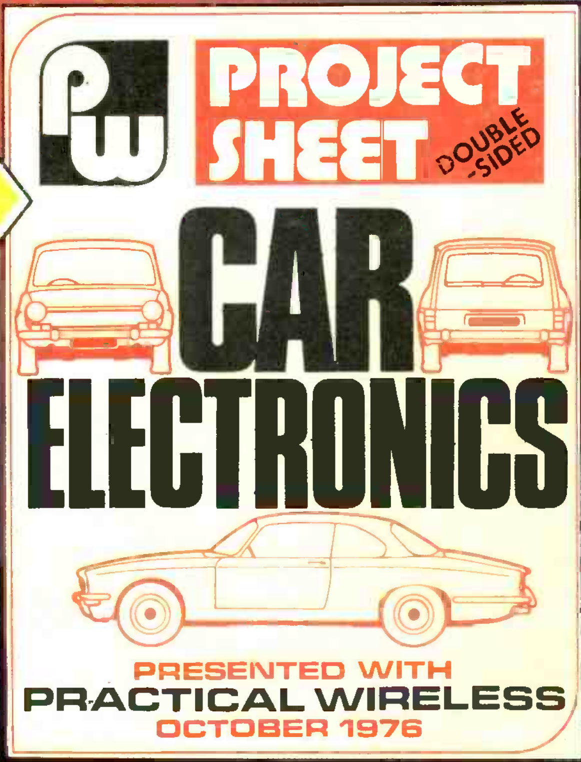
PRACTICAL WIRELESS

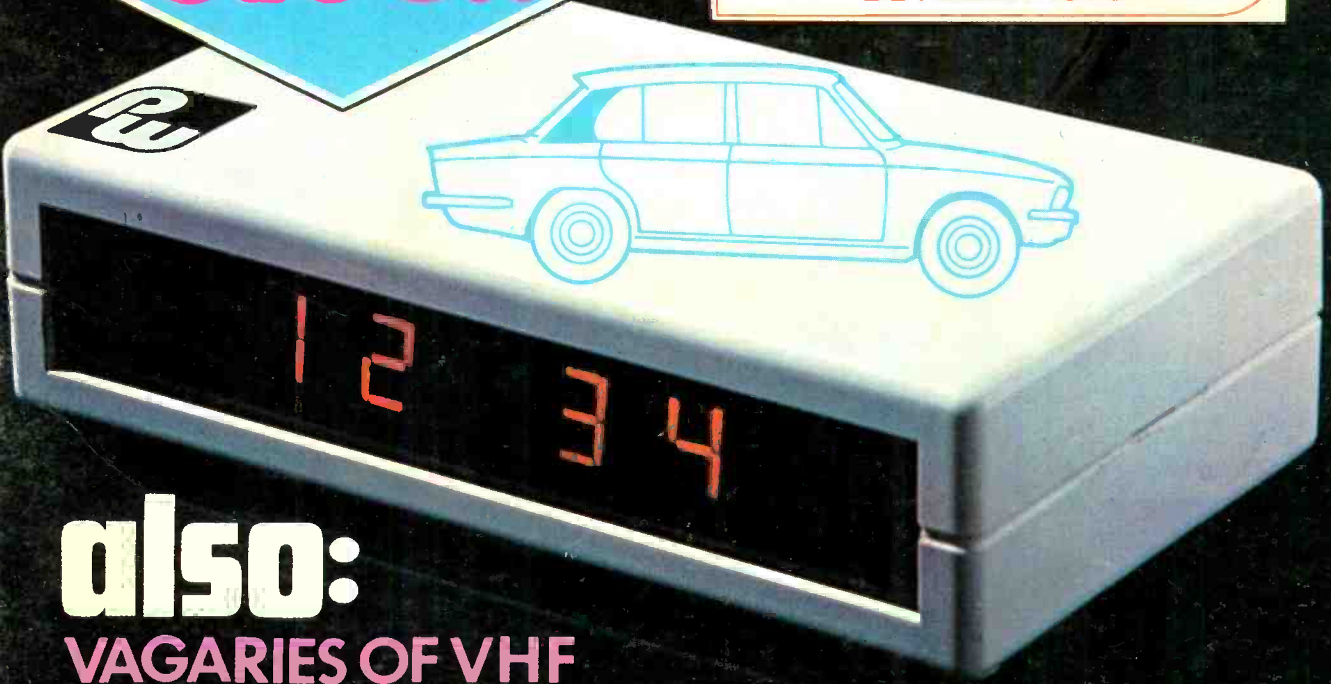
OCTOBER 1976

40p

FREE inside



DIGITAL CAR CLOCK



also:

VAGARIES OF VHF

CRYSTAL CONTROLLED CONVERTER

TRAMPUS ELECTRONICS LTD

58-60 GROVE RD.,
WINDSOR, BERKS.
SL4 1HS.
TEL. 54525.

ADD 8% VAT TO PRICES MARKED *
ADD 12½% TO ALL OTHER PRICES,
OR AS CURRENT VAT LEGISLATION
SEND C.W.O. (EXCEPT GOV'T DEPT)
POST & PACKING 20p FOR THE UK.
BARCLAYCARD & ACCESS BY POST
OR £5 MIN ON TELEPHONE ORDERS.
CATALOGUE LIST FREE SEND SAE
MONEY BACK IF NOT SATISFIED.

A SEMICONDUCTOR POWERHOUSE

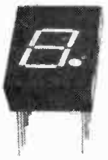
FAST SERVICE

NORMALLY 24 HOURS
ON EX STOCK ITEMS.

QUALITY PRODUCT

ADD VAT TO PRICES

OPTO-ELECTRONICS



DISPLAYS
DL707 0.3" £1*
DL704 o.3" £1*
DL747 0,6" £1.25*
DL727 2x½" £1.99*
3015F or G £2*

ZENON STROBE TUBES
DISCO/FLASH GUN
TE606 TUBE £7*
605 SMALL £4*

RED POLARISE FILTER 6"x1" £1.50*

RED LEDS 10P.

RED LEDS 209 STYLE 0.125" DIA.
OR 0.2" DIA. NO CLIP ONLY 10p.*

TIL209 RED LED & CLIP 12p*
BIG 0.2" RED LED & CLIP 14p*
GREEN LED LARGE OR SMALL 29p*
ORANGE LED LARGE OR SMALL 29p*
ORP12 60p* 2N5777 39p* TEC12 £1*

AUDIBLE WARNING BLEEPER

12VOLT 35mA.SPARKLESS £1*

Technology Toy

ELECTRONIC CONSTRUCTION KITS.
4 in 1 £3.50. 10 in 1 £6.
Subject to availability.
Send S.A.E. for details.

0-365Pf Tuner 99p

SHORT/MED WAVE AIRSPACED
0-365 pf CAPACITOR 99p
3 DIGIT & RESET TAPE COUNTER 99p
SET 3 455KHZ IF CANS 7 or 10 mm £1

DALO pen 75p

ETCH RESIST PEN & 2 TIPS 75p*
FEC ETCH PAK 500gm £1.
6"x4" BOARD.NYLON £1.SRBP 50p*
PCB KIT:8 ITEMS £2.
DECON DESOLDER BRAID REEL 69p*

vero

VERO 0.1" PITCH COPPERCLAD
2½"x5" 40p* 3¾"x5" 45p*
2½"x3¾" 36p* 3¾"x3¾" 40p*
3¾"x17" £2*FACE CUTTER 65p*
DIL BREADBOARD 6"x4" £2.25*
VERO PINS: 36 30p.200 £1.16*
5 MIN CLEAR EPOXY GLUE 75p*

TRADE SUPPLIED

IC's LOW PRICES

703 RF/IF 29p
709 T099 25p*
709 DIL 14 29p*
710 DIL 14 35p*
723 Regulator 49p*
741 DIL 8 PIN 22p*
741 DIL 14 35p*
741 T099 33p*
747 Dual 741 69p*
748 DIL 8 PIN 33p*
4195 15-0-15 £3 *
7805 5V 1A+ £1.50*
7812 or 15 £1.69*
7905/12 & 15 £3 *
76013 6W AF £1
CA3046 65p
CA3048 £2.20
CA3054 £2.20
CA3130 OPA 84p*
ICL8038 Sigen £3 *
LM300 OPA £1.50*
LM301 OPA 38p*
LM304 0-40V £3 *
LM308 Hi Bo £1 *
LM309K 5V Reg. £2 *
LM318 70Vus £3 *
LM372 IF £2
LM377 2x2W AF £3
LM380 (60745) 89p

LM381 2xpreA. £2
LM1808 radio £3
LM3900 4xOPA 60p*
MC1303 2x Pre £2 *
MC1310 stereo £2 *
MC1312 SQ £2 *
MC1318 £2.50 *
MC1330 75p*
MC1339 2xPre £2
MC1350/1/2 £1 *
MC1466/1469 £4 *
MFC4000 ¼W AF 75p
NE536 FET OPA £2 *
NE540 Buffer £2 *
NE550 2V ref £2 *
NE555 TIMER 35p*
NE556 Dual555 99p*
NE560 PhaseLL £4 *
NE561 PLLoop £4 *
NE562 PLLoop £4 *
NE565 £3 *
NE567 £3 *
SN72741 as 741
SN76660 IF £1
SN76611 IF £1
TBA 800 AF 80p
TBA 810 AF 7W 95p
TBA 820 AF 80p
ZN414 Radio £1.20

TRANSISTORS FULL SPEC. DEVICES

PRICE EACH:-
AC127/8 176 20p*
AC187/8 20p*
AD149 49p*
AD161/162 ea50p*
BC107 10p*
BC107B 13p*
BC108 9p*
BC108B 13p*
BC109 9p*
BC109B 14p*
BC109C 15p*
BC147/8/9 9p
BC157/8/9 12p
BC167/8/9 12p
BC177/8/9 20p
BC182/3/4a&l 10p
BC212/3/4a&l 12p
BCY70/1/2 18p*
BD131 &132ea39p
BFR39/88250V39p
BFY50 15p*
BFY51 15p*
BFY52 & 53 15p*
BSX19/20/21 20p*
MJ2955 T03 95p*
MJE3055 64p*
MPU131 PUT 49p

MATCHING 25p
TIP29 & 30 ea 64p*
TIP29C & 30C 85p*
TIP31 & 32 ea 74p*
TIP31C & 32C £1 *
TIP41 74p*
TIP41C £1.35 *
TIP42 85p*
TIP42C £1.50 *
TIP2955 99p*
TIP3055 69p*
TIS43 Unijunc 27p*
2N706 & 8 16p*
2N2646 UJT 49p*
2N2904 & 5 pnp29p*
2N2926broyg. 11p
2N3053 18p*
2N3055 115W 45p*
2N3055 RCA 89p*
2N3614 TO3 £1.50 *
2N3702/3/4/5 10p
2N3706/7/8/9 12p
2N3710/11 14p
2N3771/2/3 £2.25*
2N3819e &23e 16p
2N3820 FET 40p
2N3904/5/6 17p
2N5457 FET 29p

INS BUSH SETS 5p. DATA LIST 15p.

741 22p 8pin
555 35p
BC 109 9p
2N3055 45p
FET3819 16p
MC1310 £2

CMOS TTL

SAFE MOTOROLA		7400N	15p*
CD4000	15p*	7401	16p*
CD4001	19p*	7402/3	16p*
CD4002	19p*	7404	19p*
CD4006	£1 *	7405/6/7	36p*
CD4007	19p*	7408/9/10	19p*
CD4008	87p*	7411/12	22p*
CD4009	50p*	7413	28p*
CD4010	50p*	7417	28p*
CD4011	18p*	7420/27	23p*
CD4012	19p*	7430/32	22p*
CD4013	50p*	7440	16p*
CD4015	94p*	7441	75p*
CD4016	50p*	7442	65p*
CD4017	94p*	7445	78p*
CD4020	£1 *	7447	79p*
CD4022	87p*	7450/3/4	16p*
CD4023	19p*	7470	29p*
CD4024	72p*	7472	25p*
CD4025	19p*	7473	31p*
CD4027	50p*	7474	31p*
CD4028	87p*	7475	49p*
CD4040	94p*	7476	36p*
CD4042	78p*	7480	45p*
CD4046	£1.24p*	7481	99p*
CD4049	50p*	7482	69p*
CD4050	50p*	7483	82p*
14501	26p*	7485	£1 *
14502	99p*	7486	33p*
14507	69p*	7490	42p*
14510	£1.64 *	7491	75p*
14511	£1.65 *	7492	45p*
14512	£1.20 *	7493	45p*
14516	£1.70 *	7495	68p*
14518	£1.40 *	7496	68p*
14519	£ 69p*	74100	£1.10*
14520	£1.40 *	74107	33p*
14527	£1.99 *	74121	32p*
14528	£1.00 *	74122	42p*
14541	£2.16 *	74123	65p*
14543	£1.99 *	74141	83p*
14553	£3.85 *	74145	72p*
14566	£1.59 *	74147	£2 *
14583	99p*	74151	68p*
14585	£1.25 *	74154	£1,20*

DIL sockets

DIL SOCKETS
LOW COST TYPE 8,14 & 16 pin 14p*
PROFESSIONAL TYPES BY VERO etc.
8 PIN 16p* 14 PIN 18p* 16 PIN 20p*
SOLDERCON PINS: 100 65p* 1000 £4*

DIGITAL CLOCK IC

AY51224 4DIGIT £3.49

SWITCHES

SPST 18p* DPDT 24p*
SUBMIN SPST 65p*
WAVECHANGE SWITCHES ALL 40p*
1POLE 12 WAY, 2P6W, 3P4W, 4P3W.
COIL FORMERS 0.2 or 0.3" 10p.

GAS DETECTOR TGS

TGS308 £4* MAINS KIT £6*

POTENTIOMETERS AB EGIN

2 MEG LIN OR LOG ONLY 10p. ea
2.2K 5K & 10K 100K 20p ea
ALL OTHER VALUES ONLY 16p ea

PRESETS 6p. RESISTORS ¼W 1p ea.

HEATSINKS TO5 & 18 7p* TO3 16p*
TV4 PLASTIC POWER 17p*
TO3 EXTRUDED 4" FINNED 45p*

DIN PLUGS ALL 15p ea
DIN SOCKETS all 10p ea.

LARGE RANGE OF OTHER PLUGS ETC
ALSO CASES, SOLDER, METERS ....

MANY VERO CASES AVAILABLE PLUS:-
2518 £1.90* 2520 £2.15*etc.

BLACK PLASTIC CASES IN ABS x42mm
80x60 50p*100x75 75p*
120x100 89p* MATCHBOX 40p*

CAPACITORS

CERAMIC 22pf to 0.1 uf 50V 5p
ELECTROLYTIC, IN 10,25 & 50V.
2UF/10V, 10, 50, & 100uf 25V
& 10V 7p ea. 50VOLT 10p ea.
1000 uf 25V 18p. 200/500uf 9p.

ALUMINIUM BOXES
AB7 50p* AB9 47p* AB12 44p*
AB13 85p* AB5 50p* AB10 50p*

DIL RELAY 1A 250V SPCO £1*

TRANSFORMERS 100Ma 6,9 or 12 £1.
½A/1A 6/12 or 12/24 £2 each.

TRANSISTOR DATA LEAFLET 15p
TTL DATA ....LEAFLET 15p
OPTO LED & DISPLAYSequiv 15p
CMOS BOOK £2.50- CLOCK 15p
ALL OTHER PRODUCTS e&oe 10p

DIODES

OA81 & OA91 Germanium 5p
1N4001 1A50V & 1N4002 5p*
1N4004 6p* 1N4007 9P*
1N4148 & 1N914 SILICON 4p*
ZENERS BZY88 400mW 10p
BRIDGE RECTIFIERS 1A50V 22p*
1A 400V 30p* 6AMP 100V 55p*

SCR's TRIACS

SCR's; TAG1/400 1A 400V 50p*
1A 50V 39p* 1A 600V 69p*
C106 4A 400V THYRISTOR 55p*

TRIACS: SC146 10A 400V £1*
15A 400V DISCO TRIAC £1.50*

DIACS: BR100 & MV2 25p ea.

BULK OFFERS PER 100 off

1N4001 £3.* 1N4004 £3.50*
1N4007 £5 * BC107 £8. *
BC108 £7.50* BC109 £8 *
2N3055 £33 * NE555 £30 *
741C(8)£18 *3819FET £12
1A 50V BRIDGE £16.

BARGAIN PAKS £1ea. Full spec.

PAK A: 11 RED LEDS full spec £1*
PAK B 5 741C 8 PIN OP AMP £1*
PAK C 4 2N3055 £1*D 12 BC109 £1*
PAK E 11 BC182 £1.F 11 2N3704 £1
PAK G 7 BFY51 £1* H 8 2N3819 £1
PAK J 6 2N3053 £1* K 1N914x40 £1
PAK M 3 T099 3055 £1*N 25 OA91 £1

cassettes

LOW NOISE NOT REJECTS.
C60 33p ea TEN FOR £2.70
C90 42p ea TEN FOR £3.65

PRACTICAL WIRELESS

VOL. 52 NO. 6
ISSUE 836
OCTOBER 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

TECHNICAL EDITOR
Terry Carter

TECHNICAL SUB-EDITOR
Bill Tull

TECHNICAL ARTIST
Alan Martin

SECRETARIAL Jill Austin

ADVERTS MANAGER
01-634 4444 Roy Smith

CLASSIFIED ADVERTS
01-261 5762 Colin R. Brown

Advertisement correspondence and enquiries to the Advertisement Manager, Roy Smith, Practical Wireless, Fleetway House, Farringdon Street, London, EC4A 4AD

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

BINDERS
Binders £2·10 and indexes 45p (inc. VAT) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London, SE1 0PF.

● NEWS & COMMENT

● CONSTRUCTIONAL

● OTHER FEATURES

EXTRA THIS MONTH!
DOUBLE-SIDED CAR ELECTRONICS PROJECT SHEET

CLEARANCE OFFER!

SEW PANEL METERS

AT GREATLY REDUCED PRICES

BAKELITE PANEL METERS—MODEL MR 65

Dimensions: Front 80mm x 80mm square
Panel Hole: 65mm diameter
Accuracy ±2·5%

RANGES

100μA	5A DC	300V AC*
500μA	10A DC	600V AC*
50-0-50μA	15A DC	1A AC*
100-0-100μA	30A DC	30A AC*
500-0-500μA	50A DC	50A AC*
1mA	5V DC	500mA AC
1-0-1mA	10V DC	50mV DC
5mA	15V DC	100mV DC
10mA	20V DC	
50mA	50V DC	
100mA	150V DC	
500mA	300V DC	
1A DC	30V AC*	
2A DC	50V AC*	

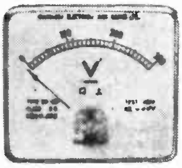
* Moving iron (all others are moving coil).

£2·95 each

25μA	£3·95 each
50μA	£3·25 each
VU Meter	£3·40 each

P/P + Ins. 15p

CLEAR PLASTIC PANEL METERS—MODEL MR 85P



Dimensions: Front 110mm x 120mm wide
Panel Hole: 85mm
Accuracy ±2·5%

RANGES

50μA	10mA	50V DC
200μA	50mA	150V DC
500μA	100mA	300V DC
50-0-50μA	500mA	300V AC
100-0-100μA	1A DC	1A AC*
500-0-500μA	5A DC	5A AC*
1mA	15A DC	10A AC*
1-0-1mA	30A DC	20A AC*
5mA	10V DC	30A AC*
	20V DC	

* Moving iron (all others are moving coil).

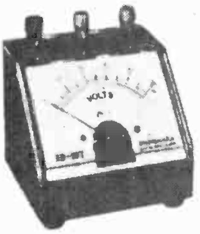
£3·95 each

'S' Meter 1mA	£4·55 each
VU Meter	£4·55 each

P/P + Ins. 15p.

EDUCATIONAL METERS—MODEL ED 107

High quality moving coil meters ideal for school use and many other applications.
Housed in strong black plastic cases. Clear view front. 3" mirror scale. Fully insulated terminals will accept either spade or 4mm plug.
Dimensions: 100mm wide x 90mm deep x 105mm high overall.
Accuracy ±2%



SINGLE RANGE MODELS

50μA	1A DC	15V DC
100μA	5A DC	20V DC
50-0-50μA	5V DC	50V DC
1mA	10V DC	300V DC
1-0-1mA		

DUAL RANGE MODELS

500mA/5A DC	5V/15V DC
5V/50V DC	1A/15A DC
	1A/5A DC

£5·95 each

P/P & Ins. 15p

Available for personal shoppers at LASKYS

LASKYS

481 Oxford Street, W.1.	01-493 8641
311 Edgware Road, W.2.	01-262 0387
42 Tottenham Court Road, W.1.	01-636 0845
3 Lisle Street, W.C.2	01-437 8204

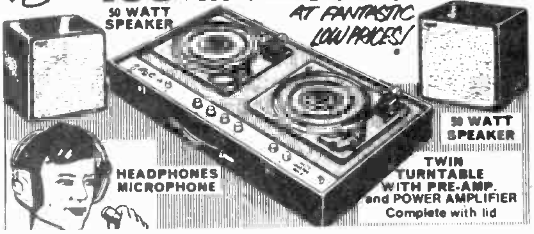
MAIL ORDERS AND ACCOUNT ENQUIRIES TO HEAD OFFICE.
LASKYS, CUSTOMER SERVICES DIVISION, DEPT. PW9 AUDIOTRONIC HOUSE, THE HYDE, HENDON, NW9 6JJ.
Telephone: 01-200 0444 Telex: 924920
Access, Barclaycard and Diners Club and Countdown accepted at all branches or by telephone at head office.

Welcome BARCLAYCARD DINERS CLUB Countdown

ALL PRICES INCLUDE VAT.

RSC 100 WATT DISCO SYSTEM

AT FANTASTIC LOW PRICES!



DISCOMAJOR Mk. 2 POWER DISCO CONSOLE with integral Power Amp. Twin Jack output sockets. **TWIN BSR** turntables. Cartridges with Diamond Styll. Separate volume controls each t/table. *Full Headphone Monitoring Facilities.* **PAIR OF 50 WATT SPEAKERS:** Black Vynide covered cabinets approx. size 18" × 18" × 8". **PAIR OF HI-FI HEADPHONES and MATCHING 'MIKE': STEREO VERSION £209·95**
PACKAGE PRICE (including VAT) Carr. £4.
OR DEPOSIT £19·95 and 18 fortnightly. payments £9·75 (Total £195·45)

£169.95

FANE DISCO 60c SPEAKER UNITS. Fabulous 'Specialist' range Speaker in heavy Vynide covered cab. Fitted protective corner pieces. List £45. **£39·95** ea.
A pair can be supplied in lieu of RSC Speakers with the above system for £25 extra.

MOBILE DISCO CONSOLE

MIC., JACK, PHONE, JACK, MONITOR VOL. CONTROL. MONITOR SELECTOR DECK (1) Vol. Control. DECK (2) Vol. control. Mic. Vol. Control. Treble Control. Bass Control. ON/OFF Switch. Neon Indicator. Twin Turntables

£59·95 Carr. £3

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

40 WATT DISCO SYSTEM

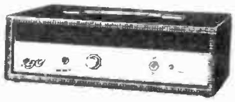
Incorporates Mobile Disco Console with output Stage. (Retail price £79·95) plus Pair 12" 25w Speakers in Rexine covered cabinets. Price for 3 items

£99.95 Carr. £3

POWER (SLAVE) AMPLIFIER 100 WATT

Suitable for use with DISCO-Consoles. Also for increasing output of lower-powered Amplifiers. Terms: Dep. £9·00 and 12 mthly payments of £4·00 (Total £57·00) carr. £1
200 Watt (100 + 100W) Model £69·95.

£49·95



TITAN GROUP/DISCO SPKRS

GUARANTEED FOR 5 YEARS

Imp.8-15 Ω

	Rec. Price	RSC Price
T12/35 12" 35w	£15·80	£11·95
T12/60A 12" 60w	£22·50	£15·95
T12/100 12" 100w	£36·00	£24·95
T15/60 15" 60w	£28·00	£18·99
T15/70 15" 70w	£28·00	£19·95
T15/100 15" 100w	£41·00	£29·95
T18/100 18" 100w	£47·00	£32·95

TERMS MODEL	MONTHLY PAYMENTS DEPOSIT	TOTAL
Model T12/35	(Pair) £6·90 & 8 at £2·62	£27·86
Model T12/60A	(Pair) £8·90 & 8 at £3·37	£35·86
Model T12/100	(Each) £5·99 & 8 at £3·00	£29·99
Model T15/60	(Each) £4·99 & 8 at £2·25	£22·99
Model T15/70	(Each) £4·95 & 8 at £2·37	£23·91
Model T15/100	(Each) £7·00 & 8 at £3·37	£33·96
Model T18/100	(Each) £9·95 & 8 at £3·37	£36·91

FANE HI-FI SPKR AT LESS THAN HALF PRICE
Model 121/15LR 12" 20W PVC low resonance cone surround 15Ω
LIST £16·93
OUR PRICE **£7·95**

R.S.C. TRANSFORMERS, L.F. CHOKES & RECTIFIERS

FULLY GUARANTEED. Impregnated and Interleaved where necessary.

200-250v. 50c/s. Screened
MIDGET CLAMPED TYPE

250v. 60mA 6·3v. 2a.	£1·75
250-0-250v. 60mA 6·3v. 2a.	£1·85

STD. UPRIGHT MOUNTING OR DROP-THRO

250-0-250v. 100mA 6·3v. 4a. 0-5-6·3v. 3a.	£4·35
300-0-300v. 130mA 6·3v. 4a. C.T. 6·3v. 1a. for Mullard 510 Amplifier	£5·20
350-0-350v. 100mA 6·3v. 4a. 0-5-6.3v. 3a.	£4·35
350-0-350v. 150mA 6·3v. 4a. 0-5-6·3v. 3a.	£5·20
425-0-425v. 200mA 6·3v. 4a. C.T. 5v. 3a.	£9·85
,, 200mA 6·3v. 4a. 6·3v. 4a. 5v. 3a.	£10·00
450-0-450v. 250mA 6·3v. 4a. C.T. 5v. 3a.	£10·45
250-0-250v. 70mA 6·3v. 2a. 0-5-6·3v. 2a.	£2·60
250-0-250v. 100mA 6·3v. 3·5a.	£2·90
250-0-250v. 100mA 6·3v. 2a. 6·3v. 1a.	£3·20
350-0-350v. 60mA 6·3v. 2a. 0-5-6·3v. 2a.	£3·20
300-0-300v. 100mA 6·3v. 4a. 0-5-6·3v. 3a.	£4·35

FILAMENT OR TRANSISTOR POWER PACK
12v. 1a. £1·10, 6·3v. 1·5a £1·06, 6·3v. 2a. £1·10. 6·3v, 3a £1·70, 6·3v. 6a. £2·60, 12v. 3a. or 24v. 1·5a. £2·60 0-9-18v. 1½a. £2·26, 0-12-25-42v. 2a. £3·19

CHARGER TRANSFORMERS
0-9-15v, 1½a. £2·03; 2½a. £2·26; 3a. £2·32; 5a. £2·84. 6a. £3·19; 8a. £3·48.

AUTO (STEP UP/STEP DOWN) TRANSFORMERS 0-110/120v. 200-230-250v. 50-80w. £2·90 150 watts £5·20. 250 watts £6·37, 500 watts £9·84.

OUTPUT TRANSFORMERS
Standard Pentode 5000 to 3 ohm, or 7000 ohm to 3 ohm £1·12. Following All Push Pull 8 watts EL84 to 3 ohm or 15 ohm £1·68; 10-12 watts 6v, 6 to 3 ohm or 15 ohm £2·61; 10-12 watts to match 6v. 6 to 3, 5, 8 or 15 ohm £2·72; EL 84 to 3 or 15 ohm 10-12 watts £2·61; Ultra Linear for Mullard 510 etc. £4·35; 15-18 watts, sectionally wound 6L6 KT66 etc. from 3 to 15 ohm. £3·71p. 20 watt high quality sectionally wound EL34 6L6 KT66 etc. to 3 or 15 ohm, fully shrouded. £6·37p.

SELENIUM RECTIFIERS
All Full wave 6/12 v. D.C. output. Max. A.C. input 18v. 1a 45p, 2a 57p, 3a 65p, 4a 95p. 5a £1·15.

L.F. CHOKES 150mA, 7-10H, 250 Ω £1·28: 100mA, 10H, 200 Ω £1·10: 60mA, 10H, 400 Ω 41p.

SPECIAL OFFER For a month only

FANE CRESCENDO COLOSSUS

18" 200w Super Bass Spkr
8 Ω or 15 Ω (List £99·95)
Terms: Dep. £9·95 & 8 mthly payments £8·70 (Total £79·55)

£69·95 Carr £1·25

RSC PRICES INC. VAT

15—240 Watts!

HY5
Preamplifier

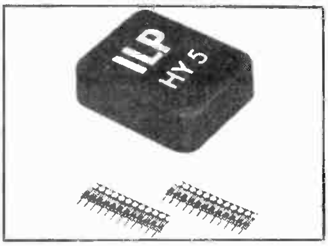
The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag Cartridge, tuner, etc) are catered for internally. The desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.

FEATURES: Complete pre-amplifier in single pack—Multi-function equalization—Low noise—Low distortion—High overload—Two simply combined for stereo.

APPLICATIONS: Hi-Fi—Mixers—Disco—Guitar and Organ—Public address

SPECIFICATIONS:
INPUTS. Magnetic Pick-up 3mV; Ceramic Pick-up 30mV; Tuner 100mV; Microphone 10mV; Auxiliary 3-100mV; input impedance 4·7kΩ at 1kHz.
OUTPUTS. Tape 100mV; Main output 500mV R.M.S.
ACTIVE TONE CONTROLS. Treble ± 12dB at 10kHz; Bass ± at 100Hz.
DISTORTION. 0·1% at 1kHz. Signal/Noise Ratio 68dB.
OVERLOAD. 38dB on Magnetic Pick-up. SUPPLY VOLTAGE ± 16-50V.

Price £4·75 + 59p VAT P&P free.



HY30
15 Watts into 8Ω

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of I.C., heatsink, P.C. board, 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up-to-date technology available.

FEATURES: Complete Kit—Low Distortion—Short, Open and Thermal Protection—Easy to Build.

APPLICATIONS: Updating audio equipment—Guitar practice amplifier—Test amplifier—audio oscillator.

SPECIFICATIONS:
OUTPUT POWER 15W R.M.S. into 8Ω; DISTORTION 0·1% at 1·5W.
INPUT SENSITIVITY 500mV. FREQUENCY RESPONSE 10Hz-16kHz—3dB.
SUPPLY VOLTAGE ± 18V.

Price £4·75 + 59p VAT P&P free.

Available June '76

HY50
25 Watts into 8Ω

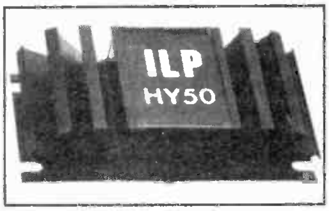
The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.

FEATURES: Low Distortion—Integral Heatsink—Only five connections—7 amp output transistors—No external components

APPLICATIONS: Medium Power Hi-Fi systems—Low power disco—Guitar amplifier

SPECIFICATIONS: INPUT SENSITIVITY 500mV
OUTPUT POWER 25W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·04% at 25W at 1kHz
SIGNAL/NOISE RATIO 75dB FREQUENCY RESPONSE 10Hz-45kHz—3dB.
SUPPLY VOLTAGE ±25V SIZE 105 50 25mm

Price £6.20+77p VAT P&P free.



HY120
60 Watts into 8Ω

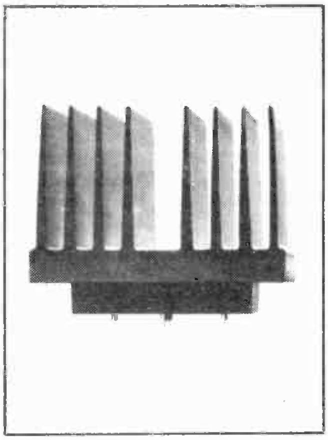
The HY120 is the baby of I.L.P.'s new high power range. Designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

FEATURES: Very low distortion—Integral heatsink—Load line protection—Thermal protection—Five connections—No external components

APPLICATIONS: Hi-Fi—High quality disco—Public address—Monitor amplifier—Guitar and organ

SPECIFICATIONS
INPUT SENSITIVITY 500mV.
OUTPUT POWER 60W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·04% at 60W at 1kHz
SIGNAL/NOISE RATIO 90dB FREQUENCY RESPONSE 10Hz-45kHz —3dB SUPPLY VOLTAGE ±35V
SIZE 114 50 85mm

Price £14.40+£1.16 VAT P&P free.



HY200
120 Watts into 8Ω

The HY200 now improved to give an output of 120 Watts has been designed to stand the most rugged conditions such as disco or group while still retaining true Hi-Fi performance.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—Integral heatsink—No external components

APPLICATIONS: Hi-Fi—Disco—Monitor—Power slave—Industrial—Public Address

SPECIFICATIONS
INPUT SENSITIVITY 500mV
OUTPUT POWER 120W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·05% at 100W at 1kHz.
SIGNAL/NOISE RATIO 96 dB FREQUENCY RESPONSE 10Hz-45kHz—3dB SUPPLY VOLTAGE ±45V
SIZE 114 100 85mm

Price £21.20+£1.70 VAT P&P free.

HY400
240 Watts into 4Ω

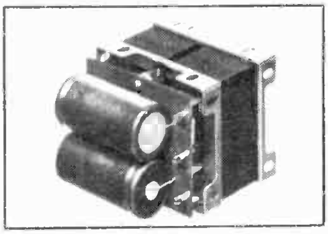
The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω! It has been designed for high power disco address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.

FEATURES: Thermal shutdown—Very low distortion—Load line protection—No external components.

APPLICATIONS: Public address—Disco—Power slave—Industrial

SPECIFICATIONS
OUTPUT POWER 240W RMS into 4Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0·1% at 240W at 1kHz
SIGNAL NOISE RATIO 94dB FREQUENCY RESPONSE 10Hz-45kHz —3dB SUPPLY VOLTAGE ±45V
INPUT SENSITIVITY 500mV SIZE 114 x 100 x 85mm

Price £29.25+£2.34 VAT P&P free.



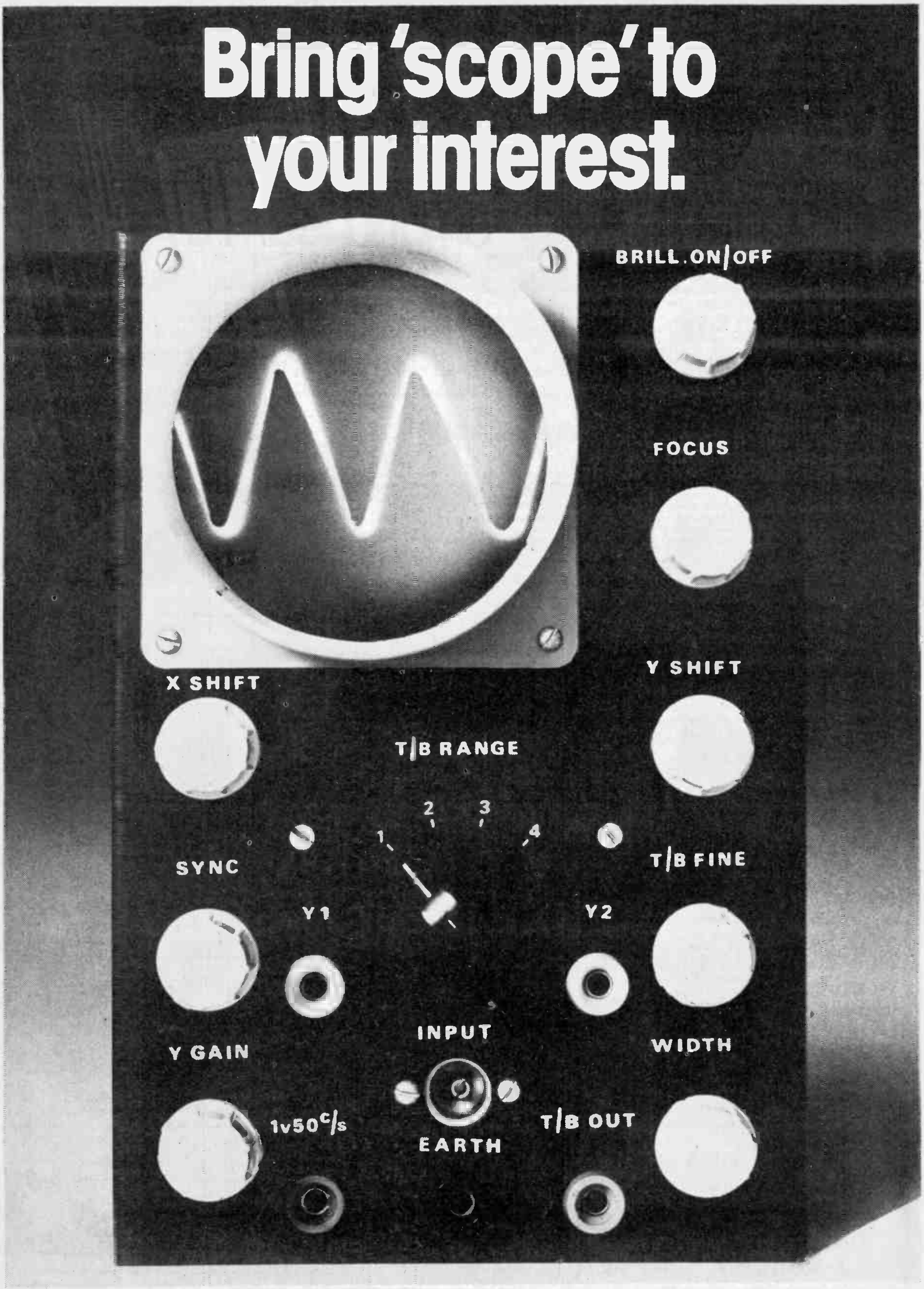
POWER SUPPLIES

PSU36 suitable for two HY30's **£4.75** plus **59p** VAT. P/P free.
PSU50 suitable for two HY50's **£6.20** plus **77p** VAT. P/P free
PSU70 suitable for two HY120's **£12.50** plus £1.00 VAT. P/P free.
PSU90 suitable for one HY200 **£11.50** plus £0·92 VAT. P/P free.

TWO YEARS' GUARANTEE ON ALL OF OUR PRODUCTS

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

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


Bring 'scope' to your interest.
BRILL.ON/OFF
FOCUS
X SHIFT
Y SHIFT
T/B RANGE
1
2
3
4
SYNC
T/B FINE
Y1
Y2
INPUT
Y GAIN
WIDTH
1v50c/s
T/B OUT
EARTH

barclay ELECTRONICS

TECHNOLOGICAL PRECISION PRODUCTS

CBM

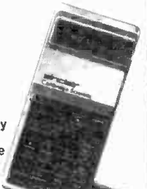
SR7919D ● 8-digit or 5-digit+2 Exp. ● Full trig and log functions ● Sq. root ● Reciprocals Yx, X², π ● Register exchange ● Memory plus ● Store recall ● Sign change ● Algebraic logic.
£11·70*

4148R—10-digits, 2 exponents, Full log and trig functions. X², Reciprocal, π, X root of Y. Polar rectangular co-ordinates. 2-store memory. Rechargeable. Mean and Standard deviation.
(R) £28·50

SR4190R. 10-digit, 2 Exp. 90 function pre-programmed, metric conversions. Extra functions to the 4148R:—Perms and combinations. Gamma. Poisson and Binomial distributions, factorial, comples numbers, hyperbolic functions, linear regression and integration of Y=f(x). **(R) £39·95**

SR1800—Similar to the 4148R. Green display. Battery operated. **£19·40***

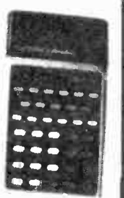
SINCLAIR



CAMBRIDGE SCIENTIFIC
5-digit ● 2 Exp ● C & CE key ● sin ● cos ● tan ● arcsin ● arccos and tan ● reciprocal ● E to the X ● natural log ● antilog ● memory + ● memory − ● memory exchange ● memory cancel ● EE exponent ● change notation ● PLUS a degree radian switch.
ONLY **£10·54**

OXFORD 300—Larger version of above. **£12·49***

DECIMO



VATMAN—SCIENTIFIC
Large green display. 8-digits, 2 exponents. 4 trig log functions 10^{-99}. Radian degrees. Exchange. Memory, π. Reciprocal. X² etc. Single Function keyboard. 20 hr battery life. **£23·50**

SUPER-VATMAN—Similar to above but with full-function memory. X² Reciprical. π. √‾. **£11·50**

ROCKWELL

44RD. 9-digit or 5-digit & 2 Exp. Green display. Store. Similar to the 63R less factorial
£17·55*

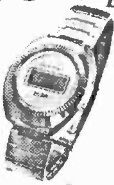
64RD. 12-digit or 8-digit+2 Exp. Additional to 44RD: Polar rec., co-ordinates, log, rad or grad.
£22·20*

63R—8-digit, 2 exponent. 10^{-99}. Memory. 2-level parenthisis. All trig and log functions. Degree radian. Factorial. Reciprocal. π. √‾ etc. Rechargeable.
(R) £23·95
Including recharger.

61R—Green display. 8-digits. All trig and log functions. **(R) £20·42**

The ZYCON *range of Quality Electronic Watches*

L.C.D.



KLC3
L.C.D. Constant display Shows Hrs, Mins & pulsating secs. Chrome finish with Stainless Steel back and **FREE** Adjustable S/Steel bracelet. **£22·68**

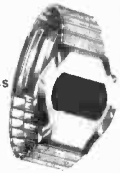
KLC5
5-Functions. Shows Hrs, Mins, **pulsating secs.** Press button once for Mth & Date. Twice for Secs readout. Auto-set back to time! **Plus** 'Nite Lite' for viewing in dark. Stylish Chrome finish. S/steel back. **FREE** matching S/steel bracelet. **£32·68**

KLC6
SWISS MADE—Solid S/steel throughout. Constant disp., shows Hrs, Mins, pulsating Secs. Single Command Button—Press once for Mth & Date, twice for Mins & Secs. Auto-reset back to time. 'Nite-Lite'. **FREE** matching S/steel bracelet. **£36·98**

Or in Heavy Gold Plate on Solid S/steel with Gold Plated bracelet. **£41·61**

L.E.D.

KED5
5-Functions. Shows Hrs, Mins Secs, Mth & Date. 4-Yr calendar. Beautifully finished with S/steel back & **FREE** Leatherette Strap. **£18·47**



KED6
A fantastic 6-Functions—window display shows Hrs, Mins, Secs, Mth & Date. **Day of week in letters. Single button.** Auto-hold & Fade-out. 4 Yr calendar. Case in Heavy Rhodium on Brass + S/steel back. **FREE** matching S/steel adjustable bracelet.
£27·33

KED6 PLUS
Month & Day of the Week in Letters! Shows Hrs, Mins, Secs, Date, Mth & Date, Day of Week, Auto 4-Yr calendar, A.M./P.M. Set/Indicate. **One of the most sophisticated watches at this price.** Accurate to within a few secs a year. Finished in Satin Stainless Steel with **FREE** matching Steel bracelet.
£34·62 ONLY

All come in FREE Presentation Box.
All Zycon watches carry our 'NO QUIBBLE' 1 Year Guarantee!

NOVUS

4525—8-digit, 2 Exp. 100 step programmable. R.P.N. Full log, & trig functions. X Y Exchange, exponent key, change sign, memory, 4 roll stack, skip, delete, accesable additional programmes within the 100 step.
(R) £39·55

4520—Non-programmable version of the 4525 incl. mem + x², deg. & Rad.
(R) £21·20

4510—8-digits. 3 level stack. All trig and log functions. √‾. π. Reciprocal. Memory etc. **£13·50***

NEW 4640. 10-digit, 2 Exponent. 54 functions. 4-level Roll Stack. 3 fully addressable memories. Logs. Trigs. Stat & Metric Conversions etc. **(R) £47·10**

4600—Same but Algebra IC **(R) £47·10**

4515—100-step programmable version. **(R) £33·10**

6010—Metric **£17·80***

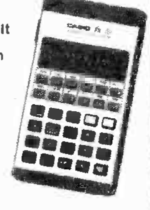
6020—Financier. **£16·65***

6025—Rechargeable. Financier 100-step programmable. **(R) £39·50**

6030—Statistician. **£16·50***

6035—100-step programmable Statistician. Rechargeable. **(R) £39·50**

CASIO



FX-20—Full trig and log functions. 8-digit mantissa or 6-digit mantissa and 2-digit exponents. 10^{99} to 10^{-99}. Bright green display. Full sin, cos, tan, inverse sin, inverse cos, inverse tan. Log X and lnx, e^X, x^y, √‾, Reciprocal Degree Radian conversion. Memory and exponent key.
ONLY
£15·65*

FX-15—As above but larger and including a larger display. x² key. π key. Reciprocal key. ONLY **£19·25***

FX-101—De Luxe model with similar functions to the FX-15 but 8-digits + 2 exponent 10^{-99} to 10^{-99}.
OUR PRICE **£23·50***

TEXAS

SR50A—10-digit. 2 exponent. Rechargeable. All trig and log functions. Hyperbolic. X to the root of Y. Radian and degree. Factorial. Memory etc.
(R) £29·95
Including recharger

SR51A—As above but with 3 independent memories. Linear regression. Mean. Variance. Standard deviation. Permutation. Random number generation + 20 basic conversions and their inverse. Rechargeable. **(R) £43·90**
Including recharger

SR56—100 step programmable. 10-digit, 2 Exp. 10 independent memories, all log, trig and statistical functions. Can be programmed for mathematics, electronic engineering, statistical, financial and navigation.
£64·90 (R)

SR52—224 programme steps. 20 independent memories. 9 level parenthesis. Card programmable. Supplied with 20 blank magnetic cards and programme manual. **FREE** any one of the following pre-programme manuals: 1. Statistics. 2. Electrical Engineering. 3. Mathematics. 4. Finance. Each worth £25.
£208·33 (R)

THE ROCKWELL STAINLESS STEEL 24K

24K—Stainless-steel Slimline. Green display. Beautiful leatherette wallet to hold pen, note-pad and credit cards (all included). Full memory. √‾. Click-buttons. Rechargeable. Including recharger **(R) £19·50**

DECIMO DIGITAL CLOCK/RADIO

£32·95 *OUR PRICE Incl. VAT plus £1 p&p*

LARGE DIGITAL READOUT

This is the most unique clock/radio in the country today having a soft 1½" high orange-glow digital readout which is completely silent and non-pulsating. In a beautiful teak style cabinet with up-to-date VHF/MW radio. You can awake to soft music or alarm—and if you want up to 10 minutes more—just press the 'Drowse' button. Automatic 60 minute 'sleep' button in case you drop off while the radio's on

ALL ITEMS CARRY A FULL YEARS GUARANTEE

* = Free B.S.I. approved adaptor.
(R) = Free recharger.
ADD 8% VAT TO ALL PRICES

ORDER FORM

PHONE CALLS AND PERSONAL CALLERS WELCOME MONS to THURS BETWEEN 2 & 5 p.m. 01-458 4755. SUNDAYS 10 a.m. to 1 p.m.
To: BARCLAY ELECTRONICS Dept. 8PW, 1115 FINCHLEY ROAD, TEMPLE FORTUNE, LONDON N.W.11

Please send me...

with/without optional mains adaptor. I enclose cheque/money order total

value £...............................Please add 55p to all items to cover p. & p.

NAME ....

ADDRESS ....

....

....

barclay ELECTRONICS

P.W.—MARSHALL'S

—SPECIAL OFFER—

MULLARD — NATIONAL — TEXAS — ITT — SIEMENS — RCA — MOTOROLA — THOMSON—TTL—CMOS—LINEARS—TRANSISTORS—TRIACS—THYRISTORS

Component	Normal Price	Offer Price	Component	Normal Price	Offer Price	Component	Normal Price	Offer Price	Component	Normal Price	Offer Price	Component	Normal Price	Offer Price
AC126	·37	·25	BC177	·19	·14	BFX86	·35	·27	CD4007	·20	·16	DL707	1·60	1·10
AC127	·44	·28	BC178B	·19	·15	BFY50	·30	·18	CD4011	·20	·16	SN7442	·55	·45
AC128	·37	·25	*BC182	·11	·085	BFY51	·38	·19	CD4012	·20	·16	SN7446	·86	·69
AC152	·50	·28	*BC182L	·14	·10	BT106	·95	·80	CD4013	·57	·38	SN7447	·81	·67
AD161	1·23	·60	*BC183	·11	·085	MJ430	1·10	·95	CD4016	·56	·47	SN7448	·81	·67
AF106	·45	·30	*BC183L	·14	·10	MJ481	1·30	1·00	CD4023	·20	·14	SN7450	·16	·13
AF109	·45	·32	*BC184	·12	·09	MJ491	1·55	1·00	DM944	·50	·10	SN7451	·16	·13
AF115	·65	·45	*BC184L	·14	·11	*MJE340	·58	·45	DM948	·75	·10	SN7453	·16	·13
AF139	·69	·50	*BC212	·14	·09	MJE370	·68	·55	*LM380-8	·98	·70	SN7454	·16	·13
AF239	·74	·50	*BC212L	·17	·10	MJE371	·81	·65	*LM381	2·07	1·75	SN7460	·16	·13
AF279	·80	·59	*BC213	·14	·09	MJE520	·65	·53	*LM741	·35	·25	SN7474	·30	·24
AF280	·85	·59	*BC213L	·16	·10	MJE521	·75	·60	*LM747	·78	·63	SN7475	·40	·35
BC107	·14	·095	*BC214	·16	·10	MJE2955	1·25	·96	*LM748-8	·44	·39	SN7486	·29	·21
BC107A	·15	·095	*BC214L	·17	·11	MJE3055	·75	·66	LM923	·45	·30	SN7490	·43	·34
BC107B	·15	·095	*BC237B	·14	·11	*MPF102	·30	·22	*MC1310P	1·91	1·60	SN7492	·43	·33
BC108	·12	·095	*BC238B	·12	·10	*MPS3638	·25	·19	*MC1312P	1·75	1·59	SN7493	·43	·33
BC108A	·12	·095	*BC239C	·16	·11	*MPSA05	·20	·15	NE555V	·48	·36	SN7496	·78	·50
BC108B	·12	·095	*BC307	·20	·15	*MPSA06	·20	·17	LM7805	1·39	1·25	SN74107	·30	·24
BC108C	·13	·095	BCY71	·26	·19	*MPSA55	·20	·16	LM7812	1·39	1·25	SN74121	·34	·24
BC109	·15	·11	BCY72	·24	·17	OC42	·50	·25	*LM3900	·55	·46	SN74123	·40	·33
BC109B	·16	·11	BD116	1·20	·50	OC71	·45	·30	SN7400	·16	·13	SN74141	·72	·47
BC109C	·17	·11	BD131	·51	·42	OC83	·50	·30	SN7402	·16	·13	SN74150	1·20	·80
*BC147B	·10	·075	BD132	·54	·42	*TIP29A	·50	·39	SN7404	·18	·13	*SN76003N	2·36	1·70
*BC149B	·13	·10	*BD138	·48	·36	*TIP29C	·75	·55	SN7410	·16	·13	*SN76013N	1·30	1·05
*BC149C	·13	·11	*BD139	·50	·36	*TIP30A	·60	·49	SN7413	·25	·16	*SN76013ND	1·45	1·05
*BC157A	·12	·10	*BD529	·35	·32	*TIP30C	·85	·60	SN7416	·43	·35	*SN76023N	1·50	1·15
*BC158A	·11	·09	*BD530	·38	·32	TIP31A	·62	·53	SN7420	·16	·13	*SN76013ND	1·45	1·05
*BC159B	·14	·11	BF180	·45	·25	TIP31C	·85	·60	SN7423	·27	·20	*SN76033N	2·50	2·00
*BC167B	·12	·10	BF181	·45	·25	TIP32A	·75	·59	SN7430	·16	·13	*TAD100	1·95	1·00
*BC168B	·12	·08	BF183	·45	·25	TIP32C	·60	·16	SN7440	·16	·13	IN4002	·08	·06
*BC168C	·12	·08	*BF194	·12	·10	TIP33A	1·00	·90	SN7441	·76	·45	IN4148	·07	·03
*BC169B	·12	·10	*BF196	·13	·10	TIP41C	1·00	·90	OA47	·10	·08	IN5402	·175	·12
*BC169C	·12	·09	*BF199	·15	·11	TIP42A	·90	·60	OA90	·06	·03	IN5404	·185	·14
*BC171	·14	·10	BF257	·37	·30	TIP2955	1·00	·74	OA91	·06	·03	IN5408	·40	·35
*BC171A	·14	·10	BF258	·49	·39	TIP3055	·50	·45	**1A Bridges**			AA119	·14	·07
*BC171B	·15	·11	BF259	·49	·39	*ZTX300	·15	·12	200V	·32	·20	BA102	·15	·12
*BC172	·12	·09	*BFR40	·24	·20	*ZTX500	·15	·12	400V	·35	·22	BA144	·12	·09
*BC172A	·12	·09	*BFR80	·24	·20	2N3055	·75	·45	600V	·40	·24	BAX13	·05	·03
*BC172B	·12	·09	BFX30	·38	·25	C106D	·65	·53	**Triacs**			BAX16	·065	·04
*BC172C	·12	·09	BFX55	·41	·28	CD4000	·20	·16	8A/400V	·80	·70	BB103	·20	·15

*=12½% VAT Rest 8%. Catalogue Price: **30p** with components **40p** catalogue only.

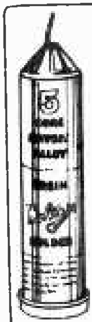
ERSIN Multicore 5 CORE SOLDER

Handy size Reels & Dispensers

OF THE WORLD'S FINEST CORED SOLDER TO DO A PROFESSIONAL JOB AT HOME

Ersin Multicore Solder contains 5 cores of non-corrosive flux that instantly cleans heavily oxidised surfaces and makes fast, reliable soldering easy. No extra flux is required.

SAVBIT handy solder dispenser



Contains 2.3 metres approx. of 1.22 mm Ersin Multicore Savbit Solder. Savbit increases life of copper bits by 10 times.
Size 5 39p

For soldering fine joints

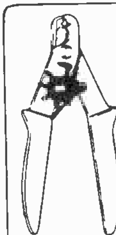
Two more dispensers to simplify those smaller jobs. PC 115 provides 6.4 metres approx. of 0.71 mm solder for fine wires, small components and printed circuits.
PC115 50 p
Or size 19A for kit wiring or radio and TV repairs. 2.1 metres approx. of 1.22 mm solder.
Size 19A 43p

NEW handy size reels of SAVBIT, 40/60, 60/40 & ALU-SOL solder alloys

These latest Multicore solder reels are ideal for the toolbox. Popular specifications cover all general and electrical applications, plus a major advance in soldering aluminium. Ask for a free copy of 'Hints on Soldering' containing clear instructions to make every job easy.

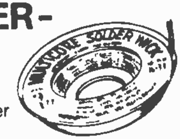
Ref.	Alloy	Diam. mm	Length metres approx.	Use	Price
Size 3	40/60 Tin/Lead	1.6	10.0	For economical general purpose repairs and electrical joints.	£1.49
Size 4	ALU-SOL	1.6	8.5	For aluminium repairs. Also solders aluminium to copper, brass etc.	£1.99
Size 10	60/40 Tin/Lead	0.7	39.6	For fine wires, small components and printed circuits.	£1.49
Size 12	SAVBIT	1.2	13.7	For radio, TV and similar work. Increases copper-bit life tenfold.	£1.49

BIB WIRE STRIPPER & CUTTER



Fitted with unique 8-gauge selector and handle locking device. Sprung for automatic opening. Strips flex and cable in seconds. **Model 8B 86 p**

SOLDER-WICK



Absorbs solder instantly from tags, printed circuits etc. Only needs 40–50 Watt soldering iron. Quick and easy to use. Non-corrosive.
Size 18 97 p

Sole U.K. Sales Concessionaires:
Bib Hi-Fi Accessories Limited,
Kelsey House, Wood Lane End, Hemel Hempstead, Herts. HP2 4RQ.

Prices shown are recommended retail, inc. VAT From Electrical and Hardware Shops. In difficulty send direct, plus 15p P&P. Prices and specifications subject to change without notice

---

Camera Kits and Ready Built Modules

Whether

4-STATION INTERCOM

£18·30

Solve your communica-

RECHARGEABLE BATTERIES

CAN SAVE YOU A FORTUNE !

Bush & Meissner's two purpose-built battery chargers for economy minded enthusiasts:

The "KESTREL-DOWN" Charger £10·69 & £11·77 for *Alkaline rechargeable batteries, no-load voltage of 1·5-volts per cell, for the following sizes* ALKALINE (All prices include VAT)

Equivalent to	Type	Capacity	PRICE
U2 size	SA-13D	2Ah	£2·37

FANE 'DISCO 80' L'SPEAKER

12″ 80 watt R.M.S. Plasticised Linen Cone Surround. Large Tweeter Cone. Range 50Hz 15KHz. Extra High Sensitivity. Robust Cast Chassis.
WE CONSIDER THE 'DISCO 80' TO BE THE BEST SINGLE UNIT AVAILABLE FOR ITS PURPOSE. WE'RE SURE THAT YOU WILL TOO.
Impedance of 8Ω or 15Ω

Rec. Price inc. VAT **£25·95**

The above is one of five

SPECIALIST RANGE SPEAKERS

Each designed to produce the individual sound requirements for its particular purpose. Other units are as follows:—

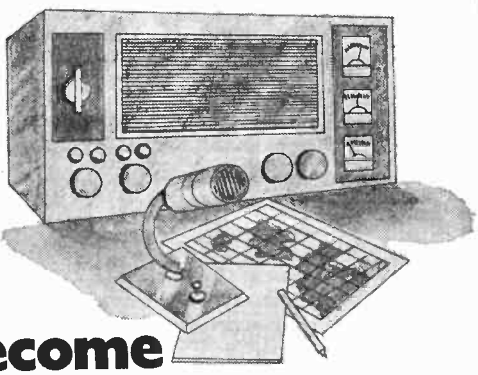
	Rec. Price
12″ **GUITAR 80L** for LEAD GUITAR	**£24·75** Inc. VAT
12″ **GUITAR 80B** for use in multiples for BASS GUITAR	**£24·95** Inc. VAT
12″ **PA80** for general purpose P.A.	**£24·75** Inc. VAT
15″ **BASS 85** for BASS GUITAR (Ideal for Bass Bin)	**£37·75** Inc. VAT

'POP' RANGE		
	POP 33T 12″ 33w £13·95	POP 60 15″ 60w £25·95
	POP 50/2 12″ 50w £15·99	POP 70 15″ 70w £28·95
	POP 55/2 12″ 60w £22·95	POP 100 18″ 100w £44·95

8Ω or 15Ω **Please send large S.A.E. for leaflets on above and other Fane Products inc. Elite Range "CRESCENDO" Models up to 200w.**

Distributors (Wholesale and Retail) **LINEAR PRODUCTS LTD., ELECTRON WORKS, ARMLEY, LEEDS**
Manufacturers enquiries to—**FANE ACOUSTICS LTD., 286 BRADFORD ROAD, BATLEY, YORKS**

Prices shown correct at 3-8-76



Become a radio amateur.

Learn how to become a radio-amateur in contact with the whole world. We give skilled preparation for the G.P.O. licence.

WAA

Free!

Brochure, without obligation to: WK10

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

NAME ____________________

ADDRESS ____________________ (Block caps please)

Sparkrite mk2

Capacitive discharge electronic ignition kit

* Smoother running
* Instant all-weather starting
* Continual peak performance
* Longer coil/battery/plug life
* Improved acceleration/top speeds
* Up to 20% better fuel consumption

Sparkrite Mk. 2 is a high performance, high quality capacitive discharge, electronic ignition system in kit form. Tried, tested, proven, reliable and complete. It can be assembled in two or three hours and fitted in 15/30 mins.
Because of the superb design of the Sparkrite circuit it completely eliminates problems of the contact breaker. There is no misfire due to contact breaker bounce which is eliminated electronically by a pulse suppression circuit which prevents the unit firing if the points bounce open at high R.P.M. Contact breaker burn is eliminated by reducing the current to about 1/50th of the norm. It will perform equally well with new, old, or even badly pitted points and is not dependent upon the dwell time of the contact breakers for recharging the system. Sparkrite incorporates a short circuit protected inverter which eliminates the problems of SCR lock on and, therefore, eliminates the possibility of blowing the transistors or the SCR. (Most capacitive discharge ignitions are not completely foolproof in this respect). All kits fit vehicles with coil/distributor ignition up to 8 cylinders.

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

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

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

PRICES INCLUDE VAT, POST AND PACKING.

Improve performance & economy NOW

POST TODAY!

Quick installation No engine modification required

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

Name ....

Address ....

	QUANTITY REQ'D	
Mk. 2 DIY Ass. Kit @ £11.80		I enclose cheque/PO's for £
Mk. 2 Ready Built Negative Earth @ £14.97		
Mk. 2 Ready Built Positive Earth @ £14.97		Cheque No.
Ignition Changeover switches @ £4.30		
R.P.M. Limit systems in above units @ £2.42		Send SAE if brochure only required.

B. BAMBER ELECTRONICS

Dept PW, 5 STATION ROAD, LITTLEPORT, CAMBS., CB6 1QE
Telephone: ELY (0353) 860185 (2 lines) Tuesday to Saturday

PLEASE ADD 8% VAT UNLESS OTHERWISE STATED

FREE WELLER 25W (SP25) SOLDERING IRON (worth £3·24 inc. VAT) with all orders over £20 Limited period only. Send now.

VARIABLE STABILISED POWER SUPPLY, mains input, 0–24V output, stabilised and current limiting at 500mA + 32V at 50mA. Brand new by British manufacturer. Size approx. 7½ × 2½ × 4in, complete with external 5kΩ 3-turn pot for voltage control. Connection data supplied. **£7.**

50µA (25–0–25µA) **EDGEWISE METERS,** modern type by Sangamo Western, display area ¼ × 1¾in with 2 mounting lugs. (Can be zeroed left or right hand.) **£1·50** each, while stocks last.

MAINS ISOLATION TRANSFORMERS. Tapped mains input, 240V at 3A + 12V at 500mA output, New, boxed, made by Gardners, **£12.**

FLEXIBLE HEATER STRIP, 240V a.c., 150W, approx. 1 metre long (insulated with fibreglass) with mains connector block. Many, many uses. **60p each.**

HEAVY DUTY RELAYS, 24V d.c. operated (will work on 18V) 3 heavy duty make contacts (around 10A rating) + 4 change over contacts + 1 break contact. New, complete with mounting bracket (ideal for switching HT on Linears.) Many uses for this high quality unit. **£1·50** each.

Good Quality Pressure Guages, 2½in dia. flange mounting. 3 models avail. 0–60 lb/sq.in. 0–100 lb sq. in, 0–200 lb/sq. in, state which **£1·25** each.

2N3055 type Transistors, O.K., but unmarked, 5 for **£1.**

110V NEONS, SCREW-IN-TYPE, 4 for 50p. Slow motion motors (suitable for programmers, displays, etc.) 230–240V a.c. input, rotation between 1 and 2 revs per minute. **£1·25** each.

MINIATURE PLIERS High quality "Crescent", made in USA **£4·35 + VAT (35p).**
SIDE CUTTERS, high quality "Crescent", made in USA, **£4·45 + VAT (44p).**

MIXED COMPONENT PACKS, containing resistors, capacitors, switches, pots, etc. All new (random sample bag revealed approx. 700 items), £2 per pack, while stocks last.

TUNED COILS, 2 section coils, around 1MHz, with a black smart tuning knob, which moves an internal core to vary the inductance, many uses, easily rewound, 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 + **12½% VAT.**

TO3 transistor insulator sets. 10 for **50p.**

MINIATURE 2 PIN PLUGS AND SOCKETS (fit into ¼in 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.**

HEAVY DUTY HEATSINK BLOCKS, undrilled, base area 2½in × 2in, with 6 fins, total height 2½in **50p** each.

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.**
BFY51 Transistors, 4 for **60p.**
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.**
1N914 diodes, 10 for **25p.**

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 35p.

Lead suppressors (10kohm) for mobile plug leads, 4 for **50p.**

PLEASE ADD 8% VAT UNLESS OTHERWISE STATED

ALU-SOL ALUMINIUM SOLDER (made by Multicore). Solders aluminium to itself or copper, brass, steel, nickel or tinplate. 16 s.w.g. with multicore flux, with instructions. Approx. 1 metre coil **30p** pack. Large reel (approx. 12 metres) **£2·75.**

1¼in polythene chassis mounting fuseholders, 6 for **30p.**

Mullard Tubular ceramic trimmers, 1–18pF, 6 for **50p.**

I.C.'s, some coded, 14 DIL type, untested, mixed, 20 for **25p.**

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).

R/S Midget 3 pole 4 way, rotary switches **40p** each.

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.** + 12½% VAT.

Miniature earphones with min. jack plug, 2 for **50p** + 12½% VAT.

TWIN I.F. CANS, approx. 1in × ½in × 1in high, around 3·5–5MHz, 2 separate transformers in 1 can, internally screened, 5 for **50p** + 12½% VAT

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 **60p.**
Plessey Electrolytics, 1000µF, 180V, **40p** each (3 for **£1**).
Dubilier Electrolytics, 5000µF, 35V, **50p** each.
Dubilier Electrolytics, 5000µF, 50V, **60p** 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 12½% VAT TO ALL CAPACITORS

A LARGE RANGE OF CAPACITORS AVAILABLE AT BARGAIN PRICES, S.A.E. FOR LIST.

TV PLUGS AND SOCKETS
TV Plugs (metal type), 5 for **50p.**
TV Sockets (metal type), 4 for **50p.**
TV Line Connectors (back-to-back sockets), 4 for 50p. **Please add 12½% VAT.**

PLUGS AND SOCKETS
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.

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, 30p + VAT (2p)
MARKSMAN SOLDERING IRONS
SP15D 15W **£3 + VAT (24p)**
SP25D 25W **£3 + VAT (24p)**
SP25DK 25W + bits, etc. kit **£3·85 + VAT (31p)**
SP40D 40W **£3·44 + VAT (28p)**
BENCH STAND with spring for Marksman Irons, **£2·22 + VAT (18p)**
SPARE BITS
MT8 for 15W, **46p + VAT (4p).**
MT4 for 25W, **38p + VAT (3p)**
MT10 for 40W, **42p + VAT (3p)**
TCP1 TEMPERATURE CONTROLLED IRON.
Temperature controlled Iron & PSU, **£20 + VAT (£1·60)**
SPARE TIPS
Type CC single flat, Type K double flat fine tip, Type P, very fine tip, **£1** each + VAT **(8p).**
ALL SPARES AVAILABLE

MULTICORE SOLDER
Size 5 Savbit 18 s.w.g. in alloy dispenser, **32p + VAT (3p).**
Size C1SAV18 Savbit 18s.w.g., **56p + VAT (4p).**
Size 12 SAVBIT 18s.w.g. on plastic reel **£1·80 + VAT (15p)**

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. CALLERS SATURDAYS ONLY 9.30–12.00. 1.30–5.00.*

TRANSFORMERS

Double Section Bobbin P.C.B. Pins + Clamp Varnish Dipped

Type	A.C. Rating Volts–Amps		D.C. Volts	D.C. Amps
101	D.C. Values		5·0	0·65
102	are obtained		6·0	0·55
103	with a		9·0	0·35
104	Bridge Rect.		10·0	0·33
105	and a 1000mf		12·0	0·275
106	Capacitor		12–0–12	0·14
107			15–0–15	0·11
108			24·0	0·14
109	6	1·0A	—	—
110	12	0·5A	—	—
111	24	0·25A	—	—
201	D.C. Values		5	2·0
202	are obtained		6	1·5
203	with a		9	1·1
204	Bridge Rect.		10	1·0
205	and a 1000mf		12	0·8
206	Capacitor		12–0–12	0·4
207			15–0–15	0·3
208			24	0·4
209	6	2·0	—	—
210	12	1·0	—	—

PRICE LIST: 1–24—List
24–100—5%

		P + P + VAT	Total
TRANS 101–111	0·98	0·35	**£1·32**
...... 201–211	1·28	0·49	**£1·77**
501–511	1·98	0·65	**£2·63**
CAPACITORS			
1000mf 10–16–25V	0·28	0·14	**£0·42**
4700mf 6V3–10V	0·78	0·40	**£1·18**
DIODE 1A 50V	0·25	0·14	**£0·39**
BRIDGE 2·5A 50V	0·50	0·20	**£0·70**
6A 50V	0·75	0·30	**£1·05**

Note:
Use transformer P + P if Trans + Bridge Rect. + Capacitor are ordered together.

Sub-Miniature Trans — 1·2VA
240V — E15 — pins + clamp.

Sec Volts	Cost	P + P + VAT	Total
3–0–3V, 6–0–6, 12–0–12	1·40	0·33	**£1·73**

C.W.O. Please send S.A.E. for details of Transformers, Diodes and Capacitors.

DELTIC SYSTEMS 507 BURNLEY ROAD, ROSSENDALE, LANCS BB4 8LZ

MAGENTA electronics ltd.

PW9, 61 Newton Leys, Burton on Trent, Staffs. DE15 0DW

for professional components and service

COMPONENTS & HARDWARE

Applications. Inclusive prices. No minimum order. Speedy despatch by first class post.

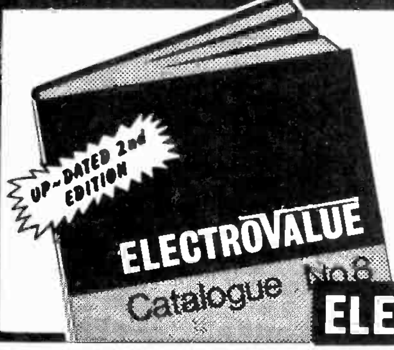
SHEET METALS; CAPACITORS; ENAMELLED & TINNED COPPER WIRES; RESISTORS; CABLE; IC's; TOOLS; SWITCHES; SCREWS, CASES, DIODES; PCB SUPPLIES; TRANSISTORS; PLUGS & SOCKETS; LEDs; DRILLS; VEROBOARD ETC.

FREE CATALOGUE

INCLUDES SAMPLES & TRANSISTOR TESTER DATA OFFER

Please send 2 x 6½p stamps to cover postage etc.

THE OPEN DOOR TO QUALITY



This 144 page catalogue—Electrovalue Catalogue No. 8 (Issue 2, up-dated) offers items from advanced opto-electronic components to humble (but essential) washers. Many things listed are very difficult to obtain elsewhere. The Company's own computer is programmed to expedite delivery and maintain customer satisfaction. Attractive discounts are allowed on many purchases; Access and Barclaycard orders are accepted.

40p

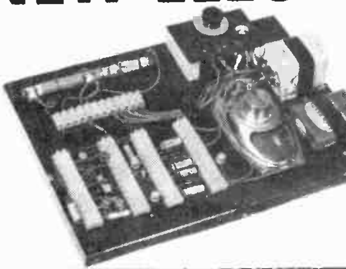
POST PAID inc. 40p Refund Voucher

+ FREE POSTAGE *on all C.W.O. mail orders in U.K. over £2·00 list value (excluding V.A.T.) If under, add 15p handling charge.*

ELECTROVALUE LTD

All communications to Dept. PW/10
28 ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY TW20 0HB. Tel Egham 3603. Telex 264475 Shop 9-5.30, 9-1 pm Sats
NORTHERN BRANCH: 680 Burnage Lane, Burnage, Manchester M19 1NA. Tel: (061) 432 4945. Shop 9-5.30pm, 1 pm Sats.

NEW ELECTRONIC MASTER KIT



Another completely solderless Electronic Construction Kit with many more projects, including Transistor Radios of various types and wavebands. Amplifiers, Metronome, Sound Amplifier, Transistor Testor, Signal Generator, Quick check component Tester, Tuners, Crystal Set, Morse Code Practice Oscillator with Morse Key, A. F. Oscillator etc. etc., Also a special project V.H.F. Aircraft Receiver!!

And all these components!! 2 x Interchangeable Control Panels (ready drilled). 4 x Solderless Construction Boards (ready drilled). Large 13 x 9½" Baseboard. (ready drilled). Ready Wound Medium Wave, Long Wave, Short Wave, and V.H.F. Coils. 7" Ferrite Rod. Quality 5" x 3" Loudspeaker. Crystal Earpiece. Also!! Knobs, Dial, Wire, Sleeving, Capacitors, Resistors, Transistors. Battery Straps, Connector Clips, Screws, Nuts and Bolts, Potentiometers, Tuning Capacitors, Instruction Manual and Pictorial Diagrams.

£14·99 Complete kit of parts including construction plans. Post Packing and Insurance

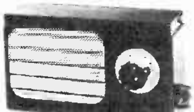
VHF AIR CONVERTER KIT

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.

£3·95 P & P and Ins. 45p.

POCKET FIVE



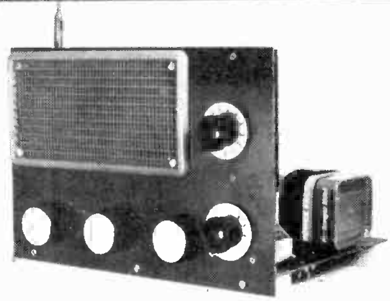
NOW WITH 3" LOUDSPEAKER

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 5½" × 1¼" × 3¼" approx.

Total Building Costs **£4·50**

All Parts including Case and Plans. P&P + Ins. 60p.

NEW ROAMER TEN MODEL R.K.3.



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

WITH Multiband V.H.F. section covering Mobiles, Air, T.V. Sound, Local V.H.F. Stations, etc., and Multiband A.M. section with Airspaced Slow Motion Drive Tuning Capacitor for easier and accurate tuning, covering M.W.1, M.W.2, LW, Three Short Wave Bands S.W.1, S.W.2, S.W.3, and Trawler Band. Built in Ferrite Rod Aerial for Medium Waves, Long Wave and Trawler Band, etc., Chrome Plated 7 section Telescopic Aerial, angled and rotatable for peak Short Wave and V.H.F. reception. Push Pull output using 600mw Transistors. Gain, Wave-Change and Tone Controls. Plus two Slider Switches. Negative Feedback circuit and **SPECIAL POWER BOOSTER SOCKET AND RESISTOR**, to virtually double gain if required. Powered by P.P.9 9 volt battery.

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

£13·99 inc. P & P.

Case Enclosure Kit (if required) £1·80 inc. P & P.

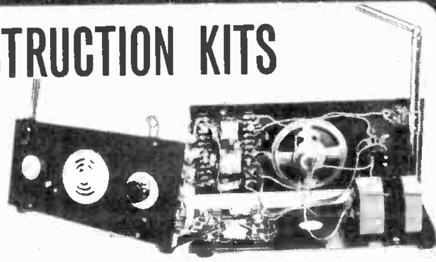
TRANS EIGHT

8 TRANSISTORS and 3 DIODES

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3, and Trawler Band. Sensitive ferrite rod aerial for MW and LW. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 x 5½ x 2½in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker.

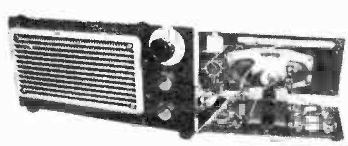
Complete kit of parts including construction plans. P & P + Ins. 70p **£7·50**

ELECTRONIC CONSTRUCTION KITS

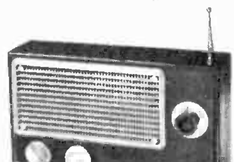


ECK2 Self Contained Multi-Band V.H.F. Receiver Kit. 8 Transistors and 3 Diodes. Push/Pull output. 3" Loudspeaker, Gain Control. Superb 9 section swivel ratchet and retractable chrome plated telescopic aerial, V.H.F. Tuning Capacitor, Resistors, Capacitors, Transistors, etc. Will receive T.V. Sound, Public 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. 70p



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. 70p.



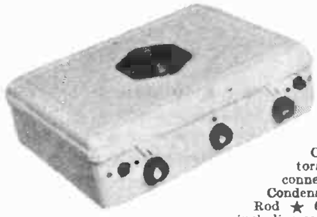
£7·10

ROAMER SIX

CASE AND LOOKS AS TRANS EIGHT

6 Tunable Wavebands: MW, LW, SW1, SW2, Trawler band plus an extra Medium waveband for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 x 5½ x 2½in. approx. Complete kit of parts including construction plans P & P + Ins. 70p.

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 Loudspeaker ★ Earpiece ★ Mica Baseboard ★ 3 12-way connectors ★ 2 Volume controls ★ 2 Slider Switches ★ 1 Tuning Condenser ★ 3 Knobs ★ Ready Wound MW/LW/SW Coils ★ Ferrite Rod ★ 6½ yards of wire ★ 1 Yard of sleeving, etc. Complete kit of parts including construction plans.

£9·00 **Total Building Costs** P & P+Ins. 85p.

RADIO EXCHANGE LTD.,

61A HIGH STREET,
BEDFORD MK40 1SA
Tel: 0234 52367

ALL PRICES INCLUDE VAT Reg. No. 788372

★ Callers side entrance "Lavells" Shop.
★ Open 10–1, 2.30–4.30. Mon–Fri. 9–12 Sat.

I enclose £ ....

for ....

Name ....

Address ....

....

PW/10/76


NEW KITS
EASY TO CONSTRUCT
DORAM KITS CONTAIN EVERYTHING DOWN TO THE LAST NUT!
AM-FM-MPX Stereo TUNER
£44·95 +H
★ Output 100mV ★ Complements audio separates
CAR PUSH-BUTTON MW/LW RADIO
£16·95 +H
OUTPUT 4W
★ Dual Polarity
★ Short Circuit Proof
COMPLETE WITH FITTING KIT & SPEAKER
Available NOW!
POWER SUPPLY
0-30V and 0-1A with a variable current limit
£19·95 +S
TV SOUND-ONLY TUNER
£36·95 +H
Picks up UHF signals from the transmitter and relays this through your hi-fi equipment
See coupon on next page
TRANSISTOR TESTER
Measures hFE, leakage for PNP, NPN, silicon or germanium transistors —includes battery check facility
£9·95 +S

MERRY~GO~ROUND

THE world of radio and electronics is an exciting one. Developments and new ideas seem to occur almost daily—some are recorded in our regular feature 'Hotlines'. For many, these new developments are a fascination and, often, the crux of what draws them into this field of technology either professionally or as an amateur or hobbyist.

But is all this development a double-edged weapon, and will fascination sour to bewilderment or boredom? Let us indulge ourselves in a little electronic nostalgia.

The valve reigned supreme for some thirty years. Then the three wise men of electronics—Brattain, Shockley and Bardeen, introduced a little thing called a transistor. This latter device occupied the throne of technology for barely ten years and then—the coronation ceremony for the integrated circuit arrived. And it hasn't stopped there. From a handful of "gates" on a silicon slice, technology has rampaged through MSI (medium scale integration) and on to LSI (large scale integration). Now, we hear terms like SSI (super scale integration) each term being more wonderful, more impressive, more technically advanced than its predecessor and the time gaps are also getting progressively less and less.

For the electronics industry itself this rampage has become a nightmare, albeit self inflicted, rather like riding a technological merry-go-round which is rushing faster and faster. True the results bring certain benefits but not without trade-off problems which affect both professional and hobbyist alike. In other words, a double-dged weapon. In the professional field, equipment is obsolete the day it is launched onto the market.

For the hobbyist it is also a double-edged weapon and at both ends of the scale, from the newest newcomer to the oldest old hand.

The beginner can no longer learn simple theory about a triode valve, nor indeed about a simple transistor. He comes straight into a galaxy of little black slabs with pins sticking out called DIPs (dual in-line packages), and hears that each one contains a few hundred transistors, resistors, diodes and heaven knows what else. If his enquiring mind wants to know more, he is buried in bewilderment by a deluge of meaningless terms like "slew rate", "open loop gain" or "maximum current offset" and so on.

Even old hands don't really benefit. They are offered a huge list of ICs to choose from and are probably confused (and bored?) by vast lists of meaningless numbers.

Isn't it about time we stopped the merry-go-round or at least slowed it? Shouldn't we learn to live with, and use wisely, what we already have?

Again, with so much circuitry crammed onto a single chip and so many chips available, has the home constructor become a mere "assembler" of IC building blocks? Is this also true for the designer?

Probably the fascination will now be to regard the vast army of available ICs as pieces in a jig saw puzzle. The trick for the future hobbyist-designers will be to juggle the pieces of the jig saw to make the picture they want. In other words, to ask themselves the question; how can the existing facilities on a particular chip be employed usefully and economically to fulfil a desired function. If this is true, then we have entered a new era in radio and electronics as a hobby.

However, it is also true that to design successfully by this method, a hobbyist-designer must know not only which chips are available, but exactly what each can do. So take another look at those long lists of IC numbers and ask yourself again what they all mean to you in practical terms, and you'll appreciate the parallel of the merry-go-round and the inference of the double-edged weapon.

LIONEL E. HOWES—*Editor*

Growth of Telecommunications

IN a recent speech to the Post Office Engineering Union, Mr. Gerald Kaufman, Minister of State, Department of Industry said, "During the last 10 years the number of telephone lines and the number of calls have both more than doubled. The U.K. now has more than 13 million exchange connections. A higher proportion of homes has a telephone in this country than in any other E.E.C. country except Denmark and Luxembourg."

He continued, "Telecommunications is a growth industry. Traffic will continue to build up year by year. During the next decade or so emphasis may well shift from coping with the massive increase in new subscribers towards measures to deal with increased traffic growth while at least maintaining service standards."

Microprocessors

THE society of Electronic and Radio Technicians (S.E.R.T.) is holding a residential symposium at Sussex University, September 26-29. The technical programme comprises 25 contributions spread over five sessions which will cover: devices evaluation, testing and diagnosis, programming and software; and two sessions on applications.

A small exhibition of microprocessors and peripheral equipment has been arranged in rooms adjacent to the Lecture Theatre and a visit to Sussex University is planned.

Delegates will get a chance to enter the S.E.R.T. Microprocessor Competition where the judges will seek a working application of a Microprocessor by a home constructor which is simple, economic, original and useful or entertaining. First prize will be £150 and the winning system will be displayed at an exhibition at the University of Sussex. Full information may be obtained by writing to: The Microprocessor Secretary, S.E.R.T., Faraday House, 8-10 Charing Cross Road, London WC2H 0HP.

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

BBC sells to Kuwait

BBC Enterprises has sold 132 educational and management training programmes to the Language Labs of Kuwait University. The programmes will all be shown in the original English versions, and cover a wide range of subjects—from "The Glory That Remains", "Heritage" and "Chronicle" series to "Economics of The Real World", "People Limited", and "Women at Work". Amongst the programmes selected by Kuwait University was "Rich Man, Poor Man".

"This sale means a substantial income for Enterprises", says Enterprises Sales Development Manager Peter Saxton. "Our agent in Kuwait is also interested in many other items in our 1000-programme catalogue. We are making a big push to sell in the Arab world, and have designed promotion material which incorporates Arabic calligraphy.

"We are very aware that each of the Arab countries has its own special requirements. You can't lump the whole Middle East together in marketing terms. Because of this we are currently meeting representatives from all the Middle East who can help us sell BBC programmes in their areas."

SPECIAL OFFER TO PW READERS

Marshalls of Cricklewood are able to make their special offer of 20-80% discount off all normal prices of 200 types of transistors, diodes, triacs and ICs because of a re-alignment of franchises.
All are branded products—the ICs including TTL and CMOS devices. The items in this special offer (see their advertisement in this issue) are available from all Marshalls branches across the counter or by post providing the coupon from their advertisement is produced.

Price increase

Regrettably, due to increased production and material costs, the cover price of Practical Wireless has had to be increased to 40p with effect from this issue.

R.A.E. courses

OAK Farm School, Farnborough, Hants. First class, Thursday, September 30, starting at 7.30p.m.

There will also be a Morse Proficiency Course beginning on Monday, September 27, at the Oak Farm School. Further gen from: J. Brett, Principal, Core School, St. John's Wood, Farnborough.

Harry Leeming, F.S.E.R.T., G3LLL tells us that providing there is enough interest, Blackburn will once again be running the City and Guilds R.A.E. Course.

Further gen from: The Principal, The College of Technology and Design, Fielder Street, Blackburn, Lancs.

Bridgnorth College of Further Education, Stourbridge Road, Bridgnorth, Shropshire.

That's the venue for the Monday evening R.A.E. Courses starting September 20. Further gen from Mr. R. A. Buckley, Deputy Head of Engineering Department, Bridgnorth College (address as above).

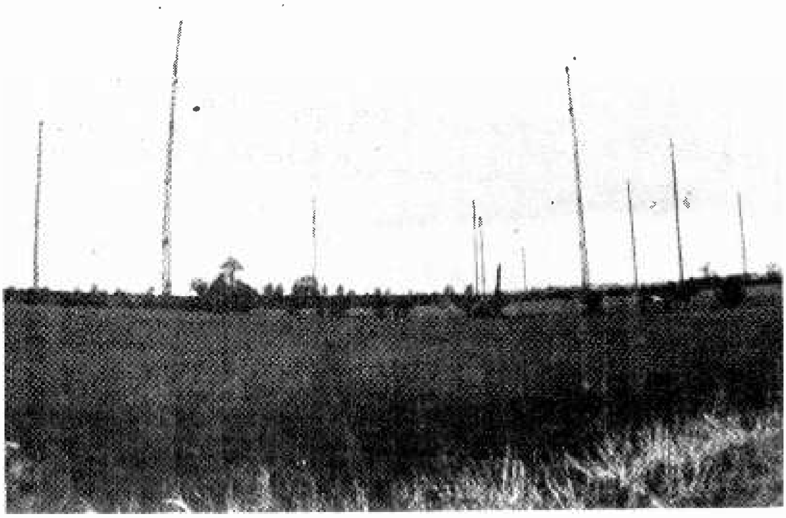
John F. Greenwood, G3ZJY, tells us that a R.A.E. Course will be run by him at a venue in Durham. The course starts September 20.

Further gen from John at 17 The Links, Belmont, Durham, DH1 2AG.

A course of study has been arranged at the Walsall College of Technology, St. Paul's Street, Walsall, West Midlands, to prepare for the R.A.E. Exam.

Further gen from: F. A. Fear, G8CVR, T.Eng, (CEI) MITE at the above college address or phone Walsall 25124.

Swinton (Manchester) — Moorside High School, East Lancashire Road. Thursday evenings, commencing September 30. Details from G8BFP, Tel: 061-794 3706.



Windy picture

What has happened to these BBC radio masts? Have any readers any explanation?

PROTECT YOUR CAR RADIO ETC.

ANTI-THEFT DEVICES

A.R.TWITE

Two basic types are described. One, which is simpler to fit, will give an alarm when an earthed wire, the alarm unit sensing lead, is removed from the radio or tape player. In this article this type is referred to as earth seeking. The second type, referred to as battery seeking, can only be fitted if there is access to the internal wiring of the unit to be protected. A positive earth and a negative earth version of each is shown, as is an alarm unit to monitor more than one item.

WITH the recent expansion of interest in In-Car Entertainment motorists have increasingly expensive radios and tape players in their vehicles and it becomes worthwhile to give them special anti-theft protection. This is especially true for soft top or convertible cars as these cannot be readily secured. It is the work of an instant to split a sports car hood and gain access to the equipment.

The units described in this article will sound an alarm, typically the vehicle's own horn but any other form of alarm may be used, if the equipment is tampered with. They are designed to be left switched on, having a very low current consumption, and therefore there is no possibility of forgetting to set the alarm when leaving the vehicle.

★ components list

In all circuits.
R1, R2 and, where fitted, R3 and R4 are 560Ω 10% ¼W.
D1 and D3 are BY126.
D2 is OA90.
FS1 is 250mA (see text for other ratings).
In Positive Earth, Earth Seeking and Negative Earth, Battery Seeking circuits Tr1, and, where used, Tr2 are AC128.

In Negative Earth, Earth Seeking and Positive Earth, Battery Seeking circuits Tr1, and, where used, Tr2 are AC187.

Miscellaneous. Switch, S1, single pole on/off low voltage at ½A. Relay RLA, 12V working, coil resistance 100Ω, two pairs of normally open contacts rated to suit the alarm used, size to suit the case used. An Alarm if vehicle's horn isn't used. Case to suit location in car. Wire for interconnections (see text for type). Epoxy resin or wax if encapsulated.

Note. The author has used three types of relay from Doram with success, codes 348-385 (open), 348-756 and 348-807 (both with dust covers but require bases).

Description and Method of Use

The alarm unit has five wires. Two are battery and earth, battery is fed via an on/off switch which acts as a reset. Two are from a pair of relay contacts which are normally open but which close if an alarm is detected. The remaining wire is the sensing lead.

With the earth seeking type the sensing lead must be connected to an earthed part of the equipment before the alarm unit is switched on. Whilst this connection is maintained the alarm unit will stay in a monitor condition. However, if the connection is broken, and a thief must break it to remove the equipment, the alarm unit locks into the alarm condition. It can only be returned to the monitor condition by the reset switch.

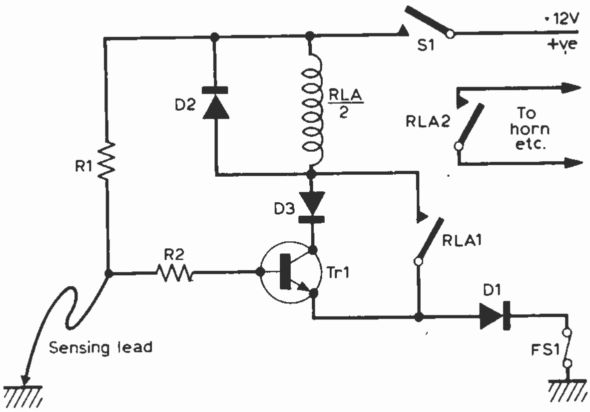
The battery seeking version works in the same way except that the sensing lead is connected to the live side of the on/off switch inside the radio or tape player.

The alarm unit should be mounted in some inaccessible place, well out of reach of anyone tampering with the radio. The current consumption of the device is approximately 2mA in its monitor condition so there is no point in switching it off in normal use. The on/off switch need not, therefore, be readily accessible to the driver. The prototype has been in use for nearly two years without giving a false alarm.

The relay contacts can be used to operate a klaxon or similar warning device. If the vehicle's own horn and battery are used, consideration should be given to extra protection for the wiring involved. It is too easy for a cool thief to open the bonnet, rip off the horn leads and swear at the horn switch for the benefit of passers-by. If he finds that he cannot stop the horn the average thief will panic.

If the earth seeking type is used the sensing lead should be frail and connected to a earthed part of the radio in an obvious position. This will tempt the thief to disconnect it at as early stage as possible. Once the alarm unit has been triggered, by the removal or cutting of the sensing lead, it can only be switched off by the reset switch or by disconnecting the battery.

The battery seeking version is used in a similar manner. The sensing lead, this time of more normal car wire, is taken inside the radio or tape player and connected to the live side of the on/off switch. It is then a good idea to leave the radio's in-line fuse-holder in a prominent position. A thief will obviously prefer a set with undamaged leads and so disconnect the fuse early on. This will set off the alarm, scare off the thief, and leave an undamaged installation. As before, the alarm can only be reset by interrupting the supply.



W267

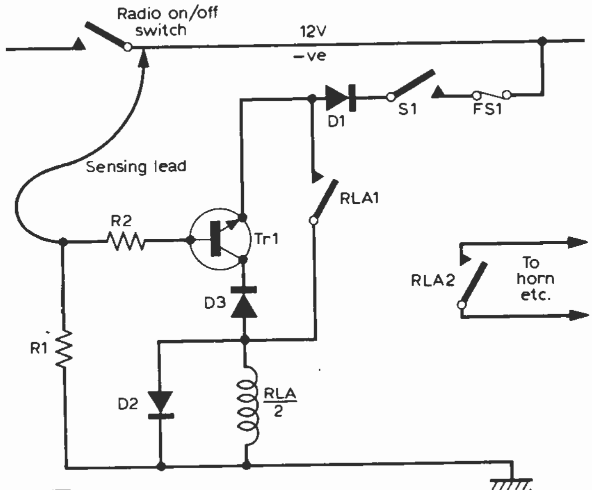
Circuit Description

Fig. 1 shows a positive earth, earth seeking version. The sensing lead is connected to earth and holds the base of Tr1 at earth potential. Tr1 is thus normally cut off. The only current which flows in this quiescent, or monitor state is through R1. When the sensing wire is broken or disconnected the base of Tr1 is supplied, by R1, with enough current to operate the relay. The relay has its own hold path, through RLA1, and therefore the transistor and sensing lead become inoperative. The relay can only be de-energised by interrupting the supply.

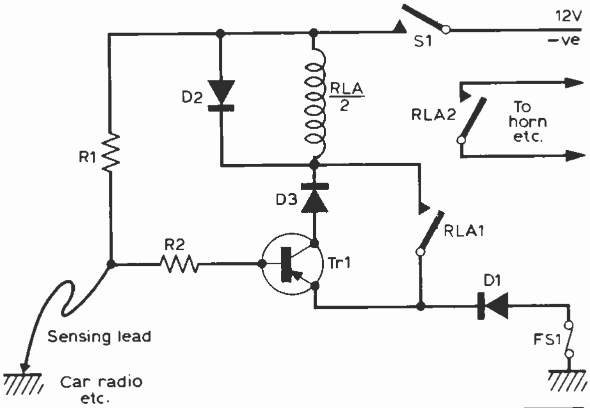
Diodes D1, D2 and D3 are protection devices. D1 and D3 completely protect the alarm unit against incorrect connection. There is no combination of connections which will damage it. Equally, of course, there is nothing a thief can do to damage it. D2 protects Tr1 from voltage surges when RLA releases.

Fig. 2 shows a negative earth, earth seeking version. It is effectively the same as Fig. 1 except that the transistor is NPN and the diodes are reversed.

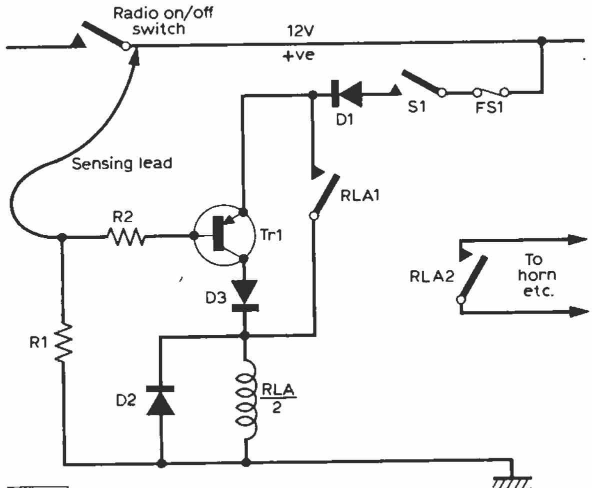
Figs. 3 and 4 show battery seeking versions. Fig. 3 is positive earth and Fig. 4 negative earth. They work in an identical manner to the earth seeking versions apart from the obvious difference that the sensing lead is normally at battery potential.



W268

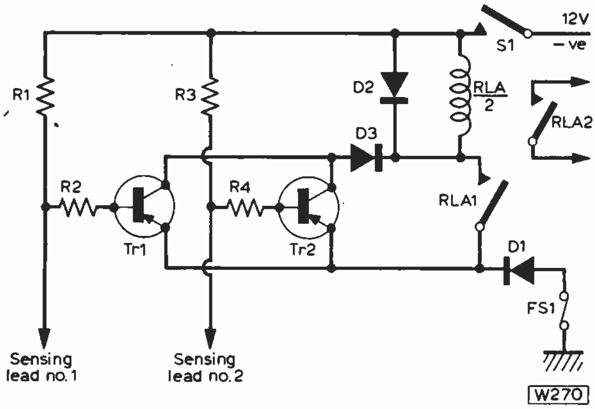


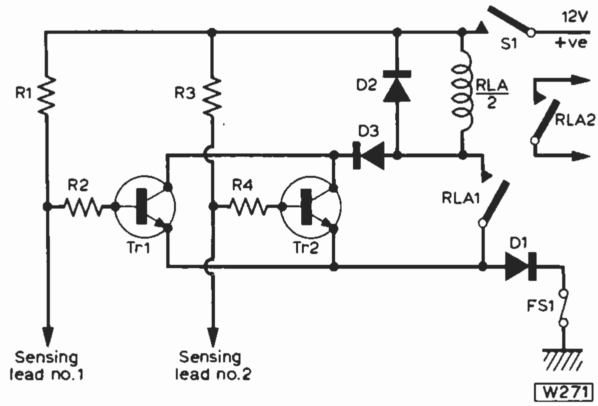
W266

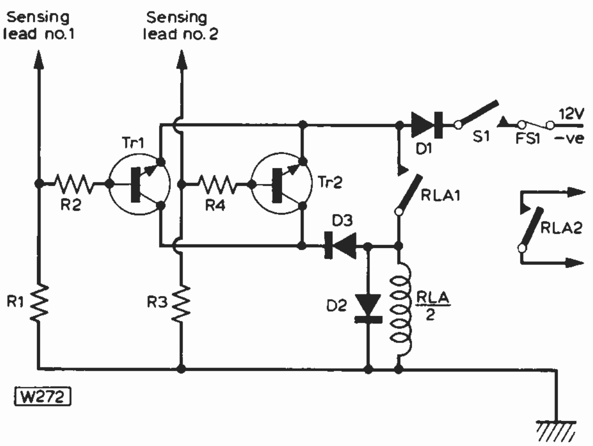


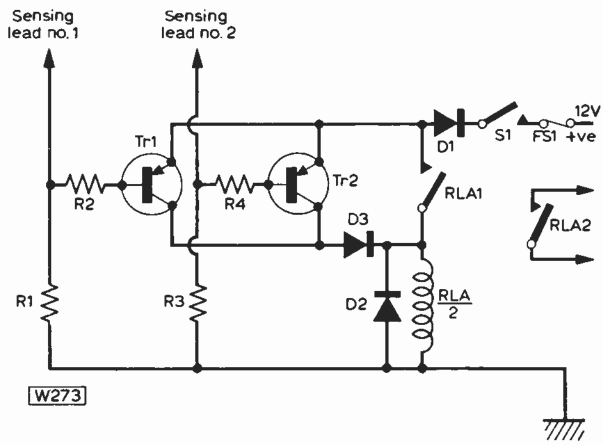
W269

The four circuit variations for protecting a single item only. Fig. 1., bottom left, is for Positive Earth, Earth Seeking. Fig. 2., upper right, is for Negative Earth, Earth Seeking. Fig. 3., centre right, is for Positive Earth, Battery Seeking. Fig. 4., bottom right, is for Negative Earth, Battery Seeking.









Protection of Two Units

If the earth seeking type is used it should be obvious that merely looping the sensing lead from radio to tape player will not have the desired effect. It would still be possible for a thief to remove one unit without affecting the alarm, as the remaining unit would maintain the earth on the sensing lead.

The answer, apart from fitting two alarm units, is to build an alarm unit with two sensing leads. Suitable designs are shown in Fig. 5 and Fig. 6. As radios or tape players occasionally break down or require servicing, the alarm system must also work when one unit is temporarily removed. This is achieved by the simple expedient of connecting the sensing lead from the missing unit directly to the car chassis. The remaining unit will then be protected as normal.

In the case of the battery seeking version limited protection for two units can be obtained from a single alarm unit if the two audio units are fed from a common supply. However, this relies on the thief being tempted to remove the fuse. If he takes a pair of wire cutters to the wiring instead it would still be possible to remove one unit without setting off the alarm. Figs. 7 and 8 show the two input, battery seeking versions.

The four variants for protecting two items. Fig. 5., upper left, is for Positive Earth, Earth Seeking. Fig. 6., upper right, is for Negative Earth, Earth Seeking. Fig. 7., lower left, is for Positive Earth, Battery Seeking. Fig. 8., lower right, is for Negative Earth, Battery Seeking.

Construction

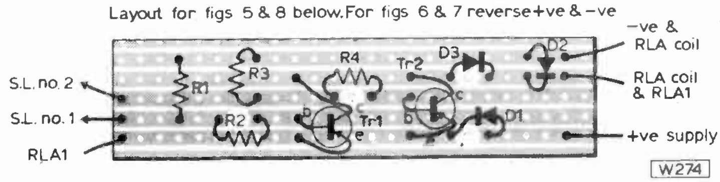
The average constructor will, no doubt, have his own favourite method of building simple circuits such as those given in this article. The author has used two methods successfully for this alarm unit. One involves making up the circuit on a scrap of Veroboard, a suitable layout is given in Fig. 9, and mounting this, together with the relay, in a diecast aluminium box. The wires are then taken to screw terminal blocks mounted on the outside of the box. The method works very well and allows for plenty of fiddling later on.

The second method is more permanent. The dust cover on the relay is firmly sealed and the relay mounted in a container. The author found a section

Fig. 9. *The layout used by the author in constructing his alarms. The pitch of the board is not critical nor is the size. Terminations to the board can be by flying leads soldered directly to the board, (push the ends through the holes first of course) or by inserting pins into the holes and then soldering wires to the pins.*

Layout for figs 1 & 4. For figs 2 & 3 reverse +ve & −ve

Layout for figs 5 & 8 below. For figs 6 & 7 reverse +ve & −ve



of square plastic drainpipe to be ideal. The associated components are then attached and the whole encapsulated. Any mistake will leal to an expensive, and very solid, length of plastic drainpipe, so considerable care is needed. For the more timorous, (less foolhardy?), wax makes an excellent substitute for epoxy resin as the encapsulating medium as there is the possibility of correcting one's mistakes. The leads must be anchored in such a way as to prevent the transmission of any strain to the circuitry.

None of the components specified are critical or difficult to obtain. The relay must have contacts suited to the load to be switched. For vehicles fitted with a horn relay this is no problem, for most other vehicles contacts rated at about 10 amps seem to be satisfactory. It is, of course, true that the relay will probably only switch a few times in its life and that even 5 amp contacts will handle a car horn under these conditions. However, any failure of the relay, especially sticking together of the contacts, would be at best embarrassing, at worst expensive. It is certainly worth the extra cost to do the job correctly.

The coil resistance must be high enough not to overload the transistor. In this case it is unlikely that any relay chosen would draw more than the 1 amp necessary to damage the specified devices. Coil resistances above 100 ohms are recommended, but values down to about 25 ohms could be used if the fuse rating is increased.

The only other possible difficulty involves mounting the Veroboard in the diecast box. The author found it impossible to purchase standoffs for this purpose and used long spacers. Threaded rod and locknuts would also do the job.

KINDLY NOTE!

Transistor Tester Part 2, August 1976

The following corrections to the text will make the setting-up and operation of the equipment easier to understand.

1. Page 302, R.H. colm., para. 3: Delete "across R30" and the whole of the bracket. Insert "to the end of R30 nearest C6 (positive lead) and the end of R3 nearest the edge of the board (negative lead)".
2. Page 303, R.H. colm., last para, 4th line: Delete "I_{CEO}" and insert "3mA".
3. Page 304, L.H. colm., para. 2: In the sentence starting "Note that ..." V_G should be V_C is set ...
4. Page 304, section on diodes: After "V_C to 10 volts" add and I_B to I_{CES}.

Please accept our apologies if you have had problems.

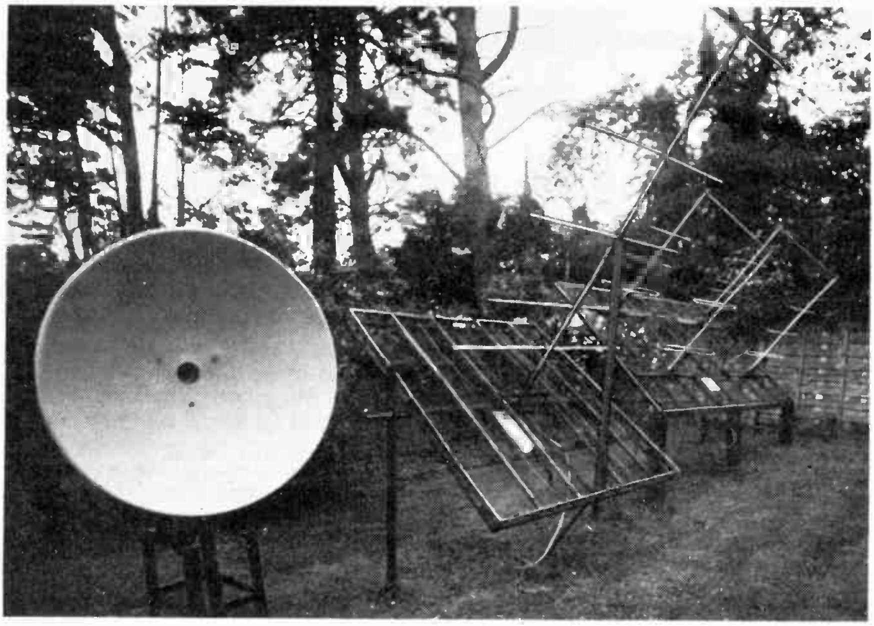
PW TECHNICROSS PUZZLE

Solution to No. 15 presented last month

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

Vagaries of VHF

Ron HAM F.R.A.S.*



Photograph of a portion of the author's garden given over to specialised aerials.

LISTENING below 28MHz is exciting, because, as the wavelengths get shorter and the frequency increases, the normal paths of radio signals become vulnerable to a variety of natural disturbances which frequently occur within the Earth's atmosphere. Under normal atmospheric conditions the range of a VHF radio signal decreases as the frequency increases and the technology of the receiver becomes more sophisticated. Because of this limited range it is possible for VHF transmitters to work on similar frequencies, provided that they are, geographically, far enough apart not to interfere with each others accepted receiving systems.

Frequency sharing is essential, because every year there is an increasing demand upon the limited space available within the VHF part of the radio frequency spectrum and the authorities endeavour to get the maximum number of stations operating in the minimum possible frequency space. It is in this field that the RSGB's negotiators play an important role in representing the interests of the amateur radio operators who use the 2m and 4m bands, as well as their allocations in the UHF and SHF parts of the spectrum.

It is essential, for the future of amateur radio, that these bands are used wisely, because there is only **one** radio frequency spectrum and the small space already allocated for amateur use must be treated like a precious commodity. It is important to bear in mind that the authorities in all countries could collect a large licence revenue if the present amateur bands were given over to commercial users.

International frequency sharing works well until a natural disturbance, such as an aurora, sporadic-E, or tropospheric opening takes place and multiplies the normal range of a VHF radio signal by ten which consequently causes considerable interference to the other systems operating on the same frequency.

SPORADIC-E

The 'E' region of the Earth's ionosphere forms at sunrise about 60 miles above the Earth's surface and disperses at sunset, but during the mid-summer months (May to August) this region may suddenly break up into clouds of more densely ionised gas and upset the normal paths of radio signals between 30 and 80MHz, and in extreme cases, it can spread it's influence to 150MHz. Sporadic-E is a curse to the Band I (41-67MHz) viewers whose mid-summer enjoyment of afternoon sports such as the Test matches and Wimbledon, as well as some early evening programmes, are spoilt when their normal crisp picture is obliterated by patterns as their TV receives signals from a variety of distant transmitters which are sharing the same frequency.

When sporadic-E is present, radio amateurs using the 4m band have frequently heard very strong signals from FM broadcast stations, mainly Polish, operating between 69 and 72MHz. Parts of this band are used in eastern Europe for national broadcasting networks and under normal conditions they are far enough away not to interfere with 4m activity in the UK.

For many years the author has made a number of daily checks on the vision frequency of the R1 television service (Russian 49·75MHz) and has found that this signal is the first to "appear" (in southern England) at the beginning of a sporadic-E disturbance and the last to fade away at the end. Some of these disturbances last for several hours and it is interesting to hear the changes in signal strength of many DX stations as their particular frequency falls under the influence of the prevailing sporadic-E. It is not unusual to find that the disturbance is limited to between 30 and 50MHz, or the higher range, say 50 to 80MHz, but whatever happens, it all seems to hinge around 50MHz because the sync. pulses from the R1 system are present throughout the event.

TROPOSPHERIC OPENINGS

Normally a radio signal transmitted between 100 and 200MHz has a range of approximately 100 miles, but during a tropospheric opening these signals can travel more than 1,000 miles. Because of this, the general public suffers from distant-station interference to their television pictures when they watch one of the ITV stations in Band III (176-215MHz) during a disturbance.

A tropospheric opening usually follows a spell of fine weather accompanied by a ridge of high atmospheric pressure. The majority of radio amateurs who use the 2m band (144-146MHz) take advantage of the "good" conditions to work some DX. The following rule of thumb can be applied. If the Band III pictures are patterning, then switch on the 2m gear. On the other hand, if the interference is affecting Bands IV and V, then take a look on the 70cm band. However, if both systems are disturbed then be prepared for a long session at the receiver, because the DX should be rolling in.

BAND II

The FM broadcast band (88-108MHz) is on the borderline; it can be affected by extreme cases of sporadic-E and a minor tropospheric opening. Band II is used by most European countries for national and local broadcasting so when a disturbance takes place it is not uncommon to hear continental signals overpowering the BBC stations between 88 and 96MHz. Although it is not unusual to hear about 20 continental broadcast stations in Band II during an opening, the author has heard up to forty during a big event, with only a horizontal dipole feeding the receiver.

AURORAL PROPAGATION

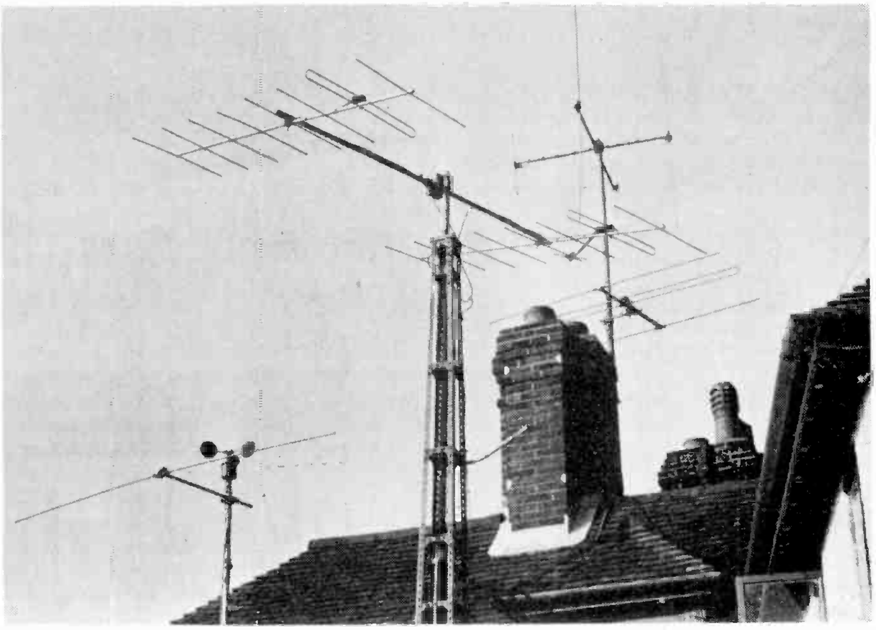
Briefly, an aurora is a region of ionised gas caused by a stream of solar particles entering the Earth's polar atmosphere. This temporary ionisation has a strange effect on terrestrial radio signals. For example, the letter 'Q' sent in Morse code under normal circumstances would sound like this "dah, dah, dit, dah" but when this signal is received via auroral reflection it would sound like "ror, ror, ri ror". In the first instance the signal has a clean T9 note and was received directly from the transmitter over a limited range but when the same signal bounces off an aurora it can travel for more than 1,000 miles and its note is so poor that the DXer logs it as Tone-A. An aurora is a beautiful sight but obviously it is only visible when it manifests itself during the hours of darkness, and then the skies must be clear, but now, with the aid of VHF radio, we can identify an unseen auroral event.

SOLAR ACTIVITY

The Sun is said to have "active" regions when dark patches, known as sunspots, can be seen on its apparent yellow disc. In the mid-1930s Denis Heightman (G6DH) and the late Nell Corry (G2YL) heard a strange "hissing" noise on the 10m band which they rightly concluded was coming from the Sun. In July 1938, Miss Barbara Dunn (G6YL) was the first to identify this noise in the 5m band.

We now know that when sunspots are present the sun may eject a stream of nuclear waste accompanied by a strong burst of metre-wave radio noise. The radio waves from this event take around eight minutes to reach the Earth, but the particles which left the sun at the same time may take between 20 and 40 hours to arrive in the vicinity of the Earth. Should these particles collide with the Earth's atmosphere then an ionospheric disturbance (which would upset the HF bands) or an auroral event can be expected.

A photograph of the roof of the author's house illustrating the impressive display of arrays. The array on the 'tower' is remotely controlled in both vertical and horizontal modes.



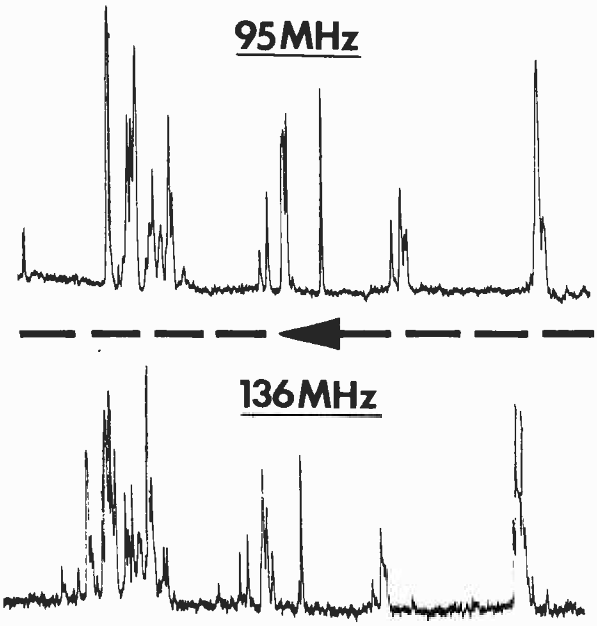


Fig. 1. A series of individual bursts of Solar Radio Noise recorded at both 95MHz (upper trace) and 136MHz (lower trace) at 1304 to 1312 GMT, January 17th 1975. Chart speed, 30ins per hour.

The author has observed the sun at 95 and 136MHz for several years and has found two definite types of activity when sunspots are present; first, there is the individual burst of radio noise which may last for several minutes, Fig. 1, and secondly, there is the continuous noise storm which may rage on the Sun for many days, Fig. 2. It is during the lifetime of one of these solar storms that an ionospheric disturbance or an aurora is most likely to occur. In fact, when one of these storms enters its second day the author telephones the information to Charles Newton (G2FKZ) the RSGB's auroral co-ordinator.

EQUIPMENT

The following list of equipment is recommended for the enjoyment of VHF listening and the study of metre-wave disturbances:

1. A general-coverage communications receiver; AR88, Eddystone 680X, Hallicrafters SX122, Hammarlund HQ180, etc.
2. A VHF communications receiver; Eddystone 770R or ex-Govt. R 216, both can be used to resolve FM signals.
3. A 2m-band converter, crystal controlled local oscillator.
4. An 8-element Yagi aerial to feed the 2m converter.
5. A barometer to monitor the atmospheric pressure.
6. A long-wire aerial suitable for the 10m band.
7. A vertical dipole cut to 50MHz for sporadic-E work.
8. A horizontal dipole cut to 100MHz for tropospheric work.

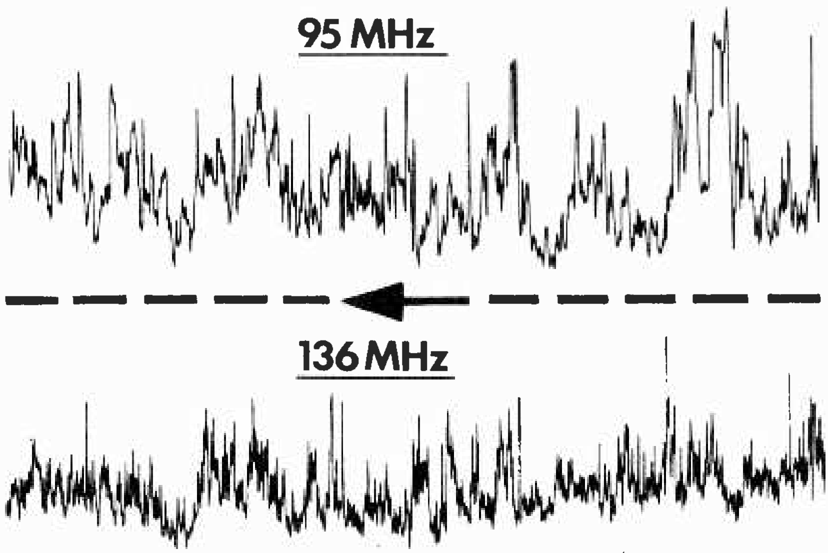
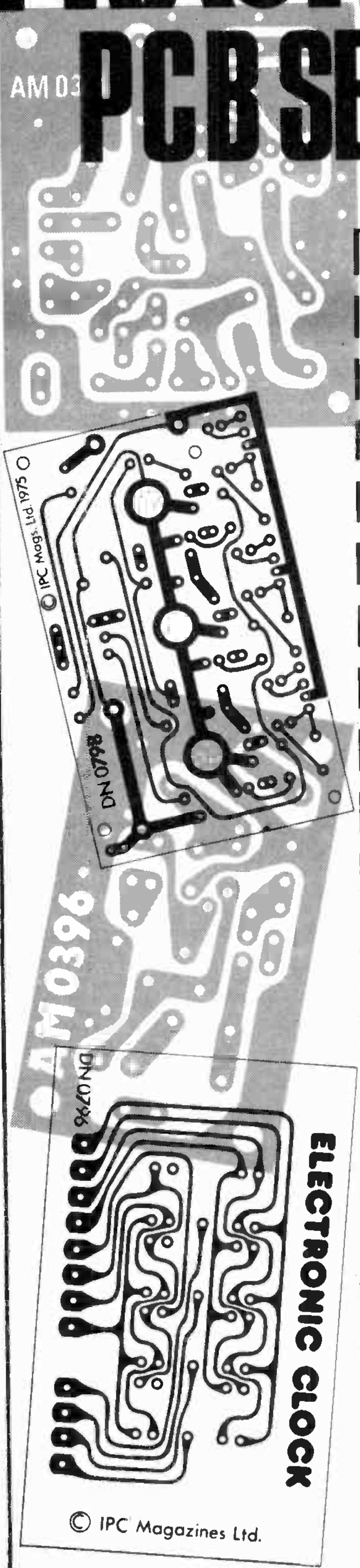


Fig. 2. A 10 minute sample of the Solar Noise Storm recorded by the author at both 95MHz (upper trace) and 136MHz (lower trace), February 17th 1974 at mid-day.

PRACTICAL WIRELESS

PCB SERVICE FOR READERS



All boards, except SRBP, are 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 P/P	
Mar 75	Electronic Organ (set of two)		AM0315 AM0318	7·56+25	☐
Sep 75	Electronic Clock (set of three)		DN0795 DN0796 DN0797	2·40+15	☐
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		AM0443	1·08+12	☐
Apr 76	Auto. Slide Synchroniser		AM0441	2·33+15	☐
June 76	Dig. Freq. Meter (set of 4)		4X A004	3·17+15	☐
Jul 76	Transistor Tester		A002	2·08+15	☐
Jul 76	Disco Preamplifier		A003	0·65+12	☐
Aug 76	Cassette Player Power Supply		A001	0·65+12	☐
Sep 76	Jingle Machine		A005	2·30+12	☐
Sep 76	Capacitance Meter		A009	2·59+14	☐
Sep 76	Octavia AF Source		A010	1·30+12	☐
Oct 76	Jingle Machine, Mains Unit		A006	2·08+12	☐
Oct 76	Digital Car Clock (set)		A001/2/3	2·08+12	☐
Oct 76	Interwipe		DN8JM	0·80+12	☐
Oct 76	Video-Writer (set)		D002/3/4/6 A007	19·44+35	☐
Oct 76	Hazard Flasher		D005	0·76+12	☐

Post and packing is for one board or set of boards. 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.

Access

ACCESS welcome.
Send card number only.

NAME...

ADDRESS ....

....

.... Post Code ....

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

in next months issue

TELEVISION

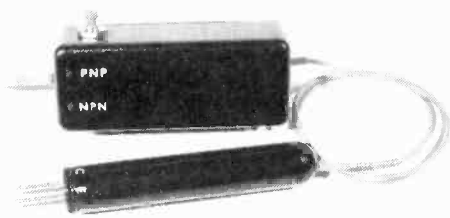
EXTRA 'SCREEN FAULTS IN COLOUR RECEIVERS'

SPECIAL 4-PAGE COLOUR SUPPLEMENT SHOWING OFF-SCREEN RECEIVER FAULTS

● TRANSISTOR TESTER

In-situ transistor tester. It's much more convenient for an engineer to be able to check whether a transistor is OK or not without having to unsolder it and check it on a conventional tester. Our project next month is an in-situ go/no-go transistor tester which can be built easily and inexpensively. Two LEDs are used for indicating the state of the device under test.

The unit is particularly easy to use and can save a great deal of time and trouble.



● ASSESSING OLDER SETS

The problem of whether or not to spend money on repairing an old set can be difficult. Vivian Capel outlines what to look for in assessing the overall condition of older receivers.

● REPLACING LINE OUTPUT TRANSISTORS SAFELY

One of the major hazards of servicing modern solid-state TV receivers is the vulnerability of line output transistors under certain fault conditions. Care and knowledge are required if the replacement is not to suffer instant destruction. E. Trundle explains the problems and the precautions required.

● SURFACE WAVE FILTERS

These devices, when used in the i.f. strip of a television receiver, obviate the need for the numerous coils which carry out the bandpass shaping.

ALSO

Servicing the Philips K70 colour chassis, equipment reviews and all the regular features.

Britain's only magazine devoted to the technical aspects of domestic television – with constructional and servicing features, coverage of the video scene and developments.

FROM BI-PRE-PAK

Stirling Sound Products

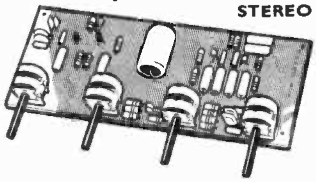
UNIT 1 PRE-AMP/CONTROL

SUPERB VALUE AT

£7.80

WITH ACTIVE TONE CONTROL CIRCUITRY

STEREO MODEL



UNIT I, latest addition in the Stirling Sound range of realistically priced constructional modules is going to assure many many more constructors of obtaining quality where price has prevented it before. UNIT I offers full stereo facilities, is guaranteed and easy to connect up.

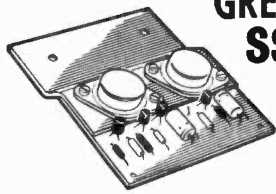
- Input sensitivity—50 mV, adjustable
- Output—200 mV for 50 mV in
- Bass control —±15 dB at 30 Hz
- Treble control—±15 dB at 10 kHz
- Balance control; vol. control; bushed controls throughout
- Operating voltage—10 to 16V

MADE IN OUR OWN FACTORY IN ESSEX

MORE POWER–LESS SPACE GREATER VALUE SS.140 MK3

POWER AMP.

Built for hard work



40 WATTS R.M.S. INTO 4Ω

£3.95

+ 8% V.A.T.

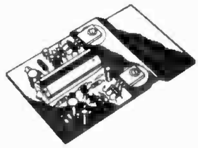
Resulting from research and development, the Mk.3 version of this most popular power amp. now includes built-in output capacitor with improved stability under severest working conditions. Greatly used for P.A., disco and similar work, SS.140 offers fantastic value for the price.

Build and save with Stirling Sound

BASIC MODULES FOR BUILDING UP TO A STEREO TUNER-AMP

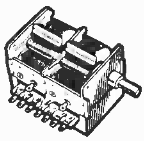
POWER AMPS

SS.103	Simple I.C. module, 3 W output	£1·75
SS.103-3	Stereo version of above	£3·25
SS.105	5 watt amplifier to run from 12V. (3½" x 2" x ¾")	£2·25
SS.110	Mk. 3 Similar to SS.105 but more powerful giving 10W into 4 ohms, using 24 volts	£2·75
SS.120	Mk. 3 20 watt module when used with 34 volts into 4 ohms	£3·00



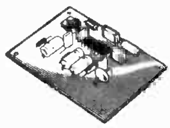
CONTROL

SS.100	Active tone control, stereo ± 15dB cut and boost with suitable network	£1·60
SS.101	Pre-amp for ceramic p.u., radio & tape with passive tone control details	£1·60
SS.102	Stereo pre-amp with R.I.A.A. equalisation, mag. p.u., tape and radio in.	£2·25



F.M. TUNING

SS.201 X	Geared variable tuning 88-108 MHz. AFC facility	£5·00
SS.202	I.F. amp A meter and/or A.F.C. can be connected (size 3" x 2")	£2·85
SS.203	**Stereo decoder** For use with Stirling Sound modules, or with any other good mono F.M. tuning section. A L.E.D. beacon can be added to indicate when a stereo signal is tuned in (3" x 2").	£3·85

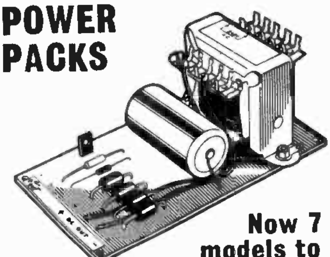


POWER STABILISER

SS.300	Add this to your unstabilised supply to obtain a steady working voltage from 12 to 50V for your audio system, workbench etc. Money saving and very reliable	£3·25*

Stirling Sound

POWER PACKS



Now 7 models to choose from

Not only do these excellent power packs stand up unflinchingly to hard work, inclusion of a take off point at around 13-15V adds to their usefulness and once again price value is outstanding.

Made to serve for years

Add 50p for p/p any model.

SS.312	12V/1A	£3·75*
SS.318	18V/1A	£4·15*
SS.324	24V/1A	£4·60*
SS.334	34V/2A	£5·20*
SS.345	45V/2A	£6·25*
SS.350	50V/2A	£6·75*

SS.310/50
STABILISED VARIABLE OUTPUT POWER SUPPLY UNIT gives stabilised output at any voltage between 10 and 50V. With special heatsink, tested and guaranteed £11·00.

NEW SHOWROOM We have extended and added exciting new stocks at our West Road premises. All welcome

TERMS OF BUSINESS:

VAT at 12½% 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 unless marked 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.

Order your Stirling Sound products from

BI-PRE-PAK LTD

Co Reg No 820919

222/224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SS0 9DF.
TELEPHONE: SOUTHEND (0702) 46344

TO STIRLING SOUND (BI-PRE-PAK LTD) 220/224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SS0 9DF

Please send ....

.... for which I enclose £ ....

Inc. V.A.T.

NAME ....

ADDRESS ....

.... PW 10B

CHEQUES/MONEY ORDERS PAYABLE TO BI-PRE-PAK LTD

a 'JINGLE' machine mains unit

P. W. BOND

In our September article we limited the design to a battery powered unit. Now, to avoid the expence and bother of changing the batteries in the unit at frequent intervals when the machine is in constant use and, perhaps even more serious, to avoid finding the batteries flat when the unit is called into use after a long period of non-use, a mains power supply has been designed to fit into the case.

★ components list

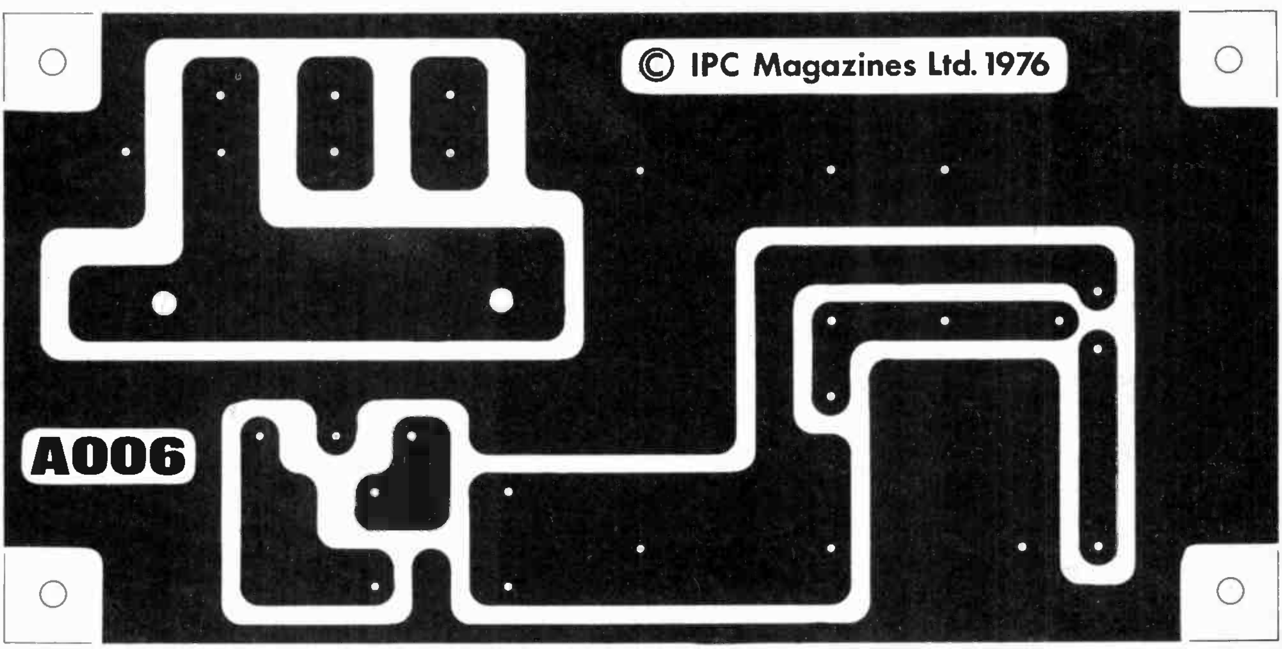
R9	560 5%, 1W
C3	1000μF, 25V
C4	10μF, 12V
D4 and D5	1N4001
D6	10V zener, type BZY88
Tr6	BFY51
T1	Mains transformer, 240V to 9-0-9V, 100mA.
S2	Double pole on/off, mains rated.
PCB	Readers PCB Service.
Note.	These components were given in the main article and reference numbers have not been changed.

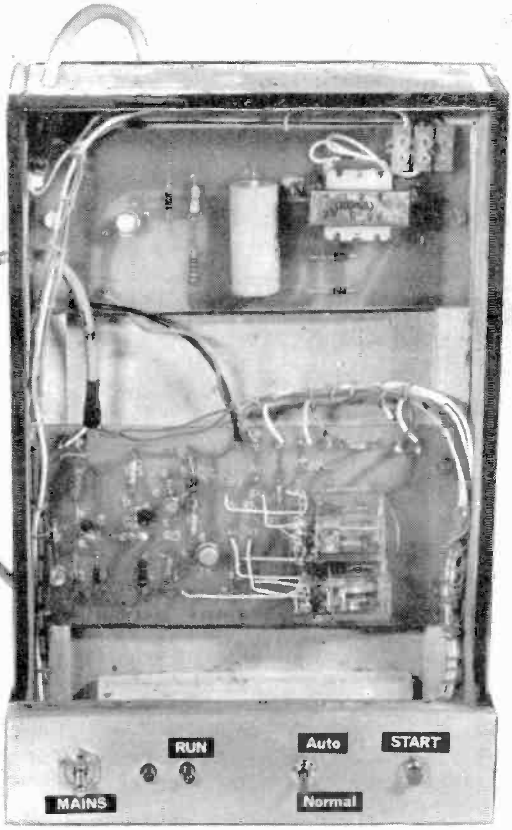
Circuit description

The unit employs full wave rectification of the LT output from the transformer and this rectified output is smoothed by capacitor C3. R9, C4, D6 and Tr6 provide a degree of stabilisation which prevents the relays chattering or the LEDs dimming.

Provision is made for earthing the OV line but this should only be used if the connections to the recorder are such that another earth is not present, thereby avoiding a hum loop. The schematic is given as Fig. 7.

Fig. 8. The printed wiring pattern of the board, drawn full size to enable tracing direct onto copper clad board, for those wishing to make their own PCB. Track widths should be maintained.





Photograph of the inside of the authors completed unit showing the mains board installed at the rear of the cabinet.

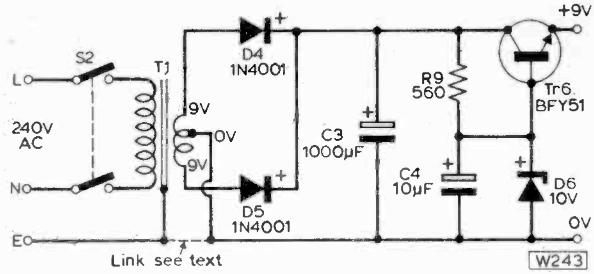
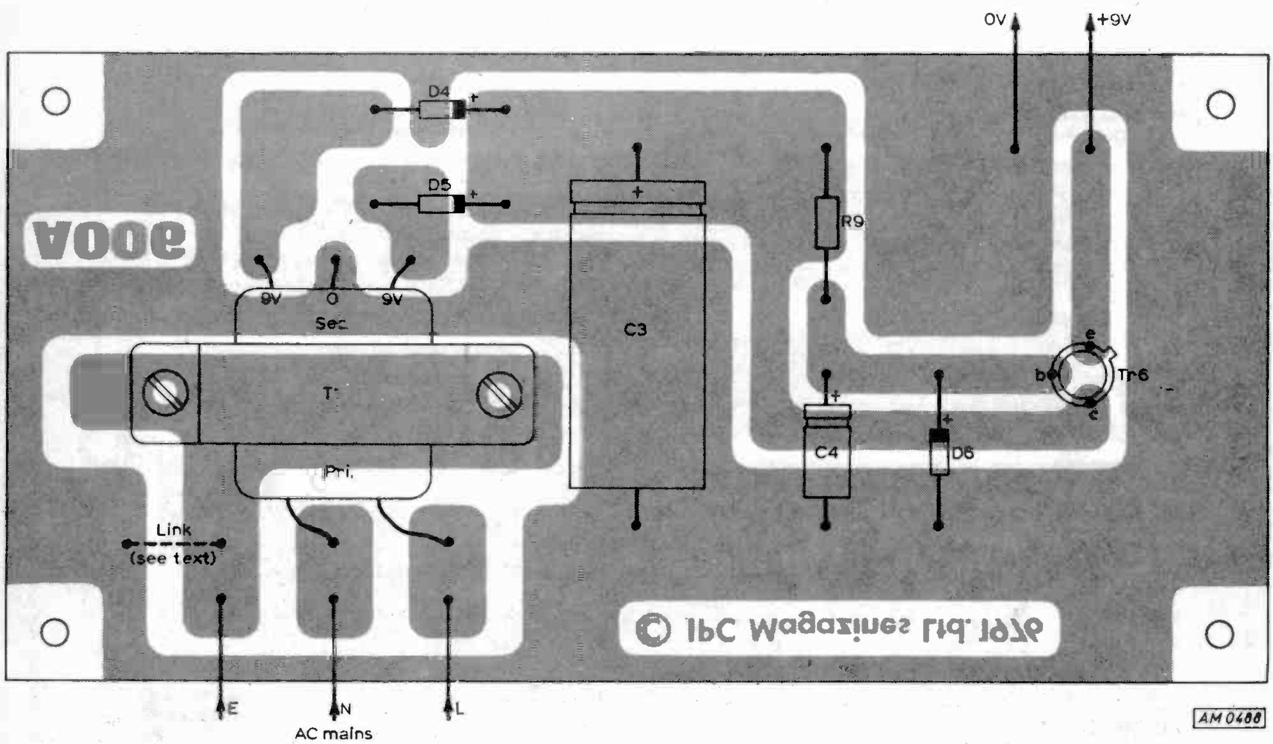


Fig. 7. The schematic diagram of the mains unit.

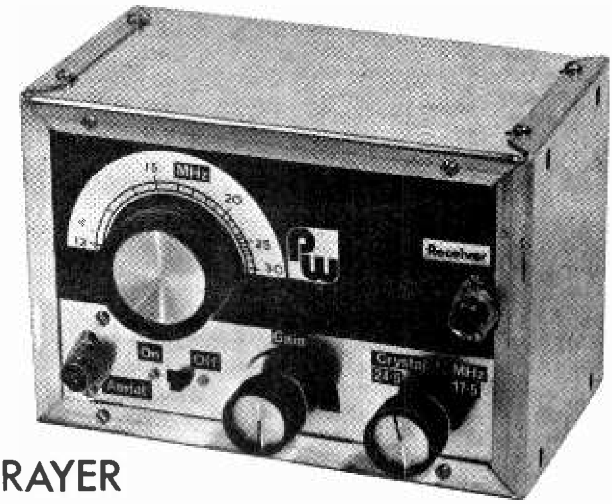
Construction

Except for the mains switch, all components are mounted on a single PCB similar in size to the electronics board described last month. Fig. 8 shows the wiring pattern for this board whilst Fig. 9 is the component side of the board. The position for the earth link is shown quite clearly.

Fig. 9. The component side of the etched board giving the location and orientation of the components used. The wiring pattern is shown as if the board were transparent. This assists the correct insertion and circuit checking.



Crystal Controlled Converter
for HF bands F. G. RAYER



THOUGH this converter is primarily intended for 14, 21 and 28MHz Amateur bands, it also covers additional frequencies in the 12-30MHz region. The output of the converter is approximately the 2·5-5·5MHz region, the converter and receiver operating as a "tunable IF" arrangement. The converter thus allows HF band reception with a receiver otherwise unable to cover these frequencies. Numerous surplus and older receivers are able to give a good performance in the 2·5-5·5MHz range, so can give good HF band results with a converter. The converter also assures very good sensitivity, and an enormous improvement in second-channel rejection of interfering signals, compared to the performance of a receiver with one RF stage, and an IF of 470kHz. An incidental advantage is the "spread out" tuning which is obtained. A general-coverage receiver may tune the whole range from 28-30MHz

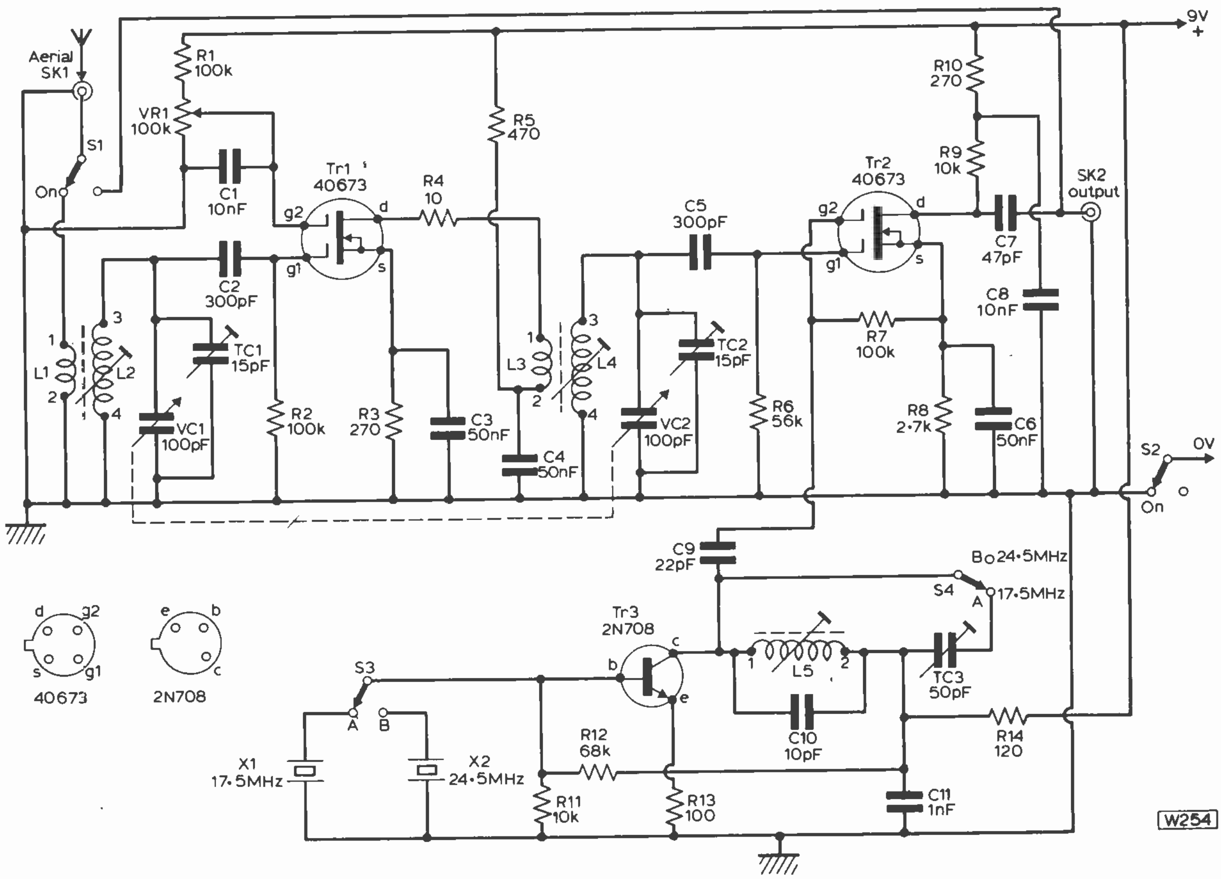


Fig. 1 : Diagram of the complete circuit of the crystal controlled converter. The circuitry is divided into two sections with the RF circuitry housed on one board, and Osc./mixer housed on another.

over a very small section of the scale, but with the converter in use this coverage would be from 3·5-5·5MHz on the receiver, which is likely to be a large part of the receiver tuning scale.

Crystal Frequencies

With a fixed frequency crystal controlled oscillator, and tunable IF (the receiver), signal frequencies lie either above or below the oscillator frequency, and differ from the oscillator frequency by the frequency to which the receiver is tuned.

As an example, assume the oscillator frequency is 24·5MHz. If the receiver is tuned to 5·5MHz, signals at 24·5 *plus* 5·5=30MHz will be received. When the receiver is tuned from 2·5MHz to 5·5MHz, reception is over the range 27-30MHz. At the same time, wanted signals could lie at the other side of the oscillator frequency. For these, 24·5MHz *minus* Receiver Frequency=reception frequency. Thus the same receiver tuning range allows 19-22MHz to be covered. The required frequencies in the 27-30MHz or 19-22MHz ranges are selected by aerial and RF circuits tuned to the wanted frequency. In this way, a 24·5MHz crystal can provide both 21 and 28MHz Amateur bands.

The converter uses two crystals, 24·5MHz and 17·5MHz. The latter thus gives reception over the 12-15MHz range and the 20-23MHz range.

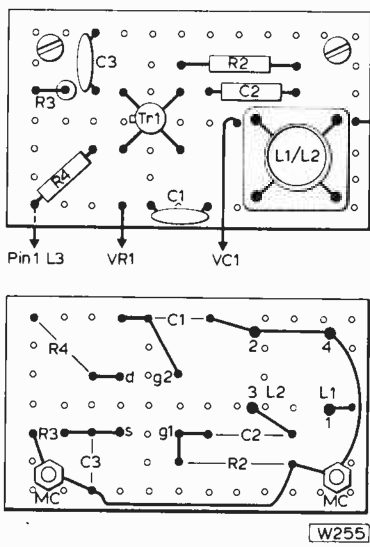


Fig. 2. Shown above are both sides of the RF board which contains Tr1 and the aerial coupling coil L1/L2.

It will be observed that tuning the receiver outside the 2·5-5·5MHz limit extends the converter range, if wanted. It is also possible to utilize only a single crystal, if main interest is in 21 and 28MHz bands, and if the receiver is considered satisfactory at 14MHz, or includes this. It is also worth noting that if the crystal oscillator frequency is correct, the frequency of signals tuned in with the converter can be read off from the LF scale of the receiver.

★ components list

Resistors

R1	100kΩ	R8	2·7kΩ
R2	100kΩ	R9	10kΩ
R3	270Ω	R10	270Ω
R4	10Ω	R11	10kΩ
R5	470Ω	R12	68kΩ
R6	56kΩ	R13	100Ω
R7	100kΩ	R14	120Ω

Capacitors

C1	10nF	C8	10nF
C2	300pF mica	C9	22pF mica
C3	50nF	C10	10pF mica
C4	50nF	C11	1nF
C5	300pF mica	TC1	15pF trimmer
C6	50nF	TC2	15pF trimmer
C7	47pF mica	TC3	50pF trimmer

VC1/2 Jackson U.102, 2-gang, 100pF each section.

Semiconductors

Tr1	40673	Tr3	2N708
Tr2	40673		

Miscellaneous

X1, 17·5MHz crystal. X2, 24·5MHz crystal. Plug-in sockets for the crystals. S1/S2, DPDT slide switch. S3/S4 DPDT rotary switch. Two co-ax sockets. 178 x 127 x 101mm Universal chassis with extra 178 x 127mm flat plate and 175 x 101mm flanged runner. (Home Radio) Mixer/Osc. board 0·15in matrix plain perforated board 87 x 50mm. RF board, 0·15in matrix plain perforated board 50 x 32mm.

RF and Mixer

Tr1, Fig. 1, is the RF stage, with aerial coupling winding L1, and winding L2 tuned to VC1. VR1 allows gain to be reduced. Drain primary L3 couples to L4, tuned by VC2. L2 and L4, with the 2-gang capacitor VC1/2, cover approximately 12-30MHz. TC1 and TC2 are for trimming these circuits, and no band-switching is required. The mixer Tr2 provides output for the receiver via C7.

S1/S2 is a DPDT switch, and in the "on" position, the aerial is connected to L1, and the battery negative circuit is completed. With the switch "off" the aerial is directly to the output socket, so that the receiver can be used on its LF bands without having to change connections by hand. If the converter is for permanent use with a receiver not employed for other frequencies, S1 can be omitted.

Oscillator

Oscillator frequency is controlled by the DPDT switch S3/S4. With S3 at B, the 24·5MHz crystal is in use, L5 being core-tuned to resonance and having C10 in parallel. With the switch in the A position, the lower-frequency crystal is in use, and TC3 is across L5 and C10, and is adjusted so that the oscillator is working at this frequency. Injection to the mixer gate is via C9.

When the oscillator is first tested, place a meter in series with R14. Tr3 should draw about 2-3mA,

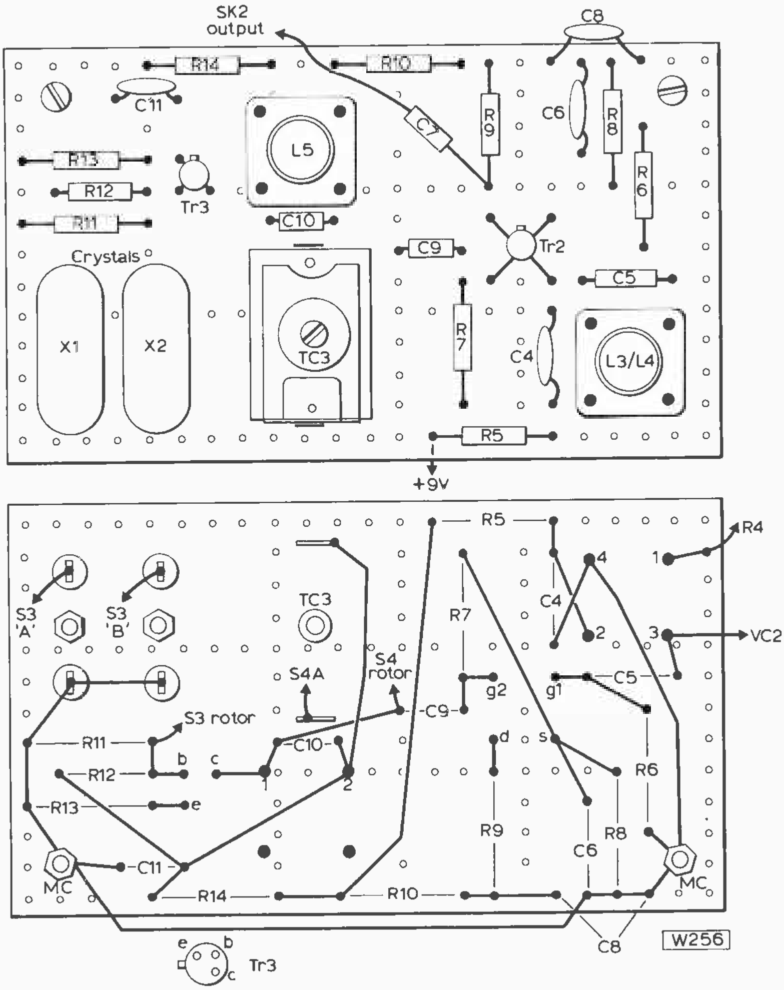
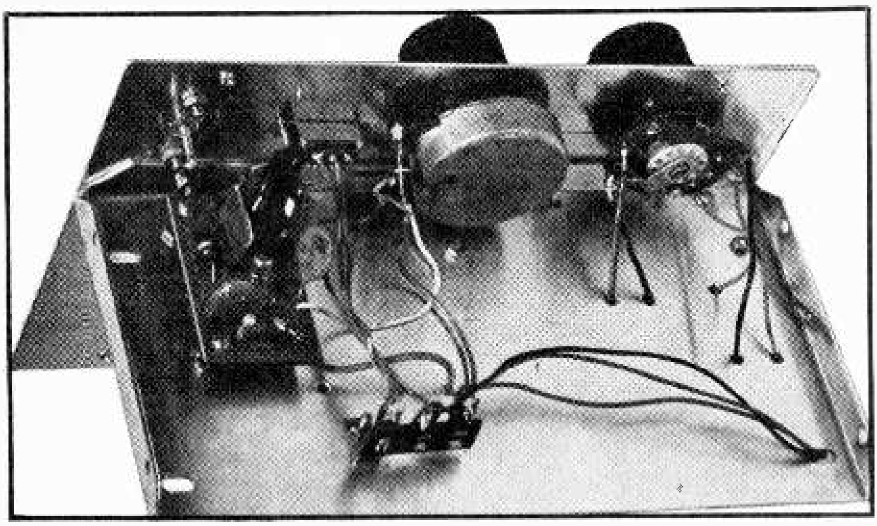


Fig. 3 Containing both crystals, the Oscillator/mixer board shown to the left is constructed from 0·15in. matrix plain perforated board.

which rises to about 4-12mA when oscillating. First adjust L5 core for the higher frequency crystal, then switch to the lower frequency and adjust TC3. These adjustments are not critical, but if Tr3 is not oscillating, the converter cannot function. Check that oscillation commences when switching on, as this usually requires L5 and TC3 to be set slightly off the peak settings giving strongest oscillation.

Inductors

All inductors are wound on 7mm diameter formers about 25mm long, with adjustable cores. Some change to diameter or wire gauge is unlikely to be



Photograph showing the underside of the unit, which houses the RF board and tagstrip.

important, provided the coils can be tuned correctly. Point 3 of L2 is near the tagged or board end of the former. Wind $15\frac{1}{2}$ turns to point 4. Immediately adjacent, wind $5\frac{1}{2}$ turns in the same direction, beginning at Point 2 and ending at point 1, for L1. L4 starts at point 4 near the board, and has $15\frac{1}{2}$ turns to point 3. L3 has $6\frac{1}{2}$ turns, in the same direction as L4, starting at point 2 and ending at point 1. All windings (including L5) except L3 are of 24SWG enamelled wire with turns side by side. L3 is thinner insulated wire such as 32SWG silk covered, overwound near the earth end of L4.

L5 is 17 turns with the windings secured by a touch of adhesive at the ends. If the formers have tags, shape the ends to solder to these. If there are no tags, leave the wire ends long enough to run down to the required connecting points.

RF Board

Components for RF are located on plain perforated board, 0·15in matrix, and 50×32mm, Fig. 2. Each point MC is a 6BA 12mm bolt with tag. Later, extra nuts allow the board to be locked to the chassis with about 6-9mm clearance.

Drill a hole in the chassis so that a lead can pass straight through from pin 3 of L2, to VC1. Leave flying leads for S1, VR1, and from R4. The lead from R4 passes up through the chassis near L3.

OSC/Mixer Board

The osc/mixer board is prepared in a similar way, and is 87×50mm, 0·15 matrix, Fig. 3. The crystals are small plug-in types with 12mm spacing, but suitable crystals are made with different pin arrangements. It is necessary to use fundamental crystals, not overtone type crystals which are of lower frequency.

Wiring is carried out as for the RF board. Leave a pin or projecting lead from 1 of L3, so that the wire from R4 can be soldered on. A short wire, shaped to reach VC2, is soldered to the latter when the board is fixed. Drill holes in the chassis under the crystal tags and Tr3 base, so that leads can run down to S3 Fig. 4. Two further holes near TC3 are for the leads to S4. When the board is fitted, cut these leads to suitable length and solder them to S3 and S4 (see Fig. 1). If the reduced frequency coverage mentioned is sufficient, omit one holder, S3/S4, and TC3.

As Tr1 and Tr2 are gate-protected devices, no special care is needed in fitting them, except for that generally exercised to avoid overheating while soldering connections.

The trimmers TC1 and TC2 are soldered directly to VC1 and VC2, as in Fig. 5. These trimmers must have a low minimum capacitance, so that 30MHz can be reached, and 60pF trimmers are unsuitable.

For 'straight through' working a lead runs from S1 to the output socket, and this should be clear of the RF and mixer boards, emerging near the panel and C7.

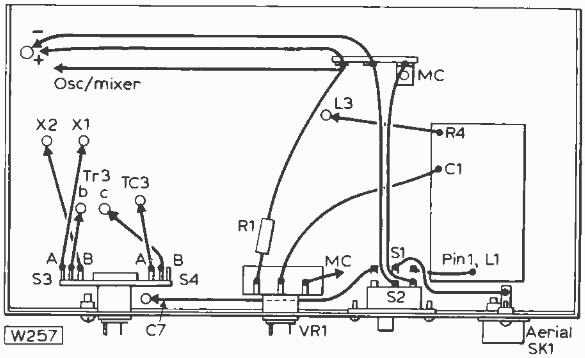


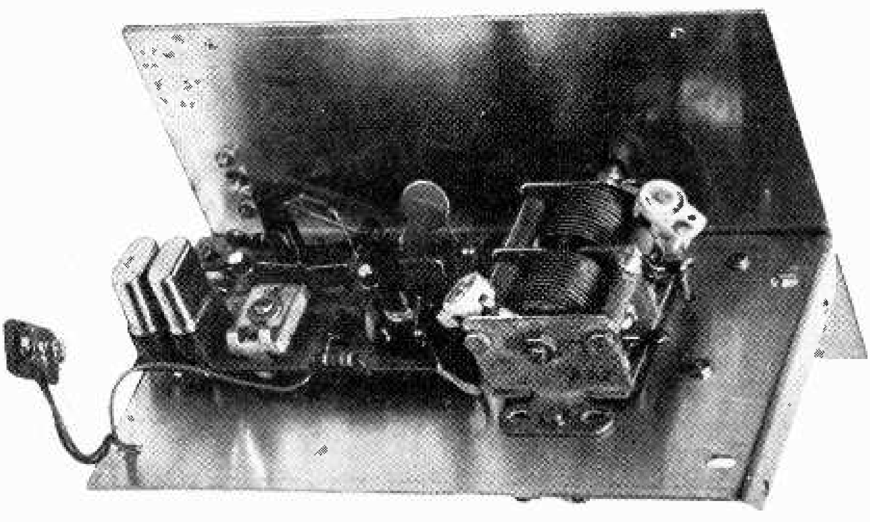
Fig. 4. Under chassis view of the RF board, switches S2, S3 and S4, volume control VR1 and aerial socket Sk1.

Metal Case

A metal case is essential to prevent pick-up at the frequencies to which the receiver is tuned, and is made from universal chassis members. A 175×100mm flanged member forms the converter chassis, and 6mm must be cut from the back of this, if the case flanges are to fit outside the panel.

Drill the panel and chassis so that items can fit

continued on page 518



Topside view photograph, showing the Oscillator/mixer board, and the position of the tuning capacitor VC1/2.

RADCOMEX 76

DAVID GIBSON G3JDG

NORTH, south, east and west, they come from everywhere to Radcomex, the first in a new series of Radio Communications Exhibitions, sponsored by the R.S.G.B., which took place at Alexandra Palace, London on July 30, 31 and August 1.

Day one saw a happy band of eager bargain hunters hoping for the choice pickings (and getting them) and many exhibitors were pleasantly surprised by the high level of activity. "We expected a quiet first day," said one.

Nearly 5,000 potential buyers invaded the Great Hall at Alexandra Palace and left clutching their bargains. It was an event of immense interest to anyone connected with Amateur radio, but it was also a bonanza for all radio and electronics constructors who found a wealth of items on offer including massive component varieties, black boxes, receivers, converters and counters.

Bargains were rife throughout the exhibition. Crystals were on sale at 40p and for the same price one could even buy a crystal oven. Four-gang 300pF variable capacitors were offered at only 75p (just check the prices of that component in catalogues today), and for v.h.f. tyros, transistors giving 5W at 175MHz could be had for only 70p. Bill Sears, a visitor from Brighton confided gleefully, "Everything I've bought is a bargain".

AROUND THE STANDS

Perhaps the busiest stand at the exhibition was that of radio component suppliers J. Birkett of Lincoln. The stand offered a truly fantastic array of components both active and passive. All items had been laid out with the greatest of care, each class of component being in a separate compartment and very clearly labelled. All the effort certainly paid off and one always had to push (just a little) to get at the Birkett goodies. With quartz crystals offered at only 40p and hundreds of other components at give-away prices, the pushing/queuing proved well worth while.

The feminine touch was provided by Cobham Engraving Company. Under the banner of "ZNI" callsigns, the company engraves some very attractive plaques, name plates and lapel badges. Mike Hawkins (G3ZNI himself) explained ,"It's really my wifes company, I just help out".

Frank Chable, a director of distributor Doram explained that his company (a stablemate of Radiospares/Electrocomponents) had made certain changes in direction. It has progressed from being a pure component distributor to supplying an expanding range of kits.

Of the exhibition itself Chable had very definite ideas. "I like the response, the number of people, and I like the space—no overcrowding; I really hope the RSGB make a go of it."

Life had its ups and downs at Radcomex, especially for Clarbrook. This company showed a range of aerial masts which are raised and lowered by compressed air. Either a car tyre pump (foot operated) can be used or, for the more leisurely bretheren, the Clarbrook special mains operated "Mast pumper-upper" can be employed. Doubtless it is rated at quite a few pFs.

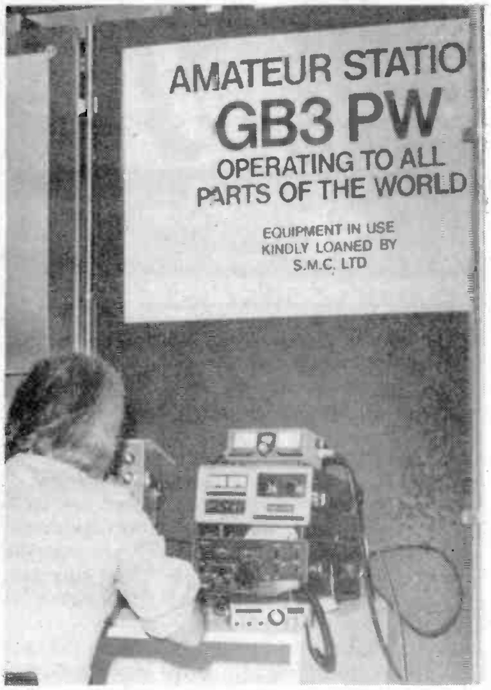
Readers near Wallington in Surrey will be pleased to hear that the Amateur Radio Bulk Buying Group has just opened a new showroom in Wallington. The company is already strong in components but in its new showrooms it will be stocking and exhibiting a full range of Amateur transmitting and receiving equipment also.

Steve Dean of Axial Products fame is an old exhibition addict. He claims that most three-day exhibitions follow a pattern; first day hectic (eager types looking to bag the best bargains); second day quiet; third day hectic (people who wished they'd gone on the first day).

The BBC engineers put on a convincing show of CEEFAX. The big question they are asking now is—what will happen when the experimental transmission stop officially in September.

Graham Berrell of the BBC engineering information department thought that if the CEEFAX service started, then the initial cost would be another £100-£200 on the price of a colour television receiver. However, he thinks that if the idea really caught on and production levels rose, then the cost could drop through mass production to as low as £30.

The R.S.G.B. page, transmitted and decoded by the B.C.C., Ceefax service. Photo taken "Off-Air".



On the left, part of the Practical Wireless Amateur Radio Station and its operator, Lionel Howes.

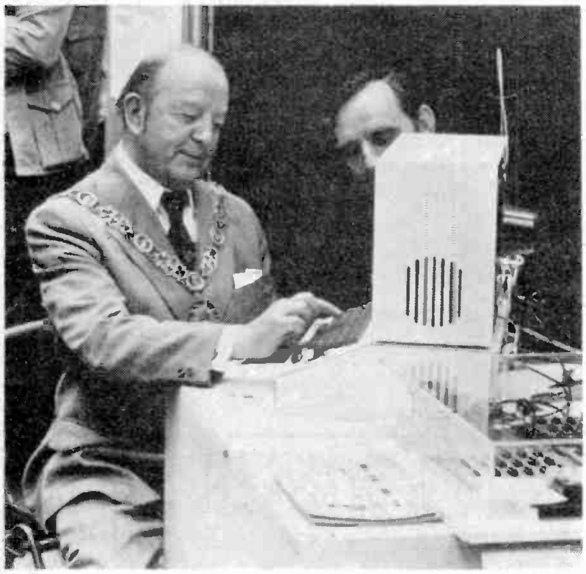
On the right, the road map and control desk for the "Talk-In" service.

The exhibition boasted several Amateur radio stations on the air, including four operated by the R.S.G.B. and one on the *Practical Wireless/Television* stand (GB3PW).

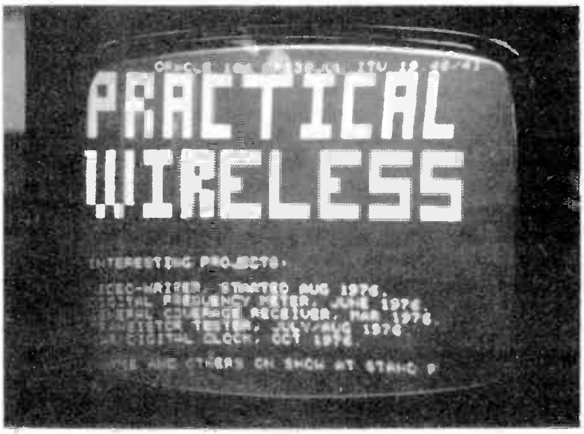
Among the many exhibits which ranked high in terms of interest was the Easybuild Video-Writer shown on the *Practical Wireless* stand. It exerted a strange attraction on all who passed and many, too shy to demonstrate their literary talents, settled for seeing their own name in print on the monitor screen after trying their hand at "writing" using the keyboard.

Also of interest on the *Practical Wireless* stand was an array of recent past projects and a sneak preview of some which are scheduled to appear in future issues of the journal.

The "Television" side of the stand featured their Teletext decoder kit. It is claimed to be the world's first kit for home constructors for decoding and displaying the ORACLE and CEEFAX television information display systems. The kit will be complete with PCBs, etc. The unit will be an r.f. to r.f. type decoder thus no mods will be necessary to the "insides" of TV sets.



The Mayor of Haringey. Mr. Vic Butler, and his Chief Executive, Mr. Royston Limb, typing a "welcome" message on the Practical Wireless Video-Writer.



An "Off-Air" photo of the Practical Wireless page transmitted by the I.B.A. Oracle service and decoded by the "Television" home constructor unit.

Tucked up in a corner but bubbling with friendly enthusiasm was the Radio Amateur Invalid Bedfast Club. Anyone who is disabled is very welcome to join but helpers may also become members. The club has its own nets: 3750kHz SSB on Tuesdays (1000hr) and Wednesdays (1400hr). There is also a

continued on page 526

EXTRA!

8 PAGE SUPPLEMENT

IN NEXT MONTH'S PRACTICAL WIRELESS

CAR ELECTRONICS

'Cirtest' Probe

Low Level Battery Indicator

Burglar Alarm

Electronic Thermostat

You may not own a Rolls or Lamborghini, but our November issue is the next best thing. We'll show you how to equip your lowly buggy with electronic gadgets that'll make your car safer, cheaper to run, less prone to breakdowns and easier to work on. Be the envy of your friends.

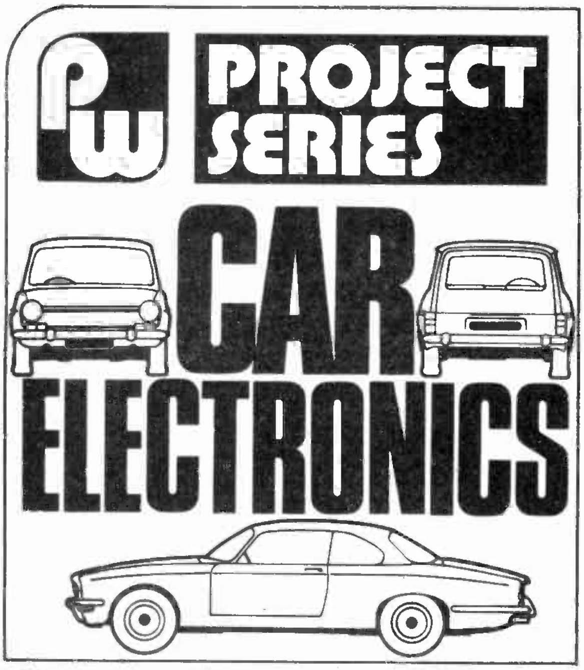
PLUS MANY OTHER FEATURES

ON SALE IN OCTOBER

VIDEO WRITER Part 4

HAVE YOU STARTED TO CONSTRUCT THIS PROJECT YET?

Parts 1-3 have covered the Power Supply and Sync Generator Board. Part 4 covers the Address Counters and Registers.



DIGITAL CAR CLOCK

DURING the last few years many articles have appeared on various types of digital time-keeping devices. There is one type of digital clock, which we present here, which has not yet been described. That is a good attractive and relatively low-cost car clock. The features that distinguish this clock from mains powered clocks are as follows:

(a) The car clock has to generate its own 50Hz timing signal.

(b) Most of the time it operates off the car battery—that is off 12V, but if this drops too low, when starting or in cold weather, or if disconnected, it runs off its own internal backup battery.

(c) The design includes a two-position intensity control switch. The display can be bright during the day and dim at night so as not to distract the driver.

Circuit description

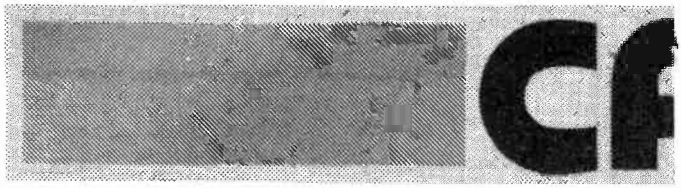
The complete circuit diagram of the clock is shown in Fig. 1. One quarter of IC3, gate A, is used as a 3·2768MHz crystal oscillator. R3 biases the gate in its linear region, and X1 and its associated capacitors create positive feedback at the crystals parallel resonant frequency, making the circuit oscillate. R4 reduces the drive to the crystal and reduces the amount the frequency shifts when the supply voltage is varied. In practice the frequency changes by about 2ppm when the voltage is reduced from 12V to 5V. Constructors may be interested to know that the accuracy of their clock should be a bit better than that of most currently available digital watches. This is because the current drawn by the IC's of a digital watch is approximately proportional to its crystal frequency. The manufacturers have made this as low as possible, in practice 32·768kHz (2^{15}Hz). They usually use a rod-shaped piece of quartz supported at each end called an XY-bar. The timebase in this clock uses a 3·2768MHz "AT CUT" crystal, (2^{16} x 100Hz) which is a thin disc of quartz supported at two points on its circumference with electrical contact pads on each face, Fig. 2.

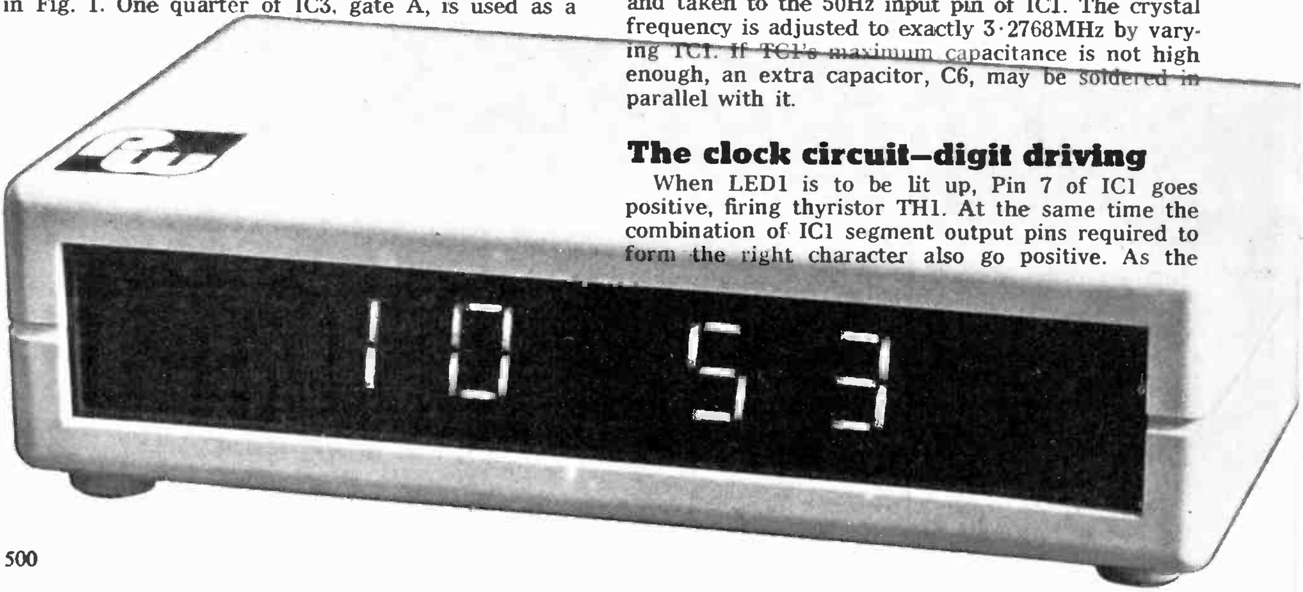
The XY bar crystal has a parabolic temperature coefficient, so there is no reasonably wide range of temperature over which its resonant frequency is constant. The AT-CUT crystal has an "S" shaped temperature coefficient, and its frequency may be virtually stable over a range of 10°C to 50°C, giving a higher accuracy than its watch counterpart. When carefully adjusted the clock should be accurate to within a few seconds per month.

Returning to the circuit in Fig. 1, the oscillator output is divided by 2^{14} by IC2, a 4020, 14-stage binary counter, to 200Hz, and then to 50Hz by IC4, a 4013 dual "D" flip-flop used as a divide-by-four counter. The 50Hz signal is then buffered by gate B of IC2 and taken to the 50Hz input pin of IC1. The crystal frequency is adjusted to exactly 3·2768MHz by varying TC1. If TC1's maximum capacitance is not high enough, an extra capacitor, C6, may be soldered in parallel with it.

The clock circuit—digit driving

When LED1 is to be lit up, Pin 7 of IC1 goes positive, firing thyristor TH1. At the same time the combination of IC1 segment output pins required to form the right character also go positive. As the





M. FISCHER

AR CLOCK

★ Specification

Display:	4 digits: hours and minutes 12·5mm character height Red Peak segment current 130mA Average segment current 19·5mA
Case:	Colour: white with red display window Size: 40mm x 154mm x 85mm
Approximate power consumption:	Displays off: 14mA Displays on dim: 25mA Displays on bright: 340mA On battery backup: 9mA

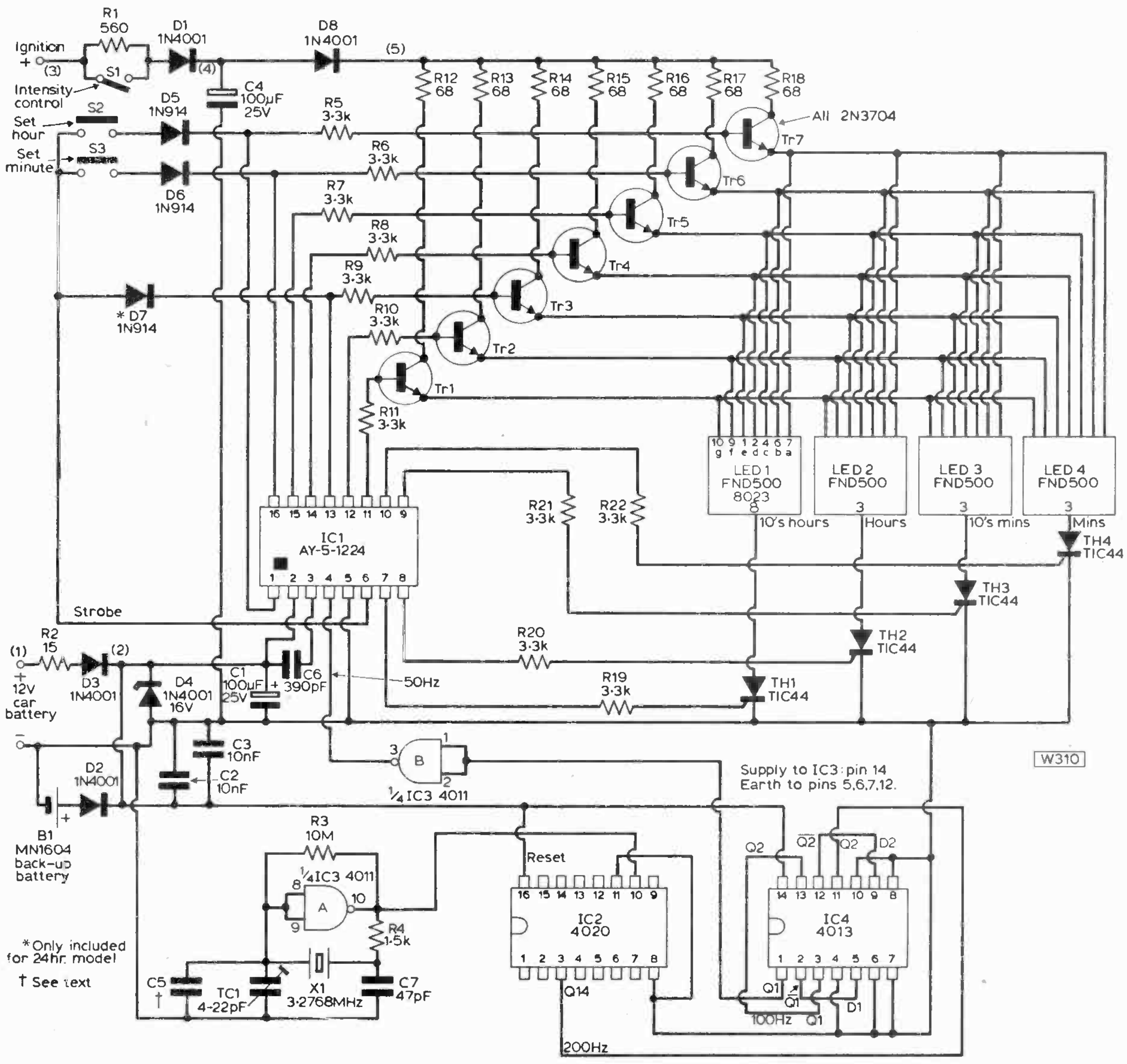


Fig. 1: Main circuit diagram of the digital car clock. Certain components may be altered or left out completely, but constructors should refer to the text for details. Supply to IC3(4011) is to pin 14, while OV is to pin 7

emitters of the segment driving transistors Tr1 to Tr7 cannot now go more than about 2V positive of 0V because of conduction by LED1 diodes and TH1 a current of about 3mA flows in the bases of the selected transistors and these turn hard "on". This causes about 130mA to flow through each of the required LED1 segments. The magnitude of this current is set by resistors R12 to R18. The peak digit current can be as much as 910mA, hence the use of thyristors TH1 to TH4.

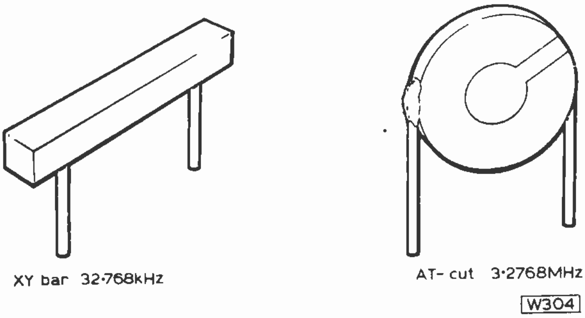


Fig. 2: To the left is shown an XY bar crystal as used in most digital watches. To the right is the type of crystal used in this project—an AT-CUT crystal.

When LED1 has been on for about 200μS the driving signals from IC1 go low, the segment driving transistors turn off, and thyristor TH1 turns off because there is no longer any current flowing through it. For an interval of about 60μS, called the inter-digit blanking time, no digits are selected, the sequence is then repeated for each of the digits in turn. Thus, although the eye sees a continuous display of four digits, what is actually happening is that the displays are flashing on one at a time, in sequence. This is called a "multiplexed" display. After the 10's of hours digit has flashed, there is a pause during which a positive pulse appears on the strobe line of IC1, pin 6. The IC then "examines" pins 1, 11, 12, 13, 14, 15 and 16.

If D7 has been included, pin 13 will be pulled positive, and IC1 will know that it is to operate in the 24hr mode. Also if S2 or S3 is being pushed, pin 16 or pin 1 will go positive and the IC will know that it must either advance the minutes or the hours digits.

Power supply

(all voltages given are with respect to 0V)

If the car battery voltage is 12V, point (1) will be at 12V. Point (2) will be about 11·1V due to the drop across R2 and D3. If B1's voltage is 9V, D2 will be reverse biased, and no current will be taken from B1. If the car battery voltage drops below 9·3V, due to starting or disconnection, point (2) will drop below 8·4V, D2 will be forward biased and the clock IC and crystal timebase will draw power from B1. R2 and D4 protect the circuitry from high voltage spikes on the car power supply, while the power for the displays is taken from the ignition switch.

When the ignition is off, point (3) is at 0V, the display drivers do not function, and the displays are off. In fact the displays will be on, but very very dim because the 3mA output from IC1 segment driving pins will flow through the displays giving them one fortieth of their "on" brightness. When the ignition is turned on, point (3) will go to +12V, and if S1 is closed, point (5) will go to +10·6V, and the displays will light up properly. If S1 is opened the total display current is limited by R1, and the intensity drops to a level suitable for night driving. R1's value can be adjusted to individual taste. Constructors who intend to use the clock in an application where battery back-up will be used frequently, should place a 1·5V battery in series with B1 to increase the back-up endurance.

Using soldercon pins

Cut off two 8-pin and eight 5-pin strips of soldercon pins, insert the two 8-pin lengths into the IC1 position on the clockboard with their carriers outwards and solder *only one* pin near the middle of each row. Inspect the pins and ensure that they are both vertical and flush with the PCB—if in doubt, reposition them with a fingertip while re-melting the solder. If the pins are not flush with the PCB they will have reduced resistance to tilting. Solder the remaining pins. Break off the carrier strips by twisting them right over backwards and up again several times, using long-nose pliers. In general, don't do this breaking off until all the soldering near the pins is finished as individual pins will topple over if the solder holding them melts. If you do want to solder near pins without carriers, first insert an IC to hold the pins in position.

Similarly use the eight 5-pin strips to make the sockets for the displays. Insert the displays into their sockets, the FND 500's have grooves at the top, TIL 322s have writing on the bottom. If you are using TIL 322s first shorten the leads to 4mm. The display board is the right way up when its markings are the right way up. Now using a pair of wire cutters, cut the 8 mounting pillars off the inside of the top and bottom halves of the case by "nibbling" around them until they come away. Mount and solder four tinned copper wire links on the display board as shown in Fig. 3.

Mounting the display

Prepare two pieces of stiff tinned copper (22SWG) wire as shown in Fig. 4 and insert them through the holes in the clock board marked "M", Fig. 5. Now solder them as shown in Fig. 4 and solder to the display board as shown in Fig. 6, with a 2mm

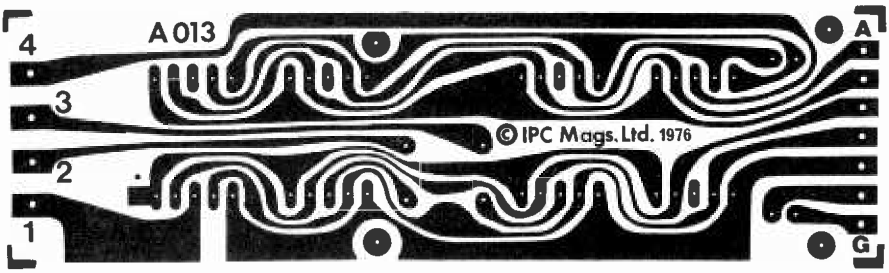


Fig. 3: Display PCB showing the foil side to the left and the component overlay to the right. Notice the four wire links required to bridge the tracks.

gap between the clock board and the display board. Solder the struts to the display board, bend the ends over on the front and trim them off.

Place the partially assembled module in the bottom of the case with the aluminium rear panel and perspex front panel in position. The back edge of the clock board should be pressed up against the aluminium panel, resting on the plastic lip. If the displays protrude too far forward, put a kink in the struts to pull the display board closer to the clock board. Adjust the module so that the displays are central, and mark the positions of the two mounting holes at the rear of the clock board in the bottom of the case. Drill these out to 3mm dia.

Mount and solder the soldercon pin sockets and components, including the crystal, on the crystal board as shown in Fig. 7. Do not yet insert the ICs into their sockets. The crystal should be mounted without bending its leads, or the seal between them and the case may be broken. The leads should be cut to 5mm. Now using a small piece of double-sided self-adhesive tape, fix the crystal to the PCB with its leads vertically above its mounting holes. Use two pieces of tinned copper wire with one of their ends bent into a "walking stick" hook to connect the crystal leads to the PCB.

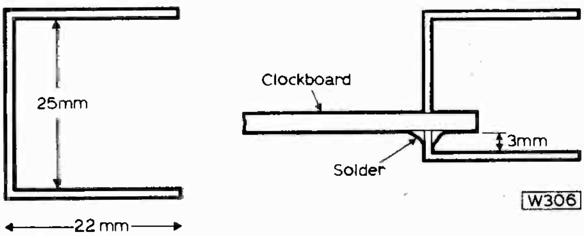


Fig. 4: To attach the Display board to the Clock board, two pieces of stiff 22SWG wire are bent to the above shapes and soldered as shown.

Wiring

Building a clock with very neat wiring involves more work than building one with untidy wiring, but the extra pleasure obtained is well worth the effort. Prepare two pieces of flat (ribbon) cable, strip and tin the ends, then trim the tinned ends to an apparently very short 3mm. Form cable to the shape shown in Fig. 8 and connect the "a" to "g" pads on the bottom of the clock board to the "a" to "g" pads on the display board. Similarly connect pads 1 to 4 on the right of the display board to the 1 to 4 pads on the bottom of the clock board. In each case the PCBs have been arranged so that the sequence of connections is the same on both PCBs. Wire up the clock board, the crystal board, back-up battery clip and the switches and power supply wires as shown in Fig. 1. A temporary 560Ω resistor, RX, should be included in series with the wire going to the ignition pad.

★ components list

Resistors

R1	560Ω	R12	68Ω
R2	15Ω	R13	68Ω
R3	10MΩ	R14	68Ω
R4	1·5kΩ	R15	68Ω
R5	3·3kΩ	R16	68Ω
R6	3·3kΩ	R17	68Ω
R7	3·3kΩ	R18	68Ω
R8	3·3kΩ	R19	3·3kΩ
R9	3·3kΩ	R20	3·3kΩ
R10	3·3kΩ	R21	3·3kΩ
R11	3·3kΩ	R22	3·3kΩ

All ¼W 10% except R12-R18 which are ⅛W 10%.

Capacitors

C1	100μF 25V	C4	100μF 25V
C2	4·7nF to 10nF	C5	see text
C3	4·7nF to 10nF	C6	390pF
		C7	47pF—see text

TC1 4 to 22 pF trimmer type Mullard 808 00006

Semiconductors

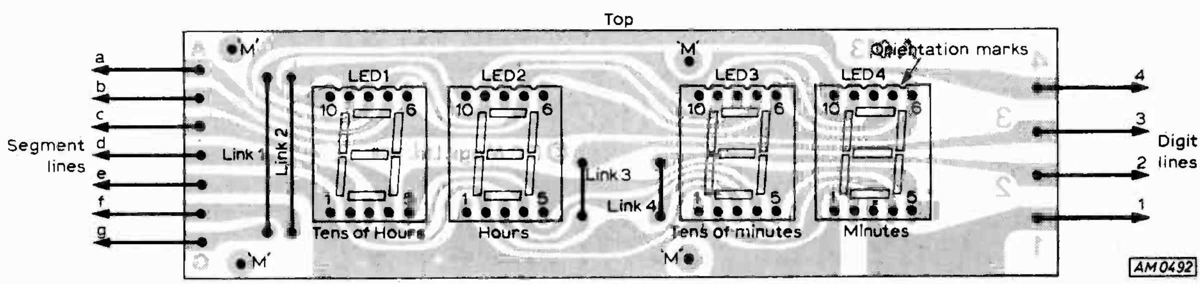
Tr1	2N3704	D8	1N4001
Tr2	2N3704	TH1	TIC44
Tr3	2N3704	TH2	TIC44
Tr4	2N3704	TH3	TIC44
Tr5	2N3704	TH4	TIC44
Tr6	2N3704	IC1	AY-S-1224
Tr7	2N3704	IC2	4020
D1	1N4001	IC3	4011
D2	1N4001	IC4	4013
D3	1N4001	LED1	FND500
D4	BZY88 400mW 15V zener	LED2	FND500
		LED3	FND500
D5	1N914	LED4	FND500
D6	1N914		
D7	1N914 (only included for 24-hour mode)		

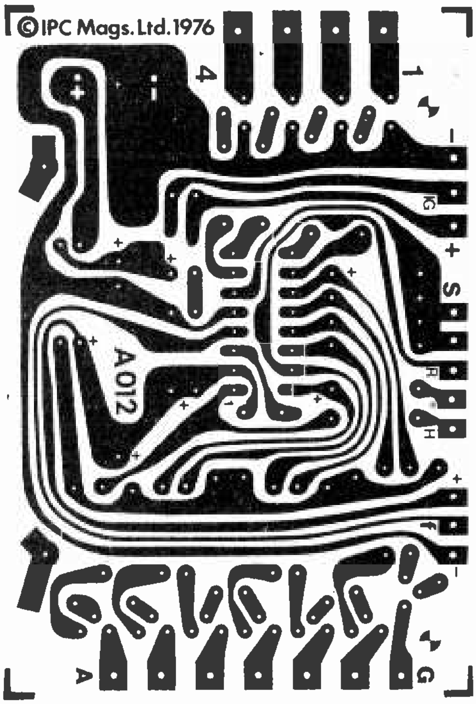
Miscellaneous

S1, single pole changeover switch. S2 and S3, single pole push-to-make miniature switches. X1, 3·2768MHz crystal. ICI perspex R400 display window 3 x 29 x 142mm. Length of flat cable of at least 7 insulated wires. Double-sided adhesive foam. 100 Soldercon pins. White Vero case type 75-1237J. 22SWG tinned copper wire. PP3 battery clips. PP3 Manganese battery. Screws, nuts and grommets. Clock PCB 60 x 90mm. Crystal timebase PCB, 50 x 45mm. Display PCB, 115 x 32mm. All three boards available from the PW Readers PCB Service (page 485).

Testing

If any step at all is not perfect, disconnect from power and find and correct fault before going further. Check that all the soldercon pin carrier strips have been broken off.





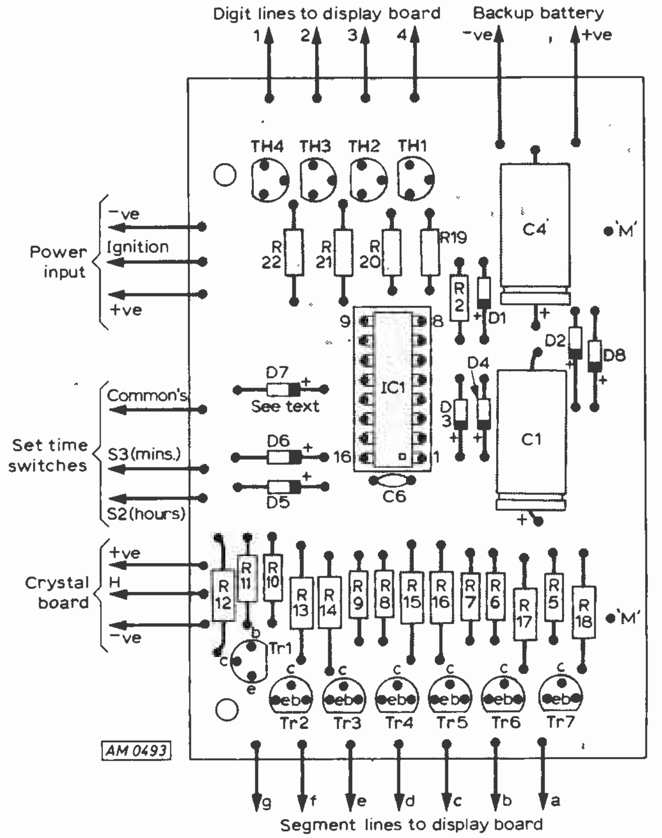


Fig. 5: Clock PCB containing IC1, an AY-5-1224 12/24hr clock circuit. Also contained on this board are the LED drivers, Tr1 to Tr7, switching thyristors TH1 to TH4 and smoothing components. D7 is included for 24hr mode only.

Connect a 9V battery to the backup battery clip, with a multimeter set to its 500mA range in series with one of the leads. No current should flow and the displays should be off. Remove the meter, connect the battery directly to the clip and check that there is approximately 9V between the following points, with the polarity indicated:

IC1 socket pin 2 (+), pin 5 (−)
IC3 socket pin 14 (+), pin 7 (−)

MOS handling

Check that the power is off. Insert all the ICs as follows:—

(a) Remove IC from its conductive foam or foil, holding the IC with the right hand, while the left hand holds the foam or foil. The right hand should be touching some of the pins. If the IC has not been used before, its leads will probably be splayed apart and will need pushing together. Do this with your fingers. The leads almost always require more bending than one expects.

(b) Hold the PCB with the left hand making contact with some tracks. Maintain this contact during the next step.

(c) Insert the IC into its socket, the right way round. Don't be afraid to use a fair amount of pressure to plug an IC into a new soldercon socket. To remove an IC reverse this procedure.

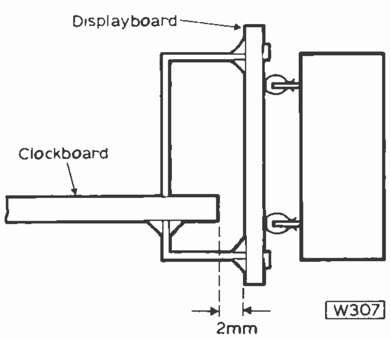


Fig. 6: The Display board should be attached to the Clock board as shown above. The ideal distance between the boards is about 2mm, however the wire may be bent to alter this distance if required.

Now connect a 9V battery between the point (1) position and the 0V lead with a multimeter in series with one of the leads, set to its 50mA range. A current of about 9mA should flow and an extremely dim display of zeros should appear. Now connect point (3) to +9V as well, with S1 closed. The current drawn should rise to about 17mA and the display should show dim zeros. Push the "set mins." button S3 and the "set hours" button S2 to check that all numbers are correctly displayed. Note that IC1 has built into it a "leading zero blanking" feature which turns the 10s of hours digit off, if it is a zero but only when the clock is in the 12 hour mode. Thus it will only come on to show a 1 or a 2.

Disconnect the batteries and connect the point (3) lead straight to the clock board, removing RX from the circuit. CAUTION: this will allow normal display currents to flow. If there are any faults present they may cause a digit to stay on continuously (due to multiplexing, a digit is normally only on one sixth of the time) and this may blow the digit and its associated thyristor. Connect power again with the

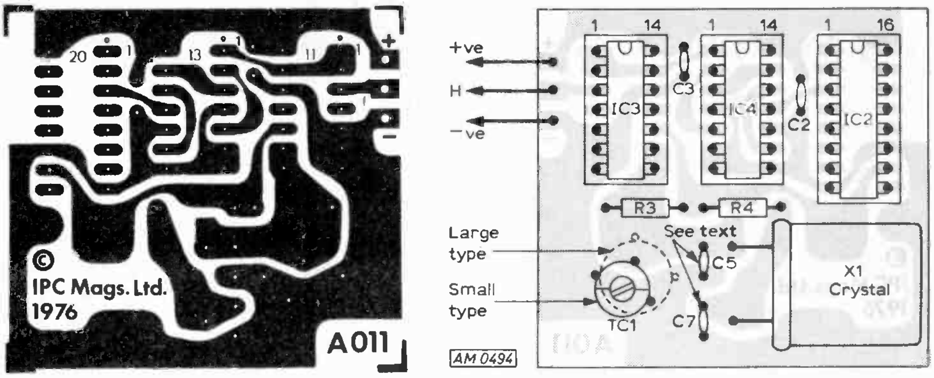


Fig. 7: Crystal PCB showing both foil and component side. Notice the provision made for the two sizes of trimmer available, and the ready drilled holes for the optional capacitor C5.

multimeter in series with the OV line set to its 500mA range (OV to OV, +9V to points (1) and (3) and the back-up battery in its clip). The display should be fairly bright drawing approximately 130mA. Although full brilliance will only be seen when operating from 12V. Check for correct operation of the various switches, and that the display dims considerably if S1 is opened.

Final assembly

Glue the Perspex window in position, drill three holes for S2, S3 and external wiring in the back panel and mount switches in position. Stick the back-up battery into the bottom of the case next to the clock board using double-sided adhesive foam. Also stick the crystal board to the inside of the top of the case using a small piece of plastic sandwiched between two pieces of double-sided adhesive foam. The adhesion of this material increases a lot in the first few days. Screw the clock board and display board module into the base of the case, run the cable out for the connection to the car, clip the case halves together and the clock is ready to install.

Setting the time

The clock does not show seconds but it is often desirable to make the minutes digit change at exactly the right moment. This requires synchronising the invisible seconds to the radio time signal or the speaking clock. The A at the end of IC1's part number, AY-5-1224A, indicates that it has "power on clear". This sets the displays, and also the seconds to zero at the instant of turning the power on. The seconds counter does not start counting up from zero until either S2 or S3 is closed. So to synchronise the clock's seconds, disconnect from power including the back-up battery, reconnect power and at the instant the time signal indicates that an exact minute has been reached, momentarily close either S2 or S3. The hours and minutes can then be set without affecting the seconds counter.

Adjusting the crystal timebase

To speed up the clock the capacitance of TC1 should be reduced. With the Mullard 808 00 006 trimmer specified, minimum capacitance occurs when the brass vanes completely cover the nickle vanes. To slow the clock down, increase the capacitance of TC1. If at maximum capacitance, the clock is still too fast, change C7 to 82pF, and if that is not enough add a capacitor in position C5, first trying 22pF, then 39 pF, etc. If the clock is too slow with no capacitor C5 and TC1 at minimum capacitance then reduce C7.

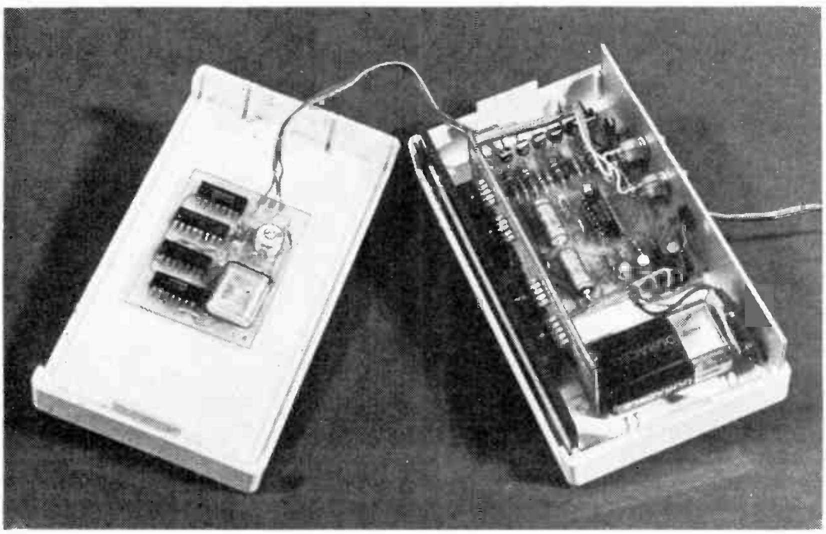


Fig. 8: Interior view photograph presenting the general layout of the three boards, switches, wiring and back-up battery.

Modification for use with positive-earth cars:
connect the OV wire to battery −ve (live)
connect the wire notated (1) to battery +ve (earth)

Instead of using the ignition switch to switch the display on, wire an extra "display on/off switch" from wire notated (3) to battery +ve (earth).

Dear Sir,

letters

Yes to CB

I refer to your Editorial Comment on Citizens' Band (July Edition). CB does fulfil its purpose, although as Ginsberg seeks to show (overreacting to possible parity of problems in the UK) it has gone beyond reasonable bounds in the USA. A ratio of 40:1 represents a potential user population of British CB of less than 900,000; less than 10% of the US usage, assuming an allocation of as little as 0·25MHz.

Regrettably, CB and Amateur Radio both suffer from the activities of a childish, irresponsible minority. If we fail to learn by others' mistakes in CB we have only ourselves to blame. This is fundamental to the existence of the Citizens' Band Association. It is significant that the CBA is the brainchild of a group of British Licenced Radio Amateurs, who hold out self-disciplined responsibility as a foundation for CB in this country. As there will be a large demand for equipment, a British manufacturer with foresight and enterprise should be able to keep Nipon out of the running, as Japan produces 27MHz. AM equipment, whereas the CBA promotes the growing opinion that UK CB must be within the VHF spectrum and *must* be FM. A full technical specification is in preparation to cover all that is needed to eliminate the known problems of 27MHz. CB.

The object of CB is to provide a reasonable and reliable means of communication, at reasonable cost to the average person for whom CB will fill what is in many cases, an obvious need. Let there be no misunderstanding, the CBA is not a closed shop for the self-defence of the Radio Amateur—it is open to any person or organisation of persons genuinely interested in promoting well planned CB and able and willing to contribute responsibly towards that end. It is not appropriate to involve the RSGB in CB. That Society is not intended to control or supervise a purely public radio service, which cannot and must not be equated in any way with the Amateur Radio Service.

Careful choice of frequency allocation coupled with sensible and responsible usage and behaviour, will overcome much that may presently be feared by many. The issue of the licence before equipment can be obtained, added to the recording of equipment serial numbers to each purchaser, should hold the potentially irresponsible element down to a minimum.

Those interested may communicate their views to the CBA at the address below, and seek membership. Further details on request, with SAE please.—**John W. Dudbridge, G3UUO:** Programme Co-ordinator: Citizen's Band Assoc., c/o Admin. Office, 16 Church Road, St. Marks, Cheltenham, Glos GL51 7AN.

Delivery delays

I, and no doubt, many other constructors are becoming very annoyed at the excessive delays and anomalies experienced in receiving equipment, kits, or components by mail order.

I will give, for example, two recent orders, one for a kit, the other for ready built equipment. The latter, a Power Supply Unit was ordered and after about ten days, my cheque was returned with a polite letter, stating, and I quote "Sorry, but we are still trying this idea out, therefore we cannot meet your requirements". That was reasonable, at least I got my money back.

The former has been more disappointing. The order with cheque was sent on 2nd May 1976, this was confirmed by the manufacturer / distributor, delivery time three to four weeks.

On the fifth week I sent a letter for an estimated date of delivery. No reply received. The following week, I telephoned the company concerned, during office hours; more expense. The reason given for the delay was, that the Construction Brochures had not been received from the Printers. I was assured that the kit would be supplied ready built at no further cost and would be posted over the weekend.

Now, being well into the eighth week, I still have not received the equipment. I know that advertisements are usually submitted months in advance. My experience indicates that retailers etc are advertising products which either do not exist or are still in the experimental stages.

I do not propose to name the company concerned. This letter will, obviously, miss the next edition of "Practical Wireless", so there will be some delay in publication. By that time, of course, the equipment may have arrived, but the implications in this letter will still be valid. There may be other would-be entrepreneurs wishing to build up working capital with cheques, money orders etc for equipment, kits and components which they cannot afford to design and market without first advertising—Catch 22? (name and address supplied).

Equal rights?

In case there are one or two who still don't know what the WARC is all about—it is a meeting of the world's countries to allocate (or reallocate) radio frequencies. Each country has one vote irrespective of the size of its population or requirements radio-wise.

This means that the citizen of some small country has the representative voting rights equal to a large number of Americans or Russians! Crazy—but that, it appears, is the only way they will play. From comments, in a certain amateur mag, it looks probable we will lose more from our HF bands.

This in spite of the fact that, world wide, the amateur has increased in numbers! In my view we should make some effort at fighting back and not act like a lot of sheep.

I suggest that we (amateurs and, I hope, supporting SWL's etc) have the right to know how each country votes on all the different issues that concern us. If we can find one magazine that will give us this information we will know our enemies. With this info we can organize some sort of action—or threatened action. But, first, there must not be any action against amateurs in hostile countries. This goes against our code. In fact the opposite tactics should be used so that they will support the rest of us against their own government, or whatever. When I write about retaliation I do hope no one will think I'm suggesting extreme action.

But some organised voluntary ban on listening to "enemy" broadcasting stations with no correspondence or asking for cards etc. Invite radio mags to exclude them from any publicity in reports etc etc. The threat of having their propaganda "blacked" might have some effect?

But I'm sure supporters could think up better ideas.

This is a free country and as long as we act within the law we have the right to protest. The alternative, with the present set-up, is the decline of world wide amateur activity. Maybe what I advocate may be futile—but at least lets put up some sort of fight. This stiff upper lip stance gets me down.

Admittedly we, the British, can make little impact alone—but if someone more eloquent than I were to take it up I'm sure there would be a response in the free world.

Oh for an amateur Winston Churchill.—**Hector Cole, G3OHK** (Workington).

PW too complicated?

I have been reading Practical Wireless for many years, and would like to thank you for a very informative, interesting magazine. However, I feel at this stage I must put forward a strong criticism. Your magazine is getting far too advanced for the "average enthusiast". Your latest project the Video Writer would also come into this category of project. Instead of producing projects that cost £150+, and a laboratory of test equipment to complete, could we not start seeing articles that are a little easier and cheaper to "attempt". This is how *PW* used to be, so couldn't we start seeing this again?

In addition, in this country we readily take for granted the easy availability of Denco coils, which are used extensively in your radio projects. However, in certain places abroad these are *not* available. Therefore, could we see in future projects the value of inductances, and perhaps details of winding our own coils.—**A. E. Skipper** (Brighton).

No to CB

Who wants a citizens' band in this country? The general public, or is there just commercial pressure? Personally, we can see no real need for one to be introduced into this country with its excellent telecommunications network. In America the original purpose of the CB was to provide reasonable communications between isolated communities and to enable aid to be summoned, for example, by motorists stranded on interstate highways etc. Misuse is, however, widespread in the US and licence conditions have been neither respected nor efficiently enforced.

We feel that in the editorial (July '76) some valid points were made, but the following require further thought. The most important point is that of frequency allocation. In the UK 27MHz is extensively used for radio control as well as other important services but, with the availability of cheap Japanese equipment, commercial pressure will be applied to take over this band. Interference would also be a problem. Even some skilled radio amateurs cause interference but what 800,000 (to use the quoted figures) unskilled CB users would do in Britain, and the problems they would cause to the GPO, would be horrific. We agree with the comments that overcrowding would result if the CB were to be introduced but there is no solution to this problem as the RF spectrum is practically fully occupied from about 15kHz to about 450MHz.

From the minutes of the council meeting of the Radio Society of Great Britain on 23rd March (ref. Radio Communications, June '76) it would appear that they are not in favour of the introduction of a CB and also that the answer to the citizens' band problem does not lie in their hands.

We feel that if a citizens' band were to be introduced, retailers should be required to hold a licence and perhaps register all sales. This would, of course, also apply to amateur equipment. CB operators would be required to hold a different licence entailing the passing of an examination on the licence conditions.

If commercial pressure by retailers and manufacturers is left unopposed then a citizens' band will undoubtedly be forced upon us. We think that further views need to be expressed on this subject, including official comment, but anyone interested in communication should either use the facilities provided by the GPO more often, or preferably obtain an amateur transmitting licence from the Home Office. The RSGB and local radio clubs will be most willing to help anyone in gaining such a licence.—**Nick Moyes, G8KMJ. C. Evans, G4EYA. M. Grovewood, G4DCD. F. Emery, G3ZMF. L. Howell, G4DMA/PA9AQL. R. Westlake, SWL. A. Short, G4EHL. P. J. Lee, G8JGJ. S. Tompsett, SWL. G. Tompsett. M. Brosnan, G4BRO. P. Brosnan, G4DRO. P. Pique, G8KDQ.**

First time success

I am writing to say that I have just successfully completed the construction of the **General coverage receiver** described in *PW* Feb & Mar 1976.

I have never tackled a project from *PW* before, although I have had some electronics education. I was absolutely amazed at the success I had.

I would therefore like to thank Mr F. G. Rayer for the article on the receiver and Watford Electronics, one of your advertisers for the prompt and accurate mail order service, through which most of my components were obtained.

I would also like to thank you for publishing the article.—**P. M. Ripley** (Ilkley)

PW 'Easybuild' VIDEO-WRITER

PART 3

M. J. HUGHES M.A., C.Eng. MIERE

Parts 1 and 2 of the series dealt with the general theory behind the Video-Writer and the power supply unit construction.

Part 3 covers the Sync Pulse board, both the detail of its construction and the investigation of the various dividing and combining circuits required to provide a suitable system.

SYNC PULSE BOARD

The first printed circuit board to construct contains the sync pulse generator, the circuit of which is given in Figs 7, 8 and 9. Before starting assembly note that throughout this project you must take special care to DOUBLE CHECK the orientation of each integrated circuit on the boards. They vary in orientation to aid the printed layout's interconnections.

If double sides printed circuit boards are used it is necessary to make connections from one side to the other by means of "soldered stakes". These are simply short lengths of tinned copper wire which are put through the "Stake Through" holes and soldered into position on either side. It is probably easiest to insert and solder all the DIL sockets first and then proceed to the staking-through operation. The sockets will provide a useful "stand-off" from your work bench when it comes to inserting the short lengths of tinned copper wire. Lead-ins and lead-outs from each board are via printed board pins; these allow inter board wiring to be completed from the "Top side" only when all the boards are firmly fixed to the main aluminium chassis.

MASTER OSCILLATOR

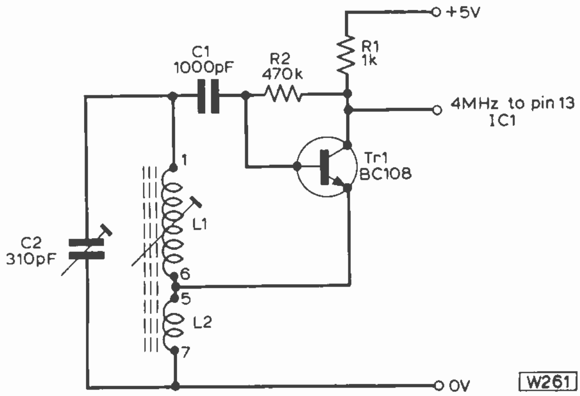
The heart of the system is the Master Oscillator set to operate at 4MHz. An LC oscillator was chosen for simplicity and stability. During the early stages of the project's design, experiments were made to phase lock this oscillator to the mains (to provide a synchronous 50Hz field frequency) but the extra complexity was not justified in the final instance. The circuit for the oscillator is shown in Fig. 7. Although, in principle, any general purpose npn silicon transistor will do for Tr1 it is recommended that a branded device be used to ensure that it has a sufficiently high gain to oscillate with no difficulties. Coarse adjustment of frequency is by C2 but final trimming is best carried out by means of the slug inside the coil.

Apart from the modulation level of the r.f. modulator, this is the only portion of the circuit that needs setting up to get the time bases operating within the specified limits and is checked by viewing the final display on the television screen.

PULSE SHAPER

The sinusoidal output from the oscillator is squared and "Normallised" to TTL drive requirements by means of a Schmitt Trigger (IC1) which is shown on Fig. 8. The triple cascade of triggers is not really necessary and is inherited from some of the early design work when it was thought possible that an inverted clock and slightly delayed signals might be required. As it turned out neither of these provisions were needed but there was no economy to be effected by changing the layout with hindsight.

Fig. 7. The schematic diagram of the 4MHz oscillator section of the board. See the text for selection of Tr1.



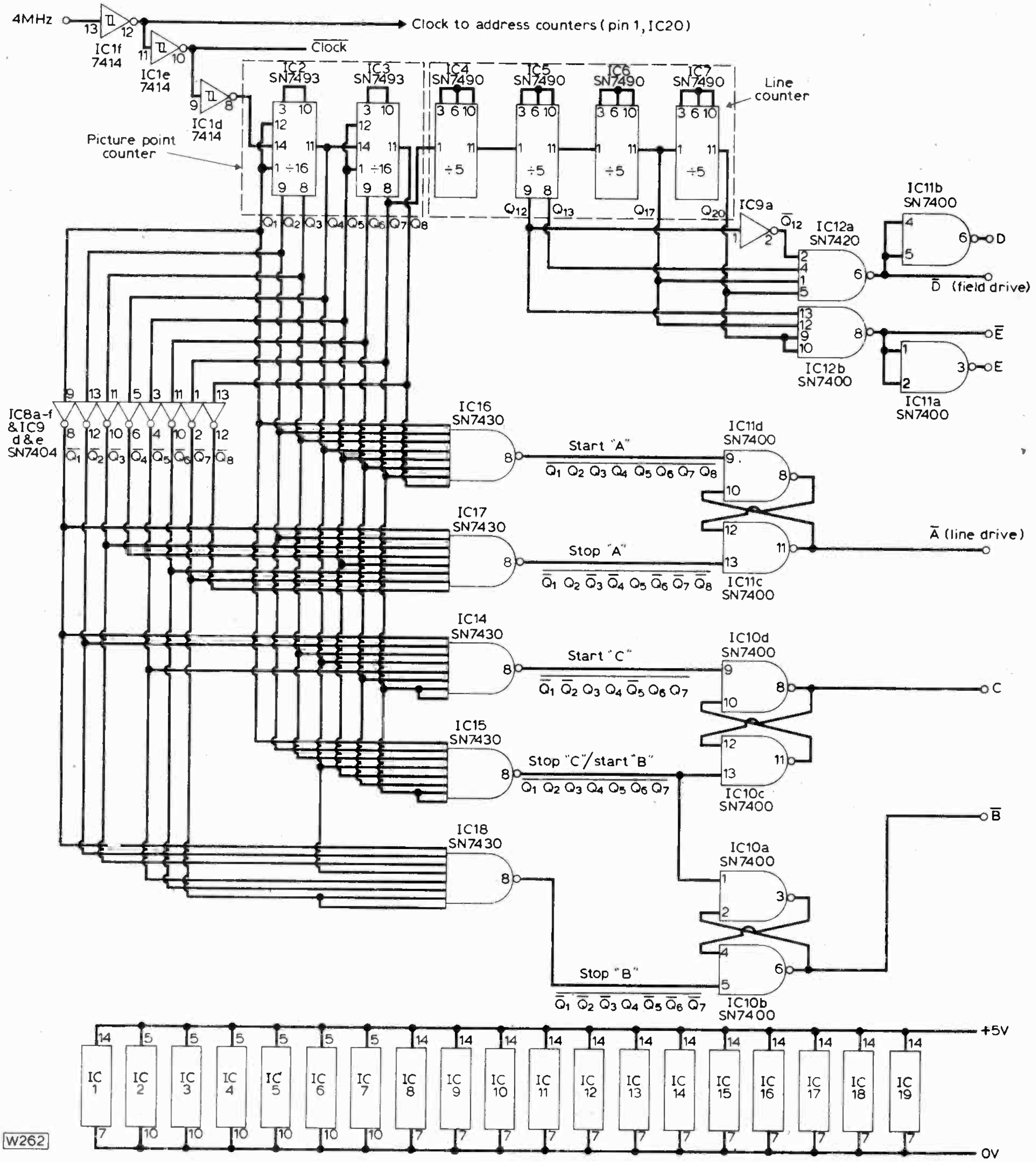


Fig. 8. The block diagram of the Principle Waveform Generator which provides the Interlaced Sync Pulses ready for combining into the final sync train. The power rail connections to all the ICs on this board are shown as a separate section to avoid confusion on the main interconnection drawing.

DURATION OF PULSES

Each cycle of the master oscillator lasts for 250nS and describes a picture point. The line period of a television raster is 64μS (from start of line sync to the end of the line) and this can conveniently be broken up into 256 picture points.

IC2 and IC3 form a simple "Divide by 256" chain which, when driven by the master oscillator, will complete a cycle of counting in a time exactly synchronous with the line period. They produce 8 binary outputs which can be decoded to designate any 250nS picture point period within a line. This is very convenient because it means the decoded outputs can be used to generate line sync pulses and the equalisation and broad pulses required for the field sync train in their correct time positions.

Because we are operating in integral factors of 250nS we cannot expect to be exactly on target when it comes to meeting a "Broadcast Standard" of sync pulses but if you compare the figures in the following table, which shows the broadcast specification (with tolerances) against what we obtain, you will see that in all instances we are within the permitted tolerances:

	Broadcast Standard	PW Video Writer
Line sync duration	4·7 +0·1uS	4·75uS
Equalisation pulse duration	2·35±0·1uS	2·25uS
Broad pulse duration	4·7 ±0·1uS	4·75uS

The same principle is used to generate the equalisation and broad pulses. There is a small difference however. Whereas the line sync occurs only once during a line scan the equalisation and broad pulses occur TWICE during the lines which occur in the field sync period. This is easily taken account of by ignoring the Q8 output of the divider in the gates made from IC14, 15 and 18.

ICs 4, 5, 6 and 7 provide a "Divide by 625" counter which takes, as its input, the signal emanating from Q7 (twice line frequency). The line counter will thus do a complete cycle of binary counting in the time it takes the picture point counter to generate 312½lines. Obviously it is not possible to produce "Half a line sync pulse" and the meaning of the "½" is that the line sync pulses are staggered by half a line, relative to the field sync train, every other field. It is this that enables us to have "Interlaced Scanning".

DECODING

Fig 8 shows how the decoding of the signals from IC1 and IC2 was effected. The Line Sync starts when all outputs of the divider rise to "1" and remains high for the complete duration of 19 picture points. This is repeated every time the counter goes through a complete cycle.

SYNC PULSE TRAIN

The broadcast standard Field Sync pulse is rather complicated. The word "Pulse" is really a misnomer because it is made up of a train of pulses.

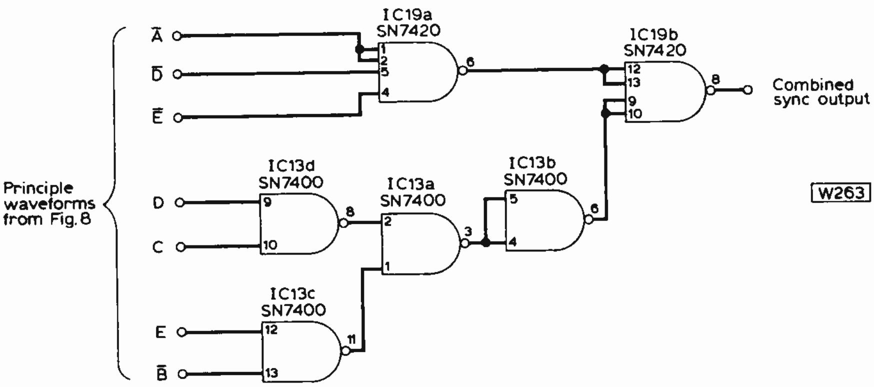


Fig. 9. The block schematic of the ICs required to combine the various individual outputs from Fig. 8. The power rail connections are shown in Fig. 8

In practice it is undesirable to rely on gating to produce this decoded signal because there are propagation delays within the counter and these would give rise to "glitches". Glitches are very short spurious pulses which, although almost insignificant for most applications, could, unless suppressed, produce white spots on the screen. We therefore use IC16 to detect the start of the line sync pulse and use the output of the gate to set a latch made from IC11c and IC11d. The end of the line sync occurs when Q1=0, Q2=1, Q3=0, Q4=0, Q5=1, Q6=0, Q7=0 and Q8=0. This condition is detected by IC17 and the output of this is used to reset the latch (IC11c and d). The output of the latch (waveform A or Ā depending on which of the outputs is taken) is thus a clean unique pulse of line sync pulse duration. See Fig. 10.

Reference to Figs 10 and 11 shows the complexity of this train together with the decoding required to produce it. Fig 11 shows the Field Sync DATUM as a line time coincident with the leading edge of waveform B and the trailing edge of waveform C. It is necessary to precede the Field Sync Datum by five narrow negative going pulses (equalisation pulses) at twice the line frequency. The Datum is immedately followed by five Broad negative going pulses at twice line frequency and these are followed by a further five equalisation pulses.

After the last equalisation pulse the line sync pulses are started either 32μS (half a line period) or 64μS (a full line period) later. This half line period displacement between the EVEN and ODD fields generates the interlace we have mentioned.

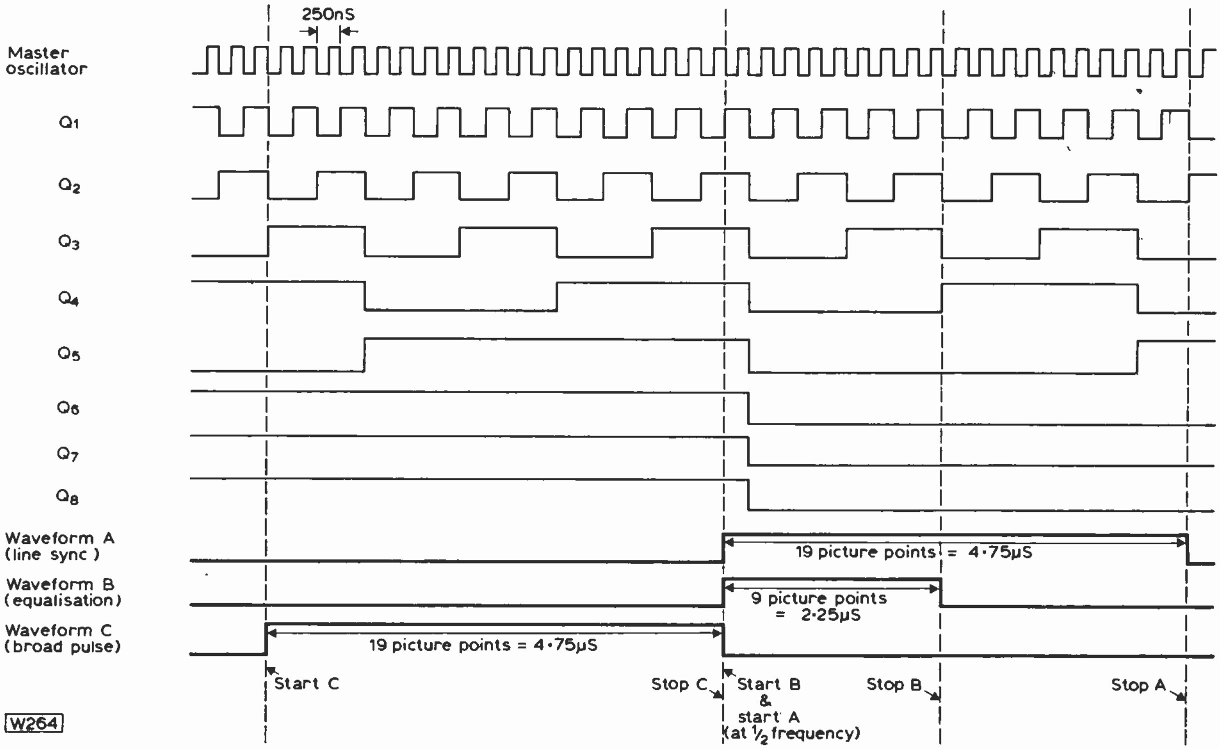


Fig. 10, above, shows the relative edges of the various outputs forming line sync, equalisation and broad pulses.

Fig. 11, below, shows the stages of combining waveforms to produce the Standard Sync Pulse Train, in this diagram the time axis is not to scale.

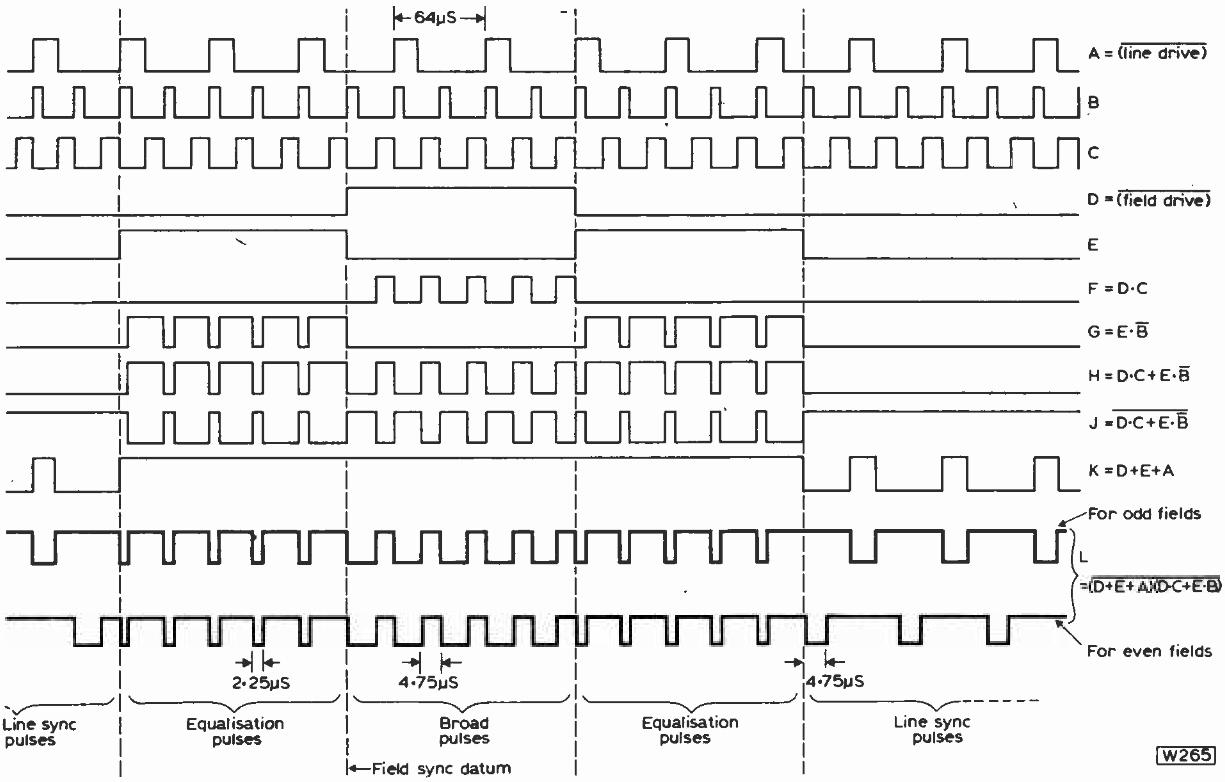


Fig. 12. The main wiring pattern on the etched board, shown full size. The extra wiring required to make the track pattern complete is shown in Fig. 13.

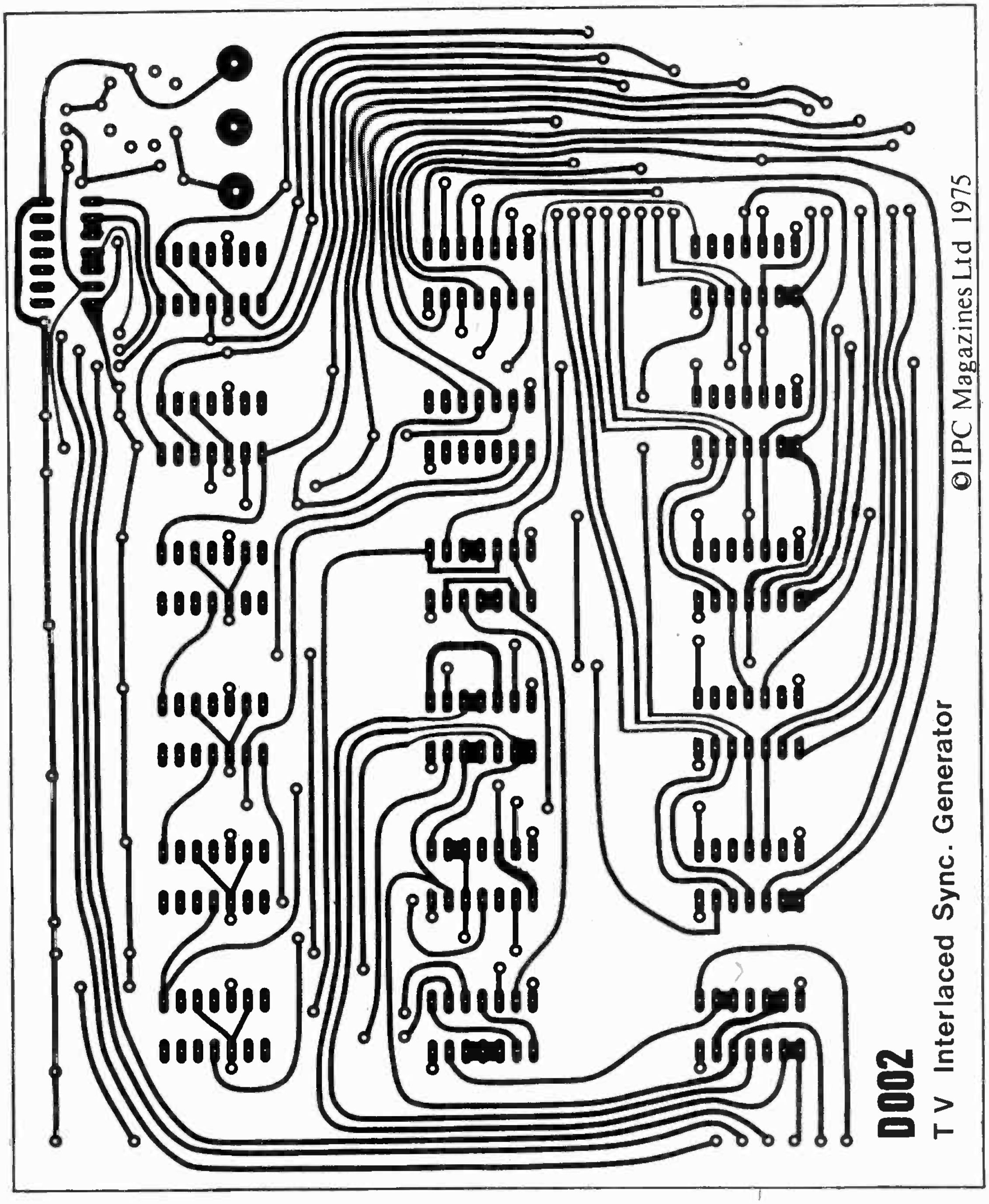
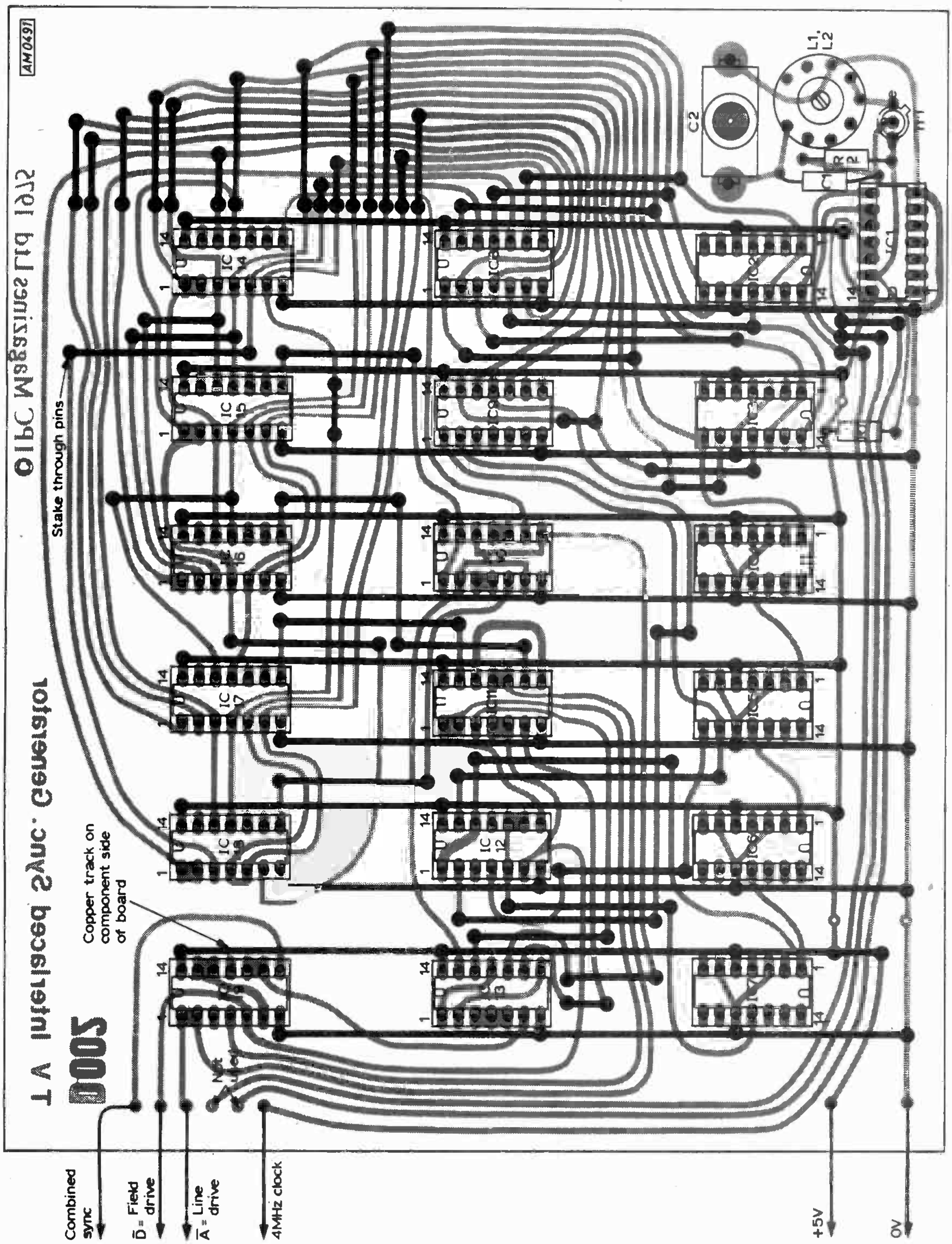


Fig. 13. The component side of the board, showing position and orientation of the ICs and Transistors.



IMPORTANT CONSTRUCTIONAL NOTE

To prevent erratic logic conditions arising from current spiking—caused by the very high switching speeds of TTL and the heavy current drawn by its output during switching operations—it is usual to incorporate small value capacitors across the power rails. When the prototype was originally designed it was felt that these capacitors could be soldered across the power supply leads on the top of each board. As it turned out, there were no problems with spurious pulses hence the illustrations of the boards do not show the capacitors. If, after construction, there is any indication of erratic operation the constructor should connect four 0·22uF capacitors between the +5V and OV rails at convenient positions on each board. These can be soldered directly to the topside printed wiring—if double sided boards are used. They should be distributed so that the de-coupling effect of each will affect as many of the IC packages as possible. There are no rules for this but, equally, there are unlikely to be any problems if the recommended layout is adopted.

★ components list

Sync Generator Board

Resistors
R1 1kΩ 10% ¼W.
R2 470kΩ 10% ¼W.

Capacitors
C1 1,000pF Polystyrene
C2 10 to 80pF, compression trimmer type MT31A

Semiconductors

Tr1	BC108
IC1	SN7414
IC2	SN7493
IC3	SN7493
IC4	SN7490
IC5	SN7490
IC6	SN7490
IC7	SN7490
IC8	SN7404
IC9	SN7404
IC10	SN7400
IC11	SN7400
IC12	SN7420
IC13	SN7400
IC14	SN7430
IC15	SN7430
IC16	SN7430
IC17	SN7430
IC18	SN7430
IC19	SN7420

Coils
L1, L2 } Denco Aerial, type 3T (blue)

Miscellaneous
PCB, Readers pcb service. 19 off DIL sockets (14 pin). Board pins.

We have already generated continuous running line sync, equalisation and broad pulses. It only remains to select the right number of the correct type of pulse at the right times and this is where the gating associated with the line counter in Fig. 8 comes in. IC12a produces a single pulse of length equal to 5 cycles of waveform C (Broad pulses), see Fig. 11. We call this Waveform D and it will be used to gate out the five broad pulses when we generate the complex sync train. It is available in either positive going form (Output of IC11b) or in negative going form $\bar{D}$ at IC12a.

The second gate (IC12b) generates two pulses, having time durations equal to 5 full cycles of Waveform B (Equalisation pulses) exactly, preceding and following the pulse of Waveform D. This signal is used to gate out the two sets of 5 equalisation pulses into the final complex train. We call this signal Waveform E and it is available at the output of IC11a or in inverted form at IC12b.

It now remains to combine all our signals to produce a combined sync pulse train. This is done by the circuitry of Fig. 9. You can follow this through by referring to the waveforms of Fig. 11. First, we AND waveforms D and C to give F. This is carried out by IC13d. Next we AND E with B in IC13c to give waveform G. The two new signals (F and G) are ORED together in IC13a to give H which is inverted by IC13b to give J. Waveforms D, E and A are ORED together in IC19a to produce an inverted line sync train with a gap in it where the field sync train will be inserted (shown as Waveform K). Finally Waveforms J and K are NANDED in IC19b to give the final sync train (Waveform L). This, of course, will have two possible forms depending on whether one is considering an ODD or an EVEN field.

CONSTRUCTION

Figs. 12. and 13. give the board patterns and the component layout for the sync board and, as you will see from the component side drawing, the board is double-sided. For those wishing to etch their own boards it is strongly recommended that two or three holes are selected and drilled before tracing is started. These holes will act as registers and assist the alignment of the two patterns. Whether the constructor buys or makes the board it will almost certainly be the item easiest to damage. Usually overheating is the culprit, so be warned!

Problems can arise in the staking operation and, in the authors experience, if the board fails to function then poor soldering (or even no soldering) of the stakes is the most likely cause, so check these first.

The second potential problem area lies in the actual insertion of the integrated circuits into their sockets. It has been arranged that IC8 to IC19 inclusive all face the same way whilst IC2 to IC7 all face the opposite way, so orientation should be easy. However, the ICs are normally supplied with the pins slightly splayed and it is very easy to fold a pin under the device during insertion and, because of the pin shape, these folded pins are difficult to see at a later date.

Our November issue will continue the details of the individual boards for this project, particularly the Address Board, covering the counters, registers and the comparators.

HOTLINES ON RECENT DEVELOPMENTS

HE SPY

Isn't it funny how one thing leads to another. A Ginsberg ago I talked about the use of a special fusing mechanism in artillery shells which allowed the shell to be fused while actually in flight and on its way to the target. I mentioned this to a colleague recently who immediately retorted, "That's nothing, they're putting miniature television cameras in artillery shells now". And so they are. When I checked I found that the American Military is, at this very moment, reported to be testing just such a system at the Yuma testing grounds in the heart of Arizona.

The basic idea is quite simple, though doubtless more difficult in practice. A minute television camera and its electonics (to transmit the picture back to base) is located inside a 155mm shell. The shell is then fired over enemy lines and at the best moment in its trajectory, the tv camera is released and allowed to float down on its own little parachute. All the time it's floating it is sending back vital real-time pictures of all enemy activities; troop movements, positions, tanks etc.

One of the major difficulties in making the system work was the tremendous acceleration of the projectile and its effect on the glass vidicon camera tube. Unfortunately, the acceleration of the shell when fired results in a force of some 15,000g which does truly terrible things to the glass vidicon—like smashing it into a million pieces!

The solution was to use a CCD (charge-coupled device) chip as the camera sensor and this is proving successful. I learn also that a small self-destruct mechanism is being built in so that the devices will not fall into enemy hands. Apparently, not only does Whiteman speak with forked tongue, him also watch from skies with floating eyeball!

HER—TZ SPY

X-ray photographs of various parts of the body have become commonplace in the medical field. Scanning the body with other types of radiation is a newer science. One such method is called Ultrasonic Scanning although the frequencies involved have crept up and up due to technical improvements and one wonders if 'ultrasonic' is really a true description.

One of the latest to come to your scribe's notice is the use of ultrasonic scanning to watch for potential stroke victims. Hardening of the arteries is a common culprit and, until recently, a painful and (according to some medics) risky method of watching for these symptoms was by injecting a special dye into the body so that X-rays could "see" where the dye collected etc. thus showing possible areas for concern.

The new ultrasonic approach is to wrap a little bag of water around the patient's neck. Of course, there is more in the bag than water—two tiny transducers to be exact. Each transducer has its own 'lens' which scans an artery at about 15 frames per second. One of the transducers gives a picture of the artery and surrounding organs, while the other gives a doppler velocity graph which watches blood flow. By superimposing this second transducer's information over the picture obtained by the first transducer, it can be seen immediately whether the blood is flowing faster in one place compared to another (thereby showing a possible blockage building up) or any irregularity in blood flow.

The scanning transducer operates at 10MHz which is much higher than previous ultrasonic systems I have heard of (2MHz is far more common). The second transducer operates at 5MHz. The higher the frequency the less the penetration but, luckily, the arteries are fairly close to the surface of the skin. Also, the higher the frequency the better the resolution—about half a millimetre in this system. Perhaps those body scanners in Startrek are not so far fetched after all.

NOW YOU SEE IT

How fast is "fast"? It all depends on what you are using as a base or standard against which to judge or measure. Offered as food for thought; have a ponder about the mode-locked laser which is shining happily away at a London College. The laser medium is rhodamine dye in a water solution and the power (peak) inside its cavity is around 300W. Where does the 'fast' bit come in? Well, this laser emits pulses which occupy only one third of a picosecond. Now consider that a picosecond is one millionth of one millionth of a second—and we're talking about a third of that!

Oh yes, the team working on the laser think that they can get this down to one tenth of one millionth of one millionth of a second. Good gracious Holmes!

NOW YOU DON'T

In an earlier Hotlines I made reference to an infra red audio system. I hear that Philips GmBH (a German subsidiary of the Dutch giant Philips) is marketing just such an IR system which may be simply plugged into any tv receiver, with accent on the word "any". It can, of course, also be used with other types of audio and hi fi equipment. The IR transmitter is located in the plug-in unit. The user has a small receiver which can be clipped to a pocket or worn round the neck. A tiny headset is connected to the receiver to complete the system. Perhaps someone will bring out an infra red system which modulates an electric fire bar. In Winter one could keep warm as well as listening to favourite records. Cooler moments would find one playing a Mozart minuet while in colder weather Bach's Fugues and Toccattas would give greater modulation peaks and thus greater warmth.

SUN SPOT

Interest in utilising solar energy continues to rise as the world eyes conflicting but no the less alarming reports about energy shortages of the future. I hear that a company has been formed called Japan Solar Energy. It is located in Japan but the interesting thing is that it is formed by three Japanese companies and two American companies. The first product is understood to be the fabrication of silicon ribbon which will be used to make solar batteries. Cor, stripe a light.

Ginsberg

continued from page 496
as in Figs. 4 and 5. If S1/S2 is omitted for the reason mentioned, VR1 may include the on/off switch. The layout places the RF stage under the chassis, with the mixer and oscillator above.

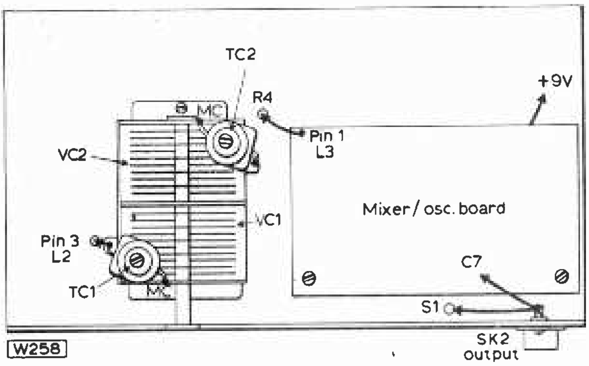


Fig. 5. Topside drawing of the chassis, showing relative positioning of the Osc/mixer board to the tuning capacitor. Notice the method of fixing the trimmer capacitors to VC1/2.

Tuning

If S3/S4 is marked with the crystal frequencies, reception will be at a frequentcy which can be found by adding receiver dial and crystal frequencies, or subtracting the dial frequency from the crystal frequency. The wanted band is selected by tuning VC1/2 to peak up signals at the required frequency. As the second channel is 7MHz away from wanted signals (receiver tuned to 3·5MHz), second channel interference is virtually absent. (This is far from the case with receivers having a low IF such as 470kHz, where interfering signals 940kHz away from wanted frequencies may come through strongly on the HF bands). TC1 and TC2 will be at very near minimum, while the cores of L2 and L4 are adjusted for suitable coverage, and maximum signal strength with VC1/2 nearly closed.

KINDLY NOTE!

SATELLITE COMMUNICATIONS
September 1976

On page 398, in the section on ISD, we have a paragraph beginning "ISD calls are...". In that paragraph we say that the timing meter pulses can be heard in the telephone.

The Post Office have pointed out that although these pulses occur at the intervals stated they cannot be heard. Makes sense when you think about it. Who wants their conversation interrupted every 1·71 seconds?

OPERATING THE EQUIPMENT

An arrangement can be made to switch the aerial socket of the general coverage receiver from the output of the 2m converter to the long-wire aerial so that the GC receiver can be used directly on the 10m band to check the signals (if any) coming from the International Beacon Project stations situated in Cyprus (5B4CY 28·180MHz), Mauritius (3B8MS 28·190MHz) and Germany (DL0IGI 28·195MHz). The German beacon is usually very strong in the UK when sporadic-E is present.

The VHF receiver, fed with the vertical dipole and tuned to the R1 frequency (49·75MHz), will serve as an early warning for sporadic-E, and when the R1 sync. pulses are heard the receiver can then be tuned through Band I television (41-67MHz) and then through the 4m and 6m bands. Using the horizontal dipole to feed the VHF receiver tune through Band II and log the continental broadcast stations which appear during a tropospheric opening. By doing this, the operator can plot the extent and direction of the prevailing disturbance.

When the barometer is reading above 30in and rising, a tropospheric opening can be expected at the time when the pressure begins to fall. The author has found that before an opening begins, French FM stations usually appear between 98-100MHz and when it is in full swing the "DX" signals are so strong, on the 2m band, that the direction of the beam is not so critical as it is under normal circumstances.

To detect VHF signals which are bouncing off an aurora the beam must be directed toward the north **irrespective** of the geographical location of the transmitter. The auroral reflected signal will be identified by its tone which sounds like someone "keying a bath waste". During the lifetime of an aurora a lot of Tone-A signals should be heard at the CW end of the 2m band, and it is worthwhile tuning the VHF receiver through the broadcast bands to see how many European commercial stations are subjected to the auroral tone. All reports should go to G2FKZ, c/o RSGB.

It is worth directing the beam toward the Sun when sunspots are present and tuning the 2m receiver just outside the band (say 143·9MHz) and listening to the receiver background noise. If the sun is "active" strong hissing and whooshing will be heard, as the aerial collects the solar radio waves. A further check can be made by turning the aerial away from the Sun when the noise should stop.

Apart from the normal enjoyment one gets from VHF listening, every enthusiast can make a contribution to science by sending a report of his observations to the right place in our selection of journals. Remember, every report that is published now is providing posterity with a contemporary record of the natural disturbances which affect the behaviour of our VHF radio signals.

*** The author has built and developed a private radio observatory situated in Storrington, Sussex. He is a Fellow of the Royal Astronomical Society and a member of both the British Astronomical Association and the Radio Society of Great Britain. He has programmed the work of his observatory to suit these organisations and to further his own interest in the science of radio.**

A. Marshall (London) Ltd Dept: PW

Get a great deal from Marshall's

40/42 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

Catalogue price 40p post paid
(30p to callers)

Call in and see us 9-5.30 Mon-Fri 9-5.00 Sat

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

Top 200 IC's TTL, CMOS & Linears

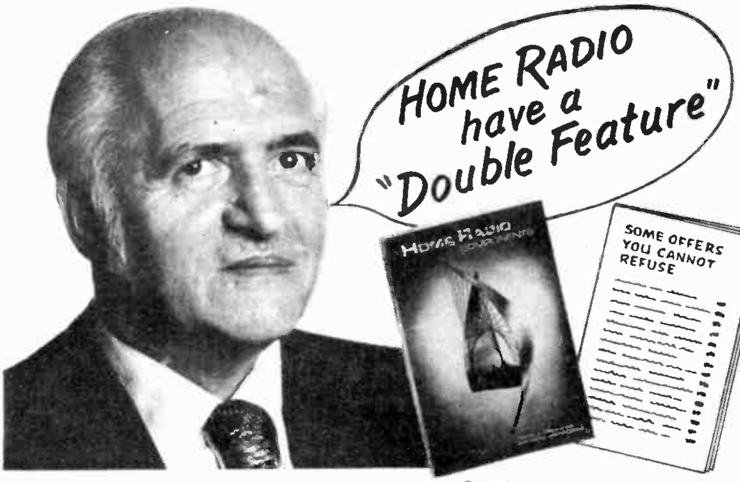
				SN74153 73p
CA3020A £1·45	CD4049 56p	NE555V 48p	SN7446 86p	SN74154 £1·29
CA3028A £1·85	CD4050 56p	NE556 £1·30	SN7447 81p	SN74157 68p
CA3035 £1·35	CD4510 £1·54	NE560 £4·48	SN7448 85p	SN74160 £1·20
CA3046 73p	CD4511 70p	NE565 £1·30	SN7450 16p	SN74161 £1·20
CA3048 £2·15	CD4516 £1·54	SL414A £2·35	SN7451 16p	SN74162 £1·20
CA3052 £1·62	CD4518 £1·38	SL610C £2·35	SN7453 16p	SN74163 £1·20
CA3089E £2·00	CD4520 £1·38	SL611C £2·35	SN7454 16p	SN74164 93p
CA3090Q £4·25	LM301AH 47p	SL612C £2·35	SN7460 16p	SN74165 93p
CA3130 88p	LM308N £1·17	SL620C £3·50	SN7470 32p	SN74167 £3·70
CD4000 20p	LM309K £1·80	SL621C £3·50	SN7472 26p	SN74174 £1·06
CD4001 20p	LM380 98p	SL623C £5·75	SN7473 30p	SN74175 94p
CD4002 20p	LM381AN £2·07	SL640C £4·00	SN7474 30p	SN74176 86p
CD4006 £1·16	LM702C 75p	SN7400 16p	SN7475 40p	SN74180 £1·23
CD4007 20p	LM709	SN7401 16p	SN7476 36p	SN74181 £2·58
CD4008 97p	TO99 40p	SN7402 16p	SN7480 45p	SN74190 £1·33
CD4009 57p	8DIL 40p	SN7403 16p	SN7481 £1·10	SN74191 £1·33
CD4010 57p	14DIL 40p	SN7404 18p	SN7482 67p	SN74192 £1·13
CD4011 20p	LM710 45p	SN7405 18p	SN7483 92p	SN74193 £1·13
CD4012 20p	LM723C 60p	SN7406 51p	SN7484 85p	SN74196 £1·81
CD4013 59p	LM741C	SN7407 18p	SN7485 £1·25	SN74197 £1·81
CD4014 £1·01	TO99 38p	SN7408 18p	SN7486 29p	SN74198 £2·04
CD4015 £1·01	8DIL 38p	SN7409 18p	SN7490 43p	SN74199 £2·04
CD4016 56p	14DIL 40p	SN7410 16p	SN7491 68p	SN76003N £2·36
CD4017 £1·01	LM747CN 78p	SN7411 20p	SN7492 43p	SN76013N £1·50
CD4018 £1·01	LM748	SN7412 25p	SN7493 43p	SN76023N £1·50
CD4019 57p	8DIL 44p	SN7413 40p	SN7494 74p	SN76033N £2·50
CD4020 £1·12	14DIL 41p	SN7416 43p	SN7495 59p	TAA263 £1·25
CD4021 £1·01	LM3900N 55p	SN7417 43p	SN7496 78p	TAA300 £2·67
CD4022 97p	LM7805P £1·39	SN7420 16p	SN74100 £1·15	TAA350A £2·48
CD4023 20p	LM7812P £1·39	SN7423 26p	SN74107 30p	TAA550 40p
CD4024 79p	LM7815P £1·39	SN7425 27p	SN74118 90p	TAA611C £2·25
CD4025 20p	LM7824P £1·39	SN7427 27p	SN74119 £1·80	TAA621 £2·15
CD4027 56p	MC1303L £1·44	SN7430 16p	SN74121 34p	TAA661B £1·32
CD4028 91p	MC1310P £1·91	SN7432 27p	SN74122 45p	TBA641B £2·50
CD4029 £1·17	MC1330P £1·35	SN7437 35p	SN74123 40p	TBA651 £1·80
CD4030 57p	MC1351P £1·87	SN7438 35p	SN74141 72p	TBA800 89p
CD4031 £2·26	MC14553 £4·07	SN7440 16p	SN74145 74p	TBA810 98p
CD4037 97p	MC1466L £3·95	SN7441 76p	SN74150 £1·20	TBA820 85p
CD4041 83p	MC1469R £2·50	SN7442 55p	SN74151 77p	TBA920 £1·79

VIDEO-WRITER PROJECT IN THIS ISSUE—WE CAN SUPPLY MOST COMPONENTS AT DISCOUNTED KIT PRICES

POPULAR SEMICONDUCTORS

2N696 25p	2N3906 22p	AF139 69p	BD139 42p	MPSA56 20p
2N697 16p	2N4058 20p	AF239 74p	BF115 36p	OC28 £2·00
2N699 55p	2N4062 18p	AF279 80p	BF117 70p	OC42 50p
2N706 12p	2N4921 60p	AF280 85p	BF154 25p	TIP29A 50p
2N708 21p	2N4923 70p	AL102 £1·50	BF180 36p	TIP31A 62p
2N916 43p	2N5245 29p	BC107 14p	BF181 36p	TIP32A 75p
2N918 34p	2N5294 35p	BC109 15p	BF184 35p	TIP34A £1·20
2N1302 37p	2N5296 36p	BC147B 10p	BF194 12p	TIP35A £2·50
2N1306 45p	2N5458 26p	BC149B 13p	BF196 13p	TIP36A £3·55
2N1308 60p	2N5459 29p	BC157A 12p	BF197 14p	TIP41A 70p
2N1711 27p	2N6027 45p	BC158A 11p	BF198 15p	TIP42A 70p
2N2102 60p	3N128 80p	BC167B 12p	BF244 35p	TIP2955 £1·00
2N2148 £1·65	3N140 £1·00	BC168B 12p	BF258 49p	TIP3055 50p
2N2218A 47p	3N141 85p	BC169B 12p	BF259 49p	TIS43 30p
2N2219A 52p	3N200 £2·60	BC182 11p	BFS98 27p	ZTX300 15p
2N2220 35p	40361 45p	BC182L 14p	BFR39 24p	ZTX301 15p
2N2221 22p	40362 48p	BC183 11p	BFR79 24p	ZTX501 15p
2N2222 25p	40406 48p	BC183L 14p	BFX29 36p	ZTX502 18p
2N2369 25p	40407 30p	BC184 12p	BFX84 38p	IN914/916 7p
2N2646 55p	40408 50p	BC184L 14p	BFX85 41p	IN4007 18p
2N2905 37p	40409 55p	BC212 14p	BFX88 32p	IN4148 7p
2N2906 28p	40410 55p	BC212L 14p	BFY50 30p	IN5404 18p
2N2907 21p	40411 £2·30	BC213L 16p	BFY51 38p	IN5408 40p
2N2926G 13p	40594 75p	BC214L 19p	BFY52 36p	AA119 14p
2N3053 25p	40595 88p	BC237B 14p	BRY39 50p	BA102 15p
2N3054 50p	40636 £1·15	BC239C 16p	ME0412 20p	BA145 19p
2N3055 65p	40673 73p	BC257A 17p	ME4102 10p	BA155 12p
2N3391 29p	AC126 37p	BC259B 18p	MJ480 £1·05	BB103B 20p
2N3393 15p	AC127 44p	BC301 45p	MJ481 £1·30	BB104B 34p
2N3440 57p	AC128 37p	BC307B 20p	MJ490 £1·05	BY126 27p
2N3442 £1·20	AC152 50p	BC309C 25p	MJ491 £1·55	BYZ11 70p
2N3638 16p	AC153 40p	BC327 20p	MJ2955 £1·00	BYZ12 70p
2N3702 17p	AC176 40p	BC328 19p	MJE370 68p	OA47 10p
2N3703 15p	AC187K 40p	BCY70 25p	MJE371 81p	OA90 6p
2N3706 14p	AC188K 45p	BCY72 24p	MJE520 65p	OA91 6p
2N3708 14p	AD161 75p	BD121 £2·00	MJE521 75p	OA200 8p
2N3716 £2·60	AD162 75p	BD124 £2·00	MJE2955 £1·25	BY164 57p
2N3771 £1·60	AF106 45p	BD131 51p	MJE3055 75p	ST2diac 20p
2N3773 £2·65	AF109 45p	BD132 54p	MP8113 45p	40669 £1·00
2N3789 £2·60	AF115 65p	BD136 36p	MPSA05 20p	TIC47 38p
2N3819 26p	AF116 65p	BD137 36p	MPSA06 20p	C106D 65p
2N3904 21p	AF118 65p	BD138 39p	MPSA55 20p	ORP12 70p

Prices correct at Sept., 1976, but all exclusive of VAT. P. & P. 30p



Perhaps you have to be of my vintage to know the phrase "a Double Feature", but up to a few years ago cinemas always ran a main film and a supplementary film. I was reminded of it because with their new catalogue Home Radio Components are now giving away a supplementary catalogue of bargain lines.

It sounds a very practical and sensible idea. After all, most electronic component firms accumulate surplus stocks of various items, and rather than dispose of them, why not offer them to customers at exceptionally low prices? I'm told that this bargain list will continue for several months and be updated from time to time.

No constructor should be without the Home Radio Components Catalogue (it contains 5,000 items clearly listed plus about 2,000 illustrations) but now you have a double incentive for buying one. In addition to getting one of the finest component catalogues available, you also receive a list of bargains at unbelievably low prices. For example, Gemini Mains Transformers: normal price £11·48, bargain list price £5, saving £6·48! This means that with a single purchase from the bargain list you can save the price of your catalogue several times over!

Please write your Name and Address in block capitals

NAME ....

ADDRESS ....

....

....

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

(Regn. No. London 912966)

POST THIS COUPON with cheque or p.o. for **£1·25**

By the way, the price of the catalogue is 90p plus 35p for postage and packing. Why hesitate? Send off your cheque or Postal Order for £1·25 today, together with the coupon on the left.

The price of £1·25 applies only to customers in the UK and the BFPO Addresses.

HOME RADIO (Components) LTD. Dept. PW 234-240 London Road, Mitcham, CR4 3HD Phone 01-648 8422

ON THE AIR

AMATEUR BANDS

by Eric Dowdeswell G4AR

MY apologies for the small number of reports which I was able to deal with last month owing to the fact that I was in hospital. Back home recuperating at the moment and endeavouring to catch up with the backlog of letters. So I'll cut the chat this month and get on with logs and reports.

My comments on the simplicity of the Radio Amateurs Examination brought in several replies. My point was that considering the very great privileges that are granted with either the 'A' or 'B' licence and the consequent interference that could be created by an inexperienced operator then the exam is far too simple and should be supplemented by a practical examination or evidence of experience of transmitters either on low power or on an artificial aerial. **H. W. Portch** of Bristol recalls making a receiver in 1922, before the days of 2LO, yet he made the effort and is now G8EQP and looking forward to a G4+3 call before too long. Congrats OM and obviously it is never too late to have a go!

David Kennedy residing in Chertsey, Surrey has an S108 set and a temporary aerial in the form of a TV beam but nevertheless got stations around the world on 20m with ZL1 and 3 on 80m. **Jeremy Hinton** continues to keep in touch although very busy on the HF bands and on 2m with his new call G4EZE, using a Europa transverter for the latter band. Thanks for the QSL card Jeremy and good luck with the DX. **Ray Woodward** in Colne has been using a Microwave Module converter on 2m and says he has nothing to report! I have already written to Ray pointing out that few would agree with this finding and suggesting he gives his set-up a good check-over because there must be something wrong somewhere! On the HF bands Ray has a Yaesu FR50B and 132ft of wire, where he does a lot better than on 2m.

What with exams and a fault on his CR300/2 **Paul Cowburn** of Leyland (Lancs) has little to report. Paul is one of many who look forward to the article on SSTV promised by Paul Barker. **Neil Whiteside,** Hitchin, also reports QRM from exams but promises to go all out for the RAE in December. He listens mainly on 2m and 70cm, when he can find the time.

Andrew Work A9091 is a newcomer reporting from Beverley, E. Yorks, where he uses a CR150/3 with 66ft of wire with an ATU. A current project is a converter for 2m. Andrew is another who would like to see PW running a series of articles to enable readers to attempt the RAE. From Bishop's Stortford, **Paul Turner** BRS36843, reports little time to get on the best bands at the right time, finding 15m the best for DX in the late afternoons.

Steve Cottis A8961 is still notching up new countries his latest including 9N1, FM7, VR3, KS6, BV2 and ST2. **Peter Allen** from Taunton has stuck to 2m and went portable with G8JXK and their best DX heard, but not worked was EA1AM. From Bognor Regis comes **Kevin Piper** for the first time. He's been searching around on 20m with a homebrew PW superhet plus a 30ft vertical. Unfortunately he is in a basement flat with little room for aerials. Our SSTV wizard **Paul Barker** of Sunderland found seven new stations using that mode, including W5GZR. It is some years since **Stephen Fletcher** last reported in to this column and in the meantime he has become G8LJM but he is going hard at the code in order to get a 'proper' licence, as he puts it! He recommends a look round the 160m band for many stations that send Morse at quite low speeds if you are swotting up the code. More from **Neil Whiteside** who has now had offers of help with the code from a couple of local amateurs and reckons he can now manage around 7wpm. During the excellent conditions on 2m and 70cm Neil has been copying many DX repeaters including the Orebro one SK4RGN.

J. W. Hodgson of Morpeth, Northumberland admits to being a complete beginner and asks many questions about our hobby. By this time he will have got the RSGB's *Guide to Amateur Radio* which will have answered just about all his queries. He has a Codar Mini-Clipper and an old TV aerial so there is plenty of room for improvement in the equipment. Very nice to hear from **Julie Rose** once again, I thought we had lost you to another hobby! Julie in Warley, West Midlands, has a 9R59DS and a couple of long wire aerials via a home-made preselector. So far she has logged 204 countries and is looking mainly for Pacific and Indian Ocean stations for some of the rarer ones. Julie took the May RAE and I hope we shall be able to congratulate her in the next issue when she has the results.

Back in circulation is **Steve Budd** A8713, after taking his 'O' levels. Projects include a quad for 10m and a 10 element job for 2m. Personally I have always reckoned that the best place to spend one's time and

ON THE AIR

money is where the signal arrives, at the aerial system. The best receiver will not put up much of a show if the signal is poor to start with! **R. Donaldson,** of Trimdon Colliery, Co. Durham, sent in a list of things heard on 2m recently using a Telford TC7 MkII receiver and G8AEV converter. At the moment his Yagi and crossed dipoles are fixed but he hopes to fit a rotator very soon. That ought to make quite a difference to the log. **Paul Barker,** again, sends in his first loggings on 2m using an MARC 56 receiver, a new one on me. Aerial is just a 20in whip at the moment. On 20m SSB station D6A was a good catch from the new Republic of the Comoros.

A late late letter from **Paul Turner** enthuses over his new 70cm converter which has been bringing in the Euro DX to his QTH in Bishop's Stortford. Another note from **Steve Cottis** queries 7X2EPM who gives his QSL address as PO Box 2, Algiers. Only one way to find out Steve, send a QSL! **Stan Sutherland** GM3BSQ of the Aberdeen ARS writes to say that they will be starting RAE classes again soon as last year's course was a great success. Write to him immediately at 67 Greenfern Road, Aberdeen AB2 6TP.

Whew! bang up to date now and I trust that no-one has been forgotten!

Log extracts

S. Cottis:— 15m TU2FW **20m** BV2B C31JW HM1BO KS6CC KZ5AS ST2SA VR3AK VR8A 7X2EPM

P. Turner:— 15m KP4DJE ZP5NA **70cm** DC1XG PA0VTW OZ2KO/A ON5NK/A GW3UBX **2m** LA6KH

S. Budd:— 80m CZ20 (Olympic Games) KZ5HP ZD9GF 9G1JX **40m** AP2P HC6TA HI8LC **20m** FG0CRZ/FS7 JW1SO (Bear Is) KJ6DL KX6BU ST2SA/ST0 (Juba, Equatoria) VR3AK (QSL KH6AHZ) ZK1BA 7Z1AB **15m** FG7TD HP7XJS 5N2NAS **10m** HI8MOG VP9AD YV4BDB ZB2DL 9Y4NP

P. Barker:— 2m DB2XI LA6OJ PA9AR PE0MBU **20m SSTV** DK3IV F5YO HA5LP I1RHB OE9IM SP3PJ W5GZR **20m** D6A HI8FVC KZ5AS OE5GM/YK (Golan Heights) TU2DB 7X2EPM 9K3TC

R. Donaldson:—2m DF3BU LA5X OZ1CX PA0EX SM6GFC UK4AA UR2RDR

N. Whiteside:— 80m PY1RO JW7FD (Bear Is) **2m** PI3ALK DB0WU DB0UO SK4RGN all repeaters. W9JFY via Oscar 7.

K. Piper:— 20m HC1HE SV0WZ (Rhodes) YS1GMV ZF1GK

P. Cowburn:— 80m EA8CR HK0AA (Serrana Bank) KZ5JM VP2LCX VP2VBG ZS6BW 8P6AH **40m** HK6DNK PY8RN VK2AM YN1JJA ZL2HE **20m** HR6MW VE8RCS VR3AK 6Y5GB

R. Woodward:— 40m VK3XI ZP5GE **20m** HI8MOG HZ1TA VP9IG 8R1CB 9Y4NP **15m** LU2OF

J. Hinton:— Worked 20m 6Y5DE OY8I DK4HB/OH0 **15m** TU2GF **2m** DC2BE F0CK/P ON4UN PA0RVP

BROADCAST BANDS

SHORT WAVE BROADCASTS

by Derek Bell

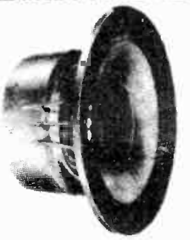
IN a recent column I asked if anyone had heard of two Russian stations Stancia Atlantika and Stancia Rodina. Imagine my surprise when no less than fifty per cent of this month's mail mentioned these stations and supplied an explanation. They are, as I suspected, offshoots of Radio Moscow, Rodina being for Russian nationals living abroad and Atlantika for Soviet merchant seamen. The language is Russian and the times are as follows: Rodina 0600 on 227m, 49, 41, 31, 25, and 19 metre bands, and 1400 and 1800 on 41, 31, 25, 19, 16, metres; Atlantika, 1000, 1230, 1530, and 1830 GMT on medium waves from Riga.

That of course was a digest of the information that poured in and you will understand and perhaps forgive me if I do not name everyone who wrote but space does not permit that but thank you all, and an extra little 'thank you' to the gentleman from the north east who wrote an interesting letter to point out that they were not "stations" in the sense of the word but merely programmes which call themselves stations. The address for QSLs is Radio Station Atlantika (or Rodina), Moscow Radio, Moscow U.S.S.R.

Its nice to be able to report a success once in a while and especially when it is caused by the demands of listeners. This one however will be tinged with a little regret for one reader. **John Goodwin** of Rugeley had what he thought was one of the last QSLs from Radio New Zealand for a transmission on 11960 at 0815 in April. You will remember that RNZ announced the closure of its overseas service and I mentioned in this column that it would be a pity for one of the rare DX stations, for us in the UK, to go off the air. Twickenham DX Clubs magazine "Communication", in its July edition, carried an item that on June 5th RNZ was back on the air again relaying its domestic service "in response to public demand".

Radio Nederland news this month comes from **Robin Bayley** of Kingswood School, Albrighton. He sends a letter packed with information, firstly Radio Nederland is issuing a QSL in memory of Eddy Startz, who died recently, and this is the first commemorative QSL I have come across! Next, that other stalwart of RN Jim Vastenhoud (the one who writes the leaflets) has been awarded the gold plaque of the European DX Council, so our heartiest congratulations go to Jim. Finally, on Radio Nederland, the 7210 transmissions at 0930, 1230 and 1400 are now changed to 9660.

Turning to Norway, Robin writes that Radio Norway's new 250 kW station is now on the air and that they are asking for reception reports for the following: 1300, 1900 and 2100 on 15175. So if you fancy a QSL from a new transmitter why not try your luck. **Stuart Eyre** is keen to join our fraternity.



WILMSLOW AUDIO

THE Firm for speakers!

SPEAKERS

Baker Group 25, 3, 8 or 15 ohms	£9·00
Baker Group 35, 3, 8 or 15 ohms	£10·75
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	£12·30
Baker Major 3, 8 or 15 ohms	£10·69
Baker Superb 8 or 15 ohms	£16·31
Baker Regent 12" 8 or 15 ohms	£9·00
Baker Auditorium 12" 8 or 15 ohms	£14·65
Baker Auditorium 15" 8 or 15 ohms	£19·41
Celestion G12M 8 or 15 ohms	£13·50
Celestion G12H 8 or 15 ohms	£16·75
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	£6·98
Celestion HF2000 8 ohms	£8·55
Celestion MH1000 8 or 15 ohms	£13·50
Celestion CO3K	£4·46
Decca London ribbon horn	£29·95
Decca London CO/1000/8 Xover	£6·95
Decca DK30 ribbon horn	£19·95
Decca CO/1/8 Xover (DK30)	£4·75
EMI 14 x 9 Bass 8 ohms 14A770	£11·92
EMI 8 x 5, 10 watt, d/cone, roll surr.	£3·56
EMI 6½" d/cone, roll surr. 8 ohms	£3·93
EMI 8 roll surr. bass	£5·73
EMI 5" mid range	£3·15
Elac 59RM109 (15) 59RM114 (8)	£3·38
Elac 6½" d/cone, roll surr. 8 ohms	£3·83
Elac 10" 10RM239 8 ohms	£3·83
Eagle Crossover 3000hz 3, 8 or 15 ohm	£1·57
Eagle FR4	£5·51
Eagle FR65	£8·95
Eagle FR8	£11·95
Eagle FR10	£14·06
Eagle HT15	£3·96
Eagle HT21	£4·95
Eagle MHT10	£4·00
Eagle FF28 multicell. horn	£8·10
Fane Pop 15, 8 or 16 ohm	£5·50
Fane Pop 33T, 8 or 16 ohm	£9·75
Fane Pop 50, 8 or 16 ohm	£12·50
Fane Pop 55, 8 or 16 ohm	£15·50
Fane Pop 60, 8 or 16 ohm	£17·95
Fane Pop 70, 8 or 16 ohm	£18·75
Fane Pop 100, 8 or 16 ohm	£27·95
Fane Crescendo 12A, 8 or 16 ohms	£37·95
Fane Crescendo 12BL, 8 or 16 ohms	£39·95
Fane Crescendo 15/100A, 8 or 16 ohms	£49·95
Fane Crescendo 15/125, 8 or 16 ohms	£59·95
Fane Crescendo 18, 8 or 16 ohms	£67·95
Fane 910 Mk II horn	£15·75
Fane 920 Mk II horn	£39·95
Fane HPX1 crossover 200 watt	£2·50
Fane 13 x 8, 15 watt dual cone	£5·50
Fane 801T 8" d/c, roll surr.	£8·96
Goodmans Axent 100	£7·60
Goodmans Audiom 200 8 ohm	£13·46
Goodmans Axiom 402 8 or 15 ohm	£19·80
Goodmans Twinaxiom 8, 8 or 15 ohm	£6·50
Goodmans Twinaxiom 10, 8 or 15 ohm	£9·76
Goodmans 8P 8 or 15 ohm	£6·20
Goodmans 10P 8 or 15 ohm	£6·50
Goodmans 12P 8 or 15 ohm	£14·95
Goodmans 12PG 8 or 15 ohm	£16·50
Goodmans 12PD 8 or 15 ohm	£16·95
Goodmans 12AX 8 or 15 ohm	£39·00
Goodmans 15AX 8 or 15 ohm	£45·00

SPEAKERS

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	£4·05
Gauss 12"	£95·00
Gauss 15"	£110·00
Gauss 18"	£121·00
Jordan Watts Module 4, 8 or 15 ohm	£15·36
Kef T27	£5·18
Kef T15	£6·25
Kef B110	£6·75
Kef B200	£7·85
Kef B139	£15·08
Kef DN8	£2·08
Kef DN12	£5·39
Kef DN13 SP1015 or SP1017	£4·05
Lowther PM6	£30·60
Lowther PM6 Mk 1	£32·85
Lowther PM7	£48·60
Peerless KO10DT 4 or 8 ohms	£7·25
Peerless DT10HFC 8 ohms	£8·26
Peerless KO40MRF 8 ohms	£9·28
Peerless MT225HFC 8 ohms	£2·95
Richard Allan CA12 12" base	£19·80
Richard Allen HP8B	£11·93
Richard Allan LP8B	£8·33
Richard Allan DT20	£6·08
Richard Allan CN8280	£16·20
Richard Allan CN820	£3·15
Richard Allan Super disco 60W 12"	£16·95
Richard Allen CG15 15" bass	£27·45
Richard Allen Super Disco 10" 50 watt	£13·25
Richard Allen Super Disco 8" 50 watt	£12·95
Radford MD9	£10·50
Radford MD6 dome mid range	£12·50
Radford TD 3	£7·25
Radford Crossover network	£13·00
BD25 Mk II	£22·00
STC 4001G	£5·90
STC 4001 K	£5·90
Tannoy 10" HPD	£78·00
Tannoy 12" HPD	£86·00
Tannoy 15" HPD	£99·95
Wharfedale Super 10 RS/DD 8 ohms	£13·50
Castle 8 RS/DD	£9·28

SPEAKER KITS

Baker Major Module 3, 8 or 15 ohms	each	£13·28
Goodmans DIN 20 4 or 8 ohms	each	£13·28
Goodmans Mezzo Twin Kit	pair	£46·50
Helme XLK 20	pair	£13·50
Helme XLK 30	pair	£17·10
Helme XLK 35	pair	£21·60
Helme XLK 40	pair	£38·50
KEF kit 1	pair	£51·00
KEF kit III	each	£46·00
Peerless 1060	pair	£54·00
Peerless 1070	each	£46·50
Peerless 1120	each	£54·00
Peerless 2050	pair	£39·50
Peerless 2060	pair	£53·00

SPEAKER KITS

Richard Allan Twin assembly	each	£13·46
Richard Allan Triple 8	each	£20·25
Richard Allan Triple 12	each	£25·16
Richard Allan Super Triple	each	£29·25
Richard Allan RA8 Kit	pair	£37·80
Richard Allan RA82 Kit	pair	£59·40
Richard Allan RA82L Kit	pair	£65·70
Fane Mode One Mk2	each	£10·35
Wharfedale Linton II kit	pair	£21·50
Wharfedale Glendale 3XP kit	pair	£47·70
Wharfedale Dovedale III kit	pair	£59·40
Wharfedale Denton 2XP Kit	pair	£23·25

HI-FI ON DEMONSTRATION *in our showrooms*

Akai, Armstrong, Bowers and Wilkins, Castle, Celestion, Dual, Goodmans, Kef, Leak, Pioneer, Radford, Richard Allan, Rotel, Tandberg, Trio, Videotone, Wharfedale, etc. Ask for our Hi-Fi Discount Price List.

THIS MONTH'S SPECIALS! Carr. £2·00. Pioneer SX737 £179·00. Rotel RD20 £135·00. Rotel RA312 £56·00. Videotone Saphir 1 pr £52·00. Videotone Minimax 2 pr £43·00.

We stock the complete Radford range of amplifiers, preamplifiers, power amplifiers, tuners, etc., and also Radford Audio Laboratory equipment, low distortion oscillator, distortion measuring set, audio noise meter, etc.

All Prices Include VAT
(Prices correct at 30.7.76)

Send stamp for Free 32 page booklet 'Choosing a Speaker'.

All units guaranteed New and Perfect. Carriage and Insurance: Speakers 55p each, 12" and up 85p each. Kits £1·00 each (£2·00 per pair). Tweeters and crossovers 33p each.

Complete kits in stock for **Radford Studio 90, Radford Monitor 180, Radford Studio 270, Radford Studio 360, HiFi Answers Monitor (Rogers), HiFi News No Compromise (Frisby), HiFi News State of the Art, Wireless World Transmission Line (Bailey), Practical HiFi and Audio Monitor (Giles), Practical HiFi and Audio Triangle (Giles), Popular HiFi (Colloms), etc.**

Construction leaflets for Radford, Kef, Jordan Watts, Tannoy, Hi-Fi On dem. Answers Monitor, State of Art, Free on Request.

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

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

WILMSLOW AUDIO

Dept. PW

Loudspeakers, Mail Order and Export: Swan Works, Bank Square, Wilmslow.

Hi-Fi, Radio & TV: Swift of Wilmslow 5 Swan Street, Wilmslow, Cheshire.

PA, Hi-Fi & Accessories: Wilmsow Audio, 10 Swan Street, Wilmslow, Cheshire.

Telephone:
Loudspeakers, Mail Order and Export Wilmslow 29599

Hi-Fi, Radio, etc., Wilmslow 26213

(Access and Barclay Card orders accepted by phone).

ON THE AIR

The main problem, he writes, is that he lacks a good receiver and in his search has become bogged down in the plethora of advice that it is possible to receive from the various books and pamphlets that are in circulation. Stuart asks that I recommend a good set for under thirty pounds! I will say that the set I would go for would be low on spurious signals, have perhaps a bandspread dial and cover as much of the short wave spectrum as possible since even though we are in the sunspot minimum I would hope the set would last long enough to be of use when the full range of SW bands comes back. In this world one gets what one pays for and most sets are a compromise in that they sacrifice one aspect in order to meet another or to keep to a price. It is however possible to improve a set by either building "bolt on" extras such as ATUs or by buying them from one of the reputable manufacturers. Stuart, it seems, has explored the home-brew aspect of our hobby for he asks "what is a permeability tuned oscillator". The answer to this, in a nutshell is a coil with an adjustable ferrite core. This may sound simple but the advantage of the PTO is that it can be used to tune a station by either a pushbutton or screw adjustment. In other words the position of the rod in the coil can be preset in order to tune a particular frequency.

While on matters technical we turn to **David Thompson** from York who is eager to identify a mystery set that is merely marked "FRC reception set R107T". This sounds to me a little like an ex-services set but perhaps some one can throw a little light. David also wants to improve his pulling power by putting an aerial in the loft. This I dealt with recently by explaining the method of erecting a long wire in the loft and feeding the downlead through the shack window frame, which is a simple job and only involves running the copper wire as near as possible to a square around the outer limits of the loft and feeding down through the eaves. David's final problem is a lack of books or leaflets, and this is solved by **Matthew Phillips** who recently had through his letter box a set of seven leaflets from Radio South Africa; these are free and the address is RSA PO Box 8606 Johannesburg.

David also logs three Africans and they are: Radio Uganda on 15325 at 1805, RTV Congolaise on 4765 at 2245 and Radio Lome, Togo on 5047 at 2245. However technical problems rear their ugly head in the form of noise in the 14 to 30MHz section of David's HRO receiver. This apparently gets worse "as the night progresses". From this distance it would seem to be a local phenomena, perhaps a factory nearby. As you say David that it varies with the amount of daylight I would not expect it to be the "innards" of the HRO. I can only advise you to contact your friendly local radio amateur and ask if they know from whence it comes, and if your local radio club can help.

Still on the African theme, **J. Hershbaum** of Plumstead, South Africa, sends an interesting insight on what is pulled in by our friends there. JH's loggings include Radio Veritas, Philippines on 11725 at 1340, FEBA Seychelles on 9665 at 1000 and Radio Pyongyang on 1000 at 1800. These were captured with a Bush EBS35 hanging on the end of a 300ft 'L' shaped long wire. This welcome letter keeps up the average of one overseas letter a month and it is pleasant to know that one's column is so well thought of as to inspire missives from so far afield. Not so far afield our Argentinian friend **Roberto Levinstein**, who is studying in London, tips us off that Radio Nacional de Brasilia is now on 11795 and in English from 2200 with a DX show fortnightly on Fridays at 2135. I am sorry that many letters will have to be held over this month due to a heavy postbag but may I wish you and yours best 73s.

BROADCAST BANDS

MEDIUM WAVE DX
by CHARLES MOLLOY

A USEFUL log of North and South American DX comes from Preston in Lancashire where **Derek Taylor** used his Realistic DX160 and medium wave loop to pull in four stations from Newfoundland; CBT on 540kHz, CBNA on 600kHz, CBN on 640kHz and CKVO on 710kHz. Two outlets from Nova Scotia, CHER on 950kHz and CHNS on 960kHz were heard plus New York City on 880kHz (WCBS), 1010kHz (WINS), 1050kHz (WHN) and WMEX is Boston near the top of the band on 1510kHz.

Four South Americans were heard between 0130 and 0330GMT; Radio Belgrano in Buenos Aires on 950kHz, Radio Sutatenza in Magangue Colombia on 960kHz, Radio Colosal in Nieva Colombia on 1005kHz. Derek, who is a regular reader of Medium Wave DX, makes a point of interest which may save readers an unnecessary report. He says that CKVO on 710kHz in Clarenville, Newfoundland is a pure relay station. Reports should go to the key station which is CHCM 560kHz in Marystown whose address is Box 560, Marystown, Newfoundland, AOE 2MO. Derek confirms that North Americans are good verifiers. A recent report to CJON (930kHz) produced, in ten days, a QSL card, 2 car stickers, 2 metrication templates, a pamphlet about broadcasting in Newfoundland and a book about Newfoundland. It could have been worse, Derek! Your scribe once had his reception report (to WKBW) read out over the air by a DJ who asked members of the audience to reply!

Middle East enthusiast **Stewart Hinsley** reports from Annan in Dumfrieshire with an interesting log of DX heard on a CR70A receiver and 80ft end fed aerial. Istanbul was logged on 1016kHz, Diyarbakir on 1061kHz, Tripoli on 1250kHz, Algiers on 980kHz, Conakry in Guinea on 1403kHz (at surprising strength with the identification "La voix de la Revolution" at 1210), Tangiers on 1232kHz and Funchal in Madeira on 1331kHz.

ON THE AIR

Stewart asked for up-to-date information about medium wave broadcasting in Jordan, Sudan, Libya, Saudi Arabia and Syria. The new 1200kW outlet in Amman has been on 912kHz since October 1975 but has not yet been reported in the UK. In Sudan, Radio Juba is on 829kHz while Omdurman has been alloted 575kHz. No word yet about the new stations planned for Nyala and Sennar. Dair es Zor in Syria has moved from 960kHz to 953kHz. Two new super power stations have been reported from Libya on 827kHz and 1570kHz but locations and powers uncertain. Saudi Arabia does not use 611kHz, 899kHz and 1520kHz but Riyadh is on 548kHz with 50kW.

Turkey is usually thought of as being in Asia although that part of the country to the west of the Bosporus, which includes Istanbul, is actually in Europe. A ferryboat from Istanbul will take you from Europe to Asia in a few minutes. (*There is a bridge, too! ED.*) DXers generally regard the whole of Turkey as being in Asia but the purist may hesitate to say that he has heard Asia on the medium waves if his sole catch is Istanbul. This is the sort of problem that confronts organisations such as the European DX Council when it attempts to compile a list of countries for DX purposes. The EDXC list of Radio Countries classifies "Turkey including European parts" under Asia, which may seem rather strange on the face of it.

Malcolm Laugharne of Witney in Oxfordshire used an aerial tuning unit (ATU) to match his 30ft longwire aerial to his Philips receiver. With this set-up he logged Manx Radio on 1295kHz and Radio Norway, in English on 1578kHz. The overseas service of Radio Norway is relayed over the medium wave transmitter on 1578kHz after the closedown of the home service. "Norway this Week" is on the air every Sunday night from 2330 until 0030GMT.

Stewart Hinsley raises an interesting question when he asks "what is the status of Spanish Sahara?" This country had two medium wave outlets, both of which have been logged occasionally in the UK. In the north of the country EAJ203 Radio Television de Sahara broadcasts on 656kHz with 50kW, while from the south EAJ202 Radio Villa Cisneros was on 998kHz with 10kW. Does anyone know if they are still on the air? The current status of the country is uncertain. It is due to be divided between Morocco and Mauretania and when this happens 'Spanish Sahara' will join the list of other odd ex-medium wave countries such as Swan Island (now part of Honduras), Biafra (Nigeria) and Tangiers (now Morocco).

There are still two Spanish enclaves in Morocco which count as radio "countries". Mellila is represented by EAJ21 on 1520kHz with the call Radio Mellila, while Ceuta, which is directly south of Gibraltar, has EAJ26 on 1106kHz with the call Radio Ceuta. Both use 2kW. Radio Ceuta can be heard during the day on the Costa del Sol with a transistor portable receiver and any DXer on holiday at Torremolinos should listen for the call "Radio Thayootah de la Cadena SER".

from page 498

Cheshire Homes net between 3650 and 3700kHz on SSB at 1330hr on Thursdays.

The RAIBC has a membership which is fast approaching the 1,000 mark and includes some members abroad. If you'd like to join, help, or know anyone who is invalided and might like some assistance, drop a line to Rita Shepherd, 59 Pantain Road, Loughborough, Leics LE11 3LZ.

Interesting information obtained was that the company trading as Burns had been bought out by another company, SCS, but that neither company is a limited company.

"This will continue now as Burns SCS until we go Limited, then there might be a name change," says spokesman Steve March.

AND WHAT'S NEXT

The RSGB, delighted with its first effort in the new series of annual exhibitions, has already booked the Hall for next year.

For traders, the London event must be an annual certainty. With a huge purchasing potential, Radcomex offers an extremely good shop window for all types of radio and electronics goods, from components to complete Amateur stations and accessories.

Many exhibitors have claimed their stand space for next year, even before the current show had closed and an outside company who missed this years' Radcomex has firmly booked 800ft^2 for next year.

Radcomex had just about everything for Amateurs, Hobbiests, constructors and their families. Quite apart from the exhibition there was an 18-hole pitch and putt golf course, boating lake, ski slope, children's playground, creche, plus superb picnic facilities backed by an all-day buffet plus two bars and a restaurant. There was even wheelchair facilities for the disabled.

The exhibition ran extremely smoothly and suspicions for this must centre on John Hitchins, G4FGN, and on retired, veteran exhibition whizz-kid, Phil Thorogood, G4KD, although one of the great mysteries of the exhibition was the organisers office. This was clearly signposted and the door boldly marked—but it was always locked and knocking produced no response. Ah well, perhaps next year?

Touring the stands in comfort around the 40,000ft^2 exhibition, optimism was the obvious keynote and without exception every exhibitor questioned replied, "Definitely back again next year".

There can be no doubt that the first Radcomex was a success. With nearly 5,000 potential buyers, the exhibitors were obviously pleased and will certainly be the envy of anyone who didn't attend or who pulled out whatever the reason.

Radcomex next year will take place at Alexandra Park, London. The Great Hall has already been booked for May 6, 7 and 8, 1977. But next year will be even better. It is to incorporate a convention which will include such things as v.h.f. and h.f. It is also planned to hold a dinner/dance on one evening. Add this increased programme to the attractions already existing and it is clear that next years' RSGB show will be an absolute must not only for the radio and electronics enthusiast, but as a day out for the whole family. Quick—put a note in your diary, you don't want to miss all those fantastic bargains a second time, do you?

RETURN OF POST MAIL-ORDER SERVICE

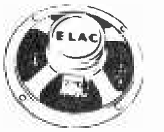
JUST RELEASED

R.C.S. 100 watt VALVE AMPLIFIER

Four inputs. Four way mixing, master volume, treble and bass controls. Suits all speakers. This professional quality amplifier chassis is suitable for all groups, disco, P.A., where high quality power is required. 5 speaker outputs. A/C mains operated. Slave output. Produced by demand for a quality valve amplifier. Send for details
Suitable carrying cabinet £14. Price **£85** carr. £2·50

ANOTHER R.S.C. BARGAIN !

ELAC 9 + 5in. HI-FI SPEAKER TYPE 59RM
This famous unit now available, 10 watts, 8 ohm.
Price **£3·25** Post 40p

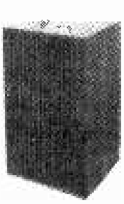


8" ELAC HI-FI SPEAKER

Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps. Bass resonance 55 cps. 8 ohm impedance. 10 watts.
10in round £4·95. Post40p **£3·95**

TEAK VENEER HI-FI SPEAKER CABINETS

MODEL "A". 20 × 13 × 12in. For 12 in. dia. or 10in. speaker. Illustrated **£13·50** Post 95p



MODEL "B". For 13 × 8in. or 8 in. speaker **£7·50** Post 75p

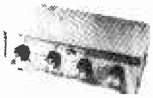
MODEL "C". 30 × 20 × 12in. Reflex cabinet will accept 1-12in. bass unit, 1-5in. mid range, 1-3in. tweeter. Teak finish. Grooved front **£21·50** Carr. £3

LOUDSPEAKER CABINET WADDING 18in. wide, 25p ft.

GOODMANS CONE TWEETER

$3\frac{1}{2}$in. diam. 18,000 C.P.S. 25 WATTS 8 Ω **£3·25**

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



STEREO VERSION OF ABOVE £6·85.

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

THE "INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER. suitable for cassettes, and all sizes of tape reels. A.C. mains 200/240V. Leaflet S.A.E. **£3.95** Post 40p

WAFER THIN HEATING ELEMENTS

OFFERING 1001 USES for every type of heating and drying applications in the home, garage, greenhouse, factory (available in manufacturing quantities). Approx. size $10\frac{1}{4} \times 8\frac{1}{2} \times \frac{1}{16}$in. Operating voltage 200/250V. a.c. 250 watts approx. Printed circuit element enclosed in asbestos fitted with connecting wires. Completely flexible providing safe Black heat. British-made for use in photocopiers and print drying equipment.
Ideal for home handymen and experimenters. Suitable for Heating Pads, Food Warmers, Convector Heaters, etc. Must be clamped between two sheets of metal or asbestos, etc., to make efficient clothes dryers, towel rails—ideal for airing cupboards. Ideal for anti-frost device for the garage—preventing frozen radiators or acting as oil sump heater. Use in greenhouse for seed raising and plant protection. Invaluable aid for bird houses, incubators, etc., etc. Can be used in series for lower heat. Or in parallel for higher heat applications.

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

BAKER MAJOR 12" £10·35

Post 60p

30-14,500 c/s, 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c/s rated 25 watts. NOTE: 3 or 8 or 15 ohms must be stated.

Module kit, 30-17,000 c/s with tweeter, crossover, baffle and instructions. **£13**

Please state 3 or 8 or 15 ohms. Post 50p

BAKER SPEAKERS "BIG SOUND"

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

GROUP "25" 12in 30 watt 3, 8 or 15 ohms. **£8·95** Post 50p

GROUP "35" 12in 40 watt 3, 8 or 15 ohms. **£10·50** Post 50p

GROUP "50/12" 12in 60 watt professional model. 8 ohms or 15 ohms. With aluminium presence dome. **£14·50** Post 80p

GROUP "50/15" 15in 75 watt 8 or 15 ohms. **£19·50** post 90p

BAKER 150 WATT QUALITY TRANSISTOR MIXER/AMPLIFIER

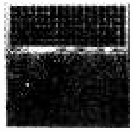
All purpose transistorised.
Ideal for Groups, Disco and P.A.
4 inputs speech and music. 4-way mixing. Output 8/15 ohm A.C. mains. Separate treble and bass controls. Guaranteed. Details S.A.E. **£68** Carr. £1·00

Latest 50 watt Model £49

100 WATT DISCO AMPLIFIER CHASSIS

MADE BY JENNINGS MUSICAL INSTRUMENTS
4 speaker outputs, vol., treble, bass controls **£52**
CAN BE USED AS 100WATT SLAVE Carr. £1

QUALITY LOUDSPEAKER ENCLOSURE



Teak veneered $\frac{1}{2}$in thick wood cabinet. Size $18\frac{1}{2}$in × $18\frac{1}{2}$in × $8\frac{1}{2}$in. Weight 23lb. This cabinet features a wide mesh Silver Grill covering a separate compartment for mounting Tweeters or Mid-Range Horn. The fully sealed bass compartment is cut out for $6\frac{1}{2}$in Woofer. £7·50. Carr. 85p. Rosewood Version £8·50. Carr. 85p. Baffle could be cut for larger speaker.

P.W. SOUND TO LIGHT DISPLAY

Complete kit of parts with R.C.S. printed circuit. Three channels. 600 to 1,000 watt each. As featured in December Practical Wireless.
Cabinet extra £3. Price **£12·50**

8 inch PHILIPS LOUDSPEAKER

4 ohm. 4 watt. ceramic magnet **£1·95**

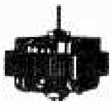
MAINS TRANSFORMERS

Post 50p

6 VOLT $\frac{1}{2}$ AMP. £1·00 3 AMP. £1·40
12 VOLT 300 MA. £1·00 750 MA. £1·30
30 VOLT 5AMP. AND 34 VOLT 2AMP C.T. £3.45
20 VOLT $\frac{1}{2}$ AMP. £1·75 1 AMP. £2·00 3 AMP. £2·20
20-0-20 VOLT 1AMP. £2 30 VOLT $1\frac{1}{2}$ AMP. £1·75
0-20-40-60 VOLT 1 AMP. £3·50

E.M.I. TAPE MOTOR

4 pole, 240 v. Size $3\frac{1}{2} \times 2\frac{1}{4}$in. 1200 rpm. Spindle $\frac{3}{16}$in. diameter. 120v version £1. **£1·85** Post 45p



E.M.I. GRAM MOTOR

240V a.c. 2,400 rpm 2-pole. Size $2\frac{3}{4} \times 2\frac{1}{4}$in. Collaro gram motor 240v. £1.50 **£1·25** Post 35p

BAKER DISCO SPEAKERS

HIGH QUALITY—BRITISH MADE

2 x 12" CABINETS

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

50 WATT R.M.S. **£43** Carr. £2

70 WATT R.M.S. **£46** Carr. £2

100 WATT R.M.S. **£59** Carr. £3

1 x 15" + 1 x 12" 100 WATT CABINET
Size 36" x 24" x 15" £65·00. Carr. £5
Ideal for Disco, Ogran or PA work.
High quality. Full range.

SUPERB HI-FI

12in 25 watts

A high quality loudspeaker, its remarkable low cone resonance ensures clear reproduction of the deepest bass. Fitted with a special copper drive and concentric tweeter cone resulting in full range reproduction with remarkable efficiency in the upper register.
Bass Resonance 25cps
FluxDensity 16,500 gauss
Useful response 20-17,000cps
8 or 15 ohms models.

£16·30 Post 80p

AUDITORIUM

12in. 35 watts

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

£15·50 Post 80p

AUDITORIUM

15in. 45 watts

A high wattage loudspeaker of exceptional quality with a level response to above 8,000 cps. Ideal for Public Address, Discotheques, Electronic instruments and the home Hi-Fi.
Bass Resonance 35cps
Flux Density 15,000 gauss
Useful response 20-14,000cps
8 or 15 ohms models.

£19·50 Post 90p

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

RADIO COMPONENT SPECIALISTS

337 WHITEHORSE ROAD, CROYDON
Open 9—6 Wed. 9—1 Sat. 9—5 (Closed for lunch 1.15—2.30)

Minimum post 30p. Components Lists 10p. Cash price includes VAT Access & Barclay cards welcome. Rail Selhurst. Tel. 01-684 1665

'GREENWAY'

Capacitors E12 Values I.T.W. Polyesters 10% 100V Radial* ·001; ·0012; ·0015; ·0018; ·0022mfd **3p** each. ·0027; ·0033; ·0039; ·0047mfd **3p.** ·0056; ·0068; ·0082; ·01mfd **3·5p** each. ·012; ·015mfd **4p.** ·018; ·022mfd **3·5p.** ·027; ·033; ·039mfd **4p.** ·047; ·056; ·068mfd **4·5p.** ·082mfd **5p.** ·1mfd **5·5p.** ·12; ·15mfd **6p** ·18mfd **6·5p.** ·22mfd **7p.** ·27; ·33mfd **9p.** ·39mfd. **10·5p.** ·47mfd **12p. Dipped Tantalum** ·1; ·15; ·22; ·33; ·47; ·68; 1; 1·5; 2·2; 3·3 35V **10p** each. 4·7; 6·8 10mfd 25V **11p.** 4·7 10mfd 10V **10p.** 15 22mfd 16V **15p.** 33 10V **15p.** 47 6V; 68 3V **15p. Electrolytic Capacitors*** Axial 1000 40V **25p.** 470 16V **15p.** 220 25V **12p.** 4·7 63V **5p.** 2·2 63V **5p.** 1mfd 63V **5p.** Radial 2200 40V (Tag) **50p.** 1000 16V **25p.** 470 25V **19p.** 220 25V **12p.** 100 25V **6p.** 47 16V **5p.** 33 16V **5p.** 10 16V **4p.** 5mfd 16V **3p.** 4·7 16V **3p.** 2·2 50V **4p.** 1mfd 50V **4p.** ¼Watt Carbon Resistors* 1R-10Meg **1·5p** each. **BARGAINS** Transformer Torrodial (Plessey) **£1·25** + 42p p&p. 500V A.C. Capacitors 16mfd **£1·25** + 42p P&P. Edge Connectors ·15 pitch 18/13/10/7 Way with Polarising Key **10p** each. *Slider Pots 47K Log Sterio **20p**—single **10p.** *1¼ Open Fuse Holders **5p.** *Phono Panel with 4 sockets **10p.**

SEND FOR FULL LIST—**Industrial Distributors.** Terms C.W.O. V.A.T. (*) add 12½%, others 8%. P&p on orders under £3 (25p).

Greenway Electronic Components

(East Grinstead), Ltd.

62 Maypole Rd., Ashurst Wood, East Grinstead, Sx. RH19-3RB.

Tel: Forest Row 3782 (STD 034-282) 3713

Please mention Practical Wireless when replying to Advertisements

VAT INCLUSIVE PRICES

Fully branded devices from RCA, TEXAS, MOTOROLA, MULLARD, etc.

Add 20p P & P—No other extras

TTLs by TEXAS

7400	16p	7485	120p
74H00	30p	7486	38p
7401	18p	7489	291p
7402	18p	7490	40p
7403	18p	7491	90p
7404	24p	7492	48p
74H04	30p	7493	40p
7405	25p	7494	99p
7406	41p	7495	70p
7407	39p	7496	84p
7408	22p	7497	291p
7409	22p	74100	116p
7410	18p	74104	60p
74H10	22p	74105	60p
7411	24p	74107	36p
7412	27p	74118	90p
7413	40p	74121	32p
7414	85p	74122	52p
7416	40p	74123	73p
7417	40p	74126	75p
7420	18p	74132	75p
7421	43p	74136	81p
7422	28p	74141	75p
7423	36p	74145	95p
7425	33p	74148	173p
7427	40p	74150	135p
7428	39p	74151	77p
7430	18p	74153	92p
7432	32p	74154	164p
7437	32p	74155	97p
7438	32p	74156	97p
7440	18p	74160	107p
7441	85p	74161	107p
7442	75p	74162	107p
7443	116p	74163	107p
7444	116p	74164	140p
7445	120p	74166	140p
7446	120p	74174	120p
7447	81p	74175	92p
7448	80p	74176	131p
7450	18p	74177	100p
7451	18p	74180	108p
7453	18p	74181	322p
7454	18p	74182	89p
7460	18p	74185	146p
7470	36p	74190	155p
7472	32p	74191	130p
7473	38p	74192	130p
7474	37p	74193	130p
7475	45p	74194	116p
7476	37p	74195	83p
7480	54p	74196	108p
7481	103p	74197	108p
7482	85p	74198	214p
7483	99p	74199	197p
7484	103p		

C-MOS ICs

4000	18p	4029	120p
4001	18p	4030	59p
4002	18p	4042	90p
4006	104p	4043	100p
4007	18p	4046	150p
4009	67p	4047	130p
4011	18p	4049	68p
4012	19p	4050	50p
4013	55p	4054	210p
4015	90p	4055	210p
4016	54p	4056	145p
4017	100p	4060	120p
4018	120p	4069	40p
4019	50p	4071	29p
4020	120p	4072	29p
4022	180p	4081	19p
4023	19p	4082	29p
4024	75p	4510	142p
4025	19p	4511	200p
4026	200p	4516	140p
4027	81p	4518	106p
4028	152p	4528	130p

LOW PROFILE DIL SOCKETS BY TEXAS

8 pin **12p**, 14 pin **13p**, 16 pin **14p**. 24 pin **40p**

VOLTAGE REGULATORS

FIXED—Plastic 3 Terminals

1 Amp	Positive	
5V	7805	150p
12V	7812	150p
15V	7815	150p
18V	7818	150p
24V	7824	150p
1 Amp	**Negative**	
5V	7905	215p
12V	7912	215p
15V	7915	215p
18V	7918	215p
24V	7924	215p

LM309K (TO3) 5V 1 Amp 150p
LM323K (TO3) 5V 3 Amp 750p
TBA625B(TO5)12V 0·5A 99p
7805 (TO3) 5V 1Amp 150p

VARIABLE VOLTAGE REGULATOR

723 2V to 37V 150 mA 14 Pin DIL 45p

TRANSISTORS

AC125	18p	BC184	14p	BFR39	37p
AC126	18p	BC187	32p	BFR40	37p
AC127	18p	BC212	14p	BFR79	37p
AC128	16p	BC213	12p	BFR80	37p
AC176	18p	BC214	17p	BFR88	37p
AC187	18p	BC337	24p	BFX30	32p
AC188	18p	BC478	32p	BFX84	28p
AD149	46p	BCY70	20p	BFX85	27p
AD161	39p	BCY71	24p	BFX86	28p
AD162	39p	BD123	120p	BFX87	22p
AF114	22p	BD124	95p	BFX88	26p
AF115	22p	BD131	39p	BFY50	17p
AF116	22p	BD132	43p	BFY51	16p
AF117	22p	BD135	54p	BFY52	17p
AF139	40p	BD136	55p	BRY39	39p
AF239	48p	BD139	56p	BSX19	18p
BC107	10p	BD140	60p	BSX20	18p
BC108/B	10p	BF115	24p	BU105	175p
BC109C	11p	BF167	25p	BU108	312p
BC147	9p	BF170	25p	MJE340	49p
BC148	9p	BF173	27p	MJ2955	110p
BC149	10p	BF177	28p	MJE2955	107p
BC157	11p	BF178	30p	MJE3055	70p
BC158	13p	BF179	35p	MPSA06	37p
BC159	13p	BF180	35p	MPSA12	62p
BC169C	15p	BF181	35p	MPSU06	78p
BC171	12p	BF182	35p	MPSU56	98p
BC172	11p	BF184	24p	OC28	70p
BC173	13p	BF185	24p	OC35	70p
BC177	20p	BF194	13p	OC41	19p
BC178	17p	BF195	11p	OC42	19p
BC179	20p	BF196	17p	OC45	19p
BC182	12p	BF197	19p	OC71	25p
BC183	12p	BF200	40p	TIP29A	50p
		BF257	34p	TIP29C	62p
		BF258	39p	TIP30A	60p

OP. AMPS

301A	Ext. Comp. 8 pin DIL	40p
536T	FET Op. Amp TO 99	300p
709	Ext. Comp. 8/14 pin DIL	30p
710	Diff. Comp. 14 pin DIL	45p
741	Int. Comp. 8/14 pin DIL	25p
747	Dual 741 14 pin DIL	76p
748	Ext. Comp. 8 pin DIL	40p
776	Prog. Op. Amp TO 99	153p
1458	Dual Op. Amp. 8 pin DIL	75p
3130	CMOS/Bipolar Mosfet	108p
3900	Quad. Op. Amp. 14 pin DIL	60p

LINEAR I.Cs.

CA 3028A	Diff. Cascade Amp. To 99	112p
CA 3046	5 Transistor Array 14 pin DIL	70p
CA 3048	Quad. Low Noise Amp.	250p
CA 3053	Diff. Cascade Amp. TO5/DIL	60p
CA 3089E	FM IF System 16 pin DIL	250p
CA 3090AQ	FM Stereo Decoder QIL	500p
ICL8038BC	VCO Fun.ken 14 pin DIL	600p
ICL8038CC	VCO Fun.ken 14 pin DIL	340p
LM380N	2W Audio Amp 14 pin DIL	100p
LM381N	Stereo Pre Amp 14 pin DIL	180p
M252	Rhythm Ken 16 pin DIL	850p
MC1310	FM Stereo Decoder 14 pin DIL	200p
MC1351P	Lim/Det. Audio Preamp	104p
MC1495	Multipher 14 pin DIL	370p
MC1496	Bal. Mod/Demod 14 DIL	115p
MFC4000B	¼W Audio Amplifier PCB	75p
MFC6040	Electronic Attenuator PCB	160p
NE540L	Audio Pwr. Driver TO99	140p
NE555V	Timer 8 pin DIL	40p
NE556	Dual 555 14 pin DIL	108p
NE561B	PLL with AM Demod	400p
NE562B	PLL with VCO 16 pin DIL	400p
NE565	PLL 14 pin DIL	200p
NE566V	PLL Function Gen 8 pin DIL	165p
NE567V	PLL Tone Decoder 8 pin DIL	200p
2567	Dual 567 16 pin DIL	400p
SN72733	Video Amplifier 14 pin DIL	150p
SN76003N	Audio Pwr. Amp with Int. HS	275p
SN76013N	Audio Pwr Amp with Int HS	175p
SN76023N	Audio Pwr Amp with Int HS	175p
SN76033N	Audio Pwr. Amp with Int. HS	275p
TAA661B	FM IF Amp Lim/Detector QIL	150p
TBA641B	Audio Amp QIL	300p
TBA800	5W Audio Amp QIL	100p
TBA810	7W Audio Amp QIL	125p
TBA820	2W Audio Amp QIL	100p
TDA2020	20W Audio Amp QIL	405p
XR2240	Prog Timer/Counter 16 pin DIL	400p
ZN414	TRF Radio Receiver TO18	140p

OPTO-ELECTRONICS

PHOTO-TRANSISTORS		LEDs	
OCP70	33p	TIL209 Red	15p
OCP71	120p	TIL211 Green	32p
2N5777	43p	TIL32 Infrared	81p
		MV5025	27p
LDRs		0·2"	
ORP12	60p	Red	18p
ORP60	75p	Green	29p
ORP61	75p	Yellow	32p

SEVEN SEGMENT DISPLAYS

3015F	Minitron 0·3"	175p
DL704	Com. Cathode 0·3"	160p
DL707	Com. Anode 0·3"	160p
DL747	Com. Anode 0·6"	250p

OPTO-ISOLATORS

Phototransistor TIL112 (IL 12) 6 Pin DIL 151p
Photodarlington ILCA55 6 Pin DIL 270p

DRIVERS

75491 Quad Segment Driver 14 Pin Dil 76p
75492 Hex Digit Driver 14 Pin DIL 87p

TIP30C	72p	40594	85p
TIP31A	56p	40595	97p
TIP31C	68p	**FETs**	
TIP32A	63p	BF244	45p
TIP32C	85p	MPF102	40p
TIP33A	97p	MPF103	40p
TIP33C	120p	MPF104	40p
TIP34A	124p	MPF105	40p
TIP34C	160p	2N3819	27p
TIP35A	243p	2N3820	50p
TIP35C	290p	2N3823	54p
TIP36A	297p	2N5457	40p
TIP36C	360p	2N5458	40p
TIP41A	70p	2N5459	40p
TIP41C	84p	3N128	81p
TIP42A	76p	3N140	92p
TIP42C	96p	3N141	81p
TIP2955	76p	40603	63p
TIP3055	60p	40673	58p
TIS93	28p	**UJTS**	
ZTX108	11p	TIS43	37p
ZTX300	16p	2N2160	95p
ZTX500	19p	2N2646	45p
ZTX504	60p	2N4871	40p
2N697	25p	**PUJT**	
2N698	32p	2N6027	60p
2N706	22p	**DIODES**	
2N708	22p	**SIGNAL**	
2N918	43p	OA47	9p
2N930	19p	OA70	10p
2N1131	25p	OA81	10p
2N1132	25p	OA85	11p
2N1304	40p	OA90	7p
2N1305	40p	OA91	9p
2N1306	40p	OA95	9p
2N1307	40p	OA200	8p
2N1613	22p	OA202	10p
2N1711	22p	1N914	4p
2N1893	32p	1N916	11p
2N2219	22p	1N4148	4p
2N2222	22p	**RECTIFIER**	
2N2369	15p	BY100	31p
2N2484	32p	BY126	15p
2N2904/A	22p	BY127	12p
2N2905/A	22p	1N4001	6p
2N2906/A	22p	1N4002	8p
2N2926RB	9p	1N4004	7p
2N2926OG	11p	1N4005	7p
2N3053	19p	1N4007	8p
2N3054	43p	**ZENER**	
2N3055	54p	2·7 to 33V	
2N3439	72p	400mW	11p
2N3442	151p	1W	22p
2N3702	14p	**TUNNEL**	
2N3703	14p	AEY11	75p
2N3704	14p	**VARICAP**	
2N3705	14p	BB105	33p
2N3706	12p	**NOISE**	
2N3708	11p	Z5J	140p
2N3709	11p	**BRIDGE RECTIFIERS**	
2N3707	14p	1A 50V	25p
2N3773	320p	1A 100V	27p
2N3866	90p	1A 400V	28p
2N3904	22p	1A 600V	32p
2N3905	22p	2A 50V	40p
2N3906	22p	2A 100V	48p
2N4058	19p	2A 400V	56p
2N4060	19p	3A 600V	63p
2N4123	22p	4A 100V	75p
2N4124	22p	6A 50V	72p
2N4125	22p	6A 100V	78p
2N4126	22p	6A 400V	90p
2N4289	24p	**TRIACS**	
2N4371	142p	Amp Volts	
2N4348	173p	3 400	130p
2N4401	34p	6 400	162p
2N4403	34p	6 500	194p
2N5089	34p	10 400	200p
2N5401	82p	10 500	270p
40360	43p	40430	108p
40361	43p	40669	105p
40362	45p	**DIAC**	
40410	65p	BR100	30p
40409	65p		
40411	243p		

SCR THYRISTORS

1A 50V TO5			43p
1A 100V TO5			45p
1A 400V TO5			50p
3A 400V STUD			81p
7A 400V TO5 + HS			97p
8A 50V Plastic			142p
16A 100V Plastic			173p
16A 400V Plastic			195p
16A 600V Plastic			238p
BT106	150p	2N3525	104p
C106D	70p	2N4444	200p
MCR101	27p	2N5064	43p

MEMORY I.C.s

2102-2 (Intel RAM) 300p

R0-3-2513 (GIM ROM) 850p

MAIL ORDER ONLY

Govt., Colleges, etc. orders accepted

TECHNOMATIC LTD.

54 SANDHURST ROAD, LONDON, NW9
Tel. 01-204-4333

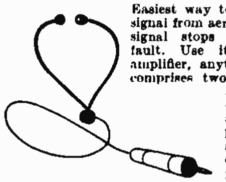
DRILL CONTROLLER

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. **£3·45** including post and VAT. Made up model £1·00 extra.

NUMICATOR TUBES

For digital instruments, counters, timers, clocks, etc. Hi-vac XNII Price **£1·25** each, inc. Post and VAT

RADIO STETHOSCOPE



Easiest way to fault find, traces signal from aerial to speaker, when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything. Complete kit comprises two special transistors and all parts including probe tube and crystal earpiece, **£2·95**, twin stetho-set instead of earpiece, VAT & postage incl.

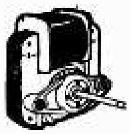
MAINS TRANSISTOR PACK

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 **£1·90** including post and VAT.

MOTORISED DISCO SWITCHES

With six 10 amp changeover switches. Multi adjustable switches are rated at 10 amp each so a total of 2000w's can be controlled and this would provide a magnificent display. For mains operating **£4·25** post & VAT Paid. Ditto 9 switch **£4·95** Post & VAT Paid. **DITTO BUT 12 SWITCH £5·75 POST AND VAT PAID.**

MAINS MOTOR

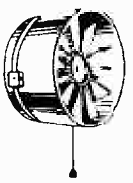


Precision made—as used in record decks and tape recorders—ideal also for extractor fans, blower, heaters, etc. New and perfect. Snip at **95p** + VAT & Postage **35p**.
1" stackmaster **£1·50** + VAT & postage 35p. 1½" stackmotor **£2** + VAT & Postage 40p.

WINDSCREEN WIPER CONTROL

Vary speed of your wiper to suit conditions. All parts and instructions to make. **£3·75** post and VAT paid.

EXTRACTOR FAN



Cleans the air at the rate of 10,000 cubic feet per hour. Suitable for kitchens, bathrooms, factories, changing rooms, etc. It's so quiet it can hardly be heard. Compact. 5¼" casing comprises motor, fan blades sheet steel casing, pull switch, mains connector and fixing brackets. **£5·25** INCLUDING POST & VAT. Monthly list available free; send long stamped envelope.

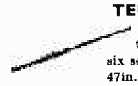
28 RPM GEARED MAINS MOTOR

This is a substantial motor (1" stack induction type) quite powerful definitely large enough to drive a rotating display or a tumbler for polishing stone, etc. Approximate overall size 4" × 3½" × 2½" these are ex-unused equipment, carrying our normal ex-equipment guarantees. PRICE **£2·95** POST & VAT PAID.

GLAMORIZE YOUR ROCKS

The way to make rock samples, stamps, etc. really show themselves off is to light them by means of our miniature UV tube. This is only 6w's so the electricity costs are negligible. Complete kit comprises UV tube and it's 2 mounting holders. Total price **£3·75** POST & VAT PAID.

TELESCOPIC AERIALS



for portable car radio or transmitter. Chrome plated—six sections, extending from 7½ to 47in. **50p** + 15p. Post & VAT. KNUCKLED MODEL FOR F.M. **80p** + 17p Post & VAT.

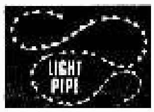
NEED A SPECIAL SWITCH

Double leaf contact. Very slight pressure closes both contacts **12p** each. Plastic pushrod suitable for operating. **10p** each 10 for **68p**

MULLARD UNILEX

A mains operated 4 + 4 stereo system. Rated one of the finest performers in the stereo field this would make a wonderful gift for almost any one in easy-to-assemble modular form and complete with a pair of Goodmans speakers this should sell at about £30—but due to a special bulk buy and as an incentive for you to buy this month we offer the system complete at only **£14·00** including VAT and postage.

LIGHT PIPE



A mains operated travelling light array. 24ft long it uses 130 miniature bulbs which flash in sequence to make bands of light move along the tube. The tube can be draped around a particular item or set and cannot fail to attract attention—complete kit consists of—24ft of translucent tubing—140 min lamps—8yds multicore cable—motorised switch—taps for quick connections and full wiring instructions. **£15** for complete kit. Post and VAT paid.

TWIN OUTPUT POWER PACKS

These have two separate R.C. smoothed outputs so can operate two battery radios or 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 a 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.

INFRA RED BINOCULARS

Made for military purposes during and immediately after the last war to enable snipers, vehicle drivers, etc. to see in the dark. The binoculars have to be fed from a high voltage source (5KV approx.) and providing the objects are in the rays of an infra-red beam then the binoculars will enable these objects to be seen. Each binocular eye tube contains a complete optical lens system as well as the infra-red cell, technical data on which is available. The binoculars are unused, believed to be in good working order, in fact they were never issued and are still in original cases, but since they were made a long time ago they can hardly be called new. Sold without guarantee. Price **£17·50** per set + £1 carriage.

THIS MONTH'S SNIP

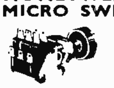
ROOM THERMOSTAT

Famous Satchwell, elegant design, intended for wall mounting. Will switch up to 20 amps at mains voltage, covers the range 0-30°C. Special snip this month **£2·50**, post and VAT paid.

MICRO SWITCH BARGAINS

Rated at 5 amps 250 volts, ideal to make a switch panel for a calculator and for dozens of other applications. Parcel of 10 for **£1·00** VAT AND POST PAID.

HONEYWELL PUSH BUTTON PANEL MOUNTING MICRO SWITCH

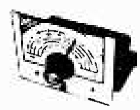


1-2-3-Bank, each bank consisting of the changeover micro switch rated at 10 amps 250 volts. Through panel fixing by 2 lock nuts complete with black 1" diameter knob. Prices:— 1 bank **40p** —2 bank **55p**—3 bank **70p**.

SMITHS CENTRAL HEATING CONTROLLER

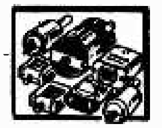
Push button gives 10 variations as follows: (1) continuous hot water and continuous central heating (2) continuous hot water but central heating off at night (3) continuous hot water but central heating on only for 2 periods during the day (4) hot water and central heating both on but day time only (5) 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 **£7·50** each INCLUDING VAT and Postage.

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 including VAT and Postage.

ONLY £1·50 FOR SEVEN ELECTRIC MOTORS



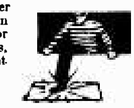
7 powerful batt. motors as used in racing cars and power models. Output and types vary for use in hundreds of projects—Tools, toys, models, etc. All brand new reversible and for 1½-12v batts. Wiring diag. inc. VAT, Post PAID.

TERMS: Where order is under £5 please add 30p surcharge to offset packing expenses.

J. BULL (ELECTRICAL) LTD.

(Dept. P.W.), 103 TAMWORTH ROAD, CROYDON CR9 1SG

SWITCH TRIGGER MATS



So thin is undetectable under carpet but will switch on with slightest pressure. For burglar alarms, shop doors, etc. 24in × 18in **£2·33**. Post & VAT 60p.
13in × 10in **£1·85**. Post & VAT 50p.

MAINS TRANSFORMERS

All standard 230-250 volt primaries

		£ p
2·4v	5 amp	**1·05**
6·3v	2 amp	**1·57**
6·3v	3 amp	**2·19**
9v	1 amp	**1·19**
9v	3·5 amp	**3·13**
12v	1¼ amp	**1·85**
12v	1 amp	**1·25**
6·5v-0·6·5v	1 amp	**1·85**
18v	1 amp	**1·85**
24v	2 amp	**2·82**
24v	3 amp	**4·75**
12-0-12v	50mA	**1·56**
6-0-6v	50mA	**1·56**
8-0-8v	½amp	**1·85**
25v	1½ amps	**2·44**
50v 2 amp & 6·3v	1 amp	**5·68**
60v 5 amp & 5v	1 amp	**9·35**
27v	8 amp	**5·68**
30v	37 amp	**27·50**
80v tapped 75v & 70v	4 amp	**6·87**
250v-60mA & 6·3v	1·5 amps	**2·19**
275-0-275v at 90mA & 6·4v	3 amps	**2·82**
EHT Transformer 5000v 23mA	(Intermittent)	**6·87**
Charger Transformers		
6v and 12v	2 amps	**1·87**
6v and 12v	3 amps	**2·82**
6v and 12v	5 amps	**4·25**

Add 30p per £1 to cover postage and VAT

MULTI SPEED MOTORS

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 × 5 in. long. Price **£2·00** including Post & VAT.

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 barbeque or to drive a tumbler for stone polishing; in fact, there are no ends to its uses. Normal mains operation. **£3·25** including POST & VAT.

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.

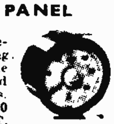
SMITHS 24-HR TIMER HEART

Really the "Autoset" without its plastic case. This is a 24 hr twice on, twice off, clock switch which will repeat until re-programmed. Switches rated at 15 amps. Limited supplies. PRICE **£4·45** INCL. POST & VAT.

PP3/PP9 BATTERY ELIMINATOR

Made in Japan for Bush Radio. This is very neat little transformer driven full wave unit totally enclosed with input mains and output leads. This power supply unit which was originally marketed by Bush at over £6 is offered as this month's snip. PRICE **£2·00** INCLUDING POST & VAT.

DC HIGH CURRENT PANEL METERS



3½" wound wide angle 240 movement meters, flush mounting, fitted with external shunts, made by Crompton Parkinson, brand new, still in maker's cartons. These are a real bargain at **£6·00** each including post & VAT. Reasonable quantities available in the following ranges 0-15 amps, 0-20 amps, 0-30 amps, 0-40 amps.

MULLARD AUDIO AMPLIFIERS

All in module form, each ready built complete with heat sinks and connection tags, data supplied Model 1153 500mW power output **£1·50** including Post & VAT. Model 1172 1W, power output **£1·85** including Post & VAT. Model EP9000 4 watt power output **£2·90** including Post & VAT. EP 9001 twin channel or stereo pre-amp. **£2·90** including Post & VAT.

SMALL ADS

The prepaid rate for classified advertisements is 17 pence per word (minimum 12 words), box number 40p extra. Semi-display setting £14.00 per single column inch (2.5cm). All cheques, postal orders etc., to be made payable to Practical Wireless and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, Practical Wireless, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

CONDITIONS OF ACCEPTANCE OF CLASSIFIED ADVERTISEMENTS

1. Advertisements are accepted subject to the conditions appearing on our current advertisement rate card and on the express understanding that the Advertiser warrants that the advertisement does not contravene any Act of Parliament nor is it an infringement of the British Code of Advertising Practice.
2. The publishers reserve the right to refuse or withdraw any advertisement.
3. Although every care is taken, the Publishers shall not be liable for clerical or printers' errors or their consequences.

NOTICE TO READERS

Whilst prices of goods shown in classified advertisements are correct at the time of closing for press, readers are advised to check with the advertiser both prices and availability of goods before ordering from non-current issues of the magazine.

Receivers and Components

PADEC COMPONENTS
(Dept. PW)

C-D IGNITION TRANSFORMERS
Laminated core, clamp fixing, 15:1 turns ratio (FREE application circuit with trans'f. if requested) £1·95 + 25p P&P.
I.T.T. DIECAST BOXES
(4¾" x 3¾" x 2" approx) £1·30 + 30p P&P.
400mW ZENERS: 6·8V, 8·2V, 9·1V, 10V, 12V, 13V, 16V, 20V, 22V, 24V, 27V, 30V
9p each ... 10 off (any mix) 83p
1N4001 5p 1N4004 6p
1N4005 7p 1N4006 8p
RESISTORS ¼w CF 2·2ohm-2·2Mohm (E12)
2p each ... 10 off (any mix) 12p
GLASS WIRE ENDED NEONS
7p each ... 10 off 60p
P&P AS INDICATED OR 15p MINIMUM

P.O. BOX 71, SOUTHEND-ON-SEA, ESSEX SS2 5DZ.

500 COMPONENTS. Resistors, capacitors, diodes, transistors, pots, coils, etc, Identified, formed leads, fall-out, and surplus. Good value at £1·75. All inclusive (UK postal rates only). CWO please to L. Penseney, PW Bankhead Farm, South Queensferry, West Lothian.

100 POLYESTER CAPACITORS £2·25
100 Fully guaranteed electrically tested polyester capacitors. No floor sweepings. All famous makes ITT, MULLARD, ERIE etc.
Mixed pack of **YOUR CHOICE** from the following values—mainly 250V. Prompt despatch.

·01 MF	·047 MF	·22 MF
·015	·068	·33
·022	·1	·47
·033	·15	

Mail Order Only.
£2·25 includes P & P.
B. Malloy, (P.W.), 66 Woodvale Avenue, Belfast, BT13 3EX, Northern Ireland.

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.

Receivers and Components

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	68p
0·15μF	27	12·7	80p
0·22μF	33	16	86p
0·25μF	33	16	92p
0·33μF	33	16	99p
0·47μF	33	19	£1·10
0·5μF	33	19	£1·16
0·68μF	50·8	19	£1·25
1·0μF	50·8	19	£1·37
1·5μF	50·8	25·4	£1·64
2·0μF	50·8	25·4	£1·95

63V DC RANGE

Value(μF)	±1%	±2%	±5%
0·01–0·2	£1·28	75p	50p
0·22–0·47	£1·32	77p	51p
0·68μF	£1·44	84p	56p
1·0μF	£1·56	91p	60p
1·5μF	£1·74	£1·16	67p
2·2μF	£1·98	£1·32	75p
3·3μF	£2·40	£1·60	99p
4·7μF	£2·82	£1·88	£1·23
6·8μF	£3·48	£2·32	£1·47
10μF	£4·98	£3·32	£2·01
15μF	£7·14	£4·76	£2·88
22μF	£9·66	£6·44	£3·90

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; 33·00μF 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***, 100 for **£9***.

TRANSISTORS & I.C.'s

BC107/8/9	9p	*BC212/212L	12p	2N3055	50p
*BC114	12p	*BC213/213L	11p	OC44/45	20p
*BC147/8/9	10p	*BC214/214L	11p	OC71/2	20p
*BC153	16p	*BF194/5	12p	NE555 Timer	61p
*BC154/7/8/9	12p	BFY50/1/2	20p	741C 8 pin Dil	32p
BC182/182L	11p	AF178	40p	ZN414	£1·15
*BC183/183L	11p	AF239	38p	SN76013ND	
*BC184/184L	12p	2N3702/4	11p		£1·50

POPULAR DIODES—1N914 **6p**, 8 for **45p**, 18 for **90p**, IN916 **8p**. 6 for **45p**, 14 for **90p**; 1S44 **5p**, 11 for **50p**; 26 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; 13V; 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 2·2 Ω to 2·2M Ω. ALL at **1p*** each. **8p*** for 10 of any one value, **70p*** for 100 of any one value. SPECIAL PACK; 10 of each value 2·2 Ω to 2·2M Ω (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; 320k; 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 12½%.
Send S.A.E. for additional stock lists.
Wholesale price lists available to bona fide companies.

MARCO TRADING (Dept. P4),
The Old School, Edstaston, Wem, Shropshire.
Tel: Whixall 464/465 (STD 094 872)
(Proprs. Minicost Trading Ltd.)

NOSTALGIA COLLECTING

VINTAGE RADIO
1920 to 1950

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

S.a.e. with enquiries and for monthly newsheet. Full 1976 catalogue, 50p post paid.

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

BRAND NEW COMPONENTS BY RETURN. Electrolytics 16V, 25V, 50V-0·47, 1·0, 2·2, 4·7, 10mfds.—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, 4·7/25V—11p. 10/25V, 22/16V, 47/6V, 100/3V—12p. Mylar Film 100V, 0·001, 0·002, 0·005—3p, 0·01, 0·02—3½p. 0·04, 0·05—4p. Mullard C280 series miniature polyester vertical mounting E6 series 0·01—0·1—4p, 0·15, 0·22—5p. 0·33, 0·47—8p. 1·0—15p. 1·5—20p. 2·2—24p. Mullard miniature ceramics 63V, 2%, E12 series 1·8 pf.—47 pf.—3p. 56 pf.—330 pf.—3½p. Plate ceramics 50V E12 series 22 pf.—1000 pf. E6 series 1500 pf.—47000 pf.—2p. Polystyrene 63V E12 series 10 pf.—1000 pf.—3p. 1200 pf.—10000 pf.—4p. Miniature Highstab carbon film resistors ⅓W E12 series 5% (10% over 1MΩ) 1Ω—10MΩ—1p. 1N4148—3p. 1N4002—5p. 1N4006—7p. 1N4007—8p. Postage 10p. Prices VAT inclusive. The C. R. Supply Co., 127, Chesterfield Rd., Sheffield S8.

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

AUTOMATIC 2-SEGMENT
PHASE MODULE

★ For electric guitar/organ/ microphone ★ Fibreglass p.c.b. ★ Only 60 x 50mm ★ Can fit inside control section of instrument ★ Continuously variable rate of phase ★ Powered by PP3 battery (not supplied). Only **£8·90** inc. SAE All Enquiries.

EXPRESS COMPONENTS, (PW), 29 White Road, Stratford, London E15 4HA

For Sale

DISCOLIGHTS. Summer Sale Now. 3-channel soundlights £16! Strobes £22! Free catalogue: Aarvak Electronics, 12a (P) Bruce Grove, London N17. (01-808 8923).

SERVICE SHEETS—COLOUR TV SERVICE MANUALS

LARGE SELECTION COVERING MOST MAKES—S.A.E. WITH ENQUIRIES PLEASE TO:

BELL'S TELEVISION SERVICES

190 KINGS ROAD, HARROGATE, N. YORKSHIRE TEL. (CODE 0423) 55885

We also have a large stock of Books & Magazines on Radio, TV, etc. Free lists on request

---

SERVICE SHEETS — COLOUR TV SERVICE MANUALS

Service Sheets for Mono TV, Radios, Record Players and Tape Recorders 75p.
Please send large Stamped Addressed Envelope.
We can supply manuals for most makes of Colour Television Recievers by return of post.
B.R.C. PYE ECKO PHILIPS ITT/KB SONY G.E.C. HITACHI BAIRD ULTRA INVICTA FERGUSON H.M.V. MARCONI AND MANY MORE
Let us quote you. Please send a Stamped Addressed Envelope for a prompt reply.
Also comprehensive T.V. repair manuals by J. M. Court. S.A.E. for details.

G. T. TECHNICAL INFORMATION SERVICE
10 DRYDEN CHAMBERS, 119 OXFORD ST., LONDON WIR 1PA
MAIL ORDER ONLY

SERVICE SHEETS, Radio, TV, etc., 50p and s.a.e. Catalogue 20p and s.a.e. HAMILTON RADIO, 47 Bohemia Road, St. Leonards, Sussex.

LARGE SUPPLIER OF SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOGRAMS, RADIOGRAMS, CAR RADIOS)

ALL AT 75p EACH (Except colour) & CAR RADIOS
Please state if Circuit will do if Service Sheet not in stock.

"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

Wanted

WE PAY £2 EACH (plus postage) for clean copies of "Radio & TV Servicing" books from 1960-61 edition onwards. Bells Television Services, 190 Kings Road, Harrogate, N. Yorkshire. Tel: 0423 55885.

TOP PRICES PAID for NEW VALVES and TRANSISTORS

popular T.V. and Radio types.

KENSINGTON SUPPLIES (C),
367 Kensington Street, Bradford 8, Yorkshire.

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

Educational

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

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 September 13th.

Prospectus from: London Electronics College, Department B10, 20 Penywern Road, London SW5 9SU. Tel. 01-373 8721.

COURSES—RADIO AMATEURS EXAMINATION City & Guilds. Pass this important examination and obtain your G8 licence, with an RRC Home Study Course. For details of this, and other courses (GCE, Professional Examinations etc) write or phone—THE RAPID RESULTS COLLEGE, Dept JX1 Tuition House, London SW19 4DS. Tel. 01-947 7272 (Careers Advisory Service) or for a prospectus only ring 01-946 1102 (24hr recording service).

Ladders

LADDERS. Varnished 25½ft extended £26. Carriage £1·90. Leaflet. Alloy extending and Loft Ladders. The Ladder Centre (WLS) Halesfield (1) Telford, Salop. Tel: 586644. Order C.O.D.

U.K. Agents Required

PACIFIC TRADING COMPANY
ALWAYS A STEP AHEAD IN ELECTRONIC FIELD

NEW INVENTIONAL
LED "MAGIC TOUCH"
WATER RESISTANCE ELECTRONIC QUARTZ WATCH
NO NEED PUSH BUTTON
JUST TOUCH. TIME WILL DISPLAY: HOUR, MIN, SEC, MONTH, DATE AND DAY

WEIGHT: LESS THAN 0·5 OZ.
THICKNESS: 0·5 CM

PACIFIC TRADING COMPANY
77A WATERLOO RD., KOWLOON
P.O. BOX SSP 8173 HONGKONG
TELEX: 84672 VRHGT HX

Books and Publications

START YOUR OWN BUSINESS REWINDING ELECTRIC MOTORS

This unique instruction manual shows step by step how to rewind motors, working part or full time, without previous experience. Everything you need to know easily explained, including where to obtain materials, how to get all the work you need, etc. A goldmine of information and knowledge.

Only £3·90 plus 26p P&P.

Magnum Publications Dept PW5
Brinksway Trading Estate, Brinksway, Stockport SK3 0BZ.
Overseas Distributors wanted.

Miscellaneous

LOW-COST I.C. MOUNTING for any size DIL package. 100 Soldercon sockets 65p. 7 and 8 hole plastic supports 5p/pair. Quantity rates. SAE details and sample. Trial pack 65p. (P & P 10p/order). P.K.G. Electronics, Oak Lodge, Tansley, Derbyshire DE4 5FE.

Miscellaneous (continued)

the **TEXAN** HiFi Amp

28 watt version available ex stock at £35 incl. tax

You are invited to send S.A.E. for lists of our very extensive range of high quality amplifier, pre-amps, F.M. tuners, Instruments, Radiocontrol, ignition units and many other kits. Please state requirements.

TELERADIO ELECTRONICS, 325 FORE STREET, EDMONTON, LONDON N9

RECHARGEABLE NICAD BATTERIES. Pencell, AA—£0·94p. Sub. 'C'—£1·16. 'C'—£1·92. 'D'—£2·59. PP3—£4·48. Chargers, £4·48, £4·48, £4·98, £4·98, £3·98 respectively. Others. All prices include VAT. Add 10% Post and Package. SAE for price list plus 25p for information booklet. Sandwell Plant Ltd., 1 Denholm Road, Sutton Coldfield, West Midlands. 021 354 9764.

MINI ACCUMULATORS

2 volt MULTI-USE Sealed Lead Acid Rechargeable Cells. Size L450—1·4" X 1·1" X ·44". 3 for £2·65 Size GA2—1·7" X 1·3" X ·5". 3 for £2·95 "Add 25p P. & P. Any Qty"

Suits Fi-Cord

GARFIELDS, 295 Rye Lane, London, S.E.15

ENAMELLED COPPER WIRE

S.W.G.	1 lb reel	½ lb reel
10 to 19	2·40	1·35
20 to 29	2·45	1·40
30 to 34	2·60	1·50
35 to 40	2·85	1·60

All the above prices are inclusive of postage and packing in U.K.

COPPER SUPPLIES

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

SUPERB INSTRUMENT CASES by Bazelli, manufactured from heavy duty PVC faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range, competitive prices start at a low 75p. Examples: width, depth, height, 8in x 5in x 3in, £1·55; 10in x 6in x 3in, £2·20; 10in x 8in x 3in, £2·75; 12in x 10in x 3in, £3·60; 8in x 4in x 4in, £1·80; 10in x 6in x 4in, £2·70; 12in x 8in x 4in, £3·60; 7in x 7in x 5in, £2·65; 8in x 10in x 6in, £3·60; 12in x 8in x 7in, £4; 12in x 12in x 7in, £4·40. Plus 71p. Carriage and 8% VAT. Over 400 models to choose from. Prompt despatch. Free literature (stamp would be appreciated), Bazelli, Dept. No. 25, St. Wilfrid's, Foundry Lane, Halton, Lancaster LA2 6LT.

GORSE'S

MAIN STOCKISTS FOR

GRUNDIG

Satellit 2000, 21 Wave Band Radio, TK545 and TK745 Stereo Tape Recorders, Radios, Radio/Cassette Recorders, Cassette Recorders, Microphones, etc., etc.

Please write, phone or call for full details and prices.

42-44 CHURCH ST., BLACKBURN Tel: 51682

77 THE MALL BURNLEY Tel: 35229

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. PW10, 4 Princes Square, Harrogate, North Yorkshire.

---

12 VOLT FLUORESCENTS

35% OFF RRP

MADE BY THORN LIGHTING. Ideal for Caravan, Boat, Tent, Emergency Lighting etc. All lamps guaranteed for 12 months.

21 ins 13 watt **£4·90**

12 ins 8 watt **£4·00**

All lamps have On/Off Switch, Wrong Polarity Protection Device and Diffuser.

C60 CASSETTES **32p**
C90 CASSETTES **45p**

All Cassettes in Plastic Case with Index and Screwed Assembly.

All prices include VAT. Add Postage 5p in £1.

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

SALOP ELECTRONICS
23 WYLE COP
SHREWSBURY
Tel. 53206

COLCHESTER COMPONENTS SHOP. Now open Sunday-Thursday 12-6 p.m. J. K. Electronics, 11 Mersea Road, Colchester 64433.

ELECTRONIC BROKERS

ELECTRONIC BROKERS LTD
49/53 Pancras Road
London NW1 2QB
Tel: 01-837 7781

Computer parts for hobby, experimental, educational and professional use.

KB6: 56-station standard Teletype layout

AS RECOMMENDED FOR PRACTICAL WIRELESS VIDEO-WRITER PROJECT

ASCII-Coded TTL-compatible 4-bank alphanumeric reed-switch keyboard with ROM encoder chip, strobed output, two-key rollover and debounce. Standard 7-bit ASCII code (no parity). Supplied complete with circuit diagrams and code chart.

SPECIFICATIONS

Power Supply: +5VDC +/−5% 150mA; −12VDC +/−10% 10mA. **Output Logic Levels:** Data Bits 1 through 7: Ov "O" ·45V; 2·6V "1" 5·25V. **Fan Out:** One standard TTL load. **Strobe:** 2·6V "1" 5·25V; Ov "0" ·46V. **Fan Out:** 10 standard TTL loads. Strobe signal delay 10 milliseconds nominal to allow data to stabilise.

Price **£35·00** plus £1·00 P&P + 8% VAT (Send £38·88)

KB7: Similar to KB6 PLUS 8 additional key-stations (standard ASCII 64 character set) PLUS lower-case Alpha facility.

Price **£42·50** plus £1·00 P&P + 8% VAT (Send £46·98)

ALSO AVAILABLE—SPECIAL LOW-COST KEYBOARD:

KB5: 3-bank alphanumeric Baudot-coded 36-station keyboard. TTL-compatible strobed output.

Price **£20·00** plus 75p. P&P + 8% VAT (Send £22·41)

10% OFF TTL THIS MONTH
7400/1/2/3/10/40 @ 11p. 7404/5 @ 13p. 7408/20/30 @ 14p. 7432 @ 15p. 7411 @ 19p. 7407 @ 24p. 7416/72 @ 22p. 7437/38/74 @ 25p. 7413/73 @ 26p. 7476 @ 28p. 74107 @ 29p. 7486 @ 30p plus many others.
Please deduct 10%, add 15p postage and 8% VAT or send SAE for catalogue to:—
FRASER-MANNING LTD.
26 HERVEY STREET, IPSWICH, SUFFOLK

EM15 COMBO AMP. General purpose amplifier and speaker. 15W RMS, 2 inputs, 2 Vol, treble, bass, £40, £3 p&p. C.W.O. cheques, P.Os, to Electronmart Ltd., 53 Middle St., Falmer, Sussex.

TRANSMIT!

★ Unique **TRANSMITTER/RECEIVER** Kit. No licence examinations or tests required to operate this transistorised equipment. Easy to build. Get transmitting. Send £7·95 plus 20p post and packing.

★ 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 plus 20p post and packing.
(All prices include V.A.T.)

Send remittance to:
BOFFIN PROJECTS,
4 CUNLIFFE ROAD,
STONELEIGH, EWELL, SURREY
(Mail order U.K. only)
Or for more details, send 20p for lists

WHAT'S ON VLF?

EXPLORE 10-150 KHz with a VLF TUNER. Listen to time signals, CW weather, DX beacons, etc. EASY to make, all parts, case, PCB, instructions, money back assurance.
ONLY £9·70, £11·20 airmail.
CAMBRIDGE KITS
45 (PK) Old School Lane, Milton, Cambridge.

PRINTED CIRCUITS and HARDWARE

Readily available supplies of Constructors' hardware, Aluminium sheet and sections. Printed circuit boards, top quality for individual or published designs. Prompt service. Send 15p for catalogue.

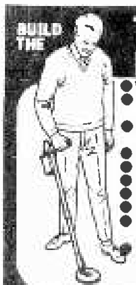
Ramar Constructor Services, Masons Road, Stratford on Avon, Warwicks. Tel. 4879

THE SCIENTIFIC WIRE CO
Copper - Nickel Chrome - Eureka - Manganin Wires.
Enamelled - Silk - Cotton - Tinned Coverings.
No minimum charges or quantities.
Trade and Export enquiries welcome.
S.A.E. Brings List.
P.O. BOX 30, LONDON, E4 9BW

Musical Miracles!

by Dewtron ®

Build your own synthesiser or musical effects using some of the huge range of **DEWTRON** modules. Or, build fuzz or waa-waa at budget prices using special kits.
Send 20p for Catalogue from—
D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset BH22 9AR.



BUILD THE TREASURE TRACER MK III Metal Locator
- Varicap tuning
- Britain's best selling metal locator kit; 4,000 sold
- Weighs only 22oz. Fitted with Faraday shield.
- Speaker and earphone operation
- Knocks down to only 17in.
- Prebuilt search coil assembly
- Thoroughly professional finish
- As seen on BBC1 and BBC2 TV
- You only need soldering iron, screwdriver, pliers and snips
- Five transistor circuit

Send stamped, addressed envelope for leaflet

Complete Kit £12·50 Post 85p + £1·00 VAT 8% — Built & tested £17·50 Post 85p + £1·40 VAT 8%
MINIKITS ELECTRONICS, 6a CLEVELAND ROAD, LONDON, E18 2AN (Mail order only)

BURGLAR ALARM EQUIPMENT—Safes, D.I.Y. SAE for list. ASTRO ALARMS, 25 Stockton Road, Sunderland, Tyne & Wear. Tel: 77825.

H. M. ELECTRONICS

275a FULWOOD ROAD, BROOMHILL, SHEFFIELD S10, 3BD.
BEC CABINETS (Illus'd)

METAL CASES
DRY TRANSFER LETTERING
Send 15p for leaflets (Refundable)
Trade enquiries invited

Please mention
PRACTICAL WIRELESS
when replying to
Advertisements

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Practical Wireless for .... insertions. I enclose Cheque/P.O. for £.......................
(Cheques and Postal Orders should be crossed Lloyds Bank Ltd. and made payable to Practical Wireless).

NAME ....

ADDRESS ....

....

Send to: Classified Advertisement Manager
PRACTICAL WIRELESS,
GMG, Classified Advertisement Dept., Rm. 2337, King's Reach Tower, Stamford Street. London SE1 9LS **Telephone 01-261 5846**
Rate
17p per word, minimum 12 words. Box No. 40p extra.

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

WATFORD ELECTRONICS

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

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

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

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

POLYESTER CAPACITORS: Axial lead type. (Values are in µf).
400V: 0·001, 0·0015, 0·0022, 0·0033 **5p**; 0·0047, 0·0068, 0·01, 0·015, 0·018, 0·022 **6p**; 0·033, 0·047, 0·068 **8p**; 0·1, 0·15, 0·22, **10p**; 0·33, 0·47, **18p**; 0·68 **24p**.
160V: 0·039, 0·15, 0·22, 0·33 **6p**; 0·47 **10p**; 0·68 **15p**; 1·0 **18p**; 1·5 **20p**; 2·2 **24p**; 4·7 **28p**
DUBILIER: 1000V: 0·01, **14p**; 0·022, **15p**; 0·047, **16p**; 0·1, **19p**; 0·47 **43p**.

POLYESTER RADIAL LEAD (Values in µf). **250V:**
0·01, 0·015, 0·022, 0·027 **5p**; 0·033, 0·047, 0·068, 0·1 **6p**; 0·15 **7p**; 0·22, 0·33 **9p**; 0·47 **10p**; 0·68 **14p**; 1·0 **19p**; 1·5 **24p**; 2·2 **28p**.

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, 47, **7p**; 22, 50, **10p**; 63, 100, **12p**; 1000, **50p**; **50V:** 1·0, **6p**; 50, **10p**; 220, **10p**; 470, **28p**; **40V:** 33, **8p**; **35V:** 1000, **38p**; **25V:** 10, 22, 40, **6p**; 80, 100, 160 **8p**; 220, **13p**; 470; 640, **21p**; 1000, **27p**; 2200, **34p**; 3300, **39p**; 4700, **47p**; **16V:** 10, 40, 47, 68, 100, 125, 220, **6p**; 470, **11p**; 1000, 1500, **18p**; 4700, **46p**; **10V:** 4, 100, **6p**; 640, **10p**; 1000, **14p**; **64V:** 3300 **93p**; 2200, **18p**; **TAG-END TYPE: 70V:** 2500, **98p**; 4700, **111p**; **50V:** 2000, **72p**; **40V:** 10000 **145p**; 4000 **70p**; 2500 **65p**; **25V:** 4700, **48p**; **16V:** 4500, **38p**.

TANTALUM BEAD CAPACITORS
35V: 0·1µF, 0·22, 0·33, 0·47, 0·68, 1·0, 2·2µF, 3·3, 4·7, 6·8. **25V:** 1·5, 10. **20V:** 1·5, **16V:** 10µF, 22, 47. **10V:** 4·7, 15, 25, 33. **6V:** 47µF. **3V:** 100µF.
Price: **11p** each.

MYLAR FILM CAPACITORS

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

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**

POTENTIOMETERS (AB or EGEN)
Carbon Track, 0·25W Log & 0·5W Linear values

1KΩ & 2KΩ (LIN. ONLY) Single gang	**21p**
5KΩ–2MΩ single gang	**21p**
5KΩ–2MΩ single gang D/P switch	**40p**
5KΩ–2MΩ dual gang stereo	**53p**

SLIDER POTENTIOMETERS
0·25W log and linear values 60mm

5KΩ–500KΩ single gang	**45p**
10KΩ–500KΩ Dual gang	**58p**
50KΩ Lin 150mm WS 150	**£3·50**

PRESET POTENTIOMETERS

0·1W 50Ω–5MΩ Mini. Vert. & Horiz.	**7p**
0·25W 100Ω–3·3MΩ Horizontal	**7p**
0·25W 200Ω–4·7MΩ Vertical	**8p**

JACKSONS VARIABLE CAPS.

Dielectric	
100/300pF	**95p**
500pF	**105p**
DILEMIN	
300pF/500pF	**165p**
4832/2K 2 speed Drive Unit complete with knobs and coupling	**322p**
Drum 54mm	**30p**
6:1 Ball Drive 4511/DAF	**107p**
Dial Drive 4103 6:1/36:1	**468p**
0-1-365pF	**260p**
00 2 365pF	**265p**
00 280/176	**270p**
„ „ with slow motion drive	**290p**
C804–5pF; 10; 15; 20; 25; 50pF	**135p**
100, 150pF	**195p**
'L' 3x310pF	**392p**
00-3x25pF	**348p**

RESISTORS–Eire make 5% carbon Miniature High Stability, Low Noise

	RANGE	Val.	1–99	100+
0·25W	2·2Ω–4·7M	E24	2p	1·5p
0·5W	2·2Ω–4·7M	E12	2p	1·5p
1W	2·2Ω–10M	E12	3p	2p

2% 0·25W Metal Film (Welwyn) E12 now available **8p**

CERAMIC TRIMMER CAPACITORS
2–7pF; 4–15pF; 6–25pF; 8–30pF **20p**

MINIATURE TYPE:
2·5–6pF; 3–10pF;
3–30pF; 10–40pF **22p**
5–25pF; 60pF; 88pF **30p**

COMPRESSION TYPE
3-40pF **18p**; 100–500pF **32p**

SILVER MICA
(Values in pF)
3·3, 4·7, 6·8, 10, 12, 18, 22, 33, 47, 50, 75, 82, 85, 100, 120, 150, 200, 250, 300, 330, 360 **8p** each.
1000, 2200pF **11p** each.

RELAYS miniature for PW projects **85p**

CRYSTALS

1MHz	**323p**
1·6MHz	**395p**
3·2768	**360p**
Holder HC6U	**18p**

PW PROJECTS
Easy Build Organ Music Box General Coverage Receiver Direction Finder Transistor Tester Now Available Send SAE plus 10p per list.

For any other projects please send list plus SAE for quotation.

DENCO COILS

Dual Purpose 'DP' Rng.1-5 B,Y,R,W	**76p**
6-7 B. Y. R	**68p**
1-5 Green	**82p**
'T' Type (Tr. tuning) Rng. 1-5 B, Y, R, W	**83p**
B9A Valve Base	**23p**
RFC 5 chokes	**84p**
IFT 13/14/15/16/17	**79p**
IFT 18/1·6 or 465	**90p**
TOC1	**80p**
MW 5FR	**72p**
MW/LW 5FR	**94p**

HEAT SINKS*

TO92	**8p**
TO5	**9p**
TO18	**8p**
TO88	**16p**
TO3	**16p**
TO66	**16p**
Insulation Kit Mica plus 2 Bushes for TO3/TO66 or PlasticTrns.	**5p**
Silicon Grease	**120p**

EARPHONES
Magnetic

2·5mm	**15p**
3·5mm	**15p**
Crystal	**30p**

FUSES*

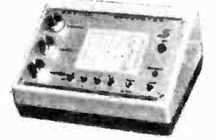
20mm	**4p**
1·25"	**4p**
1" Mains	**5p**
Anti Surge	**7p**
Holders Open	**6p**
Enclosed	**20p**

DIL SOCKETS*

Low profile (Texas)		Wire Wrap CAMBION
8 pin	**12p**	
14 pin	**13p**	**28p**
16 pin	**14p**	**34p**
24 pin	**30p**	
26 pin	**45p**	

SOLDERCON PINS*
100 **50p**; 1000 **400p**

RHYTHM GENERATOR (PW MAY-JUN 1976 by A. S. WEBB)



Build this PW Author approved, Easy build Low cost Rhythm Generator. We are the sole suppliers of the complete Kit including the Case, predrilled printed front Panel and the three *RE-DESIGNED* Fibre-glass P.C. Boards. **Prices including VAT.** Complete Kit **£39·95** (p. & p. and insur. £1·00). Ready Built **£49·95** + £1·00. Semiconductor kit **£12·75**. Set of three boards **£5·90**. **M252AA £7·50** (incl.VAT).
Send SAE for complete list. (Demonstration on at our shop).

TRANSISTORS

	p
AC107*	16
AC117	35
AC125*	32
AC126*	16
AC127*	18
AC128*	15
AC141*	22
AC141K*	38
AC142*	20
AC142K*	38
AC176*	18
AC187*	18
AC188*	19
ACY17	35
ACY18	28
ACY19	25
ACY20	24
ACY21	29
ACY22	16
ACY28	21
ACY39	78
ACY40	24
ACY41	28
ACY44	39
AD140*	48
AD149*	46
AD161*	36
AD162*	36
AF114*	20
AF115*	20
AF116*	20
AF117*	23
AF118*	47
AF121*	33
AF124*	30
AF125*	30
AF126*	30
AF127*	30
AF139*	33
AF178	70
AF179	70
AF180	70
AF181*	48
AF185	60
AF186	48
AF239*	39
AFZ11	138
AFZ12	136
ASY26*	38
ASY29*	40
ASY50	17
ASZ21*	220
AU104	125
AU105	135
BC107*	9
BC107B	10
BC108*	9
BC108B*	12
BC108C*	12
BC109*	9
BC109B*	12
BC109C*	12
BC113	15
BC114	16
BC115	18
BC116	18
BC117	20
BC118	15
BC119	25
BC135	13

	p
BC136	15
BC137	15
BC142*	24
BC143*	24
BC147	7
BC148	7
BC149	9
BC153	99
BC154	20
BC157	10
BC158	12
BC159	13
BC167	12
BC168	12
BC169C	14
BC170	11
BC171	11
BC172	11
BC177*	16
BC178*	16
BC179*	18
BC182	10
BC182L	12
BC183	10
BC183L	11
BC184	11
BC184L	12
BC186	22
BC187*	28
BC212	12
BC212L	13
BC213	11
BC213L	13
BC214	14
BC214L	16
BC307B	15
BC328	18
BC441*	30
BC461*	40
BC462*	30
BC549C	45
BCY30*	55
BCY32*	65
BCY34*	80
BCY40*	90
BCY55*	204
BCY59	18
BCY70*	15
BCY71*	20
BCY72*	15
BCY78	20
BD115*	52
BD121*	98
BD123*	95
BD124*	75
BD131*	36
BD132*	38
BD133*	60
BD135*	45
BD136*	39
BD137*	42
BD138*	47
BD139*	54
BD140	60
BD142	53
BD145*	55
BDY17	135
BDY60*	75
BDY61*	65
BF115*	22
BF154	18

	p
BF156	25
BF173*	25
BF177*	26
BF178*	28
BF179*	33
BF180*	33
BF181*	33
BF182*	33
BF183*	33
BF184*	32
BF185	30
BF194	10
BF195	10
BF196	14
BF197	15
BF198	15
BF224A	12
BF244	17
BF256*	34
BF257*	34
BF258*	38
BF259*	41
BF594	20
BF595	18
BFR39	30
BFR40	30
BFR79	30
BFR80	30
BFX18	54
BFX29*	28
BFX38*	38
BFX53*	40
BFX55*	40
BFX64*	15
BFX81*	140
BFX84*	24
BFX85*	28
BFX86*	28
BFX87*	33
BFX88*	26
BFY50*	18
BFY51*	18
BFY52*	18
BFY65	25
BSY26	28
BSY29	27
BSY78	25
BSX20*	22
BSY95A	18
BU105*	260
MJ400*	120
MJ491	160
MJ2955*	90
MJE340*	45
MJE370*	68
MJE371*	80
MJE520	65
MJE521*	55
MJE2955*	95
MJE3055*	65
MPF102	36
MPF103	36
MPF104	42
MPF105	42
MPF106	00
MPF107	00
MPSA05	25
MPSA	55
MPSA06	30
MPSA56	30
MPSA70	32
MPSUO2	00

	p
MPSU52	00
MPU131*	39
2N2907*	20
2N2907A*	22
OC25*	48
OC26*	48
OC28*	58
OC29*	58
OC35*	54
OC36*	58
OC41*	18
OC42*	18
OC44*	18
OC45*	18
OC46*	21
OC70*	17
OC71*	17
OC72*	27
OC77*	56
OC79*	30
OC81*	18
OC81D*	24
OC82*	18
OC82D*	30
OC83*	28
OC84*	44
OC84N*	44
OC123	115
OC139	94
OC140	100
OC141	157
OC170	30
OC171	32
OC201*	80
OC202*	90
OC203	60
OC204*	70
OCP70*	50
OCP71*	65
TIC44*	30
TIC45	
TIP29	43
TIP29A	45
TIP29C	68
TIP30	52
TIP30A	54
TIP30B	64
TIP30C	76
TIP31*	54
TIP31A*	58
TIP31B*	70
TIP31C*	84
TIP32*	64
TIP32A*	68
TIP32B*	80
TIP32C*	99
TIP33*	95
TIP33A*	95
TIP33B*	112
TIP33C*	130
TIP34*	110
TIP34A*	115
TIP34B*	167
TIP35*	259
TIP35A	225
TIP35C	280
TIP36A*	370
TIP41A*	68
TIP41B*	73
TIP42A*	78
TIP42B*	79
TIP2955*	65

	p
TIP3055*	60
TIS43	25
TIS44	18
TIS46	31
TIS48	25
TIS49	32
TIS50	32
TIS74	31
TIS91	20
ZTX107	12
ZTX108	12
ZTX109	13
ZTX300	14
ZTX301	14
ZTX302	18
ZTX303	15
ZTX304	24
ZTX311	10
ZTX314	16
ZTX341	19
ZTX500	16
ZTX501	13
ZTX502	18
ZTX503	14
ZTX504	47
ZTX531	28
ZTX550	18
2N526	40
2N696*	15
2N697*	13
2N698*	30
2N699*	33
2N706*	12
2N706A*	15
2N707*	50
2N708*	15
2N918*	40
2N914	18
2N916	27
2N920*	51
2N930*	18
2N961	61
2N987	42
2N1131	22
2N1132	23
2N1302*	17
2N1303*	20
2N1304*	24
2N1305*	28
2N1306*	28
2N1307*	28
2N1308*	35
2N1671	120
2N1671B	132
2N1893*	30
2N2160*	80
2N2217*	23
2N2218A	20
2N2219A*	24
2N2220A*	26
2N2221A*	23
2N2222*	20
2N2303*	30
2N2369*	14
2N2483*	30
2N2484*	30
2N5485	
2N2646	41
2N2904*	20
2N2904A*	24
2N2906*	18
2N2926G	10

	p
2N2926D	8
2N2926R	8
2N2926Y	8
2N3011	16
2N3053*	20
2N3054*	45
2N3055*	45
2N3525	76
2N3614*	89
2N3615*	99
2N3702	10
2N3703	12
2N3704	10
2N3705	12
2N3706	10
2N3707	10
2N3708	9
2N3709	9
2N3710	12
2N3711	12
2N3771*	140
2N3772*	175
2N3773*	225
2N3819	20
2N3820	40
2N3823	50
2N3824	89
2N3866*	69
2N3903	15
2N3904	15
2N3905	17
2N3906	17
2N4037	34
2N4058	15
2N4061	13
2N4062	14
2N4871	34
2N4922	52
2N5135	12
2N5136	12
2N5138	12
2N5457	36
2N5458	42
2N5459	42
2N6027*	35
40311	38
40313	98
40316	60
40317	38
40326	38
40327	48
40347	58
40348	73
40360	40
40361*	40
40362*	40
40411	220
40412	42
40430*	99
40476	131
40494	73
40495	84
40511	
40576	
40594	
40603*	58
40636	110
40673*	55

Matched Pair 10p axtra

TTL 74*

7400	14
7401	14
7402	16
7403	16
7404	20
7405	22
7406	44
7407	44
7408	19
7409	19
7410	15
7411	25
7412	25
7413	40
7414	74
7416	35
7417	39
7420	16
7421	29
7422	24
7423	30
7425	30
7426	36
7427	36
7428	48
7430	18
7432	28
7433	48
7437	30
7438	33
7440	17
7441	74
7442	74
7443	130
7444	122
7445	94
7446	116
7447	82
7448	80
7450	17
7451	17
7453	17
7454	17
7460	17
7470	32
7472	28
7473	32

7474	36
7475	36
7476	36
7480	50
7481	114
7482	82
7483	95
7484	95
7485	125
7486	36
7489	390
7490	43
7491	80
7492	53
7493	40
7494	85
7495	73
7496	82
7497	262
74100	135
74104	48
74105	48
74107	33
74109	64
74110	54
74111	76
74116	198
74118	115
74119	185
74120	105
74121	34
74122	50
74123	73
74125	69
74126	65
74128	81
74132	75
74136	75
74141	72
74142	315
74143	314
74144	314
74145	90
74147	275
74148	160
74150	128
74151	79

74153	82
74154	150
74155	76
74156	80
74157	95
74159	225
74160	116
74161	116
74162	116
74163	116
74164	121
74165	120
74166	161
74167	362
74170	246
74172	590
74173	175
74174	173
74175	90
74176	120
74177	116
74180	106
74181	299
74182	85
74184	184
74185	146
74188	650
74190	194
74191	165
74192	120
74193	120
74194	120
74195	95
74196	118
74197	118
74198	248
74199	240

CMOS*

4027	71
4054	183
4060	212
4067	308
4071	24
4072	24
4076	130
4081	18
4082	24
4516	103
4528	107

4000AE	16
4001AE	16
4002AE	16
4006AE	94
4007AE	18
4009AE	65
4010AE	46
4011AE	18
4012AE	18
4013AE	46
4015AE	81
4016AE	48
4017AE	83
4018AE	83
4019AE	46
4020AE	92
4021AE	83
4022AE	78
4023AE	18
4024AE	64
4025AE	17
4026AE	142
4028AE	74
4029AE	94
4030AE	46
4033AE	115
4034AE	156
4040AE	88
4042AE	69
4043AE	83
4044AE	77
4045AE	115
4046AE	110
4047AE	74
4049AE	48
4050AE	49
4055AE	108
4056AE	108
4069AE	18
4070AE	38
4510AE	124
4511AE	161
4518AE	100
4520AE	102

LINEAR IC'S

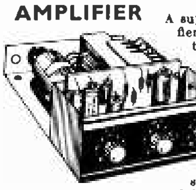
702	75p
709C 14 pin	29p
709 TO5	32p
710	43p
741 14 pin	32p
741C	22p
747C	70p
748C	28p
8038CC*	335p
AY-1-0212	550p
AY-1-5051	120p
AY-5-1224*	349p
AY-1-67216	175p
AY-5-3500*	610p
AY-5-3507*	610p
AY-5-4007	745p
CA3011	82p
CA3014	137p
CA3018	72p
CA3020	145p
CA3023	139p
CA3028	90p
CA3035	132p
CA3036	137p
CA3043	157p
CA3046*	55p
CA3048	210p
CA3075	150p
CA3081	150p
CA3089E	150p
CA3090AQ	375p
CA3123E	140p
CA3130	78p
LM300H	170p
LM301A	38p
LM301 TO5	45p
LM308	120p
LM318	155p
LM380	94p
LM381	148p
LM3900	65p
LM3909N	70p
M252AA*	695p
M253*	750p
MC724	195p
MC1303L	148p

MC1304P	360p
MC1310P	180p
MC1312PQ	150p
MC1458P	78p
MC1496	91p
MC1710CG	55p
MFC4000B	68p
MFC6040*	135p
MK50253*	550p
MM2112N	450p
NE350	160p
NE513A	210p
NE555*	41p
NE556DB*	99p
NE560	225p
NE561*	325p
NE562B*	295p
NE565A*	200p
NE566*	150p
NE567V*	200p
ROM2513	750p
SG3402	255p
SL414A	178p
SN72702	80p
SN72733	125p
SN76003	280p
SN76013	148p
SN76023	145p
SN76033	195p
SN76115	200p
SN76227	180p
TAA550B	38p
TAA621A	203p
TAA661A	155p
TAA700	00p
TAA960	
TAD100	150p
TAD110	170p
TBA120S	00p
TBA540Q	220p
TBA550Q	00p
TBA641B	225p
TBA651	150p
TBA800	85p
TBA810S	95p
TBA920Q	350p
TDA2020	300p
TCA270SQ	350p
ZN414	105p

INDEX TO ADVERTISERS

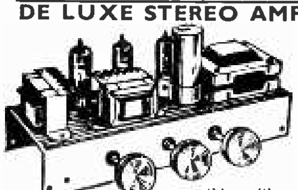
Published on approximately the 7th of each month by IPC Magazines Limited, Fleetway House, Farringdon Street, London EC4A 4AD. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon and Gotch (Asia) Ltd.; South Africa—Central News Agency Ltd. PRACTICAL 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.

SUPERSOUND 13 HI-FI MONO AMPLIFIER



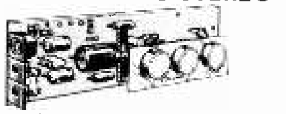
A superb solid state audio amplifier. Brand new components throughout. 5 silicon transistors plus 2 power output transistors in push-pull. Full wave rectification. Output approx. 13 watts r.m.s. into 8 ohms. Frequency response 12Hz 30KHz ± 3db. Fully integrated pre-amplifier stage with separate Volume. Bass boost and Treble cut controls. Suitable for 8-15 ohm speakers. Input for ceramic or crystal cartridge. Sensitivity approx. 40mV for full output. Supplied ready built and tested, with knobs, escutcheon panel, input and output plugs. Overall size 3" high × 6" wide × 7½" deep. AC 200/250V. PRICE £13·75. P. & P. £1·00.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:- 2 × ECL86 Triode Pentodes. 1 × EZ80 as rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built & tested to a high standard. £12·40. P. & P. £1·30.

HAVERSONIC STEREO 44



A solid state stereo amplifier chassis, with an output of 3–4 watts per channel into 8 ohm speakers. Using the latest high technology integrated circuit amplifiers with built in short term thermal overload protection. All components including rectifier smoothing capacitor, fuse, tone control, volume controls, 2 pin din sockets & 5 pin din tape rec./play socket are mounted on the printed circuit panel size approx. 9½"×2½"×1" max. depth. Supplied brand new & tested, with knobs, brushed anodised aluminium 2 way escutcheon (to allow the amplifier to be mounted horizontally or vertically) at only £7·50 plus 50p P & P. Mains transformer with an output of 17v a/c at 500m/a can be supplied at £1·50+ 40p P & P if required. Full connection details supplied.

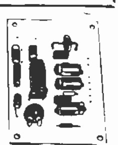
VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Our price £1·50 yd. length. P. & P. 50p per yd. (min. 1 yd.). S.A.E. for samples.

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

MAINS TRANSFORMER. For power supplies.
Pri. 200/240v. Sec. 9–0–9 at 500 mA. £1·50. P. & P. 60p.
Pri. 200/240v. Sec. 12–0–12 at 1 amp. £1·65. P. & P. 60p.
Pri. 200/240v. Sec. 10–0–10 at 2 amp. £2·35. P. & P. 90p.
Pri. 200/240V Sec. 23V at 1·5amp, 6V at ·6 amp, 8V at 50mA. £2·00 + 65p P. & P.

ALL-PURPOSE POWER SUPPLY UNIT 200/240v. A.C. input. Four switched fully smoothed D.C. outputs giving 6v. and 7½v and 9v. and 12v. at 1 amp on load.
Fitted insulated output terminals and pilot lamp indicator. Hammer finish metal case overall size 6" × 3¼" × 2½". Ready built and tested Price £5·75 P. & P. 85p.

STEREO-DECODER



SIZE 2" x 3" x ½" ready built. Pre-aligned and tested. Sens. 20-560 mV for 9-16V neg. earth operation. Can be fitted to almost any FM VHF radio or tuner. Stereo beacon light can be fitted if required. Full details and instructions (inclusive of hints and tips) supplied. £5·62 plus 20p. P. & P. Stereo beacon light if required 40p extra.

QUALITY RECORD PLAYER AMPLIFIER MK. II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide × 3in. deep × 6in. high. Ready built and tested. PRICE £6·20, P. & P. 90p.
ALSO AVAILABLE mounted on board with output transformer and speaker. PRICE £7·30, P. & P. £1.

HARVERSONIC MAINS OPERATED SOLID STATE STEREO FM TUNER

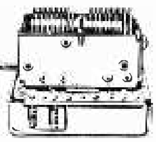
Enjoy fabulous stereo radio at this low introductory price!

Designed and styled to match our 10 + 10 amplifier but will suit any other standard stereo amplifier. The design incorporates the very latest circuitry techniques with high-grain, low noise IF stages. Automatic frequency control to "lock-on" station and prevent drift. IC stereo decoder for maximum stereo separation. L.E.D. for stereo beacon indicator. Nominal output of tuner 100mV. Approximate size 12¼" wide × 8" deep by 2½" high. Supplied ready built, fully tested and fully guaranteed. A/C Mains 200/240V (not available in kit form).

SPECIAL OFFER £22·50 + £1·40 p. & p.

SPECIAL OFFERS

Mullard LP1159 R.F.–I.F. Double Tuned Amplifier Module for nominal 470 KHz. Size approx. 2¼" × 1¼" × ¾" 7·6 Volt + earth. Brand new pre-aligned. Full specification and connection details supplied. £2·25. P. & P. 12p



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

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

HI-FI LOUDSPEAKER SYSTEM MK II

Beautifully made, simulated teak finish enclosure with attractive slatted front. Size 16½" high × 10½" wide × 9" deep (approx.). Fitted with E.M.I. Ceramic Magnet 13" × 8" bass unit, H.F. tweeter unit and crossover. AVAILABLE IN NOMINAL 4 Ohm, 8 Ohm or 16 Ohm impedance (state which).

OUR PRICE £12·00 each Carr. £1·90.

Cabinet Available Separately £7·25, Carr. £1·40.
Also available in 8 ohms with EMI 13" × 8" bass speaker with parasitic tweeter £10·25. Carr. £1·90.

LOUDSPEAKER BARGAINS
5in. 3 ohm £1·45, P. & P. 35p. 7 × 4in. 3 ohm £1·69, P. & P. 48p. 10 × 6in. 3 or 15 ohm £2·50, P. & P. 75p. E.M.I. 8 × 5in. 3 ohm with high flux magnet £2·06, P. & P. 50p. E.M.I. tweeter. Approx. 3½". Available 3 or 8 or 15 ohms, £2·00 + 25p, P. & P.

"POLY PLANAR" WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER
Size 11½" × 14$\frac{11}{16}$" × 1$\frac{3}{16}$" deep. Weight 19oz. Power handling 20W r.m.s. (40W peak). Impedance 8 ohm only. Response 40Hz–20kHz. Can be mounted on ceilings, walls, doors, under tables, etc., and used with or without baffle. Send S.A.E. for full details.
Only £7·25 each + p. & p. (one 75p, two 90p).

Now also available 8". – 8 ohm 10 watts, r.m.s. 20 watt peak 40 Hz–20,000 Hz. Overall depth 1". Ideal for Hi-Fi or for use in cars £4·90 + p. & p. (one 35p, two 65p).

SPECIAL LINES OFFERED SUBJECT TO STOCK AVAILABILITY
Hi-Fidelity stereo cassette tape deck transport mechanisms as used in Hi-Fi Music Centres. Electronicaly speed controlled motor, belt-driven flywheel capstan, three digit re-settable counter. Record/Play pre-amps bias oscillator. Record/Play and erase heads etc. Power supply required 12V D.C. Circuit diagram, etc. supplied. These units are brand new, but untested and are only offered to the more advanced constructor enthusiast. PRICE £16 87 + £1·25 P. & P.
WE REGRET THAT WE ARE UNABLE TO ENTER INTO CORRESPONDENCE ON THESE UNITS.

New but very slightly marked 'GLENBURN' BSR automatic record changer decks fitted with cueing lever, lightweight arm and ceramic Hi-Fi stereo/compatible cartridge. Can be used for automatic or manual play. PRICE £9·56 + £1·20 P. & P.

Latest model GARRARD 6300 auto/manual changer de-luxe with cueing lever, bias compensator, counter-balanced low resonance arm and fitted with ACOS 104 diamond ceramic stereo cartridge. PRICE ONLY £14·50 + £1·50 P. & P.

Limited number of the latest BSR C141R1 auto/manual changer de-luxe. Lightweight tubular arm cueing lever, bias compensator. PRICE £12·60 + £1·40 P. & P.
Also similar but without cueing lever or bias compensator. ONLY £11·00 + £1·40 P. & P.

HARVERSONIC SUPERSOUND 10 + 10 STEREO AMPLIFIER KIT

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

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

AMPLIFIER KIT	£13·50	P. & P. 65p
(Magnetic input components 35p extra)		
POWER PACK KIT	£4·85	P. & P. 85p
CABINET	£4·85	P. & P. 85p

SPECIAL OFFER—only £22·50 if all 3 items ordered at one time plus £1 p. & p.

Full after sales service

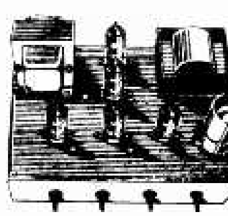
Also available ready built and tested £29·25. P. & P. £1.

3-VALVE AUDIO AMPLIFIER HA34 MK II

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½"w. × 4"d. × 4½"h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £7·80. P. & P. £1·00.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc £7·00 P. & P. £1·00.

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3–15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 25p + SAE (Free with parts)' All parts sold separately. ONLY £11·25 P. & P. £1·35. Also available ready built and tested £15·20 P. & P. £1·35.

SPECIAL OFFER Limited number of the latest BSR C141RI Auto/Manual changer de-luxe. Lightweight tubular arm, cue-ing lever bias compensator £12·60 + £1·40 p. & p. Also similar but without cue-ing lever bias compensator. Only £11·00 + £1·40 P. & P.

Prices include VAT at Current Rate

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

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

HARVERSON SURPLUS CO. LTD.

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

A few minutes from South Wimbledon Tube Station.

SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

(Please write clearly)

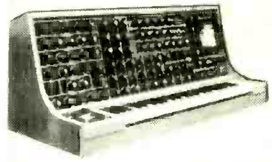
PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

Make it with MAPLIN!

ELECTRONIC COMPONENTS

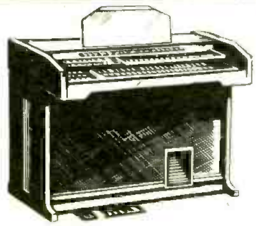
WIDE RANGE · HIGH QUALITY · FAST SERVICE

The 4600 SYNTHESISER



We stock all the parts for this brilliantly designed synthesiser, including all the PCB's, metalwork and a drilled and printed front panel, giving a superb professional finish. Opinions of authority agree the ETI International Synthesiser is technically superior to most of todays models. Complete construction details in our booklet now available price £1.50, or send SAE for specification.

ELECTRONIC ORGAN



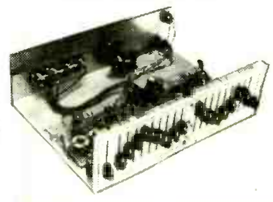
BUILD IT YOURSELF ... IN STAGES

Get started with a 49 note instrument — features tremulant and reverberation. Ideal to learn on. Leaflet MES 51. Price 15p gives full details to build this complete instrument.

Extend the range of MES 51 by adding another keyboard and several new tone colours. Leaflet MES 52. Price 15p also shows how to use 61 note keyboards.

Fully controllable attack and decay controls (normally found only on the most expensive organs), up to seven footages on each keyboard, up to 70 controls including drawbars, and a 13 note pedalboard, make up the additions described in the step-by-step 32 page instruction leaflet MES 53. Price 35p.

GRAPHIC EQUALIZER



A really superior high quality stereo graphic equalizer featuring 9 octaves per channel. We stock all the parts (except woodwork) including the metalwork drilled and printed. 15p brings you a reprint of the article.

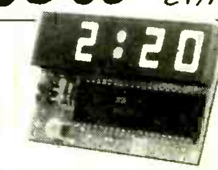
100 W PER CHANNEL STEREO DISCO

- Automatic voice operated fader
- Belt drive turntables
- Monitor facilities (Headphones and VU meters)
- Sound operated light show — plus many other advantages.

Send for our leaflet MES 41, giving full details for construction. Price 20p. Soon you'll be the Deejay everyone wants at their party!

DIGITAL CLOCK KITS

ONLY £8·60 INC. VAT & P/P



This is a fully constructed and tested electronic clock module as illustrated. Data sheet supplied. Simple to connect to alarm and your battery/mains radio. Smart case available. Data sheet available separately. Please send SAE.

- Bright 4 Digit 0.5" Display
- Flashing Colon (1Hz)
- Switch for Display Seconds
- Alarm Set Indicator
- P.M. Indicator
- Power Failure Indicator
- Sleep Timer
- Snooze Timer
- Time can be set accurately to within one second
- Leading Zero Blanking

SIMPLE CLOCK KIT – £9·38 ALARM CLOCK KIT – £10·99.
ALARM CLOCK & RADIO CONTROLLER KIT – £11·51.
SMART PLASTIC CASE with fully punched chassis – £2·49.
Please send SAE for our Clock data sheet.

Get our FABULOUS NEW 1977/78 CATALOGUE

PUBLICATION DATE OCT. 28. 1976 **ON APPROVAL**

All new. Completely re-written. Hundreds of new lines. Lots of exciting new projects to build. PRICE 50p. SEND NO MONEY NOW. Overseas send 8 International reply coupons. Everyone ordering before publication date will receive a pack of ten super special offer coupons giving big discounts on ten different popular items—YOU COULD SAVE POUNDS!! SO DON'T DELAY FILL IN AND POST THE COUPON NOW.

Please rush me a copy of your brand new 1977/78 catalogue the instant it is printed (October 28th, 1976). Only if I am completely satisfied that it is worth every penny will I send 50p within 14 days of receipt. If I am not satisfied I may return the catalogue to you within 14 days without obligation. I understand that I need not purchase anything from your catalogue should I choose to keep it.

PW

NAME ______________________

ADDRESS ______________________

____

____

JOIN OUR MAILING LIST NOW!
Published every two months our Newsletter gives full details of our latest guaranteed prices. Send just 30p and we'll send you the next six news letters as they are published.

- SAVE ££'s ON SPECIAL OFFERS!
- DETAILS OF NEW PROJECTS AND NEW LINES

If you do not wish to cut magazine, write your request for catalogue on separate sheet.
1975/76 GREEN COVER CATALOGUE STILL AVAILABLE PRICE 40p

MAPLIN ELECTRONIC SUPPLIES
All mail to P.O. Box 3, Rayleigh, Essex SS6 8LR.
Shop 284 London Road, Westcliff-on-Sea, Essex
(Closed on Monday). Tel. Southend (0702) 44101