, Co. Galway. With a 10-transistor domestic portable he logged La Voz de Madrid on 1097kHz, R. Espana Madrid on 917, Radio Madrid on 800, R. Zaragoza 872, R. Valencia 1259, R. Sevilla 809, R. San Sebastian 1025, R. Centro Madrid 1385, R. Popular de Jerez 1385, R. Reloj Barcelona 1124 and La Voz de Gerona on 1385. From North America WINS on 1010 was logged at 0300 and there was an unidentified VOA transmission on 1295 which would be from the 600kW BBC transmitter at Crowborough in the UK. Declan would like to contact other PW readers in his area. The address is c/o Bank of Ireland, Society Street, Ballinasloe, Co. Galway.

John Little writes from Sunninghill, Berks, to say he was interested in the reference in the July issue to DXing the Middle East. He has just spent two years in Iran where DXing Europe prior to going to work at 0430 was great fun! With local stations not yet on the air, being 3½ hours ahead of London, the BBC frequently came through on 200kHz, 647kHz and 908kHz both on the built-in rod aerial and on an outside inverted L. A further illustration that it is interference (QRM) rather than distance that limits the range of DX on the medium waves.

A Realistic DX160 receiver, a MW loop and a 250ft long wire from the house to a 25ft pole at the bottom of the garden is used by **Martin Liezers** who lives in Newport, in Gwent. DX heard with this set-up between midnight and 0300 included La Voix de la Revolution, Conakry, Guinea, very strong on 1403kHz; CJON St John's, Newfoundland on 930; WNEW New York City on 1130 and an unidentified with the call KB Radio on 1520. The latter is WKBW in Buffalo NY and the complete call will be used in the formal identifications on the hour and the half-hour. Many stations try to form slogans out of their call signs and some of these will mislead the newcomer. KLOK is "Clock Radio," WIOD is the "Wonderful Island of Dreams" (Miami), KYAK is in Alaska, and there used to be a KOLD in the same territory at one time! Some call signs may help the DXer. WNEW is in New York, WBAL is in Baltimore, WBOS in Boston, WCBS is owned by the Colombia Broadcasting System, WNBC by the National Broadcasting Company and WINS was the International News Service. There are no prizes for guessing what can be heard from WPOP and WFUN!

Martin raises a couple of interesting points in his letter. He mentions "a lot of crackles which disappear at dawn" and he asks what precautions can be taken to protect the house if his long wire is struck by lightning! Static, QRN, atmospherics, are the names given to the noise heard by Martin and each crackle is caused by a lightning discharge. Since the static disappears at sunrise it must, like DX, have been propagated for quite some distance. During the summer, thunderstorms in the tropics create a considerable amount of static which travels as far as the UK after dark and, although not loud enough to interfere with local reception, it can be troublesome to the DXer. A loop will reduce static provided that the DX and the static are not coming from the same direction. Summer static is usually from the south of the UK but it can come from other directions as well.

The advice about lightning protection usually offered in radio books is that the aerial should terminate at the point of entry to the building, on the moving contact of a knife switch. The upper contact goes to the receiver and the lower to a good, short, outside earth.

Summertime ends on October 23 this year in the UK and the return to GMT will mark the start of the winter season for North American DX. It will then be possible to listen to Canada and the USA before midnight and on nights when conditions are good some DX should be heard as early as 2300. The nearest, most consistent and earliest station to appear is CJON, located in St John's Newfoundland, which transmits with a power of 25kW on 930kHz. It can be found just on the low frequency side of AFN Berlin on 935. DXers who have never heard North America on the medium waves should try for CJON. Another regular is WINS in New York City on 1010kHz which is reasonably clear of QRM once the Dutch station on 1007 leaves the air, usually around 2300.

All North American medium wave stations use call signs which are mentioned over the air frequently. The prefix C is used on Canada and either a W or a K in the United States. All stations are on channels which are multiples of 10kHz. The best DX is often heard after midnight but quite a number of stations appear earlier whenever conditions are good. Tune slowly, as all these broadcasters suffer from slow fading and are easily missed. If unsuccessful, try again a few days later. If conditions are poor one night they will probably pick up again before long.

VHF BANDS

by Ron Ham BRS15744

Several contributors have expressed their pleasure at our journal's new format and the start of a series about taking the RAE. **Nigel Golds** BRS36910 West Chiltington, Sussex, leads his report with "I am pleased that there is a series which will help me with my studies for the RAE". Like many others, Nigel is a keen listener on 10m and has heard the DLs, OKs, Fs, and Gs as well as the German beacon, DL0IGI, during the periodic short skip openings in August.

While on a "junk" crawl, in aid of my early wireless

collection, I met **Vic Elliott** BRS37850 Midhurst, Sussex, who emphasised his delight about the RAE series and explained, that as an ex-RN morse instructor, he is now brushing up his basics for the next exam and plans to become active on the HF bands. Later, I called on **Gordon Goodyer** BRS37345 Petworth, Sussex, a PW reader for many years, who said that he likes the new format but the increase in size upsets his very tidy bookshelves! Gordon spends a lot of time listening on 10m with his CR100 and dipole and on 2m with his home-brew front-ends, indulging in his special interest of making and testing VHF ground plane aerials.

A period of solar activity began on July 23rd and ended on August 5th during which time our extra-terrestrial observers monitored the event. **John Smith,** Cranleigh, Surrey, recorded two definite peaks in the solar noise output at 142MHz, the first started on the 23rd, reached it's peak on the 28th, and returned to normal on August 2 when it rose again to a climax on the 5th and down again by the 10th. In both cases the maximum was about four times the normal level. While the noise was fluctuating, both John and I recorded a host of individual solar bursts, each lasting between one and five minutes, throughout the event. **Cliff Ranft,** Chilworth, Surrey, found evidence of ionospheric disturbance on July 29th and 30th and he recorded a moderate SCNA (Sudden Cosmic Noise, Absorption) between 1410 and 1510 on August 5th.

Although cloudy skies prevented systematic use of the optical instruments, John Smith did manage to see a sunspot group on July 26th, and **Cmdr. Henry Hatfield,** Sevenoaks, using his spectrohelioscope, observed a variety of sunspots between August 1st and 4th, in addition to several small filaments and plages. On August 1st and 2nd Henry saw a bright prominence on the sun's east limb and his records show that each time he sees one of these events we all record some form of radio noise at metre waves. Henry counted five sunspots, plus two plages on the 9th. I received bursts of radio noise at 136MHz on the 10th and on the 13th John Smith noted that the solar noise level was up, and Cliff Ranft again found evidence of an ionospheric disturbance.

According to my observations the cause of the disturbed conditions on the 4th was due to a mixture of tropo, due to the falling pressure noted by both Ciaran and myself, and sporadic-E which manifested itself for most of the morning. At 0913 I received a 599 signal from the 70cm beacon at Sutton Coldfield GB3SUT, a strong picture from Lichfield on Ch. 8 and good signals from ten continental broadcast stations in Band II. At the same time, the influence of sporadic-E ranged from 40 to 73MHz, bringing a host of continental signals into the UK in Band I plus 14 east-European broadcast stations between 66 and 73MHz.

Although the tropo-lift was waning I received 59 signals from F1ENH and G8FAS in Somerset, via the London repeater, GB3LO. Sporadic-E occurred again on the 5th and was most intense at 0910 when I received very strong signals from 46 east-European stations between 66 and 73MHz in addition to sync. pulses on R1, 49·75MHz and a crop of continental stations in Band I.

The falling barometer indicated another tropo opening on August 10 and 11th. At 2300 on the 10th Alan heard a GM station just above the noise on 2m and at 2355 he worked G8JJR near Doncaster on SSB and while he, at the east end of Sussex, listened to a mobile north of Darlington, via the Cambridge repeater, GB3PI. Your scribe, located at the west end of the county, listened to the Bristol Channel repeater GB3BC and it's "Bing-Bong" code, which must be familiar to our GW readers under normal conditions. I am told that the original aerial at the Brighton 70cm repeater GB3BR 433·15MHz has been changed for an improved colinear. G8LGQ who lives to the east of the repeater, with 400ft of chalk in the way, is getting a much better signal than before. Further reports to me or to G8HVV, QTHR.

I received a reasonable signal from GB3SUT from 0050 on the 10th to midday on the 11th, and at 0740 on the 11th I heard the Emley Moor beacon GB3EM 432·910MHz at 559. Slight tropo-lifts produced signals from GB3SUT on 70cm during the early mornings of the 13th and 16th; more reports about 70cm activity would be welcome.

Interest in our microwave reports is growing and a most welcome letter from **Sam Jewell** G4DDK, Stone, Staffs, who says there is some dozen stations active on 10GHz from Birmingham in the south to Manchester in the north and that there is some activity most weeks between various stations in that area. A typical path recently covered was Mow Cop on the Staffordshire-Cheshire border to Winter Hill in Greater Manchester, a line-of-sight distance of 59km. On this occasion G4DDK, G8ANZ and G8BHH were at Mow Cop and G8AXE with G8AFC on Winter Hill.

The type of equipment being used in the Midlands is typical of modern wideband FM gear for 3cm; a 12mW Gunn diode transmitter to a 16in dish and a separate tunable Gunn diode/Sim-2 mixer as receiver with a 106MHz IF, resolved on an FM broadcast receiver. I know just how good this equipment has to be because I spent part of Sunday, August 21st on the Trundle, a hilltop some 675′ ASL, just north of Chichester, Sussex, with Colin Boys G8BCO, Peter Kerry G8ARO and David Bookham G8JNI to see their respective 10GHz stations as they prepared to take part in the RSGB's 10GHz Cumulative contest.

The extreme neatness of each station was impressive. The aerials and the electronics are compact, mounted on sturdy tripods with provision for precise adjustments in both altitude and azimuth. At one time, Colin removed his 18in dish and demonstrated that he could just receive the 10·1GHz beacon GB3IOW St. Catherines, Isle of Wight, on open waveguide proving that he had the full 30dB gain of the dish in hand on that signal. It did not surprise me when I learnt that Colin's microwave gear won him the award at the construction contest organised by the Farnborough and District Radio Society. Peter was using a 12in dish, giving him 24dB gain on his receiver and a 14dB horn on his transmitter. At 1300 a 599 signal from GB3IOW was booming from his receiver and he demonstrated just how critical the direction is; in fact he lost the signal by moving his aerial just 1½in! David's receiver consists of a balanced mixer (pair of 1N23s) into a 40673 mosfet preamp at 100MHz (IF) and then to Mullard modules. His transmitter is a 160mW Gunn diode and his aerial an 18in dish. David also received the beacon signal and a strong signal from G3KSU/P at St Catherines. Each station had two-way contacts with G8BDJ/P Chanctonbury Ring, Sussex and G3IZD/P Lynch Down, Sussex. The climax of their day came at 1800 when G8BCO/P had a 55 contact with GU3JHM/P on Alderney and G8ARO/P had a 59 contact with the Alderney station. Peter told me later that several other UK stations had made it to the Channel Islands on 3cm that afternoon.

The Microwave round table meeting held on August 7th in Winchester was very successful and well-attended in view of the short notice, which goes to show that once again the amateurs are prepared to experiment and pioneer those difficult signal paths. To help them, the 3cm beacon at Alderney GB3ALD is now active and its signals have already been received on the Trundle, a distance of 167km. I understand that several of the microwave boys are planning to get going on 24GHz and I will certainly look forward to receiving their reports for this column.

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.

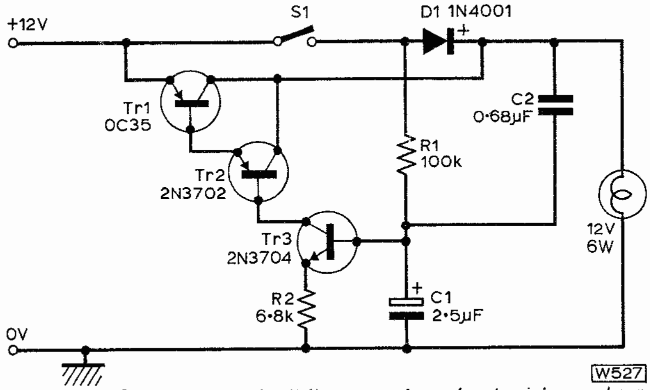


Fig. 6: The final circuit with all the snags ironed out, giving a sharp turn-off to the light, which now remains on for about 15 seconds after the car door is closed.

this is a 30W type so we shouldn't blow it if we use it as the series element. Its gain is given as 25 to 75 at 1A, so let's take a minimum of 20, which means that the base current will need to be 500/20=25mA. If we try to supply all this current from one transistor then the current drawn from C1 will be too high; the easiest way out seems to be to reduce the base current that needs to be supplied, by making the pass element a Darlington pair. The circuit will then look like **Fig. 6.**

The 2N3702 and 2N3704 transistors have been kept since we were using them in our experiments before. Previously the timing period was a bit short but this should go up with increased supply voltage—we can always make C1 bigger if the delay is still too small. R1 has been doubled in value since the supply voltage has been doubled, although this isn't really necessary. D1 can be any diode capable of taking 0·5A with a maximum reverse voltage of about 20V—a 1N4001 should be fine. Silicon types must be preferable here, since we don't want any problems with leakage currents through D1, keeping C1 charged. What value do we need for R2? Well we want 25mA of base current for the OC35 and a catalogue tells us that we can rely on a gain of at least 50 from the 2N3702: this means that the 2N3704 has to supply 500µA, at least until the voltage across C1 is down to 3V or so. A 6·8kΩ resistor should be OK here; it gives a safe limit to the maximum current that Tr3 can supply.

It would be good practice normally to put a resistor from the emitter of Tr2 up to the +12V line. This stops the Darlington pair doing funny things at low currents. However, we're not involved with low currents here so we'll not bother with this resistor.

It is not entirely obvious what effect changing the load will have on the optimum value for C2, so we'll try 0·47µF again and see what happens. We can do this final experimenting when we've built the rest of the circuit on a piece of Blob Board. With the circuit wired up we find that the courtesy light, temporarily excised from the car, stays alight for about fifteen seconds and then turns off. As for C2, the turn-off seems fast and very stable: yet again 0·1µF appears to be not quite enough but 0·47µF, 0·68µF and several larger values that we tried all speed up the switching, with none of that embarrassing flickering that we had before, so let's settle for 0·68µF as the final value for C2. A practical layout is shown in **Fig. 7.**

The output levels and the output impedances of things like cassette recorders don't always match the associated amplifiers so next month's design is for a simple matching circuit.

IT'S EASY WHEN YOU KNOW!

To avoid missing your copy of PRACTICAL WIRELESS—simply complete this order form and hand it to your newsagent.

ORDER FORM

To: ....
(name of newsagent)

Address ....

....

....

Please reserve/deliver every month one copy of PRACTICAL WIRELESS until further notice.

My Name ....

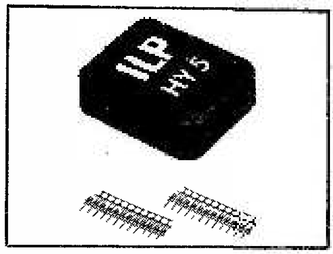
Address ....

....

....

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

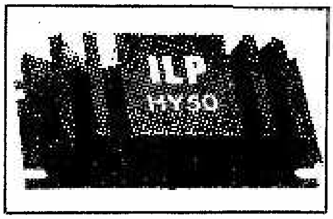
The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of I.C., heatsink, P.C. board, 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier 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

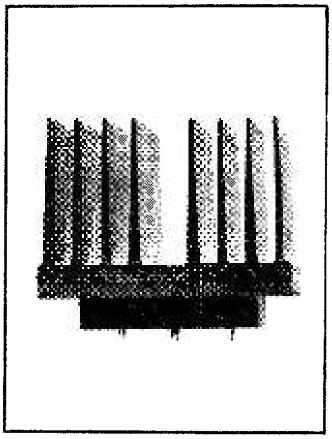
The HY120 is the baby of I.L.P.'s new high power range. Designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

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

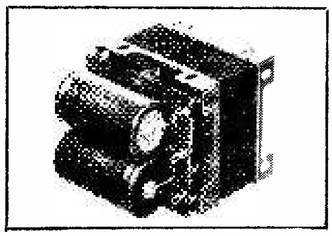
The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω! It has been designed for high power disco address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead 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.
PSU180 £23·10 + £1·85 VAT.
B1 £0·48 + £0·06 VAT.

TWO YEARS' GUARANTEE ON ALL OUR PRODUCTS

I.L.P. ELECTRONICS LTD., CROSSLAND HOUSE, NACKINGTON, CANTERBURY, KENT, CT4 7AD.

I.L.P. ELECTRONICS LTD.,
CROSSLAND HOUSE, NACKINGTON, CANTERBURY, KENT, CT4 7AD.

Please Supply ______________________
Total Purchase Price ______________________
I Enclose Cheque ☐ Postal Orders ☐ Money Order ☐
Please debit my Access account ☐ Barclaycard account ☐
Account number ______________________
Name and Address ______________________
Signature ______________________

TRANSFORMERS

ALL EX-STOCK—SAME DAY DESPATCH. VAT 8%

12 AND 24 VOLT OR 12-0-12V
PRIMARY 220-240 VOLTS

Ref	Amps 12V	Amps 24V	£	P & P
111	0·5	0·2	2·20	0·45
213	1·0	0·5	2·64	0·78
71	2	1	3·41	0·78
18	4	2	4·03	0·96
70	6	3	5·35	0·96
108	8	4	6·98	1·14
72	10	5	7·67	1·14
116	12	6	8·99	1·32
17	16	8	10·39	1·32
115	20	10	13·18	2·08
187	30	15	17·05	2·08
226	60	30	26·82	OA

50 VOLT RANGE
Prim 220/240V Sec 0-19-25-33-40-50V Voltages available 6, 7, 8, 10, 14, 15, 17, 19, 21, 25, 31, 33, 40, 50V or 25-0-25V

Ref	Amps	£	P & P
102	0·5	3·41	0·78
103	1·0	4·57	0·96
104	2·0	6·98	1·14
105	3·0	8·45	1·32
106	4·0	10·70	1·50
107	6·0	14·62	1·64
118	8·0	17·05	2·08
119	10·0	21·70	OA

MAINS ISOLATING (SCREENED)
PRIM 120/240 SEC 120/240 CT

Ref	VA (Watts)	£	P & P
07	20	4·40	0·79
149	60	6·20	0·96
150	100	7·13	1·14
151	200	11·16	1·50
152	250	12·79	1·84
153	350	16·28	2·15
154	500	19·15	2·15
155	750	29·06	OA
156	1000	37·20	OA
157	1500	45·60	OA
158	2000	54·80	OA
159	3000	79·05	OA

HIGH VOLTAGE MAINS ISOLATING
Prim 200/220V or 400/440V
Sec 100/120V or 200/240V

Va	Ref	£	P & P
60	243	5·89	1·32
350	247	14·11	1·84
1000	250	35·65	OA
2000	252	54·25	OA

30 VOLT RANGE
Prim 220/240V Sec 0-12-15-20-24-30V Voltages available 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30V 15-0-15V, 12-0-12

Ref	Amps	£	P & P
112	0·5	2·64	0·76
79	1·0	3·57	0·96
3	2·0	5·27	0·96
20	3·0	6·20	1·14
21	4·0	7·44	1·14
51	5·0	8·37	1·32
117	6·0	9·92	1·45
88	8·0	11·73	1·64
89	10·0	13·33	1·84

60 VOLT RANGE
Prim 220/240V Sec 0-24-30-40-48-60V. Volts available 6,8,10,12,16,18,20,24,30, 36,40,48,60V or 24-0-24V or 30-0-30V.

Ref	Amps	£	P & P
124	0·5	3·88	0·96
126	1·0	5·58	0·96
127	2·0	7·60	1·14
125	3·0	10·54	1·32
123	4·0	12·23	1·84
40	5·0	13·95	1·64
120	6·0	15·66	1·84
121	8·0	20·15	OA
122	10·0	24·03	OA
189	12·0	27·13	OA

AUTO TRANSFORMERS

Ref	VA (Watts)	Volts	£	P & P
113	20	0-115-210-240	2·48	0·71
64	75	0-115-210-240	3·95	0·96
4	150	0-115-200-220-240	5·35	0·96
66	300	0-115-200-220-240	7·75	1·14
67	500	0-115-200-220-240	10·99	1·64
84	1000	0-115-200-220-240	18·76	2·08
93	1500	0-115-200-220-240	23·36	OA
95	2000	0-115-200-220-240	34·82	OA
73	3000	0-115-200-220-240	48·00	OA

CASED AUTO TRANSFORMERS
240V cable in & 115V USA 2 pin outlet

VA	£	P & P	Ref
20	4·96	0·96	113W
150	8·48	1·14	4W
200	9·92	1·45	65W
250	10·49	1·45	69W
350	12·53	1·64	53W
500	15·73	1·64	67W
750	18·55	1·76	83W
1000	22·68	OA	84W
1500	26·02	OA	93W
2000	37·65	OA	95W

SCREENED MINIATURES

Ref	mA	Volts	£	P&P
238	200	3-0-3	1·99	0·55
212	1A, 1A	0-6, 0-6	2·85	0·78
13	100	9-0-9	2·14	0·38
235	330, 330	0-9, 0-9	1·99	0·38
207	500, 500	0-8-9-, 0-8-9	2·59	0·71
208	1A, 1A	0-8-9, 0-8-9	3·53	0·78
236	200, 200	0-15, 0-15	1·99	0·38
214	300, 300	0-20, 0-20	2·56	0·78
221	700 (DC)	20-12-0-12-20	3·41	0·78
206	1A, 1A	0-15-20-0-15-20	4·63	0·96
203	500, 500	0-15-27-0-15-27	3·99	0·96
204	1A, 1A	0-15-27-0-15-27	5·39	0·96
239	50	12-0-12	1·99	0·38
S112	500	12-15-20-24-30	2·64	0·78

PLUS

HIGH QUALITY MODULES

10 Watts RMS AMPLIFIER	£3·66
25 Watts RMS AMPLIFIER	£4·57
35 Watts RMS AMPLIFIER	£6·95
125W RMS AMPLIFIER	*£15·95
PRE-AMP for 5-10W	£6·70
PRE-AMP for 25W	£13·88
POWER SUPPLIES 5-10W	£1·30
POWER SUPPLIES 25W	£3·75
TRANSFORMER 5-10W	£3·09
TRANSFORMER 25W	£4·79

P & P Modules 35p. Trans 96p.
VAT 12½% *VAT 8%

MUSIC CENTRE KIT
FM Stereo Tuner + MW/LW. Output 2 × 8·5W rms. £24·12 inc.

BLOB BOARD (Pack of 3)
2·5″ × 5·1″ ·1″ or 2·5″ × 5·1″ ·15″ £0·75
3·75″ × 5″ ·1″ or 3·75″ × 5″ ·15″ £1·14
10″ × 6″ ·1″ or 10″ × 6″ ·15″ £3·78
IC Range
4·8″ × 3·2″ £0·96. 4·75″ × 7·5″ £2·13
P & P 35p VAT 8%

ELECTRONIC CONSTRUCTION KIT
10 projects (including electronic organ). No soldering needed £7·29. VAT 8% P & 70p

COMPONENT PACKS
200 Mixed value resistors (count by weight)
150 Mixed value capacitors (count by weight)
30 Mixed value precision resistors ½W 2%
15 Assorted pots
10 Reed switches
15 Wire wound resistors—mixed wattage
1 Pack wire 50 metres assorted colours
25 pre-sets assorted types and values
Please state pack required. 60p per pack
VAT 12½% P & P 40p

Prices correct 23-6-77. Please add VAT after P & P.

TEST METERS

AVO 8 MK5	£68·95
AVO 71	£28·00
AVO 73	£37·80
AVO MINOR M5	£21·94
AVO TT169 in circuit Transistor Tester	£29·00
U4315 Inc. case	£14·95

U4315 BUDGET METER
20K Ω/VDC 2K/VAC 1000V AC/DC 2·5A AC/DC 500K res. in robust steel case + lead etc,
VAT 8% P & P £1·15
AVO cases and accessories

BRIDGE RECTIFIERS

			P & P
200V	2A	£0·45	0·29
400V	2A	£0·55	0·29
200V	4A	£0·65	0·29
400V	4A	£0·80	0·29
400V	6A	£1·05	0·29
500V	10A*	£2·35	0·29

VAT 12½% *VAT 8%

AUDIO KIT 25W+25W
Complete with instructions £27·55
Teak Cab. + mounting hardware £9·20 P&P £1·73. VAT 12½%.

RECORD DECK
BSR P128R Single Player with Cartridge £16·90 P&P £1·50 VAT 12½%.

POWER UNITS
Stabilised 3-6-7 5-9V/400mA multiplug outlet £5·95
3300 fits into 13A socket 6-7 5-9V 300mA multiplug outlet £3·30
RBE 3, 4·5, 6, 7·5, 9, 12V 500mA DC plug outlet £5·32
VAT 12½% P & P 55p

DECS SOLDERLESS BREAD-BOARDING
S Dec 70 contacts £1·90
T Dec 208 contacts £3·65
U Dec "A" for I.C.s etc £3·99
U Dec "B" for I.C.s etc £6·99
VAT 8% P & P 40p

ANTEX SOLDERING IRONS
15W £3·75 18W £3·75
25W £3·40 Stand £1·40
VAT 8% P & P 43p

TI MINI-MULTIMETER
DC-1000V AC-1000V DC-100mA Res-150kΩ 1000Ω/V Bargain £5·30
VAT 8% P & P 62p

STEREO FM TUNER PHASE-LOCK LOOP
4 Pre-selected stations, Varicap tuning, switched AFC, LED Beacon.
£20·45 VAT 12½% P&P 40p

TRANSFORMERS SPECIAL OFFER
BE1 Prim 0-120, 0-120V (120 or 240V) Sec 24V 10A £5·50 P & P £1·66
BE2 Prim 0-90-110-200-220-240V Sec 0-110V 0-20-24V. 2·5A £2·25 P & P 95p. VAT 8%
BE3 100V line to 4Ω 7/10W £2·05 P & P 66p
BE4 Prim 120 or 240V 9-0-9 1A £1·88 P & P 0·38

CARTRIDGES

AT55	£4·43
SONOTONE	
V100	£4·95
9TAHC	£2·63
ACOS	
GP93-1	£2·18
GP96-1	£2·40
B.S.R.	
SX6M	£2·25
SC12M	£2·92
SHURE	
M75-6S	£10·92
M55E	£12·42

VAT 12½% P & P 25p

Our wide range of transformers are too numerous to list, please call (open 9am-5pm Mon-Fri) or send your requirements. Electrosil & semiconductor stockists. Panel, Multi Meters, Audio accessories, send 15p stamps for lists.

Barrie Electronics Ltd.
3, THE MINORIES, LONDON EC3N 1BJ
TELEPHONE: 01–488 3316/7/8
NEAREST TUBE STATIONS: ALDGATE & LIVERPOOL ST

MAINS INTERCOM

NO BATTERIES NO WIRES
ONLY **£29·99** PER PAIR + VAT £3·75

The modern way of instant 2-way communications. Supplied with 3-core wire. Just plug into power socket. Ready for use. Crystal clear communications from room to room. Range ¼-mile on the same mains phase. On/off switch. Volume control. Useful as inter-office intercom. between office and warehouse in surgery and in homes. P. & P. 97p.

4-STATION INTERCOM

£18·95 + V.A.T. £1·52

Solve your communication problems with this 4-Station Transistor Intercom system (1 master and 3 Subs), in robust plastic cabinets for desk or wall mounting. Call/talk/listen from Master to Subs and Subs to Master. Ideally suitable for Business, Surgery, Schools, Hospitals and Office. Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft. A Battery and other accessories. P. & P. 97p.

NEW! AMERICAN TYPE CRADLE TELEPHONE AMPLIFIER

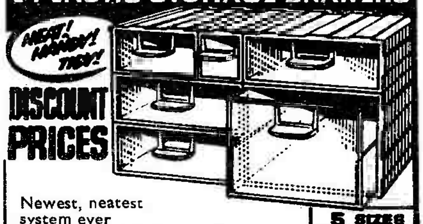
ONLY **£14·95** +VAT £1·20

Latest transistorised Telephone Amplifier with detached plug-in speaker. Placing the receiver on to the cradle activates a switch for immediate two-way conversation without holding the handset. Many people can listen at a time. Increase efficiency in office, shop, workshop. Perfect for "conference" calls: leaves the user's hands free to make notes, consult files. No long waiting, saves time with long-distance calls. On/off switch, volume, conversation recording model at £16·95 + VAT £1·36. P. & P. 87p.

10-day price refund guarantee on all items.
WEST LONDON DIRECT SUPPLIES (PW10)
169 KENSINGTON HIGH STREET, LONDON, W8
01-937 5548

I-N-T-E-R-L-O-C-K-I-N-G PLASTIC STORAGE DRAWERS

DISCOUNT PRICES



Newest, neatest system ever devised for storing small parts and components: resistors, capacitors, diodes, transistors, etc. Rigid plastic units interlock together in vertical and horizontal combinations. Transparent plastic drawers have label slots. 1D and 2D have space dividers. Build up any size cabinet for wall, bench or table top.

AS SUPPLIED TO POST OFFICE, INDUSTRY & GOVERNMENT DEPTS.

SINGLE UNITS (1D) (5ins × 2¼ins × 2¼ins). £2·90 DOZEN.
DOUBLE UNITS (2D) (5ins × 4½ins × 2¼ins). £4·90 DOZEN.
TREBLE (3D) £4·90 for 8.
DOUBLE TREBLE 2 drawers, in one outer case **(6D2). £7·25** for 8.
EXTRA LARGE SIZE (6D1) £6·25 for 8.

PLUS QUANTITY DISCOUNTS!
Orders over £20, less 5%
Orders over £60, less 7½%.

PACKING/POSTAGE/CARRIAGE: Add 75p to all orders under £10. Orders £10 and over, please add 10% carriage.

QUOTATIONS FOR LARGER QUANTITIES

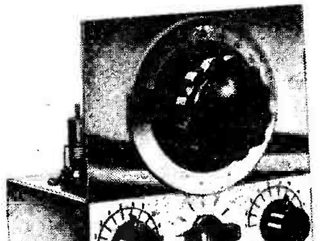
Please add 8% V.A.T. to total remittance

All prices correct at time of going to press

FLAIRLINE SUPPLIES (Dept. PW11)
124 Cricklewood Broadway, London NW2
Tel. 01-450 4844

H.A.C. SHORT-WAVE KITS

WORLD-WIDE RECEPTION



Famous for over 35 years for Short-Wave Equipment of quality. "H.A.C." were the Original suppliers of Short-Wave Receiver Kits for the amateur constructor. Special offer AR8 valves—70p each.

1977 "DX" RECEIVER
Complete kit—Price £7·20 (incl. p. & p. and V.A.T.).
Customer who sent us five QSL cards, one from each continent writes: "Other countries of interest which I have heard are Korea, Japan, Sri Lanka, Liberia and many others. I was very surprised at the simplicity of the set, compared to its efficiency."
This kit is ready to assemble and contains all genuine short-wave components, drilled chassis, valve, accessories and full instructions. Full range of other S.W. kits, including the famous model "K plus" (illustrated above). All orders despatched within 7 days. Send now for free descriptive catalogue of kits and components.

SORRY, NO CATALOGUES WITHOUT S.A.E.

"H.A.C." SHORT-WAVE PRODUCTS
P.O. Box No. 16, 10 Windmill Lane
Lewes Road, East Grinstead, West Sussex RH19 3SZ

RST VALVE MAIL ORDER CO.

CLIMAX HOUSE, FALLSBROOK ROAD, LONDON SW16 6ED

SPECIAL EXPRESS MAIL ORDER SERVICE

SEMICONDUCTORS

Type	Price
AA119	0·20
AAY30	0·13
AAY32	0·15
AAZ13	0·25
AAZ15	0·31
AAZ17	0·25
AC107	0·75
AC125	0·30
AC126	0·25
AC127	0·25
AC128	0·25
AC141	0·20
AC141K	0·30
AC142	0·20
AC142K	0·25
AC176	0·25
AC187	0·25
AC188	0·25
ACY17	0·65
ACY18	0·65
ACY19	0·65
ACY20	0·65
ACY21	0·65
ACY39	1·00
AD149	0·70
AD161	0·75
AD162	0·75
AF106	0·45
AF114	0·25
AF115	0·25
AF116	0·25
AF117	0·25
AF139	0·40
AF186	1·50
AF239	0·45
AFZ11	2·75
AFZ12	2·75
ASY26	0·45
ASY27	0·50
ASZ15	1·25
ASZ16	1·25
ASZ17	1·25
ASZ20	0·75
ASZ21	1·50
AU110	1·70*
AU113	1·70*
AUY10	1·70*
BA145	0·15*
BA148	0·15*
BA154	0·10
BA155	0·12
BA156	0·13
BAW62	0·05
BAX13	0·07
BAX16	0·07
BC107	0·12
BC108	0·12
BC109	0·13
BC113	0·15*
BC114	0·18*
BC115	0·19*
BC116	0·19*
BC117	0·22*
BC118	0·16*
BC125	0·18*
BC126	0·25*
BC135	0·15*
BC136	0·19*
BC137	0·16*
BC147	0·10*
BC148	0·10*
BC149	0·13*
BC157	0·12*
BC158	0·11*
BC159	0·13*
BC167	0·13*
BC170	0·16*
BC171	0·14*
BC172	0·13*
BC173	0·15*
BC177	0·19
BC178	0·18
BC179	0·20
BC182	0·11*
BC183	0·11*
BC184	0·12*
BC212	0·14*
BC213	0·14*
BC214	0·17*
BC237	0·17*
BC238	0·12*
BC301	0·45
BC303	0·60
BC307	0·20*
BC308	0·18*
BC327	0·22*
BC328	0·18*
BC337	0·19*
BC338	0·18*
BCY30	1·00
BCY31	1·00
BCY32	1·00
BCY33	0·90
BCY34	0·90
BCY39	3·00
BCY40	1·25
BCY42	0·30
BCY43	0·32
BCY58	0·23
BCY70	0·18
BCY71	0·22
BCY72	0·17
BCZ11	1·50
BD115	0·60
BD121	1·50
BD123	1·50
BD124	1·00
BD131	0·51
BD132	0·54
BD135	0·35*
BD136	0·36*
BD137	0·37*
BD138	0·40*
BD139	0·43*
BD140	0·47*
BD144	2·00
BD181	1·38
BD182	1·48
BD237	0·80
BD238	0·85
BDX10	0·75
BDX32	2·25
BDY20	1·42
BDY60	0·75
BF115	0·39
BF152	0·25
BF153	0·25
BF154	0·25
BF159	0·35
BF160	0·30
BF167	0·39
BF173	0·39
BF177	0·38
BF178	0·45
BF179	0·48
BF180	0·45
BF181	0·45
BF182	0·45
BF183	0·45
BF184	0·39
BF185	0·37
BF194	0·12*
BF195	0·11*
BF196	0·13*
BF197	0·14*
BF200	0·32
BF224	0·20*
BF244	0·35*
BF257	0·37
BF258	0·42
BF259	0·45
BF336	0·50*
BF337	0·53*
BF338	0·55*
BFS21	2·27
BFS28	1·38
BFS61	0·25*
BFS98	0·25*
BFW10	0·90
BFW11	0·90
BFX84	0·38
BFX85	0·41
BFX87	0·35
BFX88	0·32
BFY50	0·28
BFY51	0·26
BFY52	0·26
BFY64	0·30
BFY90	1·32
BSX19	0·34
BSX20	0·34
BSX21	0·32
BT106	1·25
BTY79/400R	3·19
BU205	2·25*
BU206	2·25*
BU208	2·50*
BY100	0·45
BY126	0·14
BY127	0·15
BZX61 Series	0·20
BZY88 Series	0·13
CRS/105	0·45
CRS/140	0·60
CRS/305	0·45
CRS/340	0·75
CRS/360	0·90
GEX66	1·50
GEX541	1·75
GJ3M	0·75
GJ5M	0·75
GJ7M	0·75
GM0378A	1·50
KS100A	0·40*
MJE340	0·58
MJE370	0·65
MJE371	0·81
MJE520	0·65
MJE521	0·75
MJE2955	1·25
MJE3055	0·75
MPF102	0·30*
MPF103	0·30*
MPF104	0·30*
MPF105	0·30*
MPSA06	0·25*
MPSA56	0·25*
MPSU01	0·32*
MPSU06	0·40*
MPSU56	0·45*
NKT401	2·00
NKT403	1·73
NKT404	1·73
NE555	0·45
OA5	0·75
OA7	0·55
OA10	0·55
OA47	0·14
OA70	0·30
OA79	0·30
OA81	0·30
OA85	0·30
OA90	0·08
OA91	0·08
OA95	0·08
OA200	0·10
OA202	0·11
OA210	0·75
OA211	0·75
OAZ200	0·65
OAZ201	0·65
OAZ206	0·65
OAZ207	0·65
OC16	1·25
OC20	2·00
OC22	2·50
OC23	2·75
OC24	3·50
OC25	0·90
OC26	0·90
OC28	2·00
OC29	2·00
OC35	1·50
OC36	1·50
OC41	0·50
OC42	0·50
OC43	1·50
OC44	0·50
OC45	0·50
OC71	0·45
OC72	0·45
OC73	1·00
OC75	0·50
OC74	0·60
OC76	0·50
OC77	1·20
OC81	0·75
OC81Z	1·00
OC82	0·75
OC83	0·55
OC84	0·60
OC122	1·50
OC123	1·55
OC139	1·25
OC140	1·95
OC141	2·25
OC170	0·60
OC171	0·60
OC200	1·00
OC201	1·50
OC202	1·25
OC203	1·25
OC204	1·25
OC205	1·75
OC206	1·75
OC207	1·25
OCP71	1·25
ORP12	0·70
R200SB	2·25*
R2009	2·25*
R2010B	2·25*
T1C44	0·36
T1C226D	1·30
T1L209	0·25
T1P29A	0·50*
T1P30A	0·60*
T1P31A	0·62
T1P32A	0·75
T1P33A	1·00
T1P34A	1·20
T1P41A	0·70
T1P42A	0·90
T1P2955	1·00
T1P3055	0·50
T1S43	0·35*
ZS140	0·25*
ZS170	0·12*
ZS178	0·54*
ZS271	0·22*
ZS278	0·56*
ZTX107	0·11*
ZTX108	0·10*
ZTX109	0·12*
ZTX300	0·12*
ZTX301	0·13*
ZTX302	0·17*
ZTX303	0·17*
ZTX304	0·19*
ZTX311	0·12*
ZTX314	0·20*
ZTX500	0·13*
ZTX501	0·14*
ZTX502	0·16*
ZTX503	0·17*
ZTX504	0·20*
ZTX531	0·20*
ZTX550	0·16*
1N914	0·07
1N916	0·07
1N4001	0·06
1N4002	0·07
1N4003	0·08
1N4004	0·09
1N4005	0·13
1N4006	0·15
1N4007	0·15
1N4009	0·15
1N4148	0·07
1N5400	0·14
1N5401	0·16
1S44	0·06
1S920	0·08
1S921	0·08
2G301	1·00
2G302	1·00
2G306	1·10
2N404	0·60
2N696	0·25
2N697	0·16
2N698	0·30
2N705	0·80
2N706	0·12
2N708	0·21
2N930	0·26
2N1131	0·26
2N1132	0·26
2N1302	0·37
2N1303	0·37
2N1304	0·45
2N1305	0·45
2N1306	0·50
2N1307	0·50
2N1308	0·60
2N1309	0·60
2N1613	0·33
2N1671	1·50
2N1893	0·33
2N2147	1·40
2N2148	1·65
2N2218	0·33
2N2219	0·42
2N2220	0·35
2N2221	0·22
2N2222	0·25
2N2223	2·75
2N2368	0·17
2N2369A	0·21
2N2484	0·21
2N2646	0·50
2N2904	0·35
2N2905	0·35
2N2906	0·25
2N2907	0·21
2N2924	0·15*
2N2925	0·17*
2N2926	0·13*
2N3053	0·25
2N3054	0·50
2N3055	0·65
2N3440	0·60
2N3441	0·80
2N3442	1·20
2N3525	0·90
2N3614	1·20
2N3702	0·15*
2N3703	0·15*
2N3704	0·15*
2N3705	0·15*
2N3706	0·14*
2N3707	0·18*
2N3708	0·14*
2N3709	0·15*
2N3710	0·14*
2N3711	0·15*
2N3771	1·60
2N3772	1·70
2N3773	2·65
2N3819	0·36*
2N3820	0·46*
2N3823	0·60*
2N3866	1·00
2N3904	0·21*
2N3905	0·22*
2N3906	0·22*
2N4058	0·20*
2N4059	0·15*
2N4060	0·20*
2N4061	0·17*
2N4062	0·18*
2N4124	0·17*
2N4126	0·17*
2N4286	0·20*
2N4288	0·25*
2N4289	0·25*
2N5457	0·35*
2N5458	0·35*
2N5459	0·35*
3N125	1·75
3N141	0·85

VALVES

Type	Price
AZ31	1·10*
CBL31	1·50
CL33	2·00*
CY31	1·00*
DAF91†	0·40*
DAF96	1·00*
DF91†	0·40*
DF96	1·00*
DK91†	0·55*
DK92	1·25*
DK96	1·10*
DL92	0·75*
DL94	1·20*
DL96	1·10*
DY86/7†	0·45*
DY802	0·68*
E88CC†	1·00
EABC80	0·40*
EAC91	0·50
EAF42	1·25*
EAF801	1·75*
EB41	1·75*
EB91†	0·30*
EBC33	1·75*
EBC41	1·25*
EBC81	1·10*
EBC90	0·65
EBF80	0·45*
EBF83	1·25*
EBF89†	0·40*
EBL31	2·50*
ECC40	1·25*
ECC81†	0·45*
ECC82†	0·45*
ECC83†	0·45*
ECC84†	0·50*
ECC85†	0·55*
ECC88†	0·60*
ECC91†	0·35*
ECC189	1·00*
ECF80†	0·60*
ECF82†	0·60*
ECH35	2·00*
ECH42	1·15*
ECH81†	0·50*
ECH83	0·85*
ECH84†	0·85*
ECL80†	0·60*
ECL82†	0·55*
ECL83	1·50*
ECL86†	0·65*
ECLL800	7·00*
EF37A†	1·60*
EF39†	1·60*
EF40	1·15*
EF41	1·20*
EF42	2·00*
EF50†	0·60*
EF80†	0·45*
EF83	1·75*
EF85†	0·50*
EF86†	0·45*
EF89	0·60*
EF91†	0·65*
EF92†	0·75*
EF98	1·25*
EF183†	0·50*
EF184†	0·50*
EH90	0·75*
EL32	1·50*
EL33	3·50*
EL34†	0·85*
EL41	1·25*
EL42	1·75*
EL81	1·10*
EL84†	0·35*
EL86†	0·50*
EL91	3·76*
EL95†	0·80*
EL360	2·25*
EM80	1·10*
EM81	1·00*
EM84	1·00*
EM85	1·25*
EM87	1·50*
EN91†	0·55
EY51†	0·75*
EY86†	0·50*
EZ40	1·25*
EZ41	1·25*
EZ80†	0·30*
EZ81†	0·35*
EZ90†	0·45*
GZ32	0·75*
GZ33	4·00*
GZ34†	1·24*
KT61	3·50*
KT66	4·00*
KT88	4·75*
KTW61	1·75*
KTW62	1·75*
KTW63	1·75*
MU14	1·00*
N78	7·50*
OA2†	0·45
OB2†	0·45
OC3†	0·45
OD3†	0·45
OZ4	0·75*
PC86†	0·85*
PC88†	0·85*
PC97	0·88*
PC900†	0·75*
PCC84†	0·45*
PCC88	0·65*
PCC89†	1·05*
PCC189†	0·65*
PCF80	0·72*
PCF82†	0·50*
PCF86†	0·65*
PCF87†	1·00*
PCF200†	1·05*
PCF201†	1·05*
PCF801†	0·55*
PCF802†	0·72*
PCF805	1·28*
PCF806	0·80*
PCF808	1·28*
PCL82†	0·50*
PCL83†	0·92*
PCL84†	0·50*
PCL85†	0·80*
PCL86†	0·65*
PCL8058/5†	0·80*
PD500	3·00*
PFL200	0·88*
PL36†	0·92*
PL81	0·55*
PL81A†	1·00*
PL82	0·60*
PL83†	0·55*
PL84†	0·60*
PL504/500†	0·96*
PL508†	1·32*
PL509†	2·16*
PL519†	2·96*
PL801	1·10*
PL802†	1·80*
PY33	0·68*
PY81†	0·72*
PY82	0·45*
PY83	0·60*
PY88†	0·68*
PY500A†	1·36*
PY800/81†	0·72*
PY801	0·72*
QQ02-6	9·00
QQV03-10†	1·60
QQV03-20A†	8·50*
QQV06-40A†	8·50*
R17	1·65*
R19	1·00*
R20	1·00*
U18-20	2·50*
U25	1·16*
U26	1·16*
UABC80†	0·50*
UAF42	0·75*
UB41	1·25*
UBC41†	0·75*
UCC84	0·75*
UCC85†	0·50*
UCF80	0·75*
UCH42	1·20*
UCH81†	0·50*
UCL82†	0·50*
UCL83	1·20*
UF41	0·75*
UF80†	0·50*
UF85†	0·50*
UF89†	0·50*
UL41	1·00*
UL84†	0·60*
UM80	1·00*
UY41†	0·75*
UY85†	0·65*
1B3GT†	0·55*
1R5†	0·55*
1S5†	0·40*
1T4†	0·40*
2AS15	10·00
2D21†	0·55
3A5	1·35
3CX100A5	20·00
3S4†	0·75*
3V4†	1·00*
4CX250B	17·50
5R4GY†	1·00*
5U4G	1·00*
5U4GB	1·00*
5V4G†	0·65*
5Y3GT	0·85*
5Z3	1·50*
5Z4G	1·00*
5Z4GT	1·00*
6-30L2	1·00*
6AB7	0·75*
6AC7	0·75*
6AF4A†	0·70*
6AG7	0·75*
6AH6†	0·70*
6AK5†	0·30
6AK6	0·95*
6AL5†	0·30*
6AM4	2·30*
6AM5	3·76*
6AM6†	0·65*
6AN5	2·50*
6AN8A†	0·70*
6AQ5†	0·75*
6AR5	0·70*
6AS6†	0·80*
6AS7G†	1·50*
6AT6†	0·65*
6AU5GT	4·26*
6AU6†	0·55*
6AV5GT	3·74*
6AV6†	0·50*
6AW8A†	1·00
6AX5GT	3·10*
6B7	0·75
6B8	0·75
6BA6†	0·50*
6BA7	5·12*
6BA8A	3·75
6BC4	3·71
6BE6†	0·45*
6BH6†	1·20*
6BJ6†	0·80*
GBK4	4·21*
6BL6	85·00
6BL7GT	3·86*
6BN6	0·80*
6BQ7A	1·55*
6BR7	4·00*
6BR8†	1·20*
6BS7	4·00*
6BW6	3·75*
6BW7	1·12*
6BX7GT	4·96*
6BZ6	1·78*
6C4†	0·40*
6CB6A†	0·55*
6CD6GA	4·00*
6CG7	1·72*
6CH6	4·32*
6CL6†	0·75*
6CW4	4·72*
6D2†	0·30*
6DK6	2·49*
6DQ6B	3·04*
6EA8	2·21*
6EB8	2·12*
6EW6	0·80*
6F6	0·75
6F23	1·32*
6F28	0·96*
6H2N	0·75*
6H3N	0·75*
6H6	0·75*
6J4†	0·75*
6J6†	0·35*
6J7	0·75*
6K4N	0·75*
6K6GT	0·75*
6K7	0·75*
6K8	0·75*
6KD6	4·79*
6L6G	2·50*
6L6GA	1·50*
6L6GT	0·75*
6L6GC	1·75*
6L7	0·75
6N2P	0·75
6N3P	0·75
6N7	0·75*
6P25	3·50*
6Q7	0·75*
6R7	0·75*
6SA7	0·75*
6SC7	0·75*
6SF7	0·75*
6SH7	0·75*
6SJ7	0·75*
6SK7	0·75*
6SL7GT†	0·55*
6SN7GT†	0·55*
6SQ7	0·75*
6SR7	0·75*
6SS7	0·75*
6U5G	2·00*
6U8†	0·40*
6U8A†	0·55*
6V6GT†	0·60*
6X4†	0·45*
6X5GT†	0·55*
7B7	1·00*
7C5	1·75*
7C6	1·25*
7H7	1·00*
7R7	1·50*
7S7	2·25*
7Y4	0·75*
7Z4	0·75*
12AT6	0·45*
12AT7†	0·45*
12AU6	0·50*
12AU7†	0·45*
12AV6	0·60*
12AV7	2·84*
12AX7†	0·45*
12AY7†	0·82*
12B4A†	1·00*
12BA6	0·50*
12BE6	0·60*
12BH7†	0·60*
12BY7†	0·80*
12E1	4·00
30C15	1·20*
30C17	1·20*
30C18	1·28*
30F5	1·00*
30FL1/2	1·00*
30FL12	1·44*
30FL14	1·28*
30L1	0·68*
30L15	1·32*
30L17	1·32*
30P4	0·92*
30P19	0·92*
30PL1	1·32*
30PL13	1·44*
30PL14	1·68*
30PL15	1·44*
35W4	0·60*
50C5	0·70*
85A2	1·50
90AG	7·26
90AV	7·16
90C1	1·50
90CG	5·74
90CV	5·99
92AG	7·26
92AV	7·16
150B2	1·80
150C2	1·50
150C4	2·30
211	5·00
723AB†	8·00
807†	0·65
811A†	3·00
812A	7·25
813†	6·00
833A	25·00
866A	8·85
872A	11·40
931A	12·24
2050	2·50
5642	3·16*
5654	3·53*
5651	1·80*
5670	2·86*
5814A	2·60*
6080†	3·40*
6146A	4·27
6146B	4·65
6159B	6·00
6442	15·00
6973	2·61
7586	6·79
7587	12·54
7868	2·93*
8068	5·50
8136	1·54

INTEGRATED CIRCUITS

Type	Price
7400	0·20
7401	0·20
7402	0·20
7403	0·20
7404	0·26
7405	0·23
7406	0·55
7407	0·55
7408	0·28
7409	0·28
7410	0·20
7412	0·26
7413	0·45
7416	0·40
7417	0·40
7420	0·20
7422	0·25
7423	0·35
7425	0·35
7427	0·35
7428	0·50
7430	0·20
7432	0·36
7433	0·37
7437	0·42
7438	0·37
7440	0·22
7441AN	0·92
7442	0·78
7447AN	1·20
7450	0·20
7451	0·20
7453	0·20
7454	0·20
7460	0·20
7470	0·35
7472	0·36
7473	0·36
7474	0·40
7475	0·59
7476	0·42
7480	0·60
7482	0·85
7483	1·00
7484	1·00
7486	0·40
7490	0·52
7491AN	0·85
7492	0·60
7493	0·70
7494	0·80
7495	0·80
7496	0·90
7497	3·67
74100	1·75
74107	0·45
74109	0·86
74110	0·57
74111	0·86
74116	1·89
74118	0·95
74119	2·00
74120	1·10
74121	0·45
74122	0·60
74123	1·00
74125	0·80
74126	0·80
74128	0·80
74132	0·80
74136	0·68
74141	0·85
74142	3·00
74143	3·00
74144	3·00
74145	1·00
74147	2·45
74148	2·00
74150	1·75
74151	0·90
74154	2·00
74155	0·90
74156	0·90
74157	0·90
74159	2·50
74170	2·60
74172	5·00
74173	1·75
74174	1·57
74175	1·00
74176	1·10
74178	1·65
74179	1·65
74180	1·65
74190	1·48
74191	1·48
74192	1·25
74193	1·25
74194	1·25
74195	1·10
74196	1·20
74197	1·00
74198	2·25
74199	2·25
76013N	1·75*
LM309K	1·50
TAA570	2·30*
TAA630S	3·50*
TBA480Q	1·84*
TBA520Q	2·30*
TBA530	1·98*
TBA540Q	2·30*
TBA550Q	3·22*
TBA560CQ	3·22*
TBA673	2·19*
TBA700	1·52*
TBA720Q	2·30*
TBA750Q	2·07*
TBA990Q	2·99*
TCA270Q	*
TCA760A	1·38*

DIL Sockets

Type	Price
8 PIN	0·15
14 PIN	0·15
16 PIN	0·17

BASES

Type	Price
BG7 unskirted	0·15
B7G skirted	0·30
B9A unskirted	0·15
B9A skirted	0·30
Int Octal	0·20
Mazda Octal	0·20
Nuvistor	0·25
Loctal	0·55
8 pin DIL	0·15
14 pin DIL	0·15
16 pin DIL	0·17
Valve screening cans all sizes	0·30

CRT'S

Type	Price
1CP31	31·00
2AP1*	8·50
2BP1*	9·00
3BP1	6·00
3DP1*	5·00
3EG1*	7·00
3FP7*	3·00
3GP1	6·00
3JP1*	8·00
3JP2*	8·00
3JP7*	10·00
SKP1*	15·00
3RP1*	35·00
4EP1	25·00
4EP7	25·00
4EP11	25·00
5ADP1	35·00
5BP1*	5·00
5CP1*	5·00
5CP1A	40·00
5FP15A	5·00
5FP7*	5·00
5UP7*	5·00
DG7-5	25·00
DG7-32	36·00
DH3-91	31·00
DH7-11	68·00
VCR97*	5·00
VCR138*	10·00
VCR138A*	12·50
VCR139A*	8·00
VCR517A*	3·00
VCR517B*	3·00
VCR517C*	3·00

Tube Bases 0·75
*=Surplus
VAT 8%

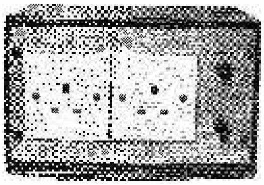
Terms of business: CWO. postage and packing valves and semiconductors 25p per order. CRTs 75p. Items marked* add 12½% VAT. Others 8%. † Indicates cheap quality version or surplus, but also available by leading UK and USA manufacturers. Price ruling at time of despatch. Account facilities available to approved companies with minimum order charge £10. Carriage and packing £1 on credit orders. Over 10,000 types of valves, tubes and semiconductors in stock. P&P 8% VAT

Telephone 01-677 2424
Telex 946708

E & O.E.

INVERTORS

KIT FORM or BUILT UP.



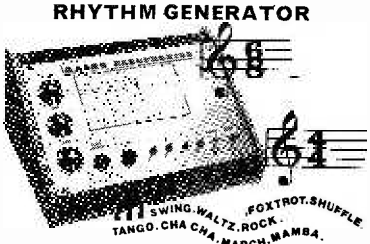
240v-50Hz from your 12v car battery.

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.

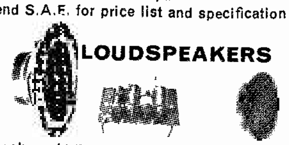
20 + 20 Watts r.m.s. into 8 ohm load. Distortion less than 0·1% 100Hz–10kHz. Frequency response ± 1dB 20 Hz to 20kHz. Hum level virtually nil with volume full on. This is a power amplifier of superb quality incorporating the very latest design features. Professional hi-fi enthusiasts have classed it 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

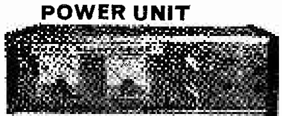


8 inch system

This system is designed for use with above amplifiers rated up to 25W r.m.s. per channel at 8 Ω. 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:

ASTRO ELECTRONICS
Springbank Road
Chesterfield (31475)
Derbyshire

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

PRACTICAL WIRELESS T.V. SOUND TUNER

(Nov. 75 article by A. C. Ainslie) *Copy of original article supplied on request*

IF Sub-Assembly (G8) **£6·80.** P & P 75p
Mullard ELC1043 V'cap UHF Tuner **£4·50.** P & P35p.
3-way Station Control Unit **£1·20.** P & P 25p.
6-way Station Control Unit (Special Offer) **£1·00.**
Power Supply Prtd Circuit Board **£1·00.** P & P 30p.
Res, Caps, Semiconds, etc. for above **£5·80**
Mains Transformer for above **£2·50.** P & P 30p

Add 12½% VAT to price of goods. P & P all items 85p.

Callers welcome at shop premises.

MANOR SUPPLIES
172 WEST END LANE, LONDON NW6
(Near W. Hampstead Tube Stn.) Tel. 01-794 8751

PLEASE MENTION PRACTICAL WIRELESS WHEN REPLYING TO ADVERTISEMENTS

Single stage stereo preamp boards Max 1/P 700Mv (high z) gain 26 d.b. new. **40p**
Grundig Electret microphone inserts with F.E.T. preamp **£1·50.**
12 volt Amp. Boards with TBA810 I.C., 2 × 1000 M.F.D. caps etc., new **70p.**
A.M./F.M. 7 trans. tuner board with Var. cap., 5 way push button unit 10·7 Mhz filter, I.F.T.'s, etc., suitable for spares **75p.**
Model motors 1·5–6v d.c. **20p**, 12 v d.c. 5 pole **40p.**
Low rev. motors—240v a.c. 1/24th r.p.m. **65p**, 1/5th r.p.m. **65p** 115v a.c. miniature motor with gearbox, 3 r.p.m. **30p.**
Plastic project boxes A.B.S. black with lid, 75 × 56 × 35mm **40p.** 95 × 71 × 35 mm **49p.** 115 × 95 × 37 mm **57p.**
Grey potting boxes A.B.S. with lugs 23 × 48 × 23 mm **11p.** 38 × 52 × 25 mm **13p.** 100 × 80 × 42 mm **28p.**
G.P.O. board with 64 BC107 (type) trans. 2 reed and one mercury relay, diodes etc. **£2·00** + 55p p & p.
500 m reels 2 core single strand wire **£4·00** + 85p p & p.
SAVBIT 500 gram cored solder per reel **£2·50** + 35p p & p.
465 kz I.F. panels 6 IF.T.'s 3 trans. etc. **30p.**
200P.F. twin dialectric variable caps. ¼" spindle **35p.**
Stereo preamp chassis with controls ceramic input with circuit **£3·50.**
300 Khz. HC6U crystals **40p.**
240v a.c. large solenoid 25 lbs. push/pull 4" travel **£3·25** + 50p p & p.
G.P.O. buzzers 6-12v d.c. **30p.** 6-12v hooters **50p.**
Miniature solid state buzzers 6, 9, 12, or 24v 15 M/a **75p.**
Omron 12v a.c. relays 11 pin series 3 c/o 5 amp **80p.**
Miniature 220v a.c. sealed relay 2 pole c/o **40p**
12v d.c. sealed relay 3 pole n/o, 1 pole n/c, 1 pole c/o, 2 amp contacts 130Ω coil **65p.**
12v reed relay 4 make **20p.**
6Mh 3 amp smoothing chokes **30p.**
Veeder root reset. 3 digit 240v a.c. counters **£1·95.**
Single digit electro mech. counter 24v d.c.
100-0-100μa level meters **75p.**
Stereo tuning meters 100μa per movement **£2·75.**
Level meter 20mm × 10 mm 10 m/A **40p.**
Smiths 270° 5mA, meters 115mm diam. scaled in tons **£1·50.**
Ferranti 250-0-250 aμ panel meter (scaled 150-0-150) 80 × 75 mm **£3·50.**
Mains transformers 240v a.c. primary A 6-0-6v 100 m/a **75p.** 9-0-9v 75 m/a **75p.** 12-0-12v 50 m/a **75p.** 12v 500 m/a **95p.** 15-0-15v 1 amp **£2·00** + 35p p & p. 0-12-15-20-24-30 2 amps **£4·95** & 35p p & p. 2·5v 2 amp **£1·75** + 35p p & p. 35v 2 amp + 2·5v 2 amp Toroid. **£2·75** + 35p p & p.
18v 1 amp rectified **£1·95** + 35p p & p. 18v 1·5 amp + 12V 1 amp **£2·20** + 35p p & p.
20v 2·5 amp **£2·20** + 35p p & p. 80 watt auto tapped 240-135-115-110v a.c. **£1·95** + 35p p & p.
300 watt auto 110-240v a.c. **£3·50** + 50p p & p.
Tape heads. JAP cassette mono std. **90p** B.S.R. MN1330 ½ track dual Imped. record/play back **50p** B.S.R. SRP90 ¼ track stereo record playback **£1·95.**
B.S.R. TD10 dual head assemblies ¼ track record playback staggered stereo with built in erase per head **£1·20.** B S R 4SE std ¼ track erase heads **30p.**
Computer capacitors new 14,000μ 35v d.c. 30,000μF 40v d.c. 4,200μF 100v d.c., 60,000 μF 30v d.c. all **75p** each.
20,000 M.f.d. 45v d.c. ex. equip. **40p**
2,200 M.f.d. 6·3v d.c. P.C. mounting and 4,700 M.f.d. 6·3v d.c. P.C. mounting new, small **5p** each type 10 M.f.d. 6·3v d.c. P.c. Mounting **£2·50** per 100.
Semiconductors 741 8 pin Dil **23p.** CD4051 CMOS single 8 channel multiplexer **50p**
TBA800 **90p.** Motorola MRD3051 PM OTO transistor **35p**, N. channel F.E.T. SIM to 2N3819 **18p.** MAN 3A 3mm led displays **50p.**
Lucas 500v 5 amp N.P.N. stud power trans. **55p.**
2" green L.E.D's **12p.** M203 dual matched paid mosfets single gate per FET **40p** SL301 dual matched pair silicon NPN transistors Ft. 300 Mhz **30p.**
CV2184 CRT 2½" with P.D.A. **£1·95** + 50p p & p.
G.P.O. keyswitch assy., 3 switches 2-3 way 1-2 way multipole **35p** Bulgin roller micros **15p.**

ORDER ADDRESS
PROGRESSIVE RADIO
31 CHEAPSIDE
LIVERPOOL 2 051 236 0982

SMALL ADS

The prepaid rate for classified advertisements is 20 pence per word (minimum 12 words), box number 60p extra. Semi-display setting £6·80 per single column centimetre. All cheques, postal orders etc., to be made payable to Practical Wireless and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, Practical Wireless, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

CONDITIONS OF ACCEPTANCE OF CLASSIFIED ADVERTISEMENTS

1. Advertisements are accepted subject to the conditions appearing on our current advertisement rate card and on the express understanding that the Advertiser warrants that the advertisement does not contravene any Act of Parliament nor is it an infringement of the British Code of Advertising Practice.

2. The publishers reserve the right to refuse or withdraw any advertisement.

3. Although every care is taken, the Publishers shall not be liable for clerical or printers' errors or their consequences.

NOTICE TO READERS

When replying to Classified Advertisements please ensure:

(A) That you have clearly stated your requirements.
(B) That you have enclosed the right remittance.
(C) That your name and address is written in block capitals, and
(D) That your letter is correctly addressed to the advertiser.

This will assist advertisers in processing and despatching orders with the minimum of delay.

Receivers and Components

VALVES

Radio – T.V. – Industrial – Transmitting

We Dispatch Valves to all parts of the world by return of post, Air or Sea mail, 2700 Types in stock, 1930 to 1976. Obsolete types a speciality. List 20p. Quotation S.A.E. Open to callers Monday to Saturday 9.30 to 5.00 closed Wednesday 1.00. We wish to purchase all types of new and boxed Valves.

COX RADIO (SUSSEX) LTD.
Dept. P.W. The Parade, East Wittering, Sussex PO20 8BN
West Wittering 2023 (STD Code 024366)

SURPLUS TRANSISTOR Amplifier Modules 75p each, Ex GPO Multimeters 20,000Ω/V DC, with leads and leather case, £8·00, plus 50p P&P. Ex GPO Cutters and Pliers, 75p each. Archer, 9 Pine Grove, Maidstone, Kent.

BRAND NEW COMPONENTS BY RETURN.

Electrolytic capacitors 16V, 25V, 50V.—0·47, 1·0, 2·2, 4·7 & 10mfd.—5p. 22, 47—5½p. (50V—6p). 100—7p (50V—8p) 220—8p. (50V—10p) 470—11p. (50V—16p) 1000/16V—15p. 1000/25V—18p. 1000/50V—22p.

Subminiature bead tantalum electrolytics—0·1, 0·22, 0·47, 1·0, 2·2 @ 35V, 4·7/25V—11p. 10/25V—13p. 22/16V, 47/6V, & 100/3V—15p.

Mullard miniature ceramic E12 series 2% 63V. 10pf. to 47pf—3p. 56pf. to 330pf.—4p.

Vertical mounting ceramic plate 50V.
E12 series 22pf-1000pf. E6 series 1500pf-47000pf.—2p.

Polystyrene E12 series 63V horizontal mounting. 10pf to 1000pf—3p. 1200pf. to 10000pf.—4p.

Mullard polyester 250V vertical mounting E6 series. 0·01 to 0·1—4p. 0·15, 0·22—5p. 0·33, 0·47—8p. 0·68—11p. 1·0—13p. 1·5—20p. 2·2—22p.

Mylar (Polyester) Film 100V vertical mounting. 0·001, 0·002, 0·005—3p. 0·01, 0·02—4p. 0·04, 0·05—4½p.

Miniature resistors Highstab E12 series 5%. Carbon Film 0·25W 1Ω to 10MΩ. (10% over 1MΩ)—1p. Metal Film 0·125W, 0·25W & 0·5W 10Ω to 2M2Ω.—1½p. Metal Film 1W. 27Ω to 10MΩ.—2p ea.

1N4148—3p. 1N4002—5p. 1N4006—7p. 1N4007—8p. BC107/3/9, BC147/8/9, BF157/8/9 & BF194 & 197—9p. Fuses 20mm. glass. 1¼" glass & 1" ceramic. 2½p. Post 10p. (Free over £4·00) Prices inclusive of VAT.

THE C. R. SUPPLY CO.
127, Chesterfield Rd., Sheffield S8.

TIRRO ELECTRONICS, the mail order division of RITRO ELECTRONICS UK offers a wide range of components for the amateur enthusiast. Large SAE or 20p brings list. GRENFELL PLACE, MAIDENHEAD, BERKS. SL6 1HL.

ORCHARD ELECTRONICS

I.C.s TTL. C/Mos. Linear. Capacitors. Resistors. (E12) SIL/Rectifiers. Diodes. LED. Thyristors. Zeners. Voltage Reg. DIL Sockets. Bridge Rectifiers. Potentiometers. Presets. Triacs. Diac. Plugs. Sockets. Cable. Vero. Carefully selected range, excellent despatch service. Same day turn round. S.A.E. List. Suppliers to A.E.R.E. U.K.A.E.A. Governments Depts. Schools. Universities. Manufacturers. Accounts opened for trade and amateur. Join the professionals. Phone by 4 p.m. Goods out 1st class by 5 p.m. Try us and prove it!

ORCHARD ELECTRONICS
Flint House, High Street, Wallingford, Oxon. Telephone 0491-35529

TOUCH CONTROLLED LIGHTING KITS

These KITS replace conventional light switches and control 300W of lighting. No mains rewiring required Insulated Touch Plates. Easy to follow instructions.
TSD300K—TOUCHSWITCH & DIMMER combined. ONE touch plate to switch light on or off. Brightness controlled by small knob—**£5·20.**
TS300K—TOUCHSWITCH. TWO touch plates ON and OFF—**£4·00.**
TSA300K—AUTOMATIC. ONE touch plate. Light turns off after preset delay—**£4·00.**

LD300K—LIGHT DIMMER KIT—**£2·80.**

CMOS—LOW PRICES!

4000	18p	4011	18p	4016	51p	4040	97p
4001	18p	4012	18p	4017	91p	4049	50p
4002	18p	4013	51p	4023	18p	4077	45p
4007	18p	4015	91p	4025	18p	4519	56p

TRIACS 400V TO220 isolated tab
8·5A **79p** Diac **21p**
6·5A with trigger **80p**

NE555 **36p** (3 for **£1**)
741 **24p** (3 for **60p**)
2N6027 (PUT) **34p**
2N3055 **36p**

Clock/Appliance Timer KIT inc. AY-5-1230, 0·5" LED display, triac, switches, box, PCBs, etc. **£15·95**
AY-5-1230 Clock/appliance Timer IC **£4·85**

QUANTITY DISCOUNTS ON REQUEST
Add 8% VAT + 25p P&P. Mail Order Only to:
T. K. ELECTRONICS (PW)
106 Studley Grange Road, London W7 2LX

NOSTALGIA **VINTAGE RADIO** COLLECTING
1920 to 1950

Receivers, valves, components, service data, historical research, books, magazines, repairs and restorations. A complete service for the collector and enthusiast of vintage radio.

S.a.e. with enquiries and for monthly newsheet. Full 1977 catalogue, 70p post paid.

TUDOR REES (Vintage Services), 64, Broad Street, Staple Hill, Bristol, BS16 5NL. Tel. Bristol 565472.

Radio Receivers

MULTIBAND RADIOS. 12 band . . . Marine, Aircraft, LPSB, HPSB, UHF (430/470), SW1/4, MW, LW, FM. RF gain. BFO. £155. GRUNDIG SATERLITT £199. BFO Units, £16·50. SHARP MW/Aircraft, £13. Langtons, High Street, Rocester, Staffordshire. SAE lists.

Electrical

STYLI, CARTRIDGES, AUDIO LEADS, etc. For keenest prices send SAE for free list to: Felstead Electronics (PW), Longley Lane, Gatley, Cheadle, Cheshire SK8 4EE.

Books and Publications

SIMPLIFIED TV REPAIRS. Full repair instructions individual British sets £4·50, request free circuit diagram. Stamp brings details unique. TV Publications (Ause PW), 76 Church Street, Larkhall, Lanarkshire.

RADIO BOOK SERVICE

50 Projects using IC CA3130 (R. A. Penfold)	£1–05
50 CMOS IC Projects (R. A. Penfold)	£1–05
A Practical Introduction to Digital IC's	£1–05
28 Tested Transistor Projects (R. Torrens)	£1–05
50 Projects using Relays, SCR's & TRIAC's (F. G. Rayer)	£1–20
How to build your own Metal & Treasure Locators (F. G. Rayer)	£0–95
Practical Repair & Renovation of Colour TV's (C. F. Miller)	£1–05
Fun & Games with your Electronic Calculator (J. Vine)	£0–85
How to build Advanced Short Wave Receivers (R. A. Penfold)	£1–30
Radio Antenna H'book for Long Distance Reception	£0–95
50 (Fet) Field Effect Transistor Projects (F. G. Rayer)	£1–35
Servicing Transistor Radio Receivers	£0–95
Solid State Short Wave Receivers for Beginners	£1–05

PRICES INCLUDE POSTAGE & PACKING... S.A.E. FOR FULL LIST
CHILCHESTER COURT, WICKHAM RD. BECKENHAM KENT BR3 2DW

YOU CAN'T HELP BUT MAKE MONEY. If you follow the planned and detailed information on how to start your own business rewinding Armatures, set out in the new manual which is profusely illustrated and leads you through easily understood stages of fault diagnosis, taking data, test procedures, laying down new windings, where to obtain work, how to cost jobs etc. NO PREVIOUS ELECTRICAL KNOWLEDGE REQUIRED. Complete instruction manual, £4, plus 30p P&P. CWO. Copper Supplies, 102 Parrswood Road, Withington, Manchester 20. Dept. PWB.

THE DALESFORD SPEAKER BOOK
by R. F. C. Stephens.

This book is a must for the keen home constructor. Latest technology DIY speaker designs. Contains full plans for infinite baffle and reflex designs for 10-100 watts, also unusual centre-bass system for those who want Hi-fi to be "Heard and not seen". £1·95 (£2.20 post paid. $5 Overseas).

VAN KAREN PUBLISHING
5 SWAN STREET
WILMSLOW
CHESHIRE

Educational

COURSES—Radio Amateurs Examination, City & Guilds. Pass this important examination and obtain your G8 licence, with an RRC Home Study Course. For details of this, and other courses (GCE, Professional examinations, etc.), write or phone: THE RAPID RESULTS COLLEGE, Dept. JX1, Tuition House, London SW19 4DS. Tel: 01-947 1102 (24hr recording service).

GO TO SEA as a Radio Officer. Write: Principal, Nautical College, Broadwater, Fleetwood FY7 8JZ.

Aerials

G2DYM AERIALS

TXers and S.W.L's.—Have a proper aerial system, anti-TVI, individually designed, purpose built for your particular interests, QTH and Equipment by and ex-BBC Transmitter and Aerial Engineer.
Details 7" × 12" SAE and 3, 9p stamps.

LAMBDA ANTENNA STUD FARM, WHITEBALL, WELLINGTON, SOMERSET

Service Sheets

SERVICE SHEETS — COLOUR TV SERVICE MANUALS

Service Sheets for Mono TV, Radios, Record Players and Tape Recorders 75p. Please send large Stamped Addressed Envelope. We can supply manuals for most makes of Colour Television Receivers by return of post.

B.R.C. PYE ECKO PHILIPS ITT/KB SONY G.E.C. HITACHI BAIRD ULTRA INVICTA FERGUSON H.M.V. MARCONI AND MANY MORE

Let us quote you. Please send a Stamped Addressed Envelope for a prompt reply. Also comprehensive T.V. repair manuals by J. M. Court. S.A.E. for details. MAIL ORDER ONLY

G. T. TECHNICAL INFORMATION SERVICE
10 DRYDEN CHAMBERS, 119 OXFORD ST., LONDON W1R 1PA

BELL'S TELEVISION SERVICES for Service Sheets on Radio, TV, etc., 75p plus SAE. Colour TV Service Manuals on request. SAE with enquiries to BTS, 190 Kings Road, Harrogate, N. Yorkshire. Tel: (0423) 55885.

SERVICE SHEETS for Radio, Television, Tape Recorders, Stereo, etc. With free fault-finding guide, from 50p and SAE. Catalogue 25p and SAE. HAMILTON RADIO, 47 Bohemia Road, St. Leonards, Sussex.

LARGE SUPPLIERS OF SERVICE SHEETS AND COLOUR MANUALS

TV, Radio, Tuners, Tape Recorders, Record Players, Transistors, Stereograms, Radiograms.
All at 75p each except Colour TV & Car Radios

Please state if circuit will do, if service sheet not in stock, large s.a.e. with all enquiries and orders otherwise cannot be attended to. Uncrossed P.O's or crossed P.O's returned if service sheets are not available. All service men, please note, we operate a same day return service, all claims of non-delivery should be made within seven days. No overseas mail please. Mail order only or 'phone 01-458 4882. Free TV fault tracing chart or TV list on request with order.

C. CARANNA, 71 BEAUFORT PARK, LONDON, NW11 6BX NO CALLERS PLEASE

SERVICE SHEETS, Radio TV, etc., 10,000 models. Catalogue, 24p, plus SAE with orders, enquiries. Telray, 154 Brook Street, Preston PR1 7HP.

For Sale

BACK COPIES, PW, T, PE, EE, RC. 20p plus postage. Phone (Aylesbury) 20758.

NEW ISSUES of "Practical Wireless" available from April 1974 edition up to date. Price 65p post free. Bell's Television Services, 190 Kings Road, Harrogate, N. Yorkshire. Tel: (0243) 55885.

Wanted

SURPLUS??? Turn it into cash. Phone 0491 35529 (Oxon).

WANTED. New Valves, Transistors. Top prices, popular types. Kensington Supplies (C), 367 Kensington Street, Bradford 8, Yorkshire.

WANTED NEW Valves, transistors, I.Cs, amplifiers, receivers, televisions (Anything Useful) any quantity. Stan Willets, 37 High Street, West Bromwich. Tel: 021-553 0186.

Miscellaneous

HIGH QUALITY LOW DISTORTION OSCILLATOR

An ideal instrument for testing hi-fi systems.
Designed by Mr. J. L. Linsley Hood

Kit price, £19·50+Tax at 8%. P/P & Ins., £1·00. Made and tested, £23.
Specification—**Frequency range:** 10 Hz–100 kHz in 4 steps.
Output: 10mV—1 volt in 3 steps.
Sine- and Square-wave forms: Dist. below ·02%.
Attenuator: Powered by 9 V battery.
Other instruments: MILLIVOLTMETER, FREQUENCY METERS, 60 V 1 A REG P.S.U. F.M. SIG GEN., DISTORTION ANALYSER. *Also:* HI-FI AMP KITS 10–100 W. F.M. TUNERS, KEF SPEAKER UNITS.
S.A.E. for further information to:

TELERADIO ELECTRONICS
325 Fore Street, Edmonton, London N.9. *Telephone:* 01-807 3719.

RECHARGEABLE BATTERIES. 'AA' pencell (HP7), £1·26; Sub 'C', £1·29; 'C' (HP11), £2·38; 'D' (HP2), £2·92; PP3, £4·98. Matching chargers £5·91 each, except PP3 charger, £4·99. Charging holders for 2, 3, 4, 5 or 6 pencells, 35p. 'C' and 'D' size holders, 4 cells only, 50p. Prices include VAT. Add 10% post, package and insurance, orders under £20. 5% over £20. SAE for full details plus 75p for 'Nickel Cadmium Power' booklet. Mail orders to SANDWELL PLANT LTD., 201 Monmouth Drive, Sutton Coldfield, West Midlands. Tel: 021-354 9764. Callers to TLC, 32 Craven Street, Charing Cross, London WC2.

MORE DX?

FREE DX from tiring WHISTLES and CW interference—FAST, with a Tunable Audio Notch Filter. Sharp notch tunes 350-6000 Hz, speaker amplifier Only £7·90
EXPLORE 10-150 KHz with a VLF Tuner. Antenna in—audio out Only £9·70
Get SPOT-ON the DX with a Crystal Calibrator. Switched 1 MHz, 100 KHz and 25 KHz with EQUAL LEVEL harmonics to VHF Only £13·80
ADD 100-600 KHz with an LF Converter. Antenna tuning, feeds 3·5-4 MHz receiver Only £8·80
Each easy-assembly kit includes ALL parts, printed circuit, 1½" × 3" × 5" case, battery, screws etc. instructions, postage and money back assurance. Get more DX, SEND TODAY.

CAMBRIDGE KITS
45 (PY) Old School Lane, Milton, Cambridge

ENAMELLED COPPER WIRE

swg	1 lb	8oz	4oz	2oz
14–19	2·40	1·20	·69	·50
20–29	2·45	1·60	·82	·59
30–34	2·60	1·70	·89	·64
35–40	2·85	1·90	1·04	·75

Inclusive of p&p and VAT.
SAE brings Catalogue of copper and resistance wires in all coverings.

THE SCIENTIFIC WIRE COMPANY
PO Box 30, London E4 9BW
Reg. Office: 22 Coningsby Gardens,

100 Resistors 75p

¼W 5% c/FILM 2·2 Ω-2·2M Ω (E12)
10 each of any value
Send stamped envelope for **FREE SAMPLE**

C60 CASSETTES 30p
C90 CASSETTES 45p

Quantity Discounts
10 Units 5%
50 Units 7%
100 Units 10%

All prices include VAT.

All Cassettes in Plastic Case with Index and Screwed Assembly.
Add postage 10p in £1.
Salop Electronics,
23 Wyle Cop,
Shrewsbury.
Tel. 53206

ARMATURE & COIL WINDING
ENAMELLED COPPER WIRE

Only top quality materials supplied.
All orders dispatched within 24 hrs.

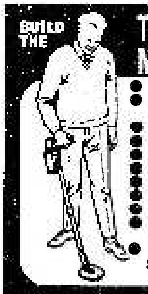
S.W.G.	1 lb reel	½ lb reel
10 to 19	£2·95	£1·60
20 to 29	£3·15	£1·80
30 to 34	£3·45	£1·90
35 to 40	£3·65	£2·10

All prices are inclusive of P. & P. in U.K.

COPPER SUPPLIES, 102 Parrswood Road, Withington, Manchester 20. Tel: 061-445 8753

SUPERB INSTRUMENTS CASES by Bazelli, manufactured from heavy duty PVC faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range, competitive prices start at a low 82p. Examples: width, depth, height, 8in v 5in x 3in, £1·70. 10in x 6in x 3in £2·42, 10in x 8in x 3in £3·02. 12in x 10in x 3in £3·96. 8in x 4 in x 4in £1·98. 10in x 6in x 4in £2·97. 12in x 8 in x 4in £3·96. 7in x 7in x 5in £2·91. 8in x 10in x 6in £3·96. 12in x 8in x 7in £4·40. 12in x 12in x 7in £4·84. Plus 85p carriage and 8% VAT. Over 400 models to choose from. Prompt despatch. Free literature (stamp would be appreciated). Bazelli, Dept. No. 25, St. Wilfrid's, Foundry Lane, Halton, Lancaster LA2 6LT.

BUILD THE **TREASURE TRACER MK III** Metal Locator



- Varicap tuning
- Britain's best selling metal locator kit;
- Fitted with Faraday shield.
- Speaker and earphone operation
- 4,000 already sold
- Knocks down to only 17in.
- Prebuilt search coil assembly
- Thoroughly professional finish
- As seen on BBC1 and BBC2 TV
- You only need soldering iron, screwdriver, pliers and snips
- Five transistor circuit

Send stamped, addressed envelope for leaflet

Complete Kit **£15·95** Post £1·20+£1·37 VAT — Built & tested **£20·95** Post £1·20+£1·77 VAT

MINIKITS ELECTRONICS,
6a CLEVELAND ROAD,
LONDON, E18 2AN (Mail order only)

MAKE YOUR OWN PRINTED CIRCUITS

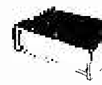
RUB-ON TRANSFERS—Starter pack (5 sheets, lines, pads, i.c. pads) **£1·30.** Spare sheets **27p.**
FERRIC CHLORIDE—1lb bags **70p** (p.&p. 30p)*
SOLDERCON SOCKETS—100 **65p.** Quantity rates.
PLASTIC SUPPORTS—7 or 8 hole. **6p**/pair.
TRANSISTOR TESTER—**£7** (p.&p. 30p)*
SAE lists, samples, P.&p. 15p/order except *.

P.K.G. ELECTRONICS
OAK LODGE, TANSLEY, DERBYSHIRE

OUTSTANDING HI-FI FM TUNER, comprises 7 transistor superhet design with Varicap tuning, AFC. Latest silicon circuitry, full coverage 88-102MHz. Supplied built and tested with metal front, panel and instruction sheet. Only £9·95 plus 30p P&P. GREGG ELECTRONICS, 86-88 Parchmore Road, Thornton Heath, Surrey.

H. M. ELECTRONICS
275a FULWOOD ROAD, BROOMHILL, SHEFFIELD S10, 3BD.

BEC. CABINETS (illus'd)



METAL CASES
DRY TRANSFER LETTERING

Send 15p for leaflets (Refundable)
Trade enquiries invited

$3\frac{1}{2}$ DIGIT DVM MODULE kit. Autozero, autopolarity only £37·50. SAE details. MLC, 116 College Road, Southwater, Horsham, Sussex.

For 1 off printed circuits
MAKE YOUR OWN PRINTED CIRCUITS

Using self adhesive mask method. Simply carbon copy original direct from published project, or draught original design directly onto mask. Apply mask to copper laminate, cut our with modelling knife to remove areas to be etched. Etch, cost around 7p per circuit.

£1·30 per pack contains sufficient material for around 20 average PCB's p.p. 20p.

J.D.M. ELECTRONICS
11 Woodland Close,
Crawley Down,
West Sussex Tel: Copthorne 714597
Trade & Export enquiries welcome

SINTEL FREE CATALOGUE

MOT. CMOS Databk £3·50
6800 Appl. Man. £12·95
NS TTL Databk. £2·10
RCA CMOS Databk. £5·45
Z80 Ass. Lang. Prog. Man. £7·50
Z80—CPU Man. £5·60

All items CWO (Books-No VAT)

35p p&p. Full range in our FREE CATALOGUE which will be sent by return. **SINTEL, P.O. BOX 75F, 209 Cowley Road, Oxford Tel.: (0865) 49791.**

1MM 9V P.C. Power Drill uses PP9. Safe, reliable, guaranteed. 2-1mm drills supplied. £3·95 c.w.o. P.E. Ltd., Coedaben, Wrexham, Clwyd.

KIT OF PARTS for Nelson-Jones Tuner, Railway model controller, capacitor discharge power supply, etc. Semiconductor knobs, meters, resistors, capacitors. S.A.E. for price list. R.B. Electronics, 24 Springfield Park, Holyport, Maidenhead 39798.

Ladders

LADDERS. Varnished. 20ft 9in extd., £25·33. Carr. £1·90. Leaflet. Also alloy ext. up to 62½ ft. The Ladder Centre (WLS), Halesfield (1), Telford, Salop. Tel: 586644. Callers welcome.

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Practical Wireless for .... insertions.

I enclose Cheque/P.O. for £......................

(Cheques and Postal Orders should be crossed Lloyds Bank Ltd. and made payable to Practical Wireless).

NAME ....

ADDRESS ....

....

Send to: Classified Advertisement Manager
PRACTICAL WIRELESS,
GMG, Classified Advertisement Dept., Rm. 2337,
King's Reach Tower, Stamford Street.
London SE1 9LS **Telephone 01-261 5846**
Rate
20p per word, minimum 12 words. Box No. 60p extra.

Company registered in England. Registered No. 53626. Registered office: King's Reach Tower, Stamford Street, London SE1 9LS

The Pictorial Method

BASIC ELECTRICITY (5vols) ELECTRONICS (6vols) TELEVISION (3vols)

You'll find it easy to learn with this outstandingly successful PICTORIAL METHOD. The essential facts are explained in the simplest language, one at a time, and each is illustrated by an accurate cartoon-type drawing. These clear and concise illustrations make study a real pleasure. The books are based on the latest research into simplified learning techniques. This easy-approach-to-learning method has proved beyond doubt that acquiring knowledge can be an enjoyable experience.

YOUR 100% GUARANTEE

Should you be, in any way dissatisfied with the MANUALS your money will be refunded by return of post.

The series will be of exceptional value in training mechanics and technicians in Electricity, Radio and Electronics.

The Selray Book Co., 70 Hayes Hill, Bromley, Kent, BR2 7HP.

My blessings go with you for making such splendid manuals available. *P.S.J., Highgate*

Thank you for a wonderful set of Books. I shall always be most grateful. *S.P., Broadwater*

Their simplicity is their attraction. *P.J.S., Stowbridge*

Your excellent manuals are the best and easiest to follow that I have come across. *P.J.L., Mottingham*

These manuals are away ahead of any others on the market. In one word I say 'par excellence'. 100% recommendation is my assessment of the outstanding qualities. *B.W., Southampton*

POST NOW FOR THIS OFFER!

To The SELRAY BOOK CO., 60 HAYES HILL, HAYES, BROMLEY, KENT. BR2 7HP

Please find enclosed P.O./Cheque value £............

BASIC ELECTRICITY 5 parts £10·50 ☐
BASIC ELECTRONICS 6 parts £12·50 ☐
BASIC TELEVISION 3 parts £6·50 ☐

Tick Set(s) required. Prices include Postage

YOUR 100% GUARANTEE. If after 10 days examination you decide to return the Manuals your money will be refunded in full.

NAME ....
BLOCK LETTERS
FULL POSTAL ....
ADDRESS ....
....

WATFORD ELECTRONICS

33/35, CARDIFF ROAD, WATFORD HERTS, ENGLAND
MAIL ORDER, CALLERS WELCOME. Tel. Watford 37774

ALL DEVICES BRAND NEW, FULL SPEC. AND FULLY GUARANTEED. ORDERS DESPATCHED BY RETURN OF POST. TERMS OF BUSINESS: CASH/CHEQUE/P.O.s OR BANKERS DRAFT WITH ORDER. GOVERNMENT AND EDUCATIONAL INSTITUTIONS OFFICIAL ORDERS ACCEPTED. TRADE AND EXPORT INQUIRY WELCOME. P & P ADD 25p* TO ALL ORDERS UNDER £10·00. OVERSEAS ORDERS POSTAGE AT COST.

VAT

Export orders no VAT. Applicable to U.K. Customers only. Unless stated otherwise, all prices are exclusive of VAT. Please add 8% to devices marked *. To the rest add 12½%.

We stock many more items. It pays to visit us. We are situated behind Watford Football Ground. Nearest Underground/Br. Rail Station: Watford High Street. Open Monday to Saturday. Ample Free Car Parking space available.

POLYESTER CAPACITORS: Axial lead type. (Values are in µf).
400V: 0·001, 0·0015, 0·0022, 0·0033 **8p**; 0·0047, 0·0068, 0·01, 0·015, 0·018 **9p**; 0·022, 0·033, **10p**; 0·047, 0·068, **14p**; 0·1, **15p**; 0·15 0·22, **22p**; 0·33, 0·47 **39p**; 0·68 **45p**.
160V: 0·039, 0·15, 0·22 **11p**; 0·33, 0·47 **19p**; 0·68, 1·0 **22p**; 1·5 **29p**; 2·2 **32p**; 4·7 **36p**.
DUBILIER: 1000V: 0·01, 0·015 **16p**; 0·022 **18p**; 0·047 **16p**; 0·1 **34p**; 0·47 **43p**.

POLYESTER RADIAL LEAD (Values in µf). **250V:** 0·01, 0·015 **6p**; 0·022, 0·027 **7p**; 0·033, 0·047, 0·068, 0·1 **8p**; 0·15 **12p**; 0·22, 0·33 **14p**; 0·47 **16p**; 0·68 **20p**; 1·0 **24p**; 1·5 **27p**; 2·2 **31p**.

FEED THROUGH CAPACITORS
1000pF/350V **8p**

ELECTRONIC CAPACITORS: Axial lead type (Values are in µF).
63V: 0·47, 1·0, 1·5, 2·2, 2·5, 3·3, 4·7, 6·8, 8, 10, 15, 22, **9p**; 47, 32, 50, **12p**; 63, 100, **27p**; **50V:** 1·0, **7p**; 50, 100, 220, **25p**; 470, **50p**; 1000, **62p**; 2200, **68p**; **40V:** 22, 33µF, **9p**; 100, **12p**; 3300, **62p**; 4700, **64p**; **35V:** 10, 33, **7p**; 330, 470 **32p**; 1000, **49p**; **25V:** 10, 22, 47, **6p**; 80, 100, 160, **8p**; 220, 250, **13p**; 470, 640, **25p**; 1000, **27p**; 1500, **30p**; 2200, **34p**; 3300, **52p**; 4700, **54p**; **16V:** 10, 40, 47, 68, **7p**; 100, 125, **8p**; 470, **16p**; 1000, 1500, **20p**; 2200, **34p**; **10V:** 4, 100, **6p**; 640, **10p**; 1000, **14p**.
TAG-END TYPE: 70V: 2000, **98p**; 4700, **121p**; **50V:** 3000 **75p**; **40V:** 2500, **65p**; **25V:** 4700, **48p**; 2000, **37p**; **40V:** 2000+2000, **95p**; **350V:** 32+32, **185p**.

TANTALUM BEAD CAPACITORS
35V: 0·1µF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2µF, 3·3, 4·7, 6·8. **25V:** 1·5, 10. **20V:** 1·5µF **13p** each. **10V:** 22µF, 33, **6V:** 22µF, 47, 68, **3V:** 100µF **20p** each.

MYLAR FILM CAPACITORS
100V: 0·001, 0·002, 0·005, 0·01µF **5p**
0·015, 0·02, 0·03, 0·04, 0·05, 0·056µF **6p**
0·1µF, 0·15, 0·2 **7p**. **50V:** 0·47µF **10p**

CERAMIC CAPACITORS 50V.
Range: 0·5pF to 10nF **3p**
15nF, 22nF, 33nF, 47nF, **4p**, 100nF **6p**

POLYSTYRENE CAPACITORS:
10pF to 1nF **6p each**
1·5nF to 47nF **10p each**

POTENTIOMETERS (AB or EGEN)
Carbon Track, 0·25W Log & 0·5W Linear values
1K Ω & 2K Ω (LIN. ONLY) Single gang **26p**
5KΩ–2MΩ single gang **26p**
5KΩ–2MΩ single gang D/P switch **55p**
5KΩ–2MΩ dual gang stereo **70p**

SLIDER POTENTIOMETERS
0·25W log and linear values 60mm
5KΩ–500KΩ single gang **60p**
10KΩ–500KΩ Dual gang **70p**
Self-Stick graduated Alum. Bezels **20p**

PRESET POTENTIOMETERS
0·1W 50Ω–2·2M Mini. Vert. & Horiz. **8p**
0·25W 100Ω–3·3MΩ Horiz. } larger **10p**
0·25W 250Ω–4·7MΩ Vert. } larger **10p**

JACKSONS VARIABLE CAPS.
Dielectric
100/300pF **105p**
500pF **125p**
DILEMIN
300pF/500pF **185p**
4832/2K 2 speed Drive Unit complete with knobs and coupling **350p***
6:1 Ball Drive 4511/DAF **107p***
Dial Drive 4103 6:1/36:1 **520p**
Drum 54mm **30p***
0-1-365pF **268p**
00 2 365pF **275p**
0 2 365pF with slow motion Drive **305p**
00 208/176 **285p**
,, ,, with slow motion drive **305p**
C804–5pF; 10; 15; 25; 50pF **135p***
100, 150pF **195p***
'L' 3x310pF **428p**
00-3x25pF **386p**

RESISTORS Erie make 5% carbon Miniature High Stability, Low Noise

	RANGE	Val.	1–99	100+
0·25W	2·2Ω-4·7M	E24	1·5p	1p
0·5W	2·2Ω-4·7M	E12	2p	1·5p
1W	2·2Ω-10M	E12	5p	4p
2% Metal Film	10Ω–1MΩ			6p

SILVER MICA (pF)
3·3, 4·7, 6·8, 10, 12, 18, 22, 27, 33, 47, 50, 68, 75, 82, 85, 100, 120, 150, 200, 250 **9p** each.
300, 330, 360, 390, 600 & 820pF **16p** each.
1000, 2200pF **20p** each.

CRYSTALS
100KHz **365p**
1MHz **323p**
1·6MHz **395p**
3·2768MHz **380p**
4·433619MHz **165p**
Holder HC6U **18p**

HEAT SINKS*
TO92 **8p**
TO5 **9p**
TO18 **8p**
TO88 **22p**
TO3 **22p**
TO66 **22p**
Silicon Grse. 20ml Syringe **125p**
Insulation Kit Mica plus 2 Bushes for TO3/TO66 or Plastic Transistors **5p**

DENCO COILS
Dual Purpose 'DP' VALVE TYPE
Range 1-5 B, Y, R, W **80p**
6-7 B, Y, R **70p**
1-5 Green **85p**
'T' Type (Trns. tuning)
Rng. 1-5 B, Y, R, W **86p**
B9A Valve Base **23p**
RDT2 **85p**
RFC 5 chokes **84p**
RFC 7(19mH) **90p**
IFT 13/14/15/16/17 **79p**
IFT 18/1·6 or 465 **95p**
TOC1 **80p**
MW 5FR **76p**
MW/LW 5FR **96p**

CERAMIC TRIMMER CAPACITORS
2–7pF; 4–15pF; 6–25pF; 8–30pF **20p**

MINIATURE TYPE:
2·5–6pF; 3–10pF; 3–30pF; 10–40pF **22p**
6–25pF; 65pF; 88pF **30p**

COMPRESSION
3–40pF; 10–80pF **22p**
25–200pF **33p**
100–500pF 1250pF **38p**

AUDIBLE Warning Devices 12V **179p***

REVERB AMP
Short spring-line Unit **448p**

S-DEC **185p***
T-DEC **340p***
U-DEC 'A' **375p***
U-DEC 'B' **655p***
16 DIL Adaptor **170p***
TO5 Adaptor **160p***
Single end lead with 1mm plug **9p***
Double ended lead with 1mm plugs **16p***

EARPHONES
Magnetic
2·5mm **18p**
3·5mm **18p**
Crystal **33p**

FIGARO GAS and SMOKE DETECTORS*
Types: 109, 308, 812 or 813 **355p each**
Sockets **20p**

DIL Sockets* Low profile (Texas)
8pin **10p**
14pin **12p**
16pin **13p**
24pin **30p**
28pin **42p**
40pin **58p**

Terminals*
Screw type Red, Black, Yellow **21p**

BATTERY CLIPS*
Polorised
PP3 **6p**
PP9 **10p**

SOLDERCON PINS*
100 **50p**; — 1000 **350p**

TRANSFORMERS* (Mains Prim. 220-240V)

6-0-6V 100mA	90p	
9-0-9V 75mA	95p	
12-0-12V 100mA	98p	
15-0-15V 100mA	185p	
0-12 0-12V 150mA	140p	
0-6 0-6V 280mA	150p	
12-0-12V 0·5A	240p+	
0-12 0-12 0·5A	240p+	
15-0-15V 0·5A	220p+	
20-0-20V 6VA	220p+	
24-0-24V 0·5A	260p+	
9-0-9V 1A	245p+	
0-12 0-12V 1A	245p+	
30-24-20-15-12-0 1A	240p	
Multi tappings	360p+	
30-24-20-15-12-0 2A multi tap	445p+	
15-0-15V 1A	245p+	
18-0-18V 1A	275p+	
30-0-30V 1A	295p+	
20-0-20 2A	320p+	
6-0-6V 1·5A	345p+	
0-18 0-18V 1·5A	379p+	
9-0-9V 2A	270p+	
12-0-12V 2A	320p+	
30-25-20-0-20-25-30 2A	497p+	
LT44	54p	
0-6 0-6V 6VA	240p	
0-12 0-12A 6VA	240p	
0-15 0-15V 6VA	240p	
0-20 0-20V 6VA	240p	
LT700 Min. O/P Pri. 1·2K, Sec. 3·2Ω	54p	
MOT Min. O/P Pri. 1·2K, Sec. 8Ω	42p	

(Please add 48p p&p charge to all prices marked +, above our normal postal charge.)

PW PROJECTS
Easibuild Organ. General Coverage Receiver. **RHYTHM GENERATOR.** Chromachase, Smoke Sensor Alarm, Reverb Amp, Metal Detector, 24 hrs. Digital Clock, Radio 2 Tuner, TV Games and Kit for Rifle attachment. 'JUBILEE' Electronic Organ, GP SW Receiver. Solo Supermind, Sine/Square Wave Generator, Wide Range Voltmeter RF Resonance Indicator.
Send SAE plus 5p per list.

PANEL METERS* FSD
60 x 46 x 35mm
0–50µA, 0–100µA, 0–500µA, 0–1mA, 0–5mA, 0–10mA, 0–50mA, 0–100mA, 0–500mA, 0–1 Amp, 0–50V DC, 0–300V DC, "S", "VU"
Price **£3·85** each
50µA–0–50µA
100µA–0–100µA
500µA–0–500µA
£4·25 each
108 x 82 x 38mm
0–50µA
0–100µA
0–500µA
£5·75 each
Illumination Kit for the above Meters **79p**
DUAL "VU" METER 100µA **£5·75**

RF CHOKES PC mounting
1µH, 4·7, 10, 22, 33µH 47 100 220 470µH 750 1mH 1·5mH 2·5 5 & 10
35p each
43mH 100mH
90p each

COIL FORMERS
4mm, 6mm, 10mm **20p each**

FUSES*
20mm Quick Blow **4p**
1·25" **5p**
20mm Anti-Surge **8p**
Holders Enclosed **22p**
PC Mount **6p**

SOLDERING IRONS* Aintex
CX 17W **340p**
CCN 15W **365p**
X25 25W **340p**
Iron Stand **140p**
Cordless Iron **1400p**
Add 40p postage on any of the above.

TRANSISTORS

	p		p		p		p		p		p
AC117	35	BC170	15	BF179*	33	MPSU56	82	TIS46	40	2N1613*	20
AC125*	22	BC171	11	BF180*	33	MPU131*	39	TIS47	50	2N1670*	150
AC126*	18	BC172	10	BF181*	33	OC23*	65	TIS48	50	2N1671B*	195
AC127*	18	BC177*	18	BF182*	33	OC25*	65	TIS49	50	2N2160*	80
AC128*	18	BC178*	16	BF183*	33	OC26*	95	TIS50	47	2N2217*	40
AC141*	24	BC179*	18	BF184*	28	OC28*	70	TIS74	47	2N2218A*	25
AC141K*	38	BC182	10	BF195*	30	OC29*	70	TIS90	24	2N2219A*	24
AC142*	24	BC183	11	BF194	10	OC35*	70	TIS91	24	2N2220A*	26
AC142K*	38	BC184	12	BF195	10	OC36*	70	ZTX107	12	2N2221A	21
AC176*	18	BC182L	13	BF196	14	OC41*	17	ZTX108	10	2N2222A*	22
AC187*	18	BC183L	12	BF197	15	OC42*	17	ZTX109	15	2N2303*	250
AC188*	18	BC184L	14	BF198	15	OC43*	25	ZTX212	18	2N2368	25
ACY17	35	BC186	24	BF199	18	OC44*	25	ZTX300	14	2N2369A*	15
ACY18	35	BC187*	28	BF200	37	OC45*	35	ZTX301	14	2N2483*	30
ACY19	35	BC212	16	BF224A	15	OC70*	25	ZTX302	19	2N2484*	30
ACY20	35	BC212L	13	BF244B	34	OC71*	23	ZTX303	22	2N2614	54
ACY21	35	BC213	11	BF256*	34	OC72*	27	ZTX304	24	2N2646*	52
ACY22	35	BC213L	14	BF257*	34	OC74*	45	ZTX311	15	2N2904*	24
ACY28	35	BC214	15	BF258*	38	OC75*	45	ZTX314	24	2N2905A*	20
ACY39	76	BC214L	16	BF259*	38	OC76*	45	ZTX320	26	2N2906*	18
ACY40	45	BC307B	20	BF594	30	OC77*	56	ZTX326	26	2N2907*	20
ACY41	39	BC308	20	BF595	28	OC79*	58	ZTX341	20	2N2907A*	22
ACY44	39	BC328	20	BFR39	25	OC81D*	28	ZTX500	17	2N2926G	10
AD149*	60	BC338	20	BFR40	25	OC82D*	35	ZTX501	15	2N3011*	30
AD161*	40	BC441*	40	BFR79	25	OC83*	28	ZTX502	19	2N3053*	17
AD162*	40	BC461*	40	BFR80	25	OC84*	44	ZTX503	19	2N3054*	49
AF114*	20	BC462*	40	BFX29*	28	OC122*	99	ZTX504	51	2N3055*	54
AF115*	20	BC547	24	BFX81*	141	OC123*	115	ZTX531	28	2N3441	140
AF116*	20	BC548	24	BFX84*	24	OC139*	140	ZTX550	18	2N3442	142
AF117*	22	BC549C	24	BFX85*	28	OC140*	125	40250	85	2N3563	32
AF118*	55	BC557	30	BFX86*	28	OC141*	157	40251	97	2N3614*	169
AF121*	48	BC559	32	BFX87*	28	OC170*	40	40311*	42	2N3615*	135
AF124*	35	BCY30*	57	BFX88*	26	OC171*	42	40313*	114	2N3663	32
AF125*	35	BCY34*	80	BFY18*	50	OC200*	125	40315	55	2N3702	11
AF127*	35	BCY39*	80	BFY50*	17	OC201*	125	40316*	69	2N3703	12
AF139*	40	BCY40*	90	BFY51*	17	OC203*	150	40317*	42	2N3704	11
AF178*	70	BCY42	85	BFY52*	17	OCP204*	40	40319	85	2N3705	12
AF180*	70	BCY43	85	BFY53*	28	SJE5039*	95	40320	85	2N3706	10
AF186*	50	BCY58	90	BFY55*	45	TIC44*	25	40323	85	2N3707	11
AF239*	39	BCY59*	19	BFY64*	45	TIC45*	45	40324	85	2N3708	12
ASY26*	45	BCY70*	17	BFY65*	25	TIP29	43	40326*	42	2N3709	12
ASY27*	45	BCY71*	20	BFY71*	20	TIP29A	44	40327*	48	2N3710	12
ASY50	95	BCY72	17	BSX20*	20	TIP29B	56	40347*	65	2N3711	12
ASY76	95	BCY78	28	BSX26*	75	TIP29C	68	40348*	83	2N3771*	164
ASZ21	60	BCZ10	145	BSX29*	45	TIP30	52	40360*	36	2N3772*	175
BC107*	9	BCZ11	145	BSX78*	55	TIP30A	56	40361*	36	2N3773*	275
BC107B*	10	BCZ106A	245	BSY78*	25	TIP30B	64	40362*	43	2N3819	22
BC108*	9	BD112	95	BSY95A	18	TIP30C	74	40377	140	2N3820	44
BC108B*	12	BD115*	62	BU105*	168	TIP31*	52	40406	65	2N3823*	49
BC108C*	12	BD124*	110	BU205	220	TIP31A*	54	40407	50	2N3824*	89
BC109	9	BD131*	38	BU208	250	TIP31B*	58	40408	75	2N3866	90
BC109B*	12	BD132*	40	MD8001	158	TIP31C*	68	40411*	295	2N3903	15
BC109C*	12	BD133*	60	ME1120	25	TIP32*	60	40412*	42	2N3904	18
BC113	17	BD135	45	ME4102	15	TIP32A*	63	40430*	99	2N3905	18
BC114	20	BD136	44	MJ400*	90	TIP32B*	80	40476	170	2N3906	18
BC115	20	BD137	42	MJ491*	160	TIP32C*	83	40594*	90	2N4037*	39
BC116	20	BD138	50	MJ2955*	120	TIP33*	95	40495*	98	2N4058	15
BC117	20	BD139	52	MJE340*	45	TIP33A*	95	40603*	62	2N4061	15
BC118	16	BD140	57	MJE370*	68	TIP33B*	112	40636*	110	2N4062	15
BC119*	28	BD142	59	MJE371*	80	TIP33C*	120	40673*	74	2N4286	20
BC134	20	BD144*	160	MJE520*	85	TIP34*	110	2N697*	21	2N4859	35
BC135	14	BD145*	55	MJE521*	74	TIP34A*	115	2N698*	39	2N5102	34
BC136	18	BD181	130	MJE2955*	98	TIP34B*	140	2N699*	45	2N5135	12
BC137	15	BD205	110	MJE3055*	62	TIP34C*	180	2N706A*	19	2N5136	12
BC140*	38	BD434	42	MPF102	36	TIP35*	219	2N707*	50	2N5138	12
BC142*	28	BD378*	65	MPF103	36	TIP35A*	219	2N708*	19	2N5179	60
BC143*	28	BD517*	65	MPF104	36	TIP35B*	240	2N914*	18	2N5180	60
BC147	7	BDY11	250	MPF105	36	TIP35C*	270	2N916*	27	2N5191	65
BC148	7	BDY17*	195	MPF106	50	TIP36*	320	2N918*	34	2N5305	40
BC149	8	BDY60*	128	MPF107	50	TIP36A*	346	2N920*	51	2N5357	35
BC153	27	BDY61*	147	MPS3904	20	TIP36B*	352	2N930*	18	2N5458	36
BC154	27	BF115*	22	MPSA05	32	TIP36C*	360	2N961*	61	2N5459	36
BC157	11	BF154*	22	MPSA06	32	TIP41A*	66	2N1131*	19	2N5485	42
BC158	11	BF156*	29	MPSA55	30	TIP41B*	73	2N1132*	25	2N5777	56
BC159	11	BF160	27	MPSA56	30	TIP42A*	78	2N1303*	27	2N6027	35
BC160*	42	BF161	60	MPSA70	34	TIP42B*	82	2N1304*	45	2N6109	45
BC167A	12	BF167	60	MPSU02	5P	TIP2955*	69	2N1305*	32	3N128	88
BC168C	12	BF173*	25	MPSU05	64	TIP3055*	56	2N1306*	37	3N140	88
BC169C	14	BF177*	26	MPSU06	64	TIS43	27	2N1307*	37	Matched Pair	
		BF178*	28	MPSU52	65	TIS44	27	2N1308*	48	10p extra	
				MPSU55	82	TIS45	37				

TTL 74*

7400	14	7476	36	74161	116	4024	85
7401	14	7480	50	74162	116	4025	19
7402	16	7481	114	74163	116	4026	185
7403	16	7482	82	74164	121	4027	60
7404	20	7483	95	74165	120	4028	95
7405	22	7484	95	74166	161	4029	109
7406	44	7485	125	74167	362	4030	58
7407	44	7486	38	74172	590	4031	230
7408	22	7489	390	74173	175	4032	100
7409	22	7490	43	74174	173	4033	145
7410	15	7491	80	74175	90	4034	196
7411	25	7492	53	74176	120	4035	120
7412	25	7493	40	74177	116	4036	325
7413	40	7494	85	74180	108	4037	100
7414	74	7495	73	74181	299	4038	110
7416	35	7496	82	74182	85	4039	320
7417	39	7497	262	74184	184	4040	110
7420	16	74100	135	74185	146	4041	85
7421	29	74104	48	74188	650	4042	85
7422	24	74105	48	74190	184	4043	100
7423	30	74107	33	74191	165	4044	95
7425	30	74109	64	74192	120	4045	145
7426	36	74110	54	74193	120	4046	135
7427	36	74111	78	74194	120	4047	99
7428	48	74116	198	74195	95	4048	58
7430	18	74118	116	74196	118	4049	60
7432	28	74120	105	74197	118	4050	55
7433	48	74121	34	74198	248	4051	95
7437	30	74122	50	**CMOS* (RCA)**		4052	95
7438	33	74123	73	4000	15	4053	95
7440	17	74125	69	4001	17	4054	120
7441	74	74126	65	4002	17	4055	134
7442	74	74128	81	4006	115	4057	2570
7443	130	74132	75	4007	18	4059	480
7444	122	74141	72	4008	97	4060	115
7445	94	74142	315	4009	60	4063	110
7446	116	74143	314	4010	60	4066	65
7447	82	74144	314	4011	19	4067	380
7448	80	74145	90	4012	18	4068	22
7450	17	74147	275	4013	55	4069	22
7451	17	74148	160	4014	104	4070	60
7453	17	74150	128	4015	99	4071	23
7454	17	74151	79	4016	55	4072	23
7460	17	74153	82	4017	104	4073	23
7470	32	74154	150	4018	105	4075	24
7472	28	74155	76	4019	60	4076	155
7473	32	74156	80	4020	125	4077	60
7474	36	74157	85	4021	105	4078	22
7475	36	74159	225	4022	95	4081	22
		74160	116	4023	20	4082	23
						4085	74
						4086	73
						4089	150

4093	90	CA3018*	82	MM2112 2N	310
4094	190	CA3020	170	NE350	168
4096	105	CA3023	170	NE518A	210
4097	372	CA3028*	102	NE555*	36
4098	110	CA3028A*	102	NE556DB*	88
4099	190	CA3035	140	NE560*	325
4502	120	CA3036	180	NE561*	410
4507	55	CA3043	190	NE562B*	410
4510	135	CA3045	140	NE565A*	185
4511	175	CA3046	80	NE566*	180
4512	98	CA3048	220	NE567V*	187
4516	140	CA3075	175	RAM2102-2*	210
4518	130	CA3080E*	80	ROM2513*	700
4519	55	CA3081	190	SAS560	210
4520	130	CA3089E	210	SAS570	210
4528	140	CA3090AQ	390	SG3402*	255
4532	135	CA3123	200	SL403D	250
4534	788	CA3130*	94	SL437A	
4539	110	CA3140	95	SN72733	125
4553	449	ICL8038CC*	345	SN76003N	240
4585	106	ICM7205*	1150	SN76013N	150
LINEAR IC'S		LM300H	170	SN76023N	150
702	75	LM301AT	39	SN76033N	230
709C 8 pin	35	LM304	240	SN76115N	215
709C 14 pin	30	LM305H		SN76227N	175
709C TO5	35	LM308T	140	TAA550	50
710*	46	LM309H	140	TAA621AX1	228
723* 14 pin	45	LM318H	205	TAA661A	155
723* TO5	53	LM318S	175	TAA700	353
741 8 pin	22	LM320-12*	150	TAA960	300
741 14 pin	32	LM379	398	TAD100	150
741 TO5	32	LM380	98	TAD110	170
747C 14 pin	70	LM381	170	TBA120S	90
748C 8 pin	36	LM382	125	TBA540	215
753 8 pin	150	LM3900	65	TBA540Q	220
78L82AWC*	51	LM3909N	70	TBA550Q	355
AY-1-0212	580	M252AA*	830	TBA641-A12	250
AY-1-5050	141	M253*	950	TBA641 BX1	250
AY-1-5051	125	MC724*	175	TBA641 B11	250
AY-1-1313A	660	MC663		TBA651	180
AY-1-6721/6	195	MC845		TBA800	90
AY-3-8500*	510	MC1303	145	TBA810S	110
AY-5-8550*	900	MC1304P	260	TBA820	80
AY-5-1224A*	349	MC1310P	185	TBA920Q	350
AY-5-1230*	490	MC1312PQ	195	TCA270Q	220
AY-5-1315	560	MC1458P*	90	TCA270SQ	220
AY-5-1317A	630	MC1496L	101	TDA2020	320
AY-5-3500*	810	MC1710CG	79	ZN414	110
AY-5-3507*	610	MEM780		ZN424E	130
AY-5-4007	650	MFC6000	95		
CA3011*	82	MFC6040*	97		
CA3014*	137	MK50253*	550		
		MK50326*	550		

INDEX TO ADVERTISERS

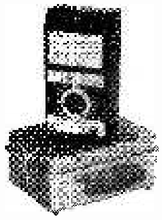
Head Office and Warehouse
44A WESTBOURNE GROVE
LONDON W2 5SF
Tel: 727 5641/2/3

Z & I AERO SERVICES LTD.

Please send all correspondence and Mail-Orders to Head Office

Retail Shop
85 TOTTENHAM COURT ROAD
LONDON W1
Tel: 580 8403
Open all day Saturday

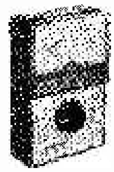
AC/DC TAUT SUSPENSION MULTIMETERS (Made in USSR)



TYPE	U4312	U4313	U4315
Sensitivity D.C.	667 o.p.v.	20,000 o.p.v.	20,000 o.p.v.
Sensitivity A.C.	667 o.p.v.	2,000 o.p.v.	2,000 o.p.v.
D.C. Current	300 μA-6A	60μA-1·5A	50μA-2·5A
A.C. Current	1·5mA-6A	0·6mA-1·5A	0·5mA-2·5A
D.C. Volts	75mV-900V	75mV-600V	75mV-1000V
A.C. Volts	300mV-900V	15V-600V	1V-1000V
Resistance	0·02-3kΩ	1K-1M	300Ω-500kΩ
Capacity	—	0·5μF	0·5μF
Accuracy	1% D.C., 1·5% A.C.	1·5% D.C., 2·5% A.C.	2·5% D.C., 4% A.C.
Price complete with pressed steel carrying case and test leads.	**£14·50**	**£17·50**	**£14·95**

TYPES U4313 & U4313 PROVIDED WITH ANTI-PARALLAX MIRROR SCALES

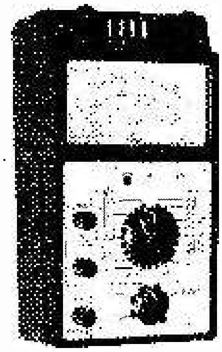
TYPE U4324



Sensitivity:	20,000Ω/V D.C. 4,000Ω/V A.C.
D.C. Current:	0·06-0·6-60-600mA-3A
A.C. Current:	0·3-3-30-300mA-3A
D.C. Voltage:	0·6-1·2-3-12-30-60-120-600-1200V
A.C. Voltage:	3-6-15-60-150-300-600-900V
Resistance:	500Ω-5-50-500kΩ
Accuracy:	D.C. 2·5%; A.C. 4% (of F.S.D.)

PRICE complete with test leads and fibreboard storage case **£14·50**

TYPE U4341



Sensitivity: 16700Ω/V D.C., 3300/V A.C.
Ranges:
D.C. current: 0·06–0·6–6–60–600mA
A.C. current 0·3–3–30–300mA
D.C. Voltage: 0·3–1·5–6–30–60–150–300–900V
A.C. Voltage: 1·5–7·5–30–150–300–750V
Resistance: 2-20–200kΩ-2MΩ
Transistor collector cut-off current 60μA
Transistor D.C. current gain in two ranges 10–350
Accuracy: 2·5% D.C. 4·0% A.C. 5% D.C. current gain
Power supplies: 4·5V battery (Eveready 1289)

Complete with steel carrying case, test lead, battery and instruction manual **£14·50**

NO OVERLOAD PROTECTION IS INCORPORATED IN THESE INSTRUMENTS

THE ABOVE PRICES ARE EXCLUSIVE OF VAT (at present 8%) HANDLING AND POSTAGE CHARGES £1·25 PER INSTRUMENT

OUR NEW 1976/1977 **CATALOGUE** IS NOW READY AND WILL BE SENT ON RECEIPT OF REMITTANCE FOR £0·30

SOUTHERN VALVE COMPANY

Upper Floor, 8 Potters Road, Barnet, Herts

Telephone: 01-440/8641 **MAIL ORDER ONLY**

ALL NEW & BOXED **"QUALITY" BRANDED** VALVES GUARANTEED 3 MONTHS.
BVA ETC. (TUNGSRAM ETC.).
6% ALLOWED IN LIEU OF GUARANTEE.
ALREADY DEDUCTED FROM OUR PRICES.
Note: Prices are correct only at time of going to press.
PLEASE VERIFY CURRENT PRICES.
Some leading makes available. TOP QUALITY
MINIMUM ORDER 75p. OUR EVERY AIM!
VAT Invoices issued on request.

AZ31 80p
DY86/7 49p
DY802 50p
EB91 19p
ECC81 36p
ECC82 36p
ECC83 36p
ECC85 40p
ECC88 50p
ECH42 80p
ECH81 44p
ECH83 82p
ECH84 58p
ECL80 52p
ECL82 50p
ECL86 60p
EF80 33p
EF85 38p
EF86 52p
EF89 42p
EF183 42p
EF184 42p
EH90 56p
EL34 £1.10
EL41 70p
EL84 40p
EL90/1 47p
EL509 £2.65
EM84 50p
EY51 50p
EY86/7 38p
EY500A £1.50
EZ80 40p

EZ81 40p
GY501 £1.10
GZ30 75p
PC86 63p
PC88 63p
PC97 72p
PC900 49p
PCC84 35p
PCC85 44p
PCC88 62p
PCC89 50p
PCC189 53p
PCF80 50p
PCF82 45p
PCF86 58p
PCF200 £1.20
PCF801 50p
PCF802 57p
PCF805 £1.45
PCF806 75p
PCF808 £1.45
PCH200 95p
PCL82 45p
PCL83 70p
PCL84 48p
PCL85 }
PCL 805 } 62p
PCL86 65p

PCL200 £1.40
PD500 £3.25
PFL200 73p
PL36 70p
PL81 50p
PL81A 55p
PL82 35p
PL83 50p
PL84 48p
PL500 }
PL504 } 90p
PL508 £1.30
PL509 £2.20
PL519 £2.80
PL802 £2 45
PY33 50p
PY81/3 40p
PY88 55p
PY800 50p
PY801 50p
PY500 £1.33
PY500A £1.33
UBF89 40p
UCC85 46p
UCH42 72p
UCH81 50p
UCL82 55p
UCL83 58p
UF41 70p
UF89 45p
UL41 75p
UL84 52p

UY85 40p
U25 60p
U26 60p
U191 50p
6/30L2 75p
6BW7 68p
6F23 60p
6F28 70p
6V6 & 6L6 99p
10F1 68p
20L1 70p
20P4 70p
30C1 50p
30C15 78p
30C17 78p
30C18 £1.45
30F5 50p
30FL1 £1.00
30FL2 £1.00
30L1 35p
30L15 50p
30L17 72p
30P12 50p
30P19 75p
30PL1 £1.40
30PL13 £1.00
30PL14 £1.10
30PL15 85p
30P4MR 90p

One valve post 12p, each extra valve 6p. MAX 75p.
LISTS & ENQUIRIES, SAE PLEASE!
Large valves 14p each.
ALL PRICES INCLUDE VAT @ 12½%.

We offer return of post service.
CWO ONLY, No C.O.D.
Post free over £15. £6 to £15—75p (max.).
Items in stock at time of going to press *but subject to possible market fluctuations if unavoidable.*
ENQUIRIES WELCOMED FROM TRADE & RETAIL (same prices).

CHROMASONIC electronics

56 FORTIS GREEN ROAD MUSWELL HILL, LONDON N10 3HN

TELEPHONE 01-883 3705

ANNOUNCING OUR LATEST SHORT FORM CATALOGUE JUST A SAMPLE OF SOME OF OUR "BEAT INFLATION SPECIALS"

	£		£		£
555	0·40*	MC1310	1·46	TBA810AS	1·24
741 (8 pin)	0·21	SL414A	2·29	TDA2020	3·29
CA3130	0·86	SL415A	2·11	ZN414	1·08
LM380	0·89	SN76003	2·50	ZN423	0·96*
LM3900	0·52	SN76013	1·66	ZN424	0·89*
LM3909	0·65*	SN76023	1·66	ZNA116E	5·40*

74TTL SERIES AND C.MOS AT NEW LOW PRICES

I.C. SOCKETS (D.I.L.)
8 pin **11p*** 14 pin **12p*** 16 pin **14p***

I.C. PINS
100 pins **54p*** 1000 pins **£3 78***

Unique Vehicle Alarm/Immobiliser Module Ready to fit complete with instructions Detail upon request. £17·27 inc. 8% V.A.T.
Memories and Microprocessors Available. Many Transisters, Opto Devices and Passives, etc., etc.

TRADE AND EXPORT CUSTOMERS VERY WELCOME

Just write, phone or call in for your copy of our Catalogue

SEE NEXT MONTH'S ADVERT for DETAILS of "A FREE £1's WORTH OF COMPONENTS" WITH EVERY ORDER OVER £4 00

All Prices are inclusive of V.A.T. Items marked * 8% others 12·5%. Postage and Packing 25p.

VALVE BARGAINS

Any 5-64p, 10-£1·20, 50-£5·00. Your choice from the list below.

ECC82, EF80, EF183, EF184, EH90, PCF80, PCF802, PCL82, PCL84, PCL85, PCL86, PCL805, PL504, PY81/800, PY88, 30PL14, 6F28, PFL200.

Colour Valves—PL508, PL509, PL519, PY500/A. All tested. **35p each.**

Aerial Splitters—2 way, 75 OHMS, Inside Type, **£1·50.**

AERIAL BOOSTERS

Aerial boosters can produce remarkable improvements on the picture and sound, in fringe or difficult areas.

B11—For TH stereo and standard VHF/FM radio.
B12—For the older VHF television—Please state channel numbers.
B45—For Mono or colour this covers the complete UHF Television band.
All boosters are complete with battery with Co-ax plugs and sockets. Next to the set fitting. **£4·20**

100—C280/1 CAPACITORS
Values from ·01uF to 1·5uF, 250v/w. Price **£1·50** (mixed packs).

100—ELECTROLYTICS
From 1uF to above 500uF. Mixed voltages. Price **£2·00** (mixed packs).

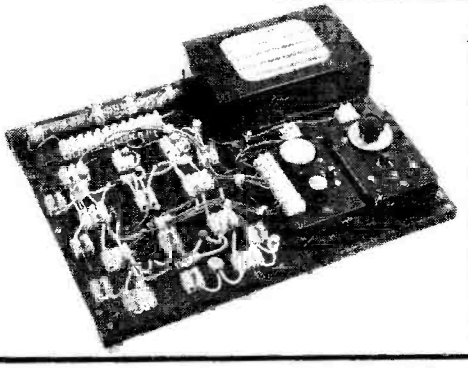
All prices include VAT. P&P 30p per order. Please send uncrossed P.O. or cheques for returning if we are out of stock of capacitor bargain packs. Exports welcome at cost.

ELECTRONIC MAILORDER LTD.

62 BRIDGE STREET, RAMSBOTTOM, BURY, LANCS.
TEL: RAMS (070 682) 3036

Published on approximately the 7th of each month by IPC Magazines Limited. Fleetway House, Farringdon Street, London EC4A 4AD. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon and Gotch (Asia) Ltd.; South Africa—Central News Agency Ltd. PRACTICAL WIRELESS is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to V.A.T. and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

RADIO EXCHANGE LTD.



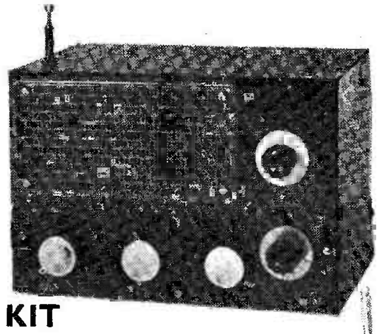
NEW ELECTRONIC MASTER KIT

WITH SPECIAL MULTI-BAND V.H.F. TUNER MODULE TO CONSTRUCT. A completely Solderless Electronic Construction Kit, with ready drilled Bakelite Panels, Nuts, Bolts, Wood Screws etc. Also in the kit: Transistors, Capacitors, Resistors, Pots, Switches, Wire, Sleeving, Knobs, Dials, 5" × 3" Loudspeaker and Speaker Case, Crystal Earpiece, etc. Also ready wound Coils and Ferrite Rod Aerial. These are the Projects you can build with the components supplied with the kit, together with comprehensive Instruction Manual Pictorial and Circuit Diagram.s

PROJECTS: V.H.F. Tuner Module ★ A.M. Tuner Module ★ M.W. L.W. Diode Radio ★ Six Transistor MultiBand V.H.F. Earpiece Radio ★ One Transistor M.W. L.W. Radio ★ Two Transistor Metronome with variable beat control ★ Three Transistor and Diode Radio M.W. L.W. ★ Four Transistor Push Pull Amplifier ★ Eight Transistor MultiBand V.H.F. Loudspeaker Receiver ★ Variable A.F. Oscillator ★ Jiffy MultiTester ★ Four Transistor and Diode M.W. L.W. Radio. ★ A.F. R.F. Signal Injector ★ Five Transistor Push Pull Amplifier ★ Sensitive Hearing Aid Amplifier ★ Three Transistor and Diode Short Wave Radio ★ Signal Tracer ★ Three Transistor Push Pull Amplifier ★ One Transistor Class A Output Stage to drive Loudspeaker ★ Sensitive Transistor Pre-Amp ★ Transistor Tester ★ Sensitive Three Transistor Regenerative Radio ★ Four Transistor M.W. L.W. and Diode Tuner ★ Five Transistor M.W. L.W. Trawler Band Regenerative Radio ★ Five Transistor V.H.F. MultiBand Tuner ★ Three Transistor Code Practice Oscillator ★ Five Transistor Regenerative Short Wave Radio ★ Four Transistor and two Diodes M.W. L.W. Loudspeaker Radio ★ Seven Transistor M.W. L.W.Radio with Loudspeaker Push Pull output ★ One Transistor Home Broadcaster.

£14·99 + P & P £1·10

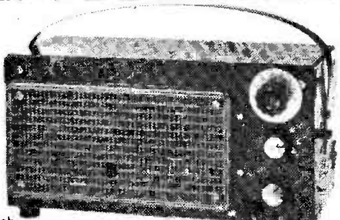
NEW ROAMER TEN MODEL R.K. 3



MULTIBAND V.H.F. AND A.M. RECEIVER.
13 TRANSISTORS AND FIVE DIODES. QUALITY 5" × 3" LOUDSPEAKER.
WITH Multiband V.H.F. section covering Mobiles, Aircraft, T.V. Sound, Public Service Band, Local V.H.F. Stations, etc. and Multiband A.M. section with Airspaced Slow Motion Drive Tuning Capacitor for easier and accurate tuning, covering M.W.1, M.W.2, L.W. Three Short Wave Bands S.W.1, S.W.2, S.W.3 and Trawler Band. Built-in Ferrite Rod Aerial for Medium Wave, Long Wave and Trawler Band, etc., Chrome Plated 7 section Telescopic Aerial, angled and rotatable for peak Short Wave and V.H.F. reception. Push-Pull output using 600mW Transistors. Gain, Wave-Change and Tone Controls. Plus two Slider Switches. Negative Feedback circuit and SPECIAL POWER BOOSTER SOCKET AND RESISTOR, to virtually double gain if required. Powered by P.P.9—9 volt Battery.

Complete kit of parts including carrying strap. Building Instructions and operating Manuals. **£14·79** + P & P £1·10

NEW MODEL R.K.1

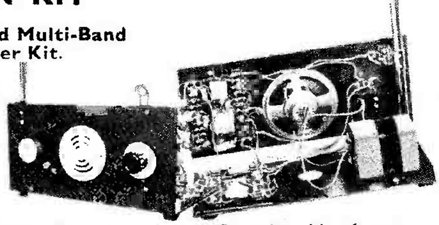


MultiBand A.M. Receiver. M. W. L. W. Trawler Band and Three Short Wave Bands. Seven Transistors and Four Diodes. Push Pull Output stage. 5" × 3" Loudspeaker. Internal Ferrite Rod Aerial. Kit includes all parts to build it up including Carrying Strap, Rubber Feet and ready-drilled Panels. Comprehensive Instruction Manual for stage by stage construction. Uses P.P.9 Nine Volt Battery.

£8·99 + P & P 90p

ELECTRONIC CONSTRUCTION KIT

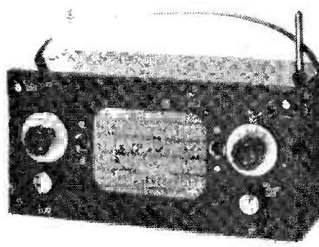
E.C.K. 2 Self Contained Multi-Band V.H.F. Receiver Kit.



8 transistors and 3 diodes. Push pull output. 3in. 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 P.P. 7 battery (not supplied with kit)

Complete kit of parts **£7·95** + P & P and Ins. 90p

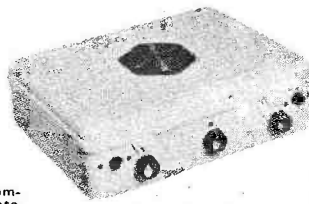
NEW MODEL R.K.2



MW, LW and Air Band Receiver. Eight Transistors and Four Diodes. 3" Loudspeaker, Telescopic Aerial, Internal Ferrite Rod Aerial. Complete with Carrying Strap. and ready-drilled Panels and all components necessary for construction. A sensitive Receiver with the additional luxury of an Air Band section to pick up Aircraft from many miles away. Full Instruction Manual enables stage by stage construction. Uses P.P.9 Nine Volt Battery.

£9·99 + P & P £1·10

EDU-KIT MAJOR



COMPLETELY SOLDERLESS ELECTRONIC CONSTRUCTION KIT
BUILD THESE PROJECTS WITHOUT SOLDERING IRON OR SOLDER

Complete kit of parts including construction plans

Total building costs **£9·99** + P & P and Ins. £1·10

- 4 Transistor Earpiece Radio
- Signal Tracer
- Signal Injector
- Transistor Tester NPN—PNP
- 4 Transistor Push Pull Amplifier
- 5 Transistor Push Pull Amplifier
- 7 Transistor Loudspeaker. 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
- Audible Continuity Tester
- Sensitive Pre-Amplifier

● 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.

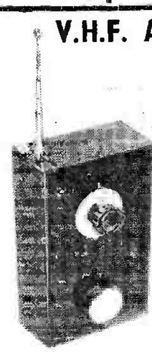
E.V.6.

Build this exciting new design. E.V.6. 6 Transistors and 2 diodes. MW/LW. Powered by 9V battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3in. loudspeaker. Attractive case with red speaker grille. Size 9in. × 5¼in. × 2¾in. approx. All parts including Case and Plans.

Total Building Costs **£5·95** + P & P and ins. 90p

ALL PRICES INCLUDE VAT

V.H.F. AIR CONVERTER KIT



Build this converter kit and receive the aircraft band by placing it by the side of a radio tuned to medium wave or the VHF 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. All parts including case and plans

£4·95 + P & P and Ins. 60p

To: RADIO EXCHANGE LTD
61A High Street, Bedford MK40 ISA
Tel.: 0234 52367 **REG NO. 788372**

- Callers side entrance "Lavells" Shop.
- Open 10-1, 2.30-4.30 Mon.-Fri. 9-12 Sat.

I enclose £ .... for ....

Name ....

Address ....

....

.... PW/1177