PRACTICAL WIRELESS

APRIL 1976

35p

extra 8-PAGE SUPPLEMENT

FAULT-FINDING GUIDE

Direction Finding receiver

Also:

MODERNISING FM TUNERS

AUTOMATIC SLIDE SYNCHRONISER

ALL MAIL ORDER BY RETURN. C.O.D. SERVICE WELCOME

C. T. ELECTRONICS

Tel: 01-994 6275

All mail order and enquiries to 270 Acton Lane, Chiswick, London W4 5DG

V.A.T.
Unless otherwise stated all prices are exclusive of VAT. Please check whether the goods you are ordering are 25% or 8%. Carriage orders under £5 please add 33p. Order over £10 post free in U.K. only. This to be at our discretion.

SEMICONDUCTORS

AAZ12	25p	BC214	14p	IS100	15p
AC107	35p	BC214L	15p	IS103	15p
AC125	25p	BC238	15p	MJ340	50p
AC126	25p	BC239	15p	MJ481	95p
AC127	25p	BC300	30p	MJ2801	£1·25
AC128	25p	BC301	30p	MJ2901	£1·95
AC176	25p	BC302	30p	MJE340	50p
AC187	27p	BC303	35p	MJE370	75p
AC188	27p	BCY31	35p	MJE371	90p
ACY17	25p	BCY32	95p	MJE520	65p
ACY18	25p	BCY33	60p	MJ2955	£1·20
ACY19	25p	BCY34	65p	MJE3055	75p
ACY20	25p	BCY38	65p	MM1613	45p
ACY21	25p	BCY39	95p	MM1712	60p
AD140	60p	BCY55	£1·50	MPF102	45p
AD142	60p	BCY70	20p	MPF103	
AD161	45p	BCY71	20p	(2N5457)	35p
AD162	45p	BCY72	20p	MPF104	
AF114	25p	BD121	75p	(2N5458)	35p
AF115	25p	BD123	85p	MPF105	
AF116	25p	BD124	70p	(2N5459)	40p
AF117	25p	BD131	40p	OA47	10p
AF118	50p	BD132	50p	OA70	10p
AF124	30p	BD135	50p	OA79	10p
AF239	60p	BD136	50p	OA81	10p
BA102	30p	BD139	75p	OA90	10p
BA112	50p	BD140	87p	OA91	10p
BA114	16p	BD153	80p	OA200	10p
BA155	16p	BD156	80p	OA202	10p
BA156	15p	BDY17	£1·50	OA210	35p
BC107	13p	BDY18	£1·75	OA211	35p
BC108	12p	BDY19	£1·90	OC16	90p
BC109	14p	BDY20	£1·20	OC19	85p
BC109c	16p	BF152	20p	OC22	55p
BC113	13p	BF166	30p	OC26	65p
BC114	13p	BF178	35p	OC28	60p
BC115	15p	BF180	35p	OC35	60p
BC116	15p	BF194	16p	OC36	65p
BC117	20p	BF195	16p	OC42	40p
BC118	15p	BF196	16p	OC44	20p
BC119	30p	BF197	16p	OC45	25p
BC143	25p	BF200	35p	OC70	15p
BC147	12p	BF224	18p	OC71	12p
BC148	12p	BF244J	18p	OC72	20p
BC149	12p	BF245	45p	OC75	25p
BC149c	14p	BF259	55p	OC76	25p
BC157	14p	BFX29	30p	OC77	40p
BC158	14p	BFX34	30p	OC81	25p
BC159	15p	BFX85	30p	OC83	25p
BC167	14p	BFX86	30p	OC84	25p
BC168	14p	BFX88	30p	OC139	30p
BC169	14p	BFY10	35p	OC170	25p
BC169c	15p	BFY44	50p	OC171	30p
BC172	13p	BFY50	25p	OC200	60p
BC182	12p	BFY51	25p	OC201	60p
BC182L	12p	BFY52	25p	OC202	75p
BC183	12p	BFY53	25p	TIP29A	45p
BC183L	12p	BFY90	65p	TIP30	55p
BC184	12p	BSV68	70p	TIP31A	57p
BC184L	12p	BSW63	65p	TIP32A	69p
BC185	35p	BSW68	80p	TIP33A	£1·00
BC186	27p	BSX19	15p	TIP34A	£1·40
BC212	12p	BSX20	15p	TIP35A	£3·20
BC212L	14p	BSX21	25p	TIP36A	£3·50
BC213	12p	BY127	20p	TIP41A	70p
BC213L	12p	BY164	65p	TIP42A	85p

TIP29B	54p	2N2369A	50p
TIP30B	60p	2N2477	30p
TIP31B	65p	2N2646	50p
TIP32B	77p	2N2846	£1·50
TIP33B	£1·06	2N4904	25p
TIP34B	£1·62	2N2905	30p
TIP35B	£2·71	2N2906	25p
TIP36B	£3·50	2N2907	25p
TIP41B	78p	2N2926	13p
TIP42B	95p	2N3053	25p
TIP29C	68p	2N3055	50p
TIP30C	72p	2N3232	£1·35
TIP31C	80p	2N3525	£1·10
TIP32C	£1·00	2N3553	£1·40
TIP33C	£1·20	2N3643	30p
TIP34C	£1·80	2N3702	12p
TIP35C	£3·00	2N3703	12p
TIP38C	£3·74	2N3704	12p
TIP41C	90p	2N3705	12p
TIP42C	£1·00	2N3706	12p
TIS50	40p	2N3707	12p
ZTX107	15p	2N3708	14p
ZTX300	15p	2N3709	14p
ZTX500	16p	2N3771	£1·50
ZTX501	20p	2N3772	£1·60
ZTX504	50p	2N3792	£1·80
ZTX531	30p	2N3794	30p
ZTX550	25p	2N3819	35p
IN659	8p	2N3820	55p
IN914	8p	2N3823	70p
IN916	8p	2N3866	85p
IN4001	8p	2N3904	22p
IN4002	9p	2N3905	25p
IN4003	9p	2N3906	25p
IN4004	10p	2N4014	80p
IN4005	12p	2N4036	62p
IN4006	14p	2N4037	44p
IN4007	16p	2N4058	14p
IN4148	7p	2N4059	14p
2N696	25p	2N4060	12p
2N697	25p	2N4061	12p
2N698	25p	2N4062	12p
2N706	12p	2N4126	18p
2N706A	14p	2N4286	25p
2N708	15p	2N4287	25p
2N929	22p	2N4288	27p
2N930	20p	2N4289	30p
2N1132	25p	2N4290	25p
2N1302	30p	2N4291	32p
2N1303	30p	2N4302	45p
2N1304	30p	2N4444	£1·90
2N1305	30p	2N4871	35p
2N1306	30p	2N4903	£1·30
2N1307	30p	2N4919	90p
2N1308	30p	2N5069	£1·30
2N1309	30p	2N5191	96p
2N1613	30p	2N5192	£1·20
2N1711	30p	2N5194	£1·10
2N1890	60p	2N5195	£1·40
2N2146	15p	2N5245	45p
2N2147	90p	2N5296	55p
2N2160	80p	2N5298	50p
2N2217	25p	2N5457	35p
2N2218	25p	2N5458	35p
2N2219	25p	2N5459	40p
2N2222	20p	2N5485	55p
2N2222A	25p	2N5490	55p
2N2306	70p	2N5555	65p
		2N5777	40p

QTY. DISCOUNTS: 12+ 10%; 25+ 15%; 100+20%

S.C.R.s

CRS1/05	40p
CRS1/10	56p
CRS1/20	60p
CRS1/40	65p
CRS1/60	90p
CRS3/10	62p
CRS3/20	62p
CRS3/40	90p
CRS7/400	£1·00
CRS16/100	85p
CRS16/200	90p
CRS16/600	£1·60
C106B	45p
C106D	70p
40669	90p
TIC44	35p
2N4444	£1·90
BT10/500A	90p

BRIDGE RECTIFIERS

W02 1A 200V 38p
BY164 1·4A 200V 57p
MDA952/2 6A 100V 80p

ZENER DIODES

BZY88 Series 400mW
3·3V-33V, 5% 11p
1·5W range 25p
10W range 45p

L.E.D.

TIL209 20p
HP5082 28p
MA2082R 20p

L.D.R.

ORP12 70p

NE555 Timer 75p

TRIACS

TXL228B 8A 400V 85p
SC40D £1·40
SC40E £1·65
SC45D £1·70
SC45E £2·10
SC50D £2·42
SC50E £2·70
DIAC 25p

LINEAR I.C.s

LM304 Neg Voltage Reg. £1·80
LM309K 5V. 1A. Voltage Reg. £2·10
LM723C 2·37V. 150mA Voltage Reg. 75p
MFC4000 250mW Audio 75p
TBA800 5 Watt Audio 99p
709C Op Amp D.I.L./TO99 45p
741C Op Amp 8/14 D.I.L./TO99 25p
747C Dual Op Amp £1·20
748C Op Amp D.I.L. 75p
ZN414 Radio I.C. £1·25
TAD100 Radio I.C. Inc. Filter £1·90
CA3014 £1·55
CA3018 £1·00
CA3028 £1·20
CA3036 £1·00
CA3046 95p
CA3048 £2·35
CA3075 £1·60
CA3089E £1·90
CA3090Q £4·85
MC1303L £2·20
MC1310P £2·80
SN76660 EQ TBA120 65p

TO3 VOLTAGE REGULATORS

L005 5V 650mA
L036 12V 600mA
L037 15V 450mA £1·60 ea.

VEROBOARD

	0·1	0·15
2½ x 3¾	32p	23p
2½ x 5	35p	35p
3¾ x 3¾	35p	35p
3¾ x 5	40p	41p
17 x 2½	£1·05	79p
17 x 3¾	£1·43	£1·12
17 x 5	£1·84	—
PIN INS. TOOL	72p	72p
SP.F. CUTTER	52p	52p
100 PINS SS	30p	30p
100 PINS DS	30p	30p
500 PINS SS	£1·55	£1·55
500 PINS DS	£1·55	£1·55

BNC PLUGS at 35p each
UHF (N) PLUGS at 50p each.
Industrial, R.F., Military, Multiway to numerous to list, also a large stock of Multiway Cable to suit.
All the above are new in original packets. Please add 8% VAT P & P 30p.

POTENTIOMETERS

Linear or Log	Single	Double
Rotary Pots	20p	45p
Rotary Switched	30p	—

★★SPECIAL OFFERS★★

MINIATURE MAINS TRANSFORMER. PRI 240V. SEC. 12V. 100Ma Manuf.: Hinchley Size. 36 x 45 x 40mm. F.C. 53mm. Price **1·65p. 100 60p ea. 1,000 50p ea.** 10,000 **40p ea.** 8% VAT.

MINIATURE MAINS TRANSFORMER. Primary 115/240v Sec. 18v/250 Ma at **80p ea.** + VAT & postage 33p, 8% VAT.

MULLARD POT CORE TYPE FX2241 at **60p ea.** + 33p p.p. 8% VAT.

24V D.C. SOLENOID by MAGNETIC DEVICES **60p** each. 2½ long x ⅝ x ⅝in. + 8% VAT.

240V. A.C. SOLENOID. Reversible operation; twin coil. Size approx. 2¾ x 1½ x 1¾in. **90p.**

30 unmarked OC71 transistors **75p**

A MILLION PLUS METAL OXIDES always in stock.
TR4/TR5 at **3p** each TR6 at **4p** each TR8 at **7p** each Manufacturers. Phone for quantity discounts.
Please state voltage required.

50 GE Diode OA47 equivalent. **£1·00**

8μF 600V WKG **PAPER CAPACITORS,** ideal for Strobe Constructors **£1·50** each + 8% VAT + 33p post.
Many other values of **PAPER CAPACITORS** in stock. Phone for details.

PLESSEY AIRSPACED CAPACITORS to suit ¼in. spindle:
100pF Two Gang at **55p** + 25% VAT
500pF Two Gang at **75p** + 25% VAT

MULLARD TUBULAR CERAMIC UHF TRIMMERS (PROFESSIONAL)
Type 092 0·8-2·2p
801 0·8-2·2p
991 0·5-1·3p
Price 10p ea.

QUANTITY DISCOUNTS PLEASE TELEPHONE

1000pF Feedthrough capacitor **5p ea.**
Miniature tubular P.C. trimmers
3·5-13pF
6-30pF **10p ea.**

Wire wounds from ½ watt–100 watts. Please phone for prices, etc.

Gold Flashed professional **TRANSISTOR SOCKETS.** To suit small signal TO18, etc. 30 for **£1·00** + 8% VAT.

W. WOUND POTS 1 Ω–100K Ω at **30p** each Colvern or Reliance styles + 25% VAT

VERO EDGE CONNECTOR 24 way ·1″ pitch **30p** each + 8% VAT. All the other sizes in stock.

SIEMENS VARLEY RELAY 4P C/O 700 Ω 24V **50p** each.

PLESSEY RELAY 2 P C/O 6V operation **40p** each.

MODERN DISC CERAMICS £1·00 a hundred, **£8·00** a thousand + 25% VAT. Phone or write for list.

ACCESSORIES
DIL SOCKETS, 8 pin **14p**, 14 pin **14p**, 16 pin **14p. Mica Washers + 2 Bushes** (TO3 or TO66) **4p.**

TTL (full stocks available)

Miniature Aerospace Synchros', Servo's, Stepping Motors by Muirhead, Rank, etc.
Muirhead Type D885-BC Synchronous Receiver **£10·00**
Servo Motor Type 11 M10 A6 **£10·00** (Both in sealed containers)+8% VAT
AEG Telefunken High Performance Oscilloscope Tube, Type D14/131 125mm x 107mm face + accessories **£25·00** each + 8% VAT. Data available.

PRICE + 8% VAT
Standard Choice of Colours

550–4mm Plug	10p each
551–4mm Socket	10p each
552–4mm Terminal	20p each
553–4mm Stackable Socket Plug	18p each
554–4mm In Line Socket	18p each
560–3mm Plug	10p each
561–3mm Socket	10p each
562–Spade Terminal	10p each
581–Phono Line Plug	25p each
582–Phono Line Socket	26p each

METAL BOXES

ALUMINIUM BOXES IDEAL FOR VEROBOARD WITH BASE & P.K. SCREWS

	Long	Wide	High	
AB7	2¾″	5¼″	1½″	60p
AB8	4″	4″	1½″	60p
AB9	4″	2¾″	1½″	60p
AB10	4″	5¼″	1½″	60p
AB11	4″	2½″	2″	60p
AB12	3″	2″	1″	50p
AB13	6″	4″	2″	77p
AB14	7″	5″	2½″	90p
AB15	8″	6″	3″	£1·16
AB16	10″	7″	3″	£1·32
AB17	10″	4½″	3″	£1·10
AB18	12″	5″	3″	£1·32
AB19	12″	8″	3″	£1·80

ALUMINIUM BOXES WITH SLOPING TOP PANEL—IDEAL FOR PRE-AMPS, ETC., USING SLIDER CONTROLS

AB20 8″ Long 9″ Wide 3½″ High at back 2″ High at front 6″ Slope to front With P.K. Screws **£2·20**
AB21 As above but 10″ long **£2·20**
AB22 As above but 12″ long **£2·60**

★ ★ SPECIAL OFFERS ★ ★

MULTICORE CABLE. 20 way 7/0076 + Screen at 70p per yard+postage by weight.

REXINE COVERED ALUMINIUM CASES WITH SCREWS and FEET

RB1	6″ x 4½″ x 1¾″	£1·05	RB4	11″ x 6″ x 3″	£1·85
RB2	8″ x 5″ x 2″	£1·20	RB5	11″ x 7½″ x 3½″	£2·35
RB3	9″ x 5″ x 2½″	£1·35	+ 8% VAT		

DIN CONNECTORS
Plugs: 3 pin, 4 pin, 5 pin, 180°, 5 pin 240°, 6 pin, 7 pin and speaker plugs. All at one price 18p each
Chassis Sockets: to fit above (please state which) 15p each
Free Sockets: 3 pin, 5 pin, 180° and speaker plugs + 25% VAT 18p each

10 TURN TRIMPOTS by Bourns, Mec, Painton, etc. All values in stock. **50p** each. Discount on quantity.

KOKUSAI MECHANICAL FILTER. 455 Kc/S, 6 Kc/S overall. Ideal for A.M. **£5** each INC VAT. Postage 33p each.

COLVERN LTD. Ten turn Pot Type CLR 2402/9S.
5 KΩ at **£1·50** each + 8% VAT
1·5K Ω at **£1·50** each + 8% VAT

OMRON 11 PIN RELAY 240V A.C. 3P c/o **75p** each+ 8% VAT.

SLEEVING 2000 pieces approx. size ¾″ x 2mm. Price **50p** +33p P&P+VAT 8%

We are open from 9.30 a.m.—6.00 p.m. Monday-Saturday.

We have the largest retail selection of components available. Phone or write if you are in difficulties obtaining a particular component.

C.O.D. service welcome. All mail order by return. Official orders welcome to Government establishments, Education Authorities, etc.

01-994-6275

PRACTICAL WIRELESS

VOL. 51 NO. 12
ISSUE 830
ARPIL 1976

BRITAIN'S PREMIER MAGAZINE FOR THE DO-IT-YOURSELF RADIO AND ELECTRONICS CONSTRUCTOR

EDITOR
Lionel E. Howes, G3AYA

ASSISTANT EDITOR
Eric Dowdeswell, G4AR

ART EDITOR Peter Metalli

PRODUCTION & NEWS EDITOR
Colin Riches

TECHNICAL SUB-EDITOR
Bill Tull

TECHNICAL ARTIST
Alan Martin

SECRETARIAL Karen O'Neil
Jill Austin

ADVERTS MANAGER
01-261 6275 Roy Smith

CLASSIFIED ADVERTS
01-261 5762 Colin R. Brown

Advertisement correspondence and enquiries to the Advertisement Manager, Roy Smith, Practical Wireless, Kings Reach Tower, Stamford Street, London, SE1 9LS

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

BINDERS
Binders (£1·90) and Indexes 30p (inc. VAT) can be supplied by the Binders Dept at Carlton House, 66-68 Great Queen Street, London, WC2 5DD.

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

● NEWS & COMMENT

● CONSTRUCTIONAL

● OTHER FEATURES

EXTRA WITH THIS ISSUE

8-PAGE SUPPLEMENT: FAULT-FINDING GUIDE

RSC 100 WATT DISCO SYSTEM

Units listed below
(a) DISCOMASTER TWIN TURNTABLE CONSOLE with integral 100W amplifier
(b) PAIR OF HI-FI H'PHONES
(c) MATCHING 'MIKE'
(d) PAIR 50 WATT SPEAKERS Black Rexine covered Cabinets Size approx. 18" × 18" × 8"
(a) (b) (c) & (d) Carr. £4·00 **£169·99**

DEP. £19·99 & 18 fortnightly payments of £9·75 (Total £195·49).

STEREO VERSION

of Above System Or DEPOSIT £34·95 and 18 fortnightly pymts. £11·19 (Total £236·37) **£209·95** Carr. £5·00

TDI DISCO CONSOLE

Incorporating twin BSR MP60 type turntables and Sonotone or Acos Cartridges with diamond styli. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Separate input for 'mike' with vol. control. Black Vynide covered Cabinet with lid, Or DEP. £14·95 and 18 fortnightly pymts. £5·47 (Total £113·41) Carr. £1·50 **£99·95**

TD2S STEREO VERSION OF ABOVE

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

FANE DISCO 60C SPKR UNITS

Supplied with above in lieu of L12/50 units
Fabulous specialist range Spkrs in heavy Vynide covered cabinets with protective Corner pieces. List Price £87 pr. for **£25** pr. extra

SYSTEMS UP TO 300 WATTS OUTPUT

AT UNBEATABLE PRICES — Send for Catalogue

DISCOMASTER TWIN TURNTABLE POWER CONSOLE £119·95

Twin McDonald MP60 type turntables. Sonotone or Acos cartridges with diamond styli. Facilities as TDI Console but with built-in 100 watt Power Amplifier, complete with lid. Or Dep. £18·95 and 18 fortnightly pymts £6·78 (Total £135·99) Carr. £2·50

STEREO VERSION £155 or DEPOSIT £25 and 18 fortnightly pymts £8·80 (Total £174·40). Carr. £3

R.S.C. COLUMN SPEAKERS

IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

All types 15 Ohms covered in Vynide & Vynair

TYPE C132 40-50 WATTS £27·95
Incorporating two exceptionally efficient 13" × 8" speaker units. Dep. £3·95 and 8 monthly payments £3·50 (Total £31·95) Carr. 65p

TYPE C8/70 70 WATTS. Fitted three 12" 25 watt Highly sensitive high flux speakers with high power voice coils. Size approx. 54" × 14" × 11". Dep. £5·11 & 8 mthly pymts. £5·11 (Total £45·99) Carr. 85p **£39·95**

FANE ULTRA HIGH POWER SPEAKERS & KITS

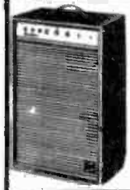
All power ratings are R.M.S. continuous. 2 YEARS' GUARANTEE High flux ceramic magnets. ALL CARRIAGE FREE. *SPECIAL PRICE

'POP' 100	'POP' 60	'POP' 50T
18" 100 Watt	15" 60 Watt	12" 50 Watt
14,000 gauss 8/15 Ω	14,000 gauss 8/15 Ω	13,000 gauss 8/15 ohm
£38·95	*£19·99	£12·95
Dep: £6·95 and 8 mthly payments £4·60 (Total £43·75)	Dep. £2·99 and 8 monthly payments £2·62 (Total £23·95)	Dual Cone. Terms for pairs Dep. £5·90 & 8 mthly pymts £3·00. Total £29·90

FOR BASS GUITAR, ELECT. ORGAN, ETC. — PAIR SUITABLE ALL PURPOSES

ALL RSC PRICES INCLUDE VAT

INTEREST REFUNDED on Credit Purchases settled in 3 months



SUPER MINSTREL 10 W GUITAR AMP.

Incorporating Tremolo and 10" Speaker. Output 10 watts R.M.S. Continuous. 3 Jack Inputs for Microphone and Instrument. Mains Neon Controls: Volume, Tone, Tremolo Speed, Tremolo Intensity.
Terms: DEPOSIT £7·78 and 8 monthly payments £3·40 (Total £34·98) Carr. free **£29·99**

FANE CRESCENDO SPEAKERS

FULL RANGE AVAILABLE AT ALL BRANCHES

'POP' 25/T 12" 25W

Dual cone. 15 ohm Imp. (Not for Bass Guitar use). Terms for Pairs: Deposit £3·98 and 8 mthly paymts of £2·75 (Total £25·98). **£10·99**

HIGH POWER TWEETER PH50

Response 3KHz-20KHz with 2 mid. Non elect. filter available 55p. Rating 50 Watt Imp 8 Ω **£6·65**

PH 50

D40 50 WATT DISCO KIT

ALL PURPOSE FULL RANGE

Consisting of 12" 13,000 Gauss Bass Unit. HPX1 Cross over and PH50. Tweeter as above. Imp 8/15 Ω (Bass Guitar requires pair in one cabinet). Terms: Dep. £3 x 8 mthly. pyts. £2·75 (Total £25) **£21·50**

HPX1 Crossover

F.A.L. MAESTRO COMBINED 30W AMP. AND 12" SPEAKER £55·95 Carr. Free

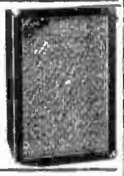
For Lead Guitar, Mic, Gram, Radio, Tape (Not for use with Bass instruments) Inc. 3 inputs and 2 vol controls plus Treble & Bass, TREMOLO with associated controls. Attractively finished in black with silver-finished fascia. Compact size Fitted carrying handle. Deposit £9·25 and 8 mthly payments £6·76 (Total £63·33)

RSC PHANTOM 50 COMBINED AMP. AND SPEAKER £59·95

Rating 50 watts. 3 inputs, 2 vol. controls. Bass, Treble, Presence Carr. £1·50 Dep. £7·95 & 8 mthly. pymts. £7·48 (Total £67·79).

HIGH QUALITY L'SPEAKER UNITS

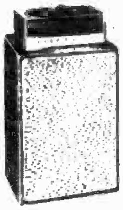
ALL 2-TONE VYNIDE & VYNAIR FINISH
L12/2 50-WATT Fitted pair of 12" 30 watt high flux speakers. Imp. 8-15 ohms. Car. £1·50. Terms: Dep. £5·11 & 8 mthly payts. of £5·11. Total £45·99. **£39·95**
L12/50 12" 50 WATT 13,000 lines 15 ohms. Terms: Dep. £4·95 and 8 mthly pymts. £3·37 (Total £31·91) Carr. 55p. **£26·95**



FAL PHASE 50-4 AMPLIFIER 50 WATT

Solid state. 4 Sep. controlled inputs Plus master vol. control. Ind. Bass and Treble Controls. Protection against serious o/p overloading. O/p for spkrs. 8 to 15 ohms. Size 17" × 7" × 7½". 200-250v. A.C. mains. O/p 50w R.M.S. Deposit £8·60 **£48·60** & 8 mthly.payments £5·75. Total £54·60 Carr. Free.

REGENT 50X 50 WATT AMP.



A powerful high quality unit for lead, rhythm guitar, vocalists, gram, radio, tape. 50w Peak O/P rating. Not for Bass Guitar.
★ Two Fane heavy duty high flux 12in. spkrs.
★ Four Jack inputs and two Volume Controls for instant use of up to four pick-ups or "mikes". Bass and Treble controls.
Send S.A.E. for leaflet. Carr. £2·50 Deposit £9·95. & 18 fortnightly payments of £4·15 (Total £84·65). **£74·95**

REGENT 50B for Bass Guitar and general purposes. Or Dep. £9·00 & 18 fortnightly payments £4·61 (Total £91·98). Carr. £2·50 **£79·95**

I.S.E. JINGLE MACHINES JINGLE 8+

Employing Standard 8 Track Cartridge Or Dep. £4·85 & 8 monthly pyts £4·85 (Total £43·65). **£37·95**

HEAVY DUTY CABINETS

Black Vynide covered. Fitted Protective Corner Pieces. Cut for various Speaker Combinations. Carr. £1 each unit. Sizes approx.:

18"	× 18"	× 9"	£10·95
24"	× 24"	× 12"	£19·95
36"	× 24"	× 12"	£26·95
36"	× 24"	× 12"	£26·95
30½"	× 28½"	× 12"	£28·95

LIQUID WHEEL PROJECTORS from £29·95

'SOUND TO LITE' SYSTEM

PULSAR special price complete kit **£106·95**
Dep. £14·95 and 18 fortnightly payts. £5·93. (Total £121·69). Super SL Unit. 1000 watt per channel. Manual override buttons, 2 spotbanks with 6 bulbs (3 sep. colours) 5 yd. and 10 yd. leads, fitted plugs. Units sold sep.
FAL SOUND-TO-LITE UNIT £21·60
,, 3-WAY SPOT BANK Excluding Bulbs Each **£16·20**
COMPLETE SYSTEM Incl. 2 Spotbanks and bulbs. Carr £1·50. **£55**

New Branches at YORK CARLISLE, DEWSBURY and PRESTON

RSC

Barclaycard and Access accepted

All items subject to availability.
Prices correct at 10.2.76 E. & O.E.

MAIL ORDERS & EXPORT ENQUIRIES TO:— AUDIO HOUSE, HENCONNER LANE, LEEDS, 13. Tel: Pudsey (09735) 77631.
MAIL ORDERS MUST NOT BE SENT TO SHOPS
TERMS C.W.O. or C.O.D. No C.O.D. under £1.
POSTAGE 40p PER ORDER OR AS QUOTED.
TRADE SUPPLIED. LARGE S.A.E. REQUIRED FOR FREE CATALOGUE.

OPEN ALL DAY SATURDAYS (5 Day Week)

BRADFORD 10 North Parade (Closed Wed.). Tel. 25349
BOLTON 23 Deansgate. (Closed Wed.). Tel. 33512
BIRMINGHAM 30/31 Great Western Arcade. Tel. 021-236 1279 (Closed Wed.).
CARLISLE 8 English Street. (Closed Thurs). Tel. 38744
COVENTRY 17 Shelton Sq., The Precinct. Tel. 25983
DERBY 97 St. Peter's Street. (Closed Wed.). Tel. 41361
DARLINGTON 19 Northgate (Cl. Wed.). Tel. 68043
DEWSBURY 9/11 Kingsway (Closed Tues.). Tel. 468058
DONCASTER 3 Queensgate, Waterdale Centre. (Closed Thurs). Tel. 63069
EDINBURGH 101 Lothian Rd. (Cl. Wed.). Tel. 229 9501
GLASGOW 326 Argyle St. (Cl'd Tues.). Tel. 248 4158
HULL 7 Whitefriargate (Closed Thurs.). Tel. 20505
LEICESTER 32 High Street (Closed Thurs.). Tel. 56420
LEEDS 5-7 County (Mecca) Arcade, Briggate (Closed Wed.). Tel. 458282
LIVERPOOL Dawson's Way, St. John's Shoppg. Cen. (Cl. Wed.).
LONDON 238 Edgware Road, W.2. (Closed Thurs.). Tel. 723 1629
MANCHESTER 60A Oldham Street (Closed Wed.). Tel. 236 2778
MIDDLESBROUGH 103 Linthorpe Rd. Tel. 210585 (Closed Wed.)
NEWCASTLE UPON TYNE 24 Newgate Shopping Centre (Closed Wed.). Tel. 21469
NOTTINGHAM 19/19A Market Street
PRESTON 41 Friargate Walk. St. Georges Shoppg Prec. (Closed Thurs.). Tel. 46068 Tel. 51979
SHEFFIELD 13 Exchange Street (Castle Mkt. Bldg.)
STOCKPORT 8 Little Underbank (Closed Thurs.). Tel. 20716 (Closed Thurs.). Tel. 480-0777
SUNDERLAND 5 Market Sq. (Closed Wed.). Tel. 70573
YORK 5 CHURCH ST. (Closed Wed.) Tel. 34355

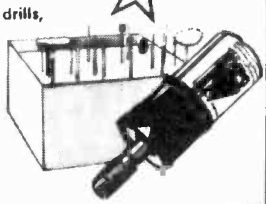
DORAM

A PROFESSIONAL DEAL FOR AMATEURS

* ORDERS BY RETURN OF POST * NO QUIBBLE REPLACEMENT PART SERVICE
* QUALITY BRANDED PRODUCTS * FREE UP-DATE INFORMATION SERVICE

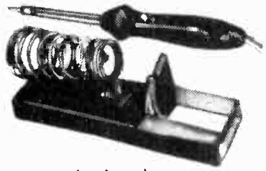
TOOLS

The handy EXPO 12V d.c. drill is supplied complete with drill kit containing 4 small drills, two spare collets, two cutters, wire brush, soft buffer, grindstone and 9 various milling and reaming tools.



Drill & kit £9.50 + s
Kit only £4.75 + s

ORYX 50W SOLDERING IRON



Temperature can be altered between 200-400°C.

Iron 240V £6.90 + s
Stand £2.80 + s

ISO-TIP CORDLESS IRON

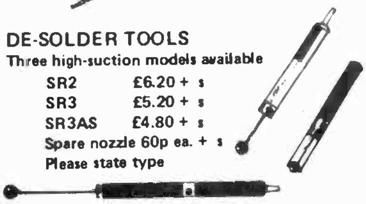
Mains and 12V d.c. versions available
£11.50 + s

DE-SOLDER TOOLS

Three high-suction models available

SR2	£6.20 + s
SR3	£5.20 + s
SR3AS	£4.80 + s

Spare nozzle 60p ea. + s
Please state type

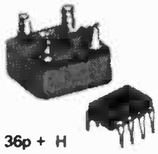


NICKEL - CADMIUM RECHARGEABLE CELLS

Sim. to dry cell	nom. capacity	charge cur. (mA)	
HP7	0·5Ah	50	£1.10 s
–	1·2Ah	100	£1.24 s
HP11	2·0Ah	200	£1.80 s
HP2	4·0Ah	400	£2.70 s

SEMI-CONDUCTOR DEVICES

RECTIFIERS

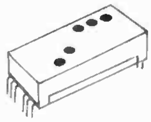


IN 4001	- 8p ea.)	
IN 4002	- 9p ea.)	+ s
IN 4003	- 9p ea.)	

1·0A bridge	(400V)	- 36p + H
1·6A "	(200V)	- 48p + H
1·6A "	(800V)	- 70p + H
2·0A "	(200V)	- 72p + H
2·0A "	(600V)	- 90p + H

MULLARD MODULES

LP 1173	- £6.75 + H
LP 1184/2	- £7.20 + H
LP 1185	- £5.60 + H
LP 1186	- £6.90 + H
LP 1400	- £7.25 + H



TRANSISTORS

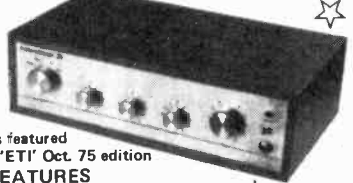
BC 107	- 18p s
BC 108	- 17p s
BC 109	18p s
BFY 50	- 24p s
BFY 51	- 24p s
BFY 52	- 24p s
2N 3055	- 80p s
2N 2646	- 94p s
TIP 2955	£1.14 s
TIP 3055	- 61p s
BC 237B	- 13p H
BC 238C	- 12p H
BC 239C	- 14p H
ZTX 107	- 12p H
ZTX 108	- 11p H
ZTX 109	- 13p H
ZTX 300	- 15p H
ZTX 500	- 16p H
MJE 340	- 62p H
TIP 31A	- 36p H
TIP 32A	- 40p H
2N 3819	- 32p H
3N 141	- 65p s
CS 715 (Similar to 2N 3819)	- 18p H
BF 180	- 40p s
BRY39	- 72p s

I.C.'s

T05 Reg	- £1.10 s
MVR 5	- £1.55 s
MVR 12	- £1.55 s
MVR 15	- £1.55 s
LM 309K	- £2.12 s
7805	- £1.50 s
7812	- £1.50 s
7815	- £1.50 s
7824	- £1.50 s
±15V D.I.L.	- £2.82 s
TBA 231	- £1.75 H
TBA 800	- £1.60 H
TBA 810S	- £1.80 H
TBA 820	- £1.20 H
ZN 414	- £1.30 H
ZN 424	- £1.25 H
741 Op-amp	- 54p s
747 Op-amp (Dual 741)	- 95p s
748 Op-amp	- 48p s
555 TIMER	- 84p s
556 (dual 555)	- £1.44 s
HA 1156 (similar to MC1310P)	- £1.60 H
ORP12	- 72p s
8A Triac	- £1.18 s
ZN 1034E	- £4.70 s

'INTERNATIONAL 25'

Build yourself a BIG SOUND amp at a budget price



As featured in 'ETI' Oct. 75 edition

FEATURES

* Triple Op-amp pre-amplifier
* Power 'Darlingtons'
* Modern styling
* 25W per channel into 8 ohms.

Complete kit with assembly instructions

£29·95 + £7.48 VAT

Overseas orders £34.50
S.A.E. for full spec.

BOOKS (Z)

Hi-fi hints and tips	38p ea.
Towers international transistor selector	£2.95 ea.
Electronic circuit design handbook – a must for electronic enthusiasts	£4.50 ea.

ELECTRONIC IGNITION UNIT

* High performance
* For 2 & 4 stroke engines
* Improved start/running
* 'Crisper' throttle response
* Reduce battery drain

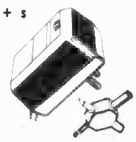
Neg. earth or pos. earth

£15.00 + s

Please state type required

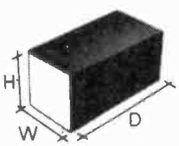
BATTERY ELIMINATOR

Switched output 6, 7·5 or 9V at 250mA. D.C. pos. or neg. earth
£3.15 + s



'SAMOS' CASES

Low-cost blue cover and white base PVC steel cases



S1	50W x 50H x 100D	£1.03 + s
S2	100W x 50H x 100D	£1.17 + s
S3	150W x 50H x 100D	£1.31 + s
S4	50W x 75H x 125D	£1.47 + s
S5	100W x 75H x 125D	£1.68 + s
S6	150W x 75H x 125D	£1.97 + s
S7	200W x 75H x 125D	£2.19 + s

SPECIAL OFFER! !
If catalogue ordered simultaneously with order for SAMOS cases - case price less 25%

CONDITIONS OF SALE

All prices are ex-VAT
If affixed with s add 8%
If affixed with H add 25%
Z = Zero rated
Package & posting free for orders over £3.00
Overseas orders add 15%
Cash with order. Cheques/Postal Orders to Doram Electronics Limited, P.O. Box TR8, Leeds, LS12 2UF
Small order handling charge of 40p for orders under £3.00

DORAM'S NEW CATALOGUE – THE AMATEURS GOOD COMPANION

ONLY 60p inc. post & packing.
Free up-date service until Aug. 1976.

DORAM "The Doorway to Amateur Electronics"
An Electrocomponents Group Company

NAME ....

ADDRESS ....

.... POST CODE ....

I enclose 60p. Please send me by return my Doram Catalogue. (Overseas orders except B.F.P.O. please add 30p for post and packing surface only).

NEW MULLARD & MAZDA VALVES

All individually boxed and guaranteed. Full trade discounts to bona fide companies. Price and availability lists on application.

EXPRESS POSTAGE
12p for 1 Valve. Each additional Valve add 2p in UK

DM70	0·69
DY86/7	0·53
DY802	0·53
EABC80	1·16
EB91	0·73
EBC81	0·89
EBF80	0·63
EBF83	0·66
EBF89	0·50
EC86	0·82
EC88	0·86
EC90	0·94
EC97	0·69
ECC81	0·54
ECC82	0·53
ECC83	0·53
ECC84	0·63
ECC85	0·78
ECC88	1·06
ECC189	0·77
ECF80	0·63
ECF82	0·90
ECF86	0·76
ECH81	1·50
ECH83	1·06
ECH84	1·30
ECL80	0·78
ECL82	0·69
ECL83	0·72
ECL86	0·73

EF80	0·53
EF83	1·10
EF85	0·53
EF86	1·50
EF89	1·47
EF91	1·35
EF92	1·51
EF95	1·63
EF183	0·69
EF184	0·69
EH90	0·91
EL34	1·21
EL36	1·15
EL84	0·53
EL86	1·21
EL95	0·89
EM81	1·24
EY51	0·89
EY86	0·50
EY86/87	0·53
EY88	0·81
EZ80	0·63
EZ81	0·53
GY501	1·30
GZ34	1·06
OC83	0·60
PC86	1·05
PC88	1·05
PC97	0·53
PC900	0·65

PCC84	0·63
PCC85	0·90
PCC88	0·98
PCC89	0·73
PCC189	0·91
PCF80	0·63
PCF82	1·37
PCF86	0·73
PCF200	1·30
PCF201	1·30
PCF801	0·73
PCF802	0·78
PCF806	0·73
PCH200	1·30
PCL82	0·63
PCL83	0·73
PCL84	0·69
PCL85	0·72
PCL86	0·73
PCL805/85	0·73
PD500	2·11
PFL200	0·91
PL36	1·06
PL81	0·91
PL81A	1·08
PL82	0·48
PL83	1·50
PL84	0·78
PL500	1·02

PL504	1·02
PL508	1·30
PL509	1·77
PL802	2·03
PY33	0·73
PY81/800	0·56
PY82	0·70
PY88	0·63
PY500A	1·15
PY800	0·56
PY801	0·56
U26	1·22
U191	1·17
U193	0·56
UABC80	1·01
UBC81	0·80
UBF89	0·65
UCC85	0·66
UCH81	1·30
UCL82	0·78
UCL83	0·78
UL84	1·06
UY85	0·73
6/30L2/ECC804	1·20
6F23/EF812	1·16
30C1/PCF80	0·43

30C15/PCF800	1·22
30C17	1·29
30C18/PCF805	1·29
30F5/PF818	1·35
30FLI/PCE800	0·98
30FL2	1·02
30FL12	1·44
30FL14	1·20
30L1/PCC84	0·63
30L15/PCC805	1·35
30L17	1·12
30P4MR	1·63
30P1Z/PC801	1·22
30P19/PC802	1·06
30PL1/PCL801	1·35
30PL13/PCL800	1·47
30PL14/PCL88	1·72
30PL15	1·44

NEW VALVES

Individually boxed and guaranteed but of European or other origin at greatly reduced prices. Quotations for any valve not listed. Send SAE for lists.

AZ1	1·00
AZ31	1·00
CBL31	1·40
CL33	1·50
CY31	1·00
DAF91	0·40
DAF96	0·60
DCC90	1·35
DF91	0·40
DF96	0·60
DK91	0·50
DK92	1·00
DK96	0·75
DL92	0·50
DL94	0·48
DL96	0·55
DY86	0·45
DY87	0·45
DY802	0·47
EABC80	0·33
EAF42	0·70
EB91	0·30
EBC33	1·00
EBC41	0·75
EBC81	0·40
EBF80	0·40
EBF83	0·40
EBF89	0·32
EBL31	2·00
ECC81	0·45
ECC82	0·38
ECC83	0·38
ECC84	0·35
ECC85	0·45
ECC88	0·50
ECH35	1·50
ECH42	0·85
ECH81	0·35
ECH83	0·50
ECL80	0·60
ECL82	0·42
ECL83	0·75
ECL86	0·55
ECLL800	3·50
EF37A	1·50

EF39	1·25
EF80	0·35
EF85	0·45
EF86	0·50
EF89	0·85
EF91	0·40
EF92	0·50
EF95	0·45
EF98	0·80
EF183	0·40
EF184	0·40
EL32	0·60
EL33	3·00
EL34	0·70
EL36	0·60
EL37	3·40
EL41	0·90
EL42	1·65
EL84	0·35
EL95	0·60
ELL80	2·00
EM80	0·55
EM81	0·60
EM84	0·40
EM85	1·00
EM87	1·00
EY51	0·45
EY86	0·45
EZ40	0·60
EZ41	0·75
EZ80	0·30
EZ81	0·31
GY501	0·90
GZ30	0·65
GZ32	0·65
GZ34	0·75
HN309	1·50
KT61	3·00
KT66	3·40
KT81(7C5)	2·00
KT81	1·75
KT88	3·65
KTW61	1·50
MU14	1·00

N78	5·00
OA2	0·45
OB2	0·45
PC86	0·65
PC88	0·65
PC97	0·55
PC900	0·55
PCC84	0·45
PCC88	0·62
PCC89	0·55
PCC189	0·65
PCF80	0·40
PCF82	0·42
PCF86	0·65
PCF801	0·60
PCF802	0·55
PCF805	0·90
PCF806	0·80
PCF808	1·00
PCL82	0·45
PCL83	0·70
PCL84	0·50
PCL85	0·60
PCL86	0·50
PCL805/85	0·60
PD500	1·50
PEN45	0·85
PL36	0·62
PL81	0·55
PL82	0·50
PL83	0·50
PL84	0·50
PL500	0·85
PL504	0·85
PL508	0·90
PL509	1·55
PL802	1·25
PX25	3·50
PY33	0·63
PY81	0·50
PY82	0·45
PY83	0·50
PY88	0·63

PY500	1·10
PY81/800	0·50
PY801	0·55
SP41	3·00
SP61	0·35
T41	1·50
U14	0·75
U25	1·00
U26	0·85
U191	0·75
UABC80	0·40
UAF42	0·75
UBC41	0·50
UBC81	0·50
UBF80	0·50
UBF89	0·50
UCC85	0·50
UCH42	0·80
UCH81	0·50
UCL82	0·40
UCL83	0·70
UF41	0·75
UF89	0·50
UL41	0·85
UL84	0·50
UY41	0·55
UY85	0·45
VR105/30	0·40
VR150/30	0·45
1R5	0·50
1S5	0·40
1T4	0·40
3S4	0·60
3V4	0·65
5R4GY	1·20
5U4G	1·25
5U4GB	0·70
5Y3GT	0·65
5Z4G	0·95
6/3OL2	0·90
6AK5	0·45
6AM5	2·00
6AQ5	0·50
6AS7G	1·00
6AT6	0·60
6AU6	0·40
6BA6	0·33
6BE6	0·45
6BH6	0·75
6BJ6	0·75
6BQ7A	0·55
6BR7	1·20
6BS7	1·40
6BW6	1·00
6BW7	1·00
6C4	0·40
6CD6G	1·60
6CH6	2·20
6CW4	3·00
6F23	0·90
6F25	1·00
6F28	0·75

6J5M	0·65
6J5G	0·45
6J6	0·35
6J7G	0·30
6J7M	0·65
6K6GT	0·80
6K7G	0·35
6K7M	0·45
6K8G	0·45
6K8M	0·70
6K25	1·00
6L6G	2·00
6L6GC	0·60
6Q7G	0·40
6Q7M	0·60
6SL7GT	0·55
6SN7GT	0·55
6SQ7GT	0·40
6U5G	1·50
6V6G	0·30
6V6GT	0·60
6X4	0·45
6X5G	0·45
6X5GT	0·55
7B6	0·80
7B7	0·80
7C5	2·00
7C6	1·00
7H7	0·80
7R7	0·80
7S7	2·25
7Y4	0·80
12AT6	0·45
12AT7	0·45
12AU6	0·50
12AU7	0·33
12AX7	0·33
12BA6	0·50
12BE6	0·60
30C1	0·40
30C15	1·00
30C17	1·00
30C18	0·90
30F5	1·00
30FL1	1·00
30FL2	1·00
30FL14	1·00
30L15	0·95
30L17	0·95
30P4MR	1·30
30P12	1·00
30P19	0·95
30PL1	0·95
30PL13	1·10
30PL14	1·10
35W4	0·60
35Z4GT	0·70
50CD6G	1·20
807	1·00
813ITT	17·50
813USSR	7·00
866A	3·00

TRANSISTORS-INTEGRATED CIRCUITS

EXPRESS POSTAGE
12p per order in UK

All transistors, I.C's offered are new and branded. Manufactured by Mullard, Texas, RCA, Ferranti, Motorola, ITT, Fairchild, Lucas, etc. Quantity discounts on application. Send SAE for full lists.

AA119	0·07
AAZ13	0.12
AAZ15	0·10
AC107	0·31
AC126	0·25
AC127	0·25
AC128	0·15
AC176	0·25
AC187	0·21
AC188	0·20
ACY21	0·35
ACY39	0·75
AD140	0·50
AD149	0·50
AD161	0·44
AD162	0·44
AF115	0·25
AF116	0·25
AF117	0·24
AF186	0·48
AF239	0·44
ASY27	0·33
ASY28	0·25
BA102	0·25
BA115	0·10
BC107	0·14
BC108	0·13
BC109	0·12
BC113	0·15
BC117	0·21
BC143	0·30
BC147	0·10
BC148	0·08
BC169C	0·15
BC182	0·12
BC182L	0·12
BC184L	0·12
BC338	0·15
BCY32	0·85
BCY33	0·33
BCY34	0·45
BCY70	0·18
BCY71	0·22
BCY72	0·15
BCZ11	0·65
BD121	1·00

BD124	0·65
BD131	0·42
BD132	0·50
BF115	0·20
BF167	0·25
BF173	0·28
BF179	0·33
BF180	0·36
BF181	0·35
BF194	0·10
BF195	0·12
BF197	0·15
BF200	0·32
BF861	0·25
BF898	0·25
BFW10	0·61
BFX29	0·28
BFX88	0·24
BFY50	0·20
BFY51	0·20
BFY52	0·20
BR100	0·40
BY100	0·27
BY126	0·14
BY127	0·15
BZX61 series	0·20
BZY88 series	0·10
CR81-05	0·35
CR81-40	0·50
CR83-05	0·40
CR83-40	0·65
MJE340	0·47
MJE370	0·68
MJE520	0·65
MJE2955	1·27
MJE3055	0·75
MPF102	0·40
MPF103	0·36
MPF104	0·35
MPF105	0·36
NKT404	1·00
OA5	0·72
OA10	0·40
OA79	0·10
OA81	0·18

OA91	0·07
OA200	0·08
OA202	0·06
OC16	1·00
OC20	2·00
OC23	1·25
OC25	0·40
OC28	1·00
OC35	0·55
OC36	0·60
OC42	0·40
OC44	0·20
OC45	0·20
OC71	0·25
OC72	0·28
OC76	0·30
OC77	0·55
OC81	0·29
OC81D	0·28
OC81Z	0·45
OC83	0·35
OC140	1·14
OC170	0·30
OC171	0·30
OC200	0·75
OC201	1·50
OC202	1·50
OC203	0·75
OCP71	1·20
ORP12	0·60
ORP60	0·55
TIC44	0·29
TIC226D	1·50
TIL209	0·20
ZTX107	0·12
ZTX108	0·10
ZTX300	0·13
ZTX301	0·14
ZTX302	0·18
ZTX304	0·24

ZTX500	0·13
ZTX501	0·15
ZTX503	0·16
ZTX531	0·25
ZTX550	0·18
1N914	0·06
IN4001	0·06
IN4002	0·07
IN4003	0·08
IN4004	0·08
IN4005	0·10
IN4006	0·12
IN4007	0·12
1N4009	0·06
1N4148	0·06
1S921	0·07
IS2033	0·20
IS2051A	0·20
IS2100A	0·20
IS3010	0·25
2N696	0·15
2N697	0·16
2N706	0·10
2N706A	0·12
2N1131	0·25
2N1132	0·24
2N1302	0·18
2N1303	0·18
2N1304	0·22
2N1305	0·22
2N1306	0·28
2N1307	0·28
2N1308	0·32
2N1309	0·30
2N1613	0·31
2N1614	0·45
2N2147	0·78
2N2160	0·78
2N2369A	0·16
2N2646	0·50

2N2904	0·20
2N2904A	0·25
2N2905	0·22
2N2905A	0·25
2N2906	0·20
2N2926	0·12
2N3053	0·18
2N3055	0·45
2N3525	0·91
2N3614	0·65
2N3615	0·65
2N3702	0·11
2N3703	0·12
2N3704	0·14
2N3705	0·15
2N3706	0·11
2N3707	0·13
2N3708	0·07
2N3709	0·10
2N3710	0·11
2N3711	0·11
2N3819	0·28
2N3820	0·50
2N3823	0·50
2N3903	0·15
2N3904	0·20
2N3905	0·25
2N3906	0·25
2N4058	0·15
2N4059	0·10
2N4060	0·12
2N4061	0·12
2N4062	0·14
2N4289	0·30
3N125	1·75
3N141	0·81
40360	0·40
40361	0·45
40362	0·40
40430	0·85

SN7400	0·16
SN7401	0·16
SN7402	0·16
SN7403	0·16
SN7404	0·26
SN7405	0·22
SN7406	0·42
SN7407	0·42
SN7408	0·28
SN7409	0·28
SN7410	0·16
SN7411	0·25
SN7412	0·30
SN7413	0·36
SN7416	0·36
SN7417	0·36
SN7420	0·16
SN7422	0·25
SN7423	0·87

SN7428	0·40
SN7430	0·16
SN7433	0·87
SN7437	0·87
SN7438	0·87
SN7440	0·22
SN7441AN	0·92
SN7442	0·79
SN7450	0·16
SN7451	0·16
SN7453	0·16
SN7454	0·16
SN7460	0·16
SN7470	0·36
SN7473	0·41
SN7474	0·42
SN7480	0·60
SN7483	1·10

SN7486	0·47
SN7490	0·55
SN7491AN	1·00
SN7492	0·70
SN7493	0·70
SN7494	0·80
SN7495	0·80
SN7496	0·95
SN7497	3·87
SN74100	1·89
SN74107	0·45
SN74110	0·58
SN74118	0·90
SN74119	1·68
SN74121	0·50
SN74122	0·70
SN74123	1·00
SN74141	0·90

SN74145	1·28
SN74150	1·75
SN74151	1·00
SN74154	2·00
SN74155	1·00
SN74156	1·00
SN74157	0·95
SN74170	2·52
SN74174	1·57
SN74175	1·10
SN74176	1·26
SN74190	2·00
SN74191	2·00

SN74192	2·00
SN74193	2·00
SN74194	1·30
SN74195	1·10
SN74196	1·20
SN74197	1·20
SN74198	2·77
SN74199	2·52

DIL SOCKETS	14 pin 15p
	16 pin 17p

VAT

To be added to all orders
VALVES & TRANSISTORS 25%
INTEGRATED CIRCUITS 8%

THIS MONTH'S

- OSCILLOSCOPE TUBES
  Types CV 1526, DG 7-5, VCR 139A
  All at £8·00 each, +p & p 25p.
  Add 8% VAT

SPECIAL OFFER

TERMS OF BUSINESS: C.W.O. A/c's available to approved companies on application. Telephone and telex orders accepted. Export and trade enquiries welcomed. Open daily to callers 9 a.m.–5 p.m. Mon.–Sat. Closed Sat. 1–3 p.m. Prices correct when going to press. Prices on application for any types not listed. Obsolete valves a speciality.

RST VALVE MAIL ORDER CO.

16a Wellfield Rd., London, SW16 2BS
Tel: 01-677 2424 Telex: 946 708.

BI-PRE-PAK

Bargains in Semi-Conductors, components, modules & equipment.

B-P-P Packs

Originated in 1959 by managing director Bernard Davis, his were the first semi-conductor and component packs to be marketed in this country, and indeed, the company's name grew out of "British Industrial Pre-Packed Components". Today, Bi-Pre-Pak continues to occupy a position of pre-eminence in the supply of packs as well as a vastly extended range of products detailed in our latest 24 page A.4 size free catalogue. Send 10p stamped large addressed envelope for your copy by return.
IT'S ALL IN OUR FREE CATALOGUE

Component Packs

CP1	150	Capacitors, mixed bag of paper, silver mica, electrolytics, etc. Approx. quantity, counted by weight. (post & packing)	60p
CP2	200	Resistors, mixed bag of different types, values, wattages, etc. Approx. quantity, counted by weight.	60p
CP3	40	Wirewound resistors, mixed types, values and wattages.	60p*
CP4	12	Potentiometers, pre-sets, w/wound, carbon, etc. Mixed types and values.	60p
CP5	5	Earphones, single low impedance for transistor radios, cassettes etc. Less plugs, for suitable plugs see PAKs CP9 and CP10.	60p
CP6	50	TO-5 mounting pads, fits between transistor and board, for that pro. finish.	60p
CP8	500	Cable clips for G.P.O. ⅛" dia. cable. Nylon with hardened steel pin (probably tungsten) per sealed box of 500.	60p*
CP9	5	3·5mm plugs, miniature jack, to fit earphones in PAK CP5.	60p*
CP10	5	2·5mm sub miniature jack plugs, to fit earphones in PAK CP5.	60p*
CP11	6	Screwdrivers, 1 x mains neon tester, 5 x grub screwdrivers.	60p*
CP12	10	Reed relay inserts, 1" long ⅛" dia. These will operate from an external magnet or coil. For magnets see PAK CP13.	60p*
CP13	10	Magnets of various sizes for operating reed switches in PAK CP12. Ideal for burglar alarms on doors and windows etc.	60p*
CP14	40	Potentiometers, presets, wirewounds, carbons, dual gangs, with and without switches etc. Mixed values and wattages	£1·20
CP15	12	Standard crocodile clips, screw fixing, good quality.	60p*
CP16	5	P.C. boards each containing a BF180 UHF amplifier transistor. A good basis for building a T.V. aerial pre-amp as various parts inc.	60p
CP17	25	Electrolytic Capacitors, various values and voltages, many useful types, from T.V. to transistor radio & HI-FI (post & packing 23p)	60p
CP18	1	Light activated SCR.50 volts 1·6 amps type L9F. Ready mounted on PC board with gate resistor and leads fitted. Full data and circuit diagrams for 14 projects, includes: slave photo flash unit, burglar alarm etc.	
CP19	3	Micro switches 1 pole change over, standard model 1¼" x ⅜".	60p*

Semi-Conductors

● Tested and guaranteed

TP4	3	SN7490 integrated circuits, 14 pin dual in line TTL type. Decade counter. Get one FREE these are 60p each in singles.	£1·20p*

ALL THE FOLLOWING ARE AT 60p EACH PACK

TP9*	5	SN7400 integrated circuits, 14 pin dual in line TTL type. Quad 2-input NAND gate. Get one FREE, these are 15p each.
TP10	2	Light dependant resistors. 400 ohms light, 1 megohm dark. ¼" dia.
TP11	10	Transistors XB102 and XB112 equivalent to AC126, AC156, OC81/2, OC72 etc.
TP12*	4	BY127 Silicon rectifiers 1000 piv 1 amp. Plastic T.V. rectifier.
TP13*	5	OCP71 Light sensitive transistors.
TP14	20	OC71 germanium PNP audio pre amp transistor, black glass type.
TP15	20	OC81 germanium PNP audio output transistor, white glass type.
TP16	20	OC200/1/2/3 transistors, PNP silicon TO-5, unmarked.
TP17	20	1 watt zener diodes, mixed voltages, 6·8 to 43 volts.
TP18	20	2N3707/8/9/10 transistors, NPN silicon plastic, unmarked.
TP19	100	Diodes, mixture of germanium, gold bonded, silicon, etc., a useful selection of many types, marked and unmarked.
TP20	10	Mullard OC45 transistors, I.F. amp. PNP germanium.
TP23	20	BFY50/1/2, 2N696/7, 2N1613, etc. NPN silicon IO-5 uncoded. COMPLEMENTARY TO PAK TP24.
TP24	20	BFY64, 2N2904/5, etc., PNP silicon TO-5 uncoded COMPLEMENTARY to PAK TP23.
TP30	20	NPN silicon planar transistors, TO-18 similar to BC108 etc. uncoded.
TP31	20	PNP silicon planar transistors. TO-18 similar to BC178 etc. uncoded.

● **Untested Packs—60p each**
Specially for keen bargain hunters

UT1	50	PNP germanium transistors, AF and RF. Very good yield.
UT2	150	Germanium diodes, miniature glass type.
UT5	40	Zener diodes, 250 mW OAZ240 range, average 50% good.
UT6	25	Zener diodes, 1–1½ watt top hat type, mixed voltages.
UT9	40	NPN silicon planar transistors, of the 2N3707–11 range, low noise amp.
UT10	15	Power transistors, PNP germanium and NPN silicon, mostly TO-3 but some plastic and some marked.
UT13	15	Integrated circuits, experimenters pak, dual in line, TO-5, TTL, DTL, marked and unmarked, some definitely good but old types.

FOR FULL RANGES—SEE CATALOGUE

● **Singles**

BRIDGE RECTIFIERS Plastic encapsulated

P.I.V.	50v	100v	400v
1 amp	25p*	35p*	45p*
2 amp	35p*	45p*	55p*
4 amp	45p*	50p*	80p*
6 amp	50p*	60p*	90p*

BY164 equiv. SKB2/02 400v 1·5 amp. 45p*

FETs

2N3919	18p
2N4416	20p

MOS F.E.Ts

3N141/MEM616	50p

UNI-JUNCTION TRANSISTORS

2N2160	65p*
2N2646	48p*
TIS43	31p*

PUTs

2N26027	50p

LEDs

TIL209—Red	18p*
TIL211—Green	33p*

Also Power Diodes, Thyristors, Triacs, Diac Zener Diodes, Opto-Electronics, etc.

POWER TRANSISTORS

	Vce	Watts	Ic Amps	Price
40P1	15	20	3	20p*
40N2	40	40	4	30p*
40P2	40	40	4	30p*
90N1	15	45	4	25p*
90P1	15	45	4	25p*
90N2	40	90	8	35p*
90P2	40	90	8	35p*

Many other types available from 3 to 115 watts

INTEGRATED CIRCUITS

MM5314 Dual in line clock chip £3*
LMS380/SL60745 Dual In line 2w. audio amp. with data, etc. 75p
Dual in line I.C. sockets 8 pin **14p**; 14 pin **15p***; 16 pin 16p*

Sundry

SIGNAL GENERATOR
For MW and IF Covers 550 KHz to 1·6 MHz for MW and 400 to 550KHz for IF. Fully portable. (p/p 40p) £4·25

POCKET SIGNAL INJECTOR
Fountain-pen type. Invaluable for finding faults £2·00*

EX-G.P.O. 5" SIDECUTTERS
Not new, but in perfect order, per pair 50p*

EX-G.P.O. 6" LONG NOSE PLIERS
Not new, but in perfect order, per pair 60p*

MAINS TRANSFORMERS

MT6	6v 0 6v 100mA	£1·22*
MT12	12v 0 12v 50mA	£1·22*
SST9/1	9v 1amp	£1·67*
SST12/1	12v 1amp	£2·05*
SST18/1	18v 1amp	£2·50*
SST25/2	25v 2amp	£3·00*
SST30/2	30v 2amp	£4·25*
SST35/4	35v 4amp	£5·50*

PC EDGE CONNECTORS

Type	Sizes	Pitch	
SSEC 6 way	1¼"	·156"	32p
SSEC 10 ,,	1¾"	·156"	50p
SSEC 12 ,,	2"	·156"	60p
SSEC 16 ,,	2¾"	·156"	75p
SSEC 18 ,,	3"	·156"	85p
SSEC 22 ,,	3¾"	·156"	1·00

BOOKS
All free of V.A.T. We carry very large stocks of technical books by Babani & Bernard Publishers, by Newnes and Butterworth as well as reference books from the Common Market in English/German/Italian. All detailed in our catalogue.

MONEY SAVERS FOR MOTORISTS

Our new "Super Spark" Capacity Discharge Ignition unit is Instantly adaptable for pos. or neg. earth; can be switched back to conventional ignition instantly and incorporates anti-burglar immobilising switching. Rev. controlling adjustment. In totally enclosed strong metal box (p/p—50p) (S.A.E. for leaflet)
KIT—**£7·95*** READY BUILT **£10·50***

NEXT MONTH LOOK OUT FOR SOME EXCITING NEW
Stirling Sounds Audio Modules **£10·50**

B-P-P SECURITY CHECK POINT

Write your own name and address clearly in block capital letters.

Check that your order is correct for description, quantity and price.

Don't forget V.A.T. at 25% of total value of order unless otherwise stated.

MAKE SURE YOU GET OUR NAME AND ADDRESS RIGHT WHEN ORDERING

Cash (cheque, money or postal order) with your order, please.

Mention this journal when ordering if you don't want to cut out the coupon.

TERMS OF BUSINESS:
VAT at 25% must be added to total value of order, except for items marked * or (8%), when **VAT** is to be added at 8%. No **VAT** on overseas orders. **POST & PACKING** Add 30p for UK orders except where shown otherwise. Minimum mail order acceptable—£1. Overseas orders, add £1 for postage. Any difference will be credited or charged. **PRICES** Subject to alteration without notice. **AVAILABILITY** All items available at time of going to press when every effort is made to ensure correctness of information.

To BI-PRE-PAK, 224-226 WEST RD., WESTCLIFF-ON-SEA, ESSEX

Please send ....

for which I enclose .... inc. V.A.T.

Name ....

Address ....

.... PW4

BI-PRE-PAK LTD

Co Reg No 820919
222 224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SS0 9DF.
TELEPHONE: SOUTHEND (0702) 46344.

WRITE ORDER SEPARATELY AND ATTACH COUPON IF REQUIRED

tecknowledgey in consumer ICs - and their applications

SGS Audio ICs

The much heralded TDA2020 is here. And just to make sure that you don't go wrong, so is the SGS application test circuit PCB for a stereo 15 + 15 (RMS) Hi Fi amplifier.

Prices :		IC	AUDIO		DISCRETES	
TBA810AS	+HS	1.09	ZTX107/8/9			14p
TCA940E	+HS	1.80	ZTX413(LN)			17p
TDA2020		2.99	ZTX212/3/4			16p
FM LINEAR		ICS	BD 535	npn	7A/60v	52p
MC1350		0.70	BD536	pnp		53p
CA3089	+QC	1.94	BD377	npn	3A/50v	29p
TBA120	+QC	1.00	BD378	pnp		32p
MPX LINEAR		ICS	BD515	npn	2A/45v	27p
			BD516	pnp		30p
MC1310P	+LED	2.20	BD609	npn	10A/90v	70p
CA3090AQ	+LED	3.75	BD610	pnp		102p

We've moved

To accomodate expanded R & D facilities, AMBIT has moved sales and administration to 25 High St. Brentwood. The existing 37 High Street premises are retained for the engineering activities.

One of the first products of this move has been the development of a TV sound tuner, from an "off air" system, using its own varicap UHF TV tuner, with ICIF amplifiers and block filters by TOKO. And then one of our best ever circuits - an electronic touch tuner, with scanning mode, and facilities for 6 preset stations. The unit is suitable for use with FM, and now AM of course, and offers a complete tuner system without any moving parts. Selection is by means of touch tuning in all cases, with manual scan and preset switching automatically interlocked.

Our R&D facilities are available for general consultancy to OEMs: further details on application. Standard project estimation fee, including project evaluation comment data is £15.00 payable in advance.

Modules & Kits

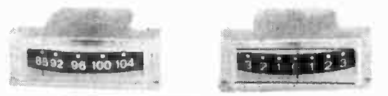
New modules:

8011	Totally touch tuned varicap controller built £14.99.
8005	Larsholt tunerset accesory unit, with pilot tone filter and audio stages, rectifier, IC stabilizer, meter driver circuits. £4.99 (kit)
8001	55kHz low pass filter (mpx birdy filter) £2.35 built £1.75 (kit)
2001	Stereo scratch and rumble filter, with continuously variable operating frequencies. £5.80 (built) £4.60 (kit)
3000	Stereo control preamp - a wide dynamic range, low distortion AF preamp, with vol, bal, bass and treble controls. kit £5.78
2020k	The TDA2020 stereo amp kit photographed on the left. £7.85
7700	TV off air UHF sound tuner - built £26.00 (4 preset stations)

9000 kit	AM/FM mpx tuner chassis, with mech. tuner	£17.50
7004 kit	MW/LW varicap tuner module, inc. ferrite rod	£9.95
7252	HiFi MOSFET FM tuner module by Larsholt	£24.00
7253	HiFi FET FM tuner module inc decoder	£24.00
5600	Hi Q MOSFET varicap tunerhead by TOKO	£11.25
EC3302	FET tunerhead from TOKO	£5.00

Complete FM Tuner kits, inc case, for use with the above modules: details SAE please. Prices range from £40 - £60.

Amongst our various accessories for entertainment electronics is a range of FM tuning, frequency and sig. strength meters with 12v, 50mA bulb. £2.50 ea.



ambit international

Trade Mark

25 high street, brentwood, essex. cm14 4rh.

tel: (0277) 216029
tlx: 995194

Free price list with an SAE, catalogue of modules and parts 40p., including postage and VAT.

General Terms: CWO please, official bodies and companies please note min. invoice £7.50. PP for CWO orders 22p per order. (UK and Eire). Overseas customers please include sufficient for postage. VAT is not included, and must be added at 25%, In stock orders despatched within 48 hours.

ADVANCED CLOCK KIT

Complete kit including attractive slim case for 6 digit alarm clock with bleep alarm, snooze, high brightness driving of Jumbo LED displays, automatic intensity control—with optional add-ons of touch switch snooze control and crystal control/battery back-up. **£27·31**

P.E. CAR CLOCK with Journey Timer

6 digit clock for use in any car with 12V battery, with an independent journey timer incorporated. Bright Jumbo LED display comes on with ignition—automatic intensity control. Complete kit of all parts needed including case, PCB's and all components. Full instructions. **£39·50**

Easy to Build **E.E. DIGITAL CLOCK** (Jan. issue). Kit of all components, including case etc., for this attractive clock with 12mm green display. Full instructions. **£16·20**

50 Hz Xtal Timebase Kit for clocks (incl. advanced kit above). **£6·28**

CMOS ICS		CD4029	0·94	CD4059	10·64	CD4511	1·28	**Displays**	
RCA MOT		CD4030	0·46	CD4060	0·92	CD4514	2·56	5LT-01	5·80
ONLY		CD4031	1·82	CD4061	16·43	CD4515	2·56	DL704E	0·85
CD4000	0·17	CD4032	0·88	CD4062	7·33	CD4516	1·12	FND500	1·02
CD4001	0·17	CD4033	1·14	CD4063	0·90	CD4518	1·03	**Display Int.**	
CD4002	0·17	CD4034	1·56	CD4066	0·58	CD4520	1·03	SN75491	0·81
CD4006	0·97	CD4035	0·97	CD4067	2·95	CD4527	1·30	SN75492	1·02
CD4007	0·17	CD4036	1·82	CD4068	0·18	CD4532	1·16	7447	1·05
CD4008	0·79	CD4037	0·78	CD4069	0·18	CD4555	0·74	7448	0·85
CD4009	0·46	CD4038	0·88	CD4070	0·18	CD4556	0·74		
CD4010	0·46	CD4039	2·86	CD4071	0·18	MC14508	2·37	**Flat Cable**	
CD4011	0·17	CD4040	0·88	CD4072	0·18	MC14528	0·86	20WAY 1M	
CD4012	0·17	CD4041	0·69	CD4073	0·18	MC14534	6·04		1·00
CD4013	0·46	CD4042	0·69	CD4075	0·18	MC14553	4·07	10M for	8·50
CD4014	0·83	CD4043	0·83	CD4076	1·27	MC14566	1·21	10WAY 1M	
CD4015	0·83	CD4044	0·77	CD4077	0·18	MCM14552			0·60
CD4016	0·46	CD4045	1·15	CD4078	0·18		8·05	10M for	4·80
CD4017	0·83	CD4046	1·10	CD4081	0·18	**Clock Chips**		**IC Socket**	
CD4018	0·83	CD4047	0·74	CD4082	0·18	MK50253	5·60	**Pins**	
CD4019	0·46	CD4048	0·46	CD4085	0·59	MM5314	4·44	100	0·50
CD4020	0·92	CD4049	0·46	CD4086	0·59	AY51224	3·66	1000	4·00
CD4021	0·83	CD4050	0·46	CD4089	1·27	AY51202	4·76	3000	10·50
CD4022	0·79	CD4051	0·77	CD4093	0·66				
CD4023	0·17	CD4052	0·77	CD4094	1·53	**CMOS**		**Verocases**	
CD4024	0·64	CD4053	0·77	CD4095	0·86	**Books**		751410J	2·64
CD4025	0·17	CD4054	0·95	CD4096	0·86	No VAT or		751411D	2·94
CD4026	1·42	CD4055	1·08	CD4099	1·50	P & P		751412K	4·00
CD4027	0·46	CD4056	1·08	CD4502	0·98	RCA1975	2·67	uA78L12WC	
CD4028	0·74	CD4057	20·35	CD4510	1·12	MCMOS	2·77		0·60

ADD VAT at 8% (Higher rate does not apply to any of above).
15p P & P on orders under £3—Despatch is by 1st Class Post.
Price list and data sent FREE with an order, or on request (an SAE helps).
Official orders welcomed (written or phoned)—Univs, Polys, Govt, Cos, etc.
Export orders: no VAT, add 35p (Europe) £1 (overseas) for Airmail p & p.

SINTEL, 53n Aston Street, Oxford. Tel: 0865 49791

ELECTROVALUE

the good components service

In relatively few years, Electrovalue has risen to a position of pre-eminence as mail-order (and industrial) suppliers of semi-conductors, components, accessories, etc. There are wide ranges and large stocks to choose from as well as many worthwhile advantages to enjoy when you order from Electrovalue.

CATALOGUE 8-ISSUE 2

With the first printing sold out, Issue No. 2 is up-dated on prices, etc. 144 pages. New items. Opto-electronics. Diagrams of components, applications. I.C. circuits, etc. Post free 40p, including voucher for 40p for spending on order over £5 list value.

DISCOUNTS

On all C.W.O. mail orders, except for some items marked NETT.
5% on orders list value £10 or more   **10%** on orders list value £15 or more

FREE POST & PACKING

On all C.W.O. mail orders in U.K. over £2 list value. If under, add 15p handling charge.

PRICE STABILIZATION POLICY

Prices are held and then reviewed over minimum periods of 3 months—Next price review due April 1st 1976.

QUALITY GUARANTEE

On everything in our Catalogue—No manufacturer's rejects, seconds or sub-standard merchandise.

ELECTROVALUE LTD

All communications to Dept. 4/1, **28, ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY TW20 0HB.** Telephone Egham 3603, Telex 264475. *Shop hours 9–5.30 daily, 9–1 pm Sats.*

NORTHERN BRANCH: 680, Burnage Lane, Burnage, Manchester M19 1NA. Telephone (061) 432 4945. *Shop hours Daily 9–5.30 pm; 9–1pm Sats.*

TRANSFORMERS

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

MAINS ISOLATING
PRI. 120/240V. SEC. 120/240.
CENTRE TAP WITH SCREEN

Ref. No.	VA (Watts)	£	p & p £
07*	20	3·77	0·58
149	60	4·69	0·72
150	100	5·33	0·85
151	200	8·54	1·12
152	250	10·32	1·41
153	350	12·47	1·41
154	500	14·33	1·61
155	750	21·94	BRS
156	1000	30·57	BRS
157	1500	34·89	BRS
158	2000	38·92	BRS
159	3000	61·48	BRS

* 115V or 240V Sec. only

12 and or 24 Volt
PRIMARY 240-250 VOLTS

Ref. No.	Amps 12v	Amps 24v	£	p & p £
111	0·5	0·25	1·54	0·28
213	1·0	0·5	1·86	0·58
71	2	1	2·41	0·58
18	4	2	2·97	0·72
70	6	3	4·43	0·72
108	8	4	5·09	0·85
72	10	5	5·50	0·85
116	12	6	5·80	0·97
17	16	8	7·48	0·97
115	20	10	10·91	1·61
187	30	15	14·20	1·41
226	60	30	17·67	BRS

30 VOLT RANGE
Prim. 200-240V
Sec. 0-12-15-20-24-30V

Ref. No.	Amps	£	p & p £
112	0·5	1·90	0·58
79	1·0	2·52	0·72
3	2·0	3·77	0·72
20	3·0	4·70	0·85
21	4·0	5·56	0·85
51	5·0	6·73	0·97
117	6·0	7·52	1·12
88	8·0	10·20	1·25
89	10·0	10·36	1·41

50 VOLT RANGE
Prim. 200-240V
Sec. 0-19-25-33-40-50V

Ref. No.	Amps	£	p & p £
102	0·5	2·71	0·58
103	1·0	3·55	0·72
104	2·0	4·95	0·85
105	3·0	6·10	0·97
106	4·0	7·98	1·12
107	6·0	12·71	1·25
118	8·0	13·63	1·61
119	10·0	17·75	BRS

60 VOLT RANGE
Prim. 200-240V
Sec. 0-24-30-40-48-60V

Ref. No.	Amps	£	p & p £
124	0·5	2·48	0·72
126	1·0	3·68	0·72
127	2·0	5·33	0·85
125	3·0	7·90	0·97
123	4·0	9·19	1·41
40	5·0	10·24	1·25
120	6·0	12·07	1·41
121	8·0	15·75	BRS
122	10·0	19·40	BRS
189	12·0	20·25	BRS

AUTO TRANSFORMERS

Ref No	VA (Watts)	Auto Taps	£	p & p £
113	20	0-115-210-240	1·75	0·51
64	75	" "	3·05	0·72
4	150	0-115-200-220-240	4·33	0·72
66	300	" "	6·11	0·85
67	500	" "	9·36	1·25
84	1000	" "	14·36	1·61
93	1500	" "	19·02	BRS
95	2000	" "	25·41	BRS
73	3000	" "	36·84	BRS

CASED AUTO TRANSFORMERS
240V mains lead input & USA 2 pin outlets.

20VA	£3·29	P&P £0·72	Ref 113W
150VA	£6·37	P&P £0·85	Ref 4W
500VA	£10·97	P&P £1·25	Ref 67W
1000VA	£18·39	P&P BRS	Ref 84W
2000VA	£28·71	P&P BRS	Ref 95W

SCREENED MINIATURES

Ref	mA	Volts	£	p&p p
238	200	3-0-3	1·62	39
212	1A, 1A	0-6, 0-6	1·93	46
13	100	9-0-9	1·56	25
235	330, 330	0-9, 0-9	1·64	25
207	500, 500	0-8-9, 0-8-9	2·02	51
208	1A, 1A	0-8-9, 0-8-9	3·07	58
236	200, 200	0-15, 0-15	1·56	25
214	300, 300	0-20, 0-20	2·03	58
221	700(DC)	20-12-0-12-20	2·38	58
206	1A, 1A	0-15-20, 0-15-20	3·63	72
203	500, 500	0-15-27, 0-15-27	3·15	72
204	1A, 1A	0-15-27, 0-15-27	4·14	72
S112	500	12, 15, 20, 24, 30	1·97	58

HIGH VOLTAGE
Mains Isolating
Prim. 200/220 or 400/440
Sec. 100/120 or 200/240

VA	Ref.	£	p & p £
60	243	4·37	0·97
350	247	10·93	1·41
1000	250	26·31	BRS
2000	252	44·12	BRS

PLUS

BRIDGE RECTIFIERS

50V	2A	35p
100V	2A	40p
100V	6A	70p
200V	1A	35p
200V	2A	45p
400V	2A	50p
400V	4A	65p
600V	2A	50p
500V	10A(PM 7A6)	£2·35

P & P 15p. *VAT* 25%

TEST METERS
AVO 8 MK5 £55·88
AVO 72 £21·72
P & P £1·10. *VAT* 8%

ANTEX SOLDERING IRONS
15W £2·68 18W £2·45 25W £2·26
SOLDERING IRON KIT £3·61
STAND FOR ABOVE £1·13
P & P 25p. *VAT* 8%

MAGNETIC TO CERAMIC CARTRIDGE CONVERTOR
OPERATING VOLTAGE 20-45V
ONLY £2·65 *P & P* 18p. *VAT* 25%

BSR MINI-DECK
4 SPEED AUTOCHANGER £6·00
P & P 72p. *VAT* 25%.

NEW STEREO 30
Complete Stereo Chassis inc.: 7+7w RMS. Amp, Pre-amp, Power Supply, Front Panel, Knobs (only needs Mains Trans.). Stereo 30 £15·75. Mains Trans £2·45. Teak veneered cab. £3·65. P. & P. 85p VAT 25%.

POWER UNIT
CC12-05 Output Switched
3-4-5-6-7·5 5-9-12V at 500mA.
£4·08. *P & P* 48p. *VAT* 8%

HIGH QUALITY MODULES

3 Watt RMS AMPLIFIER	£2·30
5 Watt RMS AMPLIFIER	£2·65
10 Watt RMS AMPLIFIER	£2·95
25 Watt RMS AMPLIFIER	£3·95
PRE-AMP for 3-5-10W	£6·50
PRE-AMP for 3-5-25W	£13·50
POWER SUPPLIES 3-5-10W	£1·20
POWER SUPPLIES 25W	£3·00
TRANSFORMER 3W	£1·48
TRANSFORMER 5-10W	£2·13
TRANSFORMER 25W	£2·60

P & P Amps/Pre-Amps/Power Supplies 18p *VAT* 25%
P & P Transformers 37p *VAT* 25%

ELECTROSIL METAL OXIDE RESISTORS

Style	Tol.	Omic range	Price per 100
TR4	2%	10R–300K	£10·50
	5%	10R–300K	£6·00
TR5	2%	10R–470K	£2·50
	2%	510K–1M	£2·60
	2%	10R–47R	£16·50
TR6	2%	51R–510K	£7·50
	2%	560K–2M	£16·50
	2%	10R–91R	£18·50
TR8	2%	100R–100K	£10·50
	2%	110K–1M5	£17·50

Qty.—P.O.A. P. & P. 25p/100

PLEASE ADD VAT AFTER P. & P.
AUDIO ACCESSORIES & BARGAIN COMPONENT PAKS
SEMICONDUCTOR STOCKIST
Callers Welcome (Mon.–Fri.) or send stamp for lists.

Barrie Electronics Ltd.

3, THE MINORIES, LONDON EC3N 1BJ
TELEPHONE: 01-488 3316/7/8
NEAREST TUBE STATIONS: ALDGATE & LIVERPOOL ST

Marshall's

A. Marshall (London) Ltd Dept. PW
42 Cricklewood Broadway London NW2 3ET Tel: 01-452 0161/2
Telex: 21492
& 85 West Regent St Glasgow G2 2QD Tel: 041-332 4133
& 1 Straits Parade Fishponds Bristol BS16 2LX
Tel: 0272 654201/2
& 27 Rue Danton Issy Les Moulineaux Paris 92 Tel: 644 2356
Catalogue price 25p Trade and export enquiries welcome

Our range covers over 7,000 items. The largest selection in Britain

Top 200 IC's TTL, CMOS & Linears

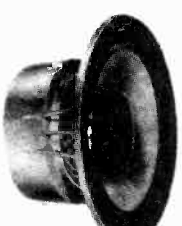
								SN74151	68p
CA3020A	£1·80	CD4049	45p	NE555V	70p	SN7442	65p	SN74153	68p
CA3028A	79p	CD4050	45p	NE556	£1·30	SN7446	84p	SN74154	£1·20
CA3035	£1·37	CD4510	£1·25	NE560	£4·48	SN7447	80p	SN74157	76p
CA3046	70p	CD4511	£1·94	NE565	£4·48	SN7448	90p	SN74160	88p
CA3048	£2·11	CD4516	£1·25	SL414	£2·35	SN7450	16p	SN74161	88p
CA3052	£1·62	CD4518	£1·87	SL610C	£2·35	SN7451	16p	SN74162	88p
CA3089E	£1·96	CD4520	£1·87	SL611C	£2·35	SN7453	16p	SN74163	88p
CA3090Q	£4·23	LM301A	48p	SL612C	£2·35	SN7454	16p	SN74164	£1·60
CA3130	88p	LM308	£1·17	SK620C	£3·50	SN7460	16p	SN74165	£1·60
CD4000	18p	LM309K	£1·88	SL621C	£3·50	SN7470	29p	SN74167	£3·30
CD4001	18p	LM380	98p	SL623C	£5·24	SN7472	21p	SN74174	99p
CD4002	18p	LM381	£2·07	SL640C	£4·00	SN7473	31p	SN74175	70p
CD4006	99p	LM702C	75p	SN7400	16p	SN7474	31p	SN74176	£1·14
CD4007	18p	LM709	38p	SN7401	16p	SN7475	45p	SN74180	£1·10
CD4008	82p	TO99	38p	SN7401AN	29p	SN7476	30p	SN74181	£1·95
CD4009	52p	8DIL	45p	SN7402	16p	SN7480	42p	SN74190	£1·86
CD4010	52p	14DIL	38p	SN7403	16p	SN7481	£1·00	SN74191	£1·86
CD4011	18p	LM710	47p	SN7404	19p	SN7482	65p	SN74192	£1·15
CD4012	18p	LM723C	66p	SN7405	19p	SN7483	82p	SN74193	£1·15
CD4013	45p	LM741C	40p	SN7406	36p	SN7484	95p	SN74196	£1·60
CD4014	89p	TO99	40p	SN7407	36p	SN7485	£1·00	SN74197	£1·58
CD4015	89p	8DIL	40p	SN7408	19p	SN7486	29p	SN74198	£1·80
CD4016	45p	14DIL	38p	SN7409	18p	SN7490	42p	SN74199	£1·80
CD4017	88p	LM747	£1·05	SN7410	16p	SN7491	75p	SN76003N	£2·92
CD4018	88p	LM748		SN7411	20p	SN7492	45p	SN76013N	£1·95
CD4019	52p	8DIL	44p	SN7412	22p	SN7493	45p	SN76023N	£1·60
CD4020	88p	14DIL	41p	SN7413	26p	SN7494	75p	SN76033N	£2·92
CD4021	88p	LM3900	61p	SN7416	28p	SN7495	68p	TAA263	£1·20
CD4022	85p	LM7805	£1·88	SN7417	28p	SN7496	68p	TAA300	£1·84
CD4023	18p	LM7812	£1·99	SN7420	16p	SN74100	£1·10	TAA350A	£1·96
CD4024	72p	LM7815	£1·99	SN7423	23p	SN74107	30p	TAA550	32p
CD4025	19p	LM7824	£1·99	SN7425	23p	SN74118	85p	TAA611C	£2·18
CD4027	43p	MC1303L	£1·50	SN7427	23p	SN74119	£1·75	TAA621	£2·03
CD4028	83p	MC1310P	£2·50	SN7430	15p	SN74121	32p	TAA661B	£1·03
CD4029	£1·06	MC1330P	90p	SN7432	22p	SN74122	42p	TBA641B	£2·25
CD4030	52p	MC1351P	80p	SN7437	28p	SN74123	65p	TBA651	£1·69
CD4031	98p	MC14553	£4·07	SN7438	28p	SN74141	75p	TBA800	89p
CD4037	88p	MC1466L	£3·50	SN7440	16p	SN74145	72p	TBA810	98p
CD4041	70p	MC1469R	£2·75	SN7441AN	68p	SN74150	£1·20	TBA820	80p

London, Glasgow, Paris and now BRISTOL It's our service that makes us grow

POPULAR SEMICONDUCTORS

2N696	22p	2N3906	19p	AF139	65p	BD139	71p	MPSA56	31p
2N697	16p	2N4037	42p	AF239	65p	BD140	87p	OC28	£1·48
2N698	82p	2N4036	67p	AF240	90p	BF115	29p	OC35	£1·16
2N699	59p	2N4058	18p	AF279	70p	BF117	55p	OC42	50p
2N706	14p	2N4062	15p	AF280	79p	BF154	20p	OC45	32p
2N708	17p	2N4289	34p	AL102	£1·00	BF159	27p	TIP29A	49p
2N916	28p	2N4920	£1·10	BC107	14p	BF180	35p	TIP29C	80p
2N918	32p	2N4921	83p	BC108	14p	BF181	36p	TIP31A	62p
2N1302	18½p	2N4923	£1·00	BC109	14p	BF184	30p	TIP32A	74p
2N1304	26p	2N5245	29p	BC147B	10p	BF194	12p	TIP33A	£1·01
2N1306	31p	2N5294	48p	BC148B	9p	BF195	12p	TIP34A	£1·51
2N1308	47p	2N5296	48p	BC149B	11p	BF196	13p	TIP35A	£2·90
2N1711	27p	2N5457	29p	BC157A	16p	BF197	15p	TIP36A	£3·70
2N2102	60p	2N5458	26p	BC158A	16p	BF198	18p	TIP41A	79p
2N2147	78p	2N5459	29p	BC167B	15p	BF244	21p	TIP42A	90p
2N2148	94p	2N6027	45p	BC168B	15p	BF257	47p	TIP2955	98p
2N2218A	47p	3N128	73p	BC169B	15p	BF258	53p	TIP3055	50p
2N2219A	52p	3N140	£1·00	BC182	12p	BF259	55p	TIS43	28p
2N2220	25p	3N141	81p	BC182L	12p	BF561	27p	ZTX300	13p
2N2221	18p	3N200	£2·49	BC183	12p	BF598	25p	ZTX301	13p
2N2222	20p	40361	40p	BC183L	12p	BFR39	24p	ZTX500	15p
2N2369	20p	40362	45p	BC184	13p	BFR79	24p	ZTX501	13p
2N2646	55p	40406	44p	BC184L	13p	BFX29	32p	ZTX502	18p
2N2904	40p	40407	35p	BC212A	16p	BFX30	34p	IN914	3½p
2N2905	47p	40408	50p	BC212LA	16p	BFX84	30p	IN3754	15p
2N2906	33p	40409	52p	BC213LA	15p	BFX85	35p	IN4007	10p
2N2907	22p	40410	52p	BC214LB	18p	BFX88	30p	IN4148	4p
2N2924	20p	40411	£2·00	BC237B	16p	BFY50	30p	IN5404	22p
2N2926G	12p	40594	74p	BC238C	15p	BFY51	28p	IN5408	30p
2N3053	25p	40595	84p	BC239C	15p	BFY52	20½p	AA119	8p
2N3054	60p	40636	£1·10	BC257A	15p	BRY39	48p	BA102	25p
2N3055	65p	40673	73p	BC258B	16p	ME0402	20p	BA145	18p
2N3391	28p	AC162	20p	BC259B	17p	ME0412	18p	BA154	12p
2N3392	15p	AC127	40p	BC301	34p	ME4102	11p	BA155	12p
2N3393	15p	AC128	35p	BC307B	17p	MJ480	95p	BB103B	23p
2N3440	59p	AC151	27p	BC308A	15p	MJ481	£1·20	BB104B	45p
2N3442	£1·40	AC152	49p	BC309C	20p	MJ490	£1·05	BY126	12p
2N3638	15p	AC153	35p	BC327	23p	MJ491	£1·45	BY127	15p
2N3702	12p	AC176	41p	BC328	22p	MJ2955	£1·00	BYZ11	51p
2N3703	13p	AC187K	35p	BCY70	17p	MJE340	48p	BYZ12	51p
2N3704	15p	AC188K	40p	BCY71	22p	MJE370	65p	OA47	6p
2N3706	15p	AD143	68p	BCY72	18p	MJE371	75p	OA81	18p
2N3708	14p	AD161	69p	BD121	£1·00	MJE520	60p	OA90	6p
2N3714	£1·38	AD162	69p	BD123	82p	MJE521	70p	OA91	6p
2N3716	£1·80	AF106	40p	BD124	67p	MJE2955	£1·20	OA200	8p
2N3771	£2·20	AF109	40p	BD131	40p	MJE3055	75p	BY164	57p
2N3773	£2·65	AF115	35p	BD132	50p	MP8113	47p	ST2diac	20p
2N3789	£2·06	AF116	35p	BD135	21p	MPF102	39p	40669	£1·00
2N3819	37p	AF117	35p	BD136	22p	MPSA05	25p	TIC44	29p
2N3820	29p	AF118	35p	BD137	24p	MPSA06	31p	C106D	65p
2N3904	19p	AF124	30p	BD138	26p	MPSA55	21p	ORP12	60p

Prices correct at March, 1976, but all exclusive of VAT. P.&P. 25p



WILMSLOW AUDIO

THE Firm for speakers!

SPEAKERS

Baker Group 25, 3, 8 or 15 ohms	£8·64
Baker Group 35, 3, 8 or 15 ohms	£10·25
Baker Group 50/12 8 or 15 ohms	£14·00
Baker Group 50/15 8 or 15 ohms	£18·62
Baker Deluxe 12" 8 or 15 ohms	£13·75
Baker Major 3, 8 or 15 ohms	£11·87
Baker Superb 8 or 15 ohms	£18·12
Baker Regent 12" 8 or 15 ohms	£10·00
Baker Auditorium 12" 8 or 15 ohms	£16·25
Baker Auditorium 15" 8 or 15 ohms	£21·56
Celestion G12M 8 or 15 ohms	£12·95
Celestion G12H 8 or 15 ohms	£15·95
Celestion G12/50 8 or 15 ohms	£16·50
Celestion G12/50TC 8 or 15 ohms	£18·00
Celestion G15C 8 or 15 ohms	£26·95
Celestion G18C 8 or 15 ohms	£34·50
Celestion HF1300 8 or 15 ohms	£7·75
Celestion HF2000 8 ohms	£9·50
Celestion MH1000 8 or 15 ohms	£13·50
Celestion CO3K	£4·95
Decca London ribbon horn	£32·00
Decca London CO/1000/8 Xover	£7·50
Decca DK30 ribbon horn	£19·06
Decca CO/1/8 Xover (DK30)	£5·00
EMI 14 x 9 Bass 8 ohms 14A770	£13·25
EMI 8 x 5, 10 watt, d/cone, roll surr.	£3·95
EMI 6½" d/cone, roll surr. 8 ohms	£4·37
EMI 8 roll surr. bass	£6·37
EMI 5" mid range	£3·50
Elac 59RM109 (15) 59RM114 (8)	£3·44
Elac 6½" d/cone, roll surr. 8 ohms	£4·06
Elac 10" 10RM239 8 ohms	£3·95
Eagle Crossover 3000hz 3, 8 or 15 ohm	£1·75
Eagle FR4	£6·12
Eagle FR65	£9·62
Eagle FR8	£12·31
Eagle FR10	£15·62
Eagle HT15	£4·40
Eagle HT21	£6·81
Eagle MHT10	£4·44
Eagle FF28 multicell. horn	£9·00
Fane Pop 15, 8 or 16 ohm	£5·25
Fane Pop 25T, 8 or 16 ohm	£7·50
Fane Pop 33T, 8 or 16 ohm	£8·75
Fane Pop 50, 8 or 16 ohm	£12·00
Fane Pop 55, 8 or 16 ohm	£15·50
Fane Pop 60, 8 or 16 ohm	£17·25
Fane Pop 70, 8 or 16 ohm	£18·75
Fane Pop 100, 8 or 16 ohm	£25·95
Fane Crescendo 12A, 8 or 16 ohms	£34·50
Fane Crescendo 12BL, 8 or 16 ohms	£36·50
Fane Crescendo 15/100A, 8 or 16 ohms	£47·50
Fane Crescendo 15/125, 8 or 16 ohms	£57·95
Fane Crescendo 18, 8 or 16 ohms	£62·95
Fane 910 Mk II horn	£14·95
Fane 920 Mk II horn	£33·95
Fane HPX1 crossover 200 watt	£2·50
Fane 13 x 8, 15 watt dual cone	£5·50
Fane 801T 8" d/c, roll surr.	£9·95
Goodmans Axent 100	£8·44
Goodmans Audiom 100 15 ohm	£13·90
Goodmans Audiom 200 8 ohm	£13·90
Goodmans Axiom 402 8 or 15 ohm	£20·00
Goodmans Twinaxiom 8, 8 or 15 ohm	£10·55
Goodmans Twinaxiom 10, 8 or 15 ohm	£10·95
Goodmans 8P 8 or 15 ohm	£5·95
Goodmans 10P 8 or 15 ohm	£6·25
Goodmans 12P 8 or 15 ohm	£13·95
Goodmans 12PG 8 or 15 ohm	£15·95
Goodmans 12PD 8 or 15 ohm	£16·95

SPEAKERS

Goodmans 12AX 8 or 15 ohm	£36·50
Goodmans 15AX 8 or 15 ohm	£40·00
Goodmans 15P 8 or 15 ohm	£22·50
Goodmans 18P 8 or 15 ohm	£39·00
Goodmans Hifax 750P	£16·00
Goodmans 5" midrange 8 ohm	£4·50
Gauss 12" 200 watt	£73·00
Gauss 15" 200 watt	£83·00
Gauss 18" 200 watt	£110·00
Jordan Watts Module 4, 8 or 15 ohm	£17·06
Kef T27	£6·06
Kef T15	£6·94
Kef B110	£8·37
Kef B200	£9·50
Kef B139	£16·95
Kef DN8	£2·31
Kef DN12	£5·99
Kef DN13 SP1015 or SP1017	£4·50
Lowther PM6	£27·50
Lowther PM6 Mk 1	£29·95
Lowther PM7	£48·00
Peerless KO10DT 4 or 8 ohms	£8·06
Peerless DT10HFC 8 ohms	£9·18
Peerless KO40MRF 8 ohms	£10·31
Peerless MT225HFC 8 ohms	£3·12
Richard Allan CA12 12" bass	£22·00
Richard Allen HP8B	£13·25
Richard Allan LP8B	£9·25
Richard Allan DT20	£6·75
Richard Allan CN8280	£18·00
Richard Allan CN820	£3·50
Richard Allan Super disco 60W 12"	£16·95
Richard Allen CG15 15" bass	£30·50
Richard Allen Super Disco 10" 50 watt	£13·25
Richard Allen Super Disco 8" 50 watt	£12·95
Radford BD25	£18·44
Radford MD9	£11·50
Radford MD6 dome mid range	£12·50
Radford TD 3	£8·06
Radford Crossover network	£14·25
BD25 Mk II	£20·95
STC 4001G	£6·56
Tannoy 10" HPD	£75·00
Tannoy 12" HPD	£81·95
Tannoy 15" HPD	£97·95
Wharfedale Super 10 RS/DD 8 ohms	£15·00
Castle 8 RS/DD	£10·31

SPEAKER KITS

Baker Major Module 3, 8 or 15 ohms	each	£14·75
Goodmans DIN 20 4 or 8 ohms	each	£14·75
Goodmans Mezzo Twin Kit	pair	£47·19
Helme XLK 20	pair	£15·00
Helme XLK 30	pair	£19·00
Helme XLK 35	pair	£24·00
Helme XLK 40	pair	£35·00
Helme XLK 50	pair	£56·00
KEF kit 1	pair	£53·00
KEF kit III	each	£48·00
Peerless 20-2	each	£17·44
Peerless 30-2	each	£24·38
Peerless 20-3	each	£26·56
Peerless 50-4	each	£40·50
Peerless 3-15	each	£17·19
Peerless 1060	pair	£56·00
Peerless 1070	each	£46·00

SPEAKER KITS

Peerless 1120	each	£50·00
Richard Allan Twin assembly	each	£14·95
Richard Allan Triple 8	each	£22·50
Richard Allan Triple 12	each	£27·95
Richard Allan Super Triple	each	£32·50
Richard Allan RA8 Kit	pair	£42·00
Richard Allan RA82 Kit	pair	£66·00
Richard Allan RA82L Kit	pair	£73·00
Fane Mode One Mk2	each	£11·50
Wharfedale Linton II kit	pair	£23·12
Wharfedale Glendale 3XP	pair	£58·00
Wharfedale Glendale 3XP kit	pair	£58·00
Wharfedale Dovedale III kit	pair	£63·12

HI-FI ON DEMONSTRATION

in our showrooms

Akai, Armstrong, Bowers & Wilkins, Castle, Celestion, Dual, Goodmans, Kef, Leak, Pioneer, Radford, Richard Allan, Rotel, Tandberg, Trio, Videotone Wharfedale etc.—Ask for our HiFi price list!

Complete RADFORD range in stock, Amplifiers, Preamps, power amps, low distortion oscillator, distortion measuring set etc.

All items guaranteed new and perfect. Prompt despatch.

PRICES INCLUDE V.A.T. & ARE CORRECT AT 30.1.76

Carriage: 50p per speaker. (12" and over 75p each)
Tweeters, crossovers 30p each
Kits 80p each (£1·60 pair)

Send stamp for free booklet "Choosing a speaker".

COMPLETE KITS IN STOCK FOR **RADFORD STUDIO 90, MONITOR 180, STUDIO 270, STUDIO 360, HIFI ANSWERS MONITOR, HIFI NEWS NO-COMPROMISE, WIRELESS WORLD TRANSMISSION LINE, PRACTICAL HIFI AND AUDIO (GILES) MONITOR ETC.**

Construction leaflets for Radford, Kef, Jordan Watts, Tannoy etc. free on request.

P.A. Amplifiers, microphones etc. by Linear, Shure, Eagle, Beyer, AKG etc.

FREE with orders over £10—"HiFi Loudspeakers Enclosures" Book

WILMSLOW AUDIO

Dept. PW

Loudspeakers: Swan Works, Bank Square, Wilmslow, Cheshire P.A., HiFi etc: 10 Swan St. Wilmslow.

HIFI, Radio etc: Swift of Wilmslow, 5 Swan St. Wilmslow. Telephone Wilmslow 29599 (speakers) 26213 (HiFi etc)

it's the complete answer!

SEE SYSTEM 7000 AT OUR SHOWROOMS OR SEND FOR LOCAL STOCKIST LIST

New! TWO STROBES TO MEET ALL REQUIREMENTS

SUPERSTROBE

- Built in Saxon reliability
- 1 flash/2 secs.—up to 20/sec.
- Compact black Bondene case
- Appearance matches other Saxon units
- Ideal for the mobile disco or smaller club

PRO-STROBE

- Giant 80 watt tube
- Discharge energy up to 6 Joules
- External trigger—audio up to 240v
- May be used with Soundlite to obtain rainbow strobe
- Smart, tough Bondene case 8″ × 8″ × 5″ approx (20cm × 200cm × 13cm)

SUPERSTROBE £24·75
PRO-STROBE £38·50

New! 150 WATT LIQUID WHEEL PROJECTOR

- Complete with wheel
- 150 watt tungsten lamp
- Wide range of extra effects may be attached
- Sturdy construction
- Adjustable feet

£29·20

Spare wheels £4·90

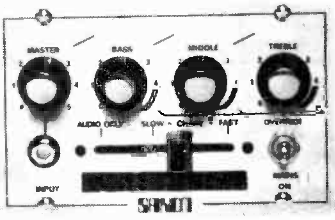
TOTAL CONTROL WITH SYSTEM 7000 LIGHTING CONTROL UNIT

- Full control of 3KW of lights (1KW/channel)
- Audio control *plus* sequence *plus* override
- Variable speed sequence with slider function control
- Stainless steel two tone panel—matches mixer
- 13 transistors 8 diodes—advanced control circuitry
- High audio sensitivity—operates from any amplifier
- Attractive Bondene case—free standing or panel mounting
- Individual tone controls *plus* master audio control

This exciting unit offers the performance of units offered at nearly twice the price.

£38·00

inc. case & plug—ready to use.



SUPERFECT MODULE

This P.C.B. sub-assembly of the System 7000 lighting control unit is recommended for those wishing to incorporate Saxon's excellent specs. in their own systems.

- All features as the System 7000 lighting control unit
- Requires only panel and plug socket, etc.
- Slider control supplied
- Glass fibre P.C.B.
- 8 amp RCA triacs
- Complete light show in one unit with instructions

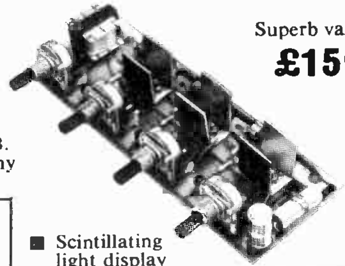
£27·75

SAXON SOUND-LITE

Our outstandingly successful 3kW converter in module form

- Up to 1kW/channel
- Individual tone controls
- Master control
- RCA 8A triacs
- Glass fibre P.C.B.
- Operates from any amplifier
- Scintillating light display

Superb value at **£15·50**



REFLECTORPOD

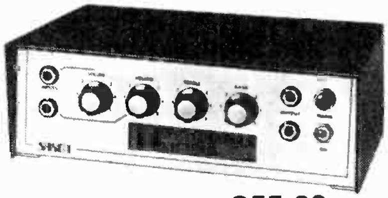
3 way light banks with twin plug socket complete with reflector lamps—attractive Bondene case with white front. **£15** each

SPECIAL OFFER—Reflector lamps (spots) 100W Red/Blue/Green £1·40 ea. or 10 for £12

SYSTEM 7000 MINOTAUR

THE LITTLE AMPLIFIER WITH THE BIG HEART

- 100W INTO 8 OHMS
- Twin mixed inputs
- Wide range bass and treble controls
- May be used as a slave amplifier
- Twin output sockets
- Two tone anodised front panel
- Fully protected against incorrect loads



With bondene cover **£49·00** With Vynide covered wooden case **£53·00**

CHASSIS LOUDSPEAKERS 12″ 50 WATT HIGH-GRADE SAXON UNITS WITH 14,000 GAUSS MAGNET *PLUS* PRESENCE DOME ONLY £14·50 EACH FULL RANGE *PROFESSIONAL QUALITY*

Ask for a quotation for a complete system to *your* specification—Systems from £280·00—consoles from £160

We stock a fine selection of consoles, loudspeaker cabinets, etc.,

Access Buy it with Access

BARCLAYCARD

Access or Barclaycard? Send or telephone your number for prompt attention. After 5.0 p.m., ring our Answerphone service on 01-684 6385

PRICES include carr. and packing but VAT at 8% must be added to all orders. C.O.D. 65p extra— SAE with all enquiries. CALLERS are welcome at our showrooms at **327-333 Whitehorse Road, Croydon, Surrey. CRO 2HS**

Orders by post to the same address—Please make cheques or crossed P.O.'s payable to

SAXON ENTERTAINMENTS LTD.

Telephone: 01-684 6385/0098

Shop Hours 9am-5pm Lunch 12.30-1.30 Sat. 9.30am-5pm. Mail Order desk 10am-4pm Mon.-Fri.
Prices and specifications subject to alteration without notice

Bona-fide trade enquiries to NORMAN ROSE ELECTRICAL LTD., London (01) 837 9111 Manchester (061) 273 1498 Birmingham (021) 236 4710 Bradford 0274 26104

VAT No. 218 6921 49 RGD England 1091993

"I MADE IT MYSELF"

Imagine the thrill you'll feel! Imagine how impressed people will be when they're hearing a programme on a modern radio you made yourself.

Now! Learn the secrets of radio and electronics by building your own modern transistor radio!

Practical lessons teach you sooner than you would dream possible.

What a wonderful way to learn—and pave the way to a new, better-paid career! No dreary ploughing through page after page of dull facts and figures. With this fascinating Technatron Course, you learn by building!

You build a modern Transistor Radio . . . a Burglar Alarm. You learn Radio and Electronics by doing actual projects you enjoy—making things with your own hands that you'll be proud to own! No wonder it's so fast and easy to learn this way. Because learning becomes a hobby! And what a profitable hobby. Because opportunities in the field of Radio and Electronics are growing faster than they can find people to fill the jobs!

No soldering—yet you learn faster than you ever dreamed possible.

Yes! Faster than you can imagine, you pick up the technical know how you need. Specially prepared step-by-step lessons show you how to: read circuits—assemble components—build things—experiment. You enjoy every minute of it!

You get everything you need. Tools. Components. Even a versatile Multimeter that we teach you how to use. All included in the course. AT NO EXTRA CHARGE! And this is a course anyone can afford. (You can even pay for it by easy instalments).

So fast, so easy, this personalised course will teach you even if you don't know a thing today!

No matter how little you know now, no matter what your background or education, we'll teach you. Step by step, in simple easy-to-understand language, you pick up the secrets of radio and electronics.

You become somebody who makes things, not just another of the millions, who don't understand. And you could pave the way to a great new career, to add to the thrill and pride you receive when you look at what you have achieved. Within weeks you could hold in your hand your own transistor radio. And after the course you can go on to acquire highpowered technical qualifications, because our famous courses go right up to City & Guilds levels.

Send now for FREE 76 page book—see how easy it is—read what others say!

Find out more now! This is the gateway to a thrilling new career, or a wonderful hobby you'll enjoy for years. Send the coupon now. There's no obligation.

POST TODAY FOR FREE BOOK

To: ALDERMASTON COLLEGE
DEPT. CPW 16, READING RG7 4PF — CPW16

Also at our London Advisory Office, 4 Fore Street Avenue, Moorgate, London, EC2Y 5EJ Tel: 01-628 2721

Yes, I'd like to know more about your course. Please send me free details—plus your big, 76-page book that tells about all your courses.

Name ....

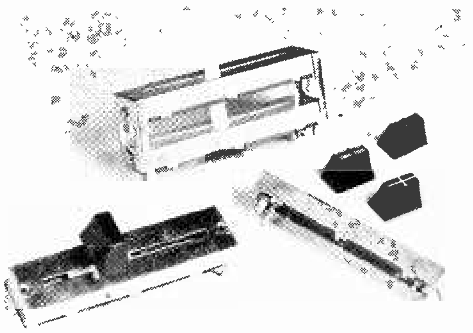
Address ....

POST CODE ....

BIET

HOME OF BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

CARBON SLIDE POTENTIOMETERS



60mm Single Track including Black Knob **60p** (inc. V.A.T.), 60mm Twin Track including Black Knob **70p** (inc. V.A.T.), 60mm Quad Slide Potentiometers—Prices upon application. 1K, 5K, 10K, 25K, 50K, 100K, 500K ohms Log, Lin, Antilog. Metal Case. 3·2db Matched Track. 15mV Nominal Noise (B.S. 2122). Life Exceeds 20,000 cycles. Fixing Holes 2 x M3 on 80mm Centres.

Designed, Manufactured and Supplied by:—

RIVLIN INSTRUMENTS LTD

DOMAN ROAD, CAMBERLEY, SURREY GU15 3DJ

Send cash with order to above address. Postage and packing 20p per order. Trade enquiries invited. Come and see us at the

HANOVER FAIR, HALL 12, STAND 2115

INDUSTRIAL PRICES FOR THE HOBBYIST
ALL 'BIG NAME' BRANDED GOODS
SAME OAY SERVICE
MONEY BACK REFUND

I/C's			£		£
		CD4015AE	0.70	CD4043AE	0.69
	£	CD4016AE	0.37	CD4044AE	0.62
CA3028A	0.64	CD4017AE	0.70	CD4045AE	0.93
CA3035	1 10	CD4018AE	0.70	CD4046AE	0.88
CA3046	0.57	CD4019AE	0.37	CD4047AE	0.60
CA3048	1 40	CD4020AE	0.74	CD4048AE	0.37
CA3052	1.00	CD4021AE	0.70	CD4049AE	0.37
CA3089E	1.60	CD4022AE	0.65	CD4050AE	0.37
CA3090Q	1.50	CD4023AE	0.14	L005T1	1.17
CD4000AE	0.14	CD4024AE	0.50	L036T1	1.17
CD4001AE	0.14	CD4025AE	0.14	LM3091C	1.25
CD4006AE	0.80	CD4026AE	1.14	TAA621	1.76
CD4009AE	0.37	CD4027AE	0 37	TAA661B	1.14
CD4010AE	0.37	CD4028AE	0.60	TBA651	1.03
CD4011AE	0.14	CD4029AE	0.75	TBA800	0.89
CD4012AE	0.14	CD4030AE	0.37	TBA810	1.00
CD4013AE	0.37	CD4037AE	0.63	TBA820	0.60
CD4014AE	0.70	CD4041AE	0.56	741c(Minidip)	0.18
TRANSISTORS			£		£
		2N4036	0.43	40636	0.91
	£	2N4037	0.35	40673	0.46
2N696	0.15	2N5296	0.30	BC107	0.06
2N706	0.10	3N128	0.61	BC108	0.06
2N1711	0.18	3N140	0.76	BC109	0.06
2N2102	0.56	3N141	0.68	BC237	0.05
2N2369	0.10	40360	0.33	BCY70	0.09
2N2905	0.27	40361	0.31	BCY71	0.18
2N3053	0.14	40362	0.33	BCY72	0.09
2N3054	0.30	40406	0.31	BFX29	0.26
2N3055	0.35	40407	0.28	BFX30	0.29
2N3440	0.24	40408	0.41	BFX84	0.21
2N3442	1.32	40409	0.43	BFX85	0.26
2N3702	0.12	40410	0.43	BFX88	0.22
2N3703	0.12	40411	1.82	BFY50	0.18
2N3704	0.15	40594	0.59	BFY51	0.17
2N3706	0.14	40595	0.69	BFY52	0.18
2N3708	0.12			OC35	0.35
DIODES/ZENERS			£		£
	£	IN4005/6/7	0 04	BZY88 400mW.	
IN/4001/2/3/4	0.03	IN4148	0.15	All voltages	0.06
				OA47	0.05

Terms: C.W.O. Add 10p P/P 8% VAT Cos/Mos
25% VAT OTHER
Send SAE for comprehensive Cos/Mos List.

ROWNSGEM LTD.

Rosebank Parade, Plough Road, Yateley, Camberley, Surrey.
Phone No. 0252 871388

THE PROFESSIONAL ORGANISATION FOR THE 'HOBBYIST'

Frequencies for all

THE Regional Administrative LF/MF Broadcasting Conference (Regions 1 and 3) was held in Geneva last autumn and, among other things, considered the frequency allocations on those bands and it is good to report that the UK seems to have come out of the affray quite well. In Europe and those African and Asian countries bordering on the Mediterranean the use of these broadcasting bands is at present governed by the European Broadcasting Convention and the Copenhagen Plan, negotiated in 1948. Delegations from 103 countries took part in the conference, the UK delegation including representatives of the BBC, the IBA and the Home Office.

The conference produced an Agreement and Plan which was signed by all but three of the delegations. Other member countries may accede later. The Plan is due to come into effect on 23 November 1978 and is intended to meet requirements for at least the following ten years. Charles Molloy has more to say about the frequency allocations in his Broadcast Bands column.

Let us hope that the radio amateurs will do as well in the World Administrative Radio Conference in 1979. It may seem strange to some that anybody should be worrying about a meeting that will not take place for some three and a half years. But a great deal of work must be done before the UK delegation can depart with a long list of the frequencies and other facilities that have been requested by every user of the radio spectrum in the UK. The radio amateur's case will, of course, be formulated by the Radio Society of Great Britain and every amateur here can be assured that they will do the best job possible in this respect.

Every amateur can help the cause by complying with his licence conditions, in particular by observing what should be normal good behaviour when on the air. There are those around who would be only too happy to snatch some of the amateur's frequencies in order to further their commercial interests. Bad behaviour on the air is playing straight into their hands.

It is a matter for regret that the number of licensed amateurs in the UK who belong to the RSGB is very much less than the ideal 100%. The answer surely must lie in the organisation of the Society. The present set-up should be reviewed and the sooner the better. If the planners of the new National Exhibition Centre saw fit to place the Centre outside London then the RSGB should take up its Headquarters and do likewise!

NEWS...

Solar Energy Watch

LASKYS have imported what is believed to be the world's first digital watch, incorporating a wrist-based calculator and powered by solar energy.

It is called the Uranus Time Computer and represents "the State of the Art" in digital integrated circuit technology.

The watch function displays, on command, hours, minutes, day of the month and seconds.

The calculator is four-function, +, ×, ÷, −, machine with an 8-digit display, full floating decimal and automatic stand.

The Time Computer contains a solar cell which draws its power from sunlight, daylight or artificial light. The batteries, therefore, never need replacing.

The heart of the Time Computer is a tiny encapsulated "chip" of silicon containing many thousands of transistors and other active electronic devices. (It is available to special order for £295 including VAT.)

The Uranus Time Computer is on special display at *Laskys 481 Oxford Street* store.

Hold very tight please!

THE passengers on the top decks of 30 buses operated by the Scottish Bus Group will be getting music-while-they-ride now. A firm called Sounds in Motion Ltd. have installed Pye auto-reversing cassette players to provide the music.

Alexandra Palace

AS an alternative to the usual Woburn Abbey Rally, the Radio Society of Great Britain is arranging to hold an exhibition at Alexandra Palace, North London, on 30 and 31 July and 1 August, 1976.

The site has very adequate car parking and outdoor facilities. Full catering exists within the building.

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

Diary Dates

March 8-14. Festival International du Son, Paris.
March 9-11. Electro-Optics/Laser International Conference and Exhibition, Metropole Convention Centre, Brighton.
March 9-11. Computermarket 76 Exhibition, Assembly Rooms, Edinburgh.
March 16-18. Computermarket 76 Exhibition, The Forum, Wythenshawe.
March 18-28. 23rd International Exhibition of Electronics, Nuclear Energy and Aerospace Technology, Rome.
March 23-25. CAD 76—Computer Aided Design Conference and Exhibition, Imperial College, London.
March 23-25. Computermarket 76 Exhibition, New Horticultural Hall, London.
March 24-26. Third Conference on Industrial Robot Technology and Sixth International Symposium on Industrial Robots, The University, Nottingham.
April 5-10. International Component Show, Paris.
April 13-15. All-Electronics Show, Grosvenor House, London.
April 26-30. IFSSEC 76—International Fire Security & Safety Exhibition and Conference, Olympia, London.
April 27 to May 2. Hi-Fidelity 76 Exhibition, Heathrow Hotel, London Airport.
April 28 to May 6. Hanover Fair, Hanover.
May 3-7. IEA 76—International Instruments, Electronics and Automation Exhibition, National Exhibition Centre, Birmingham.
May 3-7. Electrex 76—Electrical Engineering Exhibition, National Exhibition Centre, Birmingham.
May 23-27. International Home Electronics and Domestic Appliance Exhibition (AMDEA/BREMA), National Exhibition Centre, Birmingham.
May 28-31. Sound and Vision 76 TV and Audio Show, National Exhibition Centre, Birmingham.
June 8-11. Communications 76 Exhibition and Conference, Metropole Convention Centre, Brighton.
June 8-12. Internavex International Audio-visual Aids Exhibition, Olympia, London.
July 5-8. International Conference on Automobile Electronics (IEE), Savoy Place, London.
July 20-22. Conference on Video and Data Recording (IERE), The University, Birmingham.
Aug 24-26. Education and Communication Technology Exhibition, Holland Park School, London.
Sept 13-17. Micro 76—International Symposium and Exhibition of Microscopes and Ancillary Equipment, Wembley.
Sept 13-19. 21st International Audio Festival and Fair, Olympia, London.
Sept 14-16. Eurocomp—European Computing Congress, Heathrow Hotel, London Airport.
Sept 20-24. IBC 76—International Broadcasting Convention, Grosvenor House, London.
Oct 19-21. Internepcon/UK Electronic Production Conference and Exhibition, Metropole Convention Centre, Brighton.
Oct 26-29. Microforum International Exhibition, Conference Centre, Wembley.
Nov 16-18. International Minicomputer Conference and Exhibition, West Centre Hotel, London.

Man of Vision

THE University of Strathclyde recently mounted an exihibition, "Man of Vision", as a Jubilee tribute to John Logie Baird, 1888-1946, the inventor of television and a distiguished former student, who fifty years ago showed the world's first pictures by television. "Man of Vision" occupied the University's Collins Exhibition Hall in Richmond Street, Glasgow, from December 18, 1975 till January 30, 1976, and for the first time assembled under one roof a comprehensive display of Logie Baird's unique television and other equipment supported by personal, photographic, written and other memorabilia spanning his incredibly active lifetime.

Bipolar Proms and Roms

INTEL have published a 36-page booklet which provides technical information on 13 different ROMs and 24 different PROM types they manufacture. All the devices in the booklet are of Schottky bipolar construction and erasable PROMs and not included.

The booklet incorporates a data sheet for each device, and equivalents chart and gives details of PROM programming equipment.

For every Intel ROM there is a pin and performance compatible PROM, which means that no circuit changes have to be made when a project is finalised and information in PROM is committed to mask-programmed ROM.

All Intel PROMs employ polysilicon fuses which coat the surrounding area in a protective oxide layer when they are 'blown'. With polysilicon fuses there is no danger of a fuse 'growing back' as has happened before with conventional metal fuses.

Intel Corporation (UK) Ltd., Broadfield House, 4 Between Towns Road, Cowley, Oxford OX4 3NB.

International Conference

THE Institute of Physics is organising a Conference to mark the 50th Anniversary of the Discovery of Electron Diffraction. The Conference will be held on 19-22 September 1977 at Imperial College, London. It is the intention of the organisers that all aspects of electron diffraction should be covered with emphasis in specific areas such as crystal structure determination and surface structure studies. Plenary sessions will be introduced by review lectures from eminent personalities.

There will be an exhibition of equipment held concurrently with the Conference.

For further information please contact: *The Meetings Office, The Institute of Physics, 47 Belgrave Square, London SW1X 8QX.*

AUTOMATIC SLIDE SYNCHRONISER

Alan C. AINSLIE

MANY amateur photographers like to play music while presenting a slide show. With the increased popularity of semi-automatic projectors it is fairly simple to synchronise the slide changes to a recorded commentary or music. The conventional method of synchronisation involves recording tones on one track of the stereo tape machine with the commentary on the other. The commentary is played back in mono while the tones are used to close a relay connected to the slide projector remote control circuit.

OPERATION

We shall first consider the general requirements for a tape-slide synchroniser before dealing with the details of the electronics. A tone is generated at a nominal frequency of say 18kHz. This tone is generated continuously and so must be 'gated' to the output whenever the command to change slides is to be recorded. The signal is recorded for the same length of time no matter how brief the push of the slide change button. This necessitates that a form of monostable oscillator be incorporated.

The length of time that the playback relay is closed determines whether the slide projector changes forwards or backwards. Generally, closure for over one second causes the projector to change backwards to the previous slide. Therefore by using a record monostable it is possible to record reversing tones on the tape as well as forward. The detection of the 18kHz tone from the tape playback (which includes fundamentals, high harmonics and hiss) is a rather difficult task. A narrow bandwidth sensitive detector is needed. This function is provided by a 567 phase-locked loop IC. An additional feature of the synchroniser unit is that the monostable can be switched into an astable and so be used to change slides independently at preselected intervals for continuous unattended showing.

CIRCUIT DESCRIPTION

The heart of the unit is IC1, the 567 PLL device. VR1 sets the VCO frequency at about 18kHz. A square wave at the VCO frequency is available from a fairly low impedance at pin 5. The VCO is running continuously and is very stable. When recording, S1 is used as the slide change button to record bursts of the 18kHz tone on the tape. When VR2 is at minimum resistance, S2, which is mechanically ganged to VR2, is open. The 555, IC2, then operates as a monostable with the output at pin 3 normally low. Closing S1, earths pin 2 which is normally held to a slightly positive potential by R8. C10 then charges through R11 and D2 while the output at pin 3 goes high, closing the relay. After about 0·5s, C10 will have charged to 2/3Vcc and the output together with pin 7 will go low. C10 discharges through R9 and VR2 (which is at minimum resistance) to wait the next 'change' command.

Keeping S1 closed for longer than the natural monostable period holds the output high until the button is released enabling a long burst of tone to be recorded for reverse slide changes etc. Diodes D4 and D3 prevent pin 3 of the 555 going negative

Photograph showing the front panel of the Slide Synchroniser. The rotary knob marked 'Repeat' is VR2/S2 and the switch marked 'Change' is S1.

★ components list

Resistors

R1	4·7kΩ	R10	2·2kΩ
R2	10kΩ	R11	2·7kΩ
R3	2·2kΩ	R12	10kΩ
R4	10kΩ	R13	15kΩ
R5	10kΩ	R14	4·7kΩ
R6	680Ω	R15	47kΩ
R7	10kΩ	R16	10kΩ
R8	2·2MΩ	R17	47kΩ
R9	2·2kΩ	R18	10kΩ
VR1	22kΩ skeleton preset	VR2	500kΩ lin ganged with S2
VR3	200kΩ panel preset		

All resistors ¼ or ½W 10%

Capacitors

C1	1nF	C4	4·7nF
C2	1nF	C5	100nF
C3	100nF	C6	10μF
C7	100μF	C11	1nF
C8	100nF	C12	1nF
C9	10μF	C13	4·7nF
C10	100μF	C14	2200μF

Semiconductors

IC1	NE567V	D4	1N914
IC2	NE555V	D5	1N4002
D1	1N914	D6	1N4002
D2	1N914	LED1	TIL209
D3	1N914		

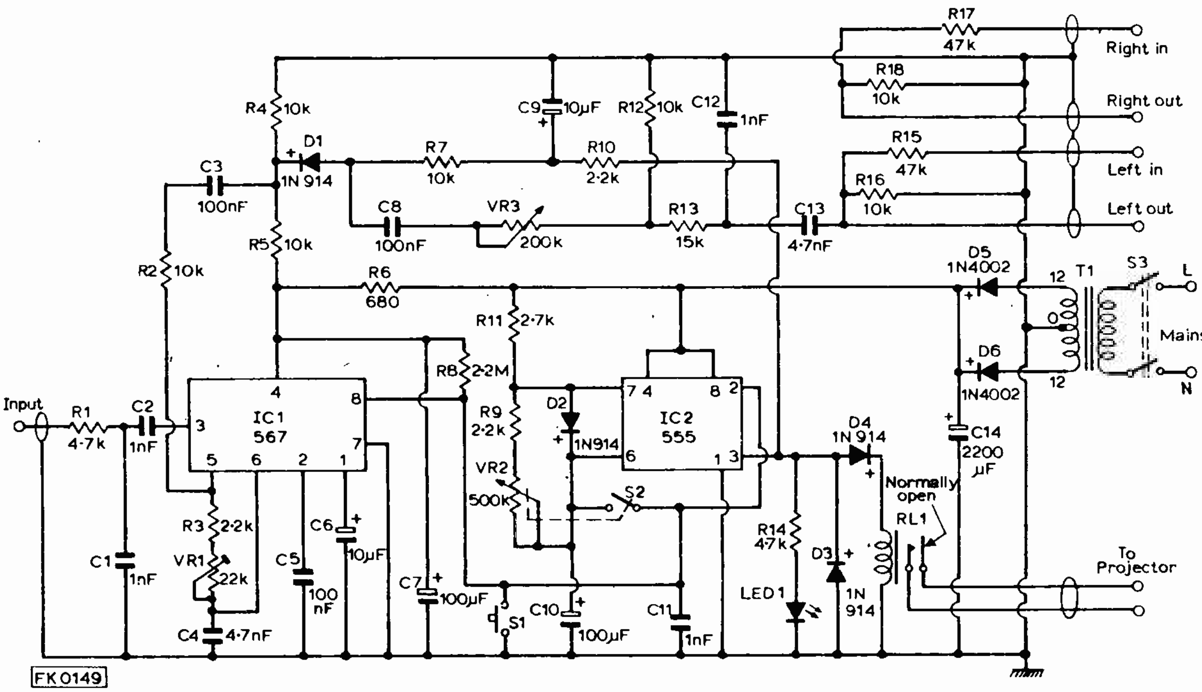
Miscellaneous

RL1, 12V 100mA max. contacts normally open with rating to suit projector. T1, 12-0-12V 100mA mains transformer. S1, switch push-to-close. S2, on/off ganged to VR2. S3, Double pole mains on/off switch. Phono sockets, plugs, leads, knob and case to suit.

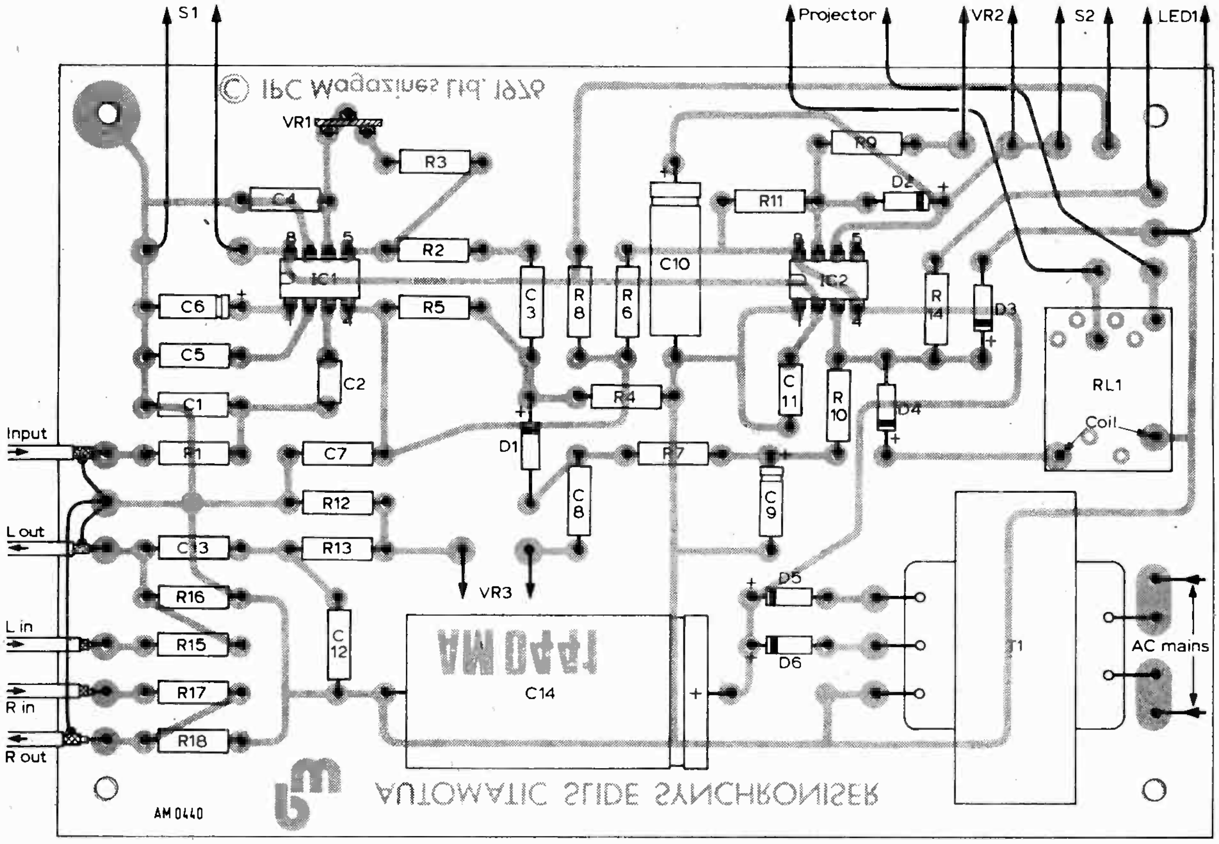
when driving the inductive load which can cause 'latch-up'. LED1 is used to show that a slide change signal has been generated or has been received when playing back.

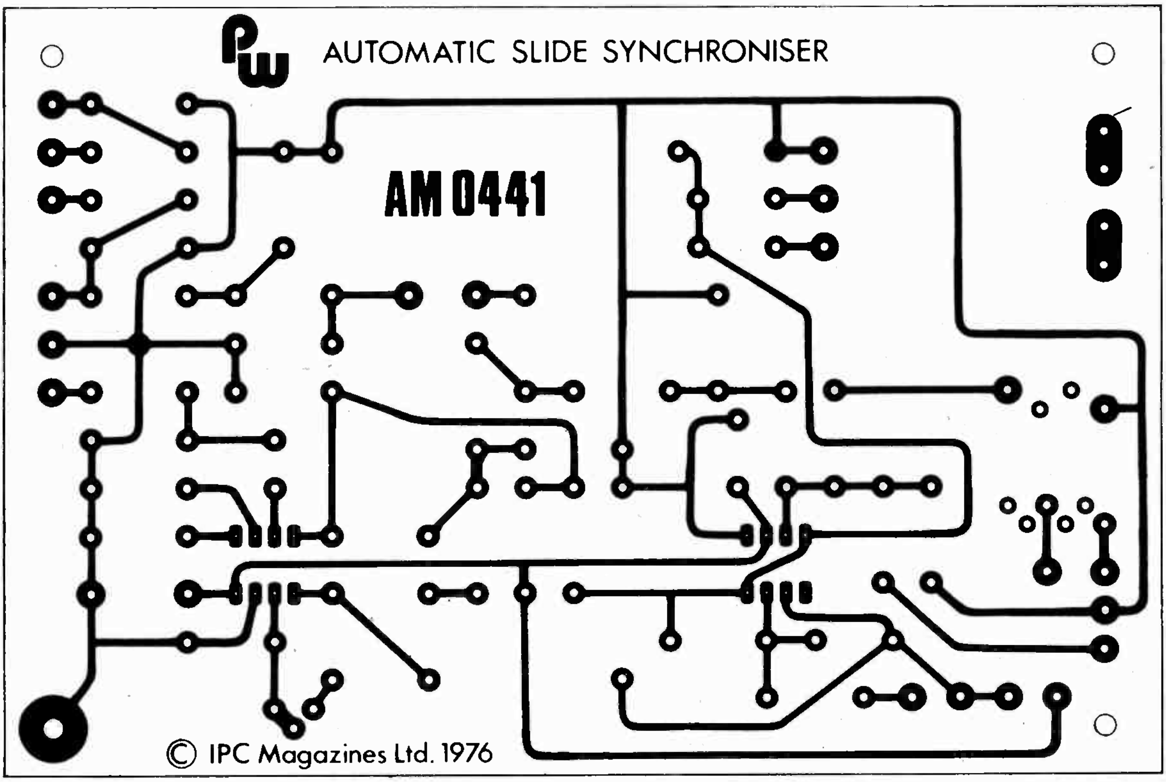
The tone at pin 5 of the 567 is gated to the output by diode D1. The cathode is fixed at about half the supply voltage of the 567, while the anode is normally at zero volts via R7 and R10. Thus the diode is normally reverse biased and cannot pass any signal. When the 555 switches, the relay on. pin 3 goes to almost the full supply voltage. The anode of D1 is thus pulled positive. C8 is the output capacitor from the gate. C9 prevents the gate switching too fast and so avoids the generation of clicks or thuds in the output.

VR3 and R12 form a potential divider for the gated tone, with VR3 setting the tone recording level. R13 and C12 form an integrator to remove some of the harmonics from the square wave and so give a sawtooth. The gated tone is mixed with the audio signal by C13 feeding into the junction of R15/R16 which form a potential divider for the left signal.



Circuit diagram of the complete unit, showing the two IC's. IC1 is a 567 phase-locked-loop device and IC2 is a 555 monolithic timing device. RL1 may be any 12V 100mA relay with at least one pair of normally-open contacts.





The printed circuit board above is shown full size and accommodates all the components of the circuit. The hole spacings for RL1 are those for the RS Components 'continental' series type 40 relay, although with careful redrilling another suitable relay may be used.

PLAYBACK DETECTION

Having got the signal on the tape, all that remains is to detect it on playback. The 567 PLL is a fairly sensitive device requiring only 20mV of tone burst to start the PLL capture process. At small inputs (less than 200mV) the PLL bandwidth decreases with decreasing signal input. C5 sets the bandwidth to be 5% or 6% with a signal just above the detection threshold. C6 controls the response of the output stage while R1, C1 and C2 form a very simple band-pass filter centred about 18kHz to reduce the possibility of the 567 detecting low frequency signals. Even pure signals below the VCO frequency can be detected if they are large enough, as the input stage is a clipper and so generates harmonics. The output of the 567 goes low for the duration of the tone, once the loop has locked (which takes typically a few μS), and so fires the 555 in the same way as closing the 'change' switch S1.

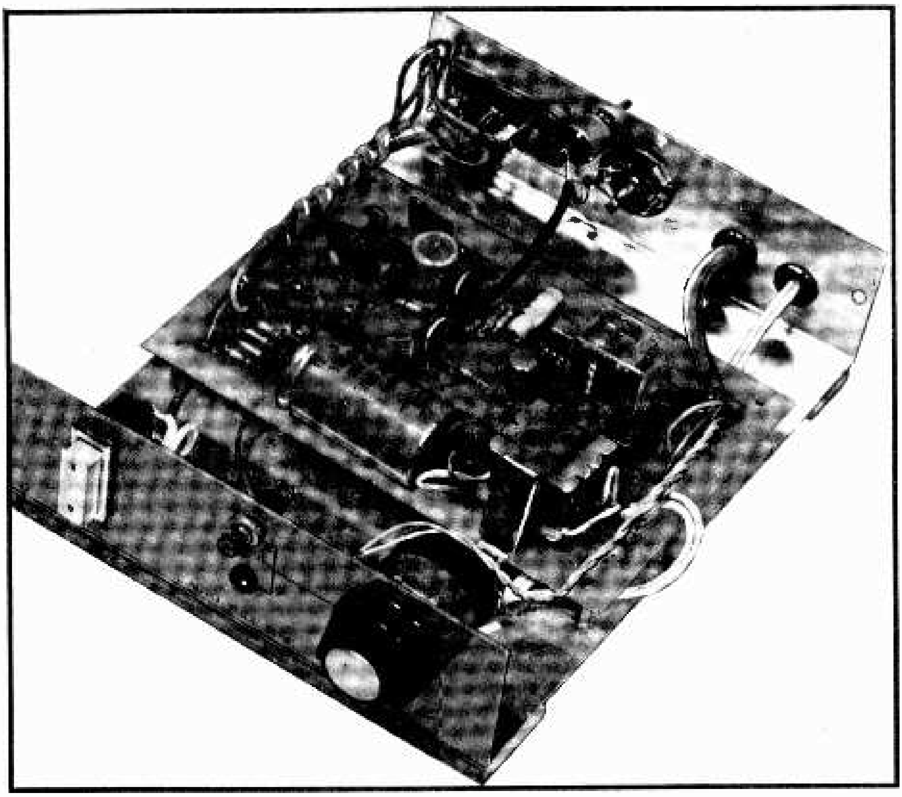
Should a pulse be missed during playback due to dirty heads, S1 still functions and allows the projectionist to catch up with the sound track manually. In the absence of a playback connection, VR2 can be turned clockwise, S1 closed and the 555 will operate as an astable of period set by VR2 over the range of 2s to about 30s. Thus the unit can be used to give repeated slide changes for demonstration and unattended showing. In the astable mode, C10 charges via R11 and D2 while pin 3 is high. When the voltage at pin 6 reaches 2/3 of the supply voltage then the output, and pin 7 go low. C10 now discharges through VR2 and R9 until pin 2 falls below 1/3 of the supply voltage. The output then goes high and the cycle repeats.

The power supply for the unit is very simple. The 555 timing is independent of the supply voltage as is the VCO in the 567. A stabilised supply therefore is not required. The supply to the 555 is about 12V or 13V while the supply to the 567 has to be limited to no more than 10V. This is accomplished by R6 with C7 for decoupling.

CONSTRUCTION

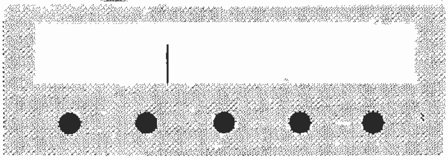
The slide synchroniser is a fairly complex unit and is fairly difficult to build other than by means of a printed panel. The layout is shown full size in Fig. 2. The connections to the relay will of course depend on the actual relay used. The board, with the layout marked in resist, is etched washed, and the resist removed with a solvent or paint stripper. Holes are then drilled with a number 60 drill (except those for VR1 and possibly C14 and RL1 which may need to be larger). The completed PCB in the prototype was mounted on 10mm stand-offs on a 'U' shaped chassis 150mm wide and 205mm deep. The front and back were bent up by 45mm to form the front and rear panels.

The rear panel has three phono sockets mounted on it (two for left and right inputs, one for the playback signal input) as well as three holes for the mains lead, lead to the projector and a pair of screened leads terminated in phono plugs to connect to the tape recorder input. These holes are fitted with grommets to protect the cables. The three sockets are connected with screened cable with the shields earthed at the securing screw for the tape replay input socket. The electronics are also earthed at this point with a short lead from the point on the print to which the braiding of the S1 lead is connected. The braidings of the screened output leads are earthed at the terminal adjacent to C13. A mains earth is not used as this could introduce earth loop problems. *continued on page 1038*



General layout view of the chassis, front and rear panels and sockets. The basic chassis is simply a piece of aluminium bent to a 'U' shape.

converting early MONO FM Tuners to STEREO



KEITH CUMMINS

THERE are in existence a considerable number of older valve tuners, such as Quad, Leak, Rogers, Armstrong, etc., which are still giving good service. However, stereo decoders for these tuners are no longer available and the writer has frequently been involved with their modification to stereo operation.

Generally the conversions have been "one-offs" with each situation being individually assessed, bearing in mind the availability of suitable decoders. Mullard have now released their LP1400 stereo decoder module, which is physically small and lends itself ideally to modifications of the type referred to, especially as it needs no alignment or other adjustments. The typical input impedance of the LP1400 is around 150kΩ which is quite suitable for connection to either a ratio detector or Foster-Seeley discriminator. It must be remembered, however, that any de-emphasis network at the output of the discriminator **must be removed.**

TRANSMISSION THEORY

A very brief discourse on the principles of stereo broadcasting would not be inappropriate at this point. Let us call the two stereo channels A and B. The FM transmitter is modulated in the normal way with a signal consisting of A and B added together (A+B). Non-stereo receivers will produce this signal only, which, being the left- and right-hand channels added, provides normal mono reception. This arrangement ensures system compatibility. The audio bandwidth of this signal extends to 15kHz.

In order to produce the stereo information, the A and B signals are subtracted, and used to modulate a sub-carrier at 38kHz. This double sideband signal therefore consists of (A−B) modulation. If the transmitted signal is monophonic, i.e. A=B, then A−B=0 and the 38kHz information vanishes completely, since the subcarrier is suppressed in the absence of "difference signal" modulation.

In order to receive and decode the suppressed subcarrier information, it is necessary to re-insert the missing 38kHz signal at the receiver. To enable this to be done simply, an unmodulated pilot tone at 19kHz is transmitted. As will be seen from Fig.1, this signal slots in between the extremes of the sidebands of the sum and difference signals. The 19kHz signal is doubled in the decoder to provide the missing 38kHz subcarrier, which is then combined with its sidebands. The difference signal can then be demodulated.

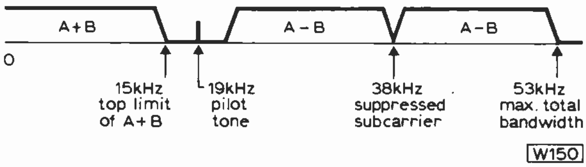


Fig. 1: Frequency spectrum of stereo Multiplex signal. The (A + B) signal provides the normal mono reception.

In order to recover the original A and B signals, a simple algebraic manipulation is carried out. To obtain A, the (A+B) and (A−B) signals are added together: (A+B)+(A−B)=2A. To obtain B, they are subtracted. (A+B)−(A−B)=(A+B)+(B−A) =2B.

Thus, we can recover the original A and B signals (the digit 2 represents a scaling factor). It will be realised that the presence or absence of the 19kHz pilot determines whether the broadcast is stereo or mono. Usually a stereo beacon lamp is provided which lights up when the decoder is presented with a stereo signal. The foregoing description applies to the Zenith-GE multiplex FM stereo broadcast system as used in the UK and Europe.

SIGNAL STRENGTH

The bandwidth spectrum of the stereo broadcast signal, Fig.1, is considerably wider than that employed for mono. Because of this, any noise present in the system will have a greater interfering effect. The noise in the upper modulation frequency area is much greater than in the lower region and in the process of decoding, this noise is shifted into the audio range and added to the output signal. In order to achieve an equivalent signal-to-noise ratio, about five times the signal is needed on stereo, compared to mono. Therefore it may be necessary to improve the aerial arrangements if stereo reception is to be entirely satisfactory.

Since the recovered A and B signals contain difference signal (A−B) components in opposite phase, the noise in the two output channels will be predominantly of opposite phase. As a result, we can revert to mono by shorting the A and B outputs together after the decoder, when the stereo noise will cancel. In our application of the LP1400 module, this method works well, so that we can "mono" the

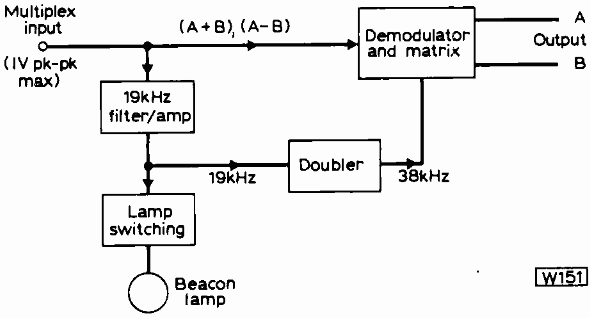


Fig. 2: Block diagram showing the basic circuits of a stereo decoder.

signal at the amplifier control unit or preamplifier without needing to employ the "stereo inhibit" input to the decoder. A block diagram, illustrating the action of the decoder is shown in Fig.2.

TUNER MODS

Readers will appreciate that "pre-emphasis" of the higher modulating frequencies is applied at the FM transmitter. When de-emphasis is applied at the receiver, the system noise is attenuated in the same proportion. A mono tuner will include a de-emphasis network after the discriminator, and as this would effectively remove the 38kHz difference signal, it is essential that the network be removed when the decoder is fitted. The reader is advised to look for components with 50μs time-constant (the de-emphasis figure) e.g. 47kΩ and 1nF, see Fig.3. When these components have been removed the discriminator

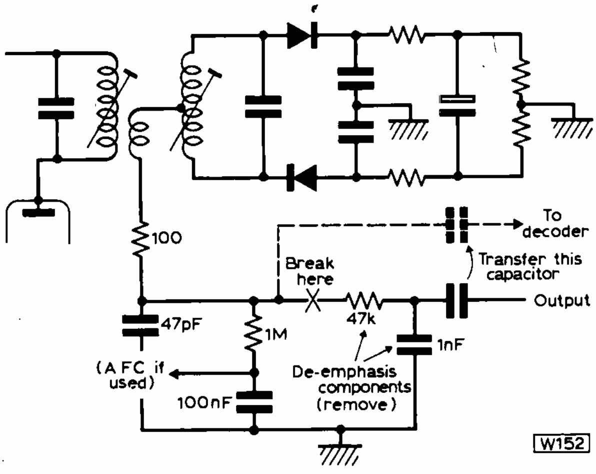


Fig. 3: A typical ratio detector circuit of a valve tuner. Note the removal of the de-emphasis components and the new take-off point.

output can be connected directly to the input of the decoder.

A complete circuit is shown in Fig.4. The low voltage supply is derived from the tuner's HT supply by the use of a resistor R4 and zener stabiliser D1. This simple approach is appropriate where only an HT rail and low voltage heater feed are available. Care should be taken to place the resistor in a position where it can dissipate its heat adequately and feed the circuit from the point where the HT comes into the tuner. Capacitor C3 provides additional filtering of the module power supply.

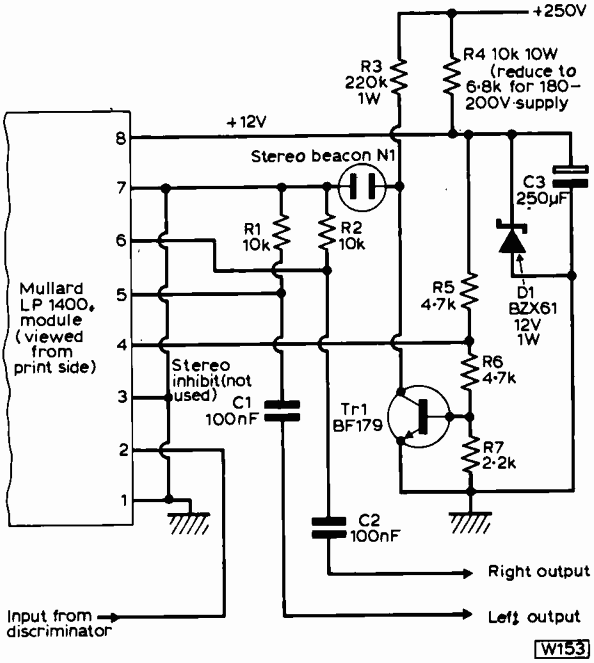


Fig. 4: For correct operation, the Mullard LP1400 module should be connected to a valve tuner, as shown above. The +12V supply to the module is derived from the tuners HT supply via R4, and stabilised by D1 and C3.

STEREO BEACON

The module is designed to feed a filament lamp as the stereo beacon. Unfortunately no suitable power supply for this is found in the average valve tuner, so a neon indicator is used instead. The filament lamp would normally connect between the supply rail and point 4 on the decoder. Upon reception of stereo, point 4 switches to earth, so turning the lamp on. The neon indicator operates as follows: Transistor Tr1 is turned on, in the absence of a stereo signal, by the base current feed from +12V via R5 and R6 (point 4 is switched open within the decoder). As a result, Tr1 is bottomed and the whole HT voltage is dropped across R3. When a stereo signal is received, point 4 switches to earth and the absence of a source of base current stops Tr1 conducting. The collector voltage then rises until the striking voltage of N1 is reached. The neon lamp then lights, indicating stereo reception.

The neon circuit has the advantage that only one transistor is needed and one side is earthed. This makes the mounting easier, in that the cap can be soldered to a bracket bolted to the chassis. The reader will have his own ideas on where to mount the neon, although a favourite place is at one end of the tuning dial.

The 10kΩ resistors R1 and R2 are needed to prevent clipping at the output. Note that the decoder module has an overall gain of 6dB under these conditions. If this is too much, R1 and R2 should be replaced by 10kΩ potentiometers so that the levels can be adjusted as required. Note that C1 and C2 are essential to isolate the DC present at the output of the decoder assuming that the unit is to feed the typically high input impedance of a valve preamplifier.

ADJUSTMENTS

In some cases it may be found that the stereo separation is unsatisfactory resulting from the tuner IF bandwidth being too narrow to accommodate all the sidebands of the difference signal. **Careful** stagger-tuning of the IF transformers will enable the bandwidth to be increased and so provide adequate stereo effect. The reader is cautioned **NOT** to attempt adjustments on the decoder board itself, since these will have been correctly carried out during manufacture.

When mounting the decoder in a tuner, make sure that it cannot move and accidently touch the HT supply! This can be an expensive mistake. The positioning should be such that adequate ventilation is provided to prevent overheating. If the unit is to be wired in using the stand-up leads, the print to the edge connector can be cut. This part of the board can then be drilled to accommodate a fixing bracket.

The Mullard LP1400 module can be obtained from Chromosonic Electronics, see ads. PW

CQ!CQ!CQ!CQ!

ISSUES WANTED

..P.W. March to May 1970 (synthesiser article).—J. O'Connor, 23 Rugby Close, Newcastle, Staffs., ST5 3JN.

..two copies of P.W. dealing with the Progressive S.W. Receiver.—T. R. Smith, 7 Purbeck Court, Park Barn, Guildford.

..P.W. for May 1953, January, March, April, August, September 1952, March, November and December 1950 and all copies 1945–1949.—J. Luxton, Bergheim, Battery Hill, Fairlight Cove, Hastings, TN35 4AP.

..issues of P.W. at beginning of 1971 with details of Stereo Tape Recorder.—C. Raymond, 4 St. Augustine's Road, Canterbury, Kent, CT1 1XP.

..May 1972 P.W. also supplement in same issue on transistors.—E. Barton, Maggieknockater, Craigellachie, Banffshire, AB3 9RA.

..issues of P.W. containing articles on metal detectors.—J. O'Connor, 19 Greenbank Road, Hoole, Chester, CH2 3RW.

..April 1972 issue of P.W. containing circuits of a transistor tester.—R. Murdoch, 5 Banks Road, Mt. Wellington, Auckland 6, New Zealand.

AUTOMATIC SLIDE SYNCHRONISER—

continued from page 1035

SETTING UP

With mains applied, a voltage check should show about 13V or 14V on pin 8 of the 555 and about 8V on pin 4 of the 567. With VR2 fully anticlockwise (S2 open), pushing S1 briefly should cause the relay to pull-in and the LED to light for about 0·5s. Keeping S1 depressed should hold in the relay. With the relay held in, the output leads are connected to the input of the tape recorder. With R8 at minimum and the recorder left hand input control turned up, a deflection should be noted on the VU meter. Switching the monitor to 'source' enables one to hear the signal from which the tone burst is derived. With VR1 at maximum the tone should be clearly audible. Decreasing VR1 takes the tone up in frequency. VR1 should be set so that the tone is just out of the audible range. S1 is now released to cut off the tone.

The leads that previously carried the tape recorder input signal from the amplifier are now plugged in to the two phono sockets on the back of the synchroniser. The recorder level controls are set to give a normal recording level. Leaving the recorder level controls untouched the audio signal leads are unplugged from the back of the synchroniser. S1 is now pressed and VR3 adjusted to give a reading of slightly less than −20VU on the left hand channel (about 6 or 7% of fsd).

A trial recording is now made of the tone at this level and played back with the left channel tape recorder output connected to the synchroniser tape replay input. Playback of a continuous tone should make the PLL lock-on and the LED light, as well as pulling in the relay. If the playback does not cause the loop to lock, VR3 will have to be reduced in value (assuming that the tape recorder output is turned up full). If this fails then it may well be that the recorder has dirty/magnetised heads or is incorrectly biased.

If all is well and the PLL picks out the replay tone then it is necessary to experiment with VR3 to ensure that there is a reasonable safety margin while on the other hand the recorded signal is not any higher in level than necessary. The tone is recorded at such a low level (−20VU) primarily because the equalisation of the recording amplifier causes the gain to increase with frequency very quickly above 10kHz. Hence the record amplifier is rather susceptible to overload at the frequency used.

When VR2 is turned away from its fully counterclockwise extreme the relay should switch on for 0·5s repeating at intervals of between 2s and about 30s.

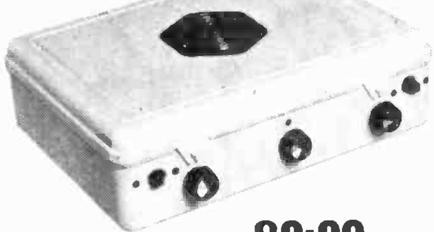
IN USE

The synchroniser is connected between the normal recorder input leads and the tape machine as detailed in the setting-up instructions. With the recorder input level controls set to produce a normal recording level (same position as when synchroniser was set up) every push of the 'change' button records the change tone. If the projector is coupled to the unit it is possible to run through the slide sequence while recording the tones. If a three head tape machine is used it is important that the tape replay input is not connected during recording, as the PLL will lock on to the replayed tones and produce a random series of tone bursts. PW

RADIO EXCHANGE LTD.

ALL PRICES INCLUDE VAT

NEW EDU-KIT MAJOR



Completely Solderless Electronic Construction Kit. Build these projects without soldering iron or solder

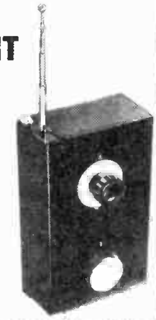
★ 4 Transistor Earpiece Radio
★ Signal Tracer
★ Signal Injector
★ Transistor Tester NPN-PNP
★ 4 Transistor Push Pull Amplifier
★ 5 Transistor Push Pull Amplifier
★ 7 Transistor Loudspeaker Radio MW/LW
★ 5 Transistor Short Wave Radio
★ Electronic Metronome
★ Electronic Noise Generator
★ Batteryless Crystal Radio
★ One Transistor Radio
★ 2 Transistor Regenerative Radio
★ 3 Transistor Regenerative Radio
★ Audible Continuity Tester
★ Sensitive Pre-Amplifier

Components include: 24 Resistors ★ 21 Capacitors ★ 10 Transistors ★ 3½in Loudspeakers ★ Earpiece ★ Mica Baseboard ★ 3 12-way connectors ★ 2.Volume controls ★ 2 Slider Switches ★ 1 Tuning Condenser ★ 3 Knobs ★ Ready Wound MW/LW/SW Coils ★ Ferrite Rod ★ 6½ yards of wire ★ 1 Yard of sleeving, etc. Complete kit of parts including construction plans.

Total Building Costs £9·99

P & P+Ins. 65p. (Overseas Seamail P & P £3·50)

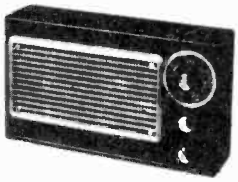
VHF AIR CONVERTER KIT



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

All Parts including Case and Plans. **£4·35** P & P and Ins. 40p.

NEW Everyday Series



Build this exciting new series of designs.

E.V. 5. 5 Transistors and 2 diodes. MW/LW. Powered by 4½ volt Battery. Ferrite rod aerial, tuning condenser, volume control, and now with 3" loudspeaker. Attractive case with red speaker grille. Size 9" × 5½" × 2¼" approx. All parts including Case and Plans.

Total Building costs **£4·75** P & P + Ins. 50p

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

Total Building costs **£5·50** P & P + Ins. 55p

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

Total Building Costs **£7·05** P & P + Ins. 55p

ROAMER TEN MARK 2

WITH VHF INCLUDING AIRCRAFT

Now with free earpiece and switched socket. 10 transistors. Latest 5" × 3" loudspeaker. 9 tuneable wavebands, MW1, MW2, LW, SW1, SW2, SW3, trawler band, VHF and local stations, also aircraft band. Built in ferrite rod aerial for MW/LW. Chrome plated. 6 section telescope aerial, can be angled and rotated for peak short wave and VHF listening. Push pull output using 600mW transistors. Car aerial. 10 transistors plus 3 diodes. Ganged tuning condenser with VHF section. Separate coil for aircraft band. Volume on/off. Wave change and tone controls. Attractive Case in rich chestnut shade with Gold Blocking. Size: 9" × 7" × 4". Easy to follow instructions and diagrams. Total building costs

£11·87 P & P + Ins. 65p

POCKET FIVE

NOW WITH 3" LOUDSPEAKER

3 Tuneable wavebands. M.W., L.W., and Trawler Band, 7 stages, 5 transistors and 2 diodes, supersensitive ferrite rod aerial, attractive black and gold case. Size 5¼" × 1¼" × 3½" approx.
All Parts including Case and Plans.

Total Building Costs **£3·99** P&P+Ins. 50p.

EDU-KIT

Build Radios, Amplifiers, etc. from easy stage diagrams.

Five units including master unit to construct.

Components include: Tuning Condenser: 2 Volume Controls: 2 Slider Switches: Fine tone 3" moving coil Speaker: Terminal Strip: Ferrite Rod Aerial: Battery Clips: 4 Tag Boards: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ¼" Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction.

All Parts including Case and Plans **£6·99** P & P+ Ins. 55p

ELECTRONIC CONSTRUCTION KITS

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

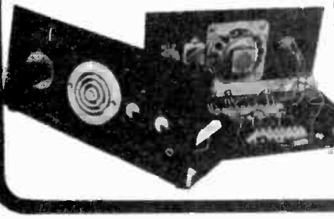
£7·95 P & P and Ins. 55p.

ECK 4 7 Transistors, 6 tuneable wavebands, MW, LW, TrawlerBand, 3 Short Wave Bands. Receiver Kit. With 5" × 3" Loudspeaker. Push/Pull output stage, Gain Control, and Rotary Switch. 7 Transistors and 4 Diodes. 6 section chrome-plated telescopic aerial. 8" Sensitive Ready Wound Ferrite Rod Aerial. Tuning Capacitor. Resistors, Capacitors, etc. Operates from a 9 Volt PP7 Battery (not supplied with kit). Complete kit of parts including construction plans. **£7·25** P & P and Ins. 55p.

JIFFY TESTER

Easy to build and operate. Fits in the pocket. A quick checker for continuity of resistors, chokes, diodes, transistors, circuit wiring (not mains) and loudspeakers. Complete with earpiece, jack plug and socket resistors, capacitors, components, etc. Complete kit of parts including construction plans. **£3·15** P & P+ Ins. 30p

EDU-KIT JUNIOR



Completely Solderless Electronic Construction Kit. Build these projects without Soldering Iron or Solder.

★ Crystal Radio Medium Wave Coverage — No Battery necessary.
★ One Transistor Radio.
★ 2 Transistor Regenerative Radio.
★ 3 Transistor Earpiece Radio Medium Wave Coverage.
★ 4 Transistor Medium Wave Loudspeaker Radio.
★ Electronic Noise Generator
★ Electronic Metronome.
★ 4 Transistor Pull/Pull Amplifier.

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

£7·25 P & P+ Ins. 55p

RADIO EXCHANGE LTD

ALL PRICES INCLUDE VAT

TO RADIO EXCHANGE LTD., 61A HIGH STREET, BEDFORD MK40 1SA. 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 ....

....

PW476

TRANSIENT DISTORTION in Audio Amplifiers

A. FOORD

THE generation of total harmonic and intermodulation distortion in power amplifiers is well known. These types of non-linear distortion may be reduced by negative feedback. However it has been shown that a form of transient distortion can be produced when the open-loop frequency response of the power amplifier is less than the frequency response of the preamplifier. This article discusses why transient distortion is produced, and how it may be eliminated by careful design of the complete amplifier.

BANDWIDTH LIMITATIONS

A complete audio amplifier can be divided into two main sections, pre-amplifier and power amplifier, as in Fig. 1. The preamplifier section may be subdivided for equalisation, tone controls, etc. Any feedback loops in the preamplifier will be over two, or at the most, three transistors.

However, the power amplifier will have a feedback loop enclosing three or more stages. In addition the small signal transistors in the preamplifier will have a much greater gain-bandwidth product than the higher power transistors used in the power amplifier. These factors usually result in the power amplifier determining the frequency response and distortion of the complete amplifier. Typically the power amplifier open-loop frequency response without feedback, may be as low as 1kHz, even though its closed-loop frequency response with feedback, may be over 20kHz.

NEGATIVE FEEDBACK

Before these topics can be discussed in any detail it is essential to understand the basic properties of a feedback amplifier, Fig. 2. The open-loop gain of an amplifier, $-A$, is the gain with the feedback loop disconnected. The minus sign indicates that the amplifier inverts. The amount of signal fed back is less than unity and B is called the feedback ratio. The closed-loop gain is the overall gain when the feedback path is closed and is given by:—

$$\text{Closed loop gain} = G = \frac{VO}{VI} = -\frac{A}{1 + AB} \text{ times}$$

For example, if the gain without feedback is 100 times, and the feedback ratio is 0·1, then the closed loop gain is:

$$G = -\frac{100}{1 + (100 \times 0{\cdot}1)} = -\frac{100}{11} = -9{\cdot}09 \text{ times.}$$

This illustrates the very important point that the gain with feedback is approximately $1/B$, when the product AB is much greater than unity, i.e. $G \doteqdot -1/B$, if $AB > 1$. In this example the overall gain is REDUCED by a factor of approximately ten times, while the bandwidth is INCREASED by the same factor.

NON-LINEAR DISTORTION

Conventional non-linear distortion arises because of the non-linearities of the input/output transfer characteristics which occur in all physical systems. The distortion produced by a given non-linearity depends on its shape and the nature of the signals. For example, a transfer characteristic such as Fig. 3(a) would cause no distortion of any sinewave having a peak value less than unity, whereas larger sinewaves would be severely distorted. However the transfer characteristic of Fig. 3(b) would severely distort music or small sinewaves, while larger sinewaves would scarcely be distorted at all.

Since musical signals are small most of the time

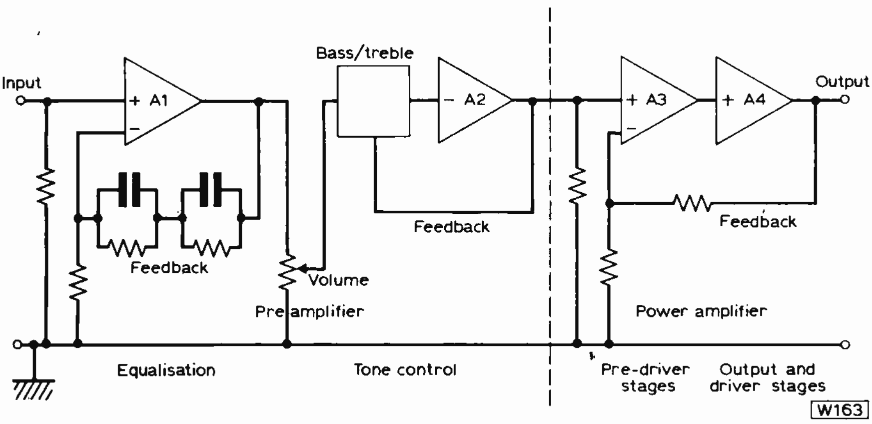


Fig. 1: This block diagram shows the two main sections of a complete amplifier. Three feedback loops, as shown, are typical of a working amplifier.

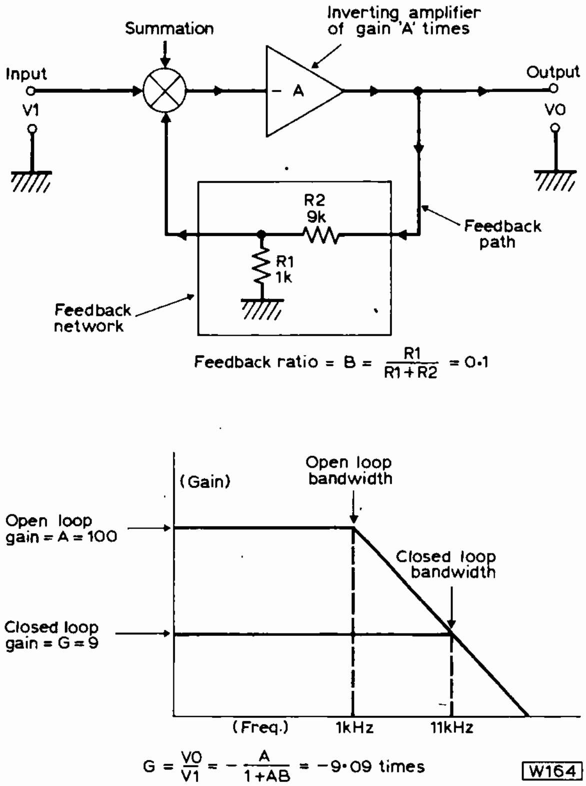


Fig. 2: Properties of an amplifier to which negative feedback is applied

exceeding the RMS value only 15% of the time, a harmonic distortion measurement at full amplifier power has little meaning. Certainly harmonic distortion measurements at lower levels are of much greater importance in detecting cross-over distortion. This can only be satisfactorily detected by using an amplitude of test signal which just spans the cross-over region of $+x$ to $-x$ in Fig.3(b).

REDUCTION OF NON-LINEAR DISTORTION

For reducing this type of distortion two approaches are usually used. Firstly the non-linearity is reduced by biasing Class B output transistors with a small quiescent current of 30mA or so. Secondly, negative feedback may be applied. A necessary and sufficient condition for low distortion is that the slope of the CLOSED-loop transfer characteristic is constant at all levels below the clipping level.

This condition is satisfied if the OPEN-loop transfer characteristic has a constant slope, or by using sufficient negative feedback to make variations in the open loop characteristic unimportant. This means that the product AB must be much greater than unity. Therefore an open loop characteristic such as Fig. 3(b) would be intolerable, while those of Fig. 3(c) and (d) are acceptable.

The preceeding paragraphs show how non-linear distortion is produced, and may be reduced by negative feedback. Most hi-fi amplifiers are satisfactory in this respect. However, when the open-loop frequency response of the power amplifier is less than the overall response of that portion of the transmission system preceding it, additional problems lead to transient distortion.

TRANSIENT DISTORTION

Fundamentally, transient distortion arises from the poor overload characteristics of feedback amplifiers. The block diagram for a typical arrangement is shown in Fig. 4. The power amplifier is split into two parts with both a limiting and a time delay section shown diagramatically. The limiting section represents the initial stages of the power amplifier which will limit before the power amplifier's output stages. The time delay section represents the low bandwidth of the power transistors.

When an input signal, having a sufficient amplitude and a higher frequency than the power amplifier open-loop cut-off frequency, is presented to the power amplifier input, overshoots in the internal loop drive voltage may be produced. This effect can best be understood by considering a step input. The overall negative feedback can only come into operation AFTER a time delay determined by the power stages. Therefore internal signals may overshoot momentarily. In a poor amplifier this may be several hundred times greater than the nominal value of this voltage. Consequently overshoots may be clipped in the amplifier driver stages if the overload margin is insufficient. This will produce temporary 100% intermodulation bursts. Since audio signals have their maximum slopes around the zero signal level these distortion bursts usually occur in this region. The audible effects resemble high frequency cross-over distortion and create a 'metallic' sound.

TYPICAL OVERSHOOT LEVELS

A complete theoretical analysis is complex, and would depend on both the preamplifier and power amplifier characteristics, but some results are given

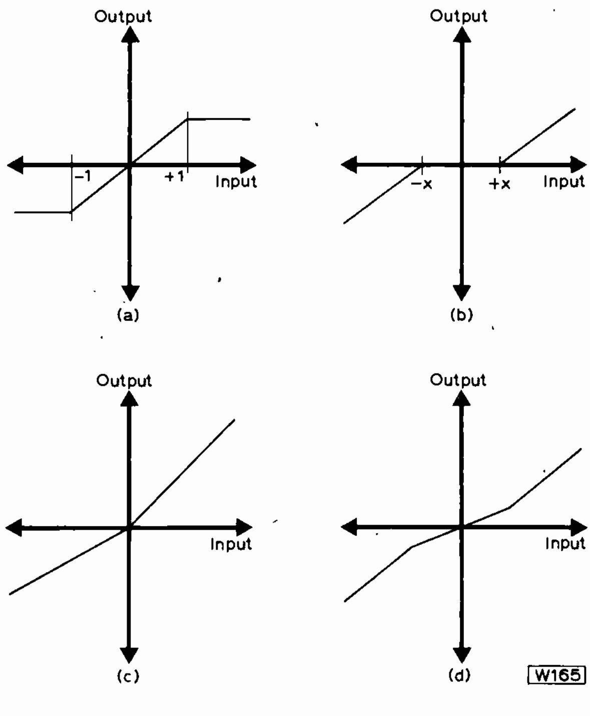


Fig. 3: Transfer characteristic (a) causes clipping, (b) would result in cross-over distortion, (c) is unsymmetrical but acceptable whilst (d) is non-linear but also acceptable.

Complete the coupon and we'll send you our complete, new catalogue.

The new Heathkit catalogue is now out. Full as ever with exciting, new models. To make building a Heathkit even more interesting and satisfying.

And, naturally, being Heathkit, every kit is absolutely complete. Right down to the last nut and bolt. So you won't find yourself embarrassingly short of a vital component on a Saturday evening–when the shops are shut.

You'll also get a very easy to understand instruction manual that takes you step by step through the assembly.

Clip the coupon now (enclosing a 10p stamp for postage) and we'll send you your copy to browse through.

With the world's largest range of electronic kits to choose from, there really is something for everyone.

Including our full range of test equipment, amateur radio gear, hi-fi equipment and many general interest kits.

So, when you receive your catalogue you should have hours of pleasant reading.

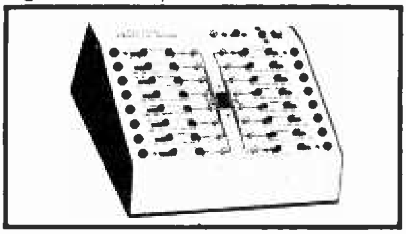
And, if you happen to be in London or Gloucester, call in and see us. The London Heathkit Centre is at 233 Tottenham Court Road. The Gloucester showroom is next to our factory in Bristol Road.

At either one you'll be able to see for yourself the one thing the catalogue can't show you.

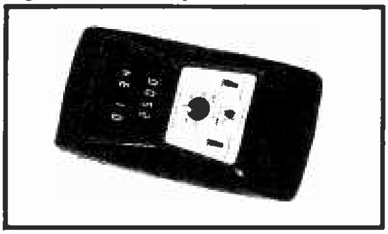
Namely, how well a completed Heathkit performs.

Heath (Gloucester) Limited, Dept. PW–46 Bristol Road, Gloucester, GL2 6EE. Tel: Gloucester (0452) 29451.

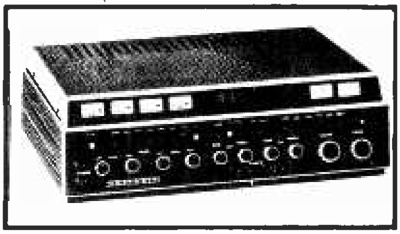
Digital IC tester.



Digital electronic stop watch.



Heathkit Modulus. A new era in Hi-Fi.



FREE SOLDERING IRON WORTH £3.50 with all orders over £30

The new Heathkit catalogue. Out now. FREE.

To: Heath (Gloucester) Limited, Dept. PW – 46, Gloucester, GL2 6EE.
Please send me my Heathkit catalogue. I enclose a 10p stamp for postage.

HEATH Schlumberger

Name ______________________ Address ______________________

______________________ Postcode __________

Full details in the catalogue. Offer available for limited period only.

EASY TERMS AVAILABLE WITH HEATHKIT MONTHLY BUDGET PLAN

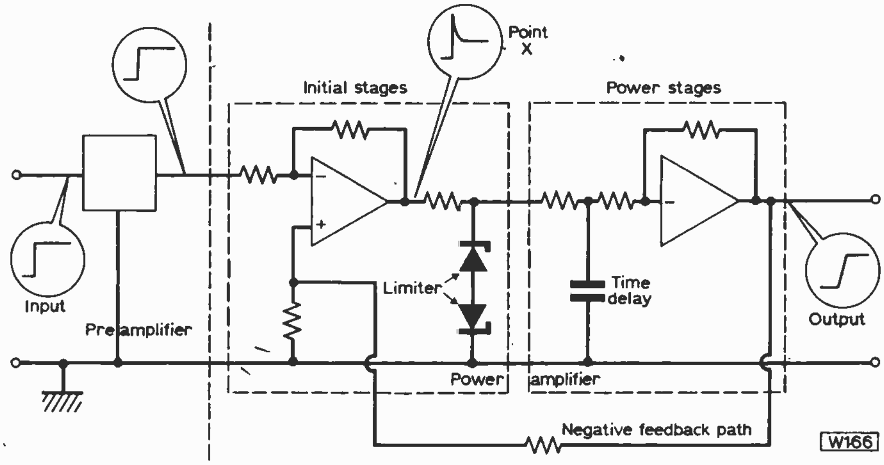
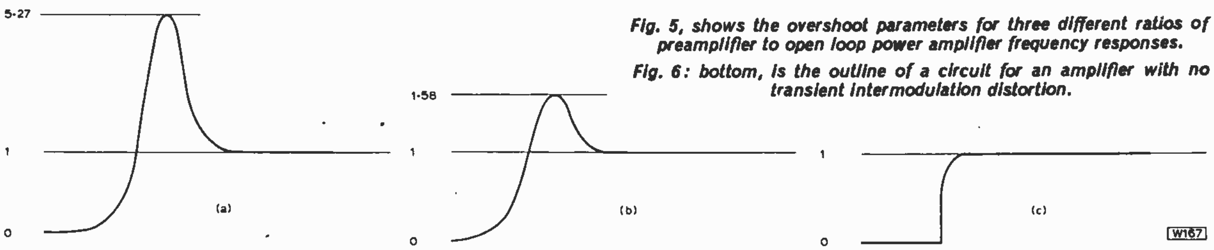


Fig. 4: Diagram to illustrate the development of transient distortion within a feedback loop, mainly due to poor overload characteristics of feedback amplifiers.

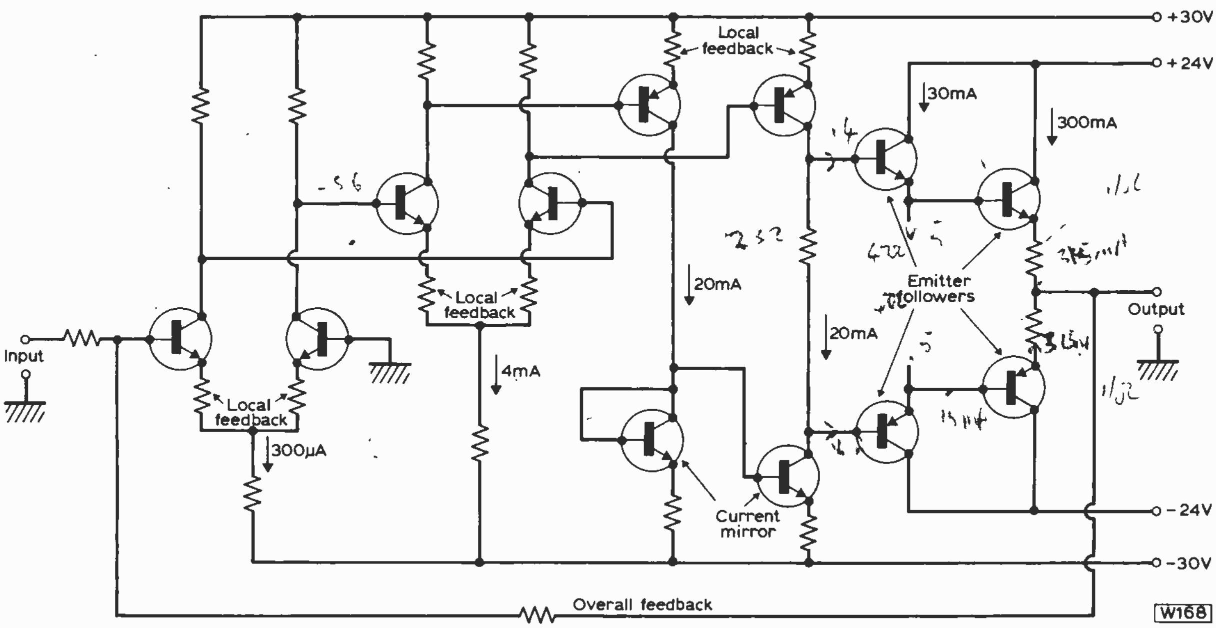
Fig. 5, shows the overshoot parameters for three different ratios of preamplifier to open loop power amplifier frequency responses.

Fig. 6: bottom, is the outline of a circuit for an amplifier with no transient intermodulation distortion.



Overall Frequency Response	Preamp. Frequency Response	Open Loop Power Amp. Freq. Resp.	Closed Loop Power Amp. Freq. Resp.	Peak Output	Overshoot
(a) 22kHz	50kHz	2·5kHz	25kHz	5·27	427%
(b) 19·6kHz	20kHz	10kHz	100kHz	1·58	58%
(c) 19·9kHz	20kHz	20kHz	200kHz	1·00	None

Note:—Peak output is output within the feedback loop, normalised to 1, point X in Fig. 4.



in Fig. 5. For this example the feedback is taken as 20dB and the overall frequency response kept at about 20kHz. In (a) the power amplifier has a closed-loop bandwidth which is half that of the preamplifier, while its open-loop bandwidth is much less. The momentary overshoot within the feedback loop is 427%!

In (b) the power amplifier has a closed-loop bandwidth which is greater than the preamplifier, while its open-loop bandwidth is half that of the preamplifier. Here the overshoot within the feedback loop is 58%. In (c) the open-loop bandwidth of the power amplifier is equal to that of the preamplifier, and there is no overshoot. The closed loop bandwidth of the power amplifier is now 200kHz.

From these results we deduce the general rule that to avoid transient intermodulation distortion the OPEN-LOOP frequency response of the power amplifier should be equal to or greater than the preamplifier frequency response. This requires a good high frequency design with a low value of feedback. When only a moderate value of feedback is used the open loop linearity has to be excellent, because heavy overall feedback is not present to decrease distortion.

When the open-loop frequency response of the power amplifier is higher than the audible frequency range, even moderate overall feedback will give a power amplifier small signal response up to 1MHz and the limiting of the frequency response to 20kHz must be accomplished in the preamplifier.

DESIGN APPROACH

A design criteria for ultimate quality requirements demands that some of the commonly used circuit 'tricks' are not employed. For example, bootstrapping and higher feedback for DC than for AC should not be used. A high DC feedback value can cause clipping effects which force DC level adjustment transients through the feedback loop every time the signal changes. If the feedback is the same for AC and DC a number of capacitors can also be eliminated.

The required high open-loop linearity is obtained by using heavy local feedback in each amplifier stage. This increases the open-loop bandwidth and minimises the amount of overall feedback needed to about 20dB.

The output transistors should be used as emitter followers to increase their frequency response and improve linearity. They should be driven from emitter followers in order to minimise the effects of non-linearity and to maximise their bandwidth.

A completely symmetrical design should be used, without bypass or bootstrap capacitors, to improve the amplifier clipping and overload characteristics and to increase linearity at high frequencies. All stages should operate in Class A except for the power transistors. These should operate in Class AB with a high quiescent current, typically 300mA, to totally eliminate cross-over distortion and asymmetrics in the critical low power region.

CONCLUSIONS

A complete amplifier design along these lines might be similar to Fig. 6. This would have harmonic and intermodulation distortion levels which are comparable with the best designs, but, in addition, would have no transient intermodulation distortion and excellent phase characteristics over the audio band. PW

An inexpensive WOBBULATOR

T. BAILEY

IF YOU build or service radios, particularly superhets, and do not possess a wobbulator then you are working under a severe handicap. A wobbulator is a signal generator whose frequency can be varied by applying an external voltage. In practice, the applied voltage is the timebase output of an oscilloscope, so that as the trace moves horizontally across the screen, the frequency of the signal generator changes. During the flyback period the frequency returns to its original value.

If the output of the wobbulator is connected to the input of an IF amplifier and the oscilloscope's vertical amplifier input applied to the detector, Fig. 1, the 'scope will display the frequency response curve of the IF amplifier. Adjustments to the IF tuned circuits may then be made and the results seen immediately.

The wobbulator to be described sweeps over a range of at least ±80% of the centre frequency and for selective circuits a "divide by ten" and a continuous control allow ±0·8% to be achieved. The principle output is a triangular wave which may be attenuated. A square wave output is included which is useful for working on harmonics at higher frequencies. The centre frequency may be varied from about 280kHz to 1·8MHz but this is easily adjusted if necessary. A poor impression may be gained of the linearity when using a very wide sweep range, but up to 40%, far more than is needed for conventional alignment, it is very good. The main use of extremely wide sweeps is for finding spurious responses when linearity is not so important.

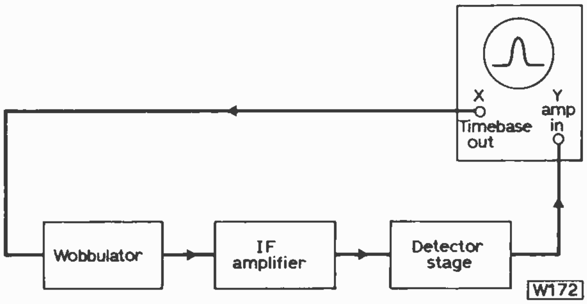


Fig. 1: Block diagram demonstrating the basic use of a Wobbulator.

THE CIRCUIT

The circuit of the complete wobbulator is given in Fig. 2. Potential constructors will notice the absence of conventional transistor oscillators and coils which always seem to cause trouble. Instead an NE566Y IC

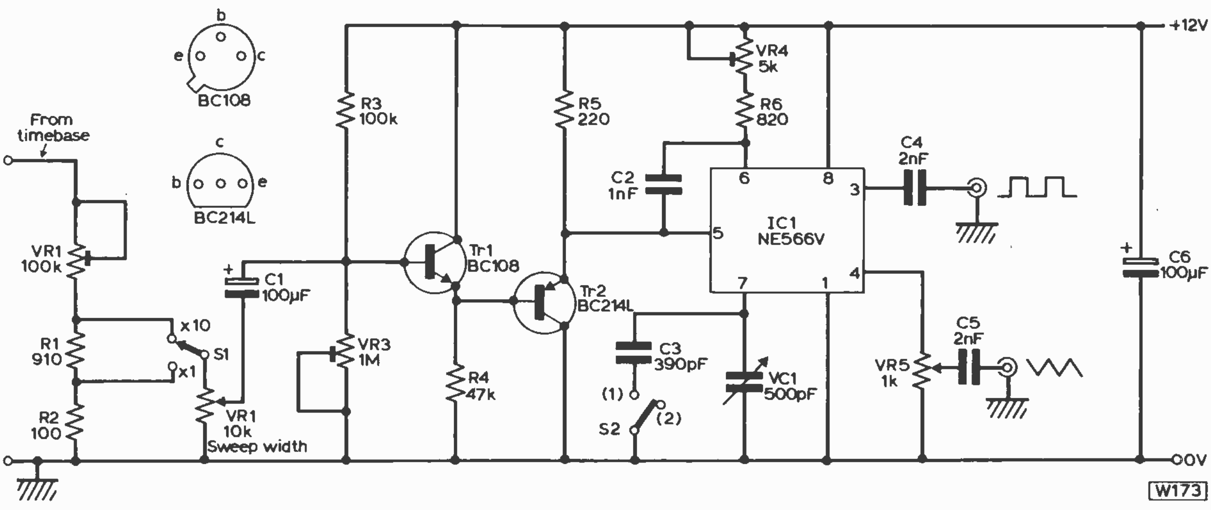


Fig. 2: Circuit diagram of the Wobbulator, showing details of the NE566 IC, and the two outputs giving both square and triangular waveforms. The sweep width control should read VR2.

function generator has been used, which has other advantages as well. A very wide sweep range has been obtained plus very good frequency linearity at moderate deviations.

The circuitry up to C1 is an attenuator VR1/2 for the timebase input voltage which sets the sweep range. Tr1 and Tr2 buffer the voltage control input to the IC with VR3 setting the centre voltage. VR4 provides a frequency adjustment used for setting the ranges whilst C3 and VC1 constitute the main frequency control components.

The wobbulator runs from an external 12V power supply which the author uses for most of his instrumentation, a technique which is recommended to save money! A suitable design for a stabiliser is given in Fig. 3.

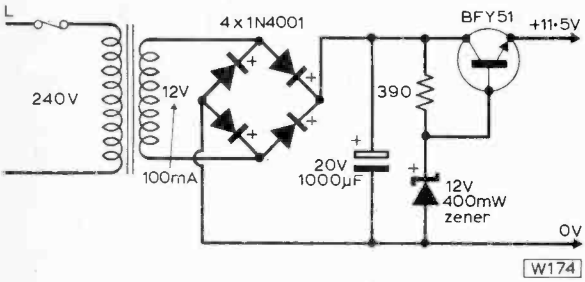


Fig. 3: The above circuit shows a suitable design for a stabilised power supply for use with this Wobbulator.

★ components list

Resistors
R1 910Ω — R4 47kΩ
R2 100Ω — R5 220Ω
R3 100kΩ — R6 820Ω
All ¼ or ⅛W 10%
VR1 100kΩ preset (PCB) — VR4 5kΩ preset (PCB)
VR2 10kΩ linear pot. — VR5 1kΩ linear pot.
VR3 1MΩ preset (PCB)

Capacitors
C1 100µF 25V — C4 2nF ceramic
C2 1nF ceramic — C5 2nF ceramic
C3 390pF SM — C6 100µF 25V
VC1 500pF variable capacitor

Semiconductors
Tr1 BC108 — Tr2 BC214L — IC1 NE566V

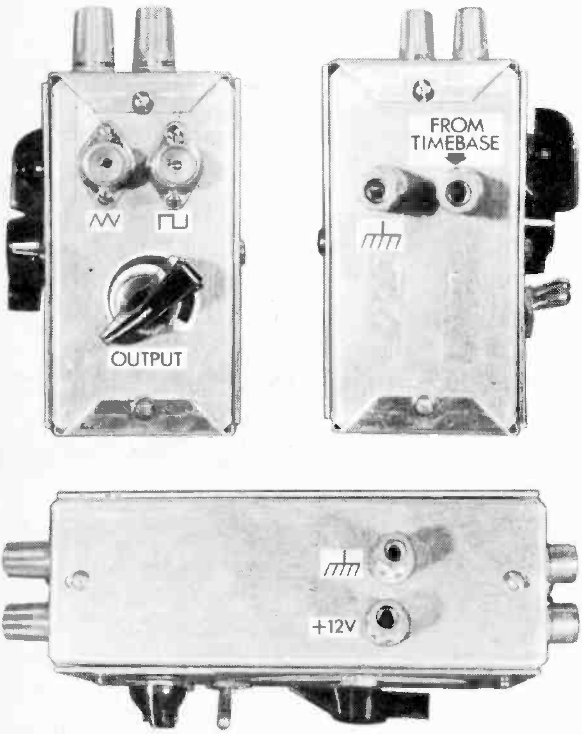
Miscellaneous
Casework, 'universal chassis' 6 x 4 x 2in. plus 6 x 4in. plate (Home Radio) or box 6 x 4 x 2in. (AB13). Switch S1, single pole changeover toggle. S2, single pole on-off toggle. Terminals, insulated (4). Coaxial sockets (2). Knobs. PCB from Readers PCB Service Ltd. see ad. page 1070

CONSTRUCTION

The prototype was built on a small piece of veroboard and housed in a "universal chassis" case. Later a PCB was devised and this is shown in Fig. 4. Constructors should find little difficulty in adapting the circuit to veroboard and pins. A piece of 0·1in matrix is cut down to 4·2×1·3in thus giving 41×12 holes with the copper strips running lengthwise. Cuts are made in the copper strips as appropriate.

The components are then mounted as in Fig. 5. The IC should be soldered last of all but if desired use an IC holder or use socket pins instead.

Mark out and drill the case with the help of the photographs. No dimensions have been given as there is plenty of room and the optimum layout may depend on the components used. The circuit board is bolted to the base with two 6BA nuts and bolts with nuts as spacers. The co-ax sockets also required 6BA fixing. Complete the wiring and check it before switching on.



External photographs of the unit, showing the positioning of the sockets and switches

SETTING UP

The process of setting up and testing consists largely of adjusting the three preset potentiometers and calibrating the main frequency control. Starting with VR3, this should be adjusted with no sweep input connected so that pin 5 of the IC is 11·5V with a supply of 12V. Next, connect the oscilloscope's timebase output to the input terminal and starting with VR1 at maximum resistance adjust it until the voltage at pin 5 is swept between the supply line of 12V and about 9V. If the oscilloscope is not calibrated vertically and hence cannot be used for this purpose, employ a very slow sweep and a voltmeter.

Lastly, adjust VR4 to achieve the desired frequency ranges (280-465kHz and 400-1800kHz were used in the prototype) and calibrate the main frequency control against a radio or signal generator, with no sweep input. A simple test is to set up the generator with one of the outputs connected to the vertical input of the 'scope, connect the sweep input and set the wobbulator for maximum sweep tuning to its lowest frequency. Adjust the timebase so that a number of cycles are visible. These should vary in period across

'SPECIALIST' RANGE
5 Models for
5 purposes

All have ROBUST CAST ALUMINIUM CHASSIS and EXTRA HIGH POWER COILS.

OUTSTANDING QUALITY FOR THE DISCRIMINATING PROFESSIONAL MUSICIAN

Available in 8 or 15Ω Imp.
2 Year full Guarantee

	Rec. Price
12″ DISCO 60 Linen cone surround Extra Large TWEETER	£25·95
12″ GUITAR 60L	£24·75
12″ GUITAR 60B For use in multiples for Bass Guitar	£24·95
12″ PA10 General Purpose	£24·75

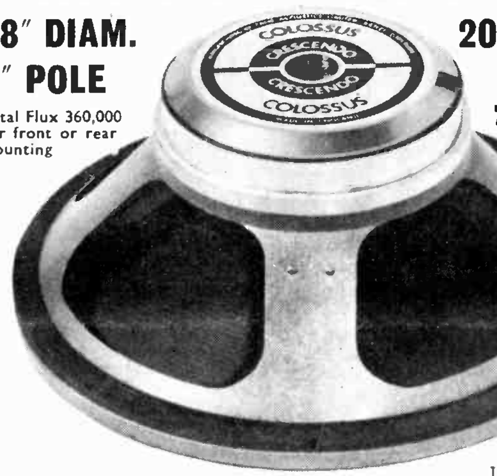
All above 60w R.M.S.

15″ BASS 70 70W For all Bass Instr	£37·75

FANE CRESCENDO COLOSSUS

18″ DIAM.
4″ POLE

Total Flux 360,000
For front or rear mounting



200w R.M.S.
Rec price inc. VAT
£99·95

Weight 31½ lb
Bass Resonance 23 Hz
Range 22 Hz – 3·2 kHz

ELITE RANGE
CRESCENDO 12A
,, 12L
,, 12 BASS
ALL 100 Watt R.M.S.
CRESCENDO 15
,, 15 BASS
,, 18 BASS
,, COLOSSUS

Rec. Prices from
£49·50
inc. VAT

And don't forget our fast selling and reliable 'Budget Speakers'

'POP' RANGE

'POP' 15 12″ 15w £7·95 'POP' 55/2 12″ 60w £20·95
'POP' 33T 12″ 33w £11·50 'POP' 60 15″ 60w £23·95
'POP' 50/2 12″ 50w £14·99 'POP' 100 18″ 100w £39·95

Above are Rec. Prices inc. V.A.T. Guarantee is for 2 years.

Please send SAE with all enquiries
Distributors (Wholesale & Retail Trade)
LINEAR PRODUCTS LTD.,
Electron Works, Armley, Leeds.
Manufacturers enquiries to: **FANE ACOUSTICS LTD.,**
286 Bradford Road, Batley, Yorks.

HIGH FREQUENCY HORN UNITS

MODEL 910 Mk II
Rating 50 watts with recommended filter. **Rec. Price**
£17·75

MODEL 920 Mk II
significantly increased sensitivity. Rating with recommended filter 100 watts (as illust) **Rec. Price** **£49·95**

HPX1 HIGH POWER CROSS-OVER UNIT
Suitable for above Horn Units **Rec. Price £2·70**

Prices shown correct at Mar. 7, 1976

ALLARD ELECTRONICS

New Branded Components—Full Specification—Guaranteed

Transistors	Price ea.
AC125/6/7/8	0·12
AD140/149	0·45
AD161/162	0·34
AF114/5/6/7	0·13
AF118	0·35
BC107/8/9	0·09
BC147/8/9	0·07
BC157/8/9	0·12
BC182/3/4	0·10
BC212/3/4	0·12
BCY70/1/2	0·13
BD131/132	0·39
BF194/5/6	0·10
MJE370	0·62
MJE371	0·76
2N1301/2/3/4	0·20
2N2219	0·20
2N2906	0·15
2N2926 all	0·08
2N3053	0·15
2N3054	0·40
2N3055	0·43
2N3702/3/4	0·11
2N3705/6	0·11
2N3707/8/9	0·08
2N3819	0·22
TIP29A	0·45
TIP30A	0·52
TIP31	0·53
TIP32	0·63
TIP41A	0·65
TIP42A	0·73

I.C's	Price ea.
709c DIL or TO.	0·27
723c DIL or TO.	0·50
741c TO	0·38
741c DIL	0·26
748c TO	0·44
748c DIL	0·26
TBA800	0·95
TBA810	1·50
2N414	1·05
S.C.R	
1A 50V	0·35
1A 100V	0·42
1A 200V	0·47
1A 400V	0·50
3A 400V	0·62
ZENERS	
BZY88 series 2·7v-33v	0·09
BZX61 series 3·3v -33v	0·16

ALI-BOXES	
2¾ × 5½ × 1½″	0·49
4 × 4 × 1½″	0·49
4 × 2¾ × 1½″	0·49
4 × 2¼ × 2″	0·50
3 × 2 × 1″	0·42
6 × 4 × 2″	0·75
7 × 5 × 2½″	0·82

VEROBOARD ·1 Matrix	Price ea.
2½ × 3¾″	0·32
2½ × 5″	0·35
3¾ × 3¾″	0·35
3¾ × 5″	0·40
2½ × 17″	1·00
3¾ × 17″	1·40
Pins 36 per pack	0·20

SPECIAL OFFER NE 555 45p

5 Core flat cable—Free with every order over £4·00

POTENTIOMETERS Lin or Log ¼″ Bush—Spindle 2″ FMF.	
5KΩ—2MΩ Single	0·16
5KΩ—2MΩ Single/D/PSW	0·32
5KΩ—2MΩ Dual Stereo	0·45
10KΩ—2MΩ Dual /D/PSW Log Only	0·62

T.T.L's	Price ea.
7400/1/2/3	0·13
7404/5	0·16
7406/7	0·36
7408/9	0·14
7410	0·13
7416/7	0·34
7422/3/5/6	0·25
7428	0·36
7432	0·25
7437/8	0·25
7441/2	0·63
7450/1/3/4	0·15
7470/72	0·35
7475/76	0·32
7480	0·42
7482	0·73
7483	0·80
7484	0·87
7486	1·25
7490	0·39
7491	0·78
74121	0·28
74141	0·63

T.T.L's Full Range Stocked
Standard low power Schottky

I.C. SOCKETS DIL	Price ea.
8 PIN	0·12
14 PIN	0·13
16 PIN	0·14
QUIL	
14 PIN	0·18
16 PIN	0·18

DIODES	
IN914/4148	0·05
IN4001/7	0·06

SPEAKERS
7″ × 4″ FANE 1·20
3-8-15 OHM
36p P & P extra

Send for FREE CATALOGUE.
Listing over 2,000 items.
S.A.E. please. Quantity Discounts

BRIDGE RECTIFIERS

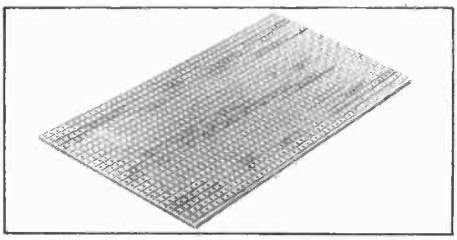
P.I.V.	1A	2A	4A	6A
50	0·20	0·30	0·45	0·55
100	0·22	0·37	0·52	0·62
200	0·25	0·42	0·57	0·68
400	—	0·66	0·60	0·78
600	0·27	0·52	0·68	0·87

DEPT. W.5, 299/301 BALLARDS LANE, LONDON N12 8NP
MAIL ORDER ONLY. Cash with order.
POSTAGE & PACKING U.K. 20p. ADD V.A.T. TO TOTAL

Veroboards are available with 0.1″ x 0.1″ or 0.15″ x 0.15″ matrix with holes, in 15 sizes. A new catalogue describing Verostrip, DIP boards, Plastic x Metal cases, Veroboxes etc is available (price 10p + S.A.E.)

vero

VARIABLE
EASY TO USE
RELIABLE
ORIGINAL...



Vero Electronics Limited, Retail Dept., Industrial Estate, Chandler's Ford, Hants., SO5 3ZR
Telephone: Chandler's Ford 2956 (STD 04125)

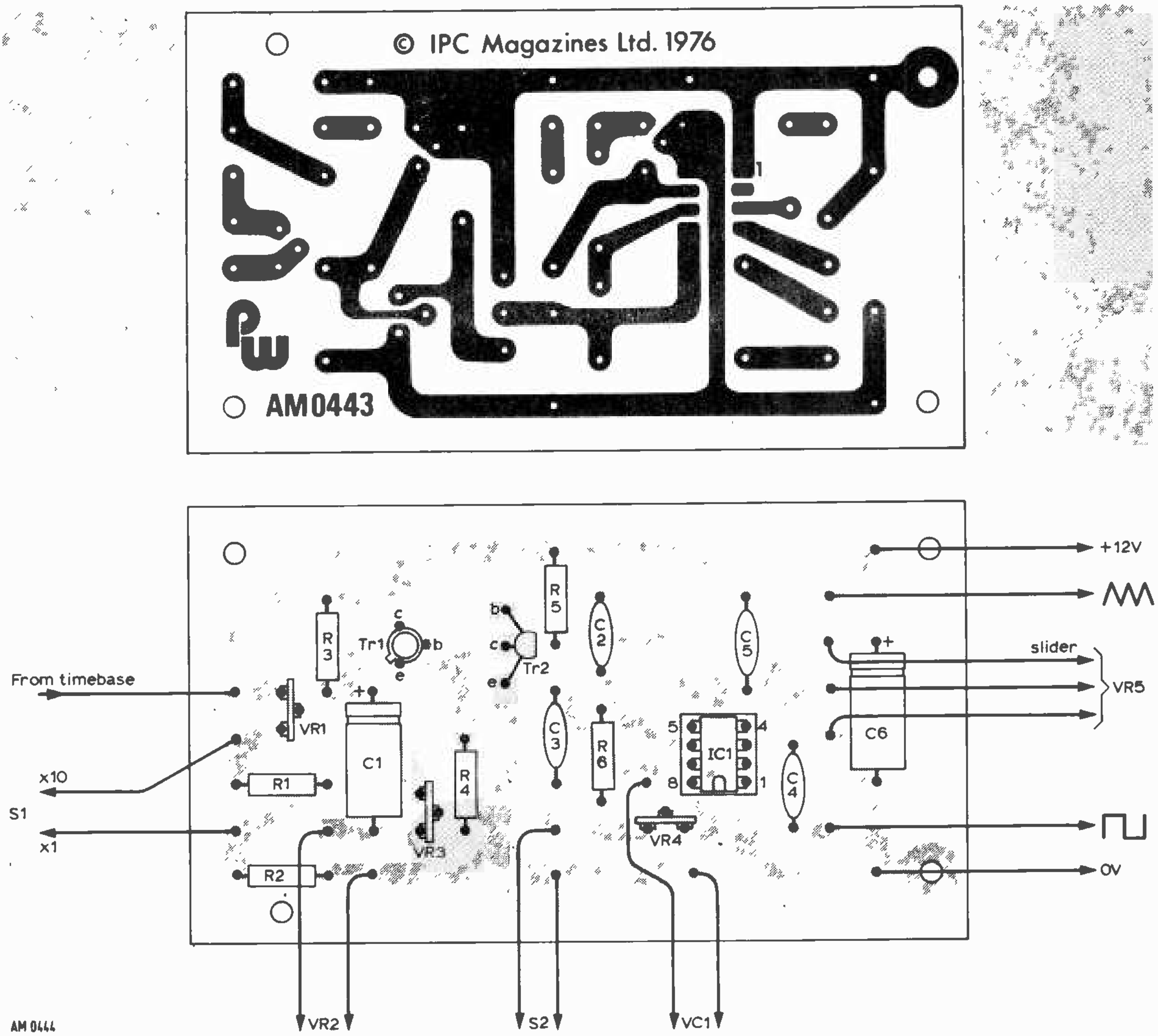


Fig. 4 and Fig. 5: The top drawing shows a foil side view of the pcb, while the lower gives the precise positioning of the various components. Both views are shown full size. **Note.** *A link is required from the rotor of S1 to VR2.*

the screen and reducing the sweep width should make the variation less.

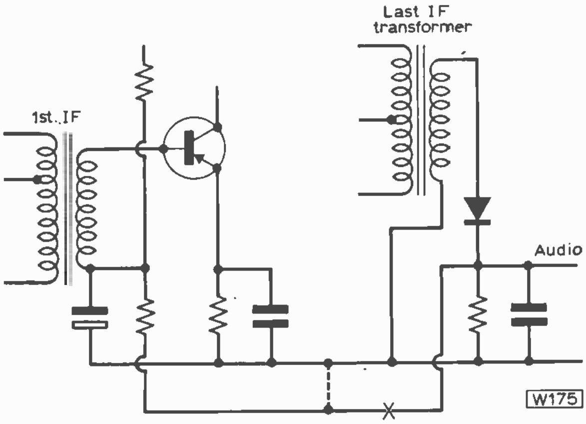


Fig. 6: In order to avoid non-linear displays at maximum sweep, the above AGC neutralising modification is recommended.

The only thing to remember about using the wobbulator is that at near maximum sweeps the display will be decidedly non-linear at the edges. Fig. 1 shows the conventional way of using the wobbulator to align IF amplifiers. When doing this it is advisable to turn off the AGC or otherwise neutralise it. A method of doing this in a conventional IF amplifier is shown in Fig. 6, the circuit being broken at point "X" and the dotted connection being made to earth.

The conventional injection point is the base (grid, in valve receivers) of the mixer which prevents loading the first IF transformer. The 'scope input is connected to the point marked "audio" and the lowest sweep speed used that gives a flicker-free and viewable trace.

Adjustments may also be made to the alignment of RF and oscillator stages but beware of adjusting a tuned circuit to which the wobbulator is connected directly as the loading will be excessive. If, at any time, the output is too great even when fully attenuated, connect a capacitor of a few pF in series with the lead to the receiver.

HOTLINES ON RECENT DEVELOPMENTS

AN EXPENSIVE RECEPTIONIST

Hands up if you ever sipped lemonade through a straw. Bet you did when you were little. Now hands up if you earn your living by sucking through a straw. Don't laugh, because that is exactly what one very brave young lady does. Her name is Margaret and she's a receptionist. She's also been paralysed from the neck down since 1956.

It seems impossible and yet, with the aid of electronics, Margaret is leading a very useful life and doing a full-time receptionist's job at a University. So how does it all work. Well, Margaret uses a kind of electronic straw—just like the one you (?) and I use to sip that lemonade through, only it's different if you see what I mean. Her straw has two tiny pressure sensors in it. One sensor responds to blowing while the other is trained to respond only to a suck or sip.

A VDU (visual display unit) is a feature and a list of available things, like telephone numbers etc. are thrown up on the cathode ray tube, At the side of the list of actions (or whatever) is a cursor and this travels down the list a line at a time with each puff in the straw. When the desired line is arrived at, Margaret simply sucks/sips and the computer-based system does the rest. A telephone number is dialled and Margaret can then speak to the person at the other end of the line. By selecting other instructions it is possible to select, say, a tape recorder facility for recording messages. Margaret can now handle a multiple-line business telephone system—all by herself.

Oh, yes, I nearly forgot, she types letters, too. The alphabet is simply called up on the VDU and the cursor "puffed" along to select the required letter or numeral. Print out of the letters is a teleprinter-type of keyboard which types out letters and numbers in response to electrical inputs. A voice terminal is the next step for her electronic helpers but this isn't "on-line" as yet. Please note the system is not available for general use and takes the form of an experiment.

TIRED TYRES

Electronics in motor vehicles has long been a field of development. Transistor ignition is one such area. An interesting development is taking place in Germany, so I hear. This ingenious application allows the driver of a vehicle to know instantly when his tyres start to go down. In other words, his tyre pressure is constantly monitored—even when the vehicle is in motion!

Transmitting and receiving coils are mounted at each wheel suspension. The transmitting coil is fed with a 7kHz signal. On each wheel rim is mounted a small coupling coil which, as each wheel rotates, passes some 10mm from the two coils on the suspension. The small coupling coil on the wheel rim is connected to a tiny pressure sensing switch located in the tyre valve. While the tyre pressure remains above a predetermined minimum level, the small coupling coil will couple the 7kHz signal from the transmitting coil to the receiving coil with each revolution of the wheel. However, if the pressure were to drop below the minimum level, then the pressure-sensing switch at the valve would open and the wheel rim coil would not couple any signal from transmitting coil to receiving coil as they passed. Thus no signal would be passed back to the control unit on the dash board and a warning would immediately be given to the driver. The company is reported to have said that it is ready to go into production with the system if sufficient demand is evident. Doubtless, motorists who are tyred of getting flat tyres will favour what amounts to an air-raising innovation.

TUBES, AGAIN

Just as I thought that the computer memory research front was going to be quiet for a while, so a group of Dutch workers have proved me wrong. They have come up with a new type of memory which is claimed to be cheaper than ferrite-core stores and offering greater density, too. The new memory relies on what is called the Phonon echoes effect. These "echoes" develop when powdered quartz is excited by high-frequency pulses. One important discovery is that the echoes so recorded and stored can be read out a year later without any problems. A tiny glass tube, 1cm in diameter and 1cm in length is filled with quartz powder and the resultant capsule has a coil plus capacitor combination around it i.e., a tuned circuit. One of these little tubes has been found to store up to 100,000 bits of information. Pulses are applied in pairs and the highest frequency to date has been 80MHz. Workers believe that up to 10GHz is possible as a frequency for these pulses.

OW!!

The ancient art of acupuncture has gained in popularity in recent years. Apparently the idea is to poke needles into the body at certain points and this makes you better. Now you wouldn't think that electronics could have anything to offer here because the actual mechanism i.e., the pin sticking is very simple. But no, you'd better believe it, electronic acupuncture has arrived. Of course it's claimed to be superior to the older techniques. It's more accurate, can be quicker and is more hygienic. First we do away with those needles and use a laser beam instead. The beam is completely sterile which can't be bad. A flexible light fibre probe is used to locate the acupuncture point accurately. Apparently the skin resistance at the exact point is slightly lower than the surrounding skin so the probe measures skin resistance at the point of contact. When the correct point is located, a helium-neon laser is persuaded to emit a one milliwatt blast of power and the beam may be continuous or pulsed. The pulses can be varied, too. Some 10 to 15mm of skin tissue is penetrated by the laser and, claims one report, it doesn't hurt. I would have thought that one would feel a bit of a prick.

It will be very sad to see all those acupuncture needles going to waste as electronics advances. I wonder what the Chinese will do with them all? (No, prizes, no prizes.).

Ginsberg

FREE INSIDE!

IN NEXT MONTH'S PRACTICAL WIRELESS

double-sided RADIO SERVICING CHART

Dead? Weak? Distorted? Intermittent? Poor Sound Quality? If you can describe the basic trouble with your radio then you can use this Radio Servicing Chart to find the cause of the trouble.

call the tune! on the PW Rhythm Generator

Name your rhythm, then select it . . . samba, rock, bossa nova, they are all there in the box! PLUS LED downbeat indicator with stop switch linked to foot switch PLUS calibrated controls for volume, tone and tempo enabling rapid reset for any rhythm PLUS snares or claves as desired.

WALTZ TANGO SWING MARCH SAMBA MAMBO CHA CHA FOXTROT ROCK BOSSA NOVA

Also

a 3-band RF mini-amplifier

ON SALE IN APRIL

Directio
Find
r

BY USING a rotatable ferrite rod aerial, advantage can be taken of its directional properties, either to obtain best reception of a station without needing to turn the receiver itself, or to obtain a directional bearing from a transmitter. The receiver described here is completely screened except for the rotatable aerial, and uses a telescopic aerial which can be brought into use if wanted. The latter is for "sense" determination, to remove the

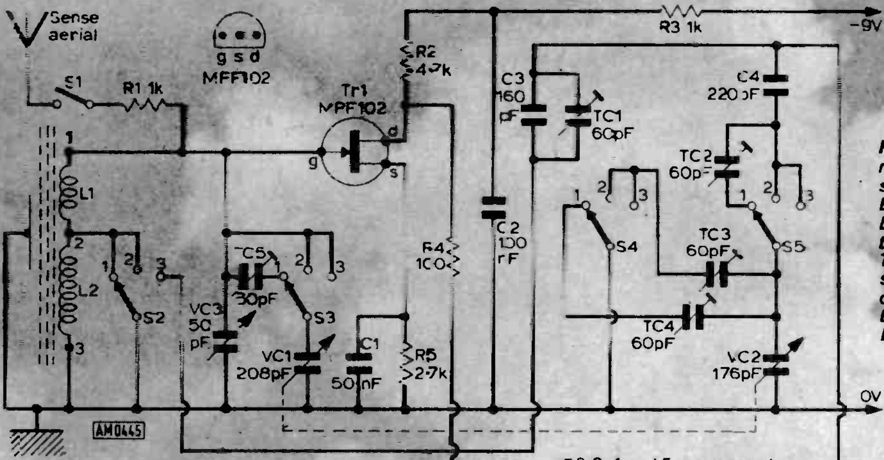


Fig. 1: Front end of the receiver containing the sense and ferrite aerials. Bandswitching is achieved by means of S2-5 and tuning by means of VC1/2. The MW band has been split into two parts, Band 1 covers 1300–1500kHz and Band 2 600–1300kHz. On LW Band 3 covers 140–250 kHz.

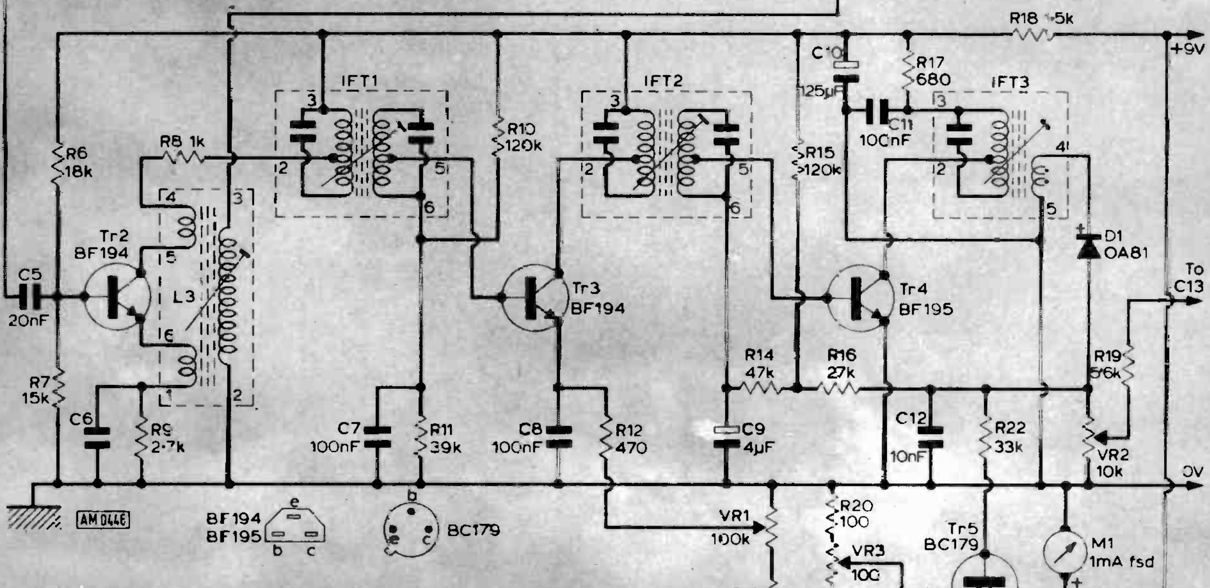


Fig. 2: The above circuit shows the following stages in this receiver. They comprise the oscillator/mixer, IF and circuitry for the tuning meter.

180° ambiguity which exists with the ferrite rod aerial alone.

The ferrite aerial has two maximum signal strength positions, with the rod at right angles to the direction of the transmitter; and two minimum positions, with the rod in line with the transmitter. These positions are shown by a panel meter. In many circumstances, as with European or other stations, the approximate direction will be known. In other circumstances the correct direction may not be known.

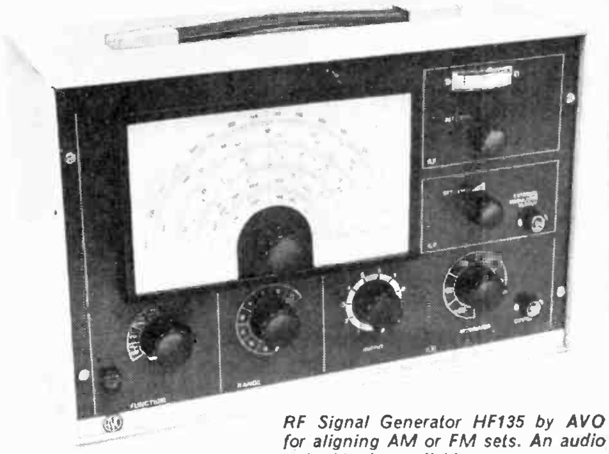
PRACTICAL WIRELESS
FAULT-FINDING GUIDE
8-Page Supplement April 1976

Fault-finding in radio and similar equipment is one of the fastest ways of learning all about electronics. Component suppliers catalogues are an invaluable source of information on the characteristics of components of all kinds and such knowledge is invaluable in locating a fault quickly from the observed symptoms. In this Guide Les Lawry-Johns, a very experienced service engineer, describes the methods of servicing that he has found so successful.

Lots of people start off with the intention of making a living out of servicing radio sets. There are several paths to take once the basic theory has been mastered, more or less. One can specialise in, say, car radios and other car entertainment gadgets, cassette players and the like, or perhaps TVs only. Those who work for a company probably stay in the trade but some who set out to be self-employed rarely stay the course. There are several reasons for this, the main one being economic.

It is extremely difficult to get an adequate return for the capital laid out on component stocks and test equipment if one is repairing domestic appliances, mainly because the time involved in properly servicing each item leaves little reward when the job is completed. Therefore a lot of servicing is done on a part-time basis or as a paying 'hobby' with the accent on the hobby aspect rather than on the paying!

We have to assume that the reader has a basic knowledge of electronics and some idea how radios and the like function. The chief requirement after this is patience and a genuine desire to do the job, and to do it properly.



RF Signal Generator HF135 by AVO for aligning AM or FM sets. An audio output is also available.

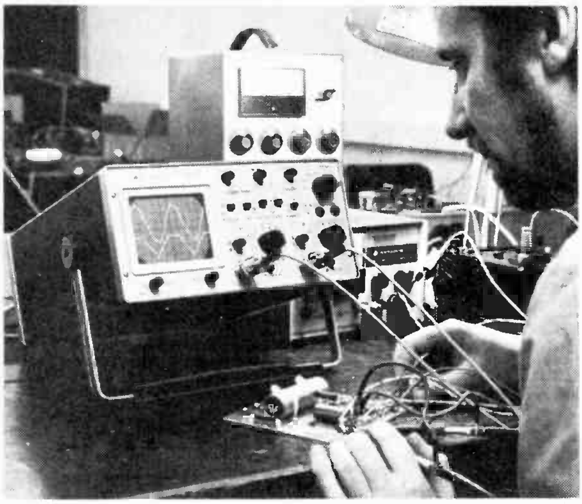
THE TOOLS

First the tools. A goodly selection of screwdrivers, among the smaller of which must be everybody's friend, the neon screwdriver. This little fellow deserves a chapter on his own, being an indicator, detective, fault tracer, a sure signaller of nearby radiated energy and a life saver. No less, but certainly more.

One must have wire cutters, and side cutters are more useful than top cutters. Pliers and tweezers of various types and sizes, files and spanners are essential and

The Advance 'Alpha' digital multimeter takes up little bench space.

FAULT~FINDING GUIDE



Shown here is the Advance Electronics low-cost dual-trace OS240 oscilloscope.

included in the latter should be the single-ended type with a handle, known as a nut spinner, in at least 6BA and 4BA sizes and with the close metric relatives. A comprehensive set of trimming tools, which can be purchased as a kit; at least two soldering irons, for delicate and heavy work. A reel of 18SWG (1·2mm) resin-cored solder and some means of removing solder, preferably desoldering braid which is copper braiding impregnated with resin flux. It draws the solder away from a heated joint allowing a component to be removed. Alternatively, some form of vacuum pump, possibly combined with a soldering iron.

A small torch which can be held in the mouth, if need be, and a magnifying glass are essential items whatever your age and eyesight! Next, the handmaiden of all electrical work, a decent multi-meter, preferably two. One should be a good quality meter for bench work, the other a smaller, less expensive, knock-about type for general use and back-up for use with the other, as one often wants to make two readings at the same time. Apart from this it often happens that the main meter is out of action for some reason, and at the most inconvenient time. Other instruments such as oscilloscopes, signal generators, bridges and the like can be regarded as highly desirable equipment to be purchased when funds allow.

MULTIMETERS

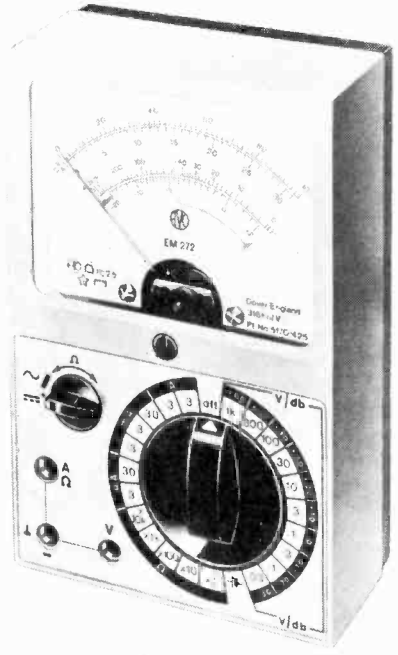
The multi-meter should impose as little loading as possible on the circuit being tested otherwise the voltage present will be different when the meter is applied from what it is normally. A voltmeter is operated by current drawn from the circuit being tested and this current must be as small as possible. Most meters are marked on the front with their sensitivity and a figure of 20 000 ohms-per-volt (OPV) should be the minimum requirement. It should also have some form of cut-out or overload protection. The man who hasn't taken a reading with the meter set to the wrong range hasn't yet been born!

As well as reading voltage, current and resistance the meter can also be used to apply tests to circuits and components since, when switched to the resistance range, a **negative** voltage appears at the positive test probe and a **positive** one at the negative probe. This enables a check of the approximate characteristics of capacitors, transistors, diodes and the like to be made. After voltage readings, this facility is probably one of the most valuable assets of a multi-meter so we will spend a little time on this subject, later on. However, we must continue with our "tools of the trade" requirements.

There are a great many aerosols (sprayers, squirters etc.) on the market at the present time, each of which has its own merits. Most engineers would select two, a contact-cleaner lubricant, which does not attack plastics, for cleaning switches, volume controls and the like, and a cooling agent or freezer. The value of these two can hardly be exaggerated. Whilst the former has always been accepted as a must, the choice of the latter has been dictated by experience over the last few years. Large numbers of small components grouped on a board can present a problem when tracing intermittent faults or where any one of a number of transistors in, say, an audio stage can be responsible for upsetting the operation of the others. A judicious squirt of freezer has solved many such baffling problems and a hair drier has its uses too!

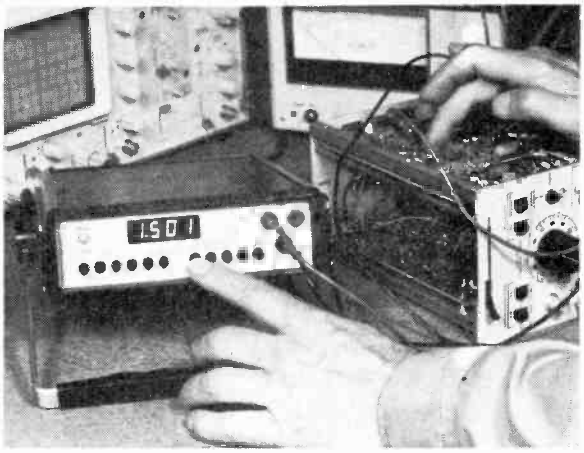
STARTING

So here we are, with a few tools of the trade and prepared to do battle. However, it is one thing to identify a faulty component, when all you have to do then is to obtain a replacement, but all too often we can only suspect and it is essential then to make a substitution check. Resistors can usually be tested and passed as fit or thrown out, but capacitors present a different problem. They can leak, partially or completely dry up, become open circuit or



The new AVO Electronic Multimeter EM272 provides 39 ranges in spite of the simplicity of its appearance.

FAULT-FINDING GUIDE



In use here is the Advance DMM7 digital multimeter, a new 3½-digit 5-function instrument.

develop a short sometimes accompanied by heat. Therefore a goodly number of capacitors of various types, capacity and voltage rating must be held in stock.

Voltage rating is important from two aspects. Obviously a capacitor rated at, say, 12V would not be put across a 25V line as the voltage rating marked on the component must not be exceeded, but it is often thought that a capacitor marked, say, 100V can be used in any circuit where the voltage is less than this. Usually this is quite true, but there are exceptions. If the capacitor is electrolytic it requires a certain polarising voltage for it to work efficiently. In some circuits the voltage is very low, say about 4V, and a replacement in such a position should be rated at not much more than 6V or whatever voltage is marked on the defective item.

Diodes are another item which can be checked with a meter, within limits, and a few of the more common types in stock will usually suffice. Bridge rectifiers are commonly used in mains powered equipment and they often give trouble. One is well advised to keep a couple to hand and two types usually suffice, the BY164 for operation up to 40V and the BY176 for higher voltages. Four silicon diodes

A new product from Advance is the J4 signal generator, with sine or square wave outputs.

can be used in place of a bridge and indeed this type of supply will often be found but where a single block bridge is encountered it is often inconvenient to fit four diodes in its place.

The choice of separate power diodes is large but one cannot go far wrong with a few BY142 (BY127 with a smaller package). Voltage regulator diodes (zeners) appear in all types of equipment and one would be very hard put to try to anticipate what is going to be required if many makes and models of radio are tackled. It is no hardship to order the right components at the right time, if one knows in advance the type of equipment which is to be serviced, but if this is not known the stock list could be endless.

The same can be said about transistors and the position is more complicated as the age of the set to be serviced usually dictates the type of device used. The following is a list of transistors which ought to be kept in stock for the general servicing of audio equipment, radios, car radios etc.

AF115	**AC187K**	**BC131**	**BC186**
AF117	**AC188K**	**BC132**	**BC194**
AC127	**AD149**	**BC147**	**BC195**
AC128	**AD161**	**BC149**	**BC196**
AC187	**AD162**	**BC157**	**BFX88**
AC188	**BC109**	**BC159**	**BFY50**

From this modest list one can often find a suitable replacement for the more difficult-to-obtain types and some which are not marked. The latter present a minor problem but this is about all.

IDENTIFYING TRANSISTORS

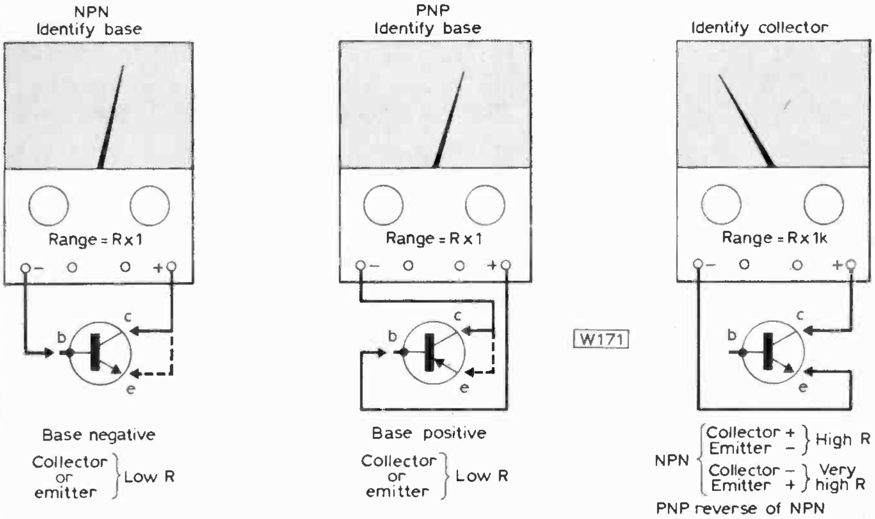
Most transistors have only three leadouts, these being emitter, base and collector. They will belong to one of two basic constructions, NPN (neg-pos-neg) or PNP (pos-neg-pos), so this is the first check to make and it is a very easy one using the ordinary multi-meter. It must be appreciated that when the meter is switched to the 'ohms' range it is battery operated and that the positive (+), or red, probe will be on the negative side of the battery with the negative (−), or black, probe at a positive potential. If the red probe of the meter is applied to the base of a PNP transistor a low reading will be shown when the black probe is touched to the collector or the emitter. On the 'ohms' scale this will look like something between 10Ω and 50Ω depending upon the transistor type and the meter.

If only one reading can be obtained note to which leadout the black probe is applied and assume this is the base of an NPN transistor, when the red probe can be applied to the other two to obtain the low reading. If there is no low reading, the red probe should be applied to another leadout on the assumption that the device is a PNP after all, but that you didn't get the base lead in the first place.

Now that the base has been identified and the device established as a PNP or an NPN, it is necessary to identify the collector and the emitter, remembering that we are supposedly dealing with a good transistor and not one with a short or open circuit.

Switch the meter to the high resistance range, and, leaving the base free, connect the probes to the other two.

FAULT~FINDING GUIDE



Diagrams to show the method of using a multimeter to identify the leadout connections of NPN or PNP transistors. As explained in the text the polarity of the test prods of most meters is the opposite of that indicated by the colour of the prods. It is best to check this point before using the meter on transistors or electrolytic capacitors.

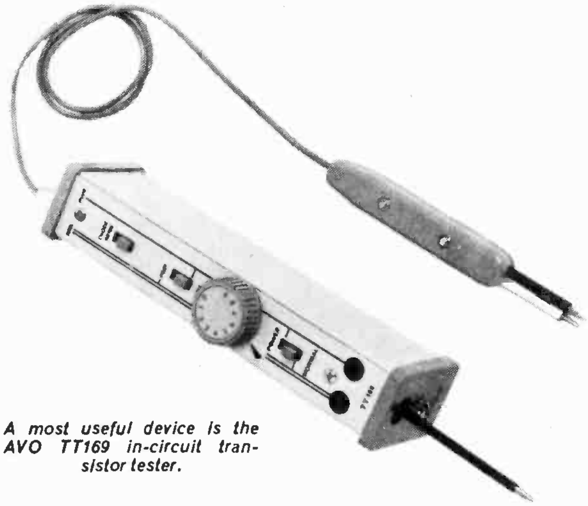
If the transistor is an NPN and a high resistance is recorded, the negative (black) lead is connected to the collector and the positive (red) lead to the emitter. Reversing the probes should then give a low reading.

If the transistor is a PNP (we have already established this in the first test, so don't get confused) the readings will be reversed, high reading positive to collector, lower reading negative to collector. A further test can be made on the transistor. Connect as above, negative lead to collector, positive to emitter, if NPN, (reverse for PNP) and note the high reading. Place a finger on the collector and base leads and the reading should drop, showing that the transistor is "turned on". The actual reading will depend upon the current gain of the transistor and the resistance of the skin of the finger. What good is this, you may ask? Well, it does enable you to make a comparison check against a known transistor and so, very roughly, identify the current gain.

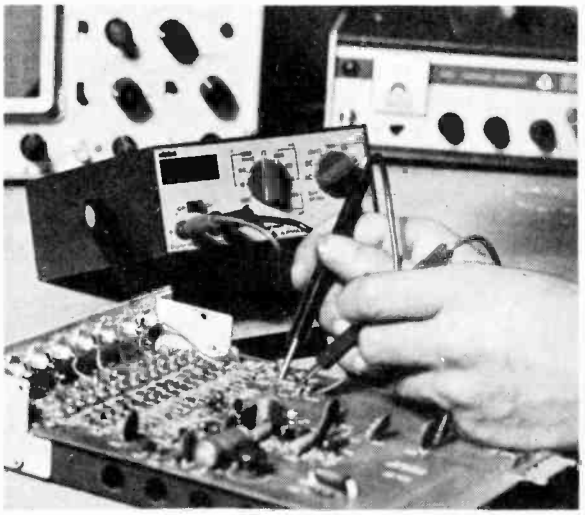
Diodes can be checked in a similar way but of course there are only two connections to make. Positive lead to cathode (+) gives a low reading, while negative lead to cathode gives a high reading. A little practice with known good transistors and diodes will show the readings which can be expected. These tests can be used on components in circuit provided the associated circuitry is taken into consideration, particularly where transistors are inter-connected, say output transistors with drivers across them, etc.

COMPONENT CHECKS

Capacitors can be checked roughly with an ohmmeter switched to the highest resistance range. When the test leads are first applied to a discharged capacitor, the applied voltage will cause the charging current to deflect the meter sharply according to the capacity, the reading going back towards infinity as the capacitor is charged. If the capacitor is leaky, current will continue to flow and a reading

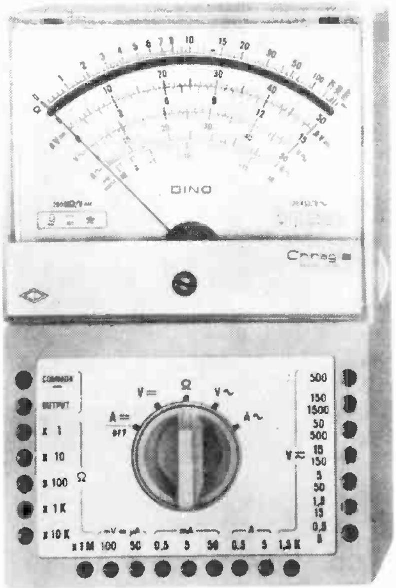


A most useful device is the AVO TT169 in-circuit transistor tester.



Another useful bench instrument is the Advance 'Alpha' digital multimeter, being used here to make resistance checks on a circuit board.

will be maintained. This is to be expected with high value electrolytics as the meter voltage is insufficient to complete the sealing process. Once again a little practice will show what is to be expected. Very little indication, except leakage, will be shown on capacitors less than say 50nF but the tests are more valuable as the capacity increases. Don't forget, electrolytics require the negative probe to be applied to the positive tag of the electrolytic in order to get the right polarity for the charging voltage.



The Dino is the latest electronic multimeter from Chinaglia, 200kΩ OPV on DC and 20kΩ OPV on AC.

Inductors, transformers and the like can be checked for continuity and resistance. The presence of shorted turns can only be assumed if the resistance reading is much lower than that specified.

When a resistor is suspected of being faulty, first look at its appearance. If the colours are clear and bright and the resistor has a fairly low value the chances are that it will be serviceable. If it has a higher value, say over 100kΩ, it could look right but the value may have increased, particularly if used in a position where it is passing a fair current. Checking depends upon the circuitry, for if it is associated with other resistors or transistors, a direct reading may be of little use and one end may have to be lifted by unsoldering in order to check it out of circuit.

If the colours are not clear or if the resistor presents a well-worn look, replace it, even if it reads right, in order to save probable trouble later. This particularly applies to the low value resistors associated with output transistors usually about 2Ω or so). If a high value resistor is suspected it can often be checked with the receiver switched on by connecting a voltmeter across it, on a high range. The recorded voltage drop being of less importance than the effect of the resistance of the meter which shunts the suspect resistor and thus, to an extent, takes its place. Care must be exercised when using this dodge in pre-amplifier stages where the meter resistance can upset the base current of a transistor if the associated resistor values are high.

SHORT CUTS

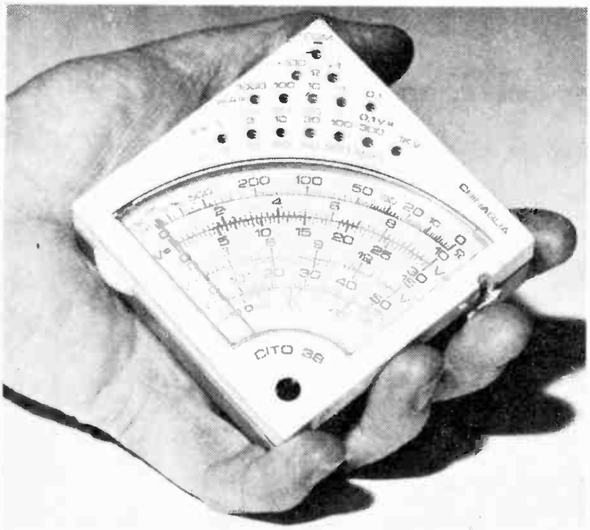
There are no substitutes for routine tests, checking supply and stage voltages in logical sequence, injecting test signals to identify the working and the faulty stages. To do this one must be able to think 'electrically', and while this comes easy to some, it is hard work for others and only comes with time. Following certain guide lines the fault will always reveal itself provided enough time is spent on the problem. However, as one becomes used to the type of equipment being serviced a pattern usually emerges which enables a short cut to be made across the routine tests and thus head straight for the source of the trouble, using eyes and ears and sometimes the sense of smell and of touch. A dry joint (one which has not been properly soldered in the first place) can often be seen, rather than traced, by its discoloured and 'powdery' appearance.

Sound distortion can be caused by many things but after a while the ears will unerringly identify the sound of a rubbing speech coil in a loudspeaker as opposed to a similar noise caused, say, by the output transistors being mismatched. The smell of some types of overloaded or faulty rectifiers immediately proclaims a defective one, whilst touching a hot transistor, apart from being painful, can cool it down and allow it to begin working for a brief period.

Some makes of printed circuit board are more liable to develop hairline cracks than others. Some types of capacitor are far more likely to fail than others. Indeed, we could go so far as to say that where certain types of capacitor are found fitted, we do not bother to check them since they are so very rarely at fault, whilst others are the first suspects and pounced on immediately. Some transistor types are more likely to fail than others. This sort of fault can be repeated over and over again and, whilst it makes life

The Model 8 Mk 5 general purpose multi-range meter is the latest in a very long line of multimeters from AVO. An early version of the meter appears in the background.

FAULT~FINDING GUIDE



Smallest of the Chinaglia range is the Cito multimeter but it still manages to provide 14 ranges on six coloured scales.

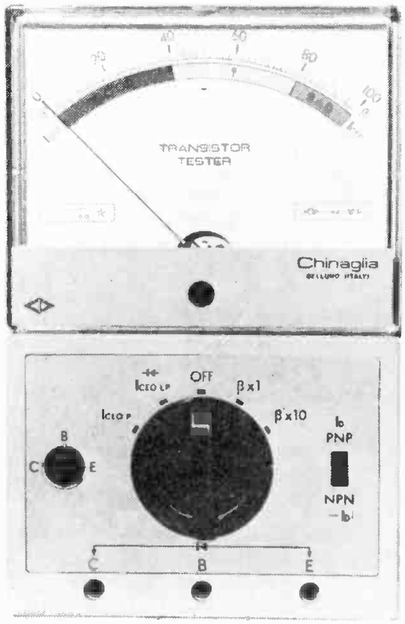
a trifle easier for the experienced, the inexperienced person has no option but to employ routine tests and finally arrive at the same conclusion, having spent a considerable amount of time in the process. If in doubt, ask someone who knows and thus profit from their experience.

PRACTICAL ASPECTS

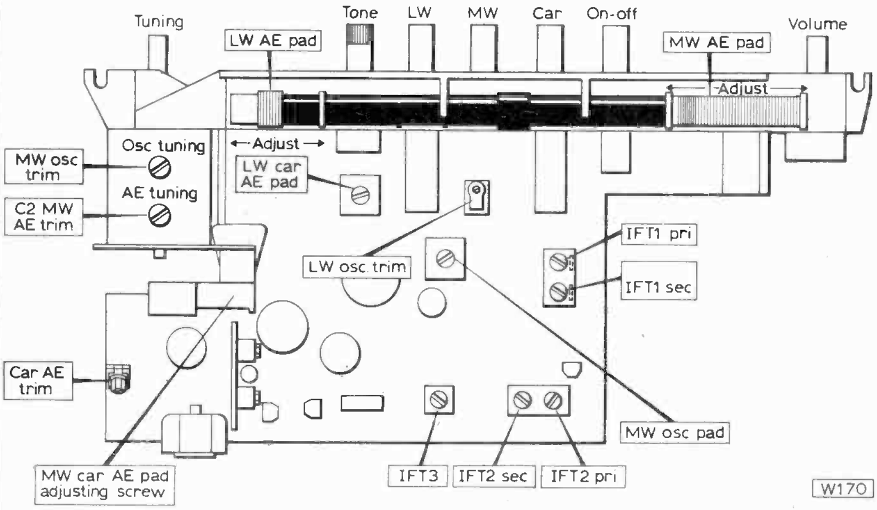
We gave a short list of the items needed to service the simplest of appliances but there are others to consider. A circuit with a layout diagram is an absolute must if the appliance is not well known. Fortunately, in addition to the maker's service information which is the best source of reference, there are volumes of service data in book form available which condense this information, so that it is possible to build up a library of information which is readily to hand and indexed.

Not all appliances are complete when they are received for repair. For example, a car radio will need a 12V supply and most likely a loudspeaker. This is not too bad since most car radios use a 3Ω speaker, although more recent imports use 8Ω in some cases. However, it is often inconvenient to remove sited loudspeakers when a unit audio goes wrong, assuming that the speakers are not at fault, so it is necessary to have suitable speakers for test purposes. These are frequently 8Ω, but not always, by any means. So be prepared to add series resistors to make up the required loading or keep a goodly selection of loudspeakers!

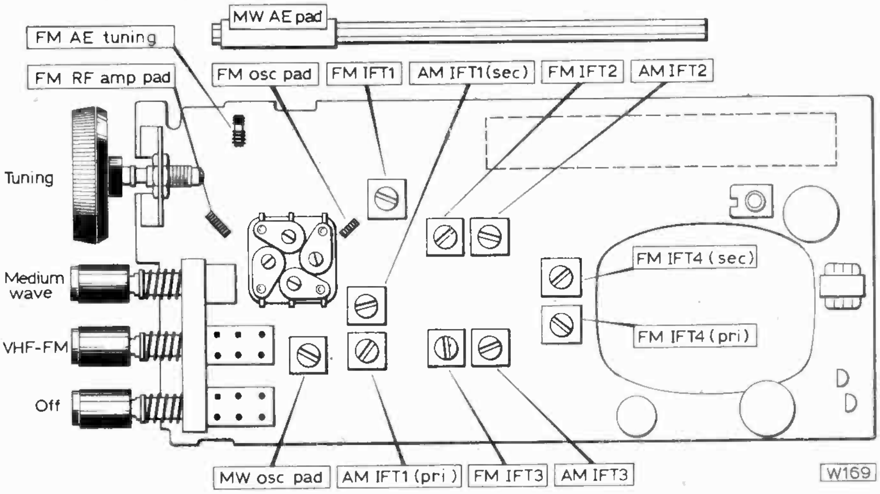
Before we drop this subject, one further point. There are always power amplifiers requiring repair. If you do



The Chinaglia transistor tester provides a Good-?-Bad indication plus leakage and β, using internal batteries. Test leads can be fitted for checking external circuits or devices.



Service sheets provide information for fault-finding and the alignment of receivers. This particular layout shows the location of the components which may require adjustment when aligning the Marconi 4173 MW and LW receiver.



The Marconi 4184 receiver also incorporates the VHF(FM) range so the number of adjustments needed for a complete alignment is increased, as shown here.

take on one of these and repair it, have a care for your test loudspeaker. To touch the input socket with the volume control well up is to ask the amplifier to deliver full power into what may be a small loudspeaker, the probable result being a wisp of smoke from the speech coil which, if it survives intact, will never be the same shape again!

OTHER TEST GEAR

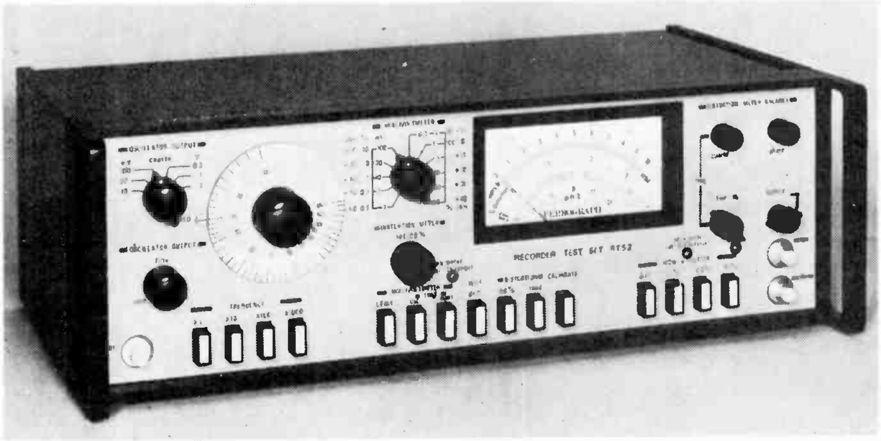
Whilst our multimeter enables us to check voltages, measure current and take resistance readings, plus a few other things, no serious service work can be carried out without the aid of other instruments, the first of which is a signal generator. This enables us to inject signals of known frequency and level and thus to check the alignment and response of the equipment under test.

Let us take an average radio set. Considering the medium wave band only, signals from say 600kHz to 1·5MHz have to be selected and amplified. Since there are several stages of amplification, it is clearly not convenient to tune each stage to each frequency separately. What is required is for all signals to be converted to a common frequency which can then be fixed tuned. This is known as the IF, or intermediate frequency, which for AM reception is usually fixed at about 470kHz. Some imported radios have a lower IF, 455kHz, which is the reason for the annoying whistle sometimes experienced adjacent to stations operating around 908kHz. Therefore the generator will have to cover this band of frequencies plus all RF frequencies likely to be covered by the receiver.

This will enable us to check the tuning of the aerial coils, the oscillator and the IFs. If these coil cores and trimmers are not accurately adjusted the receiver cannot give of its best. The signal generator provides a means of doing this, and much more, since we can now inject signals into various stages of the receiver and thus locate the stage which is not functioning correctly. The wobbulators is a variation of the signal generator, which we will not consider here, but which is essential for many kinds of accurate alignment.

An oscilloscope enables us to "see" into a circuit. The signals are amplified and appear as a trace on a screen so that the effect of each stage can be seen and adjusted, if necessary, to the required amplitude or waveform. It therefore enables us to see where signals are lost or become distorted.

The Ferrograph Test Set RTS2 from Wayne Kerr combines many of the facilities needed for checking the performance of recorders, amplifiers and other audio equipment. Included are an audio oscillator, distortion meter and AF millivoltmeter



FAULT~FINDING GUIDE

ALIGNMENT

Having mentioned these two valuable aids, let us immediately correct any misconception. In everyday radio repairs they are rarely needed. If the IF alignment has not been disturbed, do not touch it! If it has, it probably needs only a "tweek" to restore normal reception. Note which core or trimmer has been disturbed (wax or seal broken) and bring this, or them, into alignment with the other circuits. If the oscillator and aerial trimmers have been altered, switch to medium waves, set dial to about 1200kHz (250m) and set the oscillator trimmer to bring in Radio 1 (or any other frequency which is known to correspond to a particular station at this end of the dial) reset to around 1500kHz and trim the aerial trimmer. Retune to the lower end of the dial, to say Radio 3 on 647kHz, (this is the low end from a frequency point of view) with the core of the oscillator coil, appreciating the fact that this is going to upset the previous trimmer setting at the HF end which will have to be done again. Do this a couple of times until satisfactory tracking is obtained.

If a ferrite rod aerial is used adjust the medium wave winding on the rod for best reception on about 650kHz finally trimming the aerial trimmer, back on about 1500kHz. Leaving these settings untouched, switch to LW, tuning to 200kHz, or 1500 metres, then adjusting the long wave trimmer to bring in Radio 2, and setting the LW aerial trimmer to peak the signal, or adjusting the LW coil on the ferrite rod.

At this point any disturbance of the IFs can be corrected. If correct tracking cannot be achieved the IFs have probably been more seriously disturbed than was thought and the signal generator can then be brought out of cold store, set to the required IF (as marked on the set, or in the service information) and loosely coupled with a single turn of wire around the ferrite rod. With the set tuned to the low frequency end of the medium wave band, about 600kHz, increase the signal input until the modulating tone can be heard, adjusting the IF coil cores to peak and gradually reducing the signal input from the generator to the minimum, to prevent the AGC coming into action. Repeat the RF tuning procedure.

Photographs were kindly supplied by the following companies to whom all queries on the instruments illustrated should be addressed.
Wayne Kerr, Durban Road, South Bersted, Bognor Regis, Sussex PO22 9RL.
AVO Ltd., Archcliffe Road, Dover, Kent CT17 9EN.
Chinaglia Ltd., 19 Mulberry Walk, London SW3 6DZ.
Advance Electronics Ltd., through Peter Bush, Bush Steadman and Partners, Saffron Walden, Essex.

SNAGS!

Simple enough, isn't it? So where's the snag? Well, you see, we've only mentioned some of the procedure for AM sets. Two examples of the kind of component layout to be expected are shown, one a long and medium wave design as used in the Marconi 4173. Notice that the tuning adjustment for the low frequency end of the dial is called 'padding' and the high frequency adjustment is called 'trimming'.

The snag arises when there are many coil cans and lots of trimmers! The rule here is not to do anything unless you know the exact purpose of each adjustment. Otherwise you may be disturbing something which was previously correct and this is not the idea at all. Also shown is the layout of another Thorn group model, this time a Marconi 3183. Here we see the IF coil cans clearly marked AM and FM. These will not be marked as such in the actual set and therefore no coil cores should be disturbed unless such a diagram is available. Even then adjustment of the FM coils requires the use at least of an FM signal generator, preferably with 'wobbulator' and oscilloscope, in order to obtain the desired response curves.

The object of all this is to preach the sermon loud and clear. Do not touch what is not fully understood and attend only to that which really requires attention.

THE GENERAL THEME OF THE FAULT-FINDING GUIDE WILL BE CONTINUED IN THE JUNE ISSUE OF PRACTICAL WIRELESS DUE OUT ON 7 MAY.

on ing eceiver

F. G. RAYER

The sense aerial is then used to provide another signal. With one position of the ferrite rod, signals from both aerials will combine, giving a greater meter deflection than the other position, where ferrite aerial and sense aerials are out of phase. By this means it is possible to find which bearing is correct of the two minimum readings obtained withcut the sense aerial.

RF and Tuning

Fig. 1 is the circuit of the aerial, RF and oscillator tuning arrangements. L1 and L2 are MW and LW sections on the ferrite rod, which is assembled on a jack plug. This fits into a socket, through a hole in the top of the case. S1 allows the sense aerial to be connected. S2/3/4/5 are the four poles of a 3-way switch. Positions 1 and 2 of section S2, short L2, for MW reception. Position 3 introduces C3 and TC1 to load the oscillator coil L3 for LW reception. Sections S3 and S5 introduce series capacitors TC5 and TC2 in position 1, to spread the tuning at the high frequency end of the MW band. S4 connects trimmer TC4 for this band, and trimmer TC3 for the lower frequency bands.

To avoid the need for further aerial trimmers and to allow correct trimming with S1 open or closed, a panel trimmer VC3 is used for aerial circuits. Tr1 avoids the need for a coupling winding on the ferrite aerial, which would require four connections in all. A 3-way jack plug and socket may thus be used. Point 1 is the inner (tip), point 2 the centre and point 3 the outer sleeve. Tr1, together with its associated circuitry is fitted to a tag strip near the jack socket as in Fig. 1.

IF Circuit

Fig. 2 gives details of the IF circuitry, which comprises the oscillator/mixer Tr2, two IF amplifiers Tr3 and Tr4, and detector D1. External connections to Tr2 go from R4 to C5 with a lead from pin 3 of the oscillator coil, to C3, TC1 and C4, Fig. 1. R8 is under the board, from pin 4 to pin 2.

As strong signals can give more than full-scale on the tuning meter, the 1st IF amplifier Tr3 is arranged to have the manual gain control VR1. This can be adjusted to bring the meter back to a central position, when required, as well as controlling IF gain. Bias from D1 is thus applied for automatic gain control purposes to Tr4, via R14 and R16. The meter is positioned to one side of the tuning scale, while the meter amplifier Tr5, is assembled on a tag strip secured to the dial plate. Trimmer pot VR3 is set so that the meter reading is just beginning to rise, with no signal. Increasing signal strength then causes negative base bias to Tr5 to raise collector current, so that the meter reading rises. Maximum meter reading corresponds to maximum signal strength, when rotating the aerial or VC3. With VR1 set so that this is about half-scale on the meter, the directional null should give almost zero reading on the meter, and is used for bearings, as it is sharper than the maximum.

Audio from the volume control VR2 passes to the AF amplifier.

Audio Amplifier

The AF amplifier comprises pre-amplifier, driver and output stages, Fig. 3, and uses few components and easily obtained transistors. The most suitable

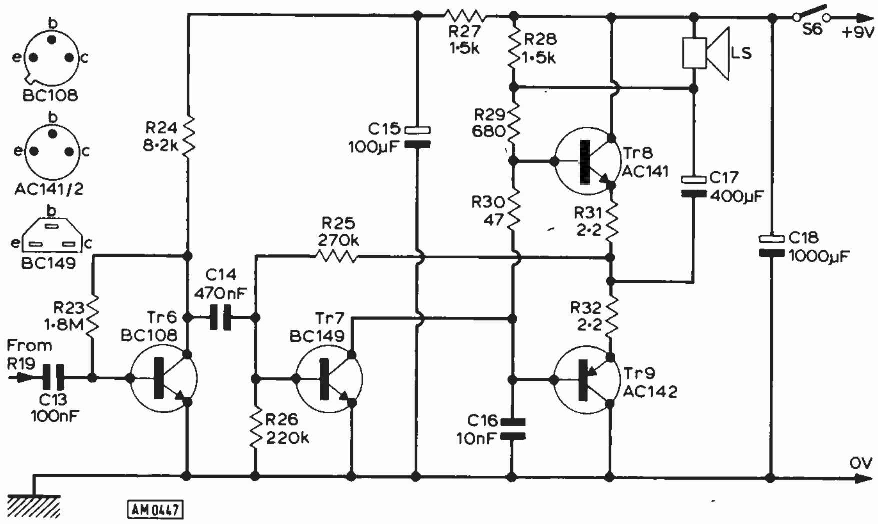


Fig. 3: This shows the circuit for the audio amplifier, which uses for its output a matched pair of AC141/2 transistors. Speaker impedance should be around 15Ω.

speaker impedance is about 15Ω, although the actual value is not too important. However, a speaker of less than about 10Ω ought not to be used, unless pressed into service by including a series resistor to make up the total, while speakers of over about 25Ω will result in some saving on battery current, but reduction in output.

Chassis and Panel

Holes are drilled in the front of the chassis as in Fig. 4. For the cabinet listed, allow the panel to project below the chassis about $\frac{1}{2}$in and mark the hole positions on it. The 7×2$\frac{1}{2}$in scale plate is bolted a little back from the panel, which is not fitted until later. Fit the ganged capacitor with 4BA bolts, noting it is essential to use short bolts, or add washers, so that they do not project beyond the thickness of the metal plate. Two small pulleys are pivoted on 4BA bolts, held with lock nuts to the plate. The cord passes twice round the drum, and then round the small wheels, and is held taut by a spring. Drill a hole in the panel for the slow-motion spindle of the capacitor. The pointer is a straight wire soldered to a small piece of tinplate, which is clipped on the cord. Arrange this so that it is fully to the right with VC1/2 closed and the spring to the left.

The case requires two $\frac{3}{4}$in diameter holes. One is placed centrally, for the ferrite aerial, and the other near the back right hand corner, for the telescopic aerial. Using a universal chassis flanged runner, 8×1in, cut sections from each flange 3in from the ends, so that it can be bent to form the mount shown in Fig. 5. This is bolted to the chassis so that the jack socket comes under the central hole in the case.

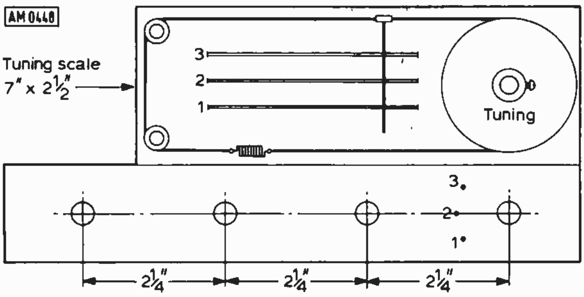


Fig. 4: Details of the scale card, and the spacings required for the variable control positions.

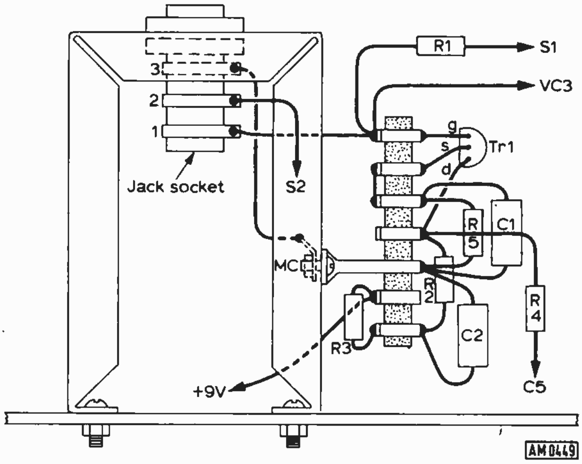


Fig. 5: The mounting for the rotating aerial, and the tag strip that holds the RF stage, is constructed from a Universal chassis flanged runner and bent to fit.

Should a little adjustment of height be required so that the jack socket will clear the top of the case, the legs of this metal part can be spread outwards to lower it. Check that there is sufficient space for the IF board between the mount and scale plate.

The sense aerial must be insulated from the chassis. This was arranged by punching a 1in diameter hole, over which a piece of paxolin is fixed with 6BA screws. The bolt on which the aerial screws fits vertically in the paxolin, and a lead runs from it to S1. If necessary, the paxolin can be spaced from the chassis, either above or below, so that the aerial closes flush with the case top. This aerial is run on to its screw after placing the receiver in its case.

The internal speaker is mounted on the left side of the cabinet. A grid of nine $\frac{3}{4}$in holes was punched over the position to be occupied by the cone. An alternative is to cut a larger hole and cover this with fabric or expanded metal. A 4×1$\frac{1}{2}$in opening is cut in the panel, and is covered by a slightly larger

★ components list

Resistors

R1	1kΩ	R17	680Ω
R2	4·7kΩ	R18	1·5kΩ
R3	1kΩ	R19	5·6kΩ
R4	100Ω	R20	100Ω
R5	2·7kΩ	R21	1·5kΩ
R6	18kΩ	R22	33kΩ
R7	15kΩ	R23	1·8MΩ
R8	1kΩ	R24	8·2kΩ
R9	2·7kΩ	R25	270Ω
R10	120kΩ	R26	220kΩ
R11	39kΩ	R27	1·5kΩ
R12	470Ω	R28	1·5kΩ
R13	560Ω	R29	680Ω
R14	47kΩ	R30	47Ω
R15	120kΩ	R31	2·2Ω
R16	27kΩ	R32	2·2Ω

All resistors 5% ¼W
VR1 100kΩ linear potentiometer
VR2 10kΩ log. potentiometer with switch S6
VR3 100Ω pre-set potentiometer

Capacitors

C1	50nF	C10	125µF
C2	100nF	C11	100nF
C3	160pF 2% silver mica	C12	10nF
C4	220pF 2% silver mica	C13	100nF
C5	20nF	C14	470nF
C6	2nF	C15	100µF 10V
C7	100nF	C16	10nF
C8	100nF	C17	470µF 6V
C9	4µF 4V	C18	1000µF 10V

VC1/2 Jackson 00 208/176pF slow motion gang
VC3 Jackson C804 50pF
TC1-TC5 60pF trimmers

Semiconductors

Tr1	MPF102	Tr6	BC108
Tr2	BF194	Tr7	BC149
Tr3	BF194	Tr8	AC141
Tr4	BF195	Tr9	AC142
Tr5	BC179	D1	OA81

Miscellaneous

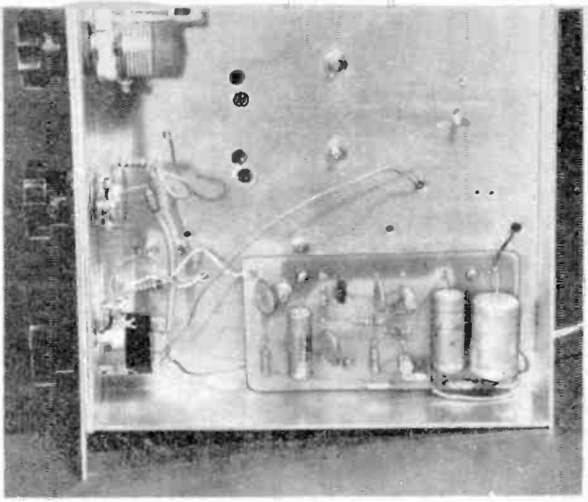
L1/L2, Denco MW/LW 5FR. IFT1, Denco IFT18/465. IFT2, Denco IFT18/465. IFT3, Denco IFT14.L3, Osc. coil Denco TOC1. S1, miniature slide switch. S2-S5 4-pole 3-way rotary switch. Moving coil meter 1mA fsd 42 x 42mm. Jackson 54mm diameter drum. Paxolin tube 150 x 29mm diameter. 6mm stereo jack socket. 5 control knobs. 550mm telescopic rod aerial. 6mm stereo jack plug. 15Ω speaker. 156mm dia. 360 degree protractor. Plastic bowl 156 x 30mm. OSC/IF PCB, 105 x 55mm. AF PCB, 129 x 55mm. Both boards available from the PW Readers PCB Service, page 1070.

Case

Type W case 10 x 7 x 5½in. Type K chassis 9 x 6½ x 1½in. Type A screen 7 x 2½ x ½in. All HL Smith & Co. 8 x 1in. flanged Universal chassis runner—Home Radio Ltd.

piece of 1/16in Perspex, held with two screws. A card scale, upon which three lines have been drawn, is fixed with adhesive, so that the three bands can be calibrated later.

A bracket is bent from scrap metal to hold the PP7 battery and is screwed down behind the aerial mount. Do not overlook that holes are required under IFT1 and IFT2, so that the lower cores can be reached. These are simply positioned by marking them through the circuit board before fitting the IFT's.

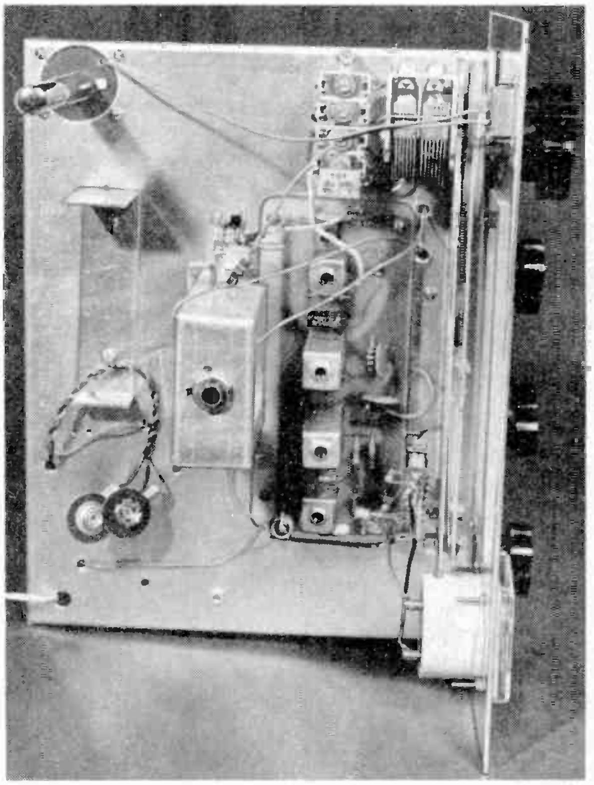


Underside view of chassis, showing the volume control, IF gain and aerial trim controls. The PCB in the lower righthand corner is the Audio board.

RF Stage

The RF circuit is wired as in Fig. 5, which also shows connections to the jack socket. Leads are fitted to run to S1, VC3, C5, battery positive line and S2. The jack plug and socket, S1 and aerial, as well as VC3, contribute to the stray capacitance across L1 and L2 so when wiring, these unavoidable capacitances should be kept as low as possible, otherwise there may be difficulty in reaching the HF end of the range.

With individual samples of Tr1 it is possible that changes to the resistors R2 and R5 could improve gain. Otherwise the values given should be suitable. R4 may be the lowest value which does not allow instability to develop.



General plan view photograph of the receiver, showing layout of the Osc/IF board, tuning capacitor and trimmers, and the rotating aerial mounting.

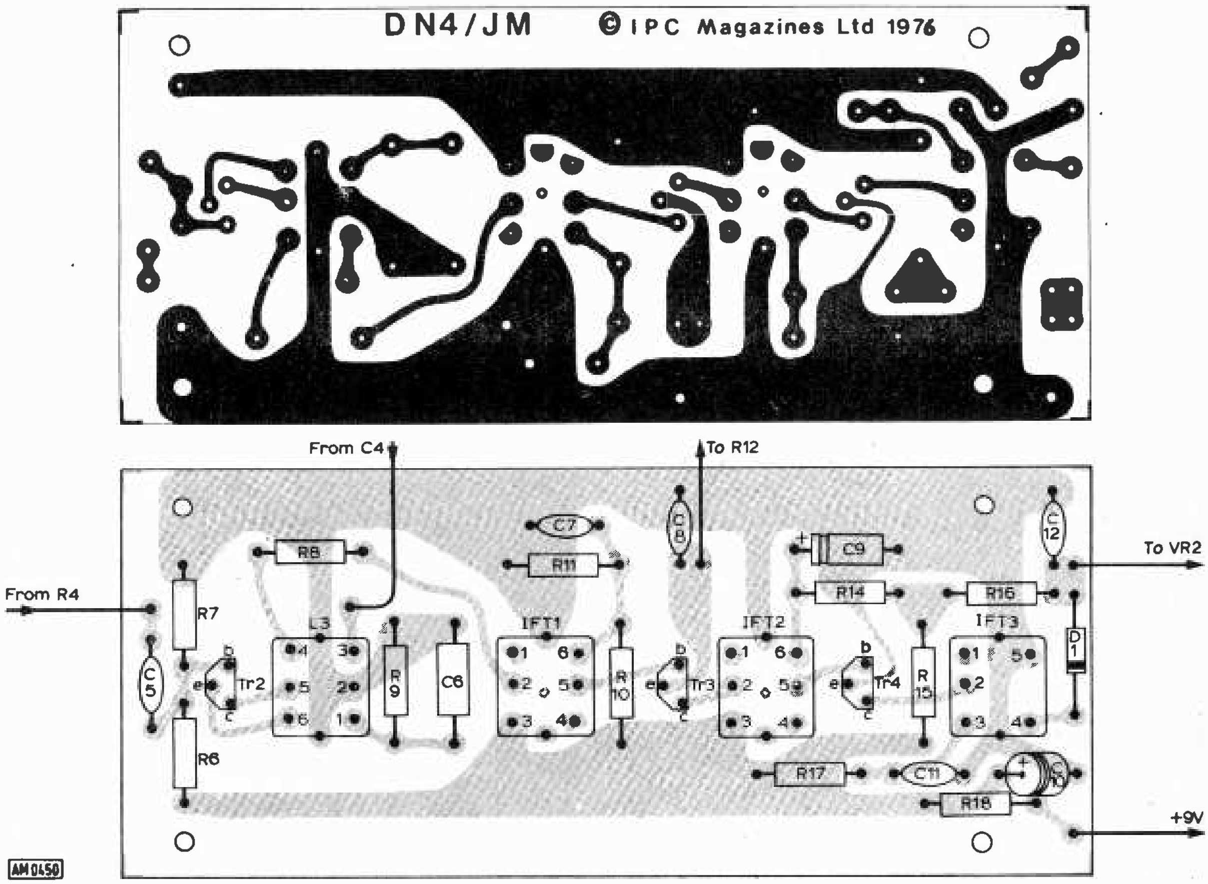


Fig. 6: Foil side and component side views of the Osc/IF board. Both are shown full size. If the board is to be tested outside the receiver, VR2 must be connected

Osc/IF Board

Fig. 6 shows the PCB carrying the Osc/IF sections of the receiver. The input goes to C5 and the output taken from D1. The oscillator coil and IFTs should fit without any need to use force. If not, the holes for these may be slightly enlarged, taking care not to break the foil. Components are inserted as in Fig. 6, excess length of wire being snipped off after soldering. Provide flying leads for input, output, battery positive (S6), meter amplifier and IF gain control. (If this board is tested before fitting, VR2 must be connected.) Mounting is by means of four ½in 6BA bolts, with extra nuts to give spacing from the chassis and locked firmly to provide the necessary chassis return.

Since the gain of individual transistors varies, it might be possible to modify the value of R8, using the lowest value which does not result in uncontrollable oscillation at any frequency. Normally, however, the value given can be fitted.

Audio Amplifier

The AF board is shown in Fig. 7. Colour coded leads can be soldered on for R19, speaker and battery positive. The PCB is mounted under the chassis with three bolts, with the speaker leads made long enough to allow the receiver to come well out of the case. If a jack socket is used here, it must be completely insulated from the chassis or be of the insulated type.

Meter Amplifier

Components for the meter amplifier are wired to the tag strip as in Fig. 8. The meter is a 1mA instrument calibrated in S-points, though the meter is primarily required to show minimum signal positions for the rotating ferrite rod aerial. If after maximum adjustments to VR3 the meter cannot be set so that it is just beginning to rise, with no signal tuned in, then either R20 or R21 may be changed in value, to correct this. Alternatively, R3 can be changed to 250Ω, provided R20, VR3 and R21 in series total about 1·5 to 2kΩ. It does not matter how the potential divider is made up, except that adjustment of VR3 becomes more critical if it forms most of the total resistance.

Bandswitch

Connections to the switch are shown in Fig. 9, and can be followed in conjunction with Fig. 1. The rotor tag of VC3 must be wired to the chassis. TC5 is soldered directly across the switch, while the four trimmers TC1 to TC4 are mounted on a strip fixed

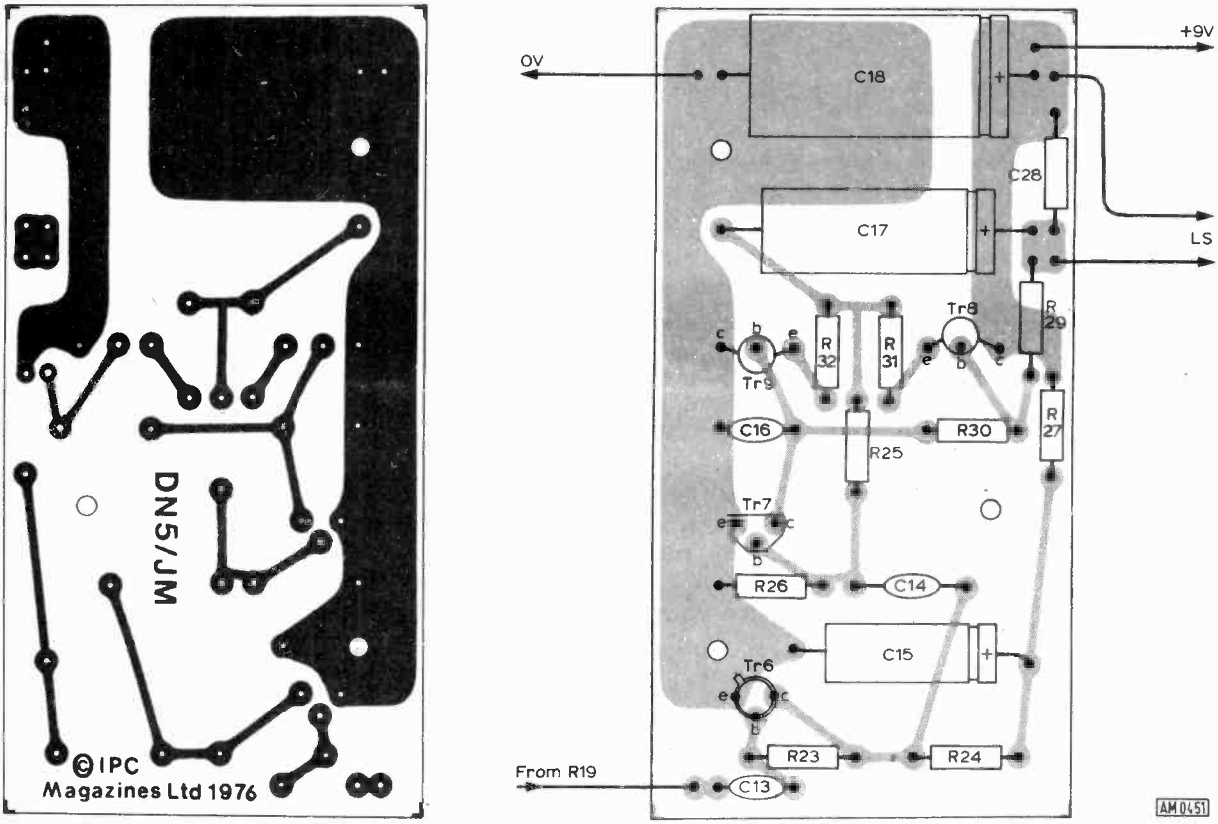


Fig. 7: Audio amplifier board showing the foil side to the left and the component side to the right. Again, both are shown full size. Chassis mounting is by three bolts.

clear of the chassis, by spacers, and behind VC1/2. It is convenient to use these trimmers, from left to right, for the circuit positions in Fig. 1. That is, TC1 LW oscillator trimmer; TC2 Range 1 bandspread coverage; TC3 Range 2 (and LW) oscillator trimmer; and TC4 Range 1 trimmer. This allows a short lead to run from pin 3 of the oscillator coil to TC1 and C4, which is connected from TC1 to TC2. For short leads, use the lower tags of VC1 and VC2, as in Fig. 10.

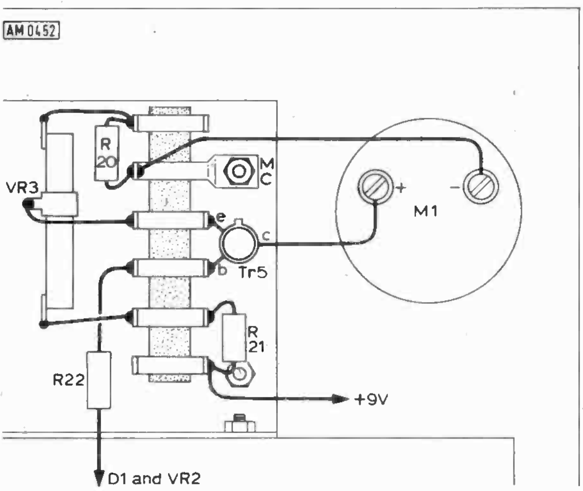


Fig. 8: Components that make up the meter amplifier are mounted on a tag strip adjacent to the meter itself. VR3 can be any pre-set pot of 100Ω.

Rotating Aerial

A 3-way jack plug is used as a pivot and is assembled as in Fig. 11. A $4^1{}_4$in disc is cut from plywood (this diameter was chosen to suit the diameter of the 0-360° protractor and is a tight push fit on the insulated part of the jack, to which it is cemented. If necessary, a block with a central hole can be glued here to strengthen the assembly. Insulated thin flexible leads are soldered to the plug contacts; these may be green for 1, red for 2, and black for 3. Thread these wires up through the jack moulding and bring them out on top of the disc.

The ferrite rod aerial as received has a few turns for base coupling to L1 and these are removed. L1 and L2 must be in the same phase when connected in series, or LW alignment is impossible. The rod is secured to a small piece of paxolin by thread and

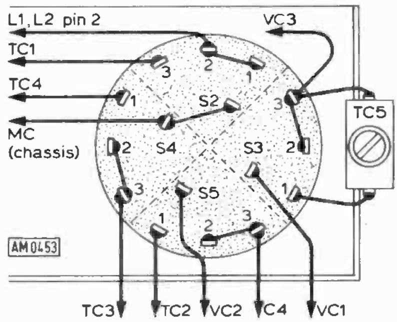


Fig. 9: The band switch comprises four poles and three positions, and the above drawing shows the connections to this switch, and the trimmer TC5.

The Black Watch – using the unique Sinclair-designed state-of-the-art IC.

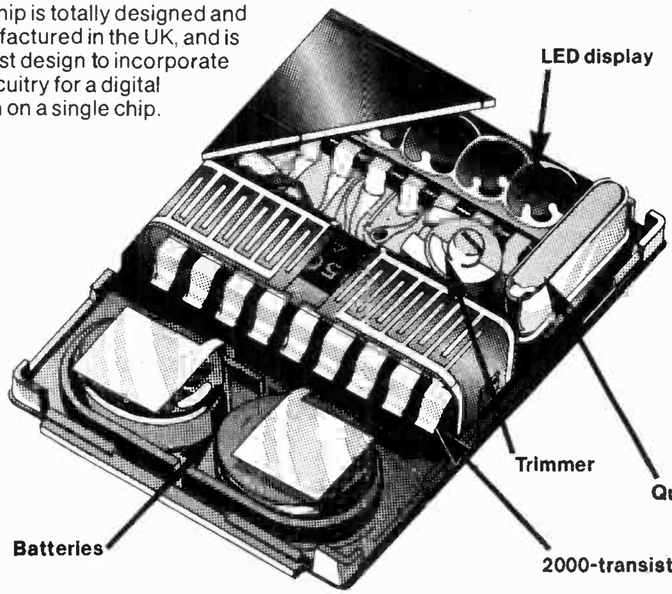
The chip…
The heart of the Black Watch is a unique IC designed by Sinclair and custom-built for them using state-of-the-art technology – integrated injection logic.

This chip of silicon measures only 3 mm x 3 mm and contains over 2000 transistors. The circuit includes

a) reference oscillator
b) divider chain
c) decoder circuits
d) display inhibit circuits
e) display driving circuits.

The chip is totally designed and manufactured in the UK, and is the first design to incorporate *all* circuitry for a digital watch on a single chip.

…and how it works
A crystal-controlled reference is used to drive a chain of 15 binary dividers which reduce the frequency from 32,768 Hz to 1 Hz. This accurate signal is then counted into units of seconds, minutes, and hours, and on request the stored information is processed by the decoders and display drivers to feed the four 7-segment LED displays. When the display is not in operation, special power-saving circuits on the chip reduce current consumption to only a few microamps.



Complete kit £14.95!

The kit contains

1. printed circuit board
2. unique Sinclair-designed IC
3. encapsulated quartz crystal
4. trimmer
5. capacitor
6. LED display
7. 2-part case with window in position
8. batteries
9. battery-clip
10. black strap (black stainless-steel bracelet optional extra – see order form)
11. full instructions for building and use.

All the tools you need are a fine soldering iron and a pair of cutters. If you've any queries or problems in building, ring or write to Sinclair service department for help.

Take advantage of this no-risks, money-back offer today!

The Sinclair Black Watch is fully guaranteed. Return your kit in original condition within 10 days and we'll refund your money without question. All parts are tested and checked before despatch - and correctly-assembled watches are guaranteed for one year. Simply fill in the FREEPOST order form and post it - today!

Price in kit form: £14.95 (inc. black strap, VAT, p & p).
Price in built form: £24.95 (inc. black strap, VAT, p&p).

sinclair

Sinclair Radionics Ltd,
London Road, St Ives,
Huntingdon, Cambs., PE17 4HJ.
Tel: St Ives (0480) 64646.
Reg. no: 699483 England. VAT Reg. no: 213 8170 88.

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

Please send me — Total £

.... (qty) Sinclair Black Watch kit(s) at £14.95 (inc. black strap, VAT, p&p). ....

.... (qty) Sinclair Black Watch(es) built at £24.95 (inc. black strap, VAT, p&p). ....

.... (qty) black stainless-steel bracelet(s) at £2.00 (inc. VAT, p&p). ....

* I enclose cheque for £.................................... made out to Sinclair Radionics Ltd and crossed.

* Please debit my *Barclaycard/Access/American Express account number

....

Name (please print) ______________________________

Address ______________________________

____

____

Signature ______________________________ PW/4

FREEPOST – no stamp required.

* Delete as required

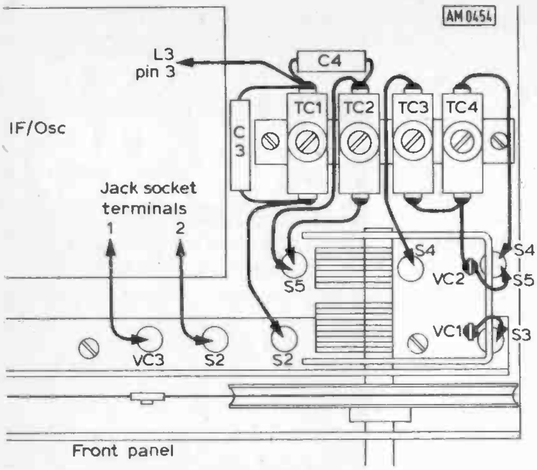


Fig. 10: The trimmers TC1 to TC4 are mounted in the above configuration to enable the leads to be kept as short as possible.

adhesive. This is held with two small screws, with strips to space it slightly from the disc, to clear the plug leads. These are soldered to the appropriate leads from L1 and L2, using pins as anchorage points if required. When the aerial has been tested, it is protected by a 6×1in paxolin tube, cut away just sufficiently on the underside to allow it to be fitted over the rod. A lead from point 3 is brought out from the tube.

The metal shield is bent from aluminium, about $3\frac{1}{2}\times 2$in, to clamp the paxolin to the wooden disc and it is earthed by a tag under one fixing screw, soldered to lead 3. Its purpose is to improve the minimum null by reducing non-directional pick-up by the connecting wires. Approximate alignment can be made before fitting the paxolin tube. Final small adjustments to the positions of L1 and L2 may be made with an insulated tool, through the open ends of the tube. The ends of the tube may be closed with discs of insulating material. Due to stray pick-up by other wiring, the sharpest directional nulls are obtained only with the receiver in its metal cabinet.

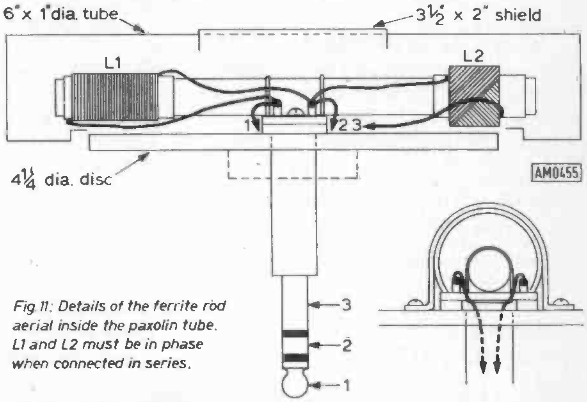
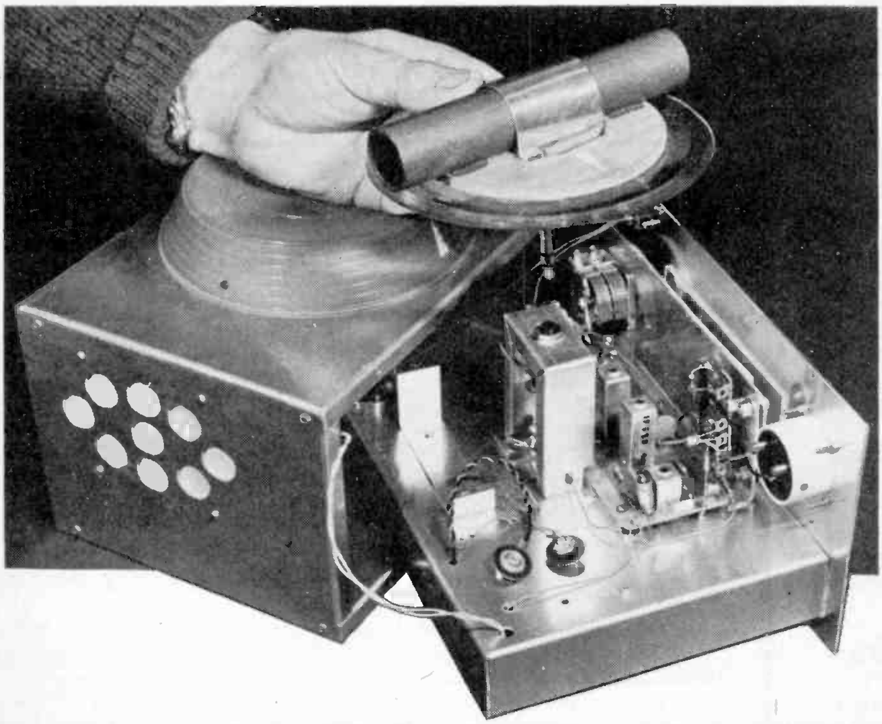


Fig. 11: Details of the ferrite rod aerial inside the paxolin tube. L1 and L2 must be in phase when connected in series.

Alignment

Band coverage is most easily checked if a signal generator is available, but satisfactory alignment is possible without this. The IFTs are pre-aligned by the maker so only small adjustments to these cores should be necessary and should not in any case be made until signals are received. A correctly shaped tool, such as that available from the IFT maker, must be used, otherwise the cores may crack.

To check the IFTs, tune in any steady, stable signal correctly, with VR1 near maximum gain, but reducing signal strength if needed by rotating the aerial, so that the meter does not go beyond full scale. All the IFT cores can then be adjusted slightly to give the best meter reading. When the IFTs are correctly aligned in this way, they must not be altered or re-adjusted when aligning the aerial and oscillator



The ferrite aerial is mounted inside a paxolin tube and connected via a stereo jack plug. This permits the aerial to be rotated to find the 'Null' point.

continued on page 1080

GOING BACK...

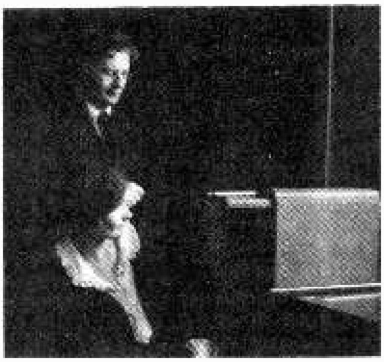
1970 60 50 40 30 20

COLIN RICHES

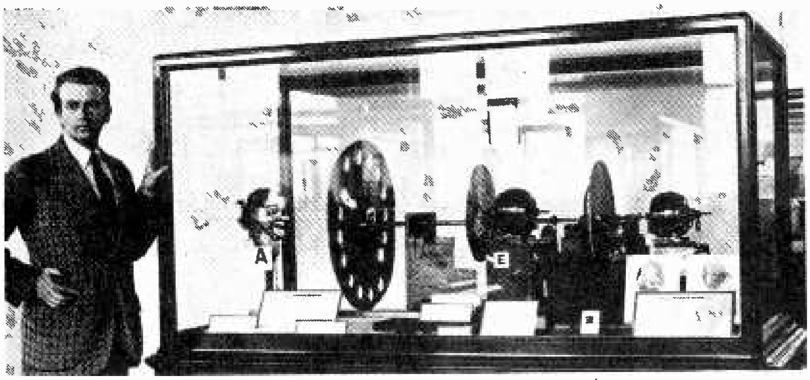
J. L. B.

SEVERAL readers have expressed interest in the picture of John Logie Baird's "Televisor" shown in the February 1976 Going Back so I thought I would show another couple of pics. of the great man. The small photograph shows J. L. B. with Miss King—the first girl ever to be televised. The larger picture shows J. L. B. in 1926 with his original television apparatus. If anyone wants to see this fantastic piece of equipment, pop along to the Science Museum—it's there in a glass case just like the one in our picture.

Some J. L. B. milestones: **May 1924**—The Baird Television System. "Mr. Baird has achieved some remarkable results which go a long way towards proving that television is practicable." **October 1926**—"The first TV licence was recently granted to Mr. J. L. Baird's stations. One is situated in St. Martin's Lane and the other at Harrow. At present the London Station is a transmitter and, except for an interval of a fortnight, 'looking-in' has been in progress every night for some weeks on a wavelength of about 200 metres." **May 1927**—Said J. L. Baird, "In ten years time, I prophesy, we shall be able to see on our wireless televisors topical events, such as the finish of the Derby or the finish of the Boat Race."



J.L.B. and his 'first lady'



J.L.B. and original apparatus.

Anyone Help?

MR. M. HILL, Hillside, Peaslake, Guildford, Surrey is desperately anxious to obtain an old Murphy A92 "Stationmaster" receiver of 1940 vintage. It's an 8-waveband all-mains receiver which was claimed to have a very good short-wave performance. If you can help, please contact Mr. Hill direct.

Overseas News

MR. KEN McKenzie, one of our New Zealand cousins recently wrote to say that he has been a radio enthusiast since 1924 when he heard, via the telephone, for the first time in his life, a radio broadcast. It was from the South Seas Exhibition on South Island, N.Z. In 1927 he built his first one-valve receiver from a design published in the journal *N.Z. Radio*. His ultimate project was a three-valve receiver working a Philips "Baby Grand" cone speaker.

For a long time his nearest transmitter was 2YA Wellington, which ran at 5kW and was over 40 miles away. Later, for a town of a then population of about 12,000 they became very well served by two dealers in radio sets and parts who set up broadcast transmitters. They were N.R. (Ray) Cunningham with 2ZQ and W. D. (Bill) Ausell, with 2ZD.

It's always good to hear from our overseas enthusiasts so keep the letters coming in folks!

Vintage Radio Society

I HEARD from our friend Tudor Rees (of Antique Wireless Newsheet fame) again recently and he says there is a saying "Put two Englishmen upon a desert island and they will form a club". This however certainly isn't based on fact when it comes to a British Vintage Radio Society. There must be literally many thousands of enthusiasts but no sign of a club or society as yet. Things may be looking up though, for a Mr. A. Constable, 18 Ravensbourne Gardens, Ealing, London, W.13 wishes to conduct an initial survey as to the possibility of forming such a group. He would like all those with a genuine interest in a Vintage Radio Club to write to him (I would suggest you enclose a s.a.e.).

Vintage CQ Column

FROM time to time we publish a special "Vintage CQ Column" for readers who have requests for old books, equipment etc, and those who wish to dispose of such items. If you want to be included in our next column, please address your request to "Vintage CQ", Practical Wireless, Fleetway House, Farringdon St, London EC4A 4AD.

PRODUCTION LINES

colin riches

Please mention Practical Wireless when writing to manufacturers and suppliers whose addresses are given in these pages.

—Thank you.

NEW MIC

A noise cancelling microphone which the manufacturers state has exceptional qualities of discrimination between the voice and random noise is now in production at the Eastleigh, Hampshire works of Selsound Limited.

In their search for the clearest possible transmission of speech, Selsound engineers have demonstrated that the microphone is able to eliminate extraneous noise to an exceedingly high degree. Exhaustive laboratory development resulted in a high level of response within that band of frequencies most important for clarity of speech, a marked diminution on each side of this band and a steep gradiant to the sensitivity/proximity curve.

Selsound microphones are available in the form of a microphone insert, styled "Type 2500", but the company state that they can provide special housings to suit specific requirements and installations.

Full technical details are available from *Selsound Ltd., (Dept. P.W.) Victory Close, Industrial Estate, Chandlers Ford, Eastleigh, Hants. Tel: Chandlers Ford 67158.*

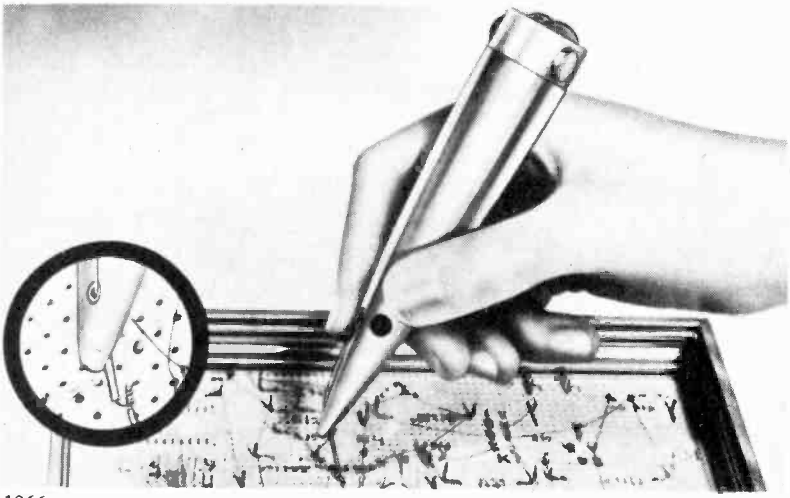
WIRING PENCIL

This new wiring pencil, patented by Vector Electronic Co., U.S.A. comprises a lightweight plastic housing, a replaceable spool of wire, and extended metal tip to guide and cut the wire. The wire is said to be a unique solder through nylon-polyurethene insulated tape which, when heat is applied to the wrapped connection points with a fine-tipped soldering iron, the insulation melts away, and produces a soldered joint. The wiring tip of the pencil is angled to facilitate wrapping and to provide a clear view of operations.

The makers claim that the average time required to make a soldered joint is only seconds—and reckon it's about three times faster than conventional soldering.

The pencil, complete with two 250ft. spools of wire, sells for £6·75 plus postage.

Further information from: *J. H. Equipment Limited, (Dept. P.W.) 91 Redbrook Road, Timperley, Trafford, Lancs.*



THE ALL BRITISH CARTRIDGE

Goldring have just brought out a new Cartridge—the G900SE. The key to the G900SE performance is the great mass reduction (moving mass 32g) which immediatley results in extremely low intermodular distortion. (Physical mass has been reduced to 5mg.)

These reductions in mass have been achieved firstly by the introduction of minature magnets to a specification previously believed impossible. Then spurning conventional methods, the coil assembly used in the main body of the cartridge is created using formerless winding techniques through which Goldring have saved valuable space and therefore weight, which in turn reduces the mass which the stylus has to move.

Welded to the magnet is a micro gold plated nickel tie bar, which is there partly as an earth to reduce crucial static discharges that can occur and also to control the movement of the stylus in unwanted modes. The whole assembly is then pivoted via a special Butyl polymer with optimised damping.

Specification:

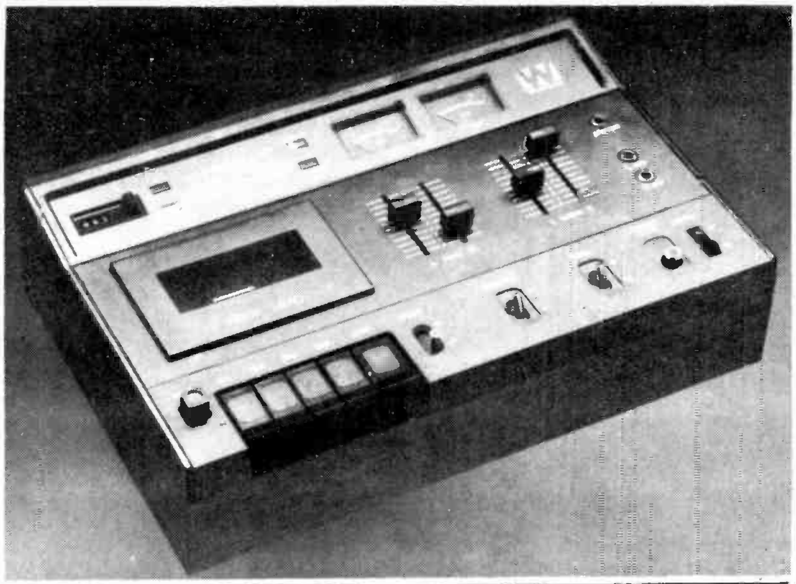
Frequency range: 10Hz-28kHz.
Frequency response: 20Hz-20kHz $\pm$2dB.
Playing weight: 1 gm.
Playing weight range: 0·75-1·5 gm.
Tip mass: 0·32 mG.
Stylus point radius: ·0007″ × ·0002″ (18μ × 5μ).
Inductance at 1kHz: 640 mH.
Inductance at 10kHz: 630 mH.
DC resistance: 720 Ohms.
Channel separation: 25dB NOM.
Output (sensitivity) @ 5 cm/sec: 1kHz. RMS 5mV $\pm$ 1·5dB.
Compliance (static): 40 LAT × 10^{-6}cm dyne, 20 VER × 10^{-6}cm dyne.
Vertical tracking angle: 24° Net weight: 5 gm.

Goldring Limited (Dept. P.W.) 10 Bayford Street, Hackney, London E8 3SE.

WHARFEDALE DECK

Rank Hi-Fi have announced the Wharfedale XP cassette deck (with Dolby) at £165 (inc. VAT). Finished in black and walnut, this 4-track stereo deck has an electronically governed DC motor and automatic bias selection. Tape speed: 4·8 cm/sec ($1\frac{7}{8}$ips) ± 1·5%. Wow and flutter: DIN 45507 0·20% (maximum) (peak weighted). Output levels: DIN socket more than 10K ohm, OVU input, 580mV ± 1·5%, headphone jack, 2 volts into 50 ohms. Input level: microphone/DIN 2mV, line 30mV. Input impedance (nominal): microphone/DIN 5·6kΩ, line 50-500kΩ. Bias frequency: 79kHz. Frequency response (record/playback): standard tape (Dolby out) 50-10,000Hz ±3dB, 10,000-12,500Hz −3 to −5dB; CrO_2 tape (Dolby out) 50-12,500 ±3dB, 12,500-14,000Hz −3 to −5dB; Dolby in from Dolby out frequency characteristics within ±3dB. Frequency response (playback only): within 3dB of record/playback, response from 50-10,000Hz. Total harmonic distortion (max.): 3·0%. Typical signal/noise ratio: Dolby out 54dB, Dolby in 61dB. Erasure (minimum): 60dB. Channel separation (min. at 1KHz): 32dB.

Rank Audio Visual Ltd., (Dept. P.W.) P.O. Box 70, Great West Road, Brentford, Middx.

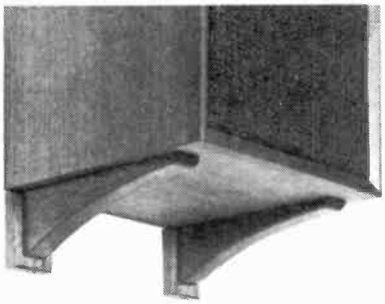


PHILIPS MULTI-TESTER

Model SMT-111 has as one of its most important features, a high input impedance of 0·5MΩV. This derives from an integrated circuit amplifier which enables the instrument to be used in many AC applications, up to 25kHz on the 12V range, for example. The use of an integrated circuit amplifier also enables a lower-impedance moving coil movement to be incorporated.

The SMT-111 is based on the combined experience of Philips own engineers and technicians throughout the world. Its thirty-five measuring ranges were selected with them in mind and an additional feature has been the inclusion of an AC current range. Both the integrated circuit and movement have been fully protected against peak overload and a checking point for the battery has been incorporated in the range selector switch. The SMT-111 is priced at £30·00. *Philips Electrical Limited, (Dept. P.W.), Century House, Shaftesbury Avenue, London WC2H 8AS.*

SPEAKER BRACKETS



The brackets holding this speaker are made of hardwood and are manufactured by Esta Limited, Staffs.

These "Astute" brackets, which are very easy to fit can easily be removed for decorating etc. Rubber pads are incorporated to hold speakers so that no screws need to be driven into the actual speaker cabinets.

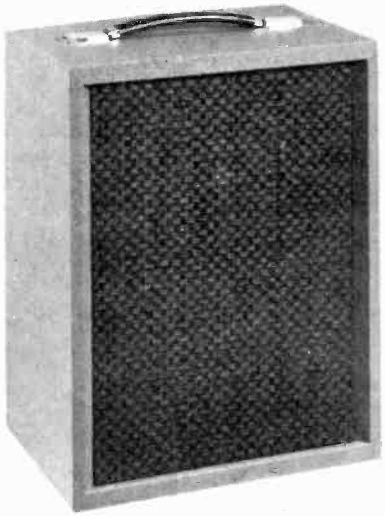
They come supplied sanded ready to finish and are complete with screws and plugs. Prices: 14cm £1·71; 19cm £2·16; 26cm £2·70 further gen from *Esta Heating Products Limited, (Dept. P.W.) Green Lane, Walsall, Staffordshire.*

FOR CINE FANS

The Leeds firm of Farnell-Tandberg Limited recently introduced two new loudspeakers aimed mainly at the home-movie market, for both of them are suitable for use with cine sound projectors. Model FT 108 has a 4Ω impedance which accurately matches the output of most 8mm sound film projectors. The FT 116 has an impedance of 8Ω to match the output of the majority of 16mm sound projectors on the market.

The robust cabinets (and you need them to be pretty strong if you are lugging equipment around doing film shows) are finished in grey rexine with matching vynair. Both incorporate a 10in. loudspeaker giving 10W RMS output. The units are supplied with 15 metres of twin-core sheathed cable which terminates in a DIN speaker plug. All of this can be neatly stowed away in the back of the cabinet where there is a compartment with a removable lid.

We tried one of these speakers on an 8mm projector and also tested it with an ordinary cassette tape recorder to play back sound for slide shows. In both cases results were very good. The price of these speakers



is set at £23·25 plus VAT. Further gen on these and other Farnell-Tandberg equipment for sync sound systems may be obtained from *Mr. M. R. Cowing, Promotional Services Manager, Farnell-Tandberg Limited, (Dept. P.W.) Farnell House, 81 Kirkstall Road, Leeds, LS3 1HR.*

THE OTHER SIDE HEARD

IGOR HAJEK

SOME time ago, I suggested in the pages of this magazine that it might be worthwhile to explore possibilities of long distance VHF reception on the East European (OIRT) band, 65 to 73MHz. At that time (PW October 1974) I wrote that Sporadic E openings on these lower frequencies could take place more often than those reaching into the 90 to 100MHz region though the statement was rather in nature of an educated guess, being partly based on other people's observations.

SEASON 74/75

During the 1974 and 1975 SpE seasons (mid-May to mid-August) I conducted some experiments of my own and the results have shown that if anything, my prediction had not been optimistic enough. In 1974, long distance propagation of FM radio signals caused by reflection from the ionosphere was observed on 27 occasions; only on 5 of these occasions did the exceptional DX conditions also affect the West European (CCIR) FM band, 87·5 to 104MHz. In 1975, the ratio was 35:6 and there were a few additional days last July when broadcasting stations from Eastern Europe could be received due to enhanced tropospheric propagation.

The duration of these favourable receiving conditions, as well as the times at which they occured, differed widely. They would last from less than one hour to several hours at any time of the day and on some occasions OIRT stations could be heard from early in the morning till late at night.

Signals were usually of a long-skip character and stations most frequently received were those from the north-western and western parts of the USSR (i.e. Estonia, Latvia, Lithuania, Byelorussia and the Ukraine), eastern Poland, Romania and Hungary, while Bulgarian and Czechoslovakian FM stations appeared less often. The strength was sufficient to make listening in stereo possible, though at times with a considerable level of noise. Indeed, stereo programmes have been received from all the OIRT countries, the only exception being the USSR, where a different system is used for stereo broadcasts (unsuppressed subcarrier at 31·25 kHz), which the common 19kHz pilot tone type of decoder cannot resolve.

—a long-skip character

EQUIPMENT

My equipment consisted at first of a small 4 metre converter with the oscillator set at 173MHz and an IF at 100MHz, used in connection with an ordinary FM tuner, an aerial preamplifier and a wideband Yagi array. For the 1975 season, however, the converter was replaced with one of the currently available FM tunerheads. Retuned to the 65 to 73MHz band it was built into the tuner as an alternative, switchable front end.

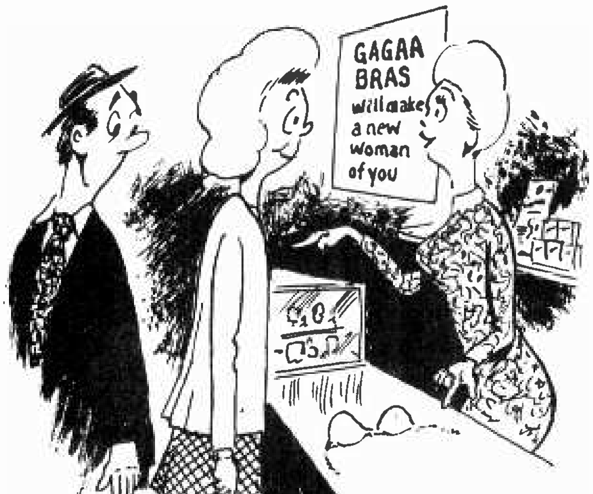
It is this latter arrangement that I can recommend to anyone interested in similar experiments, and results achieved over the past two years certainly do confirm that the lower FM band is ideally suited to VHF DXing. However, it is impossible to give any advice as to the choice of a suitable front end. There are quite a few types available, costing mostly under £10 (e.g. from Ambit International) and the actual selection has to be made with regard to the specifications of the tuner with which it is to be used.

A word of caution seems to be in order as retuning may prove to be a tricky business as it requires a signal generator or, ideally, a calibrated wobbulator. A simple adjustment of cores and trimmers would probably be not enough. In my case, at least, it was necessary to add approximately two turns to each coil as well as increasing the oscillator feedback capacitor by a few pF.

On the other hand, there should not be any difficulty about finding a suitable aerial as any old 405 line TV aerial will do, in particular those for Channel 5. The OIRT transmitters are both vertically and horizontally polarized.

EXPECTATIONS

The 65 to 73 MHz band is, under normal conditions, fairly quiet in this country. There is some RT traffic, amplitude modulated, around 71MHz and in most areas of the UK the vision buzz of TV channel B5 can be heard on 66·75MHz. There seem to be less and less amateurs operating on 4 metres (70MHz) these days. This means of course that anything else that may suddenly appear on these frequencies in the summer months is fairly sure to be coming from Eastern Europe via SpE, and do not be surprised if it happens to be English pop, as they play a lot of it over there.



—advice on a suitable front-end

An exception is the frequency of 67·75MHz on which TV sound can be heard on such occasions originating from Yugoslavia, Spain, Italy and other continental countries. It should also be mentioned that while the OIRT FM band nominally starts at 65MHz, few stations can actually be found below the 66MHz point because there is a small overlap with channel R2 TV sound on 65·75MHz so that frequencies between 65 and 66MHz are used by FM radio only in areas not covered by this TV channel.

For the British DXer the most difficult problem may well turn out to be the identification of individual stations and countries of origin. Being able to recognize the main languages of the area is of some importance and listening to the foreign broadcasts of the BBC, which are always introduced in English, could be quite helpful in this respect. After a time, one gets attuned to the sound of a language and it is then possible to identify it without actually understanding it. Once this point is reached, it should be much easier to catch the odd word which makes closer identification possible. News broadcasts and weather reports are particularly revealing as the emphasis tends to be on local events and temperatures PW

PW TECHNICROSS PUZZLE

Solution to No. 12 presented last month

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

Mail Order Protection Scheme

The Publishers of *Practical Wireless* are members of the Periodical Publishers Association which has given an undertaking to the Director General of Fair Trading to refund monies sent by readers in response to mail order advertisements, placed by mail order traders, who fail to supply goods or refund monies owing to liquidation or bankruptcy. This arrangement does not apply to any failure to supply goods advertised in a catalogue or in a direct mail solicitation.

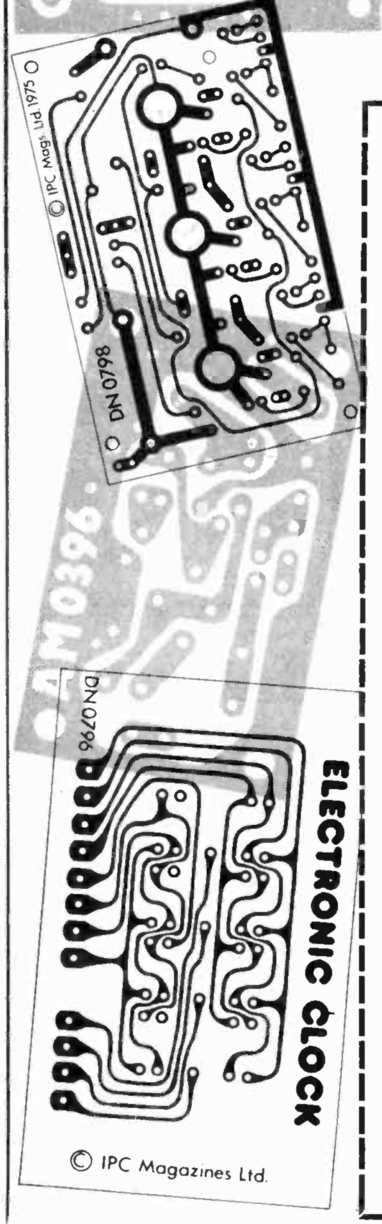
In the unhappy event of the failure of a mail order trader readers are advised to lodge a claim with *Practical Wireless* within three months of the date of the appearance of the advertisement, providing proof of payment. Claims lodged after this period will be considered at the Publisher's discretion. Since all refunds are made by the magazine voluntarily and at its own expense, this undertaking enables you to respond to our mail order advertisers with the fullest confidence.

For the purpose of this scheme, mail order advertising is defined as—

'Direct response advertisements, display or postal bargains where cash had to be sent in advance of goods being delivered'. Classified and catalogue mail order advertising are excluded.

EDITORIAL ANNOUNCEMENT

NEW! PRACTICAL WIRELESS PCB SERVICE FOR READERS



Our new PCB service is well under way and we are now able to add PCBs for two popular projects published prior to December 1975. All boards, except SRBP, are epoxy glassfibre, drilled and roller-tinned.

To:- READERS PCB SERVICES LTD, PO BOX 11, WORKSOP, NOTTS

Please supply PCB/s as indicated by tick/s in box/es

Issue	Project		Ref	Price	
Mar 75	Electronic Organ (set of two)		AMO315 AMO318	7·80 + 25	☐
Sep 75	Electronic Clock (set of three)		AMO387 AMO389 AMO392	2·40 + 15	☐
Dec 75	Radio-Pickup Link		DN0792	0·98 + 12	☐
Dec 75	Random Number Selector		DN0793A	0·98 + 12	☐
Dec 75	Sound-To-Light Display		DN0798	1·15 + 12	☐
Dec 75	12V PA System		DN2/JM	0·98 + 12	☐
Dec 75	Disco System, Amplifier (2 required)	each	AM0421	3·40 + 18	☐
Dec 75	Disco System, Light Modulator		AM0423	2·70 + 18	☐
Jan 76	Music Box	SRBP	DN1/JM	2·25 + 18	☐
		glassfibre	DN1/JM	3·00 + 18	☐
Jan 76	Emergency Light Unit		AM0419	3·50 + 18	☐
Mar 76	CMOS Crystal Calibrator		AM0438	1·19 + 12	☐
Apr 76	DF Receiver (set of two)		DN4/JM DN5/JM	1·92 + 15	☐
Apr 76	Wobbulator		AMO443	1·08 + 12	☐

Post and packing is for one board. For each additional board add 4p to the 10p or 18p rate as applicable. Prices include VAT.

Remittances with overseas orders must be sufficient to cover despatch by sea or air mail as required.

I enclose Postal Order/Cheque No.......................... for £................ made payable to READERS PCB SERVICES LTD.

NAME..

ADDRESS ....

....

.... Post Code ....

Any correspondence concerning this service must be addressed to READERS PCB SERVICES and not to the Editorial offices.

I.C. OF THE MONTH

Number 57 RCA CA3130 CMOS OPERATIONAL AMPLIFIER

THE relatively new CA3130 operational amplifiers manufactured by RCA employ the well-known CMOS (Complementary Metal Oxide Silicon) techniques in which the complementary FET's are fabricated on the same silicon chip as conventional bipolar transistors. This enables important advantages to be obtained in circuits employing this device.

HIGH INPUT IMPEDANCE

One of the most noticeable features of the CA3130 is the very high typical input impedance of $1\cdot5 \times 10^{12}$ ohms ($1\frac{1}{2}$ million megohms). In practice this means that either of the inputs of a CA3130 device can be connected into almost any circuit without affecting the operation of that circuit by taking an appreciable load current from it. The input current required by a typical CA3130 device is only about 5pA (5 millionths of a microamp) which again shows that this device imposes an extremely small load on the circuit feeding its input. The input current increases by a factor of about two for each 10°C rise in temperature, but even at 80°C it rises only to about 100pA.

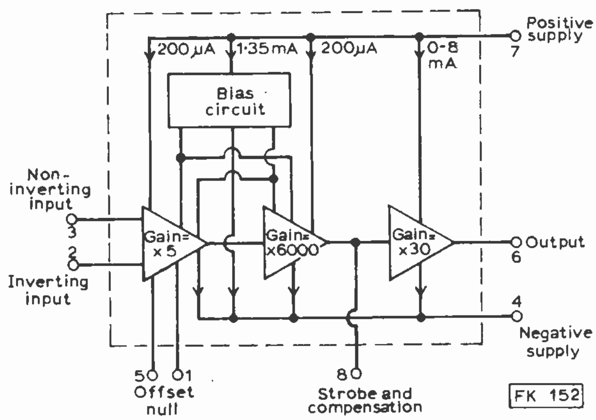


Fig. 1: Internal block diagram of the CA3130, showing the three amplifiers connected in cascade.

Another advantage is obtained by the use of CMOS circuitry in the internal output stage of the device. The CA3130 output voltage can swing to within a few mV of the potential of either supply line if the load impedance is relatively high.

The gain-bandwidth product of this very economical device is 15MHz, being a very high value for an amplifier with such a high input impedance. In addition, the slew rate of the CA3130 is about 30V/µs with no capacitance in the output circuit; this may be compared with the value of about 0·5V/µs quoted for the well-known 741 device. The CA3130 can therefore deliver a higher output voltage than the 741 at a given frequency when this is determined by the slew rate.

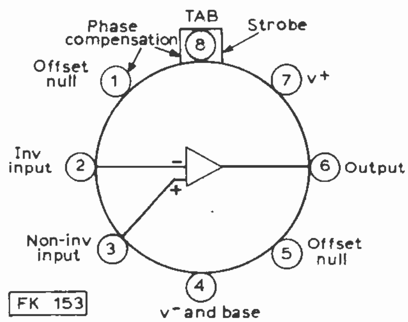


Fig. 2: The CA3130 is encapsulated in a TO-5 type can, and is supplied via eight leads as shown above. The view is from above.

INTERNAL CIRCUIT

The internal circuit of the CA3130 comprises three amplifier stages in cascade together with a biasing circuit for the first two stages, as shown in Fig. 1. The input amplifier stage employs CMOS devices to provide a very high input impedance, but the voltage gain of this stage is only about five times. The gate electrodes of CMOS devices are susceptible to damage when an electrostatic charge accumulates in the high input impedance circuit, since such charges can puncture the insulating layer of silicon oxide between the gate and the channel. Four zener diodes are integrated on the silicon chip to protect the device from damage by static charges in most circumstances.

The second amplifier stage employs a bipolar transistor in a circuit which provides a voltage gain of about 6000 times. The third stage of the CA3130 operates in Class A with a typical voltage gain of thirty times varying with the load impedance of the circuit.

CONNECTIONS

The CA3130 is available only in a metal can type package with eight leads, Fig. 2, like a TO-5 type of transistor encapsulation but with eight leads instead of three. The CA3130 has the normal inverting and non-inverting inputs of an operational amplifier. The quiescent output voltage can be adjusted to a value half way between the power supply lines if a potentiometer is connected between pins 1 and 5 with its rotor connected to pin 4 (the negative supply).

The output stage can be rendered inoperative by connecting pin 8 (input to this stage) to the negative line at pin 4. The output potential at pin 6 then rises virtually to the positive supply line voltage of pin 7. Electrical strobing pulses may be applied to pin 8 so that the device only operates at the desired times.

TYPES AVAILABLE

The most economical device of the series is the CA3130, suitable for most applications. However, specially selected devices are available for more critical purposes. The CA3130A has a lower maximum input current than the CA3130 and lower input offset voltage and current. The input circuit specifications of the CA3130B have even tighter tolerances. All of the devices operate satisfactorily over the very wide temperature range of −55°C to +125°C.

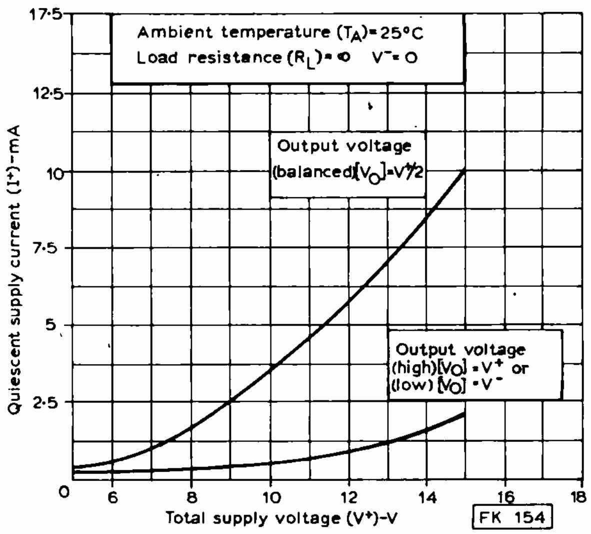


Fig. 3: Graph of the CA3130, showing increase in supply current with supply voltage. These curves occur when the device is not supplying output current.

A letter 'T' or an 'S' may be added. For example, RCA produce types CA3130T, CA3130AS, CA3130BT, etc. The 'T' signifies that the device has straight leads, whilst the 'S' types have their leads bent so that their ends are in an 8 pin dual-in-line configuration.

POWER SUPPLY

The CA3130 will operate from supply voltages of 3V to 16V or from balanced positive and negative supplies of ±2·5V to ±8V. The current required is very low, especially if the load impedance is high and the power supply voltage is low, an advantage obtained with most CMOS devices. Typical power supply currents when the output current is zero are shown in Fig. 3. The supply current is particularly low when the output voltage from the device is equal to either of the supply line potentials, but is higher when the output voltage is half way between the supply line potentials. If a single supply of 5V is

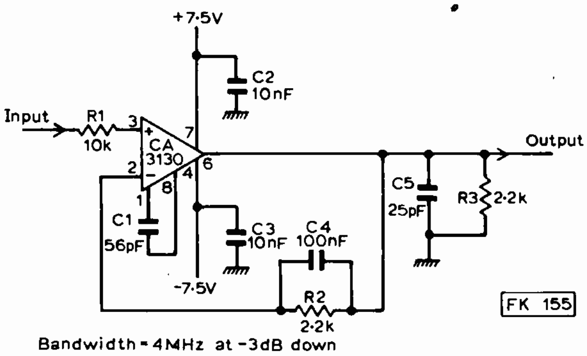


Fig. 4: To achieve a high degree of accuracy between the input and output voltages, the device is connected with a balanced power supply.

employed, the power supply current is only about 300μA when the load impedance connected to pin 6 is infinity and when the potential at this pin is 5V; if the output potential falls to 2·5V, the supply current rises to about 500μA for the same load impedance. The CA3130 series is therefore very useful with equipment which must be operated from small batteries.

TYPICAL CIRCUITS

One of the most useful applications of the CA3130 is as an impedance transformer. The non-inverting input of the device is connected to a signal source which may have a very high impedance and which can therefore supply only a very small current. The output circuit of the CA3130 can either supply or accept an output current of up to about 20mA, this being of the order of four thousand million times the input current required by the device. Thus the CA3130 can be used to drive a stage which requires appreciable current; in other words it can 'transform' a high impedance at its input to a relatively low impedance in its output circuit.

A typical impedance transformer circuit is shown in Fig. 4. In this case the device is used as a 'voltage follower' where the output voltage 'follows' the input voltage. One can achieve an accuracy of 0·01% between the input and output voltages in this type of circuit.

The capacitor C1 in Fig. 4 provides frequency compensation. Negative feedback from the output to the inverting input is provided by R2 in parallel with C4. The circuit shown employs balanced power supplies with a supply voltage near to the maximum so as to obtain maximum output voltage swing. Supplies of ±2·5V may be used for minimum current consumption.

Another voltage follower circuit is shown in Fig. 5 in which a single power supply is employed. The potentiometer VR1 enables the quiescent voltage at the output to be adjusted to a required value. In both Figs. 4 and 5 capacitors are incorporated in the power supply lines to assist stability at high frequencies.

Voltage followers of this type are useful when the potential of the high impedance input is to be measured, since it is transformed to the low output impedance which can be measured with a conventional meter.

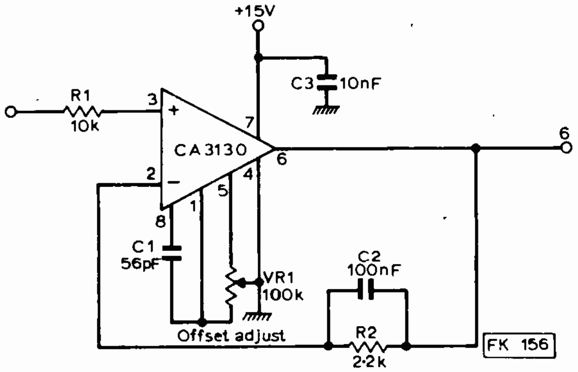
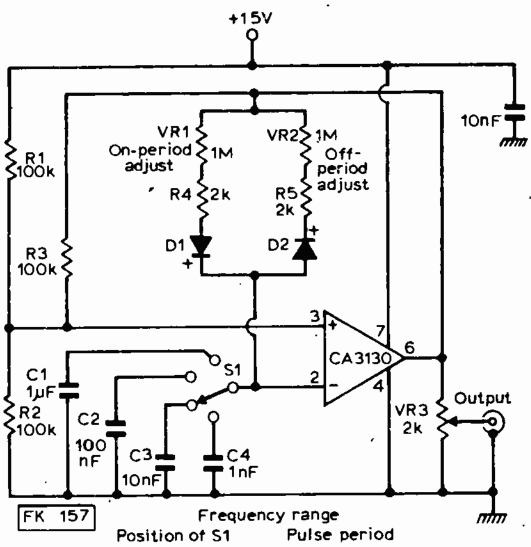


Fig. 5: The circuit above is similar to that shown in Fig. 4, but in this case is supplied by a single power supply. The potentiometer VR1 is used for setting the quiescent voltage at the output.

OSCILLATOR

A simple square-wave generator circuit is shown in Fig. 6. The resistors R1 and R2 bias the non-inverting input of the CA3130 to a mean voltage equal to half the supply voltage. The timing capacitor is selected by the range switch, S1. The time for which the output voltage is in its 'high' state can be adjusted by VR1 and the time for which it is in its 'low' state by VR2. When the largest capacitor, C1, is selected by S1, each part of the pulse can have a period in the range 4ms to 1s (according to the setting of VR1 and VR2). This period varies by factors of ten with the setting of S1 until one obtains 4μs to 1ms with the capacitor C4.

When the voltage at the inverting input is low, the output voltage will be high and the capacitor selected by S1 will charge through VR1, R4 and D1. As the voltage across this capacitor increases, the potential at pin 2 rises above that at pin 3 and the voltage at the output falls to a low value very suddenly. The same timing capacitor now discharges through D2, R5 and VR2 until the pin 2 voltage falls below that at pin 3, when the output switches back to its former high voltage state. The potential at pin 3 varies with the CA3130 output potential owing to the current flowing through R3.



Frequency range

Position of S1	Pulse period
1 nF	4μs to 1 ms
10 nF	40μs to 10 ms
100 nF	0·4 ms to 100 ms
1 μF	4 ms to 1 s

Fig. 6: In this circuit, the CA3130 is used as the heart of a square wave generator equipped with independent adjustment for both periods of the waveform.

The use of the CA3130 in this type of circuit has certain advantages. The high input impedance enables relatively high values of timing resistor (VR1 and VR2) to be used and therefore one can obtain very low frequencies with a moderate capacitor value. The timing capacitors used in this circuit should not be electrolytics as they pass an appreciable leakage current which would produce a large voltage drop across VR1 and VR2. The potentiometer VR3 is an attenuator in the output circuit. The supply voltage shown enables square waves of about 15V amplitude to be obtained, but smaller supply voltages down to about 5V may be employed for smaller output amplitudes.

HANDLING CMOS DEVICES

Although the gate electrodes of the CA3130 are protected with internal zener diodes, it is recommended that reasonable precautions should be taken when using them. Whilst the manufacturer's recommendations are often ignored without the device being damaged, it is certainly wise to observe them. Soldering iron tips used for soldering CMOS devices should be earthed. The devices should not be soldered into the circuit whilst power is applied or even removed from a socket, since transient voltages can be developed which can cause damage. No signals should be applied to the inputs unless the power supply is connected and the input current should be limited to 1mA.

The CA3130 is available from Chromasonic Electronics, 56 Fortis Green Road, London, N10 3HN, at 84p (including VAT) plus 20p packing and postage.

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

AN oft-repeated complaint from those who would wish to listen to the bands in some sort of reasonable quiet concerns the radiation from the line timebases of colour TV sets. **Paul Turner** (Bishops Stortford) asks for advice since he now finds DX-chasing almost impossible because of the QRM from a set just across the road. All I can suggest is that the equipment is checked for complete screening, that the aerial is placed as far away as possible from the source of the QRM and that some experiments be made on the earthing of the equipment. I think that I have mentioned before that the removal of the mains earth from the equipment can often effect a cure but this can mean an electrical hazard so due care must be taken. Experimentally, a separate earth in the garden can be tried.

Strangely enough the ordinary TV viewer is completely unaware of the trouble he is causing because his own radio is off! But just try walking around the house with a portable radio and see how widespread is the QRM! Particularly near the TV set's coax! If one of us radiated a signal on another frequency at the same field strength of the average colour TV set we would soon be in trouble! Of course, in some civilised countries the set has to be screened but I wonder how long it will be before we get around to taking some practical measures to combat yet another form of pollution.

A mild reprimand from **Tom Brady** G8GAZ for saying that Alan Rae had held the callsign GM8GRO before becoming GM4ENN. G8GRO is a pal of Tom's so apologies all round. Callsigns are very personal, often conveying much more than actual forenames to the distant listener. Incidentally, the junior op at the GAZ QTH is G8HEB. Dad said it, not me!

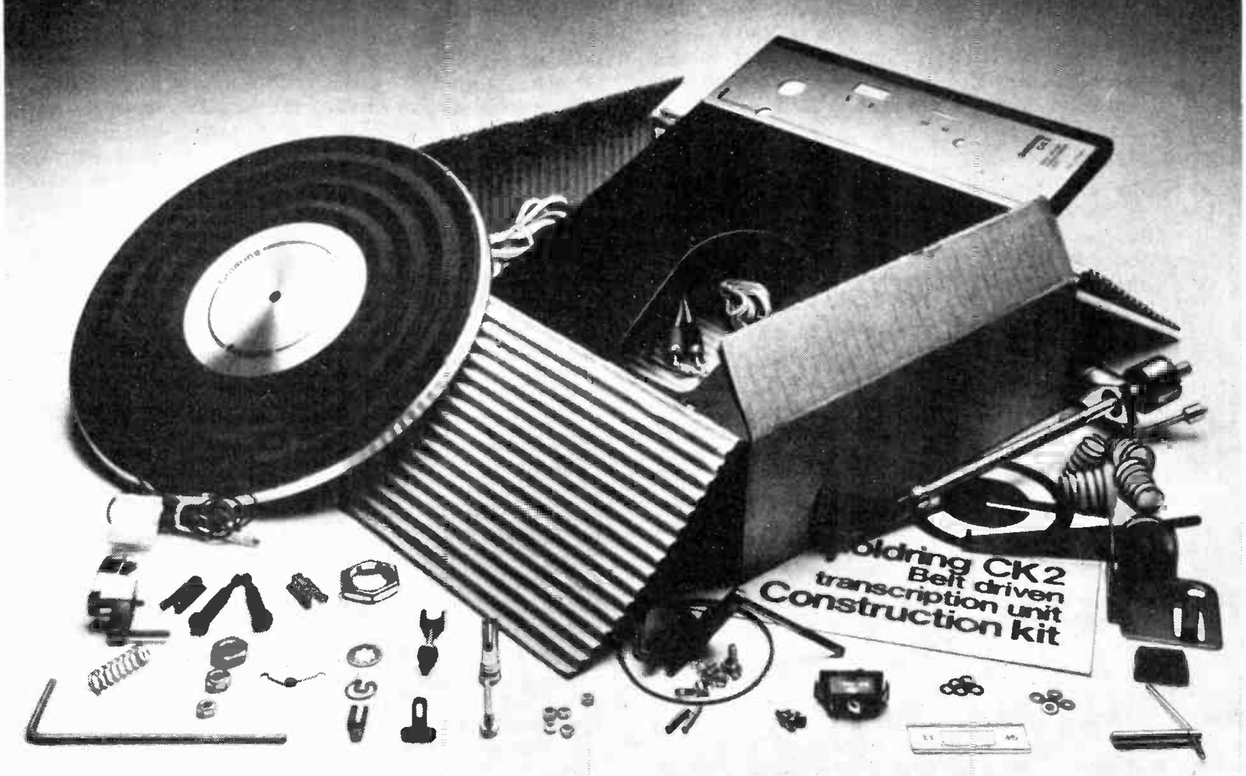
Pete Allen (Taunton) decided to take my advice and put up a 132ft wire. The improvement in his log shows that it was all worthwhile. Now he has fun switching between the long wire and his G5RV. **Mike Green** A8088 (Northwich) has been reorganising his equipment to the detriment of his log. He now has a new 2m beam consisting of an 8+8 slot fed at 20ft. His log shows four stations on 2m heard via the aurora of Jan. 10th. **Martin Kessel** A9016 (Stoke-on-Trent) has now abandoned his one-valver plus five-valve superhet in favour of an AR88D. He is still wearing a groove in the carpet awaiting his RAE results and if successful will be on with a Liner 2 and a five element beam on 2m at 35ft. A Microwaves Modules converter has been added to the AR88 on the receiver side. Notwithstanding the 2m bias Martin is getting his code up to the speed required for the Morse test.

Robin Bayley (Kingswood School, Nr Wolverhampton) has started off his DX-ing career with an ex-RAF 1475 set and a long wire, 30ft up. A converter for 2m is under construction. Welcome OM and I am sure that you will soon get into the swing of short wave radio. Overseas now to New Zealand and **Mark Corrigan** of Wanganui whose Heathkit SW717 pulled in some good Europeans for him using either a 20m dipole or 75ft long wire. Seems this column is responsible for Mark becoming a regular correspondent with another Mark, Mark Hill, another contributor of ours. **Dennis Anderson** is now using the receiver section of a 62 set and wonders if anyone has made up a mains unit to power this rig. He'd appreciate any help at 33 Manor Crescent, Pirbright, Brookwood, Surrey. **Mike Bennett** (Slough) finds the 80m band wide open all night with the Far East and Africa coming in from dusk to midnight and the North and South Americans continuing on until mid-morning. However, he has not neglected the other bands, I'm glad to report. **Steve Cottis** A8961 (Harrogate) also found plenty on 80m including ZL3NR/C which looks like Chatham Island, a good catch for anyone. Steve likewise roamed around the other bands from 15 to 40m.

Paul Barker BRS34898 (Sunderland) reports some W's on 80m, frequently missing from other people's logs, perhaps because they do not realise that they are to be found only above 3·8MHz! Paul's SSTV station-of-the-month was CT1JI, commended for his excellent picture quality. **Graham Sewell** (Greenford) stuck to 20m and the VK and ZL gang as garnered on his Codar CR70A and 20ft of wire. Don't know how far he would get with a decent aerial! **Peter Walton** A9002 pulls me up for saying he has a 359x, should be 358x of course. I must have been thinking about signal reports! Peter now has a half wave aerial up aimed at South America. **Alan Doherty** (Portrush) now sports an inverted vee aerial on 80m but as he says, "it's a bit close to the dirt".

Stephen Terry BRS35669 (Banbury) has a Microwave Modules converter feeding into his FR50B on 2m driven by a 6 over 6 element beam at 20ft

How to get a reputation overnight for making Hi Fi equipment as good as ours.



To be perfectly honest, it's not that difficult.

Simply go out and buy a Goldring CK2 turntable construction kit. Follow the simple step by step instructions.

And in no time at all you'll be the proud owner of a superb, hand built, precision engineered deck.

Which can hardly fail to make your reputation amongst those who know about HiFi. And all acheived with the minimum capital outlay: around £28.00.

The Goldring CK2 kit is, in fact, based around the rather more widely known G102 turntable.

Which means it's belt driven, to reduce wow, flutter and rumble to an absolute minimum. (The same system most really expensive decks employ.)

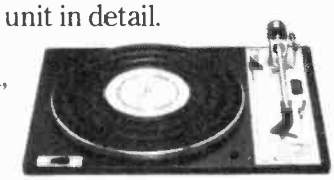
The pick-up arm features a viscously damped raising and lowering device.

For the protection of your records, there's an anti-skate mechanism. And with an easily adjustable playing weight, the arm will accept a wide range of cartridges, such as the Goldring G800.

A final touch is that both the on-off function and speed selection are via neat rocker switches.

If you fill in the coupon, we'll send you our free colour brochure, which describes the CK2 construction unit in detail.

And if you're serious about HiFi, you couldn't hope to ask for a better start than that.



To: Goldring Limited, 10 Bayford Street, Hackney, London E8 3SE.
Please tell me more about the Goldring CK2 Construction unit.

Name ____________________

Address ____________________

PW 1

Goldring

ON THE AIR

which, considering he is at 425ft asl, sounds like a good set-up! Lastly, **Ray Woodward** (Colne) is also a first-timer to the page and seems to have been doing well with his Codar CR70A and he awaits the associated ATU. He is one of the brave few that get up at 4a.m. to get in on the DX!

Log extracts

P. Turner:— 10m from 2m via Oscar 7 OE3JBC DB8QP DC6HY PA0GBL I2SRR

P. Allen:— 80m FP8DH KP4AM VP9HM **20m** CR9AJ VK4PX VK6LK

M. Green:— 20m KZ5AS VK1JC **2m Auroral** DC9DZA GI8HY GM8FFX

M. Kessel:— 80m ZC4PK **40m** EA8CR **20m** EA9FE FY0BHI VK5MS VP2EEG YB0ACG **15m** SV0WZ VK6HE YN7MHN ZS6DQ

M. Corrigan:— 80m OA4ASN VK0DA VR1AT ZK2AE 3D2AN **20m** C21DC CX7DC KJ6BZ KS6SFA VR1Z YN1AZ WA6LRG/KB6

M. Bennett:— 80m A4XFW HK1CHL JY1 KZ5HP VS5DB 9M2PV **20m** FB8ZG Amsterdam Is. HR6SWA Swan Is. KC4AAA VK9XI Christmas Is. VU7ANI Andaman Is. YJ8DS **15m** A6XP FY0BMI YB0ACG

S. Cottis:— 80m CR9AK CT2BU PJ3BB VS5JH ZL3NR/C **40m** EA6DA VK9AAN VP8AA **20m** CX5DT TG9GI VQ9DF **15m** EA8ND KZ5AL ZD7FT 9H4K

P. Barker:—80m EA8JP **20m SSTV** CT1JI F3RT I1RHB K1WPS OE1SBA YU2CB **20m** A2CGD EA9FC C9MAF VP2LBR 9L1BH

G. Sewell:— 20m VK1BH VK6HS ZL1KN

P. Walton:— 20m KH6BB ZB2A 5L7F 8P6FX 9J2LL

A. Doherty:— 80m A4XFW EL7F FG7AO HI8RRD JY3ZH KZ5HP VP2LC VR1AA VR4DX VR8A ZL3NR/C **40m** YN1AWS **20m** PZ9AJ VP8HA 9N1MM **2m via Oscar 7** DC6PZ F1BFH I8CVS ON5PX

S. Terry:— 2m EI9Q HB9AEN/P HB9AKG

R. Woodward:— 80m CR4BS **15m** AC2PV M1D 9G1LZ

All SSB except those in bold which are CW.

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

STRANGE are the items that are used for aerials! **Neil Braeman** from Southwater sleeps on his! He has hooked his bedframe to a Pye radio of uncertain vintage by way of a thirty foot length of wire. I would imagine that in the event of an electric storm in close proximity the results could be rather alarming!

Andrew Gay of Wernham Farm, Marlborough, Wiltshire asks if anyone can oblige by letting him have their redundant copy of the Radio Nederland antenna amplifier leaflet. He has written twice with no reply forthcoming and is willing to refund any expenses incurred. Andrew is a jazz fan and has high praise for the SBC Sunday afternoon show on 11870 at 1530. It is packed with inside information for jazz enthusiasts and, comments Andrew, often has a quality that is good enough for recording.

A representative of the clan Mcleod, namely **John Mcleod** of Inverness, sends some interesting notes on the stations that he picks up that are, shall we say, not for our ears. These are the services for other target areas, that pass over the UK. John thinks that living in the highlands of Scotland he has more advantage in DXing than those of us who live rather more south. In this I rather agree with him, considering the DX that the Scandinavians pull in. It is on the cards however that other DXers will be able to tune to these stations and a selection follows:

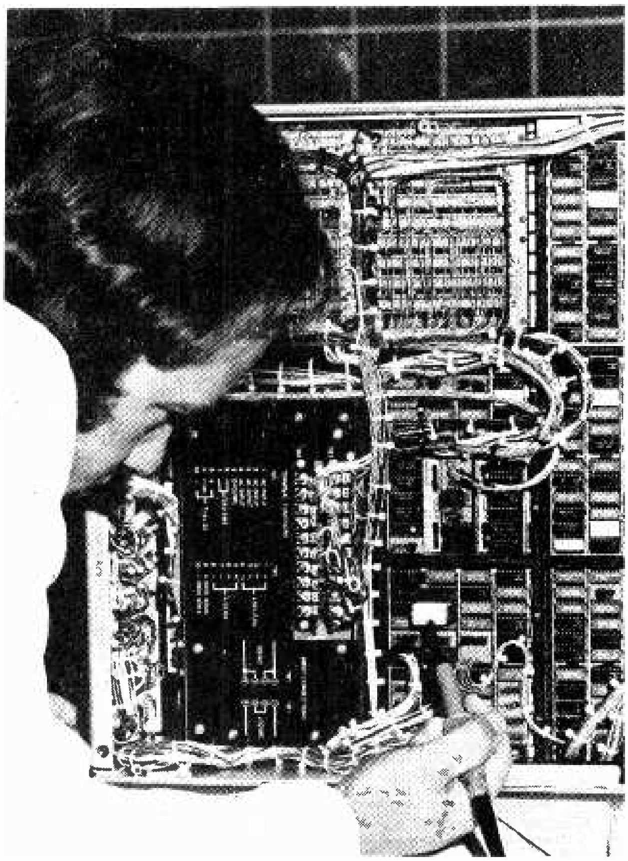
RAI Rome, to N. America 6010 at 0100
SBC Bern, to Africa 9590 at 0530
ORF Austria, to E. Asia 15105 at 0830
Deutsche Welle, to N. America 6010 at 0530

John goes on to tell us that ORF Austria has informed him that "in future QSL cards will only be issued by ORF if they are specifically requested". This policy statement also says that they are looking for more critical comment on their programmes than hitherto. This is a station sticking its neck out with a vengeance! While on the subject of ORF, **Richard Fuchs** of Windsor points out the difference between Radio Austria and Austrian Radio. If this is a little confusing to you, Richard says that the Radio Austria station is a commercial firm and Austrian Radio is the one often referred to as "ORF" and is the station that transmits the Austrian Short Wave Panorama DX show on 6115 and 9770 at 0915 on Sundays, from Moosbrun.

Having sorted out your Austrian stations **Niels Montanana** recommends that the booklet issued by ORF is well worth having. To get this the DXer sends a reception report in to PO Box 700, A-1136 Vienna, Austria.

These are days of belt tightening and general pulling in of horns. Not least in the area of our hobby and one such person affected is **H. E. Forder** of Leeds. H.E.'s problem is that he would like to buy a rig that will pull in the short wave bands but not one that is expensive. Asks Mr. Forder, "are the sets under £50 as good as the advertisers claim?" This is a question that I cannot really answer but I will say that many good sets can be obtained for under £50 that are mains operated and can be improved by the addition of extra aerial wire or an aerial tuner unit in a matter of minutes, with little technical knowledge.

Over the water we go now for a couple of letters from readers who's DXing is a little different from ours. **Lindsey Crawford Cull** of Salisbury, Rhodesia forwards the address of the recently featured National Public Radio the Public Affairs segment of the AFRTS network. This system comprises 142 member stations and can be contacted at 2025 M. Street N.W., Washington DC, 20036 USA. **Vincent Carabott** of Malta GC whose name I have managed



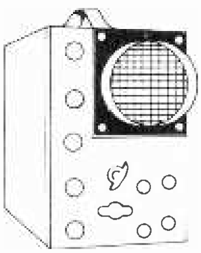
This hobby brings big rewards.

A soldering iron and a screwdriver. If you know how to use them, or at least know one end from the other, you know enough to enrol in our unique home electronics course.

This new style course will enable anyone to have a real understanding of electronics by a modern, practical and visual method. No previous knowledge is required, no maths, and an absolute minimum of theory.

You build, see and learn as, step by step, we take you through all the fundamentals of electronics and show you how easily the subject can be mastered and add a new dimension not only to your hobby but also to your earning capacity.

All the training can be carried out in the comfort of your own home and at your own pace. A tutor is available to whom you can write, at any time, for advice or help during your work. A certificate is given at the end of every course.

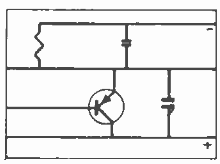


1

Build an oscilloscope.

As the first stage of your training, you actually build your own Cathode ray oscilloscope! This is no toy, but a test instrument that you will need not only for the course's practical experiments, but also later if you decide to develop your knowledge and enter the profession. It remains your property and represents a very large saving over buying a similar piece of essential equipment.

2



Read, draw and understand circuit diagrams.

In a short time you will be able to read and draw circuit diagrams, understand the very fundamentals of television, radio, computers and countless other electronic devices and their servicing procedures.

3

Carry out over 40 experiments on basic circuits.

We show you how to conduct experiments on a wide variety of different circuits and turn the information gained into a working knowledge of testing, servicing and maintaining all types of electronic equipment, radio, t.v. etc.

PLUS FREE GIFT!

ALL STUDENTS ENROLLING IN OUR COURSES RECEIVE A FREE CIRCUIT BOARD ORIGINATING FROM A COMPUTER AND CONTAINING MANY DIFFERENT COMPONENTS THAT CAN BE USED IN EXPERIMENTS AND PROVIDE AN EXCELLENT EXAMPLE OF CURRENT ELECTRONIC PRACTICE

To find out more about how to learn electronics in a new, exciting and absorbing way, just clip the coupon for a free colour brochure and full details of enrolment.

Brochure without obligation to:
BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL, Dept WL46
P.O. Box 156, Jersey, Channel Islands.

NAME ______________________

ADDRESS ______________________

______________________ (Block caps please)

BENTLEY ACOUSTIC CORPORATION LTD.

7a GLOUCESTER ROAD, LITTLEHAMPTON, SUSSEX
All prices inclusive of V.A.T. at 25% **Telephone 6743**

OB2 ·45, OZ4 ·55, 1A3 ·65, 1A5GT ·59, 1A7GT ·60, 1B3GT ·59, 1H5GT ·80, 1L4 ·25, 1N5GT ·76, 1R5 ·50, 1S4 ·39, 1U4 ·70, 1U5 ·88, 2D21 ·60, 2GK5 ·75, 2X2 ·70, 3A4 ·60, 3D6 ·47, 3Q4 ·85, 3Q5GT ·70, 3S4 ·47, 3V4 ·82, 4CB6 ·75, 5CG8 ·75, 5R4GY ·94, 5U4G ·50, 5V4G ·59, 5Y3GT ·55, 5Z3 ·88, 5Z4G ·55, 5Z4GT ·55, 6/30L2 ·80, 6A8G 1·46, 6AC7 ·60, 6AG5 ·35, 6AH6 ·80, 6AJ5 ·76, 6AK5 ·47, 6AK6 ·70, 6AM8A ·70, 6AN8 ·82, 6AQ5 ·53, 6AR5 ·80, 6AS7 1·17, 6AT6 ·53, 6AU6 ·40, 6AV6 ·53, 6AW8A ·90, 6AX4 ·88, 6B8G ·35

6BA6 ·41, 6BC8 ·90, 6BE6 ·41, 6BH6 ·75, 6BJ6 ·64, 6BK7A ·85, 6BQ7A ·64, 6BR7 1·20, 6BR8 1·25, 6BS7 1·64, 6BW6 1·00, 6BW7 ·65, 6BZ6 ·57, 6C4 ·47, 6C5G ·59, 6C6 ·47, 6C9 2·00, 6CB6A ·47, 6CD6G 1·60, 6CG8A ·88, 6CL6 ·76, 6CL8A ·94, 6CM7 ·88, 6CU5 ·88, 6CW4 1·17, 6D3 ·75, 6DE7 ·88, 6DT6A ·88, 6EW6 ·88, 6E5 1·17, 6F1 ·80, 6F6G ·60, 6F13 ·90, 6F14 ·88, 6F15 ·76, 6F18 ·64, 6F23 80, 6F24 1·00, 6F25 1·17, 6F28 ·78, 6F32 ·70, 6G6G ·60, 6GH8A ·88, 6GK5 ·76, 6GU7 ·88, 6H6GT ·29, 6J5GT ·35, 6J6 ·35, 6J7G ·35, 6JU8A ·88

6K7G ·35, 6K8G ·53, 6L1 2·34, 6L6GC ·68, 6L7 ·59, 6L18 ·64, 6L19 2·00, 6LD20 ·88, 6N7GT ·70, 6Q7G ·50, 6Q7GT ·60, 6Q7(M) ·64, 6R7G ·70, 6SA7 ·55, 6SC7GT ·50, 6SG7 ·52, 6SH7 ·55, 6SJ7 ·64, 6SK7GT ·52, 6SQ7 ·50, 6V6G ·30, 6V6GT ·53, 6X4 ·47, 6X5GT ·50, 7B6 ·88, 7B7 ·82, 7H7 ·88, 7R7 2·00, 7Y4 ·80, 7Z4 ·80, 9D7 ·70, 10C2 ·76, 10DE7 ·88, 10F1 ·88, 10F9 ·76, 10F18 ·50, 10LD11 ·82, 10P13 ·88, 10P14 2·34, 12A6 ·75, 12AC6 ·90, 12AD6 ·90, 12AE6 ·90, 12AT6 ·47, 12AU6 ·53, 12AV6 ·59, 12BA6 ·53, 12BE6 ·59, 12BH7 ·59, 12BY7 ·85

12E1 3·51, 12J7GT ·70, 12K5 1·17, 12K7GT ·50, 12K8 ·85, 12Q7GT ·50, 12SC7 ·50, 12SG7 ·55, 12SH7 ·50, 12SJ7 ·60, 12SQ7 ·76, 12SR7 ·75, 14H7 ·64, 14S7 1·10, 19AQ5 ·65, 19G6 7·00, 20D1 ·80, 20F2 ·88, 20L1 1·29, 20P1 1·00, 20P3 ·94, 20P4 1·17, 20P5 1·50, 25A6G ·70, 25L6G ·70, 25Y5G ·60, 25Z4G ·50, 25Z5 ·75, 25Z6G ·80, 28D7 2·00, 30A5 ·76, 30C15 ·80, 30C17 ·85, 30C18 ·85, 30F5 ·75, 30FL1 1·10, 30FL2 1·10, 30FL13 ·64, 30FL14 ·82, 30L15 ·82, 30L17 ·76, 30P4MR 1·05, 30P12 ·80, 30P19/30P4 ·88, 30PL1 1·00, 30PL13 1·20, 30PL14 1·29, 30PL15 ·90

35A3 ·76, 35C5 ·85, 35D5 ·90, 35L6GT ·88, 35W4 ·60, 35Z3 ·88, 35Z4GT ·82, 35Z5GT ·90, 42 1·00, 43 1·00, 50B5 1·00, 50C5 ·70, 50CD6G 1·46, 50EH5 ·88, 50L6GT 1·00, 85A2 ·75, 85A3 ·75, 90AG 2·98, 90C1 ·88, 90CG 2·81, 150B2 1·00, 2158G ·59, 807 1·17, 5702 1·20, 5763 1·76, 6057 1·00, 6060 1·00, 6067 1·00, 7193 ·68, 9002 ·59, 9006 ·50, ACPEN 1·17, AC2/PEN/DD 1·00, AC6PEN ·60, AC/TH1 1·00, AL60 1·17, ATP4 ·50, AZ1 ·50, AZ31 ·60, AZ41 ·50, BL63 2·34, CL33 1·85, CY1C 1·00, CY31 ·70, DAF91 ·40, DAF96 ·60, DC90 ·70

DF91 ·30, DF96 ·65, DK40 ·82, DK92 1·15, DK96 ·70, DL96 ·64, DM70 ·80, DM71 1·76, DY87/6 ·41, DY802 ·47, E80CC 2·57, E80F 2·20, E88CC 1·20, E92CC ·70, E180F 1·17, E182CC 3·00, E1148 ·62, EA50 ·40, EA76 1·40, EABC80 ·45, EAC91 ·65, EAF42 ·88, EAF801 ·80, EB34 ·35, EB91 ·23, EBC41 ·88, EBC81 ·45, EBF80 ·40, EBF83 ·50, EBF89 ·40, EBL21 2·34, EC86 ·90, EC88 ·90, EC92 ·55, ECC33 2·00, ECC35 2·00, ECC40 1·20, ECC81 ·40, ECC82 ·39, ECC83 ·39, ECC84 ·40, ECC85 ·47, ECC86 1·00, ECC88 ·55, ECC189 ·80, ECC807 1·41, ECF80 ·50, ECF82 ·50, ECF86 ·88, ECF804 2·63

ECH21 2·34, ECH35 1·60, ECH42 ·80, ECH81 ·40, ECH83 ·52, ECH84 ·50, ECL80 ·50, ECL82 ·45, ECL83 ·82, ECL84 ·70, ECL85 ·70, ECL86 ·47, EF22 1·00, EF40 ·88, EF41 ·82, EF42 ·90, EF73 1·76, EF80 ·30, EF83 1·45, EF85 ·40, EF86 ·50, EF89 ·35, EF91 ·50, EF92 ·60, EF97 ·94, EF98 ·95, EF183 ·40, EF184 ·40, EF804 1·75, EH90 ·44, EL32 ·60, EL34 1·00, EL35 3·00, EL37 3·00, EL41 ·60, EL81 ·70, EL83 ·70, EL84 ·36, EL86 ·60, EL95 ·70, EL360 1·80, EL506 1·20, EM80 ·53, EM81 ·76, EM83 ·64, EM84 ·47, EM85 1·20, EM87 1·10, EMM803 2·50, EY51 ·50

EY81 ·50, EY83 ·70, EY84 ·92, EY86/7 ·40, EY88 ·60, EY91 ·50, EZ40 ·55, EZ41 ·55, EZ80 ·35, EZ81 ·35, GY501 ·82, GZ32 ·59, GZ33 1·46, GZ34 ·80, GZ37 1·20, HABC80 ·80, HL23DD ·80, HL41DD 1·00, HL42DD 1·00, HN309 1·76, HVR2 1·00, HVR2A 1·17, KT41 1·17, KT66 2·93, KT81 2·10, KT88 5·75, KTW61 1·76, KTW62 1·76, KTW63 1·17, MHLD6 1·00, P61 ·60, PABC80 ·45, PC86 ·70, PC88 ·70, PC95 ·70, PC97 ·42, PC900 ·30, PCC84 ·40, PCC85 ·50, PCC88 ·65, PCC89 ·50, PCC189 ·60, PCF80 ·47, PCF82 ·50, PCF84 ·70

PCF86 ·50, PCF200 1·00, PCF201 1·05, PCF801 ·65, PCF802 ·50, PCF806 ·60, PCH200 1·00, PCL82 ·45, PCL83 ·50, PCL84 ·50, PCL86 ·55, PCL805 ·70, PEN45 1·00, PEN45DD 1·00, PEN46 ·60, PEN453DD 2·00, PENDD 4020 1·00, PFL200 ·82, PL33 ·50, PL36 ·70, PL81 ·53, PL81A ·60, PL82 ·43, PL83 ·50, PL84 ·50, PL504/500 0·82, PL505 1·65, PL508 1·10, PL509 1·65, PY33/2 ·50, PY80 ·47, PY81 ·40, PY82 ·40, PY83 ·45, PY88 ·47, PY500A 1·11, PY800 ·45, PY801 ·45, PZ30 ·50, QQV03/10 2·10, Q875/20 1·00, Q895/10 1·00

QS150/15 1·90, QV06/20 3·50, R19 ·75, TH233 1·00, TP2620 1·00, UABC80 ·47, UAF42 ·75, UBC41 ·60, UBC81 ·60, UBF80 ·47, UBF89 ·47, UBL21 2·34, UC92 ·60, UCC84 ·90, UCC85 ·53, UCF80 ·90, UCH21 2·34, UCH42 ·88, UCH81 ·47, UCL82 ·45, UCL83 ·64, UF41 ·82, UF42 ·82, UF80 ·41, UF85 ·52, UF89 ·47, UL41 ·75, UL84 ·49, UM80 ·60, UY41 ·50, UY85 ·50, U10 1·17, U12/14* 1·17, U19 4·00, U25 ·70, U26 ·65, U33 1·75, U35 1·75, U45 1·17, U81 ·80, U191 ·50, U251 ·94, U301 ·65, U403 ·90, U404 ·75, U801 ·80, U4020 ·75, VP23 ·65

VP41 ·88, VR105 ·59, VU111 ·80, VU120 1·17, VU120A 1·17, VU133 ·80, W107 ·75, W729 1·17, X66 1·46, Z759 5·85

Transistors & Diodes

1N4744 ·18, 2N404 ·23, 2N966 ·68, 2N1756 ·64, 2N2147 1·10, 2N2297 ·29, 2N2369 ·18, 2N3053 ·42, 2N3121 3·22, 2N3703 ·25, 2N3709 ·26, AA119 ·20, AA120 ·20, AA129 ·20, AAZ13 ·23, AC107 ·20, AC113 ·33, AC126 ·16, AC127 ·23, AC128 ·26, AC132 ·26, AC154 ·33, AC156 ·26, AC157 ·33, AC165 ·33, AC166 ·33, AC168 ·49, AC176 ·71, AC177 ·36, ACY17 ·33, ACY18 ·26, ACY19 ·25, ACY20 ·23

ACY21 ·25, ACY22 ·20, ACY28 ·23, AD140 ·47, AD149 ·64, AD161 ·59, AD162 ·59, AF114 ·33, AF115 ·20, AF117 ·25, AF121 ·39, AF124 ·33, AF125 ·29, AF126 ·23, AF180 ·62, AF186 ·71, BA115 ·18, BA116 ·23, BA129 ·16, BA130 ·13, BA153 ·20, BC107 ·16, BC108 ·16, BC109 ·16, BC113 ·33, BC115 ·20, BC116 ·33, BC118 ·29, BCY10 ·59, BCY12 ·64, BCY33 ·26, BCY34 ·29, BCY38 ·29, BF158 ·23, BF159 ·33, BF163 ·26, BF173 ·49, BF180 ·39, BF181 ·52, BF185 ·53, BFY50 ·29, BFY51 ·25, BFY52 ·26, BY100 ·23, BY114 ·23, BY126 ·20

BY127 ·23, BYZ10 ·33, BYZ11 ·33, BYZ12 ·33, BYZ13 ·33, FSY11A ·29, FSY41A ·29, OA9 ·16, OA10 ·55, OA47 ·13, OA70 ·20, OA73 ·20, OA79 ·12, OA81 ·12, OA85 ·12, OA90 ·16, OA91 ·12, OA95 ·12, OC44 ·13, OC45 ·14, OC46 ·20, OC70 ·16, OC71 ·14, OC72 ·14, OC74 ·29, OC75 ·14, OC76 ·20, OC77 ·35, OC78 ·20, OC78D ·20, OC81 ·14, OC81D ·14, OC82 ·14, OC82D ·14, OC83 ·26, OC84 ·31, OC123 ·29, OC169 ·29, OC172 ·46, OC200 ·59, OC201 ·59, OC202 ·55, OC203 ·39, OC204 ·39, OC205 ·55, OC206 1·17

MATCHED TRANSISTOR SETS:— LP15 (AC113, AC154, AC157, AA120) ·68p per pack, 1—OC81D & 2—OC81, 55p. 1—OC44 & 2—OC45, ·55p. 1—OC82D. & 2—OC82 ·62p. Set of 3—OC83 ·84p.

VALVES ALSO REQUIRED TO PURCHASE. LOOSE OR BOXED, BUT MUST BE NEW. OFFERS MADE BY RETURN.

All goods are unused, tested, and guaranteed. Despatch charges:—25p on all orders below £10 in value. Orders over £10 post free. Orders despatched same day as received. Any parcel insured against damage in transit for 5p per parcel extra. Terms of business available on request. Many others in stock too numerous to list. Please enclose S.A.E. for reply to any correspondence.

B. BAMBER ELECTRONICS

Dept PE, 5 STATION ROAD, LITTLEPORT, CAMBS., CB6 1QE
Telephone: ELY (0353) 860185 (2 lines) Tuesday to Saturday

PLEASE ADD 8% VAT UNLESS OTHERWISE STATED

SMALL MAINS SUPPRESSORS (small chokes, ideal for radio, Hi-Fi inputs, etc.) approx. ½in × 1½in, 3 for 50p.
PERSPEX TUNER PANELS (for FM Band 2 tuners) marked 88-108 MHz and Channels 0-70, clear numbers, rest blacked out, smart modern appearance, size approx. 8½in × 1½in, 2 for 36p.
Valveholders, mixed bag of 10 for 50p.
Springs, 1in long × $\frac{1}{16}$in dia. per pack 25p.
LF chokes on ½in × 2in cores, 5 for 20p.
2–6pF 10mm circular ceramic trimmers (for VHF/UHF work) 3 pin mounting, 5 for 50p.
TO3 transistor insulator sets, 10 for 50p
PC Board Withdrawal handles, mixed cols. 8 for 50p
Solder, 20 SWG, 60/40 alloy, approx 8 yds for 25p.
Multiturn Pots, 10 turn, ¼in spindle (ex-equip), following values available, 2kohm, 5kohm, 400kohm, £1 each
Lead suppressors (10kohm) for mobile plug leads, 4 for 50p.
1mA Meters, 2 in square, plastic fronts (these have a paper scale stuck over the original marked 0–1mA which is easily peeled off and an internal 18K resistor which is easily removed), £1·75 each or 2 for £3.
R/S Midget 3 pole 4 way, rotary switches, 40p each

SPECIAL OFFER
Miniature 50ohm Coax, high quality, PTFE insulation and blue PTFE cover, solid silver plated inner, and silver plated braid, approx 3m overall diameter (ideal for unit wiring of RF stages up to 23cms, etc.), 4 metres for 50p.

TRANSISTOR HEATSINKS, to take 2 × TO18 transistors, screw in clamps, block size 1 × ½ ½in, with holes for mounting, 3 for 50p.

HIGH QUALITY SPEAKERS, 8½in × 6in elliptical, only 2in deep, inverse magnet, 4 ohms, rated up to 10W, £1·50 each, or 2 for £2·75 (qty. discount available). + 25% VAT.

TV PLUGS AND SOCKETS
TV Plus (metal type), 5 for 50p.
TV Sockets (metal type), 4 for 50p.
TV Line Connectors (back-to-back sockets), 4 for 50p. Please add 25% VAT.

MINIATURE 2 PIN PLUGS AND SOCKETS (fit into ½in hole, pins enclosed, with covers for chassis mounting, or can be used for in-line connectors). Bargain pack of 3 plugs + 3 sockets + covers, 50p.
PROGRAMMERS (magnetic devices). Contain 9 microswitches (suitable for mains operation) with 9 rotating cams, all individually adjustable, ideal for switching disco lights, displays, etc., or industrial machine programming (Need slow motion motor to drive cams, not supplied) 9 switch version £1·50, or 15 switch version £2.
HEAVY DUTY HEATSINK BLOCKS undrilled base area 2½in × 2in, with 6 fins, total height 2½in 50p each
9V RELAYS, Continental type, 2 pole change over 35p
RUBBER MAGNETS ½in square, with mounting hole, 20 for 30p
SPERRY 7-SEGMENT P.G.D. DISPLAYS, digit height 0·3in red, with decimal points, 150V to 200V (nominal 180V) operation. These are high-volt industrial type and therefore brighter than normal displays. All brand new. AT THE BARGAIN PRICE OF 50p PER DIGIT TYPE 332 (two digits in one mount) £1 each, TYPE 333 (three digits on one mount) £1·50. (Sorry, no single digit available.) Data Supplied

BSX20 (VHF Osc/Mult), 3 for 50p
BC108 (metal can), 4 for 50p.
PBC 108 (plastic BC108), 5 for 50p.
OC200 Transistors, 6 for 50p.
BSY95A Transistors, 6 for 50p.
BFY51 Transistors, 4 for 50p.
BCY72 Transistors, 4 for 50p.
PNP audio type TO5 Transistors, 12 for 25p.
BF152 (UHF amp/mixer), 3 for 50p.
BA121 Varicap Diodes, 4 for 50p.

Rotary switches, min. 4 pole 2-way, 2 for 50p.
Telephone Type earpiece insert, 50p.
1½in polythene chassis mounting fuseholders, 8 for 30p.
LES Lamps, 24V 1 2W, 10 for 40p.
Mullard Tubular ceramic trimmers, 1–18pF 6 for 50p
I.C.'s, some coded, 14 DIL type, untested, mixed, 20 for 25p.
Miniature slider switches, 2 pole 2-way, 5 for 50p.

PLUGS & SOCKETS.
BNC Socket (Single-hole mounting type) Ex-equipment (special offer) 3 for 50p
BNC Plugs (ex-equipment), 5 for £1
N-Type Plugs 50 ohm, 60p each, 3 for £1·50.
N-Type Sockets (4-hole chassis mounting, 50 ohms (a small coax lead type), 50p each
PL259 Plugs (PTFE), brand new, packed with reducers, 65p or 5 for £3.
SO239 Sockets (PTFE), brand new (4-hole fixing type), 50p each or 5 for £2·25.
25-way ISEP Plugs and Sockets, 40p set (1 plug + 1skt)
Plugs and sockets sold separately at 25p each.
Bulgin Round Free Skts 3 pin, for mains input on test equipment, etc. 25p each
Bulgin Flat 2-pin Flex Connectors non-reversible 40p each

Mobile Converters, 24V DC input 13·8V at approx 3·4A DC output, fully stabilised. £3·50 each (ideal for running 12V car radio from 24V lorry battery)
Pkts. of 2BA Nuts (the self-locking ones with the nylon insert) 100 for 50p.

We now stock Spiralux Tools for the electronic enthusiast. Screwdrivers, Nut Spanners, BA and Metric sizes, pop rivet guns, etc. S.A.E. for list

I.F. Cans, ½in square, suitable for rewind, 6 for 30p.
Miniature earphones with min. jack plug, 2 for 50p.

Dubilier Electrolytics, 50µF, 450V, 2 for 50p.
Dubilier Electrolytics, 100µF, 275V, 2 for 50p.
Plessey Electrolytics, 470µF, 63V, 3 for 50p.
TCC Electrolytics, 1000µF, 30V, 3 for 50p.
Plessey Electrolytics, 1000µF, 180V, 40p each (3 for £1).
Dubilier Electrolytics, 5000µF, 35V, 50p each
Dubilier Electrolytics, 5000µF, 50V, 60p each
Dubilier Electrolytics, 5000µF, 70V, 65p each
ITT Electrolytics, 6800µF, 25V, high grade, screw terminals, with mounting clips, 50p each
Plessey Electrolytics, 10,000µF at 63V, 75p each
Plessey Cathodray Capacitors, 0-0·4µF at 12·5kV DC. Screw terminals. £1·50 each
PLEASE ADD 25% VAT TO ALL CAPACITORS

A LARGE RANGE OF CAPACITORS AVAILABLE AT BARGAIN PRICES, S.A.E. FOR LIST

SPECIAL OFFER!
MAINS TRANSFORMER, TYPE 14/4 14V at 4A, £2·50.

DIECAST BOXES (approx size in inches)

4·3 × 2·3 × 1·2	83p
4·8 × 2·3 × 1·5	75p
[illegible]	85p
[illegible]	£1·[illegible]
[illegible]	£1·45
[illegible]	£1·[illegible]
[illegible]	£2·[illegible]
[illegible]	£1·[illegible]
10·6 × 6·8 × 2	£2·[illegible]

Please add 8% VAT

WELLER SOLDERING IRONS.
EXPERT. Built-in-spotlight illuminates work Pistol grip with fingertip trigger High efficiency copper soldering tip
EXPERT SOLDER GUN. £6·80 + VAT (54p)
EXPERT SOLDER GUN KIT (spare bits case, etc.), £9·80 + VAT (78p)
SPARE BITS, PAIR, 28p + VAT (2p)
MARKSMAN SOLDERING IRONS
SP15D 15W £2·52 + VAT (20p)
SP25D 25W £2·52 + VAT (20p)
SP25DK 25W + bits, etc, kit £3·12 + VAT (25p)
BENCH STAND with spring for Marksman Irons £1·80 + VAT (14p)
SPARE BITS
MT8 for 15W, 42p + VAT (3p)
MT4 for 25W, 35p + VAT 3p)
TCP1 TEMPERATURE CONTROLLED IRON. Temperature controlled iron & PSU, £18·43 + VAT (£1·47).
SPARE TIPS
Type CC single flat, Type K double flat fine tip 90p each + VAT (8p)
ALL SPARES AVAILABLE

MULTICORE SOLDER
Size 5 Savbit 18 s.w.g. in alloy dispenser, 32p + VAT (3p).
Size C15AV18 Savbit 18s.w.g, 56p + VAT (4p).
Size 12 SAVBIT 18s.w.g. on plastic reel £1·80 + VAT (15p)

MINIATURE PLIERS High quality "Crescent" made in USA. £4·35 + VAT (35p).
SIDE CUTTERS, high quality "Crescent", made in USA. £5·45 + VAT (44p).

Terms of Business: CASH WITH ORDER. MINIMUM ORDER £1. *ALL PRICES INCLUDE POST & PACKING (UK ONLY). SAE with ALL ENQUIRIES Please.*
PLEASE ADD VAT AS SHOWN. *ALL GOODS IN STOCK DESPATCHED BY RETURN*

ON THE AIR

to decipher this time, reports that the Deutsche Welle African service is coming in very strongly in that part of the world. On his Philips 361A Vincent reports this service at 1340 on 17500 and alongside this go Radio Pakistan on 5955 at 2140 and SBC on 6309 at 2120.

One of the main snags with radios is the nagging thought that the set may not be properly calibrated and may be pulling in a frequency other than that shown on the dial. This is particularly so when one builds a set or when that faint station that has never been heard before whispers in and is just the one to fill that gap in your QSL album. Our old friend **G. E. W. Hewlett,** whom many will remember from columns past, writes of a station that is not only a calibration aid but also a test of that copper wire cobweb in the loft. While tuning around a few weeks ago George decided to try for WWV in order to check his calibration. The service in question is located at Fort Collins, Colorado USA and transmits on 2·5, 5, 10, 15, 20 and 25MHz. The distinctive signal is a time signal and a male voice announcement every minute. Much to George's surprise he also heard a female voice which is the other time and frequency checking station WWVH at Kauai, Hawaii. WWVH transmits on the same frequencies but is most unlikely to be heard here very frequently.

George goes on to tell us that Radio Australia has opened a 250kW transmitter at Carnarvon to cover the gap in its Asian service. The test transmissions are, at the moment, as follows:

9540 Indonesian 0800 to 1030
9560 Mandarin 1030 to 1300
9560 Cantonese 1300 to 1430

The 9560 channel is best heard around 1300 but in summer, when the short route gets better and an extra transmitter has been put into service, these signals should be worth listening for.

For those who like the African stations **John Dipre** using a VEF204 comes up with a few goodies:

4850 Radio Mauritania at 2038
4904 Radio Chad at 2035
4915 Radio Ghana at 2300
4940 Abidjan at 2250
5047 Radio Togo at 2257

To these we can add the loggings of **Charles Winpenny** who reports ETLF Ethiopia at 2020 on 11755 to give you a good handful of the infrequently reported services. Charles also asks if anyone knows what has happened to the Voice of Turkey English service on 9515 at 2200, which seems to have been dropped in favour of a Turkish language service.

Finally, we welcome two newcomers, **Julian Blake** of London and, lo and behold, our first lady correspondent **Diane Kinnear** from Cullicudden, Ross-shire. Both ask the same question. "Please recommend a book to start us off and fill the gaps." The one I would plump for is "A Guide to Amateur Radio" by Pat Hawker G3VA from the Radio Society of Great Britain, 35 Doughty St., London WC1, price £1·14 inc. Don't be put off by the title, however, since our SWL DXing owes a lot to the licensed amateur. As well as explaining many of the terms that they use, the book explains many of the matters that the two branches of our hobby have in common. This winds up the session for this month so I will say 73s to you and yours.

MEDIUM WAVE DX
by CHARLES MOLLOY

STEVE WHITT (G8KDL) reports from London NW4 with a good bag of North American medium wave DX. With his Chapman S6BS communications receiver, MW loop and FET pre-amplifier he logged WINS in New York City on 1010kHz at 0130 which he describes as "a phenomenal signal, I actually considered ringing into their phone-in programme". Other North Americans logged by Steve include CJOX Grand Bank in Newfoundland on 610kHz; WOR in New York City on 710kHz; WABC in NYC on 770kHz; CHNS in Halifax, Novia Scotia on 960kHz; KDKA in Pittsburg on 1020kHz and WNEW in NYC on 1130kHz.

North American medium wave stations are allocated identifying call letters which are used frequently by announcers, which makes identification easy for the DXer. These stations can be logged in the UK throughout the year whenever the path across the North Atlantic is in darkness. Even in midsummer, reception is possible for about an hour before sunrise. During March and April start listening around 0130GMT. Reception can be very good at this time of year since interference from Europe is much less than during the earlier winter months owing to the approach of daybreak from the east.

An interesting letter comes from New Zealand reader **Ash Nallawalla** of Dunedin. Ash is president of the Otago branch of the New Zealand Radio DX League and is a keen medium wave DXer. With his Sanyo receiver, 40in delta shaped loop and an FET booster he logged Malta on 1570kHz and Munich, West Germany on 1602kHz. Reception in New Zealand of European broadcasts at the HF end of the medium waves has been reported before. In 1971, the well known New Zealand DXer Arthur Cushen in a letter to the writer, mentioned his reception of Langenburg on 1586kHz and Munich on 1602kHz at 2000GMT. The path at that time of day would be on the western route across South America, propagation being by five-hop F layer rather than by the E layer, which is responsible for most of the DX heard on the medium waves. New Zealand and Australia are not heard on the medium waves in the UK probably because there are so few high power transmiters in these countries and the high level of interference at our end of the path. Reception of 4QD, the 50kW outlet at Emerald in Queensland has been reported on more than one occasion from Finland on 1550kHz, a frequency that is almost buried in QRM in this country during the evening.

Tuning-in a signal on a radio receiver is usually quite a straightforward business. The tuning control is adjusted to give maximum reading on the S meter, or if there isn't a tuning indicator, then the control is "rocked" until the receiver is spot-on the carrier frequency. This procedure works well in the absence of interference when adequate bandwidth is available (selectivity control at "wide") to include both sidebands of the transmitted signal. When trying to pick-out a weak DX signal in a crowded MW band, high selectivity is desirable to try to reduce adjacent channel interference. High selectivity leads to side-band cutting and loss of HF response at audio frequencies. Speech becomes muffled and difficult to follow. Intelligibility can be improved if the receiver it detuned slightly. Its IF passband now covers all one sideband instead of part of both, speech clipping is reduced while selectivity is maintained and cleaner and easier to understand speech will be the result. If the interference is coming from only one side of the DX then detune away from it. The strength of the unwanted transmission will be reduced while the level of the DX will be unchanged.

The second session of the International Telecommunications Union Conference on the future of medium and longwave broadcasting in Regions 1 and 3, which includes Europe, was held in Geneva last autumn. As expected, the 9kHz channel spacing in Europe is to continue though many channels on the medium waves will have their frequency increased by 1kHz so that they are multiples of 9kHz. Heterodyne interference will be reduced if each channel is harmonically related to the channel spacing. The UK is allowed two additional transmitters on the longwaves, both of which will be located in Scotland. One will be on 200kHz (1500m), the existing longwave channel and the other will be on 227kHz (1321m). They will come into use after the start of the new plan in November 1978.

The retention of the 9kHz spacing will continue to favour the DXer who is interested in reception of Region 2 (North and South America) where the spacing is 10kHz but the 1kHz change in Europe will bring its problems. Reception of KOMO in Seattle and WCFL in Chicago both on 1000kHz will become more difficult as the nearest European will now be on 999kHz. Whether there will be any compensating gains, remains to be seen.

Latin American medium wave stations, especially those situated along the east coast of South America, come in well in the UK. The long sea path across the North and South Atlantic favours propagation from Argentina and Brazil enabling some of the higher powered broadcasters in Buenos Aires and Rio de Janeiro to be heard at surprising strength at times. **D. R. Mayhew** (Littlehampton) has been chasing DX from this area between the hours of midnight and 0300 using a Philips receiver and a 20in loop with RF amplifier. He says "the Brazilians are very exciting and well worth waiting for" and he mentions hearing two broadcasts from Buenos Aires; Radio Belgrano on 950kHz and Radio el Mundo on 1070kHz and no fewer than five from Rio de Janeiro; Radio Mundial on 860kHz, Radio Jornal do Brazil on 940kHz, Radio Nacional on 980kHz, Radio Globo on 1180kHz and Radio Eldorado on 1220kHz plus Radio Record in Sao Paul on 1000kHz.

Portuguese is spoken in Brazil, a language that sounds a bit different from Spanish which is used in Argentina and the remainder of Latin America. The majority of Brazilian stations are commercial, owned often by newspapers. Musical programmes include the rhythms of the samba and bossa nova which beat out from trumpets, guitars and marimbas to entertain the distant DXer!

D. F. RECEIVER—*continued from page 1064*

circuits. Band coverage is determined by the settings of TC1, TC2, TC3, TC4 and the position of the oscillator coil core.

Aerial alignment is determined by TC5, VC3 and the positions of L1 and L2 on the rod. Correct alignment of the aerial tuning is shown by maximum meter reading. If VC3 enables a signal to be peaked up, and is not fully open or fully closed, alignment may be regarded as correct at that frequency. However, the settings of TC5, L1 and L2 must be approximately correct or the trimming compensation afforded by VC3 may be insufficient at some frequencies.

Band 1. With each band the low frequency end is reached with VC1/2 closed and the high frequency end with VC1/2 open. For this band, TC4 sets the HF limit and TC2 the LF limit. TC5 is set so that VC3 can be peaked as described and may need re-adjustment after dealing with Band 2.

Band 2. TC3 sets the HF band limit. With a signal tuned in near the HF end of the band, adjust VC3 for best volume or meter reading. Tune in a signal near the LF band end and move L1 on the rod for best signal level, leaving VC3 untouched. Check that VC3 can peak signals throughout the band.

Band 3. Oscillator coverage is independently adjusted by TC1 and L2 which is adjusted at the LF end of the band. A 60pF trimmer may be wired from pin 2 to pin 3, for LW trimming, but is not essential.

On all bands a small adjustment to the oscillator coil core setting will cause a substantial shift in frequency. So if this is made on any one band, the other two bands have to be checked again, as described. The actual coverage which is obtained can be modified quite substantially. It is not necessary that any particular bands are obtained by these adjustments, as other settings will result in no loss of efficiency, provided VC3 allows signals to be peaked up. The ranges actually provided were: Band 1: 1300-1500kHz; Band 2: 600-1300kHz; Band 3: 160-250kHz.

In use

To locate the position of the receiver, bearings have to be taken from at least two transmitters whose positions are known. If these are plotted on a map or chart, the receiver will lie roughly at the intersection of the lines. A third bearing can be expected to give more accuracy and should confirm the first result. To locate the position of a transmitter, directional bearings on its signal have to be taken from two known positions. When these are plotted, their intersection shows the transmitter location.

Low frequency and ground wave signals will generally give quite accurate bearings. Ground wave signals are those which have not been reflected by ionised layers above the earth. Their useful range depends on power, frequency and other factors and may extend to fifty miles or more. Sky-waves, on the other hand, are those reflected down and they provide greatly increased range, especially for higher frequency signals after dark but they may give confused bearings. In coastal areas wavefront bending may cause a deviation of 10-15° while nearby metal objects or structures may also modify the apparent direction of a signal. For ordinary reception purposes, it is only necessary to rotate the aerial for best reception, or minimum interference.

TANGENTIAL BLOWER HEATER

240V 2KW can be switched for two speeds and 1KW Robust and efficient. Aperture 7½" x 1¾" size overall length 10". Price £4·25 plus p. & p. 75p.

DIGITAL DISPLAY INDICATOR

by KGM, Type M4. window size ⅞" wide, 1¼" high, depth 1⅞", height 3½" plus front flange (⅛" top and bottom). This is an Acrylic edgelit unit illuminated by 12V flange type bulbs (as our min. lamp type D) Currently sold at £14·00 plus, our price £3·95 inc. lamps, plus p. & p. 35p.

A B C D E F G

MINIATURE LAMPS

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: Types A-F £4·00 for 25, 50 and upwards 13p each Type G 45p each. p. & p. 20p per order.

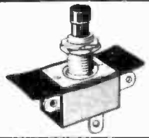
RIBBON CABLE

4 way side by side P.V.C. 7 strand red-green-blue-yellow (miniature) 50 metre reels £4·50. 250 metres £20 P & P 70p 50 metres. £1·50 250 metres.

CENTRIFUGAL BLOWER

240V powerful, efficient by Universal Electric. 3,100 r.p.m., inlet dia. 4", outlet approx. 2¾" x 2¼", overall width 5", overall dia. 5½". Price £4·75 plus p. & p. 75p.

ARROW SWITCH



Press on/press off, single hole fixing SP ST size 1⅞" x ⅞" prestle extends ⅞". Rated 2½ amps. Robust. Price for 5 (min qty.) £1·75. 10 or more 30p each. p. & p. 30p for 5.

MEM LIMIT SWITCH

Snap action 5 amps at 240/410 A.C. size base 3⅞" x 1⅛" x 1⅞" plus heavy duty roller plunger 1⅛" ext. or 1" when compressed. Very robust for tireless operation, weather proof. Price £2·20 plus p. & p. 25p.

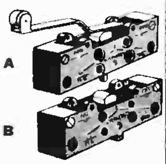
RELAYS

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

10 K.W. ISOLATION TRANSFORMER

Prim. 200-240V sec. 120-0-120V, size 18" x 15" x 26" high, weight approx. 250lbs. Price £110 inc. VAT delivery charge at cost.

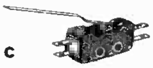
CROUZET MICRO SWITCHES (NON ARC)



A

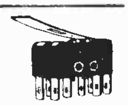
B

Types A/B no. 83-112 n/o or n/c as desired, rating 5 a 240V, size 1⅞" x ½" x ⅞" high. Can be stacked horizontally or vertically, in this mode, top switch can operate multiples. Type A has straight through plunger, whilst Type B is encased at bottom. Makers price approx. £1·40 each, our price 45p each (min. qty. 5) plus 15p per roller (as shown) plus 20p p. & p.



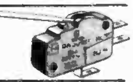
C

Type C miniature no. 83-132, size ⅞" x ¼" x ⅞" high, plus tags, 5 a 250V. Price 30p each (min. 5) Lever ⅞" long 19/16" long either type 8p each, plus p. & p. 20p.



D

Type D similar to Type C, but with tags underneath, uses same lever as Type C or can be banked horizontally and double lever (as shown) supplied at 12p. Prices as type C.



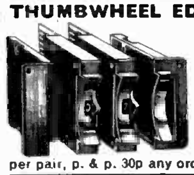
E

Type E no. 83-131, 10 a 250V size 1⅛" x ⅞" x ⅞" high. 30p each (min. 5) plus lever 1⅞" long, 8p each plus p. & p. 20p each.

NORPLEX COPPERCLAD FIBREGLASS

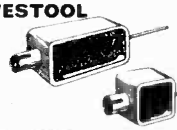
First grade material. 1 & 2 oz. copper size 43" x 37" thickness double sided $^1/_{32}$" $^1/_{16}$" $^3/_{64}$" $^3/_{32}$" single sided $^1/_{32}$" & $^3/_{64}$" all types £10 per sheet. Carriage £2 one sheet plus 50p additional sheets (G.B.).

THUMBWHEEL EDGE SWITCHES



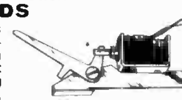
(Plessey) ten position no. 0-9 (single pole ten way) modular, any number may be banked. Contact rating 2a. A.C. or D.C., colour black, size overall 52·58 high x 12 wide x 49 mm deep. P.C. pitch 156. Price £1·50 per unit, end mounting cheeks £1·00 per pair, p. & p. 30p any order.

SOLENOID BY WESTOOL



240 a.c. type MM6 3lb pull. 2¾" x 1" x 1½". Travel 1". £1·50 each, plus p. & p. 25p. 240 a.c. type MM4 2lb pull. 1¾" x 1⅜" x 1". Travel 1". £1·25 each, plus p. & p. 25p.

MAINS SOLENOIDS

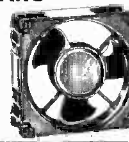


This little unit gives vertical lift of approximately 1in. through hinged "elbow". Bracket incorporates 2 fixing screws. Length of arm, 2½" 240V. a.c. Pull at coil is approximately 1lb. Price £1·25 plus p. & p. 20p.

ALL PRICES INCLUDE V.A.T.

Whilst we welcome official orders from established companies and Educational Departments, it is no longer practical to invoice goods under £10. Therefore, please remit cash with orders below this amount.

MUFFIN "PANCAKE" FANS



As used in computers and other installations where silent continuous efficient cooling is needed. These fans are 115V. 50Hz drawing only 14 watts 4⅜" x 4⅜" x 1⅝". They can be coupled in pairs for use on 240V dropping resistor can be supplied for 50p. ONLY £6·50 plus p. & p. 50p.

SPRITE "PANCAKE" FANS

Similar to "Muffin", physically smaller, drawing only 9 watts but still giving extremely high efficiency with minimum fuss. 115V 50 Hz can be used in pairs from 240V a.c. dropping resistor supplied for 50p. Size: 3⅛" x 3⅛" x 1⅝". (Large quantity available, special quotations). ONLY £4·50 plus p. & p. 50p.

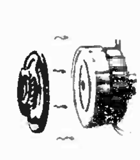
6 DIGIT 24V d.c. COUNTER

Non re-set 3 watts, size 1⅞" x 1" x 13/16". Brand new. Plastic encased. Price £2·25 plus p. & p. 25p.

SOLDER GUN BY ETP

240V for instant heat and speedy soldering. 100 watts, built in spot lamp. Price £3·50 plus p. & p. 50p.

BENDIX MAGNETIC CLUTCH



A superb example of Electro-mechanics! The main body is in two sections. The coil section is fixed and has a ⅜in sleeve. The drive section rotating on the outer perimeters. The uniting plate has ⅜in ID bearing concentric with main section and 18-tooth cog wheel. When energized transmission is extremely powerful, 24V d.c. at 240 MA. Our price just £2·70 plus 30p p. & p.

PROGRAMME TIMER

12 bank. cam operated micro switches, infinitely variable switching 240V. Speed 15 r.p.m. (4 secs per rev). Price £8·95 plus p. & p. 70p.

SHADED POLE GEARED MOTORS 110 r.p.m.

240 a.c., high Torque, approximate overall size 3½" x 3½" x 2¼" and spindle dia. ⅛". Price £3·50 plus p. & p. 50p.

SYLVANIA SWITCH

Complete with magnet. normally closed, 3 amp vacuum sealed. 1½" long ⅛" dia. 10 for £2·50, 50 for £11·00, 100 for £18·00 plus p. & p. 30p. for 10 to 100.

LIGHT DEPENDENT RESISTORS

Matched pairs, Pioneer type 174 similar to orp 12 resistance 1K to 40K, dia ⅞" with ⅛" flanges. £1·50 for two pairs (minimum) 10 or more pairs 50p. per pair plus p. & p. 15p.

EDGE CONNECTORS (CINCH)

Single contact sockets, 27 way .15, can be cut to length, moveable end mounts. 10 pieces (minimum) for £4·00 plus p. & p. 25p.

ELECTRO-TECH
COMPONENTS LTD.

317 and 364 EDGWARE RD., LONDON, W2.
Tel: 01-723 5667 01-402 5580
WE ARE OPEN 9-6 MON. TO SAT.

VISIT OUR NEW BIGGER AND BETTER SHOP—NOW OPEN AT 364 FOR A WIDE RANGE OF INTERESTING ITEMS!

PRACTICAL WIRELESS T.V. SOUND TUNER

IF Sub-Assembly (G8) **£6·80.** P & P 55p.
Mullard ELC1043 Varicap UHF Tuner **£4·20.** P & P 30p.
3-way Station Control Unit **£1·20.** P & P 25p.
6-way Station Control Unit (Special Offer) **£1·00.**
Resistors, Caps, Semiconds etc. **£5·22.** P & P 55p.
Printed Circuit Board **£1·00.** P & P 25p.

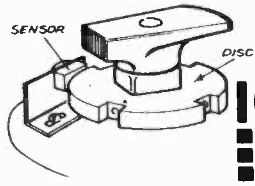
Add 25% VAT to price of goods. P & P all items 65p.

Callers welcome at shop premises.

MANOR SUPPLIES

172 WEST END LANE, LONDON NW6

(Near W. Hampstead Tube Stn.) Tel. 01-794 8751



Capacitor Discharge IGNITION

- **MAXIMUM PERFORMANCE**
- **MAXIMUM ECONOMY**
- **EASY COLD START**

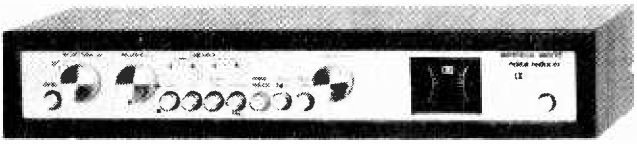
SYSTEM I

Professional photoelectric ignition using L.E.D. light source and reflective disc. This machined aluminium disc gives a timing accuracy far superior to other methods and is simple to fit. Unit housed in diecast box 4½" x 3½" x 2½" Price £18.80 (Kit £16.80) State car/model/measurement across cam lobes.

SYSTEM II

Contact breaker model as above less sensor. Price £12.80 (Kit £10.80) M/C Twin unit Price £15.00. S.A.E. for descriptive leaflet – ALL UNITS IN STOCK. Mail orders to CDI Electronic Systems Ltd, 275 Vale Road, Ash Vale, Aldershot, Hants.
Demonstration/Callers to Hillside Motors, 292 Carshalton Road, Carshalton, Surrey. telephone 01-642 9973.

Dolby™ Noise Reducer Kit



PRICE: £34·40 + VAT

'Wireless World'
May, June, July '75

Trademark of Dolby Laboratories Inc.

The latest addition to our exclusive range of matching high fidelity units.

The Dolby Noise Reduction System is designed to reduce background noise on open reel or cassette tape recorders. Used in the signal path to and from the tape recorder, the unit will encode (Dolbyise) signals during recording, and, during playback, may be used to decode either your own encoded material, or commercially available Dolby encoded cassettes.

Featuring:

- switching for both encoding (low-level h.f. compression) and decoding
- a switchable f.m. stereo multiplex and bias filter
- provision for decoding Dolby f.m. radio transmissions (as in USA)
- no equipment needed for alignment
- suitability for both open-reel and cassette tape machines
- check tape switch for encoded monitoring in three-head machines

The kit includes:

—complete set of components for stereo processor
—regulated power supply components
—board-mounted DIN sockets and push-button switches
—fibreglass board designed for minimum wiring
—solid mahogany cabinet, chassis, twin meters, front panel, knobs, mounting screws and nuts

Typical performance
Noise reduction better than 9dB weighted
Clipping level: 16·5dB above Dolby level (measured at 1% third harmonic content)
Harmonic distortion 0·1% at Dolby level (typically 0·05% over most of band, rising to a maximum of 0·12%)
Signal-to-noise ratio: 75dB (20Hz to 20kHz, signal at Dolby level) at Monitor output
Dynamic Range > 90dB
30mV sensitivity

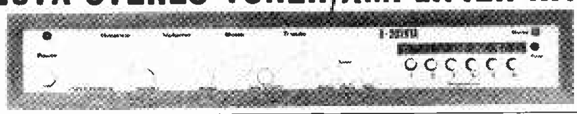
Calibration tapes are available for open-reel use and for cassette (specify which) **PRICE £1·80 + VAT***

S-2020TA STEREO TUNER/AMPLIFIER KIT

PRICE: £48·95 + VAT

SOLID MAHOGANY CABINET

A high-quality push-button FM Varicap Stereo Tuner with Interstation mute combined with a 20W r.m.s. per channel Stereo Amplifier.



THD < 0·1% @ 20W
Tuner S/N 30dB @ 1·8μV (mono)
Toroidal Transformer

Please add VAT at 25% unless marked thus * when 8% applies
We guarantee full after sales technical and servicing facilities on all our kits

INTEGREX LTD.

Please send SAE for complete lists and specifications
Portwood Industrial Estate, Church Gresley, Burton-on-Trent, Staffs DE11 9PT
Tel. Swadlincote (0283 87) 5432. Telex 377106

Access
Barclaycard

LYNX ELECTRONICS (LONDON) LTD

Transistors

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
AC126	15p	BC183	10p*	BF257	30p	C106F	35p	2N696	14p
AC127	16p	BC183L	10p*	BF258	35p	CRS1-05	25p	2N697	12p
AC128	13p	BC184	11p*	BF337	32p	CRS1-10	25p	2N706	10p
AC128K	25p	BC184L	11p*	BFW60	17p*	CRS1-20	35p	2N929	14p
AC141	18p	BC207B	12p*	BFX29	26p	CRS1-40	40p	2N930	14p
AC141K	28p	BC212	11p*	BFX30	30p	CRS1-60	65p	2N1131	15p
AC142	18p	BC212L	11p*	BFX84	23p	CRS3-05	34p	2N1132	16p
AC142K	28p	BC213	12p*	BFX85	25p	CRS3-10	45p	2N1304	20p
AC176	16p	BC213L	12p*	BFX88	20p	CRS3-20	50p	2N1305	20p
AC176K	25p	BC214	14p*	BFY50	20p	CRS3-40	60p	2N1711	18p
AC187	18p	BC214L	14p*	BFY51	18p	CRS3-60	85p	2N2102	44p
AC187K	25p	BC237	16p*	BFY52	19p	MJ480	80p	2N2369	14p
AC188	18p	BC238	16p*	BFY64	35p	MJ481	£1·05	2N2369A	14p
AC188K	25p	BC300	34p	BFY90	65p	MJ490	90p	2N2484	16p
AD140	50p	BC301	32p	BR100	20p	MJ491	£1·15	2N2646	50p
AD142	50p	BC323	60p	BRY39	40p	MJE340	40p*	2N2905	18p
AD143	46p	BC327	18p*	BSX19	16p	MJE371	60p	2N2905A	22p
AD149	45p	BC328	16p*	BSX20	18p	MJE520	45p	2N2926R	10p*
AD161	35p	BC337	17p*	BSX21	20p	MJE521	55p	2N2926O	9p*
AD162	35p	BC338	17p*	BSY95A	12p	OA5	50p*	2N2926Y	9p*
AL102	95p	BCY70	12p	BT106	£1·00	OA90	8p	2N2926G	10p*
AL103	93p	BCY71	18p	BT107	£1·60	OA91	8p	2N3053	15p
AF114	20p	BCY72	12p	BT108	£1·60	OC41	15p	2N3054	40p
AF115	20p	BD115	55p	BT109	£1·00	OC42	15p	2N3055	50p
AF116	20p	BD131	36p	BT116	£1·00	OC44	12p	2N3440	56p
AF117	20p	BD132	40p	BV105	£1·80*	OC45	10p	2N3442	£1·20
AF118	50p	BD135	36p	BV105/02	£1·90*	OC70	10p	2N3570	80p
AF139	33p	BD136	39p	BV126	£1·60*	OC71	10p	2N3702	10p*
AF239	37p	BD137	40p	BY206	15p*	OC72	22p	2N3703	10p*
BC107	14p	BD138	48p	BY207	20p*	OC84	14p	2N3704	10p*
BC107B	16p	BD139	8p	BYX36-300	12p*	SC40A	73p	2N3705	10p*
BC108	13p	BD181	86p	BYX36-600	15p*	SC40B	81p	2N3706	10p*
BC109	14p	BD182	92p	BYX36-900	18p*	SC40D	98p	2N3707	10p*
BC109C	16p	BD183	97p	BYX36-1200	21p*	SC40F	65p	2N3714	£1·05
BC117	19p*	BD184	£1·20	BYX38-300	50p	SC41A	65p	2N3715	£1·15
BC125	18p*	BD230	00p	BYX38-600	55p	SC41B	70p	2N3716	£1·25
BC126	20p*	BD231	00p	BYX38-900	60p	SC41D	85p	2N3771	£1·60
BC141	28p	BD232	00p	BYX38-1200	65p	SC41F	60p	2N3772	£1·60
BC142	23p	BD233	00p	BZX61 series zeners	20p	ST2	20p	2N3773	£2·10
BC143	23p	BD237	06p	BZX83 or BZY88 series zeners	11p*	TIP29A	44p*	2N3819	28p*
BC144	30p	BD238	00p	C106A	40p	TIP30A	52p*	2N3904	16p*
BC147	9p*	BD239	00p	C106B	45p	TIP31A	54p	2N3906	16p*
BC148	9p*	BDY20	80p	C106D	50p	TIP32A	64p	2N4124	14p
BC149	9p*	BDY38	60p			TIP34	£1·05	2N4290	12p
BC152	25p*	BDY60	60p			TIP41A	68p	2N4348	£1·20
BC153	18p*	BDY61	65p			TIP42A	72p	2N4870	35p*
BC157	9p*	BDY62	55p			IN2069	14p	2N4871	35p*
BC158	9p*	BF178	28p			IN2070	16p*	2N4919	70p*
BC159	9p*	BF179	30p			IN4001	4p*	2N4920	50p*
BC160	32p	BF194	10p*			IN4002	5p*	2N4922	58p*
BC161	38p	BF195	10p*			IN4003	6p*	2N4923	64p*
BC168B	9p*	BF196	12p*			IN4004	7p*	2N5060	20p*
BC182	11p*	BF197	12p*			IN4005	8p*	2N5061	25p*
BC182L	11p*	BF224J	18p*			IN4006	9p*	2N5062	27p*
		BF244	17p*			IN4007	10p*	2N5064	30p*

NATIONAL CLOCK CHIPS

MM5314 £3·75. MM5316 £5·25.

DIGITAL DISPLAYS & LED's

DL704	99p	DL747	1·75	·2 RED LED ONLY	13p
DL707	99p	DL750	1·75	GREEN CLEAR	15p

THYRISTORS

	·8A (TO92)	1A (TO5)	3A (C106 type)	6A (TO220)	8A (TO220)	10A (TO220)
50	20	25	35	41	42	47
100	25	25	40	47	48	54
200	27	35	45	58	60	68
400	30	40	50	87	88	98
600		65	70	1·09	1·19	1·26

TRIACS (PLASTIC TO-220 PKGE, ISOLATED TAB)

	4A (a)	4A (b)	6·5A (a)	6·5A (b)	8·5A (a)	8·5A (b)	10A (a)	10A (b)	15A (a)	15A (b)
100 V	0·60	0·60	0·70	0·70	0·78	0·78	0·83	0·83	1·01	1·01
200 V	0·64	0·64	0·75	0·75	0·87	0·87	0·87	0·87	1·17	1·17
400 V	0·77	0·78	0·80	0·83	0·97	1·01	1·13	1·19	1·70	1·74
600 V	0·96	0·99	0·87	1·01	1·21	1·26	1·42	1·50	2·11	2·17

N.B. Triacs without internal trigger diac are priced under column (a). Triacs with internal trigger diac are priced under column (b). When ordering please indicate clearly the type required.

74 TTL mixed prices

	1–24	25–99	100+		1–24	25–99	100+		1–24	25–99	100+
7400	14p	12p	10p	7445	85p	71p	57p	7492	57p	46p	36p
7401	14p	12p	10p	7447	81p	75p	65p	7493	45p	40p	32p
7402	14p	12p	10p	7448	75p	62p	50p	7495	67p	55p	45p
7403	15p	12½p	10p	7447A	95p	83p	67p	74100	£1·08	89p	72p
7404	16p	13p	11p	7470	30p	25p	20p	74107	35p	28p	22p
7408	16p	13p	11p	7472	25p	21p	17p	74121	34p	28p	23p
7409	16p	13p	11p	7473	30p	25p	20p	74122	47p	39p	31p
7410	16p	13p	11p	7474	32p	26p	21p	74141	78p	63p	53p
7413	29p	24p	20p	7475	47p	39p	31p	74145	68p	58p	48p
7417	27p	22½p	20p	7476	32p	26p	21p	74154	£1·62	£1·48	86p
7420	16p	13p	11p	7482	75p	62p	50p	74174	£1·00	83p	67p
7427	27p	22½p	18p	7485	£1·30	£1·09	87p	74180	£1·06	88p	71p
7430	16p	13p	11p	7486	32p	26p	21p	74181	£3·20	£2·50	£1·90
7432	27p	22½p	18p	7489	£2·92	£2·80	£2·10	74192	£1·35	£1·14	90p
7437	27p	22½p	18p	7490	49p	40p	32p	74193	£1·35	£1·14	90p
7441	75p	62p	50p	7491	65p	55p	45p	74196	£1·64	£1·34	99p
7442	65p	55p	43p								

LINEAR IC's

301A 8 pin DIL	35*	3900 14 pin DIL	70*	565 14 pin DIL	£2·00*
307	55*	709 8/14 pin DIL	35*	566 8 pin DIL	£1·50*
309K	1·60	741 8/14 pin DIL	28*	567 8 pin DIL	£2·00*
380 14 pin DIL	90*	748 8 pin DIL	36*	CA3046 14 pin DIL	50*
381 14 pin DIL	1·60*	555 8 pin DIL	45		

Matching charge 20p per pair. P & P 20p—Overseas 80p. SEND SAE FOR COMPLETE LIST.

HIGHAM MEAD, CHESHAM, BUCKS. Tel. (02405) 75154

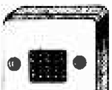
VAT—Please add 8% except items marked * which are 25%

MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied.

Model 1153 500mW power output £1·10 + 40p post & VAT.
Model 1172 1W. power output £1·35 + 45p post & VAT.
Model EP9000 4 watt power output £2·40 + 50p post & VAT.
EP 9001 twin channel or stereo pre amp. £2·50 + 50p post & VAT.

LIGHT SWITCH

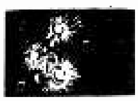


Automatically switches on lights at dusk and off at dawn. Can also be used where light and dark is a convenient way to stop and start an operation. Requires only a pair of wires to the normal switch. In bakelite box, normal switch-plate size. 1 amp model £3·75. **VAT and Postage 50p.**

MAINS TRANSISTOR PACK

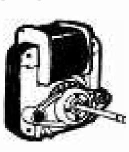
Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: main transformer rectifier, smoothing and load resistor condensers and instructions. Real snip at only **£1·50 VAT & Postage 60p.**

SOUND TO LIGHT UNIT



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

MAINS MOTOR



Precision made—as used in record decks and tapes recorders—ideal also for extractor fans, blower, heaters, etc. New and perfect. Snip at **95p** + VAT & Postage 35p.
1" stackmotor **£1·50** + VAT & postage 35p. 1½" stackmotor **£2** + VAT & Postage 40p.

6 DIGIT COUNTER

Made by famous American Company, operated by 24V D.C. or mains through resistor, 19/16" x 1" x 2½" deep. **80p** Post & VAT 20p each.

MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at **30p** + 15p post & VAT each.

MULTI-SPEED MOTOR

Six speeds are available 500, 850 and 1,100 r.p.m. and 8,000, 12,000 and 15,500 r.p.m. Shaft is ¼ in. diameter and approximately 1 in. long. 230/240v. Its speed may be further controlled with the use of our Thyristor controller. Very powerful and useful motor size approx. 2 in. dia. x 5 in. long. **Price £1·40** + 45p post & VAT.

BATTERY CHARGER

Famous Atlas in metal case with meter, output leads terminated by crocodile clips. For 6 or 12V charging simply by changing plug on front panel. Ready built new and still **£2·95** plus £1 Post & VAT.

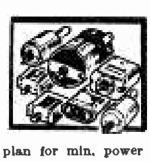
AMMETERS

Ideal for chargers etc. 2" sq. full vision 0·8 amp **95p.** 1½" *round* 0·2 amp **55p**, 0-3 amp **65p**, 0-4 amp **75p.** Post & VAT 25p each.

RELAY BARGAIN

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

ONLY £1·50 FOR SEVEN ELECTRIC MOTORS



7 powerful batt. motors as used in racing cars & power models. Output & types vary for use in hundreds of different projects — Tools, toys, models, etc. All brand new reversible & for 1½-12v. batts. Wiring diagram. inc. VAT & Post 40p. FREE plan for min. power station.

AUDIO AMPLIFIER

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

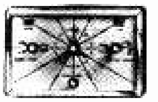
TWIN OUTPUT POWER PACKS

These have two separately R.C. smooth outputs so can operate two battery radios on a stereo amp without cross modulation (they will of course operate one radio-tape-cassette-calculator in fact any battery appliance and will save their cost in a few months). Specs.: Full wave rectification, double insulated mains transformer—total enclosed in hard P.V.C. case—three core mains lead—terminal output. When ordering please state output voltage 4½v, 6v, 7½v, 9v, 12v or 24v. Price **£3·95**, post and VAT included.

TANGENTIAL HEATER UNIT

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

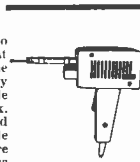
ISA ELECTRICAL PROGRAMMER



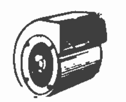
Learn in your sleep: Have radio playing and kettle boiling as you awake—switch on lights to ward off intruders—have a warm house to come home to. All these and many other things you can do if you invest in an electrical programmer. Clock by famous maker with 15 amp. on/off switch. Switch-on time can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

THIS MONTH'S SNIP

YOUR TIME is the most precious thing you have. Do you waste it waiting for the soldering iron to heat up? You can be soldering in a few seconds with the E.T.P. Soldering Gun which we offer at a specially keen price. It is in fact this month's snip. A well made lightweight unit with flash lamp to illuminate the work. Has 100 watt double insulated mains Transformer and is built into a shockproof Thermo-plastic case. Suitable for 240 volt, 50c.p.a. This comes complete with 5 spare tips and is offered at a special snip price **£2·75** plus 85p Post & VAT.

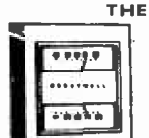


CENTRIFUGAL FAN



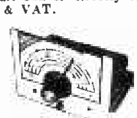
Mains operated, turbo blower type. Pressed steel housing contains motor and impeller. Motor is 1/10th h.p. giving considerable air flow but virtually no noise Approx. dimensions 10½" x 4½" **£9·50** plus Post & VAT.

THERMOSTAT WITH THERMOMETER



Made by Honeywell for normal air temperatures 40-80 F (5-25 C). This is a precision instrument with a differential which can be adjusted to better than 1·5 F. A mercury switch breaks on temp. rise. Elegantly styled and encased in an ivory plastic case with clear plastic windows, thermometer above and switch setting scale below—size approx. 3·8" x 3·2" x 1·4" deep—can be mounted on conduit box or directly on wall. Price **£2·25** plus 50p Post & VAT.

SHORTWAVE CRYSTAL SET

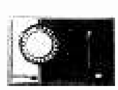


Although this uses no battery it gives really amazing results. You will receive an amazing assortment of stations over the 19, 25, 31, 29 metre bands—Kit contains chassis front panel and all the parts, **£1·50**—crystal earphone **55p, VAT & Postage 75p.**

SWITCH TRIGGER MATS

So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc. 24in x 18in **£1·99.** Post & VAT 80p. 13in x 10in **£1·50.** Post & VAT 65p.

SMITHS CENTRAL HEATING CONTROLLER



Push button gives 10 variations as follows:—(1) continuous hot water and continuous central heating (2) continuous hot water but central heating off at night (3) continuous hot water but central heating on only for 2 periods during the day (4) hot water and central heating both on but day time only (5) hot water all day but central heating only for 2 periods during the day (6) hot water and central heating on for 2 periods during the day time only—then for summer time use with central heating off (7) hot water continuous (8) hot water day time only (9) hot water twice daily (10) everything off. A handsome looking unit with 24 hour movement and the switches and other parts necessary to select the desired programme of heating. Supplied complete with wiring diagram. Originally sold, we believe, at over **£15**—we offer these, while stocks last, at **£6·95 each, VAT & Postage 65p each.**

TERMS: Where order is under £5 please add 30p surcharge to offset packing expenses. **Send SAE for monthly list.**

J. BULL (ELECTRICAL) LTD.

(Dept. PW), 103 TAMWORTH RD. CROYDON CRO IXX

THIS MONTH'S SPECIAL OFFER is a very versatile transformer which can be used for many purposes. Rated at 250 watts it is very well built with frames for upright mounting and is varnish impregnated. Its primary is for 230/240 volts 50 cycles, it has four secondaries each 10v very high current windings. Just a few of the circuits it can power are: 10-0-10v at up to 12 amps; 20-0-20v at up to 6 amps; single 10v at 25 amps; single 20v at 12½amps; single 30v at 9 amps; single 40v at 6·5 amps. The transformer can be used for power circuits (charging, etc.) or for amplifiers, there being an earth screen between primary and secondaries. A transformer like this to-day would cost at least £15 from the makers; however, we are making a special offer at **£3·50** + 28p, post £1 + 8p each. Grab some while you can, out stock may not last long.

Mains isolation kit. Apart from the fact that it is illegal for you not to provide adequate protection for any staff or persons working for or with you, your own personal comfort will be greater when you work isolated from the mains. Also, you are not likely to damage equipment if your soldering iron becomes earthy, as often happens. Isolation transformers are normally very costly, in fact we see that the average wholesaler is charging **£15** plus for a 250w model. We can offer 250 watts of isolation at only **£7** + 56p. Carriage **£2** + 16p.

Telephone handsets, ex GPO, but in good order, all you need to make an intercom between the kitchen and your cellar, attic or shed down the bottom of the garden is a battery, a length of wire and two of these handsets. Price **50p** + 40, post 25p + 2p. Twin wire **£4** + 32p per **100** metres, post **60p** + 5p.

Spit motor with Carter gear box, probably one of the best spit motors made. Originally intended to be used in very high priced cookers; however, this can be put to plenty of other uses, for instance your garden barbecue or to drive a colour disc for a dance or display or to drive a tumber for stone polishing; in fact, there is no end to its uses. Normal mains operation. Special price during January and February **£2·50** + 20p, post 30p + 2p.

Multiple contact panel, size approx. 4½" × 2½", this has 200 contacts each cross referenced above and below alphabetically and numerically so each can be easily identified. Contacts are capable of making positive connection with a strip or wire as each contact is spring loaded and has a gold "pip". Ideal if you want to make yourself a computer or for circuit bread-boarding (resistors, etc. plug straight in) or for working out printed circuits, even for teaching electronics and novelties such as puzzles, combination locks, etc. Taken from unused computer panels, price only **£2** + 16p each which works out to only 1p per contact, probably less than the value of the gold pip. Post 15p + 1p.

Gold plated strips for permanent contacts into slot of above panels, 15 for **£1** + 8p.

Vennor 1 rev per hour motor with spindle threaded and nutted ready to easily attach discs or drums. Bakelite encased motor beautifully made and finished. **£2** + 16p, post 20p + 2p. Very many uses for this, for instance a disc or drum attached could operate microswitches for display or mood lighting, etc.

Digital Display Unit, 'Digivisor'. This is a precision instrument which consists basically of 12v lamp focused by a lens system through a numbered scale, the number appears on a ground glass front screen. The number is selected by applying a different voltage to the coil which rotates the scale e.g. 1 volt applied shows figure 1 on scale—by using shunts or multipliers however any voltage or current could be made to indicate any number, or if a photo cell is positioned on the screen then an alarm could be triggered. Similarly this could be used for voltage or current regulation. Overall size of the unit is 2½" × 1½" × 4½". Price **£4·50**+36p.

Pulse transformer with circuit for sound to light unit. It is a very simple circuit and all parts are readily obtainable from us or you may already have them in your junk box. Price of the transformer with circuit **75p,** post and VAT paid.

ORP 12 light cell. This device has been going for some years now but it has not been bettered and new applications keep being found for it. We have good stocks, price **65p** + 5p.

Throat mikes. These are an ex WD item as used by air crew on their intercom, but being electromagnetic they also serve as pick-ups on musical instruments, talking to passengers on motor bike and no doubt many other uses. Price **60p** a pair + 15p.

One chip radio. Ferranti ZN 414 IC radio is still in stock, current price **£1·49** + 38p. We can also still supply the **Hi Q kits** to go with them, most popular **one kit No. 4,** comprises a permiability tuner for medium wave, and the resistors and condensers which when added to the ZN 414 complete the radio for medium wave band. Price of this HQ kit No. 4 is **68p** + 17p, post 20p + 5p.

12½ watt speaker bargain, 8" round mid-range, made for high priced hi-fi outfit, a really super speaker, **£3** + 75p, post 60p + 15p.

Microswitch, Honeywell ref. no. YZ RW 84-N88. This has fairly long lever and is changeover 15 amp 250v rating. Price **30p** + 2½p each.

Two circuit microswitch, famous American Licon, maker's ref. 16-40411, size approx. 1" long × ½" wide × ⅜" thick. Two electrically separate circuits, one makes, the other breaks, when nylon push rod is depressed. Circuit rating we estimate at 5 amps 250v. A real bargain at **15p** each + 1p—subject to normal quantity discounts.

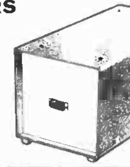
Reed relay in solenoid. Resistance 1·5K, this will operate from voltages of 10v upwards on a current of 12mA upwards. The flow of the control current closes the reed switch but if you bias this with a small magnet or an opposing current, then the flow of the control current could be made to open the reed switch. Price **75p** + 6p.

A.S.P. LTD

(DEPT. PW4), SIMMONDS ROAD, WINCHEAP
CANTERBURY, KENT Tel: (0227) 52436

TRANSFORMERS VAT 8%

CASED TRANSFORMERS



Housed in smart resin coated steel cases with 3 core power cable and outlet socket, fused primary winding. Isolation types are fitted with 3-pin outlet sockets and are available with 110 volt or 240 volt output (please state). Auto types are fitted with 2-pin flat style sockets up to 500VA. 3-pin sockets from 750 to 3000VA. See Auto Isolation Sections for prices. Plugs extra.

SAFETY ISOLATING

See catalogue for full range. Prim. 120/240V. Sec. 120/240V. Centre Tap with screen.

VA (Watts)	REF NO.	PRICE CASED £	PRICE PLUGS 2 Pin + Earth £	PRICE OPEN £	POST £
60	149	9·03	0·98	4·70	0·72
200	151	12·29	0·98	8·61	0·97
250	152	13·81	0·98	10·31	1·18

AUTO TRANSFORMERS

See catalogue for full range.

VA (Watts)	REF. NO.	PRICE CASED £	PRICE PLUGS 2 & 3 pin £	PRICE OPEN £	POST £
1500	93	23·26	0·95	19·22	O/A

MINIATURE & EQUIPMENT

Primary 240V with screen. See catalogue for full range.

VOLTS Sec. 1	VOLTS Sec. 2	MILLIAMPS Sec. 1	MILLIAMPS Sec. 2	REF. NO.	PRICE £	POST £
3-0-3	—	200	—	238	1·56	0·34
0-6	0-6	500	500	234	1·56	0·34
0-6	0-6	1000	1000	212	2·12	0·46
9-0-9	—	100	—	13	1·60	0·34
0-9	0-9	330	330	235	1·62	0·34

12 & 24 VOLTS

Primary 200–240 Volts. See catalogue for full range.

AMPS 12V	AMPS 24V	REF. NO.	PRICE £	POST £
2	1	71	2·47	0·61
4	2	18	3·07	0·62
6	3	70	4·50	0·72
8	4	108	5·11	0·85

30 VOLTS

Primary 200/240V
Secondary 12, 15, 20, 24, 30V

AMPS	REF. NO.	PRICE £	POST £
0·5	112	2·04	0·61
1	79	2·57	0·66
2	3	3·91	0·72
3	20	4·80	0·85
4	21	5·58	0·85
5	51	6·75	0·95
6	117	7·52	0·97
8	[illegible]	9·93	1·18
10	89	10·27	1·18

50 VOLTS

Primary 200/240V
Secondary 19, 25, 33, 40, 50V

AMPS	REF. NO.	PRICE £	POST £
0·5	102	2·71	0·61
1	103	3·58	0·76
2	104	5·30	0·85
3	105	6·10	0·85
4	106	7·97	1·08
6	107	12·93	1·18
8	118	13·75	1·44
10	119	17·79	1·86

60 VOLTS

Primary 200/240V
Secondary 24, 30, 48, 60V

AMPS	REF. NO.	PRICE £	POST £
0·5	124	2·51	0·72
1	126	3·75	0·72
2	127	5·36	0·85
3	125	7·91	0·97
4	123	9·20	1·18
5	40	10·22	1·18
6	120	12·10	1·36
8	121	15·74	O/A
10	122	20·10	O/A
12	189	18·87	O/A

BRIDGE RECTIFIERS

One Amp	Price	Four amp	Price
50P.I.V.	0·25	100P.I.V.	0·55
100P.I.V.	0·25	200P.I.V.	0·59
200P.I.V.	0·28	400P.I.V.	0·65
600P.I.V.	0·30	600P.I.V.	0·75

Two Amp	Price	Six Amp	Price
50P.I.V.	0·35	50P.I.V.	0·65
100P.I.V.	0·40	100P.I.V.	0·70
200P.I.V.	0·45	200P.I.V.	0·80
400P.I.V.	0·50	400P.I.V.	0·90

Add 25% VAT on all prices.

SPECIAL OFFER
2 KVA ISOLATORS

Fully impregnated & screened 2 Primary windings 110V each 2 Secondary windings 115V each (2 matching transformers) £29·50 plus carriage VAT 8%.

NEW! 2" and 4" PANEL METERS VAT 8%

2" Size: 60mm wide × 45mm high × 40mm deep.

4" Size: 110mm wide × 82mm high × 43mm deep

Movement (2")	I.R. Ohms	Movement (4")	I.R. Ohms
0–5 micro A	1250	0–50 micro A	1400
0–100 micro A	580	0–100 micro A	730
0–500 micro A	170	0–500 micro A	200
0–1 mA	170	0–1 mA	200
0–5 mA	170	0–5 mA	200
0–10 mA	6	0–10 mA	6
0–50 mA	0·5	0–50 mA	0·5
0–100 mA	0·5	0–100 mA	0·5
0–500 mA	0·5	0–500 mA	0·5
0–1 Amp	0·5	0–1 Amp	0·5
0–2 Amp	0·5	0–2 Amp	0·5
0–25 Volt	15K	0–25 Volt	15K
0–50 Volt	50K	0–50 Volt	50K
0–300 Volt	300K	0–300 Volt	300K
"S" meter	170	"S" meter	200
Vu meter	9250	Vu meter	9250

Vu meters are complete with detectors. Modern wide view. Price 2" £3·20 Post 10p. Price 4" £4·00 Post 10p. VAT 25%. Lamps 95p per set. Plus 8% VAT.

FOR MULTI-METERS, INSTRUMENTS, RESISTORS, NEONS, TOOLS, POWER SUPPLIES, etc. Send for Catalogue.

NEW CATALOGUE 25p | **NEW CATALOGUE 25p**

---

orchard electronics

TRANSISTORS

	p		p		p		p		p		p
				BC132*	11	BC178B	18	BC261A	16	BC559*	9
AC125	20	ASY26	30	BC135*	12	BC179B	19	BC262A	15	BCY70	15
AC126	20	ASY27	34	BC136*	16	BC182B*	10	BC266A	18	BCY71	18
AC127	20	ASY28	30	BC137*	16	BC182L*	11	BC267A	14	BCY72	14
AC128	20	ASY29	34	BC138	15	BC183B*	10	BC268B	13	BD115	60
AC132	35	ASY67	70	BC139	35	BC183L*	10	BC269	13	BD121	90
AC141	20	BA145*	15	BC142	22	BC184B*	12	BC287	20	BD123	90
AC142	17	BA154	10	BC143	24	BC184L*	11	BC300	27	BD124	68
AC151	24	BA155	12	BC147A*	9	BC186	25	BC301	26	BD131	36
AC153	27	BAX12	10	BC147B*	10	BC187	26	BC302	24	BD132	38
AC176	20	BAX13	4	BC148*	9	BC204A*	16	BC303	30	BD133	65
AC188	20	BAX16	6	BC148B*	10	BC205A*	15	BC304	27	BD135*	37
AD161	42	BC107	11	BC149B*	11	BC206A*	15	BC307A*	16	BD136*	39
AD162	42	BC107A	12	BC149C*	11	BC207A*	11	BC308A*	14	BD137*	44
AF114	24	BC108	10	BC153*	18	BC208A*	11	BC309B*	16	BD138*	47
AF115	24	BC108B	11	BC154*	18	BC209B*	13	BC317A*	12	BD139*	54
AF116	24	BC109	11	BC157B*	12	BC212A*	13	BC319B*	12	BD155*	75
AF117	24	BC109B	12	BC158A*	12	BC212L*	15	BC322B*	15	BD165*	34
AF118	47	BC109C	13	BC159A*	12	BC213B*	12	BC327*	20	BD232*	70
AF124	30	BC115*	15	BC167A*	11	BC213L*	14	BC328*	18	BDY20	80
AF125	30	BC116*	15	BC168B*	14	BC214*	15	BC337*	18	BF115	22
AF126	28	BC117*	18	BC171A*	14	BC214L*	17	BC338*	16	BF154*	20
AF139	34	BC118*	10	BC172A*	15	BC237A*	16	BC461	35	BF158*	20
AF186	50	BC119	28	BC173B*	16	BC238A*	15	BC557*	9	BF159*	26
AF239	37	BC125*	14	BC177	17	BC2395*	15	BC558*	9	BF160*	20

SILICON RECTIFIERS

50V 3A	13p
100V 3A	15p
200V 3A	18p

THYRISTORS

100V 1A	30p
200V 1A	40p
600V 1A	60p
BT 106	120p

RESISTORS
1p* each
½ watt E12 range
1Ω–10mΩ

DIODES

1N4002	6p
1N4006	10p
1N4148	5p

INTEGRATED CIRCUITS
TTL DIGITAL

7400	18p
7401	20p
7402	18p
7403	18p
7404	23p

SAE for full list of components "same day despatch to mail order customers" "Minimum order £1 p & p 25p". Callers Mon.–Sat. Incl.

INTEGRATED CIRCUITS LINEAR

709 (8 pin Dil)	40p
741 (8 pin Dil)	43p
NE555	60p

ZENERS (400mW)
52X83/BCY88
3V3, 3V6, 3V9, 4V3, 4V7, 5V1, 5V6, 6V2, 6V5, 7V5, 8V2, 9V1, 10V, 12V, 13V, 15V, 18V, 30V.
All at 12p* each

VOLTAGE REGULATORS (TO3)

5V 1A	175p
12V 1A	175p
15V 1A	175p

LED

125R Red	20p
125A Amber	27p
125Y Yellow	27p
TIL209 Red	25p

VAT—Items marked * add 25%, Rest at 8%
Flint House, High Street, Wallingford, Oxon OX10 0DE
Tel. Wallingford (0491) 35529 Telex 4SPWALFRD849349

SAVE SAVE SAVE

Save your money on:

★ **TOUCH SENSITIVE PIANO KIT**
★ **SYNTHESISER KIT**
★ **ELECTRONIC PIANO KIT**

★ Portable Organ kit with 4-Octave keyboard 2 pitches, external tuning, 10 Voices Vibrato. Plywood cabinet and cover finished in black rexine. Price **£99·00**. ★ Portable Organ kit with 4-Octave keyboard, 3 pitches, external tuning, 10 Voices Vibrato. Plywood cabinet and cover finished in black rexine. Price **£145·29**. ★ Portable Piano kit with touch-sensitive 5-Octave keyboard. Plywood cabinet and cover finished in black rexine. Price **£145·00**. ★ Console Organ kit with 5-Octave keyboard 3 pitches, external tuning, 10 Voices, Sustain, Delay Vibrato, Piano Marimba and Wah Wah effects. Console finished in walnutt. Price **£250·93**. ★ Console Organ kit with 2 x 4-Octave keyboards and 13 note pedal board, 4 pitches external tuning, 15 Voices on upper keyboard, 5 pitches and 10 Voices on lower keyboard. 2 Voices on pedal, Sustain Reverberation Delay Vibrato, Snare Drum and Cymbal on Pedal, Piano Marimba and Wah Wah effects, 4 Drum Unit buttons. Console finished in Teak or Walnutt. Price **£470·65**. ★ Console Organ kit with 2 x 5-Octave keyboards and 32 note R.C.O. Pedal Board. 6 pitches all effects and finish as above. Price **£680·00**. ★ Console Organ kit with 3 x 5-Octave keyboards and 32 note polyphonic R.C.O. Pedal Board, 9 pitches, magnificent range of voices. Price **£960·00**.

★ **Components: 4-Octave keyboard C-C £15·50, 5-Octave keyboard C-C and F-F £20·00. Top octave tone generator, complete with external tuning capacitor, GU500, £12·95. Top octave tone generator and divider unit complete with external tuning capacitor, GD500 £50·00. Construction Manual for Portable Organ, using discrete components £2·25. Catalogue 60p.**

ELVINS ELECTRONIC MUSICAL INSTRUMENTS

Organ Centre: 12, Brett Rd., Hackney, London E8 1JP. 01-986 8455
Component Shops: 8, Putney Bridge Rd., London SW18 1HU, 01-870 4949. 40/42a, Dalston Lane, Hackney, London E8 2AZ, 01-249 5624.

All prices are exclusive of VAT.

PUSH BUTTON CAR RADIO KIT– THE TOURIST TT*

NO SOLDERING REQUIRED

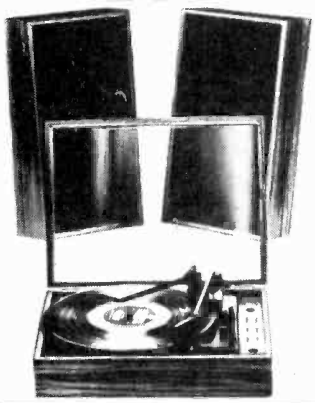
NOW BUILD YOUR OWN PUSH BUTTON CAR RADIO **£9.50** +£1.05 p & p.
Easy to assemble construction kit comprising fully completed and tested printed circuit board on which no soldering is required. All connections are simple push fit type making for easy assembly. Fine tuning push button mechanism is fully built and tested to mate with printed circuit board.
TECHNICAL SPECIFICATION: (1) **Output** 4 watts RMS output. For 12 volt operation on negative or positive earth. (2) **Integrated circuit** output stage, pre-built three stage IF Module. **Controls volume** manual tuning and five push buttons for station selection, illuminated tuning scale covering full, medium and long wave bands. Size chassis 7" wide 2" high and 4¼" deep approx.

Speaker including baffle and fixing strip £2.00 +45p p & p. Car Aerial Recommended – fully retractable £1.60+40p p & p.
The Tourist I Kit For the experienced constructor. If you can solder on a printed circuit board you can build this model. Same technical specification as Tourist TT. **Price £8.20**+£1.05 p & p.

SPECIAL OFFER

The Tourist I Kit, same specification as Tourist TT complete with speakers, fixing kit and fully retractable aerial **£10.50** + p & p £1·50

*STEREO 21 QUALITY SOUND FOR LESS THAN £24.00



Stereo 21, easy to assemble audio system kit. No soldering required.
The unit is finished in teak veneer and the acrylic top presents an unusually interesting variation on the modern deck plinth.
Includes—**BSR 3 speed deck**, automatic, manual facilities together with stereo cartridge.
Two speakers with cabinets.
Amplifier module. Ready built with control panel, speaker leads and full, easy to follow assembly instructions.
Specifications—For the technically minded:
Input sensitivity 600mV. Aux. input sensitivity 120mV. Power output 2.7 watts per channel. Output impedance 8-15 ohms. Stereo headphone socket with automatic speaker cutout. Provision for auxiliary inputs—radio, tape, etc., and outputs for taping discs.
Overall Dimensions. Speakers approx 12"×9"×5" Complete deck and cover in closed position approx. 15¼"×12"×6".

Complete only £23.20 +£3.00 p & p.

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

*DISCO AMPLIFIER

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

£20.00 +£1.35 p & p.

8 TRACK HOME CARTRIDGE PLAYER

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

Yours for only **£14.00** +£1.70 p & p

SPECIAL OFFER

As above but complete with build yourself Unisound Amplifier Kit (see opposite panel) + 2 'Compact' easy to build speaker kits (see opposite page) **£25.00** + p & p £2·00

BUILD YOUR OWN STEREO AMPLIFIER*

For the man who wants to design his own stereo – here's your chance to start, with Unisound – pre-amp, power amplifier and control panel. No soldering – just simply screw together. 4 watts per channel into 8 ohms. Inputs: 120mV (for ceramic cartridge). The heart of Unisound is high efficiency I.C. monolithic power chips which ensure very low distortion over the audio spectrum. 240V. AC only.
Also available with 2 speakers (7"×4") £10 + £1.75 p & p. **£8.95** + £1.05 p & p.
Also available with the 'Compact' (see opposite page) easy build speaker kit £13.50 + £2 p & p

PORTABLE DISCO CONSOLE*

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

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

Console size –
Unit Closed – 17¾"×13¾"×8¾" (app.)
Unit Open – 35¾"×13¾"×4¾" (app.)
This disco console is ideally matched for the Reliant IV and Disco 50 or any other quality amplifier.
The unit is finished in black PVC with contrasting simulated teak edging, diamond spun control knobs with matching control panel.

Yours for only £49.00 +£6.50 p & p.

All prices include VAT at current rates

BARCLAYCARD — Buy it with Access

DO NOT SEND CARD
Just write your order giving your credit card number

Mail orders to Acton. Terms C.W.O. All enquiries stamped addressed envelope. Goods not despatched outside U.K.

Leaflets available for all items listed thus* Send stamped addressed envelope. All items subject to availability. Prices correct at 1st Feb. '76 and subject to change without notice.
● Minimum order on ACCESS/BARCLAYCARD £11

R T V C

21C HIGH STREET, ACTON, LONDON W3 6NG
323 EDGWARE ROAD, LONDON W2
Personal Shoppers **EDGWARE RD**: 9 a.m.–5.30p.m. Half day Thurs
ACTON: 9.30a.m.–5p.m. Closed all day Wed.

PLEASE MENTION PRACTICAL WIRELESS WHEN REPLYING TO ADVERTISEMENTS

PRICES INCLUSIVE OF VAT

TTL by TEXAS

7400	13p	7486	32p
7401	14p	7489	291p
7402	15p	7490	40p
7403	14p	7491	81p
7404	17p	7492	48p
7405	17p	7493	40p
7406	41p	7494	81p
7407	39p	7495	70p
7408	17p	7496	84p
7409	22p	7497	290p
7410	15p	74100	117p
7411	24p	74107	32p
7412	25p	74121	32p
7413	34p	74122	52p
7414	65p	74123	73p
7416	32p	74141	70p
7417	32p	74145	75p
7420	15p	74150	135p
7422	19p	74151	77p
7423	36p	74153	92p
7425	33p	74154	164p
7427	40p	74155	82p
7430	15p	74156	82p
7432	28p	74160	107p
7437	28p	74161	107p
7440	15p	74162	107p
7441	70p	74163	107p
7442	64p	74164	130p
7445	90p	74166	136p
7447	81p	74174	130p
7448	75p	74175	92p
7450	16p	74176	108p
7453	17p	74180	108p
7454	18p	74181	322p
7460	16p	74182	89p
7470	29p	74185	146p
7472	27p	74190	155p
7473	32p	74191	150p
7474	32p	74192	130p
7475	48p	74193	130p
7476	32p	74194	116p
7480	54p	74195	83p
7481	103p	74196	99p
7482	75p	74197	108p
7483	86p	74198	214p
7484	103p	74199	197p
7485	130p		

FEB. SPECIAL OFFER
(VAT INCLUSIVE) 100
555 £37
741 RCA 8 pin DIL £20
MFC4000B £63

Add 20p p & p—NO OTHER EXTRAS

OP AMPS

301A	Ext Comp 8 pin DIL	40p
709	Ext Comp 8/14 pin DIL	30p
710	Diff Comp 14 pin DIL	54p
741	Int Comp 8/14 pin DIL	25p
747	Dual 741 14 pin DIL	75p
748	Ext. Comp 8 Pin DIL	40p
776	Prog. OpA TO 99	153p
CA3130S	CMOS OpA 8 Pin DIL	108p
LM3900	Quad OpA 14 Pin DIL	60p
MC1458	Dual OpA 8 Pin DIL	75p
NE536T	FET OpA TO 99	300p

LINEAR ICS

CA3028	Diff. Cascade Amp	112p
CA3046	5 Transistor array	55p
CA3048	Quad low noise Amps	250p
CA3089E	FM IF System 16 DIL	250p
CA3090Q	FM Stereo Decoder	160p
ICL8038CC	VCO Funct. Gen	300p
LM380	2W Audio Amp	115p
LM381	Stereo Pre Amp	200p
MC1310P	FM Stereo Dec.	220p
MC1312/4/5	SQ Quad Dec	1375p
MFC4000B	¼W Audio Amp	75p
MFC6040	Electronic Attenuator	112p
NE555V	Timer 8 Pin DIL	40p
NE556	Dual 555 14 Pin DIL	108p
NE561B	PLL with AM Demod	350p
NE562B	PLL with VCO	350p
NE565	PLL	200p
NE566	PLL Funtion Gen	180p
NE567V	PLL Tone Decoder	180p
SN72733	Video Amp	150p
TBA800	5W Audio Amp	112p
TBA810	7W Audio Amp	125p
TBA820	2W Audio Amp	100p
ZN414	TRF Radio Receiver	140p

M252 RHYTHM GENERATOR
16 pin DIL MOS IC
Drives 8 sound Generators 15 Programmable Rhythms £12 inc. 25% VAT, P & P. 1-16 pin DIL Socket and 25 pages Data & Application notes. (data 50p + S.A.E.)

LOW PROFILE DIL SKTS BY TEXAS
8 pin 14p, 14 pin 15p, 16 pin 16p, 24 pin 54p

VOLTAGE REGULATORS (PLASTIC)

	1 Amp	+ve		−ve	
723 14 Pin DIL 48p	5V	7805	150p	7905	215p
	12V	7812	150p	7912	215p
Data Sheets on	15V	7815	150p	7915	215p
Vol. Regs. 10p	18V	7818	150p	7918	215p
each	24V	7824	150p	7924	215p

OPTO ELECTRONICS

		Seven Seg. Displays		LEDS	
OCP70	33p			TIL209	16p
OCP71	120p	3015F	130p	(Red)	
ORP12	60p	MAN 3M	65p	TIL211	34p
ORP60	75p	DL704	160p	(Green)	
ORP61	75p	DL707	160p	TIL32	
2N5777	43p	DL747	250p	Infrared	75p

SCR-THYRISTORS OTHERS

1A 50V TO5	43p	BT106 1A 700V Plastic	150p
1A 100V TO5	45p	C106D 4A/400V	59p
1A 400V TO5	48p	2N4444 8A/600V TO66	200p
3A 100V Stud	53p	2N3525 5A/400V TO92	98p
3A 400V Stud	81p	MCR101 ½A/15V	27p
7A 100V TO5+HS	87p	2N5060 ·8A/30V	38p
7A 400V TO5+HS	97p	2N5062 ·8A/100V	45p
16A 400V Plastic	200p	2N5064 ·8A/200V	50p
16A 600V Plastic	250p		

TRIACS

	100V	400V	500V
3 Amp	92p	120p	130p
6 Amp	95p	150p	160p
10 Amp	117p	180p	200p
15 Amp	156p	220p	270p

OTHERS

40430	110p
40486	110p
40669	105p
BR100	25p

BRIDGE RECTIFIERS

1A 50V	25p
1A 100V	30p
1A 400V	34p
1A 600V	37p
2A 50V	37p
2A 100V	44p
2A 400V	56p
2A 600V	60p
4A 100V	65p
6A 100V	70p

DIODES

BY100	31p	1N4001	8p
BY126	15p	1N4002	6p
BY127	15p	1N4004	7p
OA47	9p	1N4007	8p
OA81	9p	1N4148	5p
OA85	11p	**ZENERS**	
OA90	7p	3·3v to 33v	
OA91	9p	400mW	11p
OA95	9p	1W	22p
OA200	7p	**OTHER**	
OA202	9p	AEY11	70p
IN914	4p	BB105	33p
		ZIJ	140p

TRANSISTORS

AC126/7	13p	BU105	175p	2N2484	32p
AC128	12p	BU108	312p	2N2904/5	22p
AC141/2	20p	MJE340	49p	2N2926RB	9p
AC176	12p	MJE2955	107p	2N29260	10p
AC187/8	14p	MJE3055	70p	2N2926YG	11p
AD149	46p	MPSA06	37p	2N3053	19p
AD161/2	39p	MPSA12	62p	2N3054	43p
AF114/5	18p	MPSU06	78p	2N3055	54p
AF116/7	18p	MPSU56	98p	2N3442	151p
AF139	35p	OC28	70p	2N3702/3	14p
AF239	43p	OC35	70p	2N3704/5	14p
BC107/8	10p	OC71	20p	2N3706	12p
BC109C	11p	OC72	25p	2N3707	14p
BC147/8	9p	OC83	35p	2N3708/9	11p
BC149	10p	TIP2955	76p	2N3773	240p
BC157	11p	TIP29A	50p	2N3866	90p
BC158/9	13p	TIP30A	54p	2N3904	22p
BC169C	15p	TIP31A	56p	2N3905/6	22p
BC177	20p	TIP32A	63p	2N4058	19p
BC178	17p	TIP33A	97p	2N4060	19p
BC179	20p	TIP34A	124p	2N4289	25p
BC182/3	12p	TIP35A	243p	40361	41p
BC184	14p	TIP36A	297p	40362	43p
BC187	32p	TIP41A	70p	40410	59p
BC212	14p	TIP42A	76p	40411	243p
BC213	12p	ZTX108	11p	40594	81p
BC214	17p	ZTX300	16p	40595	92p
BCY70	20p	ZTX500	19p	**FETS**	
BCY71	24p	ZTX504	60p	BF244	45p
BD131	39p	2N697	14p	MPF102	37p
BD132	43p	2N698	32p	MPF103/4	37p
BD135	54p	2N706	13p	MPF105	37p
BD139	79p	2N708	19p	2N3819	27p
BD140	87p	2N930	19p	2N3820	50p
BF115	24p	2N1131/2	19p	2N3823	54p
BF167	25p	2N1306	30p	2N5457	32p
BF173	27p	2N1613	22p	2N5458/9	32p
BF194	12p	2N1711	22p	3N128	81p
BF195	10p	2N1893	32p	3N140	92p
BF257	34p	2N2219	22p	3N141	81p
BFR39/40	37p	2N2221/2	22p	40603	63p
BFR79/80	37p	2N2369	15p	40673	54p
BFX84	28p			**UJT's**	
BFX85/6	27p			TIS43	34p
BFX87	22p			2N2160	86p
BFX88	26p			2N2646	38p
BFY50	17p			2N4871	37p
BFY51	16p			**PUJT**	
BFY52	17p			2N6027	60p
BRY39	39p				
BSX19/20	18p				

MAIL ORDER ONLY
GOVT/ COLLEGE ORDERS WELCOME

MINIMUM ORDER £2·00
(OFFICIAL ORDER £5·00)
VAT INVOICE SUPPLIED

TECHNOMATIC LTD.
54 SANDHURST RD, LONDON NW9 Tel. 01-204 4333

NEW 1976 OFFER

IN4148 SWITCHING DIODES
10 For 30p 50 for £1·25
100 For £1·50 1000 for £10

LIMITED OFFER

BC107 — BC108 — BC109 9p each
100 for £7·50

POPULAR BRANDED TRANSISTORS

BC147 — BC148 — BC149 — BC157 — BC158 — BC159 — BF194 — BF195 — BF196 — BF197
8p each. 100 for £6·50. Type numbers may be mixed for quantity discount.

8 PIN DIL 741's NEW LOW PRICES
1+ **25p** 10+ **22p** 25+ **20p** 100+ **18p**

1 Amp diodes IN4001 IN4002 IN4003 4p each **30 for £1**
IN4004 IN4005 IN4006 6p each **30 for £1·50**

ZENER DIODES BZY88 400 MW 3·3V to 33 VOLTS 7p each **100 for £6·00**

MULLARD FERRITE CORES LA3 100 to 500 kHz **54p**
LA5 30 to 100 kHz **81p**, LA7 L 10kHz **81p**
LA13 for W.W. OSCILLOSCOPE **£1·50**

ASSORTED RESISTORS CARBON AND CARBON FILM TYPES ¼ WATT to 3 WATTS (25 DIFFERENT VALUES)
300 for only £1·50

WIRE-ENDED **GLASS NEONS 20 FOR £1**

PLESSEY/T.C.C. CAPACITORS WIRE-ENDED ·02/300V, ·02/350V, ·03/350V, ·05/350V, ·25/250V. 100 OF ANY VALUE £2·00 OR 100 OF YOUR OWN CHOICE.

PLEASE NOTE THAT ALL PRICES INCLUDE POSTAGE AND V.A.T. AT 8 OR 25% AS APPROPRIATE

MAIL ORDER ONLY

XEROZA RADIO

1, EAST STREET, BISHOPS TAWTON, BARNSTAPLE, DEVON

Do Something Useful for a Change!

Do it in your spare time. And enjoy it. And, perhaps, you'll save yourself some money. The secret is to be practical about the way you spend your spare time.

These practical magazines show you how.

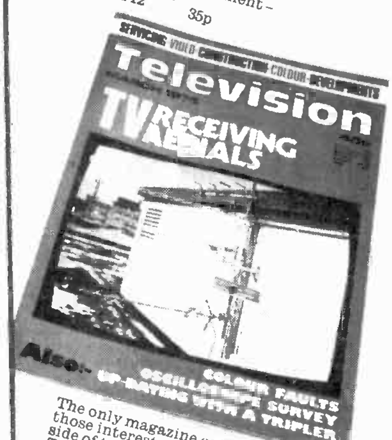
Every month these six popular titles are packed with fascinating and constructive projects – full instructions for making your own furniture and fitments for the home as well as electronic gadgets for home, car or hobby.

See which 'practical' can widen your range of interests, whether in home-improvement, hi-fi or electronics – and on jobs you really could call useful.

Over the past decade, this widely-read magazine has gone from strength to strength. *Practical Electronics* projects bring the latest technology within reach of the home constructor. April issue: 8-page supplement – Sound Effect Units.
OUT MARCH 12 35p

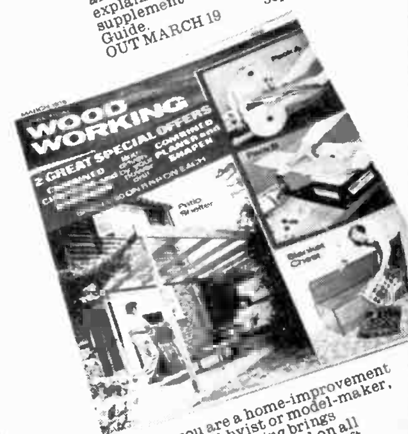
For over 40 years Britain's premier magazine for the do-it-yourself radio and electronics constructor. See how *Practical Wireless* makes technicalities crystal clear even to the newcomer. April issue: 8-page supplement – Fault-Finding Techniques.
OUT MARCH 5 35p

The only electronics magazine catering exclusively for the beginner. *Everyday Electronics* projects are easy to construct and their theory is simply explained. April issue: 8-page supplement – Beginner's Construction Guide.
OUT MARCH 19 30p



The only magazine catering for those interested in the technical side of television in the home. *Television* covers servicing, maintenance, construction and modification. April issue: 8-page supplement – TV Test Patterns and Signals.
OUT MARCH 15 40p

Every aspect of the sound scene is covered in *Practical Hi-Fi & Audio*, which month by month shows you how to choose, match and improve your equipment. April issue: 12-page supplement – Buying on a Budget.
OUT MARCH 12 30p



Whether you are a home-improvement enthusiast, hobbyist or model-maker, *Practical Wood Working* brings you the coverage you need on all aspects of wood and timber craft. April issue: 8-page supplement – The Language of Woodworking.
OUT MARCH 19 40p

Be Practical...Get a 'Practical' Today!

If you are unable to obtain a copy of any of the above titles from your newsagent, please contact:
Sales Manager, IPC Magazines Ltd., 66 Great Queen Street, London WC2B 5DD.

Practical Wireless Classified Advertisements

The pre-paid rate for classified advertisements is 14p per word (minimum 12 words), box number 35p extra. Semi-displayed setting £12·00 per single column inch. 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 GMG Classified Advertisement Manager, PRACTICAL WIRELESS, IPC Magazines Ltd. King's Reach Tower, Stamford Street, London SE1 9LS for insertion in the next available issue. (01-261 5846).

Situations Vacant

Telecommunications Engineering

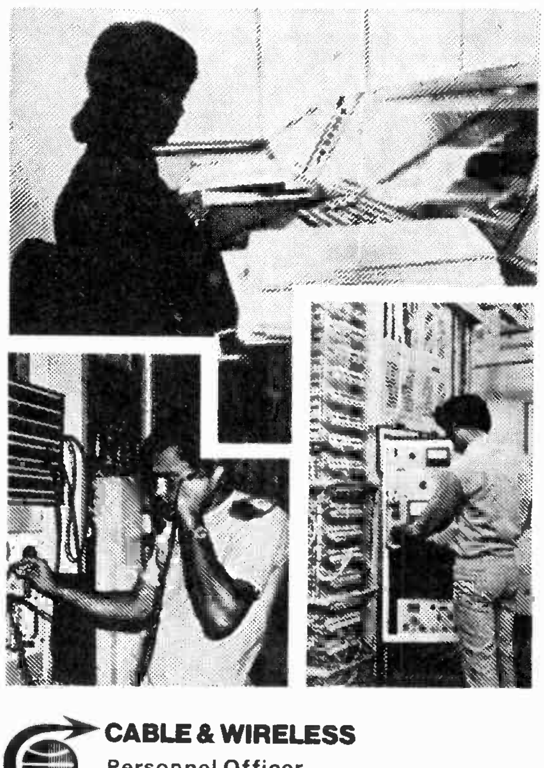
Train with the Experts

We are a forward-looking international group of companies specialising in the engineering and operation of Radio, Cable, Satellite Earth Station, Telephone and Computerised Communications systems.

Every year we need to recruit career-minded young people as career-minded Telecommunications Engineers in order to ensure that our worldwide organisation maintains its high standard of operations. If you are single, not older than 21, and have as minimum qualifications 5 GCE passes including Mathematics or Physics at 'A' level and English Language at 'O' level, we would like to hear from you.

Interviews will be held late March, early April and training will commence on 12th July 1976. The course, which lasts about 20 months takes place at our Engineering College at Porthcurno near Lands End. On successful completion of training you would probably be appointed to one of our many overseas branches : for instance a Caribbean or Indian Ocean Island. There is ample opportunity for further training (which could include a B.Sc. degree course), and you can develop a really worthwhile and rewarding career with Cable and Wireless, both overseas and at our headquarters in Central London.

We have a great deal to offer to those wishing to make the best of their qualifications and ability. If you want to train with the experts by taking advantage of one of the best telecommunications training schemes around, and join us in this rapidly expanding field, please write for further details and an application form to :–



CABLE & WIRELESS

Personnel Officer
(Recruitment),
Dept A181/479
Cable & Wireless Ltd.,
Theobalds Road,
London, WC1X 8RX.

Receivers and Components

BC107	10p	1N4003	4p	LEDS W/CLIP, 0·125"	
BC108	10p	1N4004	5p	TIL209 (Red)	17p
BC109	10p	1N4007	6p	MV5174 (Orange)	22p
TIP3055	49p	3A/800V		MV5274 (Green)	22p
TIP2955	68p	Rec.	15p	MV5374 (Yellow)	22p
ZTX300	15p			**CAPACITORS**	
ZTX304	25p	**Bridges**		10mfd/12V	10/20p
ZTX500	15p	1A/200V	26p		100/£1
ZTX504	25p	2A/600V	33p	10mfd/70V	10/30p
2N3055	49p	**DIL IC's**		22mfd/50V	100/
1N914	4p	741 8 pin	25p	100mfd/16V	£1·50
1N4148	4p	555 Timer	49p	1000mfd/6V	
1N4002	4p				

VAT INC. P & P 20p

AUDIO-OPTICS
19, MIDDLEWAY, CHINNOR, OXON
Tel. Kingston Blount 52683

COMMUNICATIONS RECEIVER modules. Small superhet circuit boards requiring only controls and tuned circuits. 9 volt. Mosfet mixer, IC IF, BFO, Prod. Det. Excellent AM/CW/SSB results reported by delighted users. From £11·50. SAE details. PR Golledge Electronics, Millend, Stonehouse, Glos.

12,000 ex R.A.F. Electronic Radar Valves for sale as one lot; comprises the following types:—

CV.447.KB/F	CV.2215.KB/P
CV.391.KB/F	XR1.12A
CV.2799.KB/D	CV.4060.KBE
CV.4014.KB/D	CV2115.KB/Z
13.E1.7972	CV.5968.GXU.KB/2
CV.2210.KB/D	XR1.3200A

CHEAP Similar quantities arising monthly.
N.E. Trading Company, 30/32 Witham, HULL. HU9 1BY.

TESTED
MIXED
MINIATURE
ELECTROLYTIC
CAPACITORS
6V – 63V

50 PACK	1 – 68 MFD	£1·00
100 PACK	1 – 68 MFD	£1·84
50 PACK	10 – 1000 MFD	£1·52
100 PACK	10 – 1000 MFD	£2·52

CASH WITH ORDER PLUS 25% VAT

P & P INCLUDED

M.C.L. (Dept. C)
12 OAKINGTON AVE
RAYNERS LANE
HARROW, MIDDX.

BRAND NEW COMPONENTS BY RETURN: Electrolytics—16V, 25V, 50V—0·47, 1·0, 2·2, 4·7, 10 mfds.—5p. 22, 47—5½p. (50V—6p) 100—7p. (50V—8p), 220—8p. (50V—10p), 500—11p. (50V—16p), 1000/25V—18p. Subminiature bead-type tantalums —0·1/35V, 0·22/35V, 0·47/35V, 1·0/35V, 2·2/35V, 4·7/35V, 10/20V, 22/16V, 47/6V, 100/3V.—11p. Mylar Film 100V.—0·001, 0·002, 0·005, 0·01, 0·02.—3p. 0·04, 0·05—3½p. Mullard tubular polyester 400V E6 series 0·001-0·022—3½p. 0·033-0·1—4½p. Mullard miniature C333 ceramics 63V E12 series 2%, 1·8 pf.-47 pf.—3p. 56 pf.-330 pf.—3½p. Polystyrene 63V E12 series 10 pf.-1000 pf.—3p. 1200 pf.-10,000 pf—4p. Miniature Highstab. carbon film resistors ⅓W E12 series 5% 1Ω-10MΩ. (10% over 1MΩ) 1·2p. Postage 10p. Prices VAT Inclusive. The C.R. Supply Co., 127, Chesterfield Road, Sheffield S8.

BRAND NEW, GUARANTEED, components by return. Sescosem BDY56 £1·75. Motorola MC1310P £2·70, BD529 65p, BD530 65p, 2N5457 45p, 2N5459 45p, MPSA12 40p, BF258 35p, BFR39 35p, BFR79 35p, BC109C 12p, BC182L 10p, BC184L 11p, BC212L 12p, BC214L 13p. Inclusive prices. P&P 10p. I. G. Bowman (Dept. PW), 59 Fowey Avenue, Torquay, S. Devon.

Yes, still the same JUMBO bottle
Beware of imitations
175cc **P.C.B. Ink** £1·50
Quick drying ferric chloride etch resist ink, applied by pen or brush.
MAWSON ASSOC.
64, Brookbank Road, London SE 13

500 COMPONENTS. Resistors, capacitors, diodes, transistors, pots, coils, etc. Identified, formed leads, fall-out, and surplus. Good value at £1·60. All inclusive (U.K. postal rates only). CWO please to L. Penseney, PW Bankhead Farm, South Queensferry, West Lothian.

Precision Polycarbonate Capacitors

All High Stability—extremely Low Leakage

440V AC RANGE

Value (μF)	Dimensions (mm) L	D	Price each
0·1μF	27	12·7	51p
0·15μF	27	12·7	59p
0·22μF	33	16	64p
0·25μF	33	16	67p
0·33μF	33	16	75p
0.47μF	33	19	80p
0·5μF	33	19	87p
0·68μF	50·8	19	93p
1·0μF	50·8	19	£1·03
1·5μF	50·8	25·4	£1·21
2·0μF	50·8	25·4	£1·44

63V DC RANGE

Value μF	±1%	±2%
0·01μF & 0·1μF	66p	49p
0·22μF; 0·33μF;	67p	50p
0·47μF	67p	50p
0·68μF	74p	53p
1·0μF	88p	62p
1·5μF	89p	71p
2·2μF	96p	75p
3·3μF	£1·15	82p
4·7μF	£1·62	£1·18
6·8μF	£1·96	£1·38
10μF	£2·40	£1·95
15μF	£3·22	£2·79
22μF	£4·28	£3·68

TANTALUM BEAD CAPACITORS—Value available: 0·1, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2, 3·3, 4·7, 6·8μF at 15V/25V or 35V; 10·0μF at 16V/20V or 25V; 22·0μF at 6V/10V or 16V; 33·0μF at 6V or 10V; 47·0μF at 3V or 6V; 100·0μF at 3V. ALL at 12p* each; 10 for £1·10*, 50 for £5·00*, 100 for £9·00*.

TRANSISTORS & I.C.'s

BC107/8/9	9p	*BC212/212L	14p	2N3702/4	11p
*BC114	12p	*BC213/213L	11p	2N3055	50p
*BC147/8/9	10p	*BC214/214L	11p	OC71/2	12p
*BC153/154	12p	*BF194/5	12p	NE555Timer	61p
*BC157/8/9	12p	BFY50/1/2	20p	741C8pin DIL	32p
*BC182/182L	11p	AF178	30p	ZN414	£1·15
*BC183/183L	11p	AF234	38p	SN76013ND	£1·50
*BC184/184L	12p				

POPULAR DIODES—1N914 6p, 8 for 45p, 18 for 90p; 1N916 8p, 6 for 45p, 14 for 90p; 1S44 5p, 11 for 50p, 24 for £1·00, 1N4148 5p, 6 for 27p, 12 for 48p; 1N4001 5½p; 002 6p; 003 6½p; 004 7p; 005 7½p; 006 8p; 007 8½p

LOW PRICE ZENER DIODES—400mW, Tol. ±5% at 5mA. 3V; 3V3; 3V6; 4V7; 5V1; 5V6; 6V2; 6V8; 7V5; 8V2; 9V1; 10V; 11V; 12V; 13·5V; 15V; 16V; 18V; 20V; 22V; 24V; 27V; 30V; 33V. All at 7p each, 5 for 33p, 10 for 65p, 50 for £3·12. SPECIAL OFFER: 100 Zeners (may be mixed) for £6·00.

RESISTORS—High stability, low noise carbon film 5%, ½W at 40°C, ⅓W at 70°C. E12 series only—from 2·2Ω to 2·2MΩ. ALL at 1p* each, 8p* for 10 of any one value, 70p* for 100 of any one value. SPECIAL PACK: 10 of each value 2·2Ω to 2·2MΩ (730 resistors) £5*.

SILICON PLASTIC RECTIFIERS—1·5 amp, wire-ended DO27: 100 P.I.V. 7p (4 for 26p); 400 P.I.V. 8p (4 for 30p).

BRIDGE RECTIFIERS—2½ amp: 200V 40p; 350V 45p; 600V 55p.

SUBMINIATURE VERTICAL PRESETS—0·1W only: All at 5p* each 50; 100; 220; 470; 680 ohm; 1K; 2K2; 4K7; 6K8; 10K; 15K; 22K; 47K; 100K; 250K; 680K; 1M; 2M5; 5M.

PLEASE ADD 20p POST AND PACKING ON ALL ORDERS. EXPORT—ADD COST OF SEA/AIRMAIL.

Add 8% VAT to all items except those marked with * which are 25%

Send S.A.E. for additional stock lists.
Wholesale price lists available to bona fide companies.

MARCO TRADING (Dept. W4),
The Old School, Edstaston, Nr. Wem, Shropshire.
Tel: Whixall 464/465 (STD 094 872)
(Proprs. Minicost Trading Ltd.)

COMPONENTS GALORE, pack of 500 assorted Radio, TV and Electronic components, a real bargain at a realistic price. Send only £1·50 c.w.o. This applies only to United Kingdom and Ireland. Overseas prices by arrangement. Caledonian Components. PO Box 3, Glenrothes, Fife, Scotland.

ELECTROLYTICS 500 untested £1 p&p 42p. Mullard 250V 5% **POLYESTERS** 50 mixed 1/2, 2μF some imperfections £1. p&p 30p. R. Wardle, 3 Erpingham Road, London SW15 1BE.

VALVES

Radio-TV Industrial Transmitting
2200 Types. 1930 to 1975, many obsolete. List 20p. S.A.E. for quotation. Postal export service. We wish to purchase all types of new and boxed valves. Wholesaler's, Dealer's, etc., stocks purchased.
COX RADIO (SUSSEX) LTD., The Parade, East Wittering, Sussex. West Wittering 2023

TRIACS (plastic) 10A/400V 67p (3+64p), DIAC 19p, NE555 44p, 13×BC148 80p*, 10×BC158 80p*, LEDs 0·2in dia, red 20p, yellow, amber, green 25p. 300W dimmer kit £1·95. P&P 15p, add 8% VAT (*25%). TK Electronics, 106 Studley Grange Road, London W7 2LX.

BARGAIN COMPONENTS, Brand New: 309K 5v 1A reg. £1·20; 380 2W AF amp. 90p; 555 timer 49p; 565 PLL £2·40; 723 reg. 40p; MAN1 7 seg. LED £1·80; MAN3M 7 seg. LED 48p; 5314 clock £3·65; 1N4005 600V, 1A diode 5p; SAE extensive lists. Mail order only, minimum £1.
All prices inclusive.
MELLOW ELECTRONICS
5 Sheepcot Drive, Watford, Herts, WD2 6DZ

LEARN the principles of operation of five different t.r.f. receivers, from the basic crystal set to better circuits employing reflex and regenerative techniques. Uses printed circuit board construction. (soldering required) Clear instructions and circuit explanations

BEGINNER'S RADIO KIT

ONLY £3·28
(p & p=29p)
Money Back Assurance

HOLME ELECTRONICS
36A FRONT ST.
ARNOLD
NOTTS.

For Sale

DISCOLIGHTS. Best! Cheapest! Reliable! Bumper catalogue: Aarvak Electronics, 12a(P) Bruce Grove, N17 6RA. 01-808 8923.

MICROPHONES: AKG D202EI, £45·00; AKG D190C or E, £20·00; AKG D224, £60·00; Sennheiser MD211N, £45·00. All brand new and boxed. Please add 25% for VAT. All other AKG and Sennheiser mikes, SAE for quote. J. J. Francis (Wood Green), Ltd., Manwood House, Matching Green, Harlow, Essex. Tel: Matching 476.

COPPER CLAD LAMINATE FOR PRINTED CIRCUITS
Single sided 1/16" paper base—1·5p/sq. inch.
Single sided 1/16" glass-epoxy—2·0p/sq. inch.
Any rectangular sizes cut to your requirements.
Please send cash with order.
Price includes postage and packing.
From: **SIMTECH ENGINEERING LTD**
Dedham Road, Ardleigh, Colchester, Essex, CO7 7QA
Telephone 0206 230133

MONOCHROME CCTV industrial studio rig—3 cameras, VTR, Telecine, mixer, monitors, lights. Offers.—SAE for list. Box No. 128.

FOR SALE. Sinclair Project 60 FM tuner in case, £20. Also Project 605, 40W amplifier kit, £15. M. Stanley, 9 Ormiston Gardens, Belfast BT5 6JD.

Service Sheets

SERVICE SHEETS — COLOUR TV MANUALS

Service Sheets for Black and White TV, Radios, Record Players and Tape Recorders 50p.
Please send large Stamped Addressed Envelope.

We can supply manuals for most makes of Colour Television Recievers.

B.R.C. PYE ECKO PHILIPS ITT/KB SONY G.E.C. HITACHI BAIRD ULTRA INVICTA etc.

Please send a Stamped Addressed Envelope for a prompt reply.

G. T. TECHNICAL INFORMATION SERVICE
10 DRYDEN CHAMBERS, 119 OXFORD ST., LONDON WIR 1PA
MAIL ORDER ONLY

LARGE SUPPLIER OF SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOGRAMS, RADIOGRAMS, CAR RADIOS)
ALL AT 50p EACH

"PLEASE ENCLOSE LARGE S.A.E WITH ALL ENQUIRIES & ORDERS"
Otherwise cannot be attended to

(Uncrossed P.O.s please, original returned if service sheets not available.)

PLEASE NOTE
We operate a "by return of post" service. Any claims for non-delivery should be made within 7-days of posting your order.

C. CARANNA
71 BEAUFORT PARK
LONDON, N.W.11 6BX

We have the largest supplies of Service Sheets (strictly by return of post). Please state make and model number alternative. Free TV fault tracing chart or TV list on request with order.

Mail order or phone 01-458 4882

Large Stocks of Colour Manuals

NO OVERSEAS MAIL PLEASE

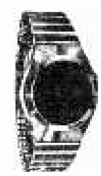
SERVICE SHEETS for Radio, TV, Tape Recorders, Stereo, etc., with free fault-finding guide, 50p and SAE, Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex.

BELL'S TELEVISION SERVICES for service sheets, manuals & books on radio/TV etc. Service sheets 50p plus SAE. Service sheet catalogue 25p. Back issues of magazines from April '74 onwards cover price plus 12p post. Free booklists on request. SAE with enquiries please to B.T.S., 190 Kings Road, Harrogate, Yorkshire. Telephone Harrogate (code 0423) 55885.

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

U.K. Agents Required

ELECTRONIC
LED WATCH



Manufacturers & Exporters
PACIFIC TRADING COMPANY
Electronics Division
77A, Waterloo Road,
Ground Floor, Kowloon,
P.O. Box 8173, Hongkong.
Cable: PACIFICTRA

Books and Publications

Technical Books – Radio & Electronics

World's Radio & TV Stations (International Edit).	£0–70
WORLD RADIO TV HANDBOOK 1976	£5–00
Boys Book of Crystal Sets	£0–35
Television Timebase Circuits	£1–20
Radio TV and Industrial Tube & Valve Equiv	£0–70
How to get the best out of your Tape Recorder	£1–70
Practical Electronic Science Projects	£0–85
Jack Darr's Service Clinic	£1–60
Transistor Circuits for Modern Test Equipment	£0–70
Modern Tape Recording Handbook	£0–85
1st Book of Transistor Equiv. and Substitutes	£0–50
Hi Fi, PA & Disco Amplifier Design Hndbk.	£0–87
Radio Servicing Problems	£0–75
Electronic Circuits for the Amat Photographer	£0–70
52 Projects using IC 741 or Equivs	£0–85
TV Fault Finding	£1–15
Transis Circuits for Rad. Control'd Models	£0–50
Practical Stereo & Quadrophony Handbook	£0–85
Radio Amateur Operator's Handbook	£0–85
Coil Design & Construction Manual	£0–60
Radio TV & Electronics Data Book	£0–70
79 Electronic Novelty Circuits	£0–85
The Complete Car Radio Manual	£0–85
Radio Technicians Bench Manual	£3–40
Servicing Transistor Radio Receivers	£0–95
1st Book of Hi Fi Loudspeaker Enclosures	£0–70
2nd Book of Hi Fi Loudpeaker Enclosures	£0–70
Manual of Electronic Circuits for the Home	£0–60
Modern Crystal Set Circuits for Beginners	£0–45
Electronic Novelties for the Motorist	£0–60
2nd Book of Transistor Equiv.& Substitutes	£1–10
Handbook of Electronic Musical Novelties	£0–60
Transistorised Novelties for Hi Fi Enthusiast	£0–45
Fault Location Exercises in Rad.& TV Vol.1	£1–00
Fault Location Exercises in Rad.& TV Vol.2	£1–60
Colour TV Picture Faults	£2–80
Practical Transistor Novelty Circuits	£0–50
Boys Book of Practical Radio & Electronics	£0–70
Radio Receiver Construction using ICs & Transis.	£0–70
ICs & Transistor Gadgets Construction Handb'k	£0–70
Integrated Circuits Equiv.& Substitutes Hbk.	£0–85
Audio Technicians Bench Manual	£3–40
Radio Antenna H'bk for Long Dist. Reception	£0–90
Guide to Printed Circuits	£3–40
Diode Characteristics Equiv & Substitutes	£1–10
Electronic Gadgets & Games	£0–90

All prices include Postage & Packing

RADIO BOOK SERVICE
40 Elwill Way, Beckenham BR3 2RZ

CHARTS & CONSTRUCTION PLANS

UFOs:

Transistor Optical Detector	70p
Radiation—Optical Detector	50p
TV Doppler Detection*	70p
Wave Prediction Chart	58p
Daily Flight Pattern	50p
Map, England (Midland, S.)	50p
Propulsion Theory	56p
"Anti-Gravity"	60p
Microdetector Circuits (UFO, Baby/Burglar alarms)	80p
Sighting Recorder	55p
Mars Flight Pattern, astronomical prediction table	60p

DIGITAL:

Frequency/Period Crystal Counter Timer (Mod. I)	£1·00
Multimeter 22 ranges FET interfacing Mod. I (or analogue)	£1·05
7-10 Digit Clock-Calendar Programmable	£1·10

PCB's — P.O.A.

R & E PUBLICATIONS
Highlands, Needham Market
Suffolk IP6 8DR
Publishers since 1969

* New Edition

Educational

TELEVISION TRAINING

16 MONTHS' full-time practical and theoretical training course in Radio and TV Servicing (Mono and Colour) for beginners with GCE (or equivalent) in Maths, and English.

13 WEEKS' full-time Colour TV Servicing course. Includes 100 hours practical training. Mono revision if necessary. Good electronics background essential.

NEXT SESSION commences on April 20th.

Prospectus from: London Electronics College, Department B4, 20 Penywern Road, London SW5 9SU. Tel. 01-373 8721.

C AND G EXAMS

Make sure you succeed with an ICS home study course for C and G Electrical Installation Work & Technicians Radio/TV/Electronics Technicians, Telecomms Technicians and Radio Amateurs.

COLOUR TV SERVICING

Make the most of the current boom! Learn the techniques of servicing Colour and Mono TV sets through new home study courses, approved by leading manufacturers.

TECHNICAL TRAINING

Home study courses in Electronics and Electrical Engineering, Maintenance, Radio, TV, Audio, Computer Engineering and Programming. Also self-build radio kits. Get the qualifications you need to succeed.

Free details from:
INTERNATIONAL CORRESPONDENCE SCHOOLS,
Dept. 778R, Intertext House, London SW8 4UJ.
Or Phone 01-622 9911 (All Hours)

TAPETALKS are the CLEVER way to LEARN.
THIS MONTHS SPECIAL OFFER:—
TWO C60 Cassettes entitled
'INTRODUCING ELECTRONICS'
will be sent to you by return of post for only £5·42 plus 55p. VAT/P.Pkg.
TAPETALK, P.O. BOX 99 (PW), MILTON KEYNES MK3 5BR.
Tel: Milton Keynes (0908) 77710.

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

LADDERS. Varnished. 25½ ft extended, £24·05, carriage £1·40. Leaflet, aluminium ladders and loft stairways. Tel: Telford 586644.

Electrical

STYLI & CARTRIDGES. For the best at keenest prices send SAE for free illustrated list to Felstead Electronics (PW), Longley Lane, Gatley, Ches. SK8 4EE.

Tape Recorders

TAPETALK

The NATURAL way to learn.
New release: Two C60 cassettes entitled
'The Science of Soldering'
£5·44 plus 55p. VAT/P. & P.

TAPETALK P.O. BOX 99 (PW)
Milton Keynes MK3 5BR.
Tel: Milton Keynes (0908) 77710

MUSICASSETTES FOR HIRE

Over 3,000 titles to chose from, for as little as 2½p per day. Many special benefits to members. Free brochure from:

THE STEREO CASSETTE LENDING LIBRARY, Room 16, SHERWOOD HOUSE, SIMMONDS ROAD, CANTERBURY CT1 3RL

Miscellaneous

HIGH QUALITY ELECTRO TOOL SETS IN SMART CARRYING CASES

from
WESTERN ELECTRONICS (UK) LTD.,
1-3 West Park Rd., Southampton
Tel: 27464. Send 30p for catalogue

GLASS FIBRE PCBs. Send 1:1 master and 30p per board plus 7p per square inch tinned or plus 9p per square inch drilled and tinned. Send for quotation on double sided boards. Discount for quantity. PROTO DESIGN, 4 Highcliffe Way, Wickford, Essex, SS11 SLA.

***JAYBEE* FOR KITS**

AMTRON, JOSTYKIT, BABANI & BERNARDS Books
Send S.A.E. for full information
JAYBEE ELECTRONICS, Sarum Farm Est. SARUM ROAD, WINCHESTER, HANTS
Telephone 0962-61806

TRANSMIT!

★ Unique TRANSMITTER/RECEIVER Kit. No licence examinations or tests required to operate this transistorised equipment. Easy to build. Get transmitting. Send £7·95 for yours now!

★ Psychedelic MINI-STROBE Kit. Take a pocket-sized lightning storm to Disco's & parties. 'Brain-freeze' 'em with vari-speed stop-motion flashes. Includes super case too. Send £3·50 now!
(all prices include V.A.T., packing & postage.)

Send remittance to:
BOFFIN PROJECTS, 4 CUNLIFFE ROAD, STONELEIGH, EWELL, SURREY
(*Mail order U.K. only*)
Or for more details, send 20p for lists

DIY PCB. How to make any PCB with professional finish in your kitchen—send for our booklet containing all information, including where to get supplies—75p plus SAE. PLESSIS ELECTRONICS, 237 Bicester Road, Aylesbury, Bucks.

BINOCULAR MAGNIFIER

FOR PRECISION CLOSE-UP WORK—LEAVES BOTH HANDS FREE

See close-up work with less eye strain & fatigue. Lightweight adjustable headband. Powerful optically ground lenses from Continental glass-works. Can be worn over normal glasses. An essential aid in industry. Home, Workshop, Collecting, Modelling, Jewellery, Watchmakers. Any fine work. De-luxe models with superior quality lenses PLUS hinged lens mount. 2½ × mag. £10·00 + 40p p. & p. 3× mag. £11·00 + 40p p. & p.

£10·00

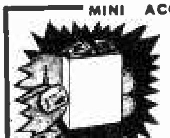
Access accepted.
JOHN DUDLEY & CO. LTD., Dept. WP6., 301 Cricklewood Lane, Finchley Road, London, NW2.
Tel. 01-458 5917. (Callers welcome)

LOW-COST I.C. MOUNTING for any size DIL package. 100 Soldercon sockets 60p. 7 and 8 hole plastic supports 5p/pair. Quantity rates. SAE details and sample. Trial pack 60p. (P & P 10p/order). P.K.G. Electronics, Oak Lodge, Tansley, Derbyshire DE4 5FE.

RECORD from TV

Make SOUND RECORDINGS from a TV set using this ADAPTOR with your cassette recorder or use it with your Hi-Fi or headphones. Completely Safe, Fully isolated. Leads, connectors and full instructions included. £6 inc. post and VAT or write for leaflet.
CROWBOROUGH ELECTRONICS (PW) Eridge Road, Crowborough, Sussex

MINI ACCUMULATORS



2 volt MULTI-USE Sealed Lead Acid Rechargeable Cells.
Size L450—1·4" x 1·1" x ·44". 3 for £2·15 inc. P. & P.
Size GA2—1·7" x 1·3" x ·5". 3 for £2·65 inc. P. & P.
Suits Fi-Cord
GARFIELDS, 295 Rye Lane, London, S.E.15

METAL BOXES/INSTRUMENT CASES. Range of over 100 standard sizes with punched holes to your specification if required. B.M.S. cut to size. Components. Audio equipment, kits and complete. 2 x 6½p stamps for lists. Nottingham Audio Services, 13/15, Foxhall Road, Nottingham NG7 6NA.

Synthesiser "Sounds Supreme" by Dewtron (25% VAT extra.)

Famous kits, e.g. waa-waa complete kit £4·50; Fuzz kit £6·50 P&P 25p under £10. Ring Modulator modules £11. "Mister Bassman" Bass Pedal Units and whole range of synthesiser modules, musical novelties, etc. Catalogue 20p from D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset.

MAY 1968 PRACTICAL WIRELESS issue with fault finding chart No. 2 and onward to cover repairing radio sets by Gordon King. H. Day, 23 Masefield Drive, Upminster, Essex.

TEXAN AMPLIFIER PARTS

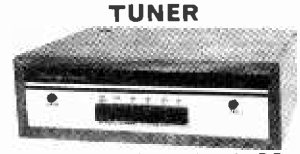
Pack 1: Res. 80p. Pack 2/3: Caps. £3·56. Pack 6: Pots £1·50. Pack 7: Semi Conductors £8·25. P.C. Bd. £3. Chassis £3 (p.p. 50p). Case £3·50 (p.p. £1).
p.p. 25p. Tax extra 25%.

TELERADIO ELECTRONICS
325 FORE ST., LONDON N9. 807 3719

SEND S.A.E. FOR FURTHER INFORMATION AND DETAILS OF 1 WATT to 75W AMPLIFIERS & F.M. TUNERS.

RADIO. Learn from the beginning. 16 vintage circuit diagrams, receivers and transmitters with notes. £1. Allister, 58 Wavell Road, Maidenhead, Berks, SL6 5AD.

THE P.E. 'VARICAP' STEREO PUSH BUTTON TUNER



Using the latest Mullard modules for R.F. and I.F. circuits—pre-aligned for ease of construction—this KIT has an F.M. tuner with stereo decoder, push button tuning, self regulated power supply, etc., etc., for highest quality reproduction.

Price £43·50
inc. V.A.T. P & P

S.A.E. for FREE brochure

We also still supply ALL components for the P.E. 'GEMINI' STEREO AMPLIFIER. Send 55p + 12p P&P for a full constructional booklet containing performance details, specification assembly instruction and fault finding guide.

ELECTRO SPARES
Dept. P.W.
288, Ecclesall Road, Sheffield, S11 8PE

DO-IT-YOURSELF loudspeakers for hi-fi are our speciality. Full range of components and accessories including chassis speakers, crossovers, sound absorbent, grille fabrics etc. always available. We stock the fabulous value Helme speaker kits complete with full and easy instructions, also Peerless and Wharfedale kits. Just about the lowest prices anywhere! Send 8½p stamp for bargain list to: Audioscan, Dept. PW475, 4 Princes Square, Harrogate, North Yorkshire.

WATFORD ELECTRONICS

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

ALL DEVICES BRAND NEW 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, AIR/SURFACE. (SEND 25p FOR OUR CATALOGUE).

VAT Applicable to U.K. Customers only. All prices are exclusive of VAT. Please add 8% to devices marked* To the rest add 25%.

Callers welcome to our retail shop at 33, Cardiff Road, behind Watford Football Ground. Monday to Saturday. Ample Free Car Parking space available.

POLYESTER CAPACITORS: Axial lead type. (Values are in μf). 400V: 0·001, 0·0012, 0·0015, 0·0018, 0·0022, 0·0033 4p; 0·0047, 0·0068, 0·01, 0·015, 0·022 5p; 0·033, 0·047, 0·068 6p; 0·1, 0·15, 0·22, 9p; 0·33, 13p; 0·47, 17p. 160V: 0·1, 0·15 4p; 0·22 5p; 0·33 6p; 0·47 9p; 0·68 13p; 1·0 18p; 2·2 24p.
DUBILIER: 1000V: 0·01, 14p; 0·022, 15p; 0·047, 16p; 0·1, 23p; 0·47 43p.

POLYESTER RADIAL LEAD P.C. TYPE (Values are in μf). 250V: 0·01, 0·015, 0·022, 0·033 4p; 0·047, 0·068, 0·1 5p; 0·15 6p; 0·22, 0·33 8p; 0·47 9p; 0·68 10p; 1·0 14p; 1·5 22p; 2·2 24p.

FEED THROUGH CAPACITORS
1000pF/350V 8p

ELECTROLYTIC CAPACITORS: Axial lead type (Values are in μF). 250V: 100μF, 40p; 100V: 20, 6p; 63V: 0·47, 1·0, 1·5, 2·2, 2·5, 3·3, 4·7, 6·8, 8, 10, 15, 22, 6p; 32, 47, 68, 10p; 100, 12p; 50V: 1·0, 6p; 220, 15p; 1000, 42p; 40V: 33, 100, 6p; 470, 22p; 2200 40p; 35V: 1000, 38p; 30V: 3500, 41p; 25V: 8, 10, 22, 40, 68, 80, 160 6p; 220, 11p; 470, 13p; 640, 18p; 1000, 24p; 2200, 34p; 3000, 39p; 4700, 47p; 16V: 10, 40, 125, 250, 6p; 470, 11p; 1000, 1500, 18p; 4700, 46p; 10V: 4, 100, 6p; 640, 10p; 1000, 14p; 2200, 18p. **TAG-END TYPE:** 70V: 2500, 98p; 4700, 111p; 50V: 2000, 72p; 25V: 4700, 48p; 16V: 4700, 36p.

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. 16V: 10μF, 22. 10V: 15μF, 33, 6V: 47μF. 3V: 100μF.
Price: 11p each.

POTENTIOMETERS (AB or EGEN)
Carbon Track, 0·25W Log & 0·5W Linear values

1KΩ (LIN. on) Single gang	17p
5KΩ–2MΩ single gang	17p
5KΩ–2MΩ single gang D/P switch	37p
5KΩ–2MΩ dual gang stereo	50p

MYLAR FILM CAPACITORS

100V: 0·001, 0·002, 0·005, 0·01μF	4p
0·015, 0·02, 0·04, 0·05μF, 0·1μF	5p
0·15, 0·2 50V: 0·47μF	6p

SLIDER POTENTIOMETERS
0·25W log and linear values 60mm

5KΩ–500KΩ single gang	40p
10KΩ–500KΩ Dual gang	52p
50KΩ Lin 150mm WS 150	£3·00

CERAMIC CAPACITORS
50V d.c. Plaquette body 25mm leads.

Range: 0·5pF to 10,000pF	3p
0·015μf, 0·022μf, 0·033μf, 0·047μf	4p

PRESET POTENTIOMETERS

0·1W 50Ω–2·5MΩ Sub Min Vert. only	6p
0·25W 100Ω–2·2MΩ Horizontal	7p
0·25W 200Ω–1MΩ Vertical	7p

JACKSONS VARIABLE CAPS.

Dielectric		0-1-365pF	240p
100/300pF	86p	00 2 365pF	240p
500pF	95p	00 208/176	240p
Dilemin		with sl. mt. dr.	260p
300pF	125p	C804 5, 10, 15, 20, 25 50pF	120p
500pF	195p	100, 150pF	195p
6:1 Ball Drive 4511/DAF	97p	'L' 3x310pF	372p
Drum 54mm	30p	00-3x25pF	323p

RESISTORS—Erie make
Carbon, Miniature, High Stability, Low Noise

POWER	Tol.	RANGE	Val.	1–99	100+
0·25W	5%	2·2Ω–4·7M	E24	1p	0·8p
0·5W	5%	2·2Ω–4·7M	E12	1p	0·8p
1W	5%	2·2Ω–10M	E12	3p	2p

100 off price per value not mixed.

CERAMIC TRIMMER CAPACITORS
2–7pF; 4–15pF; 6–25pF; 8–30pF 17p each

MINIATURE
3–10pF; 3–30pF; 10–40pF 15p

COMPRESSION TRIMMERS

3–40pF	18p
20–250pF	27p
100–500pF	32p

SILVER MICA
4·7, 6·8, 12, 18, 22, 33, 50, 82, 85, 100, 120, 150, 250pF 7p each

EARPHONES
(with cord and Jack plug)

MAGNETIC	
2·5mm plug	15p
3·5mm plug	15p
CRYSTAL	
3·5mm plug	30p

SPEAKERS

3Ω 2½" 0·2W	58p
2½" 0·3W	56p
3" 0·5W	58p
64Ω 2½" 0·3W	60p
16Ω 7 x 4" 5W	170p
8Ω 13 x 8" 8W	398p

P.W. PROJECTS
(Send 10p stamp per parts list) Kits available Easybuild Elect. Organ, Easybuild Music Box, Rythum Generator.

SEE OUR CATALOGUE FOR
Soldering Iron, Solder, Bits, microphones, Aerials, Audio Adaptors and many other items.

HEAT SINKS*

TO5/5F	8p
TO18/18F	8p
TO66/TV2	15p
TO3/TV3	15p
Insulation Kit (Mica & 2 washers)	6p

DIL SOCKETS
Low profile

8 or 14 pin	13p
16 pin	14p
24 pin	36p
26 pin	58p

SOLDERCON PINS*
100 pins 65p

DENCO COILS
Dual Purpose 'DP'

Rng. 1-5 B,Y,R,W	69p
6-7 B,Y,R	60p
1-5 Green	74p
Transistor Tuning coils 'T' Type	
Rng. 1-5 B,Y,R,W	78p
B9A Sockets	20p
IFT 13/14/15/16/17	70p
IFT18/465 or 1·6m	80p
TOC 1	75p
MW 5F.R.	72p
MW/LW 5FR	94p

ALUM. BOXES
with lid*

2¾x5¼x1½"	46p
4x4x1½"	46p
4x2¾x1½"	46p
4x5¼x1½"	58p
4x2¼x2"	46p
3x2x1"	40p
6x4x2"	78p
7x5x2½"	84p
8x6x3"	106p
10x7x3"	122p
10x4½x3"	110p
12x5x3"	120p
12x8x3"	180p

PLASTIC BOXES (VERO)*

L	W	H (mm)	Price
120	65	40	135p
150	80	50	155p
188	110	60	205p
71·5	49	24·5	30p

WITH ALUM. F & R PANELS*

205	140	40	244p
205	140	75	274p
205	140	109	355p

WITH SLOPING ALUM. F/PANEL*

220	174	(F52) (R100)	359p

ETCHING KIT*
(jumbo size) comprising of
1lb Ferric Chloride
2 Copper Boards
Etching Tray
Etch Resist Pen
Laminate Cutter
Plastic Spoon
Instruction Leaflet
£3·45* (p & p 45p)

DALO ETCH RESIST PEN only 76p

COPPER CLAD SRBP LAMINATE*

Single Sided 8½x9½"	48p
Double Sided 4½x7"	35p

FIBREGLASS BOARD:

Single Sided 6x6"	64p
Single Sided 12x6"	115p

FERRIC CHLORIDE
1lb Bag* 65p+ 30p (p & p)

VEROBOARD* Pitch

	0·1	0·15 (copper clad)	0·15 (plain)
2½ x 3¾"	32p	24p	15p
2½ x 5"	35p	35p	13p
3¾ x 3¾"	35p	35p	—
3¾ x 5"	40p	41p	29p
2½ x 17"	105p	73p	60p
3¾ x 17"	145p	115p	75p
4¾ x 17"	185p	—	110p

Pkt of 36 pins	22p
Spot face cutter	52p
Pin insertion tool	72p

TRANSISTORS

	p		p								
				BD138*	45	OC35*	54	TIS44	18	2N2906*	18
				BD139*	45	OC36*	58	ZTX107	12	2N2907*	20
AC125*	28	BC147	7	BD140	60	OC41	18	ZTX108	12	2N2907A*	22
AC126*	14	BC148	7	BD145*	55	OC42	18	ZTX109	13	2N2926G	10
AC127*	14	BC149	9	BDY60	75	OC44	18	ZTX300	14	2N2926O	8
AC128*	14	BC154	20	BDY61	85	OC45	18	ZTX301	14	2N2926R	8
AC141*	24	BC157	10	BF115*	22	OC70	17	ZTX302	18	2N2926Y	8
AC142*	25	BC158	12	BF177	26	OC71	17	ZTX303	15	2N3011	16
AC176*	14	BC159	13	BF178*	28	OC74	28	ZTX304	24	2N3053*	18
AC187*	14	BC167	12	BF179*	33	OC76	37	ZTX311	10	2N3054*	42
AC188*	15	BC168	12	BF180	33	OC81	18	ZTX341	19	2N3055*	45
ACY17	35	BC169	12	BF181	33	OC81D	24	ZTX500	16	2N3614*	95
ACY18	28	BC170	11	BF184	32	OC82	18	ZTX501	13	2N3615*	95
ACY19	25	BC171	11	BF185	30	OC83	28	ZTX502	18	2N3702	10
ACY20	24	BC172	11	BF194	10	OC139	94	ZTX503	14	2N3703	12
ACY21	29	BC177*	16	BF195	10	OC140	100	ZTX504	47	2N3704	10
ACY22	16	BC178*	16	BF196	14	OC141	157	ZTX531	28	2N3705	12
ACY39	78	BC179*	20	BF197	15	OC170	30	ZTX550	18	2N3706	10
AD140*	48	BC182	11	BF224A	12	OC171	32	2N696*	15	2N3707	10
AD149*	48	BC182L	12	BF244	17	OC201*	80	2N697*	13	2N3708	9
AD161*	35	BC183	10	BF256*	32	OC202*	90	2N698*	30	2N3709	9
AD162*	35	BC183L	11	BF257*	32	TIC44*	30	2N706*	12	2N3710	12
Mtch.pr.*	80	BC184	11	BF258*	35	TIP29	43	2N708*	15	2N3711	12
AF114*	18	BC184L	12	BF595	18	TIP29A	45	2N918*	40	2N3771*	140
AF115*	18	BC186	22	BFR40	30	TIP29C	78	2N920*	51	2N3772*	175
AF116*	18	BC187*	28	BFR79	30	TIP30	52	2N930*	18	2N3773*	225
AF117*	18	BC212	12	BFR80	30	TIP30A	54	2N1131	18	2N3819	20
AF121*	33	BC212L	13	BFX85*	25	TIP30B	64	2N1132	18	2N3820	40
AF124*	30	BC213	11	BFX86*	24	TIP30C	76	2N1301*	20	2N3823	50
AF125*	30	BC213L	13	BFX88*	22	TIP31*	54	2N1302*	17	2N3824	89
AF126*	30	BC214	14	BFY50*	15	TIP31A*	58	2N1303*	20	2N3866*	69
AF127*	30	BC214L	16	BFY51*	15	TIP31B*	70	2N1304*	24	2N3903	15
AF139*	33	BC441*	30	BFY52*	15	TIP31C*	84	2N1305*	28	2N3904	15
AF178	49	BC461*	40	BSX20*	20	TIP32*	64	2N1306*	28	2N3905	17
AF179	59	BC462*	30	BSY95A	14	TIP32A*	68	2N1307*	28	2N3906	17
AF180	55	BCY42	28	MJ481	130	TIP32B*	80	2N1308*	35	2N4037	34
AF181*	48	BCY43	28	MJ491	160	TIP32C*	99	2N1893*	30	2N4058	15
AF185	60	BCY58	18	MJE370*	68	TIP33*	95	2N1990*	48	2N4061	13
AF186	48	BCY59	18	MJE371*	80	TIP33B*	112	2N2160*	55	2N4062	14
AF239*	34	BCY70*	18	MJE520	65	TIP33C*	130	2N2217*	23	2N4871	34
ASY26	31	BCY71*	18	MPF102	30	TIP34*	110	2N2218A	20	2N4922	52
ASY29	40	BCY72*	18	MPF103	30	TIP34A*	115	2N2219A*	22	2N5457	30
ASY50	17	BD115*	52	MPF104	30	TIP34B*	167	2N2220A*	18	2N5458	30
AU104	115	BD121*	115	MPF105	30	TIP35*	259	2N2221A*	21	2N5459	30
BC107*	9	BD123*	95	MPSA06	30	TIP36A*	271	2N2222*	20	2N6027*	45
BC108*	9	BD124*	75	MPSA56	30	TIP41A*	68	2N2303*	30	3N140*	95
BC108B*	12	BD131*	40	MPSA70	32	TIP41B*	73	2N2369*	14	3N141*	95
BC108C*	12	BD132*	40	OC23*	144	TIP42A*	78	2N2483*	30	40361*	40
BC109*	9	Mtch.pr.*	85	OC25*	48	TIP42B*	79	2N2484*	30	40362*	40
BC109B*	12	BD135*	55	OC26*	48	TIP2955*	65	2N2646	38	40430	85
BC109C*	12	BD136*	50	OC28*	58	TIP3055*	60	2N2904*	20	40673*	55
BC117	20	BD137*	45	OC29*	58	TIS43	25	2N2904A*	24		

CMOS * less 5% 25+MXD

4000AE	16p	4028AE	74p
4001AE	16p	4029AE	94p
4002AE	16p	4033AE	111p
4006AE	77p	4040AE	88p
4007AE	16p	4042AE	67p
4009AE	65p	4043AE	81p
4010AE	44p	4044AE	75p
4011AE	16p	4045AE	111p
4012AE	16p	4046AE	109p
4013AE	44p	4047AE	74p
4015AE	81p	4049AE	44p
4016AE	44p	4050AE	44p
4017AE	71p	4055AE	106p
4018AE	71p	4056AE	106p
4019AE	44p	4069AE	16p
4020AE	90p	4070AE	18p
4021AE	81p	4510AE	124p
4022AE	78p	4511AE	191p
4023AE	16p	4518AE	100p
4024AE	64p	4520AE	99p
4025AE	17p		

LINEAR IC'S

709C 14 pin	29p	ICL8038CC*	270p	SL403D	176p
710	43p	LM300H	170p	SL414A	176p
741C	20p	LM301AM	38p	SN76033	150p
747C	70p	LM380	90p	SN76115	200p
748C	28p	LM381	160p	TAA550B	36p
AY-1-0212	850p	LM3900	65p	TAD100	130p
AY-1-5051	120p	M252	820p	TBA540Q	265p
AY-5-1224*	349p	" " Data	25p	TBA800	80p
AY-1-67216	175p	MC1303L	148p	TBA810S	95p
AY-5-3500*	610p	MC1304P	360p	TBA920Q	350p
AY-5-3507*	610p	MC1310P	180p	TDA2020	300p
AY-5-4007*	735p	MC1312PQ	150p	TCA270SQ	399p
CA3018	72p	MC1458P	70p	ZN414	99p
CA3020	145p	MC1710CG	55p		
CA3028	90p	MFC4000B	48p		
CA3046	59p	MFC6040*	86p		
CA3048	210p	MK50253*	550p		
CA3075	150p	ME555*	45p		
CA3081	150p	NE556DB*	99p		
CA3089E	150p	NE561*	325p		
CA3090AQ	250p	NE562B*	270p		
CA3123E	140p	NE565A*	200p		
		NE567V*	200p		

REGULATORS*

723C DIL	45p
723C(TO5)	45p
5V 1A(TO3)	140p
12V 1A(TO3)	140p
18V 1A(TO3)	185p
MVR12(TO3)	158p
TBA625B	95p

TTL 74* Less 5% for 15 + mxd; Less 10% for 25 + mxd
DIGITAL ICs

7400	13p	7473	33p	74148	170p
7401	13p	7474	32p	74150	143p
7402	14p	7475	32p	74151	69p
7403	15p	7476	32p	74153	70p
7404	18p	7480	44p	74154	150p
7405	18p	7481	99p	74155	70p
7406	38p	7482	75p	74156	70p
7407	38p	7483	83p	74157	80p
7408	15p	7484	90p	74159	196p
7409	15p	7485	125p	74160	101p
7410	13p	7486	35p	74161	101p
7412	20p	7489	275p	74162	101p
7413	35p	7490	40p	74163	101p
7414	60p	7491	80p	74164	132p
7416	35p	7492	48p	74165	132p
7417	35p	7493	39p	74166	140p
7420	15p	7494	80p	74167	315p
7422	27p	7495	63p	74170	215p
7423	22p	7496	72p	74172	540p
7425	27p	74100	135p	74173	153p
7426	27p	74104	40p	74174	118p
7427	27p	74105	40p	74175	92p
7428	38p	74107	33p	74176	103p
7430	15p	74109	54p	74177	101p
7432	25p	74110	43p	74178	142p
7433	36p	74111	63p	74179	142p
7437	27p	74116	170p	74180	106p
7438	27p	74118	100p	74181	301p
7440	15p	74119	160p	74182	83p
7441	65p	74120	93p	74184	160p
7442	65p	74121	30p	74185	169p
7443	120p	74122	45p	74186	950p
7444	105p	74123	63p	74188	494p
7445	88p	74125	54p	74190	160p
7446	105p	74126	54p	74191	160p
7447	80p	74128	70p	74192	125p
7448	70p	74132	70p	74193	125p
7450	15p	74141	63p	74194	125p
7451	15p	74142	266p	74195	79p
7453	15p	74143	274p	74196	103p
7454	15p	74144	274p	74197	103p
7460	15p	74145	88p	74198	210p
7470	30p	74147	233p	74199	210p
7472	26p				

DIODES

AA119	11p
AA120	10p
BA100	10p
BY126	12p
BY127	12p
OA5	39p
OA9	9p
OA10	40p
OA47	8p
OA70	8p
OA79	10p
OA81	8p
OA85	10p
OA90	6p
OA91	6p
OA95	8p
OA200	9p
OA202	6p
PL4001	6p
PL4004	8p
PL4006	12p
IN914	4p
IN4001/2	5p
IN4003	6p
IN4004/5	6p
IN4006/7	7p
IN4148	5p
IS920	7p
IS921	7p

BRIDGE RECTIFIERS
(plastic case)

1A50V	20p
1A100V	24p
1A200V	26p
1A400V	27p
1A600V	29p
2A50V	30p
2A100V	38p
2A200V	44p
2A400V	48p
2A600V	54p
4A100V	53p
4A400V	60p
4A800V	90p
6A100V	64p
6A400V*	80p
BY122	54p
BY164	54p

ZENERS
Rng: 3·3V–33V

400mW	9p
1·3W	17p

VARICAPS

MVAM1	270p
MVAM2	105p

SMOKE DETECTOR
TGS209 200p

SCR's* Thyristors

1A50V	38p
1A100V	42p
1A200V	47p
1A400V	52p
1A600V	70p
3A50V	38p
3A100V	43p
3A200V	55p
3A400V	74p
3A600V	99p
5A400V	90p
7A400V	125p
C106D	50p
MCR101	29p
TIC44	29p
2N4444	191p

TRIACS*

3A400V	100p
6A400V	120p
6A500V	150p
10A500V	165p

DIAC*
ST2 20p

OPTO ELECTRONICS*

LEDs with clips		DL704 ·3" Red	75p
TIL209	14p	DL 707 ·3" Red	75p
0·2" Red	16p	DL727 ·5" Red	180p
Larger Yellow Green, Amber	20p	DL728 ·5" Red	180p
OCP 70	40p	DL747 ·6" Red	150p
OCP 71	85p	XAN354 ·3" Grn	140p
ORP 12	58p	XAN652 ·6" Grn	170p
ORP 61	50p	MAN 3610	170p
2N 5777	36p	MAN 3640	170p
		MINITRON 3015F	110p

INDEX TO ADVERTISERS

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.

CHROMASONIC electronics

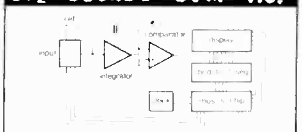
Dept. 1 56, Fortis Green Road,
Muswell Hill, London, N10 3HN.
telephone: 01-883 3705

C-MOS

mix prices

	1-24	25-99	100up
CD4000AE	19p *	17p *	14p *
CD4001AE	19p *	17p *	14p *
CD4002AE	19p *	17p*	14p *
CD4006AE	£1.59 *	£1.33 *	£1.06 *
CD4007AE	23p *	19p*	15p *
CD4008AE	£1.75 *	£1.46 *	£1.17 *
CD4009AE	Use	CD4049*	
CD4010AE	Use	CD4050*	
CD4011AE	19p *	17p*	14p *
CD4012AE	19p *	17p*	14p *
CD4013AE	59p *	50p*	46p *
CD4014AE	£1.75 *	£1.46 *	£1.17 *
CD4015AE	£1.75 *	£1.46 *	£1.17 *
CD4016AE	55p *	48p*	44p *
CD4017AE	£1.29 *	£1.07 *	93p *
CD4018AE	£1.89 *	£1.56 *	£1.25 *
CD4019AE	80p *	66p*	53p *
CD4020AE	£1.97 *	£1.64 *	£1.31 *
CD4021AE	£1.75 *	£1.46 *	£1.17p *
CD4023AE	19p *	17p*	14p *
CD4022AE	£1.83 *	£1.53 *	£1.22 *
CD4024AE	£1.26 *	£1.05 *	84p *
CD4025AE	19p *	17p*	14p *
CD4026AE	£2.79 *	£2.32 *	£1.86 *
CD4027AE	98p *	82p*	65p *
CD4028AE	£1.53 *	£1.28 *	£1.02 *
CD4029AE	£1.89 *	£1.56 *	£1.15 *
CD4030AE	71p *	59p*	47p *
CD4035AE	£1.75 *	£1.46 *	£1.17 *
CD4040AE	£2.01 *	£1.69 *	£1.34 *
CD4042AE	£1.49 *	£1.24 *	99p *
CD4046AE	£2.15 *	£1.79 *	£1.44 *
CD4049AE	69p *	58p*	46p *
CD4050AE	69p *	58p*	46p *
CD4051AE	£2.78 *	£2.32 *	£1.85 *
CD4052AE	£2.78 *	£2.32 *	£1.85 *
CD4056AE	£2.12 *	£1.76 *	£1.41 *
CD4060AE	£2.39 *	£1.99 *	£1.55 *
CD4066AE	£1.13 *	94p*	75p *
CD4068AE	28p *	24p*	19p *
CD4069AE	28p *	24p*	19p *
CD4070AE	28p *	24p*	19p *
CD4071AE	28p *	24p*	19p *
CD4077AE	71p *	59p*	47p *
CD4081AE	28p *	24p*	19p *
CD4082AE	28p *	24p*	19p *
CD4085AE	£1.28 *	£1.06 *	85p *
CD4086AE	£1.28 *	£1.06 *	85p *
CD4093AE	£1.56 *	£1.20 *	£1.04 *
CD4099AE	£2.95 *	£2.46 *	£1.96 *
CD4511AE	£2.36 *	£1.79 *	£1.44 *
CD4528AE	£1.30 *	£1.08 *	87p *

3½ DECADE DVM I.C.



This state-of-the-art MOS LSI chip contains all the logic necessary for a 3½ decade, dual slope integrating, automatic polarity detecting DVM. Supplied with free data and circuit booklet. AY-5-3507

OUR PRICE ONLY £6.59.*

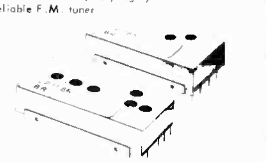
(Data and Circuit Booklets alone 20p.)

The AY-5-1224 tick-tock

Another marvel from G.I. A 16 pin 12-24 hr. Clock I.C. with 25 pin capability and low external parts count. Supplied with manufacturers detailed leaflet £3.95p*(inc VAT) (Leaflet alone 20p.) Full Kit (excluding case) available towards end of 1975. Phone Clive for details.

MULLARD MODULES

Still make the simplest, highly reliable F.M. tuner



LP1186	Varactor front end	£8.60
LP1185	I.F. Strip	£6.95
LP1400	Multiplex decoder	£9.02

I.C. SOCKETS

Pin Sockets, pins in strips of 100. Just snip off what you need. 65p per strip *

Dual in line

8 pin 13p	24 pin 26p	TO5
14 pin 15p	28 pin 30p	8 pin 31p
16 pin 15p	36 pin 39p	10 pin 35p

FREE CIRCUITS

Our 8 Page A4 Audio I.C. Booklet is supplied FREE with purchases of Linear I.C.'s worth £1 or more (35p if sold alone) Contains circuits and pin connections

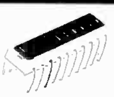
- 15 Amplifiers 250 mW to 20 watts
- 5 Audio Pre-Amplifiers
- 1 Tape Pre-Amplifier
- 1 Power Driver
- 1 Instrument Amplifier (Bifet)
- 1 General Purpose Mini Amplifier
- 1 D.C. Controlled Gain Control
- 1 Micro-mini radio (2 I.C's)

PHOTO-DARLINGTON

Vceo	25v	2N5777
Vcbo	25v	
Vebo	8v	
Il	250 mA	
Pd	200 mW	
Hfe	2500	

35p

LINE-O-LIGHT



NEW LED Linear Cursors each device contains 10 light emitting diodes in a 20 pin dual-in-line package. Ideal for solid state analogue meters or dials. Type 101 RED £2.26.* Complete with leaflet.

74 TTL

mix prices

	1-24	25-99	100+
7400	14p*	12p *	10p *
7401	14p*	12p *	10p *
7402	14p*	12p *	10p *
7403	15p*	12½p*	10p *
7404	16p*	13p *	11p *
7408	16p*	13p*	11p *
7409	16p*	13p*	11p *
7410	16p*	13p*	11p *
7413	29p*	24p*	20p *
7417	27p*	22½p*	20p *
7420	16p*	13p*	11p *
7427	27p*	22½p*	18p *
7430	16p*	13p *	11p *
7432	27p*	22½p*	18p *
7437	27p*	22½p*	18p *
7441	75p*	62p*	50p *
7442	65p*	55p*	43p *
7445	85p*	71p*	57p *
7447	81p*	75p*	65p *
7448	75p*	62p*	50p *
7447A	95p*	83p*	67p *
7470	30p*	25p*	20p *
7472	25p*	21p*	17p *
7473	30p*	25p*	20p *
7474	32p*	26p*	21p *
7475	47p*	39p*	31p *
7476	32p*	26p*	21p *
7482	75p*	62p*	50p *
7485	£1.30 *	£1.09 *	87p *
7486	32p*	26p*	21p *
7489	£2.92 *	£2.80 *	£2.10 *
7490	49p*	40p*	32p *
7491	65p*	55p*	45p *
7492	57p*	46p*	36p *
7493	45p*	40p*	32p *
7495	67p*	55p*	45p *
74100	£1.08 *	89p*	72p *
74107	35p*	28p*	22p *
74121	34p*	28p*	23p *
74122	47p*	39p*	31p *
74141	78p*	63p*	53p *
74145	68p*	58p*	48p *
74154	£1.62 *	£1.48 *	86p *
74174	£1.00 *	83p*	67p *
74180	£1.06 *	88p*	71p *
74181	£3.20 *	£2.50 *	£1.90 *
74192	£1.35 *	£1.14 *	90p *
74193	£1.35 *	£1.14 *	90p *
74196	£1.64 *	£1.34 *	99p *

LINEAR I.C.'s

555 (8 pin dip)V	55p *
555 (TO-99)T	81p *
556 (14 pin dip)	£1.29 *
703 (RF/IF Amp)	68p
709 (8 pin dip)	38p
709 (TO-99)	45p
709 (14 pin dip)	39p
710 (8 pin dip)	39p
710 (TO-99)	45p
710 (14 pin dip)	44p
711 (TO-99)	51p
711 (14 pin dip)	44p
720 (A.M. Radio)	£1.76
723 (TO-99)	£1.09
723 (14 pin dip	55p
741 (8 pin dip	30p
741 (TO-99)	43p
741 (14 pin dip)	36p
747 (14 pin dip)	£1.04
748 (8 pin dip)	42p
748 (TO-99)	46p
748 (14 pin dip)	49p
753 (F.M. 1st I.F)	£1.08
75491	88p *
75492	£1.10 *
Regulators 100 mA	
78L05WC (TO-92)	60p *
78L12WC (TO-92)	60p *
78L15WC (TO-92)	60p *
Regulators 100mA	
78L05AWC (TBA625A)	90p *
78L12AWC (TBA625B)	90p *
78L15AWC (TBA625C)	90p *
Regulators 500mA	
78M05HC	£1.35
78M12HC	£1.35
78M15HC	£1.35
78M18HC	£1.35
78M24HC	£1.35
Regulators 1A	
7805KC (TO-3)	£2.09 *
7812KC (TO-3)	£2.09 *
7815KC (TO-3)	£2.09 *
7818KC (TO-3)	£2.09 *
7824KC (TO-3)	£2.09 *
Regulators 1A	
7805UC (TO-220)	£1.72 *
7812UC (TO-220)	£1.72 *
7815UC (TO-220)	£1.72 *
7818UC (TO-220)	£1.72 *
7824UC (TO-220)	£1.72 *
ICL8030	£3.52 *

AY-1-0212	£6.93
AY-1-5051	£1.44
AY-5-1224	£3.95 *
AY-5-3500	£6.59 *
AY-5-3507	£6.59 *
AY-5-4007	£7.94 *
8HA0002	£3.01
CA2111	£1.19
CA3045	£1.69
CA3046	88p
CA3053	59p
CA3065	£1.60
CA3075	£1.64
CA3078	£1.26
CA3080	59p
CA3081	£1.86
CA3082	£1.86
CA3089E (TDA1200)	£2.43
CA3097E	£1.67 *
CA3123E	£1.76
CA3130	84p
CA3401E (LM3900)	68p
CA3600E	£1.44
CT7001	£5.34 *
L005T1 (TO-3)	£1.46 *
L036T1 (TO-3)	£1.46 *
L037T1 (TO-3)	£1.46 *
L129 (SOT-32)	85p *
L130 (SOT-32)	85p *
L131 (SOT-32)	85p *
LM301T (TO-99)	65p
LM301S (8 pin dip)	59p
LM301AT (TO-99)	67p
LM301AS (8 pin dip)	59p
LM307T (TO-99)	59p
LM307S (8 pin dip)	57p
LM308T (TO-99)	£1.96
LM308S (8 pin dip)	98p
LM308AT (TO-99)	£7.92
LM308AS (8 pin dip)	£6.90
LM309K	£2.34 *
LM339	£2.25
LM370N	£2.85
LM371	£2.08
LM372N	£1.99
LM373N	£2.99
LM377N	£2.71
LM380	£1.25
LM381	£1.85
LM382	£1.66
LM703	68p
LM1820	£1.03

LM2111	£1.12
LM3900	69p
LM3909	66p *
MC1303L	£1.94
MC1306P	85p
MC1310P	£2.10
MC1312P	£2.52
MC1314P	£4.34
MC1315P	£4.85
MC1327P	£1.48
MC1330	89p
MC1339P	£1.60
MC1350	68p
MC1351	92p
MC1352	92p
MC1357	£1.60
MC1358 (CA3065)	£1.23
MC1375	£1.56
MC1455(555T)	65p *
MC1456CG	£1.77
MC1458CPI	89p
MC1468G	£2.30 *
MC1495L	£4.48
MC1496G	£1.01
MC3302P	£1.65
MC3401P	81p
MFC4000B	87p
MFC4060A	85p *
MFC6030A	85p *
MFC6040	£1.01
MM5314	£4.80 *
MM5316	£9.99 *
MVRSV (T0-3)	£1.45 *
MVR12V (T0-3)	£1.45 *
MVR15V (T0-3)	£1.45 *
NE5401	£1.25
NE546A	£1.16
NE555V	69p *
NE556	£1.29 *
NE560B	£5.06
NE561B	£5.06
NE562B	£5.06
NE563	£2.96
NE565N	£2.63
NE566V	£1.87
NE567V	£2.63
SD6000	£1.22
SL414A	£2.09
SL415A	£2.75
SL437D	£7.50
SL440	£2.84 *
SN75491N	88p *
SN75492N	£1.10 *

SN76001N (TAA611)	£1.82 *
SN76003N	£3.30
SN76013N	£1.98
SN76023N	£1.98
SN76227N(MC1327)	£1.89
SN76532N	£1.86
SN76544N	£1.81
SN76550-2(TAA550)	89p
SN76552-2	81p
SN76660N(TBA120)	75p
SN76666N (CA3065)	£1.12
TAA263	£1.50
TAA300	£2.16
TAA310A	£1.87
TAA320	£1.44
TAA350	£2.43
TAA370	£3.45
TAA550	75
TAA570	£2.75
TAA700	£5.03
TBA120S	£1.25
TBA231	£1.02
TBA281 (723)	£2.59
TBA500Q	£3.16
TBA520Q	£3.85
TBA530Q	£3.27
TBA540Q	£3.72
TBA550Q	£5.29
TBA560CQ	£5.29
TBA625A	£1.03 *
TBA625B	£1.03 *
TBA625C	£1.03 *
TBA651	£1.87
TBA720Q	£2.79
TBA750Q	£2.79
TBA800	£1.11
TBA810S	£1.24
TBA810AS	£1.24
TBA820	86p
TBA920Q	£4.71
TBA990Q	£4.71
TCA270Q	£5.24
TCA760	£2.16
TCA800Q	£7.24
TCA830S	£1.04
TCA940	£2.25
TDA1054	£1.50
TDA1200	£2.43
TDA1405	80p *
TDA1412	80p *
TDA1415	80p *
TDA2010	£3.00
TDA2020	£3.75
ULN2111A	£1.52
ZN414	£1.26 *

ZN414 Leaflet free with devices (10p alone)

MC1310, 2, 4 & 5 Leaflet free with devices (10p alone)

LED DISPLAYS

Litronix Double Digit Displays 0.5" Common Anode; 2 R/H Decimal Points
DL721 ± 1.9
DL727 0.0 to 9.9
Suitable for Clocks, Meters, Instruments, Channel Indicators
Our price £4.75 * each

NEW

Low cost Red GaAsP Motorola MLED 500 in a T092 package 15p.*

		C.Anode R/H Dec. pt.	C.Anode, L/H Dec. pt.	C.Anode ±1	C.Cathode R/H Dec. Pt.	
0.33"	Litronix DL 707 Series	✓	✓	✓	✓	all £1.82* each (Red only)
0.33"	Monsanto MAN 50/70/80/3600	✓	✓	✓	✓	all £1.82* Each (Red, green, yellow, Orange)
0.33	Xciton XAN 70 Series	✓		✓	✓	all £1.49* Each (Red Green, yellow)
0.43"	Monsanto MAN 4000 Series	✓	✓	✓	✓	all £2.32* Each (Red, Green, Yellow, Orange)
0.63	Litronix DL747 'Jumbo' Series		✓	✓		all £2.42* Each (Red only)

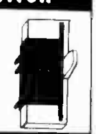
Common Cathode as Common Anode (Red only)

NOTE: MAN 4000 Series pin outs are 14 pin dil the same as MAN 50; 70 and 80 series.

DIGITAL SWITCH

BCD encoded digital switch Reading 0 to 9. Suitable for digital clock alarm setting DVM input Scaling etc.

1 to 9. £1.49 each *



LIGHT EMITTING DIODES

Free snap-on plastic retainer

	0.125" dia. lens (TIL 209) 1+	10+	100+	0.16" dia. lens 1+	10+	100	0.2" dia. lens (MLED 650) 1+	10	100+
Red	16p	15p	13p *	27p	24p	22p*	18p	16p	14p *
Green	27p	24p	22p*	33p	30p	27p*	30p	27p	25p *
Orange	27p	24p	22p*	33p	30p	27p*	30p	27p	25p *
Yellow	34p	31p	29p*	35p	32p	29p*	35p	33p	30p *

.......Cont'd

Our Bulk Buying Power enables a repeat of our Special Offer:
0.33" (LIT 707) 90p.*(inc. VAT)
0.63" (LIT 747) £1.99 .*(inc. VAT)

OPTO-ISOLATORS

TIL 4N25 or TIL116
6 pin industry standard package
2.5KV isolation £1.00.*

MAINS TRANSFORMERS

Secondaries

6-0-6V	100 mA	97p *
9-0-9V	100 mA	97p *
12-0-12V	100 mA	97p *
20-0-20V	1 A	£4.55 *
24-0-24V	500 mA	£2.48 *
28-0-28V	1 A	£6.18 *

	½A	1A	2A	4A
0-9-17 V	-	£1.95 *	£2.27	£2.64 *
0-12-15-20-24-30 V	-	£2.48 *	£4.15.	- *
0-24-30-40-48-60 V	-	£5.18 *	£7.02	- *
0-19-25-33-40-50 V	£2.70 *	£3.40 *	£4.53	- *

p.p. on transformers 10% of price min. 20p

VAT INC

Items followed by a* inc. VAT at 8% all others include 25%

Overseas Customers deduct 2/27 from * items, 1/5 from others

Orders for over £6, post free. Except transformers

Data Sheet and photocopy service available 10p per page

Advert No. 1A of Series B

CALLERS WELCOMED

69